

Network Modernization Whitepaper

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Network Modernization Drivers

Operators continuously aim to include in their offering new services to drive fresh revenue streams. Most times these new services require a new supporting infrastructure, improved not only in terms of increased capacity but also in terms of extended flexibility for example in case they needed to address low latency requirements. Among these new services there is video content distribution: an operator may wish to introduce distributed caching close to the access points to speed up the content delivery while minimizing the waste of bandwidth in the metro/core network that would be otherwise used to transport the same content over and over again. Undeniably all these new services drive the need for higher and higher bandwidth.

Although network modernization is a topic that has been talked about for several years, it has reached maturity only now, and it is becoming one of operators' top interests, driven by costs of the network, technology and above all the need to generate new revenues streams.

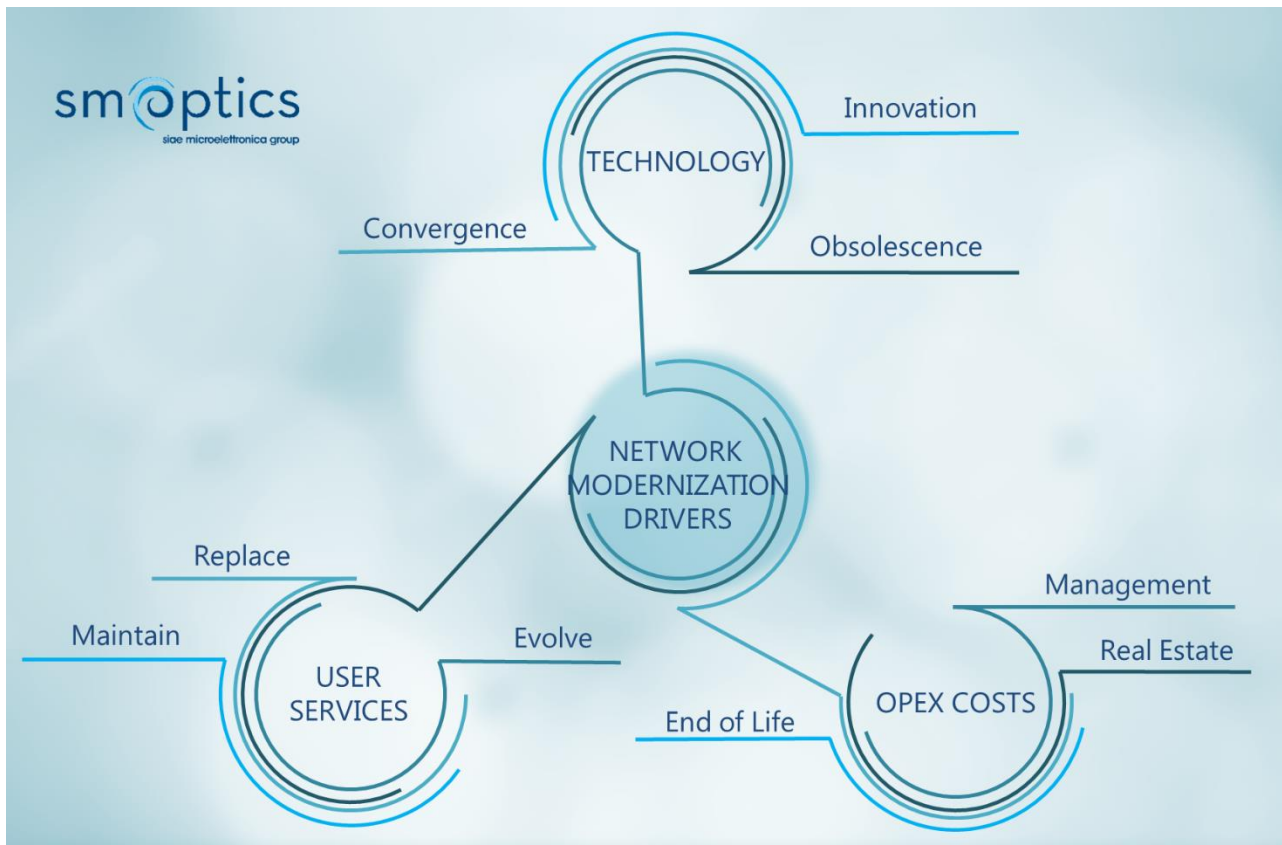


Figure 1: NETWORK TRANSFORMATION DRIVERS

The focus of migrating legacy services from TDM to IP or Ethernet for technology sake wasn't as strong as an argument as it is the enablement of new services. Today these are already driving new revenue streams although they run over un-optimized transport infrastructure. *Video, Cloud Services, Distributed Caching, Ultra-low Latency Services, Massive Capacity Delivery* are just some examples of these new services demanding a more cohesive, convergent and performing network, from access to core.

In the modernization of legacy networks there are several aspects to be considered that can be grouped into three major drivers:

USER SERVICES: legacy services are not all done for. While some have evolved and became IP services, others are still active and driving revenues. Service Level Agreements (SLAs) are well established and have been in place for years unchanged. Any network migration plan should aim to keep those Service Level Agreements unchanged.

TECHNOLOGY: introduction of IP and Ethernet enabled a new variety of services and kick started a natural migration of some legacy services towards IP/Ethernet platforms. Nevertheless due to the quantity, nature of services, and time spent in operations, large-scale migration of TDM services proved to be impractical and unsustainable on a cost model base, probably also due to a lack of specific software tools.

