Global Information Infrastructure Next Generation Networks

Espoo, *13th June 2008*

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Global Information Infrastructure

- GII is a network of networks.

- GII is the developing communications framework intended to eventually connect all telecommunications and computer networks world-wide.

- GII would eventually make all electronically stored or transmitted information accessible from anywhere on the planet.

Next Generation Networks

- NGN is a packet-based network in which service-related functions are independent of the underlying transport-related technologies.

- NGN supports generalised mobility which will allow consistent and ubiquitous provision of services to users.

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Reading Material

- ITU-T Recommendations

  - http://www.itu.int/rec/T-REC-Y/e

    - Global information infrastructure: Y.100–Y.899

    - Internet Protocol aspects: 1000–Y.1899

    - Next Generation Networks: 2000–Y.2899

- ETSI standards and deliverables

  - http://www.etsi.org/WebSite/Standards/Standard.aspx

  - http://www.etsi.org/tispan

- 3rd Generation Partnership Project

  - http://www.3gpp.org
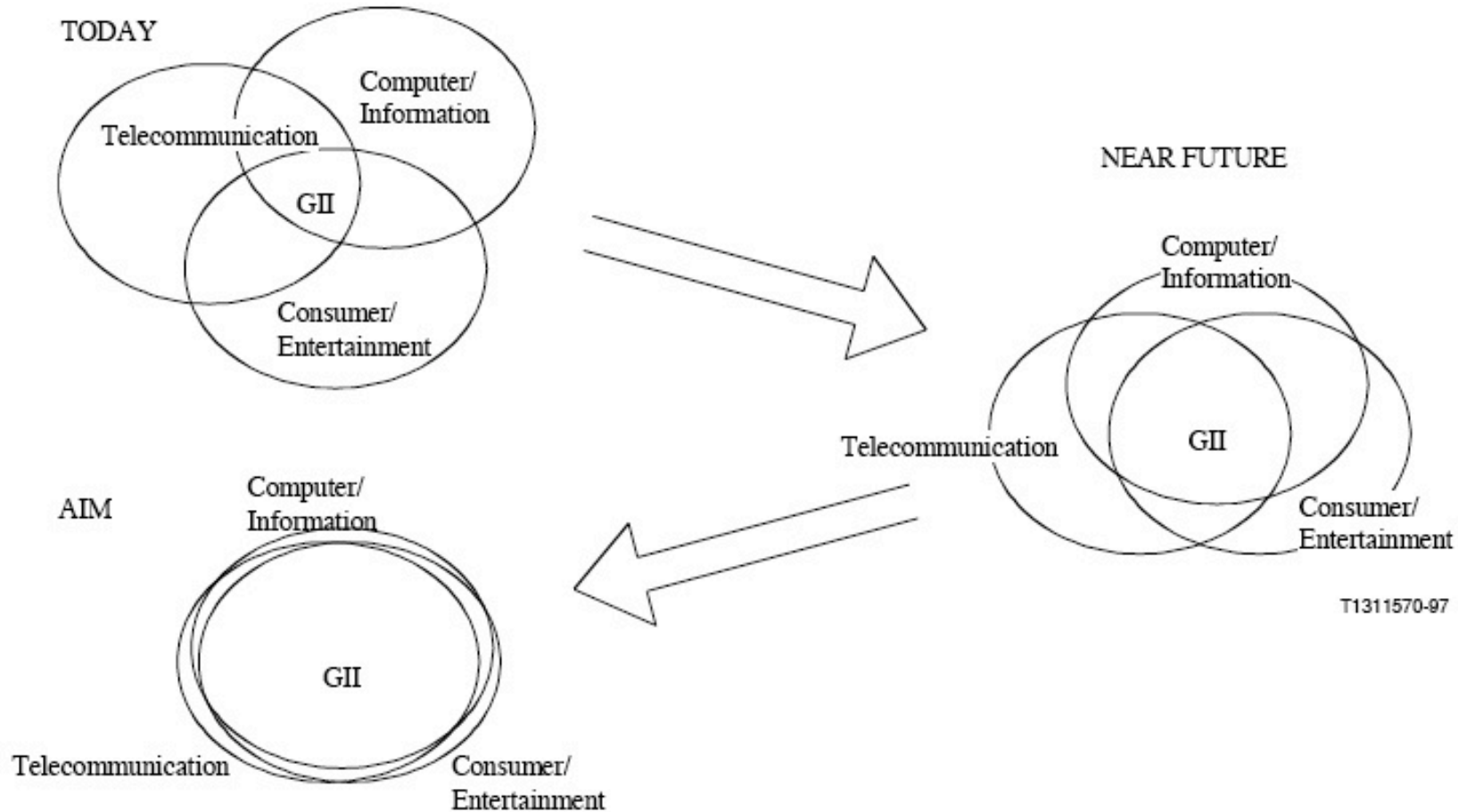
Global Information Infrastructure

Outline

- Industrial convergence

- Structural and Infrastructural roles

- Relationship between roles

- Network segments

- Environment components

- Global multimedia mobility

- Management requirements

Global Information Infrastructure

- Enable information providers and users (e.g. individuals, information users, information providers, and information service providers) to communicate securely with each other any time and anywhere at acceptable cost and with acceptable quality;

- Provide a set of communication services;

- Support a multitude of open applications;

- Embrace all forms of information (audio, text, data, image, video, etc.), and of information generation, use and transportation;

- Operate in a transparent, user-friendly and straightforward way;

- Provide seamless, interconnected and interoperable communication networks, information processing equipment, databases and terminals (including TV sets);

- Enable competition between the players in the information and telecommunications (including broadcasting) sectors.

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GII is at the centre of the threefold industrial convergence

Global Information Infrastructure
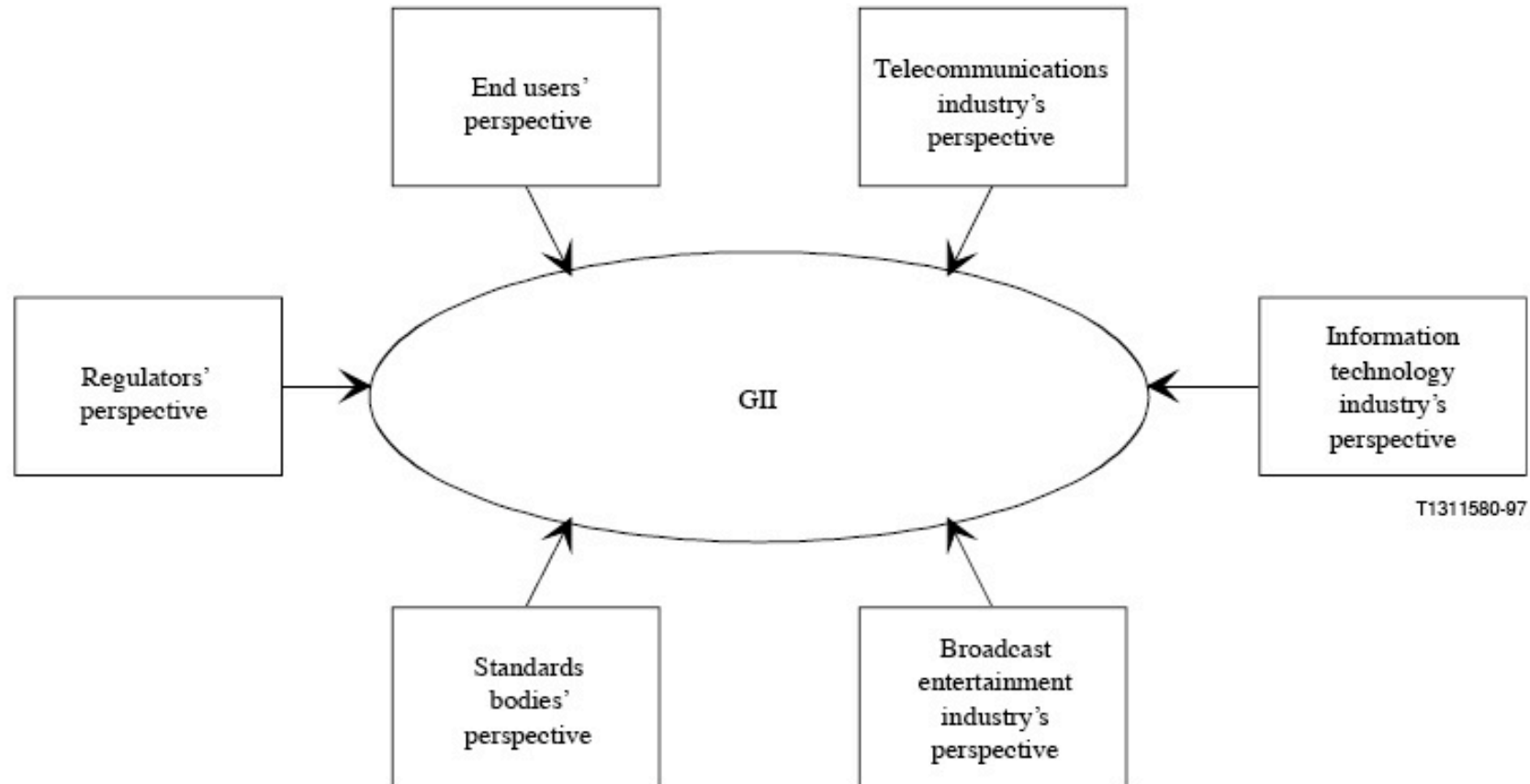
Viewpoints on the GII

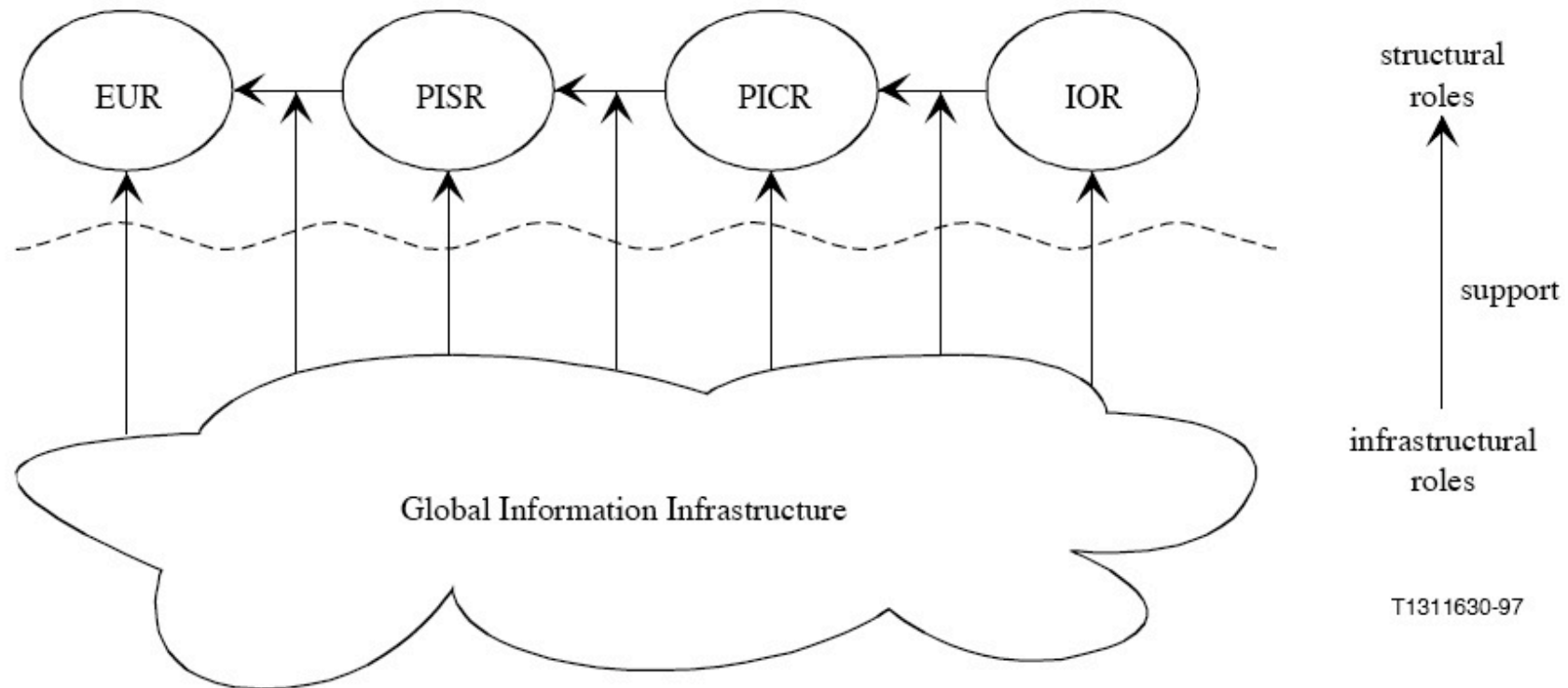# Global Information Infrastructure

- ## Roles of the GII

  - The role is a business activity which fits in a value chain.

  - The role is constrained by the smallest scale of business activity which could exist independently in the industry and so a marketplace will exist for every relationship between roles.

  - Structural Roles

    - Primary value chain of an industry.

  - Infrastructural Roles

    - Supplies goods/services for one or more roles to the primary value chain of that industry.

Structural roles of the GII

A structural role will involve a business activity which is directed towards that industry and, in general, only towards that industry.

