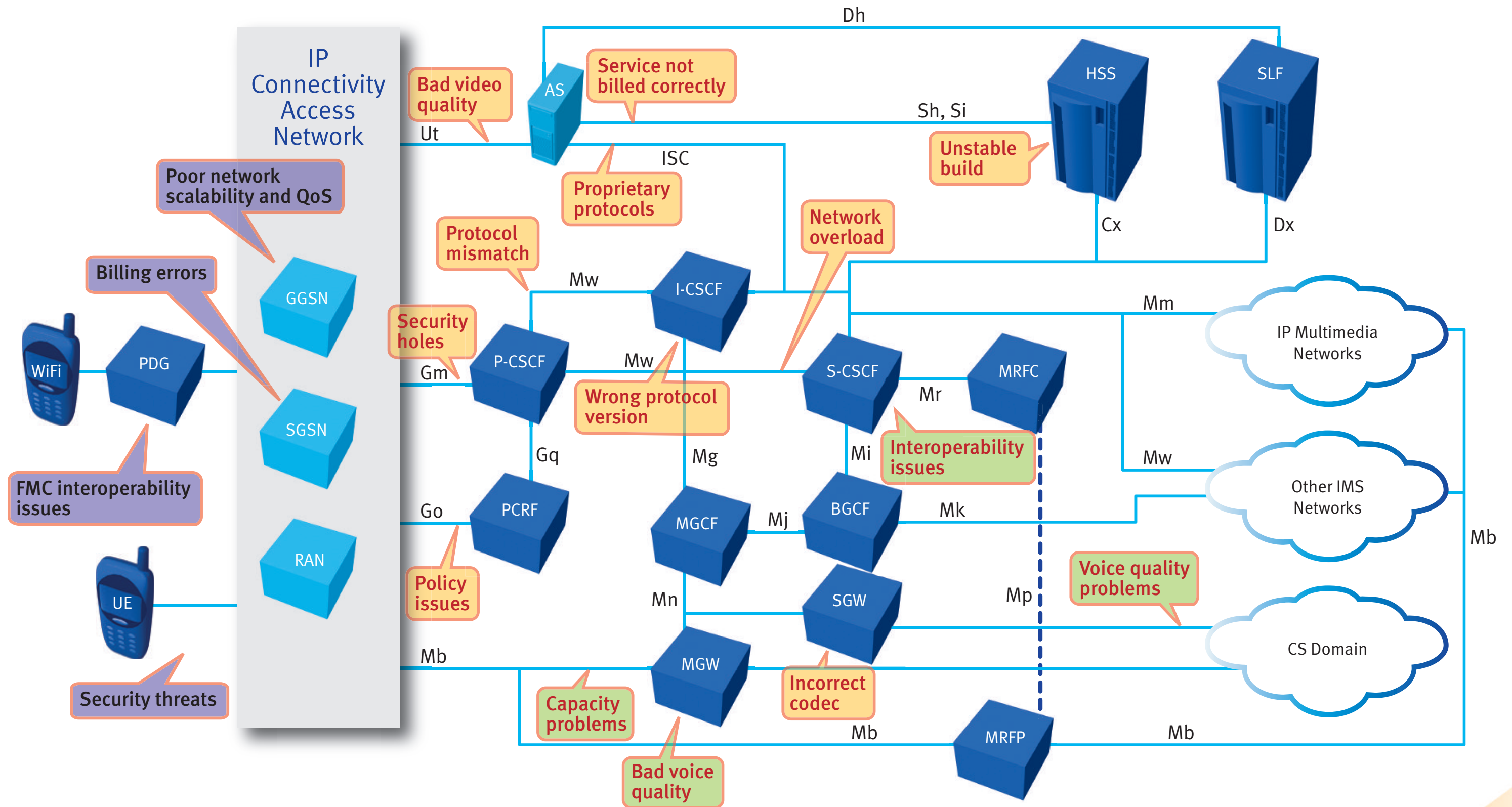


Spirent IMS Test Solutions



Pitfalls of an Untested IMS Network

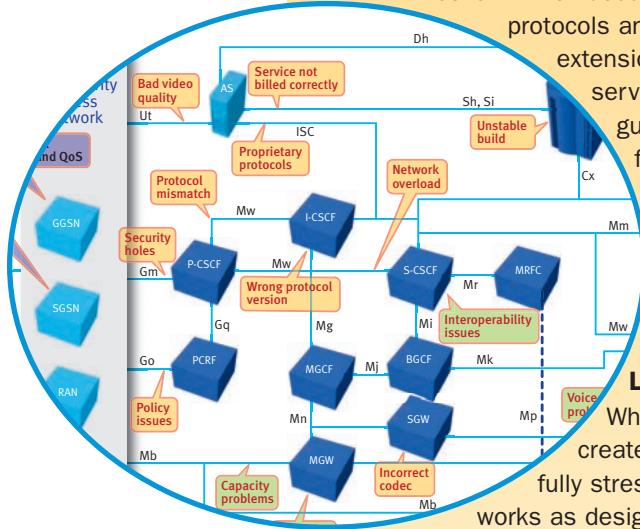


Testing with Spirent Resolves IMS Network Pitfalls

CORE NETWORK

Conformance Testing

A comprehensive conformance test methodology was used to remove several issues with the network which used proprietary protocols and non-published extensions. Now the service provider can guarantee service features will work consistently across multiple platforms from different vendors.



When a feature is created, the only way to fully stress it is to ensure it works as designed under load conditions. In this way, the billing server will be stressed as well as the CSCFs, the Media Gateway (MGW) and all the interconnections. Feature testing without load is not a viable way to catch many problems. Always test features with a full load.

Load Testing

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Service Validation

After a service is designed and created, it must be validated. Call flows must be created, captured and analyzed so that the expected operation works as anticipated. Graphical debugging tools and state-machine based test equipment are needed to fully validate any service.

Billing Verification

After a service is designed and created, the associated Call Detail Records (CDRs) must be verified to make sure the customer is being billed and billed correctly. In this scenario, complex call-flows provided 100% test coverage on the billing to certify it as ready for service.

