



# **SPIRENT**

ACTIVE AND PASSIVE TESTING, DIAGNOSTICS AND PM TO ENSURE QOS

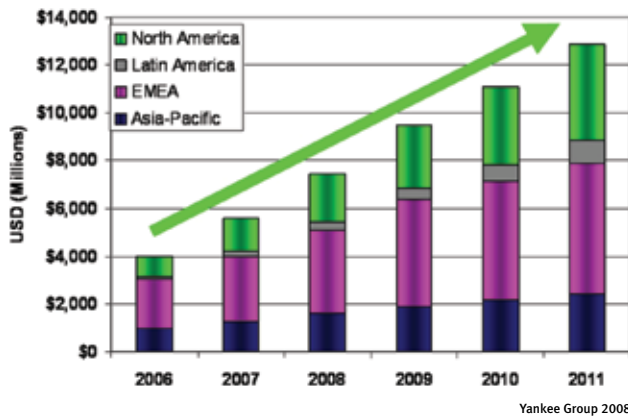
## **TESTING AND DIAGNOSTICS OF ETHERNET FOR WIRELESS SERVICE PROVIDERS**

# Testing and Diagnostics of Ethernet for Wireless Service Providers

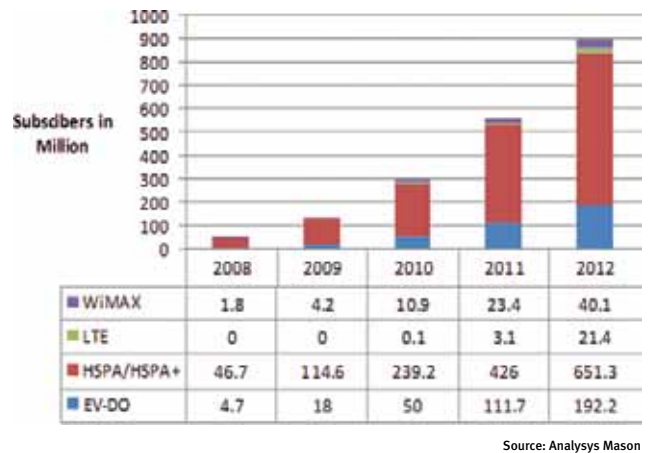
## ENSURING YOUR ETHERNET QUALITY OF SERVICE (QoS) AND YOUR CUSTOMER'S QUALITY OF EXPERIENCE (QoE)

The evolution of today's network has seen the migration of Ethernet technology from the Local Area Network (LAN) to Metro Area Networks (MAN) as service providers have embraced Ethernet architecture as the replacement for traditional TDM services. The promise of the Ethernet service offering is the extension of the customer's Local Area Network (LAN) with greater flexibility and simplified management in a cost-effective solution. This promise is one of the key drivers responsible for the unprecedented 40% growth of Ethernet services worldwide, as shown in the Ethernet revenue growth projection by the Yankee Group (2008).

**Growth In Ethernet Revenue**



**Subscriber Growth by Technology**



## The Ethernet Market

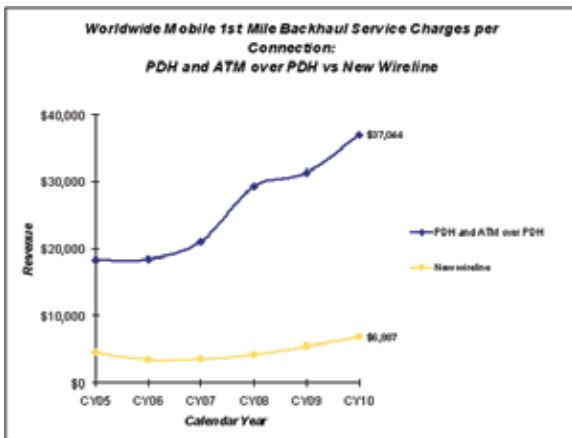
Ethernet networks are fast becoming the choice as new services are added. This dramatic growth in Ethernet services is being fueled by the need to support a constantly evolving set of bandwidth requirements, network performance and end user applications which is evident in the wireless subscriber growth projection by Analysys Mason that nearly doubles each of the next two years regardless of the wireless technology.

The evolution of wireless technology to produce this market-driven bandwidth is forcing Wireless Service Providers to shift to Ethernet as the preferred backhaul network transport as can be seen in the table below.

EVOLUTION OF WIRELESS TECHNOLOGY									
UMTS CDMA	GSM IS 95A	GPRS 1X-RTT	Edge 3X-RTT	UMTS R99 EVDO R-0	HSPA EVDO R-A	E-HSPA EVDO R-B	LTE EVDO (UMB)	Mobile WiMax	FIXED WiMax
<b>Wireless Generation</b>	2 G	2.5 G	2.75 G	3 G	3.5 G	3.75 G	4 G	4 G	4 G
<b>UMTS Peak Rate (Down)</b>	112 Kb/s	160 Kb/s	480 Kb/s	2 Mb/s	14.4 Mb/s	28 Mb/s	100 Mb/s	15 Mb/s	75 Mb/s
<b>CDMA Peak Rate (Down)</b>	14.4 Kb/s	153 Kb/s	450 Kb/s	2.4 Mb/s	3.1 Mb/s	14.7 Mb/s	100 Mb/s		
<b>TDM DS1 Rate</b>	1.5 Mb/s	1.5 Mb/s	1.5 Mb/s	1.5 Mb/s	1.5 Mb/s	1.5 Mb/s	1.5 Mb/s	1.5 Mb/s	1.5 Mb/s
<b>TDM E1 Rate</b>	2.0 Mb/s	2.0 Mb/s	2.0 Mb/s	2.0 Mb/s	2.0 Mb/s	2.0 Mb/s	2.0 Mb/s	2.0 Mb/s	2.0 Mb/s