The output goods/services of a structural role will be directed, in general, only to the next structural role in the primary value chain.
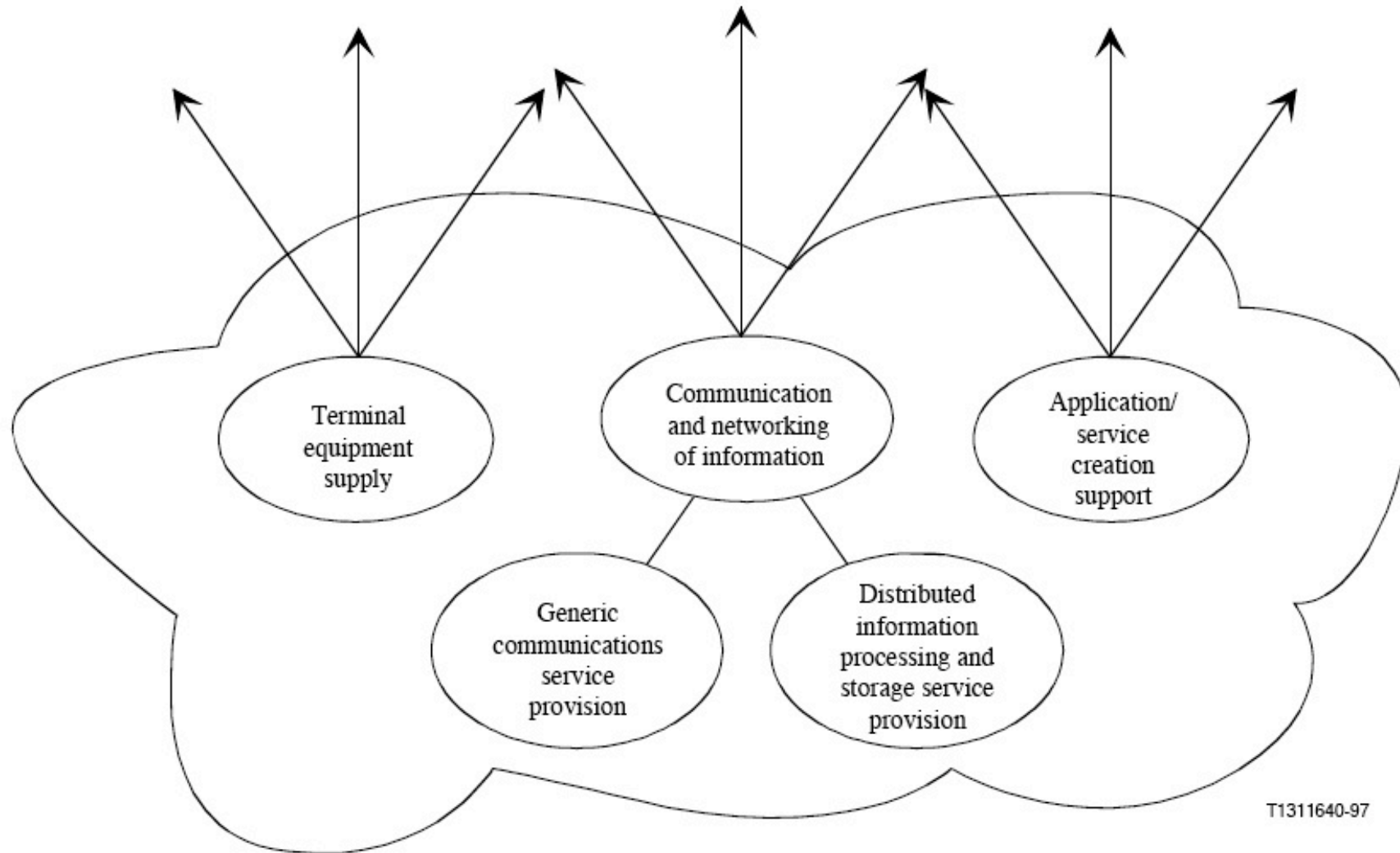
Structural roles of the GII

EUR   End User Role
PISR   Provision of Information-based Services Role
PICR   Provision of Information and related Content Role
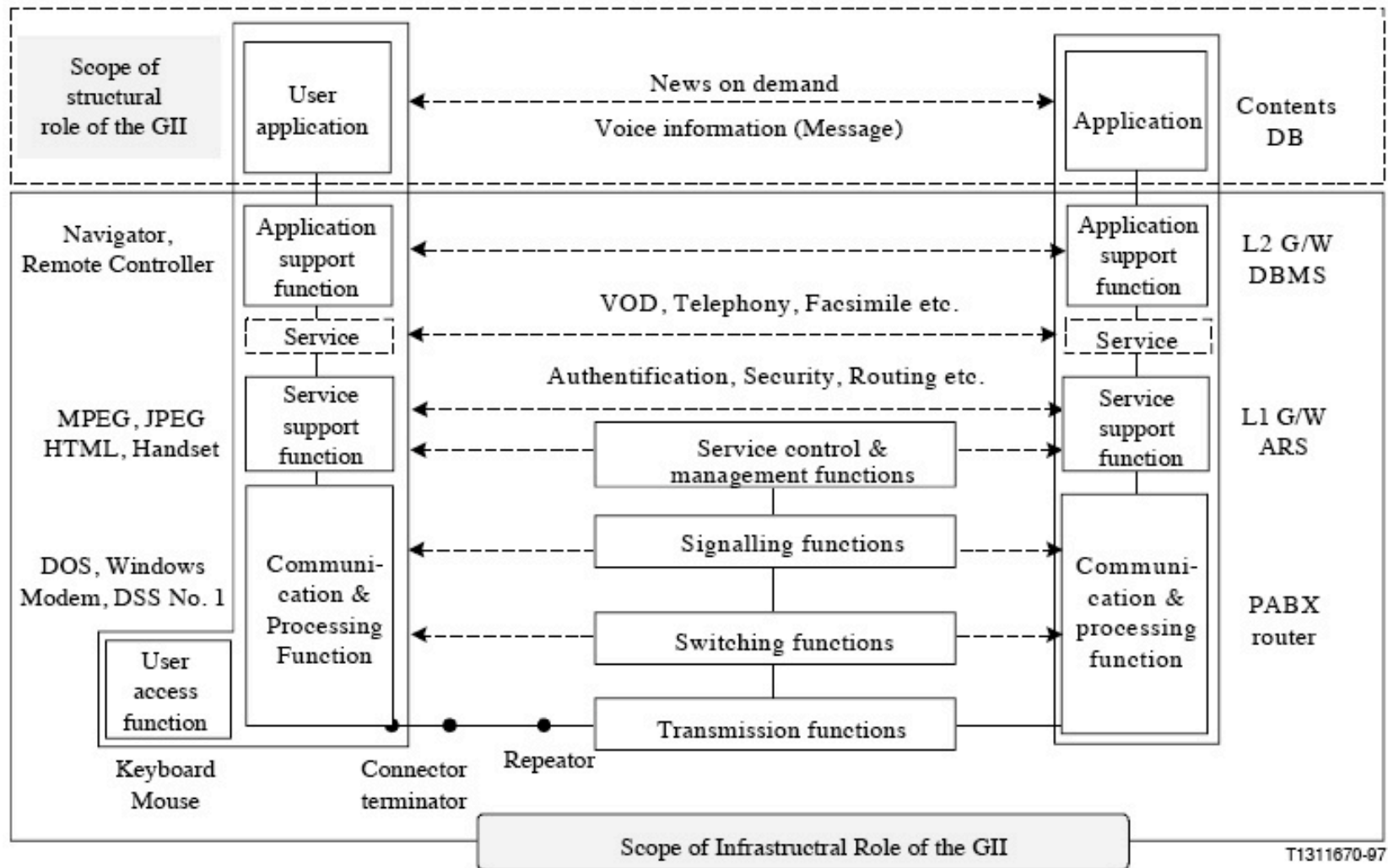IOR   Information Ownership Role

Infrastructural roles of the GII

- An infrastructural role is not in the primary value chain of the industry which is under consideration, but supplies goods/services for one or more roles to the primary value chain of that industry.

  - The business activity of an infrastructural role will normally be directed towards many other roles, even roles belonging to more than one primary value chain.

  - The output goods/services of an infrastructural role are likely to be based on reusable components in order to meet the requirements of its many customer roles.
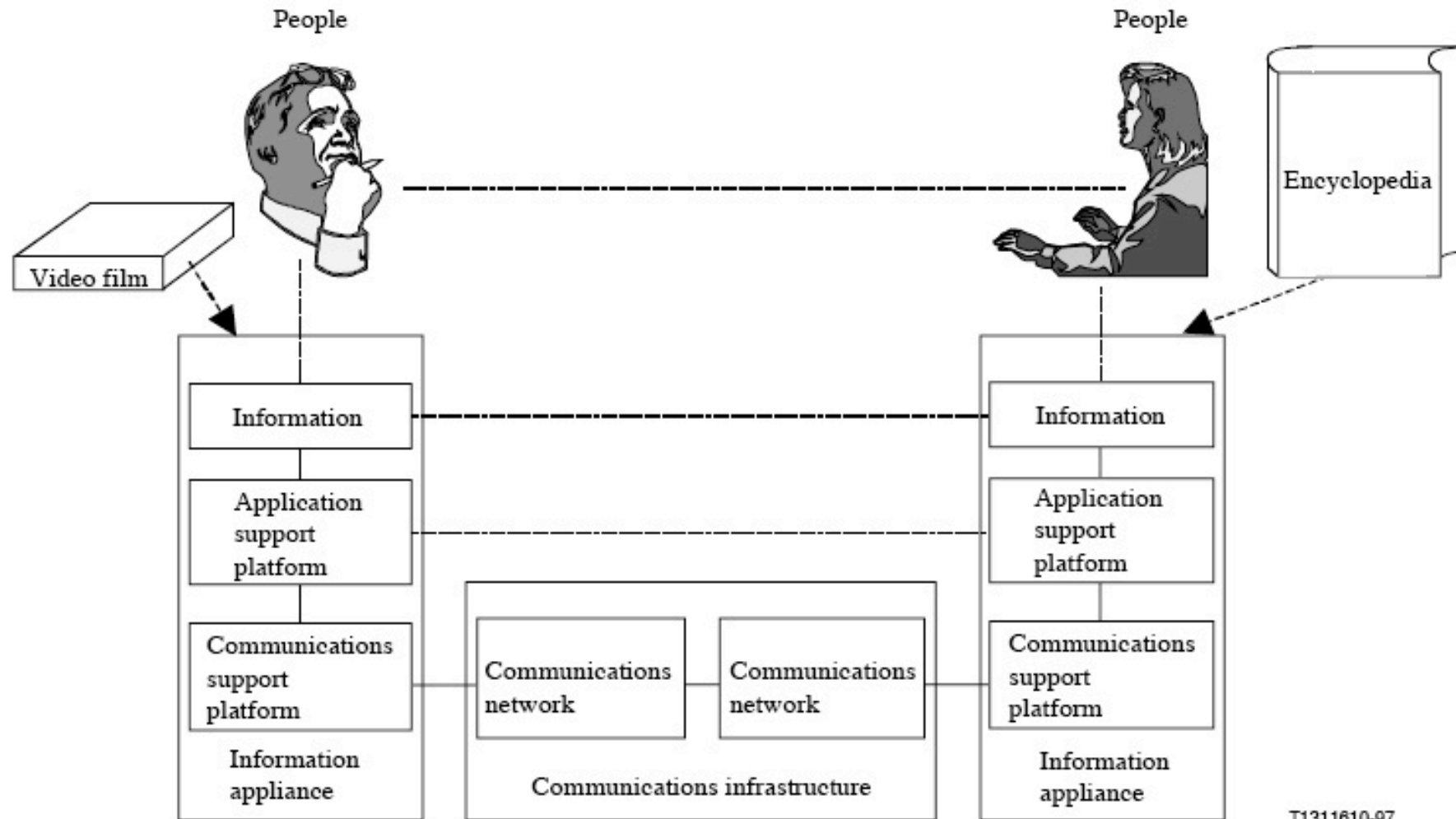
Infrastructural roles of the GII

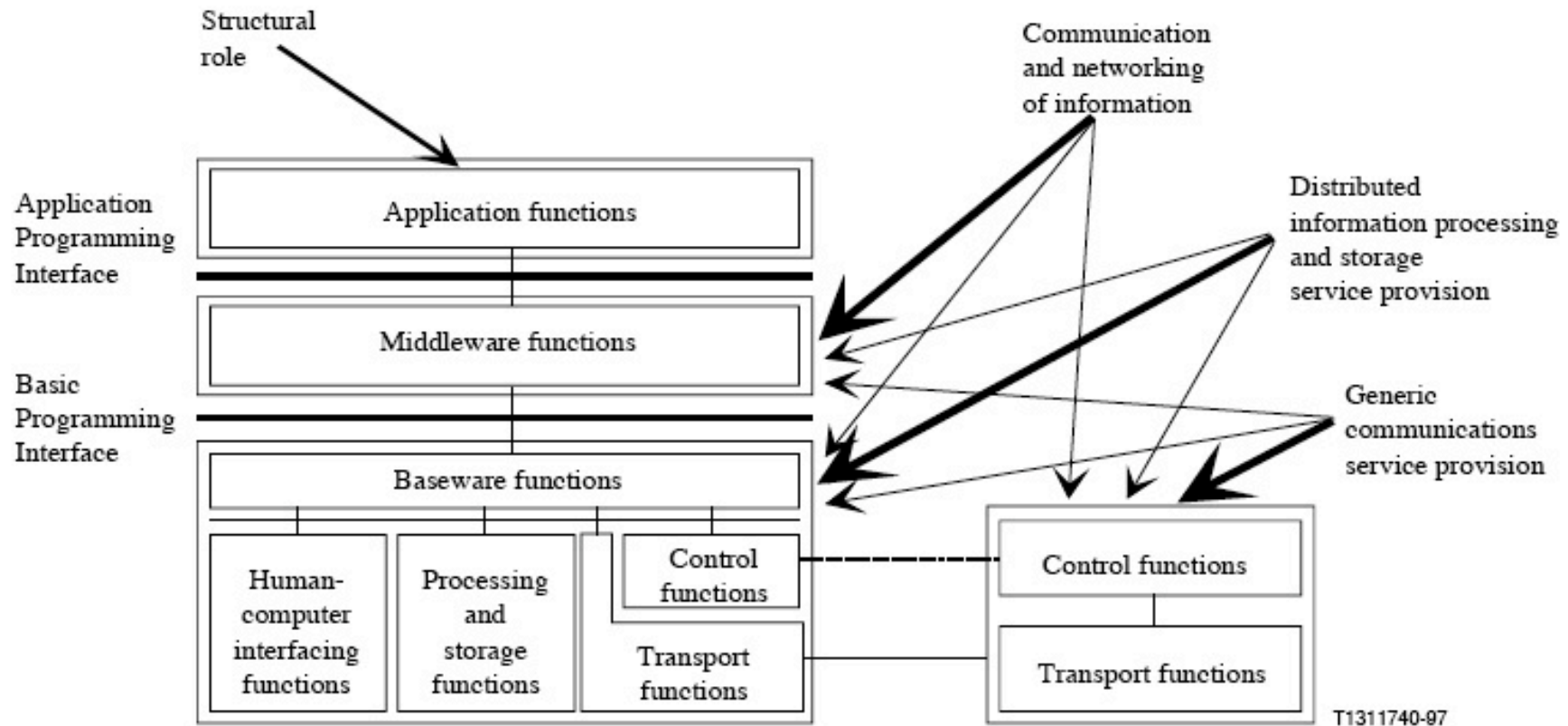# Configuration of infrastructural roles in the GII

