Next Generation Network

2008/12/16
Hideaki YAMADA
KDDI Corporation (KDDI R&D Labs.)
INDEX

1. Trends of the telecommunication industry
2. Overview of NGN
3. Standardization
4. NGN key functionalities
5. NGN Services
6. Case study: CJK test-bed
7. Summary
Worldwide trends 1

Sales of telecommunications services.

(One billion dollars)

- Gross Income
- Fixed communications, etc.
- Mobile communications

Based on the materials by ITU
Worldwide trends 2

Numbers of subscriptions to fixed phones and mobile phones, and number of internet users.

Based on the materials by ITU
Japanese trends 1

Changes in the number of subscriptions to fixed communications, mobile communications and IP phone.

Based on the materials by MIC
Japanese trends 2

Trends in the number of Internet users and penetration rate.

(Source) “Communication Usage Trend Survey,” MIC
INDEX

1. Trends of the telecommunication industry
2. Overview of NGN
3. Standardization
4. NGN key functionalities
5. NGN Services
6. Case study: CJK test-bed
7. Summary
Expectation for NGN

IP based multi-service platform capable of any traffic type and services on an architecture.

- Anxiety of Security and Reliability
- Without guarantee of end-to-end Quality (QoS and QoE)
- Open and Flexibility
- High Reliability
- High Quality
- High Capacity
- High Security
- Mobility
- Handover
- availability
- Supporting individually for various needs and functions
Network infrastructures for NGN

Mobile

- cdmaOne
- cdma2000 1x
- EV-DO Rev.0
- EV-DO Rev.A
- W-CDMA
- HSDPA
- HSUPA
- Enhanced 3G
- IMT-Advanced (4G)

Broadband Wireless

- Wireless BB
- Mobile WiMAX(*)
- Wireless LAN

Fixed

- Analog ISDN
- ADSL
- CATV
- FTTH

From copper to Optical fiber

2000

2005

2010

* IEEE802.16e: seamless connection when traveling at 120 km/h. Maximum speed is said to be around several tens of Mbps.
Characteristic of NGN 1

Providing services with separating Services and Transport.

NGN

- Convenience
- Flexibility
- Security
- Safety
- Reliability

Service Stratum
- Service Delivery Platform
- Network Service Control

Transport Stratum
- Transport Control
- Access Network, Core Network

Application

Information Technology

Networking Technology

Consumer

Enterprise

Public Agency
Characteristic of NGN 2

**Characteristic of NGN**

1. Broadband
2. Control for QoS/QoE (Quality of Experience)
3. Packet based network
4. Providing services with separating Service and Transport
5. Without limitation of Access Network
6. Providing general Fixed and Mobility services

**Providing “Network Infrastructure”**

With High Speed and High Capacity

**Providing “Service Platform(*)”**

and “Application” used it

(*) Service Platform: Platform to provide Common Services (accounting, authentication, etc) that support Applications

---

**Architecture of Existing Network**

- Network Service A
- Network Service B
- Network A
- Network B

**Architecture of NGN**

- Open Interface
- Network Service
- Service A
- Service B
- Service Platform
- Network
- Network Infrastructure
INDEX

1. Trends of the telecommunication industry
2. Overview of NGN
3. **Standardization**
4. NGN key functionalities
5. NGN Services
6. Case study: CJK test-bed
7. Summary
Standardization study steps for NGN

Services and Capabilities

Ubiquitous services

Streaming services

Multimedia, PSTN/ISDN Services

Release 1 functions

Revision of Release 1 functions

NGN Release 2
- IPTV
- Home network etc.

Future NGN
- Networked-ID etc.

Revision of Release 2 functions

July 2006

2008

2009?

IPTV Focus Group (GSI) stars
- Triple or quarto plays

A use case: IMS
- Multimedia supports (Voice, Video, Conferences, etc.)
- PSTN/ISDN Emulation / Simulation
- Others (VPN, Emergency telecommunications, etc.)
Several organizations are working actively for NGN standardization.

