A Holistic View of Telco Clouds

Cloud Computing in the Telecom environment, bridging the gap

Miyazaki, 4 March 2012

(A workshop in conjunction with World Telecom Congress 2012)

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Agenda

1. **Introduction**

2. End User Services

   Telecom Benefits

3. Telecom Applications

   Cloud Management

   Network Management

4. Related Research at Nokia Siemens Network

5. Summary

Nokia Siemens
Networks

Who we are?

NSN Research

- *Ensure that NSN has the technology base to be competitive and can serve its customers well in the future*

Research and Technology covers

- All communications technologies
- Systems research for new standards, architectures and features
- Hardware and software technologies including new product concepts
- End to end features like security
- Network and Service management

Disclaimer

- *Paper represents the authors' view only*
- *Not harmonized across the whole company*


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- R&D Manager
- Transport, Aggregation and Fixed Access
  - Transport Networks
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- SW Technologies
  - Virtualization
  - Cloud Computing
  - Runtime Architectures
  - Dependable Computing
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Cloud Computing and Infrastructure as a Service
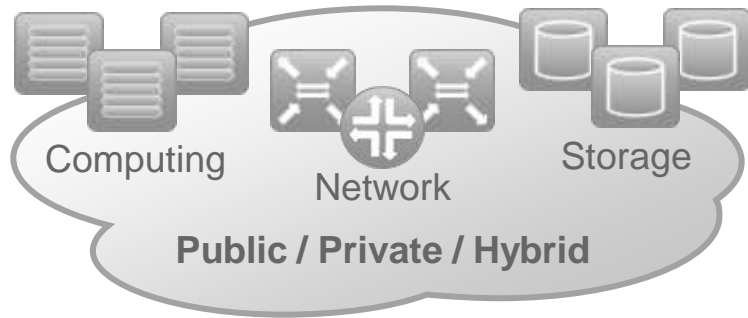
Computing

Network

Storage

Public / Private / Hybrid

**Infrastructure
as a Service (IaaS)**

Cloud computing

A style of computing in which dynamically scalable (and often virtualized) resources are provided as a service over the internet
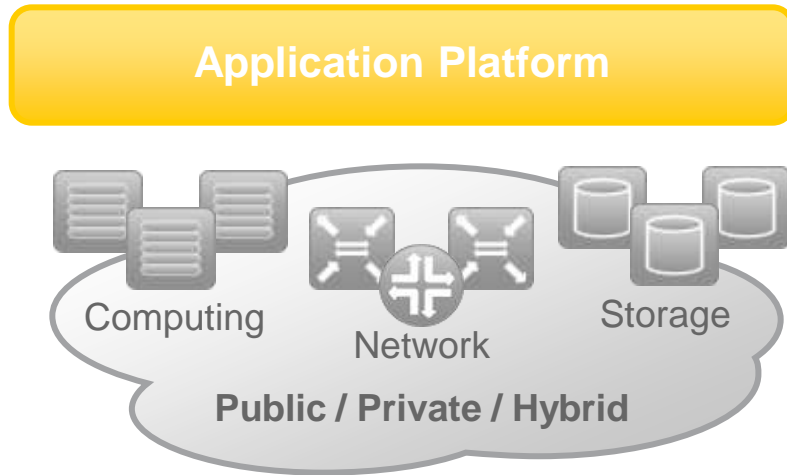
(Source: NIST)

Infrastructure as a Service

Scalable computing infrastructure exposed as a service, driven through APIs

(Source: Nokia Siemens Networks)

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Cloud Computing and Platform as a Service

Application Platform

Computing

Network

Storage

Public / Private / Hybrid

Platform as a Service (PaaS)

Infrastructure as a Service (IaaS)

Cloud computing

A style of computing in which dynamically scalable (and often virtualized) resources are provided as a service over the internet
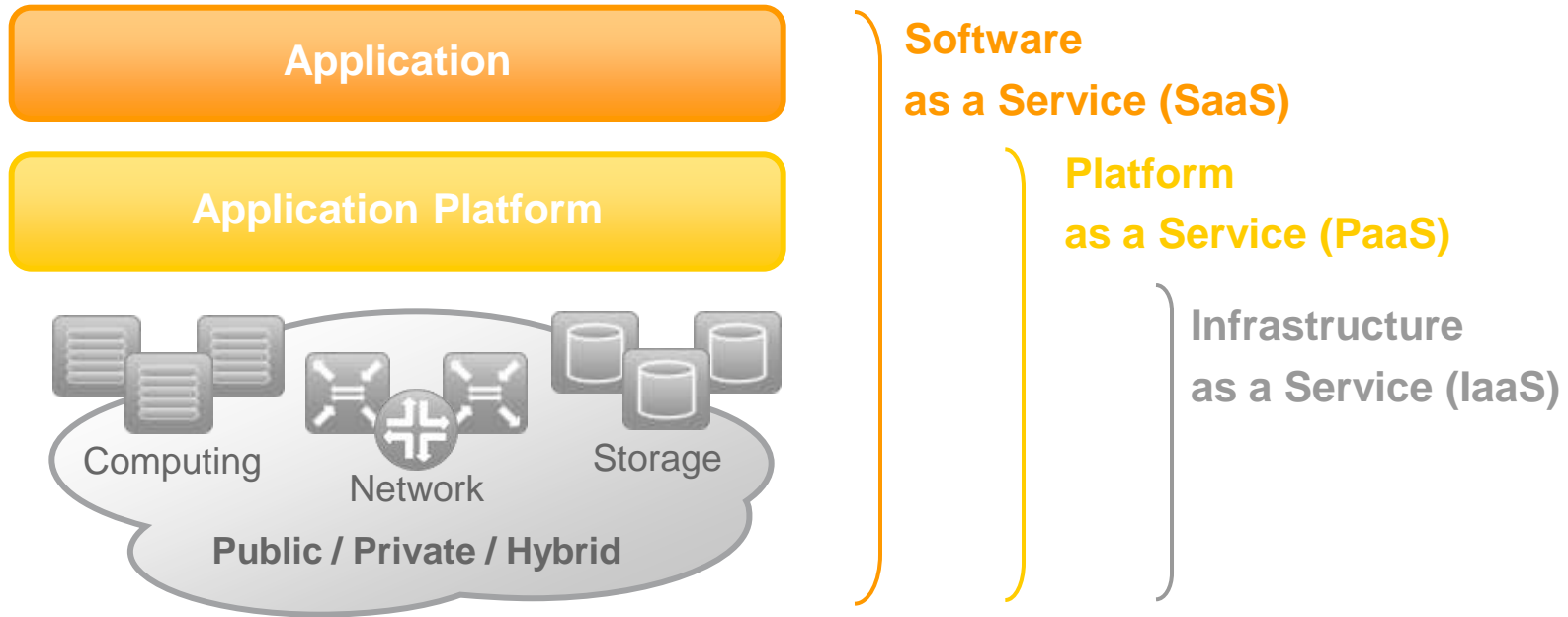
(Source: NIST)

Platform as a Service

Web-based application development, deployment and configuration environment.

(Source: Nokia Siemens Networks)

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Cloud Computing and Software as a Service

Application

Software as a Service (SaaS)

Application Platform

Platform as a Service (PaaS)

Computing

Network

Storage

Public / Private / Hybrid

Infrastructure as a Service (IaaS)

Cloud computing

A style of computing in which dynamically scalable (and often virtualized) resources are provided as a service over the internet
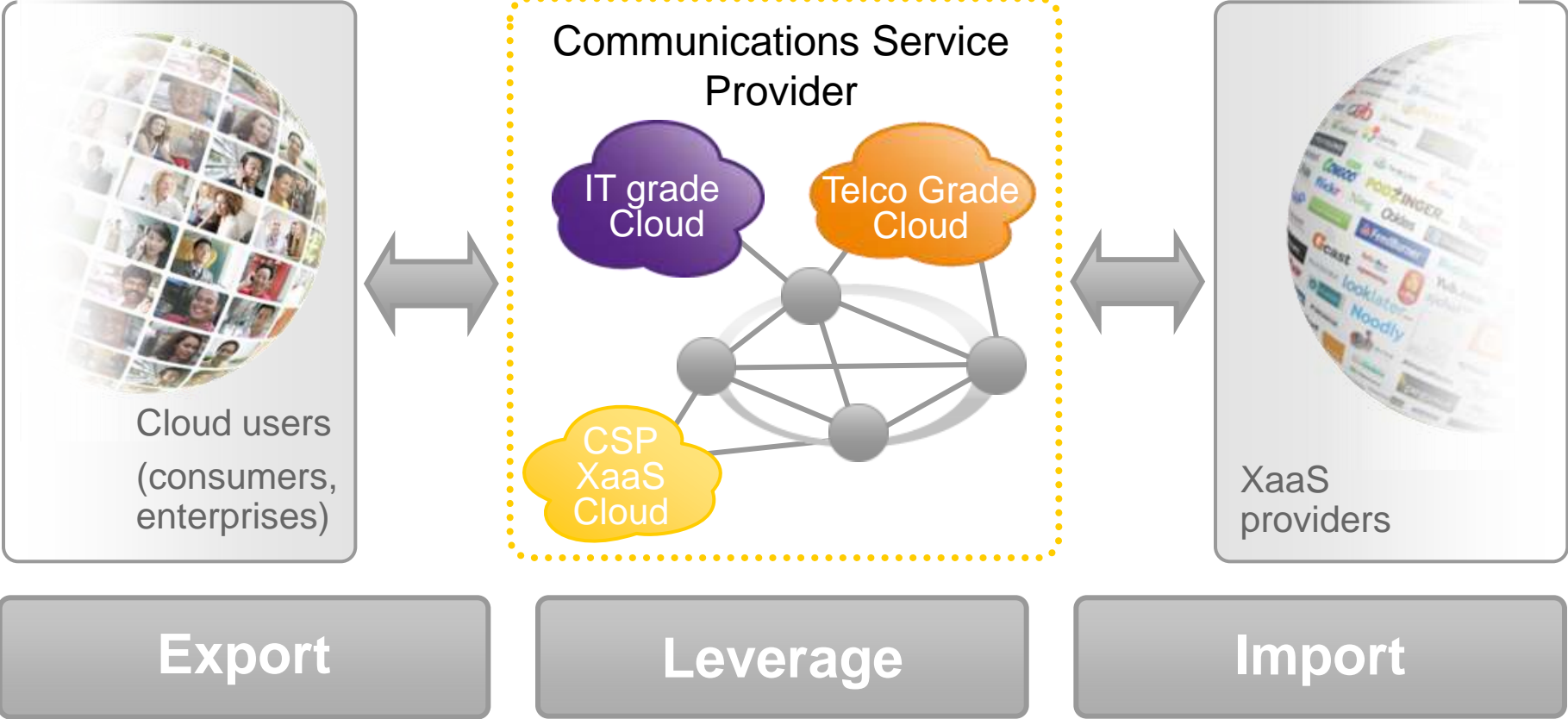
(Source: NIST)

Software as a Service

Use applications running in the cloud via thin client interfaces (typically web browsers)

(Source: Nokia Siemens Networks)

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Impact of Cloud Computing on CSPs

Communications Service Provider

IT grade Cloud

Telco Grade Cloud

CSP XaaS Cloud

Cloud users (consumers, enterprises)

XaaS providers

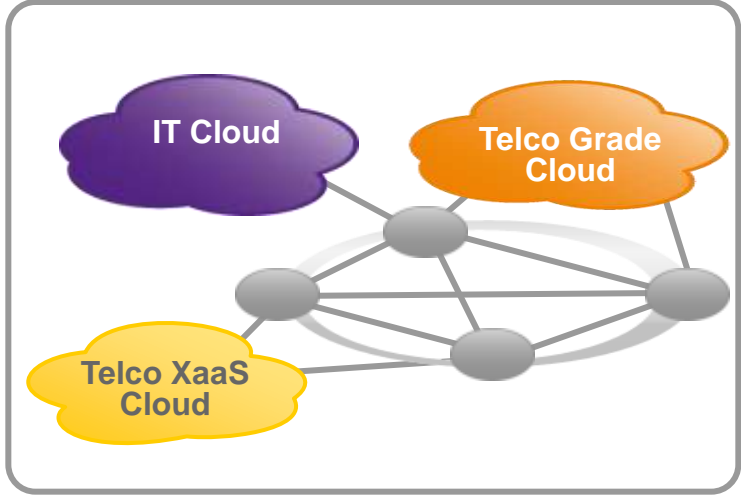**Export**

Leverage

Import

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What is a Telco Cloud?