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People

People

Video film

Encyclopedia

Information appliance
- Information
- Application support platform
- Communications support platform

Communications infrastructure
- Communications network
- Communications network

Information appliance
- Information
- Application support platform
- Communications support platform
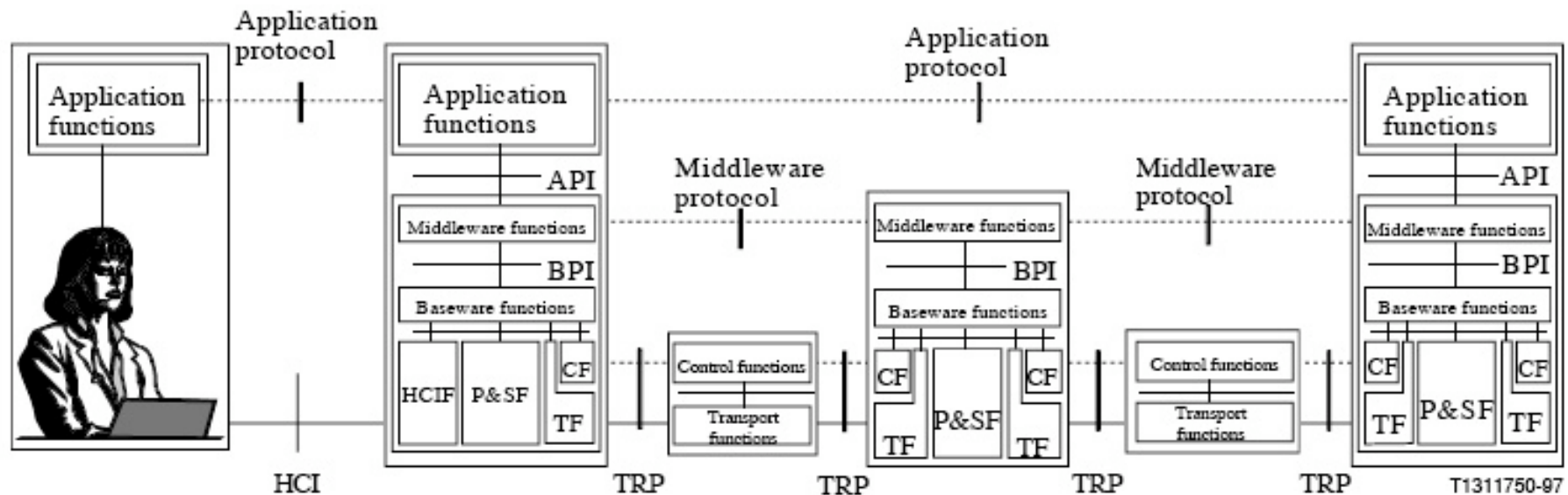
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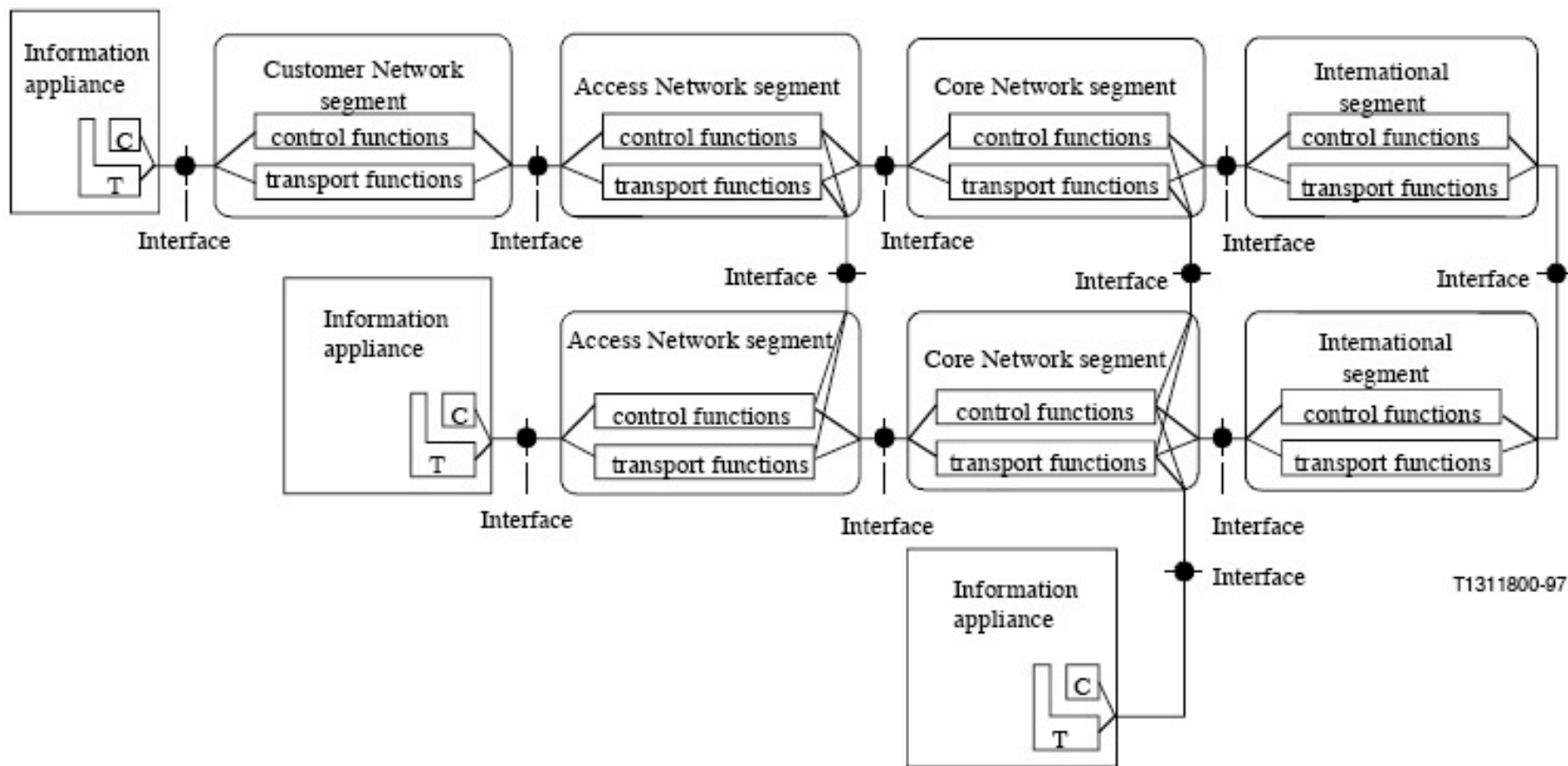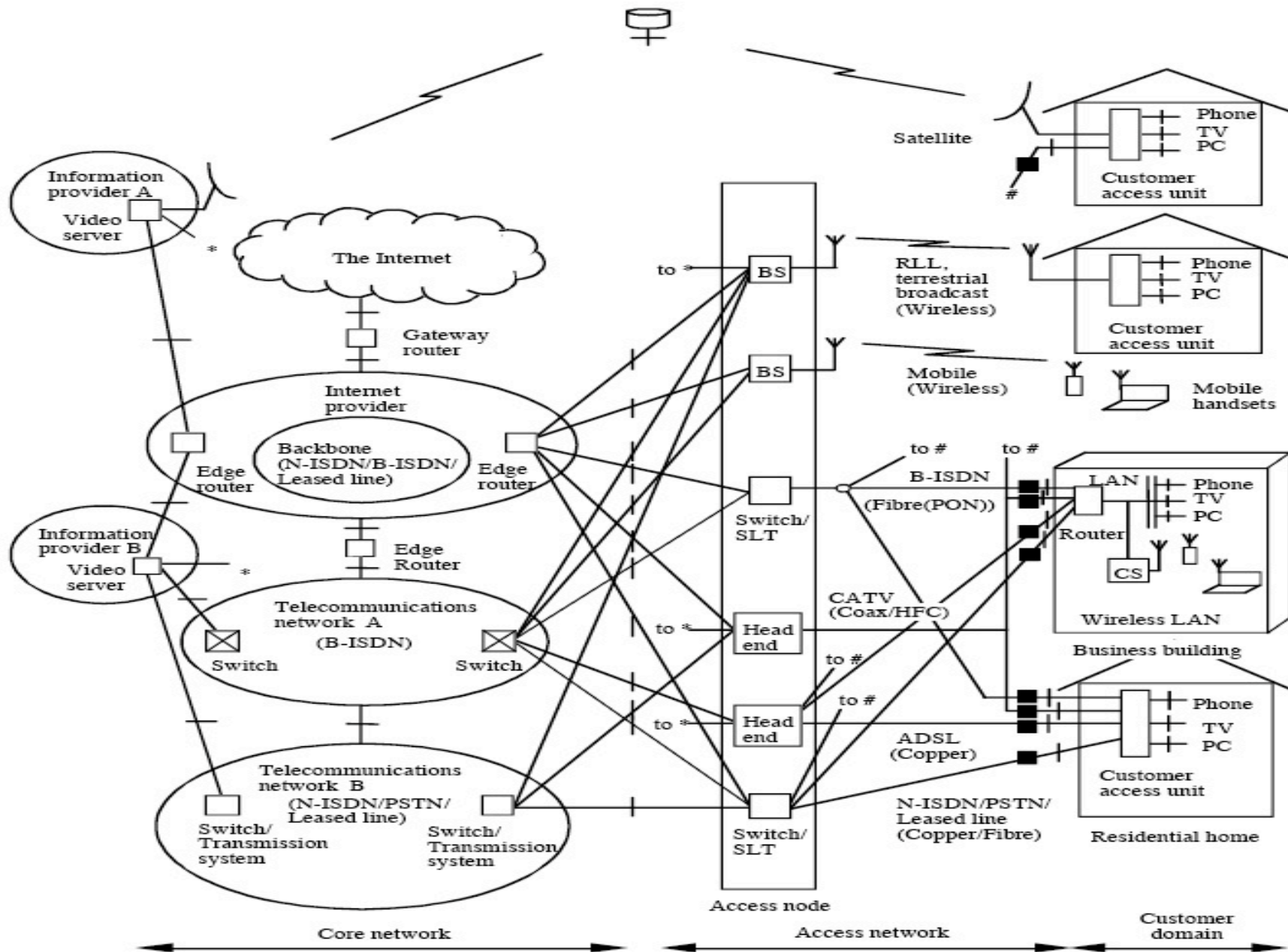

Types of functions and their relationship

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Distribution and logical interfaces