**Evolution of Wireless Technology – Peak Rates Down (Data from Telcordia 2008 – Evolution of Wireless Data Network)**

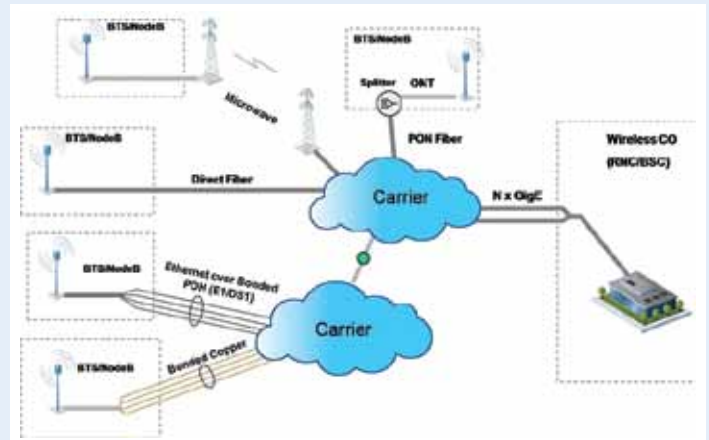
The data clearly indicates that as Wireless Service Providers move to 3G networks and beyond, just adding traditional DS1/E1 connections for the backhaul will not efficiently handle (shown in red print) this dynamic expansion in bandwidth. In addition, the cost of providing this increased bandwidth via traditional TDM SONET/SDH technologies is also driving providers to shift to Ethernet as the backhaul architecture as demonstrated by the skyrocketing costs per connection of PDH and ATM transport in the first mile of backhaul services taken from Infonetics - *Research Mobile Backhaul Equipment, Installed Base, and Services, 2007*.



Source: Infonetics Research Mobile Backhaul Equipment, Installed Base, and Services, 2007

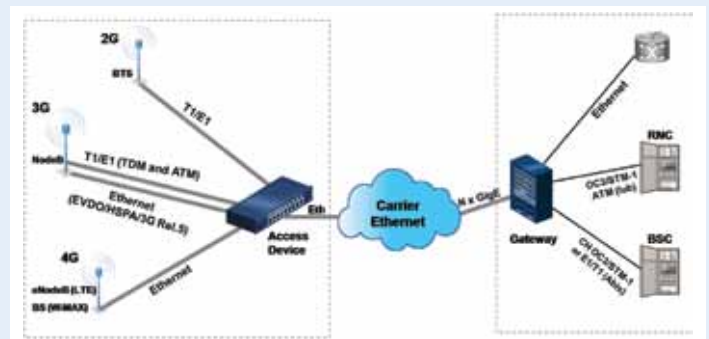
Ethernet is by far the most robust, scalable and price prudent backhaul network alternative for the Wireless Service Provider wanting to deploy 3G networks and beyond which is why Ethernet is playing an ever increasing role in supporting the wireless backhaul infrastructure for cellular and WiMax networks. Ethernet is compatible with almost any network technology, configuration or medium and has become the choice for providers looking to eliminate single purpose service networks and transition to converged network topologies where multiple services can be efficiently and cost effectively provisioned and maintained.

## Ethernet networks provide enormous benefits allowing the WSP to:



### Versatility of Ethernet Carrier Networks (MEF 2008)

- Economically address growing bandwidth requirements currently constrained by the prohibitive costs of legacy networks
- Leverage rapid transition to Carrier Ethernet for wire line traffic; enabling a single integrated wire line and mobile backhaul network
- Reduce management and maintenance costs
- Optimize the network for packet data traffic; most mobile traffic is broadband/IP centric
- Overcome TDM (T1/E1) services scalability



### Ethernet Utilized In Wireless Networks

Ethernet provides these capabilities easily and quickly with high reliability while delivering the bandwidth needed for next generation services.

# Testing and Diagnostics of Ethernet for Wireless Service Providers

## Challenges of Ethernet Services for Wireless Service Providers

With the explosion in demand for Ethernet Business Services, it is imperative that Wireless Service Providers employ strategies that simultaneously support maintenance of their current networks and growth of next generation Ethernet networks and simplifies service assurance for their technicians. Ethernet can pose providers with significant service and cost control questions:

- Can I improve my Quality of Service (QoS)?
  - Do I have good visibility into the actual service?
  - Am I able to turn-up circuits on time as demand for new service swells?
  - Can I sectionalize service issues into the correct network or provider segment?
  - How do I deal with intermittent Ethernet service issues?
  - Are we providing the Quality of Service and Experience necessary to deliver reliable voice, data and video services (2G thru 4G) over the Ethernet backhaul networks?
- Can I achieve a competitive Return on Investment (ROI)?
  - How do I significantly reduce repeat dispatches (sometimes three or four times per turn-up or trouble)?
  - How do I reduce dual dispatching to two locations on most service issues?
  - How do I expand my Tier 1 technician efficiency with their limited Ethernet experience?
  - How can I expand my process automation to match product growth?

In order to reduce New Circuit Failures (NCF) and Failure Frequency (FF), Repeat Reports, Chronic Circuits, and non-productive dispatches, Ethernet Test, Diagnostic, and Performance Monitoring (PM) solutions must answer critical service issue resolution questions.

