INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Report

ITU-T Workshop on NGN and its Transport Networks

(Kobe, Japan, 20-21 April 2006)

Table of Contents

EXECUTIVE SUMMARY

At the kind invitation from ITU Association of Japan, ITU-T organized a workshop on *NGN and its Transport Networks* at the International Conference Center Kobe (ICCK), Japan, 20 to 21 April 2006.

NGN Standardization work is now well underway in the ITU-T and other SDOs. Following the success of the NGN Focus Group and the establishment of the NGN Global Standards Initiative (NGN-GSI) in ITU-T, this ITU-T workshop was an opportunity to review the status of the work, identify technology trends, and provide a framework for moving forward standardization work.

This event provided an overview of the architecture, performance and transport aspects of NGN as well as the market drivers and challenges. Particular emphasis was given to network technologies, standards that address architecture and the performance aspects of NGN and transport networks aspects to support NGN services.

During the 2-day workshop, 423 representatives from 22 countries attended discussions in 6 technical sessions: 1) NGN Architecture and Requirements, 2) Network QoS and Control, 3) Transport Network Control, 4) Market Opportunities and Challenges, 5) Broadband Access, and 6) Data over Transport networks.

Nine exhibitors namely Jujitsu, Hitachi, Japan Telecom, KDDI, Mitsubishi Electric, NEC, NTT, OKI and Softfront demonstrated their equipments/systems related to the workshop theme.

All presentations of the event are also available at the workshop website at: http://www.itu.int/ITU-T/worksem/ngn/200604/index.html.

HIGHLIGHTS OF SESSIONS

Session 1: Opening Session

After welcome address from Mr. Hiroshi Matsui, and opening speech from Mr. Houlin Zhao, Mr. Masao Matsumoto from MIC, Japan introduced Japan's NGN strategy. Then Mr. Yuji Inoue from NTT shared NTT's experience of broadband service deployment. Mr. Chae-sub LEE, Mr. Brian Moore and Mr. Yoichi Maeda overviewed the current developments of NGN related standards and other standardization work in ITU-T.

Session 2: NGN Architecture and Requirements

Mr. Carugi introduced NGN Release 1 environment objectives, services, and capabilities with brief comparison with ETSI TISPAN Release 1 work with respect to services, access network, QoS, and evolution towards NGN, summarized study subjects for interconnection between NGN domains and user networks and equipment and identified future work items includes consideration about multiple service scenarios, customer and enterprise networks, more services, service delivery platforms, profiling, interconnection etc.

Mr. Knightson introduced NGN definition, general reference model, and mediated/non-mediated service concept, examined effects of separation into service and transport strata. He noted resource and admission controls as the bridging function. More work need to be done on architectural aspects on fixed to mobile convergence and home gateway architecture/functionality.
Areas for further study are streaming services (IPTV), identity based systems (RFID), and home networks.

Mr. Knight introduced key components of IP Multimedia Subsystem (IMS), CSCFs and HSS, examined how to adapt IMS to NGN and application to PSTN emulation service (PES). Advantages of IMS PES are 1) preserves common interface to RACF & transport network, 2) common service control functions, 3) common Routing and configuration data between emulated PSTN/ISDN Users and NGN Users (Important), and 4) economy of scale.

Ms. Schuelke noted that trends for service revenue are headed for multimedia, contextual/personal awareness, and social and community focused. She introduced Open Mobile Alliance (OMA) organization and its Service Environment (OSE). Developed service architectures under OMA are presence, group management, and Push-to-Talk over cellular. Ongoing service developments include messaging, content-related services (content screening, dynamic content delivery, and digital rights management), and delivery mechanism such as mobile broadcast.

Session 3: Network QoS and Control

This session summarized Quality of Service (QoS) and resource control requirements for NGNs, and how those requirements are being addressed in international standards and emerging networks. The session focused on the "upper layer" controls enabling individual IP packet flows to be established, across IP router networks, among end users and application service providers. It also explored how upper layer controls may interact with "lower layer" controls enabling aggregate flows to be established, across optical transport networks, among IP router networks operating as OTN clients.

Session 4: Transport Network Control

Mr. McGuire noted the starting point of transport network control is Service Management. Radically Simplified Network - Mesh and Cross-Connect based rather than Ring Based – will have more effective utilization. OPEX reduction eliminates manual steps and CAPEX reduction achieves

more efficient utilization through shared restoration. Soft Permanent Connections are the primary driver today. We are not ready for high penetration of Dynamic Switched Services (bandwidth on demand). From long holding times, Erlang theory indicates delay to set up service would be unacceptable when blocking occurs.

