

Exploring the Regulatory Implications of Software Networks

Diego R. Lopez - Telefónica I+D

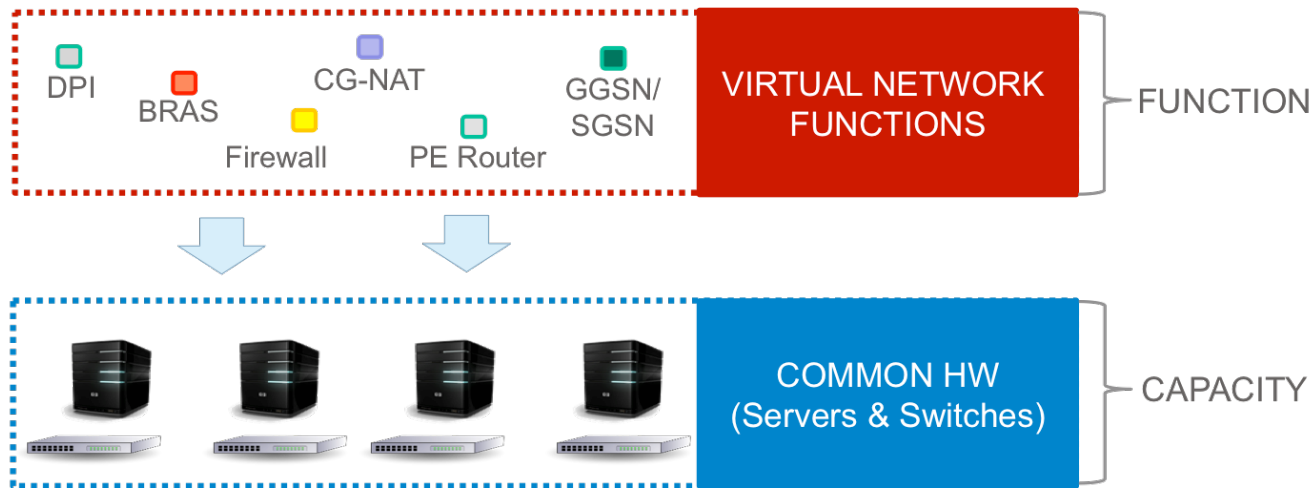
An Initial Disclaimer

- The statements in this presentation reflect the position of the presenter and the Telefónica research team on Software Networks
- While they have been discussed and aligned with several other views within Telefónica, they do not correspond to an official positioning of the company on these matters

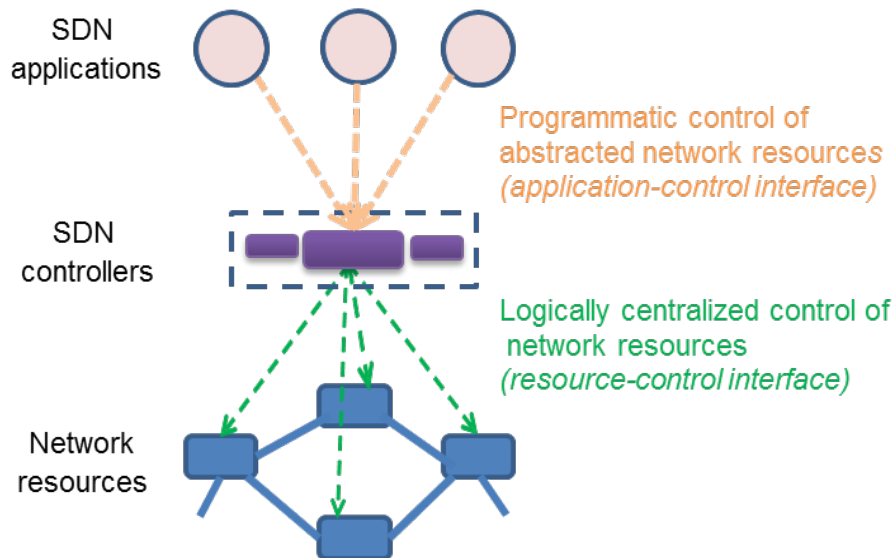
ALL CHARACTERS IN THIS FILM ARE FICTITIOUS,
AND THERE IS NO RESEMBLANCE
TO ANY PERSON LIVING OR DEAD.