Interoperability Testing

Overcoming interoperability problems can be complex. An easy test methodology which can be employed in the network is to perform end to end calls/invoke services that run through as much of the network as possible. This will test the interfaces and data carriage between network elements and foster interoperability confidence in the network.

Debugging Analysis

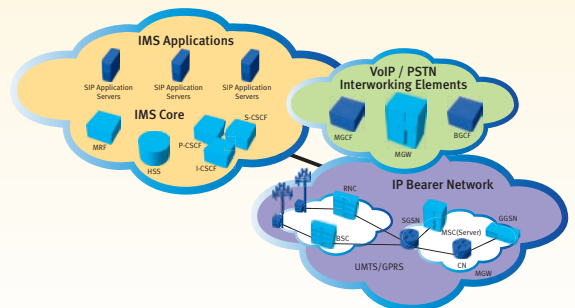
Where issues exist between the core network elements such as the P-CSCF and I-CSCF visual debugging tools will overcome and fix the problem. These problems are most effectively solved if debugging tools allow the rapid re-creation of the call flow, so that further simulation or emulation of a network element can be achieved.

Robustness Testing

The Policy Decision Function (PDF) is a core network element, allowing subscribers to access the network and deciding the level of service. To make sure such a vital part of the network is ready for deployment, and to find any hidden service outage affecting problems, a suite of robustness tests will uncover such issues.

Proprietary Call Flow Testing

Where standards have not caught up with the needs of a service provider in a fast moving market, it can be necessary to test a proprietary call-flow. A test tool that allows non-standard testing is needed. Very often these test tools are based upon "state machines" and not on protocols. This will allow the service provider to prototype or modify call flows as needed.