OPEX COSTS: with legacy equipment approaching end of operational life, comes an exponential growth of associated costs of operational and maintenance activities worsening the business case of service profitability, specifically:

- Legacy equipment have a lower port density, resulting in larger footprint, greater physical space occupied, and associated floor management expenses (worst port number per m2)
- Low power efficiency, multiplied by a large number of equipment results in high energy costs and high Co2 emissions (worst cost per bit).
- Difficulties in sourcing spare parts and in repairing faulty cards raise equipment maintenance costs, and extended turnaround time.
- Cannibalization for spare parts of infield equipment makes it hard or impossible to trace real equipment configurations.

Opex cost minimization is a key step to ensure sustainable business.

These goals cannot be reached without having a deep understanding of current network architecture and all associated issues arising when implementing new strategies, such as:

- Unused cabling: Legacy SDH came with big patch panels and a large amount of cabling. Many of those cables are now inactive as some services have been migrated, reduced or even dismissed.
- SDH E2E service mapping: tracing where each service physically flows, through each equipment, is a difficult task that can only be performed by network inventory and network management systems that unfortunately are not always aligned. This drives for infield activities for data harmonization.
- New equipment deployment, integration and management has an associated cost that need to be considered. Maintaining current network practice can be a value as well as identification of new technologies able to replace legacy ones without disrupting active services.

Addressing Changes in the Network

Many operators have a difficult time introducing innovation in their network because they face a complex infrastructure which is the result of decades of technological overlaying, a vast variety of equipment type with different ages and sometimes even a mix of traffic flow rules.

With such an articulated scenario it is fundamental to first consolidate the existing infrastructure and create a solid building ground for a new architectural model.

Two steps can be put in place (in form of services) to achieve building this foundation:

Revitalization and **Modernization**.

