NFV and SDN
Answer or Question?

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TM Forum: A Brief Introduction

TM Forum is a non-profit global industry association which brings together the collective genius of our diverse members to collaborate to build highly successful digital business ecosystems

90,000+
Member Professionals

950+
Member Companies

Global
Coverage

Agenda

- The marketplace context - the opportunity?
- The wider technical context – the enabler?
- The implications for management
- Really?
- The work of the TM Forum

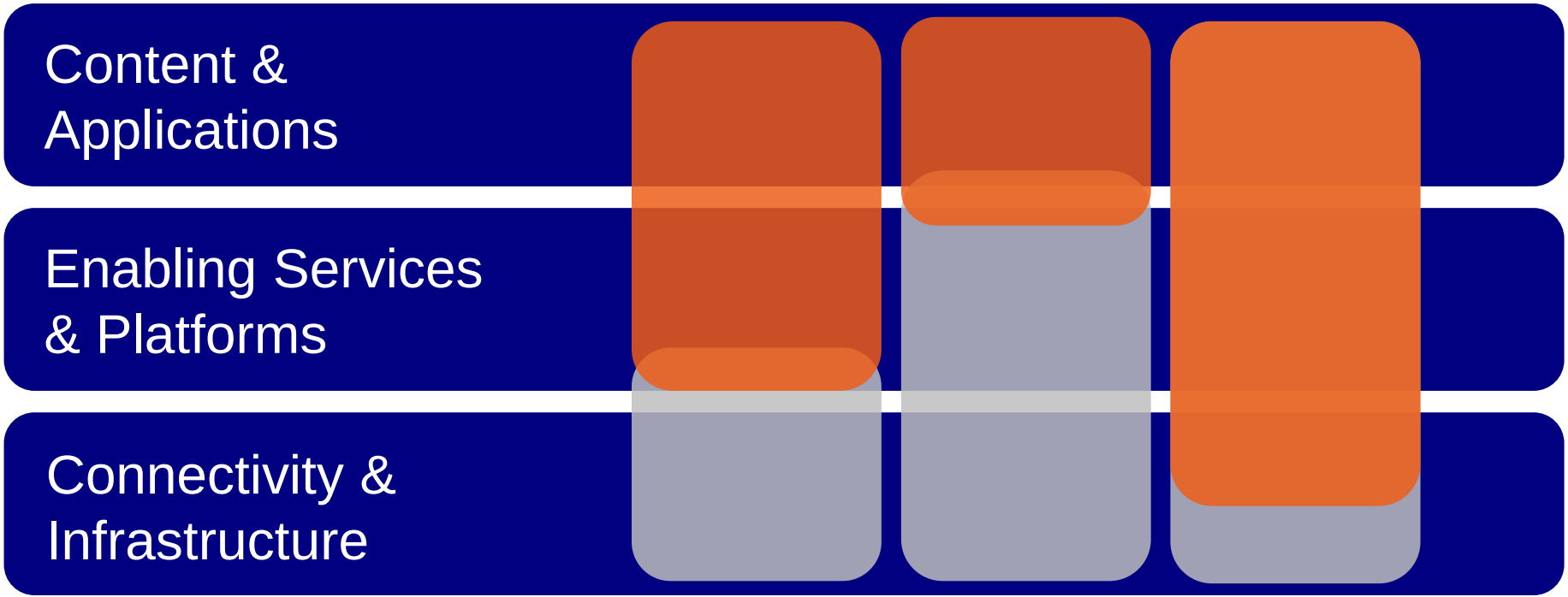
Digitization of Industries

Everything that can be digitized, will be

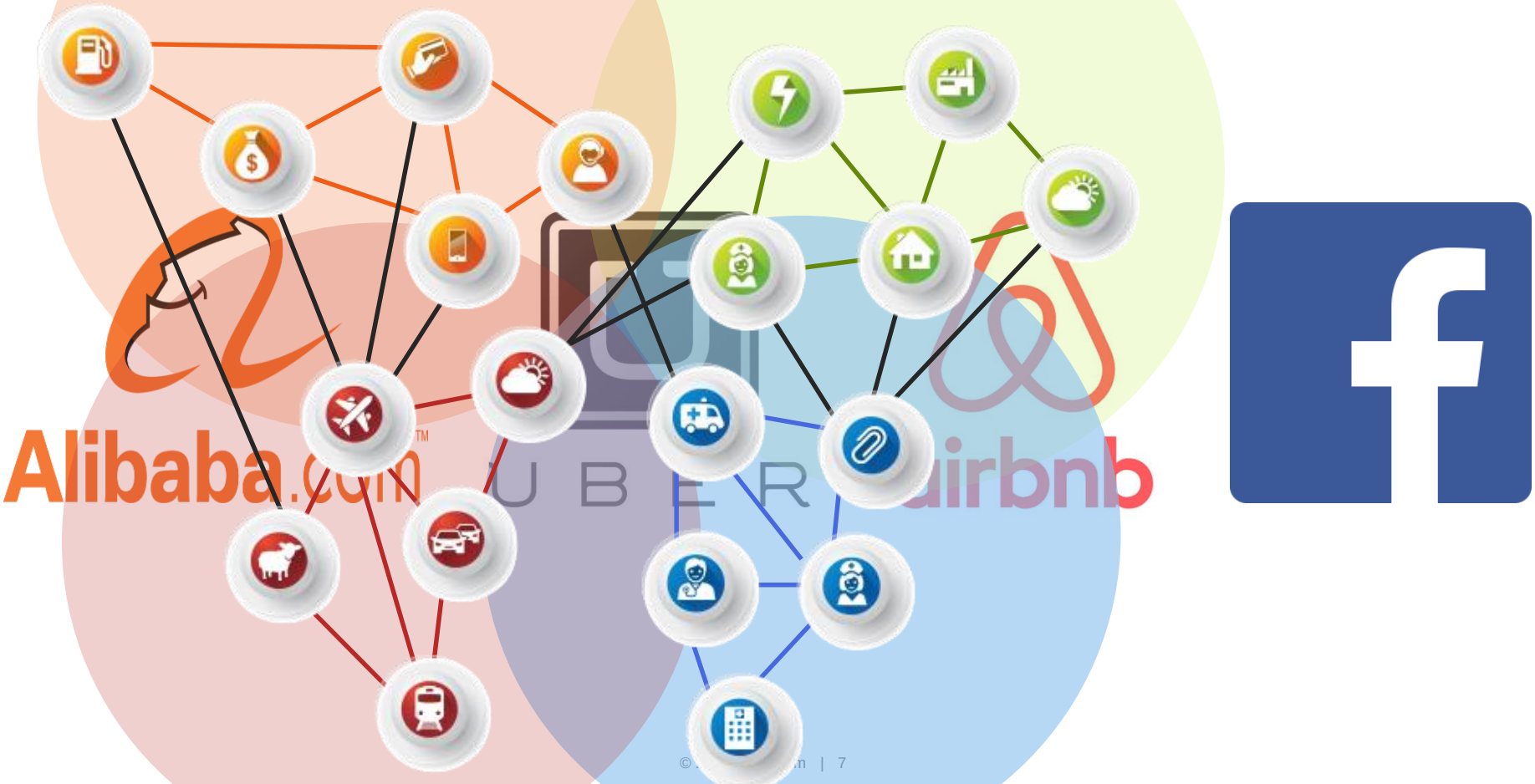
Telco ➡ Digital Business Enabler


The value chain is now a
complex value fabric of partners –
a series of digital ecosystems