Looking for a definition…

?

- Ownership
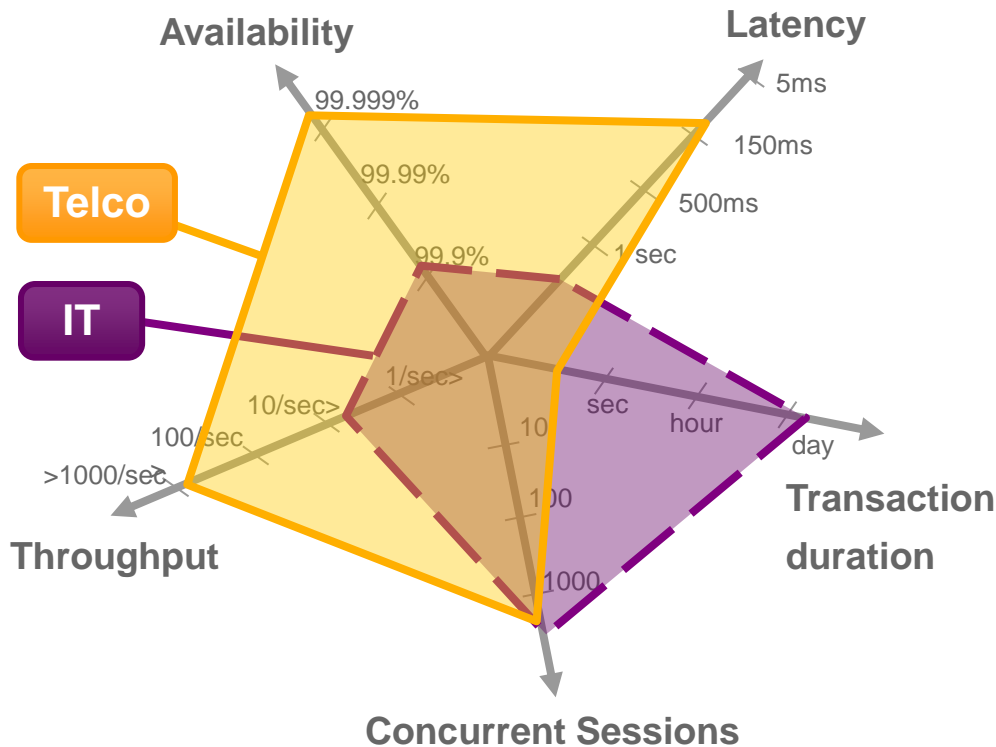- Functionality
- Quality
- Service models
- Deployment models

IT Cloud

Telco Grade Cloud

Telco XaaS Cloud

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What is a Telco Cloud?

Telco cloud defined by functionality

Telco assets to end users

Hosting telco infrastructure

For public use

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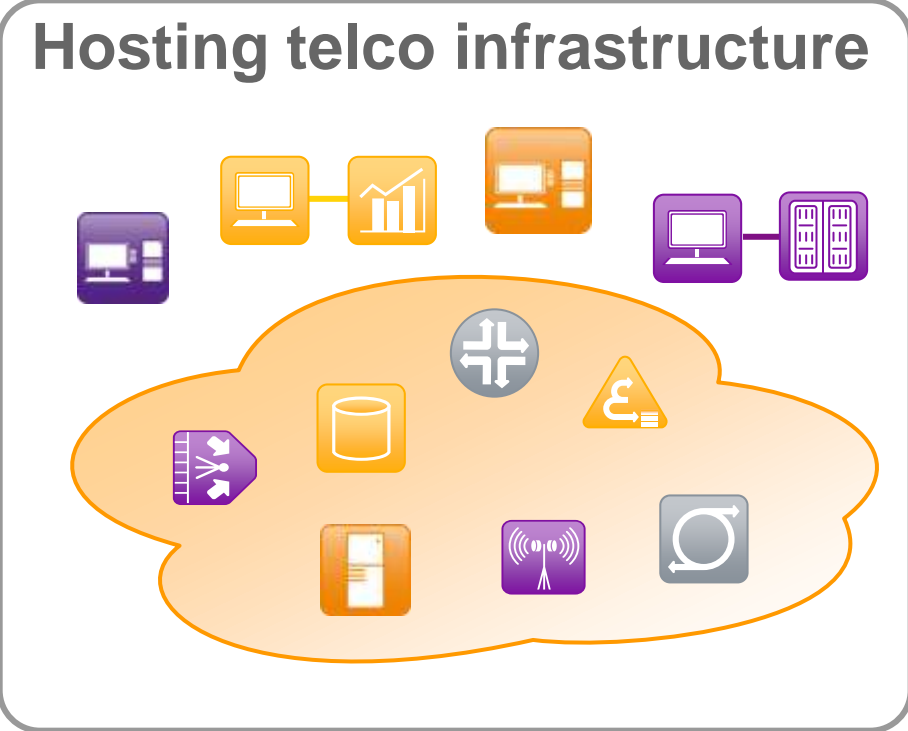
What is a Telco Cloud?

Telco cloud defined by quality

Telco

IT

Availability
99.999%
99.99%
99.9%

Latency
5ms
150ms
500ms
1 sec

Transaction duration
sec
hour
day

Throughput
100/sec
>1000/sec
10/sec>
1/sec>

Concurrent Sessions
1/sec>
10
100
1000

A Telco Grade (aka Carrier Grade) Cloud will be a cloud that can support telco grade applications

Telco Grade requirements

- High availability (5-7 nines)
- High performance (large number of transactions, scalability)
- Serviceability
- Long life time (5-10 years)
- Security
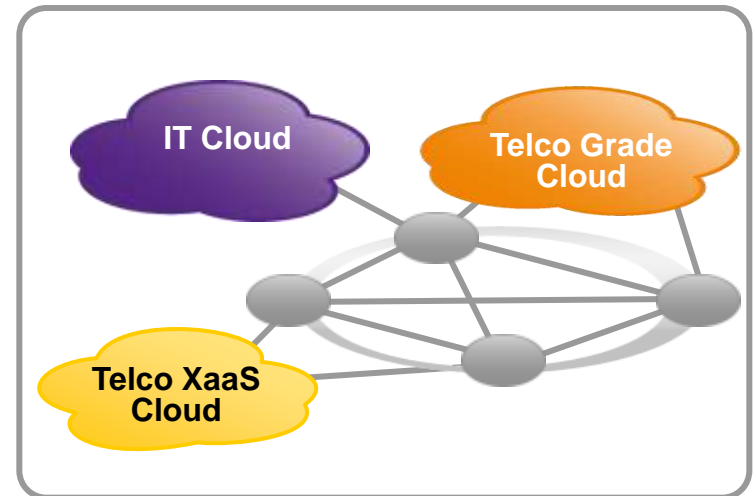- Real-time behavior (soft)
- Standard-compliant HW

(Source: Scope Alliance)

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What is a Telco Cloud?

Looking for a definition…

!

- **Several valid definitions**
  - **BTW, a taxonomy of telco aspects in cloud computing would be desirable**
- **Do not expect a complete taxonomy**
  - **Some initial thoughts**
  - **A few specific aspects mentioned**

IT Cloud

Telco Grade Cloud

Telco XaaS Cloud

Agenda

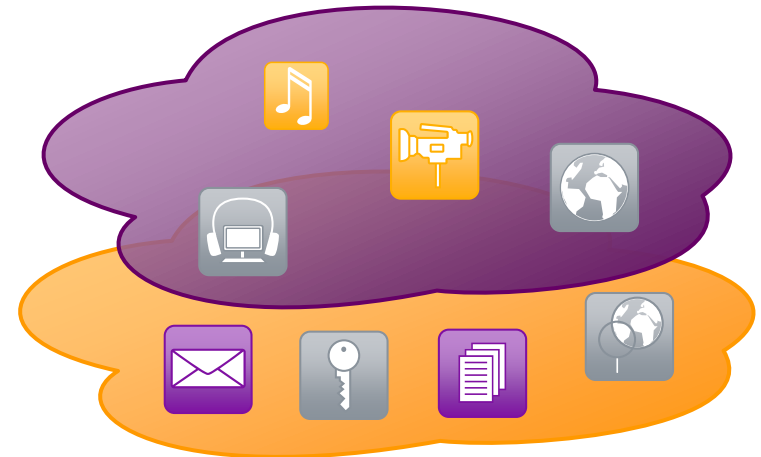Nokia Siemens Networks

End User Services

SaaS

- Gaming
- Video-On-Demand
- Video conferencing
- Augmented Reality Navigation
- Location-based services
- Etc.

PaaS

- Messaging (SMS/MMS)
- Location
- Authentication
- User data
- Connectivity / Connectivity Control
- Proxies/Caches (bandwidth)

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End User Services

- These application could work on a „pure" IT cloud as well
- Role of telco cloud:
  - Application uses telco network
  - Application uses mobile terminal
  - Application uses telco assets
    - See the list of previous slide
    - *(strictly speaking, the network and the terminal are "assets", too)*
  - Telco services restricted to telco cloud (e.g. financial/security/reliability reasons)
  - Local telco cloud available in every country: supports distributed service model well (may not be economically viable for an IT Cloud provider to do the same…)
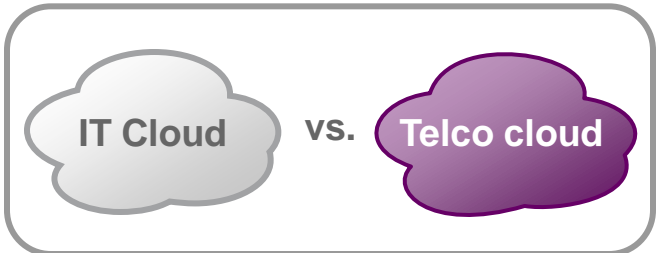
IT Cloud vs. **Telco cloud**

Telco assets to end users

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End User Services: telecom benefits

Benefit for the operator:
- Better utilization of existing assets
- New service/charging models

Benefit for the users (as opposed to an IT-only application):
- Mobile terminal
  - Mobile terminal can be "internet-enabled"
  - Wi-fi does mean concurrency, though
- Telco network
  - Certain functionality available only in the telco network (e.g. location)
- Combination of components results in enhanced quality for the service
  - E.g. ATM authentication enhanced by mobile location info from operator
- Better quality, higher SLAs
  - Telco grade cloud

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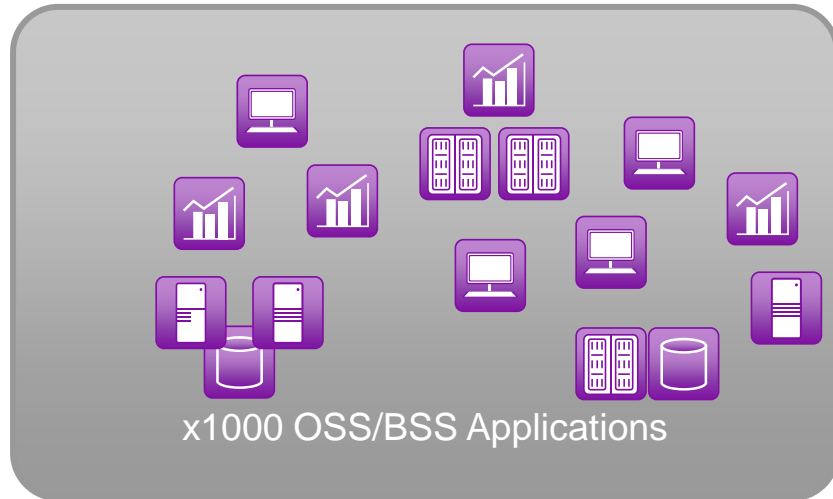
1. Introduction

