

Open Transport Network (OTN)

OTN MANAGEMENT SYSTEM (OMS)

Introduction

The OMS allows users to manage a single OTN ring, or a network consisting of several OTN rings. Up to 500 system cards can be managed with a single OMS.

Operation

Hardware and Software

The OMS runs on "low cost" hardware, i.e. a standard PC, and operates under Microsoft® Windows® operating systems (both 32- and 64-bit systems are supported).

The OMS consists of a server software module and one or more client software modules. Both software modules (server and client) can run on the same OMS PC, or they can be distributed over multiple PCs (e.g. 1 server and 2 clients).

OMS Server

The OMS server module is connected to the OTN hardware and ensures all communication with the hardware. It contains a database with the hardware and services present in the network. It is also responsible for network alarm and event monitoring. The OMS server makes all this information available to the OMS client(s).

In-band Management Channel

The OMS Server has access to any of the nodes via an in-band management channel, which is established using fixed reserved systems bits in the OTN frame. The in-band management channel guarantees that the OMS can reach any of the nodes as soon as the network is synchronized. It also allows to automatically detect new nodes in the network or topology changes.

Additionally, the dedicated bandwidth for the in-band management channel guarantees constant monitoring/configuration performance independent of the load of user traffic in the network.

Features

Centralized or distributed network management

- Hardware management
- Connection management
- Alarm monitoring
- Event logging

User-friendly graphical user interface

Multiple OTN-150/600/X3M rings can be managed simultaneously

Up to 500 system cards in the total network

Runs on a standard PC

Client-server architecture

Simple, wizard-driven configuration of Ethernet L2 and L3 features via OMS Front End Manager (OMS-FEM)

Redundant Network Management

User Management

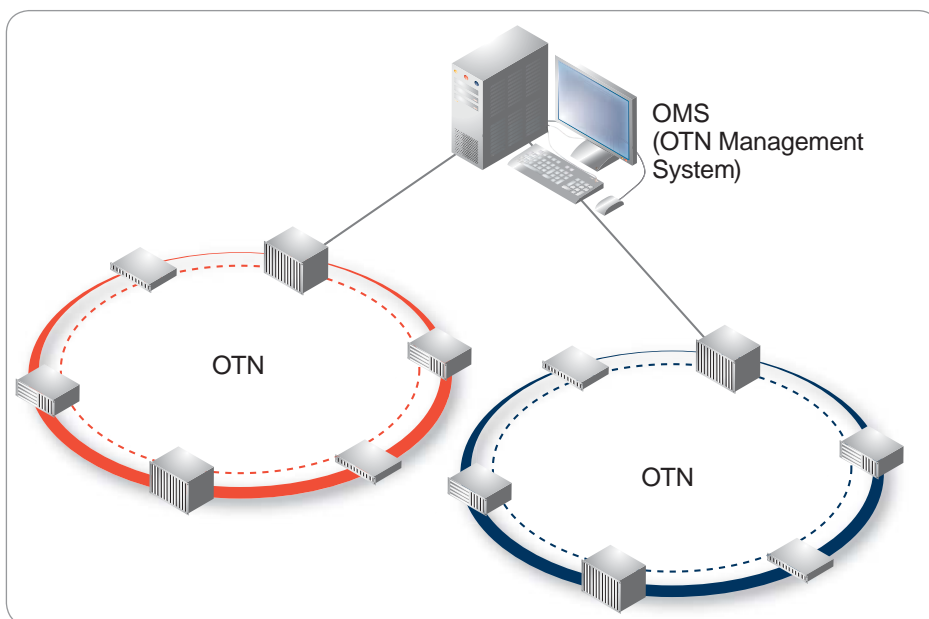


Figure 1: The OTN Management System (OMS)



OMS Client

The OMS client module is the system's user interface (OMS GUI). It interacts with the OMS server and presents the network information to the network operator in a user-friendly way. It also allows the network operator to configure the hardware and the services present in the network. Multiple OMS clients can be active simultaneously. The OMS GUI is password protected.

