# Seminar on ITU-T hot topics for Standardization

## (Mar del Plata, Argentina, 2 September 2009)

# Functional requirements of NGN including overall architecture

**Marco Carugi**
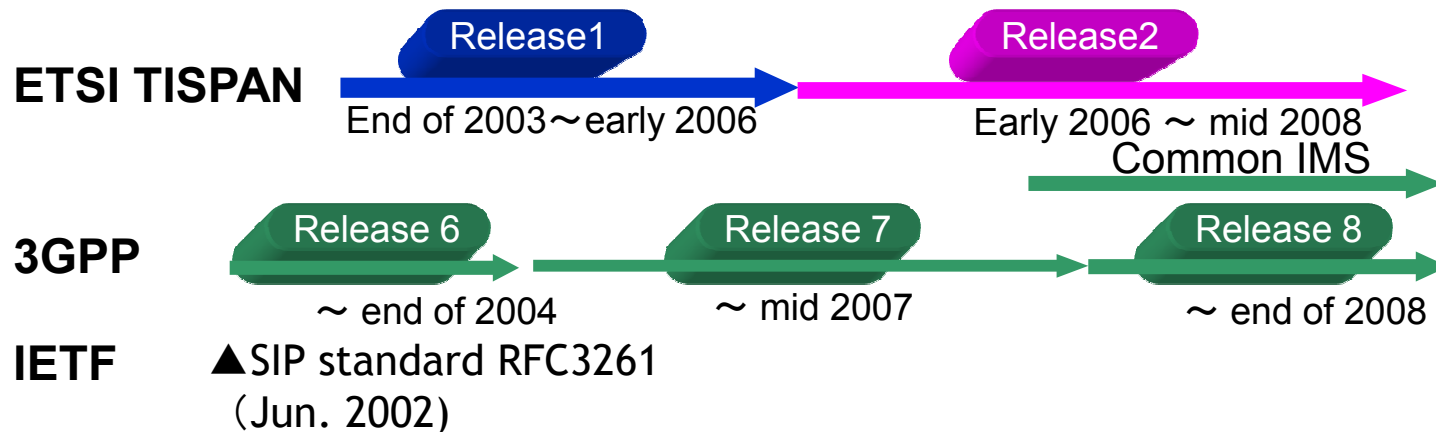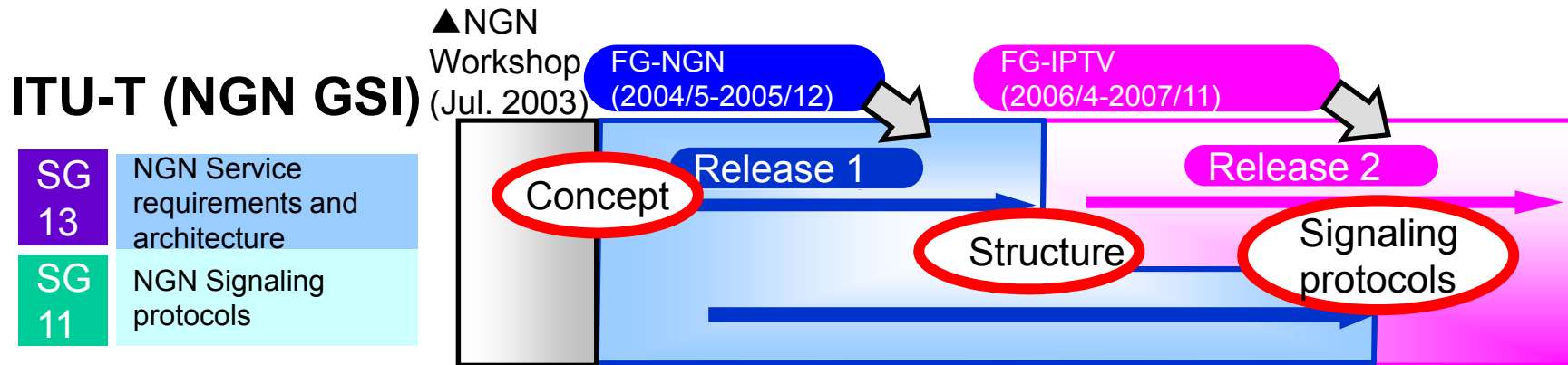
**ITU-T SG13 WP2 co-chair**

**and Q.3/13 Rapporteur**

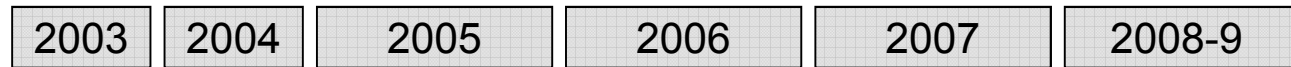## Outline

o   ITU-T NGN standardization

  o   Introduction elements, service objectives and capabilities

  o   High level functional requirements and overall architecture elements

    o   Some key core NGN areas

    o   Some emerging NGN areas

# ITU-T NGN standardization timeline

- **13 ITU-T Recommendations on NGN basic concepts published in July 2006**
- **ITU-T NGN Release 1 practically completed in January 2008**
- **More advanced services/features (IPTV, FMC etc.) currently in progress**



| 2003 | 2004 | 2005 | 2006 | 2007 | 2008-9 |

**ITU-T (NGN GSI)**

▲NGN Workshop (Jul. 2003)

FG-NGN (2004/5-2005/12)

FG-IPTV (2006/4-2007/11)

| SG 13 | NGN Service requirements and architecture |
| SG 11 | NGN Signaling protocols |

Concept
Release 1
Release 2
Structure
Signaling protocols

**ETSI TISPAN**

Release1
Release2
End of 2003～early 2006
Early 2006 ～ mid 2008
Common IMS

**3GPP**

Release 6
Release 7
Release 8
～ end of 2004
～ mid 2007
～ end of 2008

**IETF**

▲SIP standard RFC3261 （Jun. 2002）
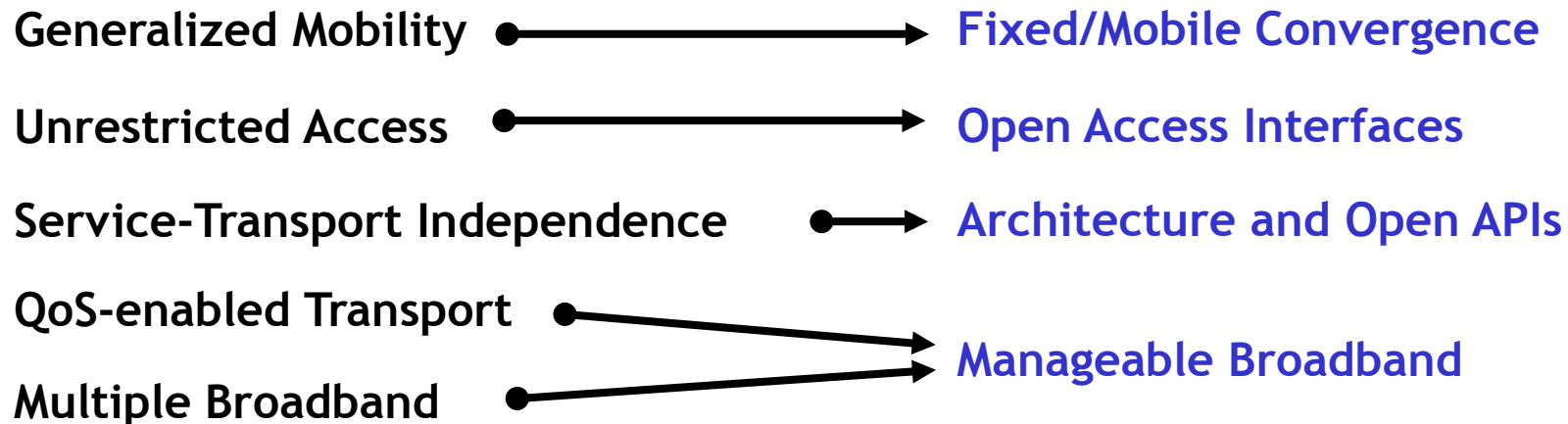
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# NGN definition and basic features

**Definition of NGN (Rec. Y.2001)**

A NGN is a packet-based network able to provide telecommunication services and able to make use of <u>multiple broadband</u>, <u>QoS-enabled transport</u> technologies and in which <u>service-related functions are independent from underlying transport-related technologies</u>. It enables <u>unfettered access for users to networks and to competing service providers and/or services of their choice.</u> It supports <u>generalized mobility</u> which will allow consistent and ubiquitous provision of services to users.