ఈ చిత్రంలోని పాత్రలు, సన్నివేశాలు
ఎవరినీ ఉద్దేశించబడినవి కావు.
కేవలం కల్పితాలు

The Concepts



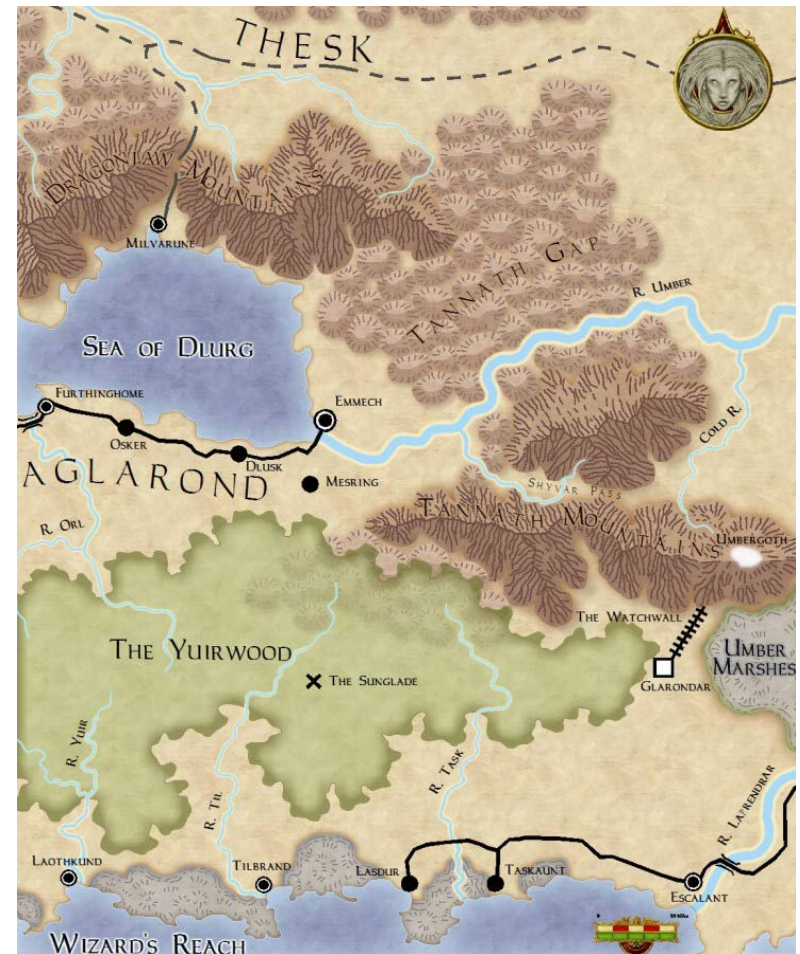
- NFV: Separate functionality from capacity
 - Increase network elasticity
 - Address heterogeneity



