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## OMS 3255

## Product Description



# OMS3255 SDH/ODU 640GB/S COMPACT MULTIPLEXER

Product Description

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## Table of Context

1	Introduction .....	7
1.1	Overview .....	7
1.2	Main Features of OMS3255 .....	8
1.3	Traffic Types.....	9
2	Network Applications .....	10
2.1	General network level.....	10
2.2	Replacing Stacked Networks .....	12
2.3	LO-VC Integration .....	14
2.4	ODU Switching .....	15
2.5	Photonic Interworking.....	16
2.6	Data applications.....	16
2.6.1	Ethernet Private Line.....	16
2.6.2	Ethernet Virtual Private Line.....	18
2.6.3	Ethernet Private LAN.....	18
3	Product Overview.....	20
3.1	Mechanical overview .....	20
3.2	OMS3255 Core Shelf .....	22
	Architecture Overview .....	24
3.2.1	Line Terminating Units (LTUs) .....	26

4	Interfaces .....	27
4.1	SDH Traffic Units.....	27
4.2	OTN Traffic Units.....	28
4.3	Data Cards .....	32
4.3.1	Multi-protocol Data card .....	32
4.3.2	Ethernet Layer 2 Aggregation card .....	32
4.3.2.1	L2 transport .....	33
4.3.2.2	L2 switching.....	33
4.3.2.3	Enhanced Packed Switching capability .....	34
4.4	LO-VC Switching Matrixes .....	35
4.5	System Units .....	37
4.5.1	TDM Switching Unit.....	37
4.5.2	Synchronization Interface.....	38
4.5.3	Auxiliary Unit .....	39
4.5.4	COMMS Controller Unit.....	39
4.6	External System Interfaces .....	40
4.6.1	Power Supply Interfaces .....	40
4.6.2	Control and Communication (Management) Interface.....	40
5	Protections .....	41
5.1	AUTOMATIC SWITCHING TRANSPORT NETWORK with OMS3255.....	41
6	Network Management.....	43
7	Technical Specifications .....	44
7.1	Mechanical Construction .....	44
7.2	Safety .....	44
7.3	Electrical Environment.....	44
7.4	Climatic and Mechanical Environment .....	44

**List of Abbreviations**

ADM	Add-Drop Multiplexer
ALS	Automatic Laser Shutdown
APS	Automatic Protection Switching
ASTN	Automatic Switching Transport Network
AUX	Auxiliary (Unit, Channels, Services)
BA	Booster Amplifier
CBS	Committed Burst Size
CIR	Committed Information Rate
CoS	Class of Service
CPU	Central Processing Unit
DCN	Data Communication Network
DWDM	Dense Wavelength Division Multiplexing
DXC	Digital Cross-Connect
EC	Electrical Connections
ECC	Embedded Control Channel
EIR	Excess Information Rate
EMC	ElectroMagnetic Compatibility
EMF	Equipment Management Function
EOW	Engineering Order Wire
EPL	Ethernet Private Line
EQP	Equipment Protection
ETSI	European Telecommunication Standardization Institute
FEC	Forward Error Correction
GbE	Gigabit Ethernet
GFP	Generic Framing Procedure
GigE	Gigabit Ethernet
IB FEC	In Band Forward Error Correction
IP	Internet Protocol
ISP	Internet Service Provider
ITU-T	International Telecommunication Union, Telecommunications Sector
LAN	Local Area Network
LAPS	Link Access Procedure – SDH
LCAS	Link Capacity Adjustment Scheme (for Virtual Concatenated signals)
LCT	Local Craft Terminal
LTU	Line Termination Unit
LVDS	Low Voltage Differential Signaling
MPLS	Multi Protocol Label Switching
MS	Multiplex Section
MSP	Multiplex Section Protection
MS-SPRING	Multiplex Section-Shared Protection Ring
MV36	Marconi Communications Element Level Management System
MV38	Marconi Communications Network Level Management System
NE	Network Element
NMS	Network Management System
OCh	Optical Channel
ODU	Optical Data Unit
OH	OverHead
OMS	Optical Multiplex Section
OPU	Optical Payload Unit
OSC	Optical Supervisory Channel

OSI	Open System Interconnection
OTH	Optical Transport Hierarchy
OTS	Optical Transmission Section
OTU	Optical Transport Unit
PBS	Peak Burst Size
PIR	Peak Information Rate
PSU	Power Supply Unit
QoS	Quality of Service
RMON	Remote Network Monitoring Management Information Base
SDH	Synchronous Digital Hierarchy
SEMF	Standard Equipment Management Function
SETG	Synchronous Equipment Timing Generator
SNCP	Sub-Network Connection Protection
SOH	Section OverHead
STM-N	Synchronous Transport Module - N
TCM	Tandem Connection Monitoring
TDM	Time Division Multiplex
TLS	Transparent LAN Service
TM	Terminal Multiplexer
TMN	Telecommunication Management Network
VC	Virtual Container
VLAN	Virtual Local Area Network
VLL	Virtual Leased Line
VPN	Virtual Private Network

## Foreword

The product information contained herein is independent by a product release and does not refer to a defined product release. The technical information and the estimated time scales provided in this document are offered, in good faith, as an indication of Marconi's intention to evolve its Optical Networks portfolio to meet the demands of the marketplace. Unless commercially agreed, the information contained herein should not be taken as implying any commitment or obligation on the part of Marconi.

# 1 Introduction

## 1.1 Overview

The **OMS3255** is the new compact SDH and OTH cross-connect, developed by Marconi. It is designed to provide switching capability of both wavelength services and higher order synchronous traffic simultaneously in the same network element. In addition, the integration of LO-VC switch permits the use of OMS3255 as a compact and cost-effective solution for those network nodes where, in conjunction with a wide HO-VC/ODUK switch, the capability to groom a percentage of the traffic down to VC-3/VC-2/VC-12 level is required.

Moreover, the addition of L2 switching capability in **OMS3255** permits to provide maximum integration of high capacity packet switch together with SDH/OTH traffic handling, to cope with more data-centric networks.

**OMS3255** is designed and realized in order to both accept new generation of high density traffic units (i.e. 40G bandwidth) together with the fully-proven set of units already implemented for the OMS32xx family (i.e. OMS3250, OMS3240 and OMS3260).

Thank to the above features, **OMS3255** represents an efficient and extremely flexible transport solution in networks with an increasing proportion of data traffic and will be a straightforward solution for operators in the high growth regional and national backbones.



## 1.2 Main Features of OMS3255

**OMS3255** is an SDH/OTH cross-connect that can support a number of high-speed optical and electrical interfaces and provides the following switching capacity:

- ❑ **720G configuration:** 4608x4608 STM-1 equivalents at HO-VC/ODUk (i.e. **720G** @ VC-4/4nc/ODUk);
- ❑ **640G configuration:** 4096x4096 STM-1 equivalents at HO-VC/ODUk (i.e. **640G** @ VC-4/4nc/ODUk);
- ❑ **160G configuration:** 1024x1024 STM-1 equivalents at HO-VC (i.e. **160G** @ VC-4/4nc);

Both the above configurations can be enhanced with optional LO-VC switching capability (i.e. Nx40G @ VC-3/2/12).

The **640G**-traffic capability is provided in the following way:

- **640G** directly collected by the 16 traffic slots of **OMS3255** (i.e. 40Gb/s capacity per slot).

The **720G**-traffic capability is provided in the following way:

- **640G** directly collected by the 16 traffic slots of **OMS3255** (i.e. 40Gb/s capacity per slot);
- **80G** optionally collected by a subtended **OMS3240** used as peripheral port subrack.

The **160G**-traffic capability is provided in the following way:

- **160G** directly collected by the 16 traffic slots of **OMS3255** (i.e. 10Gb/s capacity per slot).

Therefore **OMS3255** can be used in "**stand alone**" configuration to provide a 160G/640G switching capability or in "**extended**" configuration, using OMS3240 as peripheral port subrack, to reach the total 720G switching capacity.

The peripheral port shelf can be provided day one or added in a second step, via an in-service upgrade of the "stand alone configuration".

Furthermore OMS3255 can be in-service upgraded as port shelf of the multi-bay Marconi's switching platforms (e.g. **OMS3260** and **OMS3270** respectively with **960G** and **2.88Tb** switching capacity), thus providing a seamless path towards required higher traffic capacities.

In addition OMS3255 integrates **packet-switching** capability, in order to cope with the ever-growing importance of data-based traffic.

The OMS3255 shares interfaces and common units with the existing OMS32xx family, this offers operators significant benefits in providing a family of products which use the same slide-in units, thus providing reduced inventory and whole life costs.

The OMS3255 incorporates a fully distributed, network aware **control plane** to support advanced, dynamic network architectures that require fast network restoration and customer driven routing. Both SDH/OTH management and the emerging **ASTN** (i.e. Automatic Switching Transport Network) control mechanism are included.

Thank to the above features Marconi, via OMS3255, offers a genuine future-proof network architecture, which can be scaled to meet the demands of tomorrows' network.

### 1.3 Traffic Types

The **OMS3255** can carry different types of network traffic data.

In addition to its capability of transferring standard **SDH** and **OTH** signals, it can also perform processing on other types of signals:

- Transfer **CBRx** signals;
- Transfer **Fibre Channel**, **FICON**, **ESCON**, **SBCON** and **DVB-ASI** signals;
- Transfer, consolidate, switch and groom **Ethernet** signals.

To provide the above services OMS3255 support the following types of interfaces:

- **SDH**: STM-1, STM-4, STM-16, STM-64 and STM-256 (future option);
- **OTH**: OTM-0.1/1r.1, OTM-0.2/1r.2 and OTM-0.3/1r.3 (future option);
- **CBRx**: CBR2G5 and CBR10G;
- **ETH**: 10M, 100M, 1GE, 10G LAN PHY and 10G WAN PHY (future option);
- **Storage signals**:
  - 'Full speed' Fibre Channel and FICON (i.e. 850M), ESCON and SBCON (i.e. 160M).
  - 'Half speed' (i.e. 425M) and 'Quarter speed' (i.e. 212M) and DVB-ASI (i.e. 216M) (future options)

## 2 Network Applications

### 2.1 General network level

Due to the increasing demand for bandwidth, the loads of existing SDH nodes are exceeding their limits. An upgrade to higher capacity equipment is essential to keep the network running. The **OMS3255** can replace existing networks based on more stage of SDH multiplexers by saving space and simultaneously increasing network flexibility.

Compliance with SDH standards at a common management solution will also allow the **OMS3255** to be deployed in existing networks alongside current equipment. It can cover all applications and the interfaces it requires.

The **OMS3255** is not only an extremely compact SDH DXC4/4 product, but it also provides **ODU switching**, giving the capability to switch both wavelength services and higher order synchronous traffic simultaneously in the same network element. Marconi **OMS3255** is designed to support the migration of the transport network to the Optical Transport Network (i.e. OTN). Marconi has combined the SDH and OTN layers in the same equipment to provide the grooming and consolidation at the SDH layer with the flexibility of transparent services offered by the G.709 OTN layer.

In addition the integration of a **LO-VC switch** permits to use **OMS3255** as a compact and cost-effective solution for all those network nodes where, in conjunction to a wide HO-VC switch, the capability to groom a percentage of the traffic down to VC-3/VC-2/VC-12 level is required.

Furthermore **Packet switching** capability is provided as well in order to cope with more data-centric network.

Due to its highly flexible architecture and features, it can drastically reduce the amount of equipment at one location. Additional it delivers future options to increase the network level up to **STM-256/OTM-x.3**.

To illustrate the flexibility of the **OMS3255**, some special examples of network applications are shown below. Certainly, **OMS3255** covers all standard node configurations like DXC, Add/Drop, Ring, Meshed and Star networks.

Below you can see a general transport network application based on **OMS3255**. All of these structures can be covered by **OMS3255** in different compositions to be optimized for each application in the different network levels (e.g. ODU cross-connect for the Optical Backbone, ODU/SDH DXC/ADM with LO-VC and packet switching capability for Regional and Metro Layers).

