# Revision History

## Documentation Revisions

<table>
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<th>Date</th>
<th>Revision</th>
<th>Description</th>
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<td>02/15/2017</td>
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<td>Tech Edits based on release of RPC Broker Patch XWB<em>1.1</em>65:</td>
<td>Developer H. W.</td>
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<td>• Reformatted document to follow current documentation standards and style formatting requirements.</td>
<td>Technical Writer: T. B.</td>
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<td>renamed “Hash Unit” to “XWBHash Unit” in Section 2.3 and moved “XWBHash Unit” to Section 2.3.10.</td>
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<td>Added Section 2.3.11, “XWBSSOi Unit.”</td>
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<td>Added the following properties to Table 4:</td>
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<td>o SecurityPhrase Property</td>
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<td>o SSHHide Property</td>
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<td>o SSHport Property</td>
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<td>o SSHpw Property</td>
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<td>o SSHUser Property</td>
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<td>o SSOIToken Property</td>
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<td>o SSOiSECID Property</td>
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<td>o SSOiADUPN Property</td>
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<td>o SSOiLogonName Property</td>
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<td>o UseSecureConnection Property</td>
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<td>Added the following properties to Table 6:</td>
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<td>o SSOIToken Property</td>
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<td>o SSOiSECID Property</td>
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<td>o SSOiADUPN Property</td>
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<td>o SSOiLogonName Property</td>
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<td>Added Section 2.1.5, “TXWBSSOiToken Component.”</td>
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<td>Added Caution statement to the reference PType in Table 11, Table 14, and Table 61.</td>
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<td>Added the following new properties:</td>
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<td>o SSOiADUPN Property (TRPCBroker Component)</td>
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<td>o SSOiADUPN Property (TXWBSSOiToken Component)</td>
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<td>o SSOiLogonName Property (TRPCBroker Component)</td>
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<td>o SSOiLogonName Property (TXWBSSOiToken Component)</td>
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<td>o SSOiSECID (TRPCBroker Component)</td>
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<td>o SSOiSECID Property (TXWBSSOiToken Component)</td>
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<td>o SSOIToken Property (TRPCBroker Component)</td>
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<td>o SSOIToken Property (TXWBSSOiToken Component)</td>
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<td>Removed Note reference to the</td>
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<td></td>
<td></td>
<td>example in Sections 2.6.32.3, 2.6.71.3, 7.16.2.1, and 7.16.2.2; those sample files no longer distributed.</td>
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</tbody>
</table>
|      |          | • Modified/Renamed Section 4.1.5;  
|      |          | o Added new RPC Broker APIs Section 4.1.5;  
|      |          | o Moved content and added Section 4.2.9.1;  
|      |          | • Updated the option parameter description to clarify it is an "encrypted name" in Section 4.1.5. |        |
|      |          | • Added the following new RPCs to Section 4.2:  
|      |          | o XWB CREATE CONTEXT  
|      |          | o XWB GET BROKER INFO  
|      |          | o XWB IM HERE  
<p>|      |          | • Updated Section 4.2.9.1 regarding Windows registry entries. |        |
|      |          | • Added Section 5, &quot;Broker Security Enhancement (BSE).&quot; Consolidating all developer-related content from the standalone Broker Security Enhancement (BSE) Supplement to Patch: XWB<em>1.1</em>45 &amp; XU<em>8.0</em>404 document into the RPC Broker Developer's Guide. Specifically, content taken from Sections 3-6. |        |
|      |          | NOTE: Once all content is transferred from the BSE standalone document into the appropriate RPC Broker documents, the Broker Security Enhancement (BSE) Supplement to Patch: XWB<em>1.1</em>45 &amp; XU<em>8.0</em>404 will be deleted and removed from the VDL. |        |
|      |          | • Changed references from &quot;Borland Delphi&quot; to &quot;Embarcadero Delphi,&quot; removed Note referring to CAPRI, and updated Steps 1-2, removed old Step 3 (including RPC Broker login components) and old Step 8 (recompiling application), updated new Steps 3-7 in Section 5.1.2. |        |
|      |          | • Updated Section 6.2. |        |
|      |          | • Deleted &quot;BAPI32.DLL not able to support SSH&quot; Note from Section 8.1. |        |
|      |          | • Added the MySsoToken Function to Table 40. |        |</p>
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<th>Date</th>
<th>Revision</th>
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<td>04/28/2016</td>
<td>2.0</td>
<td>Tech Edits based on release of RPC Broker Patch XWB<em>1.1</em>60 (released 06/11/2015):</td>
<td>Developer H. W.</td>
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<td>• Reformatted document to follow current documentation standards and style formatting requirements.</td>
<td>Technical Writer: T. B.</td>
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<td>• Updated the “Orientation” section.</td>
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<td>• Updated Section 1.3.</td>
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<td>• Updated Section 1.4.2.1 for deprecated (removed) components.</td>
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<td>• Updated Section 1.4.4 for added functionality.</td>
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<td>• Added Figure 1 caption.</td>
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<td>• Removed deprecated properties from Table 4, Table 6, Table 7, and Table 9.</td>
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<td>• Modified command line parameter in Section 2.1.3.4.</td>
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<td>• Updated Section 2.6.52.4.</td>
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<td>• Modified property references in Sections 2.6.55.3 and 2.6.56.3.</td>
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<td>• Updated Figure 53.</td>
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<td>• Removed malfunction note in Section 4.2.7.1.</td>
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<td>• Updated Figure 59.</td>
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<td>• Removed Winsock reference note from Section 5.4.</td>
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<td>• Removed caution note regarding writing to Windows registry in Section 6.17</td>
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<td>• Corrected sort order of properties in Table 6.</td>
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<td>• Added the “run-time only” icon to the Socket Property (read-only) and</td>
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<td>User Property throughout.</td>
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<td>• Added bullet list of Units described in this document in Section 2.3.</td>
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<td>• Deleted TMult Class from the list in Section 2.3.8.1.</td>
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<td>• Made other minor format and content updates.</td>
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<td>04/14/2014</td>
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<td>• Updated the “Definitions” section for Units, Classes, Components, and</td>
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<td>Routines.</td>
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<td>• Updated the “About this Version of the RPC Broker” section.</td>
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<td>• Updated the order of the classes in the “Classes—Added” section.</td>
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<td>• Updated the “Components—Added or Modified” section.</td>
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<td>• Changed references from “TVCEdit Unit” to “VCEdit Unit” throughout.</td>
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<td>• Updated the “Properties—Added or Modified” section.</td>
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<td>• Technical Writer: T. B.</td>
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<td>• Developer H. W.</td>
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<td>Modified” section for properties added with XWB<em>1.1</em>50.</td>
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<td>*Updated Section 2.1.1.7 for reference to Sample directory.</td>
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<td>*Updated “TContextorControl Component” section. Added Parent class, Unit, and Description subsections.</td>
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<td>*Updated Table 6 with duplicate properties from TCCOWRPCBroker, because they have been made available within the TRPCBroker component.</td>
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<td>*Updated Section 2.1.3.8 for CCOW methods added to the TRPCBroker Component.</td>
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<td>*Changed references to correct Sample directory throughout: BDK32\Samples\BrokerEx</td>
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<td>Also, changed references to the BDK32\Samples\SharedRPCBroker directory, since these were not included with XWB<em>1.1</em>50.</td>
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<td>o Changed Assign Method (TMult Class) to Assign Procedure (TMult Class).</td>
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<td>o Changed Order Method to Order Function throughout.</td>
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<td>o Changed Position Method to Position Function throughout.</td>
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<td>o Changed Subscript Method to Subscript Function throughout.</td>
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<td>*Updated Section 2.2.3.3 title and added the ParamArray property.</td>
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<td>*Updated Section 2.2.3.4 title and ParamArray Property.</td>
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<td>*Updated Table 7; added the NTToken Property.</td>
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<td>*Updated description in Section 2.2.6.2.</td>
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<td>*Added Caution note to Section 2.3.</td>
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<td>*Updated Encryption and Decryption Function links in Section 2.3.2.1.</td>
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<td>*Added description in Section 2.3.4.</td>
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<td>• Added description and Caution note in Section 2.3.5.</td>
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<td>• Added IsIPAddress Function to Section 2.3.5.1.</td>
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<td>• Added description to Section 2.3.6.</td>
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<td>• Added the following methods to Section 2.3.6.1: GetSessionInfo Procedure, GetUserInfo Procedure, SilentLogIn Function, ValidAppHandle Function, ValidAVCodes Function, and ValidNTToken Function.</td>
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<td>• Added description to Section 2.3.7.</td>
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<td>• Added “Procedure to library methods in Section 2.3.7.1.</td>
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<td>• Added the “Wsockc Unit” section.</td>
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<td>• Removed or modified references to the BDK32\Samples\SilentSignOn directory throughout.</td>
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<td>• Added the “SecurityPhrase Property” section.</td>
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|      |          | • Added the following properties/sections:  
  o SSHHide Property  
  o SSHport Property  
  o SSHpw Property  
  o SSHUser Property  
• Added the “UseSecureConnection Property” section.                                                                                                                                                                                                                      |        |
<p>|      |          | • Corrected sample app name in Section 3.7.8; added “.exe” and deleted the Note.                                                                                                                                                                                                                                                        |        |
|      |          | • Added Caution and Note to Section 4.2.3.                                                                                                                                                                                                                                                                                             |        |
|      |          | • As per Keith Cox, head of the ICR team, changed all XWB “public” RPCs to “Controlled Subscription throughout to improve VistA security. Added Notes where appropriate.                                                                                                                                                  |        |
|      |          | • Updated Figure 53.                                                                                                                                                                                                                                                                                                                       |        |
|      |          | • Added Windows 7 Note to Section 4.2.7.1.                                                                                                                                                                                                                                                                                              |        |
|      |          | • Added Caution to Section 4.2.8.1.                                                                                                                                                                                                                                                                                                   |        |
|      |          | • Deleted first reference Note in Section 4.2.12.1, since repeated with the Example.                                                                                                                                                                                                                                                      |        |
|      |          | • Updated Table 39: Added errors                                                                                                                                                                                                                                                                                                       |        |</p>
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<tr>
<td>20008 - 20112.</td>
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<td>• Updated Figure 74.</td>
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<td>• Updated example in Step 2 in the “Tutorial—Step 4: Routine to List Terminal Types” section.</td>
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<td>• Updated Figure 81.</td>
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<td>• Updated example in Step 3 in the “Tutorial—Step 8: Routine to Retrieve Terminal Types” section.</td>
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<td>• Updated Figure 90.</td>
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<td>• Updated Note in Section 6.16.4.1 and 6.16.4.2.</td>
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<td>• Added Caution note to Section 6.17.</td>
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<td>• Updated references to the VB5EGCHO sample application to have been distributed with an earlier BDK.</td>
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<td>04/10/2014</td>
<td>1.0</td>
<td>Initial document:</td>
<td>Technical Writer: T. B.</td>
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<td>• Content derived from the RPC Broker 1.1 online HTML help topics using RoboHelp utility.</td>
<td>Developer H. W.</td>
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<td>• Reformatted document and made sure it conforms to the current OI&amp;T National Documentations Standards.</td>
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<td>• Made other minor grammar and punctuation corrections throughout.</td>
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<td>RPC Broker 1.1</td>
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**Patch Revisions**

For the current patch history related to this software, see the Patch Module on FORUM.
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Orientation

How to Use this Manual
Throughout this manual, advice and instructions are offered regarding the use of the Remote Procedure Call (RPC) Broker 1.1 Development Kit (BDK) and the functionality it provides for Veterans Health Information Systems and Technology Architecture (VistA).

Intended Audience
The intended audience of this manual is the following stakeholders:

- Enterprise Program Management Office (EPMO)—VistA legacy development teams.
- System Administrators—System administrators at Department of Veterans Affairs (VA) regional and local sites who are responsible for computer management and system security on the VistA M Servers.
- Information Security Officers (ISOs)—Personnel at VA sites responsible for system security.
- Product Support (PS).

Disclaimers

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Documentation Disclaimer
This manual provides an overall explanation of RPC Broker and the functionality contained in RPC Broker 1.1; however, no attempt is made to explain how the overall VistA programming system is integrated and maintained. Such methods and procedures are documented elsewhere. We suggest you look at the various VA Internet and Intranet Websites for a general orientation to VistA. For example, visit the Office of Information and Technology (OI&T) VistA Development Intranet website.

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any editorial control over the information you find at these locations. Such links are provided and are consistent with the stated purpose of this VA Intranet Service.

Documentation Conventions

This manual uses several methods to highlight different aspects of the material:

- Various symbols are used throughout the documentation to alert the reader to special information. Table 1 gives a description of each of these symbols:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="NOTE / REF:" /></td>
<td>NOTE / REF: Used to inform the reader of general information including references to additional reading material</td>
</tr>
<tr>
<td><img src="image" alt="CAUTION / RECOMMENDATION / DISCLAIMER:" /></td>
<td>CAUTION / RECOMMENDATION / DISCLAIMER: Used to caution the reader to take special notice of critical information</td>
</tr>
</tbody>
</table>

- Descriptive text is presented in a proportional font (as represented by this font).
- Conventions for displaying TEST data in this document are as follows:
  - The first three digits (prefix) of any Social Security Numbers (SSN) begin with either “000” or “666.”
  - Patient and user names are formatted as follows:
    - [Application Name]PATIENT,[N]
    - [Application Name]USER,[N]
      Where “[Application Name]” is defined in the Approved Application Abbreviations document and “[N]” represents the first name as a number spelled out and incremented with each new entry.

      For example, in RPC Broker (XWB) test patient names would be documented as follows:
      XWBPATIENT,ONE; XWBPATIENT,TWO; XWBPATIENT,14, etc.

      For example, in RPC Broker (XWB) test user names would be documented as follows:
      XWBUSRE,ONE; XWBUSRE,TWO; XWBUSRE,14, etc.

- “Snapshots” of computer online displays (i.e., screen captures/dialogues) and computer source code is shown in a non-proportional font and may be enclosed within a box.
- User’s responses to online prompts are in **boldface** and highlighted in yellow (e.g., <Enter>).
- Emphasis within a dialogue box is in **boldface** and highlighted in blue (e.g., **STANDARD LISTENER: RUNNING**).
- Some software code reserved/key words are in **boldface** with alternate color font.
- References to “<Enter>” within these snapshots indicate that the user should press the <Enter> key on the keyboard. Other special keys are represented within < > angle brackets. For example, pressing the PF1 key can be represented as pressing <PF1>.
• Author’s comments are displayed in italics or as “callout” boxes.

NOTE: Callout boxes refer to labels or descriptions usually enclosed within a box, which point to specific areas of a displayed image.

• The following conventions are used with regards to APIs:
  
  o The following API types are documented:
    
    – **Supported:**
      
      This applies where any VistA application may use the attributes/functions defined by the Integration Control Registration (ICR); these are also called “Public”. An example is an ICR that describes a standard API. The package that creates/maintains the Supported Reference must ensure it is recorded as a Supported Reference in the ICR database. There is no need for other VistA packages to request an ICR to use these references; they are open to all by default.
    
    – **Controlled Subscription:**
      
      Describes attributes/functions that must be controlled in their use. The decision to restrict the Integration Control Registration (ICR) is based on the maturity of the custodian package. Typically, these ICRs are created by the requesting package based on their independent examination of the custodian package's features. For the ICR to be approved the custodian grants permission to other VistA packages to use the attributes/functions of the ICR; permission is granted on a one-by-one basis where each is based on a solicitation by the requesting package.
  
  o Private APIs are not documented.
  
  o Headings for developer API descriptions (e.g., supported for use in applications and on the Database Integration Committee [DBIC] list) include the routine tag (if any), the caret (“^”) used when calling the routine, and the routine name. The following is an example:
    
    $$BROKER^XWBLIB$$
  
  o For APIs that take input parameter, the input parameter is labeled “required” when it is a required input parameter and labeled “optional” when it is an optional input parameter.
  
  o For APIs that take parameters, parameters are shown in lowercase and variables are shown in uppercase. This is to convey that the parameter name is merely a placeholder; M allows you to pass a variable of any name as the parameter or even a string literal (if the parameter is not being passed by reference). The following is an example of the formatting for input parameters:
    
    $XGLMSG^XGLMSG(msg_type, [.]var[,timeout])$
  
  o Rectangular brackets [ ] around a parameter are used to indicate that passing the parameter is optional. Rectangular brackets around a leading period [.] in front of a parameter indicate that you can optionally pass that parameter by reference.
  
  o All APIs are categorized by function. This categorization is subjective and subject to change based on feedback from the development community. In addition, some APIs could fall under multiple categories; however, they are only listed once under a chosen category.

APIs within a category are first sorted alphabetically by Routine name and then within
routine name are sorted alphabetically by Tag reference. The “$$”, “^”, or “^%” prefixes on APIs is ignored when alphabetizing.

- This manual refers to the M programming language. Under the 1995 American National Standards Institute (ANSI) standard, M is the primary name of the MUMPS programming language, and MUMPS is considered an alternate name. This manual uses the name M.

- All uppercase is reserved for the representation of M code, variable names, or the formal name of options, field/file names, and security keys (e.g., the XUROGMEM security key).

  NOTE: Other software code (e.g., Delphi/Pascal and Java) variable names and file/folder names can be written in lower or mixed case.

**Documentation Navigation**

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1. Right-click anywhere on the customizable Toolbar in Word (not the Ribbon section).
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3. Select the drop-down arrow in the “Choose commands from:” box.
4. Select All Commands from the displayed list.
5. Scroll through the command list in the left column until you see the Back command (circle with arrow pointing left).
6. Select/Highlight the Back command and select Add to add it to your customized toolbar.
7. Scroll through the command list in the left column until you see the Forward command (circle with arrow pointing right).
8. Select/Highlight the Forward command and select Add to add it to the customized toolbar.
9. Select OK.

You can now use these Back and Forward command buttons in the Toolbar to navigate back and forth in the Word document when selecting hyperlinks within the document.

  NOTE: This is a one-time setup and is automatically available in any other Word document once you install it on the Toolbar.
Commonly Used Terms

Table 2 is a list of terms and their descriptions that you may find helpful while reading the RPC Broker documentation:

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
<th>REF: For a more detailed description, see the <em>Embarcadero Delphi for Windows User Guide</em>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td>A single term used interchangeably to refer to a user, the workstation (i.e., PC), and the portion of the program that runs on the workstation.</td>
<td></td>
</tr>
<tr>
<td>Component</td>
<td>A software object that contains data and code. A component may or may not be visible.</td>
<td></td>
</tr>
<tr>
<td>GUI</td>
<td>The Graphical User Interface application that is developed for the client workstation.</td>
<td></td>
</tr>
<tr>
<td>Host</td>
<td>The term Host is used interchangeably with the term Server.</td>
<td></td>
</tr>
<tr>
<td>Server</td>
<td>The computer where the data and the RPC Broker remote procedure calls (RPCs) reside.</td>
<td></td>
</tr>
</tbody>
</table>

REF: For additional terms and definitions, see the “Glossary” section in this manual and other RPC Broker manuals.

How to Obtain Technical Information Online

Exported VistA M Server-based software file, routine, and global documentation can be generated using Kernel, MailMan, and VA FileMan utilities.

NOTE: Methods of obtaining specific technical information online is indicated where applicable under the appropriate section.

REF: For further information, see the *RPC Broker Technical Manual*.

Help at Prompts

VistA M Server-based software provides online help and commonly used system default prompts. Users are encouraged to enter question marks at any response prompt. At the end of the help display, you are immediately returned to the point from which you started. This is an easy way to learn about any aspect of VistA M Server-based software.
Obtaining Data Dictionary Listings

Technical information about VistA M Server-based files and the fields in files is stored in data dictionaries (DD). You can use the List File Attributes option on the Data Dictionary Utilities submenu in VA FileMan to print formatted data dictionaries.

REF: For details about obtaining data dictionaries and about the formats available, see the “List File Attributes” chapter in the “File Management” section of the VA FileMan Advanced User Manual.

Assumptions

This manual is written with the assumption that the reader is familiar with the following:

- VistA computing environment:
  - Kernel—VistA M Server software
  - Remote Procedure Call (RPC) Broker—VistA Client/Server software
  - VA FileMan data structures and terminology—VistA M Server software
- Microsoft® Windows environment
- M programming language
- Object Pascal programming language.
- Object Pascal programming language/Embarcadero Delphi Integrated Development Environment (IDE)—RPC Broker

References

Readers who wish to learn more about RPC Broker should consult the following:

- RPC Broker Release Notes
- RPC Broker Installation Guide
- RPC Broker Systems Management Guide
- RPC Broker Technical Manual
- RPC Broker User Guide
- RPC Broker Developer’s Guide (this manual)—Document and BDK Online Help, which provides an overview of development with the RPC Broker. The help is distributed in two zip files:
  - Broker_1_1.zip (i.e., Broker_1_1.chm)—This zip file contains the standalone online HTML help file. Unzip the contents and double-click on the Broker_1_1.chm file to open the help.
  - Broker_1_1-HTML_Files.zip—This zip file contains the associated HTML help files. Unzip the contents in the same directory and double-click on the index.htm file to open the help.

You can create an entry for Broker_1_1.chm in Delphi’s Tools Menu, to make it easily accessible from within Delphi. To do this, use Delphi’s Tools | Configure Tools option and create a new menu entry.
• RPC Broker VA Intranet website.

This site provides announcements, additional information (e.g., Frequently Asked Questions [FAQs], advisories), documentation links, archives of older documentation and software downloads.

VistA documentation is made available online in Microsoft® Word format and in Adobe Acrobat Portable Document Format (PDF). The PDF documents must be read using the Adobe Acrobat Reader, which is freely distributed by Adobe Systems Incorporated at: http://www.adobe.com/

VistA documentation can be downloaded from the VA Software Document Library (VDL) Website: http://www.va.gov/vdl/

The RPC Broker documentation is located on the VDL at:
https://www.va.gov/vdl/application.asp?appid=23

VistA documentation and software can also be downloaded from the Product Support (PS) Anonymous Directories.
1 Introduction

The RPC Broker is a client/server system within Department of Veterans Affairs (VA) Veterans Health Information Systems and Technology Architecture (VistA) environment. It enables client applications to communicate and exchange data with VistA M Servers.

This manual describes the development features of the RPC Broker. The emphasis is on using the RPC Broker in conjunction with Delphi software. However, the RPC Broker supports other development environments.

The manual provides a complete reference for development with the RPC Broker. For an overview of development with the RPC Broker components, see the *RPC Broker User Guide*.

This manual is intended for the VistA development community and system administrators. A wider audience of technical personnel engaged in operating and maintaining VA software might also find it useful as a reference.

The following topics are discussed in this section:

- **Broker Overview**
  - Broker Security Enhancement (BSE) Overview
  - Broker Call Steps
- **Definitions**
- **About this Version of the RPC Broker**
- **What’s New in the BDK**
- **Developer Considerations**
- **Application Considerations**
- **Online Help**

REF: For the latest RPC Broker product information, see the RPC Broker VA Intranet Website.
1.1 Broker Overview

The RPC Broker is a bridge connecting the application front-end on the client workstation (e.g., Delphi-based GUI applications) to the M-based data and business rules on the VistA M Server.

Table 3: Broker Client-side and Server-side Overview

<table>
<thead>
<tr>
<th>Client Workstation: RPC Broker</th>
<th>VistA M Server: RPC Broker</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Manages the connection to the client workstation.</td>
<td>• Manages the connection to the client.</td>
</tr>
<tr>
<td><strong>REF:</strong> For details, see the <em>RPC Broker Systems Management Guide</em>.</td>
<td><strong>REF:</strong> For details, see the <em>RPC Broker Systems Management Guide</em>.</td>
</tr>
<tr>
<td>• The RPC Broker components allow Delphi-based applications to make RPCs to the server.</td>
<td>• Authenticates client workstation.</td>
</tr>
<tr>
<td>• The Broker Dynamic Link Library (DLL) provides support for Commercial-Off-The-Shelf (COTS)/HOST client/server software.</td>
<td>• Authenticates user.</td>
</tr>
<tr>
<td></td>
<td>• Manages RPCs from the client, executes the M code, and passes back return values.</td>
</tr>
</tbody>
</table>

The RPC Broker frees GUI developers from the details of the client-server connection and allows them to concentrate executing operations on the VistA M Server.

1.1.1 Broker Security Enhancement (BSE) Overview

Some VistA application users require access to data located at remote sites at which the users:

- Do not have assigned Access and Verify codes.
- Have not been entered into the NEW PERSON file (#200) by system administrators.
- Want to avoid having multiple Access/Verify code pairs.

Some applications use the Broker Security Enhancement (BSE) to obtain such access. BSE enters the user’s information into the NEW PERSON file (#200) as a visitor, but does not require an Access or Verify code for the user at the remote site. This process accomplishes the following:

- Enables RPC Broker applications to access remote VistA M Servers with increased security.
- Ensures correct information for user access to prevent the mistaken identification of an incorrect or non-existent user (spoofing) via unauthorized applications.
- Provides the ability for RPC Broker applications that have implemented BSE to specify their own context option.

BSE adds a step to the RPC Broker signon process to authenticate the connecting application. This involves passing a secret encoded phrase that is established on the VistA M Server via a patch and KIDS build. BSE also adds a step to the RPC Broker signon context on the remote VistA M Server to authenticate the user by connecting back to the authenticating VistA M Server to validate a token established during the authentication process and retrieve the user’s information from the authenticating server.
1.1.2 Broker Call Steps

These steps present a basic outline of the events that go into an RPC Broker call, starting with the initial client-server connection. Once the client machine and user are authenticated, any number of calls (Steps 3-5) can occur through the open connection.

GUI developer issues are noted for each step.

1. Authentication of client workstation. When a client workstation initiates a session, the Broker Listener on the server spawns a new job. The server then calls the client back to ensure that the client’s address is accurate.

   **GUI Developer Issues:**
   
   None. This process is built into the RPC Broker.

   **REF:** For more details, see the *RPC Broker Systems Management Guide* on the VDL at:
   
   [http://www.va.gov/vdl/documents/Infrastructure/Remote_Proc_Call_Broker_(RPC)/xwb_1_1_sm.pdf](http://www.va.gov/vdl/documents/Infrastructure/Remote_Proc_Call_Broker_(RPC)/xwb_1_1_sm.pdf)

2. Authentication of user. After the server connects back to the client workstation, the user is asked for user credentials, either 2-factor authentication (Public Key Infrastructure [PKI] certificate and Personal Identification Number [PIN]) or an Access and Verify code. User authentication and identification is done with calls to VistA Kernel RPCs, including:

   - XUS SIGNON SETUP
   - XUS ESSO VALIDATE
   - XUS AV CODE

   **GUI Developer Issues:**

   Broker Security Enhancement (BSE) — BSE user authentication and identification on remote VistA M servers is performed by passing a token to the XUS SIGNON SETUP RPC, which the server then uses to validate the user’s credentials on the authenticating VistA M Server.

   Creating user context — Applications must create a context for the user by calling the XWB CREATE CONTEXT RPC. This process checks the user’s access to individual RPCs associated with the application.

   Enabling Silent Login — Developers must decide whether to enable Silent Login.

3. Client makes a Remote Procedure Call.

   **GUI Developer Issues:**

   Connecting to VistA — Developers creating Delphi GUI applications can use the TRPCBroker Component to connect to VistA. For each transaction, the application must set parameters and execute a call. Issues include:

   - Determining data types for input and return.
   - Determining the kind of call to make.

   In addition to the RPC Broker components, other components are available. The VA FileMan Delphi components (FMDC) encapsulate the details of retrieving, validating, and updating VA FileMan data within a Delphi-based application.
4. RPC execution on server.

**GUI Developer Issues:**

A Remote Procedure Call (RPC) is a defined call to M code that runs on a VistA M Server.

**REF:** For RPC information, see the “[RPC Overview](#)” section.

Issues include:

- Determining the best RPC—The BDK provides some RPC Broker APIs.
  
  **REF:** For more information on RPC Broker APIs, see the “Application Programming Interface (API)” section.

- Creating RPCs from scratch—In many cases, an existing M API can be wrapped into an RPC.
  
  **REF:** For more information, see the “Creating RPCs” and “RPC Overview” sections.

- Registering RPCs. RPCs must be registered on the server, so users of the GUI VistA application have access to them.
  
  **REF:** For more information on registering RPCs, see the “[RPC Security: How to Register an RPC](#)” section.

5. RPC returns information to the client.

**GUI Developer Issues:**

Handling the return values, including any error messages.

### 1.2 Definitions

The RPC Broker BDK includes:

- **Units**
- **Classes**
- **Objects**
- **Components**
- **Types**
- **Methods**
- **Routines: Functions and Procedures**
For each Class, Object, and Component, this manual lists the unit, declaration, properties, methods, and a
description of how to use the class, object, or component.

Some types and properties are public, some are private, and some are available only within the function or
procedure in which they are defined:

Unit

  Interface {specifies that this unit is an interface to a class}

Uses

  {list of external units being referenced within this unit}

Type

  {Class definition}

Private

{private (available within this unit) variable, type, property, method, function, and procedure definitions}

Public

{published (available to units using this unit) Variable, type, property, method, function, and procedure
definitions}

Implementation

{Method, Function, and Procedure programming, which can contain their own Uses, Type, and
property definitions within themselves}

1.2.1 Units

A Unit is a Pascal source-code file or program composed of classes, objects, and components containing
all of the other elements. The BDK includes a number of units (e.g., winsockc.pas). This manual
document some of the units provided, and details what parts of the BDK are declared in each unit.

Sometimes it is helpful to know in which unit a particular item, such as a type or routine, is declared in
the BDK. This is because if you use the item in your own code, you may need to include the
corresponding unit in your own Pascal unit’s Uses clause.

The BDK is not really a standalone program, but the units in the BDK are compiled with an application
(e.g., Computerized Patient Record System [CPRS]) to make a program. The interfaces to those units are
called components (well-defined and published to be used externally). For example, the wsockc unit in
the BDK uses (references) other external units (i.e., BDK and Delphi Run Time Library: AnsiStrings,
SysUtils, WinSock2, XWBBut1, WinProcs, WinTypes, Classes, Dialogs, Forms, Controls, StdCtrls,
ClipBrd, TRPCB, RpcbErr) to make the functions and procedures in those units available to wsockc.

1.2.2 Classes

A class, or class type, defines a structure consisting of fields, methods, and properties.

1.2.3 Objects

An object is a specific instance of that class with associated values.
1.2.4 Components

A component as defined by this document is a self-contained object with a well-defined interface defined by properties, methods, and events that makes it suitable for specialized purposes. Embarcadero Delphi documentation uses a more generic definition of component to refer to the elements within a class.

REF: For a more detailed description, see the Embarcadero Delphi for Windows User Guide.

1.2.5 Types

A type defines the possible range of values for a property or a method. A number of types are declared in the BDK, which you may need to make use of in the code. Some types and properties are public, some are private, and some are available only within the function or procedure in which they are defined.

NOTE: For sections describing types in this manual, the unit and declaration for each type, as well as a description of the type is also provided.

1.2.6 Methods

Delphi’s definition: “A method uses the same calling conventions as ordinary procedures and functions, except that every method has an additional implicit parameter “Self”, which is a reference to the instance or class in which the method is called. For example, clicking on a button invokes a method which changes the properties of the button.”

1.2.7 Routines: Functions and Procedures

Procedures and functions, referred to collectively as routines, are self-contained statement blocks that can be called from different locations in a program. Routines can either be functions or procedures. A function returns a value, and a procedure does not.

NOTE: For sections in this manual describing routines, the unit and declaration for each routine is listed, as well as a description of the routine is provided.

NOTE: In Delphi, routine is the generic term. It is not the same as a VistA M routine. In M, a routine is the file containing everything else, including functions and procedures. In Delphi, that would be called a Unit.

1.3 About this Version of the RPC Broker

RPC Broker 1.1 provides developers with the capability to develop VistA Client/Server software using the following RPC Broker Delphi components in a 32-bit environment (listed alphabetically):

- TCCOWRPCBroker Component
- TContextorControl Component
- TRPCBroker Component (original component)
- TXWBRichEdit Component
- TXWBSSOItoken Component
RPC Broker 1.1 supports IPv4/IPv6 dual-stack network addressing. It also supports 2-factor authentication (2FA) using Identity and Access Management (IAM) Secure Token Service (STS) delegated authentication.

To develop Delphi client VistA applications in a 32-bit environment you must have Delphi XE4 or newer. This version of the RPC Broker does not support Delphi versions older than XE4 and has been tested with versions up to and including Delphi 10 Berlin (10.1). This version of the RPC Broker does not allow you to develop new applications in older versions of Delphi or in a 16-bit environment. However, the RPC Broker routines on the VistA M Server continue to support VistA applications previously developed in the 16-bit environment.

NOTE: Applications developed using previous versions of the RPC Broker Development Kit (BDK) can be adapted to use Delphi XE8 or newer by renaming references to the “Hash” Unit to “XWBHash” to resolve a conflict with a new “Hash” Unit provided in Delphi XE8. Current versions of the BDK use the renamed XWBHash Unit.

The default installation of the RPC Broker creates a separate Broker Development Kit (BDK) directory (i.e., BDK32) that contains the required RPC Broker files for development.

CAUTION: This statement defines the extent of support relative to use of Delphi. The Office of Information and Technology (OI&T) only supports the Broker Development Kit (BDK) running in the currently offered version of Delphi and the immediately previous version of Delphi. This level of support became effective 06/12/2000.

Sites can continue to use outdated versions of the RPC Broker Development Kit, but do so with the understanding that support is not available and that continued use of outdated versions do not afford features that can be essential to effective client/server operations in the VistA environment. An archive of old (no longer supported) Broker Development Kits is maintained in the VA Intranet Broker Archive.

1.4 What’s New in the BDK

This section highlights the major changes made to the Broker Development Kit (BDK). Changes are listed by BDK patch release in reverse order (latest to earliest):

1.4.1 XWB*1.1*65

As of BDK Patch XWB*1.1*65, the following changes were made to RPC Broker 1.1:

Functionality Added or Modified:

- Support for 2-Factor Authentication (2FA)—The TRPCBroker Component provides Windows client support for 2-factor authentication using an IAM STS token. The user is authenticated into IAM with smart-card credentials:
  - Public Key Infrastructure (PKI) Certificate
  - Personal Identification Number (PIN)
The credentials are exchanged for a digitally signed token that is forwarded to VistA to authenticate and identify the user.

- Support for Later Delphi Versions—BDK supports Delphi 10 Berlin (10.1), 10 Seattle (10.0), XE8, XE7, XE6, XE5, and XE4.

**Components Added or Modified:**

- **TXWBSSOiToken Component**—Added this component to explicitly obtain an Identity and Access Management (IAM) Secure Token Service (STS) token for 2-factor user authentication and identification. It is used by the BAPI32.DLL to make the STS token available to non-RPC Broker applications. It is not needed for TRPCBroker or TCCOWRPCBroker applications, as the STS token is obtained and consumed internally for user authentication and identification.

- **TRPCBroker Component**—Modified to support 2-factor authentication by obtaining and using an IAM STS token.

**Library Methods Modified:**

- **Silent Login** Function—Used to authenticate into a VistA server without user interaction. It was modified to accept a new **lmSSOi** login mode. A silent login is used to authenticate into VistA with STS token credentials obtained from an earlier 2-factor authentication into IAM.

**Properties Added or Modified (listed by component/class):**

- **TXWBSSOiToken Component** Properties:
  - SSOiADUPN Property (TXWBSSOiToken Component) (Published)
  - SSOiLogonName Property (TXWBSSOiToken Component) (Published)
  - SSOiSECID Property (TXWBSSOiToken Component) (Published)
  - SSOiToken Property (TXWBSSOiToken Component) (Published)

- **TRPCBroker Component** Properties:
  - SSOiADUPN Property (TRPCBroker Component) (Public)
  - SSOiLogonName Property (TRPCBroker Component) (Public)
  - SSOiSECID (TRPCBroker Component) (Public)
  - SSOiToken Property (TRPCBroker Component) (Public)
  - Connected Property (Published)

**Types Modified:**

- **TLoginMode Type**
1.4.2 XWB*1.1*60

As of BDK Patch XWB*1.1*60, the following changes were made to RPC Broker 1.1:

**Functionality Added or Modified:**

- Support for IPv4/IPv6 Dual-Stack—The [TRPCBroker Component](#) provides Windows client support for IPv4/IPv6 dual-stack environment using new Application Programming Interfaces (APIs). This patch also upgrade from WinSock 1.1 to WinSock 2.2. By using this BDK for development of a Delphi client application, the application will be protocol independent and will be able to connect to both IPv4 and IPv6 VistA servers.

- Support for Later Delphi Versions—BDK supports Delphi XE7, XE6, XE5, and XE4.

**Components Deprecated (Removed):**

- TSharedBroker Component—Deprecated and removed the TSharedBroker component from RPC Broker 1.1. This component allowed applications to share a single Broker connection.

- TSharedRPCBroker Component—Deprecated and removed the TSharedRPCBroker component from RPC Broker 1.1. This component allowed applications to share a single Broker connection.

⚠️ **CAUTION:** The Shared Broker components have been deprecated and removed with RPC Broker Patch XWB*1.1*60. They were not widely used, and had proven to be difficult to maintain. They will not be updated to support IPv6 functionality or 2-factor authentication. Application developers are encouraged to migrate their applications to the standard TRPCBroker component when adding support for IPv6 and 2-factor authentication.

**Components Modified:**

**TRPCBroker Component:**

- Modified to upgrade Windows Sockets (WinSock) from Version 1.1 to Version 2.2.

- Modified to support IPv4/IPv6 dual-stack addressing for connection to a VistA server. Applications compiled with this BDK will be protocol independent and will be able to connect to both IPv4 and IPv6 VistA servers.

- Modified to support lookup to the Windows Registry for Secure Shell (SSH) configuration for connection to a VistA server.

- Deprecated and removed the old-style Broker (where VistA calls back to a different port on the client workstation when making a connection). Applications compiled with this BDK will use the new-style Broker (where VistA calls back to the originating port on the client workstation).

- Deprecated and removed the old-style Broker (where VistA calls back to a different port on the client workstation when making a connection). Applications compiled with this BDK will use the new-style Broker (where VistA calls back to the originating port on the client workstation).

**Library Methods Modified:**

**GetServerInfo Function**—Used to select the desired Server name and ListenerPort (see [ListenerPort Property](#)). Added a new **SSH Username** field when adding a new Server/ListenerPort combination. This field can be used to identify the Attachmate® Reflection/Micro Focus® SSH Username for SSH connection to the specified server.
Properties Deprecated (Removed; listed by component/class):

- **TRPCBroker Component** Properties:
  
The following TRPCBroker Component properties were deprecated, as the old-style Broker connection is no longer supported:
  
  - IsBackwardCompatibilityConnection Property (Deprecated)
  - IsNewStyleConnection Property (read-only) (Deprecated)
  - OldConnectionOnly Property (Deprecated)

- **TSharedBroker Component and TSharedRPCBroker Component** Properties:

  The following TSharedBroker Component and TSharedRPCBroker Component properties were deprecated, as the Shared Broker itself has been deprecated:
  
  - OnConnectionDropped Property (Deprecated)
  - OnLogout Property (Deprecated)

### 1.4.3 XWB*1.1*50

As of BDK Patch XWB*1.1*50, the following changes were made to RPC Broker 1.1:

#### Functionality Added or Modified:

- **Support for Secure Shell (SSH) Tunneling**—The TRPCBroker Component enabled Secure Shell (SSH) Tunnels to be used for secure connections. This functionality is controlled by setting an internal property value (mandatory SSH) or command line option at run time. Support is provided for the Attachmate® Reflection/Micro Focus® terminal emulator software using SSH tunneling for clients within the VA, and support is provided for PuTTY Link (Plink) for secure channels for clients outside the VA.

- **Support for Broker Security Enhancement (BSE)**—The TRPCBroker Component enabled visitor access to remote sites using authentication established at a home site.

- Support for Later Delphi Versions—BDK supports Delphi XE5, XE4, XE3, and XE2.

#### Components Added or Modified:

**TRPCBroker Component**:

- Modified to include support for Secure Shell (SSH) tunneling using Attachmate® Reflection/Micro Focus® Reflection SSH or PuTTY Link (Plink).

- Modified to include support for Broker Security Enhancement (BSE) modifications introduced in patch XWB*1.1*45.

- Modified by wrapping CCOW User Context into the primary TRPCBroker Component so that if the Contextor Property is set, then CCOW User Context is used.

**NOTE:** All of the CCOW functionality used by and for the TCCOWRPCBroker Component is still present, but it is now part of the regular TRPCBroker Component.

This means that there is no longer a need to have the separate TCCOWRPCBroker Component. The TCCOWRPCBroker Component is included separately in XWB*1.1*50 for backward compatibility.
Properties Added or Modified to the **TCCOWRPCBroker Component**:

- **SecurityPhrase Property** (Published)
- **SSHHide Property** (Published)
- **SSHport Property** (Public)
- **SSHpw Property** (Public)
- **SSHUser Property** (Public)
- **UseSecureConnection Property** (Published)

### 1.4.4 XWB*1.1*40

As of BDK Patch XWB*1.1*40, the following changes were made to RPC Broker 1.1:

**Functionality Added or Modified:**

Supports Single Sign-On/User Context (SSO/UC)—As of RPC Broker Patch XWB*1.1*40, the **TCCOWRPCBroker Component** enabled Single Sign-On/User Context (SSO/UC) in CCOW-enabled applications.


**Class Added:**

**TXWBWinsock Class**

**Components Added or Modified:**

- **TCCOWRPCBroker Component**—Allows applications to be CCOW-enabled and Single Sign-On/User Context (SSO/UC)-aware.
- **TContextorControl Component**—Communicates with the Vergence Locator service.

**Library Methods Added to the TCCOWRPCBroker Component:**

- **GetCCOWtoken Method**
- **IsUserCleared Method**
- **IsUserContextPending Method**
- **WasUserDefined Method**

**Properties Added or Modified (listed by component/class):**

- **TCCOWRPCBroker Component** Properties:
  - **CCOWLogonIDName Property** (read-only) (Public)
  - **CCOWLogonIDValue Property** (read-only) (Public)
  - **CCOWLogonName Property** (read-only) (Public)
  - **CCOWLogonNameValue Property** (read-only) (Public)
  - **CCOWLogonVpid Property** (read-only) (Public)
  - **CCOWLogonVpidValue Property** (read-only) (Public)
Types Added or Modified:

- **TLoginMode Type**
- TShowErrorMsgs (see **ShowErrorMsgs Property**)
- TOnLoginFailure (see **OnFailedLogin Property**)
- TOnRPCBFailure (see **OnRPCBFailure Property**)
- **TParamType**

**1.4.5 XWB*1.1*35**

As of BDK Patch XWB*1.1*35, the following changes were made to RPC Broker 1.1:

**Functionality Added or Modified:**

Supports Non-Callback Connections—The RPC Broker components are built with a UCX or non-callback Broker connection, so that it can be used from behind firewalls, routers, etc.

**Properties Added or Modified in the TRPCBroker Component:**

- **BrokerVersion Property (read-only)** (Public)
- **CurrentContext Property (read-only)** (Public)
- IsBackwardCompatibleConnection Property (Published; deprecated with XWB*1.1*60)
- IsNewStyleConnection Property (read-only) (Public; deprecated with XWB*1.1*60)
- **KernelLogIn Property** (Published)
- **LogIn Property** (Public)
- OldConnectionOnly Property (Published; deprecated with XWB*1.1*60)
- **OnRPCBFailure Property** (Public)
- **RPCBError Property (read-only)** (Public)
- **ShowErrorMsgs Property** (Public)
- **User Property** (Public)
1.4.6 XWB*1.1*26
As of BDK Patch XWB*1.1*26, the following changes were made to RPC Broker 1.1:

Components Added or Modified:

- TSharedBroker Component (component deprecated with XWB*1.1*60)—Added the TSharedBroker Component to RPC Broker 1.1. This component allows applications to share a single Broker connection.
- TSharedRPCBroker Component (component deprecated with XWB*1.1*60)—Added the TSharedRPCBroker Component to RPC Broker 1.1. This component allows applications to share a single Broker connection.

1.4.7 XWB*1.1*23
As of BDK Patch XWB*1.1*23, the following changes were made to RPC Broker 1.1:

Properties Added or Modified (listed by component/class):

TSharedBroker Component and TSharedRPCBroker Component Properties (components deprecated with XWB*1.1*60):

- AllowShared Property (Public; deprecated with XWB*1.1*60)
- OnConnectionDropped Property (Public; deprecated with XWB*1.1*60)
- OnLogout Property (Published; deprecated with XWB*1.1*60)

1.4.8 XWB*1.1*14
As of BDK Patch XWB*1.1*14, the following changes were made to RPC Broker 1.1:

- Separate Run-time and Design-time Packages:

  REF: For details and compiling instructions, see the “Design-time and Run-time Packages” section in the “Developer Considerations” section.

