

# Performance Assurance Solution Components

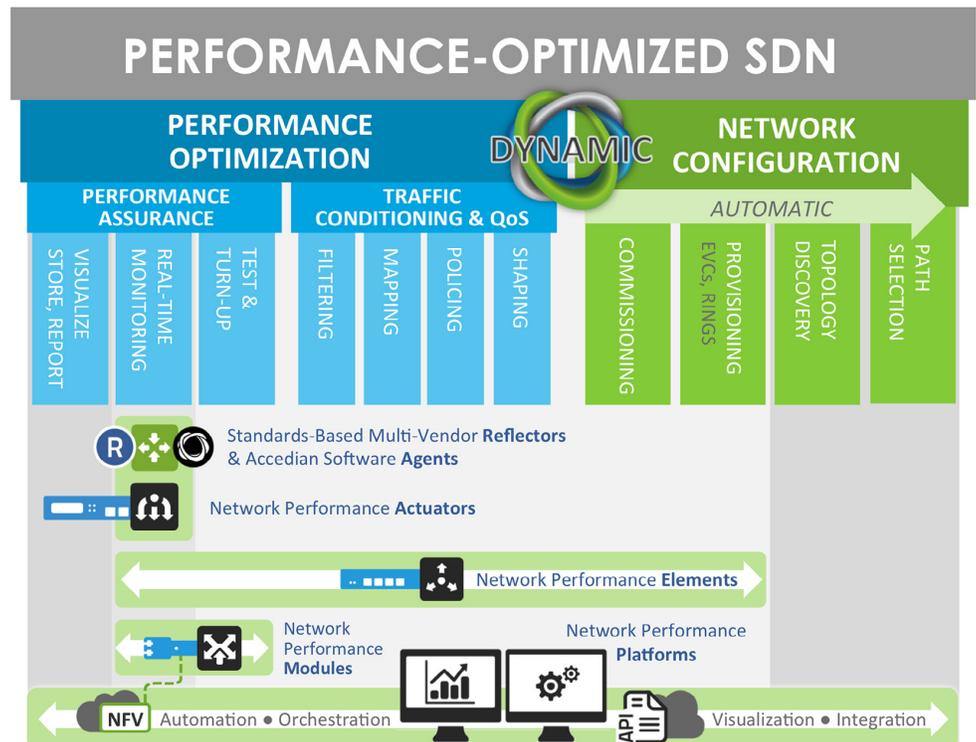
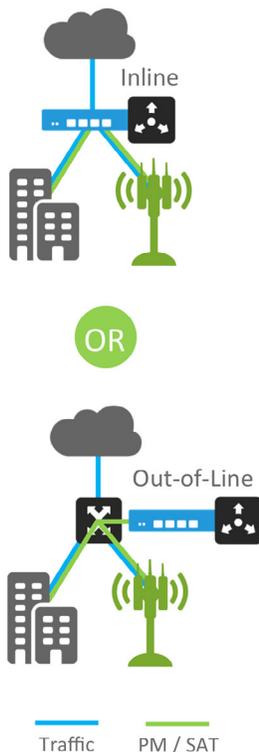
## Network Performance Platforms, Elements, Modules & Agents

Accedian is the performance assurance solution specialist, with a complete range of components covering service turn-up and monitoring from core-to-edge. With open automation and visualization platforms, Accedian's programmable hardware and virtualized instrumentation bring actionable, real-time quality of experience (QoS) and quality of experience (QoE) reporting to your network operations.

Flexible, extensible, and easily integrated into multi-vendor networks, Accedian solution components are right-sized to provide coverage and scale throughout the core, metro, and access.

Orchestrated by highly automated, programmable performance platforms, the right mix of components are easily combined into tailored solutions that span performance assurance, optimization and networking functions specific to an operators' application requirements and network design.

From initial service turn-up to per-second performance visibility, and the tools to establish and enforce QoS throughout the network, Accedian can customize a solution that will scale and evolve with the network and services they assure.