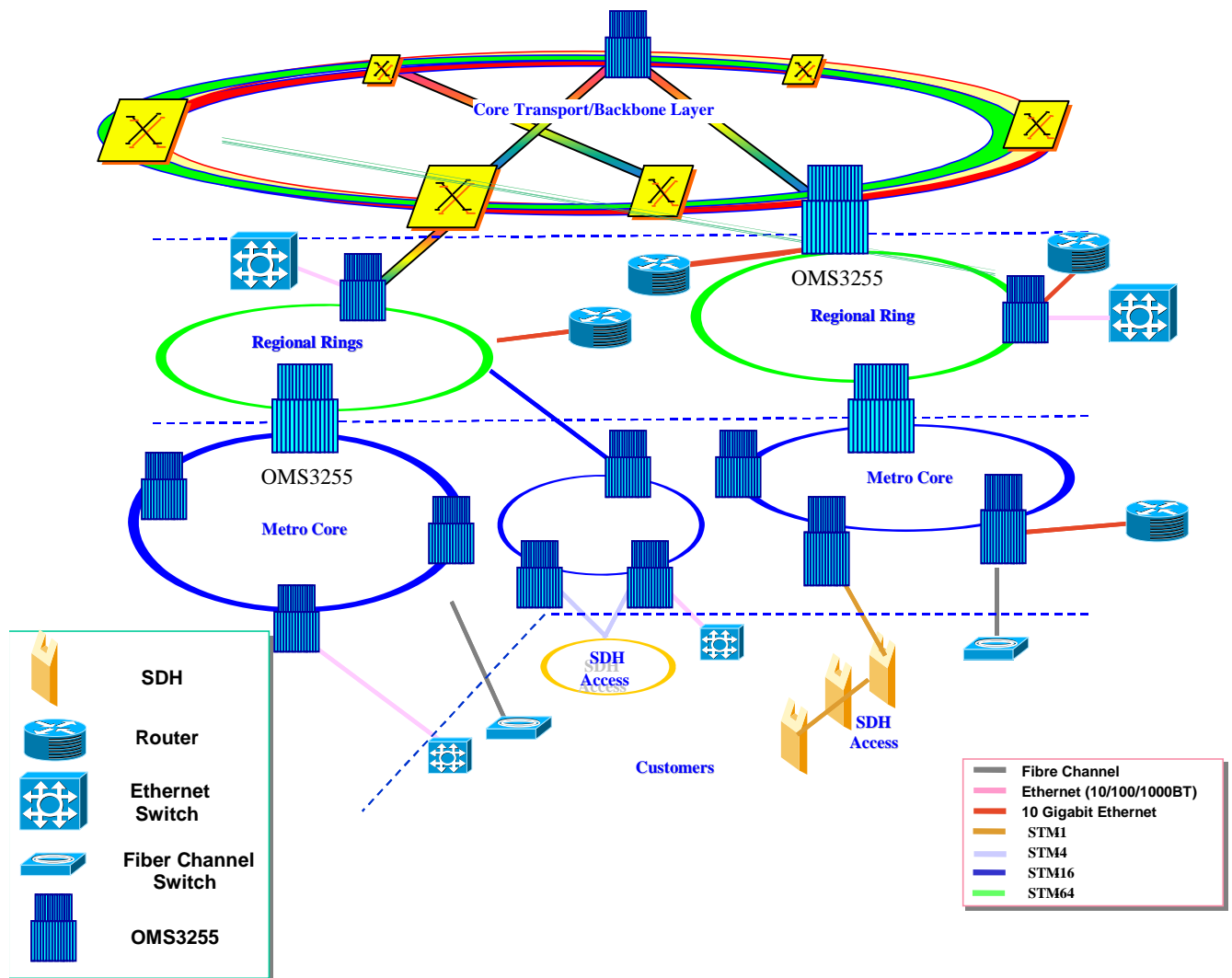


Figure 1: Applicable network levels

## 2.2 Replacing Stacked Networks

Stacked or layered networks are very common today. VC granularity (i.e. VC-4) multiplexers/DXC are used for the high bandwidth transport (e.g. STM-64) and, at sites with lower interfaces (e.g. Data/Voice), additional multiplexers with fine VC granularity (i.e. VC-12, V2 and VC-3) into a VC-4 signal are situated.

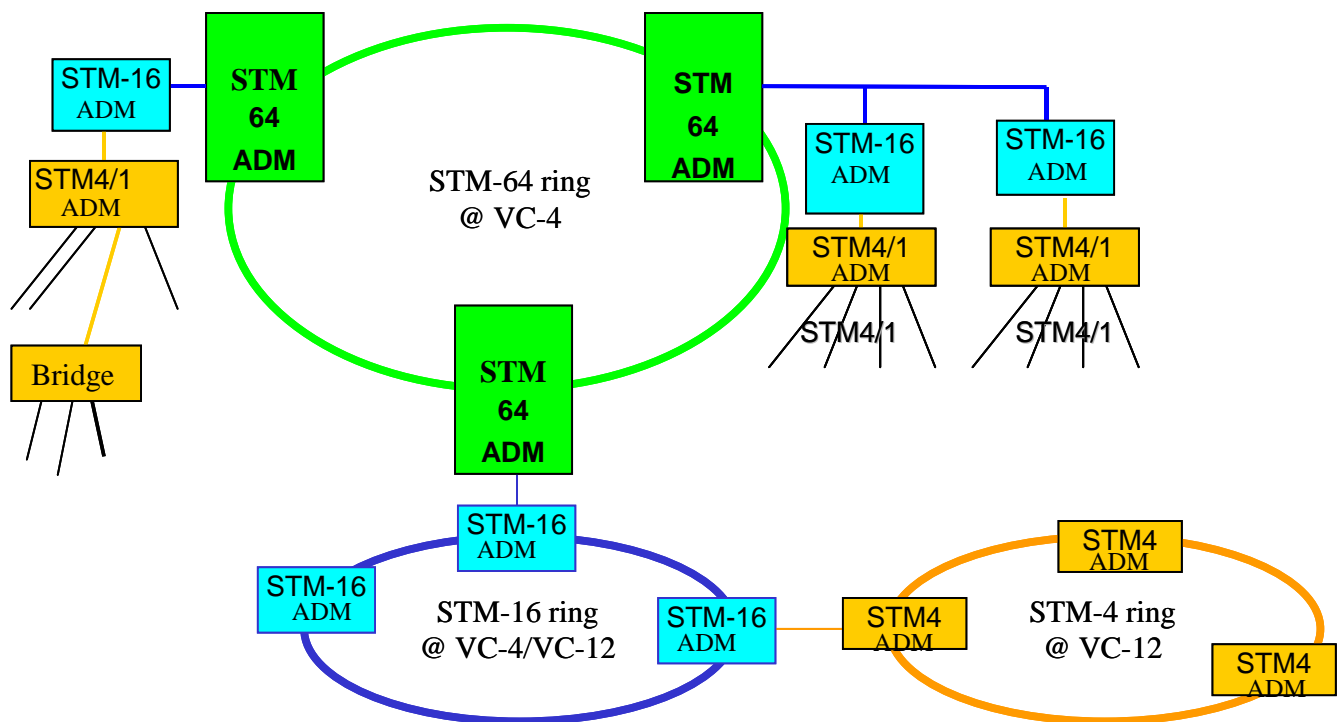


Figure 2a: Common solution with stacked networks

The **OMS3255** makes obsolete such stacked networks. The possibility to close multiple STM-64 and STM-16 rings in addition to the availability of STM-4/1, Data interfaces and LO-VC blades permits to use **OMS3255** as a single box and therefore to reduce network complexity, saving costs, space and operation effort.

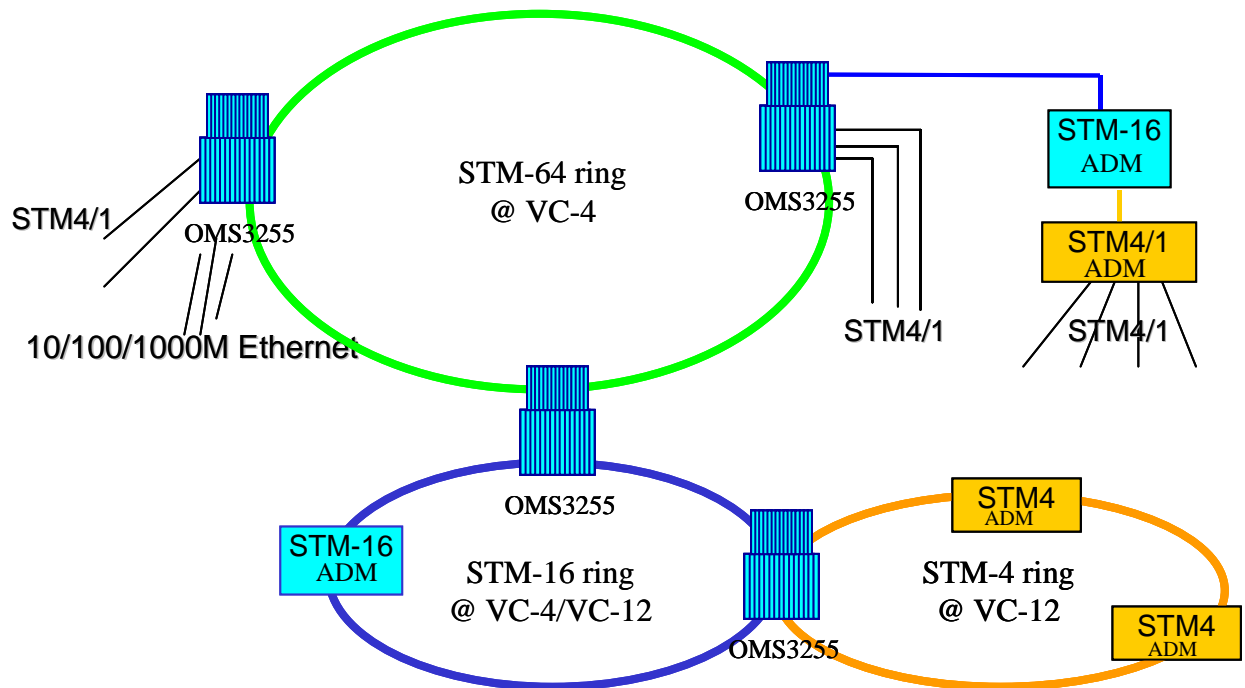


Figure 2b: OMS3255 makes stacked networks obsolete

## 2.3 LO-VC Integration

The **OMS3255** is designed to satisfy in a cost effective way the request to have a percentage of LO-VC (i.e. VC-12/VC-2/VC-3) grooming, co-located in the nodes where HO-VC switching is performed. The possibility to equip **OMS3255** with LO-VC Switch Units permits to avoid the management of a dedicated equipment to provide LO-VC switching.

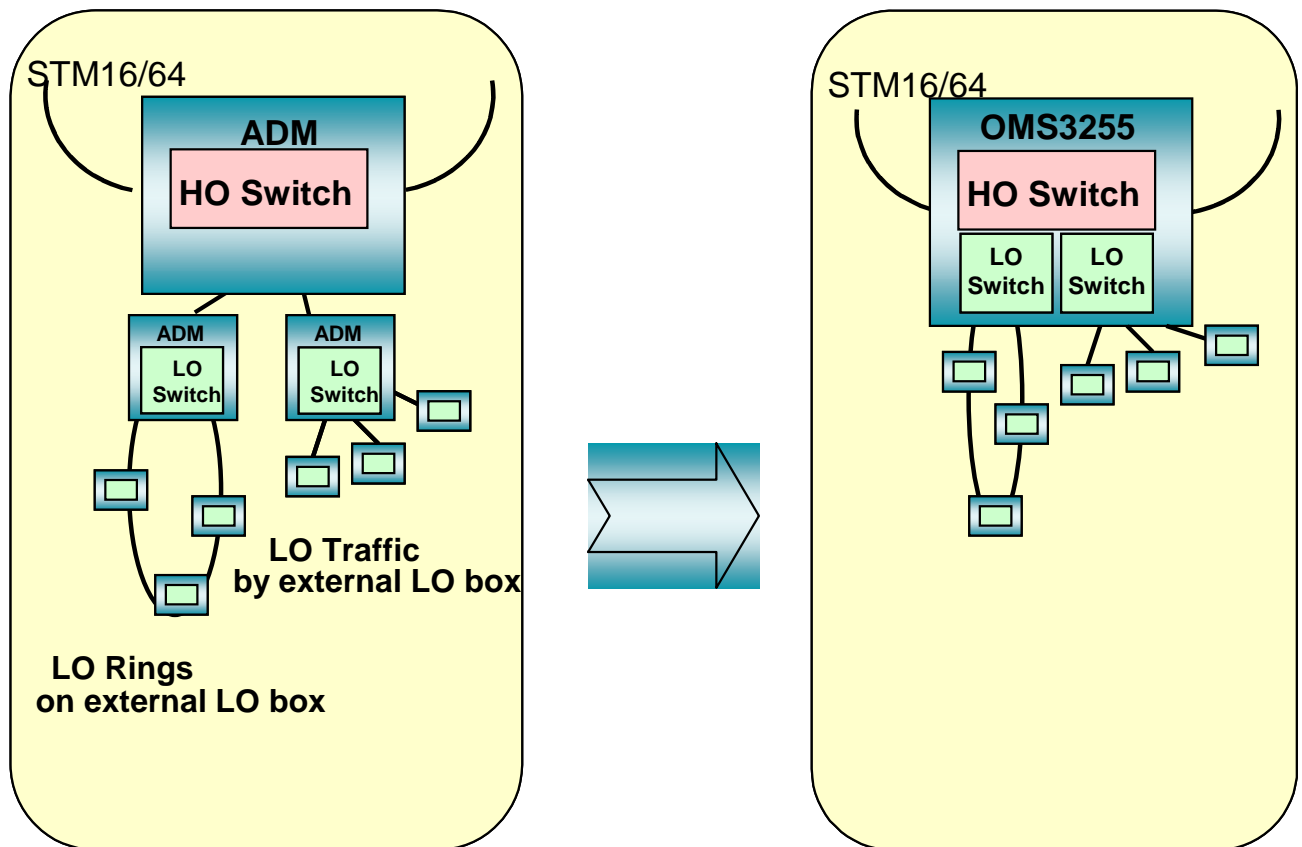


Figure 3: LO-VC Switch integration

## 2.4 ODU Switching

The ODUk and VC-n switching into a single switch platform, permits to use **OMS3255** in a **pure SDH** network, in a **pure OTN** or to merge in the same equipment an OTH and SDH network element.