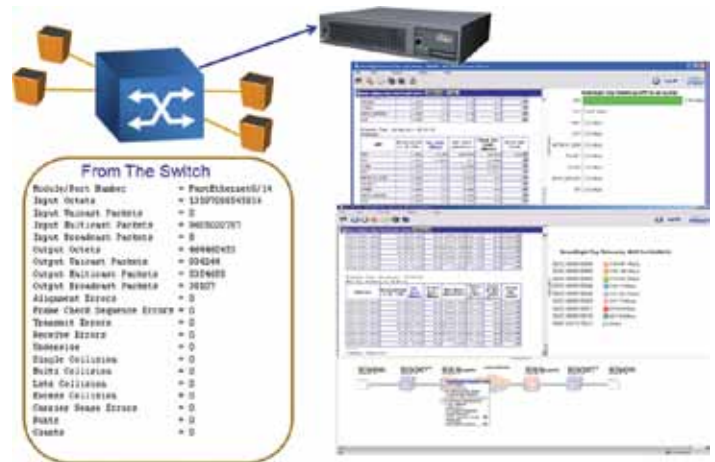


Competition is driving WSPs to be SURE the service is ready for the customer

### Ethernet Service Complexities

As competition between the various providers intensifies, it is imperative that service assurance organizations are equipped with the appropriate tools. The amount and granularity of information available directly from the Ethernet switch will not address the service level questions. The information provided by the switches is typically limited to aggregated counts of packets into and out of the switch which doesn't allow providers to evaluate information from a specific port such as:

- **Traffic** - frame sizes, protocol distribution, utilization, top talkers, top applications, etc.
- **Specific Service Applications** - VoIP and Video analysis



Typical Information Available from an Ethernet Switch

For Ethernet service assurance, WSPs are confronted with tough questions such as:

- Can I tell what type of traffic is running across the network?
- Can I validate the port/VLAN assignments and configurations?
- Can I validate the end-to-end Quality of Service (QoS) of the underlying network characteristics?
- Is the QoS performing correctly, and is the CIR correct?
- Can I identify the network segment causing the service issue?
- Do I have service visibility across my network?

## Alarm Monitoring Versus Testing and Diagnostics

Typically, as new services are deployed, Tier 1 technicians have little expertise and a high percent of the trouble issues are routed to a limited number of highly paid Tier 2 or Tier 3 technicians in the service centers or Network Operations Centers (NOC). The most common Ethernet service assurance tools in use today are fault or performance tools and neither are service-centric. They attempt to solve problems by looking at the network and aggregations of services. While fault and performance tools are absolutely necessary for service assurance they are not sufficient by themselves. This traditional approach works to a certain degree, given that network element vendors are equipping the network devices with alarms and event triggering capabilities, but is limited on several counts:

- Alarms and events are network centric and do not directly relate to the effect on the service.
- Alarms are sometimes unreliable - setting up each network element to trigger on threshold crossings as the network expands and threshold values change requires a significant ongoing administrative effort and may not be done effectively.
- Alarms are triggered under conditions of hard failure while most Ethernet service issues are intermittent.
- Alarms are primarily targeted for core network elements and facilities and most Ethernet service issues are in the access network.

Providers will have problems despite their best alarming and monitoring efforts. If they did not, call centers would be unnecessary. Testing and Diagnostic tools are different in that they are on-demand and can give the Ethernet service centers the detailed service specific troubleshooting information and analysis needed to ensure quick problem resolution.

The chart below contains a high-level comparison of fault and performance monitoring functionality versus testing and diagnostic functionality.

FAULT AND PERFORMANCE FUNCTIONALITY VS. TESTING AND DIAGNOSTIC FUNCTIONALITY			
Functionality	Fault Surveillance	Performance Monitoring	Testing and Diagnostics
	Identify up/down status of network elements and interfaces	Report on network performance characteristics	Troubleshoot network/ service issues
Monitoring Paradigm	X	X	
Testing Paradigm			X
Alarm Collecting and Reporting	X		
Periodic Network and Quality Reporting SLA		X	
Trouble Shooting Reports/Results			X
Tune-up Testing			X
QoS Measurement		X	X
Dedicated Hardware Solution		X	X
Packet Decodes			X
Expert Analysis and Processing			X
Configuration Validation			X

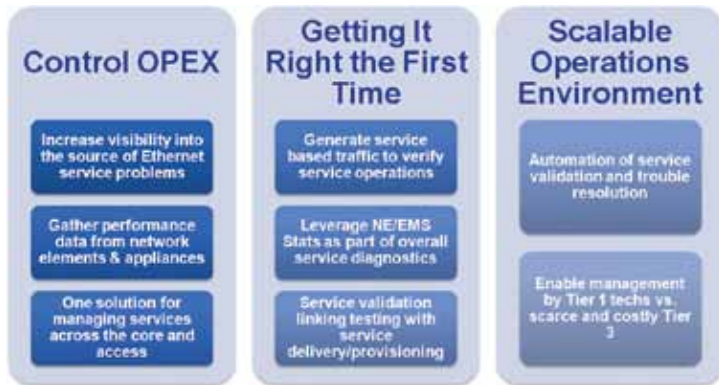
# Testing and Diagnostics of Ethernet for Wireless Service Providers

## Spirent's Family of Ethernet Solutions Is the Answer

The evolution of Ethernet has seen the migration of Ethernet technology from the Local Area Network (LAN) to Metro Area Networks (MAN) as service providers have embraced the flexibility and efficiency of the Ethernet architecture as a replacement for traditional TDM services. Many of the Ethernet services today carry mission critical data and the networks carrying this data must be monitored continuously to meet service requirements for system uptime, loss, latency and jitter and inability to prove network performance may result in lost revenue. Spirent delivers very scalable, highly accurate Ethernet testing and diagnostic solutions that address all aspects of the Ethernet life cycle including service activation, service assurance and performance management.