NETWORK ACCESS

QoS and Network Scalability Testing

The mobile packet core network plays a critical role in delivering application traffic to the user. If the packet core is not properly tested, perceived quality of the entire network can be jeopardized. Many potential pitfalls exist, including low throughput of data, poor Quality of Service (QoS) for delay or loss sensitive applications, dropped calls during handovers, and call establishment failures due to capacity overloads. Proper testing consists of the emulation and testing of every network element in the packet core in isolation or as a system. It must be possible to emulate millions of IMS enabled mobile nodes with real world traffic models.

Billing Accuracy and Reliability Testing

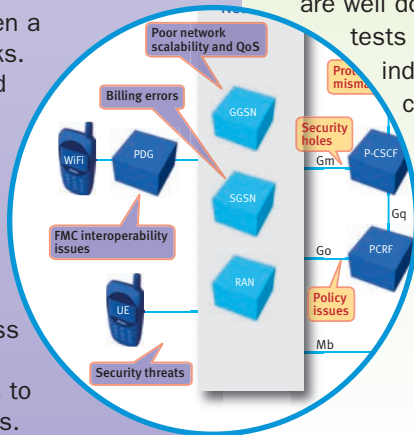
Accurate billing is the lifeblood of networks. Billing errors mean loss of revenue and will rattle customer confidence. Billing in wireless starts with Call Detail Record (CDR) collection on the SGSNs and GGSNs. Lack of automated ways of measuring the accuracy and stability of CDR collection procedures can lead to corner cutting in testing.

WLAN and Cellular Interworking Testing

IPSec encryption technology is used extensively to secure access of WLAN traffic to 3G networks. IPSec adds considerable overhead and processing requirements. If Packet Data Gateway (PDG) elements are not properly tuned for performance, the network can appear sluggish to the end user. The handover capabilities of dual-mode handsets from WLAN to cellular networks creates another potential failure point that must be tested.

Security Testing

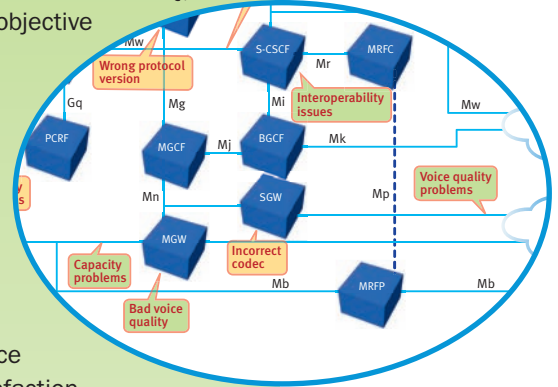
Security issues have long been a concern of Enterprise networks. The proliferation of IMS-based applications makes wireless and IMS networks a prime target for malicious attacks. Security gateways and firewalls are coming forth to offer protections against viruses, denial of service attacks, and unauthorized access to network services. Testers must process the capabilities to emulate these security threats.



INTERNETWORKING

Voice Quality Testing

By using standardized tests such as PESQ, MOS, R-Value & E-Model, objective values can be obtained to understand how network changes affect voice quality. Such testing will help a service provider understand how Box A is better than Box B, as well as how network latency, delay and jitter all play an important role in good voice quality and customer satisfaction.



Failover Testing

Since over 90% of existing traffic passes through to the PSTN domain, both the Media and Signaling interconnection between the IMS and PSTN domain experience great traffic demands. A backup gateway for the links should be provided and adequate failover testing completed prior to service deployment.