Without this unique functionality it would be necessary to build two layers in the network: one to consolidate and groom SDH traffic and one to switch in the OTN/ODU layer, each layer with its own dedicated nodes. With **OMS3255**, the same network element can be used to assure flexibility to both the layers.

This functionality, in addition to other offered features (e.g. grooming VC-4 based SDH traffic into ODUk, transparently mapping of CBRx signals into their respective ODUk containers and ODUk multiplexing), make **OMS3255** not only an advanced **gateway to the optical layer** but also a **flexibility point** of the **optical backbone** and can be used to build flexible networks and to offer a very competitive set of services in a cost effective and efficient manner.

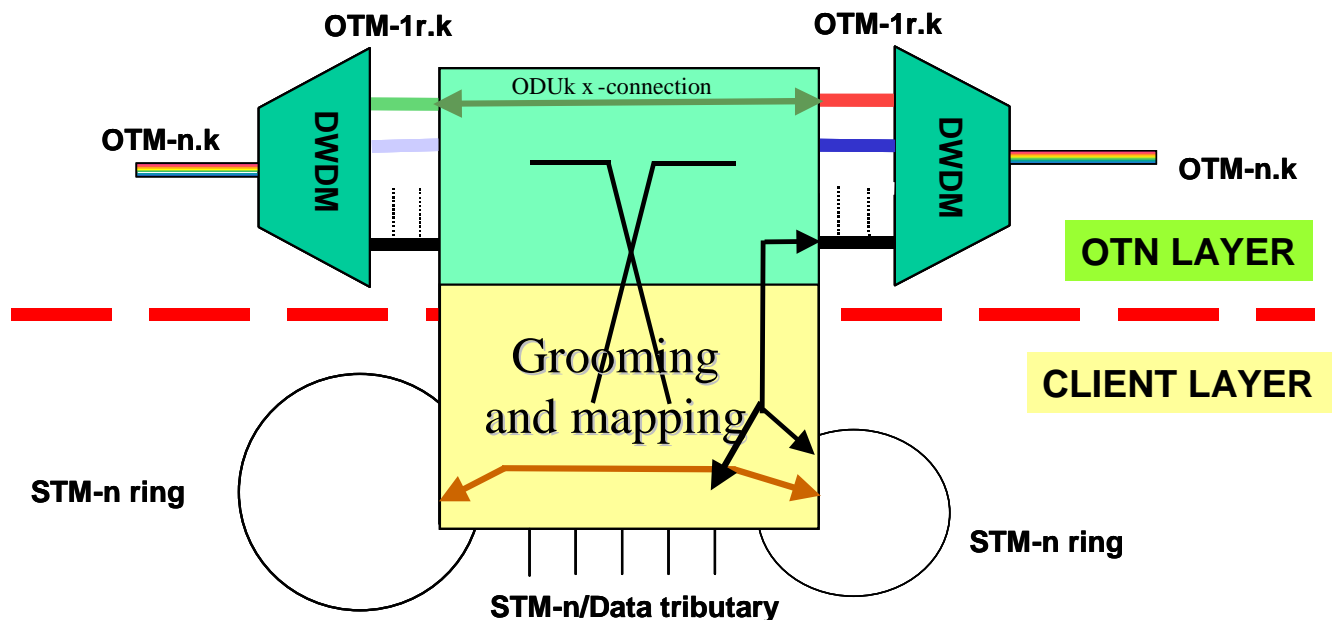


Figure 4: OMS3255 OTN application



## 2.5 Photonic Interworking

In order to provide the most cost-effective solution for interconnection to the Optical layer **OMS3255** can be equipped with STM-64 and OTM-1r.2 coloured interfaces without the need to use transponders on the DWDM equipment.

In addition, ODUk multiplexing capability permits to optimize the use of the fibres of the optical backbone: for instance if 4 STM-16/CBR2G5 shall be transported over the DWDM ring, **OMS3255** can **multiplex** them **transparently** into an ODU2 and forward them via a single fibre to the DWDM equipment.

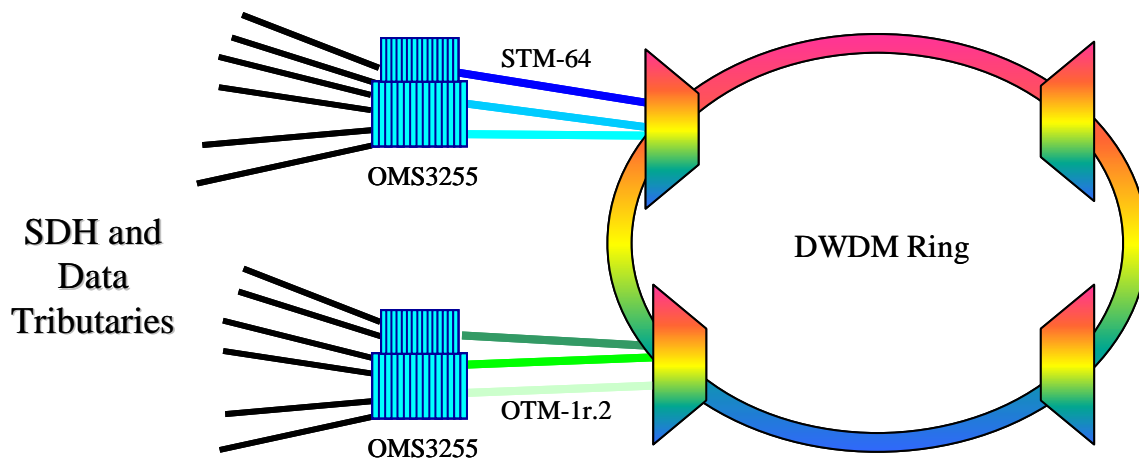


Figure 6: Optimized Photonics interconnections

## 2.6 Data applications

### 2.6.1 Ethernet Private Line

Ethernet Private Line (i.e. **EPL**) provides **end-to-end transparency** for the Ethernet stream. Each packet arrived from end user LAN will be mapped via Generic Frame Procedure (i.e. GFP) into SDH-leased line (see in the following figure the **single point-to-point application**). The transfer capacity may be a fixed or flexible leased line, resized via Link Capacity Adjustment Scheme (i.e. LCAS). For each point-to-point connection an own VC-x-nv VC-group will be used. This application, on **OMS3255**, is supported for 10/100/1000M and 10G Ethernet signals.

### Single Point-to-Point Application

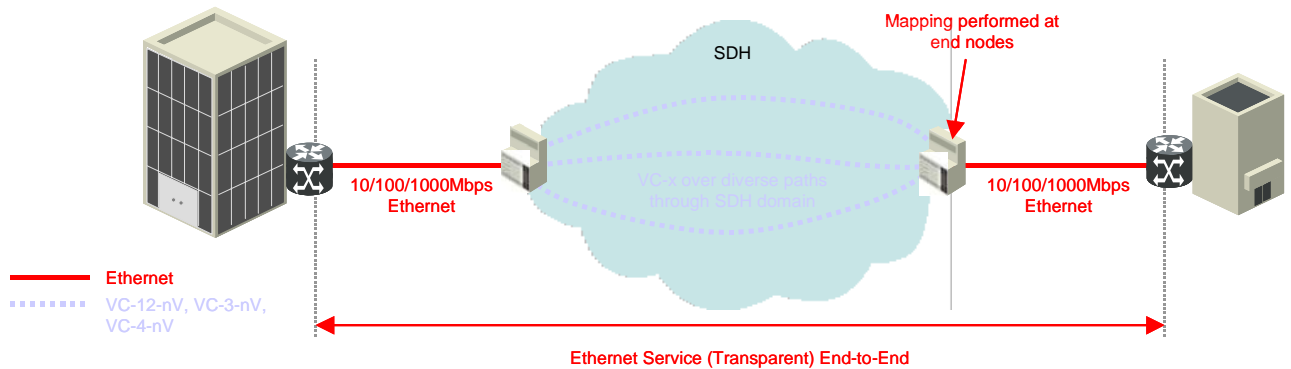


Figure 7: EPL Single Point-to-point Application

In case of multiple end-points (e.g. remote switches) served by a centralized Ethernet switch deputed to aggregate all remote traffic (see the following figure), the connection between the head-end Switch and the SDH node is optimized if the SDH node merges/aggregates the Ethernet flows before sending them to the head-end Switch.

This type of Multipoint-to-Point application, supported by OMS3255 for 10/100/1000M and 10G Ethernet signals, is known as Multiplexed Ethernet Private Line (i.e. **M-EPL**) and is possible via the management of VLAN tags used to identify the flows sent to the head-end switch.

The support of **M-EPL** services in the SDH node provides the following main benefits:

- **Single connection** to core switch/router  
Less cabling to install.
- **Single card** to present several remote customers to the core switch/router.  
More remote customer served and/or few slot used.
- **Installation and operational cost savings.**  
Further logical connections can be added remotely once the single interface is installed.

### Head-End Aggregation Application (MultiPoint-to-Point )

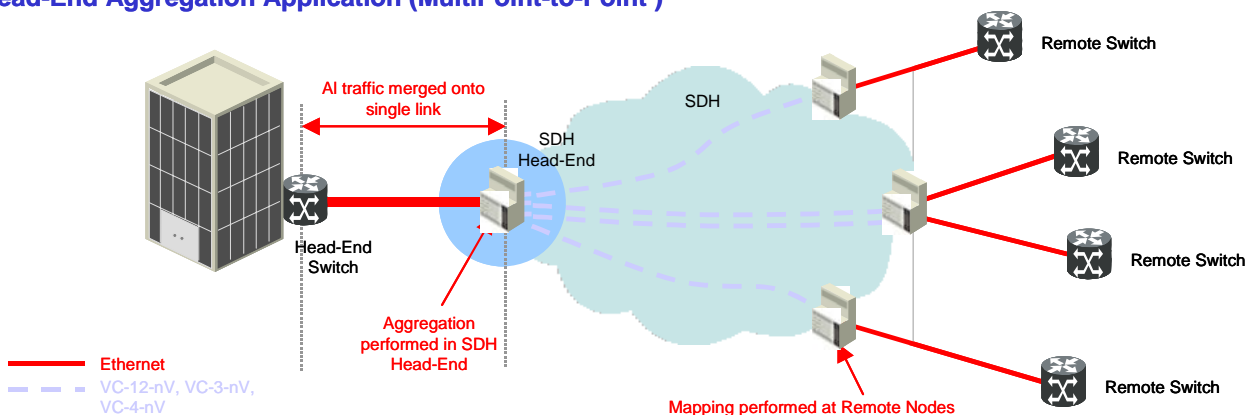


Figure M-EPL Multipoint-to-Point Application

### 2.6.2 Ethernet Virtual Private Line

Ethernet Virtual Private Line (i.e. **EVPL**) functionality merges flows at remote ends before passing VCG into SDH domain. Instead of using different VC-groups for each Point-to-Point connection transported inside the SDH Network, a single VC-group is used based on statistical traffic of each location. VLAN tags are used to differentiate between different flows on the same VCG.

In fact in the Ethernet Private Line (i.e. **EPL**), the service offered to the Ethernet flow can be characterized at SDH level for example via the different type of configured protection (not protected, LCAS protected, SNCP protected, re-routed, fast re-routed via ASTN...) but in any case foreseen a dedicated bandwidth to it (i.e. **CIR**).

Such Ethernet capability permits to collect many 10/100/1000M Ethernet signals and **aggregate** them to only one summary signal to transport.

The support of **EVPL** services in the SDH node provides the following main benefits:

- **Increasing the granularity of the network service.**  
No more limitations due to VC-12/VC-4 granularity as more than one customer flow can be transported in a single VC.
- **Increasing the number of provided services.**  
Not only a CIR can be set up for an Ethernet flow, but also an EIR, in conjunction with CIR or as a unique agreed service.
- **Increasing of the network bandwidth usage.**  
Service using the EIR can advantage of bandwidth in different time period, optimizing the overall usage of the SDH available bandwidth.