2. End User Services

   Telecom Benefits

3. **Telecom Applications**

   Cloud Management

   Network Management
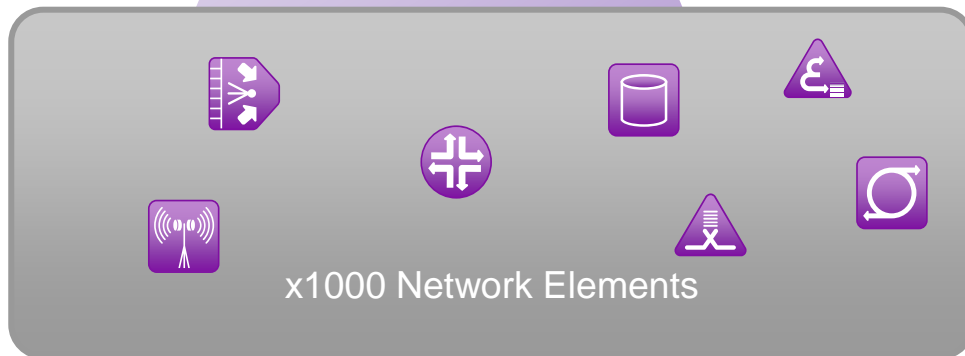
4. Related Research at Nokia Siemens Network
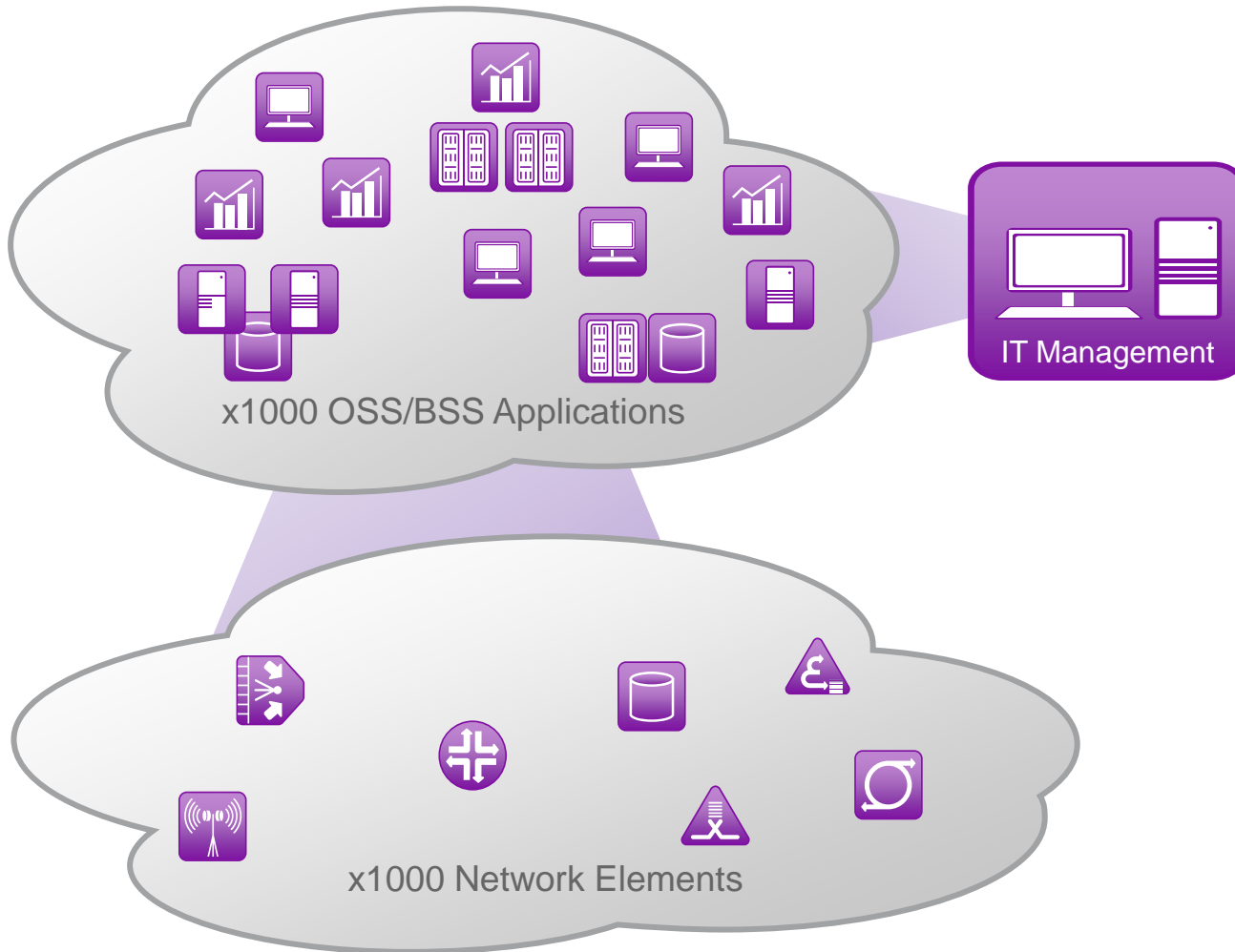
5. Summary

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Telecom Applications

x1000 OSS/BSS Applications

IT Management

x1000 Network Elements

Today

- Monolithic network elements
- Monolithic OSS/BSS systems

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Telecom Applications

x1000 OSS/BSS Applications

IT Management

x1000 Network Elements

Tomorrow

- Self-service deployment
- Resource pooling
- Rapid elasticity

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Telecom Applications

Stepwise towards telco clouds
The phased approach

1 Virtualization of telco applications

Virtualization of telco applications

2 Telco grade virtual infrastructure

Telco-grade virtual infrastructure

Virtual Infrastructure

3 Telco grade cloud

Telco apps

... as a Service

Telco-grade IaaS Cloud

4 Connecting clouds

Connecting clouds

IT grade Cloud

Telco Grade Cloud

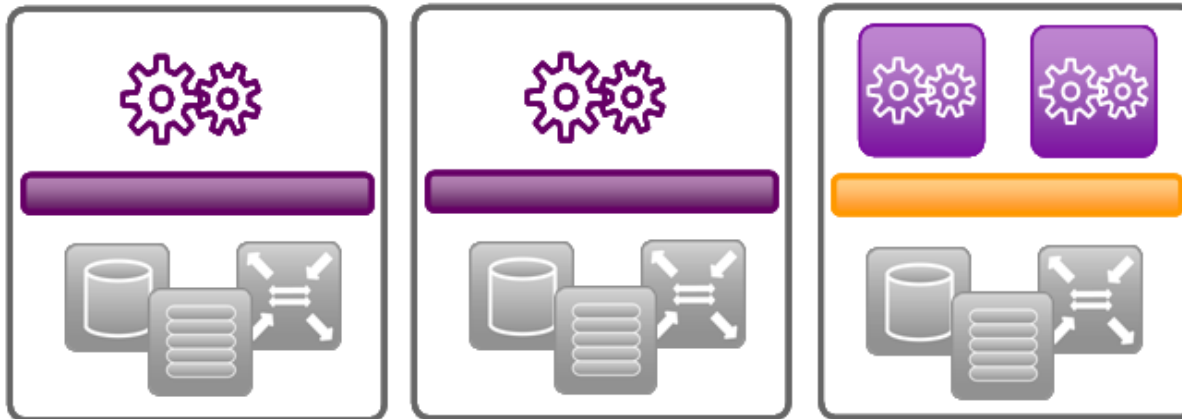CSP XaaS Cloud

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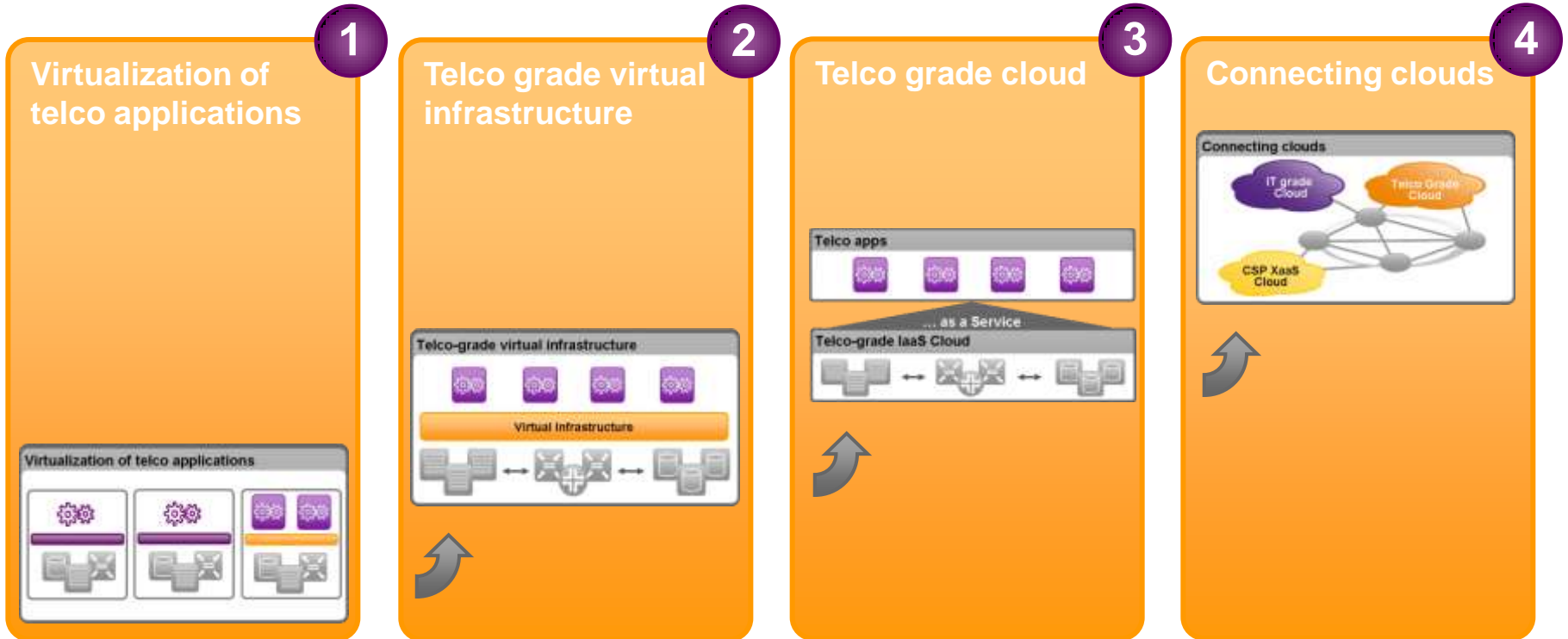
Telecom Applications
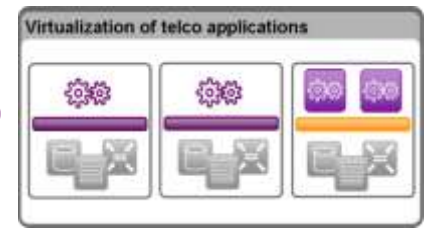
Apply virtualization techniques for selected telco applications on a case by case basis