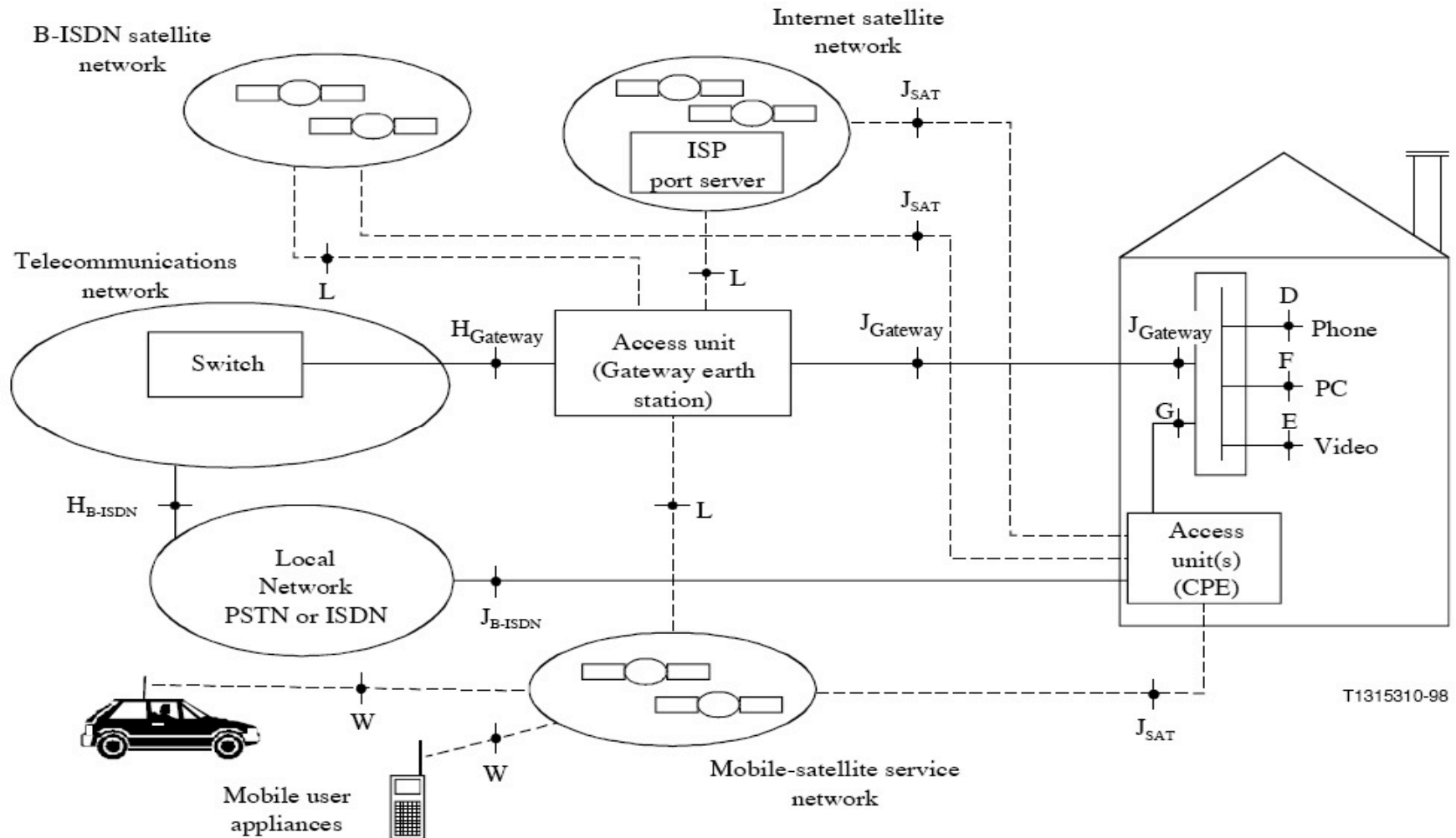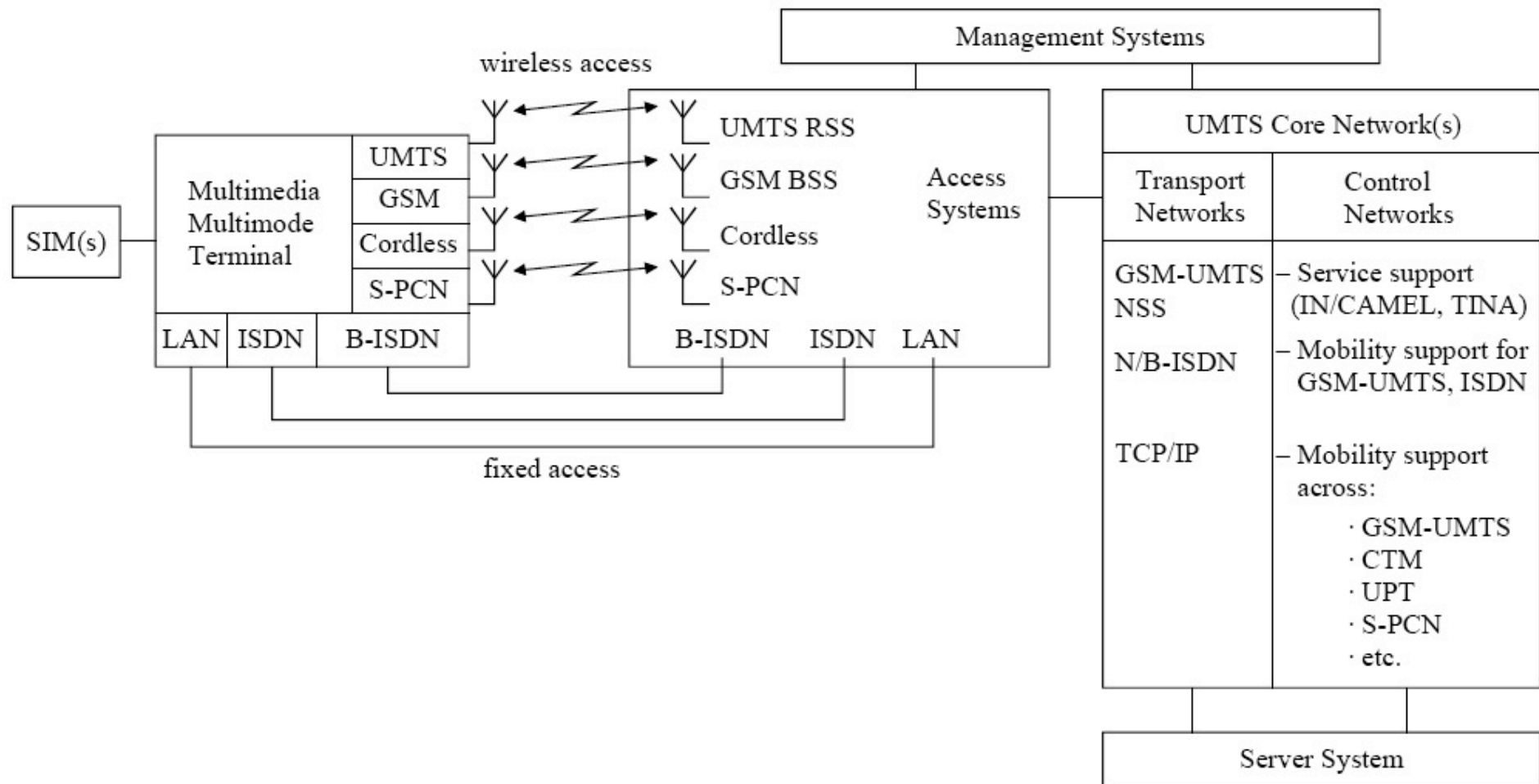# Telecommunications network segments

Summary of scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
Services	a) Voice/Data over telecom network and Video over cable, Radio & DSB b) Voice/Data/Video over 2-way cable	a) Voice/Data over telecom network and Video over cable b) Voice/Data/Video over 2-way cable	Voice/Data & Video over ADSL/VDSL	Voice/Data & Video over Fibre Network	a) Wireless Phone/Voice/Data over telecom network; Video over cable b) Voice/Data/Video over Radio	B-ISDN, Internet and Mobile Phone via Satellite	a) Data over Internet b) Voice/Video and/or Data over Internet
Core Network	Existing Infrastructure (PSTN/N-ISDN) B-ISDN		B-ISDN	B-ISDN	N-ISDN or B-ISDN	B-ISDN or Existing (N-ISDN)	1) POTS/ FR/ATM 2) ATM Backbone
Local network	a) 1-way Cable Distribution Network b) 2-way Cable Distribution Network DSB/terrestrial broadcasting in 1a)		ADSL/HDSL	Fibre (Fibre to the curb/home)	Radio/Wireless for Voice/Data; Cable for Video	Satellite	1) ADSL 2) PSTN/ISDN, HFC, PON
CPN	Access Unit TV, PC, Phone	Access Unit TV, PC, Phone	Access Unit TV, PC, Phone	Access Unit TV, PC, Phone	Access Unit TV, PC, Phone, Wireless Phone	Access Unit TV, PC, Phone	Access Unit TV, PC, Phone
Information flow	a) Video Distribution over 1-way cable network, return via PSTN/ISDN				2-way Wireless	2-way Satellite	

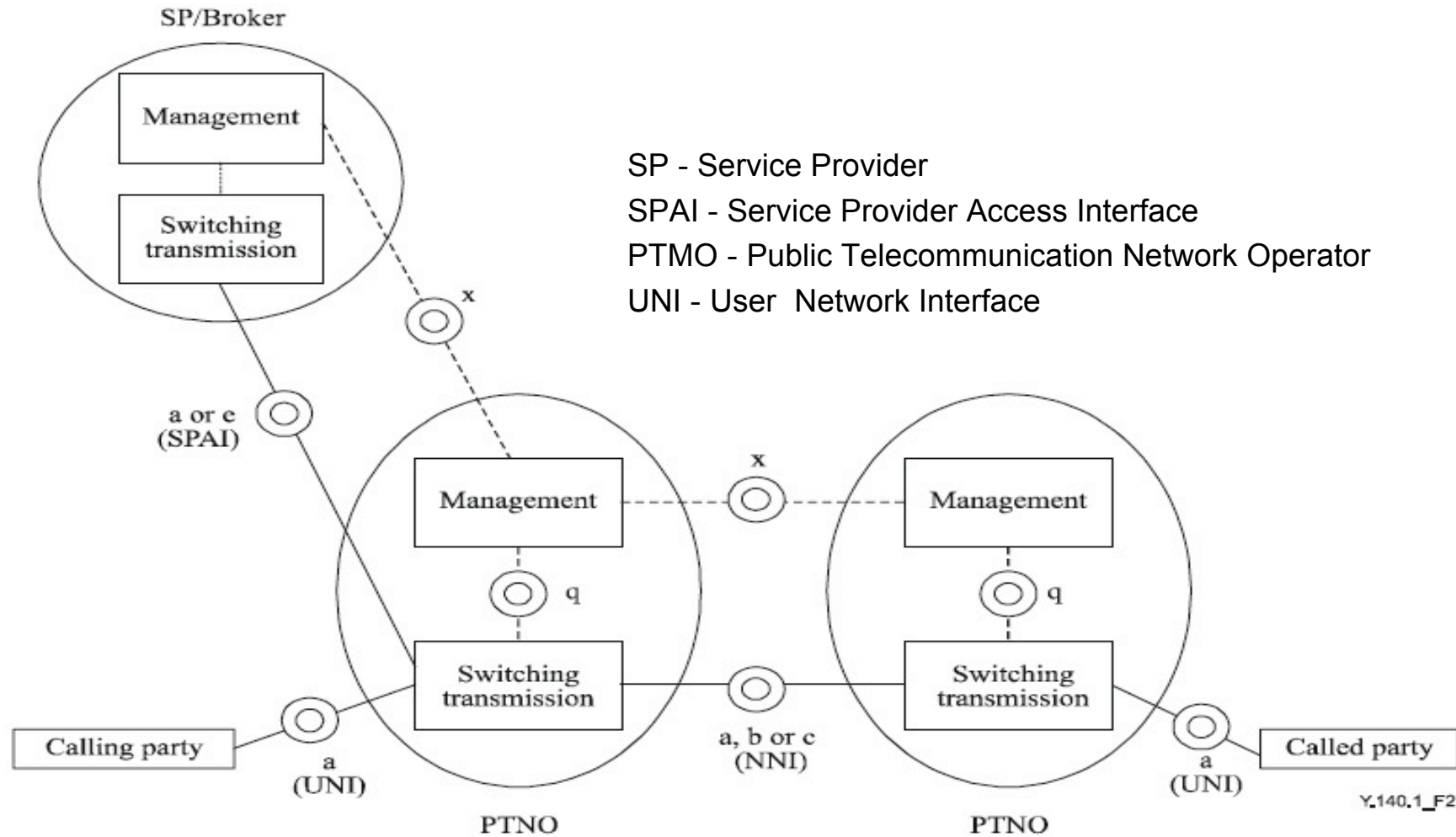# Access using satellites

Global Multimedia Mobility

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Management requirements

SP - Service Provider

SPAI - Service Provider Access Interface

PTMO - Public Telecommunication Network Operator
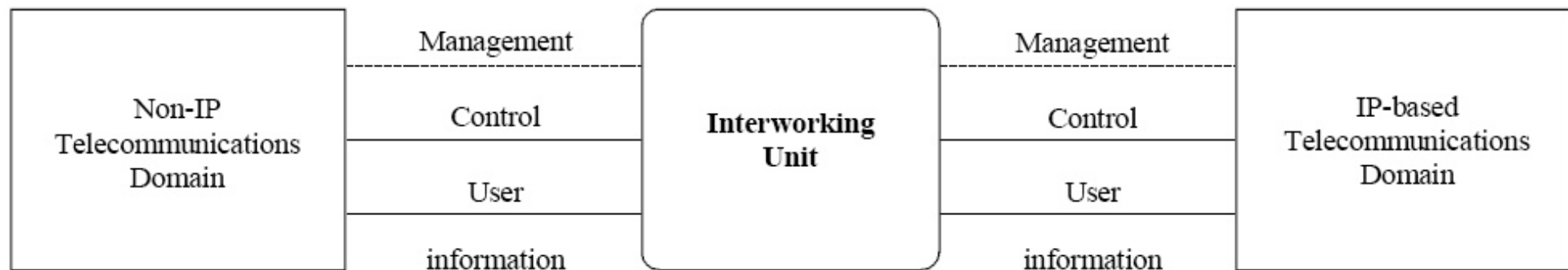
UNI - User Network Interface

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## Interworking between non-IP and IP-based telecommunications domains

- – The definition of reference points does not necessarily imply the provision of a physical interface.
- – Where separate physical interfaces are involved, they do not necessarily imply the use of completely different protocols.

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- ## Global standards are required for the information and infrastructure:

  - Representation and secure context specific access to or exchange of information independently of the location of the information provider and information user;

  - Technological convergence and interconnection of telecommunications equipment, computers and much of consumer electronics has lead to new demands on the communications infrastructure by information providers and information users.

Next Generation Networks
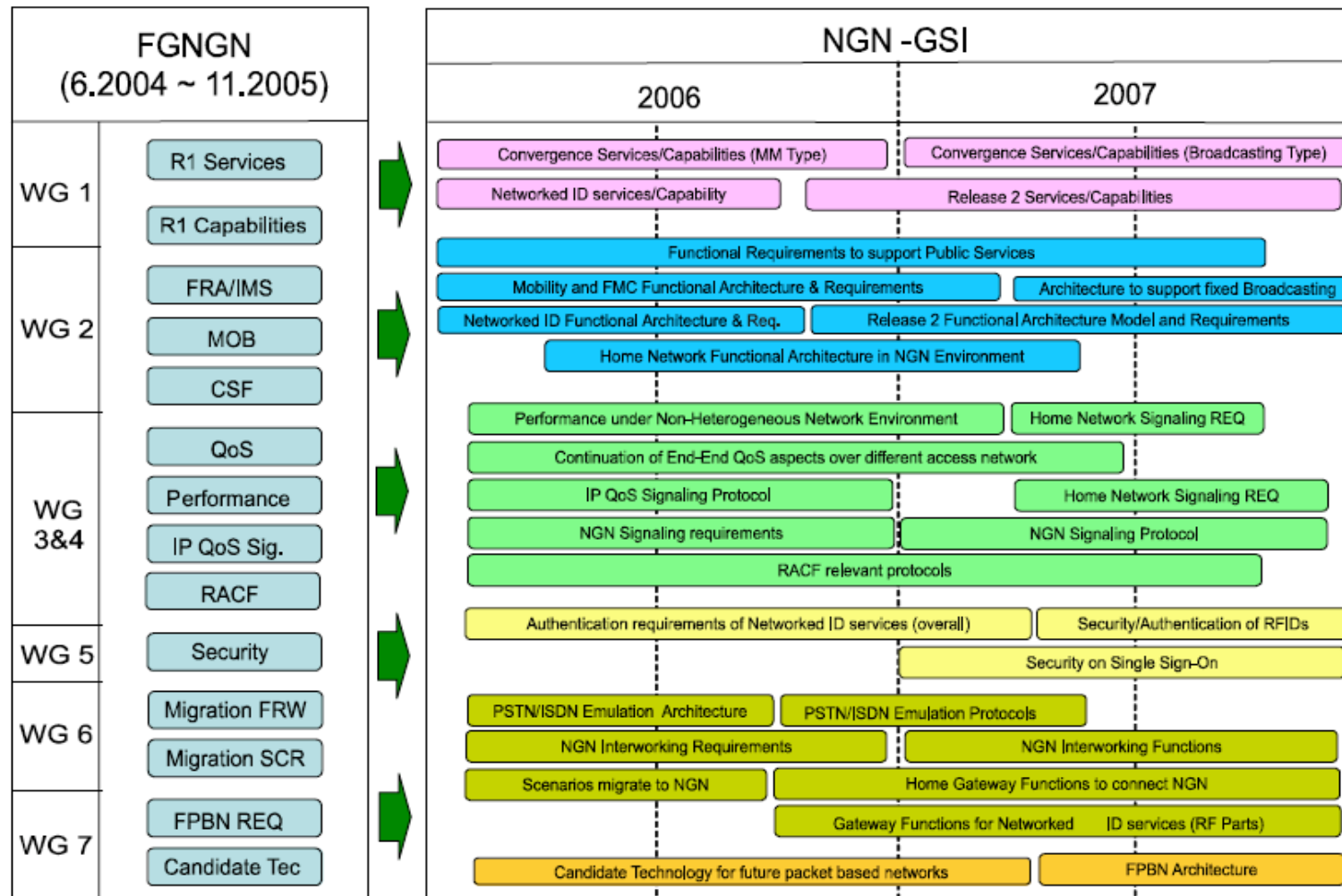
Next Generation Networks

Outline

- Areas of key importance

- Functional architectures

- Control functions

- Quality of service

- Management

- Mobility

- PSTN/ISDN emulation and simulation

- IP Multimedia Subsystem: ETSI TISPAN activities

Areas of key importance

A Next Generation Network (NGN) is a packet-based network able to provide Telecommunication Services to users and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent of the underlying transport-related technologies:

– It enables unfettered access for users to networks and to competing service providers and services of their choice;

– It supports generalised mobility which will allow consistent and ubiquitous provision of services to users.

