

# Delivering TMN to Embedded Environments

## Overview

Vertel's M\*Ware Embedded Telecommunication Solutions (ETS) products provide TMN communication services and management between operation support systems (OSSs), network elements (NEs) and gateway network elements (GNEs).

Vertel ETS products run on VxWorks and VRTX, and can easily be ported to any embedded system running a real-time operating system (RTOS).

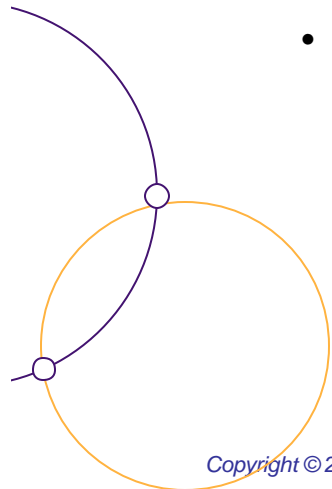
ETS products were designed primarily for NE hardware and software vendors. They are widely deployed; standards based, and work with a variety of integrated, modular products and components. They contain a fully GR-253 conformant OSI protocol stack as well as a CMIP agent designed specifically for RTOS environments.

The ETS product line is designed for both TL1 and CMIP network management application environments.

ETS can be expanded to support the new G.7712 standard that allows mutual tunneling for OSI and IP management. Read our detailed G.7712 white paper to understand its power.

## Highlights

- Deployed in many SONET/SDH networks worldwide
- Intelligent use of precious resources on the NE
- Well-defined "message-passing" APIs
- Complete vertical solutions — CMIP, FTAM, TL1 applications
- Multi-processor support available for several levels
- Simple porting and integration — standard encapsulation for popular RTOSs and hardware
- Maximum reusability of existing code
- ETS CMIP stack supporting GNE-to-NE and NE-to-NE communications
- Routing support configurable for an end-system or intermediate system
- Efficient tasking model
- Support for all RTOS development tools including
  - VxWorks for the PPC and 68K platform
  - VRTXsa for the PPC and 68K platform
  - Other platforms can be made available upon request
- ETS conforms to the Bellcore GR-253-CORE Operations Communications Architecture.



## Architecture

Vertel provides a variety of components which are combined to make complete solutions. Solutions include fully implemented MIBs for specific technologies and network configurations, encapsulated portation functions, stack configurations, and transport interfaces.

The following figure shows the components that make up the ETS product line.

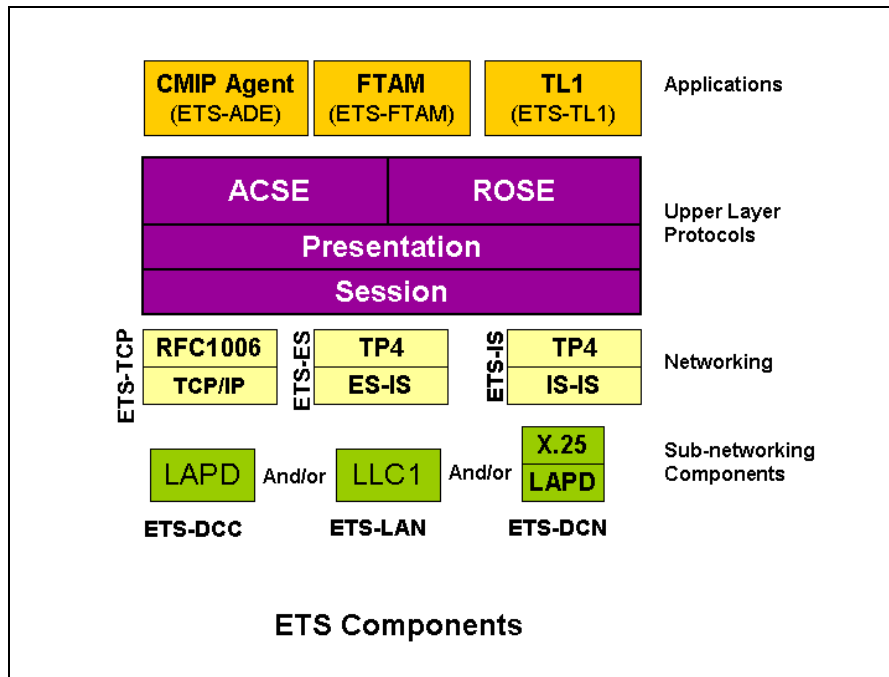
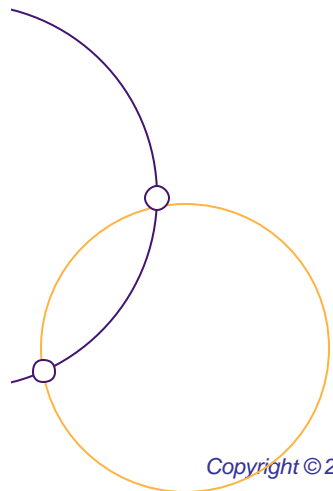


