Setting the Scene

Reference: draft-arkko-arch-virtualization-01

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+ numerous contributors
Starting Point

• There are a number of existing (and evolving) tools

• Virtual networks, network function virtualization, software-defined networking, service chaining, data models, traffic engineering, MPLS, QoS mechanisms, deterministic networking tools, orchestration, service-based architectures, application middleware, data center networking tools, …

• Our day jobs are about building systems out of these lego bricks

• … and we will also be providing “slices” in 5G networks

• Are these the same thing, or different, and if latter, how?
General Goals

• Separation of concerns
  - Providing tailored services
  - Separation (of traffic, security, resources, …)
  - Resource allocation/reservation

• Independent technology evolution

• Ability to benefit from modern IT technology practises (cloud, virtualization, …)

Ok, can this be achieved with what we have? What do we have?
Virtualization, Slicing & Protocols

- **Virtualization does not generally affect TCP/IP or applications**

- **Some exceptions to this**, when assumptions made somewhere are broken due to virtualization, leading to a need to add information to application protocols:
  
  - E.g., early HTTP versions assumed that 1 server = 1 website
  
  - With virtual hosting, modern HTTP versions carry intended web site name inside the protocol
Virtualization & Slicing Tech @ IETF

- **Instance selection** at lower layers

- **Provider-based VPNs**
  - MPLS, L2-3VPN, NVO3, ...
  - Traffic engineering, e.g., TEAS WG

- **Service chaining** — SFC WG’s NSH

- **Management frameworks** — e.g., NETCONF, YANG

- **Data models** — e.g., L2SM, L3SM
Architectural Observations 1

- Trend: **Increasing role of software**
  - In many cases, this replaces the need for protocol mechanisms

- Trend: **Centralization of functions** — makes things easy
  - Still need to work even if the “center" is down

- Observation: **Stark complexity contrast** between selection/packet processing/networking and orchestration/creation/management
  - “Execution Plane” vs. “Creation Plane”

- Example: 5G slice selection ( NSSF selects and redirects to appropriate AMF) vs. actually setting up the slices
Architectural Observations 2

• Question: **Tailored vs. general-purpose networking**; what are the economics of special-purpose treatment and QoS?

  • It is possible that the industry at times gets over-excited about offering everyone added value… there’s also a great economic benefit to bulk

  • Tuning one infrastructure to server multiple different categories of customers is fine, however

• Question: **What needs require something new?**

  • There are plenty of QoS tools, virtualisation platforms, orchestration mechanisms, and data models or other descriptions at varying levels. What’s missing?

• Observation: new systems (like 5G) have specific goals, but ultimately, those **goals are fulfilled through a combination of the current tools and (some) new mechanisms** or enhancements… not through redesigning everything
Architectural Observations 3

• Advice: Think about **data model layering**! E.g., service vs. network/device data models
  
  • May need appropriate tools for different layers
  
  • And there are multiple tools, YANG, Tosca, ...
  
• Advice: Think about what is needed to for a working, **interoperable** system that maps layers of models to each other.
  
  • Merely the models + magic software? Or common software? Or common specification or data that the software can do its magic?
Architectural Observations 4

• Advice: **General over specific** — does it make sense for IETF to do general designs or designs for someone’s specifics requirements at specific time?

  • IETF probably wants to do tools that work across industry as opposed to only for 5G (no matter how important it is)

• Some **terminology and conceptual alignment across industry** would also be useful, e.g., to know what words to use in SLAs…
Some 5G Slicing Use Cases

- Many **simple cases** (QoS, access to specific networks, etc)
  - Existing tools often sufficient for these
- Everything runs on top of virtualisation and cloud platforms
  - Mobile networks running on the same tech as other applications
- One interesting case that demands interest tech is **serving a factory that requires very low-latency network** between its machines
  - May need to build a separate instance of 5G core on site, using virtualisation, cloud, orchestration and other similar tools + hardware on site
Some 5G Slicing Use Cases

• Another interesting case: for <these users>, run a completely new version of 5G core network
  • Important for evolving tech quickly
  • Also useful for using competing suppliers or providers

• Some more demanding cases
  • Have the ability to control resources for a slice in both radio and core network
  • Provision a network (slice) across administrative boundaries
Thoughts for Going Forward

• Consider **all the technology**!
  
  • Virtualization, separation, resources, management & orchestration; in and outside IETF

• Find the **concrete missing things** that still need doing
  
  • Connect the top-down and bottom-up way of thinking

• There are relevant existing and new topics to work on at the IETF:
  
  • **Data model** development — e.g., work on commonly used data models at several layers of abstraction
  
  • End-to-end, heterogeneous networks, **cross-domain**
  
  • How our different pieces fit together
Reading List

• draft-irtf-nfvrg-gaps-network-virtualization
  Good summary of the various technologies, plus a discussion areas that need further development

• RFC 8309
  Service models explained

• draft-geng-coms-architecture
  Architecture view to slicing as an orchestrator function, how slicing relates to NFV, etc.

• draft-netslices-usecases & draft-qiang-coms-use-cases
  Use cases

• draft-wu-model-driven-management-virtualization
  Model drive-management and layered data models

• draft-bryskin-teas-use-cases-sf-aware-topo-model
  Good example of enhancing IETF-based management data models with additional information

• …