Heavy Reading's View

Virtual EPC for Smaller Operators

December 15, 2015

Gabriel Brown, Senior Analyst, Heavy Reading

Prepared for the Cisco Knowledge Network

Agenda

1. Market background & opportunities
2. Use-cases for virtual EPC
3. Deployment
4. Q&A

Opportunities for Smaller Scale Virtual EPC

- Clear opportunities for Tier 2 & 3 operators to take advantage of service-oriented virtual core networks
- A practical near-term choice for smaller-scale operators to deliver commercially valuable services
- Progress in the evolution toward software-centric networking

A Loose Definition of Tier 2 & 3 Operators

- Typically mobile operators with < 5 million subscribers
- In more affluent markets, revenues of up to $2 billion qualify
- Not a strict definition; caters to a range of operator types
- Can include national OpCos of large operator groups

Examples of Smaller-scale Mobile Operators

National MNO

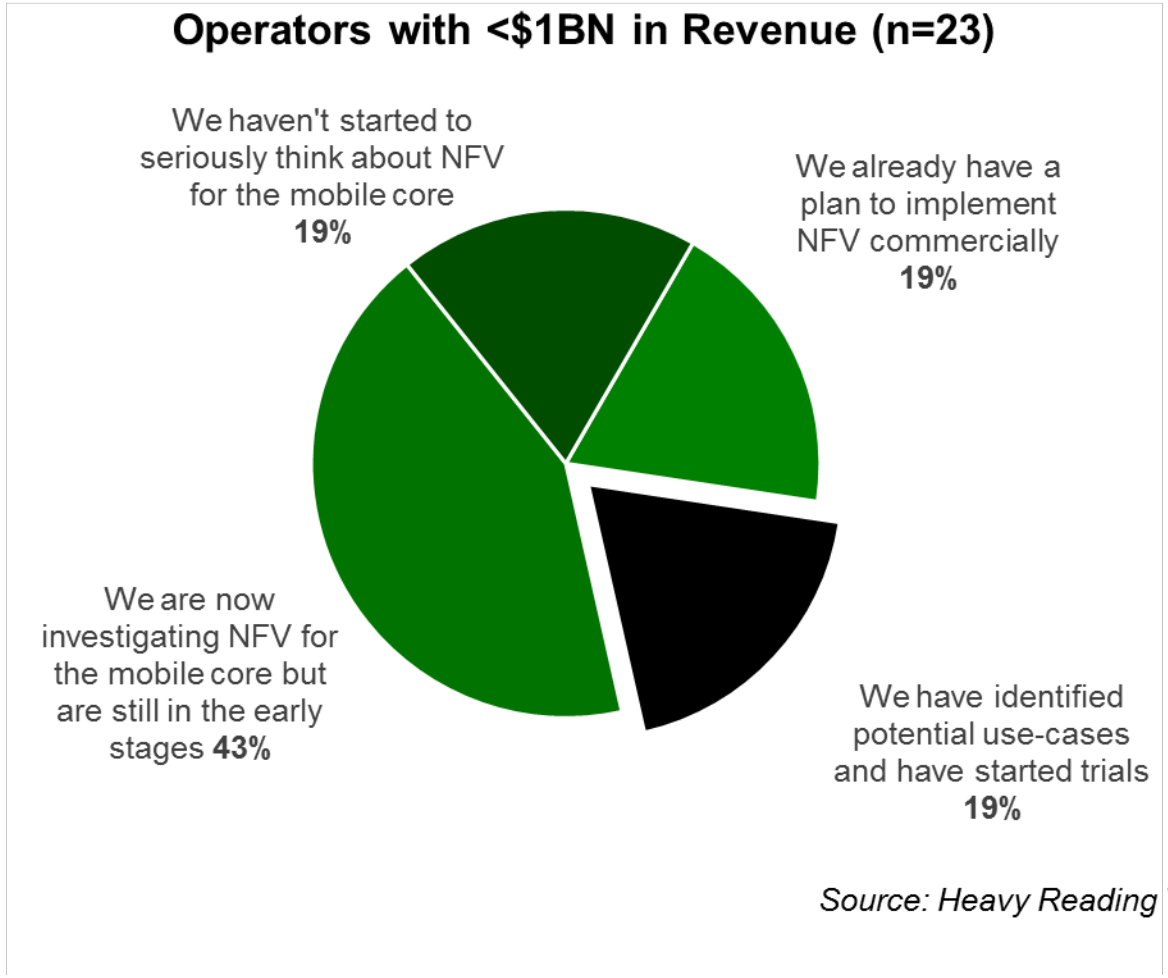
MVNE / MVNO

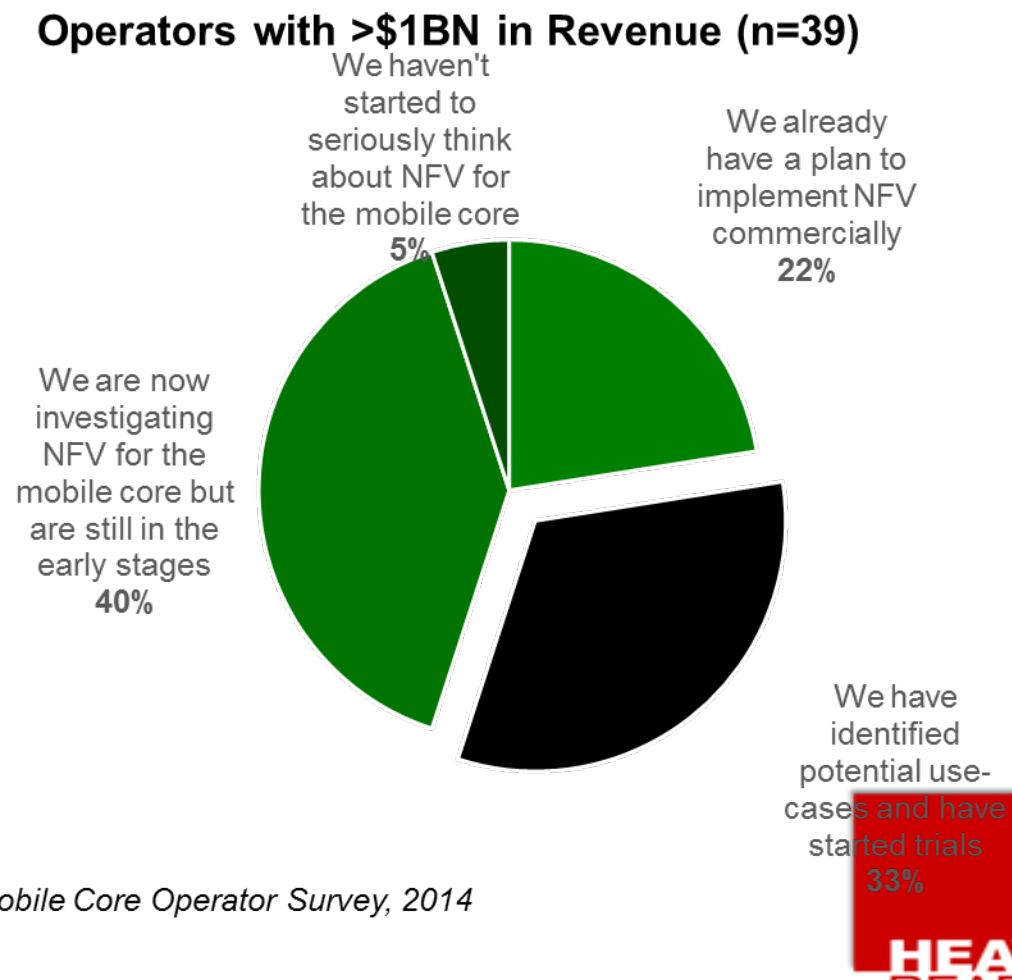
Innovation

- In Europe alone more than 100 mobile operators fit the profile
- Ex-incumbent operators associated with prestige of being the biggest national operator?

Status of Virtual Mobile Core

In the mobile core, what is the status of your company's NFV deployment strategy?





Source: Heavy Reading Virtual Mobile Core Operator Survey, 2014

Drivers for vEPC deployment