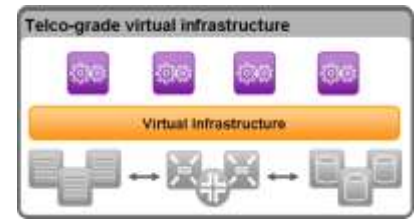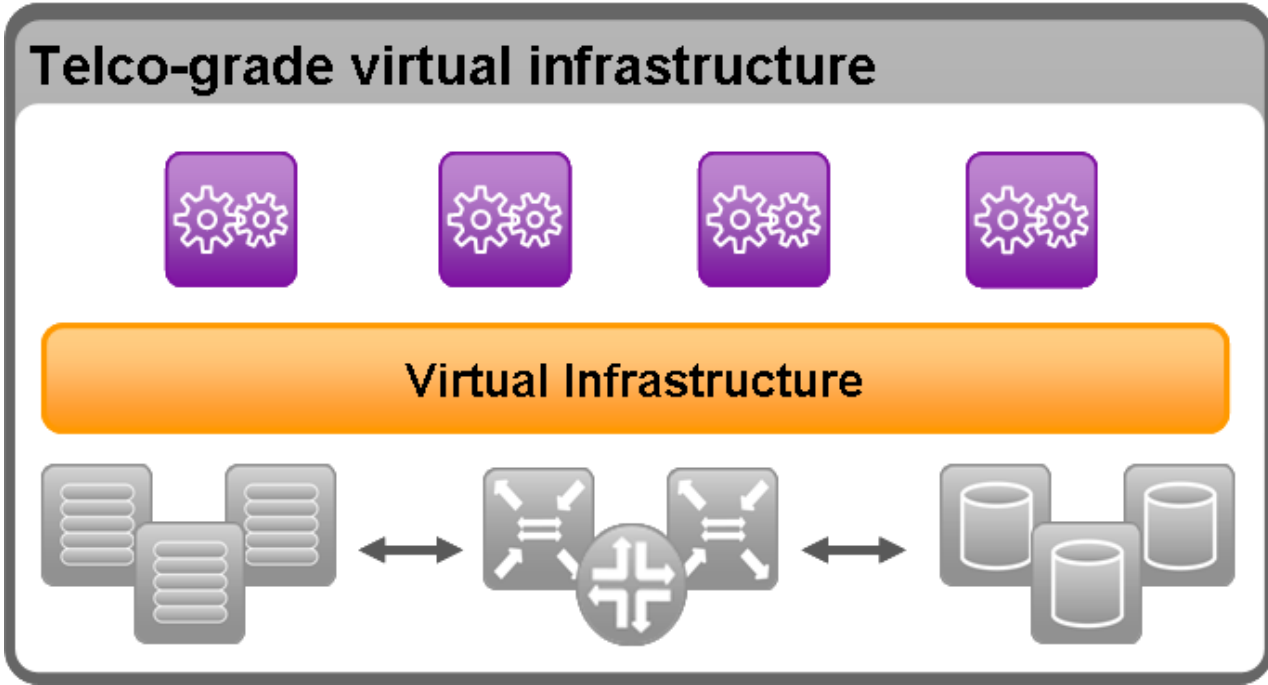### Virtualization of telco applications

Benefits

- Legacy applications on modern multicore hardware
- Eliminate dependencies and version conflicts on legacy HW/OS
- Ease HW & SW maintenance

Telecom Applications

Create a virtualized infrastructure designed for hosting telco applications

Telco-grade virtual infrastructure

Virtual Infrastructure

Benefits

- Co-deployment of telco applications
- Flexible and effective resource utilization
- Security
- Multi-tenant capable infrastructures

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Telecom Applications
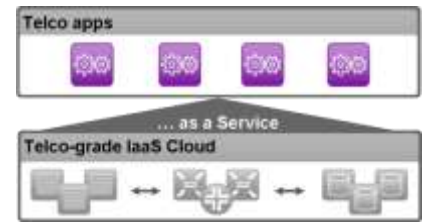
Open the telco grade virtualized infrastructure via suitable service interfaces

Telco apps

... as a Service

Telco-grade IaaS Cloud
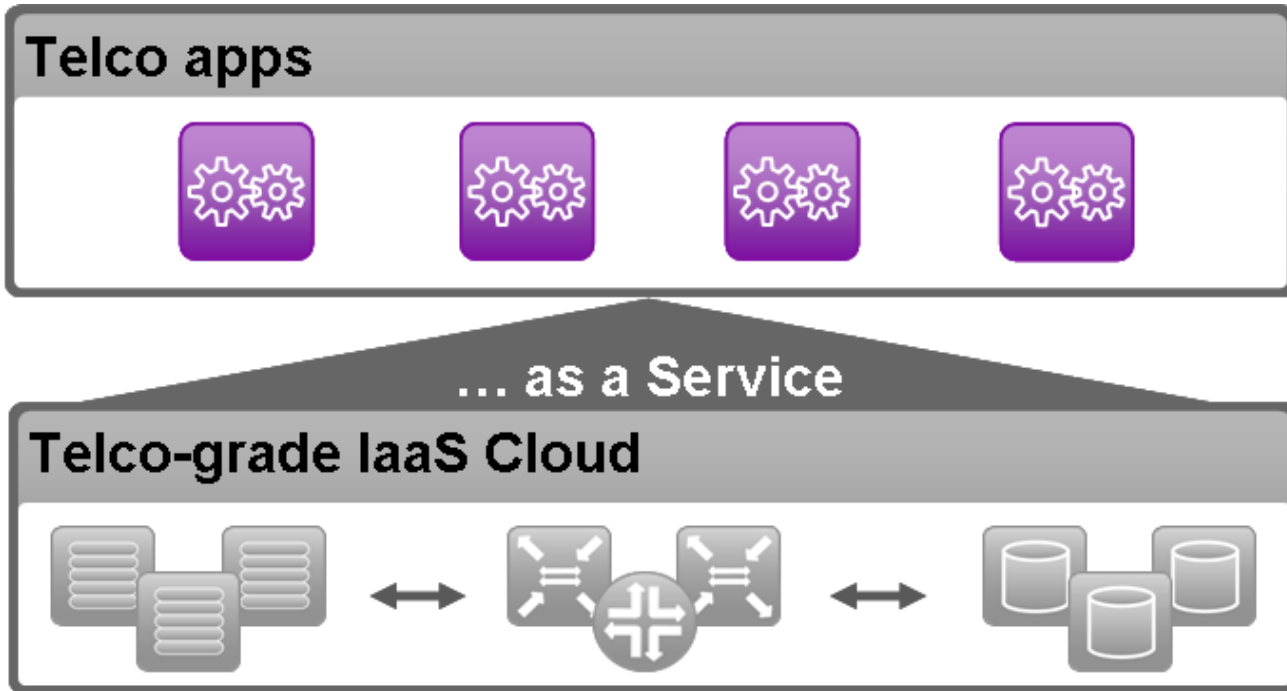
Benefits

- Telco resources offered on demand
- Cross-vendor harmonization for application requirements
- Elasticity
- Efficiency

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Telecom Applications
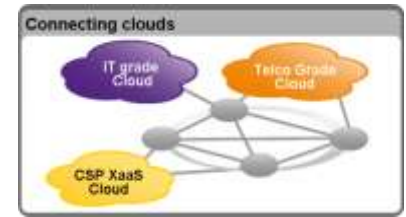
Create an infrastructure for seamless cloud interoperability

Connecting clouds

- IT grade Cloud
- Telco Grade Cloud
- CSP XaaS Cloud
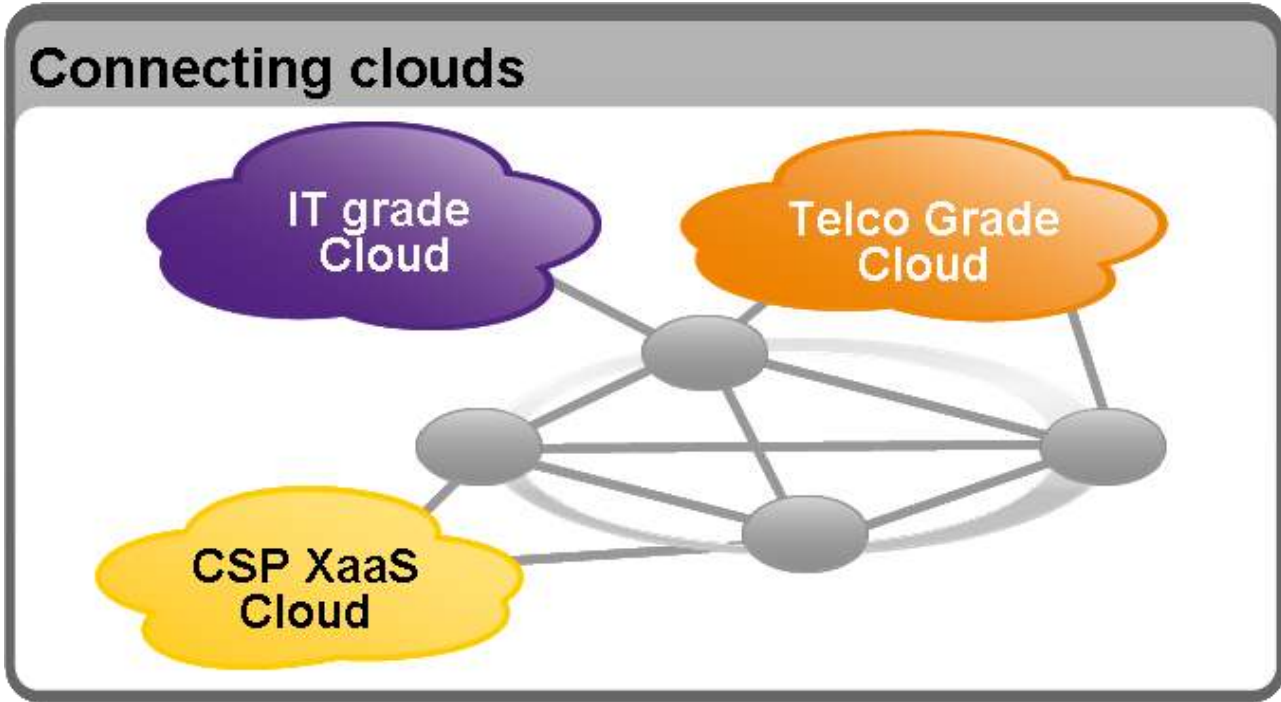
Benefits

- Achieve **richer user experience** by combining resources of multiple clouds

- Ensure **quality of service** is maintained even if a single cloud is overloaded or breaks down