**Spirent's Ethernet Life-Cycle Toolbox**



**Spirent's Ethernet Solution's Benefits**

These capabilities will ensure the provider can achieve the following critical value propositions:

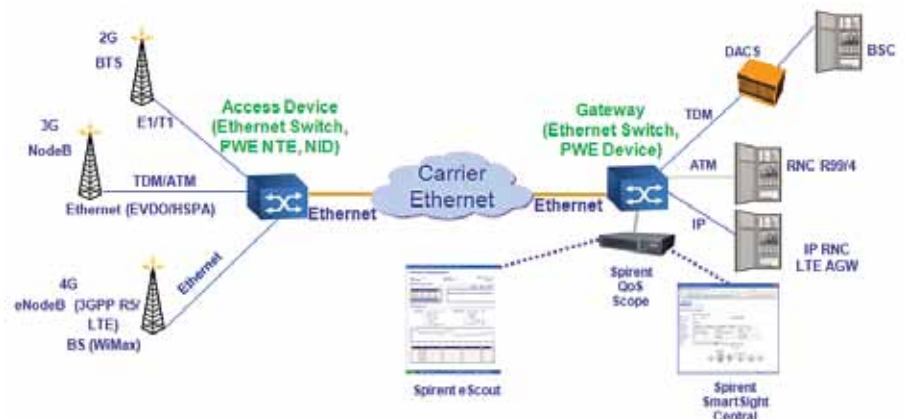
- **Service Readiness Testing:** Turn up right the first time
- **Rapid Trouble Resolution:** Dispatch to fix not find
- **Service Validation & Historical Performance View –** Reduced Repeats, Chronic and Churn

In addition, Spirent's Ethernet testing and diagnostic solution enables standardization of Ethernet service activation and assurance while providing a stable scalable operations environment to provide the benefits to the left.

The current approach for diagnostics in the market place is to provide access to the statistics from different points in the network and in some cases present a rudimentary cross-correlation of data. The ability to pick the appropriate data for analyzing the problem is "left to the technician". This results in dependencies on expensive resources, training and knowledge issues and creates lengthy troubleshooting times.

Spirent's family of Ethernet services products consisting of the SmartSight™ Central software, the Quality of Service Scope (QoS Scope™) probes and the eScout performance management solution are the answer for WSPs looking for an efficient cost effective testing and diagnostic Ethernet solution. These solution components bring real intelligence into the normal Ethernet issue resolution process so that the correct set of tests and data correlation are established for service issues in the network.

Furthermore, Spirent's process automation capability allows technicians to simultaneously diagnose problems for more than one customer instead of being limited to one customer issue at a time. In addition to managing rapid diagnostics, the solution addresses flow-through trouble processing by providing open interfaces to several industry leading inventory and provisioning systems and can be customized to interface to others as required.



**Spirent's Ethernet Solution in a Wireless Service Provider's Network**

## Solution Components

Spirent's Ethernet solution provides an unmatched view of the network, service quality and subscriber experience. The solution utilizes service performance history and testing and diagnostics and performs cross-correlation of this data gained from multiple points in the network and across multiple OSI layers.

### SmartSight Central (SSC) Software Platform

SmartSight Central provides a Graphical User Interface (GUI) via a Web Interface and an open Northbound Interface for testing Ethernet services. Through an intuitive point and click GUI, users can initiate active, passive and coordinated testing to various points in the service. Additionally the SmartSight solution makes use of the statistical data available in the Network Elements (NE) to provide a comprehensive view of the service as it traverses the network. SmartSight hides the complexities of the network and provides a service centric view to the technician. All testing available through the SmartSight Central Web interface can also be initiated over an XML API by a WSP's back office work management systems. This integration enables flow through automated testing to address the WSP's rising volumes of Ethernet services allowing Ethernet to be scaled economically.

### SmartSight Quality of Service Scope (QoS Scope) Diagnostic Probes

Spirent's SmartSight Ethernet QoS Scope, deployed at the aggregation points of Ethernet IP networks, provides a diagnostic appliance which uses the NE for access to "join the service" in real time. The QoS Scope provides the most extensive suite of performance and throughput tests and protocol decodes in the industry as an Ethernet aggregation point solution. The SmartSight Ethernet QoS Scope increases service quality visibility and plays a vital role in measuring service. When strategically placed at the aggregation point (Ethernet Switch\Router, NTE, NID, PWE) the QoS Scope provides maximum visibility into the network. This visibility extends to multiple locations throughout the network, including other aggregation locations or end-points and provides a complete end-to-end transport network view and service validation system with unique sectionalization features.

The QoS Scope generates traffic for active analysis of service quality and passively monitors traffic to diagnose service troubles. The QoS Scope verifies the operational status of the underlying network and the IP services that transverse it and quickly identifies and sectionalizes any network service issues that are present then provides information to support accurate dispatches. The QoS Scopes support both 1GigE and 10GigE interfaces and can be inserted into VLANs for on-demand active testing or passive monitoring of specific data streams. SmartSight Central (SSC) handles the QoS Scope insertion via the mirror or span port of the network element seamlessly.

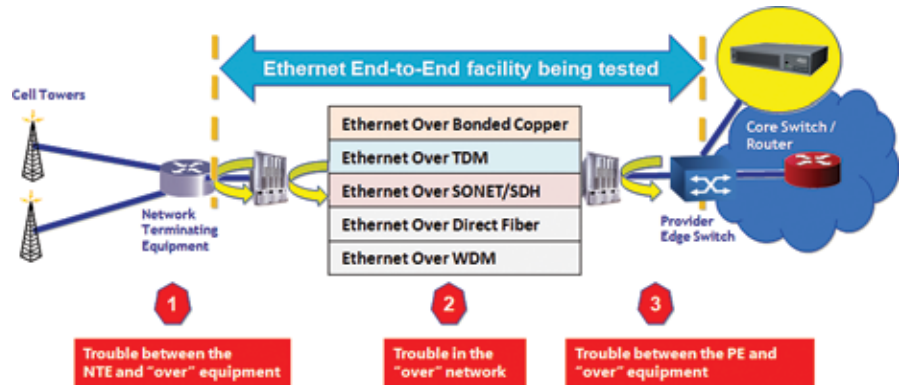


**Spirent's QoS Scope Probe**

# Testing and Diagnostics of Ethernet for Wireless Service Providers

## Active Testing

With QoS Scopes located in key locations and the power of Spirent's Ethernet test and diagnostic solution's active and passive test functionality providers can answer those tough service questions discussed earlier. The QoS Scope will access the Ethernet switch and join the VLAN to be tested. From this access, a technician could run an active network quality test to get a snapshot of the basic health of the network measuring important characteristics such as jitter, latency and loss to each end point. A second active test, RFC2544, could be run to determine the Committed Information Rate (CIR) the service will support. Additional network quality tests could be run from the PE or PWE switch to each end point to confirm that each end point can be reached and to generate various streams of different class of service at



## Sectionalizing Wireless Ethernet Services

a sustained Mbps rate to see the resulting QoS. If during the initial troubleshooting the technician finds a connectivity issue, then sectionalizing the access link to determine exactly where the problem resides is a significant piece of information required to rapidly dispatch the right technician to the right place.