- Broker Source Code Released:

  The source code is located in the following directory:

  BDK32\Source

CAUTION: Modified BDK source code should not be used to create VistA GUI applications. For more details, see the “Developer Considerations” section.

Not all methods and properties found in the source code are documented at this time. Only those documented methods and properties are guaranteed to be made backwards compatible in future versions of the BDK.
1.4.9 XWB*1.1*13

As of BDK Patch XWB*1.1*13, the following changes were made to RPC Broker 1.1:

**Functionality Added or Modified:**

- Supports **Silent Login**—Provides functionality associated with the ability to make logins to a VistA M Server without the RPC Broker asking for Access and Verify code information.

- Documented Deferred RPCs and Capability to Run RPCs on a Remote Server:
  - Running RPCs on a Remote Server
  - Deferred RPCs

- Multi-instances of the RPC Broker—RPC Broker code was modified to permit an application to open two separate Broker instances with the same Server/ListenerPort (see **Server Property** and **ListenerPort Property**) combination, resulting in two separate partitions on the server. Previously, an attempt to open a second Broker instance ended up using the same partition. For this capability to be useful for concurrent processing, an application would have to use threads to handle the separate Broker sessions.

  ![](CAUTION: Although there should be no problems, the RPC Broker is not guaranteed to be thread safe.

- Operates in a 32-bit Microsoft® Windows environment.

**Classes Added:**

- **TVistaLogin Class**
- **TVistaUser Class**

**Component Added or Modified:**

**TXWBRichEdit Component**—This component replaced the Introductory Text Memo component on the Login Form. It permits URLs to be identified and launched.

**Library Methods Added to VCEdit Unit:**

- ChangeVerify Function
- SilentChangeVerify Function
- StartProgSLogin Method

**Library Methods Modified:**

- **CheckCmdLine Function**—Changed from procedure to function with a Boolean return value.

- **GetServerInfo Function**—Used to select the desired Server name and ListenerPort (see **ListenerPort Property**). It was modified to allow users to add a new Server/ListenerPort combination to those available for selection. It also accepts and stores a valid IP address, if no name is known for the location. This permits those who have access to other Server/ListenerPort combinations that may not be available in the list on the current workstation to access them. However, they still need a valid Access and Verify code to log on to the added location.

- **TParams Class**—Clear procedure was moved from Private to Public.
TRPCB Unit:

- TOnLoginFailure: Changed from Object: TObject, since this is what should be expected by the procedure if it is called.
- TOnRPCBFailure: Changed from Object: TObject, since this is what should be expected by the procedure if it is called.

Properties Added or Modified in TRPCBroker Component:

- BrokerVersion Property (read-only) (Public)
- CurrentContext Property (read-only) (Public)
- IsBackwardCompatibleConnection Property (Published; deprecated with XWB*1.1*60)
- IsNewStyleConnection Property (read-only) (Public; deprecated with XWB*1.1*60)
- KernelLogIn Property (Published)
- LogIn Property (Public)
- OldConnectionOnly Property (Published; deprecated with XWB*1.1*60)
- OnRPCBFailure Property (Public)
- RPCBError Property (read-only) (Public)
- ShowErrorMsgs Property
- User Property (Public)

Types Added or Modified:

- TLoginMode Type
- TShowErrorMsgs (see ShowErrorMsgs Property)
- TOnLoginFailure (see OnFailedLogin Property)
- TOnRPCBFailure (see OnRPCBFailure Property)
- TParamType

1.5 Developer Considerations

1.5.1 Source Code

As of RPC Broker Patch XWB*1.1*14, the RPC Broker source code was released. The release of the source code does not affect how a developer uses the Broker Components or other parts of the BDK.

⚠️ CAUTION: Modified BDK source code should not be used to create VistA GUI applications.

Suggestions for changes, bugs, and enhancements to the BDK should be done via the Service Desk Manager (SDM) support system for review and possible inclusion in a future patch.

The source code is located in the following directory:

BDK32\Source
1.5.2 Design-time and Run-time Packages

As of RPC Broker Patch XWB*1.1*14, the BDK has separate run-time and design-time packages. There is no longer a VistA Broker package. The new packages are:

- XWB_DXEn
- XWB_RXEn

Where:

- “D”—Design-time
- “R”—Run-time
- “XEn”—Delphi version with which it should be used

For example, XWB_DXEn5 is the design-time package for Delphi Version XE5.

Delphi 10 Seattle (10.0) and 10 Berlin (10.1) both use the XWB_RunTime and XWB_DesignTime packages. The run-time package should not be used to create executables that depend on a separate XWB_RXEn.bpl installed on client workstations. There is no procedure in place at this time to reliably install the correct version of the run-time bpl on client workstations.

⚠️ CAUTION: Do not compile your project so that it relies on dynamic linking with the BDK’s run-time package; that is, do not check the “Build with runtime packages” box on the “Packages” tab of the “Project Options’ dialogue.

1.5.3 Resource Reuse

Developers should be aware of existing resources that may be of use. These resources may be available nationally or through a particular project. Possibilities include:

- Delphi components, such as the VA FileMan Delphi components (FMDC).

**REF:** For more information on the VA FileMan Delphi components (FMDC), see the FMDC VA Intranet website.

- RPC Broker: Developer Tools
- Using an Existing M API

1.5.4 Component Connect-Disconnect Behavior

1.5.4.1 Connect

The first time one of the Broker components in your application connects, it establishes an actual connection with the server. The connection record is added to the list of all active connections for your application. This list is internal to the application and is completely under the control of the Broker component and is transparent to you. If another Broker component tries to connect to the same server/port, the existing connection record is found in the list and its socket is shared. The new connection is also added to this list. This process is repeated with each connection request.

1.5.4.2 Disconnect

When a Broker component disconnects, its connection record is removed from the internal list of active connections. If it happens to be the last record for the particular server/port combination, the connection is
actually closed. This scheme provides the illusion of multiple connections without “clogging up” the server.

1.6 Application Considerations

1.6.1 Application Version Numbers

There may be a need to set or pass application version numbers. The suggested format is as follows:

VersionNumber_PatchNumber (3 digits)

For example, Patch 22 of Version 8.2 would be formatted as follows:

8.2_022

1.6.2 Deferred RPCs

In order to increase efficiency, applications can run RPCs in the background.

REF: For more information on Deferred RPCs, see the “Deferred RPCs” section.

1.6.3 Remote RPCs

In order to work with patient data across sites, applications can run RPCs on a remote server.

REF: For more information on running RPCs on a remote server, see the “Running RPCs on a Remote Server” section.

1.6.4 Blocking RPCs

Applications can install RPCs that should be used only in certain contexts. It is possible to block access to an RPC.

REF: For more information on blocking access to an RPC, see the “Blocking an RPC” section.

1.6.5 Silent Login

In special cases, applications can use one of three types of Silent Login to log in users without the RPC Broker prompting for login information.

1.7 Online Help

Distribution of the BDK includes online help, which provides an overview of development with the RPC Broker (e.g., components, properties, methods, etc.).

The help is distributed in two zip files:

- Broker_1_1.zip (i.e., Broker_1_1.chm)—This zip file contains the standalone online HTML help file. Unzip the contents and double-click on the Broker_1_1.chm file to open the help.
- Broker_1_1-HTML_Files.zip—This zip file contains the associated HTML help files. Unzip the contents in the same directory and double-click on the index.htm file to open the help.

NOTE: You can make an entry for Broker_1_1.chm in Delphi’s Tools Menu to make it easily accessible from within Delphi. To do this, use Delphi’s Tools | Configure Tools option and create a new menu entry (see Figure 1).
Figure 1: Delphi XE4 Tool Properties Dialogue: RPC Broker Help File Entry
2 RPC Broker Components, Classes, Units, Methods, Types, and Properties

2.1 Components

2.1.1 TCCOWRPCBroker Component

- Properties (All)
- Methods
- Example

2.1.1.1 Parent Class

TRPCBroker = class(TComponent)

2.1.1.2 Unit

CCOWRPCBroker.pas

2.1.1.3 Description

The TCCOWRPCBroker component (CCOWRPCBroker.pas) is derived from the existing TRPCBroker Component. The TCCOWRPCBroker component (Trpcb.pas) allows VistA application developers to make their applications CCOW-enabled and Single Sign-On/User Context (SSO/UC)-aware with all of the client/server-related functionality in one integrated component. Using the TCCOWRPCBroker component, an application can share User Context stored in the CCOW Context Vault.

When a VistA CCOW-enabled application is recompiled with the TCCOWRPCBroker component and other required code modifications are made, that application becomes SSO/UC-aware and capable of CCOW single sign-on (SSO).

**REF:** For more detailed information on the application developer procedures and code modifications needed to make CCOW-enabled RPC Broker-based applications SSO/UC aware, see the “RPC Broker-based Client/Server Applications” section in the “Making VistA Applications SSO/UC-aware” chapter in the Single Sign-On User Context (SSO/UC) Deployment Guide.

**NOTE:** Properties inherited from the parent component (i.e., TComponent) are not discussed in this manual (only those properties added to the parent component are described). For help on inherited properties, see Delphi’s documentation on the parent component (i.e., TComponent).

**REF:** For help on inherited properties, see the parent component (i.e., TRPCBroker Component).
### 2.1.1.4 Properties (All)

- **Properties (Unique)**

Table 4 lists all properties available with the **TCCOWRPCBroker Component** (includes those properties inherited from the parent **TRPCBroker Component**):

**Table 4: TCCOWRPCBroker Component—All Properties (listed alphabetically)**

<table>
<thead>
<tr>
<th>Read-only</th>
<th>Run-time only</th>
<th>Property</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>BrokerVersion Property (read-only)</td>
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<tr>
<td></td>
<td></td>
<td>CCOWLogonIDName Property (read-only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCOWLogonIDValue Property (read-only)</td>
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<td>CCOWLogonName Property (read-only)</td>
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<td></td>
<td>CCOWLogonVpid Property (read-only)</td>
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<td></td>
<td></td>
<td>CCOWLogonVpidValue Property (read-only)</td>
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<td></td>
<td>ClearParameters Property</td>
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<td></td>
<td></td>
<td>ClearResults Property</td>
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<td></td>
<td>Connected Property</td>
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<td></td>
<td>Contextor Property</td>
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<td></td>
<td></td>
<td>CurrentContext Property (read-only)</td>
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<tr>
<td></td>
<td></td>
<td>DebugMode Property</td>
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<td></td>
<td></td>
<td>KernelLogIn Property</td>
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<td>ListenerPort Property</td>
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<td>LogIn Property</td>
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<td></td>
<td>OnRPCBFailure Property</td>
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<tr>
<td></td>
<td></td>
<td>Param Property</td>
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<td></td>
<td></td>
<td>RemoteProcedure Property</td>
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<tr>
<td></td>
<td></td>
<td>Results Property</td>
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<tr>
<td></td>
<td></td>
<td>RPCBError Property (read-only)</td>
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<td>RPCTimeLimit Property</td>
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<td>RPCVersion Property</td>
</tr>
<tr>
<td>Read-only</td>
<td>Run-time only</td>
<td>Property</td>
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<td>-----------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SecurityPhrase Property</td>
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<td></td>
<td>Server Property</td>
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<td></td>
<td>ShowErrorMsgs Property</td>
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<td></td>
<td></td>
<td>Socket Property (read-only)</td>
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<td>SSHHide Property</td>
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<td>SSHport Property</td>
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<td></td>
<td></td>
<td>SSHpw Property</td>
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<td></td>
<td></td>
<td>SSHUser Property</td>
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<tr>
<td></td>
<td></td>
<td>SSOIToken Property (TRPCBroker Component)</td>
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<tr>
<td></td>
<td></td>
<td>SSOiSECID (TRPCBroker Component)</td>
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<td></td>
<td>SSOiADUPN Property (TRPCBroker Component)</td>
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<tr>
<td></td>
<td></td>
<td>SSOiLogonName Property (TRPCBroker Component)</td>
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<tr>
<td></td>
<td></td>
<td>User Property</td>
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<tr>
<td></td>
<td></td>
<td>UseSecureConnection Property</td>
</tr>
</tbody>
</table>

2.1.1.5 Properties (Unique)

- **Properties (All)**

Table 5 lists the unique properties available with the TCCOWRPCBroker Component:

<table>
<thead>
<tr>
<th>Read-only</th>
<th>Run-time only</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>CCOWLogonIDName Property (read-only)</td>
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<tr>
<td></td>
<td></td>
<td>CCOWLogonIDValue Property (read-only)</td>
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<td></td>
<td>CCOWLogonName Property (read-only)</td>
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<td></td>
<td>CCOWLogonNameValue Property (read-only)</td>
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<tr>
<td></td>
<td></td>
<td>CCOWLogonVpid Property (read-only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCOWLogonVpidValue Property (read-only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contextor Property</td>
</tr>
</tbody>
</table>
NOTE: Since the TCCOWRPCBroker Component is a class derived from the TRPCBroker Component, it contains all of the Properties (All), Methods, etc., of its parent.

2.1.1.6 Methods
- GetCCOWtoken Method
- IsUserCleared Method
- IsUserContextPending Method
- WasUserDefined Method

2.1.1.7 Example
For examples, see the Samples directory on the use of the TCCOWRPCBroker Component; located in the following directory:

BDK32\Samples\BrokerEx

2.1.2 TContextorControl Component
As of RPC Broker Patch XWB*1.1*40, the TContextorControl component was added to RPC Broker 1.1.

2.1.2.1 Parent Class
TRPCBroker = class(TOleServer)

2.1.2.2 Unit
TRPCB Unit

2.1.2.3 Description
The TContextorControl component provides Delphi developers with access to the CCOW Vergence Locator service.
2.1.3 TRPCBroker Component

- Properties (All)
- Methods
- Example

2.1.3.1 Parent Class

TRPCBroker = class(TComponent)

2.1.3.2 Unit

TRPCB Unit

2.1.3.3 Description

The TRPCBroker component provides Delphi developers with an easy, object-based access to the Broker. It is compatible with the Delphi object oriented (OO) environment. This component, when placed on a Delphi form, allows applications to connect to the VistA M Server and reference M data within Delphi’s Integrated Development Environment (IDE). It makes a Delphi form and everything on it “data aware.”

The TRPCBroker component (Trpcb.pas) provides VistA application developers with all of the client/server-related functionality in one integrated component. Using the TRPCBroker component, an application can connect to the VistA M Server by simply setting the Connected Property to True. Remote procedures on the server can be executed by preparing the Param Property and RemoteProcedure Property and invoking any of the following methods:

- Call Method
- strCall Method
- lstCall Method

The TRPCBroker component can be found on the Kernel tab in the component palette.

NOTE: Properties inherited from the parent component (i.e., TComponent) are not discussed in this manual (only those properties added to the parent component are described). For help on inherited properties, see Delphi’s documentation on the parent component (i.e., TComponent).

2.1.3.4 Support for Secure Shell (SSH) Tunneling

As of RPC Broker Patch XWB*1.1*50 support was added for a Secure Shell (SSH) tunneling service to provide secure data transfer between the client and the VistA M Server.

The Attachmate® Reflection/Micro Focus® Reflection terminal emulator software with SSH tunneling is used inside the VA to provide secure data transfer between the client and the VistA M Server. SSH tunneling is also supported for PuTTY Link (Plink) for those using VistA outside of the VA.

For SSH tunneling using Reflection, either set a command line option or a property within the application. SSH is enabled if the UseSecureConnection Property is set to “secureAttachmate”. SSH is also enabled if either of the following command line parameters are set:

- SSHPort=portnumber (to specify a particular port number—if not specified, it uses the port number for the remote server).
- SSHUUser=username (for the remote server, where username is of the form xxxvista, where the xxx is the station’s three letter abbreviation).
For SSH tunneling using Plink.exe, either set a command line option or a property within the application. SSH is enabled if the `UseSecureConnection` property is set to “securePlink”. SSH is also enabled if the following command line parameter is set:

```
SSHpw=password
```

2.1.3.5 Support for Broker Security Enhancement (BSE)

As of RPC Broker Patch XWB*1.1*45, the RPC Broker supports the Broker Security Enhancement (BSE). The TRPCBroker component was modified to enable visitor access to remote sites using authentication established at a home site.

2.1.3.6 CCOW User Context Wrapped into the Primary TRPCBroker Component

As of RPC Broker Patch XWB*1.1*50, the RPC Broker wraps CCOW User Context into the primary TRPCBroker component so that if the `Contextor Property` is set, then CCOW User Context is used. This means that there is no longer a need to have the separate `TCCOWRPCBroker Component`.

NOTE: All of the functionality used by and for the `TCCOWRPCBroker Component` is still present, but it is now part of the regular TRPCBroker component.

2.1.3.7 Properties (All)

Table 6 lists all of the properties available with the TRPCBroker Component:

<table>
<thead>
<tr>
<th>Read-only</th>
<th>Run-time only</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><code>BrokerVersion Property (read-only)</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>CCOWLogonIDName Property (read-only)</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>CCOWLogonIDValue Property (read-only)</code></td>
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<td><code>CCOWLogonName Property (read-only)</code></td>
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<td><code>CCOWLogonNameValue Property (read-only)</code></td>
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<td><code>CCOWLogonVpid Property (read-only)</code></td>
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<td></td>
<td></td>
<td><code>CCOWLogonVpidValue Property (read-only)</code></td>
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<td></td>
<td><code>ClearParameters Property</code></td>
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<td><code>ClearResults Property</code></td>
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<td><code>Connected Property</code></td>
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<td><code>Contextor Property</code></td>
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<td></td>
<td></td>
<td><code>CurrentContext Property (read-only)</code></td>
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<td></td>
<td></td>
<td><code>DebugMode Property</code></td>
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<td></td>
<td></td>
<td><code>KernelLogIn Property</code></td>
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<td></td>
<td><code>ListenerPort Property</code></td>
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<td></td>
<td></td>
<td><code>LogIn Property</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>OnRPCBFailure Property</code></td>
</tr>
</tbody>
</table>
### 2.1.3.8 Methods

- Call Method
- CreateContext Method
- GetCCOWtoken Method
- IsUserCleared Method
- IsUserContextPending Method
- lstCall Method
- pchCall Method
- strCall Method
- WasUserDefined Method
2.1.3.9 Example

The following example demonstrates how a TRPCBroker Component can be used to:

2. Execute various remote procedures.
3. Return the results.
4. Disconnect from the server.

The example in Figure 2 assumes that a TRPCBroker Component already exists on the form as brkrRPCBroker1:

![Figure 2: TRPCBroker Component—Example](image)

```
procedure TForm1.Button1Click(Sender: TObject);
begin
  try
    {connect to the server}
    brkrRPCBroker1.Connected := True;
    //assign RPC name
    brkrRPCBroker1.RemoteProcedure := 'SOME APPLICATION RPC';
    {make the call}
    brkrRPCBroker1.Call;
    {display results}
    ListBox1.Items := brkrRPCBroker1.Results;
    {disconnect from the server}
    brkrRPCBroker1.Connected := False;
  except
    //put error handling code here
  end;
end;
```

**REF:** For more examples, see the Samples directory on the use of the TRPCBroker Component; located in the following directory:

BDK32\Samples\BrokerEx
2.1.4 TXWBRichEdit Component

Property

2.1.4.1 Parent Class
TXWBRichEdit = class(TComponent)

2.1.4.2 Unit
XwbRich20

2.1.4.3 Description
The TXWBRichEdit component replaces the Introductory Text Memo component on the Login Form. TXWBRichEdit (XwbRich20.pas) is a version of the TRichEdit component that uses Version 2 of Microsoft’s RichEdit Control and adds the ability to detect and respond to a Uniform Resource Locator (URL) in the text. This component permits developers to provide some requested functionality on the login form. As an XWB namespaced component, it was required to be put on the Kernel tab of the component palette; however, it rightly belongs on the Win32 tab.

NOTE: Properties inherited from the parent component (i.e., TComponent) are not discussed in this manual (only those properties added to the parent component are described). For help on inherited properties, refer to Delphi’s documentation on the parent component (i.e., TComponent).

2.1.4.4 Property
The following is the TXWBRichEdit Component property:

URLDetect Property

2.1.5 TXWBSSOiToken Component

- Properties (All)
- Example

2.1.5.1 Parent Class
TXWBSSOiToken = class(TComponent)

2.1.5.2 Unit
XWBSSOi Unit

2.1.5.3 Description
The TXWBSSOiToken component provides Delphi developers with an easy, object-based access to an Identity and Access Management (IAM) Secure Token Service (STS) token. It is compatible with the Delphi object oriented (OO) environment. This component, when placed on a Delphi form, allows applications to authenticate a user with the IAM STS Server and exchange the user’s 2-factor authentication (Public Key Infrastructure [PKI] certificate and Personal Identification Number [PIN]) credentials for a STS token.

The TXWBSSOiToken component (XWBSSOi.pas) does not need to be explicitly added to RPC Broker applications for 2-factor authentication (2FA) into VistA, but is available should authentication be required into another system that accepts the STS token.

The TXWBSSOi component can be found on the Kernel tab in the component palette.
NOTE: Properties inherited from the parent component (i.e., TComponent) are not discussed in this manual (only those properties added to the parent component are described). For help on inherited properties, see Delphi’s documentation on the parent component (i.e., TComponent).

2.1.5.4 Properties (All)

Table 7 lists all of the properties available with the TXWBSSOiToken Component:

<table>
<thead>
<tr>
<th>Read-only</th>
<th>Run-time only</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SSOiToken Property (TXWBSSOiToken Component)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SSOiADUPN Property (TXWBSSOiToken Component)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SSOiLogonName Property (TXWBSSOiToken Component)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SSOiSECID Property (TXWBSSOiToken Component)</td>
</tr>
</tbody>
</table>

2.1.5.5 Example

The following example demonstrates how a TXWBSSOiToken Component can be used to:

1. Create (obtain) an IAM STS token.
2. Assign the token and user values to strings.
3. Delete the token (free up memory).

The example in Figure 3 assumes that a TXWBSSOiToken Component already exists on the form as mySSOiToken:

```
procedure TForm1.Button1Click(Sender: TObject; myToken: String; myName: String);
begin
  try
    {authenticate to the server}
    mySSOiToken := TXWBSSOiToken.Create(nil);
    //assign token values to strings
    myToken := mySSOiToken.SSOiToken;
    myName := mySSOiToken.SSOiLogonName;
    {release the memory used by the token}
    mySSOiToken.Free;
  except
    //put error handling code here
  end;
end;
```
2.2 Classes

2.2.1 TMult Class

- Properties
- Methods
- Example

2.2.1.1 Unit

TRPCB Unit

2.2.1.2 Description

The TMult class is used whenever a list of multiple values needs to be passed to a remote procedure call (RPC) in a single parameter. The Mult Property of a parameter is of TMult type. The information put in the TMult variable is really stored in a TStringList, but the access methods (used to read and write) take strings as subscripts and provide the illusion of a string-subscripted array.

It is important to note that items in a TMult class may or may not be sorted. If the Sorted Property is:

- False (default)—Items are stored in the order they are added.
- True—Items are stored in ascending alphabetical order by subscripts.

If you attempt to reference an element by a nonexistent subscript you get an error in the form of a Delphi exception. Do not forget that M syntax dictates that all strings must be surrounded by double quotes. So, if your goal is to pass a string subscripted array of strings using TMult as a parameter to an RPC on the VistA M Server, do not forget to surround each of the subscripts and their associated values with double quotes ("). Otherwise, M assumes that you are passing a list of variables and attempts to reference them, which is probably not what you want.

2.2.1.3 Properties

The following are the TMult Class properties:

- Count Property (TMult Class)
- First Property
- Last Property
- MultArray Property
- Sorted Property

2.2.1.4 Methods

The following are the TMult Class methods:

- Assign Procedure (TMult Class)
- Order Function
- Position Function
- Subscript Function
2.2.1.5 Example

The program code in Figure 4 demonstrates how to store and retrieve elements from a TMult variable:

```pascal
procedure TForm1.Button1Click(Sender: TObject);
var
    Mult: TMult;
    Subscript: string;
begin
    {Create Mult. Make Form1 its owner}
    Mult := TMult.Create(Form1);
    {Store element pairs one by one}
    Mult['First'] := 'One';
    Mult['Second'] := 'Two';
    {Use double quotes for M strings}
    Mult['"First"'] := '"One"';
    {Label1.Caption gets "One"}
    Label1.Caption := Mult['"First"'];
    {Error! 'Third' subscripted element was never stored}
    Label1.Caption := Mult['Third'];
end;
```

2.2.2 TParamRecord Class

- Properties
- Example

2.2.2.1 Unit

TRPCB Unit

2.2.2.2 Description

The TParamRecord Class is used to hold all of the information on a single RPC parameter. Depending on the type of the parameter needed, different properties are used. The PType Property is always used to let the Broker on the VistA M Server know how to interpret the parameter. For a single value parameter, the Value Property should be used. In the case of a list or a word-processing text, use the Mult Property.

The TParamRecord relationship to the TRPCBroker Component is as follows:

The TRPCBroker Component contains the Param Property (i.e., TParams Class).

The TParams Class contains the ParamArray property (array [I:integer]: TParamRecord Class).

The TParamRecord Class contains the Mult Property (i.e., TMult Class).

The TMult Class contains the MultArray property (array[S: string]: string).

The MultArray property internally uses a TStringList in which each element’s object is a TString.

CAUTION: Developers should rarely need to use TParamRecord by itself in their code. TParamRecord is the type of the elements in the ParamArray, default array property of the TRPCBroker Component Param Property. This means that when you are working with a Param[x] element, you are in reality working with an instance of TParamRecord.
2.2.2.3 Properties

The following are the TParamRecord Class properties:

- Mult Property
- PType Property
- Value Property

2.2.2.4 Example

The program code in Figure 5 demonstrates how you can use a TParamRecord variable to save a copy of a single parameter of a TRPCBroker Component. This example assumes that prior to calling this procedure, a TRPCBroker variable has been created and some parameters have been set up. Pay close attention to how properties are copied one at a time. This is the only way that a separate copy could be created. If you try to simply assign one of the TRPCBroker parameters to the TParamRecord variable, you simply re-point the TParamRecord variable to that parameter:

```pascal
procedure TForm1.Button1Click(Sender: TObject);
var
  ParamRecord: TParamRecord;
begin
  (Create ParamRecord. Make Form1 its owner)
  ParamRecord := TParamRecord.Create(Form1);
  (Store properties one at a time)
  ParamRecord.Value := RPCBroker.Param[0].Value;
  ParamRecord.PType := RPCBroker.Param[0].PType;
  (This is how to copy a Mult)
  ParamRecord.Mult.Assign(RPCBroker.Param[0].Mult);
end;
```

2.2.3 TParams Class

- Properties
- Methods
- Example

2.2.3.1 Unit

TRPCB Unit

2.2.3.2 Description

The TParams class is used to hold parameters (i.e., array of TParamRecord) used in a remote procedure call (RPC). You do not need to know in advance how many parameters you need or allocate memory for them; a simple reference or an assignment to a parameter creates it.

The Clear procedure can be used to remove/clear data from TParams.

NOTE: Previously, this procedure was Private, but as of Patch XWB*1.1*13, it was made Public.
2.2.3.3 Properties
The following are the TParams Class properties:

- Count Property (TParams Class)
- ParamArray Property

2.2.3.4 Methods
The following are the TParams Class methods:

- Assign Procedure (TParams Class)
- Clear Procedure

2.2.3.5 Example
The program code in Figure 6 demonstrates how a TParams Class can be used to save off the TRPCBroker Component parameters and restore them later:

```
procedure TForm1.Button1Click(Sender: TObject);
var
    SaveParams: TParams;
    SaveRemoteProcedure: string;
begin
    {create holding variable with Form1 as owner}
    SaveParams := TParams.Create(self);
    {save parameters}
    SaveParams.Assign(brkrRPCBroker1.Param);
    SaveRemoteProcedure := brkrRPCBroker1.RemoteProcedure;
    brkrRPCBroker1.RemoteProcedure := 'SOME OTHER PROCEDURE';
    brkrRPCBroker1.ClearParameters := True;
    brkrRPCBroker1.Call;
    {restore parameters}
    brkrRPCBroker1.Param.Assign(SaveParams);
    brkrRPCBroker1.RemoteProcedure := SaveRemoteProcedure;
    {release memory}
    SaveParams.Free;
end;
```

2.2.4 TVistaLogin Class

Properties

2.2.4.1 Unit
TRPCB Unit

2.2.4.2 Description
The TVistaLogin class is used to hold login parameters for Silent Login.

REF: For examples of silent logon by passing Access and Verify codes, see the “Silent Login Examples” section.
2.2.4.3 Properties

Table 8 lists all of the properties available with the TVistaLogin Class:

Table 8: TVistaLogin Class—All Properties (listed alphabetically)

<table>
<thead>
<tr>
<th>Read-only</th>
<th>Run-time only</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AccessCode Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Division Property (TVistaLogin Class)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DivList Property (read-only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DomainName Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DUZ Property (TVistaLogin Class)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ErrorText Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IsProductionAccount Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LoginHandle Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mode Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MultiDivision Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NTToken Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OnFailedLogin Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PromptDivision Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VerifyCode Property</td>
</tr>
</tbody>
</table>

2.2.5 TVistaUser Class

Properties

2.2.5.1 Unit

TRPCB Unit

2.2.5.2 Description

The TVistaUser class is used to hold parameters related to the current user. These parameters are filled in as part of the login procedure.

NOTE: This class is used as a property by the TRPCBroker class. This property, with its associated data, is available to all applications, whether or not they are using a Silent Login.
### 2.2.5.3 Properties

Table 9 lists all of the properties available with the TVistaUser Class:

**Table 9: TVistaUser Class—All Properties (listed alphabetically)**

<table>
<thead>
<tr>
<th>Read-only</th>
<th>Run-time only</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Division Property (TVistaUser Class)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DTime Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DUZ Property (TVistaUser Class)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Language Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Name Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ServiceSection Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>StandardName Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Title Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VerifyCodeChngd Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vpid Property</td>
</tr>
</tbody>
</table>

### 2.2.6 TXWBWinsock Class

#### 2.2.6.1 Unit

**TRPCB Unit**

#### 2.2.6.2 Description

The code handling connections and transmission was moved into the TXWBWinsock class, which is defined in wsockc.pas. It facilitates the ability for making and maintaining multiple independent RPC Broker connections. To get around cyclic issues with the `Uses` clause, XWBWinsock within Trpcb.pas is defined as TObject and must be cast to TXWBWinsock when it is used.

The methods in the wsockc.pas unit were originally library methods or methods not associated with a class. To ensure that the TCCOWRPCBroker Component is thread-safe (i.e., thread safe operation of RPC Broker instances created in different threads), it became necessary for each instance of the TRPCBroker to have its own instance of these methods, values, etc. Thus, the TXWBWinsock class was created to encapsulate the Public members.

Methods within the TXWBWinsock class should not be referenced directly. Connections to VistA are made by setting the TVistaLogin `Connected Property` to “true” and ended by setting the `Connected Property` to “false”.
2.3 Units

CAUTION: Not all units found in the source code are documented at this time. Only those documented methods and properties are guaranteed to be made backwards compatible in future versions of the BDK.

The following Units are described in this document (listed alphabetically):

- **CCOWRPCBroker Unit**
- **LoginFrm Unit**
- **MFunStr Unit**
- **RPCConf1 Unit**
- **RpcSLogin Unit**
- **SplVista Unit**
- **TRPCB Unit**
- **VCEdit Unit**
- **Wsockc Unit**
- **XWBHash Unit**
- **XWBSSOi Unit**

### 2.3.1 CCOWRPCBroker Unit

The CCOWRPCBroker unit authenticates a user using CCOW user context.

#### 2.3.1.1 Library Method

**AuthenticateUser Procedure**

> REF: To see a listing of items declared in this unit including their declarations, use the ObjectBrowser.

### 2.3.2 LoginFrm Unit

As of Patch XWB*1.1*13, a “Change VC” check box was added to the to the login form. The user can use this check box to indicate that she/he wants to change their Verify code. If this box has been checked, after the user has completed logging in to the system, the Change Verify code dialogue is displayed.

> REF: To see a listing of items declared in this unit including their declarations, use the ObjectBrowser.
2.3.3 MFunStr Unit

The MFunStr unit contains Delphi functions that emulate MUMPS functions.

2.3.3.1 Library Methods

- Piece Function
- Translate Function

REF: To see a listing of items declared in this unit including their declarations, use the ObjectBrowser.

2.3.4 RPCConf1 Unit

The RPCConf1 unit contains server selection dialogue.

CAUTION: This unit assumes that a single IP address is assigned to a host. That is no longer a reasonable assumption in a modern computing environment. These functions are expected to be deprecated and replaced in future versions of the BDK.

2.3.4.1 Library Methods

- GetServerInfo Function
- GetServerIP Function
- IsIPAddress Function

REF: To see a listing of items declared in this unit including their declarations, use the ObjectBrowser.

2.3.5 RpcSLogin Unit

The RpcSLogin unit contains silent login functionality.

2.3.5.1 Library Methods

- CheckCmdLine Function
- GetSessionInfo Procedure
- GetUserInfo Procedure
- SilentLogIn Function
- StartProgSLogin Procedure
- ValidAppHandle Function
- ValidAVCodes Function
- ValidNTToken Function

REF: To see a listing of items declared in this unit including their declarations, use the ObjectBrowser.
REF: For more information on silent login, see the “Silent Login” section.

2.3.6  SplVista Unit

The SplVista unit displays the VistA splash screen.

2.3.6.1  Library Methods

- SplashOpen Procedure
- SplashClose Procedure

REF: For more information on splash screens, see the “VistA Splash Screen Procedures” section.

REF: To see a listing of items declared in this unit including their declarations, use the ObjectBrowser.

2.3.7  TRPCB Unit

The TRPCB unit contains the declarations for the various RPC Broker components.

When you add a component declared in this unit to a form, the unit is automatically added to the uses clause of that form’s unit.

The following items are automatically declared in the uses clause:

```
SysUtils, WinTypes, WinProcs, Messages, Classes, Graphics, Controls, Forms, Dialogs
```

2.3.7.1  Classes

- TParamRecord Class
- TParams Class
- TVistaLogin Class
- TVistaUser Class

2.3.7.2  Component

TRPCBroker Component

2.3.7.3  Library Methods

- GetAppHandle
- TMult Class Methods
- TParams Class Method
- TRPCBroker Component Methods
2.3.7.4 Types

- EBrokerError
- TLoginMode Type
- TParamType

**REF:** To see a listing of items declared in this unit including their declarations, use the ObjectBrowser.

2.3.8 VCEdit Unit

The RPC Broker calls the VCEdit unit at logon when users must change their Verify code (i.e., Verify code has expired). There is also a check box on the Signon form that allows users to change their Verify code at any time.

2.3.8.1 Library Methods

- ChangeVerify Function
- SilentChangeVerify Function

**REF:** To see a listing of items declared in this unit including their declarations, use the ObjectBrowser.

2.3.9 Wsockc Unit

The Wsockc unit contains the interface to the Microsoft® Windows operating system TCP/IP network interface. It provides the communications between the RPC Broker GUI and the VistA M Server.

When a component declared in this unit is added to a form, the unit is automatically added to the uses clause of that form’s unit.

The following items are automatically declared in the uses clause:

```
AnsiStrings, SysUtils, Classes, Windows, WinTypes, WinProcs, Winsock2, Xwbut1, Trpcb, RpcbErr, Dialogs, Forms, Controls, StdCtrls, ClipBrd
```

2.3.9.1 Component

TXWBWinsock Component

**REF:** To see a listing of items declared in this unit including their declarations, use the ObjectBrowser.
2.3.10 XWBHash Unit

2.3.10.1 Library Methods

- Encrypt Function
- Decrypt Function

REF: For more information on encryption/decryption functions, see the “Encryption Functions” section.

REF: To see a listing of items declared in this unit including their declarations, use the ObjectBrowser.

2.3.11 XWBSSOi Unit

The XWBSSOi unit contains the interface to the Identity and Access Management (IAM) Secure Token Service (STS) server.

When a component declared in this unit is added to a form, the unit is automatically added to the uses clause of that form’s unit.

The following items are automatically declared in the uses clause:

```
Messages, Windows, Classes, SysUtils, Variants, Controls, Dialogs, Forms, Graphics, OleCtrls, MSHTML, SHDocVw, MFunStr, XWBut1
```

2.3.11.1 Component

TXWBSSOiToken Component

REF: To see a listing of items declared in this unit including their declarations, use the ObjectBrowser.
2.4 Methods

2.4.1 Assign Method (TMult Class)

2.4.1.1 Applies to
TMult Class

2.4.1.2 Declaration

```plaintext
procedure Assign(Source: TPersistent);
```

2.4.1.3 Description

The Assign method for a TMult Class takes Tstrings, a TStringList, or another TMult. In the case where the source is a TMult, the owner of the Assign method gets the exact copy of the source with all string subscripts and values. In the case where the source is a Tstrings or a TStringList, the items are copied such that the strings property of each item becomes the Value, while the index becomes the subscript in the string form.

REF: For information about the size of parameters and results that can be passed to and returned from the TMult Class, see the “RPC Limits” section.

2.4.1.4 Example

2.4.1.4.1 TMult Assign Method—Assigning listbox Items to a TMULT

To assign listbox items to a TMult, do the following:

1. Start a new VCL Forms application.
2. Drop one TListBox, one TMemo, and one TButton on the form. Arrange controls as in Figure 8.
3. Add Vcl.StdCtrls and TRPCB to the “uses” clause.
4. Copy the code in Figure 7 to the Button1.OnClick event:
Figure 7: TMult Assign Method—Code Added to the Button1.OnClick Event

```pascal
procedure TForm1.Button1Click(Sender: TObject);
var
  Mult1: TMult;
  Subscript: string;
begin
  //Create Mult1. Make Form1 its owner
  Mult1 := TMult.Create(Form1);

  //Fill listbox with some strings
  ListBox1.Items.Add('One');
  ListBox1.Items.Add('Two');
  ListBox1.Items.Add('Three');
  ListBox1.Items.Add('Four');
  ListBox1.Items.Add('Five');

  //assign (copy) listbox strings to Mult
  Mult1.Assign(ListBox1.Items);

  //configure memo box for better display
  Memo1.Font.Name := 'Courier';
  Memo1.Lines.Clear;
  Memo1.Lines.Add('Tstrings assigned:');

  //set a starting point
  Subscript := '';
  repeat
    //get next Mult element
    Subscript := Mult1.Order(Subscript, 1);
    //if not the end of list
    if Subscript <> '' then
      //display subscript
      Memo1.Lines.Add(Format('%10s', [Subscript]) + ' - ' + Mult1[Subscript])

    //stop when reached the end
    until Subscript = ''
end;
```
5. Run the project and click on the button.

The expected output is shown in Figure 8:

**Figure 8: TMult Assign Method—Assigning listbox Items to a TMULT: Sample Form Output**
2.4.1.4.2 TMult Assign Method—Assigning One TMULT to Another

The program code in Figure 9 demonstrates the use of the TMult assign method to assign one TMult to another:

1. Start a new VCL Forms application.
2. Drop one TMemo and one TButton on the form. Arrange controls as in Figure 10.
3. Add Vcl.StdCtrls and TRPCB to the “uses” clause.
4. Copy the code in Figure 9 to the Button1.OnClick event:

```
procedure TForm1.Button1Click(Sender: TObject);
var
  Mult1, Mult2: TMult;
  Subscript: string;
begin
  //Create Mult1. Make Form1 its owner
  Mult1 := TMult.Create(Form1);
  //Create Mult2. Make Form1 its owner
  Mult2 := TMult.Create(Form1);

  //Fill Mult1 with some strings
  Mult1['First'] := 'One';
  Mult1['Second'] := 'Two';
  Mult1['Third'] := 'Three';
  Mult1['Fourth'] := 'Four';
  Mult1['Fifth'] := 'Five';

  //assign (copy) Mult1 strings to Mult2
  Mult2.Assign(Mult1);

  //configure memo box for better display
  Memo1.Font.Name := 'Courier';
  Memo1.Lines.Clear;
  Memo1.Lines.Add('TMult assigned:');

  //set a starting point
  Subscript := '';
  repeat
    //get next Mult element
    Subscript := Mult2.Order(Subscript, 1);
    //if not the end of list
    if Subscript <> '' then
      //display subscript value
      Memo1.Lines.Add(Format('%10s', ['Subscript']) + ' - ' + Mult2[Subscript])
    //stop when reached the end
    until Subscript = '';
end;
```

Figure 9: TMult Assign Method—Code Added to the Button1.OnClick Event
5. Run the project and click on the button.

The expected output is shown in Figure 10:

**Figure 10: TMult Assign Method—Assigning One TMULT to another: Sample Form Output**

![Figure 10: TMult Assign Method—Assigning One TMULT to another: Sample Form Output](image)

### 2.4.2 Assign Method (TParams Class)

#### 2.4.2.1 Applies to

TParams Class

#### 2.4.2.2 Declaration

```plaintext
procedure Assign(Source: TParams);
```

#### 2.4.2.3 Description

The Assign method for a TParams Class takes another TParams Class parameter. The Assign method is useful for copying one TParams Class to another. The entire contents of the passed in TParams Class are copied into the owner of the Assign method. The Assign method first deletes all of the parameters in the receiving class and then copies the parameters from the passed in class, creating a whole duplicate copy.

**i**  
**REF:** For information about the size of parameters and results that can be passed to and returned from the TParams Class, see the “RPC Limits” section.
2.4.2.4 Example

The program code in Figure 11 demonstrates how a TParams Class assign method can be used to save off the TRPCBroker Component parameters and restore them later:

**Figure 11: Assign Method (TParams Class)—Example**

```pascal
procedure TForm1.Button1Click(Sender: TObject);
var
  SaveParams: TParams;
  SaveRemoteProcedure: string;
begin
  SaveParams := TParams.Create(self);  // create holding variable with Form1 as owner
  SaveParams.Assign(brkrRPCBroker1.Param);  // save parameters
  SaveRemoteProcedure := brkrRPCBroker1.RemoteProcedure;
  brkrRPCBroker1.RemoteProcedure := 'SOME OTHER PROCEDURE';
  brkrRPCBroker1.ClearParameters := True;
  brkrRPCBroker1.Call;
  brkrRPCBroker1.Param.Assign(SaveParams);  // restore parameters
  brkrRPCBroker1.RemoteProcedure := SaveRemoteProcedure;
  SaveParams.Free;  // release memory
end;
```

2.4.3 Call Method

2.4.3.1 Declaration

```pascal
procedure Call;
```

2.4.3.2 Description

This method executes a remote procedure on the VistA M Server and returns the results in the Results Property. Call expects the name of the remote procedure and its parameters to be set up in the RemoteProcedure Property and Param Property respectively. If the ClearResults Property is True, then the Results Property is cleared before the call. If the ClearParameters Property is True, then the Param Property is cleared after the call finishes.

**REF:** For information about the size of parameters and results that can be passed to and returned from the TRPCBroker Component, see the “RPC Limits” section.

**NOTE:** Whenever the Broker makes a call to the VistA M Server, if the cursor is crDefault, the cursor is automatically changed to the hourglass symbol as seen in other Microsoft-compliant software. If the application has already modified the cursor from crDefault to something else, the Broker does not change the cursor.

**REF:** For a demonstration using the Call method, run the RPC Broker Example (32-Bit) (i.e., BrokerExample.exe); located in the following directory:

`BDK32\Samples\BrokerEx`
2.4.3.3 Example

The program code in Figure 12 demonstrates the use of the Call Method in a hypothetical example of bringing back demographic information for a patient and then displaying the results in a memo box:

```
procedure TForm1.Button1Click(Sender: TObject);
begin
  brkrRPCBroker1.RemoteProcedure := 'GET PATIENT DEMOGRAPHICS';
  brkrRPCBroker1.Param[0].Value := 'DFN';
  brkrRPCBroker1.Param[0].PType := reference;
  brkrRPCBroker1.Call;
  Memo1.Lines := brkrRPCBroker1.Results;
end;
```

**Figure 12: Call Method—Example**

**REF:** For a demonstration using the Call Method, run the RPC Broker Example (32-Bit) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx

2.4.4 CreateContext Method

2.4.4.1 Declaration

```
function CreateContext(strContext: string): boolean;
```

Use the CreateContext method of the TRPCBroker Component to create a context for your application. To create context, pass an option name in the strContext parameter. If the function returns True, a context was created, and your application can use all RPCs entered in the option’s RPC multiple. If the TRPCBroker Component is not connected at the time context is created, a connection is established. If for some reason a context could not be created, the CreateContext method returns False.

