



Spirent Communications
Professional Services

OnDEMAND Test Services

Network Defense: Security & Application Performance

*By Spirent Communications
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1 Version

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3 Introduction

3.1 About Spirent Professional Services

Our Professional Services supplement internal capabilities with test methodology and network operations expertise so that customers can focus on their core business. We deliver quick, proven solutions compared to those undertaken in house, which can be costly, risky, and difficult to manage.

We contribute to industry forums, write RFCs, and participate in industry interoperability testing events. This involvement enables us to see the majority of test scenarios and roadblocks before they even hit the commercial marketplace. As the result, we can deliver field-proven solutions at the beginning of the technology adoption life cycle.

3.1.1 About Our Customers

Our customers comprise government, enterprise, equipment manufactures, and service providers, and range from startups to established companies. The common driver of our program is based on customers needs to optimize the process of testing through rapid test planning, product personalization, process automation and training.

3.1.2 About Our Engagements

Our engagements are differentiated from other test solution vendors by three primary elements: industry recognized test methodology expertise, broadest range of technologies, and a dedicated project team to ensure timely fulfillment.

3.1.3 Our Portfolio of Professional Services

- **Engineering Services** - Instead of addressing unique requirements with in-house custom development, reduce your risk and accelerate delivery by engaging product experts from Spirent Professional Services.
- **Implementation Services** - Spirent has the expertise and skill to successfully deploy solutions, to ensure that that the value you expect is the value delivered—on time, on budget, and to specification.
- **Integration Services** - If you need to integrate Spirent products with offerings from third parties, or to develop custom interfaces, Spirent Professional Services has the specialized knowledge and experience needed to optimize the business value of your systems investment.
- **Test Services** - Base your decisions on objective information. Whether you are selecting a new technology provider, assessing the robustness of information security measures or seeking the most promising path to improved network performance, Spirent can provide objective, expert analysis to support your decision-making.
- **Consulting Services** - Improve operational efficiencies based on expert analysis of your present methods and systems.

3.2 Spirent Global Services Overview

Spirent is a worldwide communications test and service assurance company. We place a special emphasis on capturing and redistributing test methodology and

network operations knowledge across the global customer base. Our expertise comes from:

- Global Services Advanced Test Programs, a global partnership with independent test labs, industry forums, and educational institutions
- Broad service and product portfolio encompassing all stages of product development and deployment life cycle
- Extensive technology coverage, from wire line to wireless, and from Layer 1 to Layer 7

We serve 1,500 customers in 50 countries through an expert pool of over 200 test and measurement engineers and with the help of several expert partners worldwide including Empowered Networks, EANTC, Toyo, Wipro, TCS and Sasken/iSoft.

3.2.1 Services

Our services include professional services, support services, and education services - all focused on helping you meet your complex testing and service assurance requirements.

- Our **Professional Services** provide expert test expertise so our customers can confidently design, deploy, and manage their networks.
- Our **Support Services** maximize productivity with Spirent test equipment through expert phone support, up to the minute software enhancements and bug fixes, and extended hardware warranty services, including advance replacement.
- Our **Education Services** provide product and test methodology training for customers who wish to effectively test in-house with Spirent. Please refer to <http://www.spirentcampus.com/> for more information.

3.2.2 Spirent's Service Delivery Approach

Spirent has developed a unique four-point approach for the Customer. Our methodology provides repeatable testing that thoroughly tests the devices under test to reveal weaknesses, rendering results that are meaningful to your needs. Spirent's distinctive approach provides some of the most thorough conformance testing capabilities for network equipment in the world. Below is an outline of our four-point approach.

- **Define Your Expectations:**
Our first objective is to understand what you are trying to test and identify key requirements. Next, we design a meaningful test solution that produces the desired test results and lab productivity. Our goal is to form clear expectations for a solution that achieves your business goals, leverages your team's strengths and delivers a positive return on your investment.
- **Develop, Leveraging Your Environment**
Together we develop a testing approach that addresses your specific requirements and testing goals. We make a commitment that maps exactly what we deliver, provide a schedule for the entire project, define our processes for managing the project and detail the steps to completion. We determine the best testing methodology to satisfy your test productivity goals and produce meaningful test results.
- **Deliver On Our Commitment**

Here's where the rubber meets the road. From the documented deliverables and the work product developed, we begin the process of testing the network systems and accepting the work product features agreed on. We run a series of repeatable tests, compile statistics and results, and deliver empirical data that will help you determine your network's performance capabilities and cost effective equipment needs.

- **Debrief, Detailing the Solution**

Lastly, when all of the acceptance tests are completed and signed off, we produce a project final report. We go over the results so you understand exactly what is delivered and your questions are addressed.

4 Test Plan Overview

4.1 Goal

With this testing, critical data will be acquired on your security infrastructure. This suite of tests will help you obtain an accurate evaluation of the points of failure as well as reliability, performance and scalability issues of your network infrastructure (firewall, IDS, IPS...).

This testing will also help you receive invaluable data on unexpected vulnerabilities by DDoS and signature based attacks. This would also help you determine your firewall reliability in high loads / high risks situations.

4.2 Test bed topology

The Avalanche connectivity can be as follow:

- Up to eight 1Gbps ports (clients) to up to eight 1Gbps ports (servers)
- Up to two 10Gbps ports (clients) to up to two 10Gbps ports (servers)
- A mix of copper or fiber ports for the clients and servers emulations

