



Network Modernization SDH bye-bye

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Network Modernization: SDH bye-bye

The solution to legacy SDH burden is to remove SDH from the equation

The SDH network in an operator infrastructure accounts for a big slice of the spending voice in operational cost.

- Many PDH/SDH equipment has long surpassed their end of life date
- Maintenance, sourcing spares and repair are ever growing costs
- Management is also complex, as many nodes are unmanaged or unreachable
- On site equipment configuration and item inventory mismatched vs database
- Recurrent on-site visits required

Looking forward, these costs will keep on growing as connectivity issues, difficulty to recover spare parts and engineering efforts to fix outages start to occur more often.

Further indirect costs negatively impacting the business cases also need to be considered including:

- Voracious energy consumption
- Space consumption. First generation equipment can easily take over tens of RU space, and quickly fill up rooms of space
- Use of multiple fibres due to low utilization fibre/capacity

Often embedding the SDH matrix in a muxponder or other multiservice equipment is promoted as a viable solution. This results in the removal of an old equipment for a newer one, although based on the same SDH technology. This temporary solution solves the aging of the installed base but pushes operators in continuing investing in SDH technology, therefore not solving the SDH issue but shifting it further down the line. This solution retains the operational complexity of a layered network and service nesting.

The complete decommissioning of the SDH layer is the only solution that guarantees the removal of legacy SDH equipment and all related complexity and costs. However the new technology must guarantee some fundamental needs:

- No impact to customer service SLA
- No impact to customer CPE
- Option to support new TDM services if needed
- Optimal bandwidth use, no capacity wastes
- Limited operational impact
- Step-by-step migration

Customer SLA insurance is a priority, as any service disruption generates direct revenue impact. Many of these E1 services are regulated and represent long lease services,

generating constant revenue stream for the operator. Any solution that cannot guarantee continuity, deterministic performance and or may even require customer site intervention with little to no advantage to the customer would be difficult to justify and adopt.

Several SDH migration solutions have been proposed in the past years but none of them satisfied all the “must have” needs. This was especially true with circuit emulation technology when used for massive E1 replacement. Both the capex costs, heavy operational impact and the under optimized mapping solution, (e.g. where several Mb worth of E1 is transported over Gb pipes results in a massive bandwidth wastage), prevented the solution to scale when addressing nationwide network with hundreds of thousands E1 services.

Modernizing the Access Network

Smartly and efficiently addressing the modernization of SDH at the access would completely remove the need of further adaptation elsewhere in the network. A solution that offers an efficient bandwidth usage while addressing low speed PDH traffic and underutilized STM-1/4 streams would allow to solve the scalability issue maximizing the network utilization, while decommission the SDH layer from the infrastructure.

The micro-OTN[®] solution

The micro-OTN[®] based solution maps E1 and VC12 in an OTN container dedicated to low speed services. This container is then multiplexed according to the OTN hierarchy offering

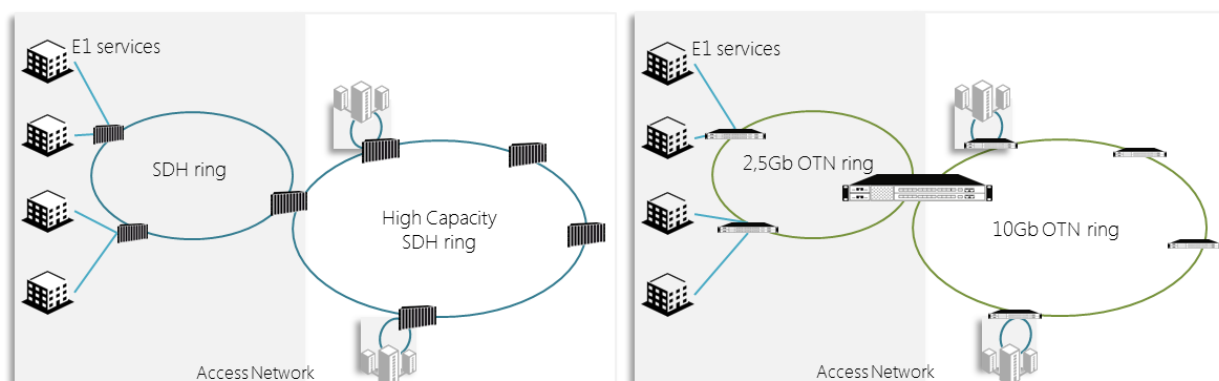
- 100% efficiency in bandwidth utilization
- It removes the need of PDH/SDH equipment
- Remove technology nesting, and multiservice path set-up
- Pushes cost effective OTN in the access ready to support any high capacity data service
- Transform STM-1/4 access rings in ODU1/2 with a tenfold capacity boost
- Offers the most performing low latency solution for 5G or critical service delivery

