



BEYOND IT: THE TELECOM CLOUD

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(ARCHITECTURE & STRATEGIES, ER CLOUD)

CLOUD COMPUTING SERVICE MODELS

Software as a Service



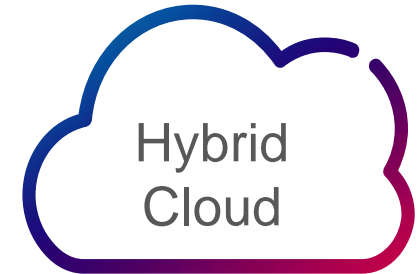
Platform as a Service



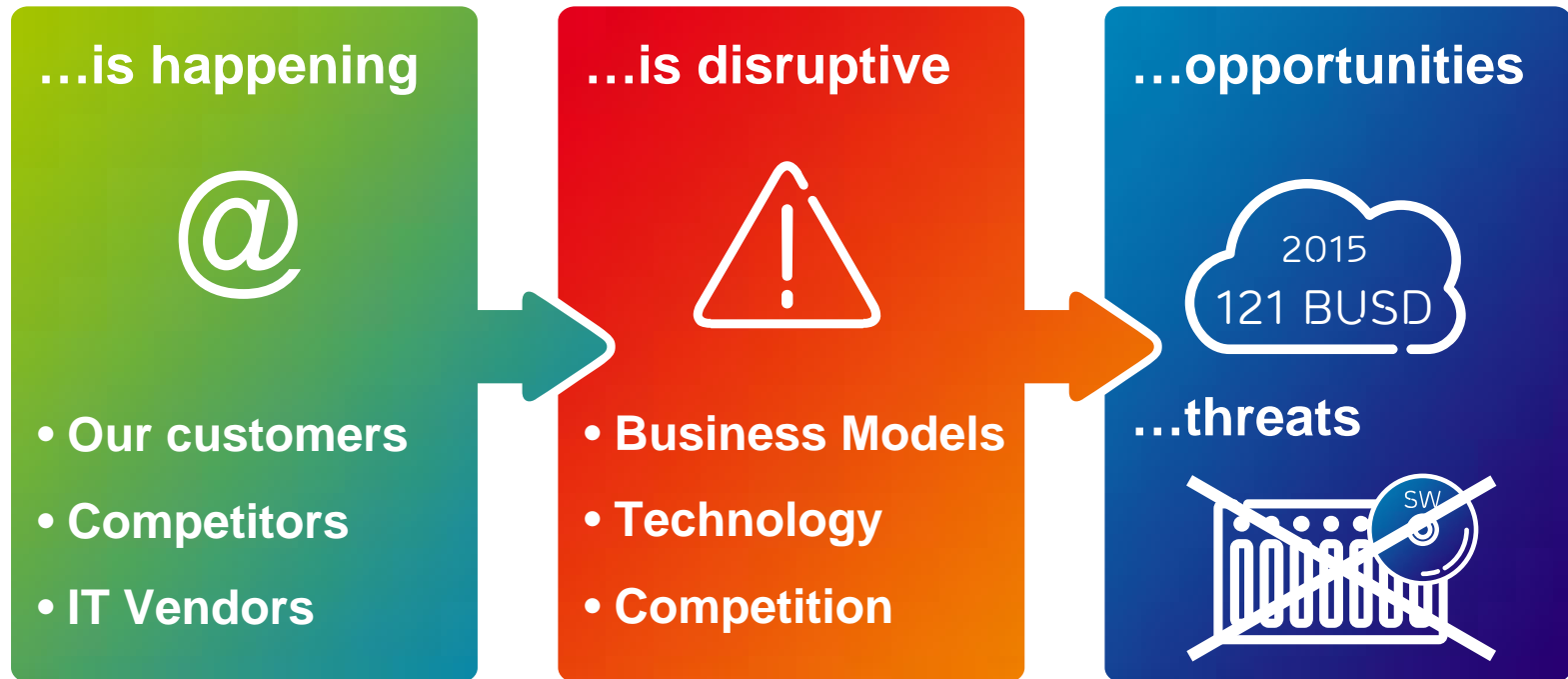
Infrastructure as a Service
Resource management
Virtualization



Physical Infrastructure
Facilities, hardware
Connectivity



CLOUD...



COMPETITIVE LANDSCAPE: TELCOS

SaaS

Cloud services revenue 68.3BUSD in 2010 (+16.6% from 2009), 148.8BUSD in 2014
Over the next 5 years, spending of 112BUSD on SaaS/PaaS/IaaS
(Gartner, 2010)

CC services are estimated to be 10.2% of the spending on external IT services in 2010

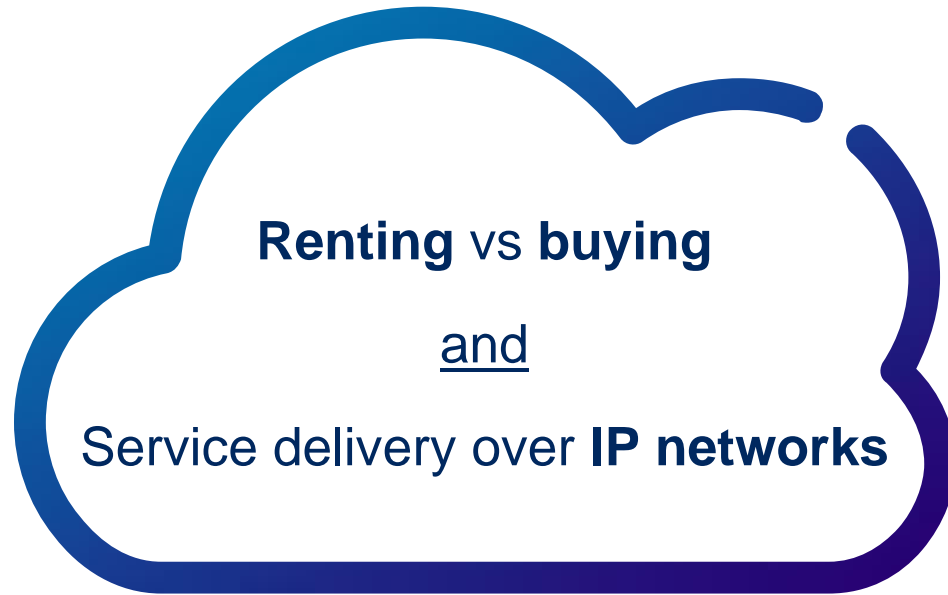
(Gartner survey of 1587 companies)