- **IETF**: Internet Engineering Task Force
  - SIP (Session Initiation Protocol)
    - RFC.2564
    - RFC.3261
- **3GPP**: 3rd Generation Partnership
  - IMS (IP Multimedia Subsystem)
    - IMS Rel.4
    - IMS Rel.5
    - IMS Rel.6
    - IMS Rel.7
- **ETSI**: European Telecommunications Standards Institute
  - Extended IMS
- **ITU-T**: International Telecommunication Union - Telecommunication sector
  - TISPAN: Telecommunication and Internet converged Service and Protocols for Advanced Networking
  - NGN
    - NGN Rel.1
    - NGN Rel.2
    - NGN Rel.3
  - FG: Focus Group
    - FG NGN
      - NGN Rel.1
      - NGN Rel.2
      - NGN Rel.3
  - NGNGSI: NGN Global Standards Initiative
## ITU-T Release 1 documents

<table>
<thead>
<tr>
<th>ITU-T Rec. No.</th>
<th>Title</th>
<th>Lead SG</th>
<th>Expected Approval</th>
<th>Approval Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplement 1 to Y.2000-</td>
<td>NGN release 1 scope</td>
<td>13</td>
<td>–</td>
<td>Approved</td>
</tr>
<tr>
<td>Y.2201</td>
<td>NGN release 1 requirements</td>
<td>13</td>
<td>Apr. 2007</td>
<td>TAP</td>
</tr>
<tr>
<td>Y.2012</td>
<td>Functional requirements and architecture of the NGN</td>
<td>13</td>
<td>Oct. 2006</td>
<td>AAP</td>
</tr>
<tr>
<td>Supplement 1 to Y.2012</td>
<td>Session:border control (S/BC) functions</td>
<td>13</td>
<td>–</td>
<td>Approved</td>
</tr>
<tr>
<td>Y.2021</td>
<td>IMS for Next Generation Networks</td>
<td>13</td>
<td>Oct. 2006</td>
<td>AAP</td>
</tr>
<tr>
<td>Y.2031</td>
<td>PSTN/ISDN emulation architecture</td>
<td>13</td>
<td>Oct. 2006</td>
<td>AAP</td>
</tr>
<tr>
<td>Y.2091</td>
<td>Terms and definitions for Next Generation Networks</td>
<td>13</td>
<td>Oct. 2006</td>
<td>AAP</td>
</tr>
<tr>
<td>Y.2111</td>
<td>Resource and admission control functions in Next Generation Networks</td>
<td>13</td>
<td>Oct. 2006</td>
<td>AAP</td>
</tr>
<tr>
<td>Y.2171</td>
<td>Admission control priority levels in Next Generation Networks</td>
<td>13</td>
<td>Oct. 2006</td>
<td>AAP</td>
</tr>
<tr>
<td>Y.2261</td>
<td>PSTN/ISDN evolution to NGN</td>
<td>13</td>
<td>Oct. 2006</td>
<td>AAP</td>
</tr>
<tr>
<td>Y.2271</td>
<td>Call server based PSTN/ISDN emulation</td>
<td>13</td>
<td>Oct. 2006</td>
<td>AAP</td>
</tr>
<tr>
<td>Y.2701</td>
<td>Security requirements for NGN release 1</td>
<td>13</td>
<td>Apr. 2007</td>
<td>TAP</td>
</tr>
<tr>
<td>Q.1706</td>
<td>Mobility management requirements for NGN</td>
<td>19</td>
<td>Oct. 2006</td>
<td>AAP</td>
</tr>
</tbody>
</table>

### ITU-T recommendation approval process (TAP and AAP)

- **TAP:** 6~9 month for policy and regulation related recommendations
- **AAP:** 2 month for technical recommendations

Experts agree that the document is mature

Approved as ITU-T recommendation by Governments' voting
TISPAN NGN Release 1 and Release 2

NGN Release 1 published in December 2005 (60 documents)

NGN Architecture, PSTN/ISDN emulation & PSTN/ISDN simulation are main outputs.

NGN Release 2 started in February 2006

Service expansion (IPTV, etc.) and architecture enhancement are main targets.

- NGN Architecture (IMS, RACS, NASS, etc.)
- PSTN emulation & simulation
- xDSL is the main access considered

NGN Release 2 (2006 - 2007)
- IPTV (IMS based & Non-IMS based)
- RACS Release 2, NASS Release 2
- Fixed Mobile Convergence (FMC)
- Corporate Networks
- Home Networks,
- Advanced Charging etc.

Main players of TISPAN are operators and vendors with wireline business, such as BT, FT, DT, TI, Ericsson, Siemens (+Nokia), and Alcatel.