Revitalization

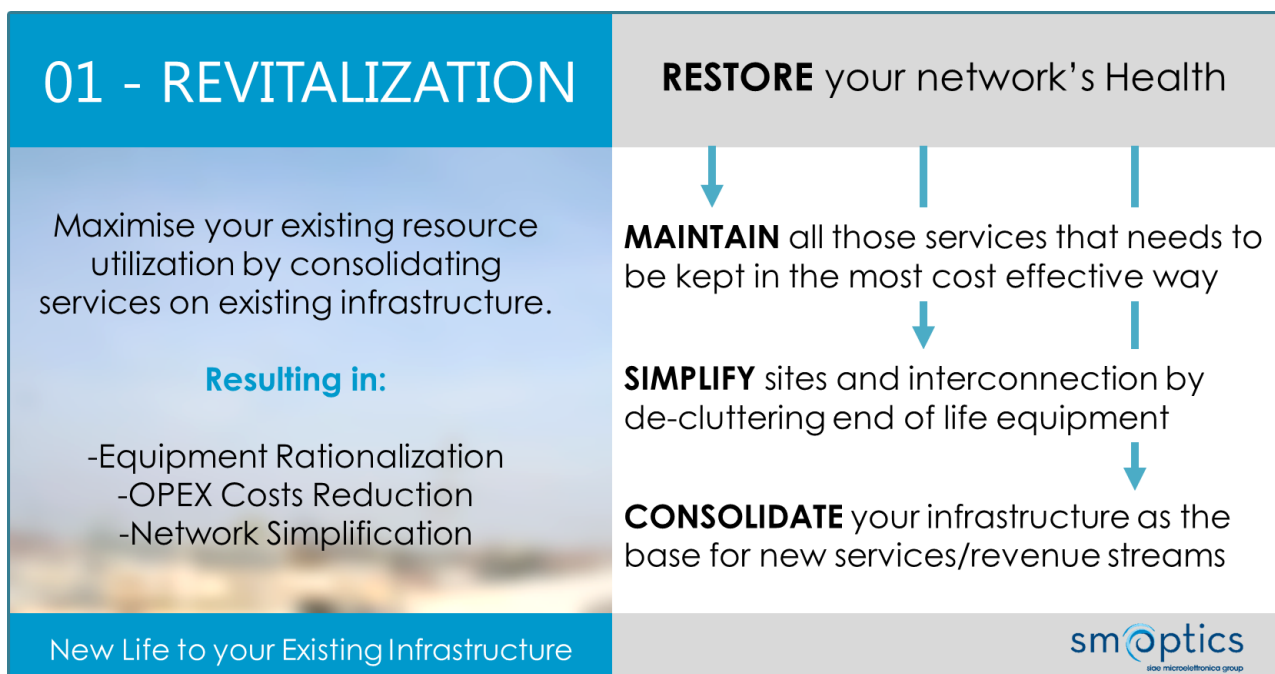


Figure 2 Revitalization

REVITALIZATION service aims to extend the life of the existing infrastructure by rationalizing existing deployed equipment while maximizing the current network utilization in term of bandwidth and equipment capabilities.

A network may have a layer of first generation TDM cross-connects extended in subsequent years with multiservice nodes aimed to both boost capacity, connectivity and introduce multiservice capabilities for broadband data services like Ethernet connectivity. It is likely that a part of TDM services running on first generation network may have been decommissioned or migrated. Nevertheless the remaining ones need to be maintained.

Revitalization service aims to decommission the first generation network, now with over 10 years of life, remapping the remaining services over the existing multiservice platform. This migration allows operators to:

- Rationalize number of equipment in the network
- Remove end-of life equipment
- Maximize already existing equipment potentials
- Reduce to a minimum CAPEX expenditure
- Drastically reduce OPEX costs of maintenance and repair
- Fully liaise on existing field engineers skill set
- Fully maintain the existing TDM services natively

Resulting in a leaner and compact network, easier to manage and to maintain.

An important topic in this context is to understand how the migration can be done minimizing traffic impacts while maximizing migration speed.