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Telecom Applications

Stepwise towards telco clouds
Key challenges
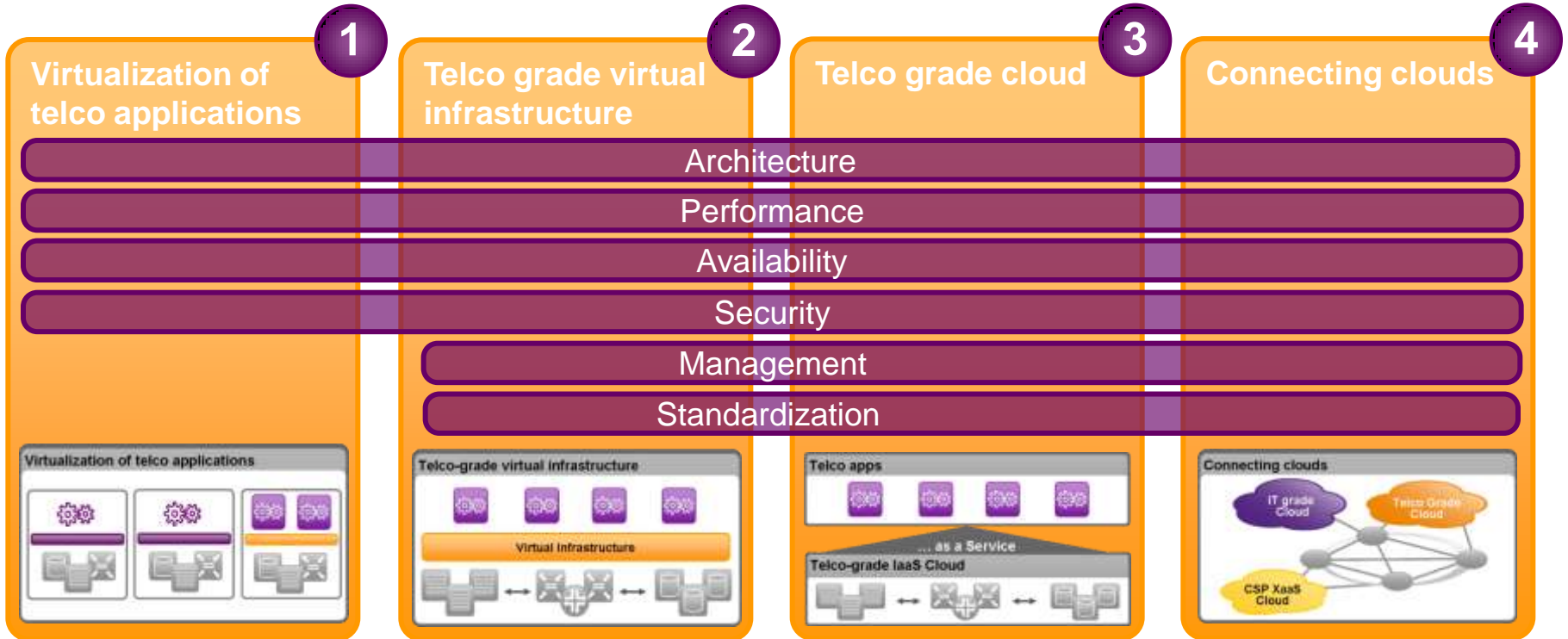
1 Virtualization of telco applications

2 Telco grade virtual infrastructure

3 Telco grade cloud

4 Connecting clouds

- Architecture
- Performance
- Availability
- Security
- Management
- Standardization

Virtualization of telco applications

Telco-grade virtual infrastructure / Virtual infrastructure

Telco apps / ...as a Service / Telco-grade IaaS Cloud

Connecting clouds / IT grade Cloud / Telco Grade Cloud / CSP XaaS Cloud

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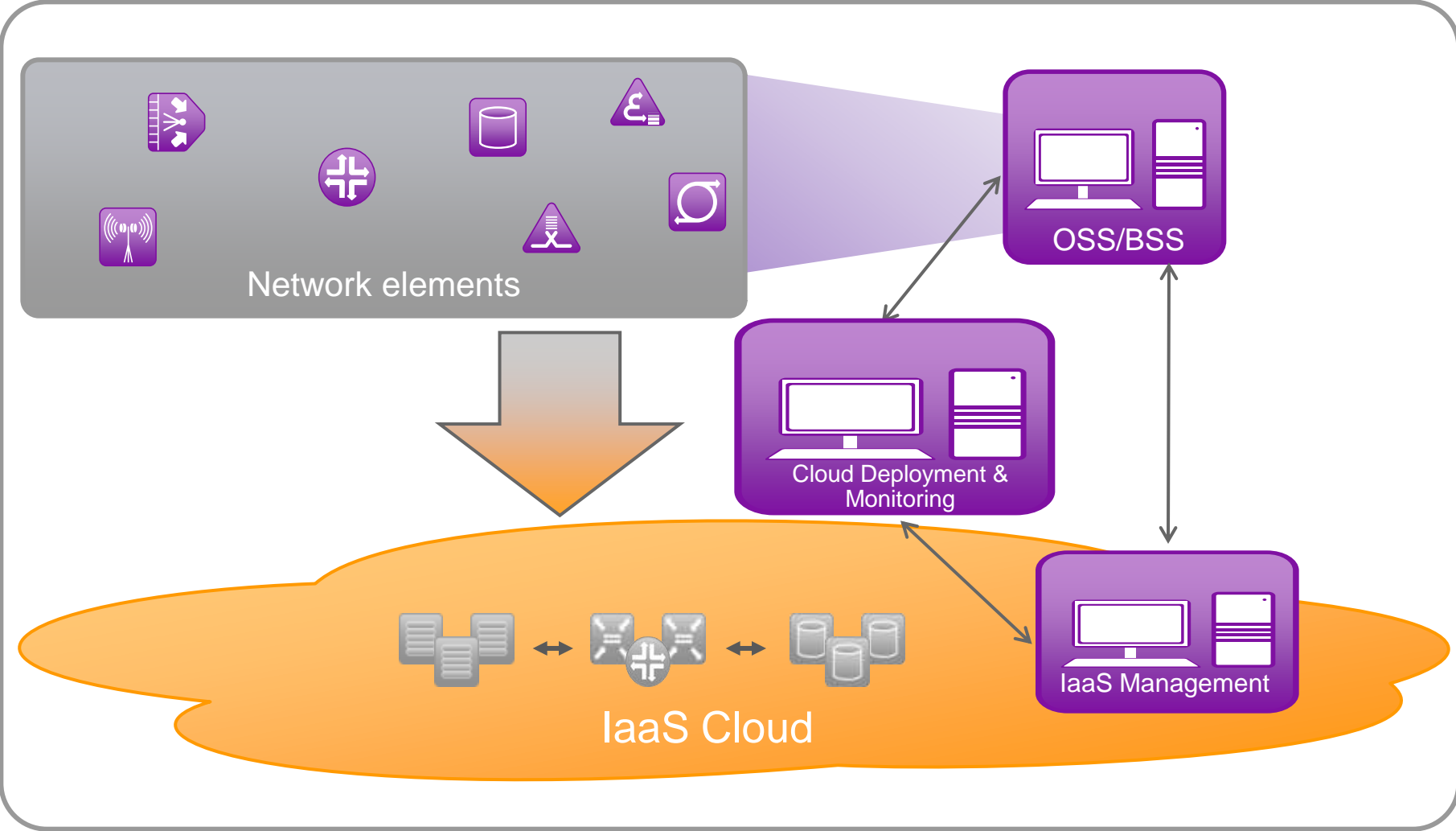
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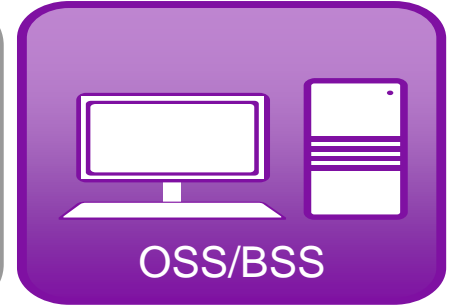4. Related Research at Nokia Siemens Network

5. Summary

Cloud Management

Network elements

OSS/BSS

Cloud Deployment & Monitoring

IaaS Management

IaaS Cloud

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Cloud Management

OSS/BSS:

•Management by Cloud Consumer

•Includes NE Mgmt (i.e. complete knowledge about NE)

•Largely deployment agnostic

OSS/BSS

Cloud Deployment & Monitoring:

•Management by Cloud Consumer

•Limited knowledge about NE (largely deployment specific)

•Limited knowledge about physical infrastructure

Cloud Deployment & Monitoring
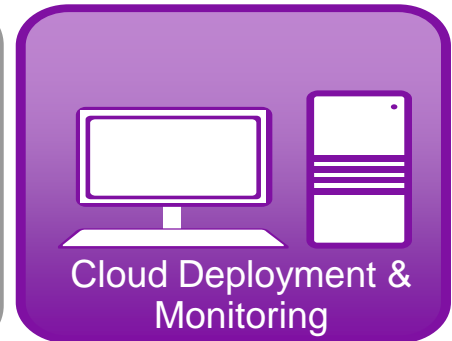
IaaS Management:

•Management by Cloud Provider

•Very limited knowledge about NE

•Detailed knowledge about infrastructure

IaaS Management

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Cloud Management

Cloud Deployment & Monitoring:

- **Ability to manage complex applications**
  - Multiple cooperating VMs
  - Complex storage and networking options
  - Application blueprints & templates
- **Monitoring & troubleshooting**
  - Performance metrics *(both for VMs and physical nodes)*
  - Faults
- **Automated services**
  - Dynamic resource allocation
  - Availability
- **Multi-cloud support**

This management layer must be telco grade, too!

Cloud Deployment & Monitoring
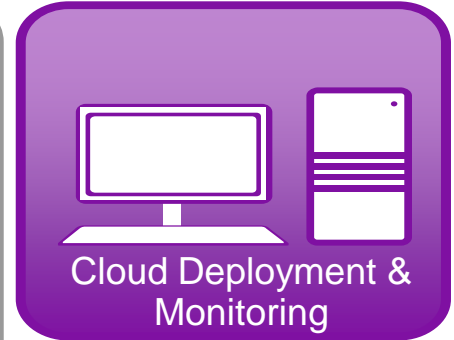
Availability
- HA support at IaaS layer (if any?)
- HA support at cloud deployment & monitoring (this layer)
- HA support at application level
Orchestration needed!

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Cloud Management

IaaS Management:

Cloud APIs

- IaaS Provider APIs
  - vCloud
  - tCloud
  - OCCI
  - AWS
  - Rackspace
- Aggregator APIs
  - deltaCloud
  - Dasein
  - libCloud

Telefonica

vmware

amazon webservices

δ·CLOUD

the rackspace cloud

dasein.org

OCCi — OPEN CLOUD COMPUTING INTERFACE

IaaS Management

Current cloud APIs support only basic IT functions

Telco grade API extensions needed!

Architecture
(HW layer visibility)

- ***Virtualization Infrastructure*** *vs.*
- ***Cloud***

IT Grade functions

- Provisioning
- Lifecycle
- Configuration
- Security (basic)

☑

Telco grade functions

- Monitoring
- QoS / SLA
- Availability
- Security (more)

☒

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Network Management

Network Resource Management Use Cases

- Within the cloud
- Between the cloud and the user/enterprise
- Between the cloud and other clouds