The NGN is characterised by:

- Packet-based transfer;

- Separation of control functions among bearer capabilities, call/session, and application/service;

- Decoupling of service provision from transport, and provision of open interfaces;

- Support for a wide range of services, applications and mechanisms based on service building blocks (including real time/streaming/non-real time services and multi-media);

- Broadband capabilities with end-to-end QoS and transparency;

- Interworking with legacy networks via open interfaces;

- Generalised mobility;

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The NGN is characterised by:

- Unfettered access by users to different service providers;

- A variety of identification schemes which can be resolved to IP addresses for the purposes of routing in IP networks;

- Unified service characteristics for the same service as perceived by the user;

- Converged services between Fixed and Mobile networks;

- Independence of service-related functions from underlying transport technologies;

- Support of multiple last mile technologies;

- Compliant with all Regulatory requirements, for example concerning emergency communications and security/privacy, etc.
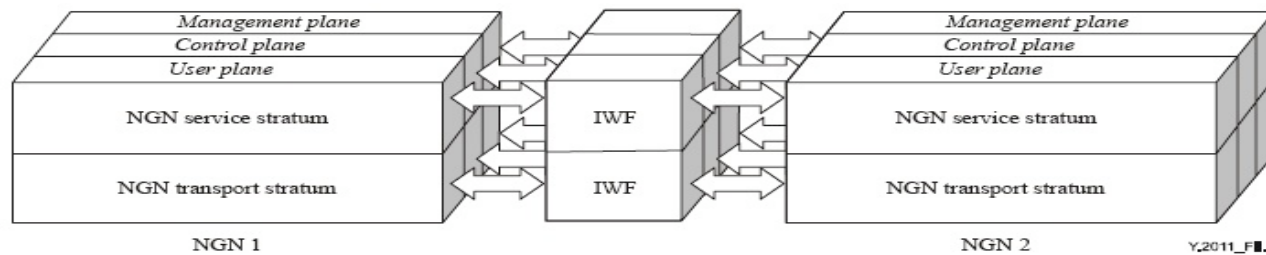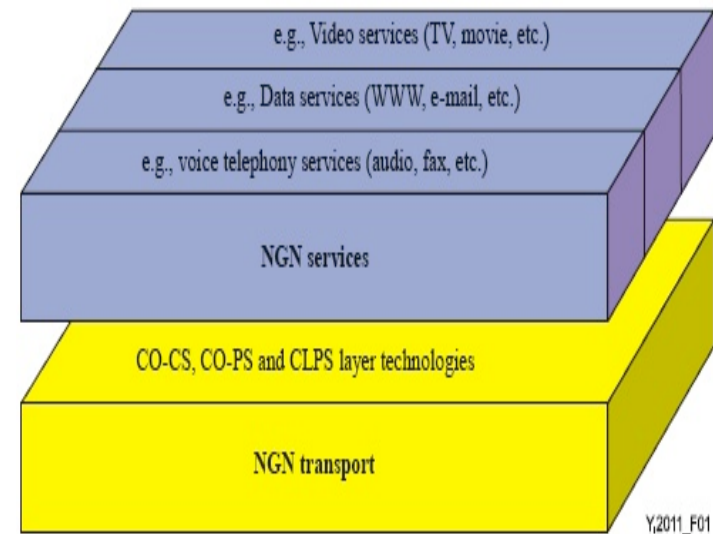
NGN functional architectures

- Generic reference modelling techniques, to help identify additional standards needed to support NGN compliant communications services either within an operator domain or in between operator domains.

- Interworking functions to support legacy (non-NGN aware) terminals.

- Determination of how end-to-end services, call control and user mobility can be supported across heterogeneous networks.

- Functionality definition of NGN-aware terminals in terms of software upgrade mechanisms, redundancy and evolution of less expensive terminals, version negotiation and management.

NGN functional architectures
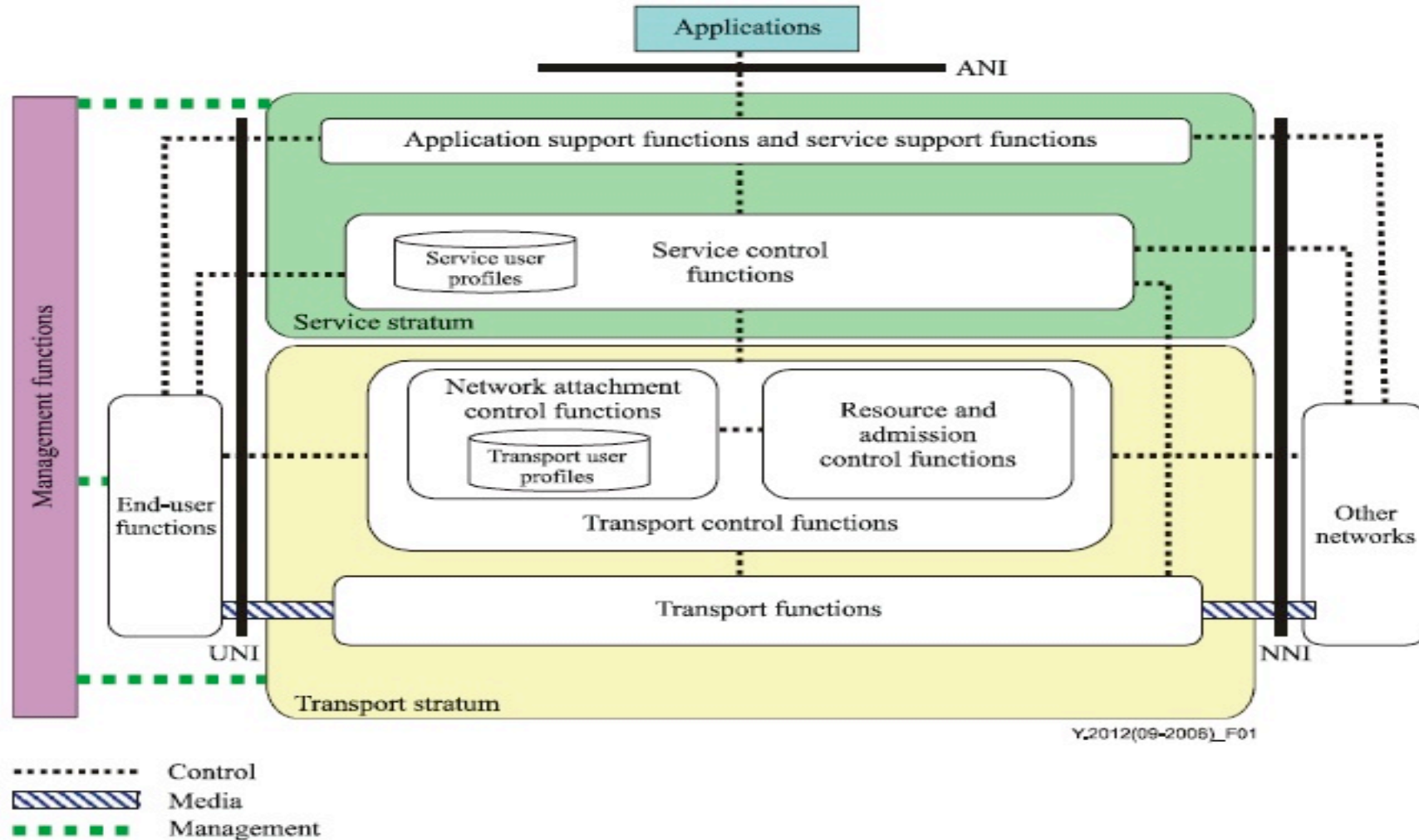
- Basic Reference Model
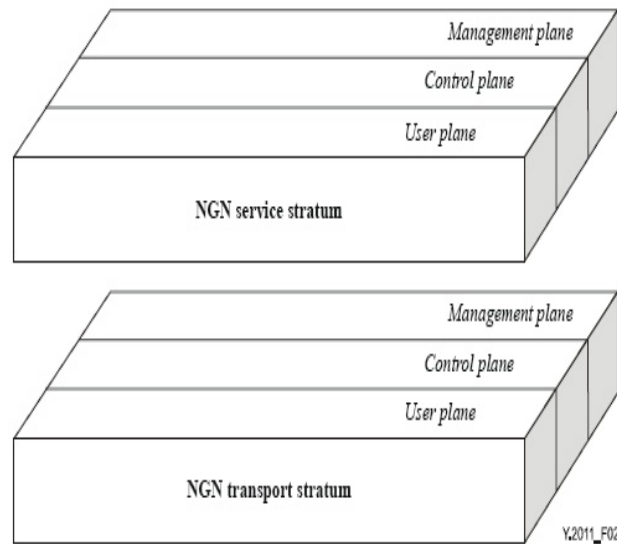
- Separation of services from transport

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NGN functional architectures

Network Attachment Control Functions

- Dynamic provisioning of IP addresses and other user equipment configuration parameters, by endorsement of user, auto-discovery of user equipment capabilities and other parameters.

- Authentication of end user and network at the IP layer (and possibly other layers). Regarding the authentication, mutual authentication between end user and the network attachment is performed.

- Authorization of network access, based on user profiles.

- Access network configuration, based on user profiles.

- Location management at the IP layer.

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NGN functional architectures
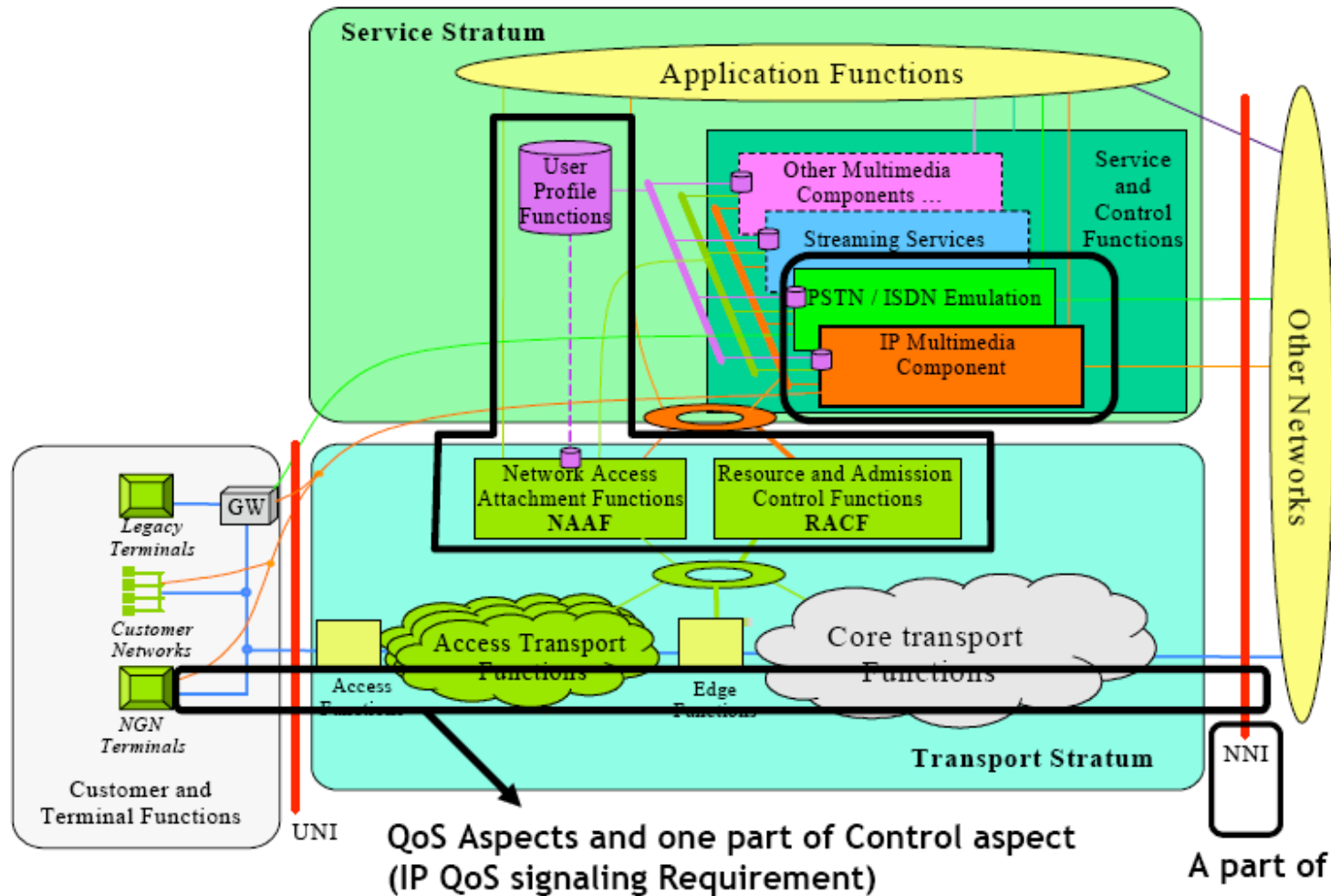
NGN End-to-end Quality of Service

- End-to-end QoS class definition for telephony over packet networks;

- End-to-end multimedia QoS class definition framework and a method of identifying QoS classes of individual media components;

- Specification of how to use lower layer QoS mechanism to achieve upper layer QoS within the network;

- Inter-domain lower layer QoS control;

- End user perception of QoS.