Mr. Lam noted that management is the key to control plane deployment. Management of control plane is as important as transport plane. Management encompasses configuration, fault, performance, accounting and security management. The framework and requirements recommendation of management plane have been approved. Information model and solution set are in progress and expected to finish soon. The management plane will still be the "captain" even with introduction of the control plane. Progress on control plane management has benefited from effective collaboration among SDOs (ITU-T, OIF, TMF, and IETF).

Mr. Shew noted signaling architecture is composed of interrelated components developed by multiple standards organizations (IETF, OIF, and ITU-T SG15). SDOs are cooperating to develop protocol pieces to support different architectures. An extensive signalling interoperability demonstration was undertaken involving 7 carriers and 13 equipment vendors. Recent signalling work is solving problems with inter-area (domain) signalling and multi-layer interworking (e.g., when a server layer connection must be established to support a client layer call).

Mr. Farrel introduced the rapidly progressing work to define essential protocol building blocks. The Path Computation Element (remote path query) is one such building block under development to deal with limited TE visibility. Virtual link and virtual node abstractions both have drawbacks. PCE can be employed in a variety of architectural models (co-located with connection controller, separate server, incorporated into NMS, or cooperating PCE servers across different domains. It's applicable to ASON architecture - new Rec. G.7715.2 requirements and architecture for remote path query.

Mr. Sadler noted that convergence drives us to networks comprised of multiple technologies. Multi-Layer routing technologies being developed to support path computation in an environment made up of many different technologies in any layer that has switching flexibility. There is a need to represent server layer within client layer and address cases where client layer link is to be established over established or potential server layer trails. Server layer can be represented as abstract node or topology shadow within client layer. Path Computation Element (PCE) can be employed as a bridge in multi-technology networks, e.g., for nodes that do not support multi-layer control plane.

Session 5: Market Opportunities and Challenges

In this session four speakers from operators and vendors/suppliers shared their views on business opportunities, driving forces for implementation, user/operator benefits and regulatory impact of NGN with a focus on the needs from Asia-Pacific region to provide a state-of-the-art overview of global trends.

Session 6: Broadband Access

Mr. Schenk introduced the VDSL2 work recently approved by ITU in February 2006. Multiple profiles have been defined to address regional and application specific requirements. ADSL/2/2+ interoperability is included. Worldwide subscribers to Digital Video Recording (DVR) services will rise by a factor of seven between 2005 and 2010. Polymer Optical Fibre (POF) might be a solution for Home Networking.

Mr. Nakano presented the PON features: very high speed data up to 1 Gbit/s to home and businesses, low cost due to fibre and CO interface shared by several customers, maintenance cost reduction due to no electronics between CO and customers and multiple applications including data (IP), video and voice (triple play). Higher transmission rate or WDM technology will increase PON bandwidth. Optical amplifier will increase PON reach and higher PON splitter ratio.

Mr. Nakamura introduced NHK's view of IPTV. Distribution of HDTV is a key application for broadband access networks. Critical issues in home networking and transport are: Domain control DRM, and QoS definition.

Mr. Nohara introduced the KDDI experience with WiMAX. Field trials have indicated its feasibility and identified further study items. Global harmonization required to promote it as global standard (i.e., such as equipment/system interoperability, common frequency band allocation, etc.)

Session 7: Data over Transport networks

Mr. Busi noted that T-MPLS can be used as a carrier grade infrastructure to support Ethernet services with multi service capability, Ethernet service segregation and multiplexing, Infrastructure OAM and protection switching. It supports p2p, mp2mp Ethernet services.

Mr. Bottorff introduced that Global Virtual Private Network supports multiple service instances by supporting multiple (client) services and offering p2p, LAN and tree topology. Ethernet continues evolution with new standardizations: 802.1ah adds full encapsulation/hierarchy for scalability and security. Y.1731/802.1ag supports carrier grade OAM and G.8031/802.1aq supports protection switching.

Mr. Ohta further introduced Y.1731 and 802.1ag for fault and performance management of OAM which supports fault isolation in multi carrier networks. Protection switching uses OAM frames and could rapidly recover for p2p services. SDH/OTN style OAM for Ethernet is also discussed.

Mr. McGuire noted that Ethernet provides ubiquity in Enterprise and the home. It's the interface of choice for many applications. New requirements to Ethernet include Multi service capability – one interface, separation network/customers and customer/customer, SDH operational features/costs and Ethernet/packet flexibility and price point. PBT is a potential solution.

Session 8: Panel – Wrap-up

At the end of the workshop, a wrap-up panel session chaired by Mr. Brian Moore and Mr. Yoichi Maeda with chairmen from previous sessions summarized the workshop.