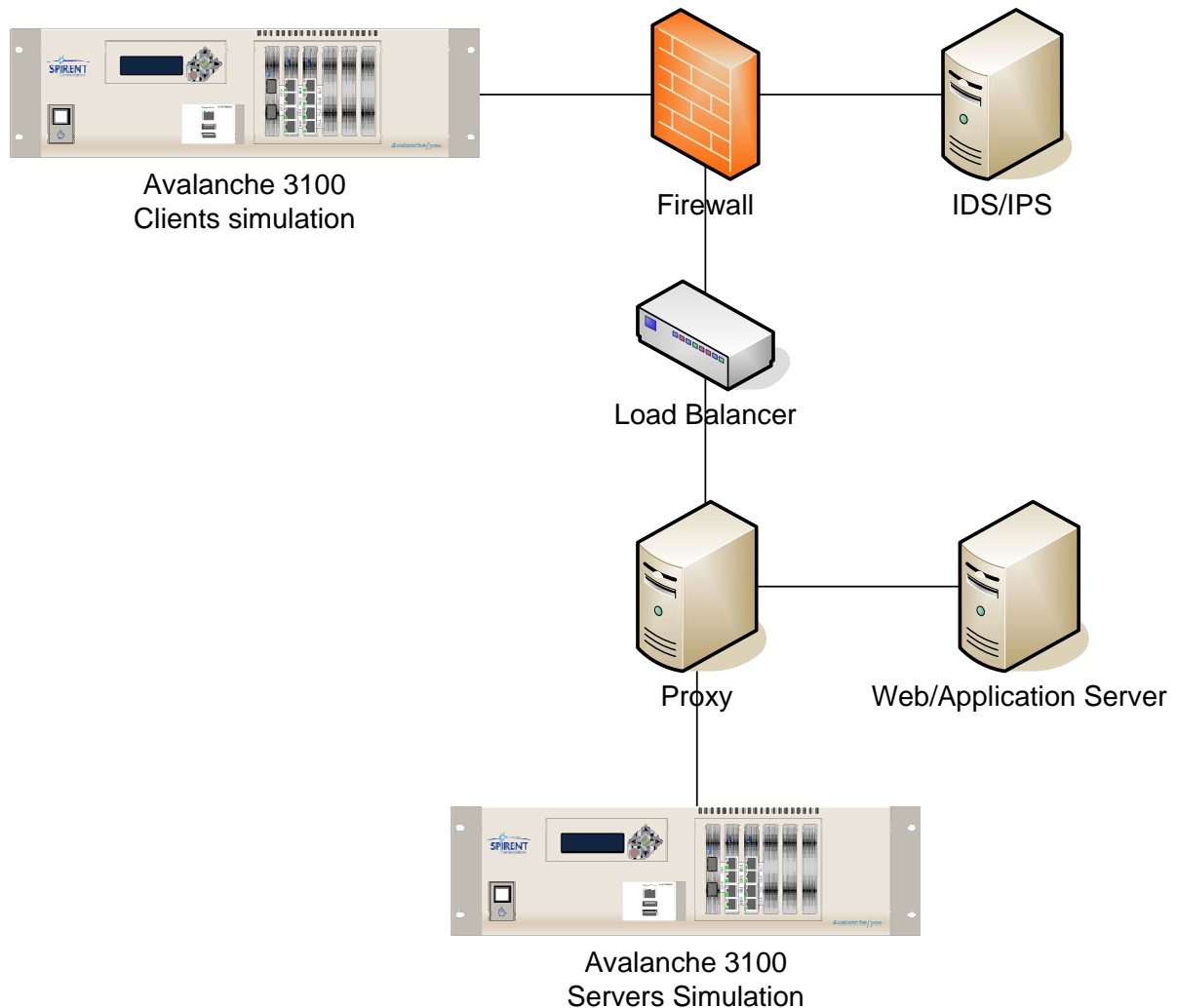


Figure 1 : Test topology

4.3 Testing summary

This security & applications assessment will rely on the following tests:

4.3.1 Test case scenarios

- a. Maximum connections per second: evaluates the maximum number of new sessions the network under test can handle
- b. Maximum concurrent connections: evaluates the maximum number of concurrent sessions the network under test can handle
- c. Maximum bandwidth: evaluates the maximum bandwidth of the network under test
- d. Threat filtering capabilities: evaluates the IDS/IPS and/or proxy filtering capabilities
- e. Fail-over testing: evaluates the high-availability of the network under test
- f. URL filtering capabilities validation: evaluates the proxy and/or IDS/IPS capabilities
- g. Application testing: evaluates the robustness of one critical application on the network

4.3.2 Performance Validation

All these tests will provide detailed information for the global performances of the device under test. Below are detailed all the tests that will be used during the test session.

5 Tests Description

5.1 Maximum new connections per second

In these tests, we will evaluate the maximum number of new users per second (new connections per second) the network under test can handle. To achieve this, the Avalanche simulates remote users connecting through the device under test to servers also simulated by the Avalanche. Once the client-server connection is established, the Avalanche downloads a variable size object and measures all the key information to evaluate the equipment performances.

- 3 tests
- Protocols: HTTP
- Object size: 128 B, 1 KB, 10 KB
- Measures: response time, connections per second, bandwidth

The maximum number of new users per second (connections per second) is reached when one of the following parameters is exceeded:

- Response time above 100ms (value to be adjusted according to customer requirements)
- Concurrent TCP connections above 200
- No unsuccessful transaction

5.2 Maximum Concurrent Users

In these tests, we will evaluate the maximum number of concurrent users (concurrent connections) the network under test can handle. To achieve this, the Avalanche simulates remote users connecting through the device under test to servers also simulated by the Avalanche. Once the client-server connection is established, the Avalanche downloads a variable size object and measures all the key information to evaluate the equipment performances, while the connection is maintained opened.

- 3 tests
- Protocols: HTTP
- Object size: 128 B, 1 KB, 10 KB
- Measures: response time, concurrent connections, bandwidth

The maximum number of concurrent users (concurrent connections) is reached when one of the following parameters is exceeded:

- Response time above 100ms (value to be adjusted according to customer requirements)
- No unsuccessful transaction

5.3 Maximum Bandwidth Validation

In these tests, we will evaluate the maximum bandwidth the network under test can handle. To achieve this, the Avalanche simulates remote users connecting through the device under test to servers also simulated by the Avalanche. Once the

client-server connection is established, the Avalanche downloads an object and measures all the key information to evaluate the equipment performances.

- 1 test
- Protocols: HTTP
- Object size: 100 KB
- Measures: response time, bandwidth

The maximum number of new users per second (connections per second) is reached when one of the following parameters is exceeded:

- No unsuccessful transaction

5.4 Threat Filtering Capabilities

In these tests, we will evaluate the threat filtering capabilities the network under test can handle. Various protocols with forged and legit requests will be injected in the network. A pass/fail result will be determined based on the success rate in blocking the malicious traffic. A detailed analysis of the server responses will determine if false-positives rose during the tests.

- 4 tests
- Protocols: various
- Authorized/Forbidden traffic percentage: 0/100, 33/67, 67/33, 100/0
- Measures: response time, transactions per second, bandwidth, false-positives

Filtering capabilities will be evaluated based on the following criteria:

- Response time below 100ms (value to be adjusted according to customer requirements)
- No unsuccessful transaction
- No false-positive

5.5 Fail-Over Testing

In these tests, we will evaluate the behavior of the device under test when one the unit of the cluster is failing. During an 80% sustained load, a failure will be simulated on one of the cluster nodes, in order to evaluate how the equipment fail-over mechanism (sessions, interruption time...).