Since context is nothing more than a client/server “B”-type option in the OPTION file (#19), standard Kernel Menu Manager (MenuMan) security is applied in establishing a context. Therefore, a context option can be granted to users exactly the same way as regular options are done using MenuMan. Before any RPC can run, it must have a context established for it to on the VistA M Server. Thus, all RPCs must be registered to one or more “B”-type options. This plays a major role in Broker security.

**REF:** For information about registering RPCs, see the “RPC Security: How to Register an RPC” section.

A context cannot be established for the following reasons:

- The user has no access to that option.
- The option is temporarily out of order.

An application can switch from one context to another as often as it needs to. Each time a context is created the previous context is overwritten.
REF: For information about saving off the current context in order to temporarily create a different context and then restore the previous context, see the “CurrentContext Property (read-only)” section.

REF: For information about the size of parameters and results that can be passed to and returned from the TRPCBroker Component, see the “RPC Limits” section.

NOTE: Whenever the Broker makes a call to the VistA M Server, if the cursor is **crDefault**, the cursor is automatically changed to the hourglass symbol as seen in other Microsoft-compliant software. If the application has already modified the cursor from **crDefault** to something else, the Broker does not change the cursor.

REF: For a demonstration that creates an application context, run the RPC Broker Example (32-Bit) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx

2.4.4.2 Example

The program code in Figure 13 demonstrates the use of the CreateContext Method:

![Figure 13: CreateContext Method—Example](image)

```pascal
procedure TForm1.Button1Click(Sender: TObject);
begin
  brkrRPCBroker1.Connected := True;
  if brkrRPCBroker1.CreateContext('MY APPLICATION') then
    Labell.Caption := 'Context MY APPLICATION was successfully created.'
  else
    Labell.Caption := 'Context MY APPLICATION could not be created.';
end;
```

REF: For a demonstration that creates an application context, run the RPC Broker Example (32-Bit) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx
2.4.5 GetCCOWtoken Method

2.4.5.1 Declaration

function GetCCOWtoken(Contextor: TContextorControl): string;

This method returns the CCOW token as a string value. This value is passed in as authentication for the current user. The developer should *not* need access to this, since it is handled directly within the code for making the connection.

NOTE: The TContextorControl component is the interface for the Sentillion Vergence ContextorControl that communicates with the Context Vault. The component is created based on the type library for the DLL.

Since developers may want to use the TContextorControl component to initialize their own instances, the TContextorControl component is placed on the Kernel palette in Delphi; however, it is almost as easy to simply create it at runtime without using a component.

REF: For an example of the GetCCOWtoken method, run the RPC Broker Example (32-Bit) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx

2.4.6 IsUserCleared Method

2.4.6.1 Declaration

function IsUserCleared: Boolean;

This method returns a value of True if the user value in the Context Vault has been cleared. The value is only of interest if the WasUserDefined Method has a True value (since unless the user has been defined previously, it would not have a value). This method returns:

- **True**—CCOWUser Context is currently cleared.
- **False**—CCOWUser Context is currently not cleared

This method is used in response to an OnPending event to determine if the pending change is User Context related, and if so, whether the User value in the Context Vault has been cleared. If the value has been cleared, then the application should shut down. Switching User Context is *not* supported, since Office of Cyber and Information Security (OCIS) policy indicates that the current user *must* sign off the client workstation and the new user *must* sign on the client workstation.
2.4.6.2 Example

In the event handler for the Commit event of the TContextorControl, developers can check whether or not the user was previously defined, and is now undefined or null. In this case, developers would want to do any necessary processing, and then halt.

**Figure 14: IsUserCleared Method—Example**

```
Procedure TForm1.CommitHandler(Sender: TObject)
begin
  with CCOWRPCBroker1 do
  begin
    if WasUserDefined and IsUserCleared then
      begin
        // do any necessary processing before halting
        halt;
      end;
  end;
end;
```

2.4.7 IsUserContextPending Method

2.4.7.1 Declaration

```
function IsUserContextPending(aContextItemCollection: IContextItemCollection): Boolean;
```

This method returns a value of True if the pending context change is related to User Context; if not, then it may be related to the Patient Context, etc. This method returns:

- **True**—CCOW pending context change is related to User Context.
- **False**—CCOW pending context change is not related to User Context (e.g., Patient Context change).

This method is used in response to an OnPending event to determine if the pending change is User Context related, and if so, whether the User value in the Context Vault has been cleared. If the value has been cleared, then the application should shut down. Switching User Context is not supported, since Office of Cyber and Information Security (OCIS) policy indicates that the current user must sign off the client workstation and the new user must sign on the client workstation.

**REF:** For an example of the IsUserContextPending method, run the [RPC Broker Example (32-Bit)](i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx
### 2.4.8 lstCall Method

#### 2.4.8.1 Declaration

```pascal
procedure lstCall(OutputBuffer: Tstrings;
```

This method executes a remote procedure on the VistA M Server and returns the results into the passed Tstrings- or TStringList-type variable, which you create outside of the call. It is important to free the memory later. lstCall expects the name of the remote procedure and its parameters to be set up in the RemoteProcedure Property and Param Property respectively. The Results Property is not affected by this call. If the ClearParameters Property is True, then the Param Property is cleared after the call finishes.

**REF:** For information about the size of parameters and results that can be passed to and returned from the TRPCBroker Component, see the “RPC Limits” section.

**NOTE:** Whenever the Broker makes a call to the VistA M Server, if the cursor is crDefault, the cursor is automatically changed to the hourglass symbol as seen in other Microsoft-compliant software. If the application has already modified the cursor from crDefault to something else, the Broker does not change the cursor.

**REF:** For a demonstration using the lstCall method, run the RPC Broker Example (32-Bit) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx

#### 2.4.8.2 Example

The program code in Figure 15 demonstrates the use of the lstCall Method in a hypothetical example of bringing back a list of user’s keys and automatically filling a list box with data:

**Figure 15: lstCall Method—Example**

```pascal
procedure TForm1.Button1Click(Sender: TObject);
begin
  brkrRPCBroker1.RemoteProcedure := 'GET MY KEYS';
  brkrRPCBroker1.lstCall(ListBox1.Items);
end;
```

**REF:** For a demonstration using the lstCall Method, run the RPC Broker Example (32-Bit) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx
2.4.9 pchCall Method
2.4.9.1 Declaration

```pascal
function pchCall: Pchar;
```

The pchCall function is the lowest level call used by the TRPCBroker Component and each of the other Call methods (i.e., Call Method, strCall Method, and lstCall Method), which are implemented via pchCall. The return value is a Pchar, which can contain anything from a null string, a single text string, or many strings each separated by Return and/or Line Feed characters. For converting multiple lines within the return value into a Tstrings, use the SetText method of the Tstrings.

2.4.10 Order Method
2.4.10.1 Applies to
TMult Class
2.4.10.2 Declaration

```pascal
function Order(const StartSubscript: string; Direction: integer): string;
```

2.4.10.3 Description

The Order method works very similar to the SORDER function in M. Using the Order method you can traverse through the list of elements in the Mult Property of an RPC parameter.

The StartSubscript parameter is the subscript of the element whose next or previous sibling is returned. If the Direction parameter is a positive number, then the subscript of the following element is returned, while if it is 0 or negative, then the predecessor’s subscript is returned. If the list is empty, or there are no more elements beyond the StartSubscript parameter, then empty string is returned. You can use the empty string as a StartSubscript parameter; then, depending on the Direction parameter, you get the subscript of the first or the last element in the list.

There are some important differences between this Order method and the M SORDER function:

- The Order method requires both parameters to be passed in.
- If the StartSubscript parameter is not an empty string, it must be equal to one of the subscripts in the list; otherwise, an empty string is returned.
- It is case-sensitive.
- Unlike arrays in M, elements in TMult may or may not be in alphabetical order, depending on the Sorted Property; so, Order may not return the next or previous subscript in collating sequence.

REF: For information about the size of parameters and results that can be passed to and returned from the TMult Class, see the “RPC Limits” section.
2.4.10.4 Example

The program code in Figure 16 demonstrates how to get the next and previous elements in a TMult list:

**Figure 16: Order Method—Sample Code to Get the Next and Previous Elements in a TMult List**

```pascal
procedure TForm1.Button1Click(Sender: TObject);
var
  Mult: TMult;
  Subscript: string;
begin
  {Create Mult. Make Form1 its owner}
  Mult := TMult.Create(Form1);
  Mult['First'] := 'One';
  {Store element pairs one by one}
  Mult['Second'] := 'Two';
  Mult['Third'] := 'Three';
  Mult['Fourth'] := 'Four';
  {Subscript is Fourth}
  Subscript := Mult.Order('Third',1);{Subscript is End}
  Subscript := Mult.Order('Third',-1);{Subscript is Third subscript does not exist}
  Subscript := Mult.Order('THIRD',1);{Subscript is First}
  Subscript := Mult.Order('',1);{Subscript is Fourth}
  Subscript := Mult.Order('',-1);
end;
```

2.4.11 Position Method

2.4.11.1 Applies to

**TMult Class**

2.4.11.2 Declaration

```pascal
function Position(const Subscript: string): longint;
```

2.4.11.3 Description

The Position method takes the string subscript of an item in a TMult variable and returns its numeric index position, much like a TStringList’s IndexOf method. Because TMult uses a TStringList internally, the IndexOf method is used to implement the Position method. The first position in the TMult is 0. If TMult is empty, or the Subscript does not identify an existing item, Position returns -1.

The Position and Subscript methods are the reciprocals of each other.

**REF:** For information about the size of parameters and results that can be passed to and returned from the **TMult Class**, see the “**RPC Limits**” section.
2.4.11.4 Example

The program code in Figure 17 demonstrates how to get the position of an item in a TMult variable:

**Figure 17: Position Method—Sample Code that Shows How to Get the Position of an Item in a TMult Variable**

```pascal
procedure TForm1.Button1Click(Sender: TObject);
var
  Mult: TMult;
begin
  {Create Mult. Make Form1 its owner}
  Mult := TMult.Create(Form1);
  Label1.Caption := 'The position of the "Third" element is ' +
    '{is -1 since the list is empty}
  IntToStr(Mult.Position('Third'));
  Mult['Second'] := 'Two';
  Label1.Caption := 'The position of the "Third" element is ' +
    '{is -1 since 'Third' item does not exit}
  IntToStr(Mult.Position('Third'));
  Label1.Caption := 'The position of the "Second" element is ' +
    '{is 0, TMult positions start with 0}
  IntToStr(Mult.Position('Second'));
end;
```

2.4.12 strCall Method

```pascal
function strCall: string;
```

This method executes a remote procedure on the VistA M Server and returns the results as a value of a function. The strCall method expects the name of the remote procedure and its parameters to be set up in the RemoteProcedure Property and Param Property respectively. The Results Property is not affected by this call. If the ClearParameters Property is True, then the Param Property is cleared after the call finishes.

**REF:** For information about the size of parameters and results that can be passed to and returned from the TRPCBroker Component, see the “RPC Limits” section.

**NOTE:** Whenever the Broker makes a call to the VistA M Server, if the cursor is crDefault, the cursor is automatically changed to the hourglass symbol as seen in other Microsoft-compliant software. If the application has already modified the cursor from crDefault to something else, the Broker does not change the cursor.

**REF:** For a demonstration using the strCall method, run the RPC Broker Example (32-Bit) (i.e., BrokerExample.exe); located in the following directory:

`BDK32\Samples\BrokerEx`
2.4.12.1 Example

The program code in Figure 18 demonstrates the use of the strCall Method in a hypothetical example of bringing back the name of the user currently logged on and automatically displaying it in a label:

Figure 18: strCall Method—Sample Code Showing the Use of the strCall Method

```
procedure TForm1.Button1Click(Sender: TObject);
begin
  brkrRPCBroker1.RemoteProcedure := 'GET CURRENT USER NAME';
  Label1.Caption := brkrRPCBroker1.strCall;
end;
```

REF: For a demonstration using the strCall Method, run the RPC Broker Example (32-Bit) (i.e., BrokerExample.exe) located in the following directory:

BDK32\Samples\BrokerEx

2.4.13 Subscript Method

2.4.13.1 Applies to

TMult Class

2.4.13.2 Declaration

```
function Subscript(const Position: longint): string;
```

2.4.13.3 Description

The Subscript method takes the numeric position of an item in a TMult variable and returns its string subscript. If TMult is empty, or the Position is greater than the number of items in the list, an empty string is returned.

The Subscript Method and Position Method are the reciprocals of each other.

REF: For information about the size of parameters and results that can be passed to and returned from the TMult Class, see the “RPC Limits” section.
2.4.13.4 Example

The program code in Figure 19 demonstrates how to get the subscript of an item in a TMult variable:

```pascal
procedure TForm1.Button1Click(Sender: TObject);
var
  Mult: TMult;
begin
  {Create Mult. Make Form1 its owner}
  Mult := TMult.Create(Form1);
  Label1.Caption := 'The subscript of the item at position 1 is ' +
    '{is empty since the list is empty}
    Mult.Subscript(1);
  Mult['Second'] := 'Two';
  Label1.Caption := 'The subscript of the item at position 1 is ' +
    '{is empty. Only one item in list so far at 0th position}
    Mult.Subscript(1);
  Mult['Third'] := 'Three';
  Label1.Caption := 'The subscript of the item at position 1 is ' +
    '{is Third}
    Mult.Subscript(1);
end;
```

Figure 19: Subscript Method—Example

2.4.14 WasUserDefined Method

```pascal
function WasUserDefined: Boolean;
```

This method is used to determine whether or not a User Context is currently or was previously defined in the Context Vault. It returns True any time after the initial establishment of User Context. This method returns:

- **True**—CCOW User Context established.
- **False**—CCOW User Context not established.

This method is used in response to an OnPending event to determine if the pending change is User Context related, and if so, whether the User value in the Context Vault has been cleared. If the value has been cleared, then the application should shut down. Switching User Context is not supported, since Office of Cyber and Information Security (OCIS) policy indicates that the current user must sign off the client workstation and the new user must sign on the client workstation.
2.4.14.1 Example

In the event handler for the Commit event of the TContextorControl, developers can check whether or not the user was previously defined, and is now undefined or null. In this case, developers would want to do any necessary processing, and then halt.

Figure 20: WasUserDefined Method—Example

```pascal
Procedure TForm1.CommitHandler(Sender: TObject);
begin
  with CCOWRPCBroker1 do
  if WasUserDefined and IsUserCleared then
    begin
      // do any necessary processing before halting
      halt;
    end;
end;
```

2.5 Types

2.5.1 TLoginMode Type

The TLoginMode type is used with the Mode Property as part of the TVistaLogin Class.

2.5.1.1 Unit

TRPCB Unit

```pascal
type TLoginMode = (lmAVCodes, lmAppHandle);
```

2.5.1.2 Description

The TLoginMode type includes the acceptable values that can be used during Silent Login. If the KernelLogIn Property is set to False, then it is a Silent Login. Thus, one of these mode types has to be set in the TVistaLogin Class Mode Property. The Broker uses the information to perform a Silent Login. Table 10 lists the possible values:

<table>
<thead>
<tr>
<th>Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>lmAVCodes</td>
<td>Used if the application is passing in the user's Access and Verify codes during Silent Login.</td>
</tr>
<tr>
<td>lmAppHandle</td>
<td>Used to pass in an application handle rather than a user's Access and Verify codes during Silent Login. It sets the mode to lmAppHandle and the KernelLogIn Property to False. Indicates that an application handle is being passed to the application when it was being started as opposed to Access and Verify codes.</td>
</tr>
</tbody>
</table>
2.5.2 TParamType

2.5.2.1 Unit

TRPCB Unit

2.5.2.2 Declaration

\[
\text{TParamType} = (\text{literal, reference, list, global, empty, stream, undefined});
\]

2.5.2.3 Description

The TParamType type defines the possible values of the RPC parameter type (PType Property of TParamRecord Class).

The global, empty, and stream values (added with RPC Broker Patch XU*1.1*40) can only be used if a new-style (i.e., non-callback) connection is present.

\[\text{CAUTION: Use of the undefined TParam Type in applications is not supported. It exists for the RPC Broker's internal use only.}\]

2.6 Properties

2.6.1 AccessCode Property

2.6.1.1 Applies to

TVistaLogin Class

2.6.1.2 Declaration

\[
\text{property AccessCode: String;}
\]

2.6.1.3 Description

The AccessCode property is available at run-time only. It holds the Access code for the lmAVCodes mode of Silent Login. The user’s Access code value should be set in as clear text. It is encrypted before it is transmitted to the VistA M Server.

\[\text{REF: For examples of silent logon by passing Access and Verify codes, see the “Silent Login Examples” section.}\]

\[\text{REF: For more information on Access codes, see the “Part 1: Sign-On/Security” section in the Kernel Systems Management Guide.}\]
2.6.2 BrokerVersion Property (read-only)

2.6.2.1 Applies to
TRPCBroker Component

2.6.2.2 Declaration

```javascript
property BrokerVersion: String;
```

2.6.2.3 Description
The BrokerVersion property is available at run-time only. This read-only property indicates the RPC Broker version used in generating the application (currently, it returns the string “XWB*1.1*60”).

2.6.3 CCOWLogonIDName Property (read-only)

2.6.3.1 Applies to
TCCOWRPCBroker Component

2.6.3.2 Declaration

```javascript
property CCOWLogonIDName: String;
```

2.6.3.3 Description
The CCOWLogonIDName property is available at run-time only. This read-only property is the name used within the CCOW Context Vault to store the LogonId.

It permits the user to identify the logon ID name associated with the CCOWLogonIDValue Property (read-only) logon ID name value used within the Context Vault related to User Context.

2.6.4 CCOWLogonIDValue Property (read-only)

2.6.4.1 Applies to
TCCOWRPCBroker Component

2.6.4.2 Declaration

```javascript
property CCOWLogonIDValue: String;
```

2.6.4.3 Description
The CCOWLogonIDValue property is available at run-time only. This read-only property gives the value currently associated with the LogonId in the CCOW Context Vault.

It permits the user to identify the logon ID value associated with the CCOWLogonIDName Property (read-only) logon ID name used within the Context Vault related to User Context.
2.6.5 CCOWLogonName Property (read-only)

2.6.5.1 Applies to
TCCOWRPCBroker Component

2.6.5.2 Declaration

```javascript
property CCOWLogonName: String;
```

2.6.5.3 Description
The CCOWLogonName property is available at run-time only. This read-only property gives the name used to store the LogonName of the currently active user.

It permits the user to identify the logon name associated with the CCOWLogonNameValue Property (read-only) logon name value used within the Context Vault related to User Context.

2.6.6 CCOWLogonNameValue Property (read-only)

2.6.6.1 Applies to
TCCOWRPCBroker Component

2.6.6.2 Declaration

```javascript
property CCOWLogonNameValue: String;
```

2.6.6.3 Description
The CCOWLogonNameValue property is available at run-time only. This read-only property gives the value of the LogonName of the currently active user.

It permits the user to identify the logon name value associated with the CCOWLogonName Property (read-only) logon name used within the Context Vault related to User Context.

2.6.7 CCOWLogonVpid Property (read-only)

2.6.7.1 Applies to
TCCOWRPCBroker Component

2.6.7.2 Declaration

```javascript
property CCOWLogonVpid: String;
```

2.6.7.3 Description
The CCOWLogonVpid property is available at run-time only. This read-only property gives the name used to store the LogonVpid value in the CCOW Context Vault.

It permits the user to identify the logon VA Person Identification (VPID) name associated with the CCOWLogonVpidValue Property (read-only) logon VPID value used within the Context Vault related to User Context.
2.6.8 CCOWLogonVpidValue Property (read-only)

2.6.8.1 Applies to
TCCOWRPCBroker Component

2.6.8.2 Declaration

```plaintext
property CCOWLogonVpidValue: String;
```

2.6.8.3 Description
The CCOWLogonVpidValue property is available at run-time only. This read-only property gives the value of the VA Person Identification (VPID) value for the currently logged on user, if the facility has been enumerated; otherwise, the value returned is a null string.

It permits the user to identify the logon VPID value associated with the CCOWLogonVpid Property (read-only) logon VPID name used within the Context Vault related to User Context.

2.6.9 ClearParameters Property

2.6.9.1 Applies to
TRPCBroker Component

2.6.9.2 Declaration

```plaintext
property ClearParameters: Boolean;
```

2.6.9.3 Description
The ClearParameters design-time property gives the developer the option to clear the Param Property after every invocation of any of the following methods:

- Call Method
- strCall Method
- lstCall Method

Setting ClearParameters to True clears the Param Property.

Simple assignment of True to this property clears the Param Property after every invocation of the Call Method, strCall Method, and lstCall Method. Thus, the parameters need only be prepared for the next call without being concerned about what was remaining from the previous call.

By setting ClearParameters to False, the developer can make multiple calls with the same Param Property. It is also appropriate to set this property to False when a majority of the parameters in the Param Property should remain the same between calls. However, minor changes to the parameters can still be made.
2.6.9.4 Example

The program code in Figure 21 sets the ClearParameters Property to True:

```
procedure TForm1.Button1Click(Sender: TObject);
begin
  brkrRPCBroker1.ClearParameters := True;
end;
```

2.6.10 ClearResults Property

2.6.10.1 Applies to
TRPCBroker Component

2.6.10.2 Declaration

```
property ClearResults: Boolean;
```

2.6.10.3 Description

The ClearResults design-time property gives the developer the option to clear the Results Property prior to every invocation of the Call Method. The strCall Method and lstCall Method are unaffected by this property. Setting ClearResults to True clears the Results Property.

If this property is True, then the Results Property is cleared before every invocation of the Call Method; thus, assuring that only the results of the last call are returned. Conversely, a setting of False accumulates the results of multiple calls in the Results Property.

2.6.10.4 Example

The program code in Figure 22 sets the ClearResults Property to True:

```
procedure TForm1.Button1Click(Sender: TObject);
begin
  brkrRPCBroker1.ClearResults := True;
end;
```
2.6.11 Connected Property

2.6.11.1 Applies to

TRPCBroker Component

```
property Connected: Boolean;
```

2.6.11.2 Description

The Connected design-time property connects the application to the VistA M Server:

- Setting this property to **True** connects the application to the server.
- Setting it to **False** disconnects the application from the server.

It is not necessary for your application to manually establish a connection to the VistA M Server. RPC Broker 1.1 automatically connects and disconnects from the server. When you invoke an RPC, if a connection has *not* already been established, one is established for you. However, a user is *not* able to run the RPC unless a context has been created with the CreateContext Method.

The Connected property is also used to authenticate a user into a VistA M Server. After making the connection, it makes a call to Identity and Access Management (IAM) Secure Token Service (STS) for 2-factor authentication of the user. The STS returns a token, which is used to authenticate the user into a VistA M Server. If a token *cannot* be obtained, VistA user authentication fails over to Access and Verify codes.

There are other advantages to establishing a connection manually. You can check if a connection is established, and branch accordingly depending on whether or not a connection was established. One good place to do this is in the application form’s **OnCreate** event. For that event, you could include code as shown in Figure 23:

```
try
  brkrRPCBroker1.Connected:= True;
except
  on EBrokerError do
    begin
      ShowMessage('Connection to server could not be established!');
      Application.Terminate;
    end;
end;
```

This code sets the TRPCBroker Component’s Connected property to **True** to establish a connection. If a Broker exception (i.e., **EBrokerError**) was raised (in which case the connection was *not* established), it provides a message to the user and calls the **Terminate** method to exit.

To verify that your application is connected to the VistA M Server, check the value of the Connected property.

If a connected TRPCBroker Component is destroyed (e.g., when the application is closed) that component first disconnects from the VistA M Server. However, for programming clarity, it is advisable to disconnect your application from the server manually by setting the Connected property to **False**.
If your application uses more than one Broker component, you should be aware of the component’s
connect and disconnect behavior.

**REF:** For more information on connect-disconnect behavior, see the “Component Connect-
Disconnect Behavior” section.

### 2.6.11.3 Example

The program code in Figure 24 sets the Connected Property to True:

```pascal
procedure TForm1.btnConnectClick(Sender: TObject);
begin
  brkrRPCBroker1.Server := edtServer.Text;
  brkrRPCBroker1.ListenerPort := StrToInt(edtPort.Text);
  brkrRPCBroker1.Connected := True;
end;
```

**NOTE:** The Server Property and ListenerPort Property *must* be set at design or run-time before setting the Connected Property to True.

### 2.6.12 Contextor Property

#### 2.6.12.1 Applies to

**TCCOWRPCBroker Component**

#### 2.6.12.2 Declaration

```pascal
property Contextor: TContextorControl;
read Fcontextor write FContextor; //CCOW
```

#### 2.6.12.3 Description

The Contextor property is available at run-time only. It *must* be set to an active instance of the
TContextorControl component in order to initiate a login with CCOW User Context. If it is not set to an
active instance, then the component basically reverts to an instance of a TRPCBroker Component, since
none of the features of CCOW User Context is used.

**NOTE:** The TContextorControl component is the interface for the Sentillion Vergence
ContextorControl that communicates with the Context Vault. The component is created based on
the type library for the DLL.

Since developers may want to use the TContextorControl component to initialize their own
instances, the TContextorControl component is placed on the Kernel palette in Delphi; however,
it is almost as easy to simply create it at runtime without using a component.
2.6.13 Count Property (TMult Class)

2.6.13.1 Applies to

TMult Class

2.6.13.2 Declaration

```pascal
property Count: Word;
```

2.6.13.3 Description

The Count design-time property contains the number of items in a TMult Class. If TMult Class is empty, Count is zero.

2.6.13.4 Example

The program code in Figure 25 displays the number of items in a Mult class in the caption of a label when the user clicks the CountItems button:

```pascal
procedure TForm1.CountItemsClick(Sender: TObject);
begin
    Label1.Caption := 'There are ' + IntToStr(Mult.Count) + ' items in the Mult.'
end;
```

2.6.14 Count Property (TParams Class)

2.6.14.1 Applies to

TParams Class

2.6.14.2 Declaration

```pascal
property Count: Word;
```

2.6.14.3 Description

The Count property contains the number of parameters in a TParams Class. If the TParams Class is empty, Count is zero.

2.6.14.4 Example

The program code in Figure 26 displays the number of parameters in a TParams variable within the caption of a label when the user clicks the CountParameters button:

```pascal
procedure TForm1.CountParametersClick(Sender: TObject);
begin
    Label1.Caption := 'There are ' + IntToStr(brkrRPCBroker1.Param.Count) + ' parameters.';
end;
```
2.6.15 CurrentContext Property (read-only)

2.6.15.1 Applies to

TRPCBroker Component

2.6.15.2 Declaration

```plaintext
property CurrentContext: String;
```

2.6.15.3 Description

The CurrentContext property is available at run-time only. This read-only property provides the current context. Developers can:

- Save off the current context into a local variable.
- Set a new context.
- Restore the original context from the local variable before finishing.

This permits the application to use the `CreateContext Method` with an additional context when an initial context has already been established.

2.6.15.4 Example

The program code in Figure 27 demonstrates the use of the `CurrentContext Property (read-only)` in a hypothetical example of saving and restoring the current context of an application:

```plaintext
procedure TForm1.MyFantasticModule;
var
  OldContext: String;
begin
  OldContext := RPCB.CurrentContext; // save off old context
  try
    RPCB.SetContext('MyContext');
  finally
    RPCB.SetContext(OldContext); // restore context before leaving
  end;
end;
```

Figure 27: CurrentContext Property—Example
2.6.16 DebugMode Property

2.6.16.1 Applies to
TRPCBroker Component

2.6.16.2 Declaration

```java
property DebugMode: Boolean;
```

2.6.16.3 Description

The DebugMode design-time property formerly controlled how the VistA M Server process should be started. The default setting is **False**. Setting this property to **True** has no effect on the VistA M Server process. Control of debugging has been moved from the client to the server.

For debugging purposes, it can be very helpful to:

1. Set break points.
2. Run the server process interactively.
3. Step through the execution.

**REF:** For more information, see the “**How to Debug the Application**” section.

2.6.17 Division Property (TVistaLogin Class)

2.6.17.1 Applies to
TVistaLogin Class

2.6.17.2 Declaration

```java
property Division: String;
```

2.6.17.3 Description

The Division property is available at run-time only. It can be set to the desired Division for a user for **Silent Login**.

**REF:** For information about handling multi-divisions during the **Silent Login** process, see the “**Handling Divisions during Silent Login**” section.

2.6.18 Division Property (TVistaUser Class)

2.6.18.1 Applies to
TVistaUser Class
2.6.18.2 Description

The Division property is available at run-time only. It is set to the division for a user when they are logged on.

2.6.19 DivList Property (read-only)

2.6.19.1 Applies to

TVistaLogin Class

2.6.19.2 Declaration

```pascal
property DivList: TStrings;
```

2.6.19.3 Description

The DivList property is available at run-time only. This read-only property is a list of divisions that are available for selection by the user for the signon division. This list is filled in, if appropriate, during the Silent Login at the same time that the user is determined to have multiple divisions from which to select. The first entry in the list is the number of divisions present, followed by the names of the divisions that are available to the user.

**REF:** For information about handling multi-divisions during the Silent Login process, see the “Handling Divisions during Silent Login” section.

2.6.20 DomainName Property

2.6.20.1 Applies to

TVistaLogin Class

2.6.20.2 Declaration

```pascal
property DomainName: String;
```

2.6.20.3 Description

The DomainName property is available at run-time only. It can be used to obtain the domain name of the server to which the RPC Broker is currently connected.
2.6.21 DTime Property
2.6.21.1 Applies to
TVistaUser Class
2.6.21.2 Declaration

```plaintext
property DTime: String;
```

2.6.21.3 Description
The DTime property is available at run-time only. It holds the user’s DTime. DTime sets the time a user has to respond to timed read. It can be set from 1 to 99999 seconds.

2.6.22 DUZ Property (TVistaLogin Class)
2.6.22.1 Applies to
TVistaLogin Class
2.6.22.2 Declaration

```plaintext
property DUZ: String;
```

2.6.22.3 Description
The DUZ property is available at run-time only. It holds the user’s Internal Entry Number (IEN) from the NEW PERSON file (#200) for TVistaLogin.

2.6.23 DUZ Property (TVistaUser Class)
2.6.23.1 Applies to
TVistaUser Class
2.6.23.2 Declaration

```plaintext
property DUZ: String;
```

2.6.23.3 Description
The DUZ property is available at run-time only. It holds the user’s Internal Entry Number (IEN) from the NEW PERSON file (#200) for TVistaUser.
### 2.6.24 ErrorText Property

#### 2.6.24.1 Applies to
TVistaLogin Class

#### 2.6.24.2 Declaration

```plaintext
property ErrorText: String;
```

#### 2.6.24.3 Description

The ErrorText property is available at run-time only. It holds text of any error message returned by the VistA M Server during the attempted Silent Login. It should be checked if the login fails. For example, it could indicate the following:

- Verify code needs to be changed.
- Invalid Access/Verify code pair.
- Invalid Division.

### 2.6.25 First Property

#### 2.6.25.1 Applies to
TMult Class

#### 2.6.25.2 Declaration

```plaintext
property First: String;
```

#### 2.6.25.3 Description

The First design-time property contains the subscript of the first item in a TMult Class. The first item is always in the 0th Position. You can think of the First property as a shortcut to executing the TMult.Order('',1) method. If a TMult variable does not contain any items, the First property is empty.

**REF:** For more information, see the “Order Method” and “Position Method” sections.
2.6.25.4 Example

The program code in Figure 28 displays the subscript and value of the first item in a Mult variable in the caption of a label when the user clicks the GetFirst button.

Figure 28: First Property—Example

```pascal
procedure TForm1.GetFirstClick(Sender: TObject);
var
  Mult: TMult;
  Subscript: string;
begin
  {Create Mult. Make Form1 its owner}
  Mult := TMult.Create(Form1);
  Mult['Fruit'] := 'Apple';
  {Store element pairs one by one}
  Mult['Vegetable'] := 'Potato';
  Label1.Caption := 'The subscript of the first element: ' + Mult.First + ', and
  its value: ' + Mult[Mult.First];
end;
```

2.6.26 IsProductionAccount Property

2.6.26.1 Applies to

TVistaLogin Class

2.6.26.2 Declaration

```pascal
property IsProductionAccount: Boolean;
```

2.6.26.3 Description

The IsProductionAccount property is available at run-time only. It can be checked to determine if the current connection is to a Production account:

- **True**—If the account is a Production account.
- **False**—If the account is not a Production account.

While it is declared as a read-write property, it should be considered to be read-only, since changing its value does not change the nature of the server to which the RPC Broker is connected.
2.6.27 KernelLogIn Property

2.6.27.1 Applies to
TRPCBroker Component

2.6.27.2 Declaration

```plaintext
property KernelLogIn: Boolean;
```

2.6.27.3 Description
The KernelLogIn design-time property is a Boolean property, which indicates the manner of signon:
- **True**—Presents the regular Kernel login security form.
- **False**—Broker uses the TVistaLogin Class for signon.

The TVistaLogin Class is referenced during Silent Login.

**REF:** For examples of silent logon by passing Access and Verify codes, see the “Silent Login Examples” section.

2.6.28 Language Property

2.6.28.1 Applies to
TVistaUser Class

2.6.28.2 Declaration

```plaintext
property Language: String;
```

2.6.28.3 Description
The Language property is available at run-time only. It holds the user’s language from the NEW PERSON file (#200).

2.6.29 Last Property

2.6.29.1 Applies to
TMult Class

2.6.29.2 Declaration

```plaintext
property Last: String;
```

2.6.29.3 Description
The Last design-time property contains the subscript of the last item in a TMult Class. The last item is always in count-1 Position. You can think of the Last property as a shortcut to executing the TMult.Order('',-1) method. If a TMult variable does not contain any items, the Last property is empty.
2.6.29.4 Example

The program code in Figure 29 displays the subscript and value of the last item in a Mult variable in the caption of a label when the user clicks the GetLast button:

```
procedure TForm1.GetLastClick(Sender: TObject);
var
  Mult: TMult;
  Subscript: string;
begin
  {Create Mult. Make Form1 its owner}
  Mult := TMult.Create(Form1);
  Mult[‘Fruit’] := ‘Apple’;
  {Store element pairs one by one}
  Mult[‘Vegetable’] := ‘Potato’;
end;
```

2.6.30 ListenerPort Property

2.6.30.1 Applies to

TRPCBroker Component

2.6.30.2 Declaration

```
property ListenerPort: Integer;
```

2.6.30.3 Description

The ListenerPort design-time property gives the developer the ability to select the Listener port on the VistA M Server. It must always be set before connecting to the server.

If one VistA M Server system has two or more environments (UCIs) that support client/server applications (e.g., Test and Production accounts), the Broker Listener processes must be listening on unique ports. Thus, you must specify which Listener port to use when you start the Listener on the VistA M Server. Consequently, if you have more than one Listener running on the same server, the application needs to specify the correct Listener for its connection request. This is accomplished using the ListenerPort property.

After the initial connection, the VistA M Server connection is moved to another port number [i.e., Socket Property (read-only)], which is used for the remainder of the session.
2.6.30.4 Example
The program code in Figure 30 demonstrates using the ListenerPort Property:

```pascal
procedure TForm1.btnConnectClick(Sender: TObject);
begin
    brkrRPCBroker1.ListenerPort := 9001;
    brkrRPCBroker1.Connected := True;
end;
```

2.6.31 LogIn Property
2.6.31.1 Applies to
TRPCBroker Component
2.6.31.2 Declaration

```pascal
property LogIn: TVistaLogin;
```

2.6.31.3 Description
The LogIn property is available at run-time only. It holds parameters that the application needs to pass for Silent Login. The instance of the TVistaLogin used for this property is created automatically during the creation of the TRPCBroker object, and is therefore, available for reference as a TRPCBroker property without any user setup.

REF: For examples of silent logon by passing Access and Verify codes, see the “Silent Login Examples” section.

2.6.32 LoginHandle Property
2.6.32.1 Applies to
TVistaLogin Class
2.6.32.2 Declaration

```pascal
property LoginHandle: String;
```

2.6.32.3 Description
The LoginHandle property is available at run-time only. It holds the Application Handle for the lmAppHandle mode of Silent Login. The Application Handle is obtained from the VistA M Server by a currently running application using the GetAppHandle function in the TRPCB Unit. The function returns a String value, which is then passed as a command line argument with an application that is being started. The new application must know to look for the handle, and if present, set up the Silent Login. The StartProgSLogin (see the “StartProgSLogin Method” section) procedure in the RpcSLogin Unit can be used directly or as an example of how the application would be started with a valid AppHandle as a command line argument. The CheckCmdLine procedure (see the “CheckCmdLine Function” section) in

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the RpcSLogin Unit can be used in an application to determine whether an AppHandle has been passed and to initiate the Broker connection or used as an example of how this could be done.

 NOTE: The two procedures referenced here also pass the current values from the Server Property, ListenerPort Property, and Division Property (TVistaLogin Class) for the user so that the connection would be made to the same VistA M Server as the original application.

The AppHandle that is obtained via the GetAppHandle function is only valid for approximately 20 seconds, after which the Silent Login would fail.

2.6.33 Mode Property

2.6.33.1 Applies to
TVistaLogin Class

2.6.33.2 Declaration

```pascal
property Mode: TloginMode;
```

2.6.33.3 Description

The Mode property is available at run-time only. It indicates the mode of Silent Login. The possible values include: lmAVCodes and lmAppHandle.

 REF: For examples of silent logon by passing Access and Verify codes, see the “Silent Login Examples” section.

2.6.34 Mult Property

2.6.34.1 Applies to
TParamRecord Class

2.6.34.2 Declaration

```pascal
property Mult: TMult;
```

2.6.34.3 Description

(Mult is a property of the TParamRecord Class used in the Param Property.)

The Mult design-time property of a TParamRecord Class, which is the type of each TRPCBroker Component’s Param[x] element, can be used to pass a string-subscripted array of strings to the VistA M Server. For example, if you need to pass a patient’s name and Social Security Number (SSN) to a remote procedure, you could pass them as two separate parameters as PType literals, or you could pass them in one parameter using the Mult property as a PType list. If one is being sent, a Mult must be the last element in the Param array.
2.6.34.4 Example

The program code in Figure 31 demonstrates how the Mult Property can be used to pass several data elements to the VistA M Server in one parameter:

```pascal
procedure TForm1.Button1Click(Sender: TObject);
begin
  with brkrRPCBroker1 do begin
    Param[0].PType := list;
    Param[0].Mult["NAME"] := 'XWBBROKER,ONE'
    Param[0].Mult["SSN"] := '000456789';
    RemoteProcedure := 'SETUP PATIENT INFO';
    Call;
  end;
end;
```

Assuming variable P1 is used on the VistA M Server to receive this array, it would look like Figure 32:

```text
P1("NAME")=XWBBROKER,ONE
P1("SSN")=000456789
```

2.6.35 MultiDivision Property

2.6.35.1 Applies to
TVistaLogin Class

2.6.35.2 Declaration

```text
property MultiDivision: Boolean;
```

2.6.35.3 Description

The MultiDivision property is available at run-time only. It indicates whether the user has multi-divisional access. It is set during the Silent Login process, if the user has more than one division that can be selected.

**REF:** For information about handling multi-divisions during the Silent Login process, see the “Handling Divisions during Silent Login” section.
2.6.36 Name Property

2.6.36.1 Applies to
TVistaUser Class

2.6.36.2 Declaration

```pascal
property Name: String;
```

2.6.36.3 Description
The Name property is available at run-time only. It holds the user’s name from the NEW PERSON file (#200).

2.6.37 OnFailedLogin Property

2.6.37.1 Applies to
TVistaLogin Class

2.6.37.2 Declaration

```pascal
property OnFailedLogin: TOnLoginFailure;
```

2.6.37.3 Description
The OnFailedLogin property is available at run-time only. It holds a procedure to be invoked on a failed Silent Login that permits an application to handle errors as desired; where TOnLoginFailure is defined as:

```pascal
TOnLoginFailure = procedure (VistaLogin: TVistaLogin) of object;
```

For example, an application could define:

```pascal
Procedure HandleLoginError(Sender: TObject);
```

And then set:

```pascal
OnFailedLogin := HandleLoginError;
```

**REF:** For examples of silent logon by passing Access and Verify codes, see the “Silent Login Examples” section.
2.6.38 OnRPCBFailure Property

2.6.38.1 Applies to
TRPCBroker Component

2.6.38.2 Declaration

```pascal
property OnRPCBFailure: TOnRPCBFailure;
```

2.6.38.3 Description

The OnRPCBFailure property is available at run-time only. It holds a procedure to be invoked when the Broker generates an exception that permits an application to handle errors as desired, where TOnRPCBFailure is defined as:

```pascal
TOnRPCBFailure = procedure (RPCBroker: TRPCBroker) of object;
```

The text associated with the error causing the exception is found in the RPCBError Property (read-only).

**NOTE:** If the OnFailedLogin Property is also set, it handles any login errors and does not pass them up.

2.6.38.4 Example

For example, an application could define:

```pascal
Procedure HandleBrokerError(Sender: TObject);
```

And then set:

```pascal
OnRPCBFailure := HandleBrokerError;
```

**NOTE:** The initialization of the OnRPCBFailure property should be before the first call to the TRPCBroker Component.
Figure 33 shows an instance of an error handler that takes the Message property of the exception and stores it with a time date stamp into a file named Error.Log in the same directory with the application exe:

**Figure 33: Error Handler—Example of Storing a Message with a Time Date Stamp**

```pascal
procedure TForm1.HandleBrokerError(Sender: TObject);
var
  ErrorText: String;
  Path: String;
  StrLoc: TStringList;
  NowVal: TDateTime;
begin
  NowVal := Now;
  ErrorText := TRPCBroker(Sender).RPCBError;
  StrLoc := TStringList.Create;
  try
    Path := ExtractFilePath(Application.ExeName);
    Path := Path + 'Error.Log';
    if FileExists(Path) then
      StrLoc.LoadFromFile(Path);
    StrLoc.Add(FormatDateTime('mm/dd/yyyy hh:mm:ss ',NowVal) + ErrorText);
    StrLoc.SaveToFile(Path);
  finally
    StrLoc.Free;
  end;
end;
```

### 2.6.39 Param Property

#### 2.6.39.1 Applies to

*TRPCBroker Component*

#### 2.6.39.2 Declaration

```pascal
property Param: TParams;
```

#### 2.6.39.3 Description

The Param property is available at run-time only. It holds all of the parameters that the application needs to pass to the remote procedure using any of the following methods:

- **Call Method**
- **strCall Method**
- **lstCall Method**

Param is a zero-based array of the `TParamRecord` class. You do not need to explicitly allocate any memory for the Param property. Simple reference to an element or a value assignment (`:=`) dynamically allocates memory as needed. You should start with the 0th element and proceed in sequence. Do not skip elements.
Each element in the Param array has the following properties:

- Mult Property
- PType Property
- Value Property

⚠️ **CAUTION:** Passing multiple parameters of PType list in one remote procedure call (RPC) is not supported at this time. Only one list parameter can be passed to an RPC, and it must be the last parameter in the actual list.

The Param relationship to the **TRPCBroker Component** is as follows:

The **TRPCBroker Component** contains the Param property (i.e., **TParams Class**).

The **TParams Class** contains the ParamArray property (array [I:integer]: **TParamRecord Class**).

The **TParamRecord Class** contains the Mult Property (i.e., **TMult Class**).

The **TMult Class** contains the MultArray property (array[S: string]: string).

The MultArray property internally uses a TStringList in which each element’s object is a TString.

If the remote procedure on the VistA M Server does not require any incoming parameters, applications can pass an empty Param property. The client application merely sets the **RemoteProcedure Property** and makes the call. If the Param property retains a value from a previous call, it can be cleared using the **ClearParameters Property**. Thus, it is possible to make a call without passing any parameters.

⚠️ **CAUTION:** The following restrictions apply with the Param property:

1. You are not allowed to “skip” passing parameters, such as TAG^ROUTINE(1,,3). If there are fewer elements in the Param array than exist as input parameters in the RPC, the subsequent parameters are not passed to the RPC.

2. Passing multiple array parameters in one remote procedure call is not supported at this time. Only one array parameter can be passed to an RPC, and it must be the last parameter in the actual list.