Single Client OMS Configuration

Figure 2 shows a client connected to an OMS server. Both software modules run on the same PC.

Multiple Client OMS Configuration

Multiple OMS clients can be connected to an OMS server (see Figure 3) allowing network management from multiple locations or by multiple users.

Remote Client OMS Configuration

A remote OMS client can be connected to the OMS Server via a TCP/IP connection over a modem link. In this way the remote OMS client can manage the OTN network from a remote location (see Figure 4).

Features

The OTN management software is designed to provide a user-friendly way of managing complete OTN networks (see Figure 5). Network management includes the configuration of hardware modules (hardware management), the creation of various services over the network (connection management), the configuration of Layer 2/Layer 3 Ethernet features via the OMS Front

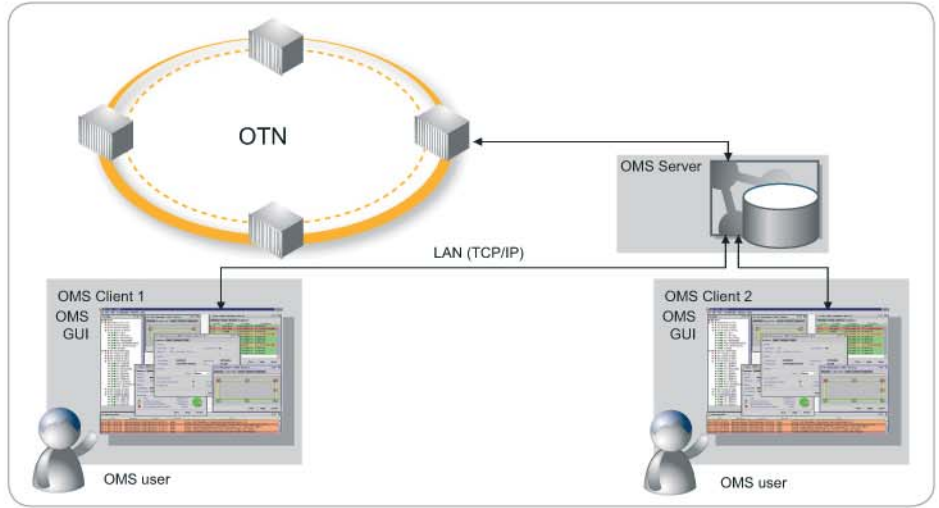


Figure 3: Multiple Client OMS configuration

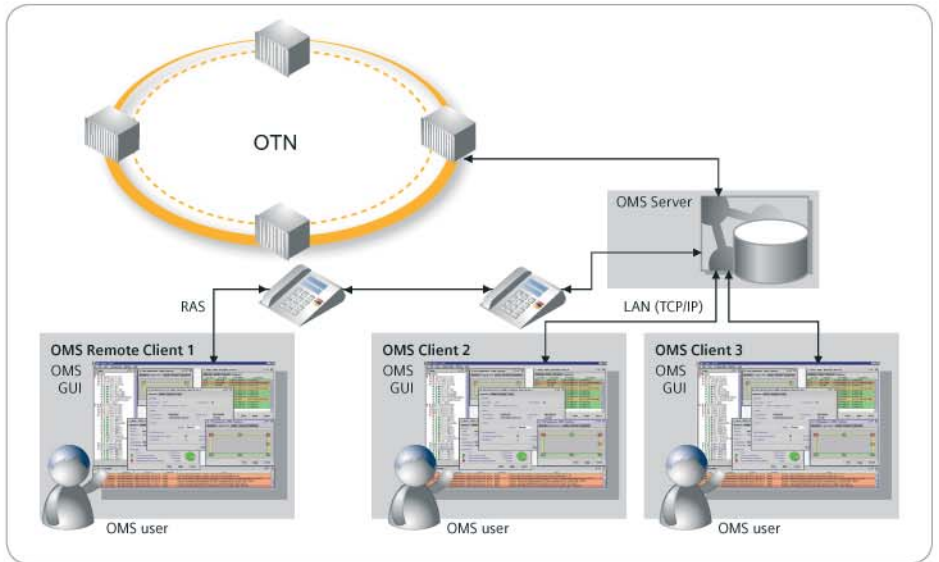


Figure 4: Remote Client OMS configuration

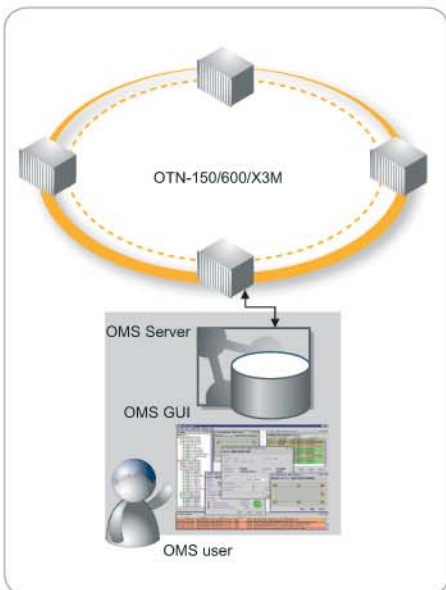


Figure 2: Single Client OMS configuration

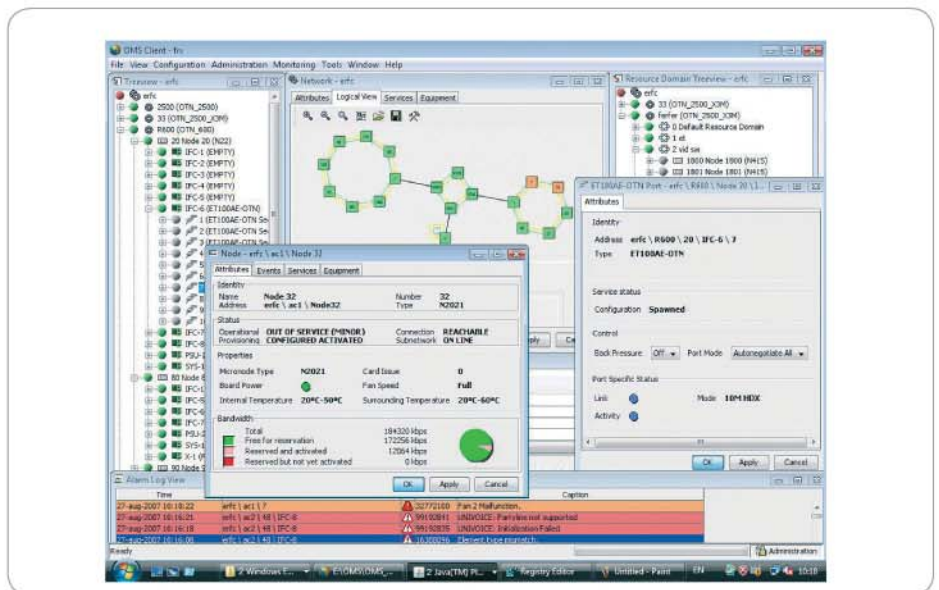


Figure 5: OMS GUI

End Manager (OMS-FEM), and the monitoring and logging of any defects that might occur in the network.

Hardware Management

The OMS can be used to configure the hardware modules that make up the network. Nodes, common logic cards, optical transceivers, interface cards and their submodules can be created and configured easily. Once the network is operational, the OMS is used to monitor the correct operation of the hardware modules.

Connection Management

Via the OMS, the user can create services on the network or remove them from the network. Connections are made by defining the ports to be interconnected.

The OMS itself allocates the transmission channels to point-to-point or multi point services in order to achieve an optimal bandwidth allocation.

Graphical User Interface (GUI)

The network configuration is presented to the operator via a graphical user interface (GUI). The use of different colors makes it easy to locate faults in the network. By means of multiple views, different parts of the network can be monitored on the OMS screen simultaneously.

The OMS command structure is based on the use of menus, objects and the PC mouse. All commands can be activated by clicking with the PC mouse on the relevant field and entering the additional information via the keyboard.