Accedian elements and modules can be installed inline or out to merge test streams into network flows and tap them for performance. Ultra-low latency hardware introduce negligible latency when installed inline, offering service providers the opportunity to increase end-to-end service performance when installed in place of traditional network elements.

## Right Sized Core to Edge Coverage

From central offices to small cells and businesses, Accedian has a right-sized solution to fits into all network areas and applications.



### Network Performance Platforms

Automating, coordinating and visualizing data in real-time, Accedian's extensible performance and SLA management platforms open Network State+ performance data to leading network and performance management systems



### Network Performance Actuators

Accedian Actuators are highly-scalable performance monitoring probes—which can be virtualized as part of the SkyLIGHT platform—used to generate granular standards-based+ performance metrics for ubiquitous, segmented monitoring. They test to diverse endpoints, including Accedian Modules, Elements, standards-based reflector agents and PM-aware network elements along all critical service delivery paths.



### Network Performance Elements

Accedian Elements' programmable hardware feature sets can be tailored to deliver a precise mix of service delivery, assurance and optimization.



### Network Performance Modules

Performance Modules virtualize the test management, metric computation and fault-management processed by Elements' CPUs, resulting in low cost, low footprint, hardware-precise units with uncompromised accuracy.



### Performance Assurance Software Agents

Accedian software agents can be installed in most network elements lacking Y.1731 OAM or TWAMP monitoring support to activate standards-based reflection directly in the units themselves.





## Network Performance Platforms

Accedian Performance Platforms offer programmable performance assurance and element management automation that openly integrates with existing NMS (network management systems), performance reporting, SDN control and other applications.

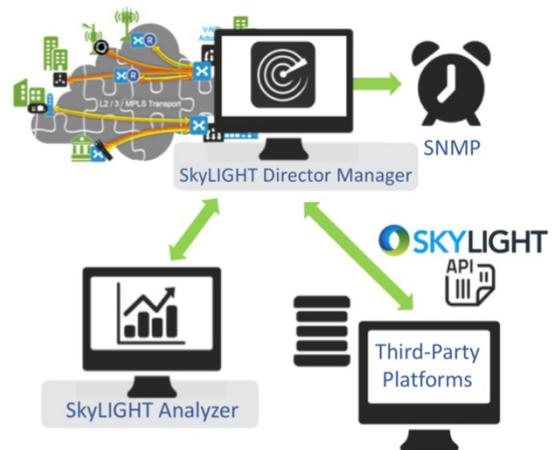
### SkyLIGHT Director™

The SkyLIGHT Director™ platform's automation engine and element management capabilities are complemented by service activation testing and workflow automation modules. SkyLIGHT Director provides workflow-driven fault, configuration, accounting, performance, and security management (FCAPS) for Accedian Elements & Modules. The Vision SP, Flow, and Collect modules add large-scale service activation testing (SAT), per-second performance monitoring (PM) measurement collection, and template-based Carrier Ethernet service provisioning.



### SkyLIGHT Centralized Performance Assurance

SkyLIGHT Director Manager Module orchestrates network-wide performance monitoring (PM) sessions from Classic Actuators and VCX Controllers, centralizing extensive analytic and mediated fault-management capabilities. With an open North Bound Interface (NBI), hundreds of real-time performance metrics—the Network State+—can be integrated into existing platforms or surgically queried to isolate precise performance trends.



