AimValley

Smart SFP
Application Brief

Introduction

Just over 10 years ago, OE Solutions and AimValley jointly conceived the Smart SFP idea and started to build a comprehensive and feature-rich Smart SFP portfolio. The idea was built upon the strengths of both companies, by joining transceiver technology with systems and network technology.
A match made in technology heaven!

It all started with a Link OAM device, swiftly followed by its feature-rich brother, a service OAM SFP. Thousands were sold to all major NEMs worldwide, ensuring the high reliability of telecom networks. Currently, these OAM devices are part of our service assurance Smart SFP range.

Today, we have built an extensive portfolio of Smart SFPs that provide you with a quick & easy solution for your network transformation. Whether you are looking to transport your PDH or SONET/SDH signals over an Ethernet network or want to extend the lifecycle of your legacy interfaces, just simply insert our Smart SFP in a GbE port, and you build your plug & play packet solution

Smart SFPs are deployed in networks for major 5G mobile operators, and communications service providers, as well as mission-critical networks for Utility, Transport, Oil & Gas, Government, and Energy.

> *"If you can imagine it – we likely have a solution for it – or we can build one for you!"*
> *Louis Stoer – AimValley's Smart SFP Authority*

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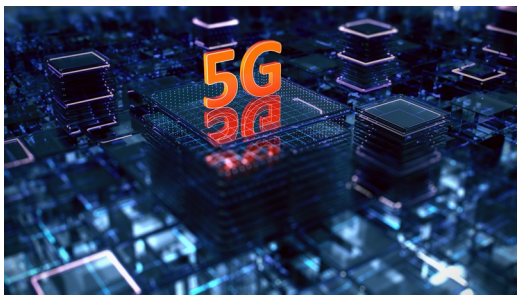
Smart SFP Applications

- 5G mobile fronthaul networks
- Fixed-line networks
- Packet-based microwave radio for 5G mobile fronthaul networks
- Mission-critical networks



1. 5G mobile fronthaul networks

With the introduction of 5G mobile networks, the network operators need to redesign and optimize their networks to support 5G as well as any of the earlier mobile standards (2G, 3G, 4G).
Older generations are sometimes decommissioned, spectrum is re-framed in favor of 5G, and networks are changed from TDM and SONET/SDH technologies to packet-based networks, such as Ethernet and IP/MPLS.

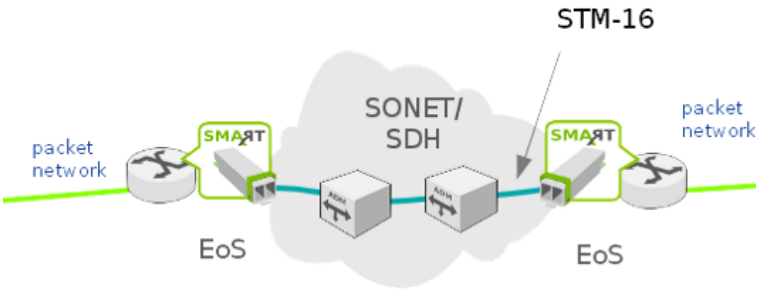
In many cases, the new 5G mobile cell site routers still need to provide a few E1/T1 or T3 interfaces. Smart SFP is used in this 5G mobile application at the cell site/base station.

At the aggregation site, a channelized point-to-multi-point Smart SFP aggregates the TDM traffic from remote (cell site) Smart SFPs and concentrates it to a high rate TDM SONET/SDH network interface.

2. Fixed-line networks

Access networks are upgraded to higher speeds (10/100G). At metro and core layers of the network, speeds go up to 400/800G if not Tb/s. While 1/10G Client Interfaces on the network edge and access equipment are common practice, the operator still needs to support the so-called TDM “Legacy” services from 1.5 Mb/s up to 2.5 Gb/s.