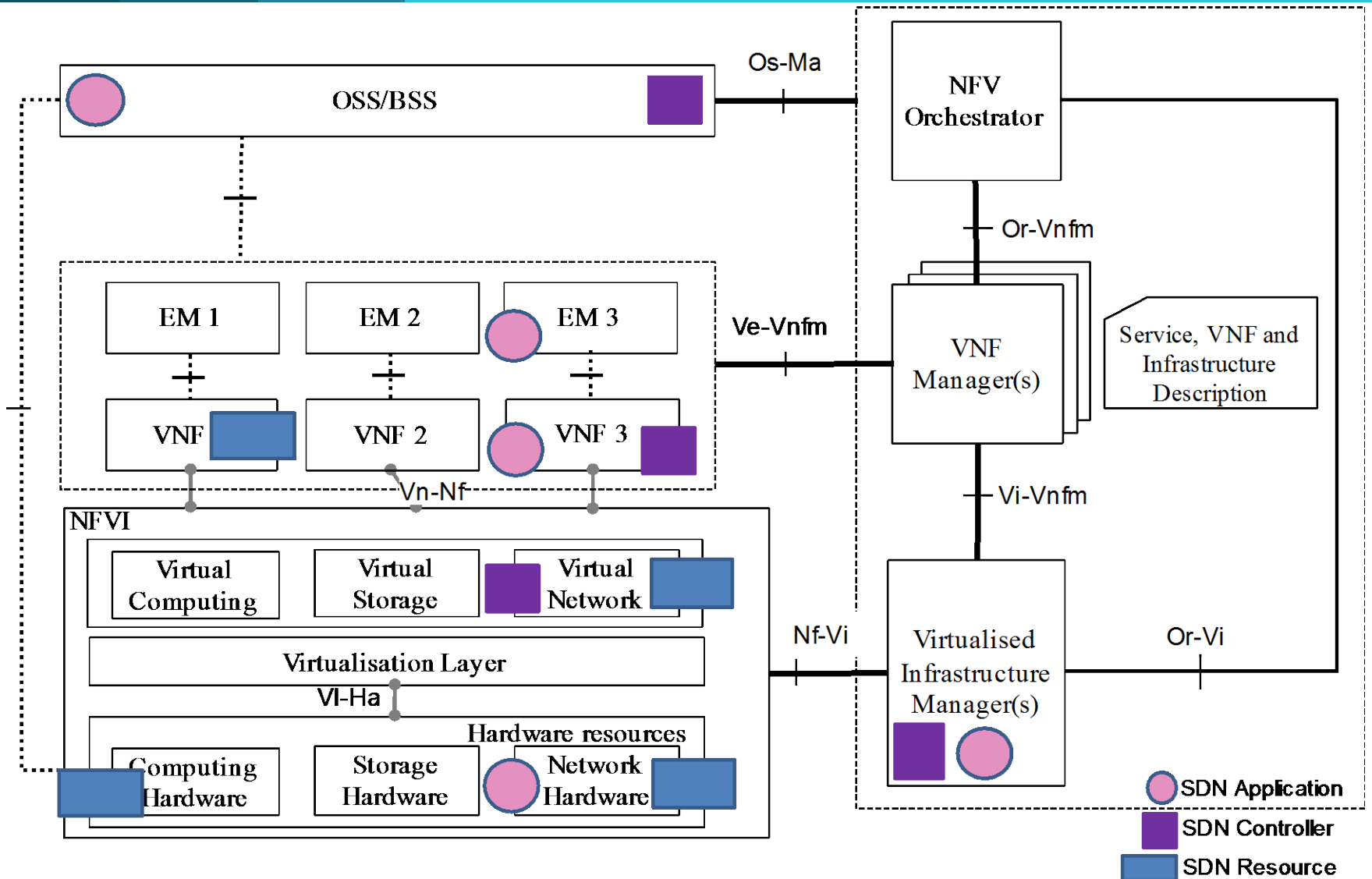
- SDN: Decouple the control and forwarding functions
 - Gain programmability
 - Abstract infrastructure

