

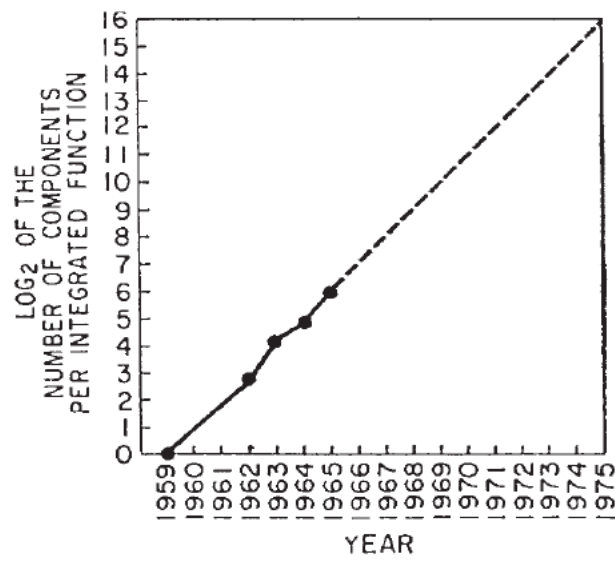
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Buenos Aires, Argentina 5/6/2013

Carrier-Grade Networks toward the Future - NGN and Its Issues -

Koichi Asatani
IEEE Distinguished Lecturer
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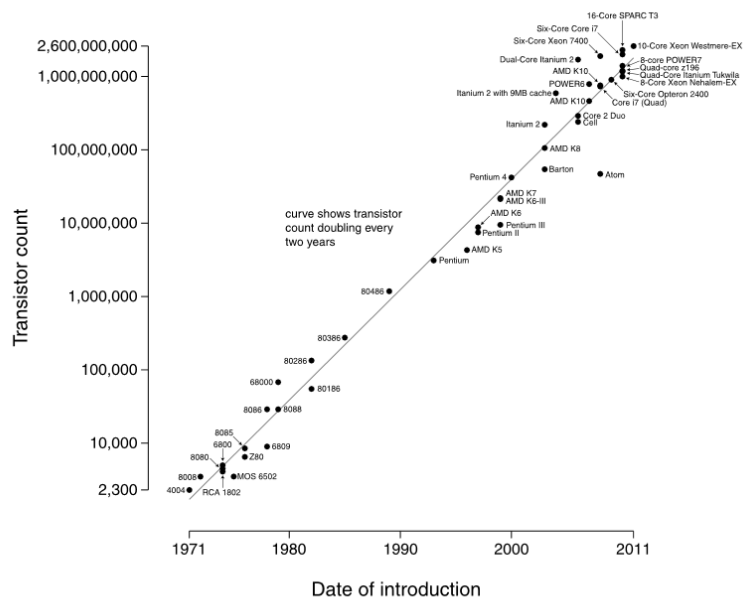
- What is going on?
- Where are we going to?
- Who will be the players?
- What will be the Next?

Moore's Law



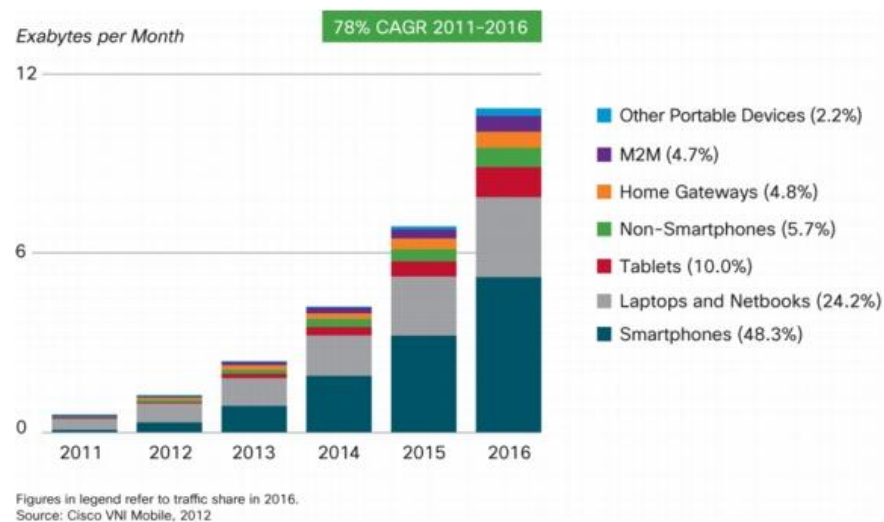
Moore, Gordon E., "Cramming more components onto integrated circuits" Electronics Magazine vol. 38, No. 8, pp.114-147, April 1965.

Microprocessor Transistor Counts 1971-2011 & Moore's Law



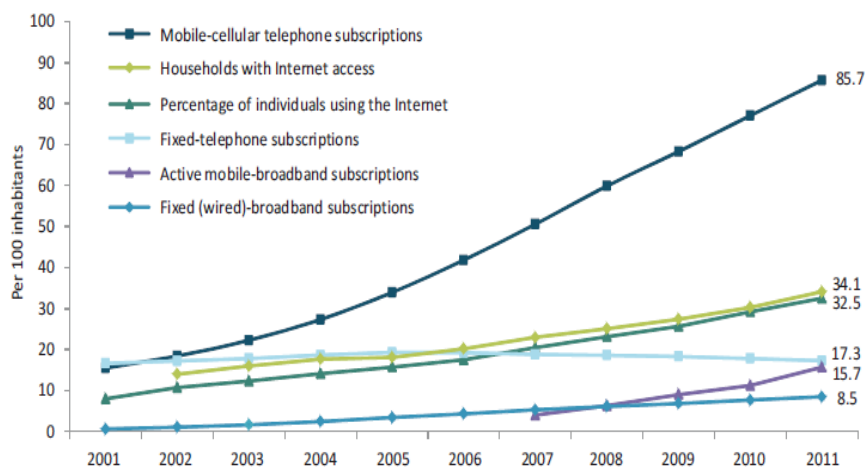
http://en.wikipedia.org/wiki/Moore's_Law