**Target Standards areas**

Generalized Mobility ⟶ **Fixed/Mobile Convergence**

Unrestricted Access ⟶ **Open Access Interfaces**

Service-Transport Independence ⟶ **Architecture and Open APIs**

QoS-enabled Transport ⟶ **Manageable Broadband**

Multiple Broadband ⟶ **Manageable Broadband**

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## Next Generation Services

o **From today's networks**
- Services are typically "vertically integrated"
- Services require specific infrastructure components for their delivery

o **to NGN : flexible service creation and provisioning**
- Horizontal Convergence: services are no more vertically integrated
- **Network functions are componentised**
- **Standard "capabilities" as service enabling toolkit**

o **Key objectives in ITU-T NGN standardization**
- Not just a new voice network
- *"A Service Level equal or better than in circuit-switched networks"*
- **Services specified in terms of required "capabilities"**
- Service definitions are not an objective like in legacy world
  - But Public Interest Services are a special case

**Service Shift as consequence of NGN service vs transport stratum separation**

## NGN Release 1 service objectives (Y.2000-series Sup.1 "NGN Rel. 1 scope")

## Services expected to be supported in NGN Release 1

o   PSTN/ISDN Emulation services

o   PSTN/ISDN Simulation services

o   Multimedia services

o   Data communication services (including VPNs)

o   Public Interest Services

o   NGN is not intended to preclude access to the Internet

*It's a Provider decision which services will be actually deployed*

## ITU-T NGN-GSI currently working on NGN Release 2

o   Service scenarios, service and functional requirements and capabilities, architecture extensions, mechanisms and protocols

o   High level Rel.2 Requirements have been completed

o   Rel.1 activity still ongoing (mainly on protocols)

NOTE: "Release" concept under replacement by "Capability Set" concept

## NGN Release 2 service objectives
## (Y.2000-series Sup.7 "NGN Rel.2 scope")

**Services expected to be supported in NGN Release 2**

o **IPTV services**

o **Managed delivery services**

o **NID related services**
- Services using tag-based identification
- Ubiquitous Sensor Network services

o **Additional multimedia services**
- Visual surveillance services
- Multimedia Communication Centre services

o **Enterprise services** (NGN support of services for Enterprises)
- Virtual Leased Line, Business Trunking, Hosted services

o **Services at Home** (NGN support of services in home environments)

## NGN Requirements and Capabilities

o **Y.2201: High level requirements and capabilities to support NGN Release 1 service objectives** – approved in April 07

- Only network capabilities (no user equipment capabilities)
- No requirements related to specific services
- Identified capabilities were mainly derived from functionalities developed in various SDOs and ready for use at Rel.1 time
- No precise "functional requirements" for specific NGN entities, rather guidelines for the NGN architecture in order to support these capabilities and associated requirements (detailed deliverables developed for the various functional areas)
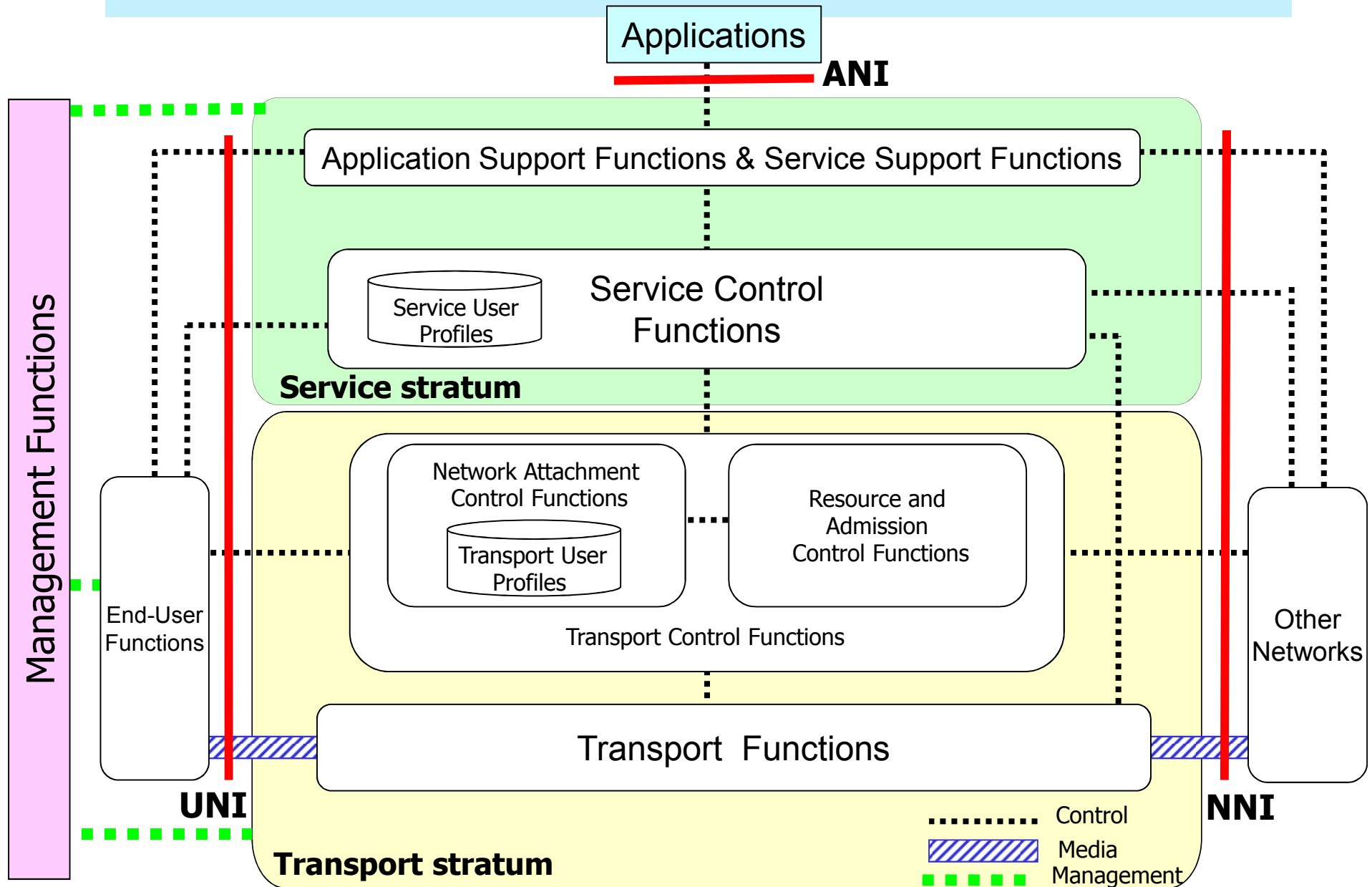
o **Y.2201 Rev.1 (formerly NGN Rel.2): High level requirements and capabilities for ITU-T NGN** – formal approval in Mar del Plata

- Includes user related and service-specific requirements

NOTE: each specific NGN realisation may support an arbitrary set of services, thus requiring the implementation of an arbitrary set of capabilities
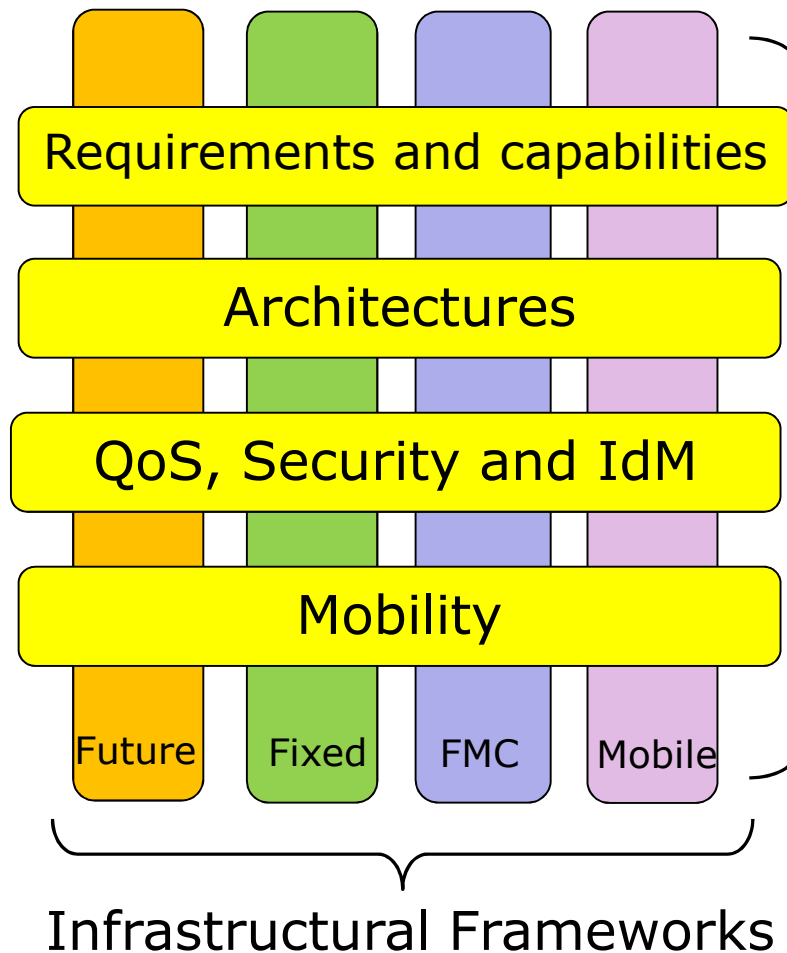
# The NGN capabilities identified in Y.2201

- Transport connectivity
- Communication modes
- Multicast
- Media resource management
- Codecs
- Access Networks, network attachment
- User networks
- Interconnection, Interoperability and Interworking
- Numbering, naming, addressing
- Identific., authentic., authoriz.
- Security
- Routing
- QoS
- OAM and Survivability
- Accounting and Charging
- Management

**Y.2201 Rev.1** ➡

- Mobility handling
- Service enablers
- Open service environment
- Profile management
- Policy management
- PSTN/ISDN emulation and simulation
- Public Interest Services support
- Critical infrastructure protection
- Non disclosure of info across NNI
- Inter-provider exchange of user-related information
- Context management
- Identity management
- Content management
- IPTV services support capabilities
- Enterprise Networks support capabilities
- IPV6 support capabilities

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# Y.2012 Rel.1 : the initial basic functional view of NGN