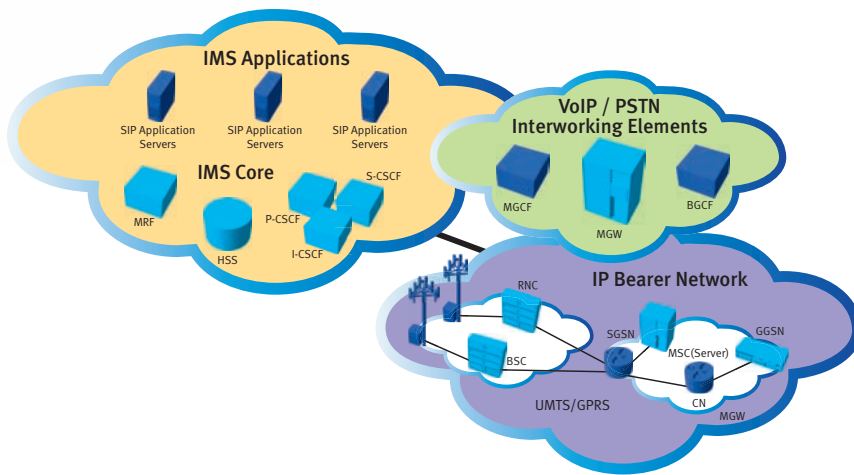
Gateway Capacity Testing

The capacity of edge and internetwork gateways should be understood on any network. A service provider can then plan and derive the most financial gain from the gateways. A return-on-investment (ROI) metric can be generated so that gateways from different vendors can be compared.

PSTN Compliance Testing

It is very easy to overcome PSTN compliance issues on large networks. Since these networks are well documented, in-depth conformance tests are available. By testing against an industry standard tester, compliance can be achieved and approval to connect to a legacy network granted.

Choose Spirent's Comprehensive IMS Testing Solutions



APPLICATIONS AND SERVICES

One of the most important promises of IMS is the rapid introduction of new multimedia services. By separating the Application/Services Layer from the control and transport planes, new individual applications can be developed faster at lower cost. Also, service providers can use third parties for application development.

This paradigm shift has a significant impact on testing strategies. Historically, 18 months or more are required to introduce a new service. IMS can potentially reduce time to a few months, even weeks. To do so, testing strategies must be nimble which they have not been traditionally. Testers must be capable of allowing quick prototyping of new services in the lab prior to deployment. Spirent's IMS test solution was designed with this in mind, inherently flexible for testers to quickly craft new call flows for specific applications. Spirent's solutions allow users to isolate individual application servers (AS) or test applications as a system, including the control plane and the AS. Testers can test for functionality, error handling, or tune an application server for performance. Presence, Push-to-Talk, Instant Messaging, and Share List Servers are some of the application types that Spirent supports.

CALL SESSION CONTROL

The Control Plane Layer of IMS is the heart of IMS. IMS standards define new network elements, Call Session Control Functions (X-CSCF), Home Subscriber Server (HSS), Policy Control and Charging Rules Function (PCRF), ways to handle user authentication, call routing, session establishment, charging, and policy enforcement. This new architecture offers very robust capabilities but introduces complexity. The signaling message flow from traditional VoIP to IMS, to register a client device and establish a session with another peer device, increases by several multiples.

This complexity has a direct impact on testing, and equipment vendors and service providers must seriously consider bringing new and high quality products and services to market quickly. This demands that testers have the capability to rapidly create custom call flows. The right balance of customization, performance, and ease of use must exist to get maximum value out of test products.

Spirent's IMS solution includes the next generation in customizable state-machine based testing with high performance, scalability, and best in class ease of use. Spirent can test or emulate any IMS core network element, X-CSCF, HSS, AS, MRFC, UE, and more. Every IMS device can be tested in isolation or in combination with other devices for system level testing. This type of testing mandates that multiple protocols (e.g. SIP, Diameter, and RTP) must be used simultaneously in the test process. This is an inherent capability of Spirent's products. Spirent provides the only solution that can run custom call flows at a high load rate. This means the same test cases used to perform functional testing can seamlessly offer performance tuning and stability tests.

SECURITY

While security threats are a major concern to Enterprises, they are relatively new for wireless service providers. Though IMS promises many new and great multimedia applications, it opens the wireless world to major security concerns. Examples are hackers, attacks on application servers, unauthorized access to network services, and viruses. Equipment vendors and service providers are working diligently to defend the network and customers. They realize one outage caused by a security breach could mean millions of dollars in lost revenue in addition to severe loss in customer confidence and loyalty. Smart vendors and carriers know meticulous security testing of firewalls, content filtering devices, and security gateways are the only ways to guard against malicious attacks. In addition, it is just as important to test and ensure that chosen security mechanisms do not add undue overhead and reduce network performance.

