

Reinvent telcos for the cloud

FutureWorks – Technology Vision 2020

- March 2015

*FutureWorks represents concepts, innovations and technologies that demonstrate possibilities (not commitments) for our future portfolio and roadmaps

Nokia Technology Vision 2020

Delivering gigabytes of personalized data per user per day profitably and securely

Support up to 1000 times more capacity 


Speed & volume

Reduce latency to milliseconds 

Instant response

Teach networks to be self-aware 

Service quality

Flatten total energy consumption 

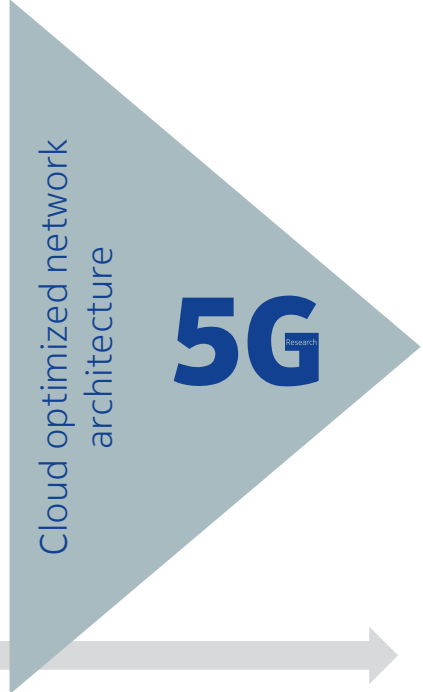
Lower emissions

Reinvent Telcos for the cloud 

New services

Personalize network experience 

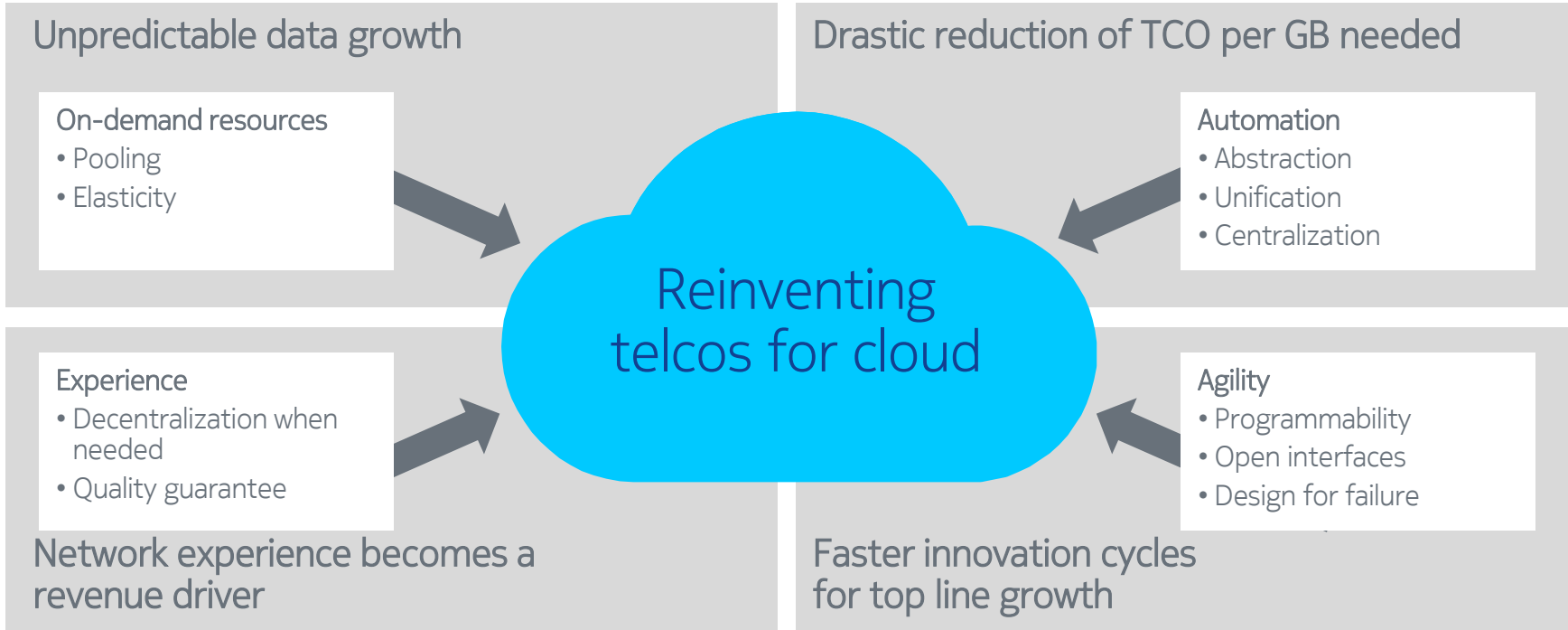
Tailored experience



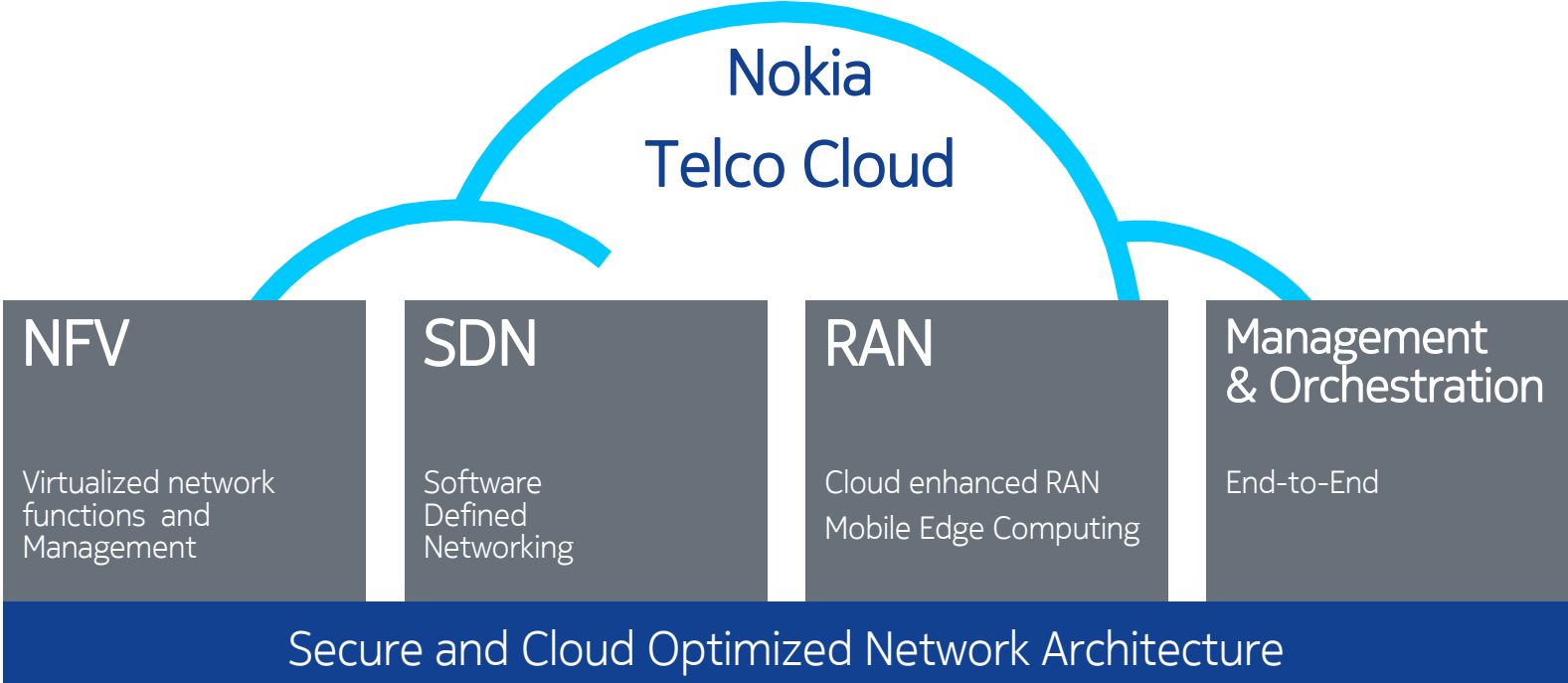
← Everything contributes to reducing cost/bit →

Why reinvent telcos for cloud?