The Software Networks Realm

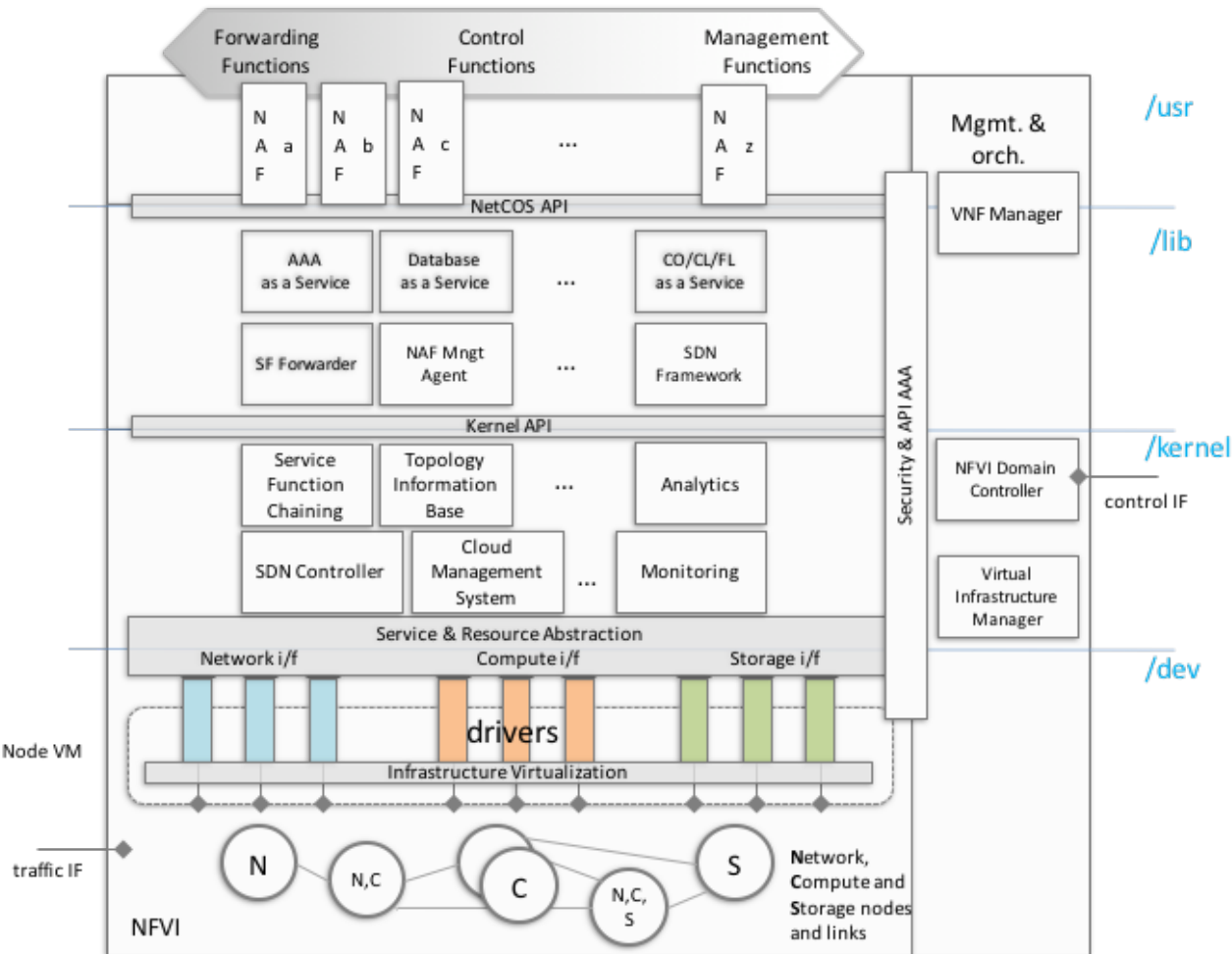
- SDN and NFV are deeply related
 - Though historically separated
- And they require each other in most cases
 - NFV would be extremely difficult to achieve without SDN
 - Most of the SDN use cases are related to NFV
 - What has been recognized by the community
- One single realm
 - Termed “Software Networks” in the 5G PPP