Spirent's IMS solution offers a complete, broad range of security test options. These include emulating network elements to surround and isolate security elements as in a firewall or security gateway. Distributed Denial of Service (DDoS) attacks can be initiated against the device under test (e.g. GGSN, SGSN, or Web Server). Also, emulation of hundreds of thousands of IPsec encrypted IMS UEs can allow testers to measure important performance criteria such as activation rate, capacity, and throughput of the target device using encrypted traffic. Security mechanisms are in a constant state of improvement, and Spirent is in the forefront of testing these new mechanisms.

SPIRENT'S IMS TEST SOLUTION:

- Test and Emulate all IMS Core Network Elements including: UEs, P-CSCF, S-CSCF, I-CSCF, HSS, SLF, AS, PDF, MRFC, MGW, MGCF, SGW
- Complete IMS Core Network Protocol Support: SIP, Diameter, RTP/RTCP, RTSP, Megaco/H.248, MGCP, H.323, LDAP, MSRP, GLMS, DHCP, SIGCOMP, DNS, XCAP, TLS, SRTP, HTTP/HTTPS, COPS/COPS-PR, RADIUS, SCTP
- Full IMS Security Protocol Support: IMS AKA, IPsec IKEv1, IKEv2, MoBIKE, EAP-TLS, EAP-MD5, EAP-SIM, EAP-AKA, EAP-TTLS
- IMS Service Testing for Push-to-Talk over Cellular (PoC), Presence, Instant Messaging, Shared List Server
- Test and Emulate all 3GPP Wireless Core Network Elements including: Mobile Nodes, GGSN, SGSN, AAA, CSG, CGF, Security Gateway, PDG, WLAN AP, Firewall, Web Servers, Video Servers

BILLING

Billing is an integral part of the new IMS architecture, and standards-based interfaces and network elements have been defined. IMS will change the rules on the number of unique/customized billing schemes carriers can implement to maximize average revenue per user (ARPU). Subscribers will have flexibility to add and delete new service offerings in real-time. Such new billing capabilities mean new testing challenges. For instance, billing systems must scale, and must be reliable and accurate. A billing system should not become a performance bottleneck for the overall system. Without proper testing, poor performing and/or inaccurate billing systems could lead to loss of revenue and loss of customer confidence. Some carriers and vendors still evaluate their billing systems in a manual and time consuming way. They should understand that billing importance, and its complexity, will only increase with IMS. Old test methods will quickly become insufficient for the Next Generation Network.

Billing in wireless starts with Call Detail Record (CDR) collection on the SGSNs and GGSNs. Lack of automation in measuring the accuracy and stability of CDR collection can lead to corner cutting in testing. Spirent offers fully automated test cases to validate billing accuracy. Thousands of records from complex traffic profiles can be verified for accuracy in minutes, not days nor weeks. Also, HSS or AAA functions can be tested to ensure correct billing procedures are strictly followed.

MOBILITY AND FIXED MOBILE CONVERGENCE (FMC)

One important aspect of FMC is dual-mode handsets, which allow users to roam from cellular to WLAN networks based on service availability and the network offering the lowest cost and highest performance. To accomplish this, WLAN networks must interwork with cellular packet data networks. The industry standards bodies for 3G (3GPP and 3GPP2) have issued specifications defining these interworking or gateway functions. New network elements referred to as Packet Data Gateways (PDG) or Packet Data Interworking Functions (PDIF) are at the center of the specifications. These new devices play a critical role in securely bridging WLAN users onto cellular networks and supporting the smooth handoff from one network type to another.