To create an agile, programmable network infrastructure



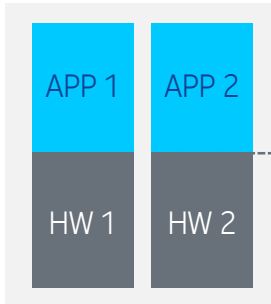
Nokia's Telco Cloud approach is based on 4 dimensions



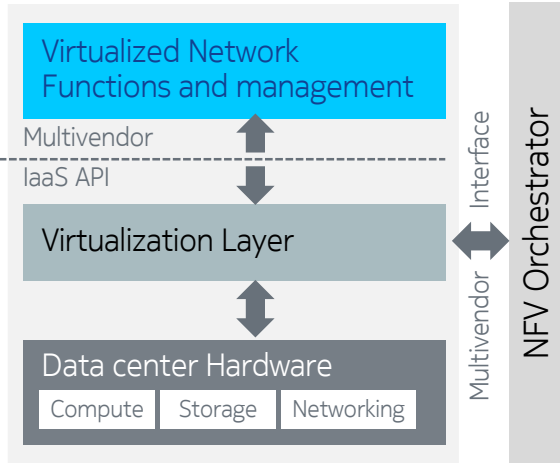
Dimension 1: NFV and Cloud Application Management

Hardware and cloud stack agnostic

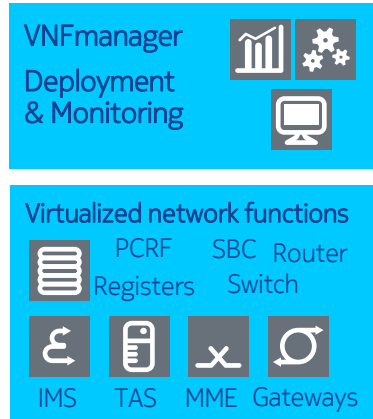
HW and SW in one box today



HW and SW decoupled with NFV



Nokia's NFV implementation

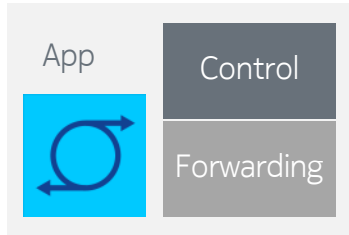


- No HW vendor lock in
- Agility**
- Dynamic load adjustment
- Efficiency**
- Automated service deployment
- Automation**
- Flexible service innovation
- Experience**

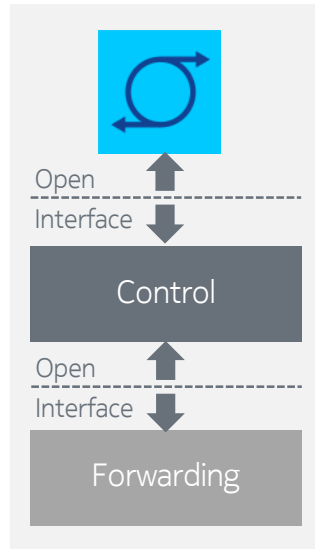
Dimension 2: Domain specific SDNs and controllers in mobile networks

Software defined networks for creating a programmable infrastructure

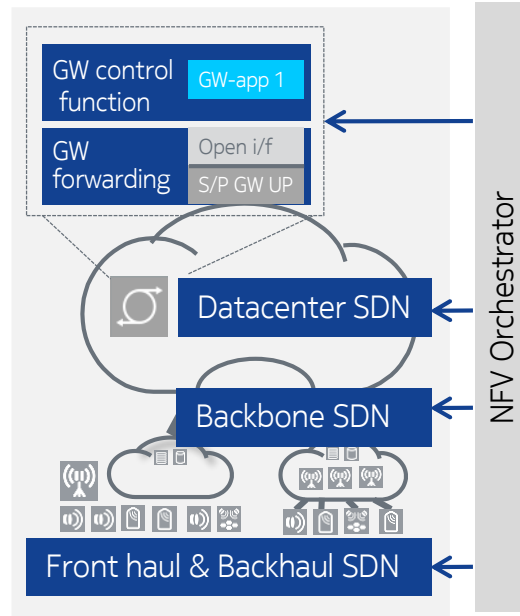
Physical functions today



Logical functions with SDN



Future SDN approach

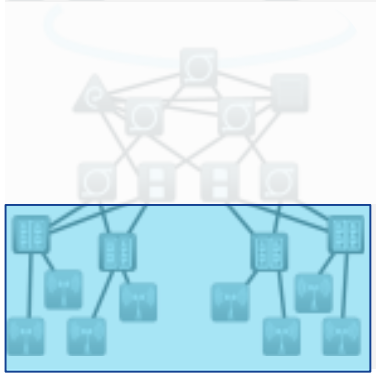


- Program & reprogram instantly
Agility
- Service and flow optimization
Efficiency
- Network in a click
Automation
- On-demand VPN capabilities
Experience