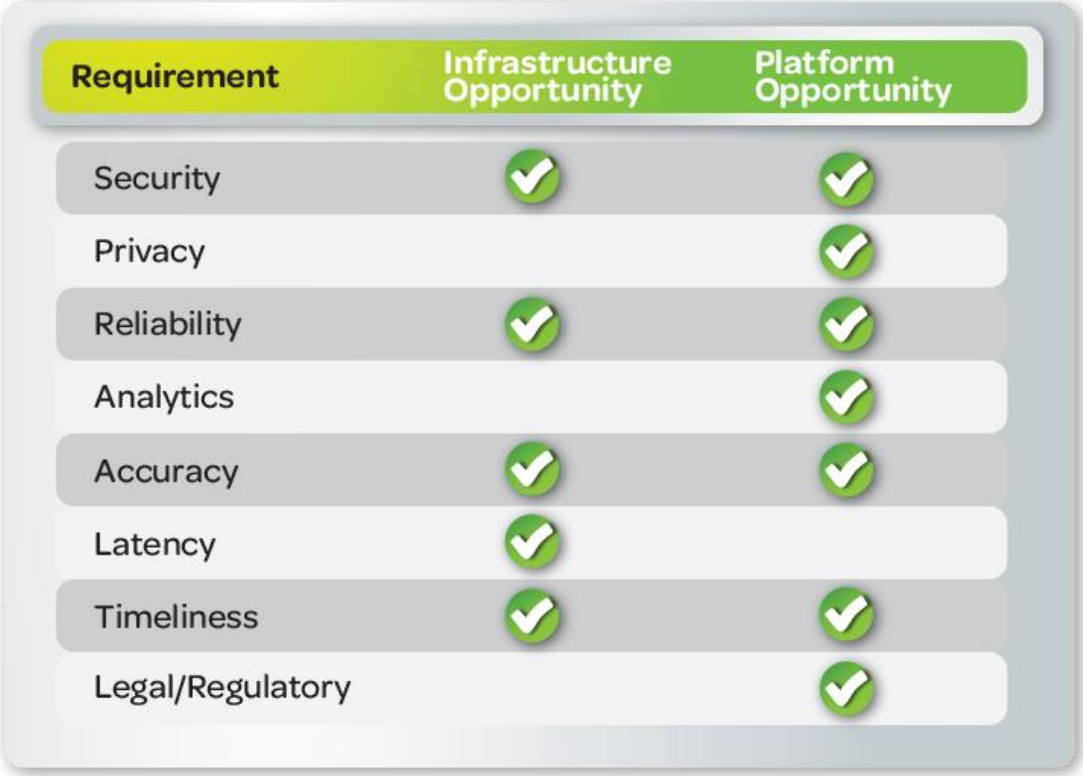
Picking Where You Play: Traditional Boundaries Are No Longer Clear



The Interface is Where the Profit Is



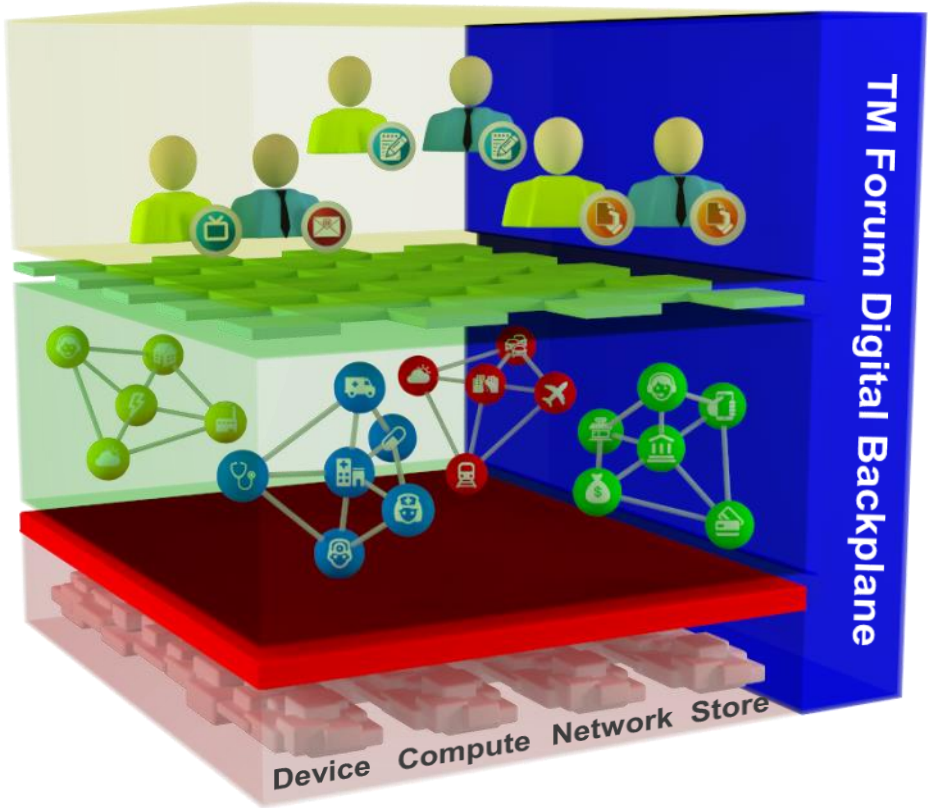
End-to-End Ecosystem Services Present Significant Opportunities for CSPs…



Requirement	Infrastructure Opportunity	Platform Opportunity
Security	✓	✓
Privacy		✓
Reliability	✓	✓
Analytics		✓
Accuracy	✓	✓
Latency	✓	
Timeliness	✓	✓
Legal/Regulatory		✓

… but you have to move fast!