A key capability of Spirent's active test functionality in the QoS Scope is the ability to send industry standard

loopback commands to various components in the network and make key determinations based on the various measurements that can be made to those loopbacks. The graphic below depicts the utilization of the solution's active test capability to run standard IEEE 802.1ag/ITU-T.Y.1731 tests to sectionalize trouble into or out of the network or access segments. This is a critical functionality, providing the value proposition of "dispatch to fix not find"

which results in "fix it right the first time" producing significant cost reductions.

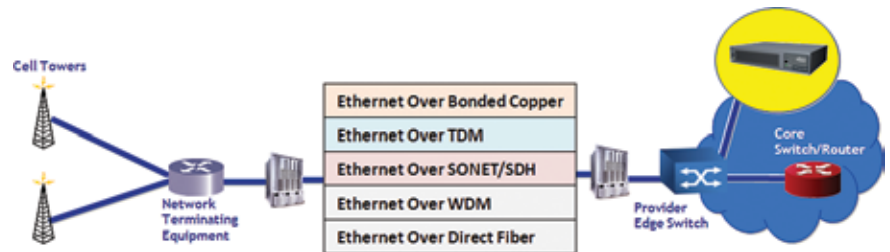
Spirent's active testing will also play a critical role for those WSPs that frequently provide service over shared networks. It is absolutely crucial in these networks that the test solution can sectionalize Ethernet service issues quickly and be able to isolate where and in whose area of responsibility the service issue resides – WSP's or third party provider's.

## Passive Testing

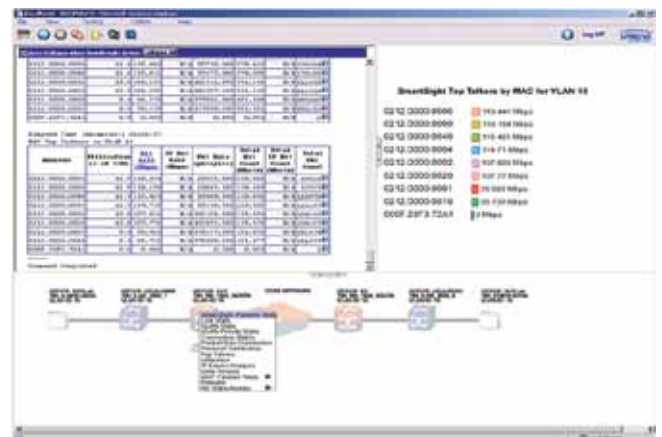
The network shown represents a WSP network with a QoS Scope placed at the Ethernet Switch. A QoS Scope placed in this location is mirrored to the VLAN or port traffic of the desired service. Once accessed, the QoS Scope can be used to perform non-intrusive passive testing for observation and analysis of subscriber generated traffic passing through that point in the network. This QoS Scope can monitor customer service entering and leaving the WSP's network to help sectionalize trouble.

The test results are brought back to SmartSight Central and presented in tables useful by the experienced technician and in a "user friendly" graphical format for inexperienced technicians.

Based on the types of passive tests executed and the diagnostics utilized valuable information evaluating the service issues is presented to the technician such as usage, traffic configured incorrectly and protocol distribution. The primary importance of passive testing is to observe the actual traffic in the network - validate a service issue exists, isolate it and provide information to resolve it.



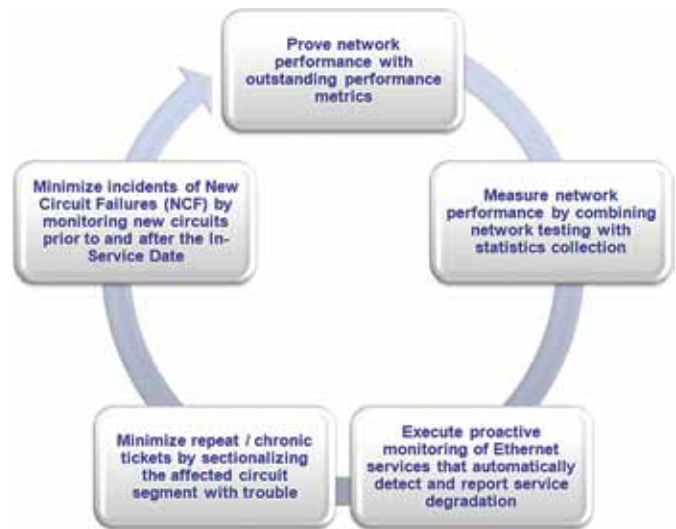
QoS Scope in a WSP Network Performing Passive Testing



Passive Test Results

## Proactive Monitoring, Network Testing and Statistics Collection

An operational strategy of provision, install, maintain, bill and hope is simply too risky to ensure new revenue acquisition and retention in the Ethernet business services market space. Wireless Service Providers must be hypersensitive to the QoS they are providing in both the initial service turn-up and after turn-up periods. Network performance is measurable and reportable using Spirent's Ethernet solutions and enables the providers to demonstrate QoS through a very effective combination of proactive monitoring, network testing and statistics collection. The solution's capabilities also reduce NCFs, repeat and chronic reports. To the right is a representation of Spirent's proactive monitoring, network testing and statistics collection supporting network performance management.