Laptops and Smartphones Lead Traffic Growth



Source: Cisco VNI, 2012
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Global ICT Development 2001-2011



Source: ITU-T Measuring the Information Society 2012
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A Decade of ICT Growth Driven by Mobile Technologies

- Mobile subscriptions are over 6 billion globally by the end of 2011*.
6.7 billion by the end of 2012**
- Mobile broadband subscriptions overtook fixed broadband subscribers in 2008, highlighting the huge potential for the mobile Internet.
- Internet users are over 2.4 billion globally**.

*http://www.itu.int/net/pressoffice/press_releases/2012/70.aspx

** Internet World Stat

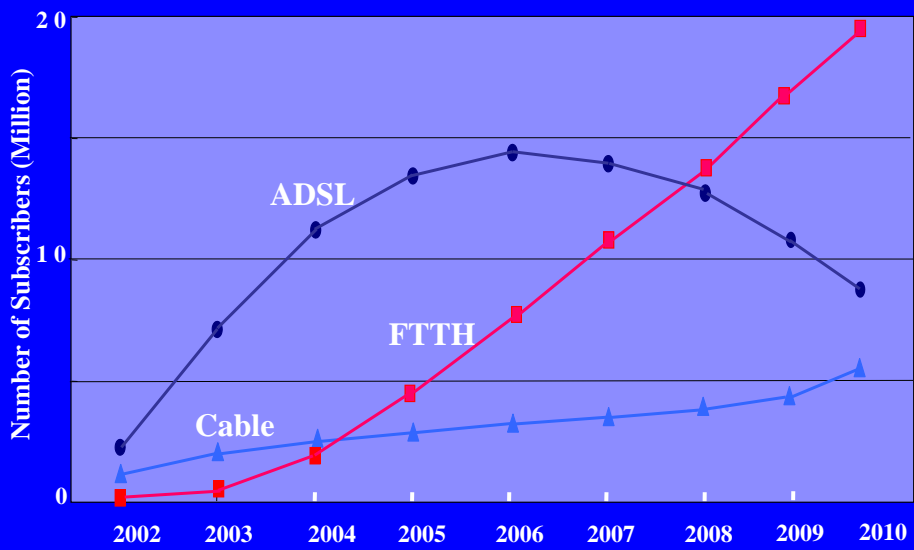
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Facts on Emails in 2012 Worldwide

- **144 billion** – Total email traffic per day.
- **4.3 billion** – Number of email clients.
- **68.8%** – Percentage of all email traffic that was spam.
- **0.22%** – Share of emails that comprised some form of phishing attack.

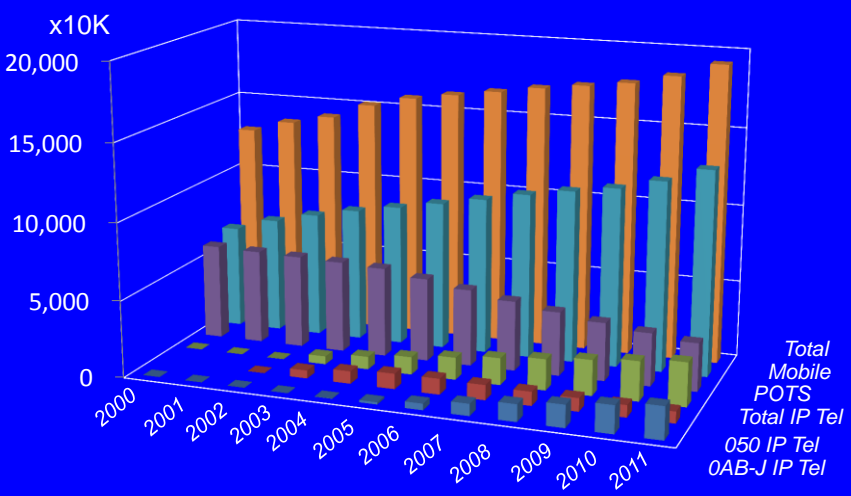
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Broadband Access in Japan



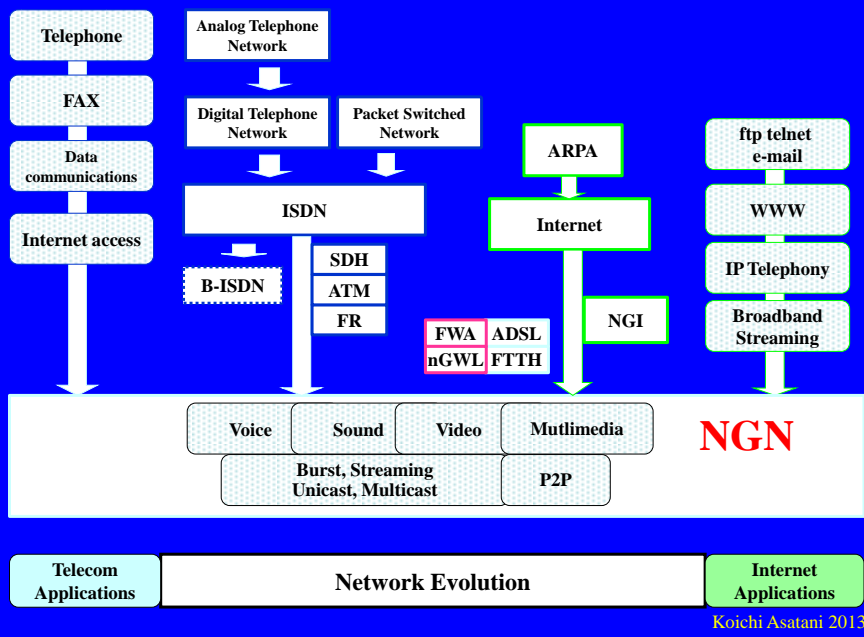
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Telephone Subscriptions in Japan