Applications

**ANI**

Management Functions

Application Support Functions & Service Support Functions

Service Control Functions

Service User Profiles

**Service stratum**

Network Attachment Control Functions

Transport User Profiles

Resource and Admission Control Functions

Transport Control Functions

End-User Functions

Transport Functions

Other Networks

**UNI**

**NNI**

**Transport stratum**

·········· Control

Media Management

# Dimensions and some key study areas in ITU-T SG13 ("Future networks including mobile and NGN")

Requirements and capabilities

Architectures

QoS, Security and IdM

Mobility

Future   Fixed   FMC   Mobile
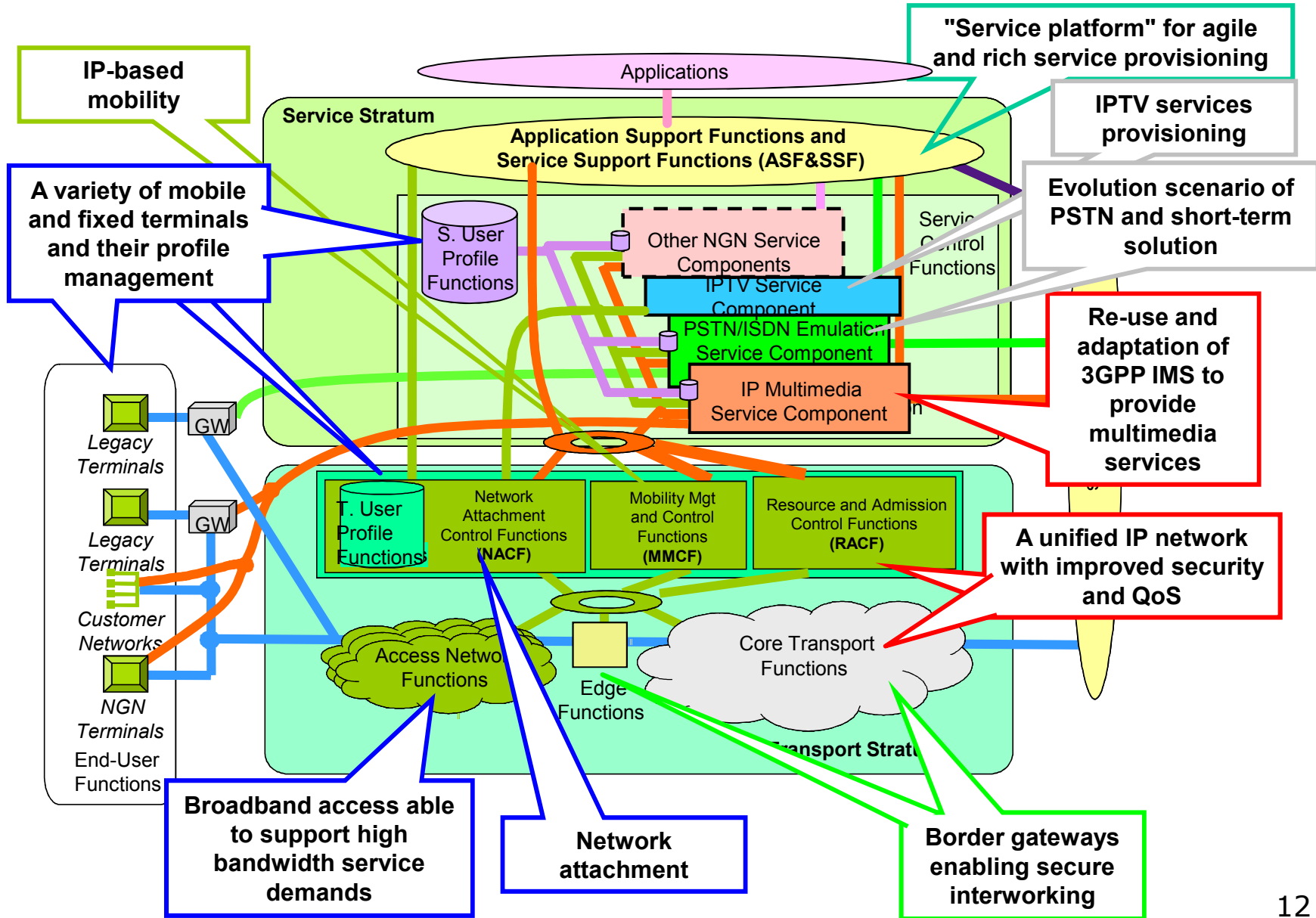
Infrastructural Frameworks

**Core NGN areas**

**Emerging NGN areas**
- Open Service Environment
- 3$^{rd}$ Party apps and Web based
- IPTV services
- NID & Ubiquitous Sensor Networks
- Ubiquitous Networking
- NGN in Home and in Vehicles
- Peer-to-Peer approaches
- Others

# NGN functional components: high level view (Y.2012 Rev.1)



"Service platform" for agile and rich service provisioning

IPTV services provisioning

IP-based mobility

Applications

Service Stratum

Application Support Functions and Service Support Functions (ASF&SSF)

A variety of mobile and fixed terminals and their profile management

S. User Profile Functions

Other NGN Service Components

Service Control Functions

Evolution scenario of PSTN and short-term solution

IPTV Service Component

PSTN/ISDN Emulation Service Component

IP Multimedia Service Component

Re-use and adaptation of 3GPP IMS to provide multimedia services

Legacy Terminals

GW

Legacy Terminals

GW

Customer Networks

NGN Terminals

End-User Functions

T. User Profile Functions

Network Attachment Control Functions (NACF)

Mobility Mgt and Control Functions (MMCF)

Resource and Admission Control Functions (RACF)

A unified IP network with improved security and QoS

Access Network Functions

Edge Functions

Core Transport Functions

Transport Stratum

Broadband access able to support high bandwidth service demands

Network attachment

Border gateways enabling secure interworking

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# Some core NGN areas

## NGN Architecture objectives and IMS

o **The advanced objectives of the NGN Architecture**

- Support of a comprehensive set of services over a unifying IP layer network
- Transport stratum support of a multiplicity of access networks and a variety of mobile and fixed terminal types
- Services separable from transport stratum into service stratum
- Services not limited to those provided by the "home network"
- Services able to traverse multiple providers' networks

o **IMS is a core component of the NGN Architecture**

- IP Multimedia Service component
- The capabilities of 3GPP IMS can be used by the NGN
  - but some extensions of 3GPP IMS specifications are required
  - IMS alone is not sufficient for the NGN
- Y.2012 "NGN Rel.1 functional requirements and architecture"
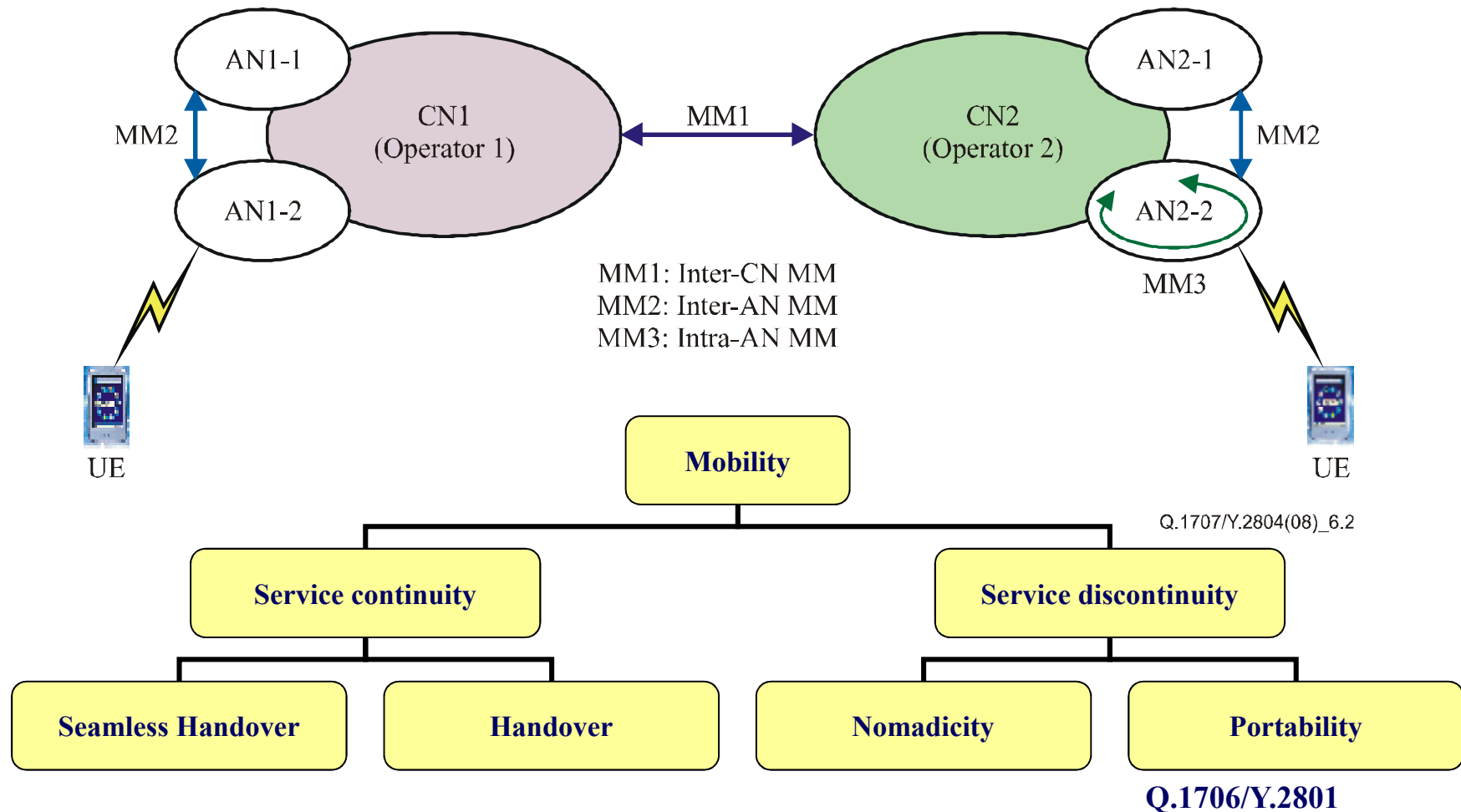- Y.2021 "IMS for NGNs" – NGN Rel.1 deliverable

## Key NGN architectural challenges

o **Application-driven QoS**
  - QoS classes
  - Explicit bandwidth selection
  - Mapping & control from Service to Transport
  - Flow awareness (monitoring, accounting)
o **Mobility**
  - Seamless handover
  - Fixed Mobile Convergence (FMC)
o **Scalability**
  - Multicast
  - Ubiquitous networking

# Mobility – multiple dimensions

**Users' basic requirements**
- Access from a variety of environments with a variety of terminals with varying capabilities
- Global roaming, ubiquitous and seamless solutions

AN1-1

CN1 (Operator 1)

MM2

AN1-2

MM1

CN2 (Operator 2)

