On demand networks

Network virtualization enabling new business and operational models

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Agenda

Market trends & requirements

Drivers for Network Virtualization

- Diversity of demand
- Extreme cost efficiency
- Networking the cloud

Virtualized networks: concepts & architecture

Business models enabled by Network Virtualization

Implementation of Network Virtualization

The world of communications is changing: Mobile Broadband, Cloud Computing, 4G, NG optics

Requirements for networks become even more challenging – be prepared for the unexpected!

Customer demand, OTT services and apps
- "Unlimited" capacity at zero cost
- Individualized user experience

Next generation radio and fiber rollout
- Cheap fronthaul
- Time shifting of capacity

Content and apps "in the clouds"
- Flexible capacity
- Elasticity
- High quality of service
- Low latency
- Resiliency

User demand diversity

Capacity cost efficiency

Service cloud agility

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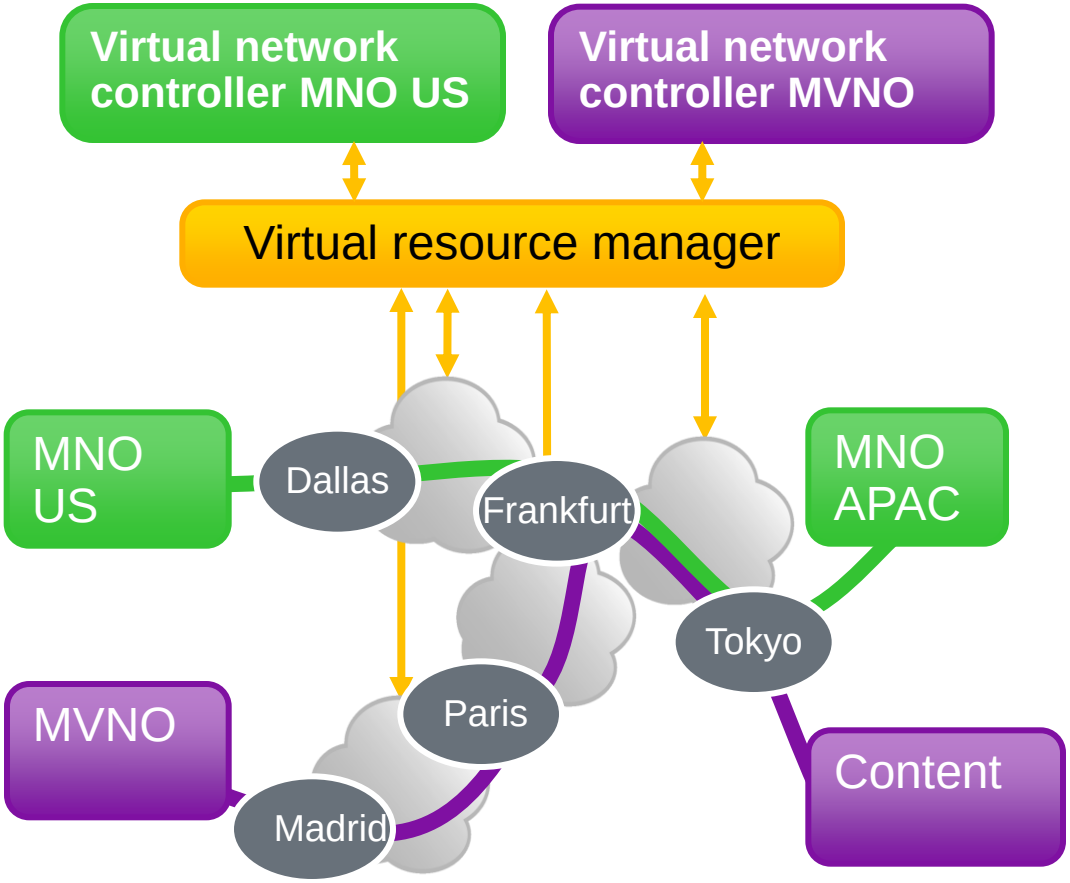
Diversity of demand: “Self serve” networks allow trading and brokering of connectivity



Diversity:
- network service profile
- SLA ensured end-to-end
- peak load timing

Automated:
- NGOSS for self-x
- standard control plane
- multi layer and multi domain network set-up