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Evolution in Networks and Applications



Pros & Cons

Telecom

Internet

PROS	Guaranteed QoS High Security High Dependability	Flexible Bandwidth Low cost
CONS	Fixed Bandwidth High Cost	Best Effort type of QoS Low Security Low Dependability Spams & Malware
REM	Regulated	Non-regulated

Why NGN -Users' Benefits-

- FMC
- Triple Play (telephone, Internet and Broadcast)
- Broadband and Ubiquitous

Users enjoys wide range of information and communication services on **safe and dependable** networks.

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Why NGN-Operators' Benefits-

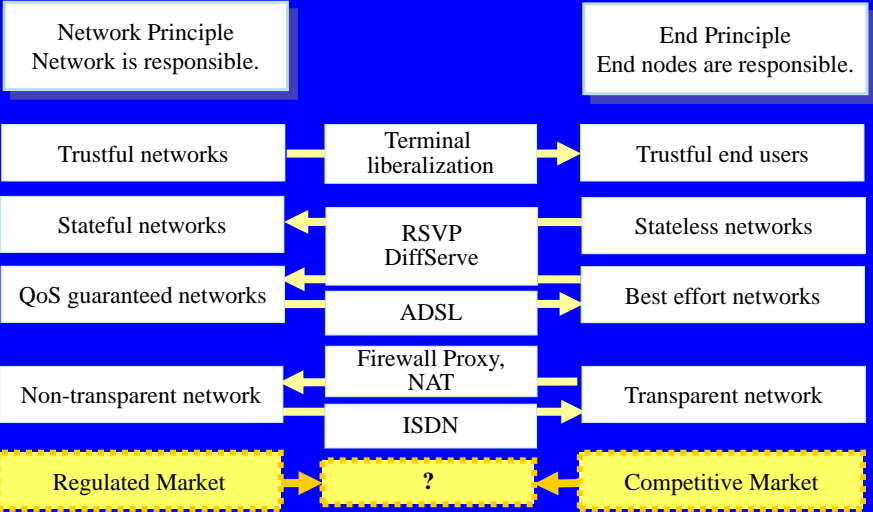
- Network Replacement by IP Equipment to Reduce CAPEX and OPEX
- Broadband and Ubiquitous Services for Revenue Shift from Telephone to New Services
- Support of FMC and Triple Play Services to be Competitive in Information and Telecommunication Market
- New Business Development to Enhance the Market

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Network Principles and Convergence

Telecom

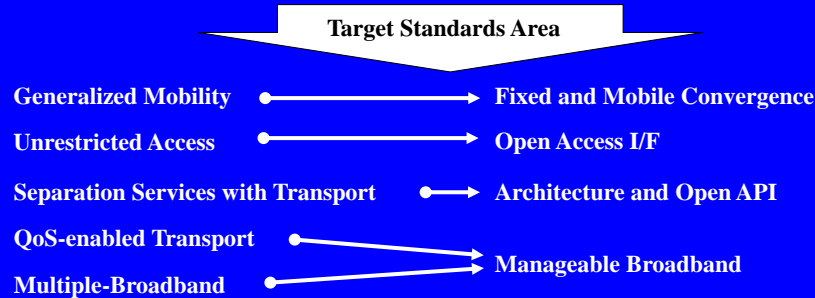
Internet



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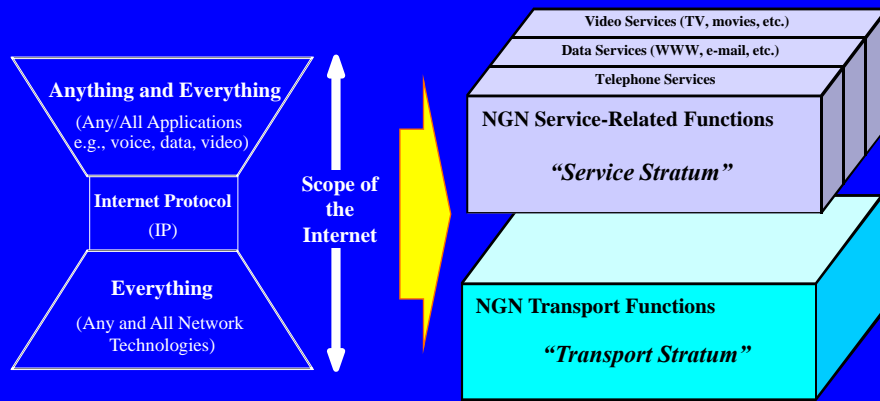
Definition & Features of NGN

- Packet-based network providing telecommunication services
- Making use of multiple broadband, QoS-enabled transport technologies
- Service-related functions independent from underlying transport-related technologies
- Providing unfettered access for users to networks and to competing service providers and/or services of their choice.
- Supporting generalized mobility, allowing consistent and ubiquitous provision of services to users.