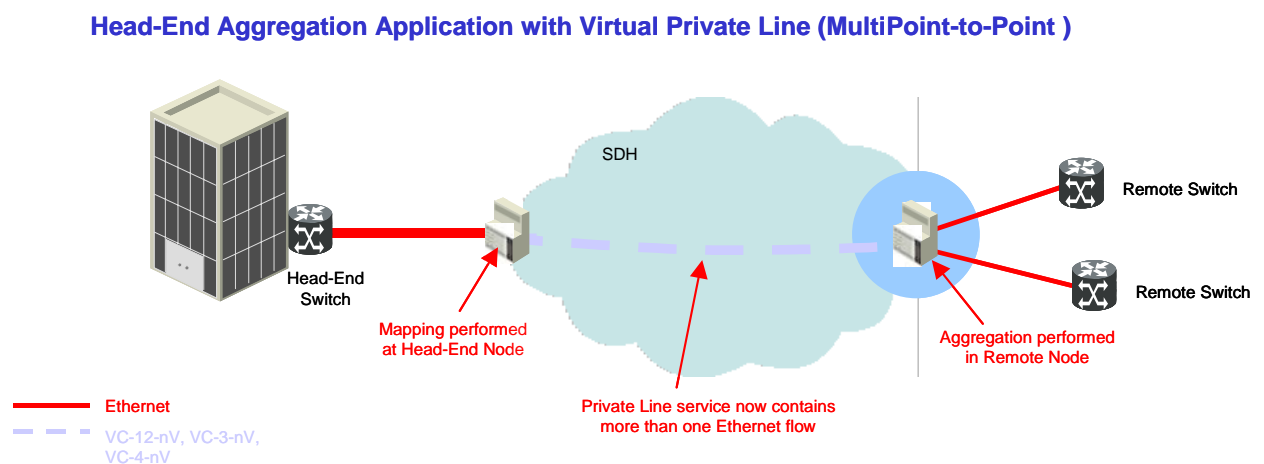


Figure 8: EVPL Multipoint-to-Point Application

### 2.6.3 Ethernet Private LAN

Ethernet Private LAN (i.e. **EPLAN**) functionality permits the interconnection between multiple sites of a customer LAN (i.e. MultiPoint-to-Multipoint application).

An SDH network supporting such service appears like a large virtual bridge: the transport network no longer provides only private lines between local area networks, but also provides an Ethernet bridged network within the operator network.

Layer 2 Switching introduces address-learning mechanisms into the transport functions to decide to which port and VC-group the signal has to be switched.

The support of **EVPL** services in the SDH node provides the following main benefits:

- **Increasing the level of service** provided by the SDH operator to the Ethernet customer.
- **Installation and operational cost savings;**  
SDH and switching functions are concentrated in one site and one device (i.e. L2 switching function embedded in the SDH node avoids the need of an external Ethernet switch device).

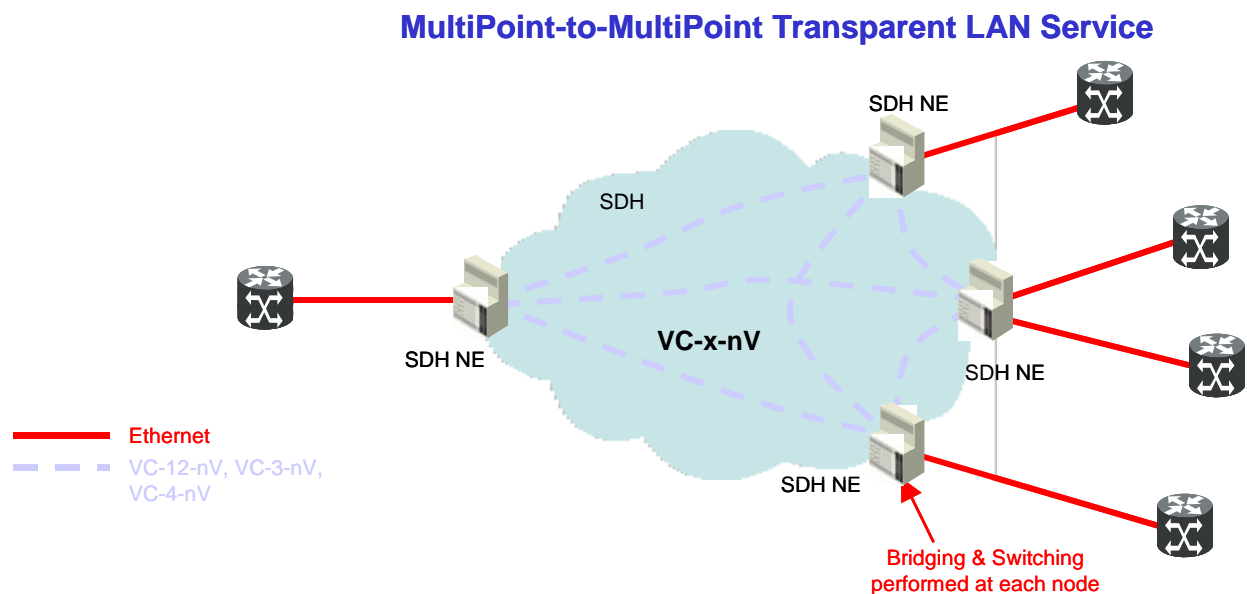
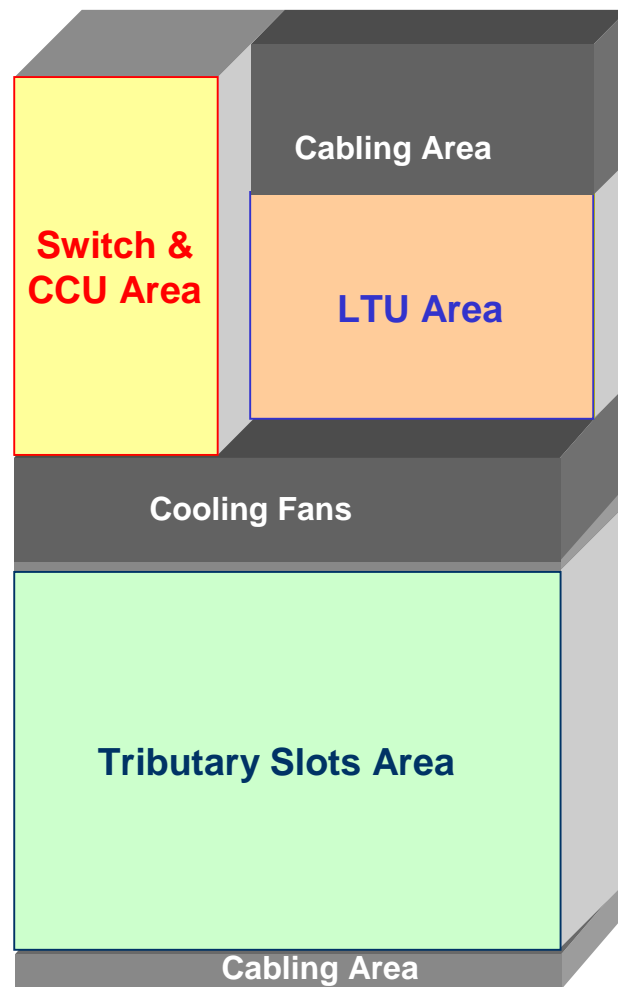


Figure 9: EVLAN Multipoint-to-Multipoint Application

### 3 Product Overview

#### 3.1 Mechanical overview

**OMS3255** has a single shelf structure as illustrated in **Figure 1**. This allows the mounting in a standard “single deep” ETSI rack (i.e. height 2.2m, width 0.6m and depth 0.3m).



*Figure 1 – OMS3255 Core Shelf overview*

Such dimensions also allow the mounting of up to **two** shelves of OMS3255 in 160G/640G configurations over a single ETSI rack as illustrated in **Figure 2**, with the simple addition of a set of cooling fans between them. This composition permits to have up to 1.28 Tb/s traffic capacity subtended by a single rack.

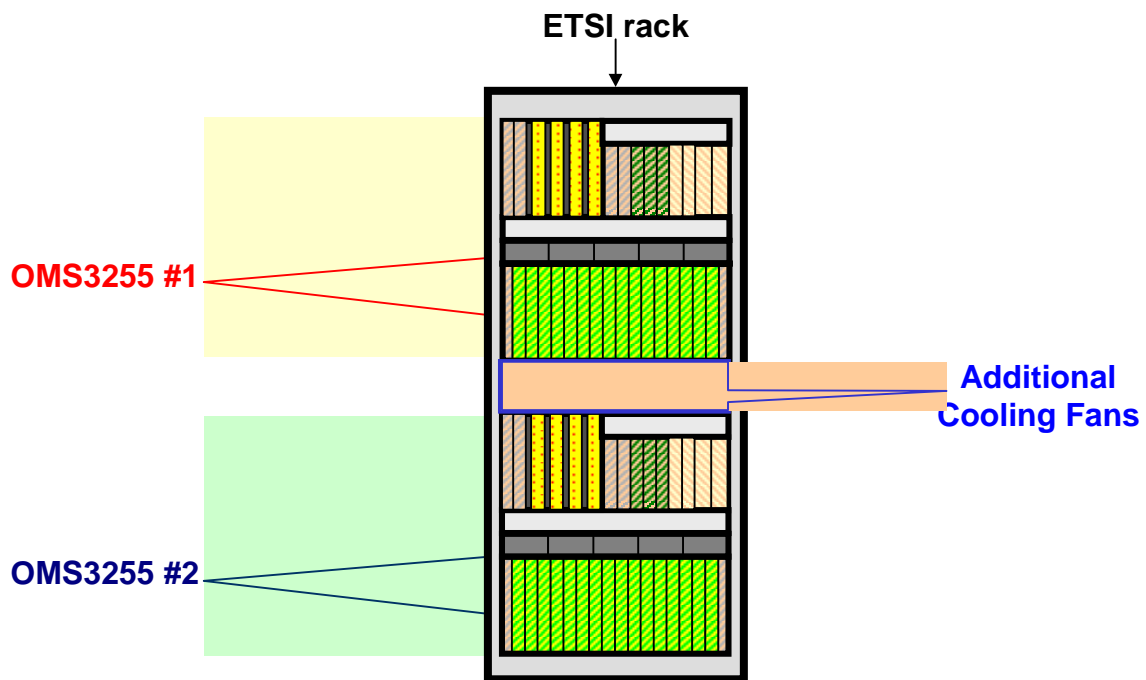


Figure 2 – Insertion of two OMS3255 's over a single ETSI rack

When in 720G configuration, the same “single deep” ETSI rack can host both the OMS3255 Core Shelf and the OMS3240 peripheral port subrack.

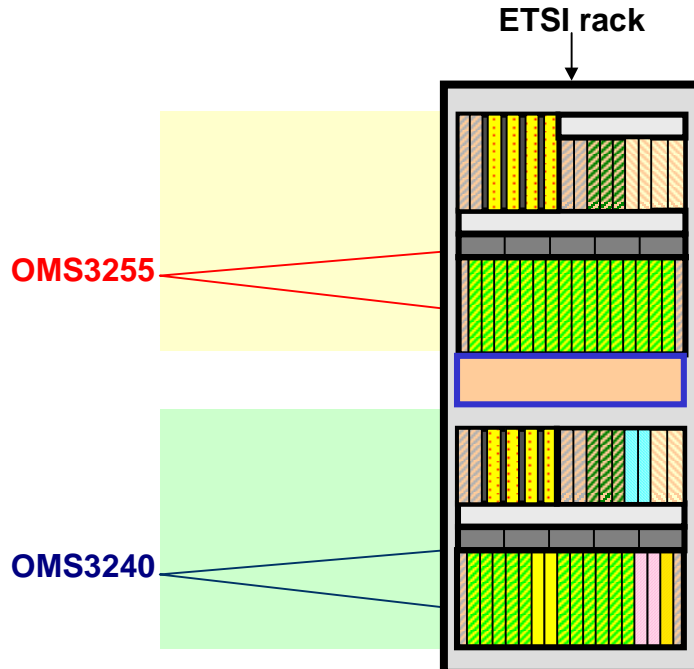


Figure 3 – Insertion of OMS3255 720G in a single ETSI rack

### 3.2 OMS3255 Core Shelf

OMS3255 Core Shelf is designed to accommodate all components and units necessary to cover large applications. It supports:

- 16 traffic slots
- 3 traffic LTUs
- Protected TDM switch matrix (720G at HO-VC/ODUK level or 160G at HO-VC level)
- Protected Control Subsystem
- Auxiliary unit for EOW services
- Alarm unit for alarm summary
- System LTU for power supply, clock, TMN and LCT access

The following **Figure 4** provides an overview of subrack layout configuration of OMS A.

