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General principles of construction and operation of next generation networks

NGN (Next Generation Network) - a network with packet switching, suitable for the provision of telecommunication services and the use of multiple broadband transport technology-enabled QoS, in which service-related functions are independent from underlying technologies are responsible for transportation.

Rec. ITU-T Y.2001

Basic principles of NGN creation

The traditional conception of NGN provide possibility creation of a new multi-service network, which carry out the role of instrument for realizing existing and feature services on one platform (equipment) where call control stratum (Softswitch and IMS) is key element of NGN
General principles of construction and operation of next generation networks

Functional model of NGN network

- Applications
- ANI
- Service stratum Functions
- Transport stratum Functions
- Management Functions

General principles of construction and operation of next generation networks

The typical operator’s NGN architecture

- SCP
- Softswitch/SSW
- Charging
- MG
- SS7 Network
- to PSTN and other network
IMS objectives and purpose

**Objectives:** effective integration of voice and multimedia traffic in a single multi-platform standards-based centralization of operational support and control system of major characteristics of the available services

**Purpose:** convergence of networks, application development, deployment of new services and reduce costs through the use of open standards, development of new business models (such as “Virtual Service Provider (VSP)”)
IMS Standardization

The central standardization organization which develop IMS standards

3GPP
3GPP2
ETSI (European Telecommunication Standards Institute)
ITU (International Telecommunication Union) – FG FN
OMA (Open Mobile Alliance)
TISPAN (Telecoms and Internet converged Services and Protocols for Advanced Networks)
ATIS (Alliance for Telecommunication Industry Solutions)

Y.2001 General overview of NGN
Y.2011 General principles and general reference model for Next Generation Networks
Y.2012 Functional requirements and architecture of next generation networks
Y.2021 IMS for Next Generation Networks
Y.2211 IMS-based real-time conversational multimedia services over NGN
Q.3904 Testing principles for IMS on model networks, and identification of relevant conformance, interoperability and functionality tests
List of ETSI/3GPP specification series

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<td>Project management. Planning</td>
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Typical aspects on network development under IMS technology

The IMS Functional model

The main functional elements of IMS can be divided into the following groups:

- **session control elements - Call Session Control (P,S,I-CSCF)**
- **database (HSS)**
- **elements that provide additional services and respond on resource reservation (application server, MRFC, MRFP)**
- **elements provide interworking with another networks (BGCF, MGCF, IMS-MGW, SGW)**
- **security elements (PDF)**
- **elements billing and statistics**
**Basic elements**

**P-CSCF** (Proxy Call Session Control Function) - first point of contact IMS terminal and the core network, on the signal level, perform the function of IPsec connections

**S-CSCF** (Serving Call Session Control Function) - central element of the IMS solution and performing a function of routing SIP messages and SIP registrar server

**I-CSCF** (Interrogating Call Session Control Function) - serves as a contact point for inter-operator interaction

**HSS** (Home Subscribers Server) - is a database that stores all information relevant to the subscriber (customer) and service profiles
Typical aspects on network development under IMS technology

Traditional scheme of operator network based on IMS architecture

Types of platform for services providing
- Application Server SIP;
- Application server OSA/Parlay;
- CAMEL Platform
Actual services widely provided to customer via IMS

- Presence
- Instant messaging and Chat
- Push to Talk
- File Transfer
- White board
- Games
- Converged TV

Approaches to IMS testing

Q.3904 ITU-T Recommendation

The scenarios, list and types of tests for TM local and NUT testing for IMS on the Model Network
IMS implementation and testing on Model and operator networks

**IMS Testing methodology**

ITU-T Recommendation Q.3904 determine integrated approach for testing IMS solutions include following sequence of tests:

- **check for compliance with standards and specifications for the implementation of basic call and provide additional services**
- **functional testing**
- **testing for interaction (network integration)**

**IMS implementation and testing on Model and operator networks**

**Typical problems identified during testing of system-network IMS solution**

**Functional checks**
Registration statistics from different types of equipment which use during session and include to IMS system-network solution

**Identified problems**
Lack of detailed call records with mandatory information on the amount of transmitted content (information) for content-oriented services
Objective
To test the possibility of IMS system-network solution to serve subscriber which is moving to guest network

Identified problems
The subscriber is connected to ISP’s P-CSC (guest network), maintain at the S-CSC another network, but can not get the basic telecom services in full

