

New Generation of Enterprise Aggregation Units

1. Background

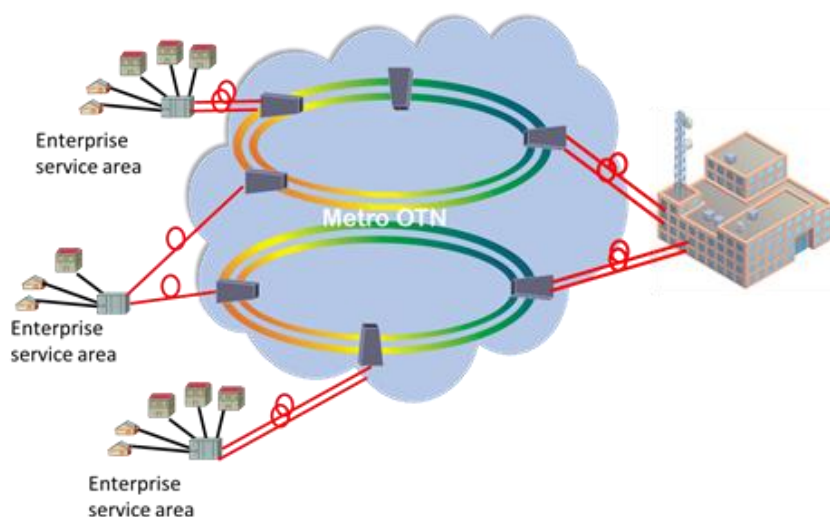
Driven by the rapid growth of the Ethernet economy, enterprise generated traffic is constantly on the growth. The rapid proliferation of digital based customer services drives a soaring demand that needs to be supported by the telecom operators.

To properly support this growing demand, the aging SDH technology that is widely used today needs to be upgraded to modern OTN bearers. New multiservice aggregation boxes are being called for. Such products need not only to support new enterprise high-rate bitstreams, but also to provide backwards compatibility for older generation and lower speed services.

The performance and functional bar for these boxes is high, as they need to support a large variety of services.

Furthermore, this new optical networking equipment needs to be remotely controlled, the physical enclosure comprising its electronics should be small (1U/2U at most), energy consumption should be minimized as much as possible, and above all, the cost of the equipment itself needs to be very low.

In general terms, from a network protection and redundancy perspective, most operators would require two OTU2/OTU1 connections to the network, as depicted in the figure below.

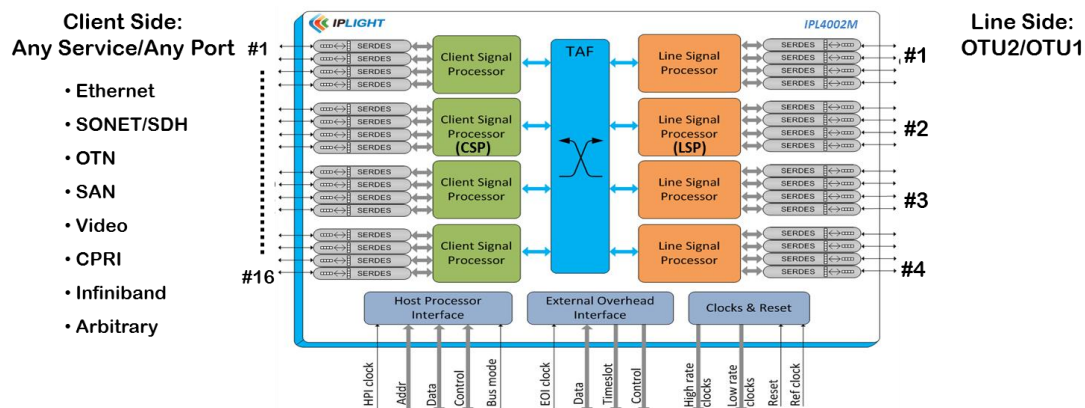


OTN based Access Network architecture

Apodis, IP Light's product family of OTN processors, is the perfect building block for such Enterprise Aggregation Units.

Apodis processors can support up to 16 Client-Side services at multiple bit-rates ranging from 100Mbps up to 10Gbps. On its Line Side, Apodis processors can support up to four OTU2/OTU1 links. Apodis consumes very low power with a small footprint.

2. Apodis Technical Description



Apodis block diagram

Apodis Main Features:

Up to 4x Line Interfaces:

OTU2:

- FEC (Programmable per Line): GFEC, I.4, I.7
- I/O: Serial or parallel SFI4.2

OTU1: (GFEC)

Up to 16x Client Interfaces:

Ethernet: FE, GbE, 10GE (Serial, XAU1)

GbE: Carrier Ethernet OA&M, IEEE 1588 V2 hardware time-stamping

SONET/SDH: STM1/STM4/STM16/STM64 (Serial, SFI4.2) Section, Line termination

OTN:

- OTU0/OTU1/OTU2 (GFEC)
- OTU2 I/O: Serial or parallel SFI4.2

SAN:

- ESCON, FC-100, FC-200, FC-400, FC-800, FC-1200
- FC-1200 I/O: Serial or parallel XAU1