AN2-1

MM2

AN2-2

MM3

MM1: Inter-CN MM
MM2: Inter-AN MM
MM3: Intra-AN MM

UE

UE

Mobility

Q.1707/Y.2804(08)_6.2

Service continuity

Service discontinuity

Seamless Handover

Handover

Nomadicity

Portability

**Q.1706/Y.2801**

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## Limited Mobility capabilities in NGN Release 1

o **NGN Release 1 requires support of "Nomadism"**
- **"The ability to change network access point on moving, without maintaining service continuity"**
- To be supported between networks and within a network

o **Two types of mobility [Y.2201, Q.1706]**
- **Personal Mobility**: the user moves (between terminals)
- **Terminal (Device) Mobility**: the device moves (with its binded user)

o **No new interfaces defined for Release 1 Mobility**

*Nomadism is the initial step towards Generalized Mobility and Fixed Mobile Convergence*

## Service continuity as step 2 of mobility [Y.2201 Rev.1]

o NGN support of service continuity is recommended in Intra-AN and Inter-AN scenarios for personal and terminal mobility

- Implementation levels may vary
- For voice services, service continuity required for terminal mobility

o NGN is recommended to allow adaptation for service continuity when users' reqts and network conditions mismatch (e.g. (re)negotiation of network QoS and terminal parameters (codec))

## "Mobility roadmap": an important ongoing activity

o Working on a multi-dimension matrix which includes the various mobility features, mobility scenarios and existing solution specifications

# Towards Fixed Mobile Convergence: functional scenarios of convergence - Q.1762/Y.2802

**Charging and Billing Functions**

**Applications**

**Application /Service Support Functions**

**Service Control Functions**

**Service Control Functions**

**Fixed Network**

**Mobile Network**

**Fixed access network**

**Mobile access network**

**Convergence may be happen at different functional levels**

Example of convergence at Application/Service Support Functions level
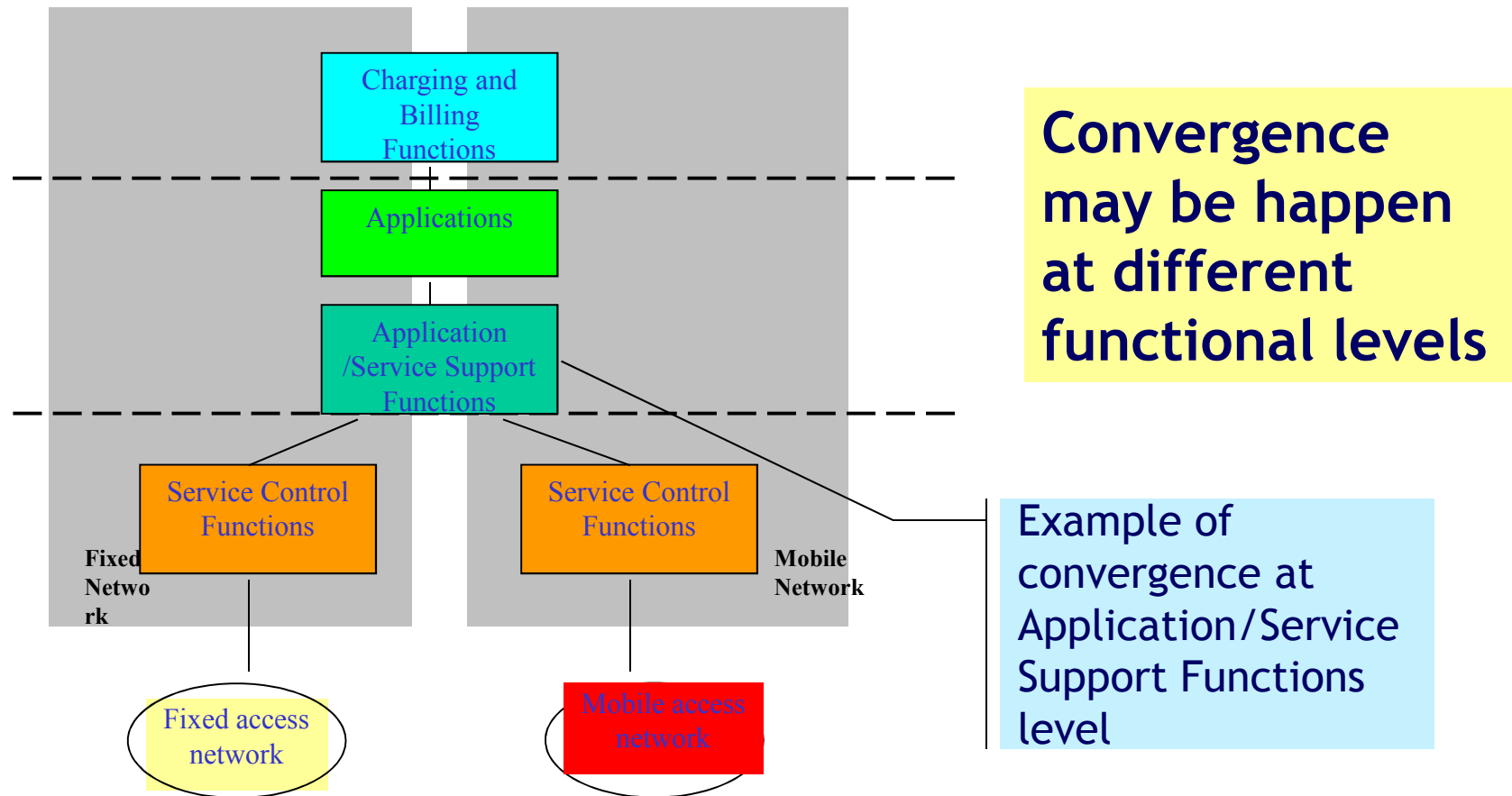
- **Y.2802: FMC characteristics, requirements, capabilities, scenarios**
- Y.2803: FMC service using legacy PSTN/ISDN as fixed AN for mobile users
- Y.2808: FMC with a common IMS session control domain

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# Interconnection

o **Interconnection at Network to Network Interface**
  - Between multiple NGN domains, between NGN and other networks

o **Two types of Interconnection between NGN domains**
  - **Connectivity-oriented Interconnect (Colx) is required** (Y.2201)
    — Simple IP connectivity, irrespective of interoperability levels
    — No service awareness, no specific requirements assurance
  - **Service-oriented Interconnect (Solx) is required** (Y.2201 Rev.1)
    — **Services offered with defined levels of interoperability**



**Source for figure: ETSI TISPAN**
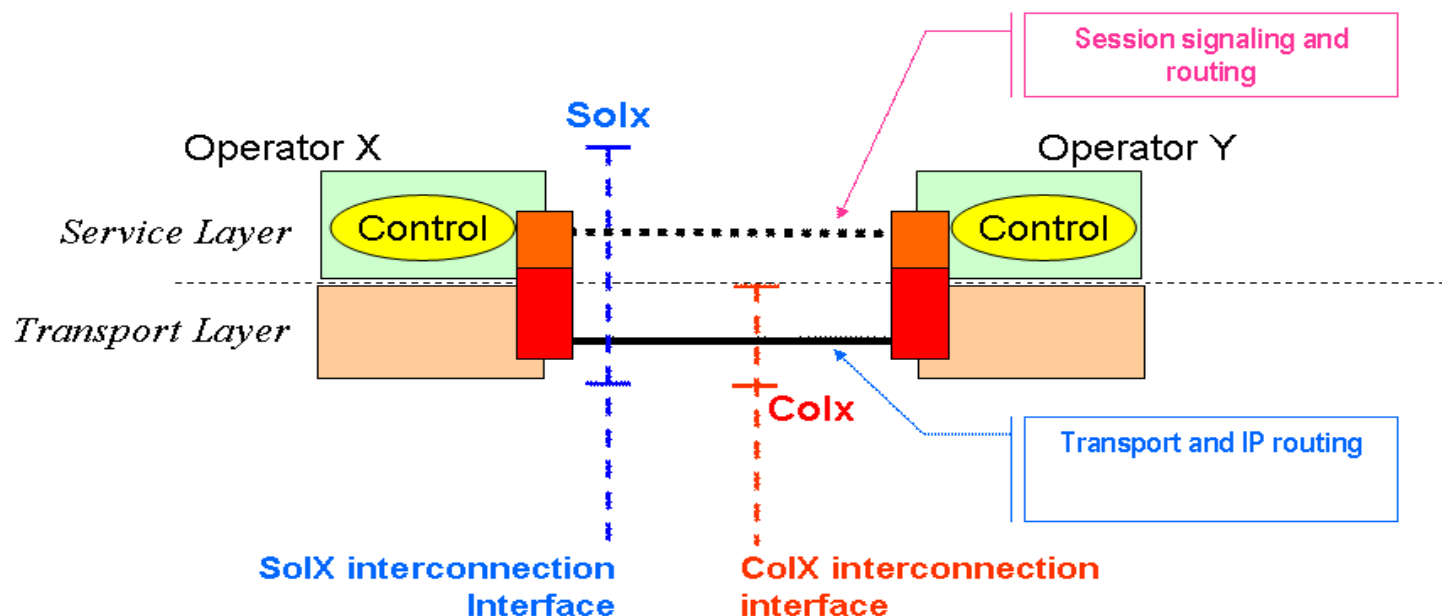
# NGN capabilities and specifications for Interconnection

## Interconnection capabilities (objectives)

o   routing;

o   signalling interworking;

o   numbering, naming and/or addressing interworking;

o   accounting and charging related information exchange;

o   security interworking;

o   QoS interworking;

o   user and terminal profile information exchange;

o   media interworking;

o   management interworking;

o   policy management

## NNI deliverables developed in SG11

o   **Q.3401**     NGN NNI signalling profile (protocol set 1) services

o   **Q.1912.5** Not an "interconnection" specification but useful in defining SIP-I

## Evolution towards NGN preserving the existing services

In evolution path to NGN, NGN Release 1 shall support:
o   legacy terminal equipment (e.g. PSTN/ISDN phones)
o   PSTN/ISDN-like capabilities