Figure 1: the ETS components.

## ETS Applications Modules

The ETS application modules make use of the networking services-provided OSI networking layer. They run as separate tasks and can be run on different processors.



## *ETS Agent Development Environments*

Specifically designed for use in embedded software, the ETS-ADEs enable developers to easily build fully functional TMN-conformant agents. The ETS-ADE leads the project team through each stage of agent application development—design, prototyping, development, testing, and deployment. The ETS-ADE has either a C interface or a C++ interface.

### *ETS-ADE/C Agent*

The Agent Toolkit provides well-defined interfaces to all the functionality of CMISE and ACSE. You can implement all or part of the capabilities and functions, or you can customize the agent's capabilities so that it works with particular platforms or constraints.

### *ETS-ADE/C++ Agent*

The ETS-ADE++ upper interface is the NMF TMN/C++ high-level API, referred to as the NMF API, which provides consistent interfaces for CMIS, GDMO, and ASN.1. Because the NMF API hides the implementation details, developers can focus on applications. The NMF API's reusable C++ objects allow iterative testing of independent objects and allow objects to be reused across agent implementations. The ETS-ADE++ is an embedded implementation of the Vertel ADE toolkit.

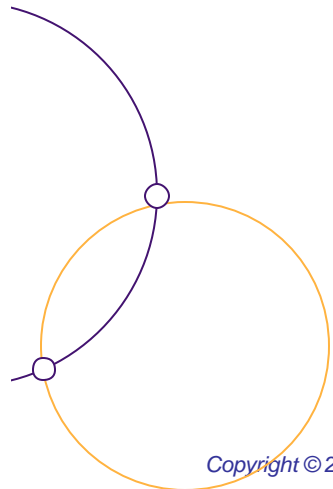
**Both Agent Toolkits (C and C++) include the following components:**

### *Systems Management Function (SMF)*

SMF functionality is provided as a set of libraries and modules that transparently enable Systems Management Functions (SMFs). The SMF libraries are provided as well-defined C functional interfaces (for the ETS-ADE) or as NMF API-conformant C++ object interface (for the ETS-ADE++). SMFs support event and log forwarding, filtering, and storage, as well as association handling.

### *Object Compiler*

The Object Compiler generates the developer interface based on your GDMO and ASN.1 MIB specifications. The Object Compiler compiles GDMO and ASN.1 notation from one or more input files.



## ***ETS-FTAM***

ETS-FTAM provides the initiator role for file transfer access management (FTAM). With ETS-FTAM,

NEs can initiate transfers from an OSS, a GNE, or a subnetwork operations controller (SOC), to any system running an FTAM-compliant responder. ETS-FTAM supports uploading and downloading of system images, configurations, backups, and logs to and from NEs in the RTOS.

ETS-FTAM allows for multiple clients to register and use FTAM services. It complies with ISO ISP 10607-3 to support simple, unstructured file transfer services. For more information on the Vertel FTAM product, please refer to the FTAM Datasheet.

## ***ETS-TL1 API***

The ETS-TL1API module is an implementation of NSIF-030-1999, the low level TL1 API. This API allows for sending and receiving TL1 Management data via a full seven layer OSI protocol stack as specified in GR-253.