New players have appeared in NGN release 2, such as Cisco and Microsoft.

Cooperation with other SDOs is emphasized to proceed NGN release 2.

Main players of TISPAN are operators and vendors with wireline business, such as BT, FT, DT, TI, Ericsson, Siemens (+Nokia), and Alcatel.

New players have appeared in NGN release 2, such as Cisco and Microsoft.

Cooperation with other SDOs is emphasized to proceed NGN release 2.
ITU-T R2 new services/capabilities

- **Service stratum related capabilities**
  - RFID; Describes RFID applications. Requirements for NGN will be added in the future
  - Open Service Environment Capabilities: Describes integrated ANI (application network interface) including 3GPP OSA. Requirements for NGN will be added in the future

- **Transport stratum related capabilities**
  - FMC; documents on requirements, IMS-based architecture, Service scenario for NGN with PSTN-based access networks are under discussion
  - Multicast with MPLS-based QoS support: Requirements, architecture overview, information flow are under discussion

- **Application related services**
  - IPTV discussion is moved to Focus Group on IPTV (~2006/07)

- **Most new services are proposed by Korea and China in ITU-T**
INDEX

1. Trends of the telecommunication industry
2. Overview of NGN
3. Standardization
4. **NGN key functionalities**
5. NGN Services
6. Case study: CJK test-bed
7. Summary
Network Convergence

- Access media independent all-IP network
- Common platform for multi-media services

Communication Services
- MRF
- AS
- Presence
- SIP-based SDP

Web Services
- My Portal
- Remote Access
- HTTP-based SDP

SDP (Service Delivery Platform)

Application

Control

Network

Access

Terminal

IP / MPLS

2.5G / 3G

WLAN / WiMAX

FTTH

Plug-in New Access
Key Technology of NGN Architecture

Service Stratum
- Service Application
- Service Delivery Platform (SDP)
- Network Service Control
  - IP Multimedia Subsystem (IMS)
- Service Control User Profile

Transport Stratum
- Transport Control
  - Network Attachment Control Function (NACF)
  - Resource Admission Control Function (RACF)
- Access Network
- Core Network

Support NGN services and Applications
SIP Server: High Guarantee, High Availability, Open Standard
Support various access method
Resource Reservation and Access Authentication (QoS, Authentication)
There are two typical operational modes in RACF.

Fig. 1 Push mode

Fig. 2 Pull mode
IMS: IP Multimedia Subsystem

- **MGW**: Media Gateway
- **PSTN**: Public Switched Telephone Network
- **BGCF**: Border Gateway Control Function
- **MGCF**: Media Gateway Control Function
- **CSCF**: Call Session Control Function
- **MRCF**: Media Resource Control Function
- **P-CSCF**: Proxy Call Session Control Function
- **PCF**: Policy Control Function
- **MRPF**: Media Resource Process Function
- **SLF**: Subscription Locator Function
- **HSS**: Home Subscriber Server
- **HLR**: Home Location Register
- **UE**: User Equipment
- **AS**: Application Server
- **ISC**: IMS Service

Diagram includes various functions and entities such as AS-FE, SAA-FE, SUP-FE, ISCMa, Db, GL-FE, «Core IMS», MGCF, MRFC, P-CSCF, MRCF, MGF, SLF, HSS, HLR, UE, ISC, and IMS Service.
SDP: Service Delivery Platform

- Quick introduction of new services using simplified API
- Creation of new ICT services by collaboration with IT application and Carrier assets

- Extraordinary ideas, contents and advance technologies of 3rd Party
- Carrier assets: Value added information and feature of operator

- User presence and location
- ID management, Virtual and anonymous ID
- Safety terminal management
- Accounting and logging
INDEX

1. Trends of the telecommunication industry
2. Overview of NGN
3. Standardization
4. NGN key functionalities
5. **NGN Services**
6. Case study: CJK test-bed
7. Summary
User trends 1

Broadband use by generation (comparison between end of 2004 and end of 2007).

(Source) “Communication Usage Trend Survey,” MIC
User trends 2

Function/services used on the website (PCs/mobile phones) (Multiple answers).

(Source) "Investigative Study on Access to Information and Consumer Behavior in the Ubiquitous Network Society"
User trends 3

Number of people who purchased digital contents through the Internet (by PCs or cellular phones).