Capacity Relief / Cap-and-Grow

- Classic EPC and vEPC capacity is pooled
- Absorb subscriber & traffic growth
- Cap investment in classic product
- Migrate to vEPC over time

Core Refresh / Replacement

- Replace aging EPC or 3G PS core
- Future-proof investment in network refresh
- Prepare for LTE-Advanced Pro & 5G

Vendor Diversity

- Alternative vendor for specific opportunities
- Prepare for replacement of incumbent vendor at end of contract

New Services

- Reduce business case threshold for new services
- Optimize for MVNO, enterprise & IOT services

Prepare for 5G

- Uncertain requirements
- New system architecture
- Underlines need for flexibility

User Cases for Virtual EPC

*"**We have a lot of smaller operators in our group and vEPC is very attractive to us**. Originally we wanted to use virtual EPC as capacity extension, but we changed our mind-set when talking with the group's operator CTOs. All the CTOs have now gone to the model of swapping out. This was a little bit surprising to us; we thought CTOs would be risk-averse, but they understood the advantages of cost saving and flexibility."*

European Operator Group

Operators on Virtual EPC

"We've done PoCs and we're still tracking for 2016 for virtual EPC. It's a challenge; we know that. It's very difficult… Our commitment is 2016 and we hope OpenStack is mature enough in that time frame."

