Spotlight on All-IP Transition: New Wireless Opportunities

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Tuesday, November 18, 2014
11:00 a.m. - 12:00 p.m. EST

Agenda

- **What is the current state of our networks in terms of progress toward All-IP?**
  - FCC Technological Advisory Council (TAC) on Supporting the Transition to IP Working Group; its findings and recommendations
- **What public switched telephone network (PSTN) services are being transitioned to wireless?**
  - General Services
  - Emergency Services
- **What new services/capabilities will be offered in the next five years as carriers continue their LTE deployment?**
  - New Services on LTE for Public Safety
  - 5G
- **Q&A**

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- For decades, the PSTN has had such dominant penetration (>80%) in U.S. households and businesses that it is de facto one of our national "systems of record" for achieving social and economic goals related to communication.
- Our population is quickly migrating to voice services (e.g., 4G LTE, VoIP, Skype, etc.) that are not part of the traditional PSTN, thus negating the assumption that the current system of PSTN regulation and subsidy can continue to support our social and economic needs as a nation.

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- When we talk about sun-setting the PSTN we are talking about:
  (a) the orderly transition from the PSTN's role as a "system of record" for achieving key national goals; and
  (b) the identification of and migration to alternative mechanisms of achieving the subset of those goals that remain important to our society and economy. This may or may not lead to the withdrawal of specific PSTN technologies and/or services.
- Findings/Summary:
  - Transition from wireline is already happening;
  - Cost to maintain PSTN will become excessive on a per user basis;
  - Universal Service is replaced with multiple technologies; and
  - Certain social objectives remain valid.

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- Copper Retirement (Re-Use)
  - Copper “replacement or transition”/retirement is premature.
  - Many services require copper: Alarm/security circuits, elevator phones, ringdown circuits, etc.
  - Transition will take place over time.
- PSTN User Impacts
  - Sunset Services
    - This set of services leverage outdated technology and are being/or have been replaced by alternate mechanisms that provide superior capability.
  - Transitional Services
    - Due to market penetration, this set of services will require strategies for ongoing support until such time as it makes commercial sense to transition.
  - Successor Network Services
    - Services definitively supported in successor networks driven by regulatory, social policy, or market.

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- Interconnection
  - Detailed matrix of technical issues that need to be worked out for an IP interconnection framework, the entities that would need to be involved in each aspect, and thoughts on possible technical solutions.
- Database Transition
  - Ensure consistency in privacy policies between PSTN and IP spheres to minimize impact on end users.
  - Define a timeline covering both the transition phase and the early stages of the All-IP successor network for industry players with which to comply.
  - Promote the standardization for common interfaces/capabilities that ensure service transparency to end users that depend on these databases.

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- Numbering (User/Service/App Identifiers)
- Quality of Service
  - Even with exacting standards, varying architectures and network topologies make comparing QoS among two carrier networks between the same endpoints very difficult and sometimes misleading.
  - If we assume use of the public internet as the transport medium, QoS Service Level Agreements (SLAs) are not currently possible, but even so, “best effort” provides acceptable quality for most users.
  - If we assume the use of privately managed dedicated facilities, then TDM-like levels of QoS SLAs are possible, not guaranteed.
- Robustness and Public Safety

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- Emergency Services - Requirements for Successor Network
- In this context, “Emergency Services” is defined as:
  - Citizen-to-Authority
  - Next Generation 9-1-1, Multimedia Emergency Services (MMES)
  - Authority-to-Citizen
  - Next Generation Alerting
  - Authority-to-Authority
  - Next Generation Network Government Emergency Telecommunications Service (NGN GETS)

General Services Being Transitioned

- Core of the new IP-based networks will be the next generation Central Office (CO), which will provide converged services to larger populations of customers across wider geographic areas.
- Circuit switches and their associated line-side equipment will be superseded by IP-based technology.
- This new equipment will support voice, data, and video in a unified architecture and will enable service providers to offer customers new, enhanced, and integrated services.
- These next generation COs may require less space, power, and environmental support than most of the individual traditional COs they will replace. At the same time, their deployment will impact vital operational areas such as network management and emergency services.