NGN functional architectures

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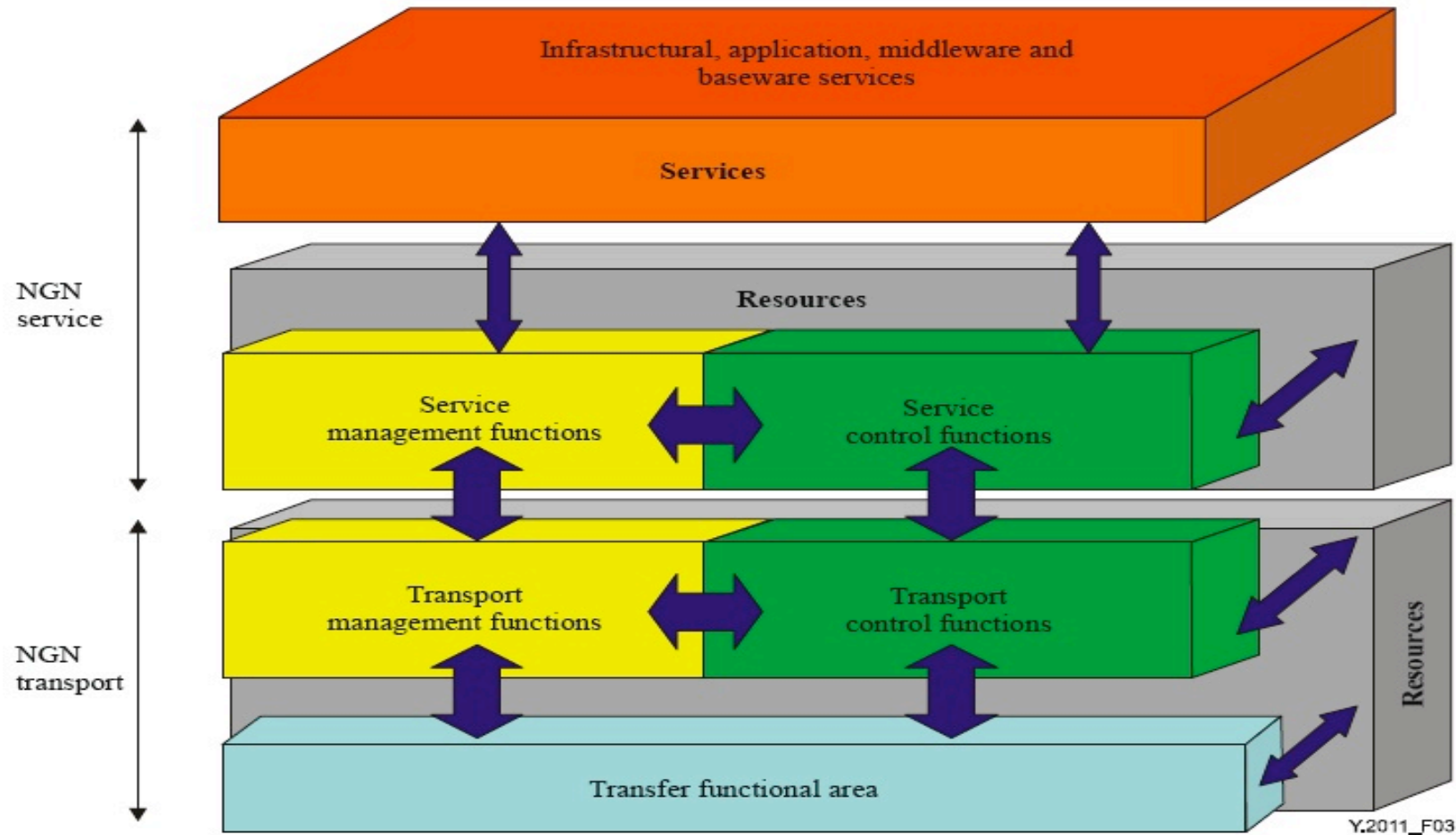
NGN Management

- Provides management functions for NGN resources and services, and offers communications between the management plane and the NGN resources or services and other management planes.

- Facilitates the effective interconnection between various types of Operations Systems (OSs) and/or NGN resources for the exchange of management information using an agreed architecture with standardized interfaces including protocols and messages.

- Recognizes that many network operators and service providers have a large infrastructure of OSs, telecommunications networks and equipment already in place, and which must be accommodated within the architecture.

- Also provides end-users with access to, and display of, management information, and end-user-initiated business processes.

- NGN are essentially about delivering new services that are available any place, any time, and on any device, through any customer-chosen access mechanism.

NGN Management views and their constructs
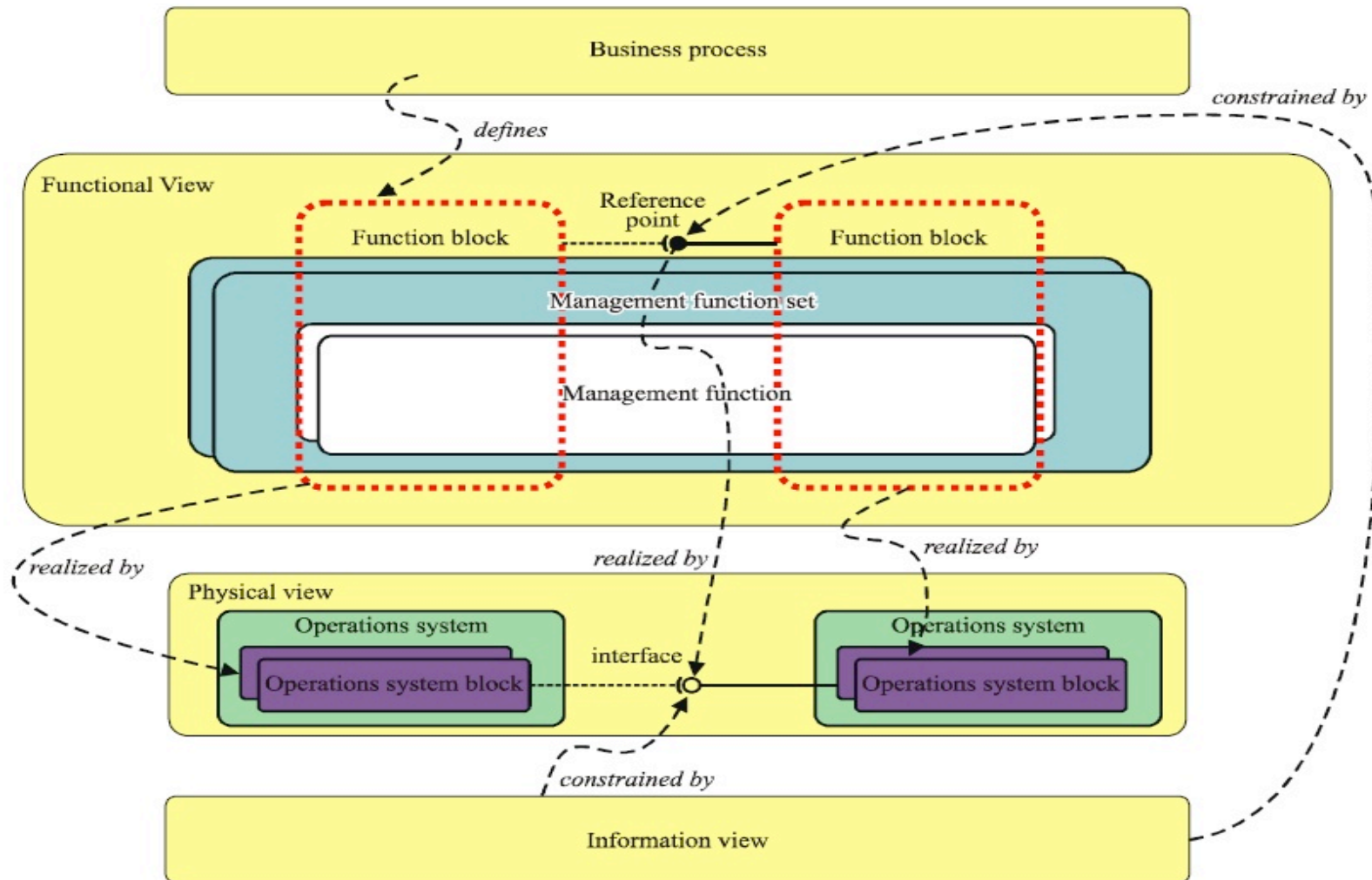
NGN Management functions

- Provide the ability to manage the NGN in order to provide NGN services with the expected quality, security and reliability.

- Allocated in a distributed manner to each functional entity (FE), and they interact with network element (NE) management, network management, and service management FEs.

- Management functions apply to the NGN service and transport strata. For each of these strata, they cover the following areas:

  - Fault management;

  - Configuration management;

  - Accounting management;

  - Performance management;

  - Security management.

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NGN Mobility Management

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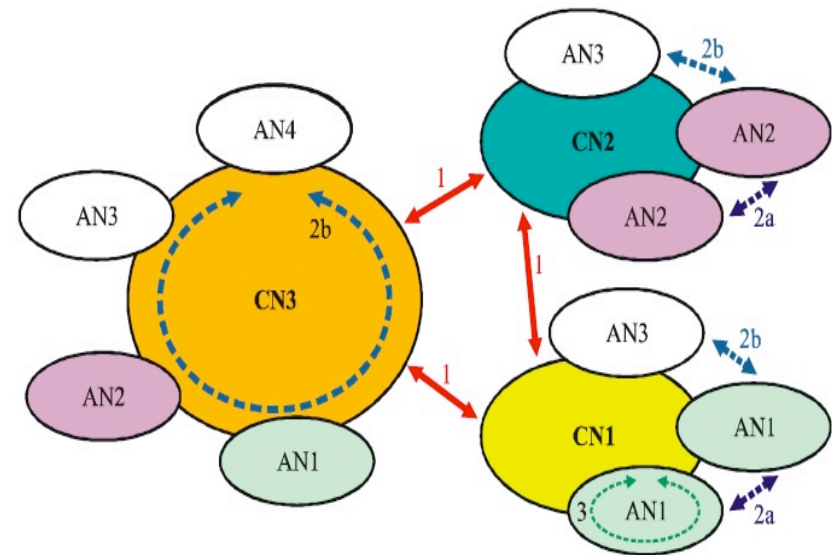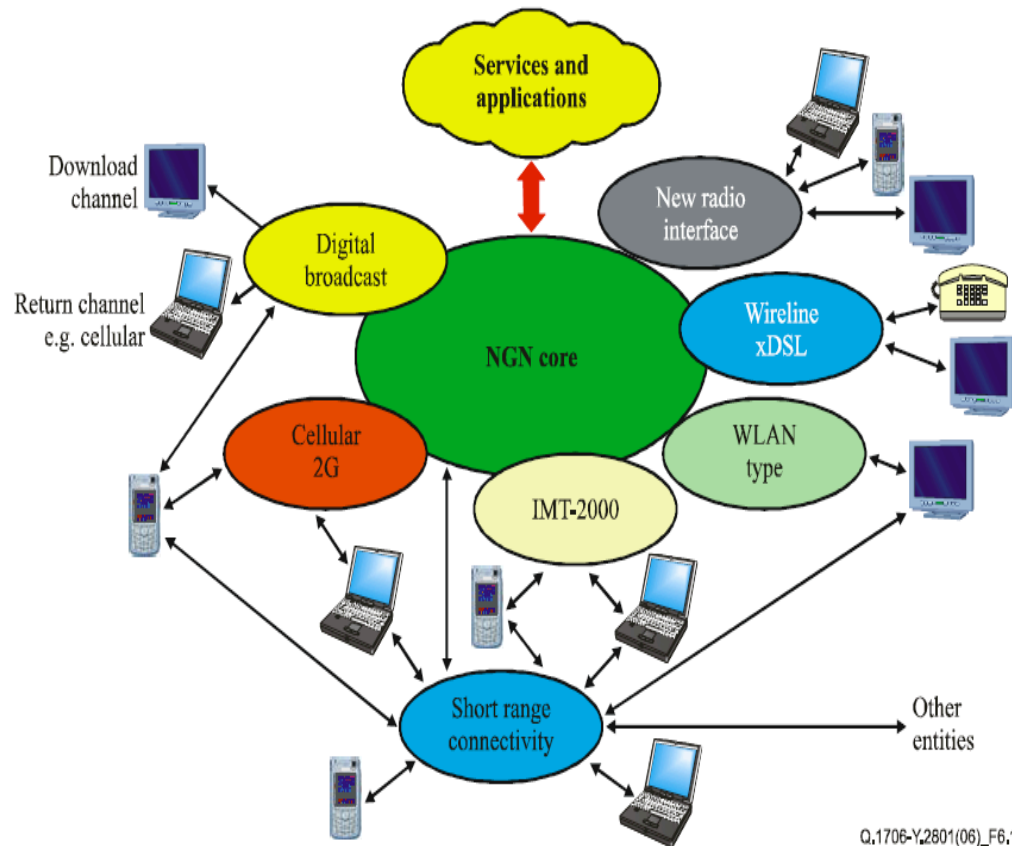
1	Inter-CN MM
2a	Inter-AN MM between same type of ANs
2b	Inter-AN MM between different types of ANs
3	Intra-AN MM
MM	Mobility management
AN	Access network
CN	Core network

User requirements for mobility

- Ability to change access point and/or terminal;

- Ability to get access from any network access point, including all access technologies identified above;

- Ability to get services in a consistent manner, subject to the constraints experienced in their current situations;

- User availability and reachability should be known to network functions, and possibly to services and applications, including those provided by a third party.