Large MNO

"The virtual EPC application works well. We're focusing on developing the tools. Now it's just a case of the user [operating company or division] selecting the templates and deploying."

M2M Virtual Core

"We wanted to start with real functionality and so we chose EPC. EPC because we see real data growth. In the near future, traffic growth could be handled on these new virtualized systems."

Large Operator Group

"We have very clearly identified the following use-cases for virtual EPC: M2M dedicated core network, MVNOs, new LTE networks, and capacity expansion."

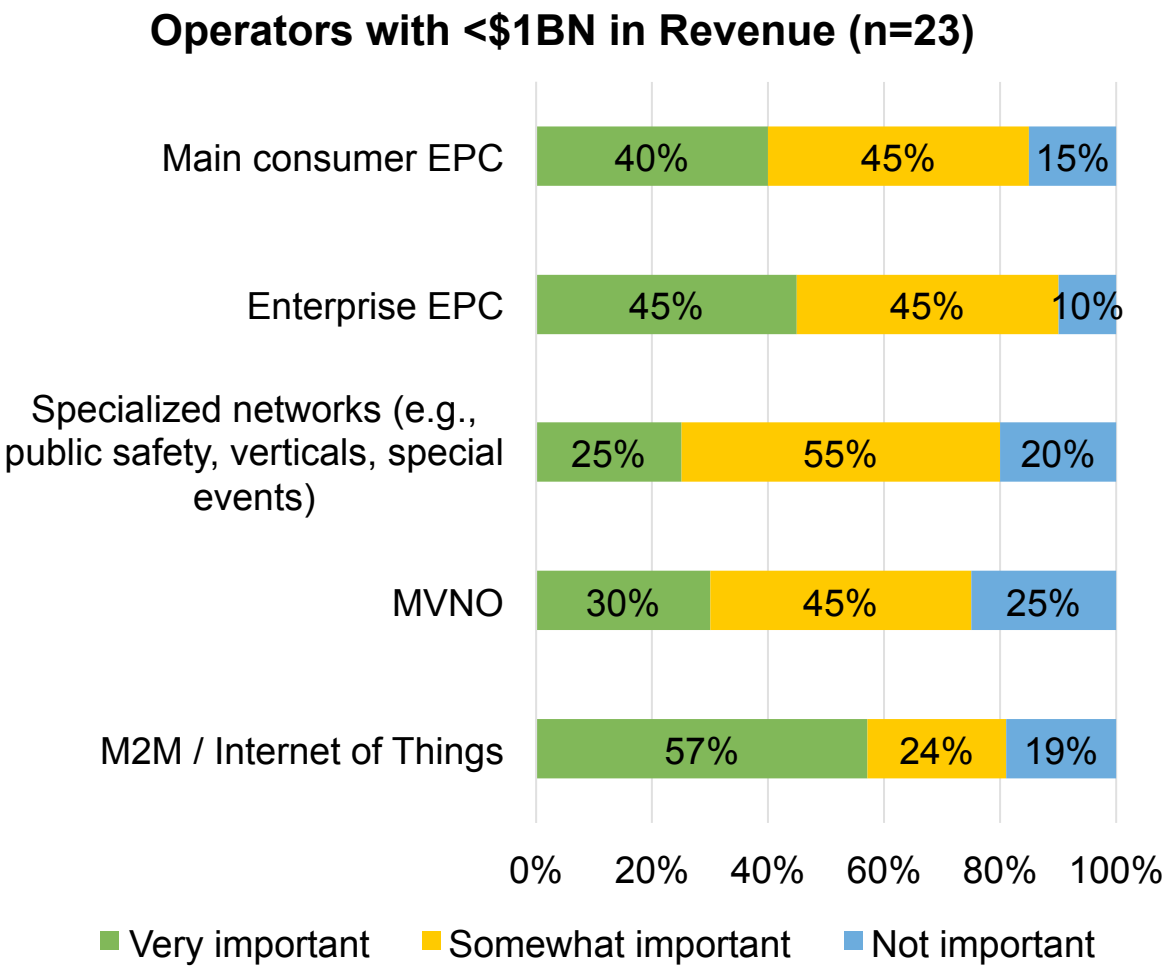
European operator

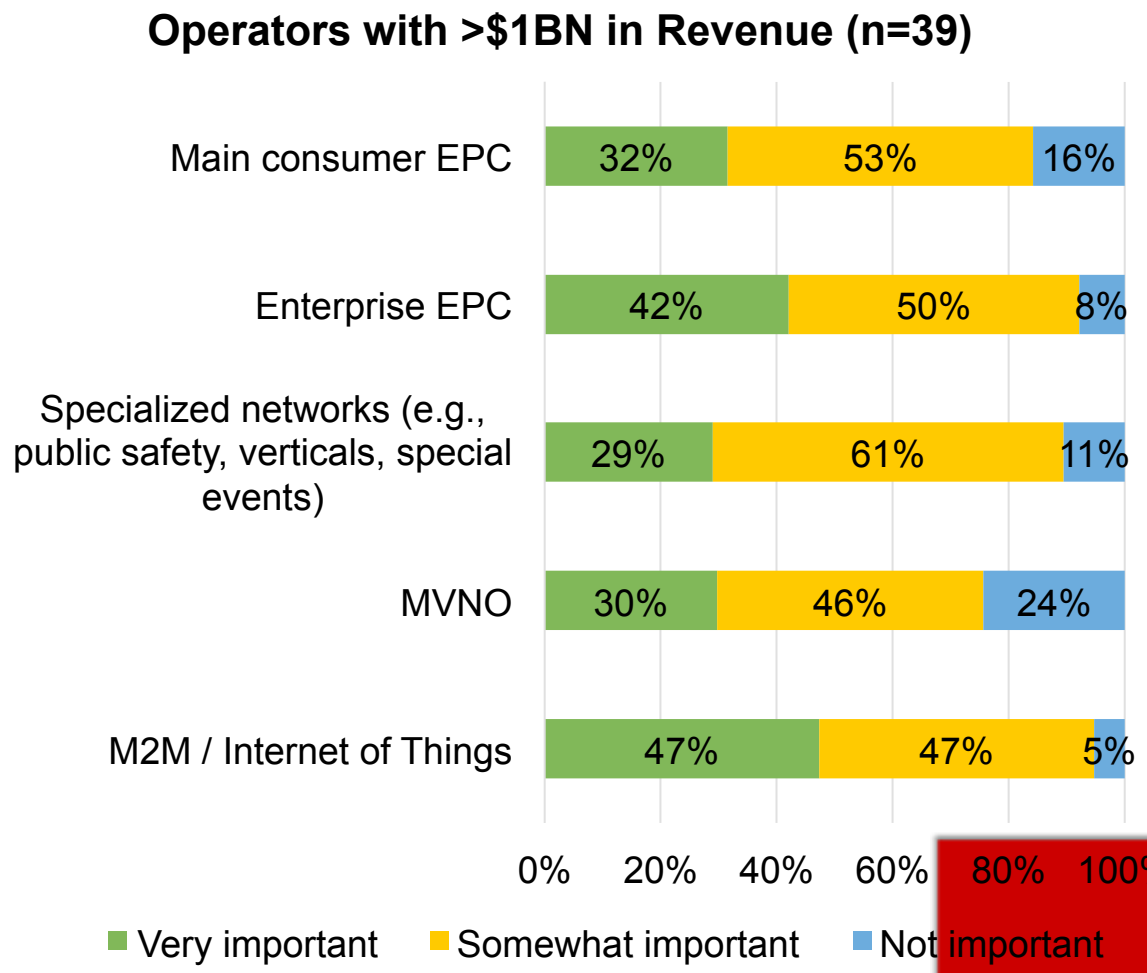
Smaller-Scale vEPC Use Cases

MVNO & Mobile Virtual Network Enabler (MVNE)	• Strong MVNO market dynamics; e.g., Google, Cable MSOs, EU consolidation • Currently complex to integrate MVNO core with RAN • Virtual core offered by host operator (with MVNO control and customization)
Enterprise Private Virtual Network Operator (PVNO)	• Dedicated virtual enterprise P-GW for mobile VPN services • Hybrid private RAN & wide-area PVNO (e.g., for corporates with several sites) • Opportunity to combine mobile VPN with enterprise cloud applications
IoT/M2M	• Wide-area IoT services on dedicated core network; optimized traffic profile • Dedicated PVNOs for utilities services (e.g., meter reading, monitoring) • Connected car services hosted on dedicated core; specific requirements
Special Events & Venues	• Multi-operator, shared small-cell networks at major venues • Deployed to support special events (sports, music festival, conventions, etc.) • Emergency networks set up by public safety agencies