Differentiated:
- service specific QoE / QoS
- traffic separation

Traded:
- spare capacity
- inter carrier

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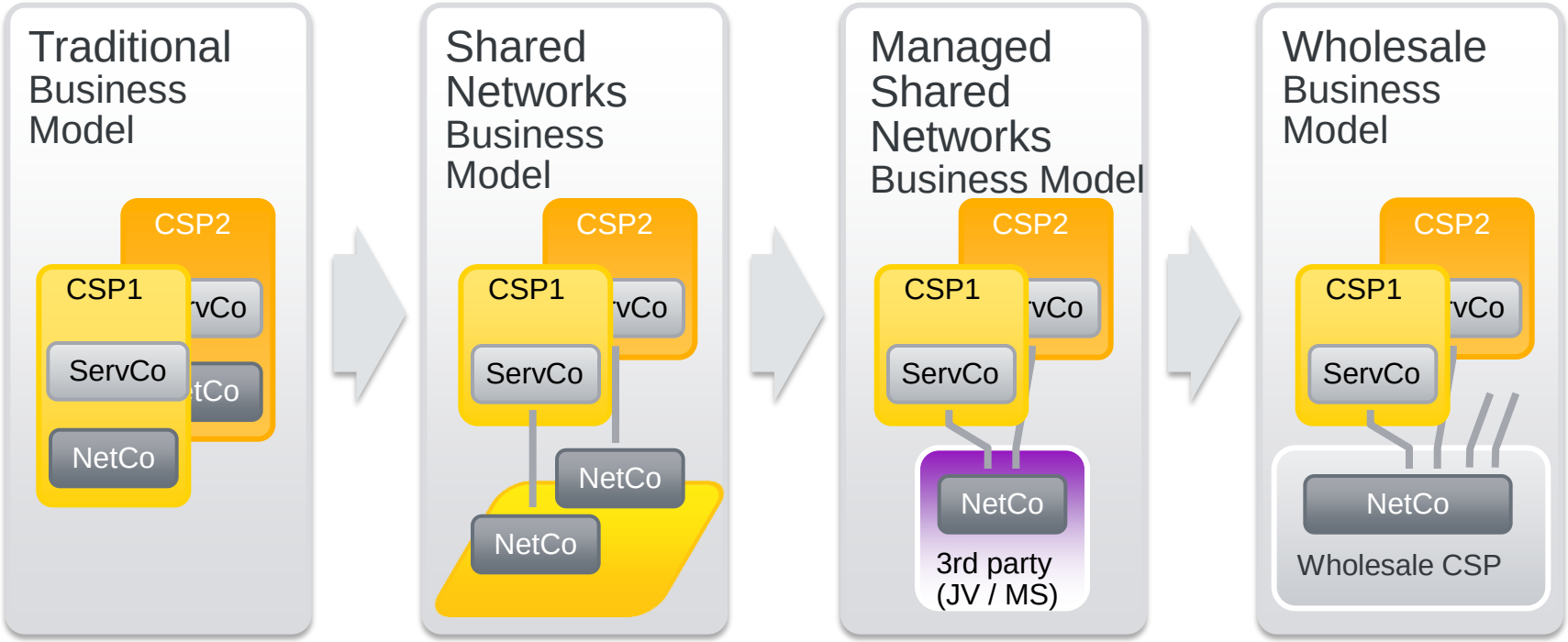
Capacity cost: Extreme efficiency drives towards multi-tenant connectivity