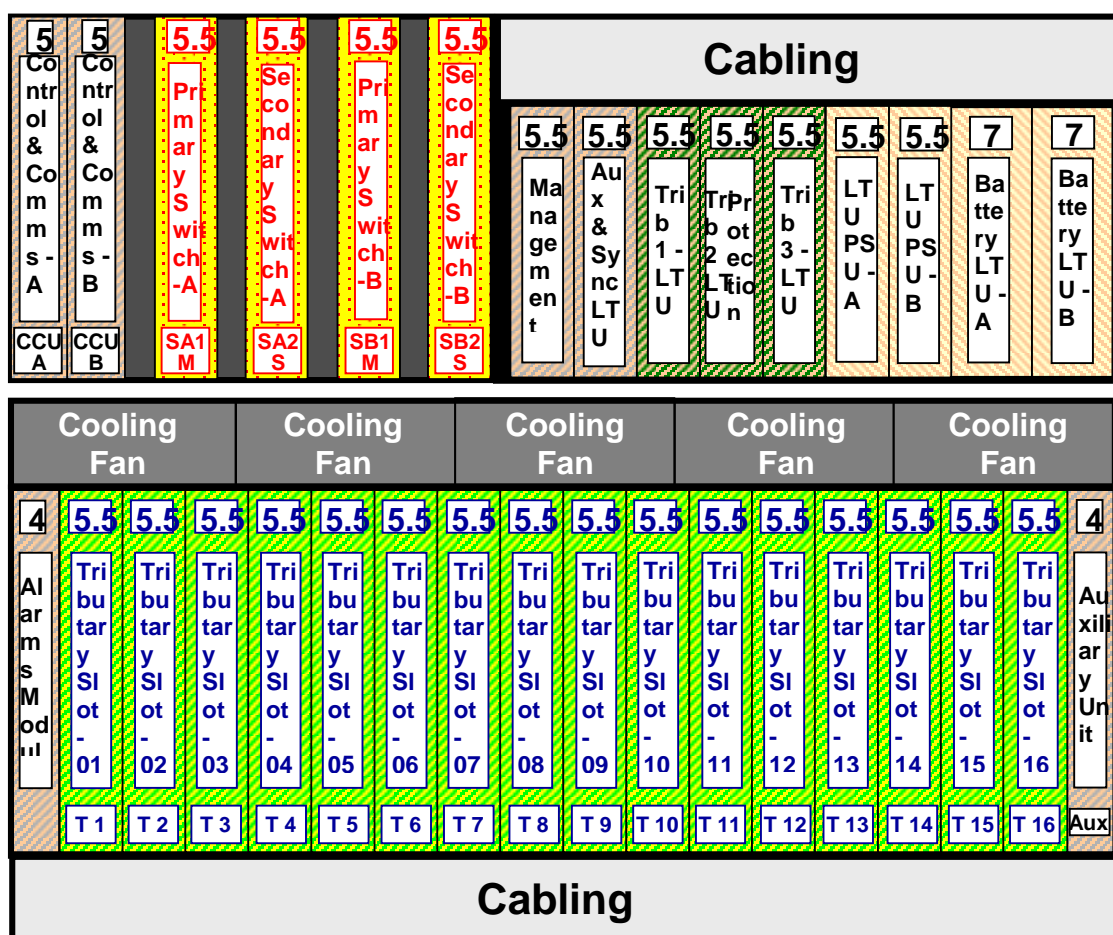


Figure 4 – Cards allocation on OMS3255 Core Shelf

The HO-SDH/OTN **switching subsystem** is housed upon the upper part of the equipment and it is based upon two slices (Primary and Secondary cards), redundant for protection purposes (Side A and Side B).

When in 720G configuration the OMS3255 and the peripheral OMS3240 are connected via dedicated cables that provide the HO-VC/ODUK, collected by the peripheral OMS3240, directly

to the OMS3255 switching core. Please note that the addition of the peripheral port shelf to an already in traffic OMS3255 doesn't require any HW modification in OMS3255.

A **Line Tributary Unit** area is provided, where a maximum of three units (e.g. ITU-T G.703-compliant electrical STM-1 interfaces) may be used (e.g. for STM-1 el. Interfaces or for embedded optical filters).

The **Control and Communications** architecture is based on redundant units (namely CCU A and CCU B). Then **OMS3255** can also feature further ancillary units: e.g. Alarm module and Auxiliary Card.

**Traffic cards** and **LO-VC switch-blades** can be located in the sixteen slots of the Tributary Slots area of OMS3255 and in the twelve traffic slots of OMS3240.

**OMS3255** has a traffic capacity of **40G per slot**, therefore optimized to be equipped with the new generation of high-density traffic units (e.g. 4xSTM-64 and 16xSTM-16 units with 40G bandwidth). In addition the fully proven set of 10G Bandwidth units already implemented for the OMS32xx family (i.e. OMS3250, OMS3240 and OMS3260) can be fitted.

In case of 160G configuration each slot has a capacity of **10G** and can be equipped only with the set of SDH units already in use in the OMS32xx family.

The 640/720 Gb/s configurations foresee mostly the use of the 40 Gb/s traffic cards, handling 2G5 and 10G traffic signals. In case of huge amount of low-rate traffic signals (e.g. STM-1/4, Fast Ethernet), in order to optimize the use of OMS3255 switching capacity, it is suggested to equip them on the peripheral OMS3240 port subrack.

Below is a detailed list containing the maximum density of interfaces that can be equipped in **OMS3255**. Please note that this list explains the maximum number for each interface type. In a real application, there will be a number of different interfaces simultaneously in each shelf.

Interface Type	No. of ports			NOTES
	per card	Per OMS3255 shelf	Per OMS3240 shelf	
STM-1 el.	16	48	160	(*)
STM-1 opt.	16	256	192	(*)
STM-4	16	256	128	(*)
STM-4 c/v	4	64	48	(***)
STM-16	2/4	N.A.	32	
STM-16	16	256	-	(**)
STM-16 c/v	1	16	12	(***)
STM-64	1	N.A.	4	(*)
STM-64	4	64	-	(***)
STM-256	1	16	-	(**)
OTM-0.1/1r.1	4	64	16	(*)
OTM-0.2/1r.2	1	16	8	(*)
Fast Ethernet	10	120	80	(@)
1GE	10	120	80	(@)
10GE	1	12	8	(@)
Escon/SBCON	10	120	80	(@)
Fibre Channel	10	120	80	(@)



Ficon	10	120	80	(@)
DVB-ASI	10	120	80	(@)
(*) 10G Bandwidth Unit (**) 40G Bandwidth Unit (***) 2G5 Bandwidth Unit, dedicated for Contiguous to Virtual concatenation conversion (!) OMS3255 is open to support also a 40G Bandwidth version (@) This composition plan to have 160G SDH Bandwidth to transport the Data traffic				

*Table 1: Number of interfaces offered by OMS3255*

All cards are hot pluggable, i.e. a card can be removed and inserted in service without impairing current traffic and can be immediately configured from a local or remote terminal.

## Architecture Overview

The OMS3255 architecture is illustrated in **Figure 5**.

**Traffic cards** and **LO-VC switches**, placed in the Traffic Slot area, exchange traffic and timing/synchronization signals with both slices (Primary and Secondary units) of the redundant HO-SDH/OTN switching matrix (Side A and Side B). The traffic collected by the peripheral port subrack is directly provided to the switching matrix via dedicated cables.

The control functions are performed by the Controller and Communication unit and by the microprocessors on each unit. The Controller and Communication unit communicates, by means of a serial bus, with the microprocessors of all the equipment cards. The Control and Communication Subsystem manages the whole equipment according to the control messages issued by the Local Controller (via F interface) or by the Element Manager (via Q or Qecc interfaces).

When in 720G configuration the Control and Communication Units of OMS3255 control also the OMS3240. The Control and Communication Units of OMS3240 became slave of the OMS3255 ones.

The Aux card then allows the provisioning of auxiliary services, i.e. Engineering Order Wire (EOW).

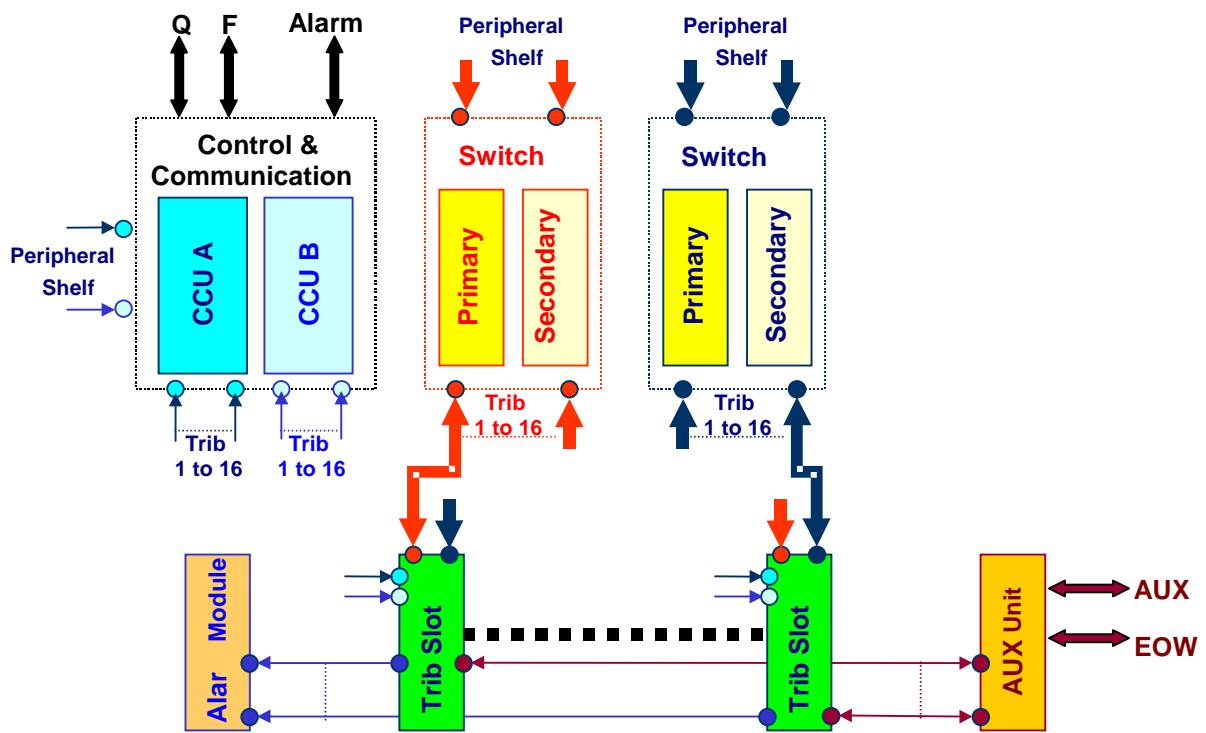


Figure 5 – OMS3255 architecture overview

### 3.2.1 Line Terminating Units (LTUs)

To support a flexible connection of electrical and optical lines, the **OMS3255** has front access only. This simplifies mounting the shelf, the cables and fibers, and drastically reduces maintenance costs.

The following traffic LTUs are available and provides access for the electrical interfaces:

LTU type	No. of ports	Comment
STM-1 el.	16	
Fast Ethernet	16	Balanced via RJ45 connector

*Table 3: Flexible access via LTU on OMS3255 Core Shelf*

STM-1/4/16/64 and OTM-0.k/1r.k optical cards support front access only.

## 4 Interfaces

All Traffic Slots of **OMS3255** Core Shelf can be populated with the whole set of traffic units already developed for OMS32xx family, included the new generation of high-density traffic units (i.e. 4xSTM-64 and 16xSTM-16 units with 40G bandwidth) that can be supported only by the OMS3255 core shelf when in the 640G/720G configurations.

Such cards will be subdivided into four groups, in accordance with their characteristics. The groups of cards considered are:

- ❑ SDH traffic units;
- ❑ OTN traffic units;
- ❑ Data cards;
- ❑ LO-VC Switching Matrixes.

### 4.1 SDH Traffic Units

On the sixteen Tributary Slots of OMS3255 the following types of high-density SDH traffic units, specific for **OMS3255**, can be equipped:

- ❑ **16xSTM-16** interfaces with **hot-pluggable** transceivers (**SFP**);
- ❑ **4xSTM-64** interfaces with **hot-pluggable** transceivers (**XFP**).

Furthermore OMS3255 is open to support **1xSTM-256** interfaces.

There are no constraints for allocation of any of the above listed units on each of the 16 Tributary Slots of **OMS3255 Core Shelf**. These units cannot be equipped in the peripheral OMS3240 Shelf and in the 160G configuration.

In addition, in the sixteen Tributary Slots of OMS3255 the following types of SDH Traffic Units, already implemented for **OMS32xx** family (i.e. OMS3240, OMS3250 and OMS3260), can be used:

- ❑ **16xSTM-1 electrical** interfaces;
- ❑ **16/4 ports modular SDH cards** with **hot-pluggable** transceivers (**SFP**);
- ❑ **1xSTM-16** and 4xSTM-4C/V conversion cards (Contiguous to Virtual conversion) with **hot-pluggable** transceivers (**SFP**);
- ❑ Single-channel **STM-64** interfaces;
- ❑ Single-channel **DWDM STM-64** interfaces.

In addition to the “classic” SDH cards, each one with its fixed rate/granularity, **OMS3255** can be equipped with extremely flexible **modular SDH** cards.

These cards are provided with a maximum of 16 ports, where hot-pluggable optical/electrical transceivers can be inserted. Such transceivers are in the form of SFP modules supporting STM-1, STM-4 and STM-16 with different optical reaches, thus providing a very high degree of flexibility both in terms of traffic management and fiber link length. SFP electrical modules for STM-1 are foreseen as well.

The **modular SDH cards** can be equipped and programmed to support many different configurations. For instance the cards can be configured to support the following full, single-rate configurations:

- 4xSTM-16;
- 16xSTM-4;
- 16xSTM-1

Mixed configurations with STM-1, STM-4 and STM-16 are also supported, with the constraint not to exceed 4 x STM-16-equivalent bandwidth.

Each port of the modular SDH cards is independent and therefore can be equipped/configured according to the user's need.

Marconi **modular SDH cards** represent the most flexible and cost-effective solution to provide STM-1/4/16 services. For instance, in a node where a low number of different STM-1/4/16 signals is required, the user is not forced to equip a card for each type of signal, with the risk to have multiple unused ports, but can decide to use a single modular SDH card to support the required mixed configuration. This reduces the volume and cost of the maintenance stock.