OMS-FEM (Front End Management)

For the management of Layer 2

and Layer 3 Ethernet features and protocols of the advanced Ethernet/IP products such as the N50 and N70 nodes, OMS provides the FEM as a dedicated management module. The graphical user interface allows easy configuration and offers a global view of complex features such as VLAN, MSTP, OSPF and VRRP. The wizards available in the FEM allow a network-wide consistent configuration of the required Ethernet L2&L3 features, without the need to configure each Ethernet switch separately, therefore guaranteeing a reliable network set-up (See Figure 6). Depending on the application requirements, separate Ethernet segments (SLANs) can be configured by the OMS-FEM to operate at Layer 2 or Layer 3.

Database Management

The OMS includes a network database with all kinds of user information, such as subnetwork name, node names, node configurations (with the installed common logic cards and interface cards), services, Ethernet Layer 2 and Layer 3 configuration parameters, alarms and fault indications.

This database can be used to restore the network configuration in case the settings in one or more nodes are lost due to a hardware defect.

Monitoring and Error Reporting

During normal operation, the OMS continuously polls all the OTN nodes in the network for status changes and compares the results with the actual information resident in its network database. If a fault or change occurs, the OMS will display an alarm message. The messages on the OMS screen indicate the nature

and the location of possible errors, allowing rapid fault clearance.

Logging Network Events

The OMS registers a number of events, e.g. synchronization losses, network reconfiguration, node failure and interface card errors. It also provides extended reporting features. The events can be displayed on the OMS GUI and are stored in the OMS database.

Off-line Operation

The OMS allows the user to configure the network and the services without being connected to the network, either via the GUI or via scripting.

Once installed, the network can be activated by downloading the prepared network database to the OTN nodes.

When existing services are being replaced with new ones, the new services can first be configured off-line via the OMS, and then be established physically according to the updated data. In this way, the unavailability of a service is restricted to a minimum.

OMS Redundancy

The OMS server can be made redundant using a master and slave OMS server PC (See Figure 7). The redundant OMS server is in warm standby: the database of the slave OMS server is automatically synchronized with the master OMS as long as both OMS server PCs remain in touch with each other. This synchronization can occur via an external LAN connection between both PCs or via an Ethernet service over OTN. In case the active OMS server fails or can no longer be detected by the backup OMS (i.e. due to a network