The OTN deterministic transport nature maintains the E1 and SDH services SLA unchanged, it also maintains unvaried the synchronization distribution over E1, from which many sites are still depending on.

Replace Legacy SDH with LM-1 micro OTN

In a scenario where an SDH access ring (STM-1/4) collects several E1 at each site, this ring can be easily migrated to OTN, boosting access capacity as well as opening the possibility to offer over that same fibre a variety of other data service, transported efficiently and transparently over the OTN frame. The LM-1 micro OTN, a 1RU fully redundant unit, offers 126 E1 connectivity with direct OTN mapping over a micro OTN container named ODUe. Up to 504 ODUe can be multiplexed in an single ODU0. Furthermore in those cases where

the access sites already supports multiservice technology, direct OTN mapping and multiplexing of 100M FE and or VC4/STM-1 or VC4 is also supported.



The E1 connectivity at customer premises are preserved with no CPE or service impact as the E1 services maintain their deterministic performances insuring the existing SLA remain unchanged. The E1 are no longer mapped into an SDH hierarchy, but multiplexed into OTN directly.

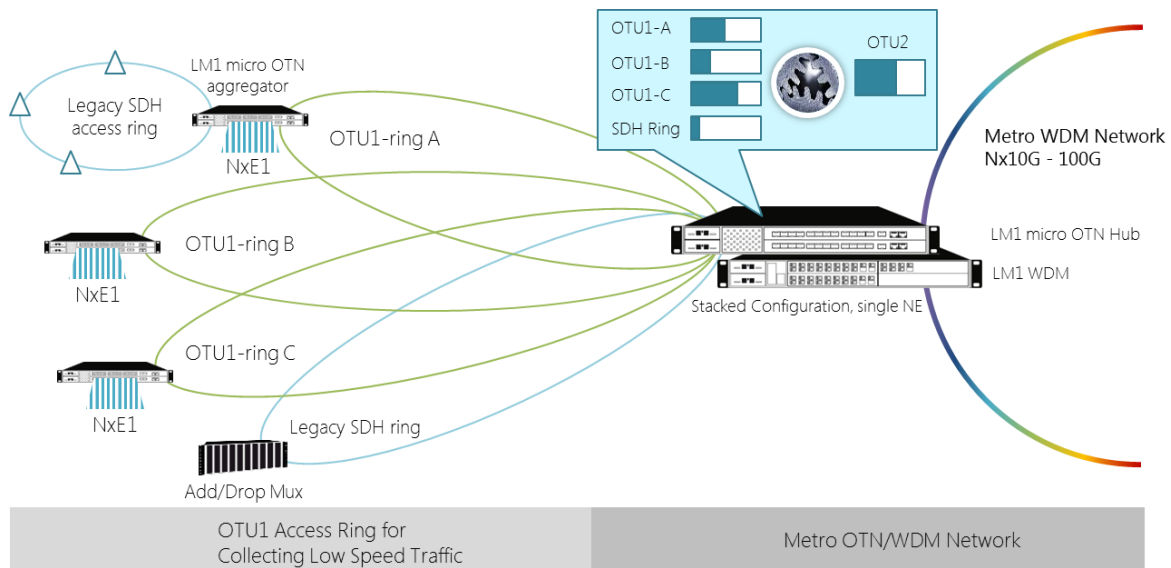
The ring now migrated to OTN is boosted in capacity and the network is now capable of offering new high bandwidth demand and low latency service. In case of overlaid technology layer (e.g. a packet layer) this can be also transported over the new access OTN network according to the OTN hierarchy, flattening the infrastructure and simplifying the operations and service set up, further cutting costs while improving network performances and bandwidth utilization. This may result in further freeing up of fibre pairs.