39% indicated cloud computing as a key initiative; Increase in spending for private cloud: 43%; for external and/or public use: 32%

(Gartner, 2010)

THE LIST IS NOT EXCLUSIVE
SOME COMPETITORS ACT AS PARTNERS FOR PARTS OF THE VALUE CHAIN

SAAS IN A BUSINESS CONTEXT



Cloud is a game changer

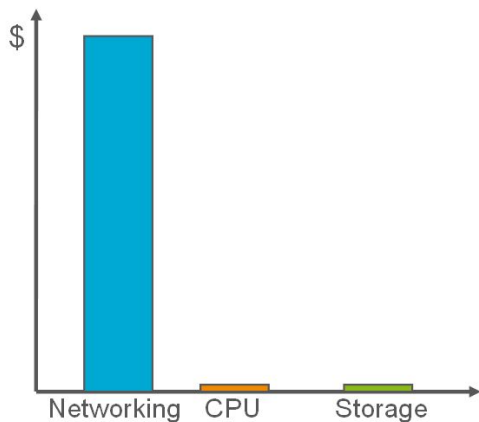
- New business models; CAPEX to OPEX
- Spurs cost efficient innovation
- Opportunity for shorter TTM and TTC
- New opportunities for platform consolidation



COST OF NETWORKING

- › The good news: computation is **cheap**
 - **Comparable or less** than for custom built systems

- › The bad news: connectivity is **expensive**
 - **Orders of magnitude higher** than for custom built systems

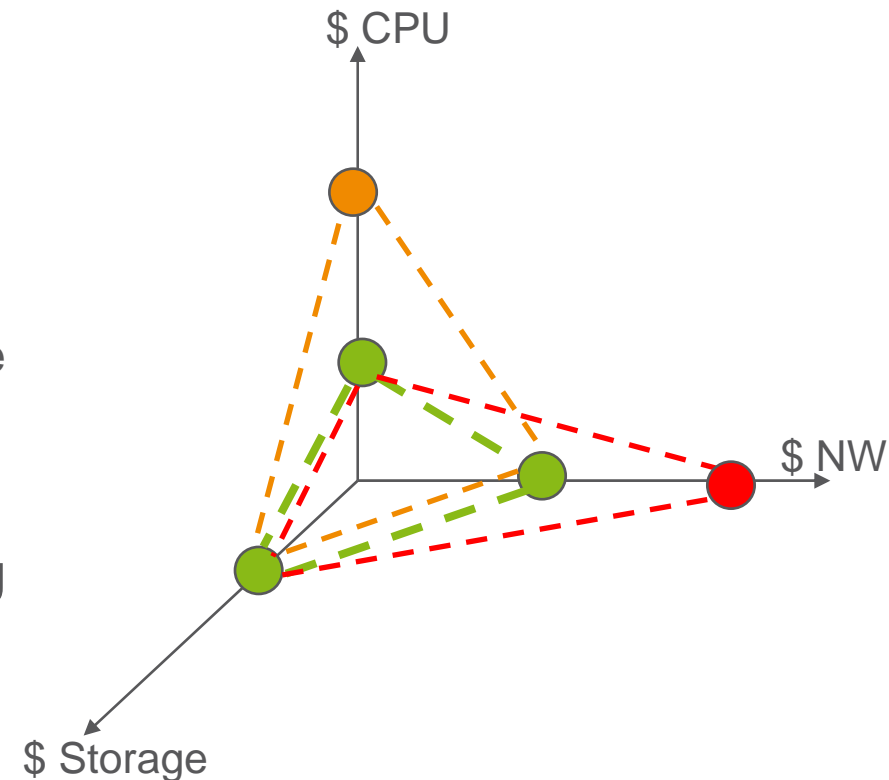


"One dirty secret of cloud computing is that from a cost perspective, **everything's pretty much free** compared to the **price of moving bytes around**"
(BitCurrent: Cloud Computing, A real World Guide)

BANDWIDTH CAN COST **50X MORE**
COMPARED TO PROCESSING

THE CONST PRINCIPLE

- › Similar to Brewer's CAP Theorem
 - You can't have Consistency, Availability and Partition tolerance at the same time
- › For clouds:
 - It is impossible to optimize the cost of Computation, Networking and Storage at the same time – at least one of these will be sub-optimal
- › Simple and intuitive – yet far reaching consequences
- › Foundation for all the efforts into
 - Distributed clouds
 - Distributed storage
 - Network as a Service (NaaS)



THE YING YANG OF CLOUD SECURITY

Security is the single most important hinderer for cloud adoption (your favorite analyst here)

By 2015, 80% of companies will require third party security attestation of cloud infrastructures (Gartner)

By 2015, 40% of the security controls used within enterprise data centers will be virtualized, from < 5% in 2010 (Gartner)

REED
TO
ER TOOL

NEW KINDS OF
ATTACKS
THIRD PARTY
ACCESS
SHARED
INFRASTRUCTURE

WHAT IS TELECOM CLOUD COMPUTING?

1. Cloud infrastructure to deliver services with **stringent real-time characteristics** and usually **high computational and network demand**
 - › What are the **differentiating factors**?