The reason for this problem
The difference in syntax P-Charging-Vector Protocol, SIP IMS, transferred from the P-CSC to the S-CSC, manufacturers support different variants of this parameter which does not determine exactly by the protocol specification

Compatibility checking
Instance of checking hardware compatibility
S-CSC <-> I-CSC

Objective
To test the possibility of system-network solutions provide correct access to IMS resources after registration SIP-terminal using the URI with the corresponding password, and denial of access when is typed an incorrect password

Identified problem
S-CSC from one vendor supports messaging protocol DIAMETER only using the transport protocol SCTP, and the I-CSC another vendor supports messaging protocol DIAMETER only over TCP. As a result of the use of means of communication, using different transport protocols for messaging protocol DIAMETER can not interact
Now the decision of the given problems come to application of the corporate standards specifying the international specifications regarding internal functionality demanded to the operator and in case of ISP interworking to the mutual arrangement by a principle of "the minimum expenses”

**Typical strategy of migration existing networks to IMS technology**

Scenarios of transition from the existing telephone network based on TDM network to the NGN/IMS network based on PSN

**Access level**

**Step 1**

interfaces V.5.x, analog lines (FXS/FXO) and PRI/ BRI interfaces are connect to the PBX separately
**IMS implementation and testing on Model and operator networks**

**Step 2** Connect all user interfaces directly to a subscriber’s xDSL equipment. Using high-speed of 1-10 Mbps symmetrical streams (VDSL, SHDSL)

**Step 3:** Migration to a fully digital network access technologies. Using high-speed and symmetric technologies Ethernet, FTTx, PON, etc.

**Scenario 1**
gradually migration to an IP network by transferring the functionality of transit nodes of TDM network to the appropriate IP network nodes
Scenario 2
Migration to NGN/Softswitch network by connecting Access Points of TDM network to voice and signaling gateway.
IMS implementation and testing on Model and operator networks

Typical migration to IMS topology (JSC Svyazinvest, Russia)

IMS implementation and testing on Model and operator networks

The set of implementing NGN services based on IMS/SDP

- VoIP
- UAN and UPT (possibility to use unique number for different TE: fix line, mobile phone, SIP-phone)
- Customer Web-portal (customer possibility to personalize and control services through Internet access)
- IP-Centrex (the set of VAS for corporative customers based on IP networks)
IMS implementation and testing on Model and operator networks

Typical business model IMS

Current situation on migration to IMS (Infonetics Research)

- More than 50% ISP are going to provide in future 12-18 month the video phone services and FMC
- 80% ISP are going to migrate more part of own customer to IMS for providing basic call services
- Next two years all ISP concentrate own customers to new service packets (RCS – presence, chat, file sharing and etc.)
Profit of telecommunication service based on SDP are provided on 16% from operators of a fixed-line telephony, and on 84% by mobile operators. The American ISP based on SDP earned 16% in 2007 from a world market of services. By the end of 2010 their share has increased to 25%. SDP will lead to a new coil of development of the telecommunication service integrating possibilities of a telephony and the Internet. The exist tendency - world leaders (ISP) buying small companies with own product in the SDP field with purpose of creation the advanced decisions under the big brand. As an instance of it is recent purchase by manufacturer Motorola of company Leapstone, and BEA Oracle.

Future telecom forecast on IMS technology (Infonetics Research)

Evaluating the effectiveness of projects is usually based on the following indicators:

- investment (capital costs)
- operating costs
- proceeds from the sale
- pre-tax profit (profit before tax)
- net profit
### Economic indicators implementing IMS

<table>
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<tr>
<th></th>
<th>Payroll</th>
<th>Number of staff</th>
<th>Wages</th>
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<tr>
<td>Operators leaders</td>
<td>+8.9%</td>
<td>-18.5%</td>
<td>+35.2%</td>
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<td>Operators of old Europe (EU15)</td>
<td>-14.8%</td>
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<td>+26.1%</td>
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<tr>
<td>Operators of the new Europe (EU15)</td>
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<tr>
<td>All operators</td>
<td>-6.4%</td>
<td>-28.9%</td>
<td>+37.2%</td>
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### The dynamics of changes in operating costs after upgrading the network

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Remote training courses

ITU Centre of Excellence for CIS countries

Training course «IMS: technical and economic aspects of implementation»

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