**Proactive Monitoring, Network Testing and Statics Collection**

## SmartSight eScout - PM with Active Traffic Generation to Determine QoS

Spirent's SmartSight eScout performance monitoring solution provides real-time performance visibility across the entire footprint of the production network without impacting revenue generating traffic. By utilizing Ethernet OAM capabilities defined by ITU Y.1731 and IEEE 802.1ag, Spirent's SmartSight QoS Scope probes are able to provide full mesh testing to any standards-compliant device or between QoS Scope probes and feed that data into a powerful centralized analysis and reporting engine. The combination of the QoS Scope and the analysis engine is eScout.

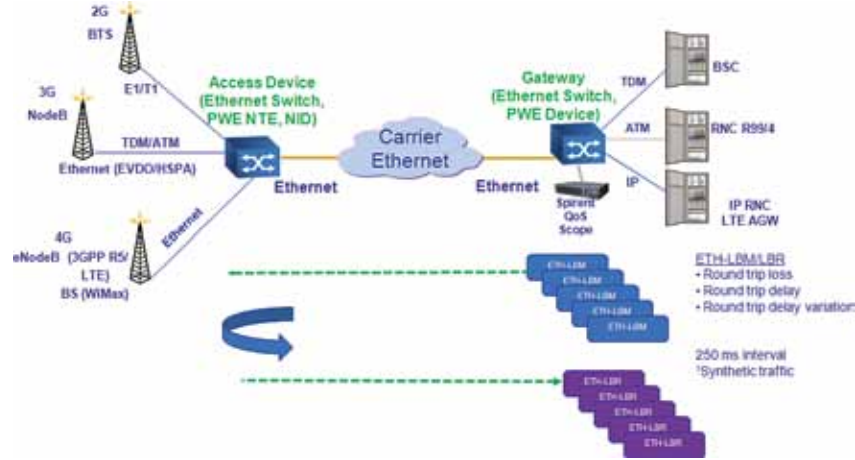
eScout's intuitive, web-based interface provides dashboard and reporting capabilities and the Northbound XML interface and direct SQL access to performance results allows rapid integration with existing OSS and back office systems. In addition to performance monitoring, the QoS Scope probes also provide simultaneous on-demand active and passive Ethernet test capabilities and can help ensure the high Quality of Service (QoS) demanded in the very competitive Ethernet services marketplace.

Incorporating Spirent's next generation eScout Performance Monitoring (PM) solution with active traffic generation in evolving Ethernet network infrastructures for enhanced service issue identification provides an efficient cost effective service assurance solution, builds the best possible QoS and maximizes profitability by providing:

- **Proactive detection of network degradation:** Proactive trouble resolution with threshold-based alarming to notify personnel of a problem immediately; significantly reducing the MTTR.
- **Flexible testing capabilities:** Support for on-demand service assurance traffic generation in the QoS Scope in addition to performance monitoring ensures efficient use of capital budgets.
- **Network historical performance:** Network-wide visibility with a Carrier class architecture designed for thousands of nodes and hundreds of simultaneous users ensures that the system can grow in concert with the network.
- **Reduced Repeat and Chronic Reports.**
- **Reduced CAPEX:** Use of ITU/IEEE standards for Ethernet OAM yield universal interoperability and reduces the need for specialized equipment.
- **Ease of Integration:** An open Northbound XML interface and direct results access via SQL allows straightforward integration into existing OSS of back office solutions.

# Testing and Diagnostics of Ethernet for Wireless Service Providers

eScout's exceptional visibility into the customer's Ethernet VLAN service using both current and historical information provides WSPs fast effective identification and sectionalization of service issues for Ethernet services. eScout is the software that manages the performance data, enables back office integration, facilitates, simplifies and improves automation and drives the QoS Scope. eScout sectionalizes trouble between the WSP and other providers in shared Ethernet networks utilizing Spirent's best in class QoS Scopes. The probe provides real time monitoring of Ethernet service performance with scaling capability to meet carrier class requirements. Unlike other performance monitoring systems, eScout uses the probe to emulate service by actively generating data patterns across the network to measure, validate and ensure QoS. The QoS Scope quickly assesses the service identifying any issues that are present and provides information to support accurate dispatches back to eScout.



**QoS Scope's Active Traffic Generation**

When strategically placed as shown in the WSP network, the QoS Scope uses the Switch/Router for access to join the service in real time and provides maximum visibility into the network. This visibility extends to multiple locations end-to-end throughout the WSP's network, including other aggregation locations or end-points. The QoS Scopes are able to monitor the service at three important layers:

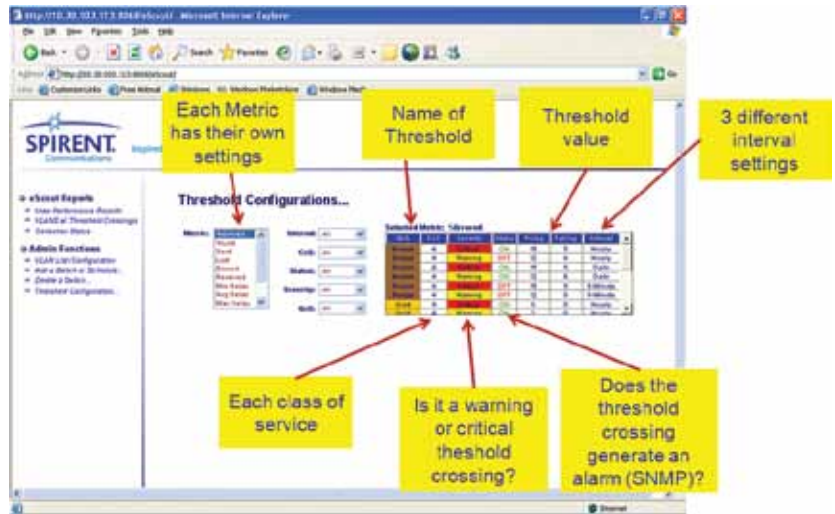
1. Layer 2 PM (EOAM)
2. Layer 3 PM (TWAMP)
3. Application Layer (Ex. VoIP)

In addition, eScout can support thousands of VLANs per port and can gather the requested information in small incremental 250 ms bursts. Reports can be for five-minute windows aggregating the 250 ms bursts of information so actual network surveillance is happening in micro slices of time while eScout reports the information in meaningful windows. The graphic to the right provides an example of an eScout Performance Report Screen and some of the data retrieval options.

