Fifth ITU Workshop on Network 2030

Geneva, Switzerland, 14 – 16 Oct 2019

Session 1: Keynote Session 1- Self-Driving Networks

Takeaways and Conclusions

1. Self-Driving Networks can be as disruptive to networking as self-driving cars can be to the automotive industry
2. Free up people from mundane tasks to work on a higher level, unleashing creation of new services while enabling greater network security
3. Need to transition through multiple stages – current state-of-the art is at stage 2 or 3 of 5
4. Machine Learning, Telemetry, Intent, and Rule-Based systems will all likely be part of a solution
5. One barrier is instinctive hesitation to give up control – needs to occur gradually to gain confidence and earn user's trust

Suggestions to FG NET2030

- ❑ Evolve management plane with data and control plane, not as an afterthought – consider management plane and manageability as part of FG NET2030 scope
- ❑ Consider architecture around a version of an OODA control loop – Observe/Orient/Decide/Act
- ❑ Self-managed SLAs for Network 2030 services an important use case to consider

Takeaways and Conclusions

1. We need to pay attention to ML5G work for 5G access network to see if we can use their work for the Access Network in our architecture.
2. We need to look into ETSI ENI specs to see if we can use it in our management architecture.
3. Network Programmability in FGNET2030 has been emphasized. We agree with it.

Takeaways and Conclusions

1. Intent-Based Networking is an important technique to keep abreast of network complexity and scale
2. IBN allows users to define desired outcomes ("what"), not how to reach them
3. Data Center use cases are a good starting point; Functional (De-)Composition is key
4. IETF has started standardization of key concepts
5. Intent-Based Monitoring and Analytics are just as important as configuration activities; graph traversal and telemetry are key for generating actionable insights

Suggestions to FG NET2030

- ❑ Consider IBN as a key component of Network 2030 Management Plane
- ❑ Define what Intent use cases in the context of Network 2030 services and infrastructure (expected to be significantly more complex than Data Center
- ❑ Take entire intent lifecycle into consideration – monitoring compliance with intent once it is defined

Takeaways and Conclusions

1. New IP provide new connecting and capability for Network 2030, which includes deterministic forwarding, interconnection manynets, instinct security.
2. A two-tier 360 video streaming framework with user Field-of-View prediction and prioritized buffer control is proposed to effectively accommodate the dynamics in both network bandwidth and user viewing direction.
3. Holographic media building blocks include packetization, High precondition, qualitative, coordinated. Future media support multi sensory for spatial compute ,teleportation etc.
4. Services and the network are intrinsically linked. Use of BPP need applications aware of BPP's behavior, and construct packets with the correct structure etc.

Suggestions to FG NET2030

- ❑ Consider new IP technologies in network 2030 including the capabilities of deterministic forwarding, interconnection manynets, instinct security, flexible address space.
- ❑ A two-tier 360 video streaming framework with user Field-of-View prediction and prioritized buffer control is proposed to consider in network 2030 technology.
- ❑ Holographic media transport technologies including packetization, High precondition, qualitative, coordinated etc. should to consider in network 2030.
- ❑ Service transport mechanism should aware transportation layer technologies

Takeaways and Conclusions

1. Edge application requires flexible computing scheduling crossing edge cloud
2. Build a computing scheduling solution based on cloud, network and edge deeply collaboration.
3. More base stations are needed to accommodate short range connectivity
4. Higher frequencies do not propagate through walls, as a result, base stations must be installed indoors
5. Spectrum regulation has to enable local frequency licensing for the benefit of different verticals
6. Virtual and micro operators are expected to enter into the 5G market where a virtual operator does not have own infrastructure but has own customer base, and a micro operator (uO) has own infrastructure but not necessarily own customer base.

Takeaways and Conclusions

1. Future network will incorporate AI, all light network, various kinds of network access and lightweight core network equipment.
2. Technologies for ultra high dense and ultra low latency will be realized.
3. THz technologies are becoming mature and will be used for communications. The THz network has several advantages, such as ultra high bandwidth, ultra low latency, cell-less network, etc.

Suggestions to FG NET2030

- ❑ Consider use cases, required technologies, etc. based on these future network direction.
- ❑ Consider future network use cases that assume the realization of ultra high dense network.
- ❑ Consider use cases, required technologies, etc. using a THz network and its advantages.

Takeaways and Conclusions

1. Integration of GEO/LEO satellite communications with emerging terrestrial network systems, such as 5G, can offer multiple benefits to fill 'gaps' that other networks can't fill. These benefits include: coverage in isolated areas; deployment 'on-demand' (e.g. disaster recovery); broadcast to large volume of users; reduce traffic burden from terrestrial networks, and, offering an additional level of resilience.
2. If we are able to integrate networked LEO satellites into Network 2030, then we foresee positive impacts upon: additional connectivity; direct connections to end user devices; edge caching; context aware traffic steering; and, the emergence of new business models.
3. There are challenges to overcome, but progress is being made at pace and is promising.

Suggestions to FG NET2030

- ❑ Consider:
- ❑ How to overcome and incorporate the challenges related to satellite networks to get the most out of the technology to realise the benefits.
- ❑ Costs to benefit ratio and business/use cases for satellite needs to be understood.
- ❑ FG Net2030 architecture should consider the scenarios (such as backhaul-only through to direct UE device access) of integrating LEO satellite networks, accounting for factors such as:
- ❑ Latency; capacity; unified addressing and routing; edge content caching; handover based on predictable constellation behaviours; admission control; and, resource management

Takeaways and Conclusions

1. Convergence in the context of Network 2030 goes beyond 'traditional' telecommunications modalities and technologies, also incorporating IT e.g. AI, ML, cloud, and distributed ledgers/block chain, as building blocks of Network 2030 - an AI and data-driven architecture
2. This enables autonomy, which in turn enables us to generate and extract the maximum value from data (for providers (operations and services) and consumers (use case/applications – such as Digital Twins and IoT)).
3. 'Trust and confidence' in the intelligent and effective use of data is critical, especially for high value, business or safety critical decision making in an increasingly decentralised paradigm. The same trust and confidence is required for algorithms.
4. Potential solutions to create trust include distributed ledgers and blockchain.

Suggestions to FG NET2030

- Consider:
  - How to interconnect decentralised platforms and networks.
  - The lessons learnt from ITU-T FG-DPM
    - Standardisation across data-driven ICT groups. What are the fundamental elements across all groups? E.g. security, privacy, governance, interoperability, trust
    - The interplay of AI, data and networks. What are the distributed data orientated and intelligence defined platforms that will drive Networks of the Future?
  - Better ways of working and communicating across ITU groups in order to:
    - Identify challenging work items ,
    - Remove silos and not re-invent wheels
    - Stimulate related activities to evolve strategic direction and increase contributions
    - Collaborate and cooperate through increased 'Liaison