- 2 tests: at 80% of maximum connections per second and concurrent connections (based on previous tests results)
- Protocols: HTTP
- Measures: response time, transactions per second, bandwidth

Fail-over will be considered as successful if all of the following values are verified:

- Response time above 100ms (value to be adjusted according to customer requirements)
- No unsuccessful transaction

5.6 URL Filtering Capabilities

In these tests, we will evaluate the URL filtering capabilities the network under test can handle. Authorized and malicious HTTP forged requests will be injected at different percentage levels during separate tests. A detailed analysis of the server responses will determine if false-positives rose during the tests.

- 4 tests
- Protocols: HTTP
- Authorized/Forbidden requests percentage: 0/100, 33/67, 67/33, 100/0
- Measures: response time, transactions per second, bandwidth, false-positives

Filtering capabilities will be evaluated based on the following criteria:

- Response time below 100ms (value to be adjusted according to customer requirements)
- No unsuccessful transaction
- No false-positive

5.7 Application testing

In this test, we will evaluate the behavior of one critical application of the network with a mixed traffic of legit and malicious traffic. This will help to have a global overview of the application robustness in a near-real-world environment. This setup will rely on accessing real Web Servers in the customer environment with the Avalanche client simulation.

- 2 tests
- Protocols: HTTP
- Authorized/Forbidden URL percentage: 100/0, 75/25
- Measures: response time, transactions per second, bandwidth

Filtering capabilities will be evaluated based on the following criteria:

- Response time below 100ms (value to be adjusted according to customer requirements)
- No unsuccessful transaction

6 Proposal

6.1 Roles and Responsibilities

The following responsibilities are agreed on prior to test start and made clear to all project and engagement stakeholders. These stakeholders will be discussed and agreed on during the introduction meeting during the readiness assessment.

6.1.1 Spirent Communications Responsibilities

- Provide Spirent engineer(s) to work onsite at the customer location for [add here the number of days] consecutive business days
- Devise the test plan and methodology
- Procure and ship all required test equipment and software to test site
- Pay for shipping rental equipment to customer
- Setup and configure the Spirent Solution test environment at the test site
- Execute test cases outlined in 'Test Plan' section of proposal
- Interpret test results
- Provide troubleshooting support throughout the engagement for the Spirent test equipment
- Project manage the activities related to configuring, executing and reporting the results
- Provide knowledge transfer of the results throughout the engagement
- Provide frequent status reports as requested by the Customer
- Coordinate all review meetings including conference bridges or digital presentation sessions
- Write the final report and deliver via email to the Customer

6.1.2 Customer Responsibilities

- Introduce Customer engineers in the introduction meeting
- Provide Spirent with simple travel logistics- e.g. address of building to go to, nearby hotels, etc.
- Provide Spirent with the shipping address at least seven (7) business days before the equipment is needed on site
- If needed, provide access to the Customer premises, including badges, for Spirent engineer(s) on arrival
- Have the network and devices under test ready and available to test throughout the engagement. If it is not ready or available for testing during the engagement, testing maybe delayed and additional days needed and charged to complete the testing. Keep in mind that Spirent engineers are expert testers, but we cannot guarantee that they will be able to effectively troubleshoot third-party network issues
- Provide Internet access for the Spirent engineers. This will primarily be used to grab updates and interact with others at Spirent if assistance is needed
- If applicable, prepare and provide beforehand a physical diagram of the test network either showing or allowing Spirent to suggest where to connect the Spirent test interfaces
- Ensure that third-party vendors (or a suitable engineer from the Customer) will be solely responsible for the configurations, setup, and troubleshooting of their products

- Be responsive to Spirent engineers' inquiries during project
- Work directly with Spirent engineers to complete project and test requirements
- Provide interconnect and connectivity to network devices, including cabling
- Provide assistance in connecting the Spirent test equipment to the test network
- Have one or two 15 amp circuits with at least 2 outlets for the Spirent test equipment, if applicable
- Have another 5 amp circuit for the Spirent engineer's laptop
- Assure that key engineers from [Insert third-party company name] will be available throughout the testing
- the Customer will provide and coordinate with engineers about the test plan, schedule, responsibility and deliverables
- Provide assistance in packaging and returning the Spirent equipment
- Return rental equipment provided by Spirent on time and pay for shipping charges. Rental equipment, if provided, is documented in Section 6.

6.2 Documents

6.2.1 Test plan

A test plan (this document) containing methodologies is provided.

6.2.2 Tests report

A report containing all the results will be delivered a maximum of two (2) weeks after the end of the engagement.

6.3 Scheduling & equipment

As of the publication date of this proposal, the onsite engagement start date is not determined. We ask that the Customer provide Spirent Professional Services with as much notice as possible. We request a minimum of seven (7) business days notice. Scheduling can begin as soon as a PO is received and a signed agreement. Once a time is scheduled and agreed upon by Customer and Spirent, we will schedule travel and acquire equipment for rental and shipment. Changes to the schedule will incur a change fee, and will be documented in a Change Request Form.

Services	Description	Timeline
SVC-6105 ONDEMAND TEST SVC-DCN- SECURITY&APP PERF	4 regular business hour onsite days, 1 eng. Testing on a single network segment. 4 day rental of two CEE-HWB-005 w/ CEE-SWB-004. Final Testing Report.	4 days on site

Equipment	Description
2 x CEE-HWB-011	AV3100 with: .8x1GiG copper ports
2 x CEE-HWB-013	AV3100 with: .8x1GiG copper ports .2x10GiG fibre port

7 Contacts

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SPIRENT AVALANCHE APPLICATION LOAD TESTING SOLUTION **AVALANCHE 3100**

Spirent's Avalanche™ appliance solution provides capacity, security and performance testing for network infrastructures, Web application infrastructures and Triple Play services ensuring Quality of Service (QoS) and Quality of Experience (QoE) for your customers.

APPLICATIONS

- Network Performance Testing
- Web Application Testing
- Triple Play Testing
- Security Testing

In today's digital world, it's essential that the performance of content aware networks, security systems and web applications are carefully tested to ensure that business transactions and communication are not impacted. The Spirent Avalanche™ 3100 is a line rate, 1 Gbps and 10Gbps Layer 4-7 stateful traffic performance solution that is capable of high throughput security testing of over 6 Gbps of bulk encrypted traffic. Avalanche™ 3100 users now have the ability to test devices to their limits at line rate simulating daily traffic and understand the impact under worse case scenarios.



PERFORMANCE AND FLEXIBILITY

In addition to 1 Gbps and 10Gbps of Layer 4-7 stateful traffic and 12 million connections (Avalanche 3100 GT supports over 25,000,000 connections), testers are able to specify load variables such as user sessions, new user sessions per second, transactions, transactions per second, connections or connections per second. One load profile can be specified for an entire test, or a separate load profile can be defined for each group of simulated users you can also turn on and off any protocol at any phase during the test. This flexible approach enables different actions, network characteristics and loads to be specified for each group of simulated users. In addition, up to eight simultaneous users can utilize the resources of a single Avalanche™ 3100 appliance to maximize your investment and test efficiencies.