Video: DVB-ASI, 270M/1.5/3G SDI

Infiniband: IB SDR/DDR/QDR

CPRI: Options 1-5, 7, 8

Arbitrary bit-rates: Mapping to ODU0, ODU1, ODU2, ODUflex

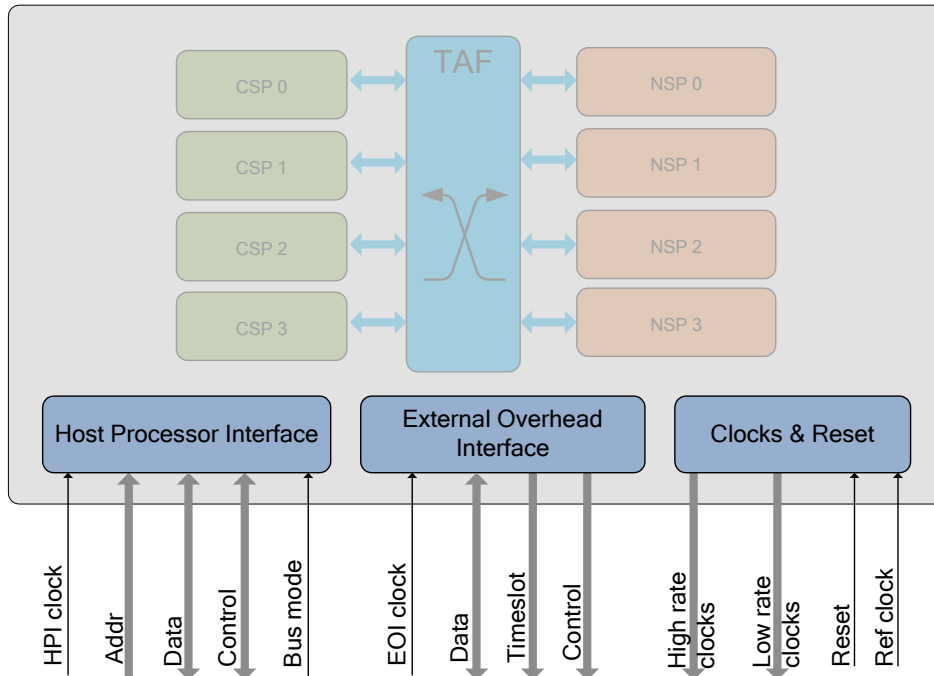
Switching Granularity: ODU0, ODU1, ODU2, ODUflex

Very low power dissipation: (4.5 W @ 2x10 GE to 2xOTU2 with GFEC)

Small Footprint: 31x31 mm

Apodis suite of OA&M capabilities:

Apodis provides a full integrated suite of OA&M (Operations, Administration and Maintenance) capabilities for OTN, SDH and Ethernet, including RMON statistics for 10GE and 1GE services.



Apodis OA&M

For access to remotely controlled optical networking devices, Apodis provides full accessibility to both the SDH DCC (Digital Communications Channel) and the OTN GCC (General Communications Channel) in-band data channels.

Jitter for CPRI-over-OTN Transport:

Apodis can support a wide range of CPRI signals (up to CPRI-7/8).

When transporting CPRI signals, Apodis processors can be configured to meet the stringent CPRI requirements of less than 2 ppb jitter.

This performance is achieved while relying only on Apodis without requiring costly external components.

Consequently, thanks to its integrated support of 1GE/10GE/CPRI signals, along with its superb jitter performance for the transport of CPRI signals, as well as reduced latency, Apodis OTN processors constitute the ideal solution for optical systems intended to support cellular networks' Backhaul/Fronthaul/5G applications.

Latency:

Apodis latency is extremely low. Some typical figures for end to end signal latencies (CPRI-OTN-CPRI) are of less than 12 μ sec and 6 μ sec for CPRI-3 and CPRI-7 signals respectively.

Power Consumption:

Apodis incorporates a sophisticated power management technique that drastically reduces Apodis' power dissipation. The table below shows the power dissipation for several configurations that could be applicable to Enterprise Aggregation units.

Application	Configuration	Power Dissipation (Typical)
10G Muxponder	4xSTM16 to 1xOTU2 Line EFEC I.4	5.3W
10G Muxponder	3xCPRI-3 + 1xGbE to OTU2 Line GFEC	4.85W
20G Muxponder	8x(STM1/4/16/64 or FE/GbE/10GE) to 2xOTU2 Lines GFEC	9.3W
20G ADM	16xGbE to 2xOTU2 Lines with EFEC I.4	6.4W
20G Transponder	1x10GE to 2xOTU2 Lines GFEC	4W
20G Transponder	2x10GE to 2xOTU2 Lines GFEC	4.5W
40G Muxponder	16xSTM16 to 4xOTU2 Lines GFEC	10.9W
40G Transponder	4x10GE to 4xOTU2 Lines with UFEC I.7	6.6W

Power dissipation

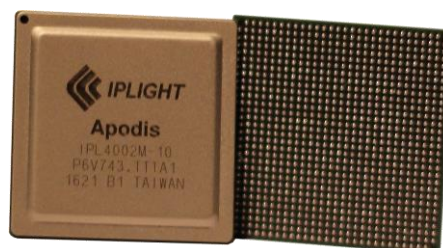
Capacity and functionality:

Apodis comes in five flavors of capacity and functionality. The table below shows the various types of products, each optimized to its relevant applications.

	Capacity	Client Ports	Client Signals		Line Ports	
			100M-8G Signals			10G Signals
			STM1/OC3 STM4/OC12 STM16/OC48 OTU0/1 FE, GbE ESCON, FC-100/200/400/800	DVB-ASI 270M SDI 1.5/3G SDI IB SDR/DDR CPRI 1-5 Arbitrary		10GE FC-1200 IB QDR CPRI 7,7A,8 STM64/OC192 OTU2 Arbitrary
IPL4002M	40G	16	v	v	4x(OTU2/OTU1)	
IPL4102M	20G	16			4xOTU1 or 2xOTU2	
IPL4202M	10G	8			4xOTU1 or 1xOTU2	
IPL4302F	40G	4		v	4xOTU2	
IPL4402F	20G	2			2xOTU2	

Apodis family of products

All Apodis versions come in the same package, 31mm X 31mm, 896 pins FCBGA, 1 mm pitch.



Apodis package