User network configuration

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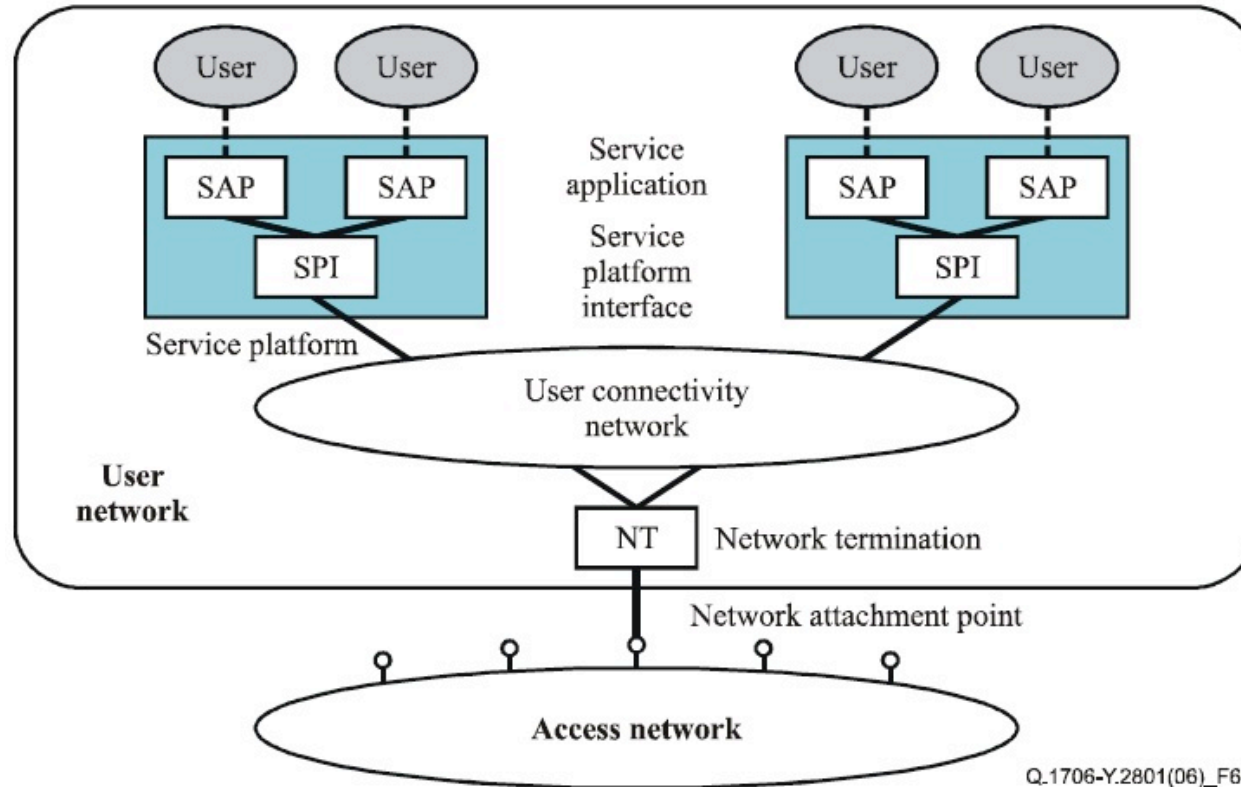
Multiple users may associate themselves with one or more service applications, by providing one of their user identifiers to the application.

PSTN/ISDN emulation and simulation

- PSTN/ISDN emulation provides most of the existing PSTN/ISDN service capabilities and interfaces using adaptation to an IP infrastructure.

  – Although PSTN/ISDN emulation supports all PSTN/ISDN supplementary services, individual carriers may choose to deploy PSTN/ISDN emulation with support for only a sub-set of PSTN/ISDN supplementary services.

- PSTN/ISDN simulation could also provide PSTN/ISDN-like service capabilities that potentially fulfil the same end-user need as existing PSTN/ISDN services.

  – There is no guarantee that PSTN/ISDN simulation would provide all features that have been available to the PSTN/ISDN user.

  – Simulated PSTN/ISDN may provide additional new features and capabilities that have not been available to the users of PSTN/ISDN.

PSTN/ISDN emulation and simulation

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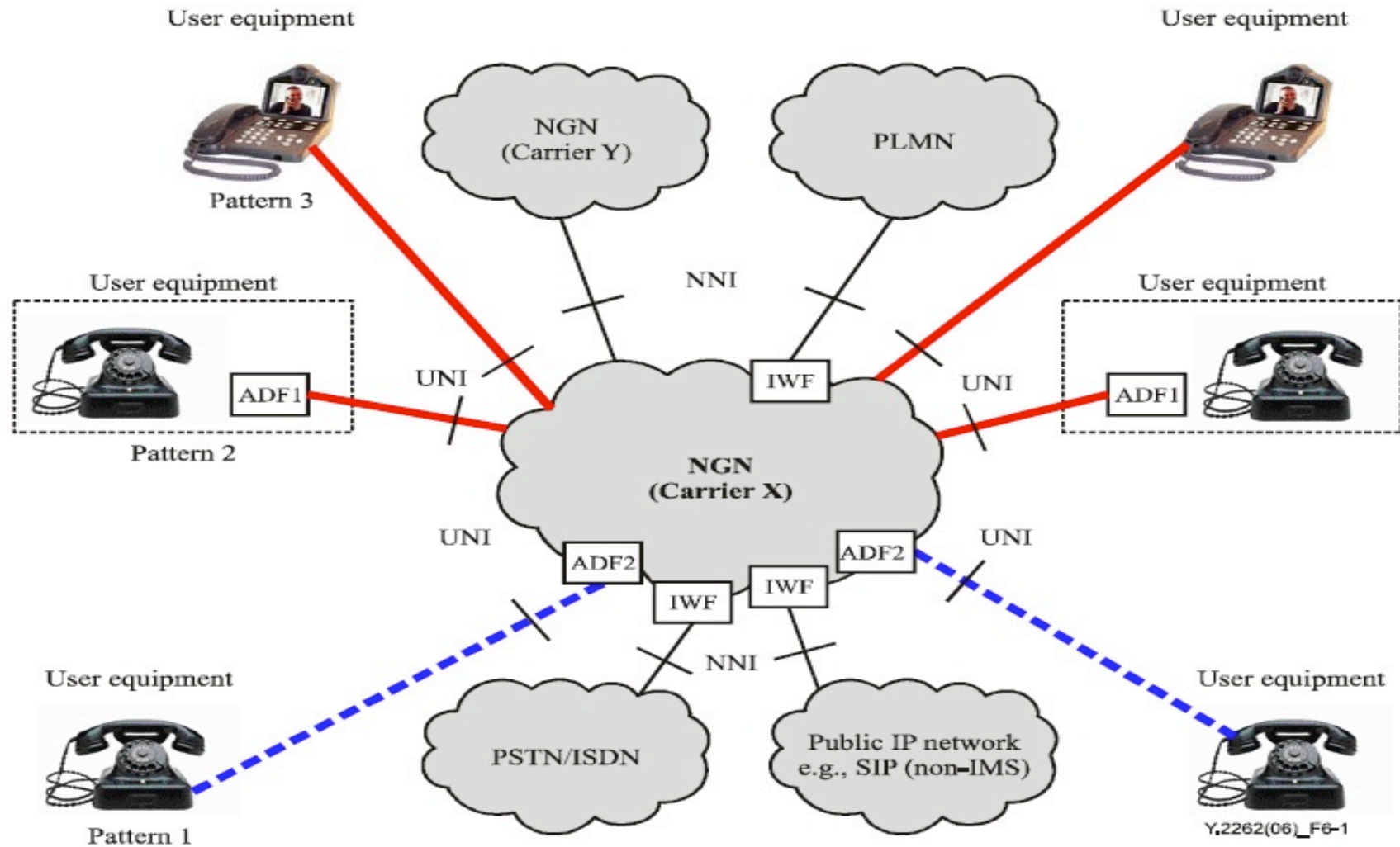
IP Multimedia Subsystem

- Supports the provision of Session Initiation Protocol (SIP) based multimedia services to NGN terminals.

- Supports the provision of PSTN/ISDN simulation services.

- Provides the adaptation and extension of the IMS specifications to support additional access network types, such as those based on xDSL and WLAN.

- IMS and its extensions support the following:

  - Control of IP connectivity access networks (QoS, admission control, authentication, etc.);

  - Coordination of multiple control components to a single core transport for resource control;

  - Interworking and interoperability with legacy and other networks;

  - Mutual de-coupling of the applications from the session/call control and the transport;

  - Access technology independence of session/call control and applications.

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Next Generation Networks

Pre-published (02/08)

Y.2006 - Description of capability set 1 of NGN release 1

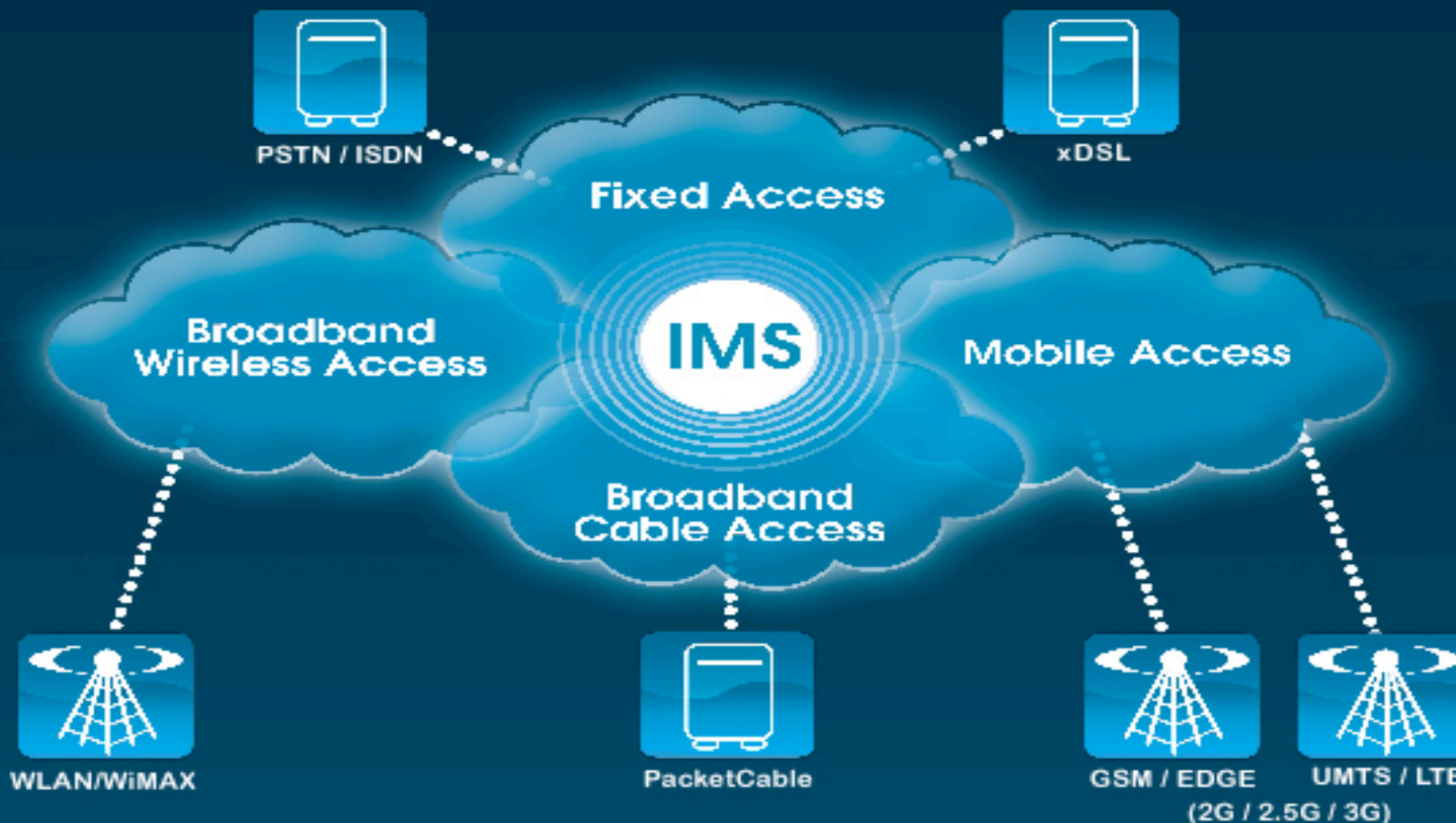Y.2051 - General overview of IPv6-based NGN

Y.2052 - Framework of multi-homing in IPv6-based NGN

Y.2053 - Functional requirements for IPv6 migration in NGN

Y.2054 - Framework to support signalling for IPv6-based NGN

Y.2232 - NGN convergence service model and scenario using Web
   Services

Telecommunication and Internet Services and Protocols for Advanced Networking

- ETSI TISPAN and 3GPP WGs are working together to define a harmonized IP Multimedia Subsystem (IMS) core for both wireless and wireline networks. Access independent IMS will be a key enabler for fixed/mobile convergence:
    - reducing network installation and maintenance costs,
    - allowing new services to be rapidly developed to satisfy new market demands.
- NGN Release 1 was launched by TISPAN in December 2005, providing the robust and open standards that industry can use as a reliable basis for the development and implementation of the first generation of NGN systems.
- TISPAN is now working on Release 2, with a focus on enhanced mobility, new services and content delivery with improved security and network management.
- TISPAN considers effective cooperation with external bodies.

Telecommunication and Internet Services and Protocols for Advanced Networking

- TISPAN is the ETSI core competence centre for fixed networks and for migration from switched circuit networks to packet-based networks with an architecture that can serve in both.