A world of opportunity



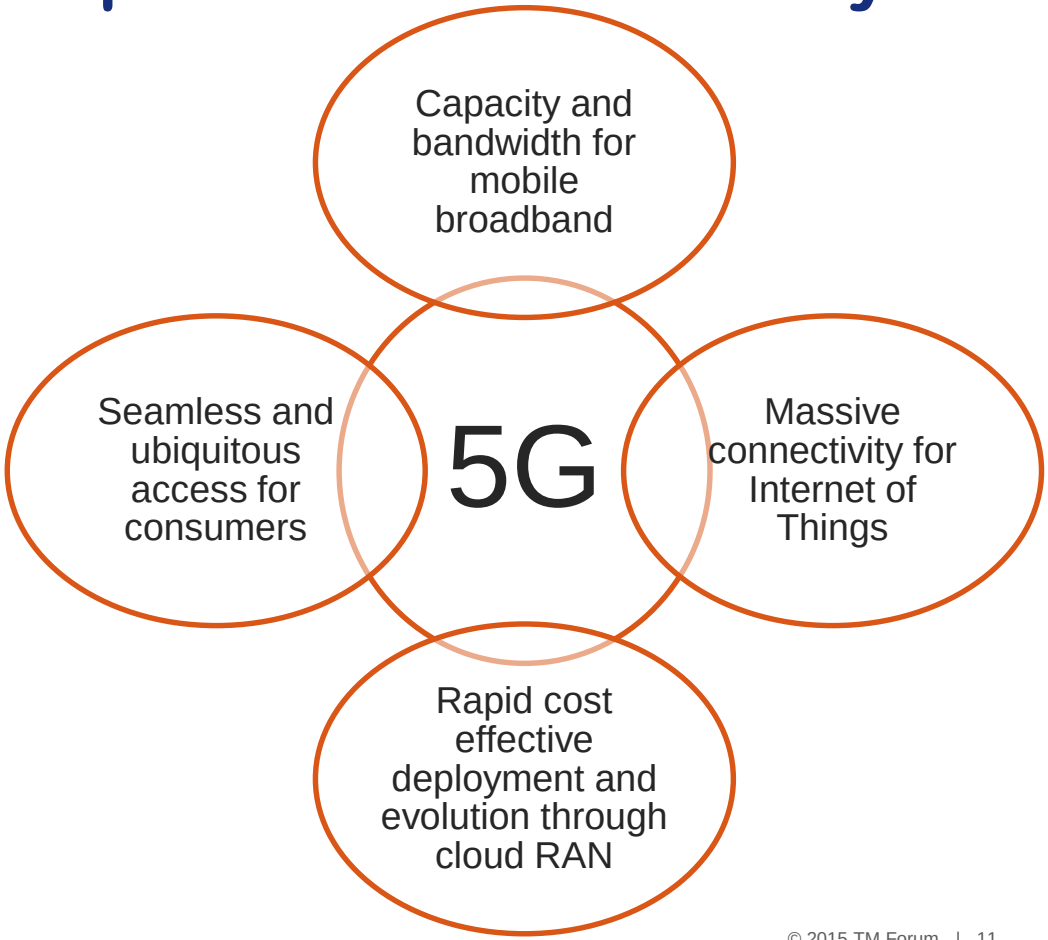
Customers want to buy high quality digital services delivered and managed seamlessly.

The value chain has become a complex value fabric.

To compete, ecosystem partners must be agile and partner efficiently, assembling service components from many partners.

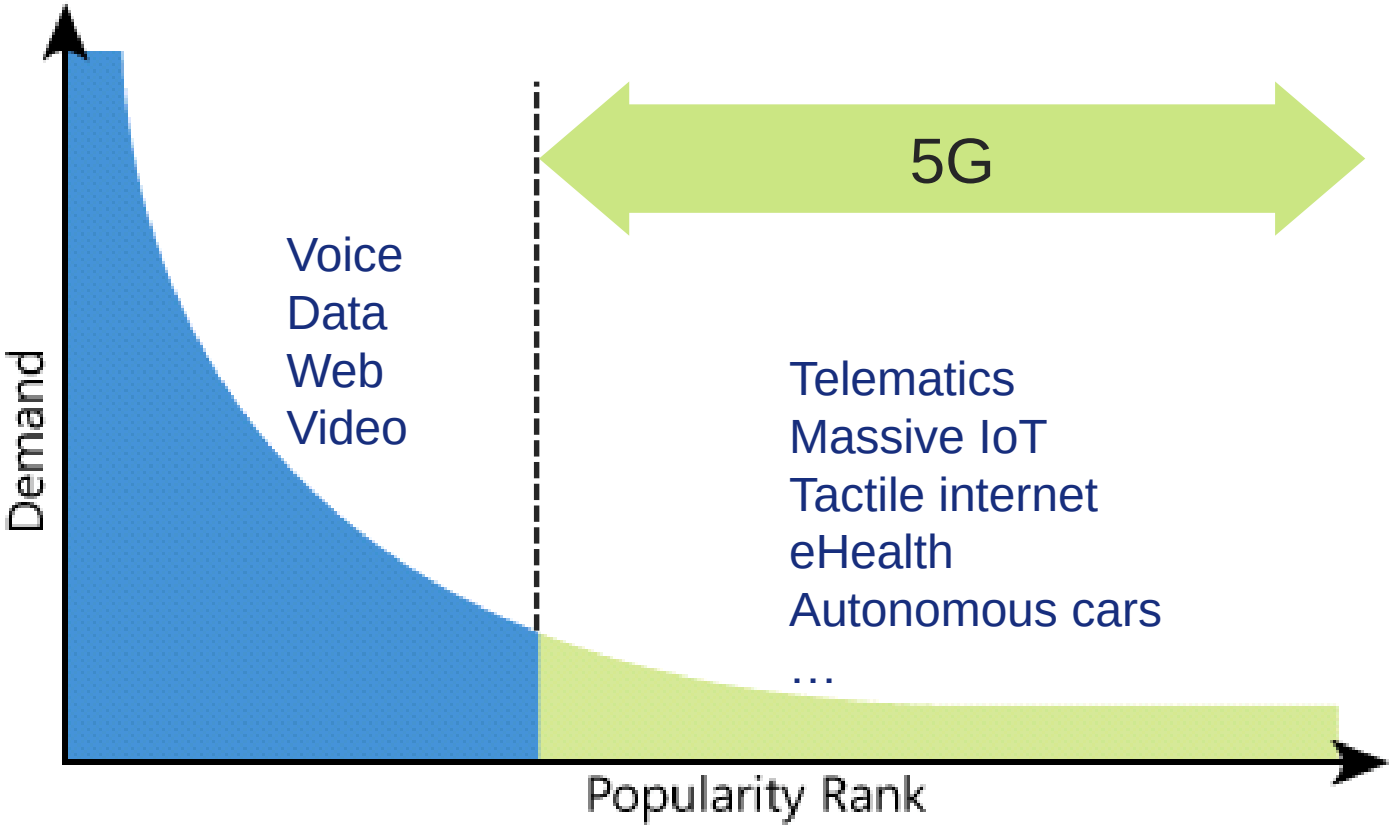
The changing technology

Impact across the ecosystem



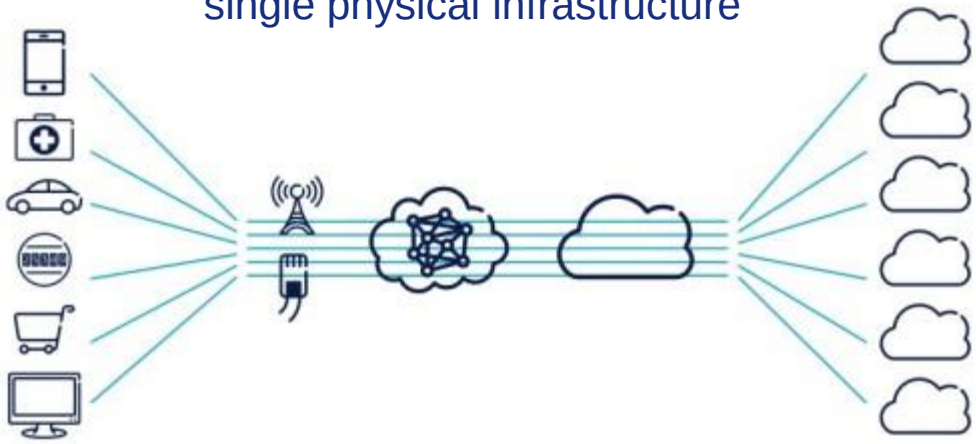
5G is not just about increased capacity and bandwidth, it offers significantly enhanced use cases opening up new business opportunities