Dimension 3a: Cloud enhanced RAN

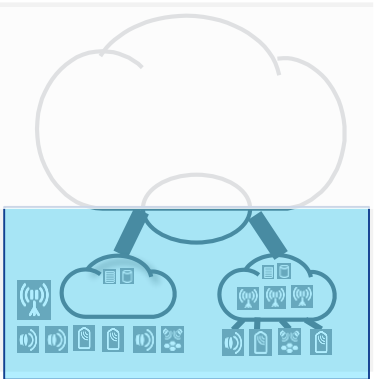
Radio network with maximum use of virtualization and cloud technology

Specialized RAN elements today

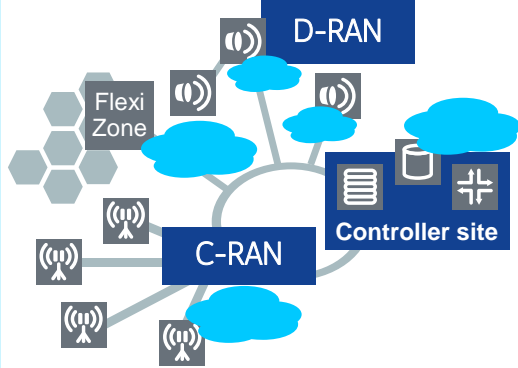


RAN layer

Cloud enhanced RAN elements



Nokia's Cloud enhanced RAN implementation



D-RAN: Distributed RAN
C-RAN: Centralized RAN

Flexibly adapting to latency and bandwidth conditions
Agility

Increased utilization of RAN assets
Efficiency

Use of server platforms
Lower TCO

Forward compatibility with 5G evolution
Evolution

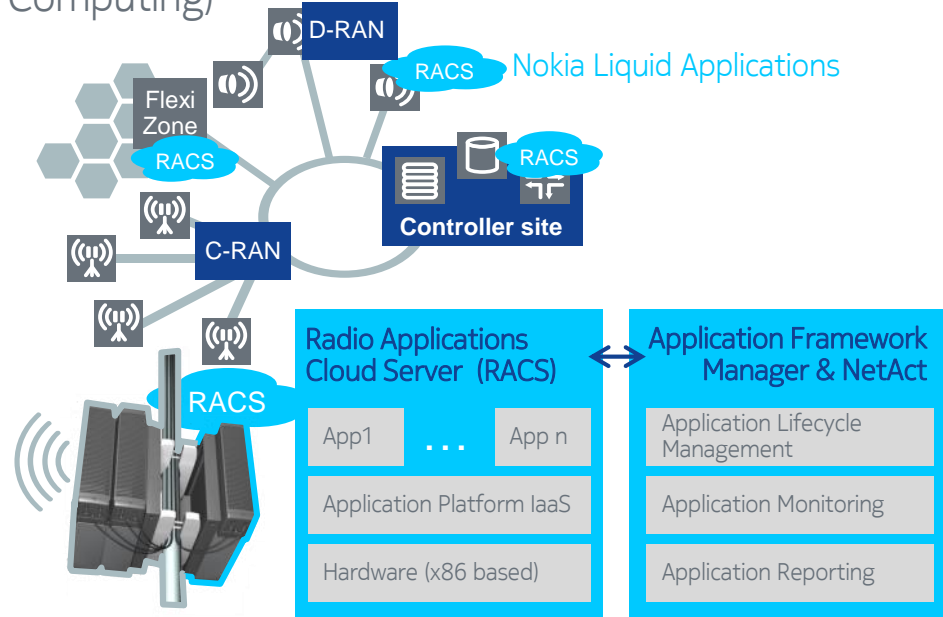
Dimension 3b: Cloud enhanced RAN

Enhance RAN services at the edge with cloud technology

Base Station today



Cloud enhanced RAN at the edge (Mobile Edge Computing)