There are no constraints for allocation of any of the above listed units on each of the 16 Tributary Slots of **OMS3255 Core Shelf**. The only exception is represented by 16xSTM-1 Electrical Tributary, which may be allocated only in the Tributary Slots associated to the electrical LTU Trib Slots.

The allocation of the same units in the 12 Tributary Slots of the peripheral shelf follows the composition rules of **OMS3240** (i.e. the 10G Bandwidth Slots accept all the above traffic units while the 5G Bandwidth Slots can be equipped with traffic units not exceeding 5G Bandwidth).

## 4.2 OTN Traffic Units

In the sixteen Tributary Slots of OMS3255 the following types of Traffic Units, able to handle OTM-0/1r.k signals, already implemented for **OMS32xx** family (i.e. OMS3240, OMS3250 and OMS3260), can be used:

- ❑ **4xCBR2G5/OTM-0.1/1r.1** interfaces with **hot-pluggable** transceivers (**SFP**);
- ❑ Single-channel **CBR10G/OTM-0.2** interfaces;
- ❑ Single-channel **1xOTM-1r.2** interfaces.

The first two types are double bit-rate cards. Each port of the card can be configured to accept two different signals from the line:

- **CBR2G5** and **CBR10G**: signals with a Constant Bit Rate of 2 488 320 Kbit/s  $\pm$  20 ppm and 9 953 280 kbit/s  $\pm$  20 ppm respectively. Examples of these signals are the STM-16, for the CBR2G5, and the STM-64 signal, for the CBR10G, as defined in ITU-T G.709;
- **OTM-0.1/1r.1** and **OTM-0.2** signals as defined in ITU-T G.709.

A specific 'Coloured' 10Gb/s card version is available (i.e. **1xOTM-1r.2**) as well.

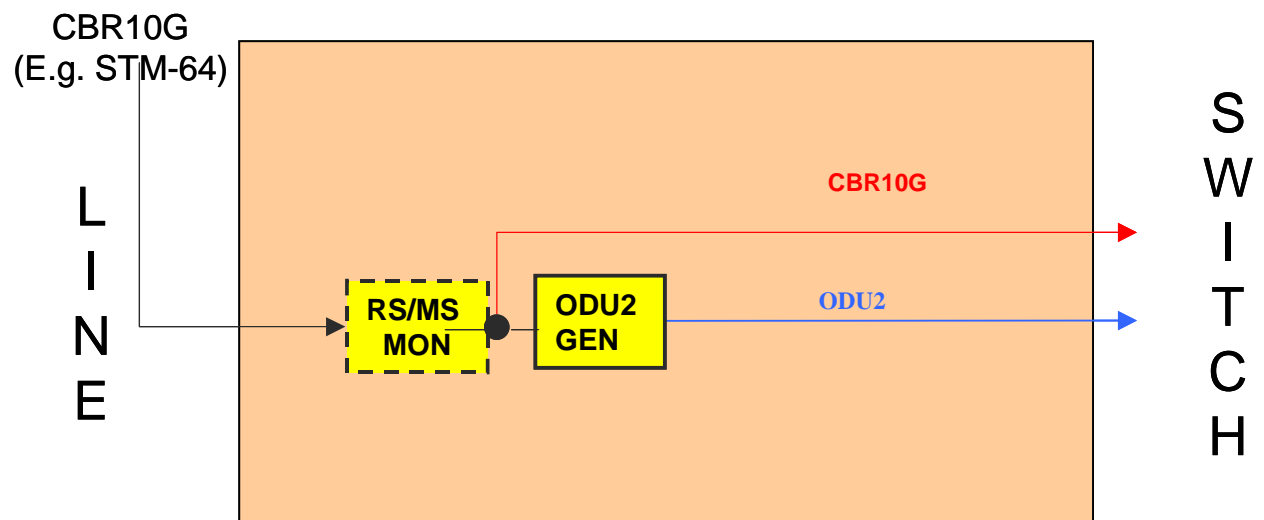
OMS3255 is open to support the equivalent for the 2.5Gb/s application (i.e. **4xOTM-1r.1**), that is obtained plugging 'Coloured' SFP on the card.

Furthermore OMS3255 is open to support new OTN traffic units with higher density (e.g. **4xCBR10G/OTM-0.2**) and able to support higher bit rate signals (e.g. **1xOTM-x.3**).

In the following figures a generic diagram of the features provided by the OTM-0.2/CBR10G card when a CBR10G signal is received from the Line.

If **CBR10G** frame is received from the line side, one of the following signal processing can be performed (see the following figure):

- **Mapping/de-mapping** of **CBR10G** signal into/from **ODU2** container.  
In this case the equipment is used as gateway between the client and the OTN.
- **CBR10G cross-connection**  
In this case the equipment is used as OXC and the CBR10G is cross-connected



transparently without any modification.

Figure 3 CBR Processing

In the following figures a generic diagram of the features provided by the OTM-0.2 and OTM-1r.2 cards when an OTM-0.2/1r.2 signal is received from the Line.

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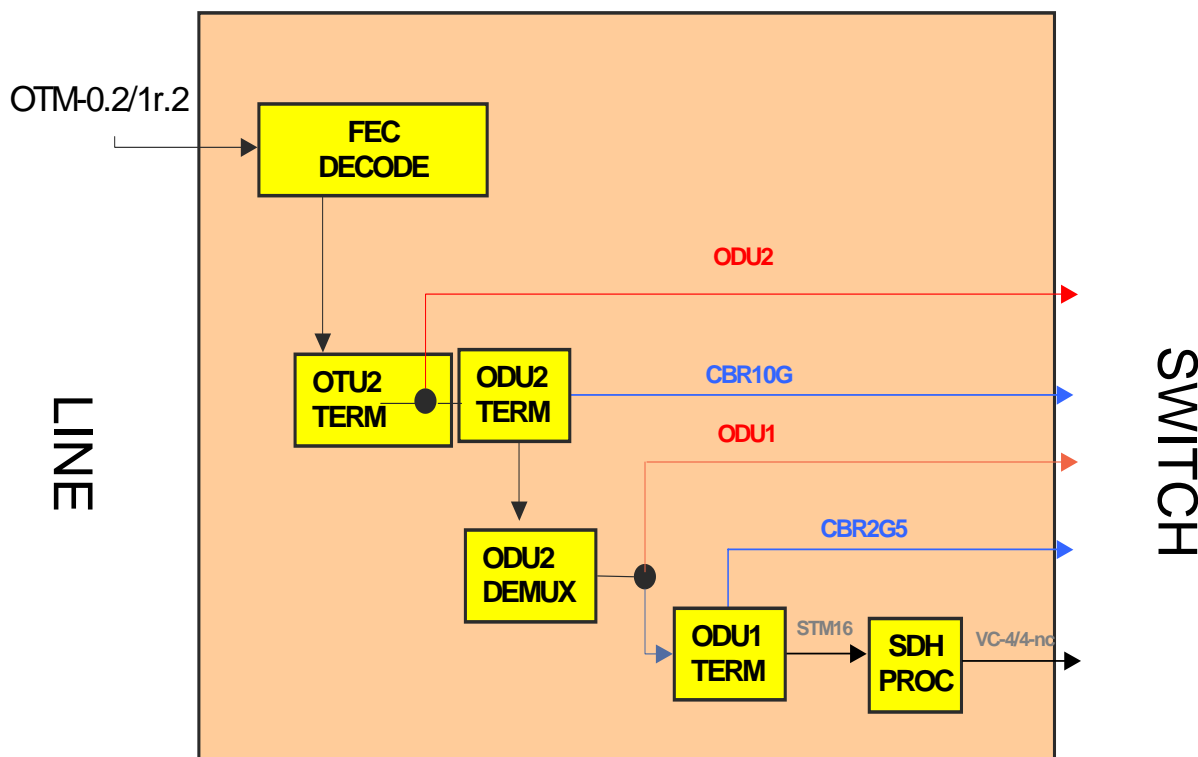


Figure 4 OTM-0.2/1r.2 Processing

If **OTM0.2/OTM1r.2** frame is received from the line side, one of the following signal processing can be performed:

- **FEC processing and OTU2 termination:**

In the Line to Switch direction the card first performs error correction decoding the G.709 RS FEC, if enabled, and then terminates the incoming OTU2 frame.

Then the following processing are available:

- **ODU2 cross-connection:**

The ODU2 OH can be optionally monitored.

- **CBR10G cross-connection:**

The ODU2 is terminated and the extracted CBR10G is then passed to the switching core for cross-connection

- **STM-64 termination:**

The ingress card extracts the STM-64 clients from the ODU2 and terminates it down to VC-4/4-nc level.

- **ODU1 multiplexing.**

The ODU2 is de-multiplexed into 4 x ODU1. At this point the card is able to perform on each ODU1 one of the following actions:

- **ODU1 cross-connection.**
- **CBR2G5 cross-connection.** The ODU1 is terminated and the extracted CBR1G5 is sent to the switching core.
- **VC-4/4-nc cross-connection.** The card can performs also the termination, down to VC-4/4-nc level, of the extracted STM-16 signal.

Similar processing are available on the **4x2.5Gb/s** card apart the ODU multiplexing and the FEC processing (i.e. FEC decoding is always disabled, while it is always encoded stuffed). On this card each port can be independently configured (e.g. two ports can be configured as OTM, while the other two as CBR2G5).

There are no constraints for allocation of any of the above listed units on each of the 16 Tributary Slots of **OMS3255 Core Shelf**.

The allocation of the same units in the peripheral shelf follows the composition rules of **OMS3240** (i.e. only the four 10G Bandwidth Slots accept the above traffic units).

These units can be used in the 160G configuration.



### 4.3 Data Cards

In the sixteen Tributary Slots of OMS3255 the following types of Data cards, already implemented for **OMS32xx** family (i.e. OMS3240, OMS3250 and OMS3260), can be used:

- ❑ **Multi-protocol** Data card with **hot-pluggable** transceivers (**SFP/XFP**);
- ❑ **Ethernet Layer2 Aggregation** cards with **hot-pluggable** transceivers (**SFP/XFP**).

There are no constraints for allocation of any of the above listed units on each of the 16 Tributary Slots of **OMS3255 Core Shelf** and **OMS3240** peripheral shelf.

#### 4.3.1 Multi-protocol Data card

The **Multi-protocol** Data card supports either 10 Multi-Protocol user interfaces or one 10 GbE user interface and perform mapping of the client signals into SDH Virtual Containers to provide **EPL** services (see Sect.2.6.1).

The type and number of interfaces to be equipped is flexible through the use of pluggable modules (i.e. SFP and XFP).

Each Multi-Protocol user interface can be configured to accept the following client signals: **Ethernet** traffic (i.e. **FastE** and **GbE**), **SAN** traffic (i.e. **ESCON/SBCON**, **Fibre Channel/FICON**), **Digital Video** (i.e. **DVB-ASI**).

Each client signal is mapped into a single Virtual Concatenation Group through **GFP encapsulation**. Framed GFP mapping (i.e. **GFP-F**) is applied to FastE, GbE and 10 GbE. The card is open to support Transparent GFP mapping for GbE. Transparent GFP (i.e. **GFP-T**) mapping is applied to SAN traffic and DVB-ASI.

The bandwidth of the SDH Virtual Containers can be flexibly configured in order to carry efficiently Ethernet traffic. **LCAS** bandwidth management protocol can be applied to GFP-F mapped signals.

Depending on the client signal bandwidth, the GFP encapsulated signals can be transported in the following SDH containers: VC-4, VC-4-nv (n=1 to 64).

#### 4.3.2 Ethernet Layer 2 Aggregation card

The **Layer 2 Aggregation Data** card supports a collection of user interfaces: the type and number of interfaces to be equipped is flexible through the use of modules directly pluggable on the front of the card (i.e. SFP and XFP) and additional interfaces provided in the LTU area.

**OMS3255** can be populated with the **Layer 2 Aggregation Data** cards developed for OMS32xx family (i.e. with 10G/20G full duplex capacity and FE/GE/10GE user interfaces), and with the advanced Data Switching Tributary cards, specific for OMS3255, that will be designed to enhance the packet switching capability (see Sect. 4.3.2.3).

The Ethernet flows are mapped SDH side via **GFP-F** into VC-4-nv, VC-3-nv and VC-12-nv VCG's, with or without **LCAS**.

The extensive usage of Ethernet connections across the SDH network requires the transport network to increase functionality to match more and more with the Ethernet L2 needs. The **Layer 2 Aggregation Data card** is designed to cover these needs, as described in the following sections.

Please note that the quality of service, in the scenarios where Data aggregation is performed, is assured, in respect of the transported service level agreement (i.e. CIR, PIR, CBS, PBS).

#### 4.3.2.1 L2 transport

The use of the Ethernet Layer 2 Aggregation card in **OMS3255** permits to optimize the connection between head-end Switch and the SDH node in case of MultiPoint-to-Point applications as described in Sect. 2.6.1 (i.e. **EPL** and **M-EPL** services).

In fact, when a larger number of connections are required per SDH head end node and per core switch or router, using a simple point-to-point transport service across the SDH network, a break point will be reached in network and equipment costs.