2. Cloud infrastructure **offered by an operator** as opposed to global players
 - › Why choose an operator?
 - › Where is the value add?

3 DIFFERENTIATORS FOR TELECOM CLOUD

› Concentration is sub-optimal for clouds in telecom networks

LOCALITY MUST BE EMBRACED BY TELECOM CLOUDS

› Telecom services have QoS Service Level Agreements (SLAs) to fulfill

SLA MANAGEMENT IS KEY IN TELECOM CLOUDS

› Identity & location confidentiality, communication and data security

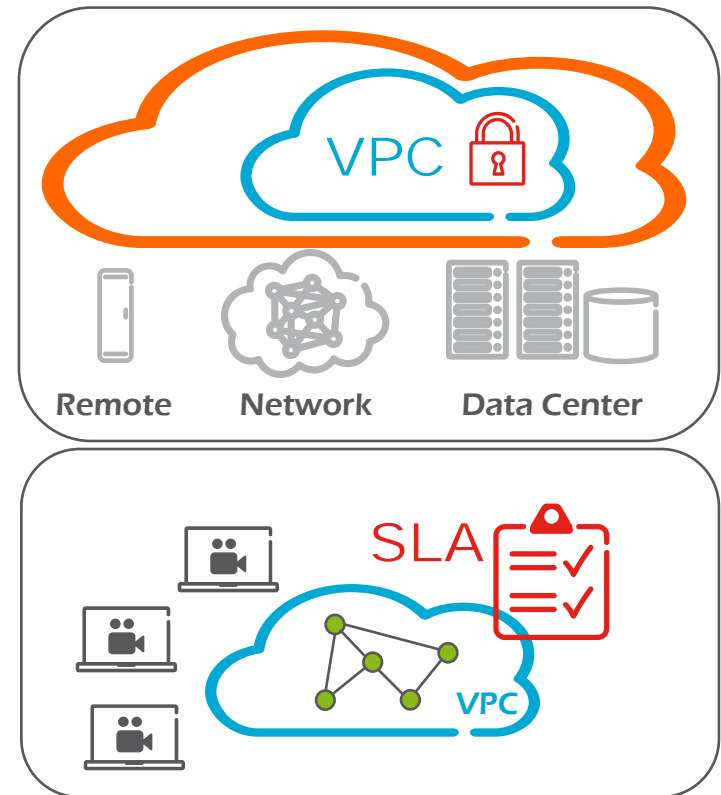
SECURITY, TRUST, PRIVACY IN TELECOM CLOUDS

CLOUD INFRASTRUCTURE FOR CARRIERS

› Differentiating features for operators

- SLA management
- Elastic network provisioning
- Security features
- Distributed clouds

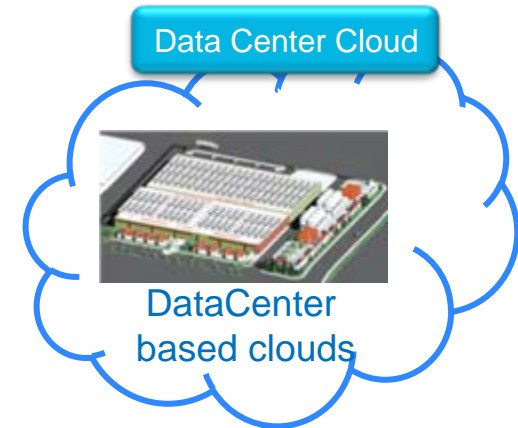
› ... but basic technology the same



OPERATOR CLOUD / GLOBAL CLOUD

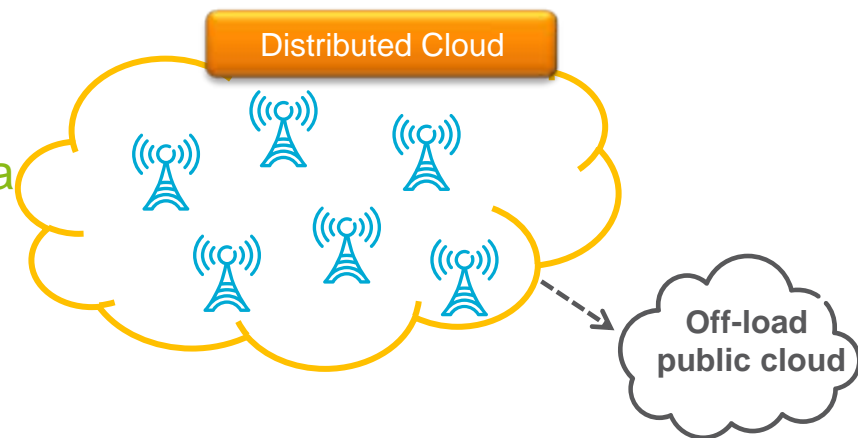
› Global cloud

- Large
- concentrated
- data-center-based
- good scaling, utility charging
- Network and legal compliance (e.g. for data) are key issues



› Operator cloud

- localized
- distributed
- smaller
- Integrates with the network: Network as a Service
- Local, trusted business relationships



