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ETSI

World Class Standards

ETSI ISG IP6, 5G AND IOT

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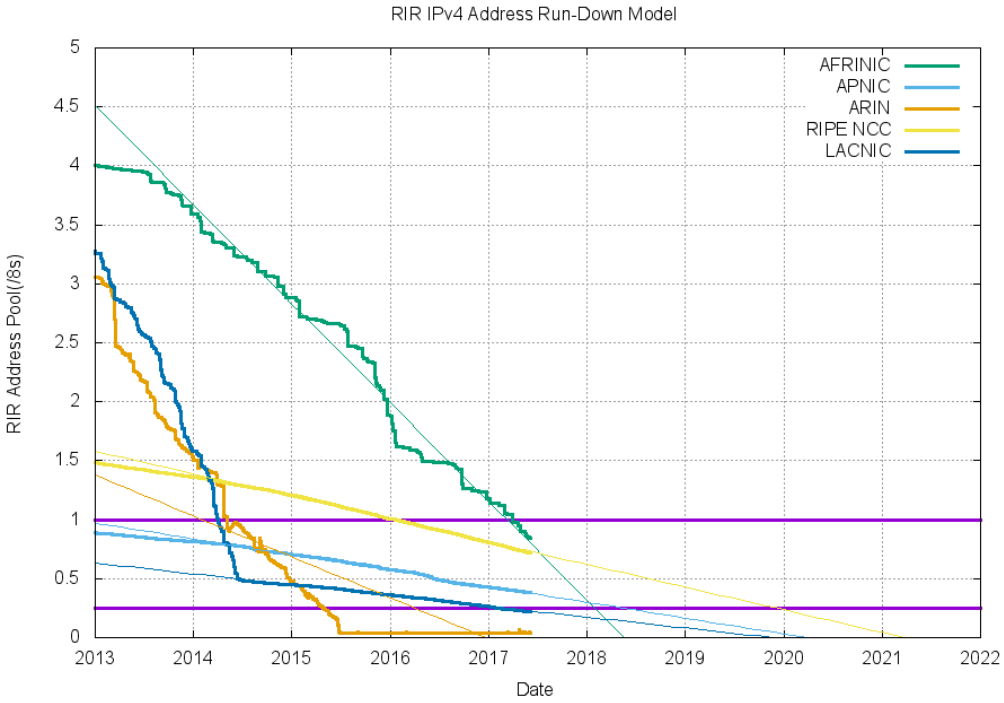
Motivation for ETSI ISG IP6



IANA Unallocated Address Pool Exhaustion: 03-Feb-2011

IPv4 Exhaustion		Remaining /8
APNIC	Apr 19, 2011	0.3815
RIPE NCC	Sep 14, 2012	0.7166
LACNIC	Jun 10, 2014	0.2185
ARIN	**Sep 24, 2015**	**0**
AfriNIC	Jun 12, 2018	0.8426

Source: http://www.potaroo.net/tools/ipv4/
Date: 04 June 2017

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Motivation for ETSI ISG IP6

- Without public IP addresses, the Internet sustainability and growth potential would be greatly reduced
- Designing solutions on IPv4/NAT, is equivalent to building non-scalable and non-end to end solutions
- Transition to IPv6 is challenging

Implementation is Complex

Must co-exist with IPv4.

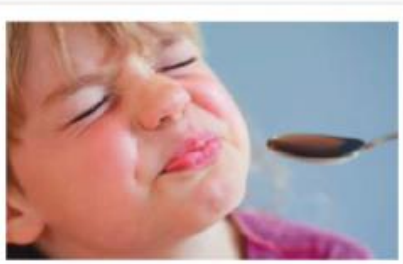
Cost Is High

Networks must be upgraded.

Lack of Native Apps

Now only a solution to running out.

End User Experience Has Not Been Great



Due to lack of native apps.

Initiation and Activities in ETSI ISG IP6

- IPv6 has not resonated very well with industry primarily due to the lack of the business case needed to commit investment and resources to do the upgrade:
  - However, Internet has become a worldwide critical infrastructure and its upgrade is of paramount importance to keep Internet growing; more specifically to cater for the new technologies that will adopt it such as IoT, Cloud Computing and 5G
  - ETSI ISG IP6 was initiated in April 2015 and defined best practices, garnered support and created awareness of the impact of IPv6 on critical infrastructure and on emerging topics such as Cloud Computing, IoT (Internet of Things), SDN/NFV (Software Defined Networking/Network Function Virtualization) and 5G;
    - Other issues addressed include IPv6 over Time-Slotted Channel Hopping (6TiSCH) technology, privacy and security
    - Expected to extend the ETSI ISG IP6 lifetime with 2 more years in order to address in more depth topics related to e.g., 5G and deterministic networking