PSTN/ISDN Emulation
o   From the end user perspective, the NGN "appears" supporting the same types of services offered by the existing PSTN/ISDN
o   Legacy terminals are enabled to continue to use existing telecommunication services while connected to NGN

PSTN/ISDN Simulation
o   NGN terminals in an NGN network are enabled to use PSTN/ISDN-like service capabilities
o   But legacy terminals with terminal adaptations may be used too
o   Implemented over IP-based control infrastructure (e.g. using SIP)

## Developments concerning Evolution to NGN

o Generalities: Scenarios for PSTN/ISDN evolution to NGN: Y.2261

- three Call Server scenarios (start from Local Exchanges, start from Transit Exchanges, one-step)
- one-step evolution of core network to IMS
- xDSL Access network evolution to NGN

o Generalities on PSTN/ISDN Emulation and Simulation: Y.2262

- **two types of adaptation functions (ADF) for legacy access equipment**

## PSTN/ISDN Emulation

o Two approaches: Call Server (SoftSwitch) based (Y.2271), IMS based

o PSTN/ISDN Emulation architecture (Y.2031)

## PSTN/ISDN Simulation

o Based on IMS capabilities (a.k.a. MMedia Telephony in 3GPP)

o Y.2211 (stage 1) has identified additional service features

o **Work is ongoing on protocol aspects - SG11, alignment with 3GPP**

# Some emerging NGN areas

## Drivers for advanced application scenarios: the NGN "service enablers"

These are a group of capabilities (as named in Y.2201) providing features for specific or advanced services, and/or enabling access to, and/or handling of, specific information that they can provide

**The currently identified service enablers largely inherit from developments of other Standards Development Organisations, mainly 3GPP (IMS) and Open Mobile Alliance**

o Group management
o Personal information management
o Message handling
o Presence
o Location management
o Push
o Device management
o Session handling
o Web-based application support
o Data synchronization

# Reusable "Capabilities": towards an open service platform in NGN

End Users
3rd Parties
NGN Providers

**Applications**

Generic concept of ANI (Application to Network Interface)

**Reusable capabilities**

*Service environment*

*NGN resources*
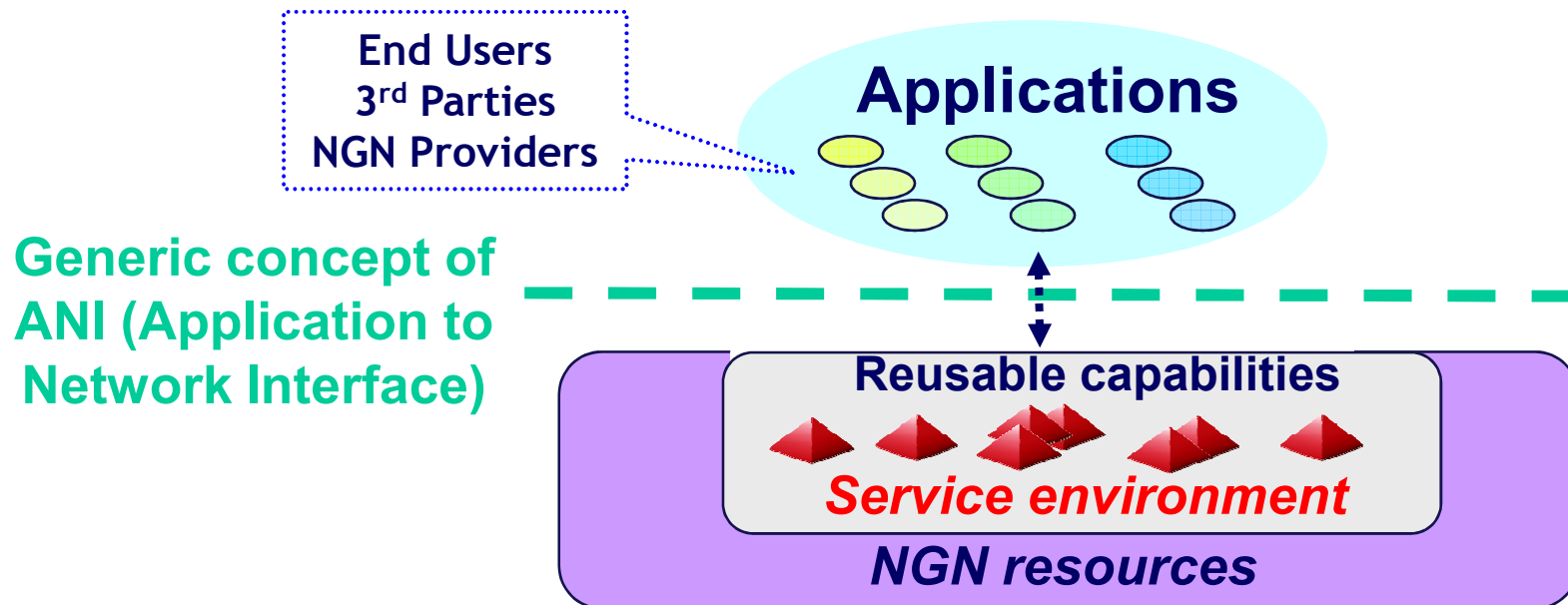
o Reusable set of "Capabilities" for reduced service development costs

o **Open service environment** for flexible and agile service creation, execution and management

- **Service platform concept (NGN SDP)**
- "Rapid change" is key for satisfying the changing customer needs
- New business opportunities via an environment integrating applications and telecom infrastructure

## Towards an open service environment in NGN

o **"Open service environment"** key attributes

- Exposure of capabilities via standard application network interfaces

- Leveraging capabilities from different network domains (Internet/Web 2.0, Broadcast Networks, Mobile Networks etc.)

- Portability and re-usability of capabilities across network domains (e.g. from the Internet to NGN, and from NGN to the Internet)

- Flexible development of services (applications) and capabilities by NGN Providers as well as by Application Providers (and End Users)

o **Enabling interworking with other service creation environments** (recommended for support in NGN Release 1):

- IN-based service creation environment (INAP, CAMEL, WIN, …)

- IMS-based service creation environment

- Open service creation environment (OSA/Parlay, OMA, …)

**Framework for value added applications leveraging network capabilities (COMMUNICATIONS-ENABLED APPLICATIONS)**

## Approaches for an open service environment in NGN

o **How to open**

- Adopting a Service Oriented Architectures (SOA) framework from the Information Technology world, and enhance it as appropriate ➡ **Telecom SOA**

- Using **enhanced Web Services (WS)** as implementation tool set of the Telecom SOA framework
  - but other tools (e.g. REST) are not excluded

o **What to open (exposing via standard interfaces)**

- NGN capabilities to Applications ➡ Telecom APIs

- NGN capabilities to other NGN capabilities

## Telecom SOA and enhanced Web Services: new challenges in the development of NGN standards

o Key values of a SOA framework
   - Cross-platform and highly reusable
o Most SOA implementations identify Web Services as the means for realizing a SOA
o **But new requirements have to supported for a Telecom SOA**

o **Web Services enhancements are required,** e.g.
   - Carrier grade reliability and performance
   - Service traceability
   - WS standards convergence and harmonization

**To a common set of Telecom APIs reusable across different implementations of NGN service platform**

## Initial ITU-T work items in the NGN service platform area

## ITU-T SG13 is increasing its activities in this area

- **Y.2234: Open service environment capabilities for NGN (Sep08)**
- Y.OSE-arch "OSE functional architecture for NGN" (launch in Jan09)
- **Y.NGN-SIDE-Req: Requirements for NGN Service Integration and Delivery Environment** (launch in May09)
- Y.2212: Requirements of Managed Delivery Services (Jan08)
- Y.2232: NGN convergence service model and scenario using WS (Feb08)
- Y.2235: Converged web-browsing service scenarios in NGN (Dec08)
- Deliverables based on past OCAF Focus Group activities (Dec06)
  - Y.2901/Y.2902 - Carrier grade open environment model/components

## Other ITU-T activities in Telecom SOA and WS include

- M.3060: Principles for NGN management (March06) (ITU-T SG4)
- SOA/WS related security aspects (ITU-T SG17)
- Middleware aspects for IPTV and USN (ITU-T SG16)

# New business models: 3rd Party services (an example from Y.2212)

o NGN service control capabilities can be made available through ANI and via MDS by the NGN Provider to 3rd Party Providers and their customers

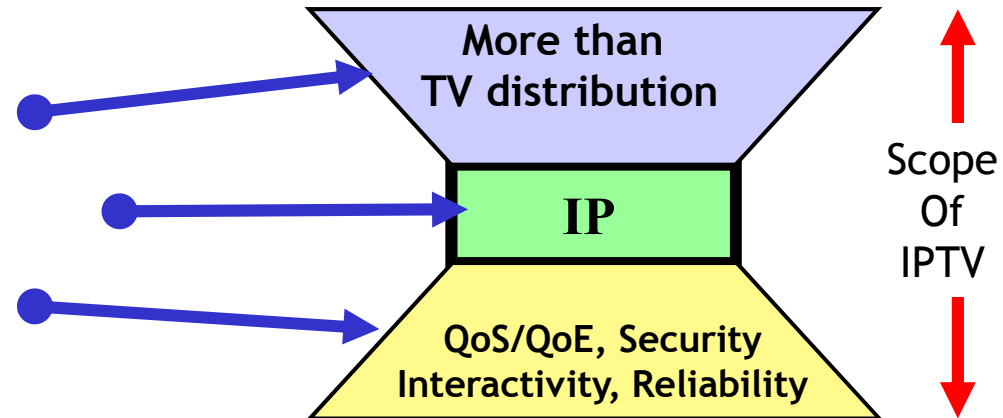o 3rd Party Providers can then offer enhanced services to their customers