General Services Being Transitioned

- Consumer POTS (Plain Old Telephone Service)
  - Including Supplementary Service Support:
    - Multiparty Voice Conferencing
    - Voice Call Waiting
    - Voice Call Hold
    - Voice Call Forward
    - Voice Call Barring
  - Transition to wireless home phone (WHP).
- Small business services
  - Transition to wireless business phone (WBP).
- WHP/WBP services will be enhanced to address 911 location accuracy requirements.
- Will include the ability to interface with home alarm systems, medical monitoring devices, fax machines, and credit card processing.

General Services Being Transitioned

- To carry voice, the G.711 codec was developed to transmit the audio signal over 64kb circuit switched lines.
  - However, CPE has evolved to make use of this transmission capability for transferring things other than voice.
- Alternative codecs exist which are either more efficient for voice or have higher quality voice or provide different types of media
  - Many of these codecs are optimized for voice, however, they are not guaranteed to work with CPE (e.g., fax, modem, Point of Sale, etc.) that assumes clear channel G.711 audio encoding.
  - Alternative mechanisms already exist for support of data applications, but these are typically not compatible with existing CPE.

General Services Being Transitioned

- Carrier-provided line power for CPE connected to voice lines.
  - It is expected that most future CPE will be digital and that the signals transmitted are digital in nature.
  - In general a separate power source is required to power the device.
    - Battery backups and uninterruptible power supplies can be used to provide power temporarily in times of power outages.
    - However, in some cases (e.g., for people with disabilities) the enhanced reliability associated with network power is seen as an important attribute. This will need to be considered moving forward.

General Services Being Transitioned

- Accessibility
  - Range of capabilities, including Telecommunications Relay Service (TRS) (http://www.fcc.gov/guides/telecommunications-relay-service-trs)
  - TRS has many variations (Text-to-Voice, Video Relay Service, IP Relay Service, etc.)
  - PSTN in Transition can generally support existing requirements, but in a few cases additional network support may still be required.
    - Potential to enhance user experience by embracing and extending existing capabilities

General Services Being Transitioned

- Number Portability
  - PSTN in Transition can generally support existing requirements.
  - Technology trends could allow number portability to be extended even further than today, but does not require that it be extended.
- Calling Party ID
  - Rules in place for voice, and being extended to interconnected VoIP.

General Services Being Transitioned

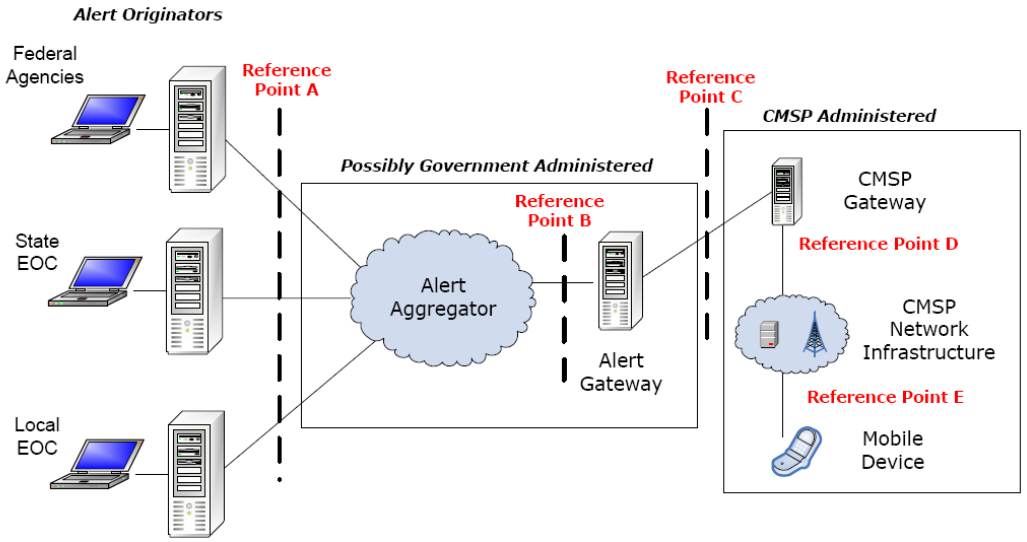
- Privacy and Security
  - PSTN:
    - Range of capabilities that support user privacy and security.
    - Caller ID restriction, anonymous call rejection, malicious call trace, etc.
    - Calling party information included in signaling (being extended to interconnected VoIP).
    - Truth in Caller ID Act [FCC 11-100]. Limitations on coverage today.
  - PSTN in Transition:
    - Existing capabilities remain important.
    - New mechanisms likely required (e.g., to deal with VoIP spam).
    - Presence and location are important new capabilities of the PSTN in Transition (and target network).
    - Significant security and privacy implications.
    - Application of existing capabilities to new services, and the implications of new capabilities such as presence, warrant further analysis.
    - Calling party ID applied to interconnected VoIP is now required.