AVALANCHE™ 3100 APPLIANCE PERFORMANCE EXAMPLES*

	Avalanche 3100	Avalanche 3100GT
HTTP GETs/Sec	700,000	700,000
HTTPS GETs/Sec	200,000	200,000
HTTP Bandwidth	20 Gbps/36 Gbps	20 Gbps/36 Gbps
HTTPS Bandwidth	6.5 Gbps	6.5 Gbps
Sustained Connections	12,000,000	25,000,000
Sustained IPSec Tunnels	200,000	400,000
Sustained Video Sessions	200,000	200,000

*The above numbers are obtained using two 3100 appliances, one being used as client and other one as server. Unidirectional/Bidirectional Traffic

USER REALISM

Avalanche supports the configuration of extremely realistic user behaviors so tests accurately reflect your company's network usage patterns. The system interacts seamlessly with sites using dynamic and interactive content, HTML links and fill-in online forms. Multiple types of browsers can be emulated, providing detailed control over browser connection behavior, SSL versions, authentication and browser client headers. User behavior such as think times and "clickaways" (HTTP aborts) can be simulated, and the system also supports HTTP basic and proxy authentication.

Avalanche sends realistic requests that include dynamically filled-in fields from a list of provided values, or values captured from a previous response such as order numbers, session IDs or transaction IDs. Avalanche also supports high-performance testing of Web services to ensure mission-critical services will perform under heavy loads. The system can also verify received content by searching for one or more strings in a response. Avalanche quickly identifies potential points of failure by stress-testing the infrastructure. With tremendous performance at your disposal, highly realistic simulated user and network traffic can be generated, recreating a wide range of real-world loading scenarios. This proactive approach enables you to correct trouble spots and bottlenecks before network slowdowns or costly outages occur. Ideal for equipment manufacturers, service providers and enterprise network operators, Avalanche eliminates the need to build expensive and cumbersome test infrastructures. The challenge of analyzing performance and security in today's Triple Play voice, video and data networks requires the best testing equipment you can get. By accurately emulating user and network behavior, the Avalanche load testing appliances help ensure tight security and optimum application performance.

FEATURES & BENEFITS

- 20Gbps Line Rate Stateful Traffic – Provides the capability to generate line rate stateful traffic up to 10Gbps allowing trunk ports to be directly tested or determine the impact of multiple GigE ports being aggregated over 20Gbps - in addition the Avalanche 3100 is capable of bidirectional testing and can operate in excess of 35Gbps from a single 3100 appliance
- Flexible Load Profile – Flexible load profile offers testers the flexibility to specify load variables such as connections per second, concurrent connections, transactions per second, new user sessions per second and concurrent users
- Expandable - The Avalanche 3100 is designed for the future in mind with the ability to be expanded to up to 4-ports of 10Gbps interfaces for a total of 40Gbps of unidirectional line-rate application traffic
- Real-Time Statistics – Real-time statistics across all protocols and reporting tool that makes analyzing results faster and easier
- Network Devices Performance Testing – Provides performance and capacity testing on a variety of network devices including: Firewall, Application Firewall, Load Balancer, Cache, Proxy, URL Filter, Content Filter, Anti-Virus, Anti-Spyware, Reverse-Proxy, SSL Accelerator, HTTP/HTTPS Accelerator, WAN Accelerators, SMTP Relay, IDS/IPS, IPSec VPN Gateway and SSL VPN Gateway
- Application Server Performance Testing – Validates the performance of several types of real servers including Web Server, CIFS Server, Application Server, Mail Server, DHCP Services, FTP Server, DNS Server, Telnet Server, RTSP/RTP QuickTime Streaming Server, Multicast Server, RTMP Servers, and more
- Triple Play Performance Testing – Performs Triple Play testing, validates Triple Play service from the user's point of view with realistic voice calling, unicast and multicast streaming video, and simulates Internet data traffic using static IP address or IP address assign by DHCP over PPPoE, VLAN and Stacked VLANs (e.g. Q-in-Q)
- Web Application Testing – Performs Web application testing including Web services, SOA, ERP and CRM applications with Spirent Avalanche's application testing capability to support cookie, session ID, dynamic link, automatic follow redirect, additional header, content validation, SOAP message, think time, variable think time and variable assignment
- Network Security Testing – Provides extensive testing for secure network communication, vulnerability assessment with over 3000 attack profiles and user authentication including: IPSec, SSL, 802.1x, Network Access Control (NAC) and RADIUS



TECHNICAL SPECIFICATIONS

SPIRENT AVALANCHE 3100 APPLIANCE	
Feature	
Number of Test Users	8 Test Users
Type of Simulation	Client and Server
Network Interfaces	- 8x 10/100/1000 Copper - 8x 10/100/1000 Fiber - 4x 10/100/1000 Copper and 4x 10/100/1000 Fiber - 2x 10Gbps Fiber Interface (SFP + Transceiver Included)
Network Access Protocol	DHCP, PPPoE and IPSec
Network Realism	Line speed limitation, network latency, packet loss and fragmentation
IP Version Supported	IPv4 and IPv6
Encapsulation Protocol	802.1Q and 802.1 Q-in-Q
Transport	TCP, UDP, SSLv2, SSLv3 and TLSv1
Data Protocol	HTTP, HTTPS, FTP (Active/Passive), DNS, TELNET, SMTP, POP3, IMAP4, CIFS, RADIUS, MMS, RTMP, ICMP and Capture/Replay
Authentication	802.1x, Network Access Control (NAC), Radius
Extended Protocols	BitTorrent, Gnutella, MSN, Yahoo, SKYPE, SQL, MYSQL, Oracle, SMB, NFS, Remote Desktop, Exchange, LDAP
Voice Protocol	SIP over TCP and SIP over UDP
Voice Codec Supported	G711A, G711U, G.723.1, G.726-32, G.728 and G.729AB
Voice Quality Measurement	MOS R-factor
Video Protocol	Flash Streaming using RTMP/RTMPT, Unicast Streaming Quicktime RTSP/RTP, Unicast Streaming RealNetwork RTSP/RTP, Unicast Streaming Microsoft MMS, Multicast Streaming IGMPv2, IGMPv3 and MLDv2
Video Codec Supported	MPEG-1, H.261, MPEG-2, H.262, MPEG-4, H.264
Video Quality Measurement	MDI measurements along with additional stats to detect picture quality
Vulnerability Assessment	L2/L4 DDOS Attacks and 3500+ L4/L7 Application Attacks including SANS Top-20 Internet Security Attacks
Reporting	Integrated CSV test results analyzer fully customizable with report generation in PDF and HTML
Automation	GUI to TCL and Automatic goal seeking using WorkSuite Manager
SPIRENT AVALANCHE 3100 APPLIANCE	
Dimensions	5.25" H x 16.53" W x 19.75" D Fits standard 19" rack, 3U high
Weight	31 lbs. (14 kg)
Operating Environment	5°C–35°C
Non-Operating Environment	0°C–50°C
Relative Humidity	10%–90% (non-condensing)
Power Requirements	115-230V, 50/60 Hz – 460W
Regulatory Approvals	FCC Class A, EN 55022 Class A, EN 55024