Cloud Provider Network

Aggregation Switches

Top-of-Rack Switches

IaaS Ctrl

Network Operator Network/Public Internet

NaaS Ctrl

Enterprise NW
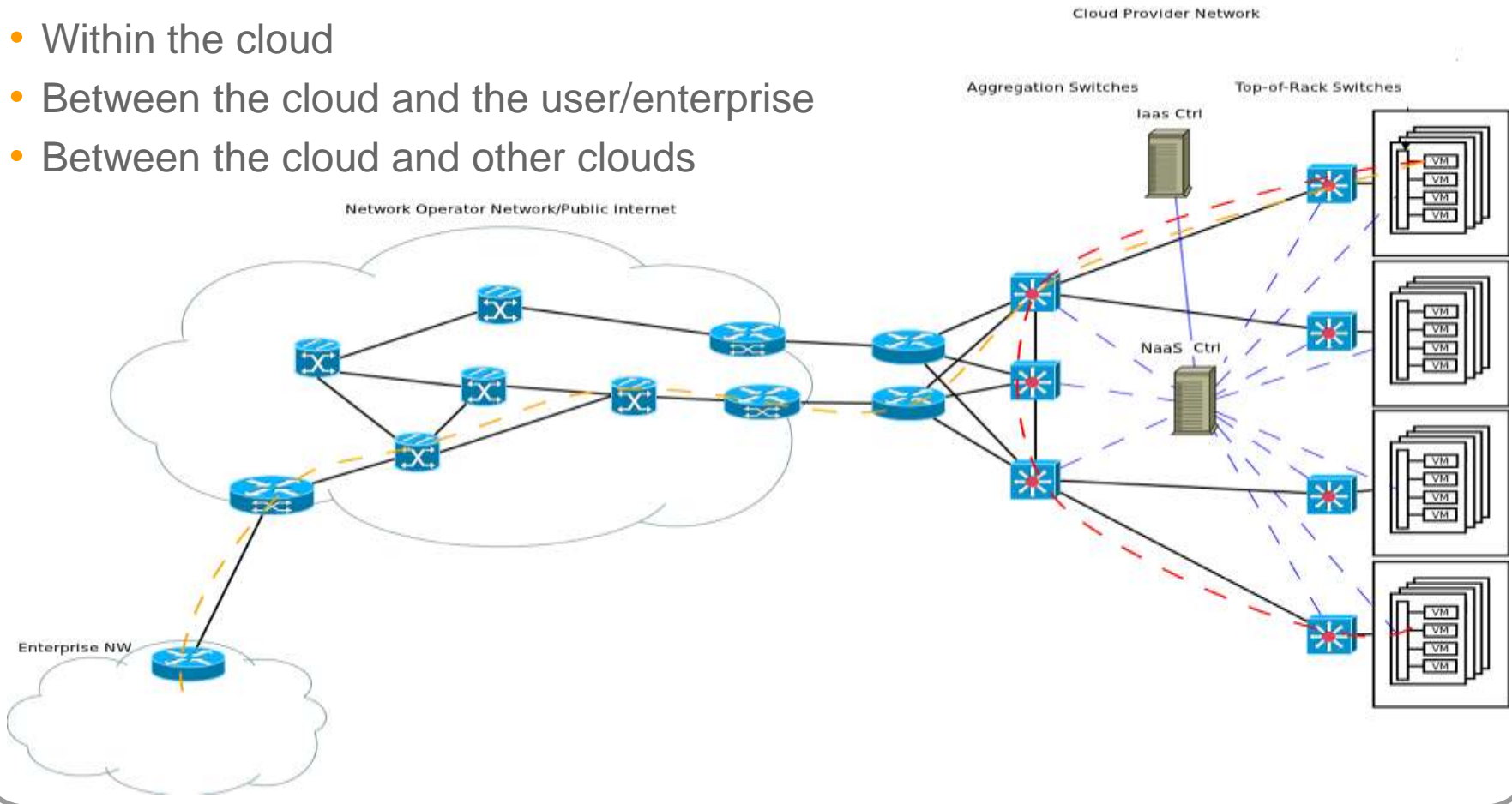
Network Management

Requirements

- A standard way of network resource allocation is needed

  (avoid the virtualization technology phenomenon – i.e. VMs not migrating between different platforms)

- Technology independent solution

  (Even in a single network domain several technology domains might exist)
    - packet/circuit switched
    - should allow the reservation to happen across multiple layers (MPLS, OTN, DWDM)

- QoS
    - Trial-and error
    - Resource reservation transactions (Complex app: QoS provided + price)

- Location
    - The closer the application is deployed to the user the less bandwidth needs to be reserved in the network
    - Finding a globally optimal solution for service deployment will be hard, but considering location and networking bandwidth is a very important aspect!
    - Concentrate on intra-operator domain in the beginning
    - Multi/-operator domain cases are even more complex

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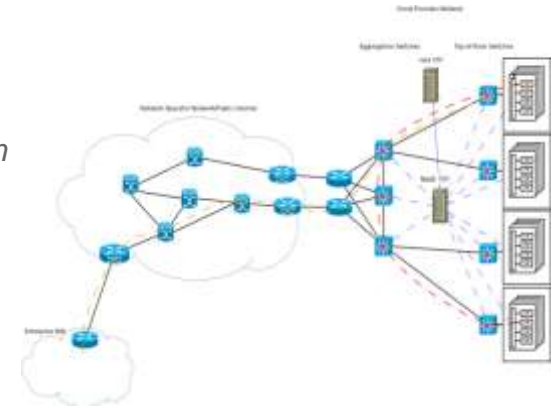
Network Management
Decision making

Cloud internal network

- Cloud Management:
  - complete view on infrastructure resources
  - centralized decision making (NaaS only hides technology details)
- NaaS Management
  - Partial view on infrastructure resources (only network)
  - Decision making in a trial and error manner
  - Shall the network be virtualized?
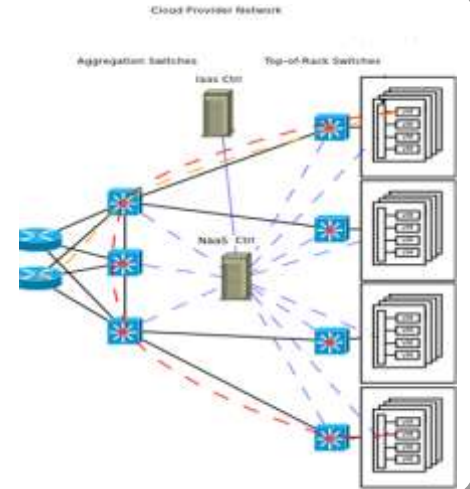
Transport network(s)

- Request for a virtual network
- Overlay model: physical path hidden from the service provider

  (it's the virtual network providers responsibility - and interest - to optimally utilize the physical infrastructure)
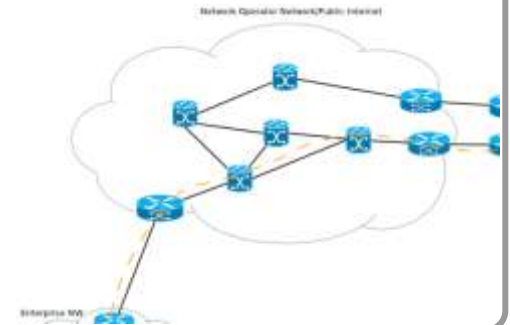
In theory, if the transport network and the cloud internal network is in the same hand (which may be the case for telco clouds) a global optimum can be found

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NSN Research projects
Cloud Framework

App Blueprint

Cloud Framework: Automated application deployment & management

Cloud Abstraction

Public IaaS Provider
(e.g. Amazon, Rackspace)
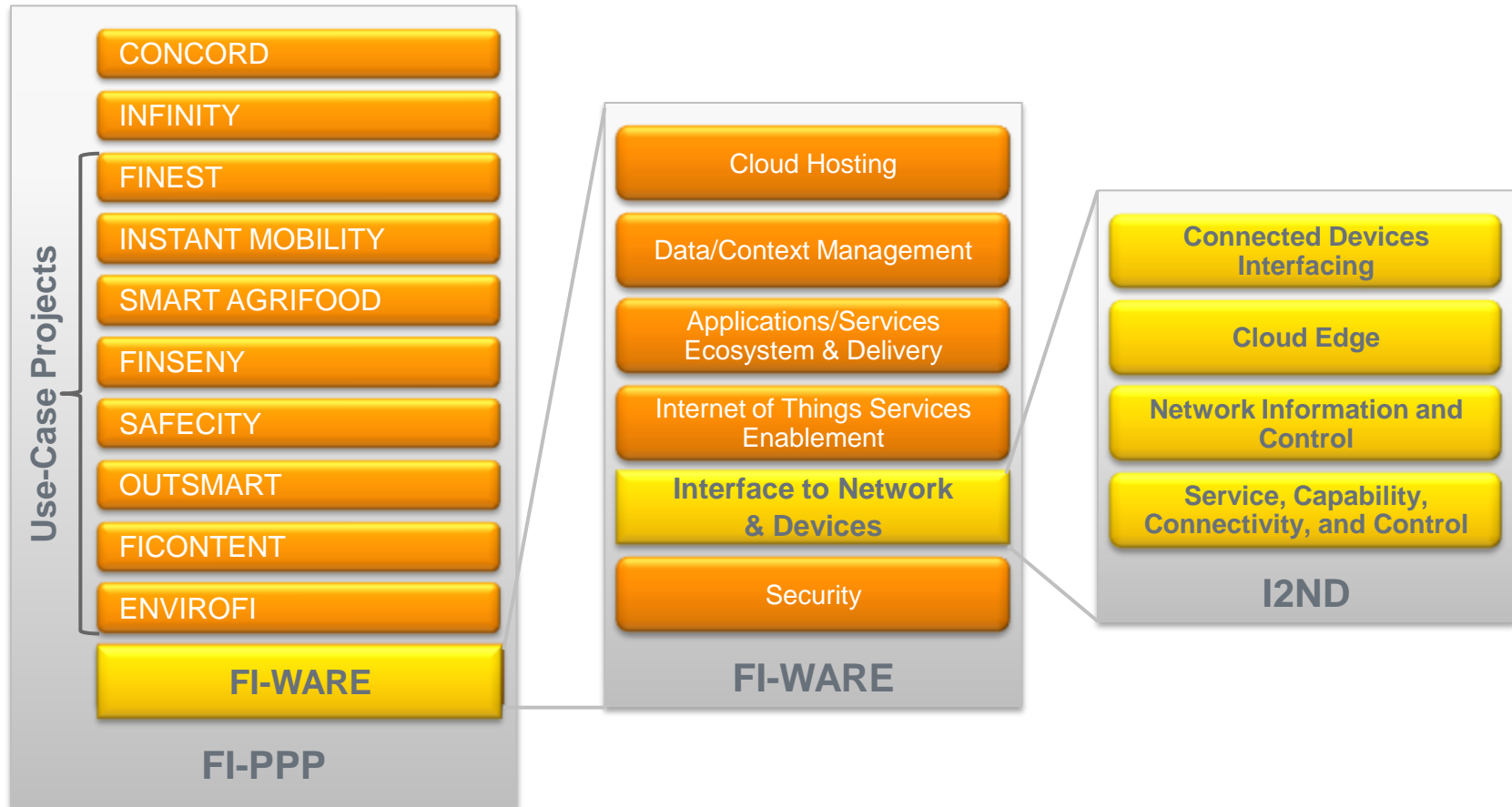
NSN IaaS cloud

CSP IaaS Cloud
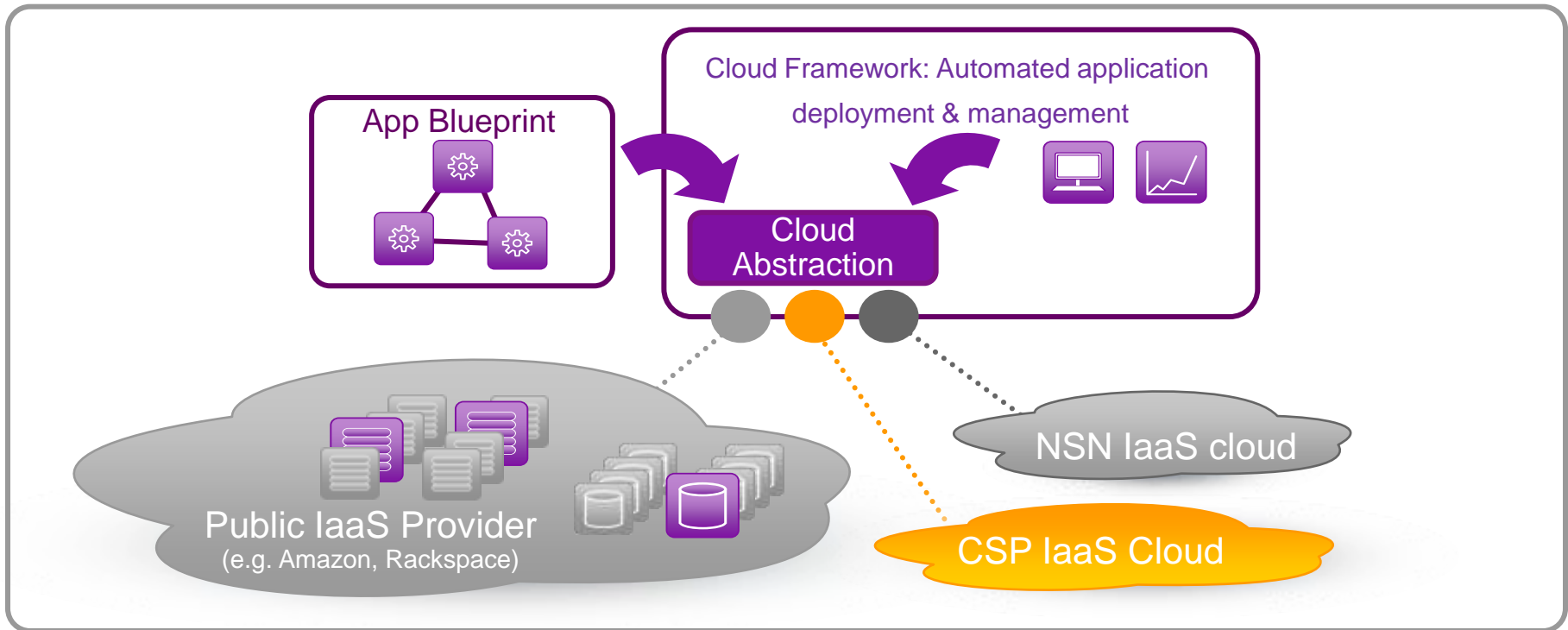
One-click deployment of multi-tier applications based on blueprints

Dynamic and automated resource management

Multi-cloud and mixed public / private cloud deployments via flexible cloud abstraction layer

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Use-Case Projects

- CONCORD
- INFINITY
- FINEST
- INSTANT MOBILITY
- SMART AGRIFOOD
- FINSENY
- SAFECITY
- OUTSMART
- FICONTENT
- ENVIROFI

FI-WARE

FI-PPP

- Cloud Hosting
- Data/Context Management
- Applications/Services Ecosystem & Delivery
- Internet of Things Services Enablement
- **Interface to Network & Devices**
- Security

FI-WARE

- **Connected Devices Interfacing**
- **Cloud Edge**
- **Network Information and Control**
- **Service, Capability, Connectivity, and Control**

I2ND

Check out the project website for more info: http://www.fi-ware.eu/

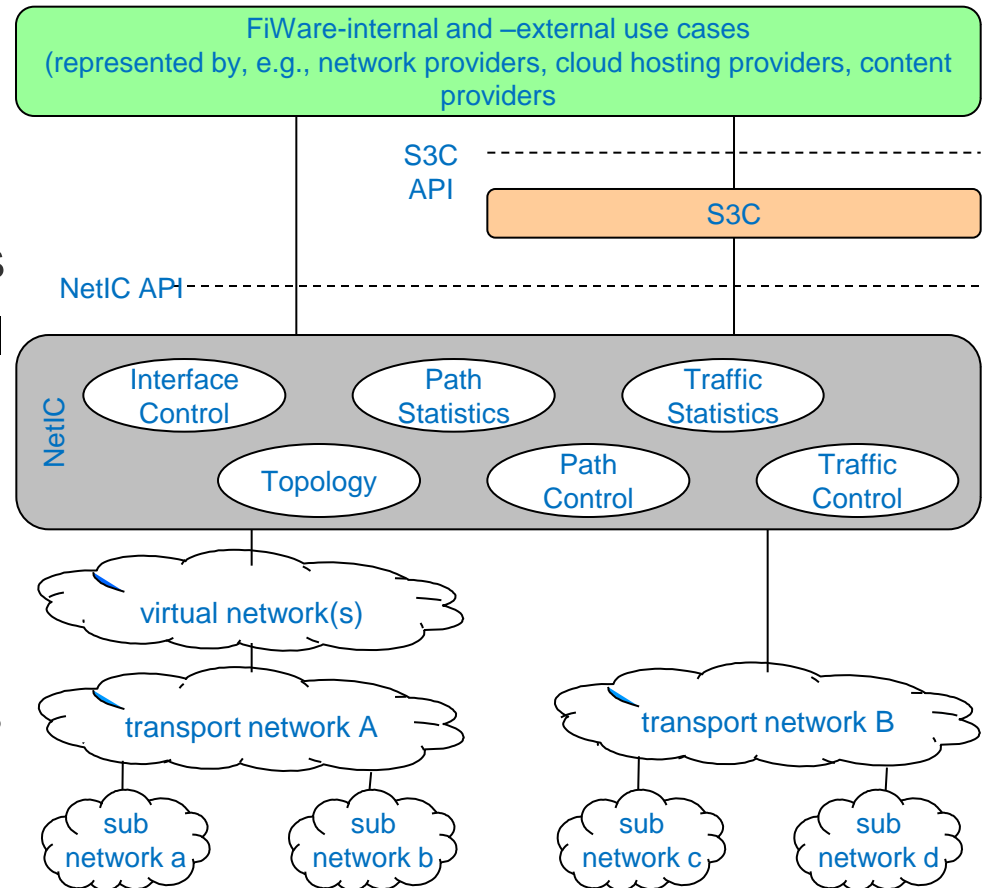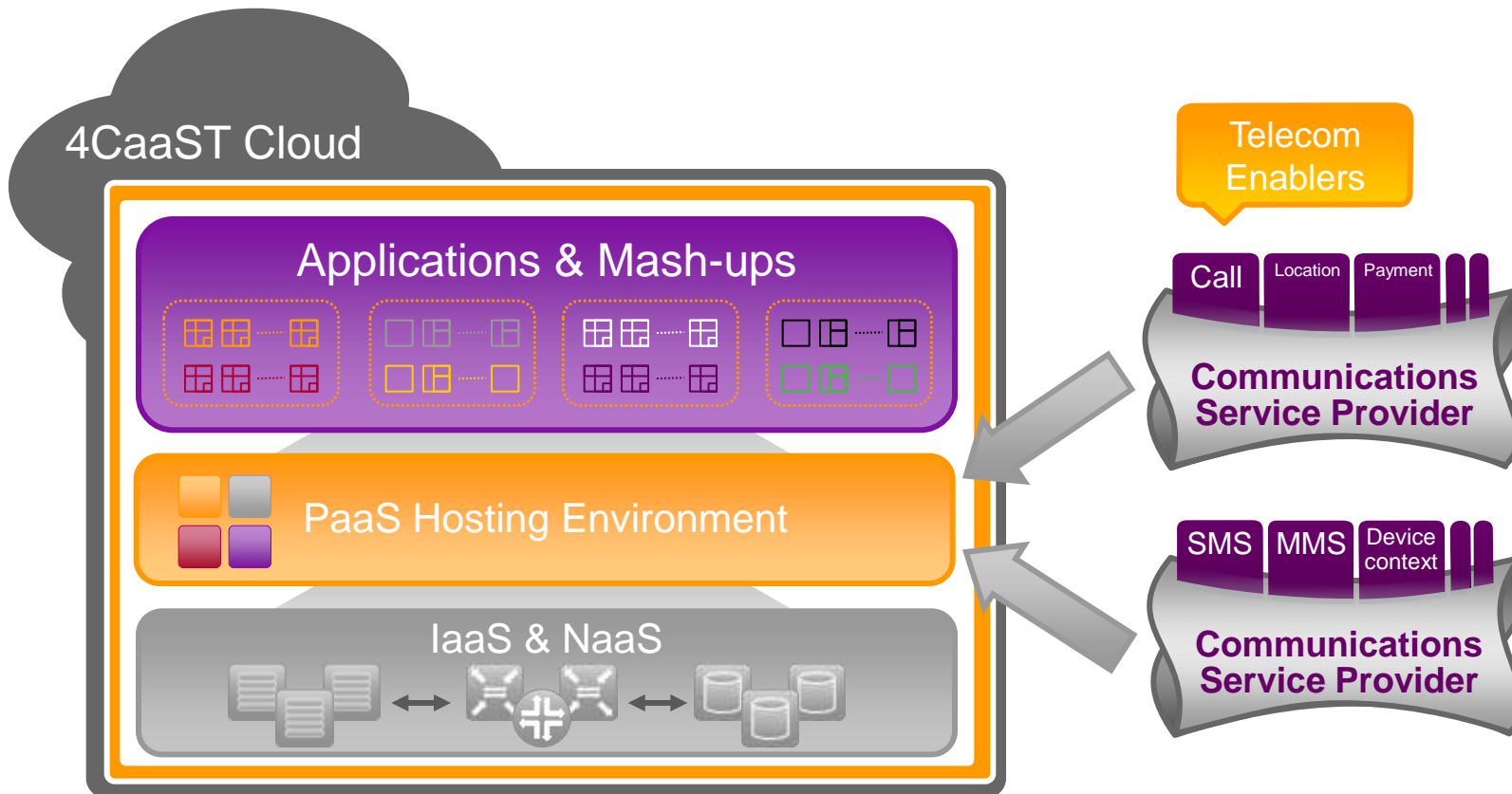## I2ND Vision: Four Classes of Interfaces (FI-WARE Generic Enablers)
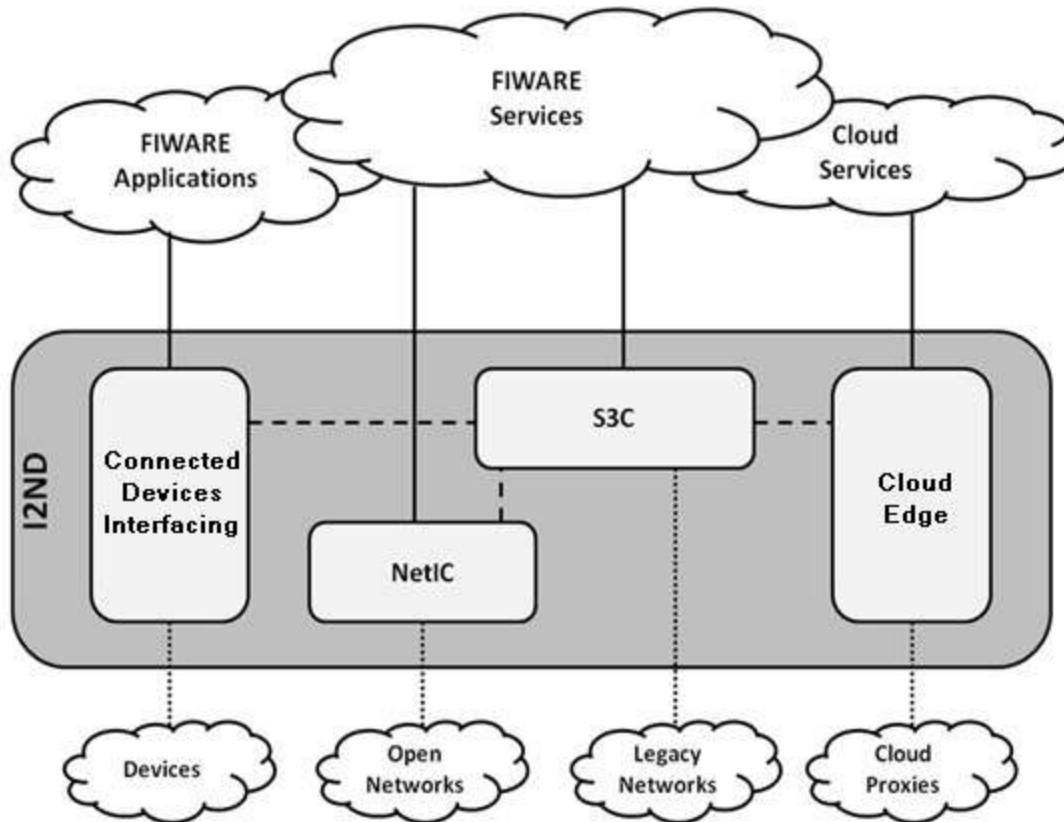
The interfaces

- Expose corresponding network state information to the user

- Offer a defined level of control and management

- Aim to overcome limitations of today's network and device interfaces

- Combining different worlds:

  - Telecommunication services (Session Initiation Protocol – SIP – speaking)

  - Web-services (Simple Object Access Protocol – SOAP – speaking)