Emergency Services Being Transitioned Citizen-to-Authorities

- ATIS has completed:
  - Standardization of IMS originating calls to an Emergency Services IP network (ESInet) and Legacy Selective Router (SR).
  - A joint standard with TIA to develop the first U.S. SMS Text to 9-1-1 standards solution (J-STD-110) in March 2013.
    - In support of the transition to an All-IP network, ATIS is developing solutions for Multimedia Emergency Services (MMES: beyond just text) and the evolution to NG9-1-1.
- ATIS is working on:
  - An IMS911 service architecture to map the IMS functional components and functions into NENA's i3 ESInet.
  - Support of location conveyance to Over-The-Top (OTT) Services for emergency services.

Emergency Services Being Transitioned Authorities-to-Citizens

- ATIS has completed multiple Commercial Mobile Alert System (CMAS) deliverables (also known as Wireless Emergency Alerts (WEAs)) that utilizes efficient broadcast technology.
  - Delivers alerts issued by the President, those involving immediate threats to safety/life, and AMBER alerts (missing people).
  - Currently developing CMAS standards in support of international roaming and Canadian requirements.
  - Aligned with 3GPP specifications.
  - An example of the results of this effort is available in this news story.



Emergency Services Being Transitioned Authorities-to-Authorities

- Active work items include:
  - A joint effort led by ATIS to develop solutions necessary for the interconnection of Land Mobile Radio (LMR) and LTE networks.
  - LTE and IMS Priority Parameters for Supporting National Security/Emergency Preparedness (NS/EP) Priority Communications.
  - Dynamic Priority for Next Generation Secure Communications.
  - LTE Access Network Security Requirements for NS/EP NGN Priority Services.
  - Evolved Packet Core (EPC) Call Flows for NGN GETS (ETS).
  - Public Safety-Related Applications (PSRA) Task Force, which has developed a preliminary view of the current environment and its challenges.

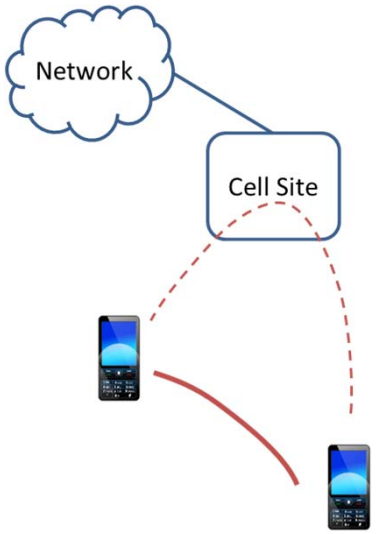
New Services on LTE for Public Safety

- Background
  - ATIS is a member of the National Public Safety Telecommunications Council (NPSTC) and is supporting public safety mission critical voice requirements for the 700 MHz LTE broadband networks via modifications to existing and development of new 3GPP and ATIS standards.
  - ATIS' objective is to ensure a global standard is developed by a global organization to fulfill Public Safety requirements of countries around the globe.
  - Since ATIS is the North American (NA) Partner to 3GPP, the main focus has been to ensure that the NA requirements are considered in 3GPP.

New Services on LTE for Public Safety

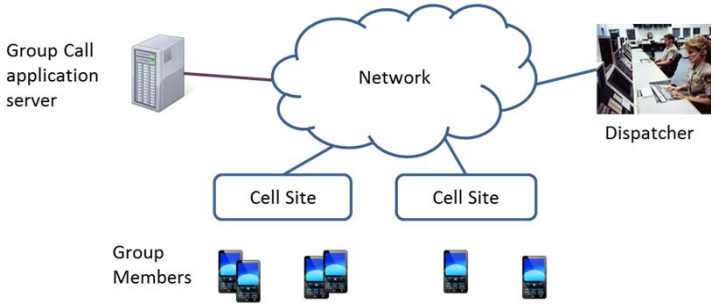
- Mission Critical Push to Talk (MCPTT)
  - Requirements are almost complete in 3GPP SA1.
  - A new 3GPP “Mission Critical Applications” group has recently been created (SA6).
  - Work has started in other 3GPP WGs.