SPIRENT AVALANCHE 3100
AVALANCHE 3100 APPLICATION LOAD TESTING SOLUTION

REQUIREMENTS

An IBM® compatible PC must meet the following minimum requirements to run the Spirent Avalanche:

- One 10/100/1000Base-T unshielded twisted pair (UTP) cable
- One 10 Mbps or 10/100/1000 Mbps Ethernet NIC card
- Intel® E6300 Core 2 Duo 4 (or equivalent)
- One serial port
- Minimum of 2 GB of RAM
- Minimum 10 GB free space on the hard drive
- Windows® XP operating system, Service Pack 2 (SP2)
- An SVGA color monitor (or equivalent) and a mouse
- Microsoft Terminal Services™ or HyperTerminal™, or equivalent communications software package
- DVD-ROM drive

ORDERING INFORMATION

- Avalanche 3100 with 8-Port GIGE Copper NICs: **CEE-HWB-011**
- Avalanche 3100 with 8-Port GIGE Fiber NICs: **CEE-HWB-012**
- Avalanche 3100 with 8-Port GIGE Fiber and 2-Port 10G NICs: **CEE-HWB-014**
- Avalanche 3100 with 8-Port GIGE Copper and 2-PORT 10G NICs: **CEE-HWB-013**

SPIRENT SERVICES

Professional Services

- Test lab optimization: Test automation engineering services
- Service deployment and service-level optimization: Vendor acceptance testing, SLA benchmarking, infrastructure and security validation
- Device scalability optimization: POC high scalability validation testing

Education Services

- Web-based training: 24 x 7 hardware and software training
- Instructor-led training: Hands-on methodology and product training
- Certifications: SCPA and SCPE certifications

Implementation Services

- Optimized new customer productivity with up to three days of on-site assistance

SPIRENT GLOBAL SERVICES

Spirent Global Services provides a variety of professional services, support services and education services – all focused on helping customers meet their complex testing and service assurance requirements. For more information, visit Global Services at www.spirent.com/gs or contact your Spirent sales representative.

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9 Exhibit A: Change Control Process

9.1 Overview

- a. If at any time either party identifies a need for change to the scope of the Services set out in the Agreement, either party may request a change in accordance with this Change Control Process.
- b. Neither Spirent or Client shall unreasonably withhold its agreement to any change provided that Client shall not be obliged to agree to any change increasing prices payable by Client or requiring Spirent to incur material expenditure.
- c. Until such time a change is made in accordance with this Change Control Process, Spirent shall, unless otherwise agreed in writing, continue to supply the Services as if the request or recommendation had not been made.
- d. Any discussions which may take place between Client and Spirent in connection with a request or recommendation before the authorization of a resultant change to the Services Agreement shall be without prejudice to the rights of either party.
- e. Any work undertaken by Spirent which has not been authorized in advance by a change to the Services Agreement in accordance with this Exhibit B, shall be undertaken entirely at the expense and liability of Spirent.

9.2 Procedures

- a. The Change Request form should be used in order to formally initiate a request for change to a project. Types of change requests to be initiated using this form includes changes to project:
 - i. A written request for a change by Spirent; or
 - ii. Agreement not to proceed further; or
 - iii. A written recommendation for a change by Client
- b. Where a written request for a change is received from Client, Spirent shall promptly upon receipt issue a written acknowledgement to Client and, unless otherwise agreed, submit a Change Control Note ("CCN") to Client within 10 days of the date of the request in the form attached to this Exhibit.
- c. A recommendation for a change by Client shall be submitted as a CCN direct to Client at the time of such recommendation.
- d. Each CCN shall contain:
 - i. the title of the change;
 - ii. the originator and data of the request or recommendation for the change;
 - iii. the reason for the change;
 - iv. full details of the change;
 - v. the variation to prices for the Services, if any, resulting from such change;
 - vi. a timetable for implementation together with any proposals for trialing and acceptance testing of the change;
 - vii. details of the likely impact, if any, of the change on other aspects of the Services including but not limited to:
 - viii. the schedule for the Services

- ix. the personnel to be provided;
 - x. the changes;
 - xi. the payment profile
 - xii. the documentation to be provided;
 - xiii. the training to be provided;
 - xiv. working arrangement; and
 - xv. other contractual issues
 - xvi. the date of expiration or validity of the CCN; and
 - xvii. provision for signature by Client and Spirent
- a. For each CCN submitted Spirent shall within the period of the validity of the CCN:
- i. allocate a sequential number to the CCN;
 - ii. evaluate the CCN and as appropriate either:
 - 1. request further information
 - 2. approve the CCN or
 - 3. notify Client of the rejection of the CCN; and
 - iii. if the CCN is approved by Client, Spirent shall arrange for 2 copies of an approved CCN to be signed between Client and Spirent.
- b. A CCN signed by both parties shall constitute an amendment to the Agreement.

10 Appendix A: Change Control Process

In reference to the Section titled Change Control Process of the above referenced agreement between Spirent Communications, Inc., ("Spirent") and HP ("Customer"), both parties hereby certify, by the signature of an authorized representative, that this Change Request Form will amend and be fully incorporated into the existing Test Plan/Statement of Work (SOW).

Project Name:

Change Request Number:

Reason for Change Request:

- Project Schedule
 Configuration Issues/Resources (Third Party)
 Test Plan/SOW Other (specify below)

Change Description

Project Schedule Impact

Project Scope Impact

Technical Design Impact

Impact Assessment

SOW/Change Request	Services	T&E	Total
Original Project Cost			
Value of Change Request			
New Value of Test Plan/SOW			

Purchase Order issuance (if applicable): Customer shall issue a written purchase order to Spirent, or shall issue an amendment to its original purchase order issued under this Test Plan/SOW, for the total amount of £TBA. Except as changed herein, all terms and conditions of the Test Plan/SOW remain in full force and effect.

