COMPAQ

Software Product Description

PRODUCT: TeMIP Expert System Access V4.0 for Compaq Tru64 UNIX SPD 70.40.02

DESCRIPTION

TeMIP for Compaq Tru64 UNIX® is a family of software products for the management of telecommunications and corporate networks, including fixed wire and mobile/cellular voice and data, multivendor, multi-technology networks. TeMIP V4.0 provides comprehensive off-the-shelf fault and trouble management functions such as Alarm Handling and Event Logging for telecommunications network management.

TeMIP supports the International Standards Organization (ISO) management standards ISO 10164-x and 10165-x, and the NMF ensembles. TeMIP and its features are applicable in the context of the International Telephone Union-Telecommunication Standards (ITU-T) X.73x and Telecommunication Management Network (TMN) M.3010, M3100 Recommendations. It gives network operators a global view of their networks, and enables them to activate management functions and operations from single or multiple workstations.

TeMIP is built on top of the TeMIP Framework, and fully benefits from the object oriented and truly distributed software architecture.

ESA FEATURES

The Expert System Access V4.0 (ESA) is part of the TeMIP program and is aimed to allow plug-in Expert System solutions, to handle the ever increasing number of alarms generated by networks.

As network topology grows, there is an exponential increase in the number of alarms from TeMIP. Operators are confronted with a deluge of alarms that must be correlated by an expert system in order to identify the underlying problems affecting network equipment. Furthermore, expert systems are also used to automate network management tasks thus improving the quality of service and decreasing operational costs. The nature of ESA means that once access has been developed, it follows the evolution of TeMIP and thus the expert system will remain upwardly compatible with it.

The ESA is used to develop a customized ESA PM that enables a specific expert system to be plugged into TeMIP. Three configurations may be envisaged:

- A single ESA PM can be used to plug several similar expert systems (same vendor system) into a TeMIP director.
- Several ESA PMs can be used to plug several different expert systems (different vendor systems) into a TeMIP management network.
- An ESA PM can be used to plug an expert system directly into a TeMIP director without using a communication layer.

TeMIP's distribution features allow the use of several ESA PMs in a distributed environment. It is also possible to have several ESA PMs on the same TeMIP director.

ESA COMPONENTS

An ESA PM consists of two main components:

- ESA Service Provider
- ESA Service Adapter

The ESA is used to customize the Service Adapter, whereas the Service Provider does not require customization.

ESA Service Provider

The Service Provider component forms a layer that makes the following high level services available to

the Expert System by means of the Service Adapter:

- Collection of TeMIP Notification Events (alarms) and Configuration Events (events).
- Monitoring of TeMIP Operation Contexts (OCs) to retrieve Alarm Objects. This is similar to the OC Monitoring that is implemented in TeMIP Alarm Handling.
- Performing TeMIP Call Requests and receiving the corresponding Responses (synchronously or asynchronously).
- Performing Population Requests to populate an expert system Knowledge Base with the attributes of entities in a specific domain.

The Service Provider supplies services to the Service Adapter using a C++ API. The services fall into the following categories:

- Request Services
- Clutch Services
- ESA User Object Services

The arguments for Request Services requests are formatted the same as TeMIP FCL PM commands. They comprise a library of C++ methods for posting requests corresponding to:

- Alarm or Event Collection
- OC Monitoring
- Call Request
- Population Request
- Expert System Failure Detection
- Spawn Request

Clutch Services comprise a C++ thread, which acts as a clutch between the information read from a communication layer (if available) and the Request Services.

ESA User Object Services create temporary objects for use in requests to TeMIP. A successful request results in the creation of one of the following objects in TeMIP:

- An alarm
- An Alarm Object (child of Operation Context)
- A Similar Alarm (child of Alarm Object)

Further results depend on the requests made to TeMIP.

ESA Service Adapter

The Service Adapter is the customizable component of the ESA PM. It is the link between the Expert System and the services provided by the Service Provider.

To customize the Service Adapter, some of the supplied C++ methods are overridden (modified) to adapt the Service Provider services for the communication layer associated with the Expert System.

There are several families of overridable methods that can be modified to develop an ESA PM.

ESA Result Object Service Overridables

The Result Object Service Overridables are a library of C++ classes, which include:

- Alarm (OSI Alarm Report and OSI Security Alarm Report) used for alarm collection.
- Event (OSI Event Report) used for event collection.
- Non OSI Event, used for non-OSI event collection.
- Alarm Object, used for Alarm Object Creation during OC Monitoring.
- Alarm Object Change, used for State Change, Attribute Value Change or AO Clearance, or indicates that a given Alarm Object collected by an OC has gone out of the specified scope of interest.
- End Of Population, indicates that a population request has terminated.
- Reply, used for call or knowledge base population requests.
- Cold Restart, indicates that the ESA PM is restarting.
- Watchdog, supports expert systems that need to be polled for temporal reasoning.