DIFFERENTIATING CLOUD TECHNOLOGIES

Distributed Cloud

Link remote resources to Cloud manager

Virtual Private Cloud

Tenants sub-lease Cloud resources to end-customers

Security in Cloud



Secure front end and trustful hypervisor platform

Elastic Networking in Cloud



Extend Data Center LAN over public network

SLA Policy and Provisioning in Cloud

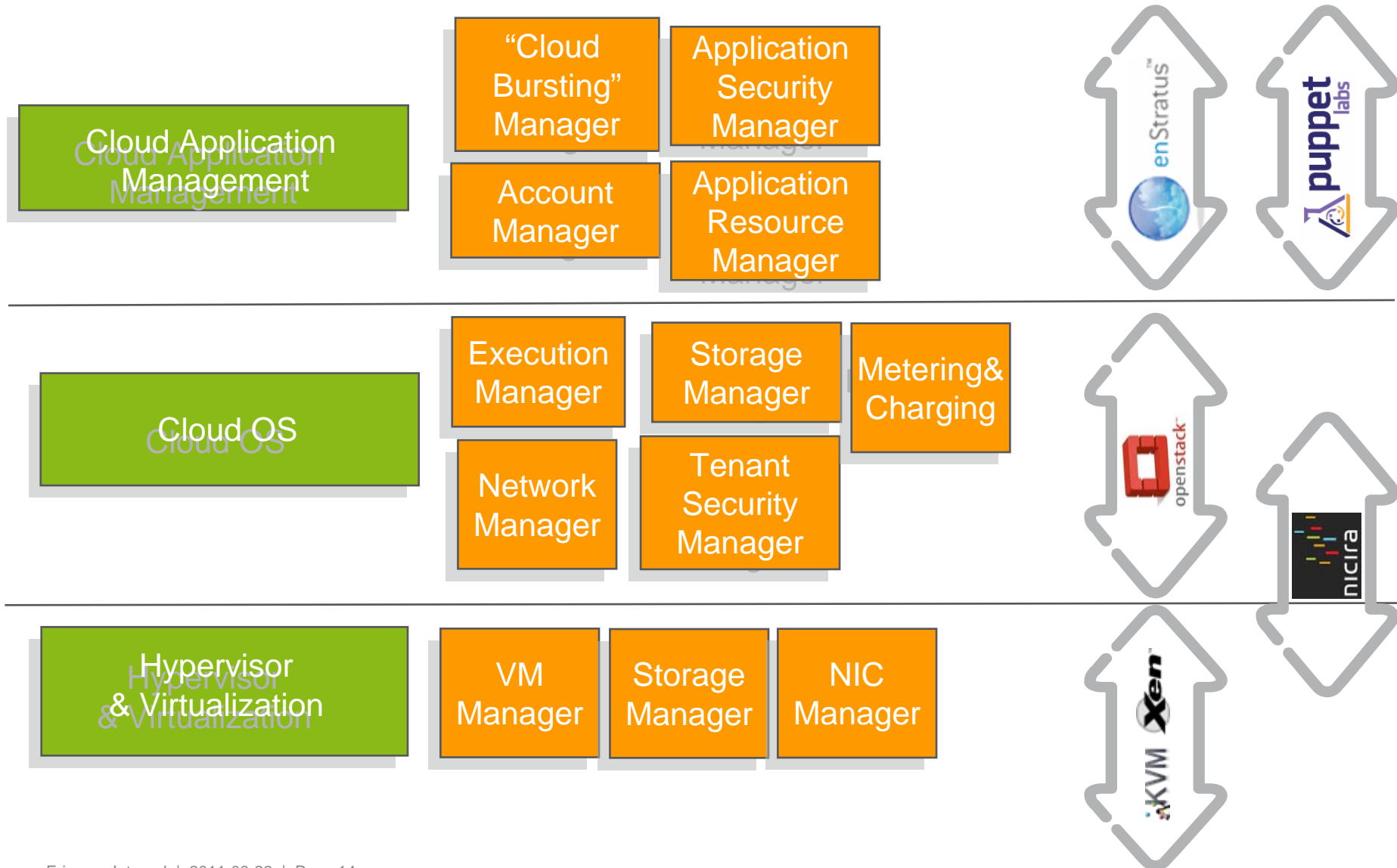