**REF:** For a demonstration using the Param Property, run the **RPC Broker Example (32-Bit)** (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx
2.6.39.4 Example

The program code in Figure 34 demonstrates how the Param Property of a TRPCBroker Component is referenced and filled with two parameters that the remote procedure expects:

![Figure 34: Param Property—Example]

```delphi
procedure TForm1.Button1Click(Sender: TObject);
begin
  {first parameter is a single string}
  brkrRPCBroker1.Param[0].Value := '02/27/14';
  brkrRPCBroker1.Param[0].PType := literal;
  {second parameter is a list}
  brkrRPCBroker1.Param[1].Mult["NAME"] := 'XWBUSER,ONE';
  brkrRPCBroker1.Param[1].Mult["SSN"] := '000-45-6789';
  brkrRPCBroker1.Param[1].PType := list;
end;
```

REF: For a demonstration using the Param Property, run the RPC Broker Example (32-Bit) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx

2.6.40 PromptDivision Property

2.6.40.1 Applies to

TVistaLogin Class

2.6.40.2 Declaration

```delphi
property PromptDivison: Boolean;
```

2.6.40.3 Description

The PromptDivision property is available at run-time only. It should be set to:

- **True**—If the user should be prompted for Division during Silent Login. The prompt only occurs if the user has multi-division access.
- **False**—If the prompt should not be displayed due to the manner in which the application is running.

However, if set to False and multi-division access is a possibility, then the application must handle it in another way. For example, the application developer would do the following:

1. Set Login.PromptDivision to False.
2. Set the Connected Property to True to signon.
3. On return, check whether the Connected Property was set to True or check whether the Login.ErrorText Property was non-null (and especially “No Division Selected”).
4. If the connection was successful, there is no problem; otherwise, proceed to Steps 5 - 8.
5. Check the Login.MultiDivision Property and see if it was set to True, which is expected.
6. If the Login.**MultiDivision Property** is set to **True**, check the Login.**DivList Property** (read-only) for a list of the available divisions (remember the first entry is the number of entries that follow), and in whatever method was available to the application, have the user select the correct division.

7. Set the Login.**Division Property** (**TVistaLogin Class**) to the selected Division.

8. Set the **Connected Property** to **True**, so the connection would be attempted to be established again.

**REF:** For examples of silent logon by passing Access and Verify codes, see the “**Silent Login Examples**” section.

### 2.6.41 PType Property

#### 2.6.41.1 Applies to

**TParamRecord Class**

#### 2.6.41.2 Declaration

```delphi
property PType: TParamType;
```

#### 2.6.41.3 Description

PType is a property of the **TParamRecord Class** used in the **Param Property**.

The PType design-time property determines how the parameter is interpreted and handled by the Broker.

**Table 11: PType Property—Values**

<table>
<thead>
<tr>
<th>Value</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>literal</td>
<td>Delphi string value, passed as a string literal to the VistA M server. The VistA M Server receives the contents of the corresponding <strong>Value Property</strong> as one string or one number.</td>
</tr>
<tr>
<td>reference</td>
<td>Delphi string value, treated on the VistA M Server as an M variable name and resolved from the symbol table at the time the RPC executes. The VistA M Server receives the contents of the corresponding <strong>Value Property</strong> as a name of a variable defined on the server. Using indirection, the Broker on the server resolves this parameter before handing it off to the application. <strong>CAUTION:</strong> The use of a reference-type input parameter represents a significant security risk. The M entry point should include code to screen the input value for M code injection (e.g., function calls, M commands, or direct global reads).</td>
</tr>
<tr>
<td>list</td>
<td>A single-dimensional array of strings in the Mult subproperty of the <strong>Param Property</strong>, which is passed to the VistA M Server where it is placed in an array. String suboscripting can be used. This value is used whenever an application wants to send a list of values to the VistA M Server. Data is placed in a local array. In this case, the content of the corresponding <strong>Mult Property</strong> is sent, while the <strong>Value Property</strong> is ignored.</td>
</tr>
<tr>
<td>global</td>
<td>This value is similar to list, but instead of data being placed in a local array, it is placed in a global array. Use of this value removes the potential problem of allocation errors when large quantities of data are transmitted.</td>
</tr>
<tr>
<td>Value</td>
<td>Definition</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>empty</td>
<td>This value indicates that no parameter value is to be passed; it simply passes an empty argument.</td>
</tr>
<tr>
<td>stream</td>
<td>This value indicates that the data should be passed as a single stream of data.</td>
</tr>
<tr>
<td>undefined</td>
<td>The Broker uses this value internally. It should <em>not</em> be used by an application.</td>
</tr>
</tbody>
</table>

For instance, if you need to pass an empty string to the remote procedure call (RPC), the `Value Property` should be set to ‘’ (i.e., null) and the `PType` to literal. Using reference, a developer can pass an M variable (e.g., DUZ) without even knowing its value. However, if the M variable being referenced is *not* defined on the VistA M Server, a run-time error occurs. When passing a list to an RPC:

1. Set the `PType` to `list`.
2. Populate the `Mult Property`.
3. Do *not* put anything into the `Value Property` (in this case, Value is ignored).

**REF:** For a demonstration using `PType`, run the [RPC Broker Example (32-Bit)](BDK32\Samples\BrokerEx) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx

### 2.6.41.4 Example

The program code in Figure 35 demonstrates a couple of different uses of the `PType Property`. Remember, that each Param[x] element is really a `TParamRecord Class`.

**Figure 35: PType Property—Example**

```pascal
procedure TForm1.Button1Click(Sender: TObject);
begin
  with brkrRPCBroker1 do begin
    RemoteProcedure := 'SET NICK NAME';
    Param[0].Value := 'DUZ';
    Param[0].PType := reference;
    Param[1].Value := edtNickName.Text;
    Param[1].PType := literal;
    Call;
  end;
end;
```

**REF:** For a demonstration using `PType`, run the [RPC Broker Example (32-Bit)](BDK32\Samples\BrokerEx) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx
2.6.42 RemoteProcedure Property

2.6.42.1 Applies to
TRPCBroker Component

2.6.42.2 Declaration

```delphi
property RemoteProcedure: TRemoteProc;
```

2.6.42.3 Description
The RemoteProcedure design-time property should be set to the name of the remote procedure call entry in the REMOTE PROCEDURE File (#8994).

2.6.42.4 Example
The program code in Figure 36 demonstrates using the RemoteProcedure Property:

```delphi
procedure TForm1.Button1Click(Sender: TObject);
begin
   brkrRPCBroker1.RemoteProcedure := 'MY APPLICATION REMOTE PROCEDURE';
   brkrRPCBroker1.Call;
end;
```

2.6.43 Results Property

2.6.43.1 Applies to
TRPCBroker Component

2.6.43.2 Declaration

```delphi
property Results: TStrings;
```

2.6.43.3 Description
The Results design-time property contains the results of a Call Method. In the case where the RPC returns a single value, it is returned in Results[0]. If a call returns a list of values, the Results property is filled in the order the list collates on the VistA M Server. The Results property can only contain values of array elements—subscripts are not returned.

For example:
On the VistA M Server, the M routine constructs the list in the sequence shown in Figure 37:

```delphi
S LIST("CCC")="First"
S LIST(1)="Second"
S LIST("AAA")="Third"
S LIST(2)="Fourth"
```
Before Broker returns the list to the client, M re-sorts it in alphabetical order as shown in Figure 38:

**Figure 38: Results Property—Sample Array List Sequence Sorted Alphabetically**

<table>
<thead>
<tr>
<th>LIST(1)</th>
<th>“Second”</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST(2)</td>
<td>“Fourth”</td>
</tr>
<tr>
<td>LIST(“AAA”)</td>
<td>“Third”</td>
</tr>
<tr>
<td>LIST(“CCC”)</td>
<td>“First”</td>
</tr>
</tbody>
</table>

On the client, the Results property content is shown in Figure 39:

**Figure 39: Results Property—Example**

```pascal
brkrRPCBroker1.Results[0] = “Second”
brkrRPCBroker1.Results[1] = “Fourth”
brkrRPCBroker1.Results[3] = “First”
```

### 2.6.43.4 Example

The program code in Figure 40 demonstrates using the Results Property:

**Figure 40: Results Property—Sample Code Using the Results Property**

```pascal
procedure TForm1.btnSendClick(Sender: TObject);
begin
  {clears Results between calls}
brkrRPCBroker1.ClearResults := True;
  {the following code returns a single value}
brkrRPCBroker1.RemoteProcedure := ‘SEND BACK SOME SINGLE VALUE’;
brkrRPCBroker1.Call;
  Label1.Caption := ‘Value returned is: ’ + brkrRPCBroker1.Results[0];
  {the following code returns several values}
brkrRPCBroker1.RemoteProcedure := ‘SEND BACK LIST OF VALUES’;
brkrRPCBroker1.Call;
  ListBox1.Items := RPCBroker.Results;
end;
```

### 2.6.44 RPCBError Property (read-only)

#### 2.6.44.1 Applies to

*TRPCBroker Component*

#### 2.6.44.2 Declaration

```pascal
property RPCBError: String;
```

#### 2.6.44.3 Description

The RPCBError property is available at run-time only. This read-only property contains the Message property associated with the exception or error that was encountered by the instance of the *TRPCBroker Component*. 
2.6.45 RPCTimeLimit Property

2.6.45.1 Applies to
TRPCBroker Component

2.6.45.2 Declaration

```plaintext
property RPCTimeLimit: Integer;
```

2.6.45.3 Description
The RPCTimeLimit property is a public integer property that is available at run-time only. It specifies the length of time a client waits for a response from an RPC. The default and minimum value of this property is 30 seconds. If an RPC is expected to take more than 30 seconds to complete, adjust the RPCTimeLimit property accordingly. However, it is not advisable to have an RPCTimeLimit that is too long; otherwise, the client-end of the application appears to “hang”, if the VistA M Server does not respond in a timely fashion.

2.6.45.4 Example
The program code in Figure 41 demonstrates using the RPCTimeLimit Property:

```plaintext
procedure TForm1.Button1Click(Sender: TObject);
var
  intSaveRPCTimeLimit: integer;
begin
  brkrRPCBroker1.RemoteProcedure := 'GET ALL LAB RESULTS';
  brkrRPCBroker1.Param[0].Value := 'DFN';
  brkrRPCBroker1.Param[0].PType := reference;
  {save off current time limit}
  intSaveRPCTimeLimit := brkrRPCBroker1.RPCTimeLimit;
  {can take up to a minute to complete}
  brkrRPCBroker1.RPCTimeLimit := 60;
  brkrRPCBroker1.Call;
  {restore previous time limit}
  brkrRPCBroker1.RPCTimeLimit := intSaveRPCTimeLimit;
end;
```
2.6.46 RPCVersion Property

2.6.46.1 Applies to
TRPCBroker Component

2.6.46.2 Declaration

```javascript
property RPCVersion: String;
```

2.6.46.3 Description

The RPCVersion design-time property is a published string type property used to pass the version of the RPC. This can be useful for backward compatibility.

As you introduce new functionality into an existing RPC, your RPC can branch into different parts of the code based on the value of the RPCVersion property. The Broker sets the XWBAPVER variable on the VistA M Server to the contents of the RPCVersion property. This property cannot be empty and defaults to “0” (zero).

You can use the application version number in the RPCVersion property.

**REF:** For a suggested method for constructing version numbers, see the “Application Considerations” section.

2.6.46.4 Example

In the following examples (Figure 42 and Figure 43), an RPC is first called with two parameters that are added together and the sum returned to the client. Again, this same RPC is called with the same parameters; however, this time it uses a different RPC version value. Thus, the two numbers are simply concatenated together and the resulting string is returned:

2.6.46.4.1 On the Client

```javascript
procedure TForm1.Button1Click(Sender: TObject);
begin
  {make sure the results get cleared}
  brkrRPCBroker1.ClearResults := True;
  {just re-use the same parameters}
  brkrRPCBroker1.ClearParameters := False;
  brkrRPCBroker1.RemoteProcedure := 'MY APPLICATION REMOTE PROCEDURE';
  brkrRPCBroker1.Param[0].Value := '333';
  brkrRPCBroker1.Param[0].PType := literal;
  brkrRPCBroker1.Param[1].Value := '444';
  brkrRPCBroker1.Param[1].PType := literal;
  brkrRPCBroker1.Call;
  {the result is 777}
  Label1.Caption := 'Result of the call: ' + brkrRPCBroker1.Results[0];
  brkrRPCBroker1.RPCVersion := '2';
  brkrRPCBroker1.Call;
  {the result is 333444}
  Label2.Caption := 'Result of the call: ' + brkrRPCBroker1.Results[0];
end;
```
2.6.46.4.2 On the Server

Figure 43: RPCVersion Property—Example on the Server

<table>
<thead>
<tr>
<th>TAG(RESULT,PARAM1,PARAM2)</th>
<th>;Code for MY APPLICATION REMOTE PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF XWBAPVER&lt;2 SET RESULT=PARAM1+PARAM2</td>
<td></td>
</tr>
<tr>
<td>ELSE SET RESULT=PARAM1−PARAM2</td>
<td></td>
</tr>
<tr>
<td>QUIT RESULT</td>
<td></td>
</tr>
</tbody>
</table>

2.6.47 SecurityPhrase Property

2.6.47.1 Applies to
TRPCBroker Component

2.6.47.2 Declaration

```delphi
property SecurityPhrase: String;
```

2.6.47.3 Description

The SecurityPhrase property is available at run-time only. It holds the unique Security Phrase for the application to be used with Broker Security Enhancement (BSE) logon. The Security Phrase identifies the application as an authorized user of BSE visitor access on the VistA M Server.

⚠️ **RECOMMENDATION:** Since the Security Phrase is the application's identifier, a good security practice is to identify the Security Phrase as a const value in an include file when compiling any RPC Broker Delphi-based program implementing BSE. Add a substitute include file containing a generic Security Phrase (not the one used to compile the application) with the release of the source code.

ℹ️ **REF:** For more information on the application Security Phrase, see the “Step-By-Step Procedures to Implement BSE” section.

2.6.48 Server Property

2.6.48.1 Applies to
TRPCBroker Component

2.6.48.2 Declaration

```delphi
property Server: String;
```

2.6.48.3 Description

The Server design-time property contains the name or Internet Protocol (IP) address of the VistA M Server system. If the name is used instead of the IP address, Microsoft® Windows Winsock should be able to resolve it. Winsock can resolve a name to an IP address either through the Domain Name Service (DNS) or by looking it up in the HOSTS file on the client workstation. In the case where the same name exists in the DNS and in the HOSTS file, the HOSTS file entry takes precedence. Changing the name of
the VistA M Server while the TRPCBroker Component is connected disconnects the TRPCBroker Component from the previous server.

**REF:** For common Winsock error messages, see the RPC Broker “FAQ: Common Winsock Error/Status Messages” at the RPC Broker VA Intranet website.

### 2.6.48.4 Example

The program code in Figure 44 demonstrates using the Server Property:

**Figure 44: Server Property—Example**

```pascal
procedure TForm1.btnConnectClick(Sender: TObject);
begin
    brkrRPCBroker1.ListenerPort := 9999;
    brkrRPCBroker1.Server := 'DHCPSERVER';
    brkrRPCBroker1.Connected := True;
end;
```

### 2.6.49 ServiceSection Property

#### 2.6.49.1 Applies to

TVistaUser Class

#### 2.6.49.2 Declaration

```pascal
property ServiceSection: String;
```

#### 2.6.49.3 Description

The ServiceSection property is available at run-time only. It holds the user’s service section from the NEW PERSON file (#200).
2.6.50 ShowErrorMsgs Property

2.6.50.1 Applies to
TRPCBroker Component

2.6.50.2 Declaration

```delphi
property ShowErrorMsgs: TShowErrorMsgs;
```

2.6.50.3 Description

The ShowErrorMsgs design-time property gives the developer the ability to determine how an exception is handled, if an error handler has not been provided through the OnRpcbError property (i.e., a procedure property that is set to the name of a procedure that is called if an error is encountered). If the OnRpcbError property is assigned, then exception processing is delegated to that procedure. Otherwise, exception handling is based on the value of ShowErrorMsgs property.

Table 12 lists the possible values:

<table>
<thead>
<tr>
<th>Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>semRaise (default)</td>
<td><strong>This is the default value.</strong> The Broker does <em>not</em> handle the error directly but passes it off to the application in general to process, which can result in a different message box display or some other type of error indication.</td>
</tr>
<tr>
<td>semQuiet</td>
<td>The error is <em>not</em> displayed or raised. This requires the application to check the value of the <strong>RPCBErroP Property (read-only)</strong> following calls to the Broker to determine whether an error has occurred, and if so, what the error was. This can be desirable, if the application requires that errors <em>not</em> result in display boxes, etc., as might be the case with an NT service or Web application.</td>
</tr>
</tbody>
</table>

2.6.51 Socket Property (read-only)

2.6.51.1 Applies to
TRPCBroker Component

2.6.51.2 Declaration

```delphi
property Socket: Integer;
```

2.6.51.3 Description

The Socket property is available at run-time only. It contains the active port being used for the TCP/IP connection to the VistA M Server. This is the port that is currently in use on the server as opposed to the ListenerPort (see **ListenerPort Property**) that was used to make the initial connection. After the initial connection, the server connection is moved to another port number (i.e., Socket), which is used for the remainder of the session.
2.6.51.4 Example

The program code in Figure 45 populates the Socket Property (read-only) with the active port on the VistA M Server:

```
function ExistingSocket(Broker: TRPCBroker): integer;
var
  Index: integer;
begin
  Result := 0;
  if Assigned(BrokerConnections) and
     BrokerConnections.Find(Broker.Server + ':' + IntToStr(Broker.ListenerPort),
     Index) then
    Result := TRPCBroker(BrokerConnections.Objects[Index]).Socket;
end;
```

Figure 45: Socket Property—Example

2.6.52 Sorted Property

2.6.52.1 Applies to

TMult Class

2.6.52.2 Declaration

```
property Sorted: Boolean;
```

2.6.52.3 Description

The Sorted design-time property value determines the order of the items in a TMult variable. If Sorted is True, the items are sorted in ascending order of their string subscripts. If Sorted is False (default), the items are unsorted, and appear in the order they were added. Keep in mind that changing Sorted from False to True irreversibly sorts the list so that changing Sorted back to False does not put the list back in its original order, unless the original order was already sorted of course.
2.6.52.4 Example

The program code in Figure 46 demonstrates the effect the Sorted Property has on a TMult variable. Notice that by setting the Sorted Property back to False, the list does not revert to its unsorted order:

1. Start a new VCL Forms application.
2. Drop one TMemo and one TButton on the form. Arrange controls as in Figure 47.
3. Add Vcl.StdCtrls and TRPCB to the “uses” clause.
4. Copy the code in Figure 46 to the Button1.OnClick event:

```pascal
procedure TForm1.Button1Click(Sender: TObject);
var
  Mult1: TMult;
  Subscript: string;
begin
  //Create Mult1. Make Form1 its owner
  Mult1 := TMult.Create(Form1);
  //Fill Mult1 with some strings
  Mult1['First'] := 'One';
  Mult1['Second'] := 'Two';
  Mult1['Third'] := 'Three';
  Mult1['Fourth'] := 'Four';
  Mult1['Fifth'] := 'Five';
  //configure memo box for better display
  Memo1.Font.Name := 'Courier';
  Memo1.ScrollBars := ssVertical;
  Memo1.Lines.Clear;
  Memo1.Lines.Add('Natural order:');
  //set a starting point
  Subscript := '';
  repeat
    //get next Mult element
    Subscript := Mult1.Order(Subscript, 1);
    //if not the end of list
    if Subscript <> '' then
      //display subscript value
      Memo1.Lines.Add(Format('%10s', [Subscript]) + ' - ' + Mult1[Subscript])
      //stop when reached the end
      until Subscript = '';

  //list is now sorted alphabetically
  Mult1.Sorted := True;
  Memo1.Lines.Add('');
  Memo1.Lines.Add('Sorted order:');
  //set a starting point
  Subscript := '';
  repeat
    //get next Mult element
    Subscript := Mult1.Order(Subscript, 1);
    //if not the end of list
    if Subscript <> '' then
      //display subscript value
      Memo1.Lines.Add(Format('%10s', [Subscript]) + ' = ' + Mult1[Subscript])
      //stop when reached the end
      until Subscript = '';

  //existing entries remain in sorted order
  Mult1.Sorted := False;
  Memo1.Lines.Add('');
```
Memo1.Lines.Add('Unsorted order:');
//set a starting point
Subscript := '';
repeat
    //get next Mult element
    Subscript := Mult1.Order(Subscript, 1);
    //if not the end of list
    if Subscript <> '' then
        //display subscript value
        Memo1.Lines.Add(Format('%10s', [Subscript]) + ' - ' + Mult1[Subscript])
    //stop when reached the end
    until Subscript = '';
end;

5. Run project and click on the button.
   The expected output is shown in Figure 47:

   **Figure 47: Sorted Property—Sample Form Output**

   ![Form1](image)

   You may have to scroll up and down to see all of the output.
2.6.53 SSHHide Property

2.6.53.1 Applies to
TRPCBroker Component

2.6.53.2 Declaration

```plaintext
property SSHHide: Boolean;
```

2.6.53.3 Description
The SSHhide property is used when making secured (Secure Shell [SSH]) broker connections. It determines whether the SSH Tunnel application control box is hidden (“true”) or minimized (“false”, default) at application run-time.

2.6.54 SSHport Property

2.6.54.1 Applies to
TRPCBroker Component

2.6.54.2 Declaration

```plaintext
property SSHport: String;
```

2.6.54.3 Description
The SSHport property is available at run-time only. It holds a specific port number for SSH Tunneling if the UseSecureConnection Property is set to “SSH” or “PLINK” (either as a command line option or within the application). If not specified, the application uses the RPC Broker listener port for the remote server. This is useful if the server is running separate listeners for SSH and non-secured connections.

To set the SSHport property as a command line option, include the following:

```plaintext
SSHPort=portnumber
```
2.6.55 SSHpw Property

2.6.55.1 Applies to
TRPCBroker Component

2.6.55.2 Declaration

```property SSHpw: String;```

2.6.55.3 Description

The SSHpw property is available at run-time only. It holds a password for SSH Tunneling if the UseSecureConnection Property is set to “PLINK” (either as a command line option or within the application). If not specified, the password is set to null.

To set the SSHpw property as a command line option, include the following:

```
SSHpw=password
```

2.6.56 SSHUser Property

2.6.56.1 Applies to
TRPCBroker Component

2.6.56.2 Declaration

```property SSHUser: String;```

2.6.56.3 Description

The SSHUser property is available at run-time only. It holds a specific username for SSH Tunneling if the UseSecureConnection Property is set to “SSH” (either as a command line option or within the application). For VA VistA servers, the username is typically of the form xxxvista, where the xxx is the station’s three letter abbreviation.

To set the SSHUser property as a command line option, include the following:

```
SSHUser=username
```
2.6.57 SSOiADUPN Property (TRPCBroker Component)

2.6.57.1 Applies to
TRPCBroker Component

2.6.57.2 Declaration

```property SSOiADUPN: String;```

2.6.57.3 Description
The SSOiADUPN property is available at run-time only. It holds the authenticated user’s Active Directory (AD) User Principal Name (UPN) for the current connection. The value is obtained from the SSOiADUPN Property (TXWBSSOiToken Component).

2.6.58 SSOiADUPN Property (TXWBSSOiToken Component)

2.6.58.1 Applies to
TXWBSSOiToken Component

2.6.58.2 Declaration

```property SSOiADUPN: String;```

2.6.58.3 Description
The SSOiADUPN property is available at run-time only. It holds the authenticated user’s Active Directory (AD) User Principal Name (UPN) for the current token. The value is extracted from the SSOiADUPN Property (TXWBSSOiToken Component).

2.6.59 SSOiLogonName Property (TRPCBroker Component)

2.6.59.1 Applies to
TRPCBroker Component

2.6.59.2 Declaration

```property SSOiLogonName: String;```

2.6.59.3 Description
The SSOiLogonName property is available at run-time only. It holds the authenticated user’s Active Directory (AD) user name for the current connection. The value is obtained from the SSOiLogonName Property (TXWBSSOiToken Component).
2.6.60 SSOiLogonName Property (TXWBSSOiToken Component)

2.6.60.1 Applies to
TXWBSSOiToken Component

2.6.60.2 Declaration

```javascript
property SSOiLogonName: String;
```

2.6.60.3 Description
The SSOiLogonName property is available at run-time only. It holds the authenticated user’s Active Directory (AD) user name for the current token. The value is extracted from the SSOiTToken Property (TXWBSSOiToken Component).

2.6.61 SSOiSECID (TRPCBroker Component)

2.6.61.1 Applies to
TRPCBroker Component

2.6.61.2 Declaration

```javascript
property SSOiSECID: String;
```

2.6.61.3 Description
The SSOiSECID property is available at run-time only. It holds the authenticated user’s Identity and Access Management Security ID (SecID) for the current connection. The value is obtained from the SSOiSECID Property (TXWBSSOiToken Component).

2.6.62 SSOiSECID Property (TXWBSSOiToken Component)

2.6.62.1 Applies to
TXWBSSOiToken Component

2.6.62.2 Declaration

```javascript
property SSOiSECID: String;
```

2.6.62.3 Description
The SSOiSECID property is available at run-time only. It holds the authenticated user’s Identity and Access Management Security ID (SecID) for the current token. The value is extracted from the TXWBSSOiToken component SSOiTToken property.
2.6.63  SSOiToken Property (TRPCBroker Component)

2.6.63.1  Applies to
TRPCBroker Component

2.6.63.2  Declaration

```c
property SSOiToken: String;
```

2.6.63.3  Description
The SSOiToken property is available at run-time only. It holds a digitally-signed XML document (stored as a string) containing user attributes needed to authenticate a user into VistA. The value is obtained from the SSOiToken Property (TXWBSSOiToken Component).

2.6.64  SSOiToken Property (TXWBSSOiToken Component)

2.6.64.1  Applies to
TXWBSSOiToken Component

2.6.64.2  Declaration

```c
property SSOiToken: String;
```

2.6.64.3  Description
The SSOiToken property is available at run-time only. It holds a digitally-signed XML document (stored as a string) containing user attributes needed to authenticate a user into VistA for the current connection. The value is obtained by authenticating the user into the Identity and Access Management (IAM) Secure Token Service (STS) server using mutual Transport Layer Security (TLS) 2-factor authentication.

2.6.65  StandardName Property

2.6.65.1  Applies to
TVistaUser Class

2.6.65.2  Declaration

```c
property StandardName: String;
```

2.6.65.3  Description
The StandardName property is available at run-time only. It holds the user’s standard name from the NEW PERSON file (#200).
2.6.66 Title Property

2.6.66.1 Applies to

TVistaUser Class

2.6.66.2 Declaration

```c
property Title: String;
```

2.6.66.3 Description

The Title property is available at run-time only. It holds the user’s title from the NEW PERSON file (#200).

2.6.67 URLDetect Property

2.6.67.1 Applies to TXWBRichEdit Component

2.6.67.2 Declaration

```c
property URLDetect: Boolean;
```

2.6.67.3 Description

The URLDetect design-time property is used to create active (“live”) links in an application. If this property is set to True, URLs (http:, mailto:, file:, etc.) are shown in blue and underlined. If the user clicks on the URL, it opens the URL in the appropriate application. If the property is False (the default), URLs appear as normal text and are not active.

2.6.68 User Property

2.6.68.1 Applies to

TRPCBroker Component

2.6.68.2 Declaration

```c
property User: TVistaUser;
```

2.6.68.3 Description

The User property is available at run-time only. This instance of the TVistaUser Class object is created during the Create process for the TRPCBroker instance. The object contains data on the current user and is updated as a part of the user authentication process.

**REF:** For examples of silent logon by passing Access and Verify codes, see the “Silent Login Examples” section.
2.6.69 UseSecureConnection Property

2.6.69.1 Applies to
TRPCBroker Component

2.6.69.2 Declaration

```
property UseSecureConnection: Constant;
```

2.6.69.3 Description

The UseSecureConnection property is used to specify whether SSH Tunneling is to be used when making the connection. It can be specified within an application or at run-time as a command line option.

To set the UseSecureConnection property within an application, use one of the following command lines:

- secureNone:
  ```
  UseSecureConnection := 0; //Do not use SSH tunneling (default)
  ```

- secureAttachmate:
  ```
  UseSecureConnection := 1; //Use Attachmate/Micro Focus Reflection SSH
  ```

- securePlink:
  ```
  UseSecureConnection := 2; //Use PuTTY Link (Plink) SSH
  ```

To set the UseSecureConnection property as a command line option, include either of the following:

- “SSH”—Attachmate®/Micro Focus® Reflection.
- “PLINK”—PuTTY Link (Plink).

2.6.70 Value Property

2.6.70.1 Applies to
TParamRecord Class

2.6.70.2 Declaration

```
property Value: String;
```

2.6.70.3 Description

The Value design-time property is used to pass either a single string or a single variable reference to the VistA M Server, depending on the PType (see Table 11).
2.6.70.4 Example

The program code in Figure 48 demonstrates a couple of different uses of the Value Property. Remember that each Param[x] element is really a TParamRecord Class.

![Figure 48: Value Property—Example](image)

```plaintext
procedure TForm1.Button1Click(Sender: TObject);
begin
  with brkrRPCBroker1 do begin
    RemoteProcedure := 'SET NICK NAME';
    {A variable reference}
    Param[0].Value := 'DUZ';
    Param[0].Ptype := reference;
    {A string}
    Param[1].Value := edtNickName.Text;
    Param[1].Ptype := literal;
    Call;
  end;
end;
```

2.6.71 VerifyCode Property

2.6.71.1 Applies to

TVistaLogin Class

2.6.71.2 Declaration

```plaintext
property VerifyCode: String;
```

2.6.71.3 Description

The VerifyCode property is available at run-time only. It holds the Verify code for lmAVCodes mode of Silent Login. Like the AccessCode Property, the user’s Verify code is also encrypted before it is transmitted to the VistA M Server.

REF: For examples of silent logon by passing Access and Verify codes, see the “Silent Login Examples” section.

REF: For more information on Verify codes, see the “Part 1: Sign-On/Security” section in the Kernel Systems Management Guide.
2.6.72 VerifyCodeChngd Property

2.6.72.1 Applies to
TVistaUser Class

2.6.72.2 Declaration

```plaintext
property VerifyCodeChngd: Boolean;
```

2.6.72.3 Description
The VerifyCodeChngd property is available at run-time only. It indicates whether or not the user’s Verify code has changed.

2.6.73 Vpid Property

2.6.73.1 Applies to
TVistaUser Class

2.6.73.2 Declaration

```plaintext
property Vpid: String;
```

2.6.73.3 Description
The Vpid property is available at run-time only. It returns the Department of Veterans Affairs Person Identifier (VPID) value for the current user from the NEW PERSON file (#200), if the facility has already been enumerated. If the facility has not been enumerated, the value returned is a null string.
3 Remote Procedure Calls (RPCs)

3.1 RPC Overview

A Remote Procedure Call (RPC) is a defined call to M code that runs on a VistA M Server. A client application, through the RPC Broker, can make a call to the VistA M Server and execute an RPC on the server. This is the mechanism through which a client application can:

- Send data to a VistA M Server.
- Execute code on a VistA M Server.
- Retrieve data from a VistA M Server.

An RPC can take optional parameters to do some task and then return either a single value or an array to the client application. RPCs are stored in the REMOTE PROCEDURE File (#8994).

The following topics are covered:

- What Makes a Good RPC?
- Using an Existing M API
- Creating RPCs
- M Entry Point for an RPC:
  - Relationship between an M Entry Point and an RPC
  - First Input Parameter (Required)
  - Return Value Types
  - Input Parameters (Optional)
  - Examples
- RPC Entry in the Remote Procedure File:
  - REMOTE PROCEDURE File
  - Key Fields for RPC Operation
  - RPC Version
  - Blocking an RPC
  - Cleanup after RPC Execution
  - Documenting RPCs
- Executing RPCs from Clients:
  - How to Execute an RPC from a Client
  - RPC Security: How to Register an RPC
  - RPC Limits
  - RPC Time Limits
  - Maximum Size of Data
  - Maximum Number of Parameters
3.2 What Makes a Good RPC?

The following characteristics help to make a good remote procedure call (RPC):

- Silent calls (no I/O to terminal or screen, no user intervention required).
- Minimal resources required (passes data in brief, controlled increments).
- Discrete calls (requiring as little information as possible from the process environment).
- Generic as possible (different parts of the same package as well as other packages could use the same RPC).

3.3 Using an Existing M API

In some cases, an existing M API provides a useful M entry point for an RPC. As with any M entry point, you need to add the RPC entry that invokes the M entry point, in the REMOTE PROCEDURE File (#8994).

REF: See also: “Relationship between an M Entry Point and an RPC” section.

3.4 Creating RPCs

You can create your own custom RPCs to perform actions on the VistA M Server and to retrieve data from the VistA M Server. Then you can call these RPCs from your client application. Creating an RPC requires you to perform the following:

- Write and test the M entry point that is called by the RPC.
- Add the RPC entry that invokes the M entry point, in the REMOTE PROCEDURE File (#8994).

3.5 M Entry Point for an RPC

3.5.1 Relationship between an M Entry Point and an RPC

An RPC can be thought of as a wrapper placed around an M entry point for use with client applications. Each RPC invokes a single M entry point.

An M entry point has defined input and output values/parameters that are passed via the standard M invoking methods. An RPC, however, needs to do the following:

- Accept input from the Broker (i.e., passing data/parameters from the client application).
- Pass data to the M entry point in a specified manner.
- Receive values back from the M code in a pre-determined format.
- Pass M code output back through the Broker to the client application.

You can use the $$BROKER\*$XWBLIB function in M code to determine whether the code is being run in an environment where it was invoked by the Broker. This can help you use M code simultaneously for Broker and non-Broker applications.

You can use the RPCVersion Property to support multiple versions of an RPC. The RPCVersion Property Example shows you how to do this on the client and server sides.
### 3.5.2 First Input Parameter (Required)

The RPC Broker always passes a variable by reference in the first input parameter to your M routine. It expects results (one of five Return Value Types) to be returned in this parameter. You must always set some return value into that first parameter before your routine returns.

### 3.5.3 Return Value Types

There are five RETURN VALUE TYPES for RPCs as shown in Table 13. You should choose a return value type that is appropriate to the type of data your RPC needs to return. For example, to return the DUZ, a return value type of SINGLE VALUE would be appropriate.

The RETURN VALUE TYPE you choose determines what values you should set into the return value parameter of your M entry point.

You should always set some value into the Return Value parameter of the M entry point, even if your RPC encounters an error condition.

The RPC settings in Table 13, combined with your M entry point, determine how data is returned to your client application:

<table>
<thead>
<tr>
<th>RPC Return Value Type</th>
<th>How M Entry Point Should Set the Return Parameter</th>
<th>RPC Word Wrap On Setting</th>
<th>Values returned in Client Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Value</td>
<td>Set the return parameter to a single value. For example:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
|                       | \[TAG\(\text{RESULT}\) ;
|                       | \ $\text{RESULT}="XWBUSER,ONE"$
|                       | \ Q\] |
| Array                 | Set an array of strings into the return parameter, each subscripted one level descendant. For example: |
|                       | \[TAG\(\text{RESULT}\) ;
|                       | \ $\text{RESULT}(1)="ONE"
|                       | \ $\text{RESULT}(2)="TWO"
|                       | \ Q\] |
|                       | If your array is large, consider using the GLOBAL ARRAY return value type, to avoid memory allocation errors. |
| Word Processing       | Set the return parameter the same as you set it for the ARRAY type. The only difference is that the WORD WRAP ON setting affects the WORD PROCESSING return value type. |
|                       | True |
|                       | False |
| Global Array          | Set the return parameter to a closed global reference in ^TMP. The global's data nodes are traversed using $QUERY, and all data values |
|                       | True |

Table 13: RPC Settings to Determine How Data is Returned
<table>
<thead>
<tr>
<th>RPC Return Value Type</th>
<th>How M Entry Point Should Set the Return Parameter</th>
<th>RPC Word Wrap On Setting</th>
<th>Values returned in Client Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Instance</td>
<td>Set the return parameter to a closed global reference. For example the following code returns the whole 0th node from the NEW PERSON file (#200) for the current user:</td>
<td>No effect</td>
<td>Value of global node, in Results[0].</td>
</tr>
<tr>
<td></td>
<td>TAG(REsULT); S RESULT=$NA(^VA(200,DUZ,0))</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M ^TMP(&quot;A6A&quot;,$J)= ^XTV(8989.3,1,&quot;INTRO&quot;) ;this node not needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>K ^TMP(&quot;A6A&quot;,$J,0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S RESULT=$NA(^TMP(&quot;A6A&quot;,$J))</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPC Return Value Type</td>
<td>How M Entry Point Should Set the Return Parameter</td>
<td>RPC Word Wrap On Setting</td>
<td>Values returned in Client Results</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Global Instance</td>
<td>Set the return parameter to a closed global reference. For example the following code returns the whole 0th node from the NEW PERSON file (#200) for the current user:</td>
<td>No effect</td>
<td>Value of global node, in Results[0].</td>
</tr>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M ^TMP(&quot;A6A&quot;,$J)= ^XTV(8989.3,1,&quot;INTRO&quot;) ;this node not needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>K ^TMP(&quot;A6A&quot;,$J,0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S RESULT=$NA(^TMP(&quot;A6A&quot;,$J))</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CAUTION:** The global reference you pass is killed by the Broker at the end of RPC Execution as part of RPC cleanup. Do not pass a global reference that is not in ^TMP or that should not be killed.

This type is useful for returning large amounts of data to the client, where using the ARRAY type can exceed the symbol table limit and crash your RPC.

For example, to return signon introductory text you could do:

```
TAG(REsULT);
M ^TMP("A6A",$J)= ^XTV(8989.3,1,"INTRO")
;this node not needed
K ^TMP("A6A",$J,0)
S RESULT=$NA(^TMP("A6A",$J))
Q
```

**NOTE:** In the M code called by an RPC, you can use the $SRTRNFMT^XWBLIB function to change the RETURN VALUE TYPE of an RPC on-the-fly.
3.5.4 Input Parameters (Optional)

The M entry point for an RPC can optionally have input parameters (i.e., beyond the first parameter, which is always used to return an output value). The client passes data to your M entry point through these parameters.

The client can send data to an RPC (and therefore the entry point) in one of the three Param Property types in Table 14:

<table>
<thead>
<tr>
<th>Param PType</th>
<th>Param Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>literal</td>
<td>Delphi string value, passed as a string literal to the VistA M Server.</td>
</tr>
<tr>
<td>reference</td>
<td>Delphi string value, treated on the VistA M Server as an M variable name and resolved from the symbol table at the time the RPC executes.</td>
</tr>
<tr>
<td>list</td>
<td>A single-dimensional array of strings in the Mult Property of the Param Property is passed to the VistA M Server where it is placed in an array. String subscripting can be used.</td>
</tr>
</tbody>
</table>

CAUTION: The use of a reference-type input parameter represents a significant security risk. The M entry point should include code to screen the input value for M code injection (e.g., function calls, M commands, or direct global reads).

The type of the input parameters passed in the Param Property of the TRPCBroker Component determines the format of the data you must be prepared to receive in your M entry point.

3.5.5 Examples

The examples in Figure 49 and Figure 50 illustrate sample M code that could be used in simple RPCs:

1. The example in Figure 49 takes two numbers and returns their sum:

   Figure 49: RPCs—Sample M Code to Add Two Numbers
   
   ```mcode
   SUM(RESULT,A,B) ; add two numbers
   S RESULT=A+B
   Q
   ```

2. The example in Figure 50 receives an array of numbers and returns them as a sorted array to the client:

   Figure 50: RPCs—Sample M Code that Receives an Array of Numbers and Returns them as a Sorted Array to the Client
   
   ```mcode
   SORT(RESULT,UNSORTED) ; sort numbers
   N I
   S I=""
   F S I=$O(UNSORTED(I)) Q:I="" S RESULT(UNSORTED(I))=UNSORTED(I)
   Q
   ```
3.6 RPC Entry in the Remote Procedure File

3.6.1 REMOTE PROCEDURE File

The RPC Broker consists of a single global that stores the REMOTE PROCEDURE file (#8994):

<table>
<thead>
<tr>
<th>File #</th>
<th>File Name</th>
<th>Global Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>8994</td>
<td>REMOTE PROCEDURE</td>
<td>^XWB(8994,</td>
</tr>
</tbody>
</table>

This is the common file used by all applications to store all remote procedure calls accessed via the Broker. All RPCs used by any site-specific client/server application software using the RPC Broker interface must be registered and stored in this file.

This file is used as a repository of server-based procedures in the context of the Client/Server architecture. By using the Remote Procedure Call (RPC) Broker, applications running on client workstations can invoke (call) the procedures in this file to be executed by the server and the results are returned to the client application.

**NOTE:** The RPC subfield (#19.05) of the OPTION File (#19) points to RPC field (#.01) of the REMOTE PROCEDURE file (#8994).

3.6.2 Key Fields for RPC Operation

After the M code is complete, you need to add the RPC to the REMOTE PROCEDURE File (#8994). Table 16 lists the fields in the REMOTE PROCEDURE file (#8994) that are key to the correct operation of an RPC:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Required?</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAME (#.01)</td>
<td>Yes</td>
<td>The name that identifies the RPC (this entry should be namespaced in the package namespace).</td>
</tr>
<tr>
<td>TAG (#.02)</td>
<td>Yes</td>
<td>The tag at which the remote procedure call begins.</td>
</tr>
<tr>
<td>ROUTINE (#.03)</td>
<td>Yes</td>
<td>The name of the routine that should be invoked to start the RPC.</td>
</tr>
<tr>
<td>WORD WRAP ON (#.08)</td>
<td>No</td>
<td>Affects GLOBAL ARRAY and WORD PROCESSING return value types only. If set to False, all data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>values are returned in a single concatenated string in Results[0]. If set to True, each array</td>
</tr>
<tr>
<td></td>
<td></td>
<td>node on the M side is returned as a distinct array item in Results.</td>
</tr>
</tbody>
</table>
| RETURN VALUE TYPE (#.04) | Yes     | This can be one of five types:  
- SINGLE VALUE  
- ARRAY  
- WORD PROCESSING  
- GLOBAL ARRAY  
- GLOBAL INSTANCE  
This setting controls how the Broker processes an RPC’s return parameter (see “Return Value Types”). |

Table 15: Remote Procedure File Information

Table 16: Remote Procedure File—Key Fields for RPC Operation
3.6.3 RPC Version

The VERSION field of the REMOTE PROCEDURE File (#8994) indicates the version number of an RPC installed at a site. The field can be set either by an application developer and exported by KIDS or by a site manager using VA FileMan.

Applications can use XWB IS RPC AVAILABLE or XWB ARE RPCS AVAILABLE to check the availability of a version of an RPC on a server. This is especially useful for RPCs run remotely, as the remote server may not have the latest RPC installed.

3.6.4 Blocking an RPC

The INACTIVE field of the REMOTE PROCEDURE File (#8994) allows blocking of RPCs. The blocking can apply to local access (users directly logged into the site) or remote access (users logged on to a different site) or both. The field can be set either by an application developer and exported by Kernel Installation & Distribution System (KIDS) or by a site manager using VA FileMan.

REF: For more information on remote access, see the “Running RPCs on a Remote Server” section.

3.6.4.1 Value in INACTIVE field

- 1 = Completely unusable
- 2 = Unusable locally
- 3 = Unusable remotely

3.6.5 Cleanup after RPC Execution

The Broker uses XUTL^XUSCLEAN to clean up globals upon application termination.

In addition, there is an RPC RETURN VALUE TYPE (see “Return Value Types“), GLOBAL ARRAY, where the application RPC returns a closed form global reference, for example:

```
^TMP(“EKG”,666333551)
```

The Broker kills the data for the global reference for this type of RPC at the end of RPC execution.

3.6.6 Documenting RPCs

Each individual application development team is responsible for identifying and providing documentation for all object components, classes, and remote procedure calls they create. Other developers using these components need to know what RPCs are called, because they need to register them with their applications.

RPCs should be documented in the DESCRIPTION field (#1) in the REMOTE PROCEDURE File (#8994) for those RPCs installed on your system. This gives you the capability of generating a catalogue of RPCs from File #8994.
3.6.6.1 Delphi Component Library and Sample RPCs

In the future, an Enterprise library of services, object components, classes, Application Programming Interfaces (APIs), Remote Procedure Calls (RPCs), etc. that are in use and available to the development community at large may be available. The essential benefit of this type of library is the promotion of object re-use; thereby, enhancing development productivity, application consistency, and quality assurance. Therefore, it could contain a wide variety of services, object components, APIs, classes, RPCs, etc. from many VistA software applications.

The immediate intent is to classify and catalogue all of the object classes in use (including the standard Delphi classes), and to make the catalogue available to all interested parties.

3.7 Executing RPCs from Clients

3.7.1 How to Execute an RPC from a Client

1. If your RPC has any input parameters beyond the mandatory First Input Parameter (Required), set a Param node in the TRPCBroker Component’s Param Property for each. For each input parameter, set the following sub-properties:
   - Value Property
   - PType Property (literal, list, or reference)

   If the parameter’s PType Property is list, instead of specifying a value, set a list of values in the Mult Property.

   Figure 51 is an example of some settings of the Param Property:

   ![Figure 51: RPCs—Param Property—Example Setting a List of Values](image)

   ```pascal
   brkrRPCBroker1.Param[0].Value := '03/31/14';
   brkrRPCBroker1.Param[0].PType := literal;
   brkrRPCBroker1.Param[1].Mult["NAME"] := 'XWBUSER, ONE';
   brkrRPCBroker1.Param[1].mult["ssn"] := "000-45-6789";
   brkrRPCBroker1.Param[1].PType := list;
   ```

2. Set the TRPCBroker Component’s RemoteProcedure Property to the name of the RPC to execute:

   ```pascal
   brkrRPCBroker1.RemoteProcedure:='A6A LIST'
   ```

3. Invoke the TRPCBroker Component’s Call Method to execute the RPC. All calls to the Call Method should be done within an exception handler try...except statement, so that all communication errors (which trigger the EBrokerError exception) can be trapped and handled. For example:

   ![Figure 52: Error Handling—Example of a “try...except” Statement](image)

   ```pascal
   try
   brkrRPCBroker1.Call;
   except
     On EBrokerError do
       ShowMessage('A problem was encountered communicating with the server.');
   end;
   ```
4. Any results returned by your RPC are returned in the TRPCBroker Component’s Results Property. Depending on how you set up your RPC, results are returned either in a single node of the Results Property (Results[0]), or in multiple nodes of the Results Property.

NOTE: You can also use the IStartCall Method and the StartCall Method to execute an RPC. The main difference between these methods and the Call Method is that the IStartCall Method and the StartCall Method do not use the Results Property, instead returning results into a location you specify.

### 3.7.2 RPC Security: How to Register an RPC

Security for RPCs is handled through the RPC registration process. Each client application must create a context for itself, which checks if the application user has access to a “B”-type option in the Kernel menu system. Only RPCs assigned to that option can be run by the client application.

To enable your application to create a context for itself:

1. Create a “B”-type option in the OPTION file (#19) for your application.

   NOTE: The OPTION TYPE “B” represents a Broker client/server type option.

2. In the RPC multiple for this option type, add an entry for each RPC that your application calls. The fields listed in Table 17 can be set up for each RPC in your option:

   **Table 17: RPC Multiple Fields for “B”-Type Options**

<table>
<thead>
<tr>
<th>Field Name (#)</th>
<th>Entry</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPC (.01)</td>
<td>Required</td>
<td>This field is used to enter a pointer to the REMOTE PROCEDURE File (#8994). This field links the remote procedure call in the REMOTE PROCEDURE File (#8994) to the package option.</td>
</tr>
<tr>
<td>RPKKEY (#1)</td>
<td>Optional</td>
<td>This field is used to restrict the use of a remote procedure call to a particular package option. The RPKKEY field is a free-text pointer to the SECURITY KEY file (#19.1).</td>
</tr>
<tr>
<td>RULES (#2)</td>
<td>Optional</td>
<td>This field is used to enter M code that is executed when an RPC request is made to verify whether the request should be honored.</td>
</tr>
</tbody>
</table>

3. When you export your package using Kernel Installation and Distribution System (KIDS), export both your RPCs and your package option. KIDS automatically associates the RPCs with the package option.

4. Your application must create a context for itself on the VistA M Server, which checks access to RPCs. In the initial code of your client application, make a call to the CreateContext Method of your TRPCBroker Component. Pass your application’s “B”-type option’s name as a parameter. For example:

   ```java
   if not brkrRPCBroker1.CreateContext(option_name) then
     Application.Terminate;
   ```

5. If the CreateContext Method returns True, only those RPCs designated in the RPC multiple of your application option is permitted to run.
6. If the CreateContext Method returns False, you should terminate your application (if you do not, your application runs but you get errors every time you try to access an RPC).

7. End-users of your application must have the “B”-type option assigned to them on one of their menus, in order for the CreateContext Method to return True. This allows system managers to control access to client applications.

3.7.3 RPC Limits

The following is a list of various constants, maximum, and minimum parameters associated with the use of the RPC Broker:

- **Maximum Number of Parameters** that can be passed to the VistA M Server.
- **Maximum Size of Array** that can be passed to the VistA M Server.
- **Maximum Size of Data** that can be received in the VistA Graphical User Interface (GUI) application from the VistA M Server.
- **RPC Time Limits**.

3.7.4 RPC Time Limits

A public READ/WRITE property (i.e., RPCTimeLimit Property) allows the application to change the network operation timeout prior to a call. This can be useful during times when it is known that a certain RPC, by its nature, can take a significant amount of time to execute. The value of this property is an integer that cannot be less than 30 seconds nor greater than 32767 seconds. Care should be taken when altering this value, since the network operation blocks the application until the operation finishes or the timeout is triggered.

There is also a server time limit for how long to stay connected when the client does not respond.

3.7.5 Maximum Size of Data

The VistA M Server can transmit very large buffers of data back to the Microsoft® Windows client. The Windows client receives the returned data from an RPC into a 32-bit PASCAL string. RPCs can be written on the VistA M Server so that they store their results in an M GLOBAL structure, which can span RAM and disk storage media. This GLOBAL storage could be quite large depending on the assigned system quotas to the VistA M Server process. The return of the RPC can deliver this quantity to the Windows client. The actual limit depends on the capacity that the Microsoft® Windows operating system allows the client to process. Tests on a 32-megabyte RAM system have allowed buffers of several megabytes of data to be transmitted from the VistA M Server to the Microsoft® Windows client.

3.7.6 Maximum Number of Parameters

The remote procedure calls (RPCs) become M DO procedures on the VistA M Server. Since RPCs are communicated to the VistA M Server through a message mechanism, additional information is included with the message.

Parameters are processed as PASCAL short strings with a maximum of 255 characters. Each parameter is encoded with a three-character length plus a type character. Therefore, every parameter occupies length (parameter) + four. The maximum transmission at this time is 240 characters, since additional header information is present with every RPC.

A theoretical maximum, where every parameter was length 1 would give number of parameters = 240/5 or 48 parameters. A single parameter (e.g., a long string) could not exceed 240 - 4, or 236 characters. Future support will be based on the PASCAL 32-bit string, which can, theoretically, reach 2 GB. Limitations on the VistA M Server still limit this to far less, however.
3.7.7 Maximum Size of Array

Although approximately only 240 characters can be sent to the VistA M Server as call parameters, a single array parameter can be passed in with greater capacity. The RPC can carry both literal and array parameters except that literal parameters are placed first and the single array last in order. Arrays are instantiated at the VistA M Server and are stored in a local array format. The maximum size is dependent on the symbol space available to the VistA M Server process. The index size and the value size are subject to limitations; the index and value each cannot exceed $255 - 3$, or 252 characters approximately for each individual array elements.

At the time of this writing, 30 to 40 K arrays have easily been passed to the VistA M Server in a single RPC call.

3.7.8 RPC Broker Example (32-Bit)

The RPC Broker Example sample application provided with the BDK (i.e., BrokerExample.exe) demonstrates the basic features of developing RPC Broker applications, including:

- Connecting to a VistA M Server.
- Creating an application context (see CreateContext Method).
- Using the GetServerInfo Function.
- Displaying the VistA splash screen (see “VistA Splash Screen Procedures” section).
- Setting the TRPCBroker Param Property for each Param PType (literal, reference, list).
- Calling RPCs with the Call Method.
- Calling RPCs with the lstCall Method and strCall Method.

REMARK: The BrokerExample.exe and client source code files for the BrokerExample.exe application are located in the following directory:

  BDK32\Samples\BrokerEx
4 RPC Broker: Developer Tools

In addition to the RPC Broker components, the Broker Development Kit (BDK) provides other development tools, including:

- Application Programming Interface (API)
- Functions, Methods, and Procedures
- Running RPCs on a Remote Server
- Deferred RPCs

4.1 Application Programming Interface (API)

4.1.1 Overview

RPC Broker uses Kernel Application Programming Interfaces (APIs) and Remote Procedure Calls (RPCs) for most user authentication (Signon) and authorization (Security) actions. However, there are a few APIs and RPCs unique to Broker connections that are used by a variety of interfaces into VistA. For example, VistALink and VistA Services Assembler both use the CHKPRMIT^XWBSEC API to determine if a user has authorization to use a particular Remote Procedure.

The RPC Broker software provides the following APIs on the VistA M Server for use in RPC code:

- $$BROKER^XWBLIB: Test for Broker Context
- $$RTRNFMT^XWBLIB(): Change RPC Return
- CHKPRMIT^XWBSEC(): Check Permissions
- CRCONTXT^XWBSEC(): Create Context
- SET^XWBSEC(): Set the State Variable

4.1.2 $$BROKER^XWBLIB: Test for Broker Context

Reference Type: Supported
Category: RPC Broker
ICR #: 2198
Description: Use this extrinsic function in the M code called by an RPC to determine if the current process is being executed by the RPC Broker.

Format: $$BROKER^XWBLIB
Input Parameters: none.
Output: return value: Returns:
- 1—If the current process is being executed by the Broker.
- 0—If the current process is not being executed by the Broker.
4.1.2.1 Example

I $$BROKER^XWBLIB D .; broker-specific code

4.1.3 $$RTRNFMT^XWBLIB(): Change RPC Return Type

Reference Type: Supported
Category: RPC Broker
ICR #: 2238
Description: Use this extrinsic function in the M code called by an RPC to change the return value type that the RPC returns on-the-fly.
Format: $$RTRNFMT^XWBLIB(type,wrap)

Input Parameters:

- type: (required) Set this to the RETURN VALUE TYPE to which you want to change the RPC’s setting. Set it to one of the following numeric or free text values:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SINGLE VALUE</td>
</tr>
<tr>
<td>2</td>
<td>ARRAY</td>
</tr>
<tr>
<td>3</td>
<td>WORD PROCESSING</td>
</tr>
<tr>
<td>4</td>
<td>GLOBAL ARRAY</td>
</tr>
<tr>
<td>5</td>
<td>GLOBAL INSTANCE</td>
</tr>
</tbody>
</table>

- wrap: (required) Set value to:
  - 1—Set RPC’s WORD WRAP ON setting to True.
  - 0—Set RPC’s WORD WRAP ON setting to False.

Output: return value: Returns:

- 0—If the return value type could not be changed.
- numeric code—Representing the return value type to which the RPC is changed.

4.1.3.1 Example

I "$RTRNFMT^XWBLIB("ARRAY",1) D .; branch to code if cannot change RPC type
4.1.4 CHKPRMIT^XWBSEC(): Check Permissions

Reference Type: Controlled Subscription
Category: Signon/Security
ICR #: 4053
Description: This API checks to see if the remote procedure is permitted to run. It checks for:

- User-held security keys
- User context (context option)
- Out-of-order settings
- RPC version

If the user is an Application Proxy, it checks to see if Application Proxy access to the remote procedure is permitted.

Some remote procedures are allowed in any context:

- XUS BSE TOKEN
- XUS CVC
- XUS GET USER INFO
- XUS GET TOKEN
- XUS IAM BIND USER
- XUS KAAJEE GET USER INFO
- XUS KAAJEE LOGOUT
- XUS KEY CHECK
- XUS SET VISITOR
- XWB CREATE CONTEXT
- XWB IM HERE
- XWB IS RPC AVAILABLE
- XWB RPC LIST

All Kernel “XUS” and RPC Broker “XWB” remote procedures are allowed in “XUS SIGNON” context.

Format: CHKPRMIT^XWBSEC(xwbrp)

Make sure to perform the following steps before calling this API:

1. NEW all non-namespaced variables.
2. Set all input variables.
3. Call the API.

Input Parameters: xwbrp: (required) This is the name of the remote procedure to look up in the REMOTE PROCEDURE file (#8994).
Output Variables: XWBSEC: Returns:

- ""—Null in XWBSEC environment variable if the remote procedure is permitted to run.
- Error Message—If the remote procedure is not permitted. If an error is returned, then the XWBSEC environment variable is set to return the same error message.

**NOTE:** XWBSEC is an environment variable, so that the information is included in the error trap should a subsequent processing error occur.

### 4.1.5 CRCONTEXT^XWBSEC(): Create Context

**Reference Type:** Controlled Subscription

**Category:** Signon/Security

**ICR #:** 4053

**Description:** This API creates a valid RPC Broker user context.

**Format:** CRCONTEXT^XWBSEC(result,option)

Make sure to perform the following steps before calling this API:

1. NEW all non-namespaced variables.
2. Set all input variables.
3. Call the API.

**Input Parameters:**

- **option:** (required) This is the encrypted name of the B-type menu option to look up in the OPTION file (#19). If the option has been assigned to the user as a SECONDARY MENU OPTION, then the context can be set.

**REF:** For more information on context options, see the “RPC Security: How to Register an RPC” section.

**Output:**

- **result:** Returns:
  - 1—Successful: If the context is successfully created.
  - 0 (and error message)—Unsuccessful: If the context could not be created.
Output Variables: XWBSEC: If an error is returned, then the XWBSEC environment variable is set to return the same error message.

**NOTE:** XWBSEC is an environment variable, so that the information is included in the error trap should a subsequent processing error occur.

### 4.1.6 SET^XWBSEC(): Set the State Variable

**Reference Type:** Controlled Subscription  
**Category:** Signon/Security  
**ICR #:** 4053  
**Description:** This API sets the XWBSTATE environment variable (array) to contain a passed in value. This is generally used to record the current status of a Broker connection for monitoring or testing.

**NOTE:** XWBSTATE is an environment variable, so that the information is included in the error trap should a subsequent processing error occur.

**Format:**  
```plaintext
SET^XWBSEC(%, value)
```

Make sure to perform the following steps before calling this API:

1. NEW all non-namespaced variables.  
2. Set all input variables.  
3. Call the API.

**Input Parameters:**  
- *value*: (required) This is free text state value to be added to the XWBSTATE array.

**Output Variables:**  
- *%*: Returns this variable equal to the value input parameter and also sets the XWBSTATE(%) environment variable equal to the value input parameter.
4.2 Functions, Methods, and Procedures

4.2.1 Overview

Additional functions, methods, and procedures include:

- XWB CREATE CONTEXT
- XWB GET BROKER INFO
- XWB GET VARIABLE VALUE
- XWB IM HERE
- M Emulation Functions
- Encryption Functions
- CheckCmdLine Function
- GetServerInfo Function
- GetServerIP Function
- ChangeVerify Function
- SilentChangeVerify Function
- StartProgSLogin Method
- VistA Splash Screen Procedures

4.2.2 XWB CREATE CONTEXT

The XWB CREATE CONTEXT RPC (distributed with the RPC Broker) is used to establish the context on the VistA M Server, which is checked by the Broker Listener before executing any other remote procedure. Since context is nothing more than a client/server “B”-type option in the OPTION file (#19), standard MenuMan security is applied in establishing a context. Therefore, a context option can be granted to users exactly the same way as regular options are done using MenuMan.

A context cannot be established for the following reasons:

- User has no access to that option
- Option is temporarily out of order

An application can switch from one context to another as often as it needs. Each time a context is created the previous context is overwritten.

Pass the encrypted (using the Encrypt function in the XWBHash unit) OPTION name in Param[0].Value, and the type (literal) in Param[0].PType. The TRPCBroker CreateContext method sets up these values and calls the RPC for you. Also, the current context of your user must give them permission to execute the XWB GET VARIABLE VALUE RPC (it must be included in the RPC multiple of the “B”-type option registered with the CreateContext Method).

NOTE: XWB CREATE CONTEXT is a Private RPC. If an application uses the TRPCBroker CreateContext method, a subscription is not needed as the RPC is owned by the RPC Broker package.
4.2.3 XWB GET BROKER INFO

The XWB GET BROKER INFO RPC (distributed with the RPC Broker) is used to return information regarding setup and parameters of the Broker Listener on the VistA M Server. The RPC currently returns only the timeout period for handler READs.

There are no input parameters.

NOTE: XWB GET BROKER INFO is currently used only within the RPC Broker package, and has not been made available to other applications.

4.2.4 XWB GET VARIABLE VALUE

You can call the XWB GET VARIABLE VALUE RPC (distributed with the RPC Broker) to retrieve the value of any M variable in the VistA M Server environment. Pass the variable name in Param[0].Value, and the type (reference) in Param[0].PType. Also, the current context of your user must give them permission to execute the XWB GET VARIABLE VALUE RPC (it must be included in the RPC multiple of the “B”-type option registered with the CreateContext Method).

WARNING: The XWB GET VARIABLE VALUE RPC is intended to retrieve the value of an M variable (e.g., DUZ or DTIME). This is the only supported function of this RPC. If the RPC is used in an application in any other way than the way it was intended, results can be unpredictable and the application could cease to function in future software patches.

NOTE: XWB GET VARIABLE VALUE is available only on a Controlled Subscription basis.

4.2.4.1 Example

Figure 53 is an example of the XWB GET VARIABLE VALUE RPC:

```pascal
brkrRPCBroker1.RemoteProcedure := 'XWB GET VARIABLE VALUE';
brkrRPCBroker1.Param[0].Value := 'DUZ';
brkrRPCBroker1.Param[0].PType := reference;
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;
ShowMessage('DUZ is ' + brkrRPCBroker1.Results[0]);
```

4.2.5 XWB IM HERE

The XWB IM HERE RPC (distributed with the RPC Broker) is used to establish continued existence of the client connection to the VistA M Server (keephive). It resets the server READ timeout. The RPC currently returns a meaningless value of “1”, which is not used on the client.

There are no input parameters.

NOTE: XWB IM HERE is a Private RPC. If an application uses the Delphi RPC Broker Development Kit (BDK), a subscription is not needed as the RPC is owned by the RPC Broker package.
4.2.6  M Emulation Functions

4.2.6.1 Piece Function
The Piece function is a scaled down Pascal version of M’s $PIECE function. It is declared in MFUNSTR.PAS.

```
function Piece(x: string; del: string; piece: integer) : string;
```

4.2.6.2 Translate Function
The Translate function is a scaled down Pascal version of M’s $TRANSLATE function. It is declared in MFUNSTR.PAS.

```
function Translate(passedString, identifier, associator: string): string;
```

4.2.6.3 Examples

4.2.6.3.1 Piece Function

```
Piece3Str:=piece('123^456^789','^',3);
```

4.2.6.3.2 Translate Function

```
hiStr:=translate('HI','ABCDEFGHI','abcdefghi');
```

4.2.7 Encryption Functions
Kernel and the RPC Broker provide encryption functions that can be used to encrypt messages sent between the client and the server.

4.2.7.1 In Delphi
Include XWBHash in the “uses” clause of the unit in which you are encrypting or decrypting.

Function prototypes are as follows:

```
function Decrypt(EncryptedText: string): string;
function Encrypt(NormalText: string): string;
```
4.2.7.2 On the VistA M Server

4.2.7.2.1 Encrypt Function

To encrypt a string, do the following:

```plaintext
S CIPHER=$$ENCRYP^XUSRB1("Hello world!") W CIPHER
/U’11TG-TV1&f-
```

4.2.7.2.2 Decrypt Function

To decrypt a string, do the following:

```plaintext
S PLAIN=$$DECRYP^XUSRB1(CIPHER) W PLAIN
Hello world!
```

These encryption functions can be used for any communication between the client and the server where encryption is desired.

4.2.8 CheckCmdLine Function

With Patch XWB*1.1*13, the CheckCmdLine method was changed from a procedure to a function with a Boolean return value.

```plaintext
function CheckCmdLine(SLBroker: TRPCBroker): Boolean;
```

4.2.8.1 Argument

Table 19: CheckCmdLine Function—Argument

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLBroker</td>
<td>The instance of the Broker with which information on the command line should be used, and to be used for the connection, if a Silent Login is possible.</td>
</tr>
</tbody>
</table>

4.2.8.2 Result

The return value indicates whether the information on the command line was sufficient to connect the RPCBroker instance to the specified Server/ListenerPort (see Server Property and ListenerPort Property).

- **True**—Broker is connected to the VistA M Server.
- **False**—Broker is not connected to the VistA M Server.
4.2.9 GetServerInfo Function

The GetServerInfo function retrieves the end-user’s selection of server and port to which to connect. Use this function to set a TRPCBroker Component’s Server, and ListenerPort (see Server Property and ListenerPort Property) to reflect the end-user’s choice before connecting to the VistA M Server.

If there is more than one server/port from which to choose, GetServerInfo displays an application window that allows users to select a service to connect:

![Figure 54: GetServerInfo Function—Connect To Dialogue](image)

4.2.9.1 Syntax

```
function GetServerInfo(var Server, Port: string): integer;
```

NOTE: The unit is the RPCConf1 Unit.

The GetServerInfo function handles the following scenarios:

- If there are no values for server and port in the Microsoft Windows Registry, GetServerInfo does not display its dialogue window, and the automatic default values returned are BROKERSERVER/9999. GetServerInfo returns mrOK.
- If exactly one server and port entry is defined in the Microsoft Windows Registry, GetServerInfo does not display its dialogue window. The values in the single Microsoft Windows Registry entry are returned to the calling application, with no user interaction. GetServerInfo returns mrOK.
- If more than one server and port entry exists in the Microsoft Windows Registry, the dialogue window is displayed. The only time that passed in server and port values are returned to the calling application is if the user selects Cancel. However, if a user selects an entry and presses OK, the server and port parameters are changed and returned to the calling application. GetServerInfo returns mrOK if the user selected OK, or mrCancel if the user selected Cancel.
A typical Microsoft® Windows Registry entry for a VistA M Server contains the following characteristics:

- Located in either of the following registries:
  - HKEY_LOCAL_MACHINE (HKLM)—Registry for accessibility to all users of a computer.
  - HKEY_CURRENT_USER (HKCU)—Registry for accessibility to a single user.
- Located in the following registry subdirectory:
  Software\Vista\Broker\Servers
- String-type registry entry, where Value name contains the IP address or Fully Qualified Domain Name (FQDN) of the server, followed by the port number of the RPC Broker listener on the server. The information should be separated by a comma. For example:
  myserver.vha.med.va.gov,19999
- The optional Value data contains the SSHUsername to be used to establish an encrypted connection to the VistA M Server.

**REF:** For a demonstration using the Broker and GetServerInfo function, run the [RPC Broker Example (32-Bit)](BDK32\Samples\BrokerEx) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx

### 4.2.9.2 Example

**Figure 55** is an example of the GetServerInfo function:

```
procedure TForm1.btnConnectClick(Sender: TObject);
var
  strServer, strPort, strSSHUsername: string;
begin
  if GetServerInfo(strServer, strPort, strSSHUsername)<> mrCancel then
  begin
    {getsvrinfo begin}
    brkrRPCBroker1.Server := strServer;
    brkrRPCBroker1.ListenerPort := StrToInt(strPort);
    brkrRPCBroker1.SSHUser := strSSHUsername;
    brkrRPCBroker1.Connected := True;
    {getsvrinfo end}
  end;
end;
```

**REF:** For a demonstration using the Broker and GetServerInfo function, run the [RPC Broker Example (32-Bit)](BDK32\Samples\BrokerEx) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx
4.2.10 GetServerIP Function

The GetServerIP function provides a means for determining the Internet Protocol (IP) address for a specified VistA M Server address. The value returned is a string containing the IP address, or if it could not be resolved, the string “Unknown!”

```
function GetServerIP(ServerName: string): string;
```

4.2.10.1 Example

Figure 56 is an example of the GetServerIP function:

```
uses RpcConf1;

procedure TForm1.Button1Click(Sender: TObject);
var
  ServerName: string;
begin
  ServerName := 'forum.med.va.gov';
  edtIPAddress.Text := GetServerIP(edtInput.Text);
  // For Forum.va.gov returns '999.999.9.99'
  // For garbage returns 'Unknown!'
end;
```

CAUTION: The GetServerIP function has limited use in a modern TCP/IP network, as multiple IP addresses can be assigned to a single server. It is expected to be deprecated and replaced in future releases with a function that returns a list of IP addresses.

4.2.11 ChangeVerify Function

The ChangeVerify function can be used to provide the user with the ability to change his/her Verify code.

```
function ChangeVerify(RPCBroker: TRPCBroker): Boolean;
```

4.2.11.1 Argument

```
<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>The Broker instance for the account on which the Verify code is to be changed.</td>
</tr>
</tbody>
</table>
```
4.2.11.2 Result
The return value indicates whether the user changed their Verify code or not.

- **True**—User changed their Verify code.
- **False**—User did not change their Verify code.

4.2.12 SilentChangeVerify Function
The SilentChangeVerify function can be used to change the Verify code for a user without any dialogue windows being displayed.

```plaintext
function SilentChangeVerify(RPCBroker: TRPCBroker; OldVerify, NewVerify1, NewVerify2: String; var Reason: String): Boolean;
```

4.2.12.1 Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>The current instance of the Broker for the account for which the Verify code is to be changed.</td>
</tr>
<tr>
<td>OldVerify</td>
<td>The string representing the current Verify code for the user.</td>
</tr>
<tr>
<td>NewVerify1</td>
<td>A string representing the new Verify code for the user.</td>
</tr>
<tr>
<td>NewVerify2</td>
<td>A second independent entry for the string representing the new Verify code for the user.</td>
</tr>
<tr>
<td>Reason</td>
<td>A string that on return contains the reason why the Verify code was not changed (if the result value is False).</td>
</tr>
</tbody>
</table>

4.2.12.2 Result
The return value indicates whether the Verify code was successfully changed or not:

- **True**—Verify code was successfully changed.
- **False**—Verify code was not successfully changed. The reason for the failure is in the Reason argument.

4.2.13 StartProgSLogin Method
The StartProgSLogin method can be used to initiate another program with information sufficient for a Silent Login, or it can be used to launch a standalone program that does not use a TRPCBroker Component connection. If the program is being used to launch another executable with information for a Silent Login, it is recommended that the CheckCmdLine Function be used in the program being launched (since this function uses the command line information to make a Silent Login if possible).

```plaintext
procedure StartProgSLogin(const ProgLine: String; ConnectedBroker: TRPCBroker);
```
4.2.13.1 Arguments

Table 22: StartProgSLogin Method—Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProgLine</td>
<td>This is the command line that should be used as the basis for launching the executable. It contains the executable (and path, if not in the working directory or in the system path) and any command line arguments desired. If the ConnectedBroker argument is not nil, then the following are added to the command line and the application launched:</td>
</tr>
<tr>
<td></td>
<td>• VistA M Server address</td>
</tr>
<tr>
<td></td>
<td>• ListenerPort</td>
</tr>
<tr>
<td></td>
<td>• Division</td>
</tr>
<tr>
<td></td>
<td>• ApplicationToken</td>
</tr>
<tr>
<td>ConnectedBroker</td>
<td>This is the instance of the TRPCBroker that should be used to obtain an ApplicationToken for a Silent Login. The VistA M Server address and ListenerPort for this instance are used as command line arguments for launching the application, so that it makes a connection to the same Server/ListenerPort (see Server Property and ListenerPort Property) combination. If the application to be launched is not related to the TRPCBroker, then this argument should be set to nil.</td>
</tr>
</tbody>
</table>

4.2.13.2 Example 1

To launch a program, Sample1.exe, with command line arguments xval=MyData and yval=YourData, and connect with a Silent Login (which would be handled in Sample1.exe via the CheckCmdLine Function):

```
MyCommand := 'C:\Program Files\VISTA\Test1\Sample1.exe xval=MyData yval=YourData';
StartProgSLogin(MyCommand, RPCBroker1);
```

This results in the command line in Figure 58 being used to launch the application:

```
C:\Program Files\VISTA\Test1\Sample1.exe xval=MyData yval=YourData s=ServerName p=9999 d=Division h=AppHandleValue
```

4.2.13.3 Example 2

To launch a program unrelated to TRPCBroker and VistA M Server connections (e.g., Microsoft® Notepad), the command line as desired is used as the first argument, and the value nil is used as the second argument:

```
MyCommand := 'Notepad logtable.txt';
StartProgSLogin(MyCommand, nil);
```
4.2.14 VistA Splash Screen Procedures

The BDK provides two procedures in the SplVista.PAS unit to display a VistA Splash Screen when an application loads:

- `procedure SplashOpen;`
- `procedure SplashClose(TimeOut: longint);`

It is recommended that the VistA Splash Screen be opened and closed in the section of Pascal code in an application’s project file (i.e., .DPR).

4.2.14.1 Using a Splash Screen in an Application

To use the VistA Splash Screen in an application:

1. Open your application’s project file (i.e., .DPR). In Delphi:
   a. Select View.
   b. Select Project Source.
2. Include the SplVista in the uses clause of the project source.
3. Call SplashOpen immediately after the first form of your application is created and call SplashClose just prior to invoking the Application.Run method.
4. Use the TimeOut parameter to ensure a minimum display time. The TimeOut parameter is the minimum number of milliseconds the splash screen is displayed to the user.

The VistA Splash Screen is illustrated in Figure 60:

*Figure 60: Sample VistA Splash Screen*
4.2.14.2 Example

Figure 61 is an example of code to display the VistA Splash Screen in an application:

**Figure 61: Sample Code to Display a VistA Splash Screen**

```pascal
uses
  Forms, Unit1 in 'Unit1.pas', SplVista;

{$R *.RES}

begin
  Application.Initialize;
  Application.CreateForm(TForm1, Form1);
  SplashOpen;
  SplashClose(2000);
  Application.Run;
end.
```

**REF:** For a demonstration using the VistA Splash Screen, run the [RPC Broker Example (32-Bit)](BDK32\Samples\BrokerEx) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx
4.3 Running RPCs on a Remote Server

4.3.1 Overview

The RPC Broker can be used to facilitate invocation of Remote Procedure Calls on a remote VistA M Server. Applications can use either XWB DIRECT RPC or XWB REMOTE RPC to pass the following:

- Desired remote VistA M Server.
- Desired remote RPC.
- Any parameters for the remote RPC.

The RPC Broker on the local VistA M Server uses VistA Health Level Seven (HL7) as a vehicle to pass the remote RPC name and parameters to the remote VistA M Server. VistA HL7 is used to send any results from the remote server back to the local server. The RPC Broker on the local VistA M Server then passes the results back to the client application.

**NOTE:** The local VistA M Server is the server the user is logged into. The remote VistA M Server is any server the user is not logged into.

4.3.1.1 Using Direct RPCs

Table 23: Direct RPCs

<table>
<thead>
<tr>
<th>RPC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>XWB DIRECT RPC</td>
<td>This RPC blocks all other Broker calls until the results of the remote RPC are returned. The data is passed and the user waits for the results to return from the remote system.</td>
</tr>
</tbody>
</table>

4.3.1.2 Using Remote RPCs

Table 24: Remote RPCs

<table>
<thead>
<tr>
<th>RPC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>XWB REMOTE RPC</td>
<td>This RPC allows other activity while the remote RPC is in process. In response to XWB REMOTE RPC, the local VistA M Server returns a HANDLE to the user application. At this point other Broker calls can commence while the server-to-server communication continues in the background.</td>
</tr>
<tr>
<td>XWB REMOTE STATUS CHECK</td>
<td>This RPC allows the application to check the local VistA M Server for the presence of results from the remote RPC. This RPC passes the HANDLE to the local server and receives back the status of the remote RPC.</td>
</tr>
<tr>
<td>XWB REMOTE GETDATA</td>
<td>This RPC retrieves the results from the remote RPC after the status check indicates that the data has returned to the local VistA M Server. The RPC passes the HANDLE and receives back an array with whatever data has been sent back from the remote site.</td>
</tr>
<tr>
<td>XWB REMOTE CLEAR</td>
<td>This RPC must be used to clear the data under the HANDLE in the ^XTMP Global.</td>
</tr>
<tr>
<td>XWB DEFERRED CLEARALL</td>
<td>Applications using XWB REMOTE RPC should use XWB DEFERRED CLEARALL on application close to clear all known</td>
</tr>
</tbody>
</table>
### RPC Description

<table>
<thead>
<tr>
<th>RPC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>data associated with the job on the VistA M Server.</td>
</tr>
</tbody>
</table>

**NOTE:** All XWB Remote Procedure Calls (RPCs) are available only on a Controlled Subscription basis.

#### 4.3.2 Checking RPC Availability on a Remote Server

Applications can check the availability of RPCs on a remote VistA M Server. Use either of the following:

- **XWB DIRECT RPC**
- **XWB REMOTE RPC**

To pass either of the following:

- **XWB IS RPC AVAILABLE** (example)
- **XWB ARE RPCS AVAILABLE** (example)

To the remote server.

The Run Context Parameter in **XWB IS RPC AVAILABLE** or **XWB ARE RPCS AVAILABLE** should be set to “R” or null to check that the remote VistA M Server allows RPCs to be run by users not logged into that remote server.

**NOTE:** All XWB Remote Procedure Calls (RPCs) are available only on a Controlled Subscription basis.
4.3.3 XWB ARE RPCS AVAILABLE

Checking RPC Availability on a Remote Server

Use this RPC to determine if a set of RPCs is available on a VistA M Server. The RUN CONTEXT PARAMETER allows you to test availability on a local or remote VistA M Server. The RPC INPUT PARAMETER passes the names and (optionally) minimum version number of the RPCs to be checked.

Table 25: XWB ARE RPCS AVAILABLE—Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETURN VALUE</td>
<td>A 0-based array. The index corresponds to the index of the RPC in the RPC Input Parameter:</td>
</tr>
<tr>
<td></td>
<td>• 1—RPC Available.</td>
</tr>
<tr>
<td></td>
<td>• 0—RPC Not available.</td>
</tr>
<tr>
<td>RUN CONTEXT PARAMETER (Optional)</td>
<td>Pass the run context (local or remote) of the RPC in Param[0].Value, and the type (literal) in Param[0].PType. Possible values:</td>
</tr>
<tr>
<td></td>
<td>• L—Check if available to be run locally (by a user logged into the VistA M Server).</td>
</tr>
<tr>
<td></td>
<td>• R—Check if available to be run remotely (by a user logged in a different VistA M Server).</td>
</tr>
<tr>
<td></td>
<td>If this parameter is not sent, the RPC is checked for both local and remote, and both run contexts must be available for the return to be “1” (RPC Available). The check is done against the INACTIVE field in the REMOTE PROCEDURE file (see the “Blocking an RPC” section).</td>
</tr>
<tr>
<td>RPC INPUT PARAMETER</td>
<td>Pass a 0-based array of the names and (optionally) version numbers of RPCs to be tested in Param[1].Mult[], and the type (List) in Param[1].PType. The format is:</td>
</tr>
<tr>
<td>RPCName^RPCVersionNumber</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The RPCVersionNumber is used only if the Run Context parameter = “R”. If a numeric value is in the second ^-piece and Run Context = “R”, it is checked against the value in the VERSION field of the REMOTE PROCEDURE file (see the “RPC Version” section). If the version number passed is less than or equal to the number in the VERSION field, the RPC is marked available.</td>
</tr>
</tbody>
</table>

**NOTE:** If the VERSION field is null, the check fails for a numeric value in this parameter.

Also, the current context of your user must give them permission to execute the XWB ARE RPCS AVAILABLE (it must be included in the RPC multiple of the “B”-type option registered with the CreateContext Method).

**NOTE:** XWB ARE RPCS AVAILABLE is available only on a Controlled Subscription basis.
4.3.3.1 Example

Figure 62 is an example of the XWB ARE RPCS AVAILABLE RPC:

```pascal
brkrRPCBroker1.RemoteProcedure := 'XWB ARE RPCS AVAILABLE';
brkrRPCBroker1.Param[0].Ptype:= Literal;
brkrRPCBroker1.Param[0].Value := 'L';
brkrRPCBroker1.Param[1].Ptype := List;
brkrRPCBroker1.Param[1].Mult['0'] = 'MY FIRST RPC';
brkrRPCBroker1.Param[1].Mult['1'] = 'MY OTHER RPC^2';
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;
```

4.3.4 XWB IS RPC AVAILABLE

Checking RPC Availability on a Remote Server

Use this RPC to determine if a particular RPC is available on a VistA M Server. The RPC PARAMETER passes the name of the RPC to be checked. The RUN CONTEXT PARAMETER allows you to test availability to a local or a remote user. The VERSION NUMBER PARAMETER allows you to check for a minimum version of an RPC on a remote VistA M Server.

Table 26: XWB IS RPC AVAILABLE—Parameters/Output

<table>
<thead>
<tr>
<th>Parameter/Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETURN VALUE</td>
<td>Boolean:</td>
</tr>
<tr>
<td></td>
<td>• 1—RPC Available</td>
</tr>
<tr>
<td></td>
<td>• 0—RPC Not Available</td>
</tr>
<tr>
<td>RPC PARAMETER</td>
<td>Pass the name of the RPC to be tested in Param[0].Value, and the type (literal) in Param[0].PType.</td>
</tr>
<tr>
<td>RUN CONTEXT PARAMETER (Optional)</td>
<td>Pass the run context (local or remote) of the RPC in Param[1].Value, and the type (literal) in Param[1].PType. Possible values:</td>
</tr>
<tr>
<td></td>
<td>• L—Check if available to run locally (by a user logged into the VistA M Server)</td>
</tr>
<tr>
<td></td>
<td>• R—Check if available to run remotely (by a user logged in a different VistA M Server)</td>
</tr>
<tr>
<td></td>
<td>If this parameter is not sent, the RPC is checked for both local and remote run contexts must be available for the return to be &quot;1&quot; (RPC Available). The check is done against the INACTIVE field in the REMOTE PROCEDURE file (see the &quot;Blocking an RPC&quot; section).</td>
</tr>
<tr>
<td>VERSION NUMBER PARAMETER (Optional)</td>
<td>Pass the minimum acceptable version number of the RPC in Param[2].Value, and the type (literal) in Param[2].PType. This parameter is only used if the RUN CONTEXT parameter = &quot;R&quot;. If a numeric value is in this parameter, it is checked against the value in the VERSION field of the REMOTE PROCEDURE file (see the “RPC Version” section). If the version number passed is less than or equal to the number in the VERSION field, the RPC is marked available.</td>
</tr>
<tr>
<td>Parameter/Output</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>NOTE:</td>
<td>If the VERSION field is null, the check fails for a numeric value in this parameter.</td>
</tr>
</tbody>
</table>

Also, the current context of your user *must* give them permission to execute the XWB IS RPC AVAILABLE (it *must* be included in the RPC multiple of the “B”-type option registered with the CreateContext Method).

**NOTE:** XWB IS RPC AVAILABLE is available only on a Controlled Subscription basis.

### 4.3.4.1 Example

Figure 63 is an example of the XWB IS RPC AVAILABLE RPC:

**Figure 63: XWB IS RPC AVAILABLE—Example**

```pascal
brkrRPCBroker1.RemoteProcedure := 'XWB IS RPC AVAILABLE';
brkrRPCBroker1.Param[0].Value := 'XWB GET VARIABLE VALUE';
brkrRPCBroker1.Param[0].PType := literal;
brkrRPCBroker1.Param[1].Value := 'R';
brkrRPCBroker1.Param[1].PType := literal;

{no version number passed in this example as XWB GET VARIABLE VALUE has only one version}
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;
.; branch code to handle RPC availability
```
4.3.5  XWB DIRECT RPC

Use this RPC to request that an RPC be run on a remote system. This RPC blocks all other Broker calls until the results of the remote RPC are returned. Use XWB REMOTE RPC to allow other Broker activity while the remote RPC runs.

**REF:** For a comparison of the two methods, see the “Running RPCs on a Remote Server” section.

<table>
<thead>
<tr>
<th>Parameter/Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION PARAMETER</td>
<td>Pass the station number of the remote VistA M Server in Param[0].Value, and the type (literal) in Param[0].PType.</td>
</tr>
<tr>
<td>RPC PARAMETER</td>
<td>Pass the name of the RPC to be run in Param[1].Value, and the type (literal) in Param[1].PType.</td>
</tr>
<tr>
<td>RPC VERSION PARAMETER (Optional)</td>
<td>Pass minimum version of RPC to be run in Param[2].Value, and the type (literal) in Param[2].PType. It is checked against the value in the VERSION field of the REMOTE PROCEDURE file (see the “RPC Version” section) on the remote VistA M Server.</td>
</tr>
<tr>
<td>PARAMETERS TO THE REMOTE RPC</td>
<td>Pass up to seven parameters for the remote RPC in Param[3] through Param[9].</td>
</tr>
<tr>
<td>RETURN VALUE</td>
<td>An array with whatever data has been sent back from the remote site. In the case of an error condition, the first node of the array is equal to a string with the syntax “-1^error text”.</td>
</tr>
</tbody>
</table>

**NOTE:** XWB DIRECT RPC is available only on a Controlled Subscription basis.

4.3.5.1  Example

*Figure 64* is an example of the XWB DIRECT RPC:

```pascal
brkrRPCBroker1.RemoteProcedure := 'XWB DIRECT RPC';
brkrRPCBroker1.Param[0].Ptype:= Literal;
brkrRPCBroker1.Param[0].Value := 'Station Number';
brkrRPCBroker1.Param[1].Ptype:= Literal;
brkrRPCBroker1.Param[1].Value := 'XWB GET VARIABLE VALUE';
{no version numbers for remote RPC so null value in Param[2]}
brkrRPCBroker1.Param[2].Ptype:= Literal;
brkrRPCBroker1.Param[2].Value := '';
brkrRPCBroker1.Param[3].Ptype:= Reference;
brkrRPCBroker1.Param[3].Value := 'DUZ';
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;
.; code to handle brkrRPCBroker1.Results[]
```
4.3.6 XWB REMOTE RPC

Use this RPC to request that an RPC be run on a remote system. This RPC allows other Broker activity while the remote RPC runs. Use XWB DIRECT RPC to block all other Broker activity while the remote RPC runs.

**REF:** For a comparison of the two methods, see the “Running RPCs on a Remote Server” section.

XWB REMOTE RPC requests the remote RPC. The return value is a HANDLE that is used to check status and retrieve data. The following RPCs must be used to complete the transaction

- XWB REMOTE STATUS CHECK
- XWB REMOTE GETDATA
- XWB REMOTE CLEAR

Table 28: XWB REMOTE RPC—Parameters/Output

<table>
<thead>
<tr>
<th>Parameter/Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION PARAMETER</td>
<td>Pass the station number of the remote VistA M Server in Param[0].Value, and the type (literal) in Param[0].PType.</td>
</tr>
<tr>
<td>RPC PARAMETER</td>
<td>Pass the name of the RPC to be run in Param[1].Value, and the type (literal) in Param[1].PType.</td>
</tr>
<tr>
<td>RPC VERSION PARAMETER (Optional)</td>
<td>Pass minimum version of RPC to be run in Param[2].Value, and the type (literal) in Param[2].PType. It is checked against the value in the VERSION field of the REMOTE PROCEDURE file (see the “RPC Version” section) on the remote VistA M Server.</td>
</tr>
<tr>
<td>PARAMETERS TO THE REMOTE RPC</td>
<td>Pass up to seven parameters for the remote RPC in Param[3] through Param[9].</td>
</tr>
</tbody>
</table>
| RETURN VALUE           | An array. The first node is equal to a string that serves as a HANDLE. This HANDLE should be stored by the application and used to check the status and retrieve the data. In the case of an error condition the first node of the array is equal to a string with the syntax “-1^error text”.

**NOTE:** XWB REMOTE RPC is available only on a Controlled Subscription basis.
4.3.6.1 Example

Figure 65 is an example of the XWB REMOTE RPC:

```pascal
brkrRPCBroker1.RemoteProcedure := 'XWB REMOTE RPC';
brkrRPCBroker1.Param[0].Ptype:= Literal;
brkrRPCBroker1.Param[0].Value := 'Station Number';
brkrRPCBroker1.Param[1].Ptype:= Literal;
brkrRPCBroker1.Param[1].Value := 'MY RPC';
brkrRPCBroker1.Param[2].Ptype:= Literal;
brkrRPCBroker1.Param[2].Value := '1';
brkrRPCBroker1.Param[3].Ptype:= Reference;
brkrRPCBroker1.Param[3].Value := 'MY RPC PARAMETER';
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;
.; code to store HANDLE returned in brkrRPCBroker1.Results[]
```

The application needs to use XWB REMOTE STATUS CHECK, XWB REMOTE GETDATA, and XWB REMOTE CLEAR to complete the transaction.

4.3.7 XWB REMOTE STATUS CHECK

Use this RPC to check for results of XWB REMOTE RPC. Periodically call this RPC and pass the HANDLE returned by XWB REMOTE RPC.

**Table 29: XWB REMOTE STATUS CHECK—Output**

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETURN VALUE</td>
<td>The return value is always an array. The first node of the array is equal to one of the following values:</td>
</tr>
<tr>
<td></td>
<td>• “-1^Bad Handle”—An invalid handle has been passed.</td>
</tr>
<tr>
<td></td>
<td>• “0^New”—The request has been sent via VistA HL7.</td>
</tr>
<tr>
<td></td>
<td>• “0^Running”—VistA HL7 indicates that the message is being processed.</td>
</tr>
<tr>
<td></td>
<td>• “1^Done”—RPC has completed and the data has been returned to the local VistA M Server. The data is not returned by this RPC. Use XWB REMOTE GETDATA to retrieve the data.</td>
</tr>
</tbody>
</table>

The second node of the array is the status from the VistA HL7 software.

**NOTE:** XWB REMOTE STATUS CHECK is available only on a Controlled Subscription basis.
4.3.7.1 Example

**Figure 66** is an example of the **XWB REMOTE STATUS CHECK** RPC:

```pascal
brkrRPCBroker1.RemoteProcedure := 'XWB REMOTE STATUS CHECK';
brkrRPCBroker1.Param[0].Value := 'MYHANDLE';
brkrRPCBroker1.Param[0].PType := literal;
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;
.; code to handle results of check
```

4.3.8 XWB REMOTE GETDATA

Use this RPC to retrieve the results of **XWB REMOTE RPC**. Before calling this RPC, use **XWB REMOTE STATUS CHECK** to ensure that the results have been returned to the local VistA M Server. When the results have arrived, call this RPC and pass the **HANDLE** returned by **XWB REMOTE RPC**.

After the application is finished with the data on the VistA M Server, it should use **XWB REMOTE CLEAR** to clear the `^XTMP` global.

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
</table>
| RETURN VALUE      | An array containing the data. In the case of an error condition the first node of the array is equal to a string with the syntax “-1^error text”.

**NOTE:** XWB REMOTE GETDATA is available only on a Controlled Subscription basis.

4.3.8.1 Example

**Figure 67** is an example of the **XWB REMOTE GETDATA** RPC:

```pascal
brkrRPCBroker1.RemoteProcedure := 'XWB REMOTE GETDATA';
brkrRPCBroker1.Param[0].Value := 'MYHANDLE';
brkrRPCBroker1.Param[0].PType := literal;
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;
.; code to handle data
```
4.3.9 XWB REMOTE CLEAR

This RPC is used to clear the data created by a remote RPC under the HANDLE in the ^XTMP. Pass the HANDLE returned by XWB REMOTE RPC.

Table 31: XWB REMOTE CLEAR—Output

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETURN VALUE</td>
<td>An array. The first node in the array is equal to 1.</td>
</tr>
</tbody>
</table>

NOTE: XWB REMOTE CLEAR is available only on a Controlled Subscription basis.

4.3.9.1 Example

Figure 68 is an example of the XWB REMOTE CLEAR RPC:

```pascal
brkrRPCBroker1.RemoteProcedure := 'XWB REMOTE CLEAR';
brkrRPCBroker1.Param[0].Value := 'MYHANDLE';
brkrRPCBroker1.Param[0].PType := literal;
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;
```
4.4 Deferred RPCs

4.4.1 Overview
Remote Procedure Calls can be run in the background with **XWB DEFERRED RPC**.

4.4.1.1 Using Deferred RPCs

<table>
<thead>
<tr>
<th>RPC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>XWB DEFERRED RPC</td>
<td>Use this RPC to pass the name of the RPC to be run in deferred mode and any parameters associated with the deferred RPC. In response to this RPC the VistA M Server returns a HANDLE to the user application. At this point other Broker calls can commence while the job runs in the background.</td>
</tr>
<tr>
<td>XWB DEFERRED STATUS</td>
<td>This RPC allows the application to check the local VistA M Server for the presence of results from the deferred RPC. This RPC passes the HANDLE to the local server and receives back the status of the remote RPC.</td>
</tr>
<tr>
<td>XWB DEFERRED GETDATA</td>
<td>This RPC is the vehicle for retrieving the results from the remote RPC after the status check indicates that the data has returned to the local VistA M Server. The RPC passes the HANDLE and receives back an array with whatever data has been returned by the deferred RPC.</td>
</tr>
<tr>
<td>XWB DEFERRED CLEAR</td>
<td>This RPC must be used to clear the data under the HANDLE in the ^XTMP Global.</td>
</tr>
<tr>
<td>XWB DEFERRED CLEARALL</td>
<td>Applications using XWB DEFERRED RPC should use XWB DEFERRED CLEARALL on application close to clear all known data associated with the job on the VistA M Server.</td>
</tr>
</tbody>
</table>

**NOTE:** *All XWB Remote Procedure Calls (RPCs) are available only on a Controlled Subscription basis.*
4.4.2 XWB DEFERRED RPC

Use this RPC to request that an RPC be run in deferred mode. The return value is a HANDLE used to check status and retrieve data. The following RPCs must be used to complete the transaction:

- **XWB DEFERRED STATUS**
- **XWB DEFERRED GETDATA**
- **XWB DEFERRED CLEAR**

Table 33: XWB DEFERRED RPC—Parameters/Output

<table>
<thead>
<tr>
<th>Parameter/Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPC PARAMETER</td>
<td>Pass the name of the RPC to be run in Param[0].Value, and the type (literal) in Param[0].PType.</td>
</tr>
<tr>
<td>RPC VERSION PARAMETER (Optional)</td>
<td>Pass minimum version of RPC to be run in Param[1].Value, and the type (literal) in Param[1].PType. It is checked against the value in the VERSION field of the REMOTE PROCEDURE file (see the “RPC Version” section) on the remote VistA M Server.</td>
</tr>
<tr>
<td>PARAMETERS TO THE REMOTE RPC</td>
<td>Pass up to eight parameters for the remote RPC in Param[2] through Param[9].</td>
</tr>
<tr>
<td>RETURN VALUE</td>
<td>An array. The first node is equal to a string that serves as a HANDLE. This HANDLE should be stored by the application and used to check the status and retrieve the data. In the case of an error condition, the first node of the array is equal to a string with the syntax “-1^error text”.</td>
</tr>
</tbody>
</table>

4.4.2.1 Example

**Figure 69** is an example of the **XWB DEFERRED RPC**:

```
brkrRPCBroker1.RemoteProcedure := 'XWB DEFERRED RPC';
brkrRPCBroker1.Param[0].Ptype:= Literal;
brkrRPCBroker1.Param[0].Value := 'MY RPC';
brkrRPCBroker1.Param[1].Ptype:= Literal;
brkrRPCBroker1.Param[1].Value := '1';
brkrRPCBroker1.Param[2].Value := 'MY RPC PARAMETER';
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;
.; code to store HANDLE returned in brkrRPCBroker1.Results[0]
```

The application needs to use **XWB DEFERRED STATUS**, **XWB DEFERRED GETDATA**, and **XWB DEFERRED CLEAR** to complete the transaction.
4.4.3 XWB DEFERRED STATUS

Use this RPC to check for results of XWB DEFERRED RPC. Periodically, call this RPC and pass the HANDLE returned by XWB REMOTE RPC.

Table 34: XWB DEFERRED STATUS—Output

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETURN VALUE</td>
<td>The return value is always an array. The first node of the array is equal to one of the following values:</td>
</tr>
<tr>
<td></td>
<td>• &quot;-1^Bad Handle&quot;—An invalid handle has been passed.</td>
</tr>
<tr>
<td></td>
<td>• &quot;0^New&quot;—The request has been sent via VistA HL7.</td>
</tr>
<tr>
<td></td>
<td>• &quot;0^Running&quot;—VistA HL7 indicates that the message is being processed.</td>
</tr>
<tr>
<td></td>
<td>• &quot;1^Done&quot;—RPC has completed and the data has been returned to the local VistA M Server. The data is not returned by this RPC. Use XWB REMOTE GETDATA to retrieve the data.</td>
</tr>
</tbody>
</table>

NOTE: XWB DEFERRED STATUS is available only on a Controlled Subscription basis.

4.4.3.1 Example

Figure 70 is an example of the XWB DEFERRED STATUS RPC:

```pascal
brkrRPCBroker1.RemoteProcedure := 'XWB DEFERRED STATUS';
brkrRPCBroker1.Param[0].Value := 'MYHANDLE';
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;
.; code to handle results of check
```

4.4.4 XWB DEFERRED GETDATA

Use this RPC to retrieve the results of XWB DEFERRED RPC. Before calling this RPC, use XWB DEFERRED STATUS to ensure that the job has finished. When the results are available, call this RPC and pass the HANDLE returned by XWB DEFERRED RPC.

After the application is finished with the data on the VistA M Server, it should use XWB DEFERRED CLEAR to clear the ^XTMP global.

Table 35: XWB DEFERRED GETDATA—Output

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETURN VALUE</td>
<td>An array containing the data. In the case of an error condition the first node of the array is equal to a string with the syntax &quot;-1^error text&quot;.</td>
</tr>
</tbody>
</table>

NOTE: XWB DEFERRED GETDATA is available only on a Controlled Subscription basis.
4.4.4.1 Example

Figure 71 is an example of the XWB DEFERRED GETDATA RPC:

```delphi
brkrRPCBroker1.RemoteProcedure := 'XWB DEFERRED GETDATA';
brkrRPCBroker1.Param[0].Value := 'MYHANDLE';
brkrRPCBroker1.Param[0].PType := literal;
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;

.; code to handle data
```

4.4.5 XWB DEFERRED CLEAR

This RPC is used to clear the data created by a deferred RPC under the HANDLE in the ^XTMP global. Pass the HANDLE returned by XWB DEFERRED RPC.

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETURN VALUE</td>
<td>An array. The first node in the array is equal to 1.</td>
</tr>
</tbody>
</table>

**NOTE:** XWB DEFERRED CLEAR is available only on a Controlled Subscription basis.

4.4.5.1 Example

Figure 72 is an example of the XWB DEFERRED CLEAR RPC:

```delphi
brkrRPCBroker1.RemoteProcedure := 'XWB DEFERRED CLEAR';
brkrRPCBroker1.Param[0].Value := 'MYHANDLE';
brkrRPCBroker1.Param[0].PType := literal;
try
  brkrRPCBroker1.Call;
except
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;

.; code to handle data
```

4.4.6 XWB DEFERRED CLEARALL

This RPC is used to CLEAR ALL the data known to a remote RPC or deferred RPC job in the ^XTMP global. It makes use of the list in ^TMP("XWBHDL".$J,handle). Applications using XWB REMOTE RPC or the XWB DEFERRED RPC should use this RPC on application close to clear all known data associated with the job on the VistA M Server.

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETURN VALUE</td>
<td>An array. The first node in the array is equal to 1.</td>
</tr>
</tbody>
</table>
NOTE: XWB DEFERRED CLEARALL is available only on a Controlled Subscription basis.

4.4.6.1 Example

Figure 73 is an example of the XWB DEFERRED CLEARALL RPC:

```
brkrRPCBroker1.RemoteProcedure := 'XWB DEFERRED CLEAR';
try
  brkrRPCBroker1.Call;
extexcept
  On EBrokerError do
    ShowMessage('Connection to server could not be established!');
end;
```
5 Broker Security Enhancement (BSE)

5.1 Overview: Implementing Broker Security Enhancement (BSE)

This section describes how application developers can modify their Veterans Health Information Systems and Technology Architecture (VistA) RPC Broker Delphi-based client/server applications in order to implement the Broker Security Enhancement (BSE). The following topics are discussed:

- Assumptions When Implementing BSE
- Step-By-Step Procedures to Implement BSE

5.1.1 Assumptions When Implementing BSE

The following assumptions are made regarding application developers and VistA software applications when implementing BSE:

- **Developer Training**—Application developers should already be knowledgeable/trained in creating RPC Broker Delphi-based applications.

- **RPC Broker-based Applications**—RPC Broker Delphi-based application already exists.

- **Login at Startup**—Applications automatically initiate login at application startup (i.e., users are presented with 2-factor authentication or an Access/Verify login dialogue).

- **VistA M Server Patches**—All BSE Project-related VistA M Server patches have been loaded on the appropriate servers.

5.1.2 Step-By-Step Procedures to Implement BSE

This section describes the procedures that VistA application developers must follow in order to implement the Broker Security Enhancement (BSE) in their RPC Broker Delphi-based applications (i.e., COM client applications developed in Embarcadero Delphi), so that the application can make remote user/visitor connections.

1. Create a unique Application Security Phrase (required).

   Use the $$SHAHASH^XUSHSH API to create a Base-64 Encoded SHA256 hashed Security Phrase (case sensitive) that is unique for your application.

   For example, in M, go to Programmer Mode and enter the following command:
   
   W $$SHAHASH^XUSHSH(256,"My Application Security Phrase","B")

   The resulting sample value is:
   
   TQu07MtTls83BGuWK/Kyb4naAUWHaVQjTzstCuDJKHw=

   **CAUTION: This is a sample value only; do not use this as your Application Security Phrase!**

   This is a one-way hash value for the Security Phrase that is only known to the application that creates it.
RECOMMENDATION: Since the Security Phrase is the application's identifier, VistA Infrastructure (VI) recommends developers identify the Security Phrase as a const value in an include file in any RPC Broker Delphi-based program implementing BSE. A substitute include file containing a phrase similar to that used above should then be included with release of the source code.

REF: For more information on the application Security Phrase, see the "Security Phrase" section in the RPC Broker User Guide.

2. Create an entry in the REMOTE APPLICATION file (#8994.5) (required).

An application must send out a patch that creates an entry for their RPC Broker Delphi-based application that has implemented BSE in the REMOTE APPLICATION file (#8994.5). Developers must add entries to the following fields in File #8994.5:

- NAME (#.01)—Enter a descriptive name for your application.
- CONTEXT_OPTION (#.02)—Enter the name of the "B"-Type context option that the users will need to run the application. This context option should be within your application’s namespace, or your application should have an Integration Control Registration (ICR) agreement in place documenting permission to use a context option owned by another application.
- APPLICATIONCODE (#.03)—Enter the hashed value of the Security Phrase you created in Step 1.
- CALLBACKTYPE Multiple (#1):
  - CALLBACKTYPE (#.01)—Current values for this field are:
    - R—RPC Broker TCP/IP connection (recommended for non-medical centers).
    - M—M-to-M Broker connection.
    - H—HyperText Transport Protocol (HTTP) connection communication. You must also add an entry in the URLSTRING field (#.04).
    - S—Station-number callback (recommended for medical centers).
  - CALLBACKPORT (#.02)—Enter the Port number to be used for the callback connection. This required field should be set to “-1” for Station-number callback type, as the actual port number is passed to the remote VistA M Server as part of the process.
  - CALLBACKSERVER (#.03)—Enter the address of the server to be used for the callback connection. This should be a Domain Name Service (DNS) name-based address rather than an Internet Protocol (IP) address, because IP addresses can change. This field is not required for Station-number callback type, as the remote VistA M Server looks up the IP address of the authenticating VistA M Server based on the site number passed to the remote VistA M Server as part of the process.
  - URLSTRING (#.04)—Used only if the CALLBACKTYPE field (#.01) contains H for HyperText Transport Protocol (HTTP). Enter the Uniform Resource Locator (URL) string for the callback to the HTTP server. This field is not required for Station-number, RPC Broker, or M-to-M callback types.
NOTE: For more information on the REMOTE APPLICATION file (#8994.5) and specific field entries, see the "REMOTE APPLICATION file (#8994.5)" section in the RPC Broker User Guide.

REF: Use the sample code in the BseSample1.pas file as a basis for implementing BSE in your application. The BseSample1.pas file is located in the following directory:

BDK32\Samples\BSE

Figure 74: fBseSample1.pas File—Sample Code Excerpt (#1)

```pascal
procedure TForm1.DoConnection(Key: String);
var
TokenValue: String;
begin
RPCB.Server := AuthServer.Text;
RPCB.ListenerPort := StrToInt(AuthPort.Text);
RPCB.Connected := True;
if RPCB.Connected then
begin
RPCB.RemoteProcedure := 'XUS SET VISITOR';
RPCB.Call;
TokenValue := RPCB.Results[0];
RPCB.Connected := False;
ShowMessage('Token: ' + TokenValue);
if not (TokenValue = '') then
begin
RPCB.Server := RemoteServer.Text;
RPCB.ListenerPort := StrToInt(RemotePort.Text);
RPCB.SecurityPhrase := Key + '^' + TokenValue;
RPCB.Connected := True;
if RPCB.Connected then
begin
ShowMessage('Signed on to Remote Server');
RPCB.CreateContext('XWB BROKER EXAMPLE');
btnDisconnect.Enabled := True;
btnEcho.Enabled := True;
btnM2M.Enabled := False;
btnTCPIP.Enabled := False;
end
else
ShowMessage('Connection to Remote Server failed!');
end
end
else
ShowMessage('Initial Sign-on Failed');
end;
```
3. Get BSE Authentication Token *(required).*

After authenticating the user into the authenticating VistA M Server, the client application calls the XUS SET VISITOR RPC to get the BSE Authentication Token for the user. This token is then passed to the RPC Broker component and used to create an extended Security Pass Phrase (see Step 4). This token is eventually used to obtain the necessary user information for populating a user as a "visitor" entry in the remote site's NEW PERSON file (#200).

VistA Kernel software on the authenticating VistA M Server creates the BSE Authentication Token. Kernel stores this token in the ^XTMP temporary global.

Figure 75: fBseSample1.pas File—Sample Code Excerpt (#2)

```delphi
RPCB.Server := AuthServer.Text;
RPCB.ListenerPort := StrToInt(AuthPort.Text);
RPCB.Connected := True;
if RPCB.Connected then
begin
    RPCB.RemoteProcedure := 'XUS SET VISITOR';
    RPCB.Call;
    TokenValue := RPCB.Results[0];
    RPCB.Connected := False;
end;
```

4. Create and encode an extended Security Pass Phrase *(required).*

The application creates an extended Security Pass Phrase (string). The Security Pass Phrase consists of the unhashed application Security Phrase (Step 1) concatenated with the BSE Authentication Token delimited by a caret ("^"). For example:

```
My Application Security Phrase^XWBHDL977-124367_0
```

Station-number callback requires the authenticating VistA M Server’s station number as identified in the INSTITUTION file (#4) and the port number of the station’s RPC Broker listener, delimited by a caret ("^"). For example:

```
My Application Security Phrase^XWBHDL977-124367_0^518^19207
```

The Delphi RPC Broker software encodes the Security Pass Phrase, which is passed to the Remote VistA M Server XUS SIGNON SETUP RPC for authentication.

For non-Delphi applications (those that do not use the Broker Development Kit), the XUS BSE TOKEN RPC accepts the application Security Phrase on the authenticating server and creates a complete encoded extended Security Pass Phrase, which can be passed to the Remote VistA M Server XUS SIGNON SETUP RPC for authentication for Station-number based callback. This RPC does not work for Delphi applications, as the encoding is done within the Broker Development Kit.

In the source code excerpt that follows (see Figure 76), the value of Key (i.e., constant) was defined earlier by importing an include file that contained the following two lines:

```delphi
const
    Key = ' My Application Security Phrase';
```
NOTE: Key is a constant, which is a type of variable that has a fixed value that cannot be changed.

Figure 76 shows the code after the RPCBroker login component connection to the Authenticating VistA M Server has been disconnected:

**Figure 76: fBseSample1.pas File—Sample Code Excerpt (#3)**

```pascal
if not (TokenValue = '') then begin
   RPCB.Server := RemoteServer.Text;
   RPCB.ListenerPort := StrToInt(RemotePort.Text);
   RPCB.SecurityPhrase := Key + '^' + TokenValue;
   RPCB.Connected := True;
   if RPCB.Connected then begin
      ShowMessage('Signed on to Remote Server');
      RPCB.CreateContext('XWB BROKER EXAMPLE');
      btnDisconnect.Enabled := True;
      btnEcho.Enabled := True;
      btnM2M.Enabled := False;
      btnTCPIP.Enabled := False;
   end
   else
      ShowMessage('Connection to Remote Server failed!');
end;
```

5. Set RPCBroker login component properties *(required).*

   The developer *must* set the following RPCBroker login component properties when calling the Remote VistA M Server:
   - **Server**—Set to the Domain Name Service (DNS) or Internet Protocol (IP) address of the Remote VistA M Server.
   - **ListenerPort**—Set to the Listener Port number of the Remote VistA M Server.
   - **SecurityPhrase** property—Set to the unhashed application's Security Phrase concatenated with the Kernel Authentication Token (See Step 4).
   - **Connect**—Set to **True**.

6. Process Remote User/Visitor Login on remote server *(required).*

   After connecting to the Remote VistA M Server, software running on the Remote VistA M Server does the following:
   a. Identify the Security Pass Phrase. Kernel identifies the data passed in as a parameter, which contains the application's Security Phrase and Kernel Authentication Token for the user.
   c. Get Authenticating VistA M Server Connection Mechanism. Kernel uses the Security Phrase to identify the application's entry in the REMOTE APPLICATION file (#8994.5).
Included in that entry is the mechanisms for contacting the Authenticating VistA M Server:

- Connection type:
  - R—RPC Broker TCP/IP connection
  - M—M-to-M Broker
  - H—HyperText Transport Protocol connection
  - S—Station-number callback

- Port number
- Address (IP, DNS, or URL)

**NOTE:** The mechanisms for contacting the Authenticating VistA M Server allows you to use either the IP address or DNS; however, VistA Infrastructure (VI) recommends that you use a DNS Fully Qualified Domain Name (FQDN).

d. Connect to Authenticating Server using Kernel Authentication Token. The Remote VistA M Server uses the appropriate mechanism to identify and connect to the Authenticating VistA M Server, passing in the BSE Authentication Token that identifies the user.

e. Obtain user demographics. Kernel uses the **XUS GET VISITOR** RPC to request and obtain the user demographic information from the Authenticating VistA M Server.

The user demographic information that is returned is a string containing information that can be used to identify the visitor (i.e., ssn^name^station name^station number^DUZ^phone^SecID^network username):

- Social Security Number (SSN)
- Name
- Station Name
- Station Number
- DUZ
- Telephone
- Identity and Access Management (IAM) Security ID (SecID)
- Active Directory Network Username

This user demographic information is used to later establish the user as a remote user/visitor on the Remote VistA M Server.

g. Set up user as a visitor entry on the remote VistA M Server. Kernel uses the demographic information obtained from the Authenticating VistA M Server to set up the user as a visitor entry on the Remote VistA M Server.

Kernel creates or matches an entry in the NEW PERSON file (#200) and provides the visitor with the context option specified for the application in the REMOTE APPLICATION file (#8994.5). The matching process uses the following precedence when matching an existing user:

1. Identity and Access Management (IAM) Security ID (SecID)
2. Social Security Number (SSN)
3. Name (do not use if name has a different SSN)

7. Test your application (recommended). Developers should test their RPC Broker Delphi-based applications to ensure they have successfully implemented BSE.

BSE Sample Test Applications

The Broker Development Kit (BDK) includes the BrokerSecurityEnhancement Sample1 application (i.e., BseSample1.exe, see Figure 77).

You can use this sample application to help test the sample entries in the REMOTE APPLICATION file (#8994.5) and to test the different connection types (i.e., TCP/IP, M2M, HTTP, and Station-number) to verify that the VistA M Server-side is set up correctly to implement BSE.

⚠️ CAUTION: In order to implement BSE and use the RPC-Broker callback type, the central Authenticating VistA M server must run the RPC Broker as a TCPIP service.
Figure 77 shows the sample application dialogue provided by the BrokerSecurityEnhancement Sample1 application (i.e., BseSample1.exe):

Figure 77: BSE Project—BrokerSecurityEnhancement Sample1 Application (i.e., BseSample1.exe)

The sample application has the following controls:

- **Server Edit Fields:**
  - **Authenticating Server IP**—IP address for the Authenticating VistA M Server. This field is empty at initial startup; it is an editable field.
  - **Remote Server IP**—IP address for the Remote VistA M Server. This field is empty at initial startup; it is an editable field.
  - **Port**—Port number for the Authenticating VistA M Server. This field is empty at initial startup; it is an editable field.
  - **Port**—Port number for the Remote VistA M Server. This field is empty at initial startup; it is an editable field.

- **Connection Buttons:**
  - **TCP/IP Connect**
  - **M2M Connect**
  - **HTTP Connect**
  - **Disconnect**
• Phrase Echo Controls:
  o **Phrase to Echo** Edit Field—Enter an echo phrase.
  o **Echo** Button—Button used to submit the phrase to be echoed back from the Remote VistA M Server.
  o **Echoed** Field—Contains the phrase that gets echoed back once the user/visitor is signed onto the Remote VistA M Server.

To successfully run and test the BrokerSecurityEnhancement Sample1 application (i.e., BseSample1.exe), do the following:

a. Edit entries for XUSBSE TEST1 and XUSBSE TEST2 in the following fields in the CALLBACKTYPE Multiple (#1) in the REMOTE APPLICATION file (#8994.5). These entries are the Authenticating VistA M Servers that are used to authenticate the current user, and to which a callback is made to obtain information to eventually create the visitor entry in the Remote VistA M Server:
  - CALLBACKPORT (#.02)
  - CALLBACKSERVER (#.03)

The Broker Security Enhancement (BSE)-related code is dependent upon the use of appropriate and valid information for the Authenticating and Remote VistA M Servers. Therefore, running the BseSample1.exe program requires that you populate these fields on the Remote VistA M Server.

The Authenticating VistA M Server is the server on which the user already has a valid Kernel Access and Verify code established (i.e., entry in the NEW PERSON file [#200]). Both the Authenticating and Remote VistA M Servers must also have RPC Broker Patch XWB*1.1*45 and Kernel Patch XU*8*404 installed.

b. Start the BseSample1.exe program.

c. Enter a valid Authenticating VistA M Server IP address and Port number.

  **NOTE:** This is the server against which the user first authenticates.

d. Enter a valid Remote VistA M Server IP address and Port number.

  **NOTE:** This is the server that the user signs onto as a visitor (and already contains the updated information for the Authenticating VistA M Server in the REMOTE APPLICATION file ([#8994.5]).

e. Press one of the connection buttons (e.g., **TCP/IP Connect** button).

f. Enter Access and Verify codes in the VistA Sign-on dialogue box when prompted.

  **NOTE:** This authenticates the user against the Authenticating VistA M Server.

g. (optional) Choose your Division (i.e., Station Number) to log into, if prompted.
h. Press **OK** when presented with the dialogue in Figure 78:

**Figure 78: Sample Kernel Authentication Token**

![Image of Kernel Authentication Token]

**NOTE:** Figure 78 indicates that the Kernel Authentication Token was created, which means the user is now authenticated on the Authenticating VistA M Server.

i. After a few moments, you get the dialogue shown in Figure 79 confirming the user is now also authenticated on the Remote VistA M Server as a visitor. Press **OK** when presented with the dialogue in Figure 79:

**Figure 79: Sample Confirmation Message Indicating the User is Signed onto the Remote VistA M Server as a Visitor**

![Image of Confirmation Message]

j. You can now enter an echo phrase to the Remote VistA M Server and get the string echoed back.
6 Debugging and Troubleshooting

6.1 Debugging and Troubleshooting Overview

The Broker Development Kit (BDK) provides facilities for debugging and troubleshooting your VistA Graphical User Interface (GUI) applications.

- How to Debug the Application
- RPC Error Trapping
- Broker Error Messages
- EBrokerError
- Testing the RPC Broker Connection
- Client Timeout and Buffer Clearing
- Memory Leaks

REF: For commonly asked questions, see the RPC Broker FAQs on the RPC Broker VA Intranet site.

6.2 How to Debug the Application

Control of debugging has been moved from the client to the server.

To start a debug session, do the following:

1. On the VistA M Server, set initial breakpoints where desired.
2. On the client, follow instructions in the InterSystems Caché documentation on “Debugging with the Caché Debugger.” Set initial breakpoints where desired.
3. Start the following VistA M Server process:

   ```
   >D DEBUG^XWBTCPM
   ```

4. Enter a unique Listener port number (i.e., a port number not in general use).
5. Connect the client application to the server using the server’s IP address and the port number you entered in Step 4 and select OK.
6. You can now step through the code on your client, and simultaneously step through the code on the VistA M Server side for any RPCs that your client calls.

6.3 RPC Error Trapping

M errors on the VistA M Server that occur during RPC execution are trapped by the use of M and Kernel error handling. In addition, the M error message is sent back to the Delphi client. Delphi raises an exception EBrokerError and a popup dialogue box displaying the error. At this point RPC execution terminates and the channel is closed.

In some instances, an application’s RPC could get a memory allocation error on the VistA M Server. Kernel does not trap these errors. However, these errors are trapped in the operating system’s error trap. For example, if an RPC receives or generates an abundance of data in local memory, the symbol table
could be depleted resulting in a memory allocation error. To diagnose this problem, users should check the operating system’s error trap.

### 6.4 Broker Error Messages

**Table 38** list of errors/messages are Broker-specific and are not Winsock related:

<table>
<thead>
<tr>
<th>Error/Message</th>
<th>Name</th>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
</table>
| Insufficient Heap             | XWB_NO_HEAP     | 20001  | This is a general error condition indicating insufficient memory. It can occur when an application allocates memory for a variable. This error occurs for some of the following reasons:  
  • Too many open applications.  
  • Low physical memory.  
  • Small virtual memory swap file (if dynamic, maybe low disk space).  
  • User selecting too many records.  
  **Resolution:** Common solutions to this error include the following:  
  • Close some or all other applications.  
  • Install more memory.  
  • Increase the swap file size or, if dynamic, leave more free space on disk.  
  • Try working with smaller data sets.  
  • Reboot the workstation. |
| M Error - Use ^XTER            | XWB_M_REJECT    | 20002  | The VistA M Server side of the application errored out. The Kernel error trap has recorded the error.  
  **Resolution:** Examine the Kernel error trap for more information and specific corrective actions. |
| Signon was not completed       | XWB_BadSignOn   | 20004  | This error indicates the user did not successfully signon.  
  **Resolution:** Either the Access and Verify codes were incorrect or the user clicked **Cancel** on the VistA Sign-on window. |
| BrokerConnections list could not be created | XWB_BldConnectList | 20005  | This error is a specific symptom of a low memory condition.  
  **Resolution:** For a detailed explanation and corrective measures, see the “Insufficient Heap” error message. |
| RpcVersion cannot be empty    | XWB_NullRpcVer  | 20006  | This error occurs when an RPC does not have an associated version number. Each RPC must have a version number.  
  **Resolution:** Contact the developers responsible for the application software to |
<table>
<thead>
<tr>
<th>Error/Message</th>
<th>Name</th>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server unable to read input data correctly</td>
<td>XWB_BadReads</td>
<td>20008</td>
<td>This error indicates that the format of the RPC input data was incorrect.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Resolution:</strong> Contact the developers responsible for the application software to take corrective action.</td>
</tr>
<tr>
<td>System was out of memory, executable file was corrupt, or relocations were invalid</td>
<td>XWB_ExeNoMem</td>
<td>20100</td>
<td>This error may indicate a low memory condition, or may have errors in the application executable file.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Resolution:</strong> Contact the developers responsible for the application software to take corrective action.</td>
</tr>
<tr>
<td>File was not found</td>
<td>XWB_ExeNoFile</td>
<td>20102</td>
<td>This error indicates that the referenced file could not be found.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Resolution:</strong> Contact the developers responsible for the application software to take corrective action.</td>
</tr>
<tr>
<td>Path was not found</td>
<td>XWB_ExeNoPath</td>
<td>20103</td>
<td>This error indicates that the referenced directory could not be found.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Resolution:</strong> Contact the developers responsible for the application software to take corrective action.</td>
</tr>
<tr>
<td>Attempt was made to dynamically link to a task or there was a sharing or network-protection error</td>
<td>XWB_ExeShare</td>
<td>20105</td>
<td>This error most likely indicates network problems.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Resolution:</strong> It may resolve itself over time. If not, contact the developers responsible for the application software to take corrective action.</td>
</tr>
<tr>
<td>Library required separate data segments for each task</td>
<td>XWB_ExeSepSeg</td>
<td>20106</td>
<td>This error indicates that the format of the RPC data was incorrect.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Resolution:</strong> Contact the developers responsible for the application software to take corrective action.</td>
</tr>
<tr>
<td>There was insufficient memory to start the application</td>
<td>XWB_ExeLoMem</td>
<td>20108</td>
<td>This error is a specific symptom of a low memory condition.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Resolution:</strong> For a detailed explanation and corrective measures, see the “Insufficient Heap” error message.</td>
</tr>
<tr>
<td>Windows version was incorrect</td>
<td>XWB_ExeWinVer</td>
<td>20110</td>
<td>This error indicates that the application was developed for a specific version of Windows, and is not compatible with this system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Resolution:</strong> Contact the developers responsible for the application software to take corrective action.</td>
</tr>
<tr>
<td>Executable file was invalid. Either it was not a</td>
<td>XWB_ExeBadExe</td>
<td>20111</td>
<td>This error indicates a problem with the Windows executable application.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Resolution:</strong> Contact the developers responsible for the application software to take corrective action.</td>
</tr>
<tr>
<td>Error/Message</td>
<td>Name</td>
<td>Number</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>--------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Windows application or there was an error in the EXE</td>
<td></td>
<td></td>
<td>responsible for the application software to take corrective action.</td>
</tr>
<tr>
<td>Application was designed for a different operating system</td>
<td>XWB_ExeDifOS</td>
<td>20112</td>
<td>This error indicates that the application is not compatible with this operating system. Resolution: Contact the developers responsible for the application software to take corrective action.</td>
</tr>
<tr>
<td>Remote procedure not registered to application</td>
<td>XWB_RpcNotReg</td>
<td>20201</td>
<td>This error indicates the application attempted to execute an RPC that was not entered into the RPC Multiple field in the REMOTE PROCEDURE File (#8994) for this application. Resolution: The developers responsible for the application should be contacted. As a “last resort” corrective measure, you can try to re-index the cross-reference on the RPC field (#.01) in the REMOTE PROCEDURE File (#8994) with the RPC field (#320) of the OPTION file (#19). Ideally, this should only be attempted during off or low system usage.</td>
</tr>
</tbody>
</table>

6.5 EBrokerError

6.5.1 Unit

TRPCB Unit

6.5.2 Description

The EBrokerError is an exception raised by the TRPCBroker Component. This exception is raised when an error is encountered when communicating with the VistA M Server. You should use a try...except block around all server calls to handle any EbrokerError exceptions that may occur.

For example:

```
try
  brkrRPCBroker1.Connected := True;
except
  on EBrokerError do
    begin
      ShowMessage('Connection to server could not be established!');
      Application.Terminate;
    end;
end;
```
REF: For descriptions/resolutions to specific error messages that can be displayed by EBrokerError, see the “Broker Error Messages” section.

6.6 Testing the RPC Broker Connection

To test the RPC Broker connection from your workstation to the VistA M Server, use the RPC Broker Diagnostic Program (i.e., RPCTEST.exe, distributed with patch XWB*1.1*47).

REF: For a complete description of the RPC Broker Diagnostic program, see Section 4, “Troubleshooting,” in the RPC Broker Systems Management Guide.

REF: For a demonstration/test using the Broker to connect to a VistA M Server, run the RPC Broker Example (32-Bit) (i.e., BrokerExample.exe); located in the following directory:

BDK32\Samples\BrokerEx

6.7 Client Timeout and Buffer Clearing

If a remote procedure call (RPC) fails to successfully complete due to a timeout on the client, the buffer on the VistA M Server contains data from the uncompleted call. Without special handling, this buffer on the server is returned whenever the next RPC is executed.

The solution to this problem is:

1. The RPCTimeLimit Property on the TRPCBroker Component on the client helps avoid the problem in the first place.

2. In the event of a cancellation of a Network I/O operation, the Broker state on the client changes from NO FLUSH to FLUSH. When this state change occurs, the next RPC executed undergoes a READ operation prior to execution where any leftover incoming buffer is discarded. At the end of this operation, the Broker state on the client returns to NO FLUSH and the RPC executes normally. While the FLUSH state exists, users can experience a delay while the corrupted RPC data is discarded. The delay is proportional to the amount of data in the buffer.

6.8 Memory Leaks

A good indication of a memory leak is when a running program is steadily decreasing the free pool of memory. As it runs or every time the program is started and stopped, free memory is steadily decreased. Specifically, a program requests some bytes of memory from the Microsoft® Windows operating system (OS). When the OS provides it, it marks those bytes as taken. The free pool of memory (i.e., unmarked bytes) is decreased. When the program is finished with the memory, it should return the memory back to the OS by calling the FREE or DISPOSE functions. This allows the OS to clear the “taken” status of that memory; thereby, replenishing its free pool. When a developer forgets to free the memory after use or the program fails before it has a chance to execute the code that frees the memory, the memory is not reclaimed.

At all times, the program should keep track of which memory it is using. It does this by storing “Handles” (i.e., memory addresses of the beginning byte of each memory block). Later, when freeing memory, the Handle is used to indicate which memory address to free. If the variable that holds such a Handle is overwritten, there is no way to determine the Handle.

Nine out of ten times, memory leakage can be traced back to the application code that requests memory and then forgets to return it, or cannot clean up after a crash.
As common with other professional-level languages (e.g., C/C++), Delphi has constructs that applications can use to:

1. Request memory.
2. Type cast it.
3. Return it.

This requires developers to use their best judgement on how to best work with the system memory.

Avoiding memory leaks (and the often-subtle coding errors that lead to them) is a challenge for Delphi developers, especially for those whose main experience is working with M.

The insidious effect of these leaks (e.g., gobbling up 1K of memory each time that a certain event occurs) makes them difficult to detect with normal program testing. “Normal testing” means exercising all the possible paths through the code once, a difficult enough process in a Microsoft® Windows environment. Often, these leaks result in a symptom only under peculiar conditions (e.g., several other applications are running, reducing system resources), or only after extended use of the application (e.g., do you notice that Microsoft® Windows problems crop up in the afternoon, even though you were doing the same thing that morning?).

The most common symptom described is the following:

“The computer was working fine until the user installed the XYZ VistA software application on their PC. Now, it freezes up (gives an error message, says it is out of memory, etc.) all the time, even when the user is not using the XYZ package. No, the user cannot duplicate it, it just happens!”

One of the reasons that there is an extensive market for automated testing tools for Microsoft® Windows and client/server applications is that thorough testing is very difficult to do manually.

Fortunately, there are diagnostic products available for detecting code that cause memory leaks. It helps developers and code reviewers to find these leaks. Its use by people just starting out in Delphi development helps them identify the situations that cause memory leaks. This can serve as a good learning experience for new Delphi developers.

No application is immune from memory leaks, careful analysis of previous Broker code revealed some places where, under certain conditions, memory was not being released after it was used (i.e., memory leaks). These areas have been identified and corrected with RPC Broker 1.1.
7 Tutorial

7.1 Tutorial: Introduction

The major functions of a TRPCBroker Component in a Delphi-based application are to:

- Connect to an RPC Broker VistA M Server system from a client.
- Execute remote procedure calls (RPCs) on that system.
- Return data results from RPC to the client.

This tutorial guides users through using a TRPCBroker Component to perform each of these tasks by having you create a Delphi-based application, step-by-step. This application retrieves a list of terminal types from the VistA M Server, and displays information about each terminal type.

After you have completed this tutorial, you should be able to:

- Include a TRPCBroker Component in a Delphi-based application.
- Retrieve the end-user client workstation’s designated VistA M Server and port to connect.
- Establish a connection through the RPC Broker component to an RPC Broker VistA M Server.
- Create M routines that return data in the formats necessary to be called from RPCs.
- Create RPCs.
- Call RPCs from a Delphi-based application to retrieve data from VistA M database.
- Pass parameters from the Delphi-based application to RPCs.

7.1.1 Tutorial Procedures

- Tutorial: Advanced Preparation
- Tutorial—Step 1: RPC Broker Component
- Tutorial—Step 2: Get Server/Port
- Tutorial—Step 3: Establish Broker Connection
- Tutorial—Step 4: Routine to List Terminal Types
- Tutorial—Step 5: RPC to List Terminal Types
- Tutorial—Step 6: Call ZxxxTT LIST RPC
- Tutorial—Step 7: Associating IENs
- Tutorial—Step 8: Routine to Retrieve Terminal Types
- Tutorial—Step 9: RPC to Retrieve Terminal Types
- Tutorial—Step 10: Call ZxxxTT RETRIEVE RPC
- Tutorial—Step 11: Register RPCs
- Tutorial—Using VA FileMan Delphi Components (FMDC)
- Tutorial—Source Code (Sample)
7.2 Tutorial: Advanced Preparation

7.2.1 Namespacing of Routines and RPCs

Each tutorial user should choose a unique namespace beginning with Z, concatenated with two or three other letters, for example ZYXU. Use this namespace as the beginning of the names for all routines and RPCs created during this tutorial. Using the unique namespace protects the system you are using from having existing routines and RPCs overwritten. This namespace is referred to as Zxxx during the tutorial.

7.2.2 Tutorial Prerequisites

To use this tutorial:

- User should already have M programming skills, and some familiarity with Delphi and Object Pascal.
- User must have Delphi and the Broker Development Kit (BDK) installed on the workstation.
- The client workstation must have network access to an M account that is running a RPC Broker server process.
- Users must have programmer access in this M account, and it should be a Test account (not Production). Also, users need the XUPROGMODE security key assigned to their user account.

7.3 Tutorial—Step 1: RPC Broker Component

The first step of this tutorial is to create a Delphi-based application that includes a TRPCBroker Component.

To create a Delphi-based application that includes a TRPCBroker Component, do the following:

1. In Delphi, create a new application. Delphi creates a blank form, named Form1.
2. Set Form1’s Caption property to Terminal Type Display.
3. From the Kernel component palette tab, add a TRPCBroker Component to your form. The instance of the component is automatically named RPCBroker1. It should be renamed to brkrRPCBroker1.

   NOTE: In general the name of the component can be any meaningful name that begins with “brkr” to indicate a TRPCBroker Component.

4. Leave the default values for Server and ListenerPort (see Server Property and ListenerPort Property) as is (they are retrieved from your workstation’s Registry). In Section 7.4 you will add code to retrieve these values at run-time from the workstation’s Registry.

5. Set the ClearParameters Property and ClearResults Property to True if they are not set to True already. This ensures that each time a call to an RPC is made, the Results Property is cleared beforehand, and the Param Property is cleared afterwards.
6. Your form should look like Figure 81:

Figure 81: Tutorial—Step 1: RPC Broker Component: Sample Form Output

The next tasks are to use the TRPCBroker Component to retrieve the client workstation’s RPC Broker server and port information (Tutorial—Step 2: Get Server/Port), and then to establish a connection through the TRPCBroker Component to the VistA M Server (Tutorial—Step 3: Establish Broker Connection).
7.4 Tutorial—Step 2: Get Server/Port

The TRPCBroker Component added to your form is hard-coded to access the Broker server and listener port that it picks up from the (developer) workstation (by default, BROKERSERVER and 9200). Naturally, you do not want this to be the only server and port to which your application can connect. To retrieve the end-user workstation’s designated Broker server and port to connect, as stored in their Registry, you can use the GetServerInfo Function.

To retrieve the end-user workstation’s designated server and port, do the following:

1. Include the RPCConf1 Unit in the Pascal file’s uses clause. This is the unit of which GetServerInfo Function is a part.
2. Double-click on a blank region of the form. This creates an event handler procedure, TForm1.FormCreate, in the Pascal source code.
3. Add code to the FormCreate event handler that retrieves the correct server and port to connect, using the GetServerInfo Function. If mrCancel is returned, the code should quit. Otherwise, the code should then set brkrRPCBroker1’s Server Property and ListenerPort Property to the returned values.

   The code should look like Figure 82:

   **Figure 82: Tutorial—Step 2: Get Server/Port: Example**

   ```pascal
   procedure TForm1.FormCreate(Sender: TObject);
   var
      ServerStr: String;
      PortStr: String;
   begin
      // Get the correct port and server from the Registry.
      if GetServerInfo(ServerStr, PortStr) <> mrCancel then
         begin
            brkrRPCBroker1.Server := ServerStr;
            brkrRPCBroker1.ListenerPort := StrToInt(PortStr);
            {connectOK}
         end
      else
      Application.Terminate;
   end;
   ```

4. Now that you have code to retrieve the appropriate RPC Broker server and listener port, the next step of the tutorial (Tutorial—Step 3: Establish Broker Connection) is for the application to use the TRPCBroker Component to establish a connection to the VistA M Server.
7.5 Tutorial—Step 3: Establish Broker Connection

Now that the application can determine the appropriate RPC Broker server and port to connect (Tutorial—Step 2: Get Server/Port), add code to establish a connection to the designated RPC Broker server from the application. The act of establishing a connection leads the user through signon. If signon succeeds, a connection is established.

To establish a connection from the application to a RPC Broker server, do the following:

1. Add code to Form1’s OnCreate event handler. The code should:
   a. Set brkrRPCBroker1’s Connected Property to True (inside of an exception handler try...except block). This causes an attempt to connect to the RPC Broker server.
   b. Check if an EBrokerError exception is raised. If this happens, connection failed, and the code should inform the user of this and terminate the application.

   The OnCreate event handler should now look like Figure 83:

   ![Figure 83: Tutorial—Step 3: Establish Broker Connection: Example](image)

   ```delphi
   procedure TForm1.FormCreate(Sender: TObject);
   var
     ServerStr: String;
     PortStr: String;
   begin
     // Get the correct port and server from the Registry.
     if GetServerInfo(ServerStr,PortStr)<> mrCancel then
     {connectOK begin}
     begin
       brkrRPCBroker1.Server:=ServerStr;
       brkrRPCBroker1.ListenerPort:=StrToInt(PortStr);
       // Establish a connection to the RPC Broker server.
       try
         brkrRPCBroker1.Connected:=True;
       except
         On EBrokerError do
         {error begin}
         begin
           ShowMessage('Connection to server could not be established!');
           Application.Terminate;
         {error end}
         end;
         {try end}
       end;
     {connectOK end}
     end
     else
     Application.Terminate;
   end;
   end

   NOTE: Every call that invokes an RPC Broker server connection should be done in an “exception handler” try...except block, so that EBrokerError exceptions can be trapped.