Source: Rec.Y.2001
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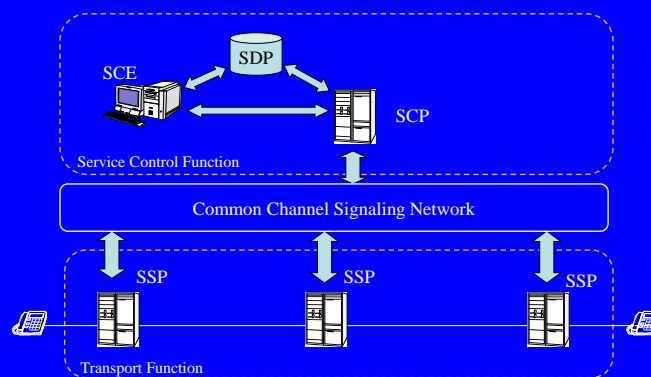
Next Generation Networks -Principles-



Source: ITU-T Recommendation Y.2011 —
General principles and general reference model for next generation networks

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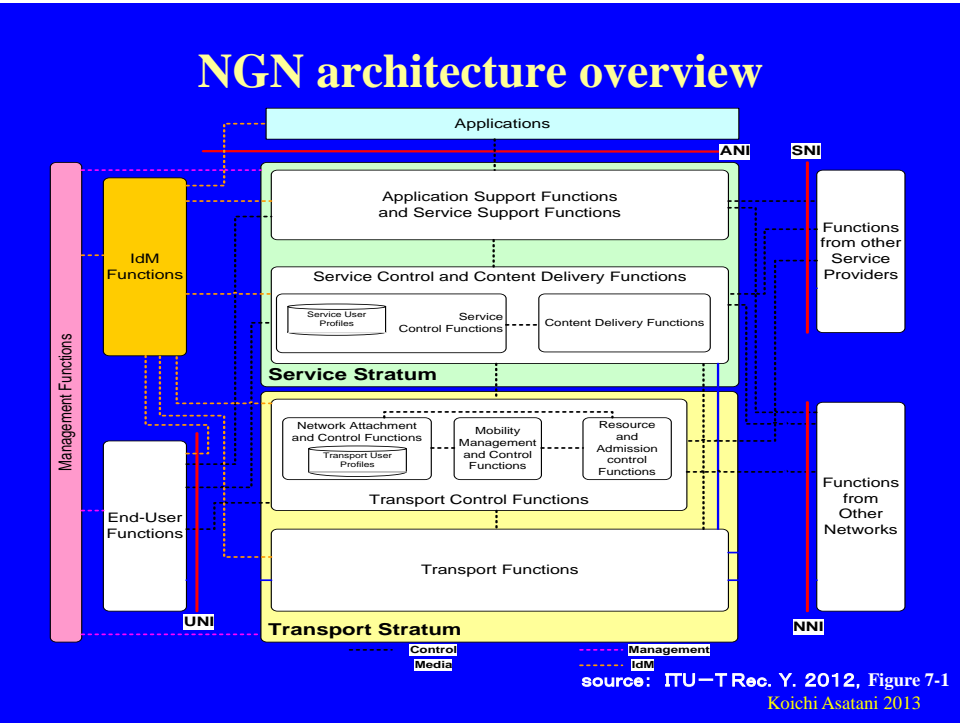
Basic Configuration of Intelligent Network



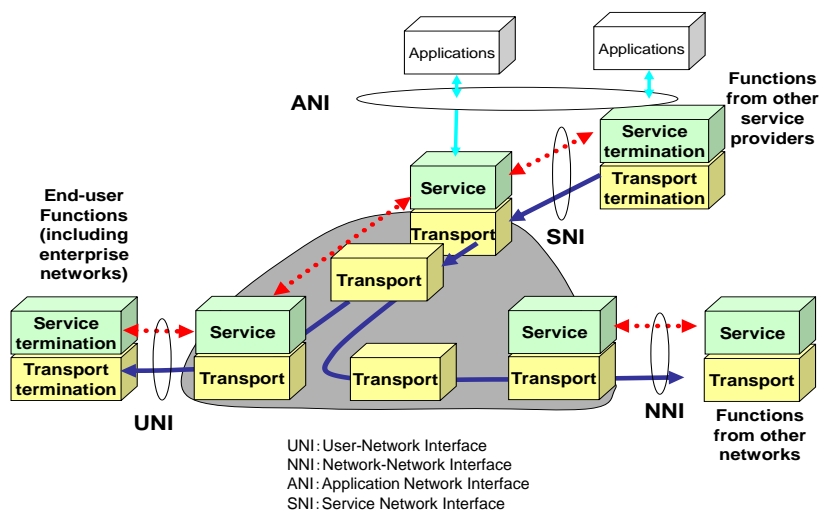
SSP: Service Switching Point (SSP)
SDP: Service Data Point (SDP)
SCP: Service Control Point
SCE: Service Creation Environment

Source: Handbook of Enterprise Integration,
Ch. 5 Next Generation Networks (NGN) in
Enterprises, Taylor and Francis, London

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Instantiation of NGN reference points