Mapping All Together

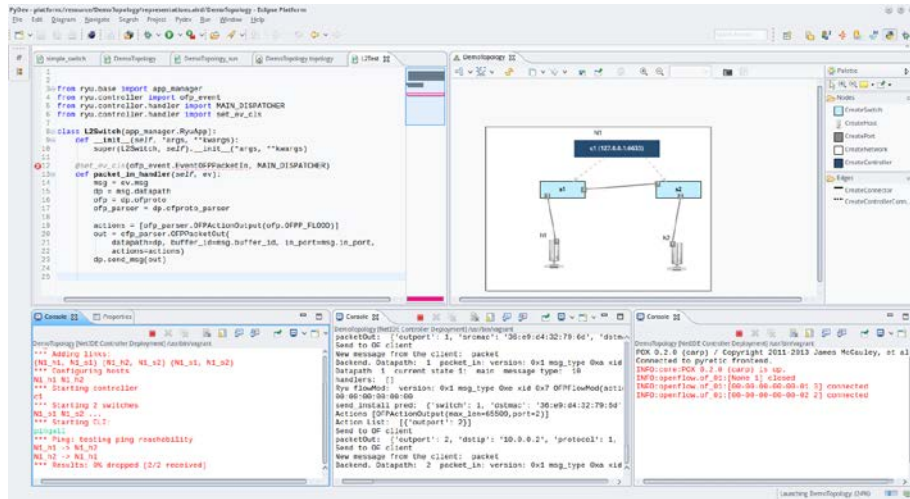


Software Principles

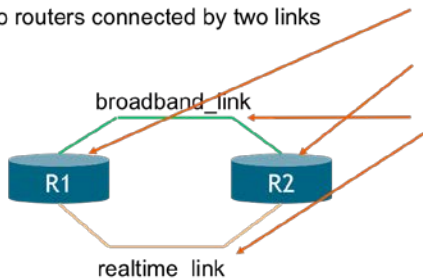


- Software Networks allow for applying IT and software engineering principles to networks
 - Operating system structure
 - Integrated development environments
 - Machine learning
 - APIs
 - DevOps
 - ...
- As a general principle to address the regulatory questions

Intent as a Convergence Path



• Two routers connected by two links



```

Node "R1"
  Type "router"
  NW "1"
  Property "ip_version": 4;

Node "R2"
  Type "router" NW "1"
  Property "ip_version": 4;

Link "broadband_link"
  Type "General"
  EndNodes "R1","R2"
  Property "bandwidth": 40000, "delay":400;

Link "realtime_link"
  Type "General"
  EndNodes "R1","R2"
  Property "bandwidth": 100, "delay": 50;
  
```

- Separate 'what I want to do' from 'how I need to do it'
 - Go a step forward in abstraction
 - Transparent recursion
- A common interface for applications
 - To SDN controllers and NFV MANO stacks
- Integrated development environments
 - Put the human in the loop, as in general software development
 - With a single, integrated entry point
 - Seek for application-network co-design
- Several on-going activities in ETSI, IETF, ODL, ONF...

Welcome to the Continuum

- Think software
 - Multi-language, multi-solution, multi-thread...
 - The human in the loop
- There will be a continuum of solutions
 - As usual in software space
- Consider what is brought by the technologies themselves
 - Additional degrees of freedom
 - Smoother migration paths
 - Shorter timespans
- Consider intent-based interfaces as the next line for convergence
 - Expanding the realm(s)
 - But potentially hard to regulate