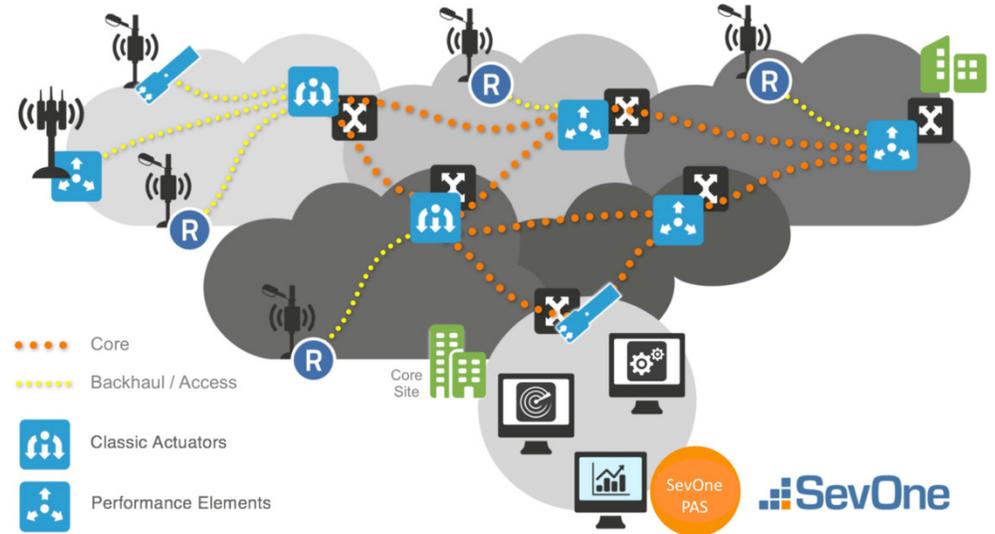
### VisionMETRIX™

VisionMETRIX™ is a comprehensive service level agreement (SLA) management and reporting tool. A software-as-a-service (SaaS) solution, VisionMETRIX collects SLA monitoring metrics via Vision Collect, SkyLIGHT Director Manager Module, or directly from elements and modules to capture a complete view of per-service QoS. VisionMETRIX secure online portals allow customers to verify service performance against their specific SLA KPIs such as availability, packet loss, latency, and more, delivering a real-time view that differentiates service provider offerings.



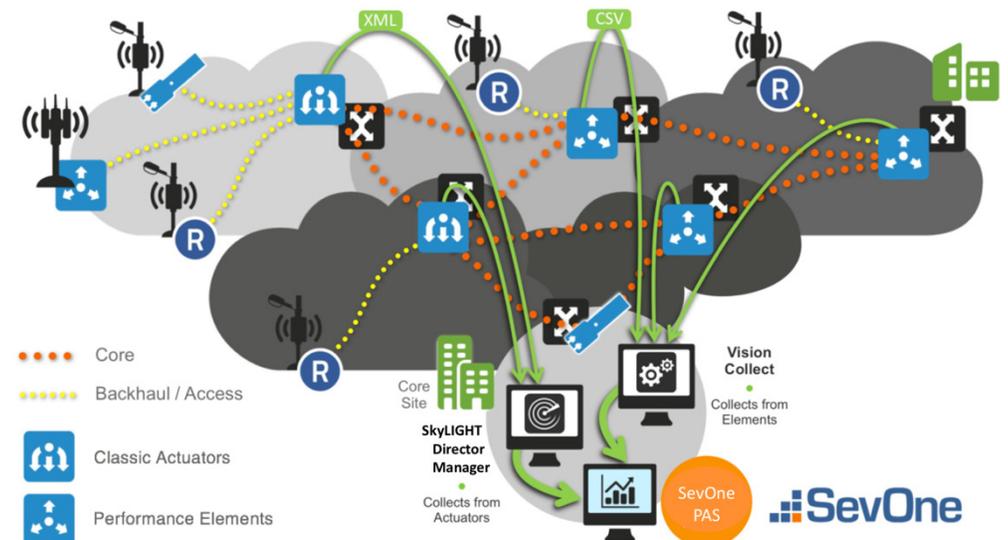
## SevOne Performance Appliance Solution (PAS)

SevOne PAS is a data gathering, visualization, alerting and reporting tool that has been specifically enhanced to seamlessly integrate with Accedian devices. With automatic discovery of new network elements and their underlying network objects, it provides a fully automated environment for the most stringent reporting needs.



The SevOne platform aggregates Accedian performance assurance metrics from Vision fashion—with as fast as per-second sampling. Integrated advanced analytics, graphing, customer report generation, integrated PDF support, user-defined alerts and more mean rapid troubleshooting, precise SLA reporting and intelligent, actionable performance monitoring are easily accessible within a single solution.