Virtual EPC Use-Cases

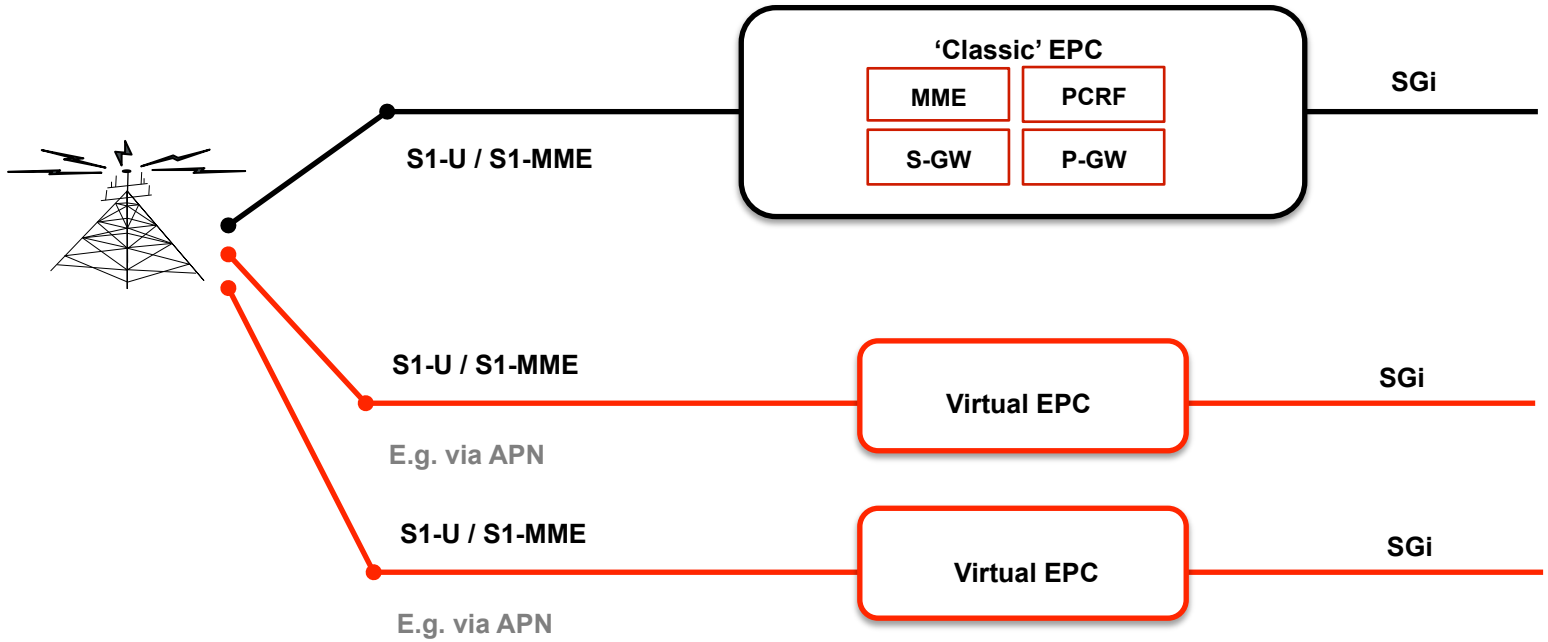
Please rate the importance to your company of the following use-cases for virtual EPC.





Source: Heavy Reading Virtual Mobile Core Operator Survey, 2014

Virtual EPC Overlay to Classic Core Network



Reliable, stable, deployed

Capacity expansion & for specific user-groups

Ability to deploy multiple core instances

Pooled physical and virtual capacity works better from a single-vendor

- Lower risk deployment option; can increase near-term costs
- Migrate traffic/users from physical to virtual core over time