Compose abstract Cloud service

Cloud Service Operation

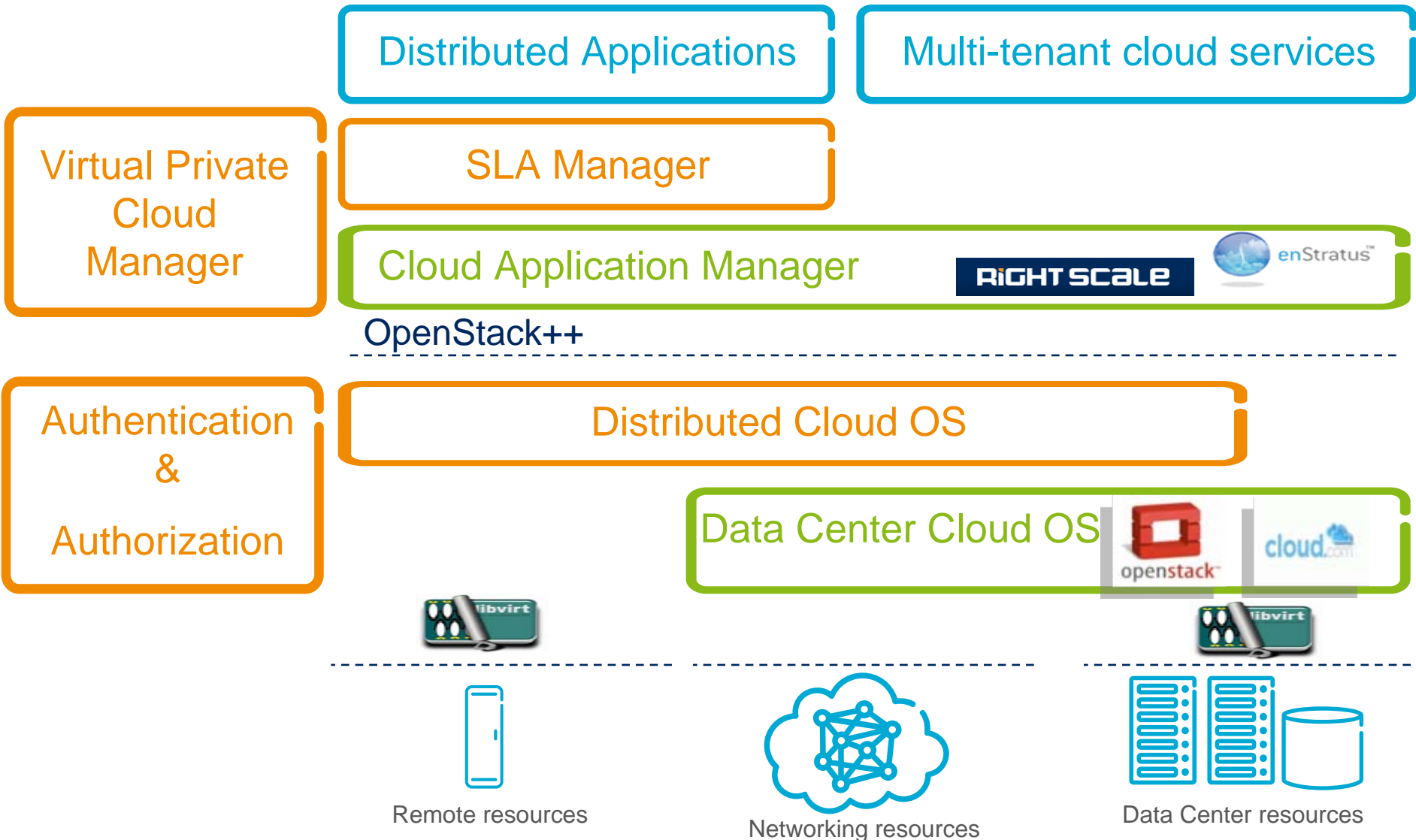


Blue Print for SaaS optimized service operation

SOFTWARE COMPONENTS



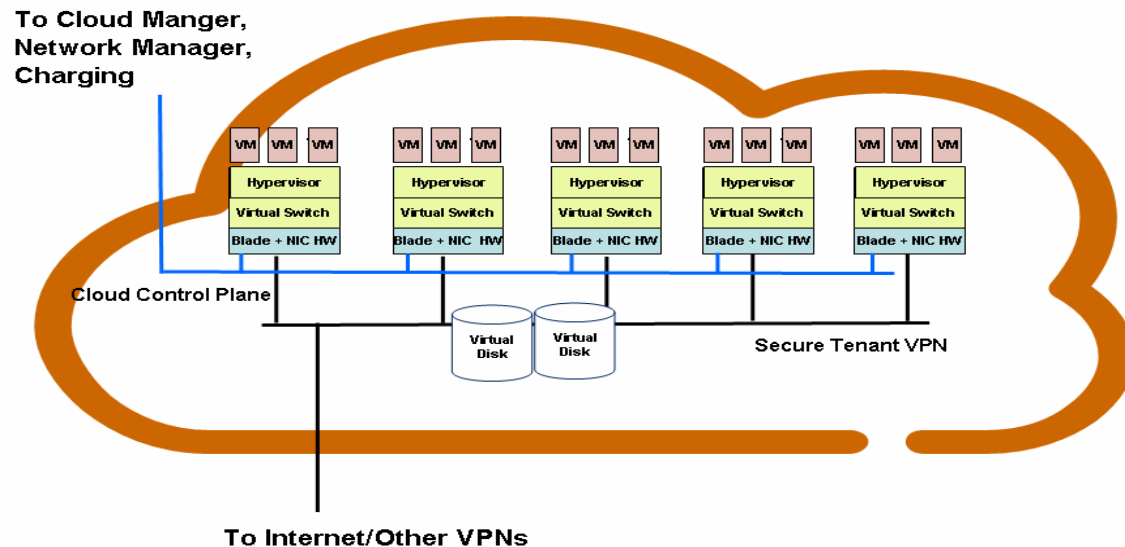
CLOUD PROTOTYPE ARCHITECTURE



VIRTUAL PRIVATE CLOUD SERVICE MODEL

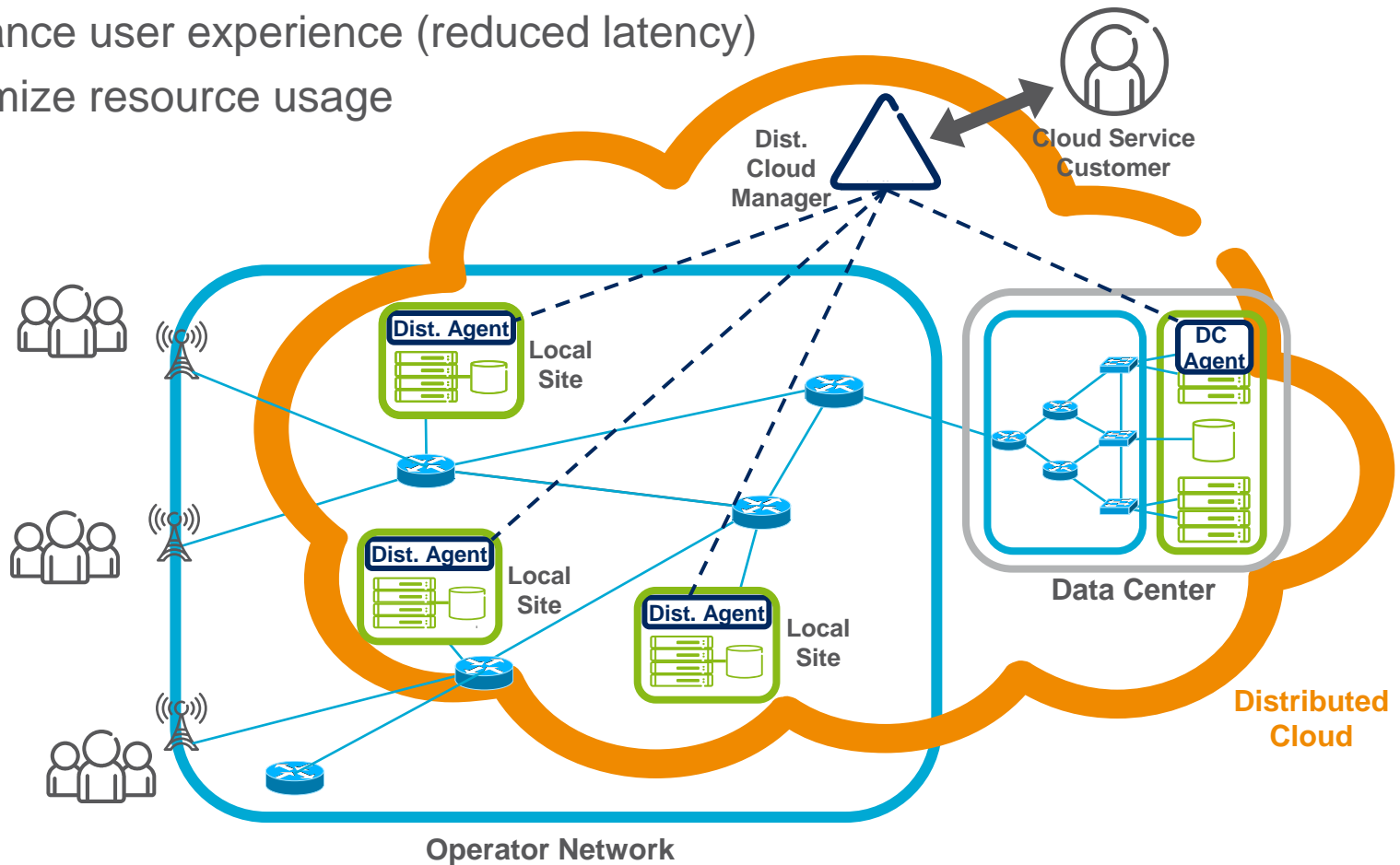
Virtual Private Cloud:

A *virtual container* consisting of *virtualized compute/network/storage