IN WITNESS THEREOF, the duly authorized representatives of the parties hereto have caused this Change Request to be fully executed.

Accepted and Agreed by:	Accepted and Agreed by: Spirent Communications
Sig X	Sig X
Date:	Date:
Print:	Print:
Title:	Title:

11 Spirent Communications Professional Services Agreement

This Spirent Professional Services Agreement (this "Agreement"), effective as of ("Effective Date"), is by and between Spirent Communications, Inc. a California corporation with offices located at 26750 Agoura Road, Calabasas, CA 91302 (hereafter "Spirent") and _____, a _____ corporation with offices located at, ("Client").

11.1 SERVICES

1.1 Statement(s) of Work. This Agreement, by itself, does not obligate Spirent to provide any services to Client nor does it obligate Client to procure any services from Spirent. To the extent Client wishes to procure services from Spirent and Spirent wishes to provide services to Client, the parties shall execute a statement of work in a format similar to Exhibit A attached which specifically references this Agreement and is signed by both parties (each an "SOW"). The SOW which may contain the following information: (a) the start date, location and scheduled completion of the project; (b) a description of the project and the services to be performed by Spirent; (c) the charges for the services; (d) any copyrightable works to be developed by Spirent and delivered to Client ("Deliverables"); and (e) such other information as may be agreed to by the parties. In the event of a conflict between the terms of this Agreement and the SOW, the terms of the SOW shall govern. Upon execution of an SOW, Spirent shall perform the services set forth in the SOW using generally accepted industry standards and practices. Spirent shall determine in its sole discretion what personnel is required to complete the work contemplated by this Agreement and may use third parties, as determined by Spirent in its sole discretion, to complete any work.

1.2 Change Control. Client may request changes in the Services to be performed by Spirent by completing a Change Request Form, attached hereto as Exhibit B and submitting to Spirent. Such requested changes will be made in writing and, in the event of acceptance by Spirent, signed by the authorized representatives of Spirent and Client. All changes will subsequently be incorporated in an amendment to the Agreement and will specify the change requested any changes in the price, adjustment to the schedule of performance and any changes to the terms and conditions. Until such time as the change is accepted by Spirent, Spirent shall continue to supply the Services as originally agreed.

1.3 Nonexclusive. Spirent shall not be required to devote its services exclusively to Client, and Spirent shall not be precluded from engaging in any other business activity during the term of this Agreement, including, without limitation, providing services to other clients and/or competitors of Client.

1.4 Client Cooperation. Client shall provide Spirent with reasonable, safe access to work space, facilities, equipment and resources (including, without limitation, people, documents, systems and data) to perform the services. Client shall ensure the performance of its employees and contractors as well as the accuracy and completeness of data and information provided to Spirent to perform the services.

1.5 Personnel. The personnel assigned to perform Services ("Personnel") shall have the skill, training and background sufficient to perform the Services. The term "Personnel" may also include such other person(s) as may be subsequently designated by Spirent in writing as its representative(s) for purposes of this Agreement or a SOW provided. The Personnel shall perform their assignments under the direction of Spirent and the Client's Project Manager. If Spirent is required to perform any work at Client's facilities in connection with the project, all Personnel assigned to work at Client's facilities shall strictly abide by Client's rules relating to security and safety applicable to the facility as advised by Client to Spirent.

1.6 Client Obligations. Client agrees that it shall have the sole responsibility for protecting and backing up its systems, networks, applications, content, and data used in connection with the services. Client shall make and be responsible for all decisions and actions based or related to advice and recommendations provided by Spirent in connection with the performance of the services hereunder.

Client shall be liable for all Spirent owned equipment while in Client's possession or control and, if lost or damaged or not returned to Spirent upon expiration of the engagement, Client agrees to pay for such equipment upon receipt of an invoice referencing this Agreement. Equipment received by Spirent from Client more than five (5) calendar days after the end of engagement shall be subject to a fifteen percent (1.5%) per month late fee based on the list price of the equipment.

11.2 FEES AND EXPENSES

2.1 Fees. Client shall pay Spirent the amount set forth in the SOW ("Fees").

2.2 Expenses. Client shall reimburse Spirent for all expenses incurred in the performance of the services hereunder including, without limitation, reimbursement for actual and reasonable travel, transportation, telephone, and lodging expenses and reimbursement for meals, incidentals and mileage in accordance with Spirent's travel policy.

11.3 INVOICES AND PAYMENTS

3.1 Payments. For Services performed in accordance with this Agreement Client shall pay Spirent the fees and expenses for all Services as described in a SOW. Spirent shall submit invoice(s) to Client as described in a SOW and each invoice submitted by Spirent to Client shall be accompanied by appropriate supporting documentation with detailed itemization to include status report for work actually performed. All payments are due thirty (30) days after receipt of a correct invoice, provided, however, that no payment shall be due sooner than any due date specified on the invoice. All fees are exclusive of federal, state, municipal or other governmental excise, value-added, sales, use, excise, personal property, occupational, withholding obligations and other levies now in force or enacted in the future. Accordingly, all fees payable to Spirent are subject to an increase equal to the amount of any such tax, excise or levy Spirent may be required to collect or pay in connection with the Services, other than a tax on the net income of Spirent. Any applicable charge or tax shall be borne by Client in addition to the fees quoted. Any amounts not paid within such thirty (30) day period shall bear interest at the lesser of the maximum rate allowable under applicable law or two percent (2%) per month. Client's payment of such interest on late payments shall not prevent Spirent from exercising any other rights under this Agreement or applicable law. All payments shall be made in US dollars.

11.4 CONFIDENTIAL INFORMATION

4.1 Confidential Information. Except as otherwise specified herein, Spirent and Client each expressly undertake to retain in confidence all information transmitted to it by the other party pursuant to this Agreement that the disclosing party identifies as being proprietary and/or confidential or that, by the nature of the circumstances surrounding the disclosure, ought in

good faith to be treated as proprietary and/or confidential ("Confidential Information"), and will make no use of such Confidential Information except under the terms and during the existence of this Agreement. Spirent and Client shall treat the terms and conditions of this Agreement as confidential; however, either party may disclose such information in confidence to its immediate legal and financial consultants as required in the ordinary course of that party's business. The receiving party's obligation hereunder shall extend for three (3) years following the disclosure of the Confidential Information. Client shall cause its employees, agents, affiliates, and assigns to retain Confidential Information in accordance with the terms of this Article 4.1.