5G to monetize the long tail



A common infrastructure for all verticals

Multiple virtual networks carried on a single physical infrastructure



Source: Ericsson

The expectation is that 5G will offer multiple virtual networks with different cost / performance characteristics across shared infrastructure

This will require an unprecedented level of virtualization and componentization supporting multi tenant at every level

NFV is the critical first step

NFV is a fundamental change

Traditional Network Model: APPLIANCE APPROACH


DPI


BRAS


GGSN/SGSN


PE Router

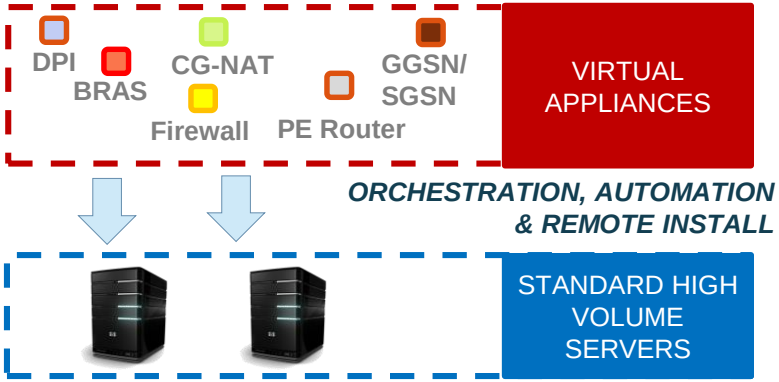

Firewall


CG-NAT


Session Border Controller

- Network Functions are **based on specific HW&SW**
- **One physical node per role**

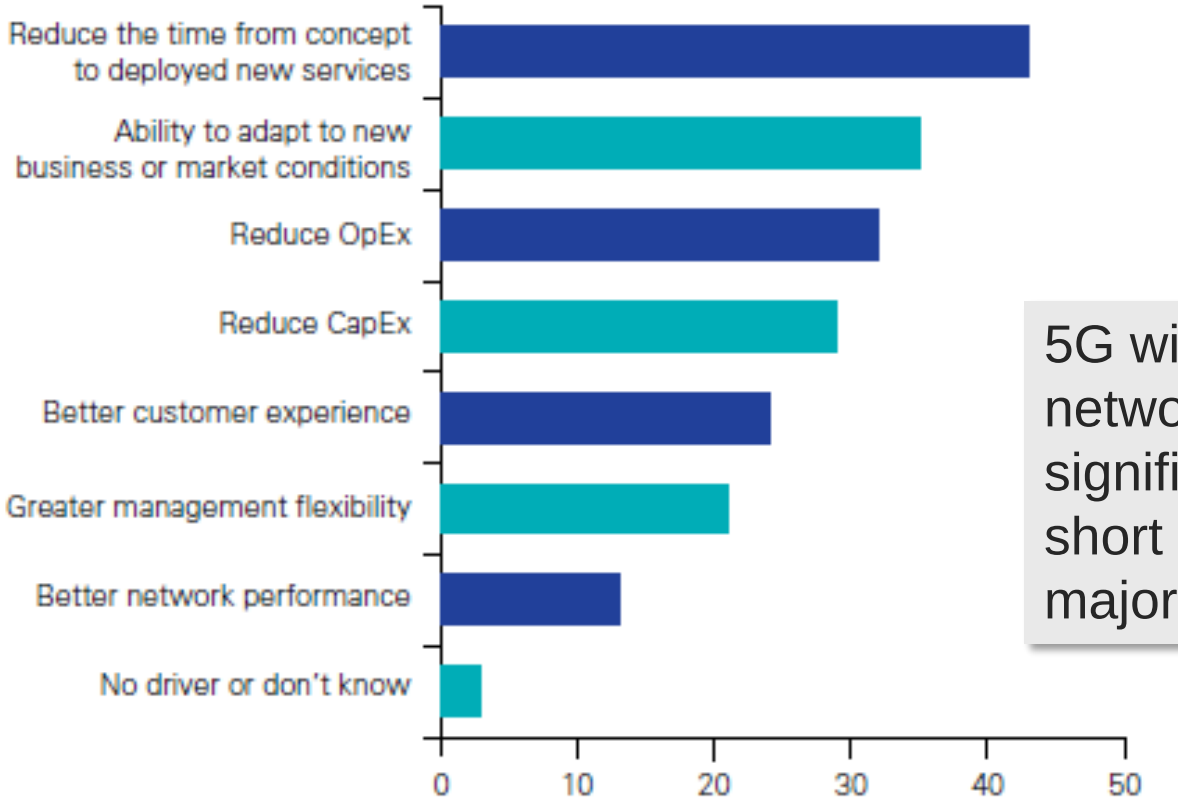
Virtualised Network Model: VIRTUAL APPLIANCE APPROACH



- Network Functions are **SW-based over well-known HW**
- **Multiple roles** over **same HW**

The most fundamental change in years with far reaching impacts

Drivers for Network Function Virtualization



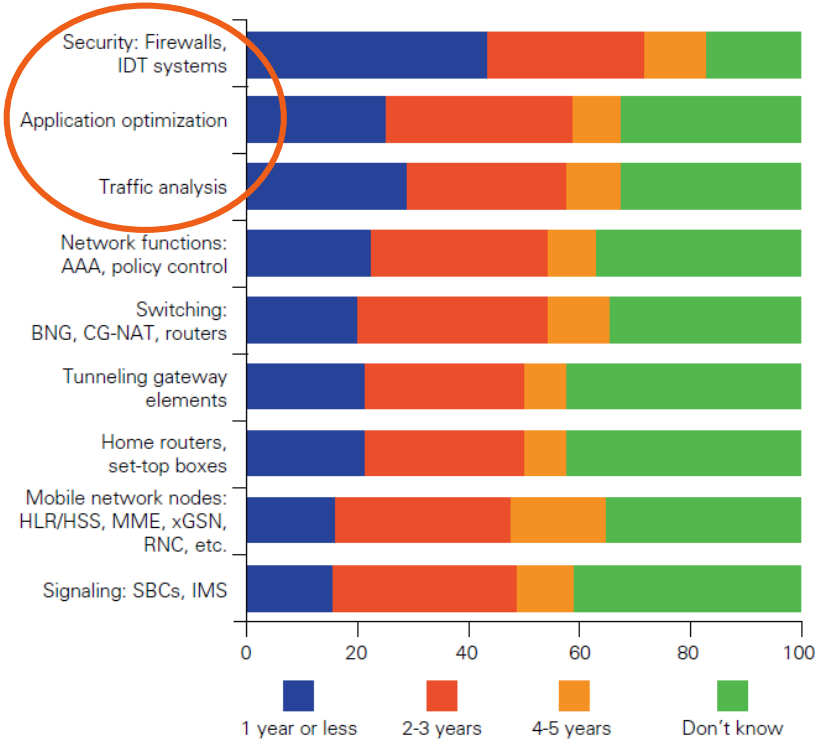
Source: TM Forum, 2015

Business Agility

5G will require a virtualised network but it can deliver significant benefits in the short and mid term and is a major industry focus

The roadmap for deployment

Figure 6-1: Estimates for production deployment of virtual network functions



Source: TM Forum 2015

There is little consensus on the sequence of deployment however a number of operators are focussing on edge functions such as vCPE to provide firewalls etc at the edge.

