Spectra2 for IMS/TISPAN Testing



Emerging technologies provide opportunities for telecommunications Network Equipment Manufacturers (NEMs) and network operators to leverage their existing solutions to create new value-added services. Built upon a foundation of ITU Next Generation Networking (NGN) architecture, IP Multimedia Subsystem (IMS) and Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN) are such technologies that offer real-time multimedia services on an open service infrastructure for both mobile and fixed network users.



IMS/TISPAN Overview

The main drivers behind IMS/TISPAN are:

- Open Infrastructure: IMS/TISPAN enables network interoperability between operators and allows for "Independence" of telecommunications networks through:
 - Access Independence: Users can access multimedia services via any wireless or wireline networks
 - Architecture Independence:
 Operators can deploy different network architectures without impacting service exchange
 - User Independence: Users are not tied to a specific operator, a connection type, or terminal equipment
 - Service Independence: Carriers are not bounded by a specific infrastructure; services can easily be integrated into IMS/TISPAN framework
- Multimedia: IMS/TISPAN supports any combination of voice, data, video, fax, and picture types of multimedia service
- Fixed Mobile Convergence (FMC): Enables seamless communication between fixed and mobile networks and allows mobility and roaming across multiple access networks

OSA Off-Line Data **On-line** XCAP Diameter HTTP **Application Server** Charging Diameter 5 HSS SH SIP SIP s-CSCF I-CSCF IWF SIP, Diameter SIP, H.248, SIGTRAN **IMS/PES** Core Interworking Diameter 32 Vetworks (PSTN & IP Network (icl. SIP & H.323) Mobile CS Core) Switched Circui Multimedia IP Network Diameter RACS NASS CNGCF AM Diameter Diameter **External Networks** H.248 RTP Legacy TE VoIP UE III PPPoE RTP T-MGF C-BGF DHCP UE **Core Transport Network** Access Transport Network

IMS/TISPAN Network Architecture

Note: TISPAN is a Technical Working Group of ETSI standard organization.





IMS/TISPAN Network Architecture

The IMS/TISPAN network architecture includes four main network components:

- 1) IMS Core/TISPAN Core (also called PES [PSTN/ISDN] Emulation Subsystem)
- 2) Application Servers
- 3) Interworking
- 4) Access Networks

IMS/TISPAN Core

- P-CSCF (Proxy-Call Session Control Function) for IMS/TISPAN: a SIP proxy that is the first contact point of IMS terminal; represents UE to other servers
- I-CSCF (Interrogating-Call Session Control Function) for IMS/TISPAN: the contact point for IMS connections destined to a subscriber; switches calls based on routing information

- S-CSCF (Serving-Call Session Control Function) for IMS/TISPAN: provides session control services and maintains the session stage and registration for users
- SLF (Subscription Locator Function) for IMS/TISPAN: provides the name of the HSS based on inquires from I-CSCF, AS and 3GPP AAA
- HSS (Home Subscriber Server) for IMS and UPSN (User Profile Server Node) for TISPAN: a database containing user information, including user ID/numbering/addressing, profile, location, and security
- AGCF (Access Gateway Control Function) for TISPAN: in addition to performing similar functions of P-CSCF, AGCF also acts as a media gateway controller to control the access media gateway or residential media gateway



Detailed IMS/TISPAN Network Architecture

IMS/TISPAN Application Servers

Application Servers offer value added multimedia services (such as gaming, messaging, etc.)

- SIP AS (SIP Application Server)
- OSA AS (Open Service Access Application Server)
- CAMEL IM-SSF (CAMEL IP Multimedia-Service Switching Function)

IMS/TISPAN Interworking with Other Networks

Interworking with the Circuit Switched Network

IMS/TISPAN interworks with Circuit Switched (CS) networks to enable the connection between IMS/TISPAN and PSTN/ISDN or between IMS/TISPAN and 2G Mobile CS Domain of the Core Network.

- MGCF (Media Gateway Control Function): controls Media Gateway and converts PSTN signaling to/from SIP signaling
- MGW (Media Gateway): supports media conversion, bearer control and payload processing
- BGCF (Breakout Gateway Control Function): allows interworking between IMS Core and Circuit Switched Network

Interworking with the IP Network

- IBCF (Interconnection Border Control Function): performs interconnection between two operator domains and enables communication between IPv4 and IPv6 SIP applications. It is also responsible for: Topology hiding, controlling transport plane functions, and generation of charging data records
- TrGW (Transition Gateway) for IMS or T-MGF (Trunking – Media Gateway Function) for TISPAN provides: codec convergence, network address/port translation, and IPv4/IPv6 protocol translation

Interworking with the Multimedia IP Network

- MRFC (Media Resource Function Controller) for IMS: interprets information coming from an AS and S-CSCF, controls media stream resources in the MRFP and generates billing records
- MRFP (Media Resource Function Processor) for IMS: controls bearers, provides resources, mixes/ sources/processes incoming streams, manages floor control for conferencing

Access Network

- Wireless Networks:
 - 3G UMTS/WCDMA, cdma2000, TD-SCDMA, EDGE, GPRS
 - WiMAX, WiFi/Wireless LAN
- Fixed Networks:
 - PSTN and ISDN
 - VoIP (SIP and H.323 families)
 - Cable and xDSL



NASS and RACS Subsystems

PSTN/ISDN terminals require additional subsystems, NASS and RACS, for transport control purpose.

NASS: Network Attachment Subsystem

NASS Functions:

Dynamic provision of IP addresses and other terminal configuration parameters, authorization of network access based on user profile, access network configuration based on user profiles, and location management.

NASS Network Elements:

- NACF (Network Attachment Control Function): Responsible for IP Address Allocation to the UE and distributes the other Network Configuration Parameters (Address of DNS Server)
- AMF (Access Management Function): performs access request translation and authentication forwarding
- CLF (Connectivity Session Location and Repository Function): associates the IP address and location information
- UAAF (User Access Authorization Function): performs user authentication and authorization checking
- PDBF (Profile DataBase Function): contains user authentication data and access configuration information
- CNGCF (CNG Configuration Function): provides CNG with additional configuration information during initialization and update of the CNG

RACS: Resource and Admission Control Subsystem

RACS Functions:

Responsible for admission control, resource reservation, and policy control.

RACS Network Elements:

- A-RACF (Access-Resource and Admission Control Function): responsible for admission control and network policy assembly
- SPDF (Service-based Policy Decision Function): makes the policy decisions by checking the request information, authorizing the requested resources, and determining the location of the border gateway and A-RACF



IMS/TISPAN Protocols

- SIP (Session Initiation Protocol): an application layer text-based protocol for creating, modifying and terminating IMS sessions
- SIP I/T: SIP carriage for PSTN/PLMN interworking with IP networks
- DIAMETER: AAA (Authentication, Authorization and Accounting), Policy Negotiation and Quality of Service (QoS) Negotiation
- H.248/Megaco: a control mechanism protocol allowing Media Gateway Controller or equivalents to control Media Gateway
- RTP (Real-time Transport Protocol): a standardized packet format for delivering audio and video over the Internet
- RTCP (Real-time Transport Control Protocol): provides out-of-band control information and QoS information for an RTP flow

- COPS (Common Open Policy Service): a simple client/server protocol model for supporting policy control over QoS signaling protocols
- BICC (Bearer Independent Call Control): allows the control protocol (ISUP) to be independent of the media bearers (IP, ATM, and TDM)
- HTTP (Hypertext Transfer Protocol): an application level protocol for distributed, collaborative, and hypermedia information systems
- XCAP (XML Configuration Access Protocol): a set of conventions for mapping XML documents and document components into HTTP URIs; XCAP allows a client to read, write and modify application configuration data stored in XML format on a server



IMS Protocols

IMS/TISPAN Protocols

Challenges

IMS/TISPAN brings both benefits and challenges to NEMs and operators.

- Different standards bodies each with unique requirements and specifications
- Immature IMS/TISPAN specifications and endless extensions
- Access Independence that requires interworking
- Architecture Independence with proprietary specifications and interoperability challenges
- User independence requires advanced authentication, authorization and security
- Service Independence requires open Application Programming Interface (API) with the consideration of today's and future services



Spectra2: a Multi-Multi System

- Multi-Technology: IMS/TISPAN, NGN, VolP
- Multi-Network Element: S-SCSF, HSS
- Multi-Protocols: SIP, DIAMETER, ISUP
- Multi-Network Interface: Mw, Cx, Mn
- Multi-Physical Interface: Ethernet, 0C3, E1/T1
- Multi-Function: Load/Function, Monitoring, QoS
- Multi-User: true multi-user, cost saving
- Multi-Media: various audio and video codecs

Testing

To rise above IMS/TISPAN challenges, NEMs need to verify and validate the products/systems under development, and the service operators need to test and monitor deployed networks. Key testing areas include:

Feature and Functional Testing

Does each network component functionally work?

Load and Stress Testing

Can the network unit or system tolerate the heavy signaling and media traffic? Can it operate under sustained traffic for long durations? Can it handle anomalies?

Conformance Testing

Does the network comply with standards or proprietary specifications?

Interoperability Testing

Can the network elements communicate with others without problems?

Quality of Service (QoS) Measurement Does the media quality meet the Service Level Agreement?

Monitoring How is it working?

Spectra2 for IMS Testing

Integrated IMS/TISPAN Solution

Spectra2 is the one product that integrates feature testing, load & stress testing, conformance testing, interoperability testing, QoS measurement and monitoring into a single platform. Tektronix Spectra2 supports emerging technologies, IMS, TISPAN, NGN and FMC, as well as legacy technologies (PSTN and ISDN) and VoIP (SIP and H.323).

Scalable:

- Scalable hardware platform with multiple interface capabilities
- Flexible software architecture to fit network size and needs

Powerful:

- High capacity signaling and media support
- Real-time manipulation of messaging
- Powerful filtering capabilities
- Built-in customizable protocols libraries
- Multi-protocol call tracing
- Remote User Access
- Test Automation/Scheduler/API

Ease-of-Use:

- Low learning curve
- Intuitive GUI interface
- Packaged conformance test suites
- Data visualization
- Scripting simplicity

Cost-Effective:

- Platform options ranging from PC Software Only version to Portable and Rackmount
- Embedded multi-user architecture (up to four simultaneous users)

Time-To-Market:

- Built-in IMS/TISAPN/VoIP/PSTN element simulations and emulations
- Protocol depth and maturity
- Media depth and maturity

Reliable:

- Stable and durable high quality system
- Proven platform with years of field experience

Support:

- World-class service and support
- Industry best maintenance contracts



Spectra2 provides comprehensive support for:

Functional Testing

No matter what IMS/TISPAN network element you need to test, Spectra2 can simulate the surrounding nodes for the Device Under Test (DUT).

- Simulates different IMS/TISPAN network nodes
 - IMS/TISPAN Core: simulate P-CSCF/AGCF, I-CSCF, S-CSCF, SLF, and HSS/UPSF
 - Application Servers: simulates various AS
 - Interworking Components: simulates MGCF, MGW, SGW, MRFC, MRFP, IBCF, TrGW, and IBGF
 - Access Network: simulate mobile, PSTN/ISDN and VoIP terminals, and NASS & RACS
- Support various IMS/TISPAN Protocols and Interfaces
 - SIP and its extensions for Gm, Mw, ISC, Mg, Mi, Mj, Mk, and Mr interfaces
 - DIAMETER for Cx, Dx, Sh, Gq, Gq', and Rf interfaces
 - H.248/Megaco version 1, 2, and 3 for Mn, Mc, Mp and la interfaces
 - BICC, SIP-T, SIP-I for Nc interface
 - HTTP/ XCAP for Ut interface
 - SIGTRAN: support SS7 over IP (SIGTRAN)
 - RTP/RTCP for Mb and Gi interface

- Support a variety of Audio and Video Codec
 - Audio: G.711 A/Mu law, G.723.1, G.726, G.729.A, AMR-NB, AMR-WB, and EVRC-A
 - Video: H.263, H.263+
 - Data: T.38 (Fax over IP)
- Pre-built IMS/TISPAN PDU Library
 - Spectra2 has pre-built message libraries for IMS/TISPAN and other technologies
 - New PDUs can be created from the protocol library, from data captured during monitoring sessions, or by importing from Wireshark traces with full capabilities to customize
- Positive and Negative testing
 - Normal cases such as IMS SIP Registration and Invite and abnormal cases such as SIP Bad Event and SIP Busy Here are supported, as well as the capability to create flawed messages

	SUT	Call Leg		+/-	Description	Spectra2
1	2222	OrigCallLeg	1		OrigCallLeg: SipCall	1111
2	2222	OrigCallLeg	-		Transmit PDU (SIP\INVITE)	1111
3			1	Ξ	OR Condition	
4	2222	OrigCallLeg	-	•	Trigger PDU (SIP\100 Trying)	1111
5	2222	OrigCallLeg	-	8	Trigger PDU (SIP\180 Ringing)	1111
6	2222	OrigCallLeg	-	Ξ	Trigger PDU (SIP\200 OK INVITE)	1111
7			-	8	Default	
8			*	Ξ	Timeout	
9					END	
10	2222	OrigCallLeg	-		Transmit PDU (SIP\ACK)	1111
11	2222	OrigCallLeg	-		Trigger PDU (SIP\BYE)	1111
12	2222	OrigCallLeg	-		Transmit PDU (SIP\200 OK BYE)	1111

SIP Script with Conditional Branching

Load and Stress Testing

Once the DUT is determined, Spectra2 can generate heavy signaling and media traffic to verify the DUT capacity limits as well as the DUT's ability to withstand high traffic.