Virtualization allows more flexible models of infra sharing

Connectivity trading helps sweating the infra assets

Variety of cooperation models coexist

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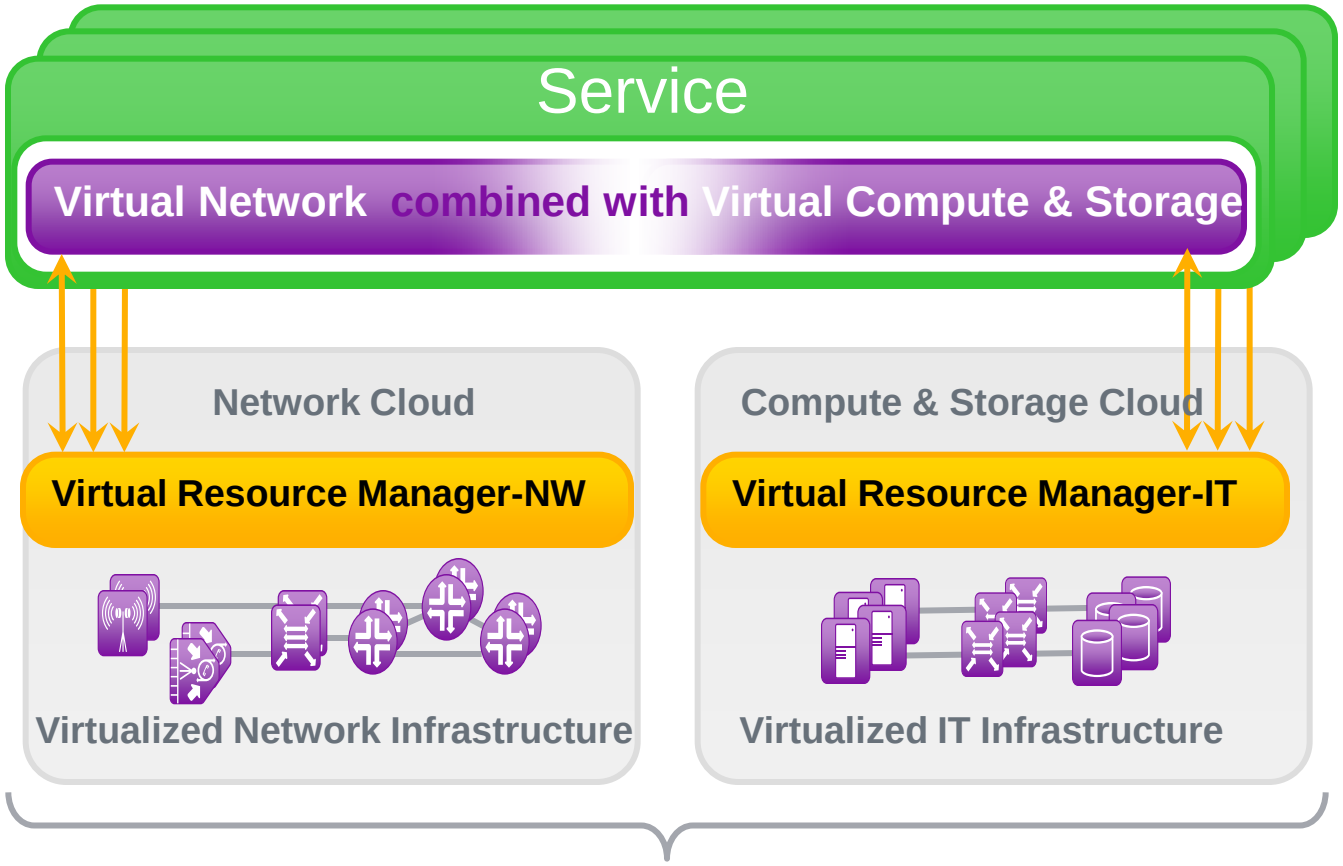
Agile services from the cloud:
Virtualization extended to the network domain



- Network and data center resources merge as clouds are distributed.
- Virtual traded connectivity
  - inter cloud
  - Intra cloud
- Service and content optimized SW/data location
- Optimized forwarding plane and all-optical connectivity