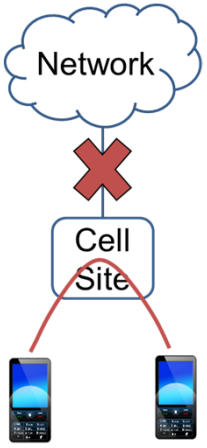
- Proximity-based Services (ProSe)
  - Enable devices to detect other devices in proximity and allows devices in proximity to communicate directly.
  - Enable communication without network coverage.
  - Reduce network load.
  - Increase capacity in given bandwidth.



New Services on LTE for Public Safety

- Group Communication Enablers
  - Enable efficient group communication.
  - Dynamic groups with mobile users and dispatchers.
  - Support for large groups (perhaps up to 5000).
  - Service continuity for transitions between unicast and multicast bearers.
- Isolated E-UTRAN operation
  - For “nomadic” eNodeBs operating without backhaul connectivity.
  - For “regular” eNodeBs experiencing temporary loss of backhaul connectivity.





5G

- The buzz in the industry on “5G” has recently seen a sharp increase, with attention now being focused on establishing the operator view of the enablers for a connected society in the 2020 and beyond timeframe.
  - Supporting new use cases in the connected society.
  - Supporting new business models.
  - Empowering the customers’ value proposition.
- 5G is expected to encompass both enhancements to the LTE-Advanced radio and core ecosystems, as well as new radio interface technologies, system architectures, and core network concepts.
- A high level industry time plan for bringing 5G to realization in 2020 has already been established.
- 5G must incorporate a flexible ubiquitous wireless ecosystem that provides significantly higher levels of capability and performance in a wide range of environments, serving a diverse customer base, ranging from the internet of things to sophisticated smart devices, for significantly lower capital and operating cost.

5G Has Many Facets

5G is viewed as a new ecosystem from end-to-end, harnessing both evolutionary as well as revolutionary technologies to:

- Expand capabilities, performance, and availability of mobile broadband for always-connected people and devices including the all-encompassing “Internet of Things”.
- Leverage enhancements to the LTE-Advanced radio and core ecosystems as well as new radio interface technologies, system architectures, and core network concepts.
- Utilize all spectrum types - licensed, unlicensed and shared access, in existing and new radio bands with ultra-narrow and ultra-wideband channel operation.
- Employ architecture concepts aligned with virtualization and flexibility, utilizing concepts such as Software Defined Networking (SDN), Cloud Computing and Network Function Virtualization (NFV).
- Address deployment and operating cost.