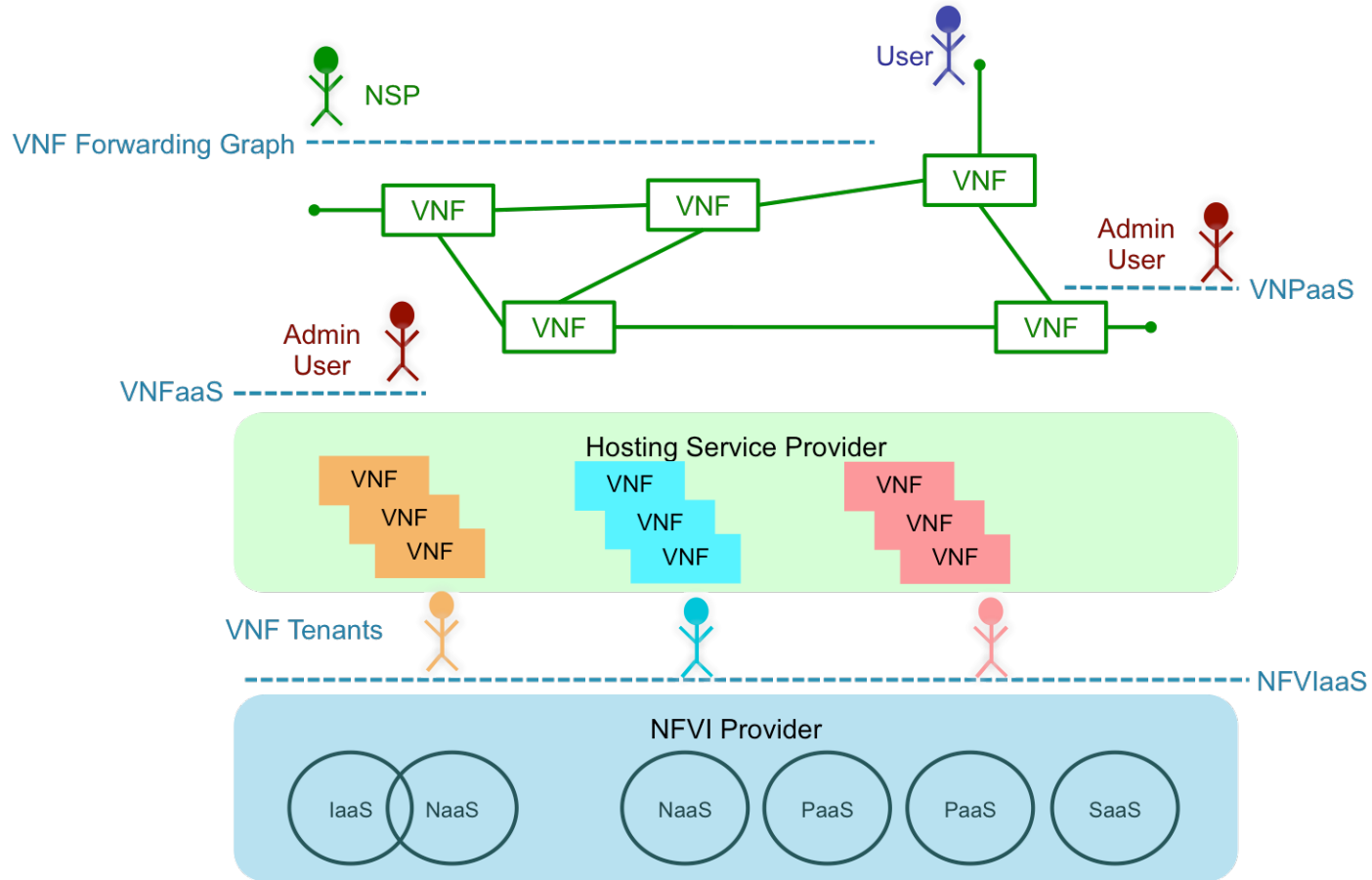
Q1: Stronger Control over Incumbent Networks

- Software Networks so far have addressed vertical integration
 - As much as cloud infrastructures in IT space
 - Considering infrastructure providers and users within a single administrative domain
 - Multi-tenancy focused at the intent layer
 - Trust and security models at a rather initial stage
- Horizontal integration is considered in terms of interconnection protocols
 - Well-known and controlled information exposure and trust models
 - Able to address realistic scenarios including mixed networks
- Extended third-party control over the infrastructure is theoretically possible, but there is the need for better understanding
 - Security and trust models
 - SLA measurement and enforcement
 - Accounting and traceability
 - Fault detection

Q2: Network-on-Demand & Network Function as-a-Service

- These are natural targets for Software Networks
- Intent-based interfaces have to consolidate to support network on demand models
 - Initial attempts already made
 - Need to define a sound conceptual model (a-la-SQL)
 - But would this be suitable for regulation, at least under the current assumptions?
- (V)NFaaS is among the original use cases of the ETSI NFV ISG
 - But not addressed in depth yet
 - Remember the single domain approach
 - Some initial experiments
 - I2NSF (IETF), SECURED (FP7), SONATA (5G PPP)
 - Suitable for generalization
 - Similar concerns on security models, measuring, accounting, traceability...