Source: Figure III.1 – Instantiation of NGN reference points
Recommendation ITU-T Y.2012
Functional requirements and architecture of next generation networks
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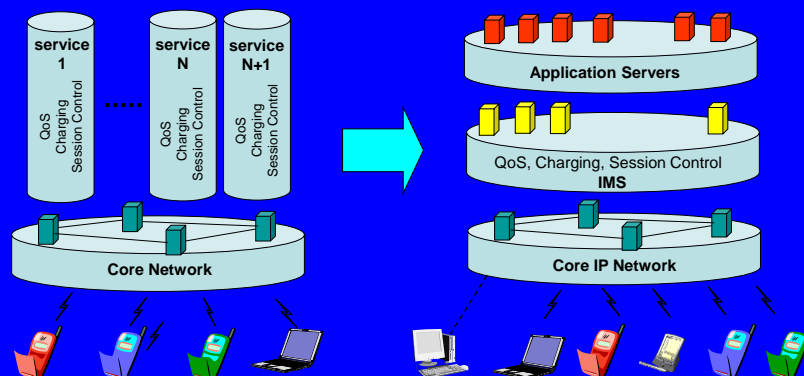
ANI and SNI

- ANI (application network interface)
 - Interface with other service providers and their applications, or application providers
 - Support of control plane level type of interaction without media (data) level interaction
 - NGN operators can be application providers
- SNI (service network interface)
 - Interface with other service providers, such as content providers.
 - Supports of both a control plane level type of interaction and a media (data) level type of interaction.

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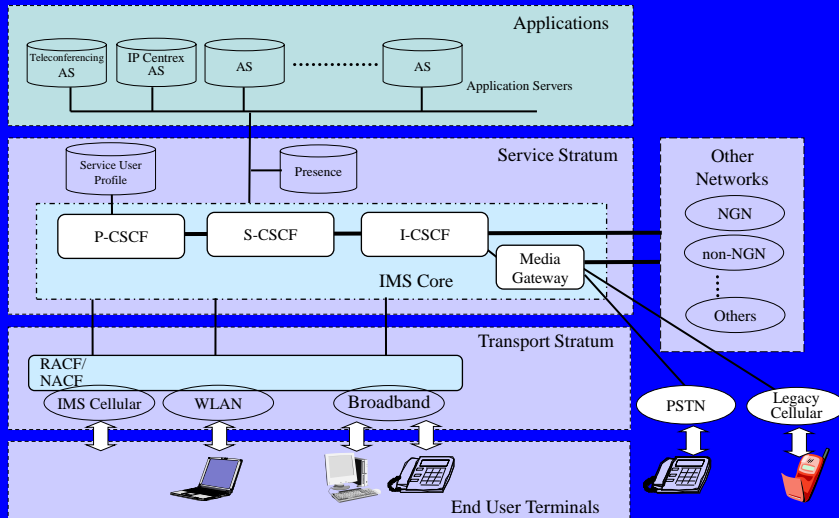
IMS (IP Multimedia Subsystem)

- 3GPP IMS Release 2 (1992), 3GPP2 (MMD) and TISPAN
- Silo to Converged Platform



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IMS-based NGN Configuration Example

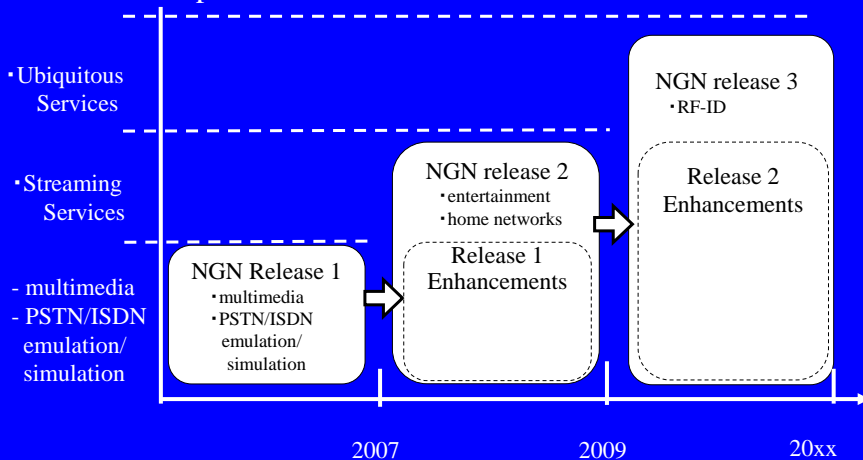


IMS: IP Multimedia Subsystems CSCF: Call Session Control Function
 S-CSCF: Serving-CSCF I-CSCF: Interrogating-CSCF P-CSCF: Proxy-CSCF
 RACF: Resource and Admission Function, PSTN: Public Switched Telephone Network

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NGN Standardization -Original Release Approach-

Services & Capabilities



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IP Network QoS Class

Network performance parameter	Nature of network performance objective	QoS Classes					
		Class 0	Class 1	Class 2	Class 3	Class 4	Class 5 Unspecified
IPTD	Upper bound on the mean IPTD (Note 1)	100 ms	400 ms	100 ms	400 ms	1 s	U
IPDV	Upper bound on the $1 - 10^{-3}$ quantile of IPTD minus the minimum IPTD (Note 2)	50 ms (Note 3)	50 ms (Note 3)	U	U	U	U
IPLR	Upper bound on the packet loss probability	1×10^{-3} (Note 4)	1×10^{-3} (Note 4)	1×10^{-3}	1×10^{-3}	1×10^{-3}	U
IPER	Upper bound	1×10^{-4} (Note 5)					U

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NGN Release 1 Service Capabilities(1/2)