resources* within which *customer-tenants of the cloud operator* can *sublease resources to their end-customers/users*.



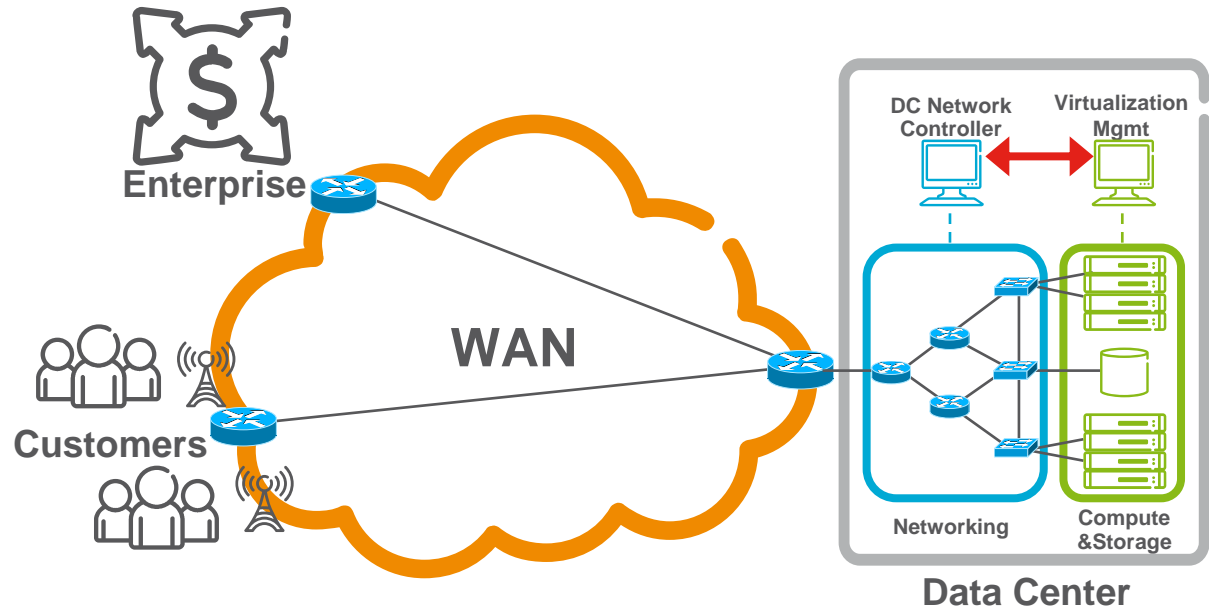
DISTRIBUTED CLOUD: MOVING EXECUTION CLOSE TO THE CUSTOMER

- › Exploit and manage operator's distributed resources
- › Dynamically redistribute applications to:
 - Enhance user experience (reduced latency)
 - Optimize resource usage