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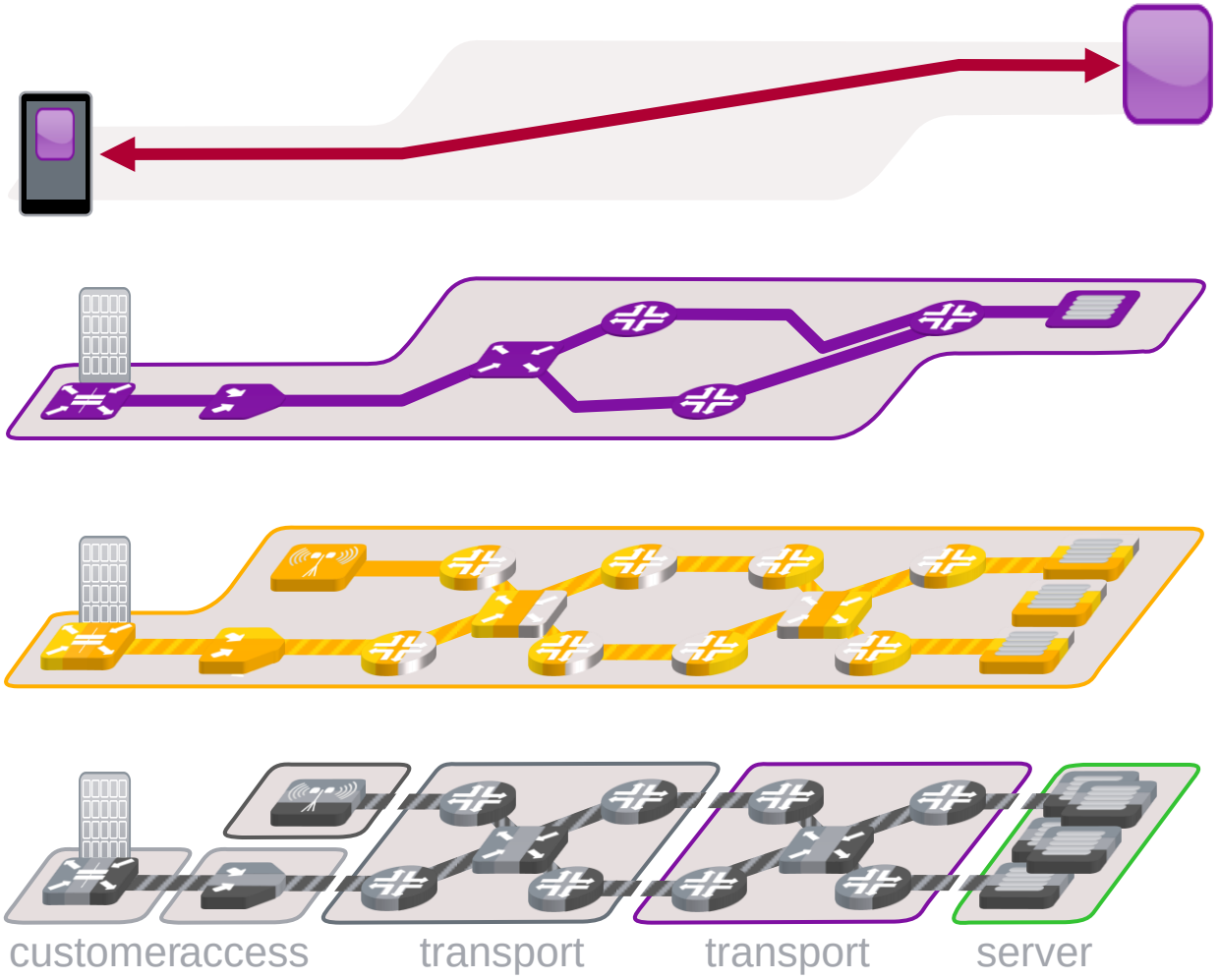
Network virtualization, a solution approach for: Efficient, diverse, agile connectivity on demand