Adapts to RAN environment requirements **Agility**

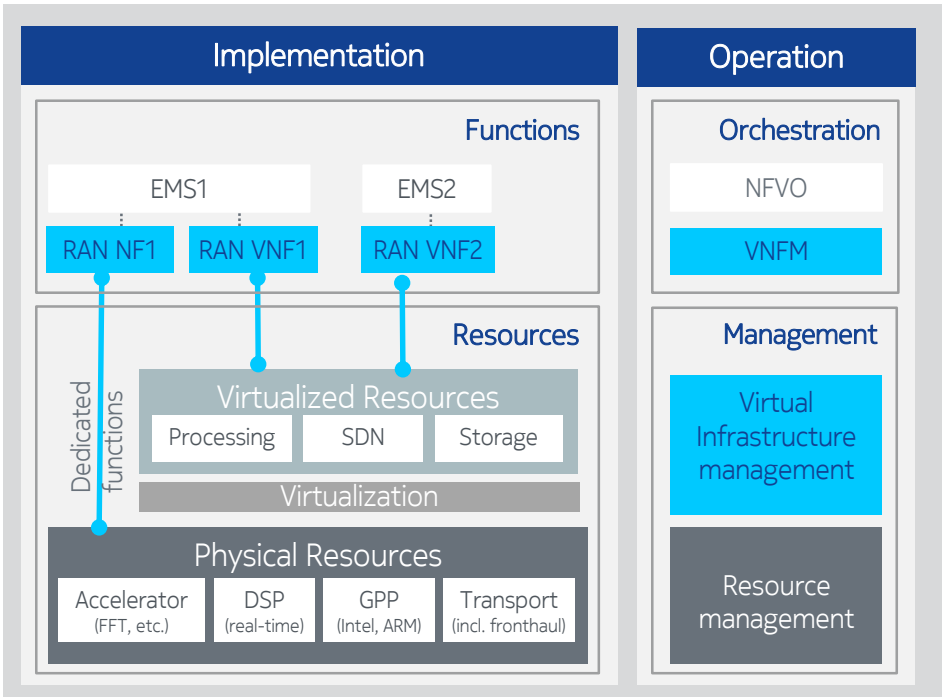
Optimized E2E resource utilization **Efficiency**

Automated service assurance **Automation**

Real time customer experience insights **Experience**

Nokia Radio Cloud vision towards 2020

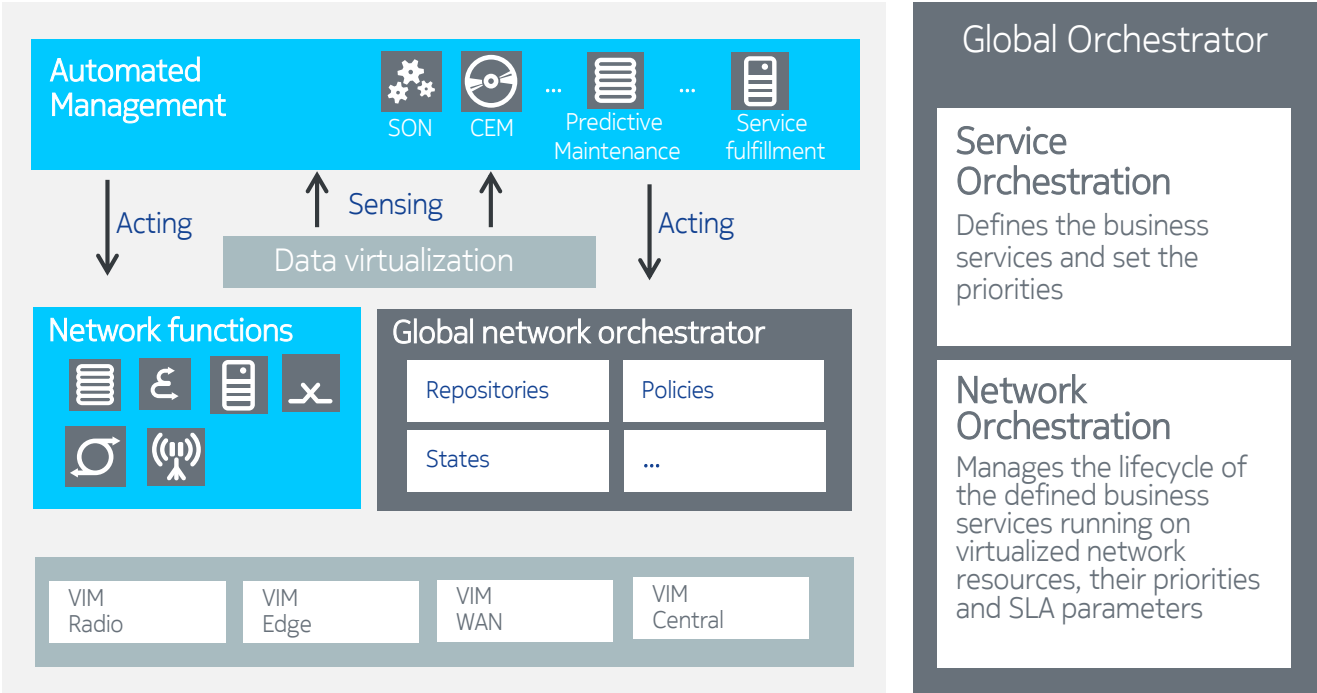
Applying cloud technologies to the RAN's unique needs