As with 5G mobile, there is a shift from TDM and SONET/SDH technologies to Ethernet and IP/MPLS. Smart SFP is both used at the network edge/access as well as higher up in the network for aggregation. These TDM/Legacy services are typically leased lines, telemetry, IoT, and government/military contracts applications that cannot be migrated to other technologies.



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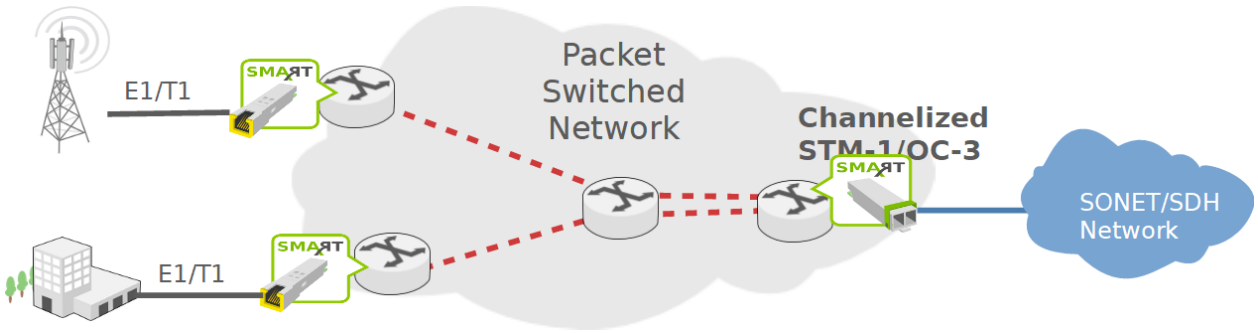
3. Packet-based microwave radio for 5G mobile fronthaul networks

Like other network technologies microwave radio transitioned from TDM/PDH SONET/SDH to packet-based Ethernet or IP/MPLS Networks. While the new 5G base stations are based on packet-based eCPRI, often the cell site needs to support 5G, as well as the older 2/3/4G mobile standards. Therefore, the new microwave radio needs to support both Ethernet, IP/MPLS, and E1/T1, T3, or OC-3/STM-1.

Smart SFPs are used on packet-based microwave radios providing mobile fronthaul services to the 5G cell site. The TDM signals from the 5G cell site are picked up with Smart SFPs and transmitted to a central site where the TDM signals are aggregated into a bigger pipe for hand-off to the mobile core switching network.

A frequently used geographical network topology in these microwave fronthaul networks is a (folded) ring or a linear chain, connecting all the Cell Sites to the core network. In legacy networks SONET/SDH Add/Drop technology was used to Add/Drop a fractional (partially used) 155 Mb/s OC-3/STM-1 signal at the cell tower. The 155 Mb/s was carrying several E1/T1s for the base band units.

This Network topology is supported by the Channelized point-to-multi point Smart SFPs.
At every 5G cell site a Smart SFP, equipped in the microwave radio, Add/Drops a fractionally used OC-3/STM-1. At a central site, a Smart SFP aggregates all the fractional bundles and concentrates them in a fully utilized OC-3/STM-1.



With the Smart SFP circuit emulation technology and the underlying IP/MPLS network it offers a flexible distributed E1/T1 cross-connect and Add/Drop network distributed in the packet layer.

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4. Mission-critical networks

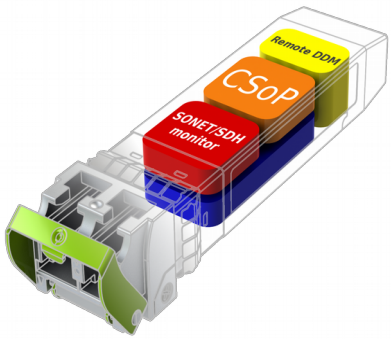
Besides mobile network operators and communication service providers, many other verticals deploy (telecommunication) networks for their mission-critical applications or services. Telecom is not their core business but they depend on it to be extremely reliable for their operations and delivery of their actual core service.