2. Save, compile and run the application. It should connect to the VistA M Server returned by the GetServerInfo Function. You may be prompted to sign on with 2-factor authentication (2FA) or Access and Verify codes. If you can connect successfully, the application runs (at this point, it is just a blank form). Otherwise, troubleshoot the RPC Broker connection until the application connects.
3. If the server system defined in the Registry is not the development system (the one on which RPCs are created for this application), update the Registry using the ServerList.exe program so that the application connects to the proper VistA M Server.

4. Now that the application can establish a connection to the end-user's server system, you can retrieve data from the VistA M Server.

   The next steps of the tutorial create a custom RPC that retrieves a list of all of the terminal types on the VistA M Server and calls that RPC from the application.

7.6  **Tutorial—Step 4: Routine to List Terminal Types**

Now that the application uses an RPC Broker component to connect correctly to an RPC Broker server (*Tutorial—Step 3: Establish Broker Connection*), you are ready to create custom RPCs that the application can call. For the tutorial, you will create an RPC that retrieves the list of all terminal types from the RPC Broker server.

The first step in creating an RPC is to create the routine that the RPC executes. You must create its input and output in a defined format that is compatible with being executed as an RPC.

To create the routine that the RPC executes, do the following:

1. Choose the data format that the RPC should return. The type of data needed to return to the client application determines the format of the routine that the RPC calls. There are five return value types for RPCs:
   - SINGLE VALUE
   - ARRAY
   - WORD PROCESSING
   - GLOBAL ARRAY
   - GLOBAL INSTANCE

   Since the type of data the tutorial application would like returned is a list of terminal types, and that list could be quite long, use a return value type GLOBAL ARRAY for the RPC. For the routine called by the RPC, this means that:
   - The routine should return a list of terminal types in a global. Each terminal type should be on an individual data node, subscripted numerically.
   - The return value of the routine (always returned in the routine’s first parameter) should be the global reference of the data global, in closed root form. The data nodes should be one level descendant from the global reference.

2. In the M account that the TRPCBroker Component connects to, create a routine that outputs a list of terminal types in the format determined above. The format for each data node that is returned for a terminal type could be anything; for the sake of this application, set each data node to “ien^.01 field” for the terminal type in question. Store each node in ^TMP($J,”ZxxxTT”,#), as shown in Figure 84.
Figure 84: Tutorial—Step 4: Routine to List Terminal Types: Example

    ZxxxTT ;ISC-SF/KC TUTORIAL RTN, BRK 1.1; 7/22/97
    ;1.0;
    TERMLIST(GLOBREF); retrieve list of term types
    ; return list in ^TMP($J,"ZxxxTT")
    ; format of returned results: ien^.01 field
    N %                        ; scratch variable
    K ^TMP($J,"ZxxxTT")        ; clear data return area
    D LIST^DIC(3.2)            ; retrieve list of termtree entries
    ; now set termtree entries into data global
    I '$D(DIERR) D
    .S %=0 F %=D($G("DILIST","$J,2,%)) Q:%="" D
    ..S
    ^TMP($J,"ZxxxTT",%)=$G(^TMP("DILIST","$J,2,%"))_%"_%$G(^TMP("DILIST","$J,1,"))
    K ^TMP("DILIST","$J")     ; clean up
    S GLOBREF=$NA(^TMP($J,"ZxxxTT")); set return value

3. Test the routine. Call it like the Broker would:

   > D TERMLIST^ZxxxTT(.RESULT)

   a. Confirm that the return value is the correct global reference:

   > W RESULT
   ^TMP(566363396,"ZxxxTT")

   b. Confirm that the data set into the global is in the format shown in Figure 85:

   Figure 85: Tutorial—Step 4: Routine to List Terminal Types: Example confirming global data format

   ^TMP(566347920,"ZxxxTT",1) = 1^C-3101
   ^TMP(566347920,"ZxxxTT",2) = 2^C-ADDS
   ^TMP(566347920,"ZxxxTT",3) = 3^C-ADM3
   ^TMP(566347920,"ZxxxTT",4) = 38^C-DATAMEDIA
   ^TMP(566347920,"ZxxxTT",5) = 106^C-DATATREE
   ^TMP(566347920,"ZxxxTT",6) = 4^C-DEC
   ^TMP(566347920,"ZxxxTT",7) = 5^C-DEC132
   ^TMP(566347920,"ZxxxTT",8) = 93^C-FALCO
   ^TMP(566347920,"ZxxxTT",9) = 6^C-H1500
   ^TMP(566347920,"ZxxxTT",10) = 103^C-HINQLINK
   ^TMP(566347920,"ZxxxTT",11) = 132^C-HINQLINK
   ^TMP(566347920,"ZxxxTT",12) = 63^C-HP110
   ^TMP(566347920,"ZxxxTT",13) = 34^C-HP2621

4. Once you have tested the routine, and confirmed that it returns data correctly, the next step (Tutorial—Step 5: RPC to List Terminal Types) is to create the RPC that calls this routine.
7.7 Tutorial—Step 5: RPC to List Terminal Types

Now that you have created an RPC-compatible routine to list terminal types (Tutorial—Step 4: Routine to List Terminal Types), you can go ahead and create the RPC itself (the entry in the REMOTE PROCEDURE File [#8994]) that calls the routine.

To create an RPC that uses the TERMLIST^ZxxxTT routine, do the following:

1. Using VA FileMan, create a new RPC entry in the REMOTE PROCEDURE File (#8994). Set up the RPC as shown in Figure 86:

   ![Figure 86: Tutorial—Step 5: RPC to List Terminal Types: Example](image)

   NAME: ZxxxTT LIST
   TAG: TERMLIST
   ROUTINE: ZxxxTT
   RETURN VALUE TYPE: GLOBAL ARRAY
   WORD WRAP ON: TRUE
   DESCRIPTION: Used in RPC Broker developer tutorial.

2. The RPC’s RETURN VALUE TYPE is set to GLOBAL ARRAY. This means that the RPC expects a return value that is a global reference (with data stored at that global reference).

3. Also, the RPC’s WORD WRAP ON is set to TRUE. This means each data node from the VistA M Server is returned as a single node in the Results Property of the TRPCBroker Component in Delphi. Otherwise, the data would be returned concatenated into a single node in the Results Property.

4. The next step of the tutorial (Tutorial—Step 6: Call ZxxxTT LIST RPC) is to call this RPC from the tutorial application, through its TRPCBroker Component.

7.8 Tutorial—Step 6: Call ZxxxTT LIST RPC

Once you have created and tested the ZxxxTT LIST RPC on the VistA M Server, use the Delphi-based application’s TRPCBroker Component to call that RPC.

To call the ZxxxTT LIST RPC from the Delphi-based application to populate a list box, do the following:

1. Place a TListBox component on the form. It should be automatically named ListBox1.

   Size it so that it uses the full width of the form, and half of the form’s height.

2. Place a button beneath ListBox1:

   Set its caption to “Retrieve Terminal Types”.

   Size the button so that it is larger than its caption.

3. Double-click on the button. This creates an event handler procedure, TForm1.Button1Click, in the Pascal source code.
4. In the TForm1.Button1Click event handler, add code to call the ZxxxTT LIST RPC and populate the list box with the retrieved list of terminal type entries. This code should:
   a. Set RCPBroker1’s RemoteProcedure Property to ZxxxTT LIST.
   b. Call brkrRPCBroker1’s Call Method (in a try...except exception handler block) to invoke that RPC.
   c. Retrieve results from brkrRPCBroker1’s Results Property, setting them one-by-one into the list box’s Items property.

   This code should look like the code in Figure 87:

   **Figure 87: Tutorial—Step 6: Call ZxxxTT LIST RPC: Example**

   ```pascal
   Procedure TForm1.Button1Click(Sender: TObject);
   var
      i: integer;
   begin
      brkrRPCBroker1.RemoteProcedure:=ZxxxTT LIST;
      try
         {call begin}
         begin
            brkrRPCBroker1.Call;
            ListBox1.Clear;
            for i:=0 to (brkrRPCBroker1.Results.Count-1) do
               ListBox1.Items.Add(piece(brkrRPCBroker1.Results[i],'^',2));
         {call end}
         except
            On EBrokerError do
               ShowMessage('A problem was encountered communicating with the server. ');
         {try end}
      end;
   end;
   ```

5. Include the mfunstr unit in the Uses clause of the project’s Pascal source file. This enables the application to use the piece function included in mfunstr (see the “XWB IM HERE” section).

6. The user account must have XUPROGMODE security key assigned. This allows the application to execute any RPC, without the RPC being registered. Later in the tutorial you will register your RPCs.
7. Run the application, and click **Retrieve Terminal Types**. It should retrieve and display terminal type entries, and appear as shown in Figure 88:

Figure 88: Tutorial—Step 6: Call ZxxxTT LIST RPC: Sample Output Form

![Terminal Type Display](image)

8. Now that you can retrieve a list of terminal type entries, the next logical task is to retrieve a particular entry when a user selects that entry in the list box.

7.9 **Tutorial—Step 7: Associating IENs**

When a user selects a terminal type entry in the list box, a typical action is to retrieve the corresponding record and display its fields. The key to retrieving any VA FileMan record is knowing the IEN of the record. Thus, when a user selects an entry in the list box, you need to know the IEN of the corresponding VA FileMan entry. However, the list box items themselves only contain the name of each entry, not the IEN.

The subscripting of items in the list box still matches the original subscripting of items returned in brkrRPCBroker1’s **Results Property**, as performed by the following code in Button1Click event handler:

```pascal
for i:=0 to (brkrRPCBroker1.Results.Count-1) do
Listbox1.Items.Add(piece(brkrRPCBroker1.Results[i],'^',2));
```

If no further calls to brkrRPCBroker1 were made, you could simply refer back to brkrRPCBroker1’s Results[x] item to obtain the matching IEN of a list boxes’ Items[x] item. But, since brkrRPCBroker1 is used again, the **Results Property** is cleared. So, the results must be saved off in another location, if you want to be able to refer to them after other Broker calls are made.
To save off the Results to another location, do the following:

1. Create a variable named **TermTypeList**, of type TStrings. This is where `brkrRPCBroker1.Results` is saved. Create the variable in the section of code where TForm1 is defined as a class:

   ![Figure 89: Tutorial—Step 7: Associating IENs: Example of Creating a Variable to Save Results](image)

   ```
   type
   TForm1 = class(TForm)
     brkrRPCBroker1: TRPCBroker;
     ListBox1: TListBox;
     Button1: TButton;
     procedure FormCreate(Sender: TObject);
     procedure Button1Click(Sender: TObject);
   private
     {Private declarations}
   public
     {Public declarations}
   // Added declaration of TermTypeList.
   TermTypeList: TStringList;
   end;
   ```

2. In Form1’s **OnCreate** event handler, call the Create method to initialize the TermTypeList. Do this in the first line of code of the event handler:

   ```
   TermTypeList:=TStringList.Create;
   ```

3. Create an event handler for Form1’s **OnDestroy** event (select Form1, go to the **Events** tab of the Object Inspector, and double-click on the right-hand column for the **OnDestroy** event). In that event handler, add one line of code to call the Free method for TermTypeList. This frees the memory used by the list:

   ![Figure 90: Tutorial—Step 7: Associating IENs: Example of Creating an Event Handler to Free Memory](image)

   ```
   procedure TForm1.FormDestroy(Sender: TObject);
   begin
     TermTypeList.Free;
   end;
   ```
4. In Button1’s **OnClick** event handler, add a line of code to populate TermTypeList with the list of terminal types returned in brkrRPCBroker1’s **Results Property**. This code uses the Add method of TStringStrings sequentially so that the subscripting of TermTypeList matches the subscripting of Results. The code for that event handler should then look like **Figure 91**:

**Figure 91: Tutorial—Step 7: Associating IENs: Example of Creating an Event Handler to Populate a List of Terminal Types**

```pascal
procedure TForm1.Button1Click(Sender: TObject);
var
  i: integer;
begin
  brkrRPCBroker1.RemoteProcedure:='Zxxx LIST';
  try
    {call begin}
    begin
      brkrRPCBroker1.Call;
      for i:=0 (brkrRPCBroker1.Results.Count-1) do begin {copy begin}
        ListBox1.Items.Add(piece(brkrRPCBroker1.Results[i],'^',2));
        // Added line.
        TermTypeList.Add(brkrRPCBroker1.Results[i]);{copy end}
      end;
    end;
    except
      On EBrokerError do
        ShowMessage('A problem was encountered communicating with the server.');{try end}
    end;
  except
  end;
end;
```

5. Determine (and display) the IEN of the corresponding terminal type when a user selects an item in the list box:

a. Create an **OnClick** event handler for ListBox1 by double-clicking on the list box.

b. Add code to the new event handler that checks if an item is selected. If an item is selected in the list box, display the first piece of the corresponding item saved off in the TermTypeList array (the index subscripts of TermTypeList and of the list box match each other). This is the IEN of the corresponding VA FileMan entry.

**Figure 92: Tutorial—Step 7: Associating IENs: Example of Creating an Event Handler to Check if an Item is Selected**

```pascal
procedure TForm1.ListBox1Click(Sender: TObject);
var
  ien: String;
begin
  if (ListBox1.ItemIndex <> -1) then {displayitem begin}
  begin
    ien:=piece(TermTypeList[ListBox1.ItemIndex],'^',1);
    ShowMessage(ien);
  {displayitem end}
end;
```
6. Compile and run the application. When you click on an item in the list box, the IEN corresponding to that item should be displayed in a popup message window.

7. Now that you can determine the IEN of any entry the user selects in the list box, you can retrieve and display the corresponding VA FileMan record for any selected list box entry.

7.10 Tutorial—Step 8: Routine to Retrieve Terminal Types

Now that you have associated an IEN for each record displayed in the list box (Tutorial—Step 7: Associating IENs), you can use that IEN to display fields from any terminal type entry in the list box that a user selects. To retrieve the fields for any selected terminal type entry, create a second custom RPC. This RPC needs to take an input parameter, the record IEN, to know which record to retrieve.

To create an RPC routine to retrieve individual terminal type records, do the following:

1. Choose the data format that the RPC should return. The type of data needed to return to the client application determines the format of the routine that the RPC calls. In this case, the RPC should, given an IEN, return fields .01, 1, 2, 3, 4, 6, and 7 (Name, Right Margin, Form Feed, Page Length, Back Space, Open Execute, and Close Execute).

Since this information is constrained and small, a return type of ARRAY would be suitable for this RPC. The return format of the array is arbitrary; for the sake of this application, the routine should return fields .01, 1, 2, 3, and 4 in node 0; field 6 (a 245-character field) in node 1; and field 7 (also a 245-character field) in node 2. This array must be returned in the first parameter to the routine.

2. The routine for this RPC also needs to be able to take an IEN as an input parameter. Any additional input parameters, such as one for the IEN, must follow the required input parameter in which results are returned.

3. Add a second subroutine to the ZxxxTT routine for the second RPC, similar to Figure 93. This subroutine uses an IEN to retrieve fields for a particular terminal type. It then sets three result nodes, each containing a specified set of fields for the record corresponding to the IEN parameter.

Figure 93: Tutorial—Step 8: Routine to Retrieve Terminal Types: Example of a Subroutine to Retrieve Fields for a Particular Terminal Type and Set Result Nodes

| TERMIN(RESULT,IEN) ; retrieve a string of fields for a termtype |
| format of results (by field number): |
| ; RESULT(0)=.01^1^2^3^4 |
| ; RESULT(1)=6 |
| ; RESULT(2)=7 |
| ; N I,ARRAY S IEN=IEN _,","RESULT(1)="" |
| D GETS^DIQ(3.2,IEN,".01;1;2;3;4;6;7","","ARRAY") |
| S RESULT(0)="" |
| I \$D(DIERR) D |
| .F I=.01,1,2,3,4 D |
| .S RESULT(0)=RESULT(0) _ARRAY(3.2,IEN,I)_"" |
| .S RESULT(1)=ARRAY(3.2,IEN,6) |
| .S RESULT(2)=ARRAY(3.2,IEN,7) |

4. Test the routine. Call it like the Broker would:

```
>D TERMIN^ZxxxTT (.ARRAY,103)
```
5. Confirm that the return array contains the specified fields in the nodes shown in Figure 94:

```plaintext
Figure 94: Tutorial—Step 8: Routine to Retrieve Terminal Types: Example Confirming Returned Array Contains the Specified Fields

ARRAY(0)=C-HINQLINK^80^#,SEC(27,91,50,74,27,91,72)^24^SEC(8)^
ARRAY(1)=U $I:(0:255::255:512)
ARRAY(2)=U $I:(::::512) C $I
```

6. Once you have tested the routine, and confirmed that it returns data correctly, the next step (Tutorial—Step 9: RPC to Retrieve Terminal Types) is to create the RPC that calls this routine.

### 7.11 Tutorial—Step 9: RPC to Retrieve Terminal Types

Now that you have created an RPC-compatible routine to retrieve fields from a terminal type record (Tutorial—Step 8: Routine to Retrieve Terminal Types), create the RPC itself.

To create an RPC that uses the TERMENT^ZxxxTT routine, do the following:

1. Using VA FileMan, create a new RPC entry in the REMOTE PROCEDURE File (#8994). Set up the RPC as shown in Figure 95:

```plaintext
Figure 95: Tutorial—Step 9: RPC to Retrieve Terminal Types: Example of an RPC Setup

NAME: ZxxxTT RETRIEVE
TAG: TERMENT
ROUTINE: ZxxxTT
RETURN VALUE TYPE: ARRAY
DESCRIPTION: Used in RPC Broker tutorial.
INPUT PARAMETER: IEN PARAMETER TYPE: LITERAL
```

2. The RPC’s RETURN VALUE TYPE is set to ARRAY. This means that the RPC expects a return value that contains results nodes, each subscripted only at the first subscript level.

3. The WORD WRAP ON setting does not affect RPCs whose RETURN VALUE TYPE is ARRAY.

4. The additional input parameter needed to pass in a record IEN is documented in the INPUT PARAMETER Multiple. Its parameter type is LITERAL, which is appropriate when being passed the numeric value of an IEN.

5. This RPC can now be called from a Delphi-based application, through the TRPCBroker Component.
7.12 Tutorial—Step 10: Call ZxxxTT RETRIEVE RPC

When a user selects a terminal type entry in the list box, the OnClick event is triggered. The ZxxxTT RETRIEVE RPC can be called from that OnClick event, as a replacement for the code there that simply displays the IEN of any selected record.

To use the ZxxxTT RETRIEVE RPC to display fields from a selected terminal type, do the following:

1. Create labels and edit boxes for each of the fields the RPC returns from the Terminal type file:

<table>
<thead>
<tr>
<th>Terminal Type Field:</th>
<th>Add a TEdit component named:</th>
<th>Add a Label with the Caption:</th>
</tr>
</thead>
<tbody>
<tr>
<td>.01</td>
<td>Name</td>
<td>Name</td>
</tr>
<tr>
<td>1</td>
<td>RightMargin</td>
<td>Right Margin:</td>
</tr>
<tr>
<td>2</td>
<td>FormFeed</td>
<td>Form Feed:</td>
</tr>
<tr>
<td>3</td>
<td>PageLength</td>
<td>Page Length:</td>
</tr>
<tr>
<td>4</td>
<td>BackSpace</td>
<td>Back Space:</td>
</tr>
<tr>
<td>6</td>
<td>OpenExecute</td>
<td>Open Execute:</td>
</tr>
<tr>
<td>7</td>
<td>CloseExecute</td>
<td>Close Execute:</td>
</tr>
</tbody>
</table>

2. Update ListBox’s OnClick event handler. Add code so that when the user clicks on an entry in the list box, the application calls the ZxxxTT RETRIEVE RPC to retrieve fields for the corresponding terminal type, and displays those fields in the set of TEdit controls on the form. This code should:

   a. Set RCPBroker1’s RemoteProcedure Property to ZxxxTT RETRIEVE.
   b. Pass the IEN of the selected terminal type to the RPC, using the TRPCBroker Component’s runtime Param Property. Pass the IEN in the Value Property (i.e., brkrRPCBroker1.Param[0].Value).
   c. Pass the PType for the IEN parameter in the brkrRPCBroker1.Param[0].PType. Possible types are literal, reference, and list. In this case, to pass in an IEN, the appropriate PType is literal.
   d. Call brkrRPCBroker1’s Call Method (in a try...except exception handler block) to invoke the ZxxxTT RETRIEVE RPC.
   e. Set the appropriate pieces from each of the three Results nodes into each of the TEdit boxes corresponding to each returned field.
The code for the **OnClick** event handler should look like **Figure 96:**

**Figure 96: Tutorial—Step 10: Call ZxxxTT RETRIEVE RPC: Sample of an OnClick Event Handler**

```pascal
procedure TForm1.ListBox1Click(Sender: TObject);
var
  ien: String;
begin
  if (ListBox1.ItemIndex <> -1) then
  begin
    ien:=piece(TermTypeList[ListBox1.ItemIndex],^',1);
    brkrRPCBroker1.RemoteProcedure:='ZxxxTT RETRIEVE';
    brkrRPCBroker1.Param[0].Value := ien;
    brkrRPCBroker1.Param[0].PType := literal;
    try
      begin
        brkrRPCBroker1.Call;
        Name.Text:=piece(brkrRPCBroker1.Results[0],^',1);
        RightMargin.Text:=piece(brkrRPCBroker1.Results[0],^',2);
        FormFeed.Text:=piece(brkrRPCBroker1.Results[0],^',3);
        PageLength.Text:=piece(brkrRPCBroker1.Results[0],^',4);
        BackSpace.Text:=piece(brkrRPCBroker1.Results[0],^',5);
        OpenExecute.Text:=brkrRPCBroker1.Results[1];
        CloseExecute.Text:=brkrRPCBroker1.Results[2];
      end;
    except
      On EBrokerError do
        ShowMessage('A problem was encountered communicating with the server.');
    end;
  end;
end;
```
3. Compile and run the application. When you click on an entry in the list box now, the corresponding fields should be retrieved and displayed in the set of edit boxes on your form, as shown in Figure 97.

Figure 97: Tutorial—Step 10: Call ZxxxTT RETRIEVE RPC: Testing the Application

7.13 Tutorial—Step 11: Register RPCs

Up until now, it has been assumed that the only user of the application is you, and that you have programmer access and the XUPROGMODE security key in the account where the RPCs are accessed.

Under any other circumstance, any RPCs that the application uses must be registered for use by the application on the host system. Registration authorizes the RPCs for use by the client based on user privileges.

To register the RPCs used by the tutorial application, do the following:

1. Create an option of type “B” (Broker). For example, create an option called ZxxxTT TERMTYPE for the tutorial application.

2. In the “B”-type option’s RPC multiple, make one entry for each RPC the application calls. In the case of this tutorial, there should be two entries:

ZxxxTT LIST
ZxxxTT RETRIEVE
3. Follow the steps in the “RPC Security: How to Register an RPC” section to create an application context, using the ZxxxTT TERMTYPE option.

Essentially, add a line of code that calls the CreateContext Method, and terminates the application if False is returned. The code for Form1’s OnCreate event should now look like Figure 98:

![Figure 98: Tutorial—Step 11: Register RPCs: Example](image)

4. Compile and run the application. Try running it both with and without the XUPROGMODE security key assigned to you. Without the XUPROGMODE security key, you are not able to run the application unless the ZxxxTT TERMTYPE option is assigned to your menu tree.
7.14 Tutorial—Using VA FileMan Delphi Components (FMDC)

Congratulations! You have created a sample application that performs entry lookup, and retrieves fields from any record selected by the end-user. You are now ready to create Delphi-based applications using the RPC Broker.

If the application needs to perform database tasks with VA FileMan on a VistA M Server, consider using the FileMan Delphi Components (FMDC). These components automate the major tasks of working with database records through Delphi. Among the functions they provide are:

- Automated entry retrieval into a set of controls.
- Automated online help for database fields.
- Automated validation of user data entry.
- Automated filing of changed data.
- IEN tracking in all controls.
- Automated DBS error tracking on the Delphi client.
- Generic lookup dialogue.
- Record locking.
- Record deletion.

If you need to do more than the most simple database tasks in your Delphi-based applications, the FileMan Delphi Components (FMDC) encapsulate most of the coding needed to retrieve, validate, and file VA FileMan data.

**REF:** For more information on the VA FileMan Delphi Components (FMDC), see the FMDC VA Intranet website.
7.15 Tutorial—Source Code (Sample)

Figure 99: Tutorial Source Code

```pascal
unit tut1;

interface

Windows, Messages, SysUtils, Classes, Graphics, Controls, Forms, Dialogs, Trpcb, 
RPCConf1, StdCtrls, MFunStr;

type
  TForm1 = class(TForm)
    brkrRPCBroker1: TRPCBroker;
    ListBox1: TListBox;
    Button1: TButton;
    Name: TEdit;
    RightMargin: TEdit;
    FormFeed: TEdit;
    OpenExecute: TEdit;
    CloseExecute: TEdit;
    PageLength: TEdit;
    BackSpace: TEdit;
    Label1: TLabel;
    Label2: TLabel;
    Label3: TLabel;
    Label4: TLabel;
    Label5: TLabel;
    Label6: TLabel;
    Label7: TLabel;
  private
    {Private declarations}
  public
    {Public declarations}
    // Added declaration of TermTypeList.
    TermTypeList: TStrings;
  end;
var
  Form1: TForm1;

implementation

{$R *.DFM}

procedure TForm1.FormCreate(Sender: TObject);
var
  ServerStr: String;
  PortStr: String;
begin
  TermTypeList:=TStringList.Create;
  // Get the correct port and server from the Registry.
  if GetServerInfo(ServerStr, PortStr)<> mrCancel then 
    {connectOK begin}
    begin
    try
    // Establish a connection to the RPC Broker server.
          
```
brkrRPCBroker1.Connected:=True;
if not brkrRPCBroker1.CreateContext('ZxxxTT TERMTYPE') then
  Application.Terminate;
except
  on EBrokerError do
    begin
    ShowMessage('Connection to server could not be established!');
    Application.Terminate;
    end;
end;

procedure TForm1.Button1Click(Sender: TObject);
var
  i: integer
begin
  brkrRPCBroker1.RemoteProcedure:='ZxxxTT LIST';
  try
    begin
      brkrRPCBroker1.Call;
      for i:=0 to (brkrRPCBroker1.Results.Count-1) do begin
        ListBox1.Items.Add(piece(brkrRPCBroker1.Results[i],'^',2));
        TermTypeList.Add(brkrRPCBroker1.Results[i]);
      end;
    except
      on EBrokerError do
        ShowMessage('A problem was encountered communicating with the server.');
    end;
  end;
end;

procedure TForm1.ListBox1Click(Sender: TObject);
var
  ien: string;
begin
  if (ListBox1.ItemIndex <> -1) then
    begin
      ien:=piece(TermTypeList[ListBox1.ItemIndex],'^',1);
      brkrRPCBroker1.RemoteProcedure:='ZxxxTT RETRIEVE';
      brkrRPCBroker1.Param[0].Value := ien;
      brkrRPCBroker1.Param[0].PType := literal;
      try
        begin
          brkrRPCBroker1.Call;
          Name.Text:=piece(brkrRPCBroker1.Results[0],'^',1);
          RightMargin.Text:=piece(brkrRPCBroker1.Results[0],'^',2);
          FormFeed.Text:=piece(brkrRPCBroker1.Results[0],'^',3);
          PageLength.Text:=piece(brkrRPCBroker1.Results[0],'^',4);
          BackSpace.Text:=piece(brkrRPCBroker1.Results[0],'^',5);
        end;
      except
        on EBrokerError do
          ShowMessage('A problem was encountered communicating with the server.');
      end;
    end;
end;
7.16 Silent Login

The RPC Broker provides “Silent Login” capability. Silent Login is a way to log in a user with known login information. Silent Login skips the step of asking the user for login information. It provides functionality associated with the ability to make logins to a VistA M Server without the RPC Broker asking for Access and Verify code information.

REF: For some examples, see the “Silent Login Examples” section.

There are three types of Silent Login provided with the RPC Broker 1.1 BDK:

- **Access/Verify Code**—Type of Silent Login that uses Access and Verify codes provided by the application. This type of Silent Login may be necessary for an application that runs as a background task and repeatedly signs on for short periods. Another case would be for applications that are interactive with the user, but are running under conditions where they cannot provide a standard dialogue window, such as that used by the Broker to request Access and Verify codes. Examples might be applications running on handheld devices or within a browser window.

- **CCOW Token**—Type of Silent Login that uses a CCOW “User Context” token that is passed for authentication.

- **Auto Sign-On (ASO) Token**—Type of Silent Login that uses an ASO token obtained by one application that is passed along with other information as a command line argument to a second application that it is starting. The token is obtained from the VistA server and remains valid for about twenty (20) seconds. When the newly started application sends this token during login the server identifies the same user and completes the login.

Due to the various conditions under which Silent Logins might be used, it was also necessary to provide options to the applications on error handling and processing. Applications that run as system services crash if they attempt to show a dialogue box. Similarly, applications running within Web browsers are not permitted to show a dialogue box or to accept Windows messages. Properties have been provided to permit the application to handle errors in a number of ways.

As a part of the Silent Login functionality, the **TVistaUser Class** providing basic user information was added. This class is used as a property by the TRPCBroker class and is filled with data following
completion of the login process. This property and its associated data are available to all applications, whether or not they are using a Silent Login.

**REF:** For more information on handling divisions during Silent Login, see the “Handling Divisions during Silent Login” section.

### 7.16.1 Handling Divisions during Silent Login

A login may be successful, but if the user has multiple divisions from which to choose and fails to select one, the connection is terminated and a failed login message is generated. This becomes a potential problem in that a Silent Login can have problems if the user has multiple divisions from which to choose and the PromptDivision Property is not set to True.

If the application wishes to handle the user specification of the division, it can attempt to set the TRPCBroker Component Connected Property to True. If upon return, the Connected Property is still False, it can check the Login, MultiDivision Property. If the MultiDivision Property is True, the user has multiple divisions from which to choose. The application finds the possible values for selection in the Login, DivList Property (read-only) (i.e., Tstrings). The values that are present in the DivList Property (read-only) are similar to Figure 100:

**Figure 100: DivList Property—Sample List of Divisions**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>^SAN FRANCISCO^66235</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>^NEW YORK^630</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>^SAN DIEGO^664^1</td>
<td></td>
</tr>
</tbody>
</table>

The first (index = 0) entry is the total number of divisions that can be selected (e.g., 3 in this example). This is followed by the different divisions comprised of the following pieces:

- The second ^-piece of each entry is the division name.
- The third ^-piece of each entry is the division number.
- The fourth ^-piece with the value of 1, if present in one of the entries, is the user’s default division.

The safest value to set as the Login.Division property might be the third ^-piece of the selected division. If the desired division is known ahead of time, it can be set into the Login.Division property for the TRPCBroker Component prior to attempting the connection.
7.16.2 Silent Login Examples

7.16.2.1 Example 1: lmAVCodes

Figure 101 is an example of how to use Silent Login by passing the Access and Verify codes to the TVistaLogin Class.

![Figure 101: Silent Login—Example of Passing the Access and Verify Codes](image)

```pascal
brkrRPCBroker1.KernelLogIn := False;
brkrRPCBroker1.LogIn.Mode := lmAVCodes;
brkrRPCBroker1.LogIn.AccessCode := ********;
brkrRPCBroker1.LogIn.VerifyCodeCode := ********;
brkrRPCBroker1.LogIn.PromptDivision := True;
brkrRPCBroker1.LogIn.OnFailedLogin := myevent;
Try
  brkrRPCBroker1.Connected := True;
except
  exit
end;
```

If brkrRPCBroker1.Connected is True, then Silent Login has worked.

7.16.2.2 Example 2: lmAppHandle

Figure 102 is an example of how to use Silent Login by passing an Application Handle to the TVistaLogin Class.

The lmAppHandle mode of the Silent Login is used when an application starts up a second application. If the second application tests for arguments on the command line, it is possible for this application to be started and make a connection to the VistA M Server without user interaction.

An example of a procedure for starting a second application with data on the command line to permit a Silent Login using the LoginHandle provided by the first application is shown in Figure 102. This is followed by a procedure that can be called in the processing related to FormCreate to use this command line data to initialize the TRPCBroker Component for Silent Login (Figure 103).

⚠️ CAUTION: The procedures shown here are included within the RpcSLogin unit, and can be used directly from there.

If the value for ConnectedBroker is nil, the application specified in ProgLine is started and any command line included in ProgLine is passed to the application.

In the second application, a call to the Broker should be made shortly after starting, since the LoginHandle passed in has a finite lifetime (approximately 20 seconds) during which it is valid for the Silent Login.
procedure StartProgSLogin(const ProgLine: String; ConnectedBroker: TRPCBroker);
var
    StartupInfo: TStartupInfo;
    ProcessInfo: TProcessInformation;
    AppHandle: String;
    CmndLine: String;
begin
    FillChar(StartupInfo, SizeOf(TStartupInfo), 0);
    with StartupInfo do
    begin
        cb := SizeOf(TStartupInfo);
        dwFlags := STARTF_USESHOWWINDOW;
        wShowWindow := SW_SHOWNORMAL;
    end;
    CmndLine := ProgLine;
    if ConnectedBroker <> nil then
    begin
        AppHandle := GetAppHandle(ConnectedBroker);
        CmndLine := CmndLine + ' s=' + ConnectedBroker.Server + ' p='
                    + IntToStr(ConnectedBroker.ListenerPort) + ' h='
                    + AppHandle + ' d=' +
        ConnectedBroker.User.Division;
    end;
    CreateProcess(nil, Pchar(CmndLine), nil, nil, False,
                 NORMAL_PRIORITY_CLASS, nil, nil, StartupInfo, ProcessInfo);
end;

{btnStart is clicked to start the second application Test2.exe}
procedure TForm1.btnStartClick(Sender: TObject);
var
    CurDir: string;
begin
    {Use Test2.exe and expecting it to be in the startup directory for the current application}
    CurDir := ExtractFilePath(ParamStr(0)) + 'Test2.exe';
    {Now start application with Silent Login}
    StartProgSLogin(CurDir, brkrRPCB1);
end;

The following procedure (CheckCmdLine) would be called in the FormCreate code of the application being started to check for command line input, and if relevant to the Broker connection, to set it up.

This code assumes that the following commands are used in conjunction with the values shown:

- s= Server
- p= ListenerPort
- d= User.Division
- h= LoginHandle

The command line might look like:

ProgramName.exe s=DHCPSERVER p=9200 d=692 h=~1XM34XYZZQQ_X
The TRPCB Unit and RpcSLogin Unit would need to be included in the USES clause.

Figure 103: Silent Login—Calling the CheckCmdLine Procedure

```pascal
procedure CheckCmdLine(brkrRPCB: TRPCBroker);
var
  j: integer;
begin
  // Iterate through possible command line arguments
  for j := 0 to 15 do
    begin
      if ParamStr(j) <> '' then
        Form1.Memo1.Lines.Add(IntToStr(j) + ' ' + ParamStr(j));
      if Pos('p=',ParamStr(j)) > 0 then
        brkrRPCB.ListenerPort := StrToInt(Copy(ParamStr(j),
          (Pos('=',ParamStr(j))+1),length(ParamStr(j))));
      if Pos('s=',ParamStr(j)) > 0 then
        brkrRPCB.Server := Copy(ParamStr(j),
          (Pos('=',ParamStr(j))+1),length(ParamStr(j)));
      if Pos('h=',ParamStr(j)) > 0 then
        begin
          brkrRPCB.Login.LoginHandle := Copy(ParamStr(j),
            (Pos('=',ParamStr(j))+1),length(ParamStr(j)));
          if brkrRPCB.Login.LoginHandle <> '' then
            begin
              brkrRPCB.KernelLogIn := False;
              brkrRPCB.Login.Mode := lmAppHandle;
            end;
        end;
      if Pos('d=',ParamStr(j)) > 0 then
        brkrRPCB.Login.Division := Copy(ParamStr(j),
          (Pos('=',ParamStr(j))+1),length(ParamStr(j)));
    // for end
    end;
end;
```

7.17 Microsoft Windows Registry

Applications built with RPC Broker 1.1 use the Microsoft® Windows Registry to store the available servers and ports accessed via the Broker.

The Windows Registry replaces the [RPCBroker_Servers] section of the VISTA.INI file. The VISTA.INI file is no longer used by applications built with Broker 1.1. However, this file continues to be used by applications built using RPC Broker 1.0. During the installation of the Broker, relevant data from the VISTA.INI file is moved to the Windows Registry. Subsequent reads and writes are done via the Registry.

⚠️ CAUTION: The VISTA.INI file created with RPC Broker 1.0 must not be removed from the Windows directory on the client workstation. It is still required for 16-bit Broker-based applications created using RPC Broker 1.0.
8 DLL Interfaces (C, C++, Visual Basic)

8.1 DLL Interface Introduction

RPC Broker 1.1 provides Dynamic Link Library (DLL) functions that allow applications written in any Microsoft® Windows-based development environment (e.g., Embarcadero’s® Delphi, Embarcadero C++, Microsoft® Visual Basic, and other COTS products), to take advantage of all the features offered by the RPC Broker component. This reflects VistA’s continued movement toward open systems that support multiple GUI and client front-ends.

The Dynamic Link Library (DLL) functions act like a “shell” around the Delphi TRPCBroker component and provide developers with an easy function-based access to the Broker component. These functions allow GUI and client front-end applications written in Embarcadero’s Delphi and other COTS products to take advantage of all the features that the Broker offers. All of the communication to the server is handled by the TRPCBroker component accessed via the DLL interface.

The functionality of the TRPCBroker Component for Delphi is provided in a 32-bit Dynamic Link Library (DLL) interface, in BAPI32.DLL. This enables the use of any development product that can access Windows 32-bit DLLs to create applications that communicate with VistA M Servers through the RPC Broker.

NOTE: The BAPI32.DLL contains all of the 32-bit Broker DLL functions. It provides an interface to the Broker component.

In Delphi, you have direct access to the TRPCBroker Component itself, and its properties and methods. In other development environments, you can only access the properties and methods of the TRPCBroker Component through DLL functions. To understand the DLL interface, you should understand how the TRPCBroker Component is used in its native environment (Delphi).

The following special issues should be considered when accessing RPC Broker functionality through its DLL:

- RPC Results from DLL Calls
- GetServerInfo Function and the DLL

REF: For a list of DLL Exported Functions, see the “DLL Exported Functions” section.

8.1.1 Header Files

Header files for using the DLL are provided for C (BAPI32.H), C++ (BAPI32.HPP), and Visual Basic (BAPI32.BAS).

- C: Guidelines Overview
- C++: Guidelines Overview
- Visual Basic: Guidelines Overview

8.1.2 Sample DLL Application

The VB5EGCHO sample application, distributed with an earlier Broker Development Kit (BDK), demonstrates use of the RPC Broker 32-bit DLL from Microsoft Visual Basic. The source code was located in the following directory:

BDK32\Samples\Vb5Egcho
8.2 DLL Exported Functions

Table 40 lists the TRPCBroker Component functions that are exported in BAPI32.DLL:

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MySsoToken Function</td>
<td>Get a Secure Token Service (STS) token from Identity and Access Management (IAM) using 2-factor authentication (2FA).</td>
</tr>
<tr>
<td>RPCBCall Function</td>
<td>Execute an RPC.</td>
</tr>
<tr>
<td>RPCBCreate Function</td>
<td>Create a TRPCBroker Component.</td>
</tr>
<tr>
<td>RPCBCreateContext Function</td>
<td>Create context.</td>
</tr>
<tr>
<td>RPCBFree Function</td>
<td>Destroy a TRPCBroker Component.</td>
</tr>
<tr>
<td>RPCBMultItemGet Function</td>
<td>Get value of a Mult item in a Param.</td>
</tr>
<tr>
<td>RPCBMultPropGet Function</td>
<td>Get value of a Mult Property in a Param.</td>
</tr>
<tr>
<td>RPCBMultSet Function</td>
<td>Set a Mult item in a Param to a value.</td>
</tr>
<tr>
<td>RPCBMultSortedSet Function</td>
<td>Sorts a Mult Param Property.</td>
</tr>
<tr>
<td>RPCBParamGet Function</td>
<td>Get the value of a Param.</td>
</tr>
<tr>
<td>RPCBParamSet Function</td>
<td>Set the value of a Param.</td>
</tr>
<tr>
<td>RPCBPropGet Function</td>
<td>Get the value of a TRPCBroker Component property.</td>
</tr>
<tr>
<td>RPCBPropSet Function</td>
<td>Set the value of a TRPCBroker Component property.</td>
</tr>
</tbody>
</table>

8.3 DLL Special Issues

8.3.1 RPC Results from DLL Calls

When executing an RPC on a VistA M Server, results from the RPC are returned as a text stream. This text stream may or may not have embedded <CR><LF> character combinations.

In Delphi, when you call an RPC using the TRPCBroker Component directly, the text stream returned from an RPC is automatically parsed and returned in the TRPCBroker Component’s Results Property, either in Results[0] or in multiple Results nodes. If there are no embedded <CR><LF> character combinations in the text stream, only Results[0] is used. If there are embedded <CR><LF> character combinations, results are placed into separate Results nodes based on the <CR><LF> delimiters.

When using the DLL interface, the return value is a text stream, but no processing of the text stream is performed for you. It is up to you to parse out what would have been individual Results nodes in Delphi, based on the presence of any <CR><LF> character combinations in the text stream.

NOTE: You must create a character buffer large enough to receive the entire return value of an RPC.
8.3.2 GetServerInfo Function and the DLL

When you use the TRPCBroker Component for Delphi, you are able to call the GetServerInfo Function to retrieve the end-user workstation’s server and port settings.

The functionality provided by GetServerInfo Function is not currently available through the RPC Broker 32-bit DLL interface. To work around this limitation when using the RPC Broker 32-bit DLL, you should prompt the user directly for the server and port to connect.
8.4 C DLL Interface

8.4.1 C: Guidelines Overview

The BAPI32.H header file defines the function prototypes for all functions exported in the RPC Broker 32-bit DLL.

REF: For a list of DLL Exported Functions, see the “DLL Exported Functions” section.

To use the DLL Broker functions, using C, exported in BAPI32.DLL, do the following:

1. C: Initialize—LoadLibrary and GetProcAddress
2. C: Create Broker Components
3. C: Connect to the Server
4. C: Execute RPCs
5. C: Destroy Broker Components

8.4.2 C: Initialize—LoadLibrary and GetProcAddress

The first step to using the RPC Broker 32-bit DLL in a C program is to load the DLL and get the process addresses for the exported functions.