- > Shared resource pool for optimized network function topology.
 - > Multi-tenant, multi-RAN capable
 - > Optimized operations through automated orchestration and deployment of RAN functions
 - > Forward compatibility with future radio evolution
- operator benefits

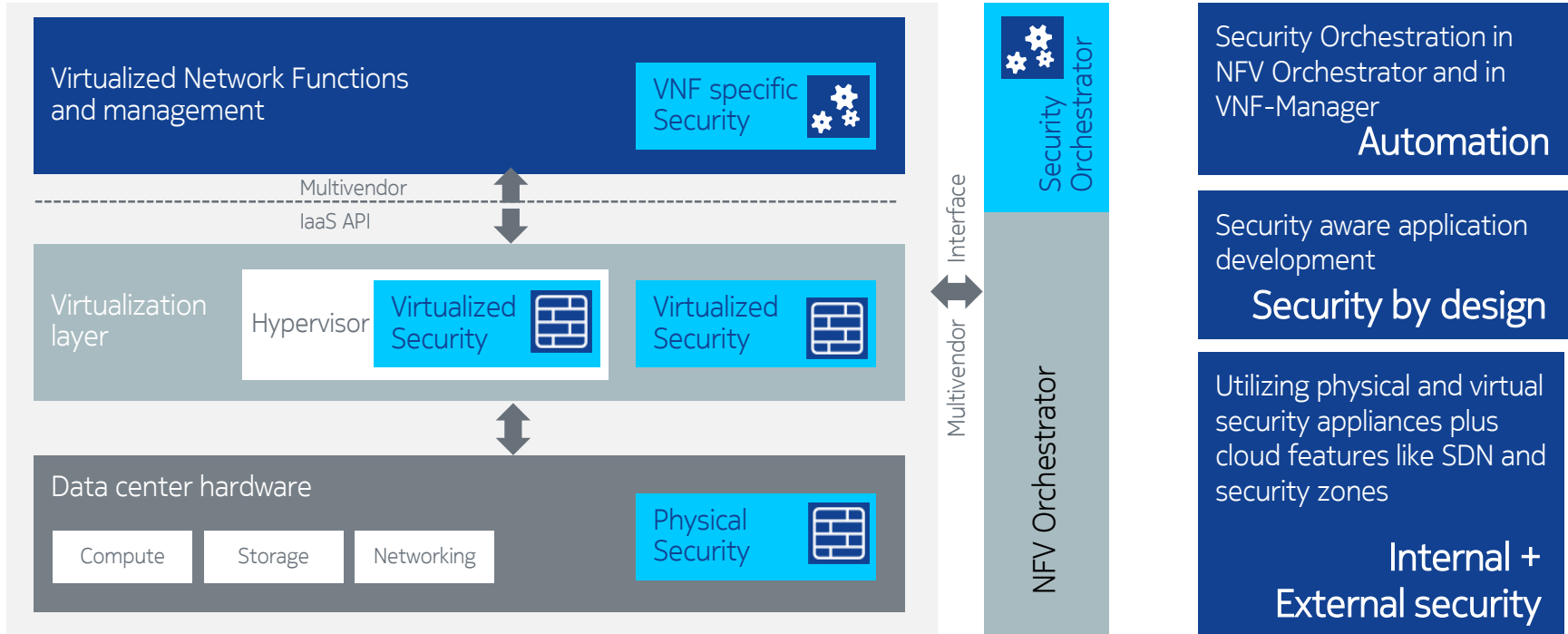
- > Flexible virtualization framework needed to mix dedicated and generic physical resources
 - > RAN optimized and real time capable cloud stack
 - > Tight latency control and SDN enabled backhaul and front haul transport
 - > High performance compute HW
- success factors