WORKSHOP CONCLUSION/RECOMMENDATION

Session 2 conclusions:
- Service enablers/capabilities and their coordination with other organizations need further work in ITU-T.
- How to accommodate expected new services such as streaming (IPTV) needs action with regard to the NGN capabilities and architecture.
- The approach would be in fact identifying basic capabilities and comparing with already-defined architecture elements.
- To what extent the NGN architecture should be common is for further study. Existing specification/equipment should be taken into account. Interworking may be the first step from the practical view point.

Session 3 conclusions:
- NGN QoS and Resource Control Architectures and Protocols
  - RACF enables dynamic, application-driven resource management
    - Edge-to-edge or end-to-end, can support many applications
  - TISPAN RACS defines similar functionality, focused on access
    - Specifies protocols/extensions for interfaces (e.g. H.248.1/v3)
- NGN OAM
  - Required to fulfill user/service provider/operator contracts (SLAs)
    - Each NGN layer must support OAM independently
  - Carrier Ethernet is a key NGN enabler ― Carrier Ethernet OAM (e.g., Y.1731) functions meet NGN OAM requirements
- Performance Interaction between IP and OTN Layers
  - ASON enables IP clients to change optical network characteristics
    - Bandwidth, topology (e.g., link creation)
  - Control may be direct or through network management systems
    - A generic inter-layer signaling model may be needed

Session 4 conclusions:
- Cooperation between SDOs (ITU-T, IETF, OIF, TMF, etc.) continues to be an essential part of control plane standards evolution.
- Primary application for carriers is soft permanent connection support for network simplification, OPEX/CAPEX reduction.
- Management is still the "captain of the ship"
- Current challenges being addressed in Signaling and Routing arise from networks comprised of multiple technologies (from convergence) (e.g., multi-layer networks), mutiple areas and domains.

Session 5 conclusions:
- QoS in Access and Core now implemented based on priority schemes, all new mechanisms need to be cost efficient for ROI
- voice and messaging services implemented on IP as a first step, MM services coming next
- migration scenarios depend on operators environment and regulatory aspects
- IMS sufficiently stable to be implemented as element of NGN
- regulation differences between fixed and mobile networks cause different migration speeds towards NGN

Session 6 conclusions:
- Distribution of High Definition TV(HDTV) is a key application for broadband access networks
- Increase PON bandwidth by using higher transmission rate or WDM technology
- Increase PON reach by using optical amplifier

- Higher PON splitter ratio (more users per PON) by using optical amplifier
- Critical issues for Home Networking and Transport
  - Domain control and Digital Rights Management (DRM)
  - Quality of Services (QoS) definition
- Global harmonization of WiMAX required to promote it as a global standard
- Polymer Optical Fibre (POF) solution for Home Networking?

Session 7 conclusions:
- The Transport infrastructure has evolved from offering simple point to point private line services over SDH/OTN/WDM
- Ethernet is the transport service interface of the future
  - Rapidly expanding "infrastructure" service
  - Supports multiple clients
- Packet transport network is evolving to meet the scalability and operational challenges
- Gap between the IP centric "top end" of the transport stratum and the evolving packet based "infrastructure" services
- Transport network economies of scale rely on the aggregation of a large number of services
- Carrier Ethernet offers flexible connectivity and QoS capabilities: How do we map from the individual dynamic service demands to the (more stable) aggregated trunks

Suggestions to NGN standardization work:
- architecture needs to be modular to enable „plug-in" concept
- priority for open interfaces may vary depending on local market
- international standards for unified database/SHLR standards (data models and protocols) may be needed later based on local implementations
- NGN needs to take requirements on openness, like access to the Internet, into account.

Suggestions of next steps for ITU-T to work together with other SDOs/fora:
- NGN QoS and Resource Control Signaling
  - Complete Y.RACF, select or develop the associated protocols
  - Harmonize RACF/RACS work and results among SDOs
  - Specify Release 2(+): Inter-PDF communications, end-to-end transactions, enterprise network connections, non-SIP applications (e.g., IPTV)
- NGN OAM
  - Resolve "Last Call" comments on Y.1731 (Ethernet OAM)
  - Coordinate OAM functions among interworking NGN technologies
  - Define OAM interactions with NGN signaling, network management
- IP/Optical Network Control and Management Interworking
  - Define how IP networks, as ASON clients, can affect OTN performance and connectivity
  - Consider/address need for inter-layer QoS allocation/accumulation
  - Consider/address need for a generic inter-layer signaling model

ANNEX

WORKSHOP EVALUATION RESULT

Of 423 participants, 56 returned the filled evaluation form. From the respondents, 13 % indicated an overall ranking for the Workshop as "very satisfied", 41% as "satisfied and 7% as "neutral".

1= very dissatisfied, 2= dissatisfied, 3= neutral, 4= satisfied, 5= very satisfied

The average overall ranking of the Workshop was: 4.1

27% of respondents would welcome another ITU_T workshop on the same subject in the next 1-2 years