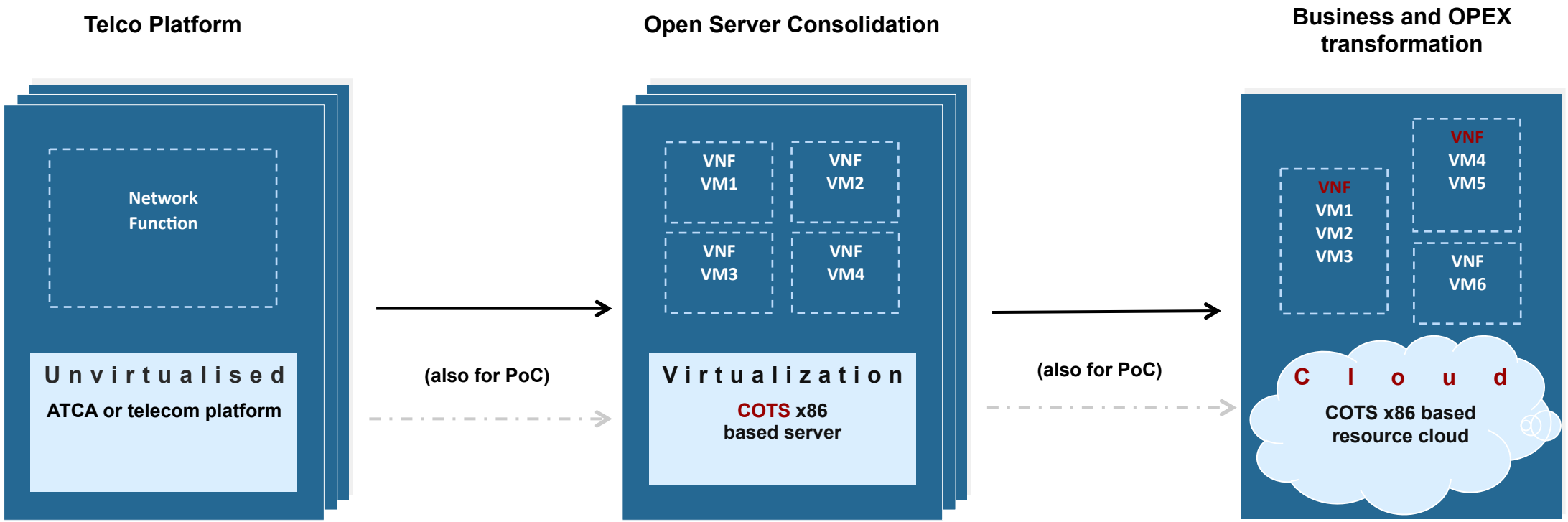
Dedicated Core Network

- Virtual core overlay requires traffic separation at the RAN
  - Multiple methods used today, but generally sub-optimal
  - SIM-based Network ID; Gateway redirects; APNs

- DECOR: A Release 13 feature (3GPP TS 23.707)
  - "Architecture enhancements for dedicated core networks"
  - A dedicated core network may provide specific characteristics and/or functions, or isolate specific UEs or subscribers belonging to a specific enterprise, or separate administrative domain
  - Possible to deploy multiple dedicated core-networks on the same RAN
  - Covers assignment of dedicated core network nodes and maintaining the association during mobility
  - No impacts to UE; shall not require the use of additional PLMN-IDs

Deploying Virtual EPC

NFV Roadmap to Cloud



- NFV Infrastructure will be distinct from enterprise cloud
- Distributed; telco-specific requirements; but *how* different?

Virtual EPC-in-a-Box: Server-based

Source: Cisco 5700

- COTS-based Mobile Packet Core
- Includes P-GW, S-GW, GGSN, SGSN, MME
- Supports integrated inline SGi-LAN services
- Scales to 50 Gbit/s and 5 million SAUs in 12 RU
- Scales down to smaller 6 RU system
- Runs on RedHat OS & KVM hypervisor
- Not (yet) an orchestrated NFV solution

Operations Challenges

*"If there was a common and mature reference architecture developed, we **would consider a multi-vendor** approach, but the reality is that it doesn't exist. ETSI has defined a reference architecture, but it's too broad, and not implementable. The issue is it **doesn't contain all the operational pieces we need to make it work**. It is too vague in some areas, with too much room for interpretation."*

International Operator

*"We will start with separate core infrastructure for M2M, residential VOIP, IMS, and so on, based on the business unit. For virtual EPC, next year and in 2017 it will be separate. We will then look to converge on a single software in 2018 and then use logical separation, but for that we would need SDN, which is not as mature as NFV…The **problem is there is no orchestration solution currently available**. We have higher request for simplicity than the ETSI MANO can deliver."*