*Example of MDS Business Model Y.2212*



3rd Party Provider

Service Charge

Service

User/Customer

Network Capability

NGN Provider

Connection Fee

<Current Business Model>

3rd Party Provider

Service Charge+

Service+

Cost

QoS, Routing others

*MDS*

User/Customer

Network Capability+

NGN Provider

Connection Fee

<MDS Business Model>
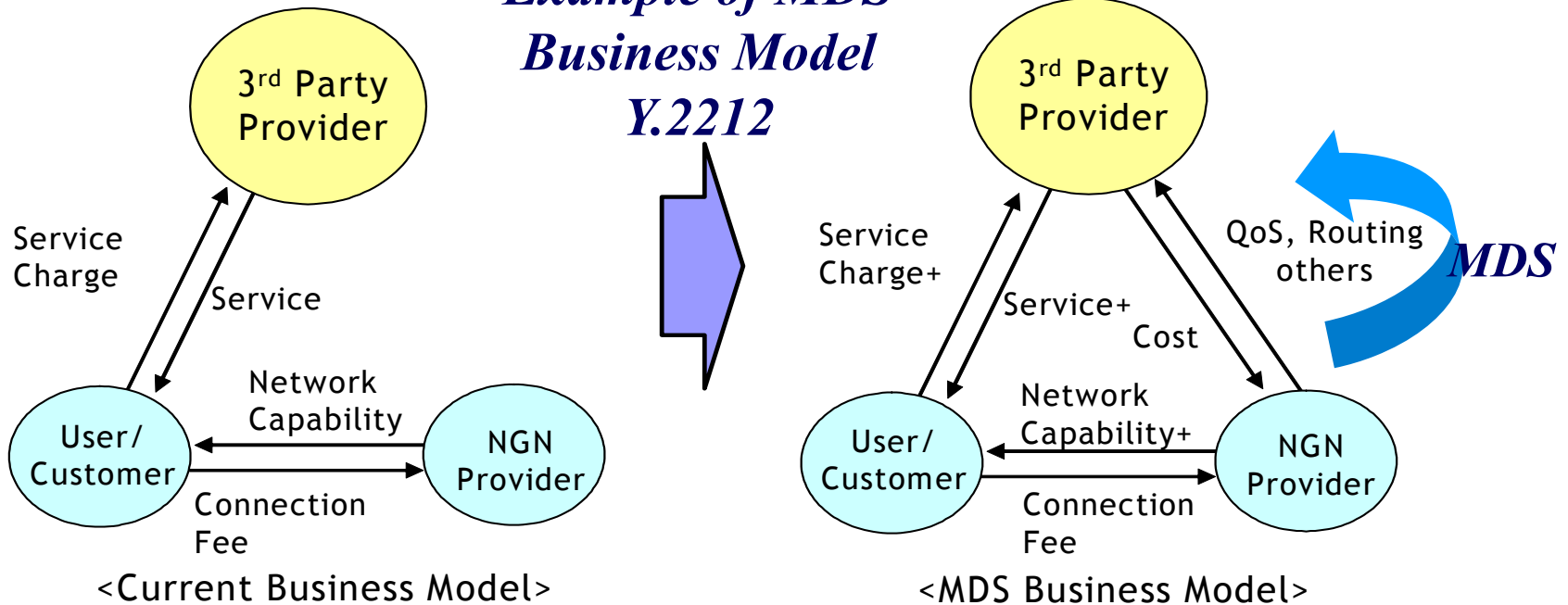
**A win-win situation for both 3rd Party Provider and NGN Provider**

# A key differentiator of future NGN service offerings: IPTV

- **Multimedia Services**

- **Over IP based networks**

- **Managed capabilities**

More than
TV distribution

**IP**

QoS/QoE, Security
Interactivity, Reliability

Scope
Of
IPTV

o **Key features of IPTV**
  - Supportable by NGN
  - Bi-directional networks
  - Real time and non-real time service delivery
o **A large spectrum of IPTV services and business models**
  - Current discussion about a phased approach of related standardization

o IPTV high level requirements specified in Y.1901 (not NGN specific)
o Much work ongoing on IPTV over NGN
  - **E.g. detailed requirements for IPTV network control, business scenarios etc.**

# IPTV domains and business models



End-user | Network provider | Service Provider | Content provider
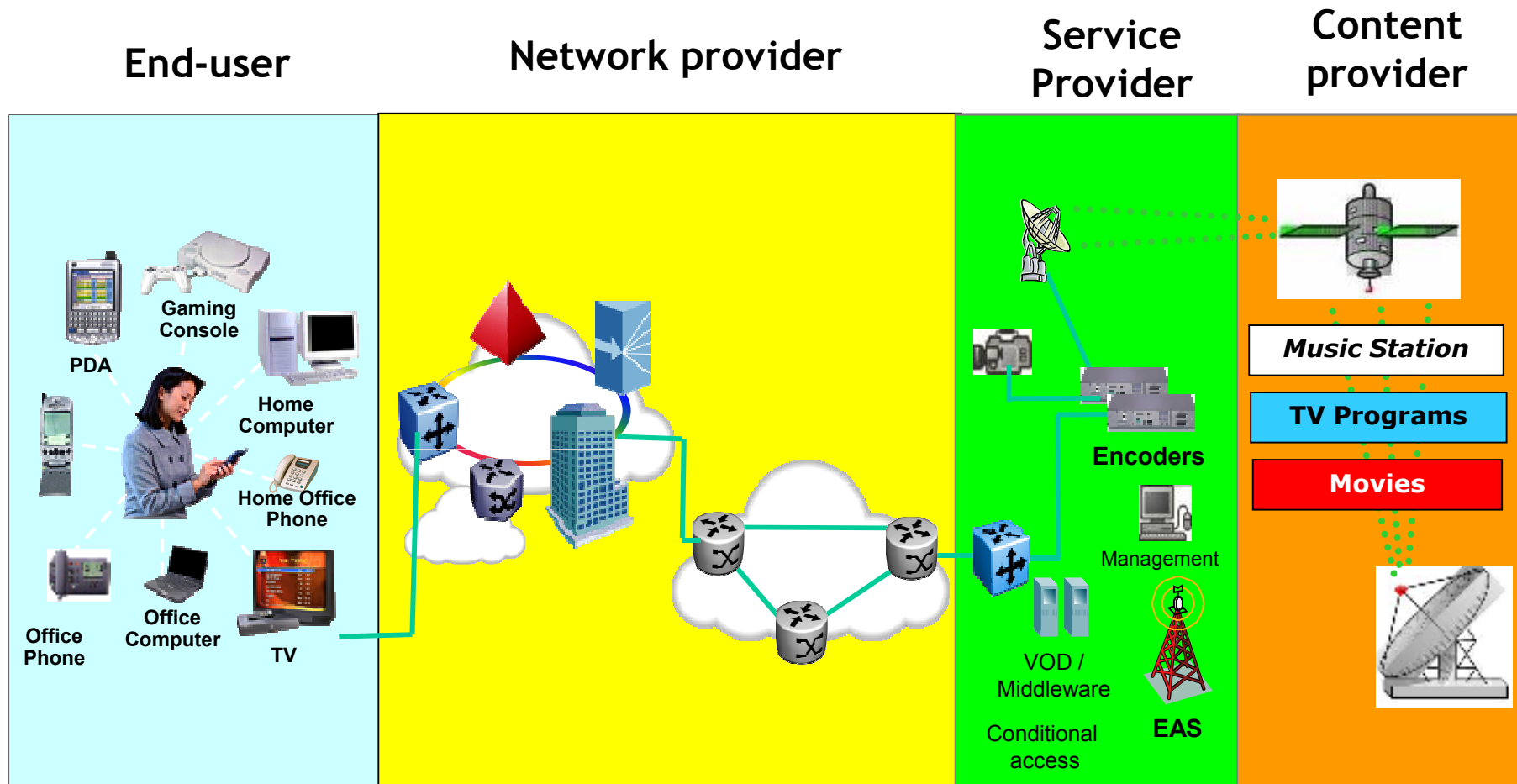
- These domains do not define a business model
- A Provider may play in multiple domains provisioning an actual service