- Highly flexible call patterns and traffic models and various load traffic combinations: Signaling only, Signaling + Authentication Signaling + Security Signaling + Media (Audio/Video) and Signaling + Media + QoS
- Traffic profiles can be customized based upon the users load profile/requirements, including BHCA, Call Per Second, Erlang, Simultaneous Call, Call Hold Time, Packet Size, Packet Rate, and Inter-packet Delay
- Detailed Statistical Reports

Conformance Testing

Spectra2's approach to IMS/TISPAN testing starts with standards-based conformance testing to ensure IMS/TISPAN protocol compliance to the specifications. Spectra2 provides hundreds of conformance test cases. Each test case can easily be edited to adapt to your testing requirements.

Interoperability Testing

IMS/TISPAN interoperability testing involves the interworking between:

- Multiple standard body protocols with their unique variants, as well as manufacturer defined proprietary specifications
- IPv4 and IPv6 networks:
 - Network Address Translation
 - Security
- Different network architectures planned and deployed by different carriers

Spectra2 supports multiple standards bodies protocol implementations and proprietary specifications, coupled with the ability to customize PDUs to meet any specialized testing need.









Quality of Service Measurement

UMTS

QoS measurements are critical for IMS/TISPAN service. Key QoS parameters, such as Network Delay, Jitter (Variation in Delay) and Packet Loss need to be measured to ensure the quality of the audio, video, and multimedia services. Spectra2 measures QoS for both audio and video media. Spectra2 supports the following Passive QoS:

- Audio: MOS (Mean Opinion Score), PESQ (Perception Evaluation of Speech Quality), R-Factor, and Jitter
- Video: MOS-V (Mean Opinion Score Video), VSTQ, and RT Delay

Monitoring

Spectra2 supports IMS/TISPAN network monitoring, statistical report generation, and provides multi-protocol analysis tools such as call trace, message filtering, and message decode.

Users can also apply filters based on source and destination IP addresses, protocol type, or user-defined ASCII or hex strings. Optional media support enables RTP stream analysis and playback. Monitored PDUs can be saved and used in test cases and generator models.

Analysis can be performed in real time or post capture. The captured data can be exported to open formats such as CSV and text for further analysis using third-party tools.

Spectra2 Advanced Features

- SIP User Agent (UA) Profiles provide highly intelligent user emulation. Spectra2 users can have maximum control and customization over profile attributes assigned to end-users
- The Spectra2 Application Programming Interface (API) allows users to run tests and save the results of those tests from a remote system. The Spectra2 API further automates the lab testing function and leverages the value of Spectra2 by providing a platform-independent method for remotely accessing and controlling Spectra2

- Conditional Branching support enables users to handle conditional scripting options such as If/Then/Else functionality. Conditional Branching is included in all Spectra2 protocol Testing Packages for both functional and load testing
- Multi-gateway Support for Megaco and MGCP Spectra2 can emulate a large number of small Media Gateways. This feature allows Spectra2 to support load testing of Media Gateway Controllers responsible for customer premise equipment such as Multimedia Terminal Adapters, Integrated Access Devices or residential gateways
- STP/SG Tester: Level 2/Level 3 TCAP and ISUP traffic blaster designed to stress STP/SG's while measuring metrics such as cross-office delay
- Historical Statistics: Collect, analyze and export statistics to end-user applications such as Microsoft Excel
- Passive and Active Quality of Service Analysis
 Passive QoS enables media analysis within an
 RTP stream and provides MOS, PESQ, and R-Factor
 based scores. Active QoS performs a comparison
 between source and destination files and provides a
 PESQ score to describe the quality of the transmitted
 media relative to the source



About Tektronix:

Tektronix Communications provides network operators and equipment manufacturers around the world an unparalleled suite of network diagnostics and management solutions for fixed, mobile, IP and converged multi-service networks.

This comprehensive set of solutions support a range of architectures and applications such as LTE, fixed mobile convergence, IMS, broadband wireless access, WiMAX, VoIP and triple play, including IPTV.

Learn more about Tektronix' communications test, measurement and network monitoring solutions by visiting: www.tektronix.com/communications

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