Providing optimized services

Providing agile virtual network

Combination & partitioning of virtual resources

Virtualization of links, paths, nodes and IT resources



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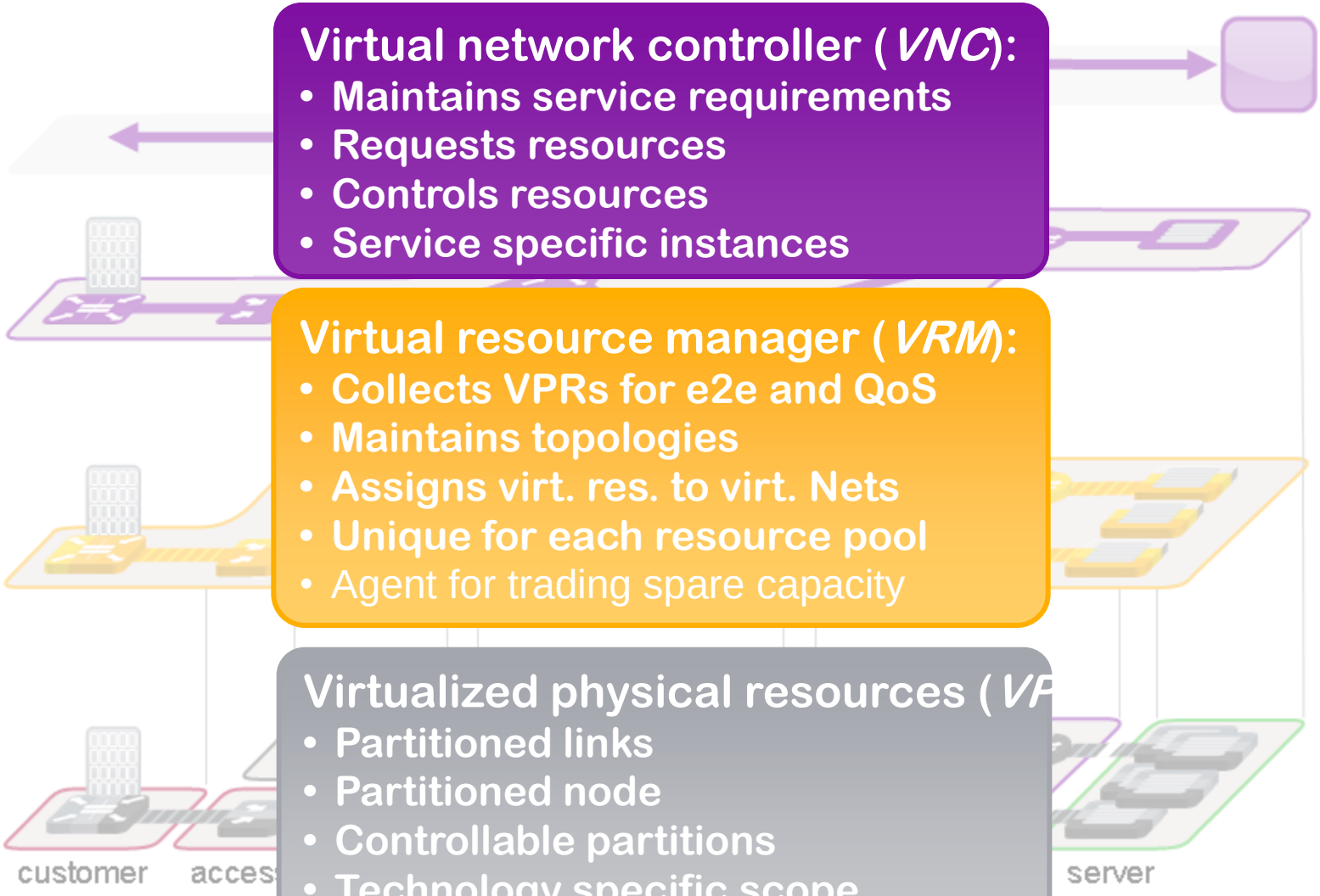
Network virtualization architecture
A functional decomposition for flexibility