4.2 Exclusions. Confidential Information shall not include any information that: (a) is at the time of disclosure or subsequently becomes publicly available without the receiving party's breach of any obligations owed the disclosing party; (b) became known to the receiving party prior to the disclosing party's disclosure of such information to the receiving party; (c) became known to the receiving party from a source other than the disclosing party other than by the breach of an obligation of confidentiality owed to the disclosing party; or (d) is independently developed by the receiving party without the use of the disclosing party's Confidential Information.

4.3 Independent Development; Residuals. The terms of confidentiality under this Agreement shall not be construed to limit Spirent's right to independently develop or acquire products without use of the other party's Confidential Information. Further, Spirent shall be free to use for any purpose the residuals resulting from access to or work with Client's Confidential Information, provided that Spirent shall maintain the confidentiality of Client's Confidential Information as provided herein. The term "residuals" means technical information related to computer software technology in non-tangible form, which may be retained by persons in their unaided memory who have had access to the Confidential Information, including ideas, concepts, know-how or techniques contained therein. Spirent shall have no obligation to limit or restrict the assignment of such persons or to pay royalties for any work resulting from the use of residuals. However, the foregoing shall not be deemed to grant to Spirent a license under Client's copyrights or patents.

11.5 5 PROPRIETARY RIGHTS

(a) "Spirent Property" is the software, source code, object code, firmware, procedures, know-how, methodologies, independent utilities, tools and programs, processes and material owned, licensed or developed by Spirent prior to the performance of any work under this Agreement or any improvements thereof, or developed independent of the scope of any work performed under this Agreement. All copyrights, patents, trade secrets, other intellectual property rights or other ownership rights associated with any Spirent Property shall belong exclusively to Spirent subject to Client's non-exclusive right to use such Spirent Property that is provided to Client as a deliverable as set forth below

(b) "Client Property" is the software, methodologies, processes and materials owned, licensed or developed by Client prior to the performance of any work under this Agreement or developed independently and outside the scope of any work performed under this Agreement. All copyrights, patents, trade secrets, other intellectual property rights or other ownership rights associated with any Client Property shall belong exclusively to Client.

(c) SPIRENT EXPRESSLY STATE THAT NONE OF THE SERVICES DELIVERED BY SPIRENT SHALL NOT BE CONSIDERED "WORK FOR HIRE" AND ANY IP RIGHTS CREATED IN PERFORMANCE OF THE SERVICES REMAIN THE SOLE AND EXCLUSIVE PROPERTY OF SPIRENT. TO THE EXTENT THAT SPIRENT CREATES ANY IP IN THE PERFORMANCE OF THE SERVICES SPIRENT SHALL GRANT A LICENSE TO CLIENT TO USE SUCH IPR SOLELY IN CONNECTION WITH THE DELIVERABLES RESULTING FROM THE PERFORMANCE OF THE SERVICES FOR THEIR INTERNAL USE AND SUBJECT TO SPIRENT'S SOFTWARE LICENSING GRANT.

11.6 INSURANCE AND INDEMNITY

6.1 Insurance. During the term of this Agreement, Spirent shall procure and maintain policies of insurance to include the following coverage: (a) Workers' Compensation Insurance for its own employees that meets the statutory limits of the states in which Spirent operates and all federal statutes and regulations, (b) Employers Liability of not less than \$1,000,000 combined single limit per occurrence, (c) Comprehensive General Liability of not less than \$1,000,000 per occurrence including personal injury, (d) Comprehensive Automobile Liability (including Automobile Non-Ownership Liability) with a combined single limit of not less than \$1,000,000 per occurrence, and (e) Umbrella or excess Liability Insurance providing coverage in excess of the coverage listed in (c) and (d) above in an amount not less than \$5,000,000 per occurrence. Upon request by Client, Spirent shall furnish Client with a Certificate of Insurance evidencing such coverage.

6.2 Indemnification. Each party shall indemnify and hold harmless the other party, its principals, officers, directors and employees from and against any and all actions, damages, claims, liabilities, costs, expenses, and losses (including, without limitation, reasonable attorney's fees and expenses) brought against, incurred by, or paid by any of them at any time, as a result of its intentional misconduct or gross negligence. This provision shall apply regardless of the form of action, damage, claim, liability, cost, expense, or loss, whether in contract, statute, tort or otherwise.

11.7 REPRESENTATIONS, WARRANTIES AND LIABILITIES

7.1 Mutual Representations. Each party represents to the other that (a) this Agreement has been duly executed and delivered and constitutes a valid and binding agreement enforceable against such party in accordance with its terms; (b) no authorization or approval from any third party is required in connection with such party's execution, delivery, or performance of this Agreement; and (c) the execution, delivery, and performance of this Agreement does not violate the laws of any jurisdiction or the terms or conditions of any other agreement to which it is a party or by which it is otherwise bound.

7.2 Limitation on Warranties. CLIENT AND SPIRENT AGREE THAT THE SERVICES ARE PROVIDED "AS IS" AND "AS AVAILABLE" AND THAT SPIRENT MAKES NO WARRANTY AS TO THE SERVICES. SPIRENT DISCLAIMS ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SPIRENT DOES NOT WARRANT THE WORK PERFORMED BY CLIENT OR THIRD PARTY CONTRACTORS OR THAT ANY SYSTEMS OR OPERATION OF SYSTEMS WILL BE DEFECT OR ERROR-FREE.

7.3 Exclusion of Damages; Limitation on Liabilities. EXCEPT AS EXPLICITLY PROVIDED HEREIN, IN NO EVENT SHALL EITHER PARTY OR ITS SUPPLIERS BE LIABLE FOR (A) ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO LOSS OF PROFITS, LOSS OF DATA, AND/OR LOSS OF BUSINESS, ARISING OUT OF OR RESULTING FROM THIS AGREEMENT EVEN IF THE OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR (B) DAMAGES IN EXCESS OF THE AMOUNTS PAYABLE HEREUNDER BY CLIENT. THE FOREGOING SHALL APPLY REGARDLESS OF THE NEGLIGENCE OR OTHER FAULT OF EACH PARTY AND REGARDLESS OF WHETHER SUCH LIABILITY SOUNDS IN CONTRACT, NEGLIGENCE, TORT, OR ANY OTHER THEORY OF LEGAL LIABILITY.

11.8 TERM AND TERMINATION

8.1 Term and Termination. This Agreement will commence on the Effective Date set forth on the signature page of this Agreement and will continue in effect for a period of two (2) years unless amended to establish a later expiration date by a written Agreement signed by both parties, or until terminated as provided in this Agreement.

8.2 Either party may terminate this Agreement and/or any individual SOW if the other party breaches a material provision of this Agreement or any SOW and fails to cure such breach within thirty (30) days of receipt of written notice of the breach from the other party.