A common business focus is around enterprise services such as customised Firewall, VPN etc

Barriers to adoption

Process and organizational issues

The Hybrid challenge

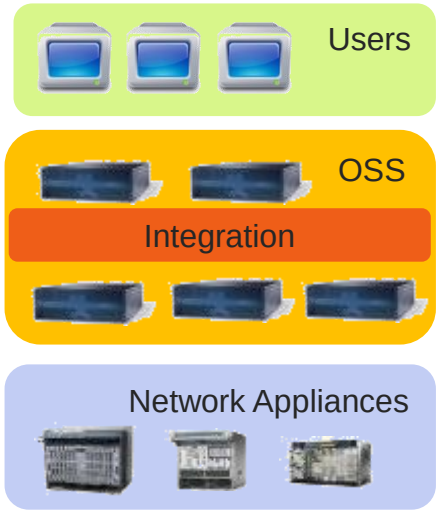
Figure 3-9: Technological or operational inhibitors to NFV adoption during the next two years

The challenge of end to end management in a hybrid environment is the biggest technological concern

What does this mean for management

The evolution of the OSS

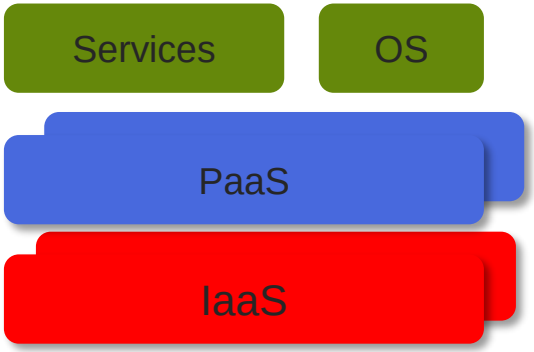
A “traditional” OSS is an integration of thousands of applications into a system. As new appliances are added new integrations are needed.



- Agile – able to incorporate new services in days not months.
- Change is constant and incremental - with a DevOps methodology
- Part of an ecosystem - services are provided by partners or owned or rented
- Componentised – Service components are granular and so are the supporting services
- Secure and private – multiple separate slices

A future OSS will be based on supporting platform services exposed by each component platform by APIs. New services will be automatically added

Self service dominates



The operations centre of the future

Focus on customers and services not network infrastructure

Extensive liaisons with ecosystem partners both as providers and channels

Agile working, frequent incremental changes incorporated using a DevOps approach

Automation driven by data analytics and policies to reduce cycle time and cost

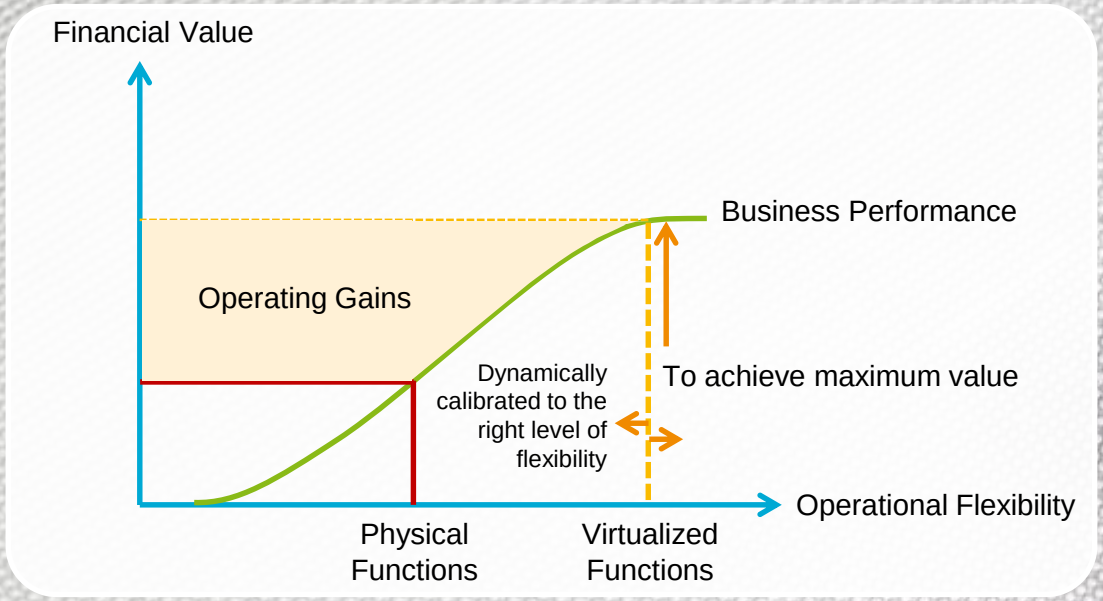
End to end management of a hybrid digital service platform

Exploring the reality

Can a more flexible system deliver real business benefits?

NFV Enables a New Perspective

… to factor in business profitability



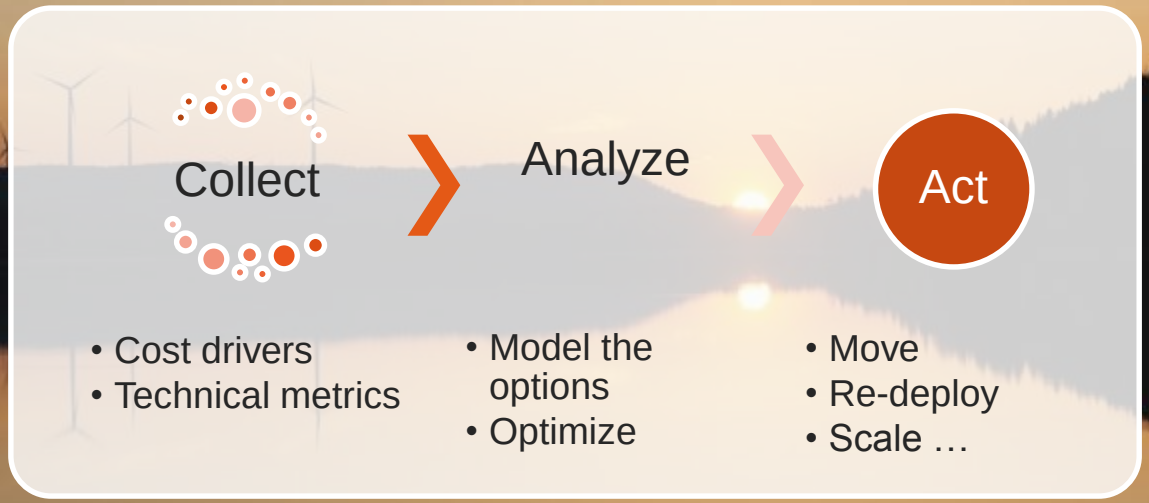
Maximizes the financial value of services by removing the operational constraints of physical functions

Source: TM Forum Maximising profitability with NFV catalyst project team

NFV Brings New Levels of Flexibility and Optimization

Creates an opportunity to consider both QoE/QoS & **financial** optimization

- Project leverages analytics and policies that dynamically determine orchestration decisions to make more well-rounded NFV instantiations
- We show a closed-loop system from mediation, monitoring, optimization analytics through policy-driven instantiation and restoral considering QoE/QoS and **financial** metrics