The mission-critical applications can be found in many market verticals, such as Utilities, Oil & Gas, Energy, Transport, Military, Government, and many more. Traditionally, the vertical mission-critical market for telecom/networking solutions is not an early adopter of new technology.
However, slow and steady, this market is also moving toward IP/MPLS-based networks.

The same rationale regarding applications and equipment types used applies to this market as for the Telcos. The various AimValley Smart SFP solutions help the verticals to make the evolution to IP/MPLS.

A proud customer anecdote – *"Who said Telco is always first?"*
Our 1st Smart SFP project some 10 years ago, was not for a Telco.
It was for a mission-critical vertical – a large Power Utility.

This customer upgraded their network from SONET to IP/MPLS microwave radio. Their network, a state-of-the-art, newest microwave, and IP/MPLS technology, needed a solution to tunnel OC-3 over this network. The customer network consists of several hundreds of microwave radio links, interconnecting various power generation plants, substations, switching, and distribution stations.
The AimValley 155 Mb/s SONET/SDH Clear Channel Smart SFP did and still does this mission-critical job.



Unique Technologies

Some years ago, Merchant Silicon Circuit Emulation chips became End Of Life. This demanded many equipment manufacturers to re-think their strategy to address their end-customer needs. As card-based solutions became difficult to design, since there were no chips on the market, more and more customers adopted the Smart SFP solutions to address their end customer TDM SONET/SDH needs.

Lately, also LIU chips became End Of Life. Making it even a bigger challenge to build card based solutions. LIU (Line Interface Unit) chips translate a Digital signal to an Analog signal (and vice versa) for transmission over copper lines (E1, T1, and T3)
AimValley developed its own AimValley Analog Front End (AAFE) and Framer technology to be used inside the Smart SFPs and be independent of merchant silicon offerings.

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Future Products

While the Smart SFP portfolio is already very comprehensive, it is by far from complete.
At AimValley we are currently working on a variety of future products. Just to name a few:

- The Ethernet over SONET/SDH Smart SFP.
  This Smart SFP plugs into a 10GE router port and tunnels the 10GE signal over an OC-48/STM-16 transport network, similar to a 10G over SONET/SDH POS card.
- A solution to enable the opposite: “Packet over TDM”.
- A solution to resolve the business-specific legacy interfaces of the verticals (an IoT solution)
- A custom DPI solution in an SPF form factor
- SD-WAN ML-PPP/HDLC Enterprise/Business Access

The common theme is the requirement to offload the new hardware with the legacy services, while still maintaining the support of the required solutions for the end customer.

Why AimValley?

AimValley is a reliable provider of Smart SFP technology since 2003, delivering solutions for:

- High-speed data processing applications
- Complex FPGA-based accelerated systems
- High-speed, low power hardware equipment
- Robust embedded software
- An early adopter of Acceleration Technology

AimValley understands the full complexities as well as the subtle nuances of designing great edge solutions. We excel in building complex systems that are part of your product in the fields of Industry 4.0, Big Data, Healthcare, and Transportation. Our combined skills represent all the important aspects required for the development of end-to-end systems.

Our customers enjoy the benefits of working with a strong team with over 2000 years of engineering experience. AimValley is a trusted partner of Tier 1 customers in Telecom and Industrial markets and has shipped more than 100 000 products.

Expertise & Proven Track Record

- Transparent Network Migration
- Channelized Network Migration
- Ethernet over SONET/SDH
- Service Assurance Endpoint
- Smart SFP Management

Quality Focus

- Outstanding track record of on-time delivery
- Best in Class Designs:
  Time, Budget, and Quality
- ISO9001, ISO140001,
- EcoVadis top 2% CSR-rating

Supporting documentation

Bare Die Technology
AimValley Development Process
Telecom Solutions
TDM over Packet Solutions
TDM Network Migration
Celebrating 10 years of Smart SFP!
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