The C++ classes are automatically instantiated by the ESA Service Provider in cases of successful collection, monitoring, call request or population. To forward the information present in the objects to the communication layer and hence to the expert system, the *OnTranslate* and *OnTransmi*t methods of the relevant classes must be overridden:

- *OnTranslate* is overridden to determine how the information present in the ESA object is to be translated into the appropriate communication layer data structures.
- *OnTransmit* is overridden to determine how to send the translated information through the communication layer. This overridable also allows intelligent filtering and forwarding functions to be added to the ESA PM. This overridable is only activated for asynchronous requests.

Clutch Service Overridables

If the communication layer does not provide a callback mechanism, it may be necessary to override the *OnListenToCommunications* method of the 'clutch' thread to implement the core processing of the 'clutch' services, which repeatedly executes the following steps:

1. Read information synchronously from the communication layer (or the expert system).
2. Subsequently activate the corresponding ESA Request Services.

The clutch approach is very flexible. Should the information received from the communication layer correspond to a service which is not supported by the ESA Request Services, the TAL, Visual TeMIP or any other API can be used to implement the necessary processing.

Communication Service Overridables

Two methods can be overridden to establish or release a connection with the communication layer:

- OnConnect, activated by the ESA Service Provider when starting the ESA PM. This method is overridden to establish the connection with the communication layer and can also be used to start the Clutch thread.
- OnDisconnect, activated by the ESA Service Provider when stopping the ESA PM. This method is overridden to release the connection with the communication layer.

Builder Service Overridables

Builder methods are used to create instances of the objects handled by the ESA. These include single-instance objects (Clutch, Communication), and multi-instance objects (Alarm Object, Reply, …). The Builder services centralize and homogenize object creation. In general, Builder methods only need to be overridden if class names are changed.

COMMUNICATION LAYER

If a communication layer is present, the plug-in with ESA involves two threads:

- Request Services are posted in the clutch thread
- Replies to these services are posted in another thread.

This implies that the communication layer must be thread safe or must be made thread safe using a mutex mechanism.

DEVELOPING AN ESA PM

The ESA consists of three subsets:

- ESA Runtime System subset, a shared library (.so file) that forms the ESA Service Provider.
- ESA Developer's toolkit subset with its associated include files (.hxx), which comprises two components:
  1. A set of stubs (.hxx/.cxx files), which contain the default overridable methods that will become the ESA Service Adapter.
  2. A Makefile to construct the customized ESA PM from the above files.
- ESA HTML Documentation subset.

FAILURE MANAGEMENT MECHANISM

Communication Failure

Some Communication Layers provide communication failure detection mechanisms. In such cases, it is possible to inform the ESA PM of a failure and send information to the expert system by activating the *TransmissionFailureDetected* Request Service.

A self-management counter attribute in the ESA PM (Failure Count) is incremented every time data cannot be delivered to an expert system.

Expert System Failure

If the communication layer is able to detect a failure of the expert system, the ESA PM can be customized to reflect this. This is achieved by calling the *IEFailureDetected* request service in the Clutch thread.

There are two possible cases of expert system failure:

- Non Hot Stand-by Failure, there is no Backup Expert System to replace the failed Primary Expert System.
- Hot Stand-by Failure, there is a Backup Expert System to replace the failed Primary Expert System.

Note that it is the developer's responsibility to detect if there is a backup system for the expert system when informing the ESA Service Provider of an expert system failure.

A Non Hot Stand-by Failure results in the following:

- The Operational State and Availability Status of the corresponding INFERENCE_ENGINE Self-Management entity are updated.
- A Quality Of Service Alarm is sent with:
  - Managed Object: MCC 0 IEG_GATEWAY_PM INFERENCE_ENGINE object
  - Severity: Major
  - Probable Cause: ApplicationSubsystemFailure
- All the pending collections, OC monitoring and call requests initiated by the failed expert system are stopped.