  - Openness to other Future Internet worlds

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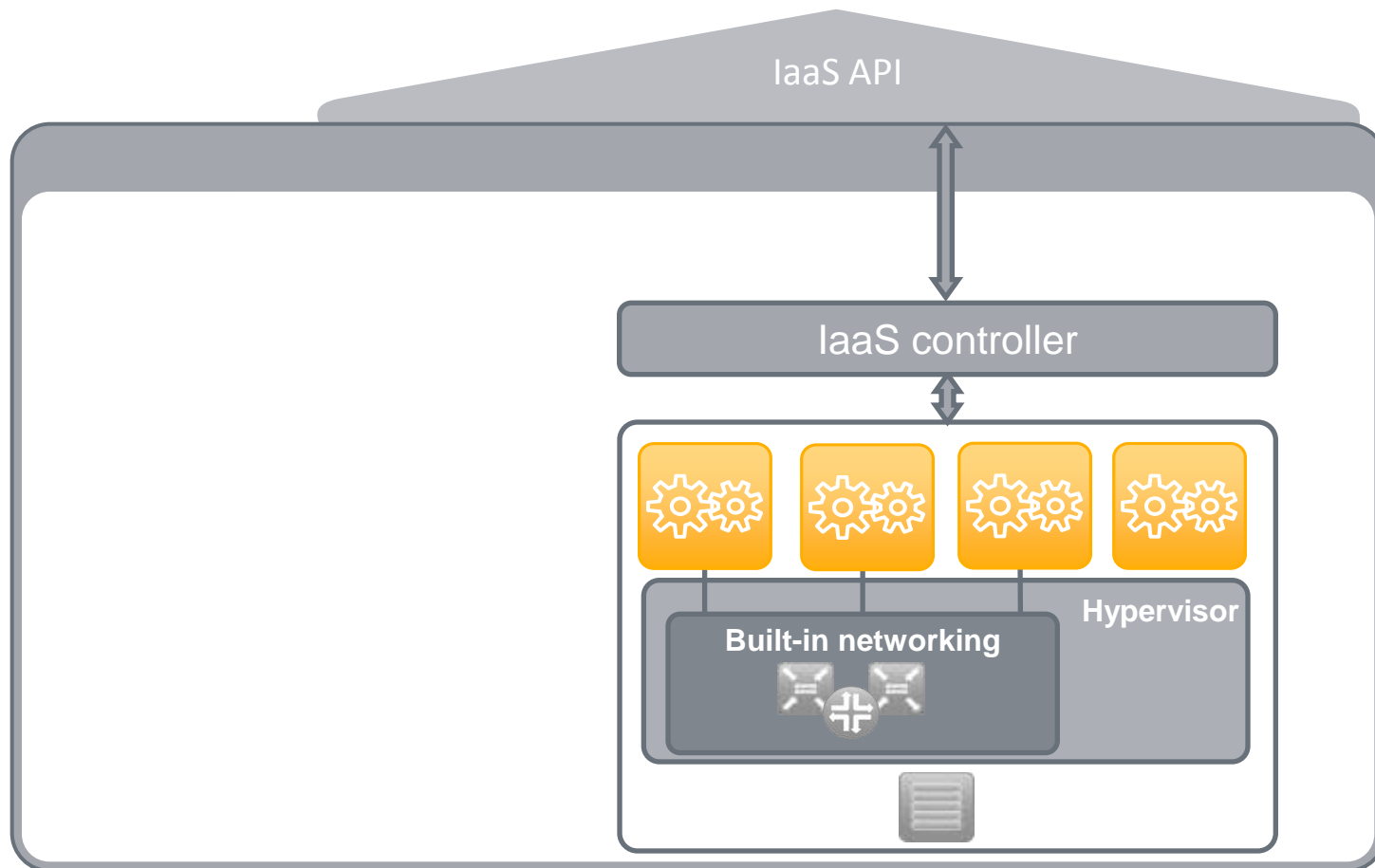
The NetIC Generic Enabler

- Open Networking concept enabling network nodes to provide intelligent network connectivity by dynamic configuration via open interfaces

- Network Information and Control

  – Programmability enablement within the network

  – Flow processing, Routing, Addressing

  – Resource management

- Homogeneous access to heterogeneous open networking devices

- Network virtualisation enablement

FiWare-internal and –external use cases
(represented by, e.g., network providers, cloud hosting providers, content providers

S3C API

S3C

NetIC API

NetIC

Interface Control | Path Statistics | Traffic Statistics

Topology | Path Control | Traffic Control

virtual network(s)

transport network A | transport network B

sub network a | sub network b | sub network c | sub network d

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4CaaST Cloud

Applications & Mash-ups

PaaS Hosting Environment

IaaS & NaaS

Telecom Enablers

Call | Location | Payment

Communications Service Provider

SMS | MMS | Device context

Communications Service Provider

Check out the project website for more info: http://www.4caast.eu/

	SEVENTH FRAMEWORK PROGRAMME	
	Internet of Services, Software and Virtualisation	
4CaaSt	**4CaaSt**	
ICT-258862	Building the PaaS Cloud of the Future	

Network as a Service

Network as a Service
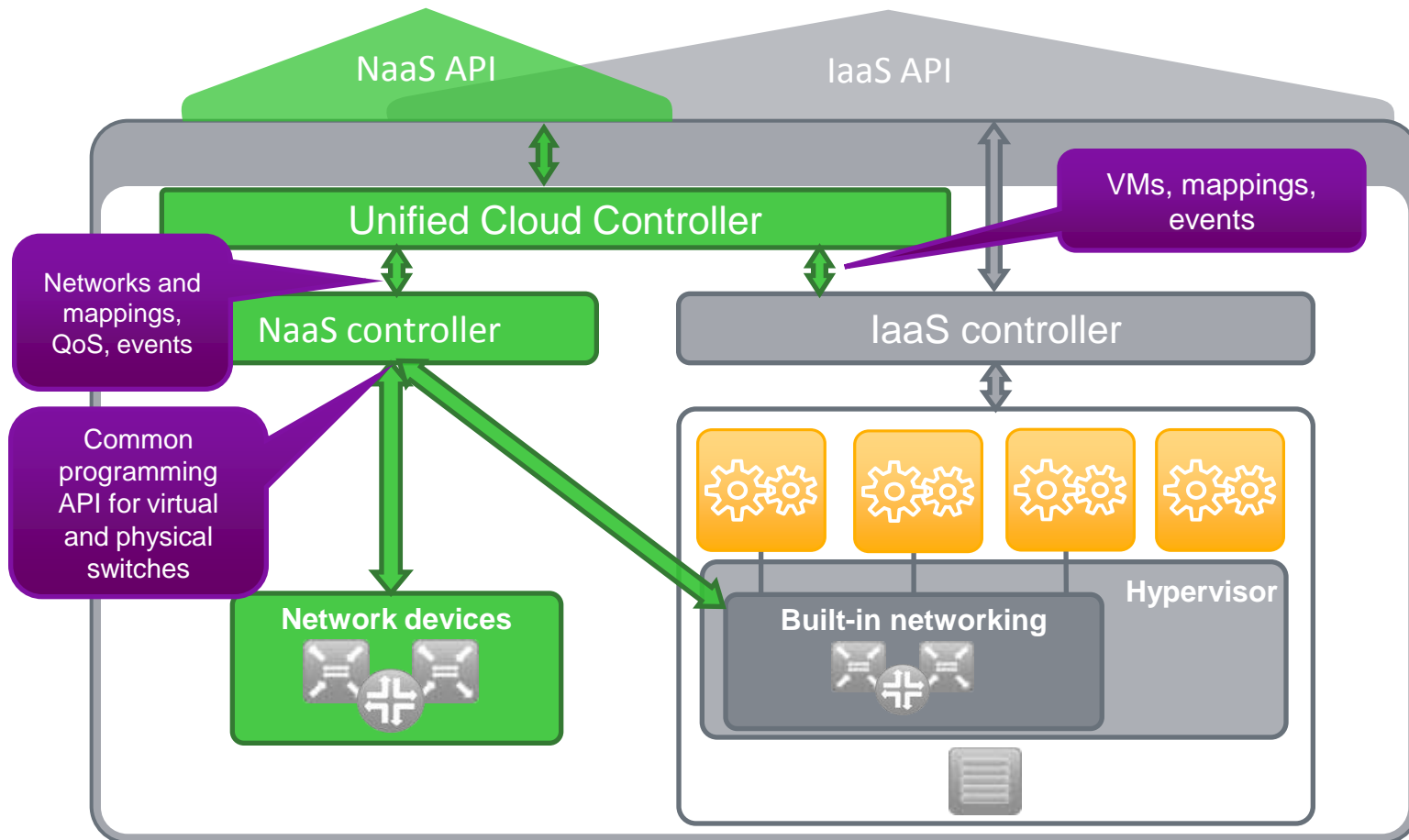
	SEVENTH FRAMEWORK PROGRAMME	
4CaaSt	**Internet of Services, Software and Virtualisation**	SEVENTH FRAMEWORK PROGRAMME
ICT-258862	**4CaaSt** Building the PaaS Cloud of the Future	

Network as a Service

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Challenging research areas

- Architecture
  - How the concept fits into the future CSP cloud architecture?
  - IT-Telco cloud convergence-integration
  - Multi-cloud scenarios
- Management
  - Layering
  - Orchestration
  - Holistic view of resources
- Network
  - Network configuration technologies for telco grade
  - QoS/performance optimizations
- Security
  - Definition of a global security architecture for cloud platforms with homogeneous security management
- Telco cloud APIs:
  - What and how to expose? (e.g. HA & networking options, telco functionality)
  - SLA management
  - Standardization!
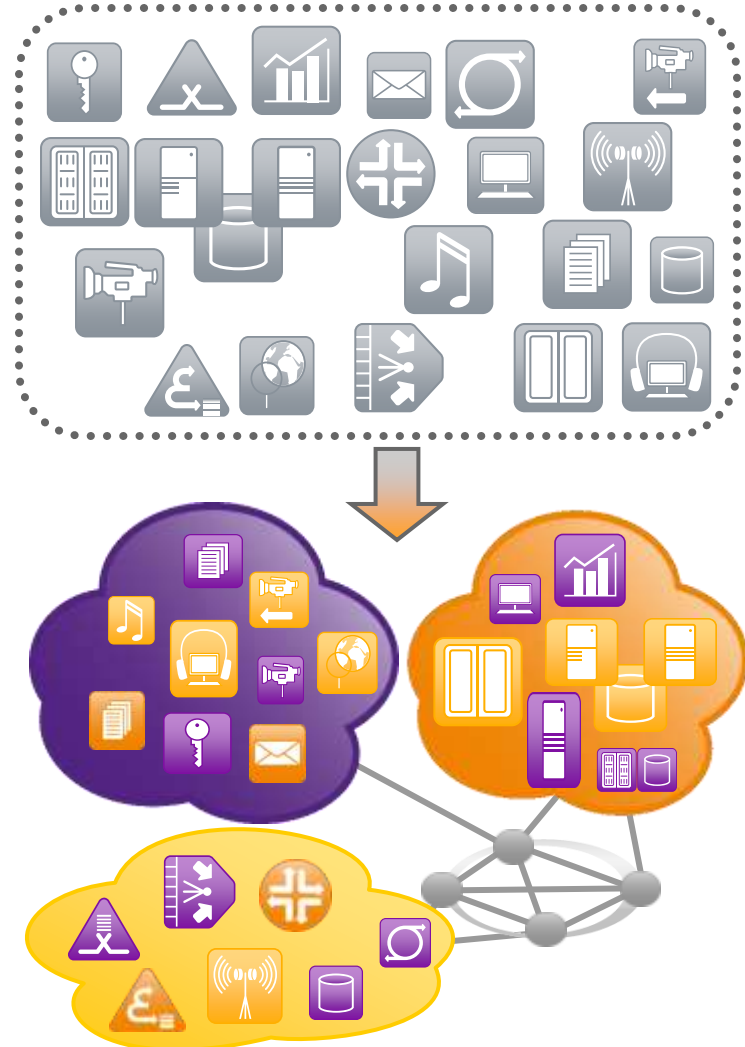
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Questions?
Comments?

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Thank You!