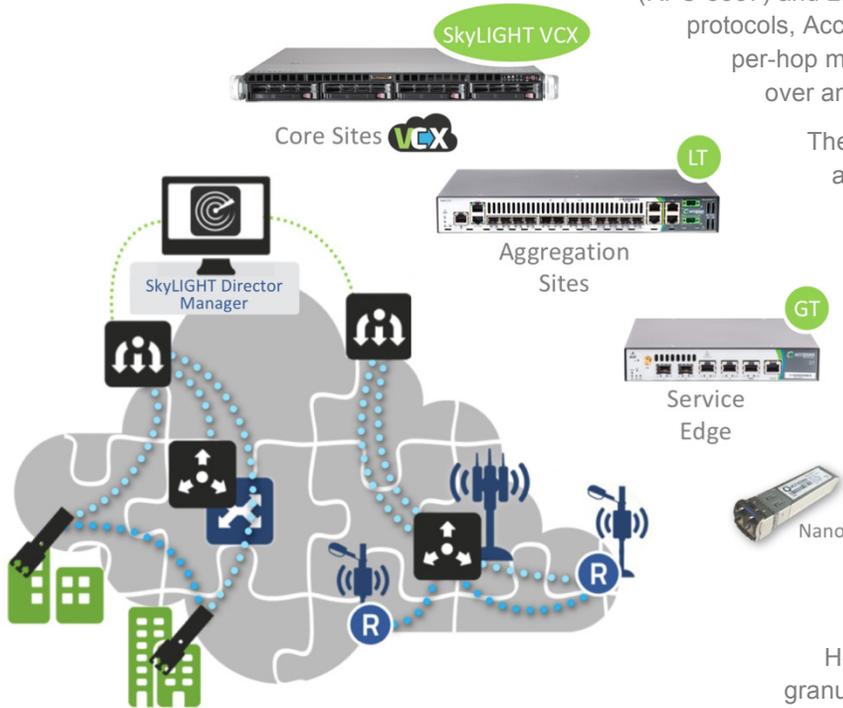
Deployed using a single node or clustered configuration of performance application servers, the SevOne solution is highly scalable and can be deployed in a fully redundant configuration.



## Network Performance Actuators



Accedian performance actuators are highly scalable active performance monitoring (PM) test probes that use existing network elements, Accedian modules, elements and agents as test reflectors. Actuators can generate thousands of concurrent PM sessions with sub-second granularity. Real-time analytics extend existing test standards with detailed statistical KPIs, derived QoE scores for HD-VoIP, VoLTE, and more: the Network State+. Supporting Ethernet OAM (Y.1731, 802.3ag), Layer 3 TWAMP (RFC-5357) and Layer 4 UDP Echo performance monitoring (PM) protocols, Accedian actuators provide multi-layer, core-to-edge and per-hop metrics for rapid fault isolation and root cause analysis over any network architecture.



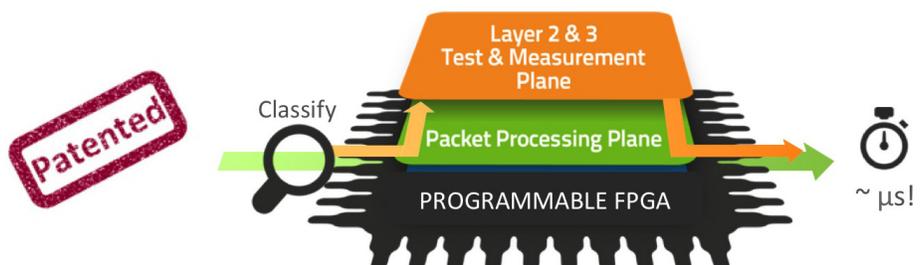
The Classic Actuator's patented virtual clock-sync algorithm maintains reference timing information for all PM sessions, measuring 50  $\mu$ s precise, 1-way delay to and from any end-point. Multiple Classic Actuators can be deployed in strategic core and aggregation sites to cost-effectively blanket networks with ubiquitous performance assurance & SLA reporting. Installed out-of-line, the Classic Actuator doesn't compromise traffic integrity while delivering a unified PM view of multi-vendor, multi-layer networks.