Service Type	Outline
Multimedia Service	Real-time conversational voice services (interworking with PSTN and cellular networks)
	Real-time text
	Presence and general notification services
	Messaging service
	Push to talk
	Point-to-Point interactive multimedia services (video telephony)
	Collaborative interactive communication services
	Content delivery services
	Push-based services
	Broadcast/multicast services
	Hosted and transit services for enterprises (e.g., IP Centrex)
	Information services (e.g., highway monitoring)
	VPN services
	3GPP release 6 and 3GPP2 release A OSA-based services
PSTN/ISDN Emulation	Same or better PSTN/ISDN service
PSTN/ISDN Simulation	PSTN/ISDN like service

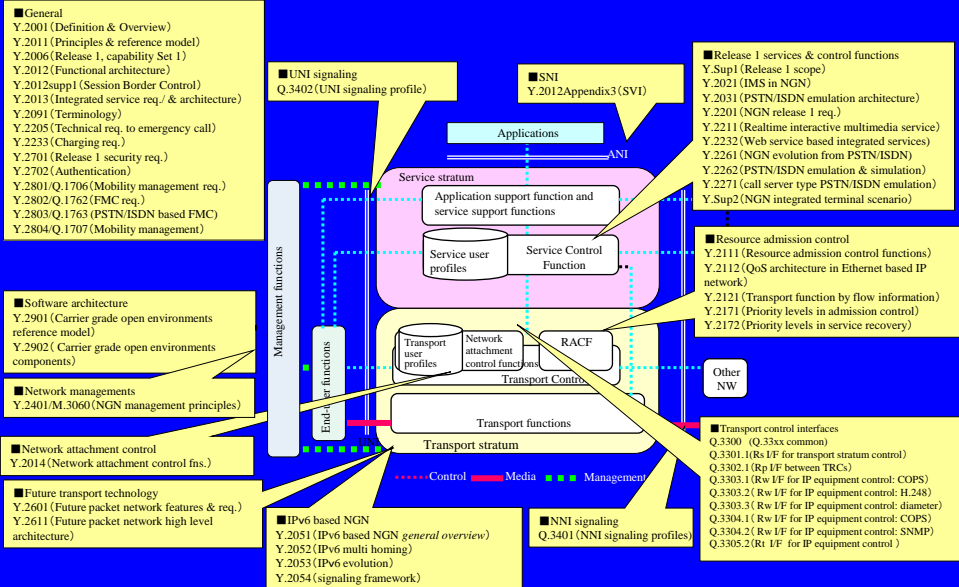
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NGN Release 1 Service Capabilities(2/2)

Service Type	Outline
Internet Access	Legacy Internet Access
Other Services	VPN
	Data retrieval (e.g., tele-software)
	Data Communications (e.g., file transfer, Web browsing)
	On-Line applications (e.g., On-line marketing, e-commerce)
	Sensor network service
	Remote Control/tele-action(e.g., Home application control, telemetry, alarming)
	OTN (Over-the-Network) device management
Public Interests	Lawful interception
	Malicious communication identification
	Emergency telecommunication
	User identifier presentation and privacy
	Network or service provider selection
	Support of users with disabilities
	Number portability
	Service unbundling
	Unsolicited bulk telecommunications protection

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ITU-T Recommendations on NGN



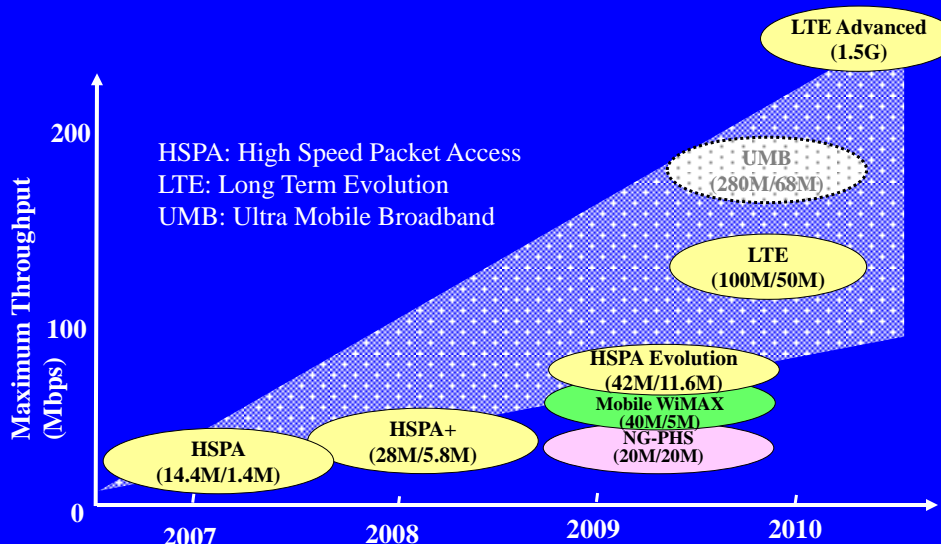
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Fixed-mobile convergence (FMC)

- Fixed and mobile services with a single phone, switching between networks on an ad hoc basis.
- ITU-T Rec.Y.2018 : Mobility management and control framework and architecture for NGN (2009.9)
- ITU-T Rec.Y.2808 : Principles, service and network capabilities, and architectures for IP Multimedia Subsystem (IMS) based FMC (2009.6)