At this site a **Layer 2 Aggregation Data card** – presenting these multiple connections, as logical flows over a single physical interface – will become the most cost-effective solution.

#### Ethernet multiplexing into SDH VCGs:

Furthermore the use of the Ethernet Layer 2 Aggregation card in **OMS3255** permits to optimize the SDH bandwidth dedicated to Ethernet transport in case of MultiPoint-to-Point applications as described in Sect. 2.6.2 (i.e. **EVPL** services).

In fact when a number of flows go from a single side to another, the use of a dedicate VCG per Ethernet flow does not cover all possible services that can be present in the transported Ethernet signal.

At both sites of the VCG trail (or just at one side if at the other end the flows are presented as aggregated to a core switch/router) a **Layer 2 Aggregation Data card** allows the multiplexing more Ethernet flows into a single VCG.

Mixed configurations of multiplexed Ethernet access and Ethernet multiplexing into SDH VCG can also be achieved.

#### 4.3.2.2 L2 switching

The use of the Ethernet Layer 2 Aggregation card in **OMS3255** permits to support MultiPoint-to-MultiPoint applications as described in Sect. 2.6.3 (i.e. **EVLAN** services), Increasing the level of service provided by the SDH operator to the Ethernet customer

The **Layer 2 Aggregation Data card** configured for the L2 switching function avoids the need of an external Ethernet switch device.

#### 4.3.2.3 Enhanced Packed Switching capability

The connection, via internal **Data plane**, of advanced Data Switching Tributary cards, permits OMS3255 to provide Enhanced Packet Switching capability. The connection in meshed configuration of 3 Aggregation cards permits to provide a 60G packet switching island inside OMS3255.

#### 4.4 LO-VC Switching Matrixes

On the sixteen Tributary Slots of OMS3255 the following types of LO-VC Switching Matrix, specific for **OMS3255**, can be equipped:

- ❑ **One-Armed (Blind) 40Gb/s LO-VC** Switching matrix.

The above unit may be used in different configurations but not in the 160G one:

- ❑ One-Armed (Blind) 40Gb/s **protected** and **unprotected** configurations.

There are no constraints for allocation on each of the 16 Tributary Slots of **OMS3255 Core Shelf**. This unit cannot be equipped in the peripheral OMS3240 Shelf.

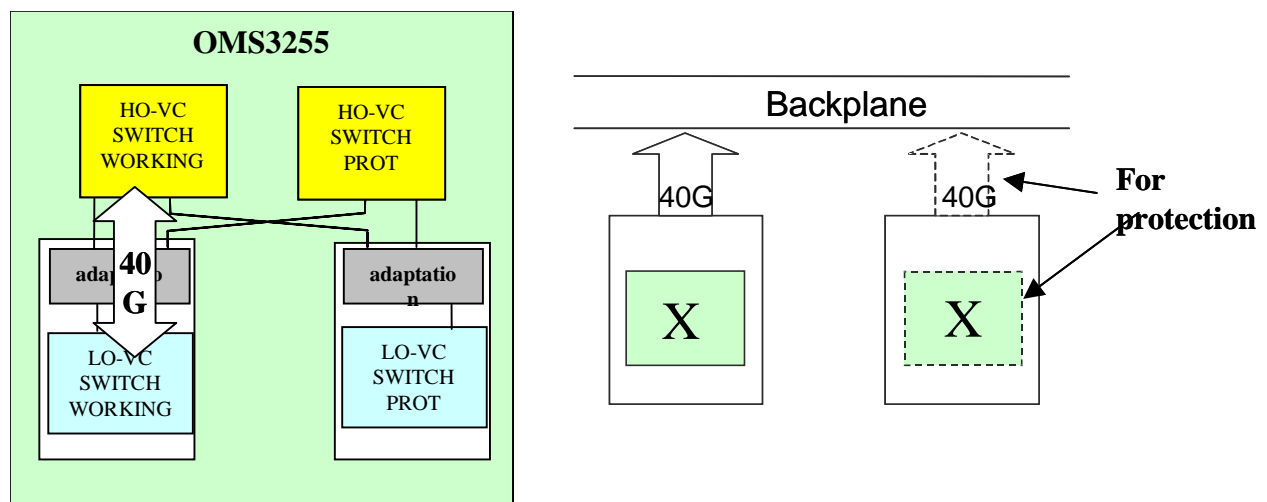


Figure 5 Integrated LO-VC DXC in One Armed 40G protected configuration

Furthermore the system is open to support the following future evolutions:

- ❑ **One-Armed (Blind) 80+Gb/s LO-VC** Switching matrixes;
- ❑ **Front Access 10G+10G LO-VC** Switching matrixes with **hot-pluggable** transceivers (**XFP/SFP**) for the on board STM-n interfaces.

Also in this case it will be possible to use the above units in different configurations:

- ❑ One-Armed (Blind) 80+Gb/s **protected** and **unprotected**;
- ❑ Front Access 10G+10G **protected** and **unprotected**;

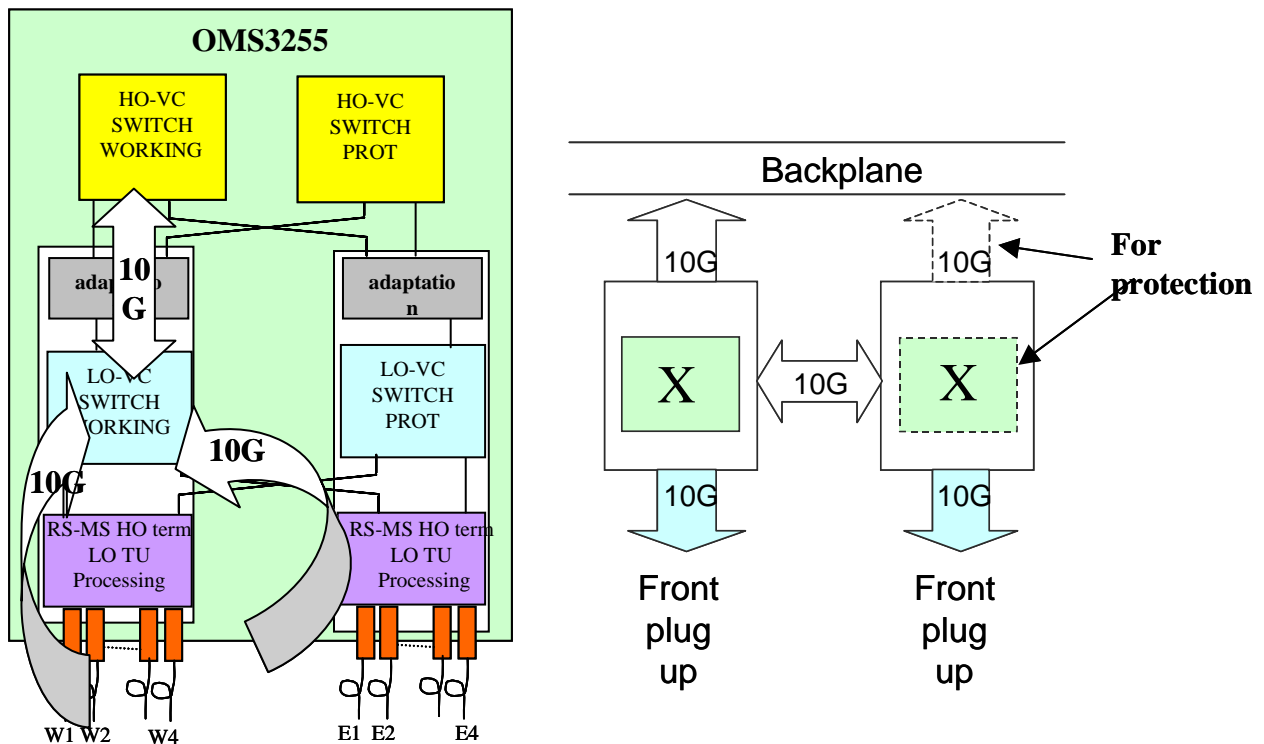


Figure 6 7 Integrated LO-VC DXC in Front Access protected configuration

In addition, the following types of LO-VC Switch Matrixes, already implemented for **OMS32xx** family (i.e. OMS3240, OMS3250 and OMS3260), can be used in the peripheral **OMS3240** Shelf:

- ❑ **One-Armed (Blind) 5 Gb/s LO-VC Switch;**
- ❑ **One-Armed (Blind) 10 Gb/s LO-VC Switch;**
- ❑ **5 G + 5G LO Switch** (with on-board STM-n interfaces).

The allocation of the above matrixes in the 12 Tributary Slots of the peripheral shelf follows the composition rules of **OMS3240** (i.e. the 10G Bandwidth Slots accept all the above matrixes while the 5G Bandwidth Slots can be equipped with the Blind 5G LO-VC Switch).

The above LO-VC Switches are supported by the 160G configuration.

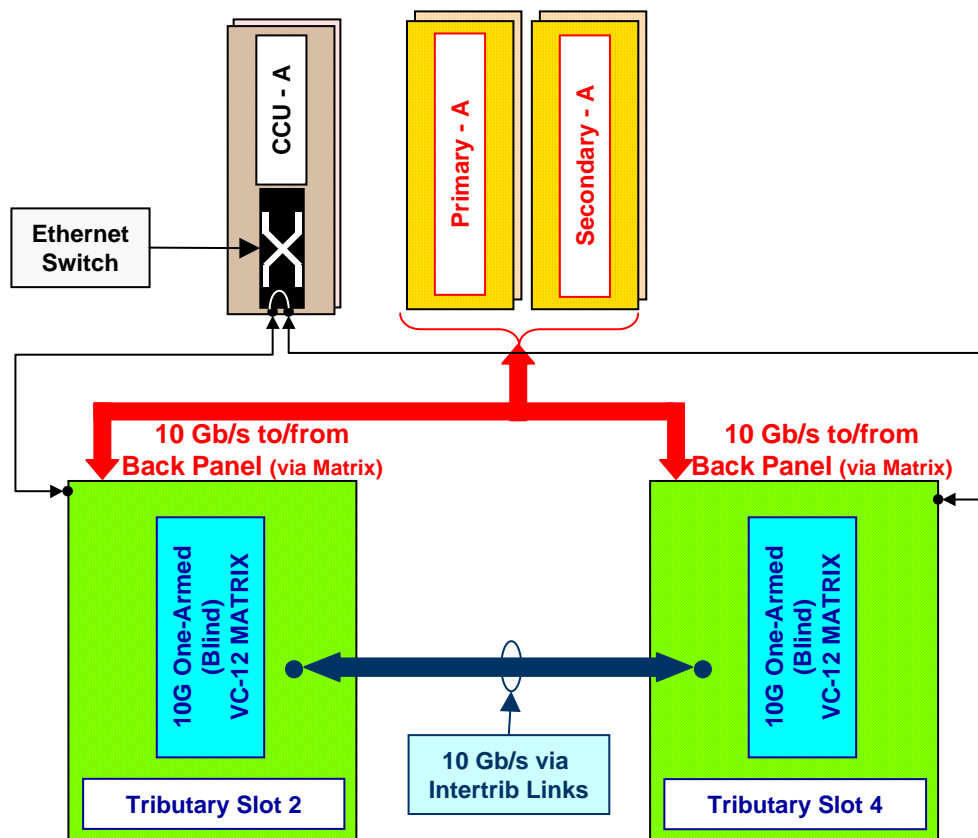


Figure 8 – 20 Gb/s One-Armed (Blind) LO Switch configuration (example)

## 4.5 System Units

### 4.5.1 TDM Switching Unit

The OMS3255 **switching subsystem** is based upon two slices (Primary and Secondary cards), redundant for protection purposes (Side A and Side B).

The OMS3255 switch core is a double technology design and is able to perform the contemporary cross-connection of the following entities:

- VC-4;
- VC-4-nc (n=4,16,64);
- ODUk (k=1,2);
- CBRx (x=2G5, 10G).

The switching subsystem of the 160G configuration supports only the VC-4/VC-4-nc cross-connections.

The switching capacity will result from:

- ❑ **640 Gb/s** as the maximum switching capacity, when **new 40G units** are equipped **over all** sixteen **Tributary Slots of OMS3255**;

- **80 Gb/s** collected **from** an external shelf (typically **OMS3240**) and then exchanged with OMS3255 **via** suitable electrical/optical **transceivers equipped upon the front-panel** of each Switch Card (40 Gb/s on **Primary** and 40 Gb/s on **Secondary** card respectively).