## ***ETS Upper Layer Protocols***

The Upper Layer component provides full common management information services, as well as application layer services and OSI upper layers. It is a full implementation of the SESSION, PRESENTATION, ACSE and ROSE OSI protocol standards. The Upper Layer protocols are used by the ETS-ADE, the ETS-FTAM and the ETS-TL1 API application modules.

## ***ETS Networking***

The ETS Lower Layer Stack provides components that enable end-system routing, intermediate-system routing, or both, as well as TMN over TCP/IP.

## ***ETS-TCP (RFC1006)***

The ETS-TCP (RFC1006) component provides an embedded telecommunications solution that incorporates the RFC1006-compliant stack. It offers RTOS support for OSI services over TCP/IP.

## ***ETS-ES***

For end system routing, ETS-ES includes the lower layers (network, transport, and data link) for an end system. The lower layers support transport protocol class 4 (TP4), connectionless network protocol (CLNP), and ES-IS protocol (end system role). The lower layers support the 802.3 and HDLC physical interfaces. No ETS source code modifications are needed for driver integration. The ETS-ES includes ETS-LAN subnetwork support.



## **ETS-IS**

For intermediate system routing, ETS-IS includes the lower layers (network, transport, and data link) for an intermediate system. The lower layers support transport protocol class 4 (TP4), connectionless network protocol (CLNP), ES-IS protocol (intermediate system role), and IS-IS protocol.

The lower layers support the 802.3 and HDLC physical interfaces. No source code modifications are needed for use with drivers. The ETS-IS includes ETS-LAN subnetwork support.

## **ETS-TARP**

TL1 applications, built on the ETS Upper or Networking Interface components, use the TID-NSAP Address Resolution Protocol (TARP) to resolve TIDs into NSAPs and vice versa. This protocol resides on top of the network layer and uses a selective PDU propagation mechanism for name resolution.

ETS-TARP provides TARP Level 1 and Level 2 support and supports all TARP PDUs (corresponding with layers 1 through 5 of the OSI reference model).

## **ETS Sub-networking**

ETS-IS and ETS-ES support LAPD, X.25, and LLC1 subnetworks.

### **ETS-DCC**

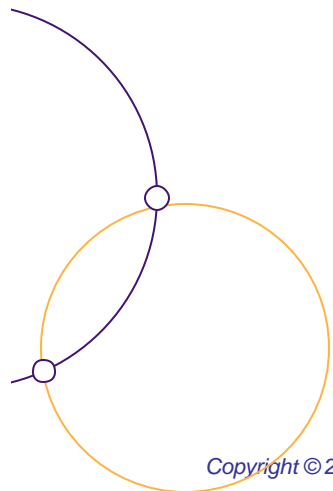
LAPD subnetwork support. Provides an interface from LAPD to a DCC Media Access Control (MAC) driver. Can be separated on a different processor or card.

### **ETS-X.25/DCN**

X.25 subnetwork support. Provides an interface to X.25 and an interface from LAPB to a LAPB Media Access Control (MAC) driver.

### **ETS-LAN**

LAN subnetwork support. Provides an interface from LLC1 to an 802.3 Media Access Control (MAC) driver.



## *About Vertel*

Vertel is a leading provider of convergent service management mediation solutions.

Since 1995, Vertel has provided network management, mediation and integration solutions to both telecom infrastructure vendors and service providers such as Alcatel, Nokia, Motorola, Lucent, Nortel, NTT, Samsung, AT&T, BT, Deutsche Telekom, Cingular and Williams Communications.

Vertel's in-depth knowledge and commitment to industry standards, combined with experience of working with many different equipment types, creates high performance solutions that enable customers to quickly cross technological barriers. Vertel's mission is to make its customers successful by enabling them to reduce operational costs and introduce new services, networks and OSSs while leveraging existing investments.

Vertel's core product offering, M\*Ware, allows seamless management in multi-technology and multi-vendor environments. M\*Ware offers a full suite of mediation based applications that can address protocol translation, data transformation, element and network management, OSS application integration, and OSS exchange services. M\*Ware components are highly scalable and are very suited for mission critical operational environments. Vertel's Professional Services organization develops customized communications software solutions tailored to individual customer requirements, and also offers project management, systems analysis and other technical services.

Vertel is based in Woodland Hills, California and has sales offices throughout the world.

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