5G Has Many Facets

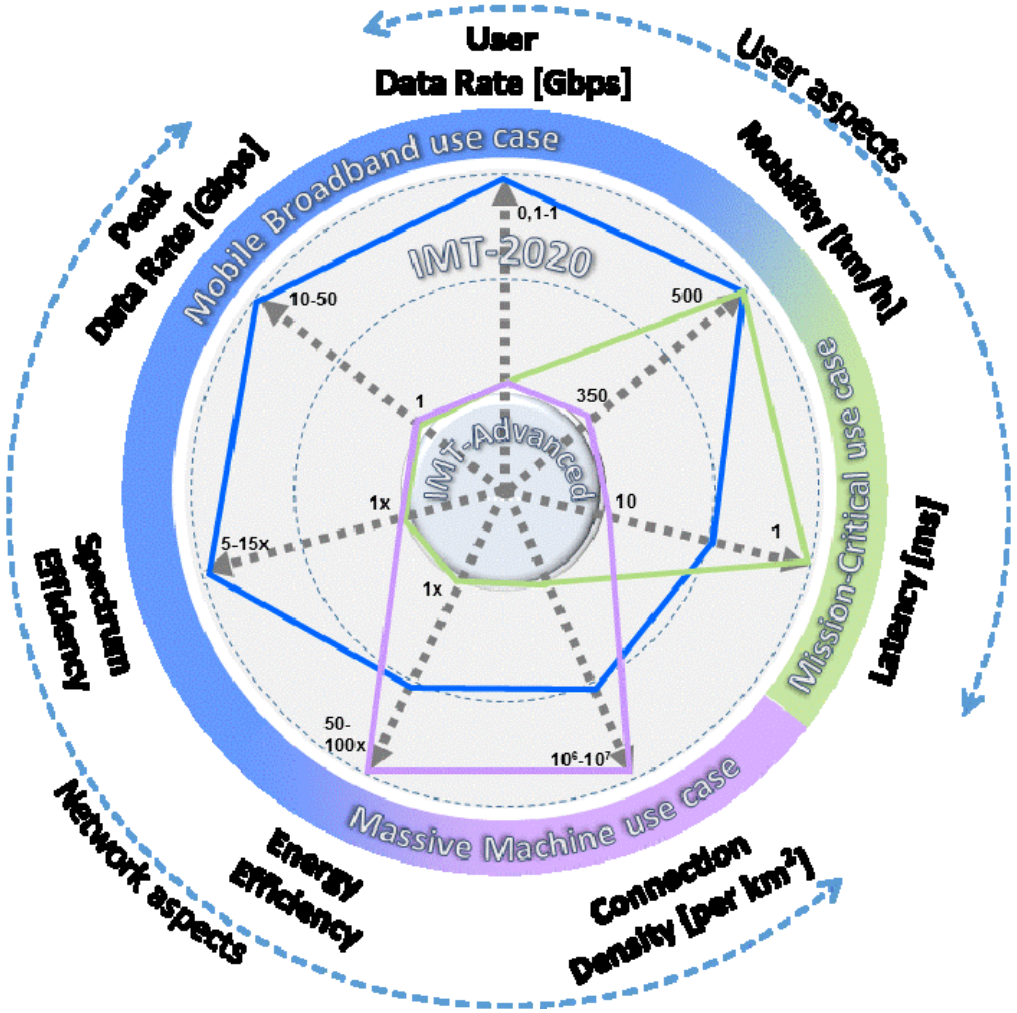
Some evolutionary technologies in play:

- These are expected to be developed before 2020 in upcoming 3GPP releases building on LTE and core network technology.
  - Device to Device Communications
  - Higher order MIMO, Carrier Aggregation
  - SDN, NFV
  - Network efficiencies for IoT/M2M