# IPTV Functional Architecture – Y.1910
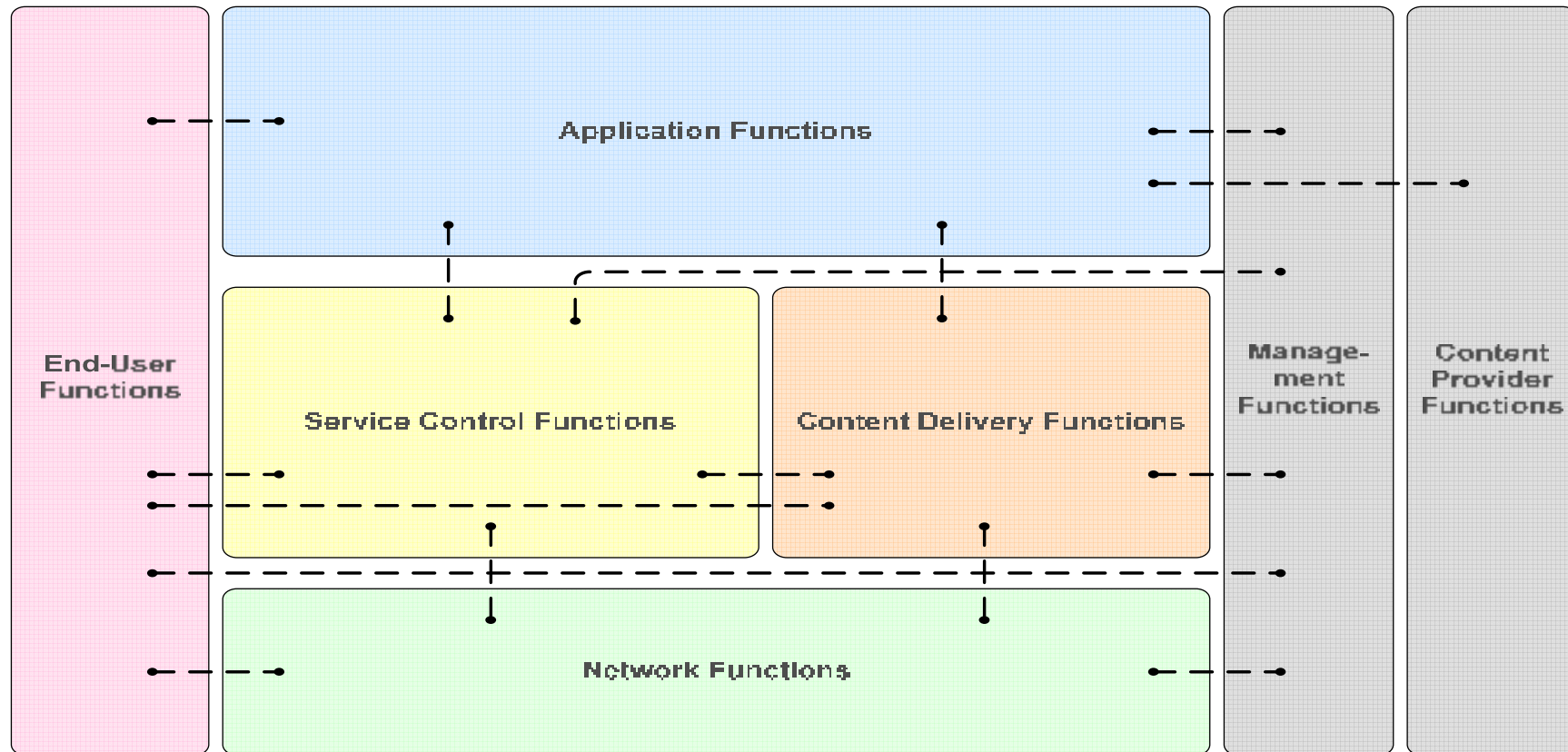


- **Open interfaces** to support multiple business models within an unified functional architecture

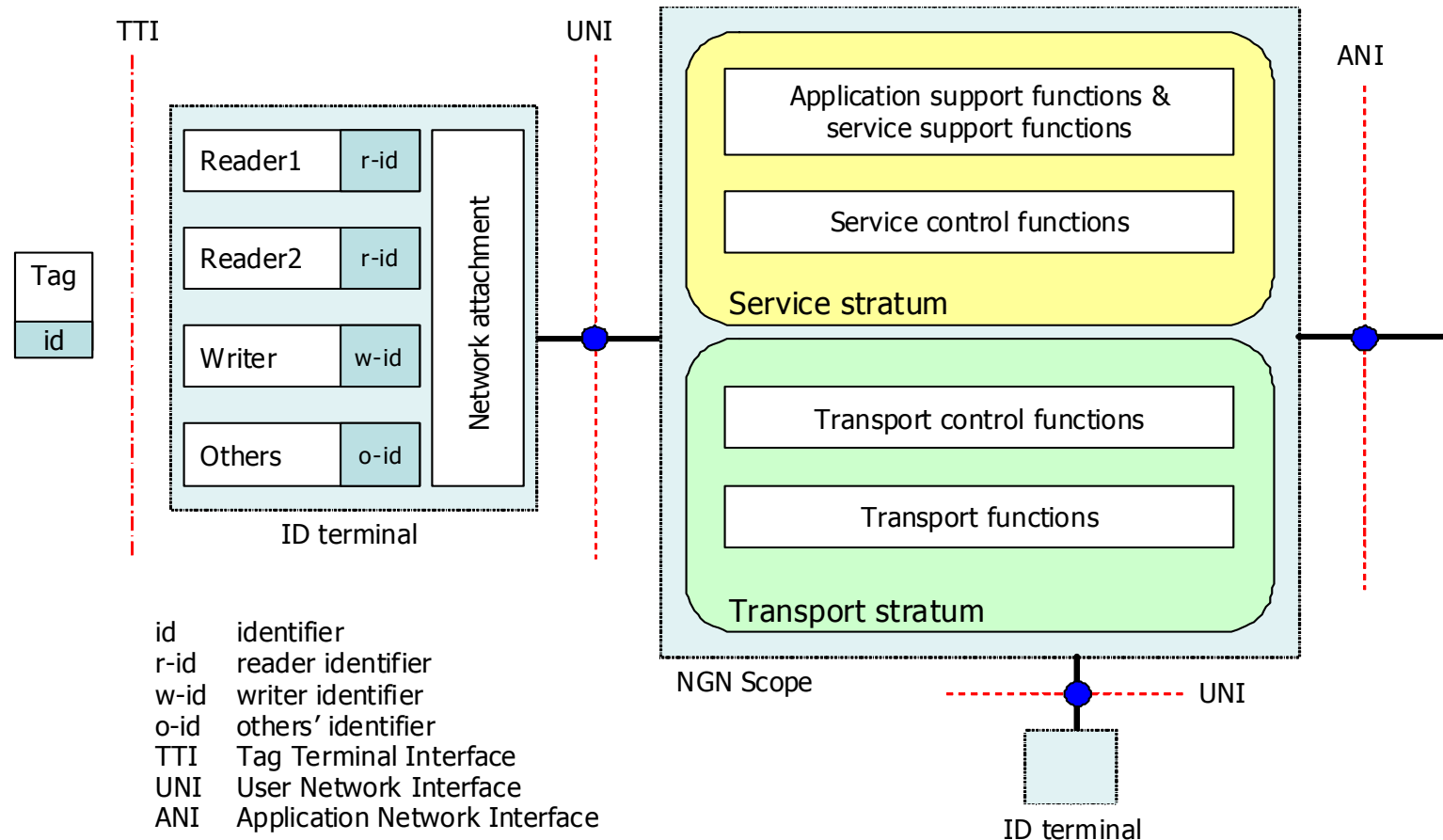- Two approaches for NGN support: non-IMS based IPTV, IMS based IPTV

**ITU-T is engaged in the standardisation of interfaces between IPTV components**

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# Network aspects of Identification systems (NID)

o **NID components:** Tag (+ Sensor), Reader (Writer), Data processing system (local system, network, server, ..), Middleware

o **Services using tag-based identification**
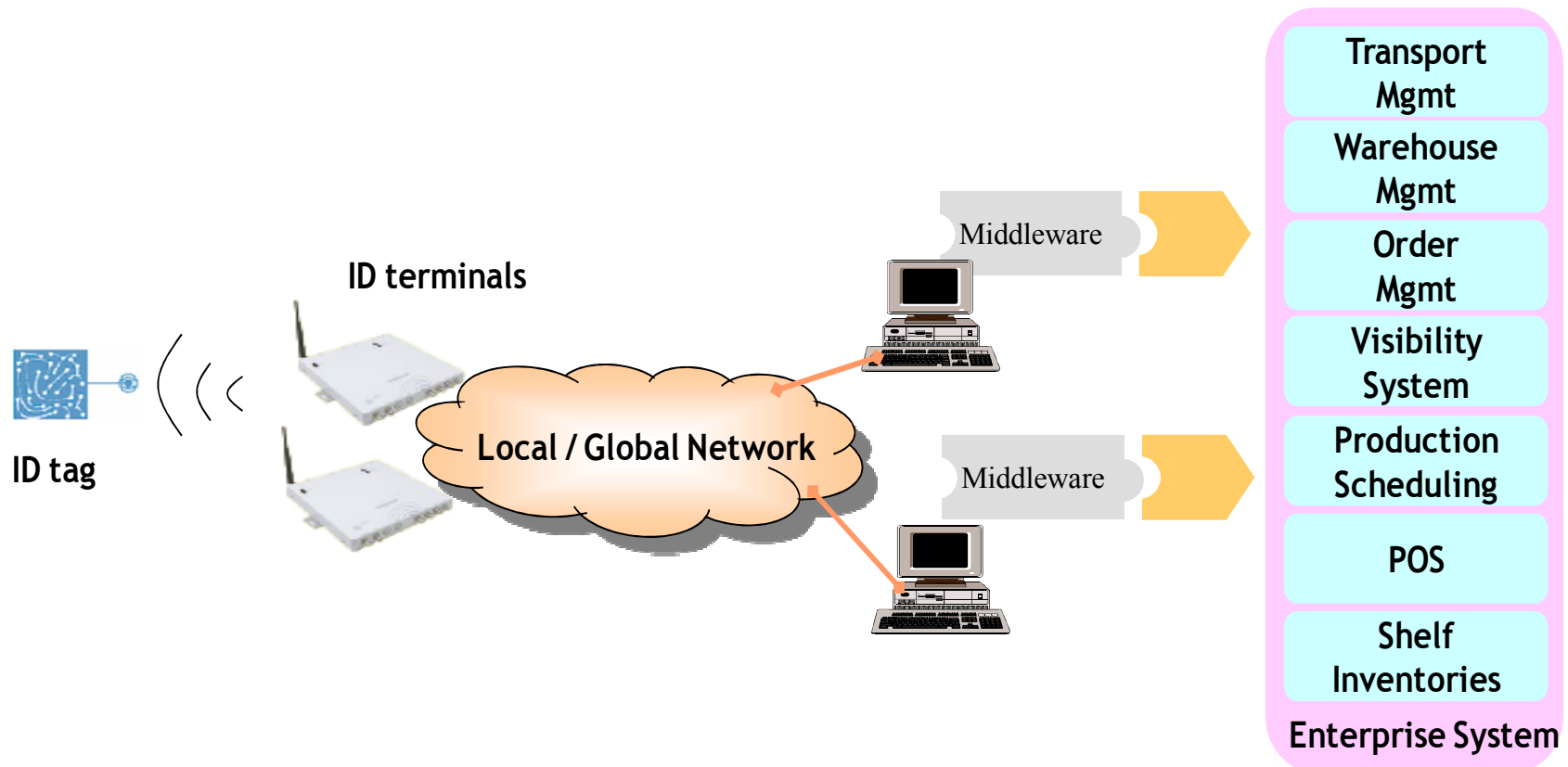
# Services using tag-based identification over NGN: reference architecture model (Y.2213)



| | |
|---|---|
| id | identifier |
| r-id | reader identifier |
| w-id | writer identifier |
| o-id | others' identifier |
| TTI | Tag Terminal Interface |
| UNI | User Network Interface |
| ANI | Application Network Interface |