Dimension 4: E-2-E management and orchestration



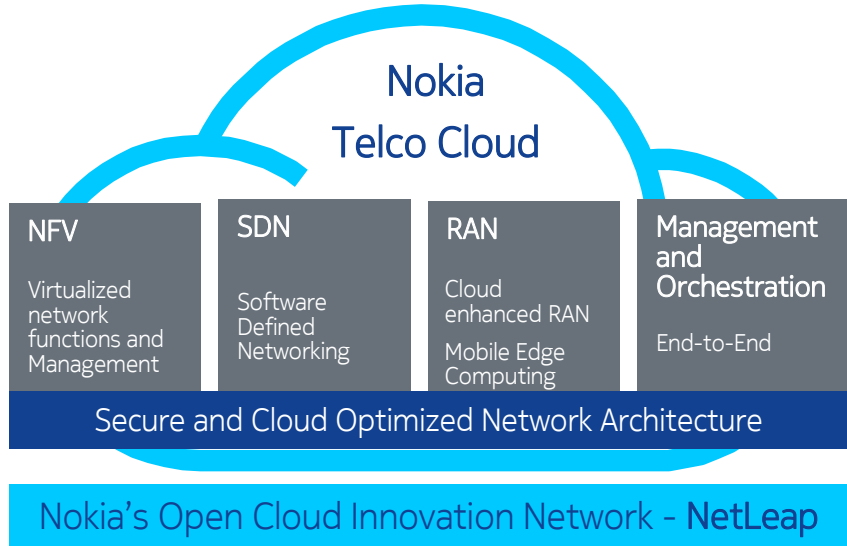
Secured Telco Cloud

Security needs to be built-in rather than add-on



Innovation examples – Reinventing Telcos for the Cloud

Cloudifying everything that can be cloudified



Launched/Roadmap	FutureWorks
Cloud Core (NFV)	Radio Cloud PoC
Cloud Application Manager (VNF Mgr)	Wi-Fi by the Cloud
Cloud Network Director	SDN for mobile Networks
Cloud Verification Service	Cloud based Network Operation Center
Liquid Applications (Mobile Edge Computing)	Cloud optimized network architecture

Nokia is bringing Telco Cloud to commercial reality

Partnering and Services are key enablers

- HW & cloud stack agnostic solution: Open eco system - no vendor lock-ins
- Complete NFV compliant E2E Cloud Core
- Full SW compatibility for smooth Telco Cloud deployments

Unique approach

- Live VoLTE on Telco Cloud with Vodafone at IFA 2013
- Complete EPC on cloud with SK-Telecom
- Live VoLTE on cloud core in 1Q2014



Recent trials

Strong Partner ecosystem

Security by design

Services to prepare, deploy, operate

Nokia committed to open and strong Telco Cloud ecosystem

Strong partnerships

Nokia architecture leadership
'taking Telco Cloud into action'