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Wireless Broadband Access



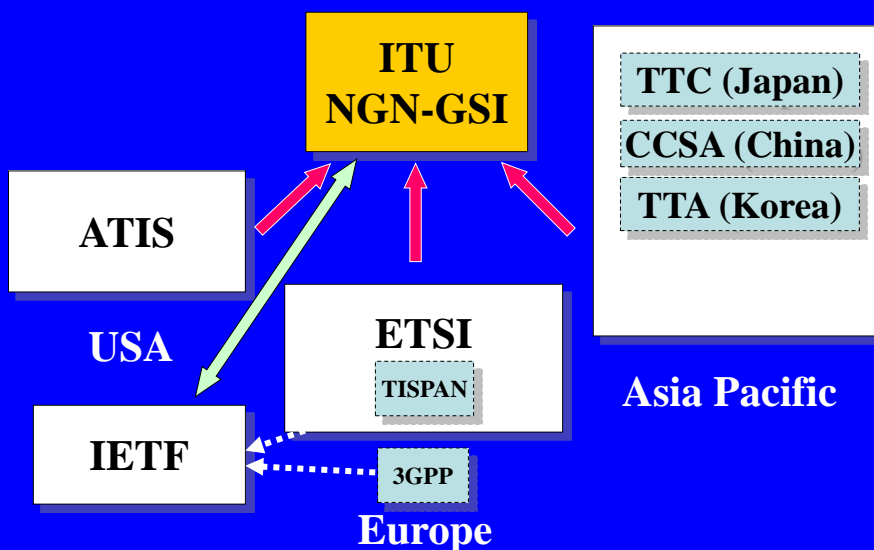
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NGN Services in Japan

Service		Content
Optical Broadband service (FLET'S Hikari Next service)		Service for Residential Users (single family house)
		Service for Residential Users (apartment house)
		Service for Business users
Optical Telephony service (Hikari Denwa and Hikari Denwa Office Type)	QoS Guaranteed	Hikari Telephony (Standard QoS, High QoS: 7kHz)
		Business Telephony
		Video Telephony
VPN service (FLET'S VPN Gate service)	QoS Guaranteed	VPN (Center-to-end, CUG) To be provided
	Best Effort	VPN (Center-to-End, CUG)
Content Delivery Service (FLET'S Cast service)	QoS Guaranteed	Unicast
		Multicast
	Best Effort	Unicast
		Multicast
Ethernet over NGN (Business Ether Wide service)		Ethernet

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NGN-related Standardization Organizations



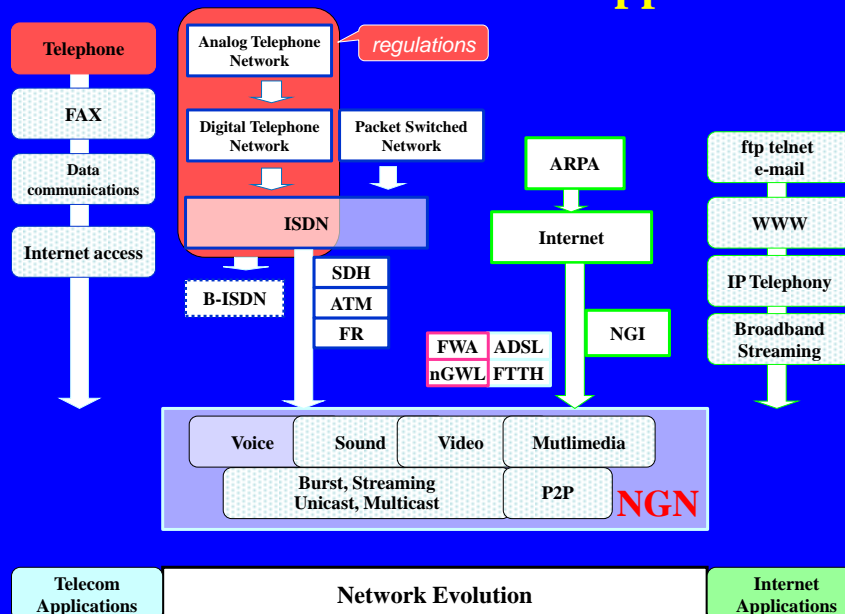
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What is Carrier-Grade Network?

- Extremely dependable:
 - “Five nines” high availability standards, and provide very fast fault recovery through redundancy
- QoS guaranteed

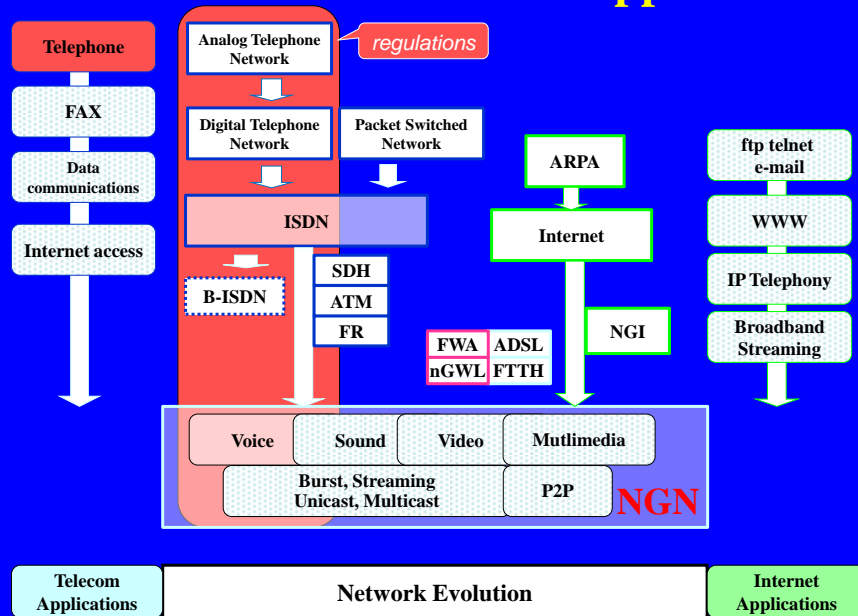
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Evolution in Networks and Applications