**eScout Performance Monitoring Details**

# Testing and Diagnostics of Ethernet for Wireless Service Providers

Reports come in several flavors, providing detailed near real time and historical data on key metrics. The reports provide views of the data in an array of intervals – 5 minute intervals for 24 hours, hourly intervals for a week and daily intervals for a week, month and quarter for example. eScout has the capability to present information showing Ethernet QoS down to each Ethernet data stream for each Class of Service (CoS). In addition, the provider can obtain the information directly from eScout or eScout can feed the information into a higher level PM OSS in their network. eScout will identify critical threshold crossings and send the alerts or SNMP alarm traps to designated fault systems. The WSPs can designate which threshold service measurements will be invoked and set these thresholds per Key Performance Metric (KPM) i.e., Frame Loss and Frame Delay for both Warning (Yellow) and Critical (Red) Threshold Violations. The graphic to the right displays several of the dynamic data fields that can be changed on the fly by the user.



**eScout Summary of VLANs with Threshold Crossings by Time Increment**



**eScout's Dynamic Changeable Threshold Crossings Results Retrieval**

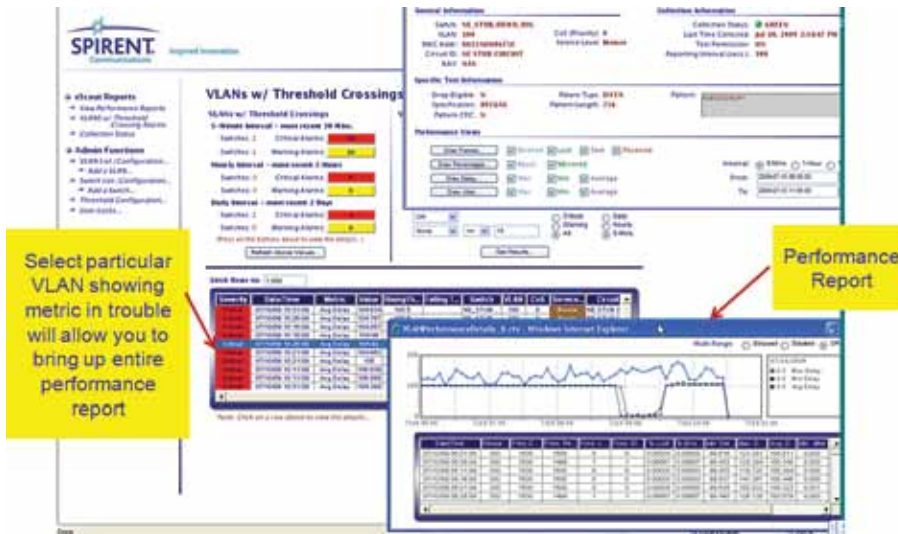
Analyzing data gathered every day and throughout each day is especially valuable to determine service trends during low, average and peak activity time periods. In addition, eScout has a constant source of near “real time” data that supports analysis of performance for reactive troubleshooting.

These reports provide valuable information that will assist personnel in determining the “root cause” of real network service issues. eScout allows the WSP to slice this information numerous ways such as by service category (Gold, Silver, Bronze, etc.), by switch or all switches or by service metric (Average Delay etc). In fact the possible data retrieval combinations a provider can get from eScout are almost limitless.



**eScout VLANs Threshold Crossings By Switch**

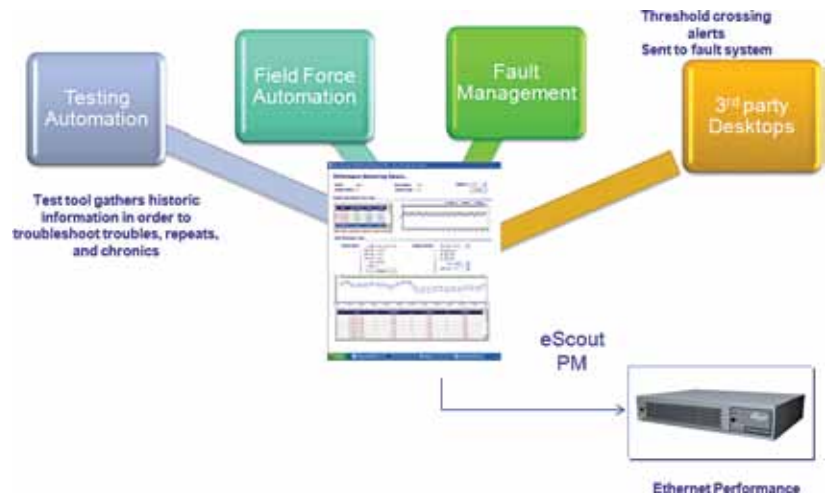
# Testing and Diagnostics of Ethernet for Wireless Service Providers



**eScout Individual VLAN Performance for SLA Support**

eScout also enables the WSP to drill down into a specific VLAN to ensure they are providing the expected QoS. eScout is vendor agnostic, allowing WSPs to utilize eScout's active traffic generation capabilities to characterize network performance in any mix of vendor NID, NTE, PWE or NEs without loss of eScout functionality. Regardless of the provider or network architecture, eScout can effectively measure key QoS metrics such as Frame Loss, Frame Delay and Frame Delay Variation.

eScout has an open northbound interface to facilitate fast and easy integration into a provider's back office systems for improved automation, such as interfacing to the trouble reporting system and automatically opening trouble tickets for SNMP alarms or service degradations detected by eScout across the provider's network. The graphic to the right is a high level view of eScout's architecture, capabilities and possible integration with a WSP's OSSs.