Open NFV standards
and interfaces



Multi-stack
cloud computing



Networking
for the cloud



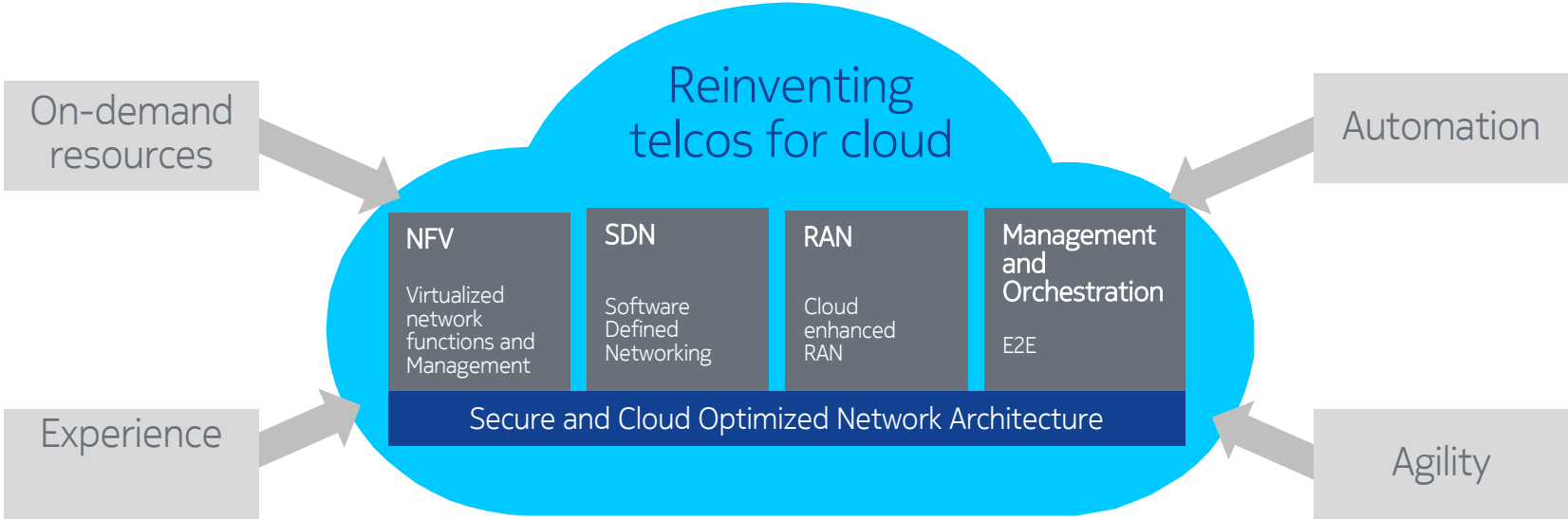
IT Hardware



Nokia's
NetLeap
open cloud
innovation
network

Re-inventing telcos for the cloud

Needed to create an agile, programmable network infrastructure



Nokia is bringing Telco Cloud to commercial reality

We are future ready
to bring our vision
to reality

GBs of personalized data per user
per day profitably and securely

<http://networks.nokia.com/innovation/futureworks>
<http://networks.nokia.com/innovation/technology-vision>
<http://networks.nokia.com/innovation/5g>



NOKIA

Our experts are happy to provide further support

Topic	Owner & speaker	Additional experts for customer engagements	Media, analyst & VIP customer engagements
V2020 overall	Kanika Atri	Regional Heads of Technology	Hossein Moiin, Lauri Oksanen, Sigurd Schuster
1000x capacity stream overall	Harri Holma	Peter Merz, Antti Toskala	Harri Holma, Peter Merz, Lauri Oksanen
5G	Agnieszka Szufarska	Kimmo Kettunen, Preben Mogensen	Peter Merz
Small cells and HetNet	Troels Kolding	Rajeev Agrawal, Timo Soirinsuo	Phil Fleming, Troels Kolding
Flexible spectrum use/ new bands	Jari Hulkkonen (Radio) Anne Leino (Standards)	Karl Josef Friederichs, Joseph Schuler, Prakash Moorut (Radio), Tuomo Säynäjäkangas	Peter Merz (Radio), Ulrich Dropmann (Standards)
Authorized Shared Access	Karl Josef Friederichs	Seppo Yrjola	Harri Holma, Peter Merz
3GPP Standards - LTE-A, HSPA+	Antti Toskala	Colin Wilcock, Benoist Sebire, Karri Ranta-Aho	Antti Toskala
Low latency	Thomas Kaps	Martti Mustajarvi, Rudi Winkelmann	Harri Holma, Lauri Oksanen
Self Aware Networks	Henning Sanneck	Kari Aaltonen, Tuuli Ahava	Lauri Oksanen
Personalize Network Experience	Ajit Kahaduwe, Tuuli Ahava	Zhi-chun Honkasalo, Norbert Kraft, Lorant Farkas, Csaba Vulkan	Lauri Oksanen, Pertti Lukander
Telco Cloud stream overall	Johannes Prade, Troels Kolding, Rajeev Agrawal	Josef Urban, Harald Bender, Nitin Shah Alan Rottinghaus, Anand Bedekar	Lauri Oksanen, Volker Ziegler Lauri Oksanen, Phil Fleming
Cloud RAN	Troels Kolding, Rajeev Agrawal	Alan Rottinghaus, Anand Bedekar	Lauri Oksanen, Phil Fleming
SDN, Orchestration, Security	Josef Urban	Johannes Prade, Kishore Albal, Lorant Nemeth	Volker Ziegler
CONE Architecture	Thomas Theimer	Johannes Prade, Kishore Albal	Volker Ziegler
Energy efficiency	Thomas Kaps	Hans Otto Scheck	Lauri Oksanen
IE, regulations, spectrum	Brian Hendricks	Balazs Bertenyi, Werner Mohr, Dirk Weiler	Ulrich Dropmann
IoT/M2M	Martti Mustajarvi	Benny Vejlgard	Sigurd Schuster
Security	Gabriel Waller	Gunther Horn, Kishore Albal	Azita Arvani, Volker Ziegler
IPR	Dhiren Patel	Dirk Weiler, Alessandro Marroni, Bernd Schaar	Hossein Moiin, Gottfried Weidel
Innovation Partnering	Azita Arvani	Chandler Kim	Azita Arvani
Technology Trends	Colin Hardenberg	Martti Mustajarvi	Sigurd Schuster