- TISPAN is responsible for all aspects of standardisation for present and future converged networks, including the NGN:
  - *service aspects,*
  - *architectural aspects,*
  - *protocol aspects,*
  - *QoS studies,*
  - *security related studies,*
  - *mobility aspects within fixed networks, using existing and emerging technologies.*

http://www.etsi.org/tispan

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TISPAN Core Competencies

- TISPAN is focused on delivering the same level of quality and global connectivity from the new NGN and IP based services that is received from today's public switched telephone network.

- TISPAN has activities that cover both circuit-switched and packet-switched networks including IP and ATM technologies.

- TISPAN would ensure that standards take account of regulatory requirements, security, lawful intercept, emergency communications, quality of service, numbering/naming, billing, mobility, service provider's requirements, Telecommunications Network Management.

TISPAN Competence Centers

WG1 - Next Generation Networks Services

WG2 - Network and System Architecture

WG3 - Protocols definitions

WG4 - Numbering, Naming, Addressing and Routeing

WG5 - Next Generation Networks Home Networking

WG6 - Next Generation Networks Testing

WG7 - Next Generation Networks Security

WG8 - Management of Next Generation Networks

TISPAN NGN Overall architecture

- **Transport layer Model**
  - Transport control sub layer
    - Network Attachment Subsystem (NASS)
    - Resource and Admission Control Subsystem (RACS)
  - Transfer functions
    - Border Gateway Function (BGF)
    - Layer Termination Function (L2TF)
    - Access Relay Function (ARF)
    - Media Gateway Function (MGF)
    - Media Resource Function Processor (MRFP)
    - Signalling Gateway Function (SGF)

- **User Equipment (UE)**
  - Authentication
  - Interfaces to the core IMS
  - Interfaces to the PSTN/ISDN Emulation subsystem
  - Interfaces with applications
  - Interfaces with the NASS
  - Interface with the RACS

- **Service Layer Model**
  - Multimedia Subsystem (IMS)
  - PSTN/ISDN Emulation subsystem (PES)
  - Streaming Subsystem
  - Content Broadcasting Subsystem (CBS)
  - Common components
    - User Profile Server Function (UPSF)
    - Subscription Locator Function (SLF)
    - Application Server Function (ASF)
    - Charging and Data Collection Functions (CDCF)
    - Interworking Function (IWF)
    - The Interconnection Border Control Function (IBCF)

- **Interconnection at the Service Layer**

- **Interconnection with other networks/domains**
  - Interconnection at the transport layer
    - Transfer Sub layer
    - NASS
    - RACS

TISPAN NGN Overall architecture
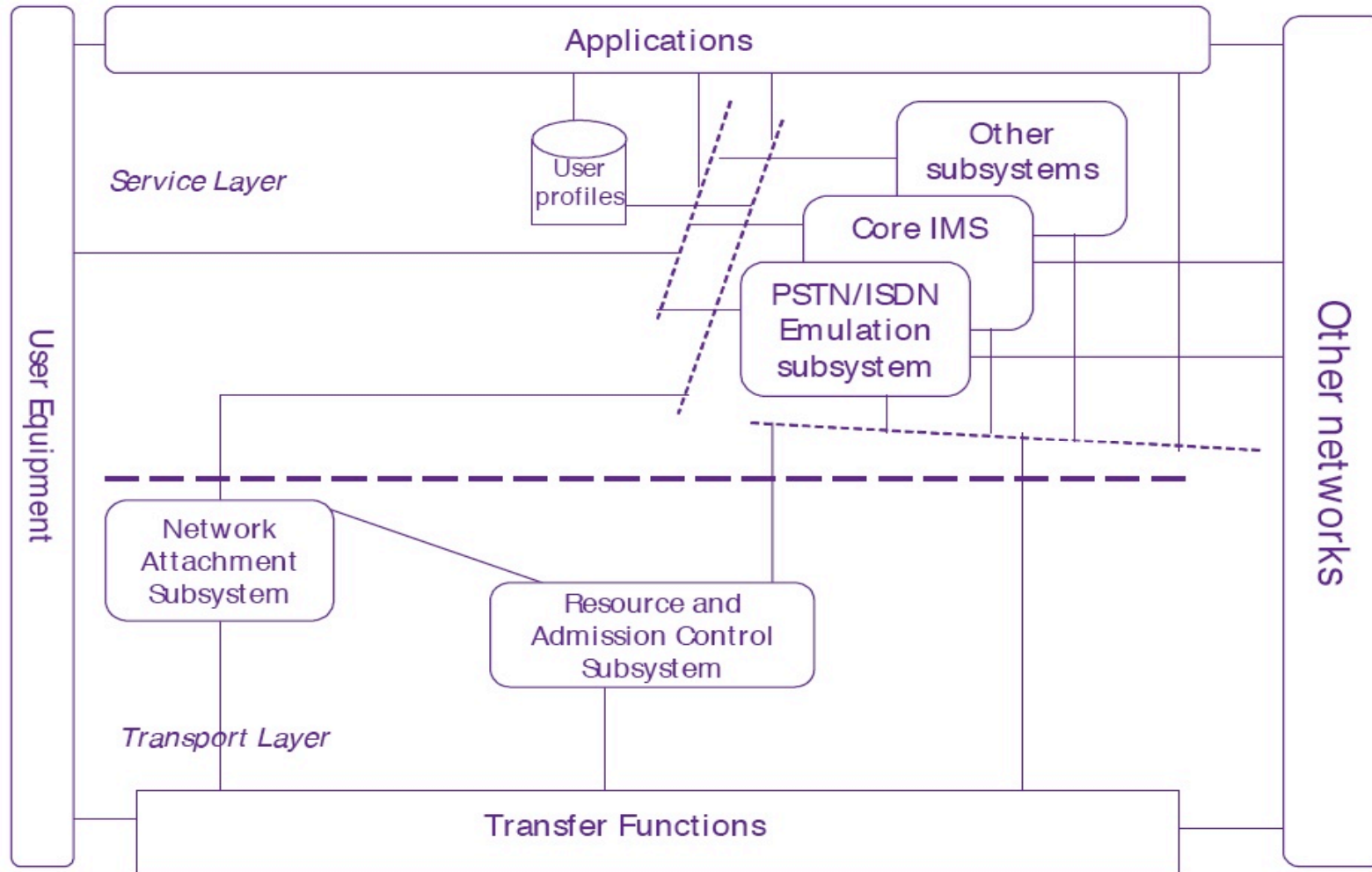
TISPAN NGN Overall architecture
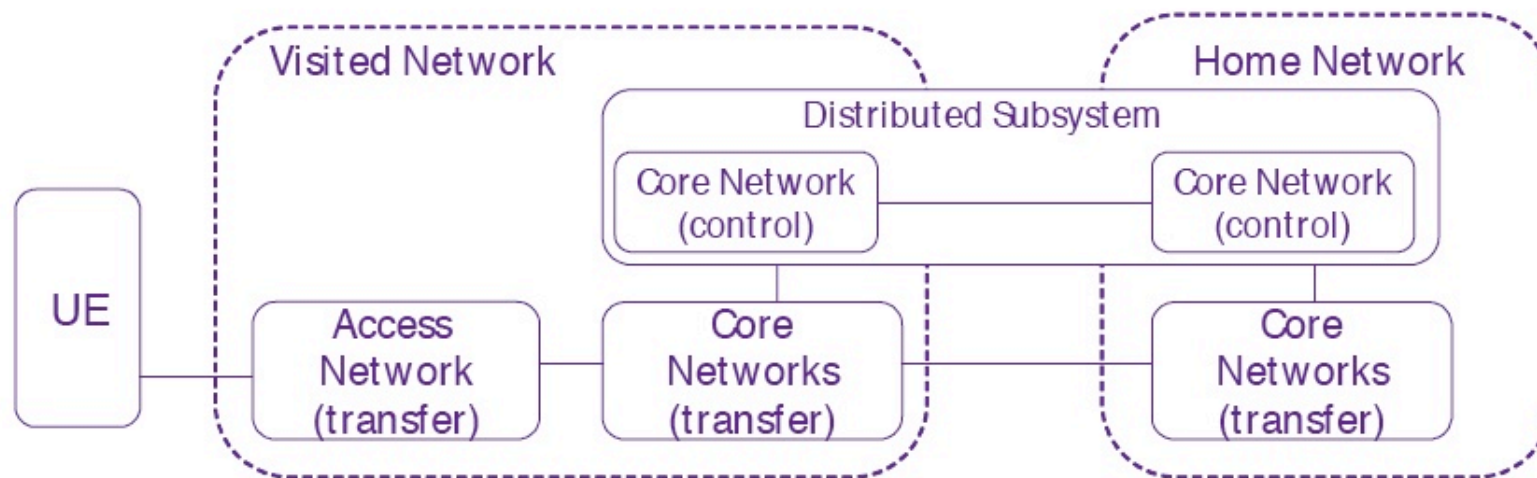
- The functional entities that make up a subsystem may be distributed over network/service provider domains
- The network attachment subsystem may be distributed between a visited and a home network.
- Service-layer subsystems that support nomadism may also be distributed between a visited and a home network.

TISPAN NGN Access Network Types

- Mobile Wireless
  - GSM
  - GPRS
  - UMTS/WCDMA
  - WiMAX (802.16e)
  - CDMA
  - EVDO

- Fixed Wireless
  - WiFi
  - WiMAX

- Fixed Broadband
  - xDSL
    - ADSL, SDSL and VDSL
  - Optical
    - Single star and xPON:
      - BPON, EPON and GEPON
  - Cable
    - Docsis and Packet Cable 2.0

- Fixed Narrowband
  - Legacy PSTN
  - ISDN

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TISPAN NGN architecture with an xDSL-based access network

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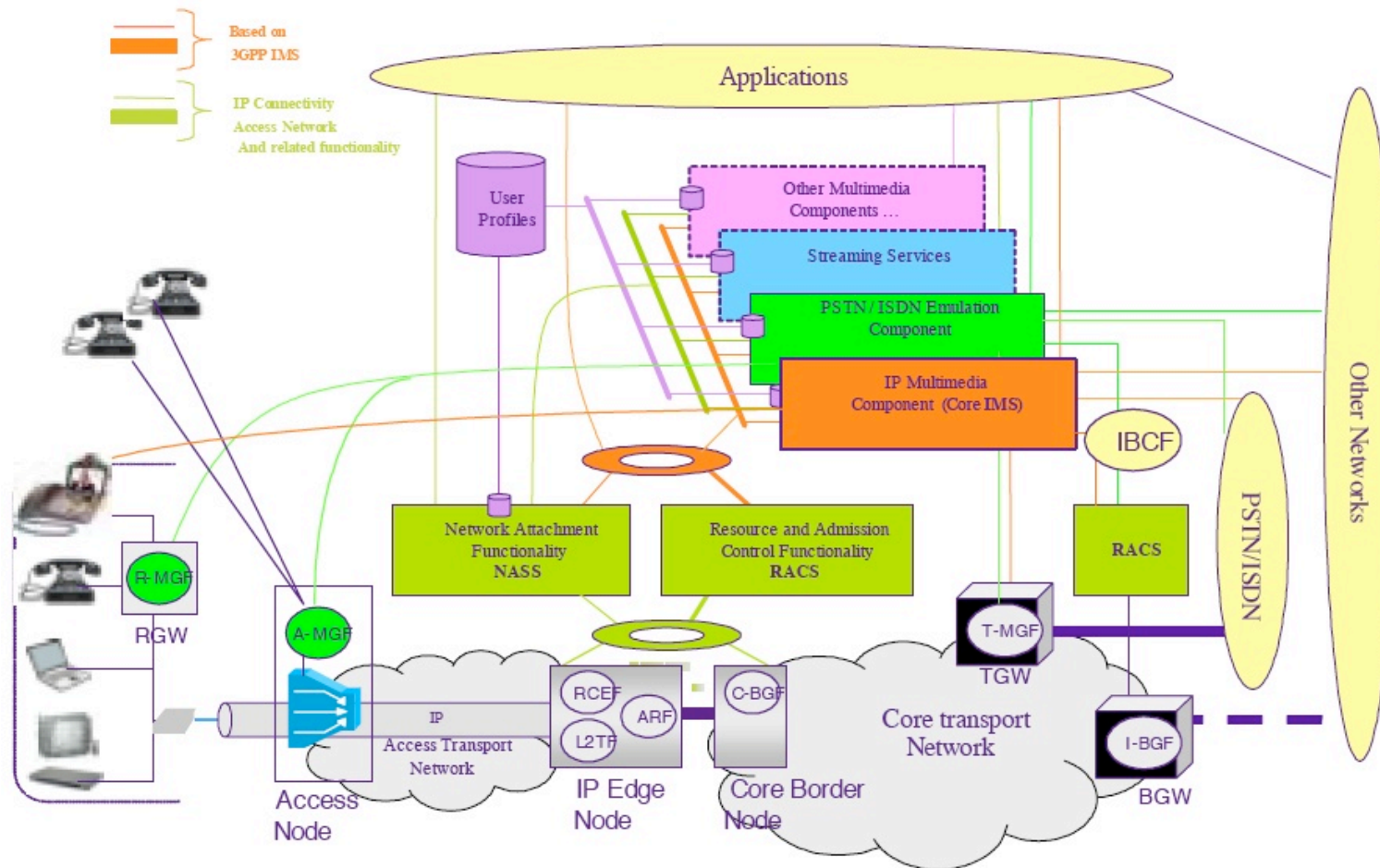
TISPAN Collaboration with other bodies

- Providing overall guidelines to other ETSI Technical Bodies to ensure the development of standards for public networks including requirements from private networks:

    - co-ordinating the position of ETSI for ITU-T Study Groups (in particular SGs 2, 4, 7, 11, 13, 16, 17 & SSG);

    - liaising and collaborating as appropriate with the CEPT/ECC Project Teams (Numbering and TRIS);

    - liaising and collaborating with the European Union via the OCG ECN&S on regulation, application of the EC Directives and other relevant network issues;

    - co-ordinating ETSI positions on network aspects as appropriate in IETF;

    - maintaining good relations with other appropriate bodies:

        ITU-T, 3GPP, IETF, ITU-R, ATM Forum, DSL Forum, Eurescom, MPLS Forum, MSF, ETNO, ICANN & its Supporting Organisations.