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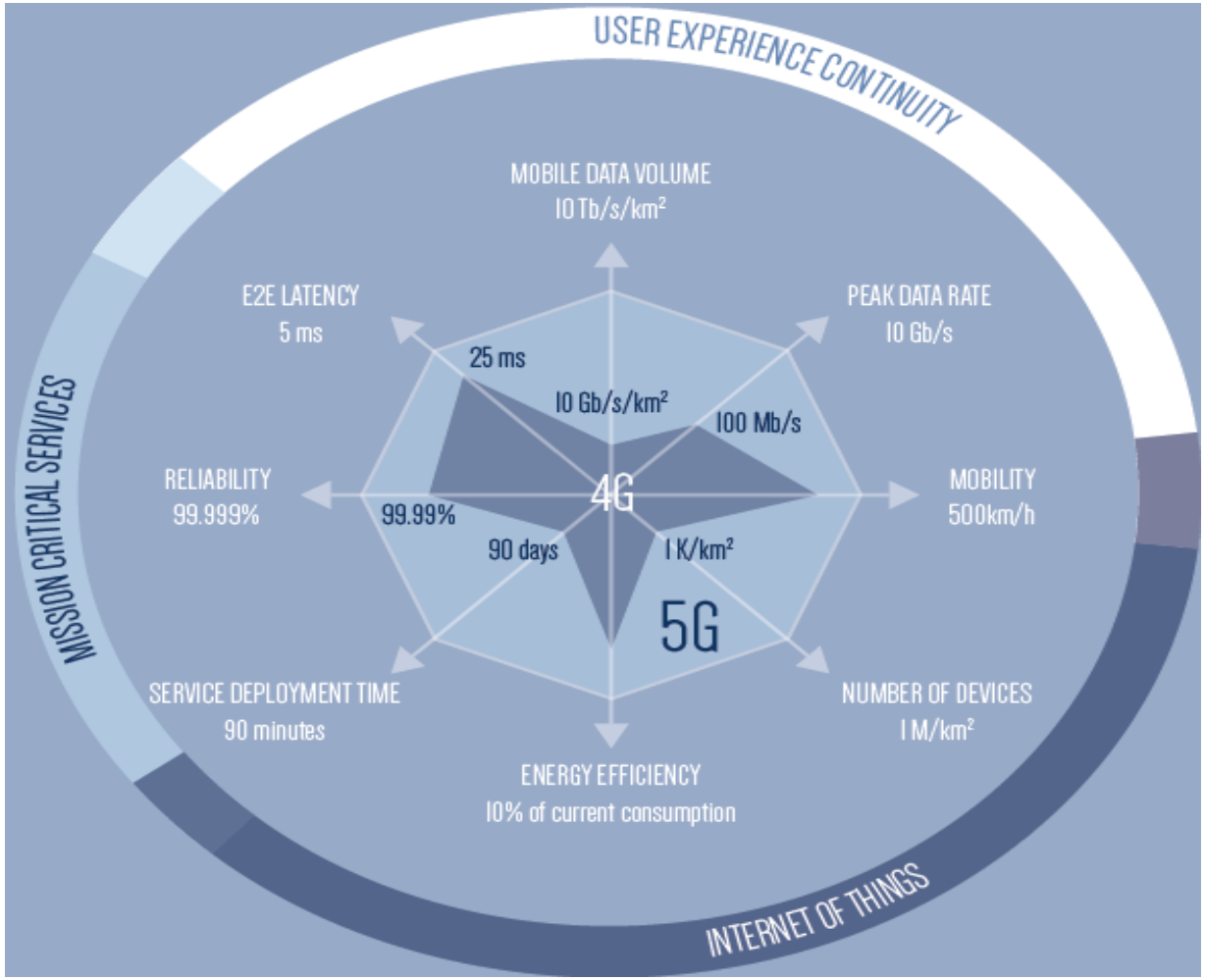
5G Key Drivers and Disruptive Capabilities