A ring-by-ring replacement strategy

A strong value of this technology is to address the network modernization with a ring-by-ring strategy. This brings several advantages all aiming at maximizing operational simplicity, limiting intervention time and operational costs:

- Addressing the most critical ring first, either for obsolescence of equipment or for need of delivery new services
- Reducing to a minimum the number of field engineers required
- The site intervention is localized, with no changes to the “customer connector” as service is not effected, guaranteeing service continuity
- Immediate opportunity to deliver new services of any type

The LM-1 micro OTN is also capable to interwork with existing SDH ring acting as a bridge between newly modernized OTN rings and rings yet to be addressed still running SDH.



The LM-1 micro OTN product line

The LM-1 portfolio has been conceived with a block functional architecture. Each unit can be stacked on top of another forming a single network element. This flexibility allows to address a multitude of sites with different needs, with a set of common building blocks. The same concept is applied to the whole Lightmode portfolio offering an even higher flexibility.

The LM-1 micro OTN, a single 1RU unit fully protected with integrated optics, is available in two variants:

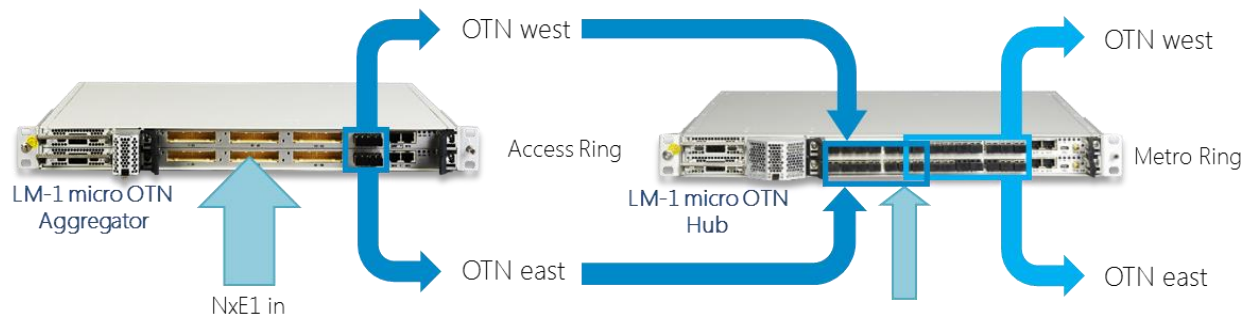
1. Aggregator

- 126xE1 client interfaces
- 2xSTM-1/4/16 client interfaces
- 2xOTU1 line interfaces
- Matrix switching at micro-OTN level

2. Hub

- 10xSTM-1/4/16 or FE/GbE or OTU1 client interfaces
- 2xSTM-1/4/16 client interfaces
- 2xOTU2 line interfaces
- Matrix switching at micro-OTN level

The two variants can be mixed and matched according to the needs of the network and the type of services required at each site.



Conclusion

Network modernization is an investment resulting in a twofold solution:

- 1) Complete decommissioning of SDH, removing this layer to achieve
 - Flattening of the infrastructure
 - Massive Opex cost reduction
 - Simplification of network and service set up
- 2) 5G & new services enablement
 - Converging over OTN from core to access, right to the CPE
 - Maximizing network utilization and capacity/cost/fibre
 - Best latency performances
 - Any service type enablement

A micro OTN[®] based solution achieve this result, offering in a single network intervention, and with a limited investment the complete modernization of the transport infrastructure.

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