Scalability, handover performance, QoS, and security aspects of the new PDGs and PDIFs are key test considerations for equipment vendors and carriers if they want to develop and deploy best in class FMC services using dual-mode handsets. Spirent's IMS test portfolio provides comprehensive test capabilities for FMC. Spirent equipment isolates the new packet and security gateway devices by emulating WLAN access points, millions of mobile nodes, and the entire 3G mobile packet core. PDGs, PDIFs, and security gateways can be tested standalone or as a system containing real mobile packet core and IMS elements.

IMS INTERWORKING WITH LEGACY NETWORKS

IMS networks are not standalone networks. For IMS to succeed, it must interwork with today's existing networks. IMS core networks will interwork with 2G cellular networks, PSTN networks, and other VoIP networks. IMS standards define Media, Control, and Signaling gateways to facilitate this. Scalability, performance, interoperability, and voice quality are key factors in determining the workability of emerging gateway functions and the service quality customers can expect.

Spirent's VoIP and PSTN test solutions enable conformance, functional and performance testing, eliminating the need for multiple test tools. Spirent helps equipment manufacturers to test their migration from legacy to converged network equipment—enabling the evaluation of the PSTN interworking part of the IMS network architecture. Spirent's test solution measures the quality of voice, video, and data traffic across fixed to mobile, VoIP and IMS networks. The solution is particularly well suited to comprehensive voice quality tests essential for proving a new network and customer satisfaction. In IMS networks, Spirent can test the impact of data and video traffic on voice quality. Integrated testing is the only way to adequately verify the converged network infrastructure.

TRANSPORT PLANE

The all IP-based Mobile Packet Core Network is an integral part of delivering new IMS-based multimedia services to mobile users. The Mobile Packet Core will carry voice, video, and data and deliver it to the user. The performance, scalability, and Quality of Service (QoS) the Mobile Packet Core delivers has substantial impact on end customers' perceived quality in a carrier network. Proper testing must be performed to quantify how network elements will perform not only in isolation but as part of a complete system.

Spirent's performance analysis test systems provides comprehensive testing capabilities for the Mobile Packet Core based on 3GPP or 3GPP2 standards. Spirent products are capable of emulating and testing every network element in GPRS/UMTS and CDMA2000 Mobile Packet Core. Spirent has best in class system scalability in the industry and is capable of scaling to millions of emulated mobile nodes in a single test bed. Real-world traffic models with a wide range of application traffic (SIP, HTTP, RTP, Mail) can be simulated in a lab environment, with a very small foot print. This saves vendors and carriers the cost, complexity, and lab space of trying to cobble multiple devices together. Canned test methodologies provide deterministic and repeatable testing. This is critical to customers wanting to accelerate time to market for their new products and services.

SPIRENT'S IMS TEST SOLUTION:

- Test and Emulate all 3GPP2 Wireless Core Network Elements including: Mobile Nodes, PDSN/HA, AAA, FA, PCF, PDIF, WLAN AP, Web Servers, Video Servers, L2TP Gateway
- Canned Performance Analysis Tests for Activation Rate, Capacity, Throughput, and Packet Loss
- Quickly Create Custom Call Flows
 - Capture-Replay Wizard Quickly Emulates the Behavior of Any SIP-based UE
 - Create Custom Signaling Flows with Legal or Illegal Behavior
 - Built-in State Machine Editor Allows New Levels of User Configurability
 - Manipulate Any Parameter Within Any Message

Spirent Communications is a worldwide provider of integrated performance analysis and service assurance systems for next-generation network technologies.

Our solutions accelerate the profitable development and deployment of network equipment and services by emulating real-world conditions in the lab and assuring end-to-end performance of large-scale networks.

Spirent performance analysis solutions include instruments and systems that measure and analyze the performance of network equipment, particularly the devices that route voice and data messages to their destination. Our service assurance solutions include remote test, fault and performance management systems that let network service providers quickly identify network faults and monitor real-time performance. Spirent's integrated performance analysis and service assurance solutions enable our customers to more rapidly develop and certify new devices, lowering the cost of widespread deployment and operation of new networking services.



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