ELASTIC NETWORKING FOR THE CLOUD

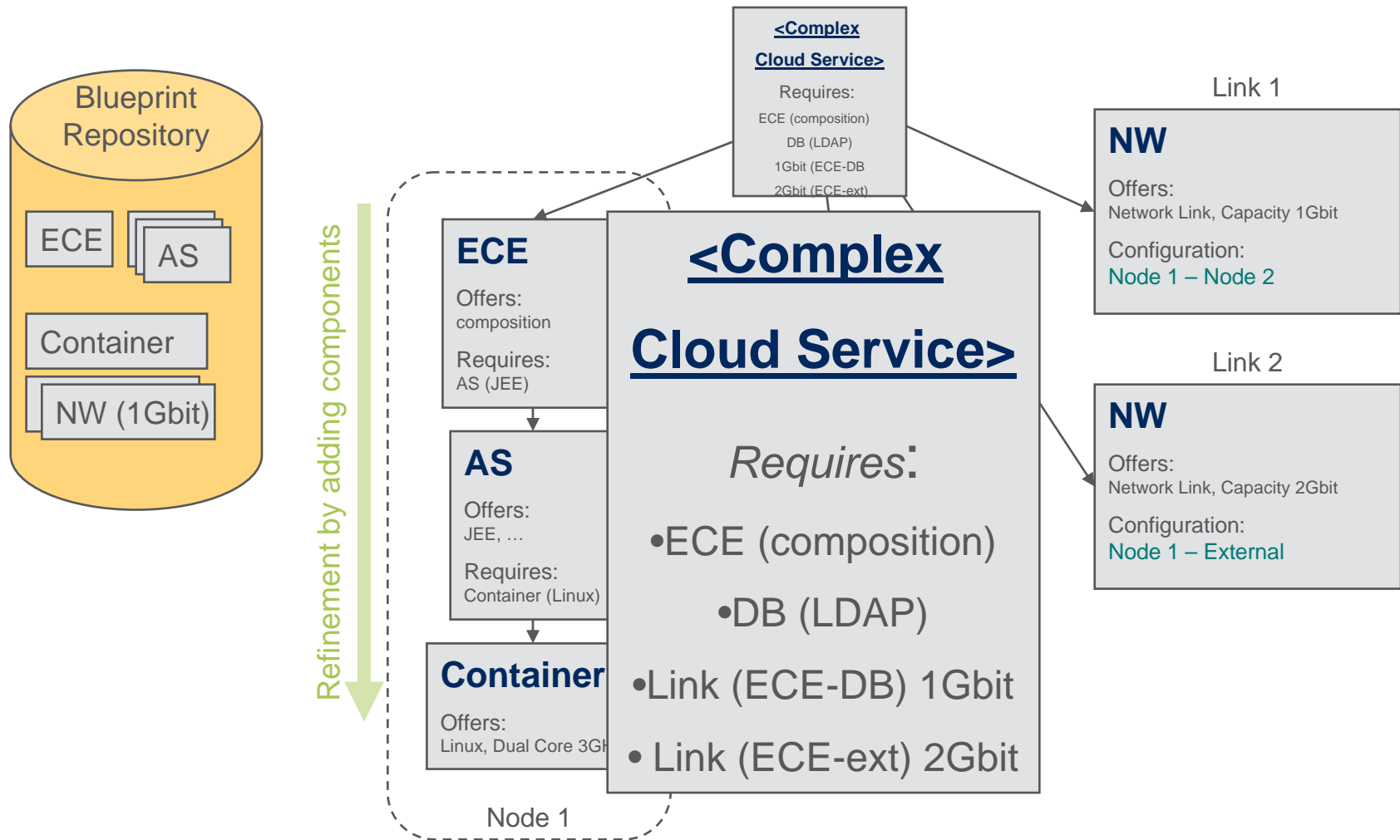
- › Provisioning and management of **bundled compute/storage and connectivity**
- › **Rapid network provisioning** to match the dynamicity and flexibility of the compute cloud