Q3: The Impact on the Value Chain

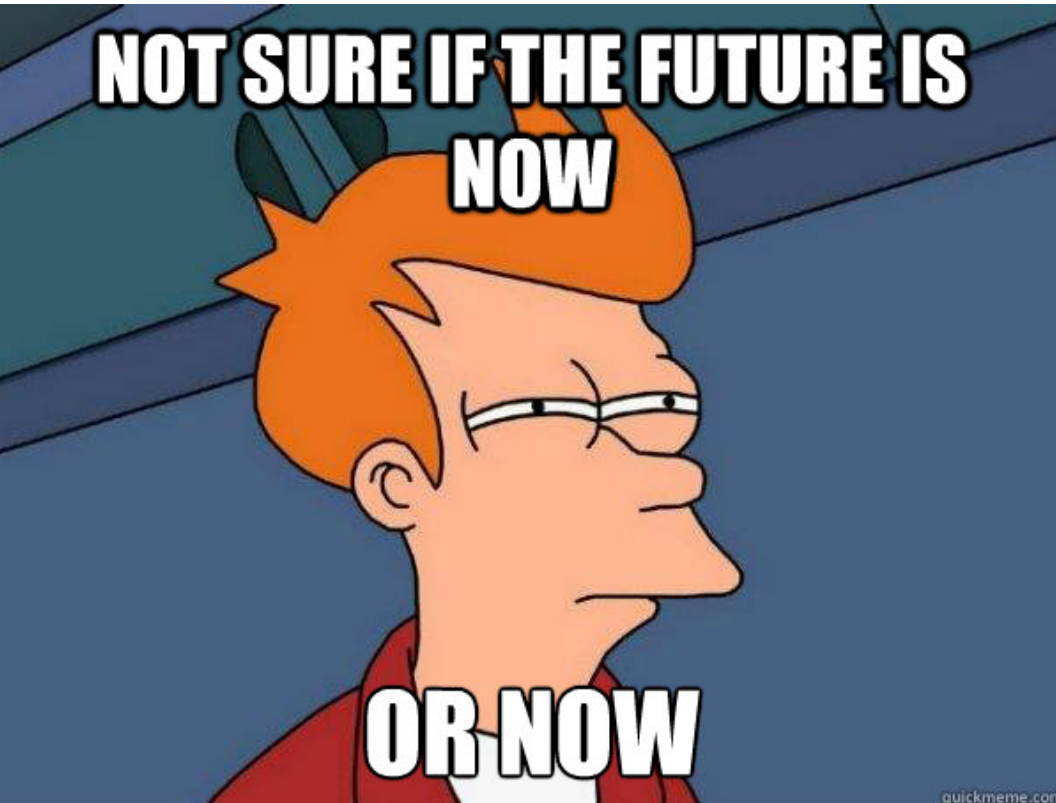


- Simply think of the impact of clouds on the IT value chain...
 - Current approach is to have all roles inside the network operator
 - First steps in exploring scenarios with several actors

Q4: The Relation with OTT Providers

- OTT and network service providers are separated terms in the current E2E service equation
- Software Networks are blurring the limits
 - The Software Network continuum connected to the OTT cloud continuum
 - And OTTs rely very much on Software Networks themselves
- The obvious questions are about how network neutrality will be defined
 - And probably the most relevant from a regulatory point of view
- Some less obvious questions
 - Addressing multi-context security
 - Collaborative management
 - Infrastructure sharing
- Some initial steps to address these questions
 - The MEC ETSI ISG
 - The MAMI H2020 project

Q5: Considerations for a Conclusion



- Software Networks bring a completely new paradigm to network planning, building and operation
- The technology is in its initial stages, as an implementation choice
 - Usual network concepts still apply
 - So regulation would continue following them
- Fully software-enabled networks will have to be addressed in a general ICT continuum

Telefonica