To initialize access to the Broker DLL functions, do the following:

1. Use the Windows API LoadLibrary function to load the DLL.

   **Figure 104: C: Initialize—LoadLibrary and GetProcAddress: Using the Windows API LoadLibrary Function to Load the DLL**

   ```c
   HINSTANCE hLib = LoadLibrary("bapi32.dll");
   if((unsigned)hLib<=HINSTANCE_ERROR)
   {
       /* Add your error handler for case where library fails to load. */
       return 1;
   }
   ```
2. If you successfully load the DLL, map function pointers to the addresses of the functions in the DLL that you need for your application:

```
Figure 105: C: Initialize—LoadLibrary and GetProcAddress: Mapping Function Pointers to the Addresses of the Functions in the DLL

MySsoToken = (void *(__stdcall*)()) GetProcAddress(hLib, "MySsoToken");
RPCBCreate = (void *(__stdcall*)()) GetProcAddress(hLib, "RPCBCreate");
RPCBFree = (void (__stdcall*)(void *)) GetProcAddress(hLib, "RPCBFree");
RPCBCall = (char *(__stdcall*)(void *, char *)) GetProcAddress(hLib, "RPCBCall");
RPCBCreateContext = (bool (__stdcall*)(void *, char *)) GetProcAddress(hLib, "RPCBCreateContext");
RPCBMultSet = (void (__stdcall*)(void *, int, char *, char *)) GetProcAddress(hLib, "RPCBMultSet");
RPCBParamGet = (void (__stdcall*)(void *, int, int, char *)) GetProcAddress(hLib, "RPCBParamGet");
RPCBParamSet = (void (__stdcall*)(void *, int, int, char *)) GetProcAddress(hLib, "RPCBParamSet");
RPCBPropGet = (void (__stdcall*)(void *, char *, char *)) GetProcAddress(hLib, "RPCBPropGet");
RPCBPropGet = (void (__stdcall*)(void *, char *, char *)) GetProcAddress(hLib, "RPCBPropGet");
RPCBPropGet = (void (__stdcall*)(void *, char *, char *)) GetProcAddress(hLib, "RPCBPropGet");
RPCBPropGet = (void (__stdcall*)(void *, char *, char *)) GetProcAddress(hLib, "RPCBPropGet");
RPCBPropSet = (void (__stdcall*)(void *, char *, char *)) GetProcAddress(hLib, "RPCBPropSet");

// GetProcAddress, returns null on failure.
//
// if( RPCBCreate == NULL || RPCBFree == NULL || RPCBCall == NULL ||
// RPCBCreateContext == NULL || RPCBMultSet == NULL || RPCBParamGet == NULL || RPCBParamSet == NULL ||
// RPCBPropGet == NULL || RPCBPropSet == NULL)
//  /* Add your error handler for cases where functions are not found. */
//  return 1;
}
```

Now you can use functions exported in the DLL.

### 8.4.3 C: Create Broker Components

To create TRPCBroker Components in your C program, do the following:

1. Create a pointer for the TRPCBroker Component:

   ```
   // Generic pointer for the TRPCBroker component instance.
   void * RPCBroker;
   ```

2. Call the RPCBCreate Function to create a TRPCBroker Component and return its address into the pointer you created:

   ```
   // Create the TRPCBroker component instance.
   RPCBroker = RPCBCreate();
   ```

Now you can use the pointer to the created Broker component to call its methods.
8.4.4 C: Connect to the Server

To connect to the VistA M Server from the C program, do the following:

1. Set the server and port to connect:

```c
// Set the Server and Port properties to determine where to connect.
RPCBPropSet(RPCBroker,"Server","BROKERSERVER");
RPCBPropSet(RPCBroker,"ListenerPort","9200");
```

2. Set the Connected Property to true; this attempts a connection to the VistA M Server:

```c
// Set the Connected property to True, to connect.
RPCBPropSet(RPCBroker,"Connected","1");
```

3. Check if you are still connected. If so, continue because the connection was made. If not, quit or branch accordingly:

```c
// If still connected, can continue.
RPCBPropGet(RPCBroker,"Connected",Value);
if (atoi(Value) != 1) return false;
```

4. Attempt to create context for your application’s “B”-type option. If you cannot create context, you should quit or branch accordingly. If RPCBCreateContext Function returns True, then you are ready to call all RPCs registered to your application’s “B”-type option:

```c
// Create Context for your application's option (in this case, XWB EGCHO).
result = RPCBCreateContext(RPCBroker,"XWB EGCHO");
return result;
```

8.4.5 C: Execute RPCs

If you can make a successful connection to the RPC Broker VistA M Server, and create an application context, you can execute any RPCs registered to your context.

To execute RPCs from your C program, do the following:

1. Create a character buffer large enough to hold your RPC’s return value:

```c
static char Value[1024];
```

2. Set the RemoteProcedure Property of the TRPCBroker Component to the RPC to execute:

```c
RPCBPropSet(RPCBroker,"RemoteProcedure","XWB GET VARIABLE VALUE");
```
3. Set the Param values for any parameters needed by the RPC. In the following example, one TRPCBroker Param node is set (the equivalent of Param[0]):

   a. A value of 0 for parameter 2 denotes the integer index of the Param node being set (Param[0]).

   b. A value of reference for parameter 3 denotes the setting for the equivalent of Param[0].PType. This uses the enumerated values for PType (see Table 11) declared in the header file.

   c. A value of “DUZ” for parameter 4 denotes that the equivalent of Param[0].Value is “DUZ”:

```
RPCBParamSet(RPCBroker, 0, reference, "DUZ");
```

4. Use the **RPCBCall Function** to execute the RPC:

```
RPCBCall(RPCBroker, Value);
```

The return value from the RPC is returned in the second parameter (in this case, the Value character buffer).

### 8.4.6 C: Destroy Broker Components

When you are done using any TRPCBroker Component, you should call its destroy method to free it from memory.

To destroy TRPCBroker Components from your C program, do the following:

1. Make sure the TRPCBroker Component is not connected:

```
RPCBPropSet(RPCBroker, "Connected", "0");
```

2. Call the RPCBFree method to destroy the object:

```
// Destroy the RPCBroker component instance.
RPCBFree(RPCBroker);
```

3. When you have destroyed all TRPCBroker Components, but before your application terminates, you should call the Windows API FreeLibrary function to unload the DLL:

```
FreeLibrary(hLib);
```
8.5 C++ DLL Interface

8.5.1 C++: Guidelines Overview

The BAPI32.HPP header file defines a class “wrapper” around the RPC Broker 32-bit DLL, defining a TRPCBroker C++ class. Objects of this class include all functions exported in the DLL, as methods of the TRPCBroker C++ class.

REF: For a list of C++ class methods, see the “C++: TRPCBroker C++ Class Methods” section.

One feature of wrapping a class around the RPC Broker 32-bit DLL is that all the ordinary details of working with a DLL (loading the DLL, getting the addresses of the functions in the DLL, and freeing the DLL) are done within the class definition. When you initialize the class, all of the details of loading and unloading the detail (LoadLibrary, GetProcAddress, and FreeLibrary) are done for you.

To use objects of the class, simply initialize the class, and then create and destroy objects of the class.

To use the TRPCBroker C++ class that encapsulates BAPI32.DLL, do the following:

1. C++: Initialize the Class
2. C++: Create Broker Instances
3. C++: Connect to the Server
4. C++: Execute RPCs
5. C++: Destroy Broker Instances

8.5.2 C++: Initialize the Class

The first step to using the RPC Broker 32-bit DLL in a C++ program is to load the DLL and get the process addresses for the exported functions.

To initialize access to the Broker DLL functions, do the following:

1. Include bapi32.hpp in the program:

```cpp
#include bapi32.hpp
```

This includes the TRPCBroker C++ class definition in the program.

2. Later, when you create a TRPCBroker C++ class object in the program, the class definition takes care of the following:
   - Loading the DLL if not already loaded.
   - Mapping the DLL functions if not already mapped.
   - Creating the instance of the TRPCBroker Component.
8.5.3 C++: Create Broker Instances

To create instances of TRPCBroker C++ class objects in a C++ program, do the following:

1. Create a variable of type TRPCBroker. This does the following:
   - Initializes the TRPCBroker class.
   - Creates a TRPCBroker C++ class object instance.
   - Creates a TRPCBroker Component.

   ```cpp
   // Initialize the TRPCBroker class.
   TRPCBroker RPCInst;
   ```

2. Access the properties and methods of the created TRPCBroker Component through the TRPCBroker C++ class object.

8.5.4 C++: Connect to the Server

To connect to the VistA M Server from the C++ program, do the following:

1. Set the server and port to connect:

   ```cpp
   // Set the Server and Port properties to determine where to connect.
   RPCInst.RPCBPropSet("Server", server);
   RPCInst.RPCBPropSet("ListenerPort", "9999");
   ```

2. Set the Connected Property to True; this attempts a connection to the VistA M Server:

   ```cpp
   // Set the Connected property to True, to connect.
   RPCInst.RPCBPropSet("Connected", "1");
   ```

3. Check if you are still connected. If so, continue because the connection was made. If not, quit or branch accordingly:

   ```cpp
   // If still connected, can continue.
   RPCInst.RPCBPropGet("Connected", Value);
   if (atoi(Value) != 1) return false;
   ```

4. Attempt to create context for the application’s “B”-type option. If you cannot create context, quit or branch accordingly. If RPCBCreateContext Function returns True, then you are ready to call all RPCs registered to the application’s “B”-type option:

   ```cpp
   // Create Context for your application’s option (in this case, XWB EGCHO).
   result = RPCInst.RPCBCreateContext("XWB EGCHO");
   return result;
   ```
8.5.5 C++: Execute RPCs

If you can make a successful connection to the RPC Broker VistA M Server, and create an application context, you can execute any RPCs registered to your context.

To execute RPCs from a C++ program, do the following:

1. Create a character buffer large enough to hold your RPC’s return value:

```
char Value [1024];
```

2. Set the RemoteProcedure Property of the TRPCBroker Component to the RPC to execute:

```
RPCInst.RPCBPropSet("RemoteProcedure","XWB GET VARIABLE VALUE");
```

3. Set the Param values for any parameters needed by the RPC. In the following example, one TRPCBroker Param node is set (the equivalent of Param[0]):
   a. A value of 0 for parameter 1 denotes the integer index of the Param node being set (Param[0]).
   b. A value of reference for parameter 2 denotes the setting for the equivalent of Param[0].PType. This uses the enumerated values for PType (see Table 11) declared in the header file.
   c. A value of “DUZ” for parameter 3 denotes that the equivalent of Param[0].Value is “DUZ”:

```
RPCInst.RPCBParamSet(0, reference, “DUZ”);
```

4. Use the RPCBCall Function to execute the RPC:

```
RPCInst.RPCBCall(Value);
```

The return value from the RPC is returned in the first parameter (in this case, the Value character buffer).

8.5.6 C++: Destroy Broker Instances

You do not need to do anything special to free up memory used by the TRPCBroker Component instances and their companion TRPCBroker C++ class objects. They are automatically destroyed when your program terminates, just as normal variables are automatically destroyed.

Also, when your program terminates, the FreeLibrary Windows API call is automatically executed to unload the RPC Broker 32-bit DLL, so there is no need to do this manually.
8.5.7  C++: TRPCBroker C++ Class Methods

The functions in the RPC Broker 32-bit DLL are encapsulated in the TRPCBroker C++ class methods shown in Table 41:

<table>
<thead>
<tr>
<th>DLL Function</th>
<th>TRPCBroker C++ Class Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>MySsoToken Function</td>
<td>char * MySSOToken();</td>
</tr>
<tr>
<td>RPCBCall Function</td>
<td>char * RPCBCall( char * s);</td>
</tr>
<tr>
<td>RPCBCreateContext Function</td>
<td>bool RPCBCreateContext( char * s);</td>
</tr>
<tr>
<td>RPCBMultItemGet Function</td>
<td>void RPCBMultItemGet( int i, char * s, char * t);</td>
</tr>
<tr>
<td>RPCBMultPropGet Function</td>
<td>void RPCBMultPropGet( void * ptr, int i, char * s, char * t);</td>
</tr>
<tr>
<td>RPCBMultSet Function</td>
<td>void RPCBMultSet( int i, char * s, char * t);</td>
</tr>
<tr>
<td>RPCBMultSortedSet Function</td>
<td>void RPCBMultSortedSet( void * ptr, int i, bool v);</td>
</tr>
<tr>
<td>RPCBParamGet Function</td>
<td>void RPCBParamGet( int i, int j, char * s);</td>
</tr>
<tr>
<td>RPCBParamSet Function</td>
<td>void RPCBParamSet( int i, int j, char * s);</td>
</tr>
<tr>
<td>RPCBPropGet Function</td>
<td>void RPCBPropGet( char * s, char * t);</td>
</tr>
<tr>
<td>RPCBPropSet Function</td>
<td>void RPCBPropSet( char * s, char * t);</td>
</tr>
</tbody>
</table>

8.6  Visual Basic DLL Interface
8.6.1  Visual Basic: Guidelines Overview

The BAPI32.BAS header file defines the function prototypes for all functions exported in the RPC Broker 32-bit DLL.

REF: For a list of DLL exported functions, see the “DLL Exported Functions” section.

To use the DLL Broker functions, using Visual Basic, exported in BAPI32.DLL, do the following:
1. Visual Basic: Initialize
2. Visual Basic: Create Broker Components
3. Visual Basic: Connect to the Server
4. Visual Basic: Execute RPCs
5. Visual Basic: Destroy Broker Components

8.6.1.1  Sample DLL Application

The VB5EGCHO sample application, distributed with an earlier Broker Development Kit (BDK), demonstrates use of the RPC Broker 32-bit DLL from Microsoft Visual Basic. The source code was located in the following directory:

BDK32\Samples\Vb5Egcho
8.6.2 Visual Basic: Initialize

The first step to using the RPC Broker 32-bit DLL in a Visual Basic program is to load the DLL and get the process addresses for the exported functions.

To initialize access to the Broker DLL functions, do the following:

1. Include BAPI32.BAS as a module in your Visual Basic program.
2. Visual Basic takes care of loading the DLL and mapping its functions.

8.6.3 Visual Basic: Create Broker Components

To create TRPCBroker Components in your Visual Basic program, do the following:

1. Create a variable to be a handle for the TRPCBroker Component:

   ```vba
   Public intRPCBHandle As Long
   ```

2. Call the RPCBCreate Function to create a TRPCBroker Component and return its address into the variable you created:

   ```vba
   intRPCBHandle = RPCBCreate()
   ```

Now, you can use the handle to the created Broker component to call its methods.

8.6.4 Visual Basic: Connect to the Server

To connect to the VistA M Server from the Visual Basic program, do the following:

1. Set the server and port to connect:

   ```vba
   Call RPCBPropSet(intRPCBHandle, "Server", "BROKERSERVER")
   Call RPCBPropSet(intRPCBHandle, "ListenerPort", "9999")
   ```

2. Set the Connected Property to true; this attempts a connection to the VistA M Server:

   ```vba
   Call RPCBPropSet(intRPCBHandle, "Connected", "1")
   ```

3. Check if you are still connected. If so, continue because the connection was made. If not, quit or branch accordingly:

   ```vba
   RPCBPropGet(intRPCBHandle, "Connected", strResult)
   ```

4. Attempt to create context for your application’s “B”-type option. If you cannot create context, quit or branch accordingly. If `RPCBCreateContext Function` returns True, then you are ready to call all RPCs registered to the application’s “B”-type option:

   ```vba
   intResult = RPCBCreateContext(intRPCBHandle, "MY APPLICATION")
   ```
8.6.5 Visual Basic: Execute RPCs

If you can make a successful connection to the RPC Broker VistA M Server, and create an application context, you can execute any RPCs registered to your context.

To execute RPCs from your Visual Basic program, do the following:

1. Create a character buffer large enough to hold your RPC’s return value:

   ```vbp
global strBuffer As String * 40000
```

2. Set the RemoteProcedure Property of the TRPCBroker Component to the RPC to execute:

   ```vbp
call RPCBPropSet(intRPCBHandle, "RemoteProcedure", "XWB GET VARIABLE VALUE")
```

3. Set the Param values for any parameters needed by the RPC. In the following example, one TRPCBroker Param node is set (the equivalent of Param[0]):

   a. A value of 0 for parameter 2 denotes the integer index of the Param node being set (Param[0]).

   b. A value of reference for parameter 3 denotes the setting for the equivalent of Param[0].PType. This uses the enumerated values for PType (see Table 11) declared in the header file.

   c. A value of “DUZ” for parameter 4 denotes that the equivalent of Param[0].Value is “DUZ”:

   ```vbp
call RPCBParamSet(intRPCBHandle, 0, reference, "DUZ");
```

4. Use the RPCBCall Function to execute the RPC:

   ```vbp
call RPCBCall(intRPCBHandle, strBuffer
```

The return value from the RPC is returned in the second parameter (in this case, the Value character buffer).
8.6.6 Visual Basic: Destroy Broker Components

When you are done using any TRPCBroker Component, you should call its destroy method to free it from memory (see the “Memory Leaks”).

To destroy TRPCBroker Components from your Visual Basic program, do the following:

1. Make sure the TRPCBroker Component is not connected:

   ```
   Call RPCBPropSet(intRPCBHandle, "Connected", "0")
   ```

2. Call the RPCBFree Function to destroy the object:

   ```
   RPCBFree(intRPCBHandle)
   ```

Visual Basic takes care of the details of unloading the DLL.

8.7 MySsoToken Function

Get a Secure Token Service (STS) token from Identity and Access Management (IAM) using 2-factor authentication. This encapsulates the following Broker Development Kit methods:

- TXWBSSOiToken Create
- SSOiToken
- Free

8.7.1 Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declaration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td>function MySsoToken: PChar; stdcall;</td>
</tr>
<tr>
<td>C</td>
<td>void *(__stdcall *MySsoToken) (void);</td>
</tr>
<tr>
<td>C++</td>
<td>void * MySsoToken(void);</td>
</tr>
<tr>
<td>VB</td>
<td>Function MySsoToken () As String</td>
</tr>
</tbody>
</table>
8.7.2 Return Value

- **String**—Digitally signed XML (SAML) token containing authenticated user identity.
- **Null string**—If authentication failed or token could not be obtained.

8.7.3 Examples

8.7.3.1 C

```c
result = MySsoToken();
```

8.7.3.2 C++

```cpp
Result = MySsoToken();
```

8.7.3.3 Visual Basic

```vb
StrResult = MySsoToken()
```

8.8 RPCBCall Function

Executes a remote procedure call, and fills the passed buffer with the data resulting from the call. This is equivalent to the TRPCBroker Component’s Call Method.

8.8.1 Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declaration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td><code>procedure RPCBCall(const RPCBroker: TRPCBroker; CallResult: PChar);</code></td>
</tr>
<tr>
<td>C</td>
<td><code>char *(__stdcall *RPCBCall) (void *, char *)</code>;</td>
</tr>
<tr>
<td>C++</td>
<td><code>char * RPCBCall( char * s);</code></td>
</tr>
<tr>
<td>VB</td>
<td><code>Sub RPCBCall (ByVal intRPCBHandle As Long, ByVal strCallResult As String)</code></td>
</tr>
</tbody>
</table>

8.8.2 Parameter Description

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>Handle of the Broker component that contains the name of the remote procedure and all of the required parameters.</td>
</tr>
<tr>
<td>CallResult</td>
<td>An empty character buffer that the calling application must create (allocate memory for) before making this call. This buffer is filled with the result of the call.</td>
</tr>
</tbody>
</table>
8.8.3 Examples

8.8.3.1 C

```c
RPCBCall(RPCBroker, Value);
```

8.8.3.2 C++

```c
void * (__stdcall *RPCBCreate)(void);
```

8.8.3.3 Visual Basic

```vb
Call RPCBCall(intRPCBHandle, strBuffer)
```

8.9 RPCBCreate Function

The RPCBCreate Function creates a new RPC Broker component for the application, which can then be used to connect to the VistA M Server and call remote procedures.

8.9.1 Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declarations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td>function RPCBCreate: TRPCBroker;</td>
</tr>
<tr>
<td>C</td>
<td>void * (__stdcall *RPCBCreate)(void);</td>
</tr>
<tr>
<td>C++</td>
<td>N/A (encapsulated in TRPCBroker class definition)</td>
</tr>
<tr>
<td>VB</td>
<td>Function RPCBCreate () As Long</td>
</tr>
</tbody>
</table>

8.9.2 Return Value

A handle for the TRPCBroker Component created.
8.9.3 Examples
8.9.3.1 C

// Create the TRPCBroker component instance.
RPCBroker = RPCBCreate();

8.9.3.2 Visual Basic

intRPCBHandle = RPCBCreate()

8.10 RPCBCreateContext Function

The RPCBCreateContext function calls the TRPCBroker Component’s CreateContext Method to set up the environment on the VistA M Server for subsequent RPCs.

8.10.1 Declarations

Table 46: RPCBCreateContext Function—Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declarations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td>function RPCBCreateContext(const RPCBroker: TRPCBroker; const Context: PChar): boolean;</td>
</tr>
<tr>
<td>C</td>
<td>bool (__stdcall *RPCBCreateContext) (void *, char *);</td>
</tr>
<tr>
<td>C++</td>
<td>bool RPCBCreateContext (char * s);</td>
</tr>
<tr>
<td>VB</td>
<td>Function RPCBCreateContext (ByVal intRPCBHandle As Long, ByVal strContext As String) As Integer</td>
</tr>
</tbody>
</table>

8.10.2 Return Value

- True/1—If context could be created.
- False/0—If context could not be created.

8.10.3 Parameter Description

Table 47: RPCBCreateContext Function—Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>Handle of the TRPCBroker Component.</td>
</tr>
<tr>
<td>Context</td>
<td>Null-terminated string identifying the option on the VistA M Server for which subsequent RPCs are registered.</td>
</tr>
</tbody>
</table>
8.10.4 Examples

8.10.4.1 C

```c
// XWB EGCHO is a "B" (Broker) type option in the OPTION file.
result = RPCBCreateContext(RPCBroker, "XWB EGCHO");
```

8.10.4.2 C++

```cpp
// XWB EGCHO is a "B" (Broker) type option in the OPTION file.
MyInstance.RPCBCreateContext("XWB EGCHO")
```

8.10.4.3 Visual Basic

```vbnet
intResult = RPCBCreateContext(intRPCBHandle, "MY APPLICATION")
'where MY APPLICATION is a "B" (Broker) type option in the Option file.
```

8.11 RPCBFree Function

The RPCBFree function destroys the RPC Broker component and releases associated memory (see “Memory Leaks” section).

8.11.1 Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declaration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td>procedure RPCBFree(RPCBroker: TRPCBroker);</td>
</tr>
<tr>
<td>C</td>
<td>void (__stdcall *RPCBFree)(void *);</td>
</tr>
<tr>
<td>C++</td>
<td>N/A (encapsulated in TRPCBroker class definition)</td>
</tr>
<tr>
<td>VB</td>
<td>Sub RPCBFree (ByVal intRPCBHandle As Long)</td>
</tr>
</tbody>
</table>

8.11.2 Parameter Description

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>Handle of the TRPCBroker Component to destroy.</td>
</tr>
</tbody>
</table>
8.11.3 Examples

8.11.3.1 C

```c
// Destroy the TRPCBroker component instance.
RPCBFree(RPCBroker);
```

8.11.3.2 Visual Basic

```vb
RPCBFree(intRPCBHandle)
```

8.12 RPCBMultItemGet Function

The RPCBMultItemGet function returns a requested item in a TRPCBroker Component Param Property’s Mult Property.

8.12.1 Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declaration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td><code>procedure RPCBMultItemGet (const RPCBroker: TRPCBroker; ParamIndex: integer; Subscript, Value: PChar);</code></td>
</tr>
<tr>
<td>C</td>
<td><code>void (__stdcall *RPCBMultItemGet) (void *, int, char *, char *);</code></td>
</tr>
<tr>
<td>C++</td>
<td><code>void RPCBMultItemGet (int i, char * s, char * t);</code></td>
</tr>
<tr>
<td>VB</td>
<td><code>Sub RPCBMultItemGet (ByVal intRPCBHandle As Long, ByVal intParIdx As Integer, ByVal strSubscript As String, ByVal strValue As String)</code></td>
</tr>
</tbody>
</table>

8.12.2 Parameter Description

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>Handle of the TRPCBroker Component.</td>
</tr>
<tr>
<td>ParamIndex</td>
<td>Integer index of the parameter that contains the Mult Property.</td>
</tr>
<tr>
<td>Subscript</td>
<td>Null-terminated string identifying the Mult element to get.</td>
</tr>
<tr>
<td>Value</td>
<td>An empty buffer that the calling application must create (allocate memory for) before making this call. This buffer is filled with the value of the Mult Property item.</td>
</tr>
</tbody>
</table>

REF: For information about the size of parameters and results that can be passed to and returned from the TRPCBroker Component, see the “RPC Limits” section.
8.12.3 Examples

8.12.3.1 C

```c
// The following corresponds to getting the value of PARAM[0].Mult["0"]
RPCBMultItemGet(RPCBroker, 0, "0", Value);
```

8.12.3.2 C++

```cpp
MyInstance.RPCBMultItemGet(0, "0", Value);
```

8.12.3.3 Visual Basic

```vb
Call RPCBMultItemGet(intRPCBHandle, 0, "0", strResult)
```

8.13 RPCBMultPropGet Function

The RPCBMultPropGet function returns a selected property value of a TRPCBroker Component Param Property's Mult Property.

8.13.1 Declarations

Table 52: RPCBMultPropGet—Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declaration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td><code>procedure RPCBMultPropGet(const RPCBroker: TRPCBroker; ParamIndex: integer; Prop, Value: PChar);</code></td>
</tr>
<tr>
<td>C</td>
<td><code>void (__stdcall *RPCBMultPropGet) (void *, int, char *, char *);</code></td>
</tr>
<tr>
<td>C++</td>
<td><code>void RPCBMultPropGet (int i, char * s, char * t);</code></td>
</tr>
<tr>
<td>VB</td>
<td><code>Sub RPCBMultPropGet (ByVal intRPCBHandle As Long, ByVal intParIdx As Integer, ByVal strProp As String, ByRef strValue As String)</code></td>
</tr>
</tbody>
</table>

8.13.2 Parameter Description

Table 53: RPCBMultPropGet—Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>Handle of the TRPCBroker Component.</td>
</tr>
<tr>
<td>ParamIndex</td>
<td>Integer index of the parameter that contains the Mult Property.</td>
</tr>
<tr>
<td>Prop</td>
<td>Null-terminated string identifying the name of the TMult property to get.</td>
</tr>
<tr>
<td>Value</td>
<td>An empty buffer that the calling application must create (allocate memory for) before making this call. This buffer is filled with value of the Mult Property that is in the Prop.</td>
</tr>
</tbody>
</table>
REF: For information about the size of parameters and results that can be passed to and returned from the TRPCBroker Component, see the “RPC Limits” section.

8.13.3 Examples

8.13.3.1 C

RPCBMultPropGet(RPCBroker, 0, ”Count”, Value);

8.13.3.2 C++

MyInstance.RPCBMultPropGet(0, ”Count”, Value);

8.13.3.3 Visual Basic

Call RPCBMultPropGet(intRPCBHandle, 0, ”Count”, strResult)

8.14 RPCBMultSet Function

The RPCBMultSet function sets an item in a TRPCBroker Component Param Property’s Mult Property to a value.

8.14.1 Declarations

Table 54: RPCBMultSet Function—Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declaration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td>procedure RPCBMultSet(const RPCBroker: TRPCBroker; ParamIndex: integer; Subscript, Value: PChar);</td>
</tr>
<tr>
<td>C</td>
<td>void (__stdcall *RPCBMultSet) (void *, int, char *, char *);</td>
</tr>
<tr>
<td>C++</td>
<td>void RPCBMultSet ( int i, char * s, char * t);</td>
</tr>
<tr>
<td>VB</td>
<td>Sub RPCBMultSet (ByVal intRPCBHandle As Long, ByVal intParIdx As Integer, ByVal strSubscript As String, ByVal strValue As String)</td>
</tr>
</tbody>
</table>

8.14.2 Parameter Description

Table 55: RPCBMultSet Function—Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>Handle of the TRPCBroker Component.</td>
</tr>
<tr>
<td>ParamIndex</td>
<td>Integer index of the parameter that contains the Mult Property.</td>
</tr>
<tr>
<td>Subscript</td>
<td>Null-terminated string of the Mult item to set.</td>
</tr>
<tr>
<td>Value</td>
<td>Null-terminated string containing the value that the Mult item should be set to.</td>
</tr>
</tbody>
</table>
REF: For information about the size of parameters and results that can be passed to and returned from the TRPCBroker Component, see the “RPC Limits” section.

8.14.3 Examples

8.14.3.1 C

RPCBMultSet(RPCBroker, 0, “1”, “12/19/97”);

8.14.3.2 C++

MyInstance.RPCBMultSet(0, “1”, “12/19/97”);

8.14.3.3 Visual Basic

Call RPCBMultSet(intRPCBHandle, 0, “1”, “12/19/97”);

8.15 RPCBMultSortedSet Function

The RPCBMultSortedSet function sets the Sorted Property of a Mult Property. In essence, sorts and keeps the Mult Property sorted or just leaves it in the order it is populated.

8.15.1 Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declaration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td><code>procedure RPCBMultSortedSet(const RPCBroker: TRPCBroker; ParamIndex: integer; Value: boolean);</code></td>
</tr>
<tr>
<td>C</td>
<td><code>void (__stdcall *RPCBMultSortedSet) (void *, int, bool);</code></td>
</tr>
<tr>
<td>C++</td>
<td><code>void RPCBMultSortedSet (int i, bool v);</code></td>
</tr>
<tr>
<td>VB</td>
<td><code>Sub RPCBMultSortedSet (ByVal intRPCBHandle As Long, ByVal intParIdx As Integer, ByVal intValue As Integer)</code></td>
</tr>
</tbody>
</table>
8.15.2 Parameter Description

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>Handle of the TRPCBroker Component.</td>
</tr>
<tr>
<td>ParamIndex</td>
<td>Integer index of the parameter that contains the Mult Property.</td>
</tr>
</tbody>
</table>
| Value           | Can be either a Boolean or, if the calling application language does not support Boolean type, can be an integer:  
|                 | • True or 1—Sorts the Mult and keeps it sorted thereafter when other elements are added.  
|                 | • False or 0—Does not sort the Mult and the elements are stored in the order they are added. |

8.15.3 Examples

8.15.3.1 C

```c
RPCBMultSortedSet(RPCBroker, 0, 1);
```

8.15.3.2 C++

```cpp
MyInstance.RPCBMultSortedSet(0, 1);
```

8.15.3.3 Visual Basic

```vbs
Call RPCBMultPropGet(intRPCBHandle, 0, 1)
```

8.16 RPCBParamGet Function

The RPCBParamGet function returns two values in two parameters: the value and the parameter type of a Param item.

You can compare the returned parameter type to the following enumerated values:

- literal
- reference
- list
8.16.1 Declarations

Table 58: RPCBParamGet Function—Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declaration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td><code>procedure RPCBParamGet(const RPCBroker: TRPCBroker; ParamIndex: integer; var ParamType: TParamType; var ParamValue: PChar);</code></td>
</tr>
<tr>
<td>C</td>
<td><code>void (__stdcall *RPCBParamGet) (void *, int, int, char *);</code></td>
</tr>
<tr>
<td>C++</td>
<td><code>void RPCBParamGet ( int i, int j, char * s);</code></td>
</tr>
<tr>
<td>VB</td>
<td><code>Sub RPCBParamGet (ByVal intRPCBHandle As Long, ByVal intParIdx As Integer, ByVal intParTyp As Integer, ByVal intParVal As String)</code></td>
</tr>
</tbody>
</table>

8.16.2 Parameter Description

Table 59: RPCBParamGet Function—Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>Handle of the <a href="#">TRPCBroker Component</a></td>
</tr>
<tr>
<td>ParamIndex</td>
<td>Integer index of the parameter to get the value.</td>
</tr>
<tr>
<td>ParamType</td>
<td>This variable, after making the RPCBParamGet call, is filled with <code>PType Property</code> of a Param[ParamIndex].</td>
</tr>
<tr>
<td>ParamValue</td>
<td>An empty buffer that you must create (allocate memory for) before making this call. This buffer, after making the RPCBParamGet call, is filled with Value of a Param[ParamIndex].</td>
</tr>
</tbody>
</table>

**REF:** For information about the size of parameters and results that can be passed to and returned from the [TRPCBroker Component](#), see the “RPC Limits” section.
8.16.3 Examples

8.16.3.1 C

// PType and Value are variables to retrieve values into.
RPCBParamGet(RPCBroker, 0, PType, Value);

8.16.3.2 C++

// PType and Value are variables to retrieve values into.
MyInstance.RPCBParamGet(0, PType, Value);

8.16.3.3 Visual Basic

Call RPCBParamGet(intRPCBHandle, 0, PType, strResult)
' where PType and strResult are variables to retrieve values into

8.17 RPCBParamSet Function

The RPCBParamSet function sets one Param item’s Value Property and PType Property, in a single call.

8.17.1 Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declaration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td>procedure RPCBParamSet(const RPCBroker: TRPCBroker; const ParamIndex: integer; const ParamType: TParamType; const ParamValue: PChar);</td>
</tr>
<tr>
<td>C</td>
<td>void (__stdcall *RPCBParamSet) (void *, int, int, char *);</td>
</tr>
<tr>
<td>C++</td>
<td>void RPCBParamSet ( int i, int j, char * s);</td>
</tr>
<tr>
<td>VB</td>
<td>Sub RPCBParamSet (ByVal intRPCCHandle As Long, ByVal intParIdx As Integer, ByVal intParTyp As Integer, ByVal intParVal As String)</td>
</tr>
</tbody>
</table>
### 8.17.2 Parameter Description

#### Table 61: RPBParamSet Function—Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>Handle of the TRPCBroker Component.</td>
</tr>
<tr>
<td>ParamIndex</td>
<td>Integer index of the parameter.</td>
</tr>
</tbody>
</table>
| ParamType | Set to the parameter type for the parameter you are setting. The value should be one of the integer values that are valid as a PType:  
  • 0 (literal)  
  • 1 (reference)  
  • 2 (list)  
  You can use the enumerated values literal, reference and list, as declared in the C, C++, or Visual Basic header file. |
| ParamValue | Null-terminated string containing the Value to set. |

#### CAUTION: The use of a reference-type input parameter represents a significant security risk. The M entry point should include code to screen the input value for M code injection (e.g., function calls, M commands, or direct global reads).

### 8.17.3 Examples

#### 8.17.3.1 C

```
RPCBParamSet(RPCBroker, 0, reference, "DUZ");
```

#### 8.17.3.2 C++

```
MyInstance.RPCBParamSet(0, reference, "DUZ");
```

#### 8.17.3.3 Visual Basic

```
Call RPCBParamSet(intRPCBHandle, 0, literal, Text3.Text)
```
8.18 RPCBPropGet Function

The RPCBPropGet function returns a requested property of a TRPCBroker Component.

8.18.1 Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declaration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td>procedure RPCBPropGet(const RPCBroker: TRPCBroker; const Prop: PChar; {var} Value: PChar);</td>
</tr>
<tr>
<td>C</td>
<td>void (__stdcall *RPCBPropGet) (void *, char *, char *);</td>
</tr>
<tr>
<td>C++</td>
<td>void RPCBPropGet (char * s, char * t);</td>
</tr>
<tr>
<td>VB</td>
<td>Sub RPCBPropGet (ByVal intRPCBHandle As Long, ByVal strProp As String, ByVal strValue As String)</td>
</tr>
</tbody>
</table>

Table 62: RPCBPropGet Function—Declarations

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>Handle of the TRPCBroker Component.</td>
</tr>
<tr>
<td>Prop</td>
<td>Null-terminated string of the property to get. Not case-sensitive. Valid properties to get are:</td>
</tr>
<tr>
<td></td>
<td>• ClearParameters Property</td>
</tr>
<tr>
<td></td>
<td>• ClearResults Property</td>
</tr>
<tr>
<td></td>
<td>• Connected Property</td>
</tr>
<tr>
<td></td>
<td>• DebugMode Property</td>
</tr>
<tr>
<td></td>
<td>• ListenerPort Property</td>
</tr>
<tr>
<td></td>
<td>• RemoteProcedure Property</td>
</tr>
<tr>
<td></td>
<td>• RPCTimeLimit Property</td>
</tr>
<tr>
<td></td>
<td>• RPCVersion Property</td>
</tr>
<tr>
<td></td>
<td>• Server Property</td>
</tr>
<tr>
<td>Value</td>
<td>An empty buffer that you must create (allocate memory for) before making this call. After this call, the buffer is filled with value of the property that is in the Prop. This procedure takes care of all the necessary type conversions. Boolean property values are returned as either of the following:</td>
</tr>
<tr>
<td></td>
<td>• 1 (True)</td>
</tr>
<tr>
<td></td>
<td>• 0 (False)</td>
</tr>
</tbody>
</table>
8.18.2 Examples

8.18.2.1 C

```c
RPCBPropGet(RPCBroker, "Connected", Value);
```

8.18.2.2 C++

```c++
MyInstance.RPCBPropGet("Connected", Value);
```

8.18.2.3 Visual Basic

```vb
Call RPCBPropGet(intRPCBHandle, "Server", strResult)
```

8.19 RPCBPropSet Function

The RPCBPropSet function sets a TRPCBroker Component property to some value.

8.19.1 Declarations

<table>
<thead>
<tr>
<th>Software</th>
<th>Declaration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphi</td>
<td><code>procedure RPCBPropSet(const RPCBroker: TRPCBroker; Prop, Value: PChar);</code></td>
</tr>
<tr>
<td>C</td>
<td><code>void (__stdcall *RPCBPropSet) (void *, char *, char *);</code></td>
</tr>
<tr>
<td>C++</td>
<td><code>void RPCBPropSet (char * s, char * t);</code></td>
</tr>
<tr>
<td>VB</td>
<td><code>Sub RPCBPropSet (ByVal intRPCBHandle As Long, ByVal strProp As String, ByVal strValue As String)</code></td>
</tr>
</tbody>
</table>
Table 65: RPCBPropSet Function—Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPCBroker</td>
<td>Handle of the TRPCBroker Component.</td>
</tr>
<tr>
<td>Prop</td>
<td>Null-terminated string of the property to set; not case-sensitive. Valid properties to set are:</td>
</tr>
<tr>
<td></td>
<td>• ClearParameters Property</td>
</tr>
<tr>
<td></td>
<td>• ClearResults Property</td>
</tr>
<tr>
<td></td>
<td>• Connected Property</td>
</tr>
<tr>
<td></td>
<td>• DebugMode Property</td>
</tr>
<tr>
<td></td>
<td>• ListenerPort Property</td>
</tr>
<tr>
<td></td>
<td>• RemoteProcedure Property</td>
</tr>
<tr>
<td></td>
<td>• RPCTimeLimit Property</td>
</tr>
<tr>
<td></td>
<td>• RPCVersion Property</td>
</tr>
<tr>
<td></td>
<td>• Server Property</td>
</tr>
<tr>
<td>Value</td>
<td>Null-terminated string of the value to which the Prop property should be set. This procedure takes care of converting the passed in value to whatever type the property expects. For Boolean properties, pass in either of the following:</td>
</tr>
<tr>
<td></td>
<td>• 1 (True)</td>
</tr>
<tr>
<td></td>
<td>• 0 (False)</td>
</tr>
</tbody>
</table>

8.19.2 Examples

8.19.2.1 C

 RPCBPropSet(RPCBroker, "ListenerPort", "9999");

8.19.2.2 C++

MyInstance.RPCBPropSet("ListenerPort", "9999");

8.19.2.3 Visual Basic

Call RPCBPropSet(intRPCBHandle, "Server", cboServer.Text)
# Glossary

**Table 66: Glossary of Terms and Acronyms**

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td>A single term used interchangeably to refer to the user, the workstation, and the portion of the program that runs on the workstation. In an object-oriented environment, a client is a member of a group that uses the services of an unrelated group. If the client is on a local area network (LAN), it can share resources with another computer (server).</td>
</tr>
<tr>
<td>Component</td>
<td>An object-oriented term used to describe the building blocks of GUI applications. A software object that contains data and code. A component may or may not be visible. These components interact with other components on a form to create the GUI user application interface.</td>
</tr>
<tr>
<td>DHCP</td>
<td><strong>Dynamic</strong> Host Configuration <strong>Protocol.</strong></td>
</tr>
</tbody>
</table>
| DLL      | **Dynamic Link Library.** A DLL allows executable routines to be stored separately as files with a DLL extension. These routines are only loaded when a program calls for them. DLLs provide several advantages:  
  1. DLLs help save on computer memory, since memory is only consumed when a DLL is loaded. They also save disk space. With static libraries, your application absorbs all the library code into your application so the size of your application is greater. Other applications using the same library also carry this code around. With the DLL, you do not carry the code itself; you have a pointer to the common library. All applications using it then share one image.  
  2. DLLs ease maintenance tasks. Because the DLL is a separate file, any modifications made to the DLL do not affect the operation of the calling program or any other DLL.  
  3. DLLs help avoid redundant routines. They provide generic functions that can be used by a variety of programs. |
| DNS      | The Domain Name Service (DNS) is a distributed database that maps names to their Internet Protocol (IP) addresses or IP addresses to their names. A query to this database is used to resolve names and IP addresses. |
| GUI      | **Graphical User Interface.** A type of display format that enables users to choose commands, initiate programs, and other options by selecting pictorial representations (icons) via a mouse or a keyboard. |
| HANDLE   | A HANDLE is a string returned by **XWB REMOTE RPC** or **XWB DEFERRED RPC.** The application should store the HANDLE and use it to:  
  1. Check for the return of the data.  
  2. Retrieve the data.  
  3. Clear the data from the VistA M Server. |
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOSTS File</td>
<td>The HOSTS file is an ASCII text file that contains a list of the servers and their Internet Protocol (IP) addresses. It is recommended that you put in a “DHCP SERVER” entry that points to the main server you intend using with the Broker the majority of the time. In your applications, you are able to specify any server you wish; however, if the Server property = “ (i.e., null), you get an error.</td>
</tr>
<tr>
<td>Icon</td>
<td>A picture or symbol that graphically represents an object or a concept.</td>
</tr>
<tr>
<td>IP Address</td>
<td>The Internet Protocol (IP) address is the network interface address for a client workstation, server, or device.</td>
</tr>
<tr>
<td>$JOB</td>
<td>Contains your operating system job number on the VistA M Server.</td>
</tr>
<tr>
<td>$ORDER</td>
<td>M code: $ORDER(variable name{,integer code}) Returns the subscript of the previous or next sibling in collating sequence of a specified array node. To obtain the first subscript of a level, specify a null subscript in the argument.</td>
</tr>
<tr>
<td>Remote Procedure Call</td>
<td>A remote procedure call (RPC) is essentially M code that may take optional parameters to do some work and then return either a single value or an array back to the client application.</td>
</tr>
<tr>
<td>SAML</td>
<td>Security Assertion Markup Language. An XML-based industry standard for communicating identities over the Internet.</td>
</tr>
<tr>
<td>Server</td>
<td>The computer where the data and the Business Rules reside. It makes resources available to client workstations on the network. In VistA, it is an entry in the OPTION file (#19). An automated mail protocol that is activated by sending a message to a server at another location with the “S.server” syntax. A server’s activity is specified in the OPTION file (#19) and can be the running of a routine or the placement of data into a file.</td>
</tr>
<tr>
<td>User Access</td>
<td>This term is used to refer to a limited level of access to a computer system that is sufficient for using/operating software, but does not allow programming, modification to data dictionaries, or other operations that require programmer access. Any of VistA’s options can be locked with a security key (e.g., XUPROGMODE, which means that invoking that option requires programmer access). The user’s access level determines the degree of computer use and the types of computer programs available. The Systems Manager assigns the user an access level.</td>
</tr>
<tr>
<td>User Interface</td>
<td>The way the software is presented to the user, such as Graphical User Interfaces that display option prompts, help messages, and menu choices. A standard user interface can be achieved by using Embarcadero’s Delphi Graphical User Interface to display the various menu option choices, commands, etc.</td>
</tr>
<tr>
<td>Window</td>
<td>An object on the screen (dialogue) that presents information such as a document or message.</td>
</tr>
<tr>
<td>XML</td>
<td>eXtensible Markup Language.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>XULONGMODE</td>
<td>A security key distributed by Kernel as part of its Menu Manager (MenuMan). This security key enables access to a number of developer-oriented options in Kernel.</td>
</tr>
</tbody>
</table>

**REF:** For a list of commonly used terms and definitions, see the OI&T Master Glossary VA Intranet Website.

For a list of commonly used acronyms, see the VA Acronym Lookup Intranet Website.