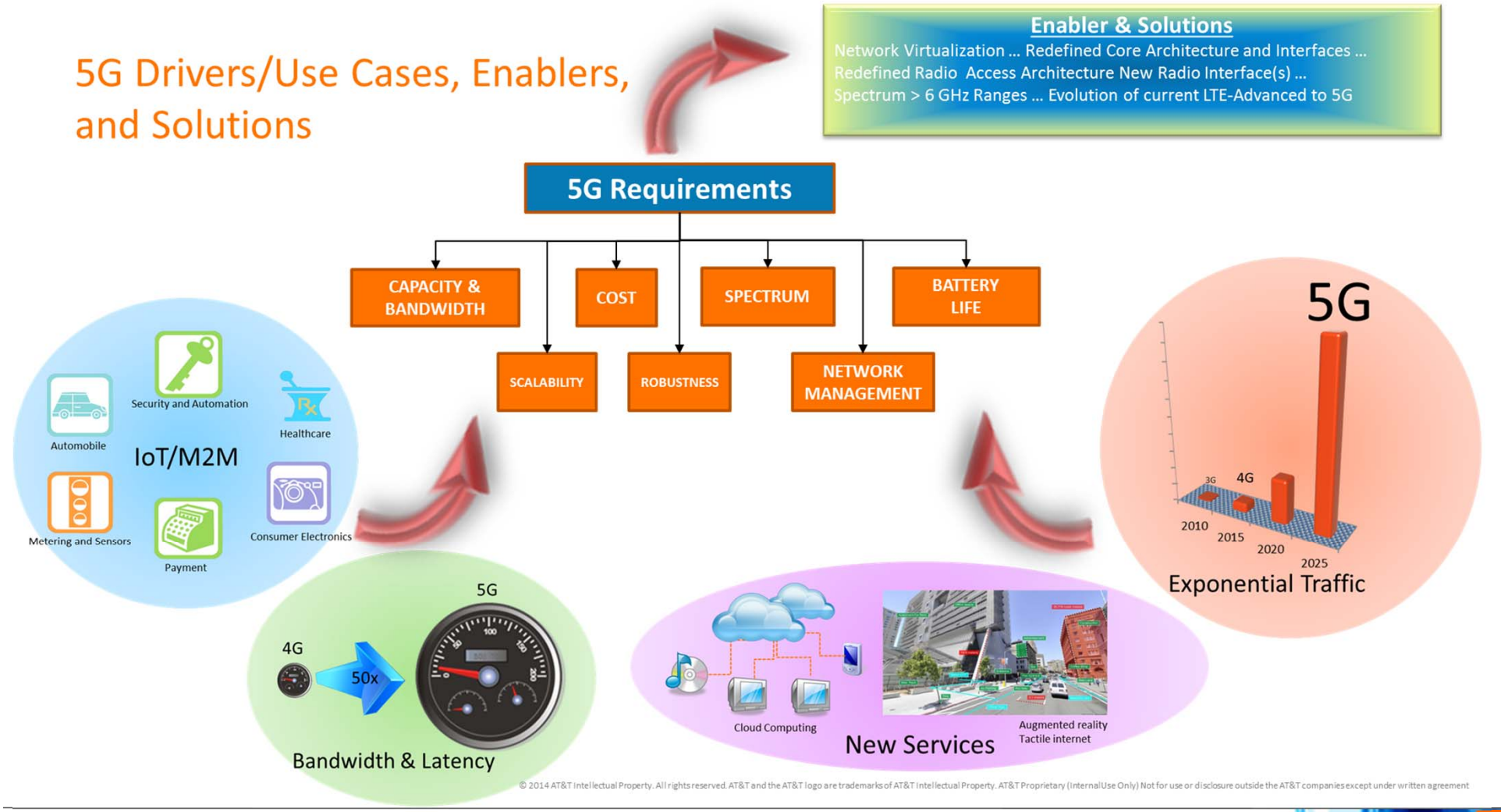
Some revolutionary technologies now in research:

- Complete re-architecture of the core network
- Harnessing Millimeter (MM) Wave spectrum
- Massive MIMO