8.3 Notwithstanding the foregoing, this Agreement and any SOW or both, may be terminated immediately by either party in the event of (i) a breach of Article 4 (Confidential Information), Article 5 (Proprietary Rights), or Article 9.4 (Export), or (ii) either party makes an assignment or trust mortgage for the benefit of its creditors, or shall file a voluntary petition under the bankruptcy or insolvency laws of any jurisdiction to which it is subject, or shall suffer an involuntary petition under such laws to be filed against it, or shall be adjudicated bankrupt or insolvent under the law of any jurisdiction to which it is subject.

11.9 GENERAL

9.1 Entire Agreement. This Agreement, together with the SOW, shall constitute the entire agreement between the parties with respect to the subject matter hereof and merges all prior and contemporaneous communications.

9.2 Amendment. No amendment, change, modification or alteration of this Agreement shall be effective unless in writing and signed by both parties.

9.3 Assignment. This Agreement shall be binding upon and for the benefit of the parties, their successors and assigns, provided that the Agreement may not be assigned without the prior written consent of the other party.

9.4 Export. Export. Spirent and Client agree to comply with the United States Export Administration Act of 1979, as amended, (the "Act"), and with the Export Administration Regulations ("EAR") promulgated from time to time there under by the United States Department of Commerce.

9.5 Waiver. No waiver of any provision of this Agreement or of the rights and obligations of the parties shall be effective unless in writing and signed by the party waiving compliance. Any such waiver shall be effective only in the specific instance and for the specific purpose stated in such writing.

9.6 Governing Law. This Agreement shall be governed by the laws of the State of California, without regard to principles of conflicts of laws.

9.7 Survival. It is expressly agreed by both parties that the provisions of Articles, 4, 5, 7, and 9, shall survive the termination or expiration of this Agreement.

9.8 Severability. If any term, clause, or provision of this Agreement shall be held by a court of competent jurisdiction to be illegal, invalid or unenforceable, the remaining terms, clauses, and provisions shall remain in full force and effect.

9.9 Construction. This Agreement is the product of the efforts of both parties and shall not be interpreted in favor of or against either party because of its effort in preparing it.

9.10 Arbitration. Any controversy or claim arising out of or relating to this Agreement, with the exception of injunctive relief sought by either party, shall be submitted to arbitration before an arbitrator agreed upon by the parties, or if the parties cannot agree upon an arbitrator within thirty (30) days, to an arbitrator selected by the American Arbitration Association. The arbitration shall be conducted under the rules then prevailing of the American Arbitration Association and each party shall have no more than one day to present its case. The arbitrator may award attorneys' fees and costs as part of the award. The award of the arbitrator shall be binding and may be entered as a judgment in any court of competent jurisdiction.

9.11 Injunctive Relief. Each party agrees that a breach of the license rights granted hereunder and/or the restrictions thereon or a breach of the confidentiality provisions hereof, may result in irreparable harm and significant injury to the other which may be difficult to ascertain. Accordingly, each party agrees that the other shall be entitled to equitable relief, including, without limitation, an immediate injunction enjoining any further breach, in addition to all other remedies available to such party at law or in equity.

9.12 Attorney's Fees. If any claim, legal action or any arbitration or other proceeding is brought for the enforcement of this Agreement or because of a dispute, breach, default or misrepresentation in connection with any of the provisions of this Agreement, the successful or prevailing party shall be entitled to recover reasonable attorneys' fees and other costs incurred in that claim, action or proceeding, in addition to any other relief to which such party may be entitled. This attorney's fees clause shall include all post-judgment attorney's fees and expenses and shall not be merged into, but rather shall survive, the judgment.

9.13 Compliance with Laws. Each party agrees to comply with all applicable laws, rule and regulations in connection with its activities under this Agreement, including without limitation the applicable regulations of the U.S. Department of Commerce and the United States Export Administration Act, as amended to assure that the Software is not exported in violation of the United States laws.

9.14 Force Majeure. Neither party will be deemed in default of this Agreement, except for defaulted obligations of payment, to the extent that performance of their obligations or attempt to cure any breach are delayed or prevented by reason of causes beyond its control, including but not limited to acts of God, war, riot, terrorism, sabotage, embargoes, acts of civil or military authorities, fire, floods, accidents, strikes, or shortages of transportation, facilities, fuel, energy, labor or materials or Internet outages. In the event of any such delay, the delayed party may defer its performance for a period equal to the time of such delay, but in no event more than Three months, provided that the delayed party gives the other party written notice thereof promptly and, in any event, within ten (10) calendar days of discovery thereof, and uses its good faith efforts to cure the excused breach.

9.15 Relationship of Parties. The relationship of the parties is that of independent contractors. No agency, partnership, joint venture, or employment relationship shall be created or inferred by the existence or performance of this Agreement, and neither party shall have any authority to bind the other in any respect whatsoever.

9.16 No Solicitation. During the term of this Agreement and for one (1) year following the termination of this Agreement, Client shall not solicit, offer to employ, employ, or contract any employee, contractor, former employee (within the prior one (1) year), or former contractor (within the one (1) year) of Spirent, without (a) the prior written consent of Spirent or (b) paying Spirent one hundred percent (100%) of employee's annual salary or contractor's fees with Client for one (1) year ("Placement Fee"). Placement Fees shall be paid to Spirent within thirty (30) days from the first date of employment or contract, unless otherwise agreed upon in writing by Spirent. Placement Fees for which payment is not received by Spirent when due shall accrue a late charge of one and one-half percent (1.5%) per month or the highest rate allowable by law, whichever is less.

9.17 Publicity. Client agrees to allow Spirent to identify Client as a Client of Spirent.

9.18 Notices. All notices shall be in writing and delivered in person or by courier service, overnight service, fax or e-mail to the addresses below. All notices shall be deemed as given on the date that the person or service delivers such notice or the date that such notice was refused, unclaimed or undeliverable by the person or service attempting to deliver such notice. Either party may change the address for purpose of giving notice by providing written notice to the other party.

To Client:

To Spirent: Spirent Communications, Inc.

9.19 Headings. The headings of the articles and sections of this Agreement are included for convenience only, and shall not affect the construction or interpretation of its provisions.

9.20 Counterparts. This Agreement may be executed in multiple counterparts, each of which shall be deemed an original, but both of which together shall constitute one and the same instrument. This Agreement may be executed by facsimile signature and facsimile signatures shall be fully binding and effective for all purposes and shall be given the same effect as original signatures.

IN WITNESS WHEREOF, the parties hereto understand, accept, and agree to the above terms and conditions.

For Spirent	For the Customer
Name:	Name:
Title:	Title:
Signature:	Signature:
Date:	Date: