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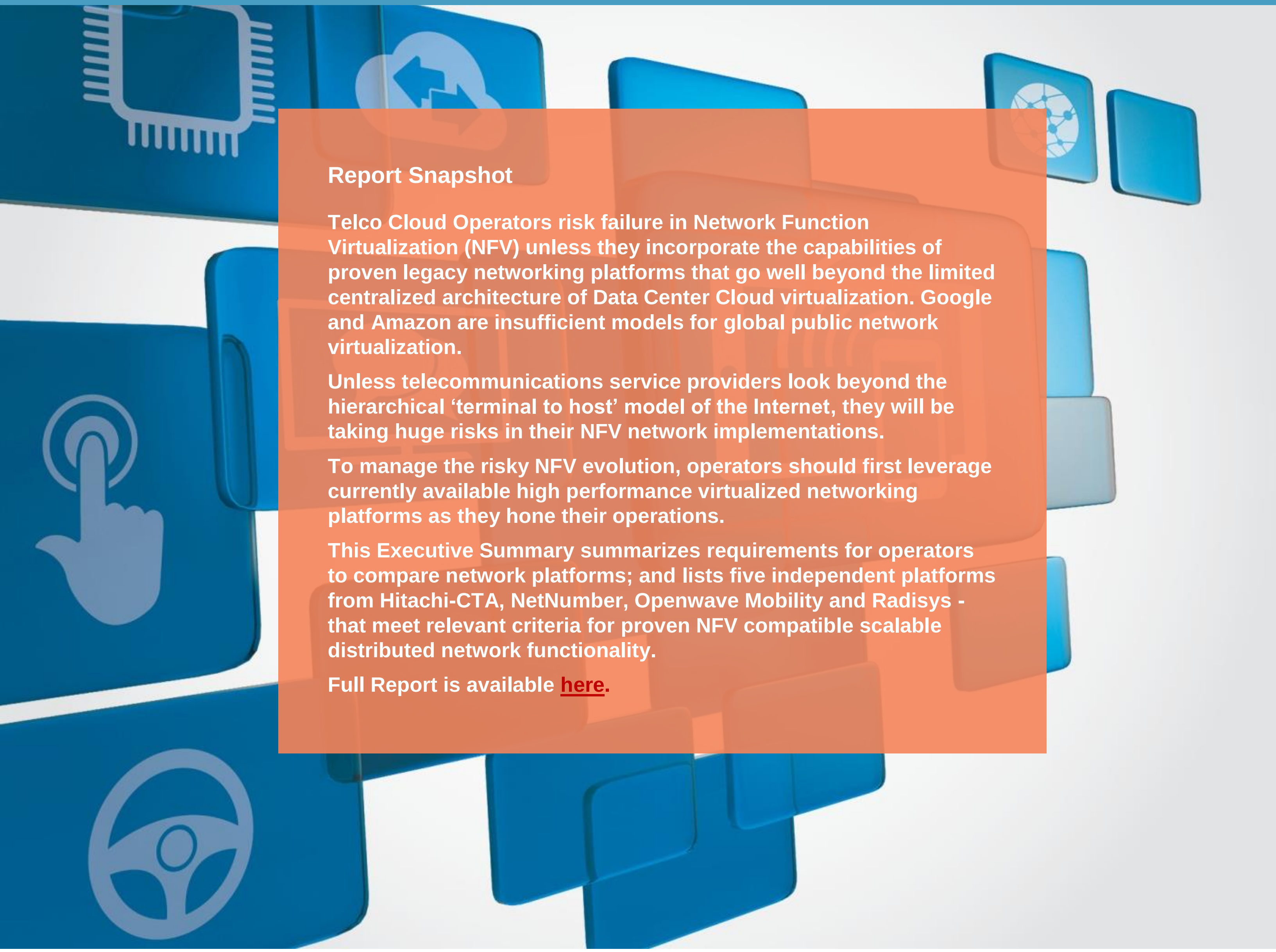
Mobile Broadband Technologies

Executive Summary: Reduce NFV Risk - Pursue Network Virtualization First - 5 Independent Platforms Meet 16 Operator Requirements Today

Wireless Networks and Platforms (WNP)



Report Snapshot

Telco Cloud Operators risk failure in Network Function Virtualization (NFV) unless they incorporate the capabilities of proven legacy networking platforms that go well beyond the limited centralized architecture of Data Center Cloud virtualization. Google and Amazon are insufficient models for global public network virtualization.

Unless telecommunications service providers look beyond the hierarchical 'terminal to host' model of the Internet, they will be taking huge risks in their NFV network implementations.

To manage the risky NFV evolution, operators should first leverage currently available high performance virtualized networking platforms as they hone their operations.

This Executive Summary summarizes requirements for operators to compare network platforms; and lists five independent platforms from Hitachi-CTA, NetNumber, Openwave Mobility and Radisys - that meet relevant criteria for proven NFV compatible scalable distributed network functionality.

Full Report is available here.

Networks

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Distributed Networking as the Paradigm for 'Telco Cloud' Network Virtualization

Virtualizing a 'Telco Cloud' is very different from virtualizing a centralized resource like a data center Cloud where 'hosts' accept requests from 'terminals' and send back responses. A true 'Telco Cloud' must operate network-wide to dynamically assign processes to processors and forward and control traffic based on agreed standards across global networks in real time. This report suggests that we look at how successful platforms already **virtualize networking on 'off the shelf' hardware;** and creates a **checklist of capabilities** that service providers may wish to include in their new Network Function Virtualization (NFV) service platform specifications. These go beyond functionality currently specified in NFV standards.

Operators need a paradigm for network virtualization that can allow NFV to evolve beyond the data center model. Without these capabilities it will be very difficult and risky for service providers to practically take the 'Cloud' model beyond the data center.

Distributed Computing and Distributed Networking

It is very important to remember that the computing industry did not transition from mainframes to PCs directly - in the 1980s minicomputers introduced networks of ***distributed computing***. That model - from which companies like VMware and HP Enterprise sprang - may offer a more relevant starting point than data centers do for a truly '*distributed flat high performance cloud*'. The 'terminal to host' client server model that emerged in the late 1980s led to an inherently centralized data center approach that is now embedded in today's TCP/IP based Internet.

Network virtualization, however, demands a truly 'flat' ***distributed networking*** model where "the network is the computer" as John Gage of Sun Microsystems (now Oracle) noted in 1984. A key "aspect … is the ability of the network infrastructure to connect many systems together … to become a huge computing environment." At that time, we did not have the connectivity and performance to create the global 'Telco Cloud' we are building today that supports ubiquitous services available everywhere and processing wherever it is needed.

[Note: Appendix A of the full report summarizes why distributed networking need not need share the problems traditionally associated with distributed computing.]

The 'Telco Cloud' requires a global virtualized network infrastructure. And that global virtualized network infrastructure requires a highly modular scalable architecture that cannot be 'retrofitted' on top of hierarchical centralized 'terminal to host' systems.

Operators need to minimize the risks of NFV by first pursuing proven scalable distributed networking platforms that now also meet NFV requirements.

Below we offer an initial list of 16 operator requirements and describe five independent vendor platforms that meet the ones their service requires.

Network Virtualization Platform Requirements

Platforms for network virtualization require far more than the ability to spin up new instances of server based Virtual Machines (VMs). ***Specific capabilities must be built into the architecture of robust distributed services software networking platforms.*** These cannot be 'added on top' of traditional compute servers if they are to deliver low latency state aware global public network services.

Strategy Analytics has developed a list of 16 key requirements for such ***Network Virtualization Platforms*** that operators can use as initial criteria to compare alternative NFV capable platforms. In the chart below we also list likely applications for each requirement.

Chart A. Sixteen Requirements for Virtualized Network Platforms

	Reqts. for Network Virtualizations Platform	Use Example/Application
1	*Logically Centralized/Physically Distributed Proc.*	Low Latency Solutions
2	*Scale Elastically* w/o loss of Performance or ΔLatency	High Availability/Capacity w. Performance at Scale
3	*Capable of Event/Transaction handling*	Deterministic/Guaranteed outcomes
4	*Real Time OS interrupts* at OS kernel	Match Proprietary Equipment Performance
5	*'State Aware' at each node* (Asynchronous State)	No lost Transactions/Calls/Sessions
6	*Low Latency <10 milliseconds*	Instant Network *and User Service* Response
7	*Transport AND layer 2 Protocol Independent*	Truly Platform and Network Access Agnostic
8	*Real Time Info. For both Virtual & Physical Instances*	Network & Service Awareness simultaneously
9	*Parallel and Re-Entrant Service Chaining Options*	Optimize Service Chain Performance/Clean-Up
10	*Multiple Service Flows/Sessions that share Class of Service (CoS) Reqt. within a Network 'Slice'*	Allow operators to aggregate Real Time flows into Network 'Slices' for Efficient CoS Mgt. & ROI
11	*Monitor and Manage Flows/Sessions in Real Time End to End (E2E)*	Deliver both Service Awareness for CRM & CEM Options in Real Time
12	*Context Awareness for multiple events Per User Flow* e.g. Minimize database dips, replicated tasks etc.	Use shared Context to dramatically reduce overhead transactions and database delays etc.
13	*Manage, Change & Store Software Image /Configuration for Instant Upgrade or Recovery*	Ensure Service Release Control & Agility for small or large feature upgrades
14	*Interprocess Communications Mechanisms* for co-ordination of *NFV Managers, SDN Controllers* etc.	Operate Seamlessly across Multiple NFVM, *SDN Controller* Domains etc.
15	*Interprocess Communications Mechanisms* for co-ordination between *Network Orchestration* Domains	Operate Seamlessly across Multiple *Network Orchestration* Domains
16	*Interprocess Communications Mechanisms* for co-ordination of *Service Orchestration* Domains	Operate Seamlessly across Multiple *Service Orchestration* Domains

Source: Strategy Analytics, Wireless Networks and Platforms [To cite: contact srudd@strategyanalytics.com]

The first six requirements above are ones that are already much discussed with respect to NFV platforms - Logical - ***not Physical*** - Centralization or Distribution (1), Scalability (2), Real Time Event/Interrupt Processing (3,4), State Awareness (5) and Low Latency (6). Others, relate to protocol independence (7), information exchange (8) and inter-process communication protocols for co-ordination between Controllers and Orchestration Domains (14,15 and 16).

The remainder relate to the Software Architecture for parallel and re-entrant code processing for Service Chaining (9), Creating and Managing Flows (10, 11), Sharing Context Information (12) and Software Configuration for Network Monitoring and Service Orchestration.

Embedded throughout the list are ***implications for software methodology*** that go from OS kernel interrupts (4) to protocol independence (5) linear, parallel and re-entrant code options (9) shared context (12) and upgrade procedures (13).

Note: The approach to platform code software development can be as important as the platform architecture overall

Applying Platform Criteria

Not all of 16 capabilities are essential for every application and operators should obviously allow for variations when applying the criteria to different platform functionality. Of course NFV purists would argue that all platforms should be 'fungible' and therefore support all functions. In reality it will likely make sense - and save money - to **optimize virtual 'pools of platform resources'** around performance and software based on domains that match the networking requirements for network and user services with shared characteristics.