Accedian performance elements and modules are also widely deployed as PM actuators, while also offering integrated service activation testing (SAT), MEF Certified Carrier Ethernet networking, H-QoS traffic conditioning and the industry's most granular  $\mu$ -shaping. With a patented dual-plane FPGA architecture, units can be installed in-line or out to combine performance assurance, optimization and monitoring in a wide range of applications. A variety of elements and modules are sized for core, aggregation, and service-edge locations, permitting distributed, large-scale PM session generation covering complex service topologies—all easily deployed, discovered and managed by Plug & Go™ instant provisioning.

## Network Performance Elements

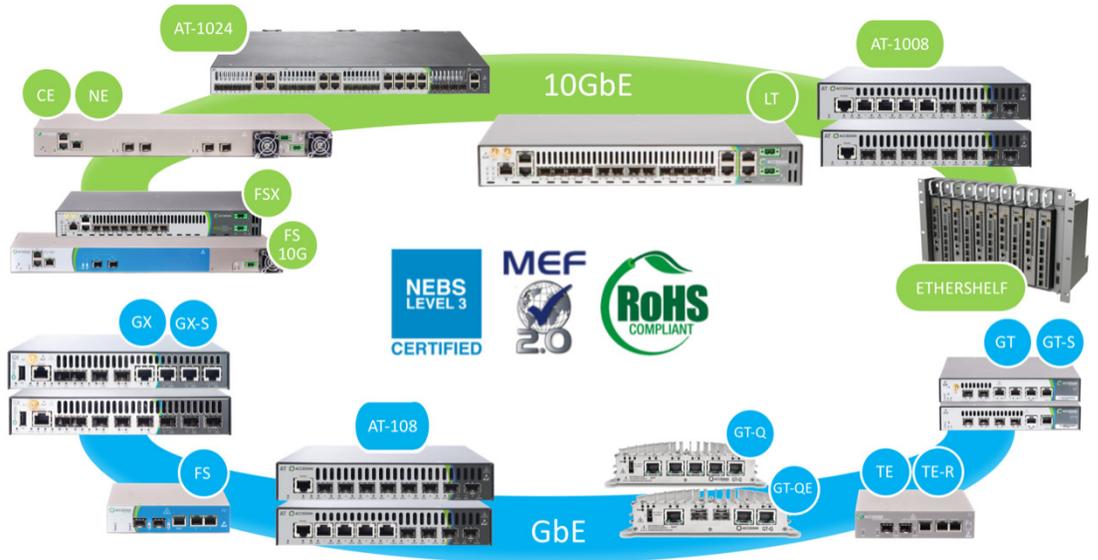


Accedian's array of Network Performance Elements fuse ultra-fast, programmable packet processing with performance assurance, optimization and MEF-certified networking. A unique dual-plane FPGA architecture separates traffic conditioning, mapping, filtering and aggregation functions from test & measurement processing. The result is fully parallel traffic processing, test traffic generation & analysis, and per-flow performance monitoring at near-zero latency.



Remotely turn-up services with integrated SAT (RFC-2544, Y.1564), then monitor ongoing performance at layers 2, 3 & 4 using standards-based Service OAM (Y.1731 / 802.3ag) and TWAMP (RFC-5357) performance monitoring. Granular, sub-second sampling, microsecond-precise 1-way measurements and real-time stats provide the most complete view of network health available.

Accedian Performance Elements are telecom grade with NEBS Level 3 and MEF Certification. Full Network Interface Device (NID) functionality—including L1-4 loopbacks, traffic tapping & mirroring, and network-to-network interface (NNI & ENNI) demarcation—means assured interoperability with third-party test sets and centralized test probes - all easily deployed, discovered and managed by Plug & Go™ instant provisioning.



