Considerations on Network Virtualization and Slicing

draft-arkko-arch-virtualization-01

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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, …

• … we build systems out of these lego bricks
Virtualization & 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 Tech @ IETF

• **Instance selection** at lower layers (@L2, @IETF, …)

• 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
Side-track to 5G & slicing use cases

- Many **simple cases** (QoS etc)

- Everything runs on top of virtualisation and cloud platforms

- 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

- Another interesting case: for <these users>, **run a completely new version of 5G** core network
  - Important for evolving tech
• 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…
Next Steps

• Discuss!
• Connecting the top-down and bottom-up approaches
• Find the **concrete missing things** that still need doing
• Divide work to existing or new WGs…
  • Data model development should be a continued topic @ IETF
  • Heterogeneous networks, cross-domain
• **How our different pieces fit together** should also be a topic
• ...
Reading List

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

- 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

- …