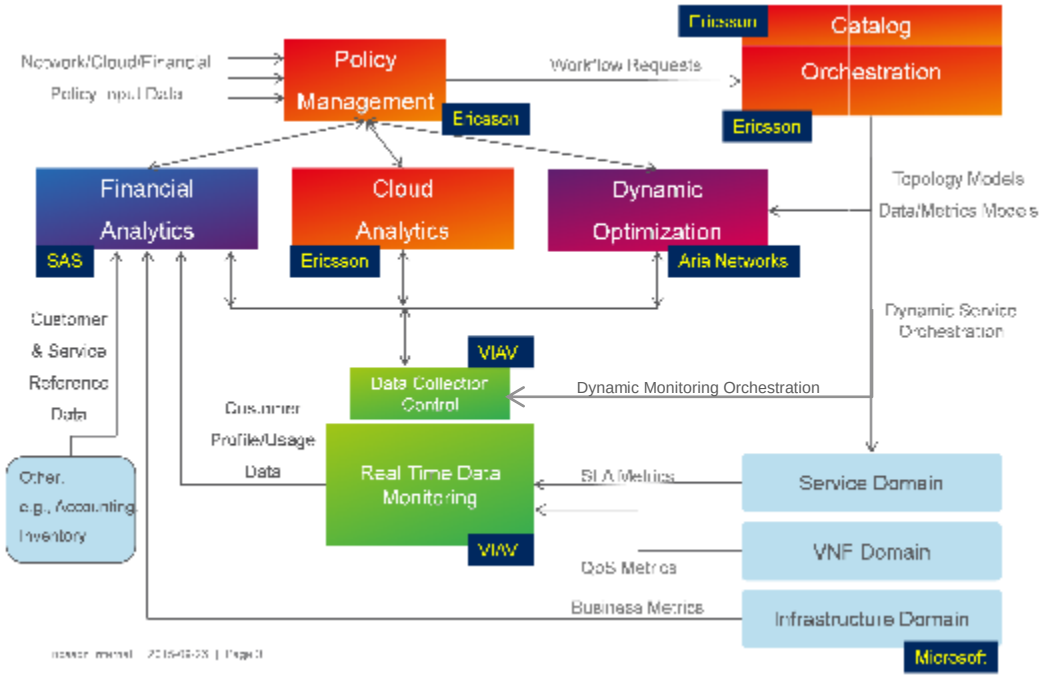


Goal is to optimize business value dynamically

Source: TM Forum Maximising profitability with NFV catalyst project team

Phase 2 Architecture & Process Enhancements

Financial Input and Analytics



- Improves the intelligence of the closed-loop control system by involving financial support systems
  - Understand the financial elements that make up the cost and revenue components of service offerings
- Explores cases where competing policies need to be reconciled to make optimization decisions
  - With inclusion of QoE and financial data, optimization/analytics becomes multi-faceted and dynamic
  - Multiple kinds of optimization may need to be reconciled (finance, CEM, network/data center) by the decision engine
- Decision engine may be human-assisted – in particular when handling exceptions
- This phase looks at new metrics, policy model extensions and optimization algorithms

Source: TM Forum Maximising profitability with NFV catalyst project team

Phase 2 Architecture & Process Enhancements

Examples of Financial-based Optimization Triggers

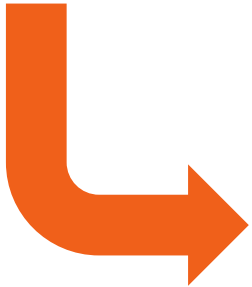
- Time of day power tariff change - As a result the cost of placement for services would force the move to another data center
- Cache resources become available - Low-cost disk caching becomes available so some services could move because the transport-cache equation changes
- Margin optimization - Service revenue for some services changes, maybe due to a marketing campaign, and as a result we move these services
- Cost creep - The cost of capacity has increased over time and a global optimization (which is being run in parallel) identifies a +X% benefit to a global optimization so services are moved
- Service protection change - A service is now offered at a higher revenue because of improved protection requirements which changes the overall cost dynamic

Source: TM Forum Maximising profitability with NFV catalyst project team

And it works!

We can build a solution that:

- Makes best use of resources to maximise profit
- Optimizes for a complex set of business goals



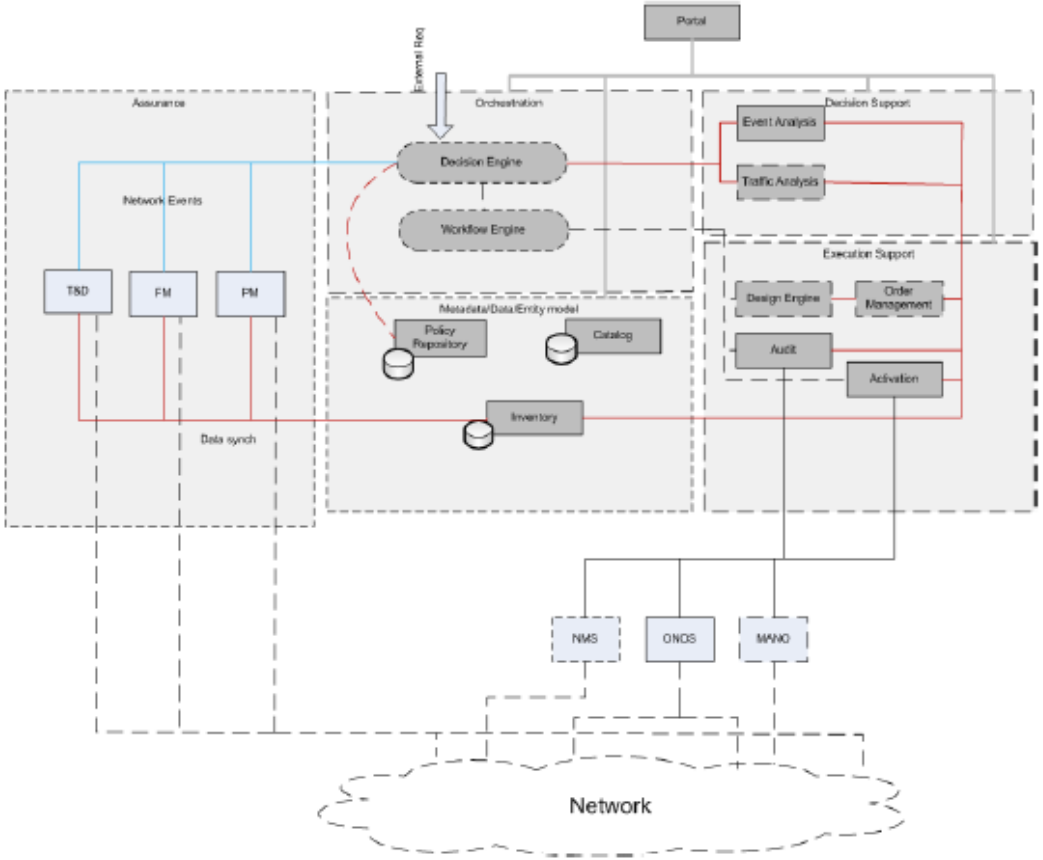
But we need:
Closed loop automation with…

- Real time performance information
- Policy based orchestration

Exploring the reality

Can we build a support system that delivers?