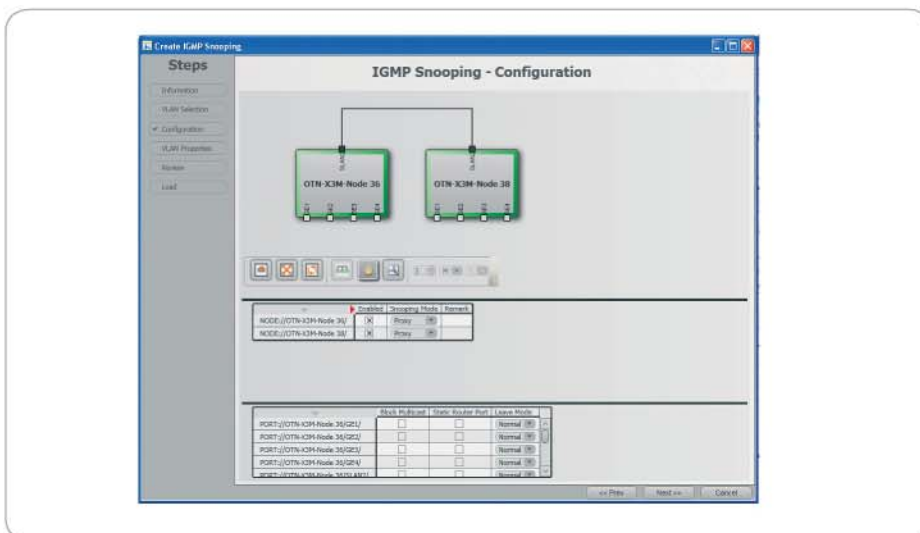


Figure 6: A typical OMS-FEM configuration wizard window

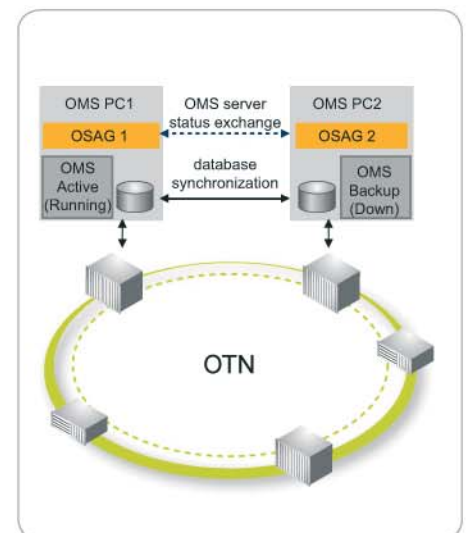


Figure 7: OMS Redundancy principle

split-up) the backup OMS will start up and will start monitoring the network. The control and status monitoring of the OMS servers occurs via a dedicated application called OSAG, which is installed on both OMS servers. The OSAG monitors the local OMS kernel, and checks the reachability of the other OMS server PC via an IP connection (either the in-band communication channel for OTN-X3M or a separate Ethernet service for OTN Classic).

User Management

The User Management functionality allows the administrator(s) to define different operator groups and operators with different rights to manage the network. Three different levels of operators can be distinguished. An administrator can manage the network without limitations and has the ability to define configuration and monitoring rights for non-administrator operators. A regular operator has the right to monitor and configure hardware and services according to his assigned rights. A monitoring operator is only entitled to monitor (part of) the network.

Extra features provided by OMS add-ons

Additional (non-standard) functionality can be provided by means of OMS add-ons.

Internal & External Events (IEE)

This add-on allows to notify an operator about specific events and/or alarms in the OTN network.

Using the digital output relays of a PLC connected to the IEE add-on PC, the status of internal OTN

network alarms can be sent to alarm devices such as acoustic or visual signals (e.g. bells, beepers or lamps). These digital output relays can also be used to convey network alarms to a third-party higher-level alarm management system. Every internal alarm severity level (warning-minor-major-critical) corresponds with a relay contact on the PLC that will be closed if an alarm with the corresponding severity occurs in the network.

External events can be monitored using an external contact connected to an RS port (a port of the RSXMM interface card or the RSX port of the N2021 node) or the input contact of an OTN node. The status of such alarm contacts external to the OTN network can be displayed in the OMS GUI. At any contact input, the OMS user can define messages for both states of the external make-and-break contact. This message is displayed according to the contact status. Similarly to the internal OTN network alarms, the status of the external contacts can also be sent to contacts on a digital output relay of a PLC in order to activate e.g. an acoustic or visual signal.

Alarms can be deactivated by acknowledgement in the OMS GUI or via the PLC.

SNMP Interface

Another way to forward OTN network alarms from the OMS to another alarm management platform is to use SNMP (Simple Network Management Protocol). The OMS SNMP Agent Add-on provides configuration and alarm information through an SNMP interface to an upper level management system and behaves like

a client in respect of the OMS server. The application acts as an SNMP proxy agent for the complete OTN system. The add-on uses OTN network information provided by the OMS Server.

The agent supports SNMP V1 and SNMP V2C. The add-on supports the MIBII architecture.

SMS and E-mail Messaging

The OTN Messenger add-on is a client module for the OMS and OVS Server Platform that facilitates SMS and e-mail messaging from the OTN Management Platform. The add-on allows to forward alarms -occurring in the managed network- to subscribed cellular phones using SMS (in combination with an SMS Terminal), or to mailboxes using the SMTP protocol through the available corporate IT infrastructure. The OTN administrator is able to define the set of rules that will be applied during alarm forwarding, using logical expressions on the different alarm attributes (e.g. id, severity and source url).

The administrator basically defines, which alarms are sent to which type of subscribers. With this alarm filtering feature the alarm message flow can be customized to the project requirements and the number of messages sent by the system can be significantly reduced, thus preventing subscribers being overloaded with irrelevant information.

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