Modernization

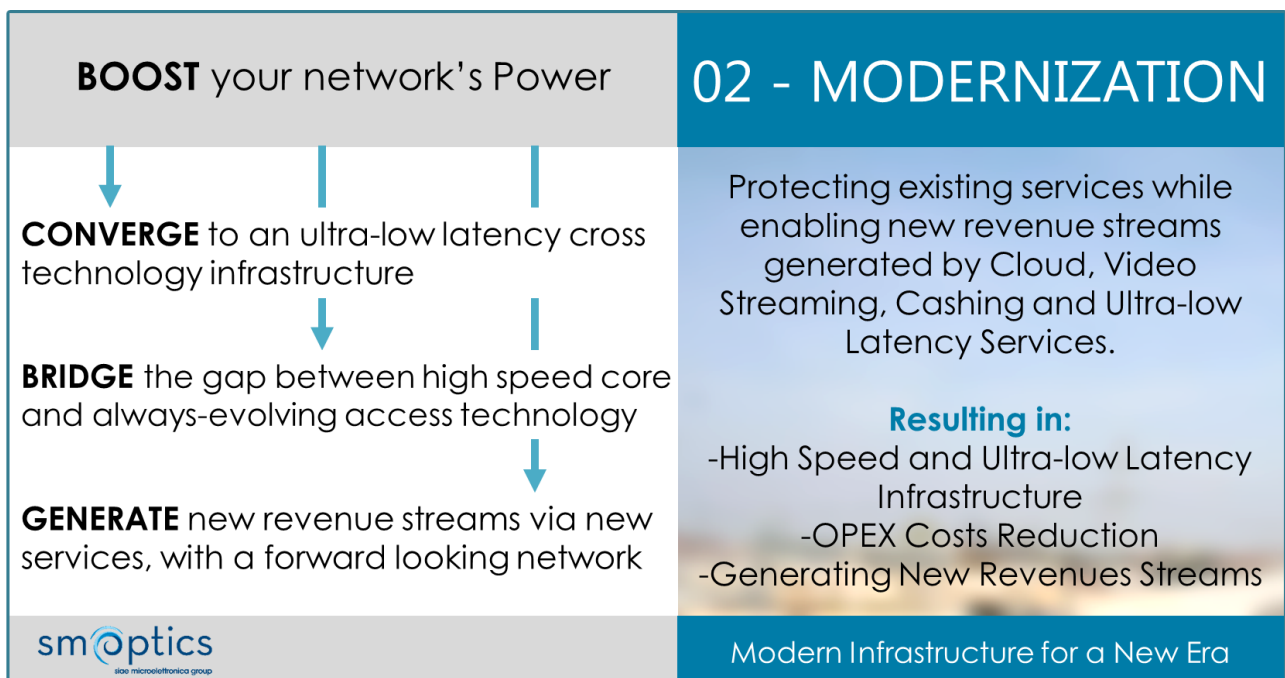


Figure 3 Modernization

MODERNIZATION service aims to update existing network infrastructure and introduce new technologies improving performances in terms of capacity and service capabilities.

Improving network performance cannot be achieved solely by adding more bandwidth; an ever increasing number of application and services have new rising needs such as the previously mentioned requirement of a low latency infrastructure or higher reliability "always on".

Flexibility in configuration and increased interaction with others network layers are key factors defining modern optical network able to deliver multiservice traffic type in a cost effective manner.

In this context, Software Defined Network (SDN) offers a way to exploit the optical network by making resources available to upper management layers. Applications at this level leveraging on the infrastructure flexibility, can consequently optimize new services allocation in response to ever-

changing service specific needs (e.g. services requiring minimum latency can be assigned specific end-to-end paths to minimize the number of electrical/optical conversions across the network)

The transport network engineering team faces the need to develop a migration strategy toward a convergent high speed transport layer matching expectations in terms of bandwidth, latency and flexibility. Such migration would allow operators to:

- Modernize the network infrastructure and architecture
- Ensure a harmonized operational model
- Drastically reduce OPEX costs of maintenance and repair
- Enable new revenue streams

Thus resulting in a forward looking network infrastructure.

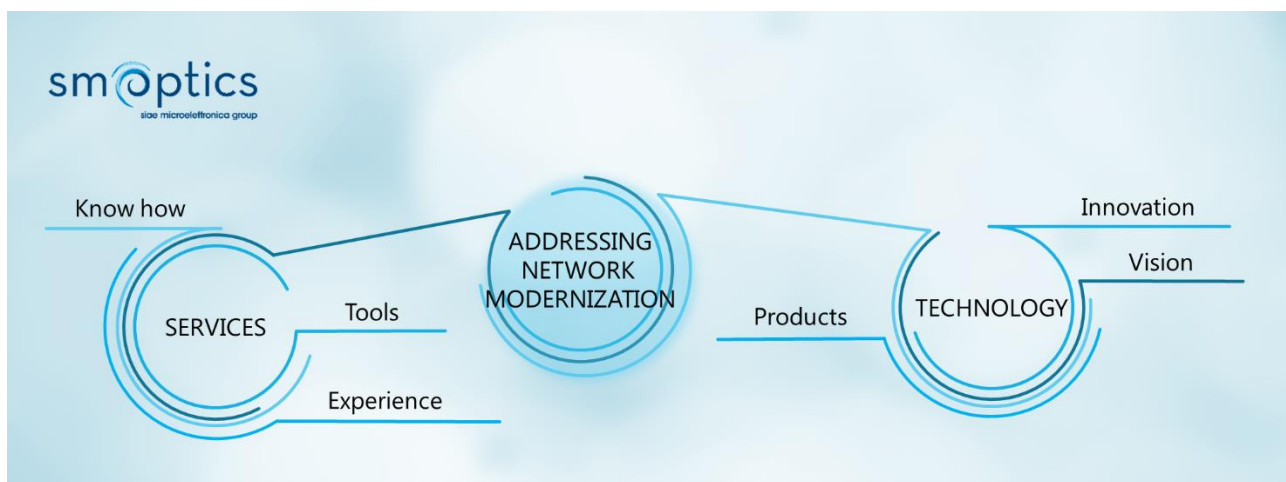


Figure 4 ADDRESSING NETWORK TRANSFORMATION

Today the need for modernization of transport networks is widely recognized by the telecom industry and several components are essential to successfully carry it out. For the scope of such project and its innate complexity, operators recognized that the skills involved go beyond those of traditional network design and deployment.

SERVICES: to deliver articulated modernization projects, a comprehensive set of skills are involved. It is vital a deep knowledge of legacy SDH/SONET networks and technology as circuit creation, circuit mapping and migration planning all require the understanding of where the service starts, where it flows and where it gets terminated. Equally relevant are the experience and know-how in network design and software integration as a solid set of software tools is a “must have” to accomplish traffic migration, path optimization and to carry out network modernization in a timely and effective manner.

TECHNOLOGY: The use of technology in an innovative way results in offering fully reliable solutions, completely compatible with the existing network with the added benefit of a future looking flexibility to revitalize the network extending its life cycle. An innovative approach for mapping legacy traffic onto optical networks allows to keep existing revenue flows and to exploit investments in next generation access network at the same time. New technology delivers flexibility, increases capacity and reduces latency in access and metro networks thanks to an optimized traffic aggregation architecture for access and metro rings.

New equipment are power efficient, compact with better footprint, lower rack space usage and SDN based, fulfilling the promise of end-to-end service creation and provisioning in a transport technology agnostic multi-platform environment.

SM-Optics Solution

Thanks to an R&D with long lasting experience in SDH/SONET products and network design, as well as packet transport innovation, SM-Optics sports one of the most solid know-how in multiservice in the industry. Revitalization and Modernization services are today one of the main offering of SM Optics as R&D-services power house.

On top of this strong and industry recognized know-how, SM-Optics has developed a software platform introducing a level of automation to the process that not only speeds up the analysis of the current network, but also allows for multiple iteration of new service design (based on customer specific KPIs and restrictions) and fast re-provisioning of services over the new network infrastructure, minimizing traffic impact during the migration.

This allows SM-Optics to provide the following services:

- Redefinition of network architecture and key sites architecture design.
- Equipment migration.
- Fast network re-provisioning over the new infrastructure.

SM-Optics expertise in design of optical transport networks created a new class of OTN equipment able to transport and switch services at E1 level. The platforms are natively SDN based and their interoperability has already been tested and certified by international organizations and working groups [ONF/OIF].

Furthermore the requirement of gradually migrate toward a modern networks translates into a gateway function able to keep unchanged a part of the network while migrating a different portion to the new technology.

E1 transformation solution, specifically, allows operators to dismiss SDH legacy network while maintaining existing E1 services directly mapped onto OTN, ensuring a smooth and gradual migration. Such a solution delivers the benefits of managing a single access network layer based on modern OTN/WDM supporting a variety of services while reducing related OPEX. This also allows the re-dimensioning of the network management infrastructure dedicated to the legacy networks focusing only to new SDN paradigm. SM-Optics solution extends to the access and metro networks the benefits of DWDM technology in increasing bandwidth, reducing latency and provides flexibility in service creation and configuration.

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