Service Platforms

In the full report we describe five platforms that exemplify high performance virtualized networking today for several important services:

- **Distributed Mobility Management (MME) and real time mobile access (SGSN)**
- **Distributed but logically centralized signaling (SS7/Diameter Signaling Controller etc.)**
- **Value Added Service (VAS) virtualization**
- **Video Delivery Optimization (VDO)**
- **Distributed Traffic Forwarding**
- **Media Content Delivery (MRF)**

These are all potential Virtualized Network Functions (VNFs) that demand high performance scalable virtual networking and network wide control.

For this initial comparison we selected five platforms from leading *independent* players and we thank them for their assistance in working with us to identify how their solutions meet each requirement. The service platforms included are:

- ***Hitachi CTA:*** *MME/SGSN Virtual Network Function*
- ***NetNumber:*** *TITAN (CSRC) Centralized Signaling and Routing Control*
- ***Openwave Mobility:*** *Integra™ NFV Platform*
- ***Radisys:*** *FlowEngine©*
- ***Radisys:*** *MediaEngine©*

All five platforms meet the first two categories of requirements and many of the others. Radisys FlowEngine data plane forwarding engine supports event handling only if required and MediaEngine generally does not require node state awareness. Openwave Integra does not require OS interrupts to optimize performance.

Chart B. How Five platforms meet 16 Network Virtualization Requirements

	Use Example/Application	Hitachi CTA vMME	NetNum-ber TITAN	OWM Integra	Radisys Flow Engine	Radisys Media Engine
		Mobile Infra-structure	*Network Signaling*	*Virtualizing Services*	*Dataplane Forwarding*	*IP Media Server*
1	*Low Latency Solution*					
2	*High Availability/ Performance at Scale*					
3	*Deterministic/Guaranteed outcomes*					
4	*Match Proprietary Equipment Performance*					
5	*No lost Transactions/Calls/Sessions*					
6	*Instant Network and User Service Response*					
7	*Truly Platform and Network Access Agnostic*					
8	*Simultaneous Network & Service Awareness*					
9	*Optimize Service Chain Perform./Clean-Up*					
10	*Allow operators to aggregate Real Time flows into Network 'Slices' for Efficient CoS*					
11	*Deliver both Service Awareness for CRM & CEM Options in Real Time*					
12	*Use shared Context to dramatically reduce overhead transactions and database delays*					
13	*Ensure Service Release Control & Agility for small or large feature upgrades*					
14	*Operate Seamlessly across Multiple NFVM, SDN Controller Domains etc.*					
15	*Operate Seamlessly across Multiple Network Orchestration Domains*					
16	*Operate Seamlessly across Multiple Service Orchestration Domains*					

KEY to Colors in Charts B above

Vendor & Product Name	Hitachi CTA vMME/ SGSN	NetNumber TITAN	OWM Integra	Radisys FlowEngine	Radisys MediaEngine
Performance Domain	*Mobile Infra-structure*	*Network Signaling*	*Virtualizing Services*	*Data Plane Forwarding*	*IP Media Server*
Not Available/Not Relevant					
Function Depends on Application/Configuration					
Function Inherent in Platform Architecture					

The five platforms meet many of the 16 requirements in the above checklist for virtualized networking but it is important to note that requirements vary by service and ***not all service platforms need to meet every requirement.***

Forthcoming Research

Later this year, we will be reviewing platforms from the large global players including new platforms from ***Cisco***, ***Ericsson***, ***Huawei*** and ***Nokia*** and the associated NFV and service migration path options.

This is the first of several reports on **how service providers can manage the significant risks of Software Defined Networking (SDN)/NFV process and platform migration.**

Future reports will cover the next stages of the SDN/NFV roadmap for:

- ***BSS/OSS Process Evolution*** - Solutions that evolve SDN/NFV processes ahead of new platforms
- ***Major Players'*** - *Vendors and Service Providers - Migration Paths* - minimizing risk in evolution from legacy to NFV solutions
- ***Software Defined Networking for Profitable 'Network Slices'***

Full report

For questions or more details on the full report please contact Sue Rudd, Director Service Provider Analysis email: srudd@strategyanalytics.com