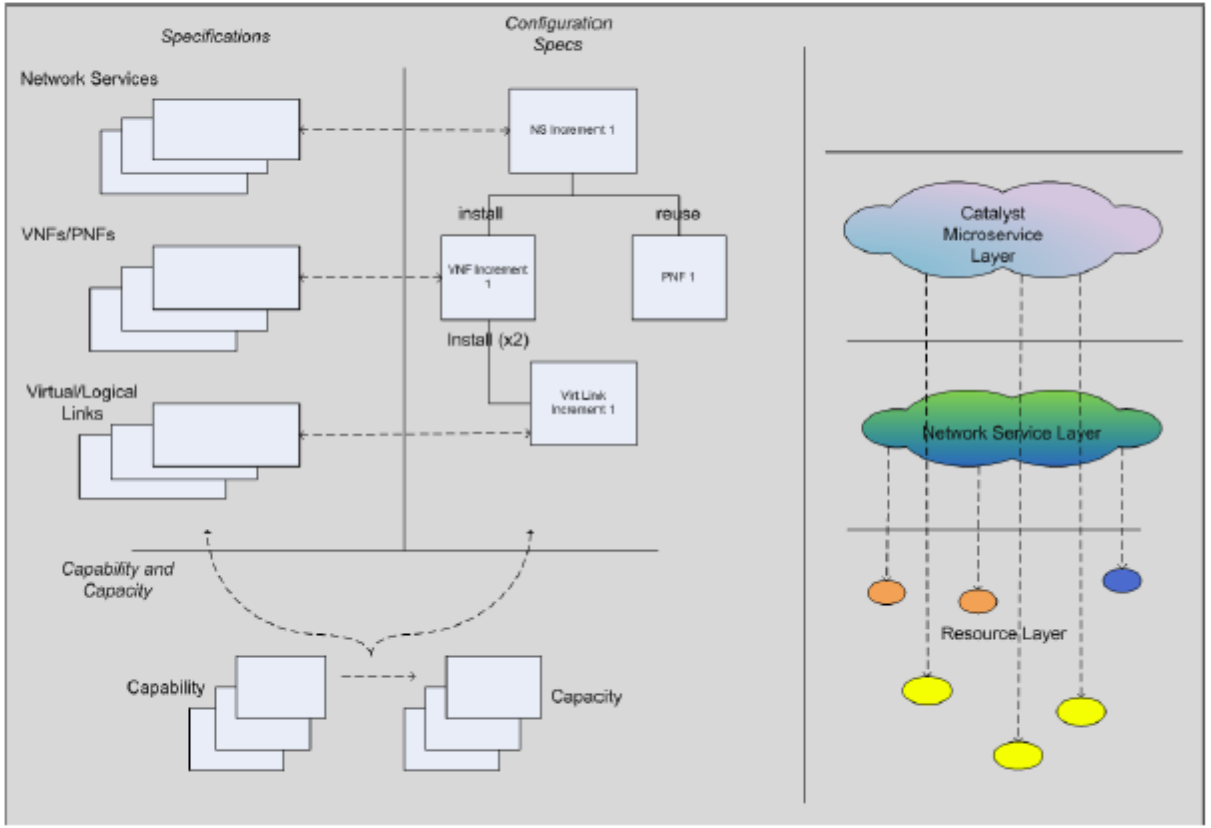
Orchestration - Microservice Architecture



- Microservices implemented as containers under Docker
- Each microservice has its own RESTful interfaces for application and management (security later) which they add to a registry
- Services initially defined at fairly coarse level of granularity (eg. policy and catalog, decision engine, workflow)

Source: TM Forum Model Driven service orchestration Catalyst project

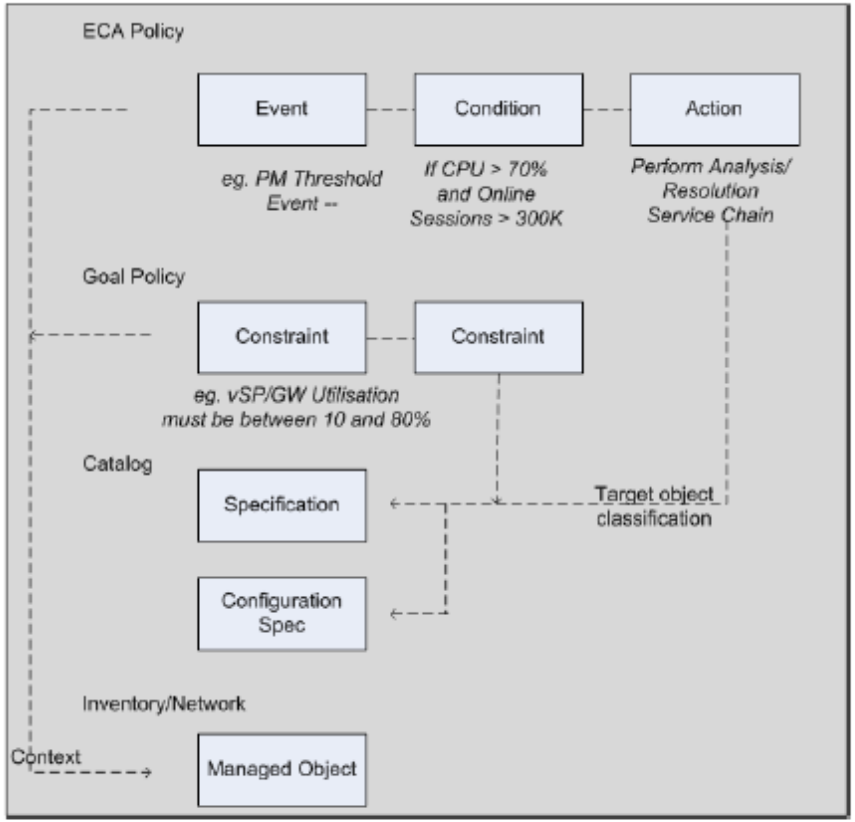
Metadata Applications - Catalog



- Configuration assisted service and resource design
- Use configuration to define function chains for OSS services as well as network services
- Introduction of capability and capacity concepts along the lines of DEN-ng and TR225

Source: TM Forum Model Driven service orchestration Catalyst project

Metadata Applications - Policy



- Standard ECA Policy is used to respond to events from other OSS components – and could also be used to respond to internally generated events from analysis
- Actions may include initiating internal microservice chain for analysis and resolution
- Goal based policy is used to describe desired network states to maintain performance
- Policy may be tied to network instances and/or specification instances to generalise policy and verify capabilities

Source: TM Forum Model Driven service orchestration Catalyst project

Outline of Demonstration

tmforumInFocus Dallas, USA November 4-5, 2015 CATALYST

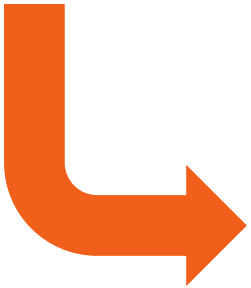
- Long Term Closed Loop Planning Execution
  - the ability to select and area of the network for analysis based on an anticipated event
  - use of capacity and traffic models to predict the anticipated shortfalls
- Short Term Closed Loop Event Based Execution
  - Real time event statistics from performance management system and generation of scale out and in events
  - Initiation of microservice based analysis using service/resource catalog, policy and inventory data
  - Corrective actions via microservice chaining with activation sequences for
    - U2000 (MME – control of traffic steering)
    - ONOS (SDN-C) – use of Huawei-ONOS IP/VPN integration to create/update IP core VPN
    - Huawei MANO (VNF instantiation)
  - Dynamic inventory managing both historical, planned, and discovered resource and service change, eg. scale out and scale in

Source: TM Forum Model Driven service orchestration Catalyst project

It works again!