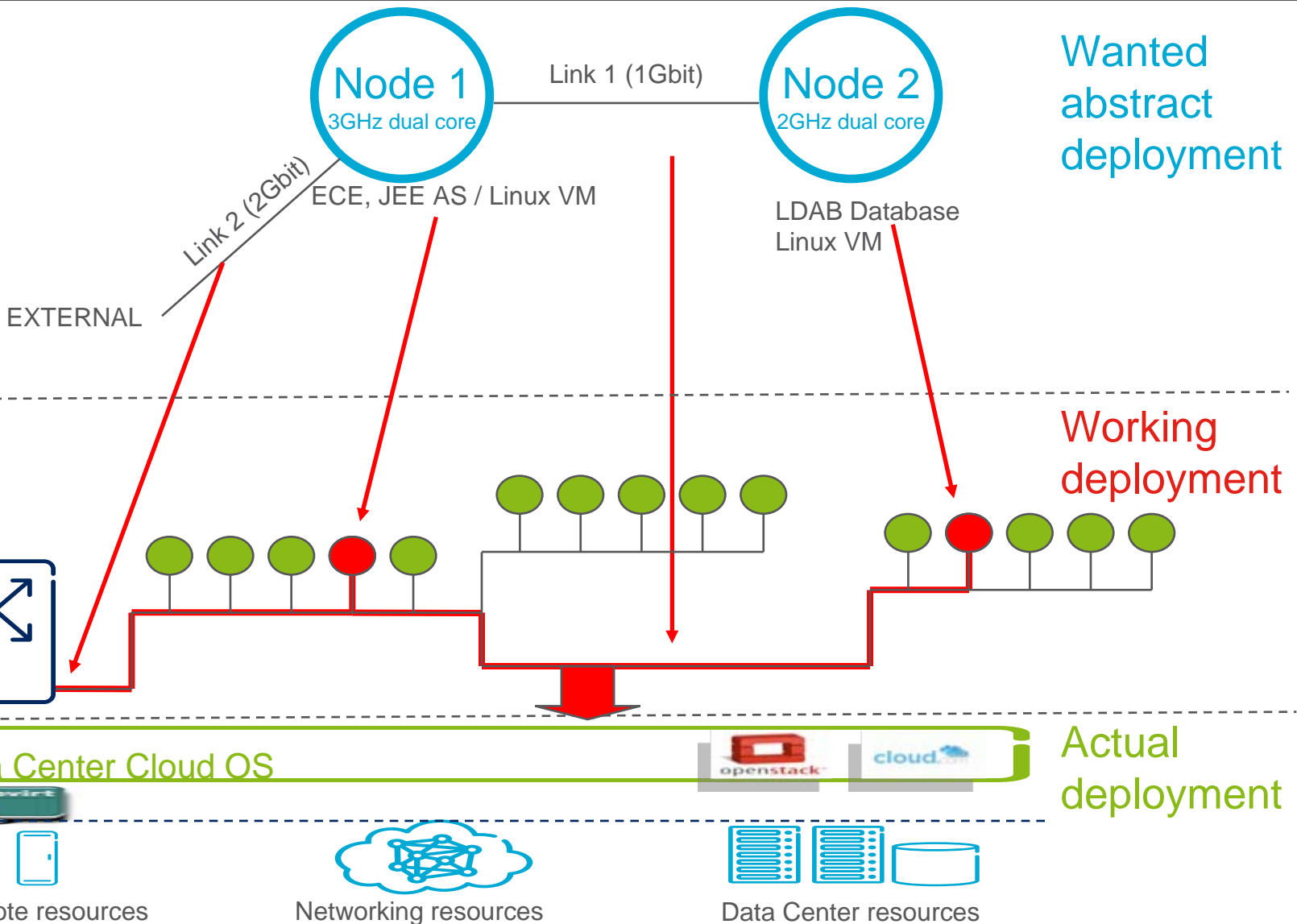
› **Essential** enablers

- Network virtualization
- Central network controllers
- Integration of virtualization- and network management

COMPOSITION BASED RESOLUTION OF SERVICE LEVEL AGREEMENTS

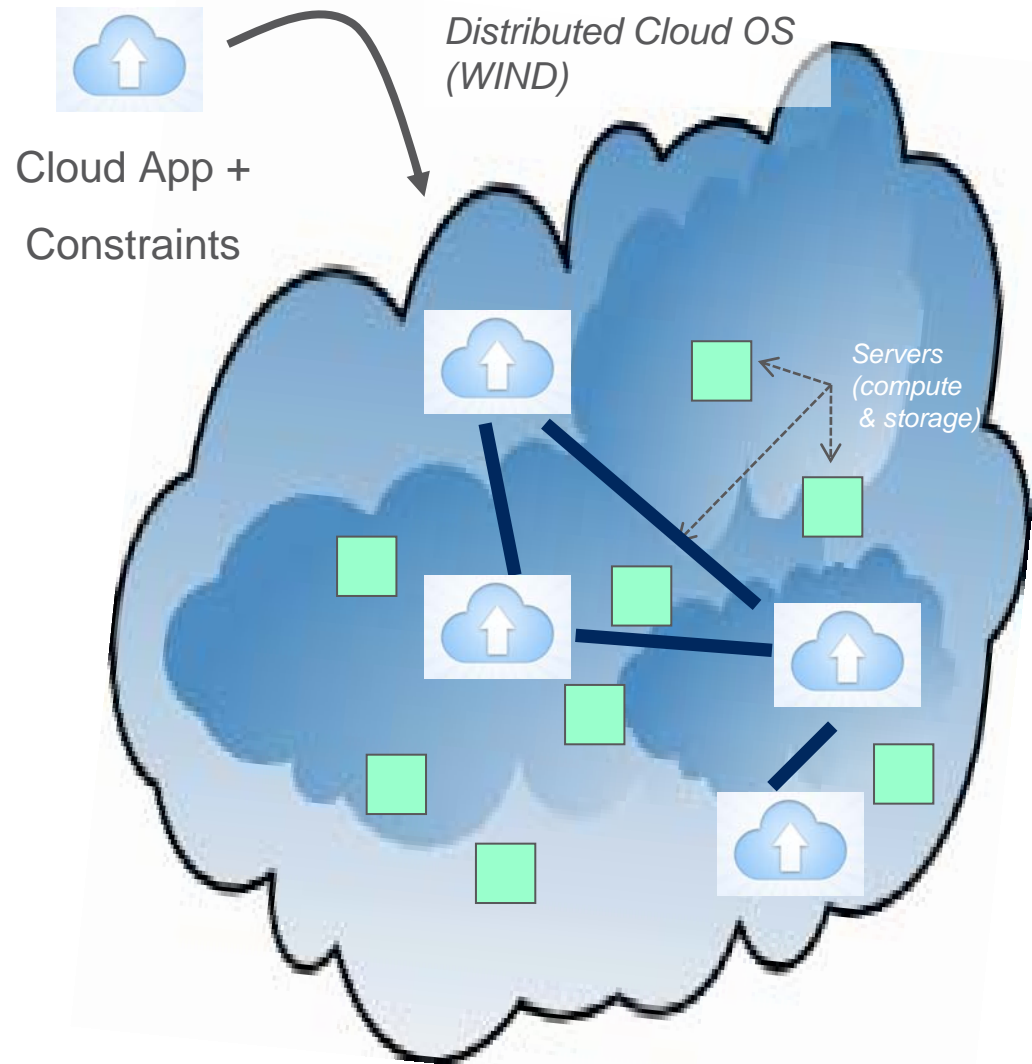


RESULT OF RESOLUTION FOR <COMPLEX CLOUD SERVICE>



APPLICATIONS IN THE DISTRIBUTED CLOUD

- › **Application** = “cloud app” + set of constraints
 - Passed to the distributed cloud OS
- › Distributed Cloud OS **schedules the app automatically based on**
 - available processing resources
 - its constraints
 - current conditions in the cloud
- › **Network is reconfigured** accordingly
- › **Robust, scalable, fault tolerant**



KEY TAKE-AWAYS

CLOUD COMPUTING HAS THE POTENTIAL OF HAVING A POSITIVE
IMPACT ON CAPEX/OPEX AND GENERATING NEW BUSINESS

CLOUD INFRASTRUCTURE FOR TELECOMMUNICATION SERVICES
NEEDS MORE THAN WHAT IT CLOUDS PROVIDE TODAY

IT'S ABOUT LOCALITY MANAGEMENT, SLA MANAGEMENT AND
TRUST & IDENTITY MANAGEMENT

THANK YOU!



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