Services are provided to end users via the following operations:

o identifier reading

o identifier resolution

o information access (from ID terminal's point of view)

# Towards the Internet Of Things:
# Ubiquitous Sensor Networks (USN) services
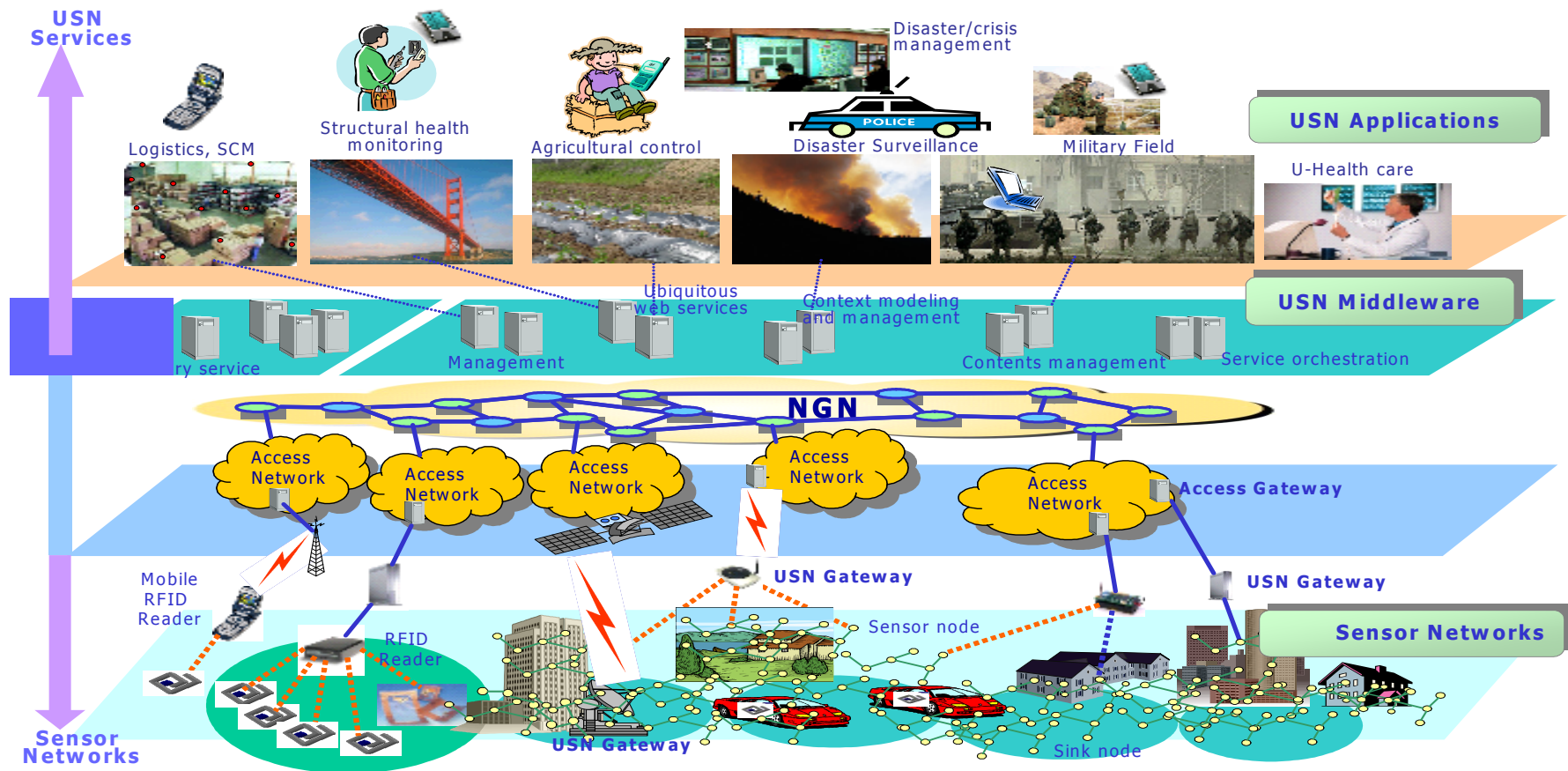


- o NGN as flexible and scalable network platform for support of a large number of potential applications
- o A number of standardisation areas to be progressed (NGN capabilities, architecture, security, middleware etc.)

# "Ubiquitous networking" as future target

o   Enabling "Any Service, Any Time, Any Where, Any Device" operations in NGN via enhanced capabilities

o   Support of human-to-human, but also human-to-machine and machine-to-machine communications
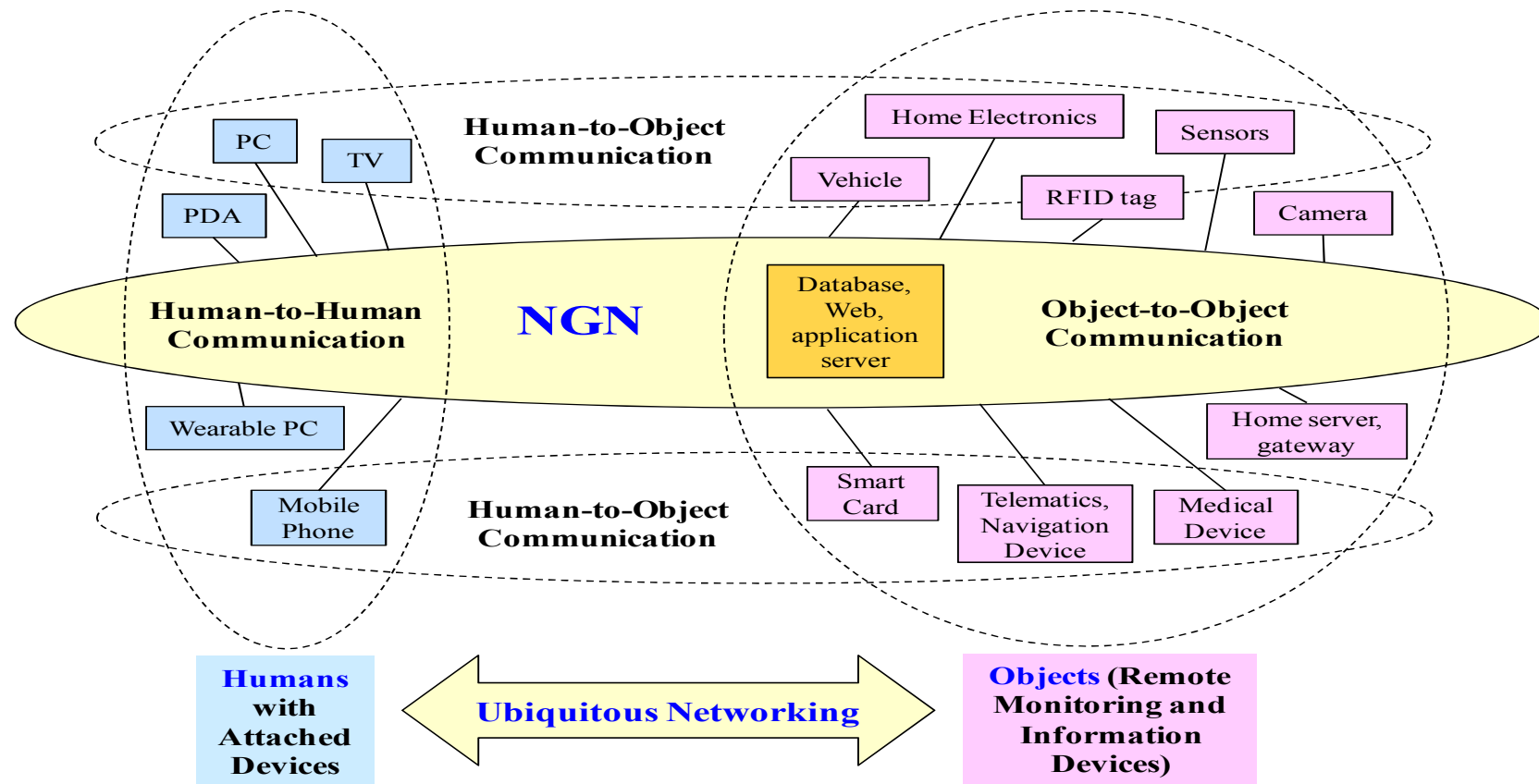
# Thank you for your attention

## Questions ?

# Backup

# NGN Recommendations: Y-series

| | |
|---|---|
| Frameworks and functional architecture models | **Y.2000-Y.2099** |
| Quality of service and performance | **Y.2100-Y.2199** |
| Service aspects: Service capabilities and service architecture | **Y.2200-Y.2249** |
| Service aspects: Interoperability of services and networks in NGN | **Y.2250-Y.2299** |
| Numbering, naming and addressing | **Y.2300-Y.2399** |
| Network management | **Y.2400-Y.2499** |
| Network control architectures and protocols | **Y.2500-Y.2599** |
| Security | **Y.2700-Y.2799** |
| Generalized mobility | **Y.2800-Y.2899** |

# NGN Recommendations: Q-series

| | |
|---|---|
| General | Q.3000–Q.3029 |
| Network signalling and control functional architecture | Q.3030–Q.3099 |
| Network data organization within the NGN | Q.3100–Q.3129 |
| Bearer control signalling | Q.3130–Q.3179 |
| Signalling and control requirements and protocols to support attachment in NGN environments | Q.3200–Q.3249 |
| Resource control protocols | Q.3300–Q.3369 |
| Service and session control protocols | Q.3400–Q.3499 |
| Service and session control protocols – supplementary services | Q.3600–Q.3649 |
| NGN applications | Q.3700–Q.3849 |
| Testing for NGN networks | Q.3900–Q.3999 |