A Hot Stand-by Failure results in the following:

- The Operational State and Availability Status of the corresponding INFERENCE_ENGINE Self-Management entity are updated.
- A Quality Of Service Alarm is sent with:
  - Managed Object: MCC 0 IEG_GATEWAY_PM INFERENCE_ENGINE object
  - Severity: Minor

  - Probable Cause: ApplicationSubsystemFailure
- All the call requests initiated by the failed expert system are stopped. The collection requests and the OC monitoring requests are not stopped, so that the collected alarms and events can be received by the remaining back-up system.

In both cases, when the expert system restarts, its initialization (Collections and Knowledge Base population) may have to be repeated.

The consistency between TeMIP and expert system information is maintained due to:

- The Population Request that retrieves the current attribute values of the TeMIP entities.
- The OC Monitoring Request performs according to the specified scope of interest, which allows access to alarms retrospectively (Collection Request does not offer this feature).

It is the developer's responsibility:

- To specify in the expert system Failure Detection Request, whether the detected failure is Hot Stand-By or not.
- Not to repeat the Knowledge Base population, OC Monitoring and Collections in the case of a Hot Stand-By Failure.

ESA PM Failure

When an ESA PM restarts after a failure, it is important that the attached expert systems recognize that there was a failure, so that they are able to maintain the consistency of their Knowledge Bases.

For this reason, when an ESA PM starts-up, it creates a Cold Restart ESA object. It is the responsibility of every ESA PM to override the OnTranslate and OnTransmit methods of the Cold Restart class to inform the previously connected Expert Systems of the re-start. The Cold Restart object contains a list of the expert systems that the ESA PM was connected to before failure.

DOCUMENTATION

The ESA documentation suite provides information to install and assist in the development or customization of ESA Presentation Modules. It includes the following documents:

- Compaq TeMIP ESA Installation Guide, AA-RDM1B-TE
- Compaq TeMIP ESA Reference Guide, AA-RDM2B-TE
- Compaq TeMIP ESA Development Guide, AA-RDM3B-TE

HARDWARE REQUIREMENTS

DIGITAL Personal Workstation au series
DIGITAL Ultimate Workstation
AlphaStation 600
AlphaServer 800, 1000A, 1200
Compaq AlphaServer DS10, DS20
Compaq Professional Workstation XP1000

AlphaServer 2000, 2100, 4000, 4100
Compaq AlphaServer ES40

AlphaServer 8200, 8400
Compaq AlphaServer GS60, GS140

Disk Space Requirements

Disk space required for installation:
5 MB

Disk space required for use (permanent):
5 MB

These counts refer to the disk space required on the system disk. The sizes are approximate; actual sizes may vary depending on the user's system environment, configuration, and software options.

Memory Requirements

For runtime systems the minimum memory supported is 128 Mbytes, this also takes into consideration the memory requirements of the TeMIP Framework.

For development systems the minimum memory supported is 256 Mbytes, this also takes into consideration the memory requirements of the TeMIP Framework.

Note that if more memory is made available for use with ESA software, performance will be improved.

SOFTWARE REQUIREMENTS

For run-time systems:

- Compaq Tru64 UNIX Operating System V4.0F
- TeMIP Framework V4.0

For ESA PM development systems the following software must be installed in addition to the above:

- DEC C++ Class Shared Libraries (subset CXLSHRDA440)

GROWTH CONSIDERATIONS

The minimum hardware/software requirements for any future version of this product may be different from the current version requirements.

YEAR 2000 READY

This product is Year 2000 Ready.

"Year 2000 Ready" products are defined by Compaq as products capable of accurately processing, providing, and/or receiving date data from, into and between the twentieth and the twenty-first centuries, and the years 1999 and 2000, including leap year calculations, when used in accordance with the associated Compaq product documentation and provided that all hardware, firmware and software used in combination with such Compaq products properly exchange accurate date data with the Compaq products.

For additional information visit Compaq's Year 2000 Product Readiness web site located at http://www.compaq.com/year2000

To ensure that this product is Year 2000 Ready, code assessment and system tests to verify the transition between December 31st 1999 and January 1st 2000 were utilized.

To ensure that this product interoperates properly with other hardware and software, the system tests involving Compaq's TeMIP V4.0 are applicable, as this product was verified as being Year 2000 Ready.

DISTRIBUTION MEDIA

This product is distributed with the following media:

Software Media: QA-6HPAA-H8

Software Documentation: QA-6HWAA-GZ

ORDERING INFORMATION

TeMIP Expert System Access licenses:

Software License: QM-6HWAA-AA
This replaces the license QL-64SA*-AA or QM-64SAA-A*

Software Product Services: QT-6HW**-**

Note: * denotes variant fields. For additional information on available services, or hardware platform tiers, refer to the appropriate price book.

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