**eScout's Architecture, Capabilities and Integration Into a Provider OSSs**

The QoS Scope gathers the results and pushes them back to eScout. eScout processes the results according to the provider's business rules and can:

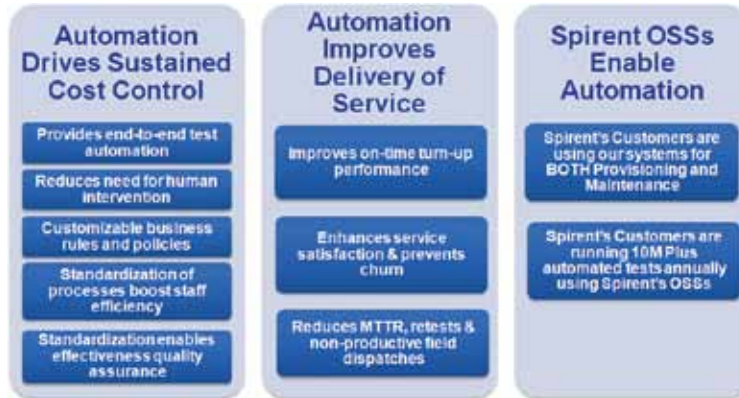
- Push the test results to a Back Office OSS
- Generate SNMP fault notifications based on threshold crossings
- Use its own dashboard and produce eScout reports for the service provider

The eScout dashboard:

- Reduces training cycles
- Provides tabular & graphic results reports
- Reports information in PDF, Email, HTTP or Excel format

## Automation

Automation is key to ensuring Ethernet services are turned up correctly, service issues are resolved as soon as possible and the business can be economically scaled to meet the customer demand. Customers are using Spirent's OSSs today for both provisioning and maintenance and are running in excess of 10 million automated tests annually. Spirent's Ethernet solution set allows service providers to achieve an average of 80% to 90% automation on all of the tests run based on the extent of the solution's integration with back office, work management and inventory systems. The graphic below lists some of the benefits of a WSP taking advantage of Spirent's automation capabilities.



**eScout's Automation Benefits for the WSP**

## Business Case Drivers

Spirent tools historically improve operational efficiencies through automation and standardization and influence the saving drivers in the “wheel” by proving the functionality outside each quadrant.



**Business Case Drivers**

## Spirent's Professional Services Available to the Provider for Spirent's Ethernet Solution

To facilitate Spirent's Ethernet Solution deployments, Spirent provides the following services for providers to utilize based on their preference:

- Implementation Services
- Integration Services
- Education Services
- Maintenance Services
- In-region Support Services

## Why Spirent?

Spirent Communications is a global provider of integrated performance analysis and service assurance systems that enable the development and deployment of next-generation networking technology such as Internet telephony, IP Video, broadband services, 3G and 4G wireless, global navigation satellite systems and network security equipment. Spirent's solutions are used by more than 1,700 customers in 30 countries, including the world's largest equipment manufacturers, service providers, enterprises and governments.

Spirent has a long history of providing MPLS & Ethernet testing solutions that offer the realistic testing scenarios required to ensure Quality of Service (QoS). Many leading network equipment manufacturers and service providers demand our offerings to meet their requirements for next-generation services whether using the Spirent TestCenter™ platform to complete the industry's largest-ever public 10 Gigabit Ethernet test or selecting Spirent SmartSight™, QoS Scope and eScout solutions to better manage their expenses while meeting the service parameters essential to win in today's competitive marketplace.

Spirent is active with standards bodies and research organizations during the new technology evaluation process and provides test and diagnostic equipment to ensure the technology meets appropriate standards. Our Service Assurance solutions utilize the expertise gained from the use of our lab test equipment by network equipment manufacturers to increase our ability to validate and resolve customer issues quickly and efficiently, with the latest technology. This total life cycle involvement with Ethernet technology uniquely positions Spirent to help Wireless Service Providers drive new services to mass market faster with fewer resources and improved profitability while enhancing customer satisfaction.

Spirent's solution has been chosen by top-tier global network operators to assure their Ethernet services worldwide. In addition, Spirent was recently recognized by Frost & Sullivan as the global leader in Ethernet testing according to the research firm's World Gigabit Ethernet Test Equipment Market report. This award underscores Spirent's unmatched Ethernet expertise and sale of more Ethernet test ports than any other vendor through its comprehensive solution portfolio that extends from the lab with product development and verification, to the field for service provisioning, troubleshooting and performance management and to the in-home network to ensure QoE of multi-play applications.



## Summary

In closing, Spirent is a leading communications technology company continuing to focus on delivering innovative systems and services to meet the needs of our customers worldwide. Spirent understands the intricacies of Ethernet networks and the services that traverse them. Our experience and deployments with early implementers allowed us to identify a common set of challenges confronting providers:

- Very little visibility into the Ethernet service.
- Limited number of operations personnel with the necessary Ethernet knowledge.
- Most service issues are intermittent and are not “hard down” link problems.

Our Ethernet solutions properly implemented with maximum integration and automation will allow Wireless Service Providers to scale Ethernet service assurance and reduce OPEX while reducing:

- Mean Time to Determine (MTTD) where service issues reside.
- Mean Time to Restore (MTTR) for resolution of the service issue or outage
- Reduced Failure Frequency (FF), Repeats and Chronics
- Non-productive dispatches.

Spirent is proud of our award-winning family of Ethernet products and continues to invest in Ethernet Business Solutions. We are committed to maintaining our leadership in developing the Ethernet performance, test and diagnostic tools the industry requires to meet the ever increasing demand for bandwidth.



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