Based on “Communications Usage Trend Survey in 2007,” MIC
Examples of applications

- Watching & listening TV or Real-time streaming services
- Multi-session based services
- Checking maps or PIM data
- Playing games
- Using the GPS navigation service
- Watching & writing Blogs (Weblogs)
- Enjoying shopping
Seamless services based on user demands

Communication service can be composed to adapt to user’s demands, situations and preferences.

- Inside Bus: Reply text massage, by video phone
- On the road after getting off the Bus: Conversation by mobile phone
- At home: Conversation by mobile phone seeing her face with conventional TV

All IP Network

IMS/MMD

FTTH
IPTV services

- High-quality video streaming with guaranteed Quality of Service
- Personalized, value-added services
INDEX

1. Trends of the telecommunication industry
2. Overview of NGN
3. Standardization
4. NGN key functionalities
5. NGN Services
6. **Case study: CJK test-bed**
7. Summary
China-Japan-Korea (CJK) NGN test bed

排序

Objective
Evaluation of the service performance by MPM (Management of Performance Measurement) among NGNs in different countries.
Standardization (MPM, RACF)

1) Estimation of QoE from QoS

2) Dynamic session controls of MoIP services in FMBC all-IP networks

- Objective QoE be estimated based on the network performances such as Packet Loss, Delays, Jitters and conditions of Codec types which include the packet loss concealment schemes, Packet generation/ buffering depending on each service.

- The RTP/RTCP based QoS measurement & estimation of QoE by terminals (CPE), and the dynamic session controls of MoIP services by network-node.
Equipment for test-bed

KDDI: IMS-Based NGN
ETRI: Call-server based and IMS-based NGN
CATR: Call server based NGN
MPMs are provided by KDDI R&D Labs.
Study phases of the NGN Test-bed

CK NGN Test-bed
- Phase 1: 2006 3rd/4th Quarter (Completed)
  - Network Connectivity
  - Scenario 2 and 4 only (2 CS and 2 domains)
- Phase 2: 2007 1st/2nd Quarter (Completed)
  - Scenario 1, 3 (simpler version of 2 and 4, single domain) and 5

CJK NGN Test-bed
- Phase 3: 2008 1st/2nd Quarter
  - Performance Evaluation of RTP/RTCP-based MoIP (Multimedia Voice/Audio/Video) over IP) service
  - Network connective for Performance evaluation and Performance Monitoring Scenarios 6-1 and 6-2
- Phase 4: 2008 3rd ~ 2009 2nd Quarter
  - Performance Evaluation of RTP/RTCP-based MoIP and IPTV services
  - Performance Monitoring Scenarios 6-3 and 6-4
  - Initial RACF Interoperability testing: Scenario 7
  - Testing of RACF and RTP/RTCP-based MPM Interactions
  - IPTV Interoperability testing
Study scenarios of the CJK NGN test-bed

- Scenario 6-1: Performance evaluation of Network Segments
- Scenario 6-2: Performance evaluation of MoIP service among CPEs
  - Local testing of MPM (Provided by KDDI R&D Labs.)
  - CPE-to-CPE performance evaluation
- Scenario 6-3: Performance evaluation of MoIP service with two MPMs
  - CPE – MPM1 – MPM2 – CPE performance evaluation
- Scenario 6-4: Performance evaluation of MoIP service with three MPMs
  - CPE – MPM1 – MPM2 – MPM3 – CPE performance evaluation
- Scenario 7: Testing of RACF and RTP/RTCP-based MPM Interactions
Study scenarios for the CJK evaluation

Scenario 6-1: Performance evaluation of Network Segments
Scenario 6-2: Performance evaluation of MoIP service among CPEs
Scenario 6-3: Performance evaluation of MoIP service with two MPMs
Scenario 6-4: Performance evaluation of MoIP service with three MPMs
Summary

**NGN**

- **Various type of user communications**
  - Development of broadband access network (e.g. CATV, ADSL, and FTTH) brings rich user experiences.
  - Inexpensive mobile networking such as Wi-Fi and 3G cellular provides anytime and anywhere communication.

- **Ubiquity in communication resources**
  - Many type of devices and applications connects to the all IP network through various access networks.

- **Unified control mechanism**
  - IP-based signaling protocol (SIP, SIP extensions, etc.)
Thank you for your kind attentions.

Q&A