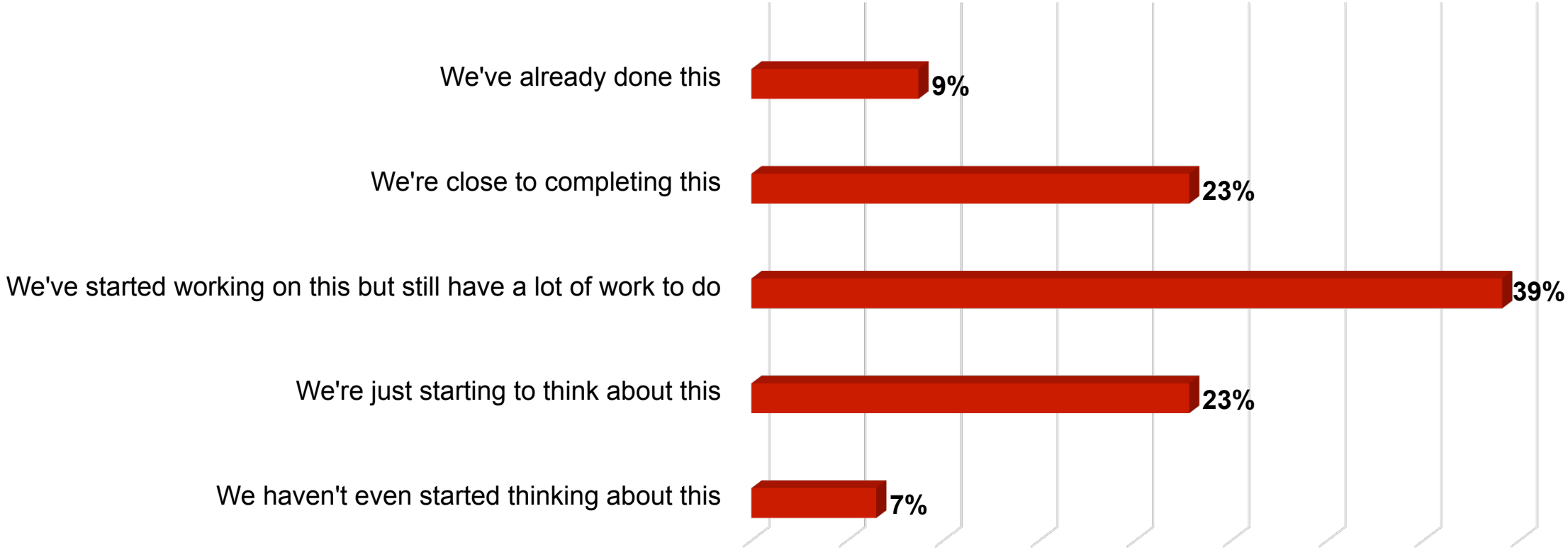
European Operator Group

"While there is no question that NFV is maturing very quickly, we are still not fully convinced that we can launch commercial applications tomorrow. It's going to take a little more time. In our case we estimate 12 months for an initial application and 2-5 years to support many VNFs."

Converged Carrier

NFV Reference Architecture Definition

How far along is your company in defining its NFV cloud reference architecture? (n=94)

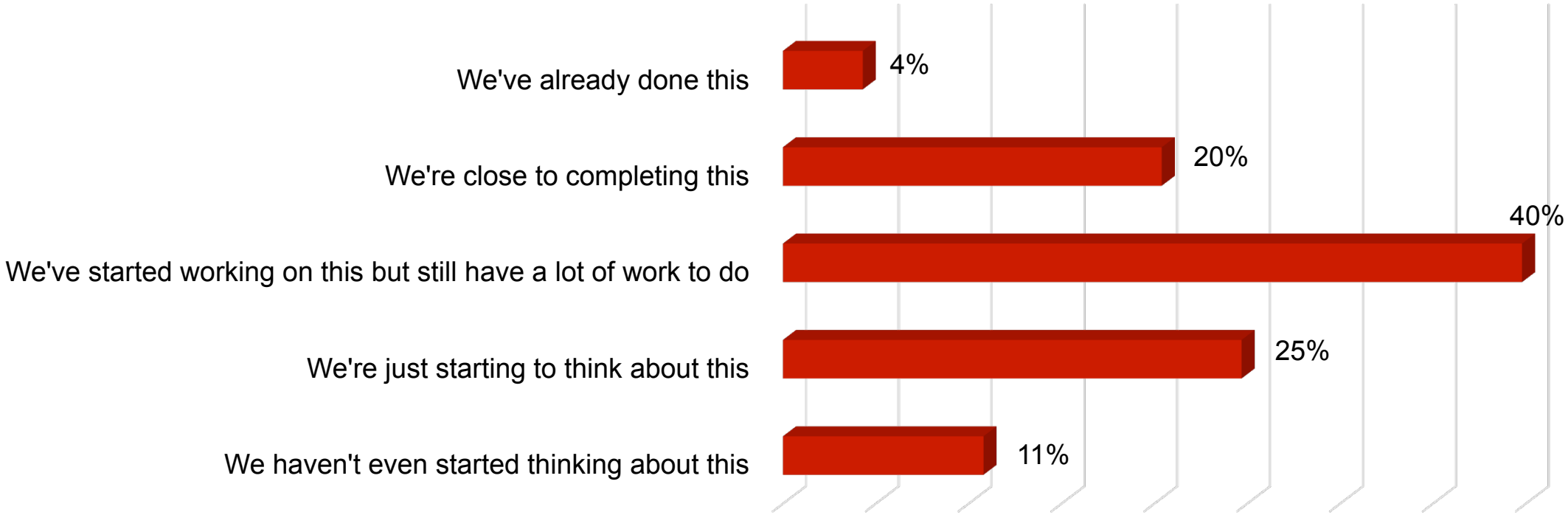


Source: Heavy Reading NFV Operator Survey, 2015

- NFV cloud platform evaluations are underway

NFV Management and Orchestration Selection

How far along is your company in choosing which NFV management and orchestration (MANO) platform to use? (n=93)



Source: Heavy Reading NFV Operator Survey, 2015

- Very few operators have taken a decision on “MANO”

HEAVY READING
REAL WORLD RESEARCH

Orchestration Challenges

"MANO is the main roadblock for us. There are two problems and issues with MANO. The first is just complexity, as it stands there are so many functions and things to consider that it is not easy to deploy a full stack of MANO architecture."