Accedian Performance Elements establish Ethernet virtual connections (EVCs) with hierarchical QoS (H-QoS). Integrated micro-shaping can dramatically improve TCP throughput, benefiting both provider and client. In addition to service-edge applications, resilient aggregation and transport are supported by G.8032v2 Ethernet ring functionality.

## Network Performance Modules



Accedian performance modules combine small footprint & pluggable hardware with NFV-powered test control, computation and analysis to bring standards-based+ performance assurance to all corners of the network. Right-sized for cost-competitive small cell backhaul and broadband business services applications, modules are fully interoperable with third-party test probes and handhelds, as well as standards-based network elements supporting Ethernet OAM (Y.1731, 802.3ag) and Layer 3 TWAMP (RFC-5357) performance monitoring (PM) protocols.



Utilization  
Metering



Turn-Up  
Testing



Real-Time  
Monitoring

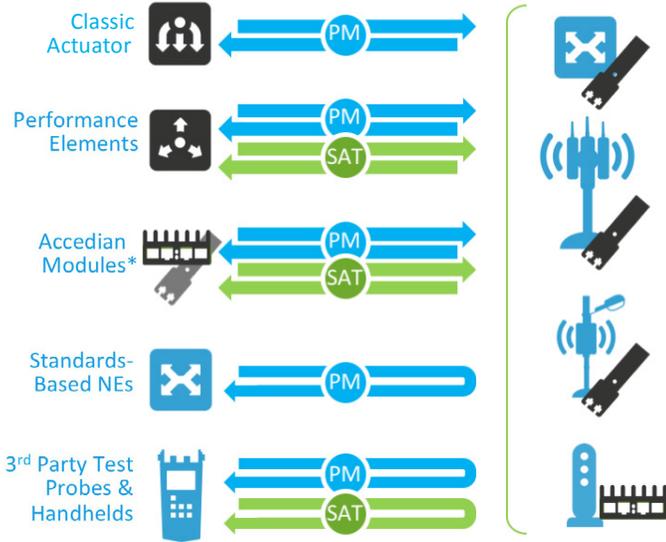




The Smart SFP and GbE units act as test reflectors for both service activation tests (SAT) or PM sessions—or can host them when paired with the SkyLIGHT™ VCX service assurance virtual network function (VNF). When used in combination with the SkyLIGHT Director Manager Module, Accedian modules provide 1-way latency measurements with exceptional precision, along with path-segmented metrics for rapid fault isolation.

Adding a performance module to legacy and enterprise-grade network elements, small cells or cable, FTTx or xDSL modems adds Ethernet OAM and PM feature support—bringing ubiquitous QoS visibility to every service edge. Units can be install in-line or out, ensuring they are never a single point of failure when installed in critical network locations.

With multiple, programmable feature banks, new capabilities can be loaded into modules remotely to keep pace with evolving standards and new applications. As VNFs evolve, Accedian performance modules will become a key component to virtual CPE (vCPE) strategies, providing hardware-assist for critical edge functions in the smallest possible package.



## Performance Assurance Software Agent

Accedian's Performance Assurance Software Agent can be installed on network elements lacking integrated PM reflector support. Lightweight and highly customizable, Accedian's software Agent is installed on third-party small cells, LTE base stations (BSTs), and network appliances, and can be installed on user equipment and virtual. With full TWAMP-Control & Light support, the Agent returns one-way metrics including latency and delay variation.



- Ethernet OAM (Y.1731, 802.3ag)
- Layer 3 TWAMP (RFC-5357)  
(including one way metrics)
- Full Line-Rate L2-4 Traffic Loopback

	TWAMP / OAM / Test Traffic Reflectors			
	Standards-Based NE	Accedian Reflector Agent	Nano Smart SFP & antModule™	Performance Element
Ethernet OAM (Y.1731, 802.3ag)	✓	✓	✓	✓
Layer 3 TWAMP (RFC-5357) (including one way metrics)	✓*	✓	✓	✓
Full Line-Rate L2-4 Traffic Loopback			✓	✓

\* One-way delay metrics, but no one-way packet stats available if Stateless Reflector is employed on the network element