Source: 5GPPP White paper

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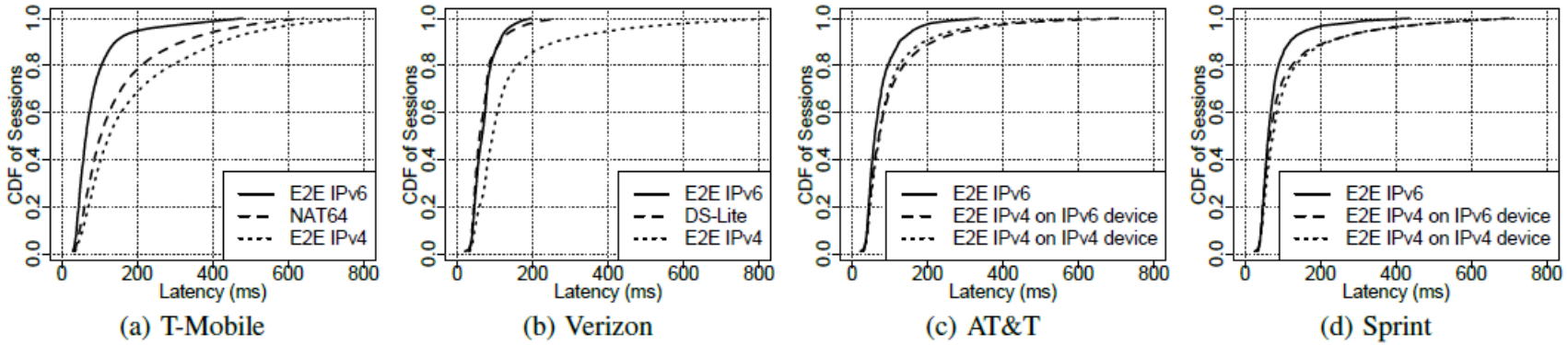
Example of Mobile Web performance improvement using IPv6



Mobile Web RTT distribution for different cellular carriers in the USA

Source: ACM MobiCom'16,
https://www.moritzsteiner.de/papers/Mobicom_IPv6.pdf

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5G and IoT

- 5G mobile networks will change our society by opening up telecom ecosystem to vertical industries
- 5G will help vertical industries to achieve the “Internet of Things” (IoT) vision of ubiquitously connected, highly reliable, ultra-low latency services for massive number of devices:
  - Extensive studies have shown that IoT requires support for a diverse range of service types, such as eHealth, Internet of Vehicles (IoV), smart households, industrial control, environment monitoring
  - Expected that these services will drive the rapid growth of IoT and facilitate hundreds of billions of devices to connect to the network, which also conceives the IoT vision especially from vertical industries

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5G and IoT

Example of Taking Advantage of IPv6 Network Services when deploying IoT in Smart Grids

Network Services	Layers and Services	Benefits
Unique device's addressing (Network Layer)	From IPv4 (32-bit address space, now deprecated at IANA) to IPv6 (128-bit address space), including multiple scopes (global, private, link)	Large address space able to cope with the IoT evolution. Private or public infrastructure
Address auto-configuration (Network Layer)	Manual (IPv4/IPv6), stateless (IPv6) and stateful (DHCP for IPv4 and IPv6), Prefix Delegation (DHCPv6 PD)	Centralized or distributed address management. Additional DHCP options Zero Touch Provisioning
Media independency (PHY & MAC layers)	IEEE 802.3 Ethernet, IEEE 802.11 Wi-Fi, IEEE 802.16 WiMAX, IEEE 802.15.4g/e RF 6LoWPAN, IEEE 1901.2 NB-PLC 6LoWPAN Serial, ATM, FR, SONET/SDH	Media diversity for local and backhaul communications Smooth evolution over long lifetime period **Note:** IPv6/6LoWPAN is the only IP protocol version defined for IEEE 802.15.4g/e and 1901.2.
Routing (Network Layer)	Static, RIP, OSPF, E-IGRP, IS-IS, MP-BGP, RPL (IPv6 only)	Dynamic reactivity to communication and network device failures. Scalability of deployment
Data Integrity and Confidentiality, Privacy (all layers)	Layer-2 (MAC specific), Layer-3 (IPSec IPv4/IPv6), Layer-4 (TCP/TLS, UDP/DTLS) and Layer-7 (application dependent authentication & Encryption) Packet filtering, Deep packet inspection (DPI), Intrusion Detection Service (IDS), Flow monitoring	Multi layered secure networking
Multicast (Network layer)	IPv4/IPv6 multicast protocols: IGMP/MLD, PIM, MP-BGP	Scalable software upgrade, group commands
Quality of Services (QoS)	Specific MAC layers Class of Services (CoS), i.e. Ethernet, WiMAX IPv4/IPv6 QoS Differentiated Services architecture	Multi services field area networks Prioritization of data traffic Service Level Agreement
Network Segmentation and isolation	Virtual Private Networks (Layer-3), i.e. IPSec VPN, VRF-Lite	Shared infrastructures but dedicated and isolated traffic paths for critical applications
Time Distribution	Layer-3, i.e. Network Time Protocol version 4 (NTPv4)	Secure NTP4 for both IPv4 and IPv6
Management	DNS, IPFix, SNMP, CoAP, SSH, Telnet, XML/Netconf, etc.	Push and Pull management models Scalable end-point management

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