Telecom Testing, Monitoring & Service Assurance

Telecom and Cable MSO networks are comprised of a myriad of geographically diverse network elements connected to each other through fiber optic cabling, copper twisted pairs of wires, coax cables and radio links. Each network element, such as customer premise equipment (CPE), network switches, edge and core routers, cellular radios etc. are each controlled by an Element Management System (EMS) that in turn feeds into and are controlled by a computer-based network and software, namely the Operating Support System (OSS).

Telecom testing, measuring, monitoring and service assurance are additional and vital operational aspects of building, operating and especially troubleshooting telecom networks.

AimValley works with some of the world's largest and best providers of test units and systems to develop telecom testing and monitoring solutions.

In addition, AimValley offers some specific Smart SFPs to support Service Assurance network monitoring systems.

Primarily the latter are SFP based loop-back devices and packet reflectors. They provide automated support of demarcation and sectionalization testing. AimValley refers to these devices as OAM Smart SFP devices.

Following are examples of how AimValley is helping telecom testing, measuring, and monitoring companies:

Delivering Solutions for a Connected World

AimValley

Utrechtseweg 38
1213 TV Hilversum
The Netherlands

phone +31 35 689 1900
sales@aimvalley.com
www.aimvalley.com

Ultra High-Speed Ethernet Packet Generation

As packet transport rates continue to rise, AimValley works with lead provders of test solutions, designing boards and modules for the evolving generations of packet data streams. With historical solutions in 1GigE, 10GigE and 100GigE and now solutions that run at 400 GigE, 800GigE, and soon Terabit Ethernet, AimValley provides cutting edge technology for the next generation of high-speed testing.

Bit Error Rate & Performance Testing

There are two methods used in determining the proper performance of a telecom service. The first method is to observe and possibly capture live traffic, packets, frames, and signals. These are analyzed based on industry standard and proprietary measurement methods and criteria. The second method is to insert artificially synthesized network traffic into the telecom service (or network element) in place of live packet streams.

Typically, the latter is used to perform a turn-up and test of the initial service whereas live traffic monitoring is more commonly used for once the service is up and running. In the case of performance testing, a very lengthy but highly predictable bit stream is transmitted into the service being tested. Then, at another location that same injected pattern is recovered into the test and measurement equipment and an assessment of the parameters and attributes of the received data, and therefore, an evaluation of performance is made.

AimValley's expertise in FPGA design is paramount in the company's ability to serve its Telecom test, measure, and service assurance customers as FPGA technology is adept at processing and evaluating very high bit rate streams on a bit-by-bit basis with zero uncertainty.

Timing & Synchronization Measurements

AimValley has a tremendous experience in sync, time stamping, and clock recovery as well. All of these parameters are vital in enabling today's complex networks.

This expertise is available to be leveraged by companies working on applications to monitor and measure such attributes of a network.
One thing is for sure, Test & Measurement companies need to avoid mistakenly introducing errors into otherwise error-free bit and packet streams. Managing clocks and synchronization is often vital in telecom test equipment.

Protocols

Telecom networks and the services offered feature a large variety of data rates, packetization schemes, multiplexing techniques, aggregations, encoding, and channelization. The test, measurement and monitoring objectives are not only centered around the ability to measure the performance of the entire data stream but also the proper functioning of channelization, tributary, or fraction of the service.

Networking Protocols
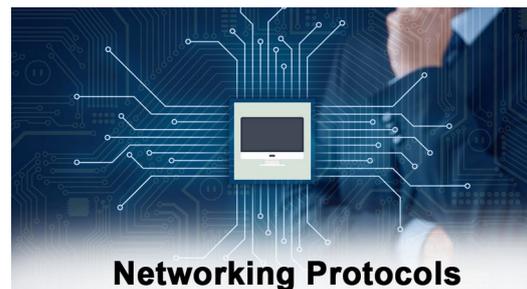
In fact, given the stacked and complex mixtures of formats and protocols, these can be greatest sources of issues to be uncovered, evaluated and optimized.

This is an area where AimValley excels as we have a long history of designing network gear that performs such packetizations, aggregations, and multiplexing. Our capabilities include TDM (T1, E1, DS-3), all rates of SONET / SDH, OTN, High-Speed Ethernet, with attributes and protocols including IP, MPLS, CPRI, VLAN, DHCP, IPv4, IPv6, CES, Pseudowires, Tunneling and many, many more.

In the Test & Measurement domain we have the technical knowledge to drill down into channels, streams and encoded streams to provide the measurements required.