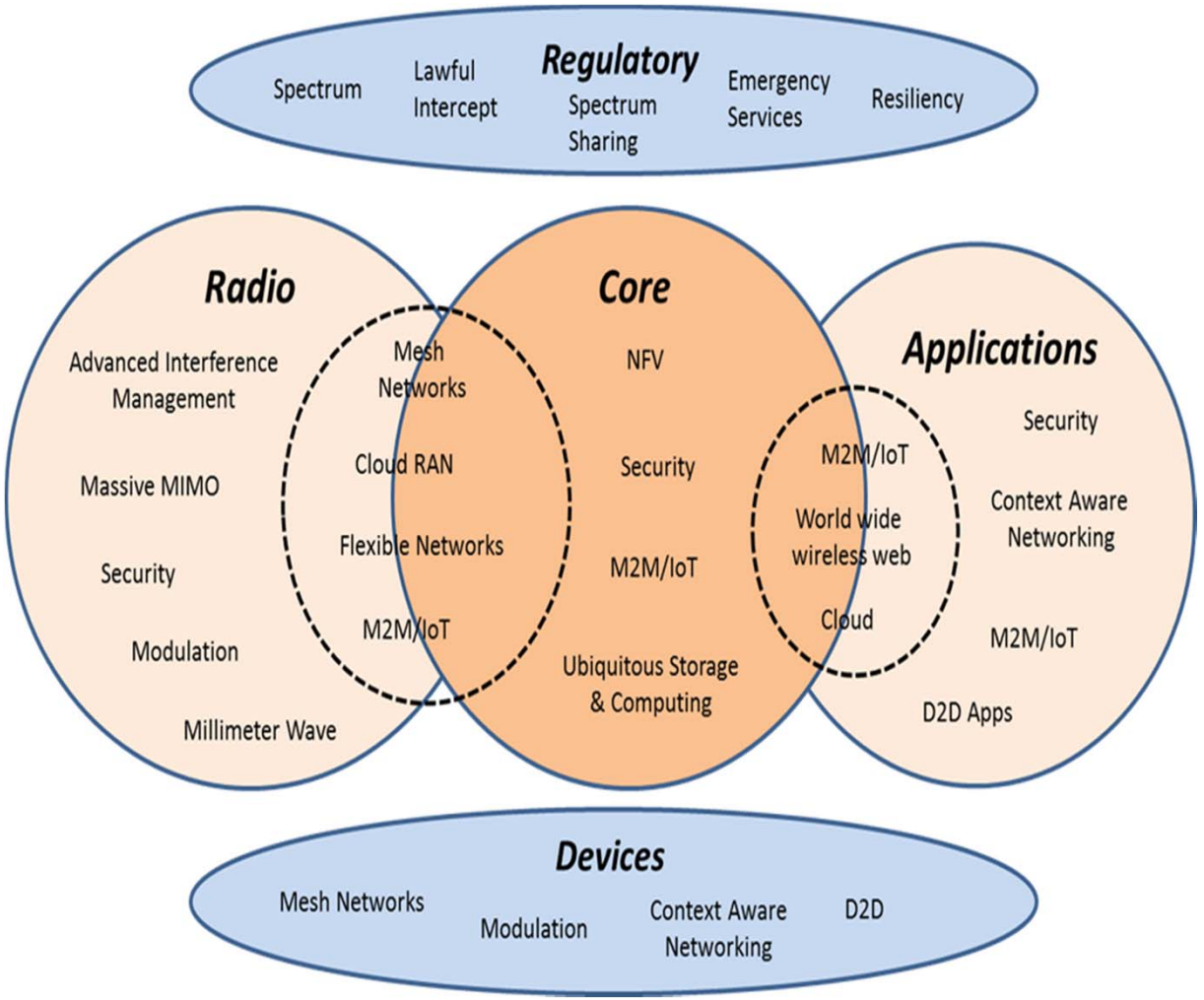
Key Drivers for 5G



5G Drivers/Use Cases

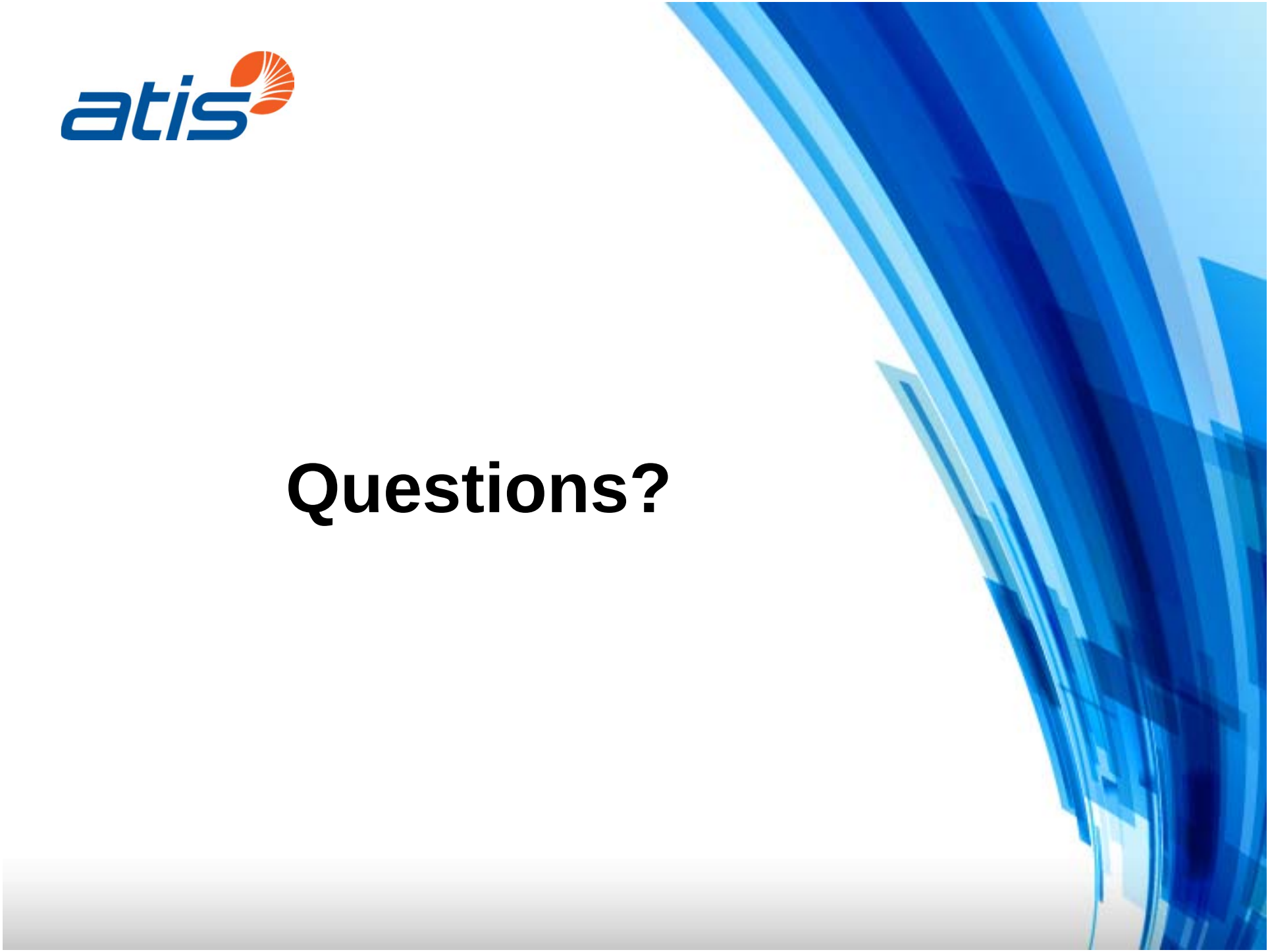


End-to-End Ecosystem View



Summary

- Transition from wireline is already underway.
  - General Services as well as Emergency Services are being transitioned.
  - As it continues to unfold, a wide array of services and systems will be impacted.
- An All-IP system enables new services.
- In the longer term, a combination of advanced radio access technologies and evolution in the core network will drive even newer use cases.
- ATIS will continue to be part of the All-IP transition, resulting in an enhanced user experience.


Questions?

Thank you for attending
Spotlight on All-IP Transition: New Wireless Opportunities

All registered attendees will receive a follow up email containing links to a recording and the slides from this presentation. For information on other upcoming ATIS events, visit www.atis.org/events

Our next webinar will be held on:
Thursday, December 11 from 1:00-2:00 pm EST
Spotlight on the All-IP Transition: The Numbering Impacts

Supplemental Material

Key Drivers for 5G – Categories for Requirements (per slide 25)

Higher Speeds and Capacity

- The next leap: 10-1000 times LTE-Advanced; Lower Cost.
- Achieve Big Gains – even at the expense of backward compatibility.
- Achieve a major decrease in cost per Gigabyte and cost per connection.
- Handle massive data volumes with much lower latencies than 4G.
- Be capable of utilizing existing cellular spectrum and new spectrum efficiently – including MM wave.

Internet of Things/Machine Centric Focus

- Support connectivity to massively larger number of low-cost, low-power, simple devices and device types in the "Internet of Things".
- Devices with widely varying degrees of data rates, latency, mobility, and reliability requirement.
- Ultra-low latency will be a "big" new requirement for a certain class of applications.

Robustness and Resiliency must be built into the fabric of the network

- To address specialized and mission critical applications (e.g., public safety services, health care).

Key Drivers for 5G – Categories for Requirements (per slide 25)

Leaps in Network Architecture, and Device Technologies

- New ways to deal with mobility management in the wake of ultra dense networks and massively large numbers of not-very-mobile devices in the Internet of Things *(Mobility-on-Demand).*
- Addresses cross layer enhanced QoS capabilities and management.
- Support multi-radio access technology networks efficiently and effectively.
- Support indoor and outdoor location determination with high precision and cost effectiveness.
- Virtualization and Software Defined Networks must be the norm.
- Etc.

Sustainability

- Massively large numbers of low power, low cost devices.
- Dense networks with massively larger numbers of “cells” – pervasive use of green technologies.