Converged Carrier Europe

"I am personally still surprised that there is still no mainstream [architecture] visible. There have been no big announcement from the ecosystem players that indicates there is mainstream reference architecture for NFV."

Large Operator

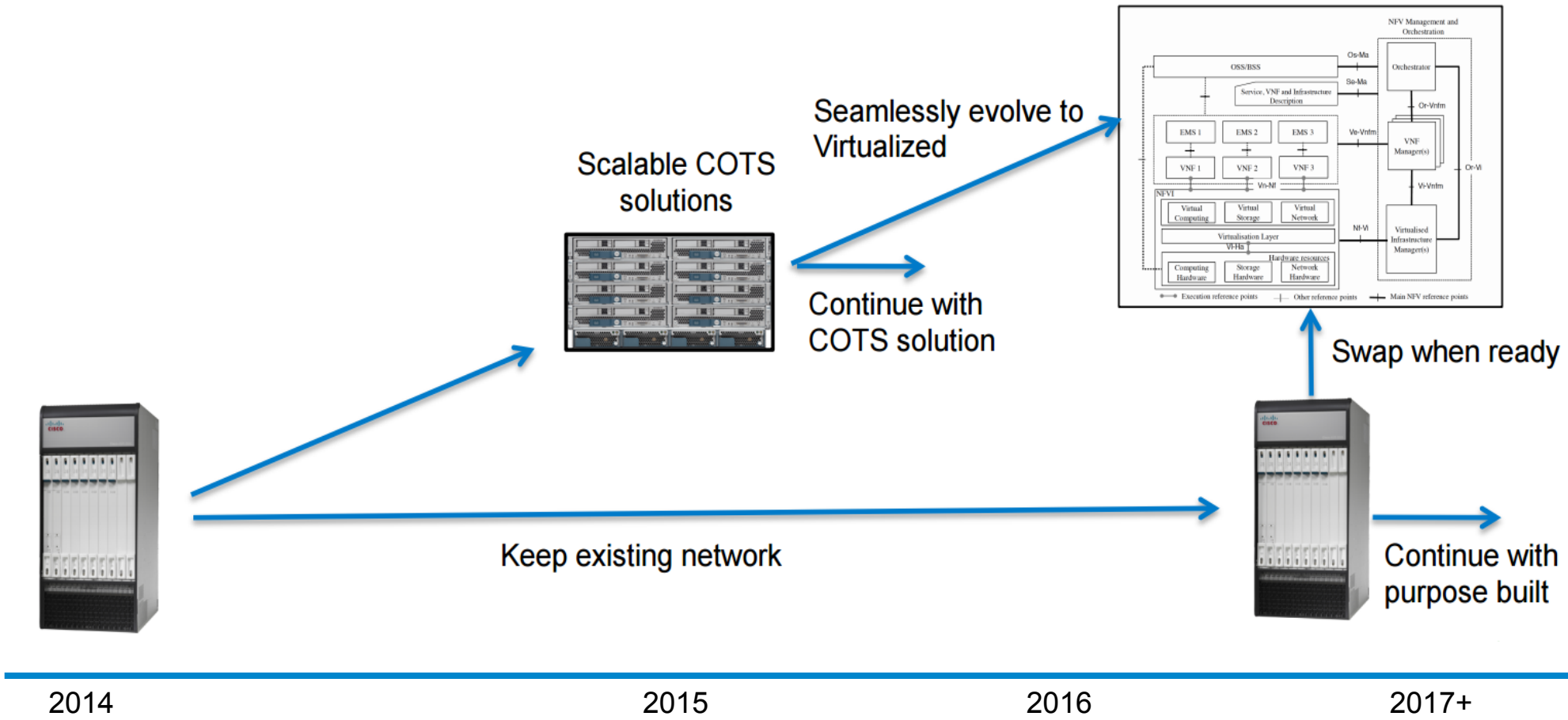
"ETSI MANO is implemented in such a way as you create a vertical silo; this is understandable from a telecom point of view, but it's against the principles of virtualization."

NFV Infrastructure Lead

"It will take three years to develop and be so complicated that the vendors who build it won't be able to maintain it. We already see this with billing software, the vendors have created software they can't maintain."

International Operator Group

Migration to Cloud-hosted Mobile Core



Source: Cisco

Future Directions

- VNF software designed-for-the-cloud
- Orchestrated network services on a “telco-operated” cloud
- Introduction of SDN for bearer-plane traffic
- Service chaining across core and SGi-LAN
- Further use-case development
- Look ahead to 5G system architecture evolution

“A virtual network architecture, including network slicing, is critical to supporting new services in the era of 5G.”
Alex Jinsung Choi, CTO, SK Telecom

Q&A

Thank You!

brown@heavyreading.com

Download Heavy Reading White Paper: Virtual EPC for Tier 2 & 3 Mobile Operators