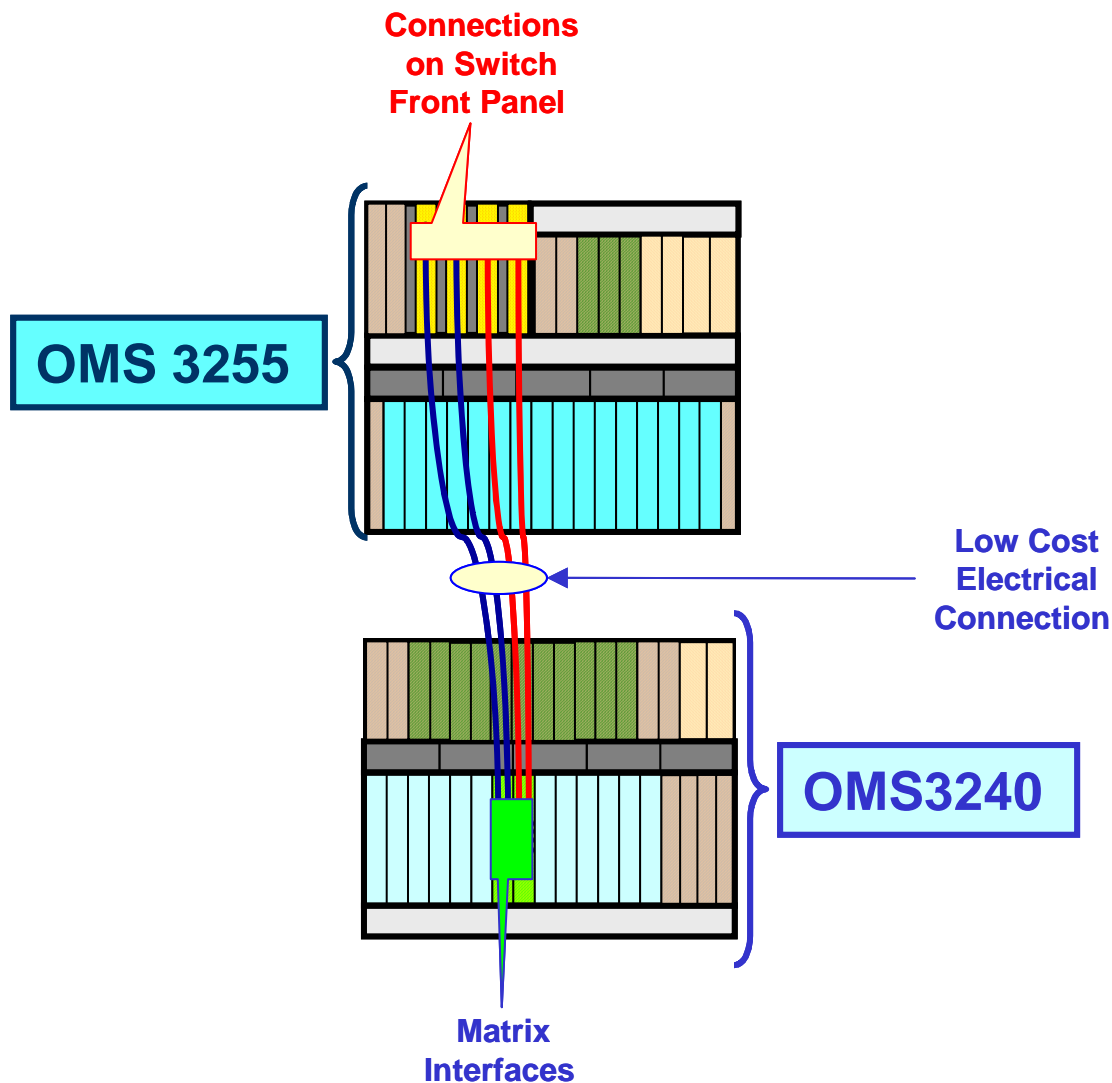


Figure 9 OMS3255 720G Configuration

#### 4.5.2 Synchronization Interface

**OMS3255** supports different synchronization functionality. It offers:

- Two T3 clock inputs according to G.703/G.704
- Two T4 clock outputs according to G.703/G.704

The SETS functionality is located at the TDM switch unit and can clock the system at:

- T1 from two independent STM-N input signals per slots
- T3 from one of the two T3 connectors
- SETG Internal oscillator with  $4.6 \times 10^{-6}$  stability

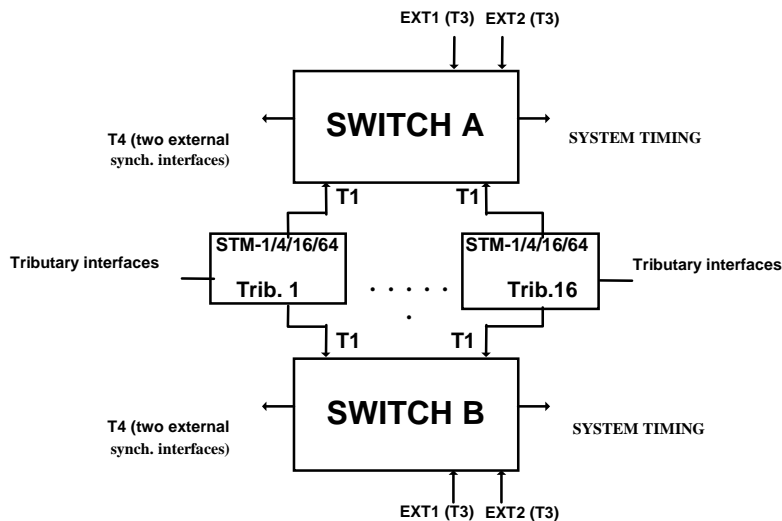


Figure 10 Distributions of Timing Signals

### 4.5.3 Auxiliary Unit

An Auxiliary unit provides operators with configurable access to selected OH bytes of terminated SOH's. Installing the appropriate physical interface unit will accommodate digital port interfaces for customized auxiliary services.

For instance the EOW service allows the audio connection between all the equipment connected by STM-N signals, making use of a standard telephone with DTMF signalling. The EOW channel uses the E1/E2 bytes.

### 4.5.4 COMMS Controller Unit

The Communication and Controller Unit, in a 1+1 protected configuration, provides the complete microprocessor-based management system for **OMS3255**, supporting both Equipment Management Functions and Management Communications Functions.

This unit contains, in its not-volatile memory, the Software executables of the cards on the subrack and all the equipment configuration data.

In addition it supports high level control and provides access to DCC/GCC of the SOH's allowing management traffic to be directly connected to the equipment via an Ethernet interface and transported to other nodes via STM-n/OTM-k traffic interfaces.

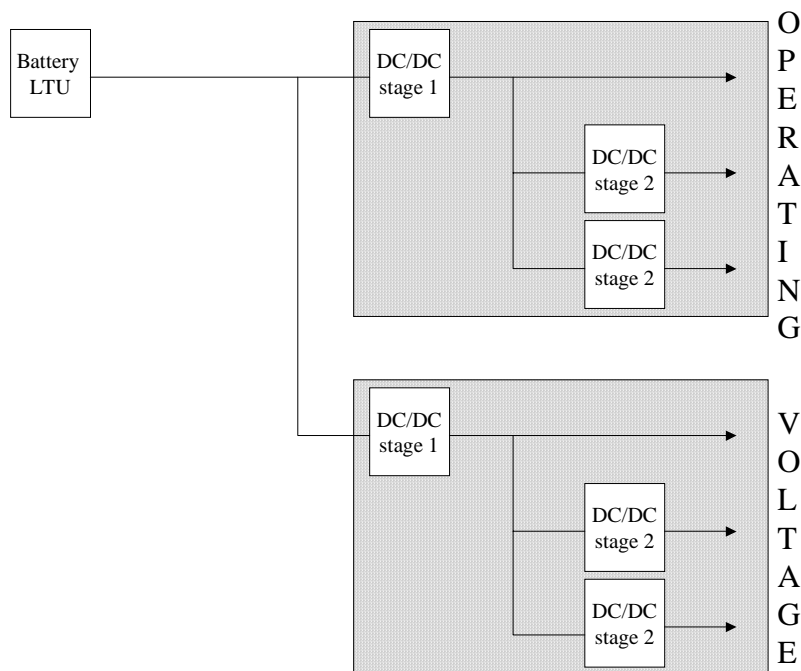
When in the 720G configuration the Control and Communication Units of OMS3255 control also the OMS3240. The Control and Communication Units of OMS3240 became slave of the OMS3255 ones.



## 4.6 External System Interfaces

### 4.6.1 Power Supply Interfaces

The **OMS3255** is powered from a 48/60v power supply, with external interface and filtering located on the Battery LTU.



*Figure 11: Power Supply Distribution*

A single voltage is supplied to all of the cards (and LTU PSU), that generate their required voltages via a two-stage voltage conversion scheme using on-card DC/DC converters. Stage 1 converter incorporates hold-up capacitors and supplies input voltage to the Stage 2 converters that supply operating voltages specific to card requirements.

All of the LTU modules will be powered from a DC/DC located on the LTU PSU. Both the Battery LTU and the LTU PSU can be duplicated for protection.

### 4.6.2 Control and Communication (Management) Interface

A management LTU provides physical connectors for Q interface for NMS access, F interface for Local Terminal access, and extension subrack.

## 5 Protections

The **OMS3255** supports the following protection schemes:

- 1+1 Sub-network Connection Protection (**SNCP**) **both** at **VC-n** and **ODUk** level:
  - ◆ Inherent **SNC/I** according ITU-T G.841;
  - ◆ Non- intrusive **SNC/N** according ITU-T G.841;
- 1:N and 1+1 multiplex section protection (**MSP**), according to ITU-T G.841;
- 2-fibre and 4-fibre **MS Spring**, according to ITU-T G.841.

In addition OMS3255 is open to support enhanced Ethernet protections schemes (e.g. Spanning Tree).

The OMS3255 incorporates a fully distributed, network aware **control plane** to support advanced, dynamic network architectures that require fast network restoration and customer driven routing (i.e. **ASTN**, see the following section).

Furthermore OMS3255 provides the following Equipment protection (EQP) facilities:

- ◆ Duplication of TDM switch core;
- ◆ Duplication of Control and Communication Subsystem;
- ◆ Inherent power supply protection (distributed power supply).

### 5.1 AUTOMATIC SWITCHING TRANSPORT NETWORK with OMS3255

The OMS32xx, including OMS3255, family can be introduced into an existing network where the concept of **ASTN** can be applied to achieve faster trail routing, connection set-up and tear down and fast network restoration.

All those operations that are currently carried out by the traditional Network Management System, with typical execution time in the order of minutes, can be carried out in hundreds of milliseconds via a distributed intelligence.

The ASTN control plane allows faster connection set-up thanks to improved automatic routing algorithms and signaling. Such mechanisms allow faster implementation of on-the-fly restoration mechanisms.

The distributed intelligence enables the first NE to recalculate the path and signal the restoration route throughout the network, thus implementing fast restoration mechanisms with the sharing of restoration resources.

The ASTN functionality is provided in three ways to satisfy the customer needs:

**Centralised routing function, distributed signalling protocol (ASTN-CD)** - A signalling protocol is implemented in the embedded software of the network elements, this will speed up

the path implementation process. The signalling protocol is compatible with the traditional OSI based DCN. For some protection schemes, the network elements will also have the capability to store the alternate route without implementing it prior to failure occurrence. The path computation function will remain centralised.

**Fully distributed implementation (ASTN-DD)** - Fully standard UNI interfaces will be integrated in the network elements, thus avoiding the need of adapter devices. A fully distributed control plane will be available directly in the network elements. This will feature a Link Management Protocol (i.e. LMP) for automatic neighbour discovery, an IP-based Link State Routing Protocol (i.e. OSPF-TE) for automatic topology and resource discovery and a signalling protocol with explicit routing capability (i.e. RSVP-TE). Centralised functions (e.g., client database) will continue to support it.

## 6 Network Management

Integrated network management control is achieved by **ServiceOn Optical** (i.e. **MV36/MV38**) Element and Network Managers via a 'Q' interface. It allows the **OMS3255** to be managed alongside existing Marconi products.

Both management systems provide comprehensive range of fault, status and performance monitoring functions with configurable parameters. Interactive operator control is provided for sub-rack commissioning, traffic connection management, maintenance and diagnostics.

In-field control is provided by an 'F' interface to a PC based Local Craft Terminal (i.e. LCT). Control via **Qecc** (i.e. DCC/GCC from STM-n/OTM-0.k interfaces) and **ASTN** control plane (see the dedicated section) is supported as well.

## 7 Technical Specifications

### 7.1 Mechanical Construction

The Standard shelf is composed of a chassis measuring 950 mm (height) x 490 mm (wide) x 280 mm (deep).

The shelf can be housed in a standard ETSI rack - ETS 300-119-3 (i.e. height 2.2m, width 0.6m and depth 0.3m).

### 7.2 Safety

**OMS3255** is designed to meet European safety standards:

#### ELECTRICAL SAFETY:

- EN 60950
- EN 41003

#### OPTICAL SAFETY:

- ITU-T G.664
- ITU-T G.958
- 

### 7.3 Electrical Environment

OMS3255 conforms to European standards on Electromagnetic Compatibility (EMC):

- ETS 300 386-2 (i.e. Installation Class= "Telecommunication Centre").

### 7.4 Climatic and Mechanical Environment

The climatic environmental criteria for **OMS3255** are based on ETS 300 019 standards with the following classifications:

- |             |  |
|-------------|--|
| • Storage   | Classes 1.2 (i.e. "Not temperature controlled storage locations"); |
| • Transport | Classes 2.3 (i.e. "Public Transportation");                        |
| • Operation | Classes 3.2 (i.e. "Partly temperature controlled locations").      |

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