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Algorithms

Not all testing is as straight forward as a bit error. In many cases the evaluation required is based on much more of a "somewhat" error tolerant data stream or the parameters may require the evaluation of signals that are fundamentally analog in nature. For example, the human ear can tolerate some clicks, pops, noise, delay, echo, and dropouts but not too many and not for too long. Likewise streaming video can use buffers and artificially introduced delay to repair or replace damaged packets, but there are limits to such techniques after which the end user's service quality is adversely affected. AimValley has worked on many algorithms that are helpful in telecom including those that enable DSL vectoring and bonding, VoIP and Streaming video.

Smart SFPs for OAM

AimValley continues to develop stand-alone box-based Network Interface Devices (NIDs). However becomes more commonplace for service providers to to build intelligent loop back capabilities and the testing and monitoring functionalities of TWAMP, Y.1731, and Y.1564 into SFP pluggable devices. AimValley is a world leader in GigE and now 10 GigE Smart SFPs that provide intelligent endpoint capabilities. AimValley provides these to Service Assurance providers and Telecom NEMs in support of their offered solutions. As is the case with all AimValley SmartSFPs they can be pre-configured, plug and play, remotely configured, or managed using AimValley's Titan software that is designed to be integrated into Network Elements.

## International Telecommunication Unit (ITU)

AimValley develops its telecoms solutions according to various ITU standards.

ITU-T Y.1731

The Y.1731 standard is used to implement end-to-end connectivity detection, loop back detection, and link trace on Metro Ethernets (MEs). It provides test diagnosis and performance monitoring functions such as frame loss, delay, jitter, and throughput measurement.

Ethernet in the First Mile (EFM) and Connectivity Fault Management (CFM) are used to detect link faults for carriers. Y.1731, an enhancement of CFM, can be configured to monitor service performance.

Hierarchical Ethernet operation, administration, and maintenance (OAM) needs to be provided based on the network architecture, as shown in the figure below.
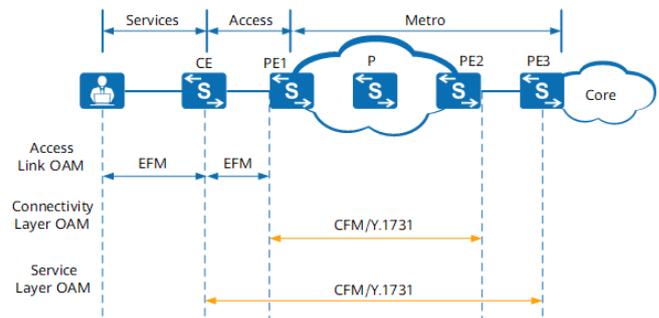
ITU-T Y.1564

This standard is designed to serve as a network service level agreement (SLA) validation method, ensuring that a service meets its guaranteed performance settings within a controlled test time to ensure that all services carried by the network meet pre-defined SLA objectives at their maximum committed rate, and to perform medium- and long-term service testing, confirming that network elements can properly carry all services while under stress during an extended soaking-in period.

ITU-T Y.1564 also defines an out-of-service test methodology to assess the proper configuration and performance of an Ethernet service prior to customer turn-up notification and service delivery. The defined test methodologies apply to both point-to-point and point-to-multi point configurations in the Ethernet layer and to the network portions that provide, or contribute to, the provisioning of such services. This recommendation does not define Ethernet network architectures or services, but rather defines a methodology to test Ethernet-based services at the service activation stage.

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AimValley proven track record

Our deep expertise in telecommunications solution designs has been leveraged by several leading telecom test and measurement companies and companies that provide service assurance solutions. Typically companies engage AimValley for specific circuit card designs coupled with FPGA developments and also possibly embedded and system level software.

Projects have included high speed generation, injected impairment and monitoring of Ethernet packets, algorithms for high speed transport, optical physical layer measurements, and complex protocol analysis. AimValley's OAM SmartSFPs are offered to service assurance solution providers and telecom NEMs to support intelligent loopbacks and in-service performance monitoring including TWAMP, round trip delay and functions called for in Y.1731, Y.1564 and others.

Why AimValley?

AimValley is a reliable provider of Testing, Monitoring and Service Assurance solutions since 2003, delivering solutions for:

- High speed data processing applications.
- Complex FPGA-based accelerated systems.
- High speed, low power hardware.
- Robust embedded software.
- Early adopters 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, Telecom, Healthcare and Transportation markets. 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 more than 2,000 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.

Quality Focus

- Outstanding track record of on-time delivery
- Best in Class Designs – Time, Budget & Quality
- ISO9001, ISO140001, EcoVadis Platinum CSR

We invite companies that develop telecommunications testing, measurement and monitoring, including Service Assurance solution providers to contact us to see how AimValley might help accelerate your portfolio of products and solutions or to add desired new functions and options.

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