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Evolution in Networks and Applications



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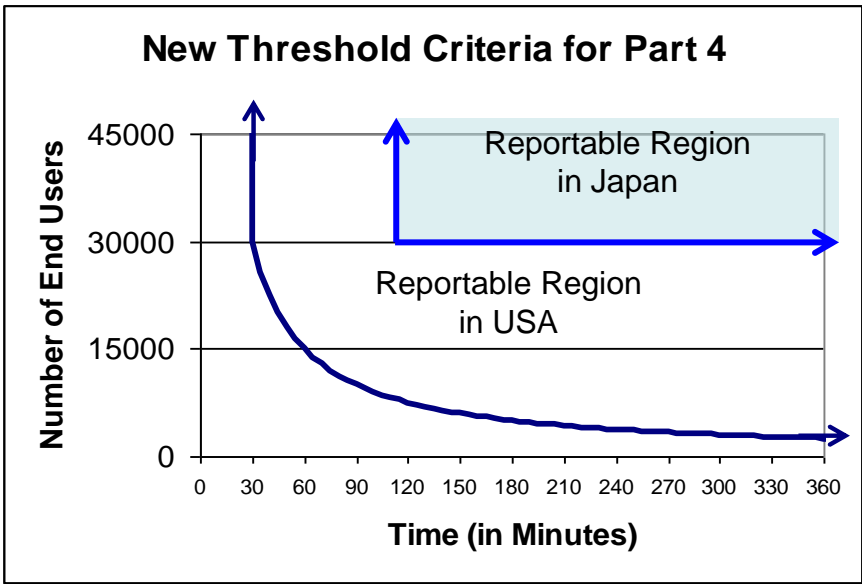
Extremely Dependable

Threshold criteria for communications outage reporting

- Japan: More than two hours outage duration affecting more than 30,000 users
- USA: The outage duration must be at least 30 minutes; *and* the number of “user-minutes” potentially affected per outage must equal or exceed 900,000. (source: FCC/DA 251763)
 - “Outage” is defined as “a significant degradation in the ability of a customer to establish and maintain a channel of communication as a result of failure or degradation in the performance of a carrier's network.

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Threshold Criteria for Outage Reporting



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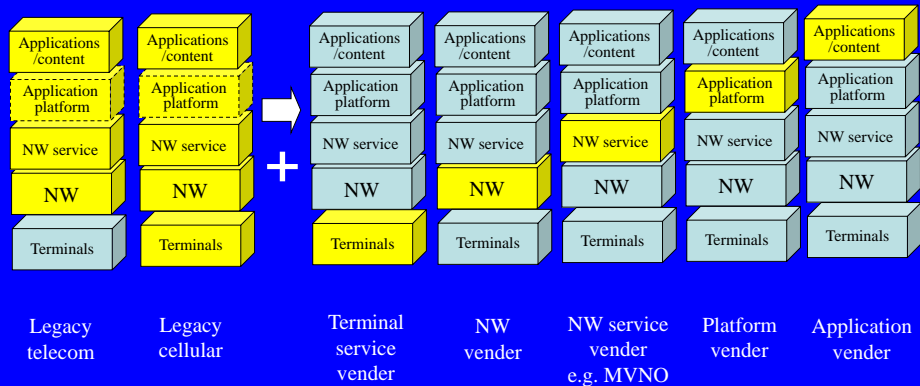
Reporting thresholds for different types of networks and outages by OFCOM

Network/service type	Minimum number of end customers affected	Minimum duration of service loss or major disruption
Network providing access to the emergency services (e.g. 112, 999, emergency SMS)	1,000	1 hour
Network providing access to the emergency services (e.g. 112, 999, emergency SMS)	100,000	Any duration
Fixed line voice service/network offered to retail customers	1,000	24 hours
Fixed line voice service/network offered to retail customers	100,000	1 hour
Fixed line voice service/network offered to retail customers	1,000,000	10 minutes
Mobile voice service/network offered to retail customers	10,000	24 hours
Mobile voice service/network offered to retail customers	100,000	1 hour
Internet access service offered to retail customers	100,000	24 hours
Broadcasting service/network for reception by the general public	100,000	12 hours

Source: Ofcom guidance on security requirements in the revised Communications Act 2003, Feb. 2012

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New Business Models



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ITU-T Focus Group on Future Networks

- Definition:

Future Network (FN) is a network which is able to provide revolutionary services, capabilities, and facilities that are hard to provide using existing network technologies. Note: FN provides mechanisms that benefit every participant as much as they contribute. It will be studied based on clean-slate approaches.
- Identified Core Areas in Vision Document
 - Network Virtualization
 - Energy Saving of Networks
 - In-system Network Management
 - ID
 - Mobility
 - Self-optimization Network

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Identified Recommendations for Future NW

Recommendation	Title
Y.amnsa	Requirements and Architectural Framework for Auto Manageable Future Networks and Services
Y.FNsdn	Framework of software-defined networking for Future Networks
Y.FNsdn-fm	Requirements of formal specification and verification methods for software-defined networking
Y.FNvirtreq	Requirement of network virtualization for Future Network
Y.FNDAN	Framework of Data Aware Networking for Future Networks

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Thank You!
Mucho Gracias!

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