We can build a solution that:

- Responds to events and uses policy to orchestrate changes
- Delivers a level of performance impossible any other way



But we need:

Nested closed loop control using

- Common models network and service elements
- Common framework for integrating microservices

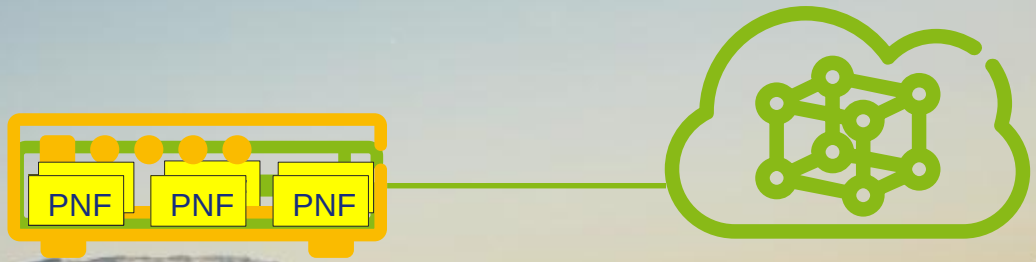
Exploring the reality

Can NFV really deliver improved customer experience and new services?

vCPE Catalyst Project - Phase 1
Virtualizing the CPE

- Evolve broadband service delivery from feature rich CPE's to a service-driven cloud architecture, facilitated by network functions virtualization and software defined networking

- Unbundle and virtualize value-added CPE functions as VNFs: to simplify the residential device, promote a better customer experience and enable service agility



This catalyst project defines the operational framework to achieve this

vCPE Catalyst Project - Phase 1

Traditional RG vs BRG

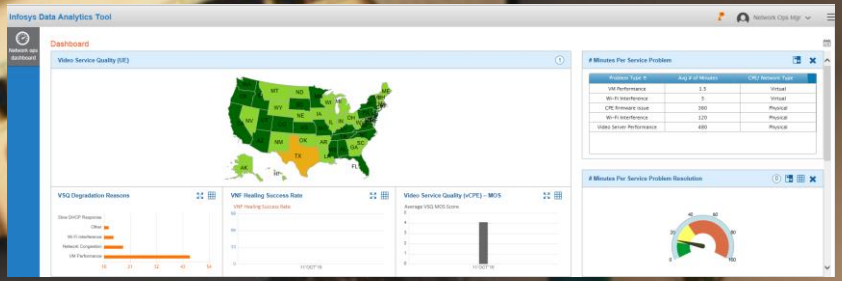
- LAN, WAN and Wi-Fi interfaces
- Layer 2 over layer 3 tunnel
- Learning bridge
- DHCP client
- Management client

- DHCP server
- NAT
- Virtual firewall (vFW)
- IPv6
- Personal Media Server

vCPE Catalyst Project - Phase 2

Taking Customer Experience to the Next Level

Moving from reactive to proactive assurance to improve customer experience



Service Provider Dashboard

Customer GUI

Analytics

Virtual Test Agent

Test Agent

BRG

DHCP

NAT

vBNG

vRG

VTS

IPv6

MGW

NFVI

So … Answer or question?

NFV and SDN on their own, simply a cheaper replacement for traditional network elements have limited appeal today.

NFV and SDN can clearly deliver improved business performance, and new and improved services and 5G will take this further

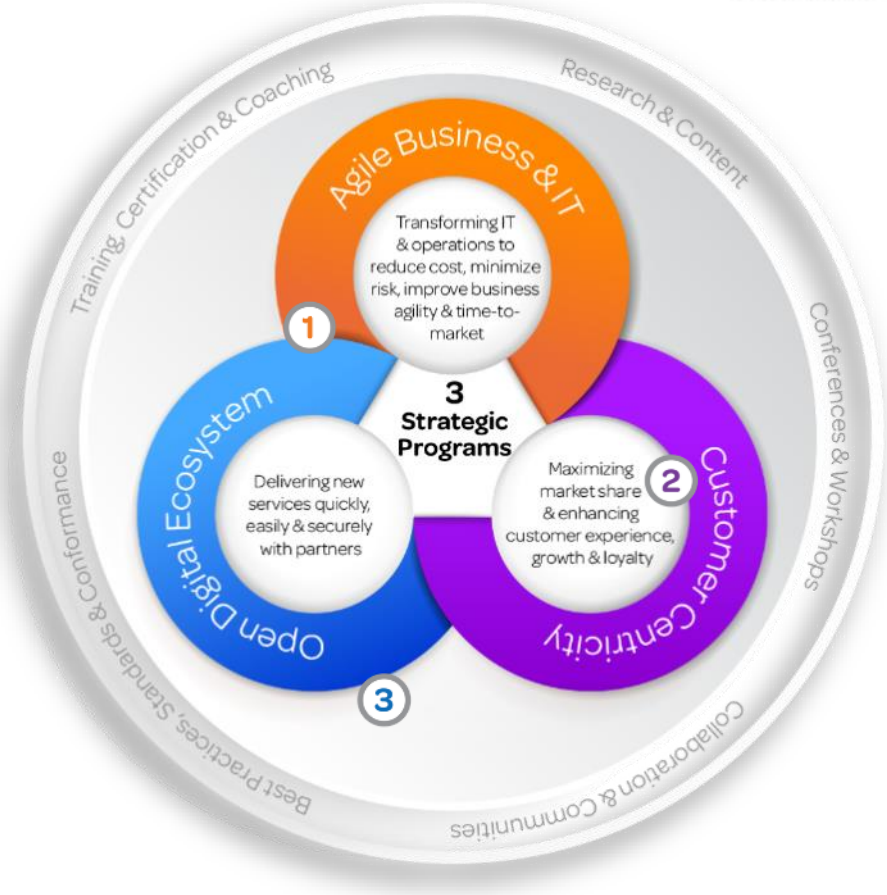
To deliver on the promise we need a complete transformation of the management services, and the *business processes that use them*

So NFV is clearly the Answer…. which raises many more questions… The good news is we are close to answering those as well!

TM Forum collaboration areas

The Forum guides our members on their digital transformation journey via **3 Strategic Programs**

1. **Agile Business & IT**
   - NFV & SDN (ZOOM)
   - Digital Transformation
   - Revenue Management
2. **Customer Centricity**
   - Customer Experience (CEM)
   - Data Analytics & Metrics
   - Security & Privacy
3. **Open Digital Ecosystem**
   - Internet of Things (IoT)
   - B2B2X, Partnering, & APIs
   - Open Digital Management



Agile Business and IT program

Digital Operations Center of the future :
Enabling the transition to an Agile Virtualized world

Managing Hybrid Networks :
Extending proven assets of today to encompass virtualization

IT Transformation:
Enabling the IT transformation to the support service of tomorrow

Related and joint work streams in ZOOM and Core Frameworx projects

APIs:
Bridging the value fabric