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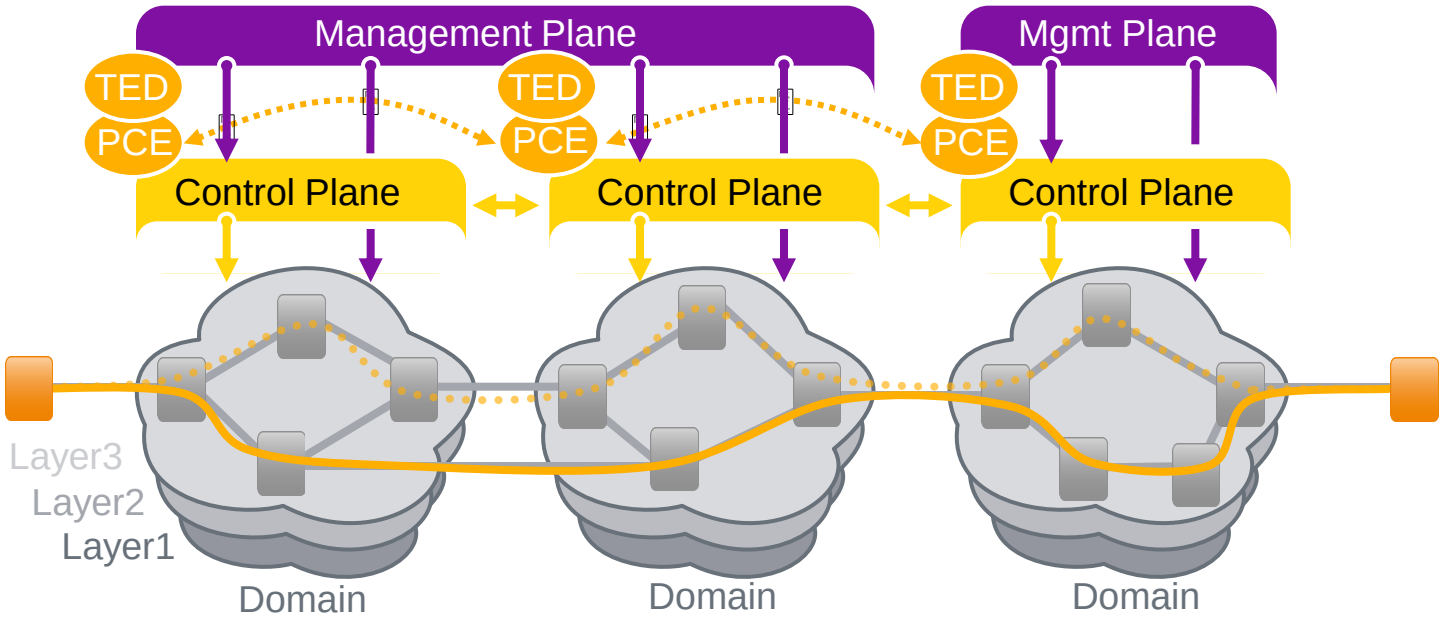
On-Demand Connectivity across multi operator domains requires e2e interoperability



Point & click provisioning over multiple layers, domains & vendor areas

Automatic restoration over multiple layers and domains

Bandwidth on demand and dynamic adjustment

PCE: Path Computation Element
TED: Traffic Engineering Database

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Network virtualization differentiates business roles: Service providers need to make their choice

Reseller

MNO/ FNO

evolved NaaS

virtual MNO/ FNO

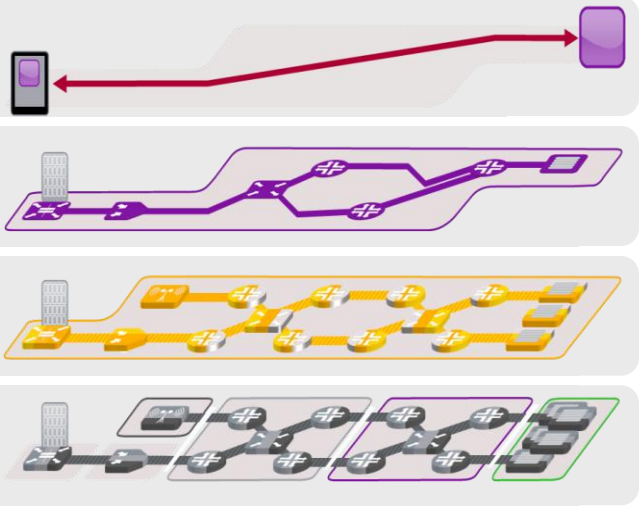
Virtual Whole-sale

MVNO FVNO

Virtual network provider

Exchange Broker

Utility



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CloudStreet - A Capacity Trading Market Place: Monetizing Wholesale/Interconnection business

….by providing a unique quote-to-cash automated cycle:

- **Partner Operators Pre-qualification and Contract management**
- **Identification and Publishing of available resources based on integrated lit building/PoP and capacities lists**
- **Matching offers to demand and getting the best price**
- **Integration of Service Ordering systems on Inter-carrier level**
- **Inter-carrier Provisioning Coordination**
- **SLA Assurance and Billing Integration**

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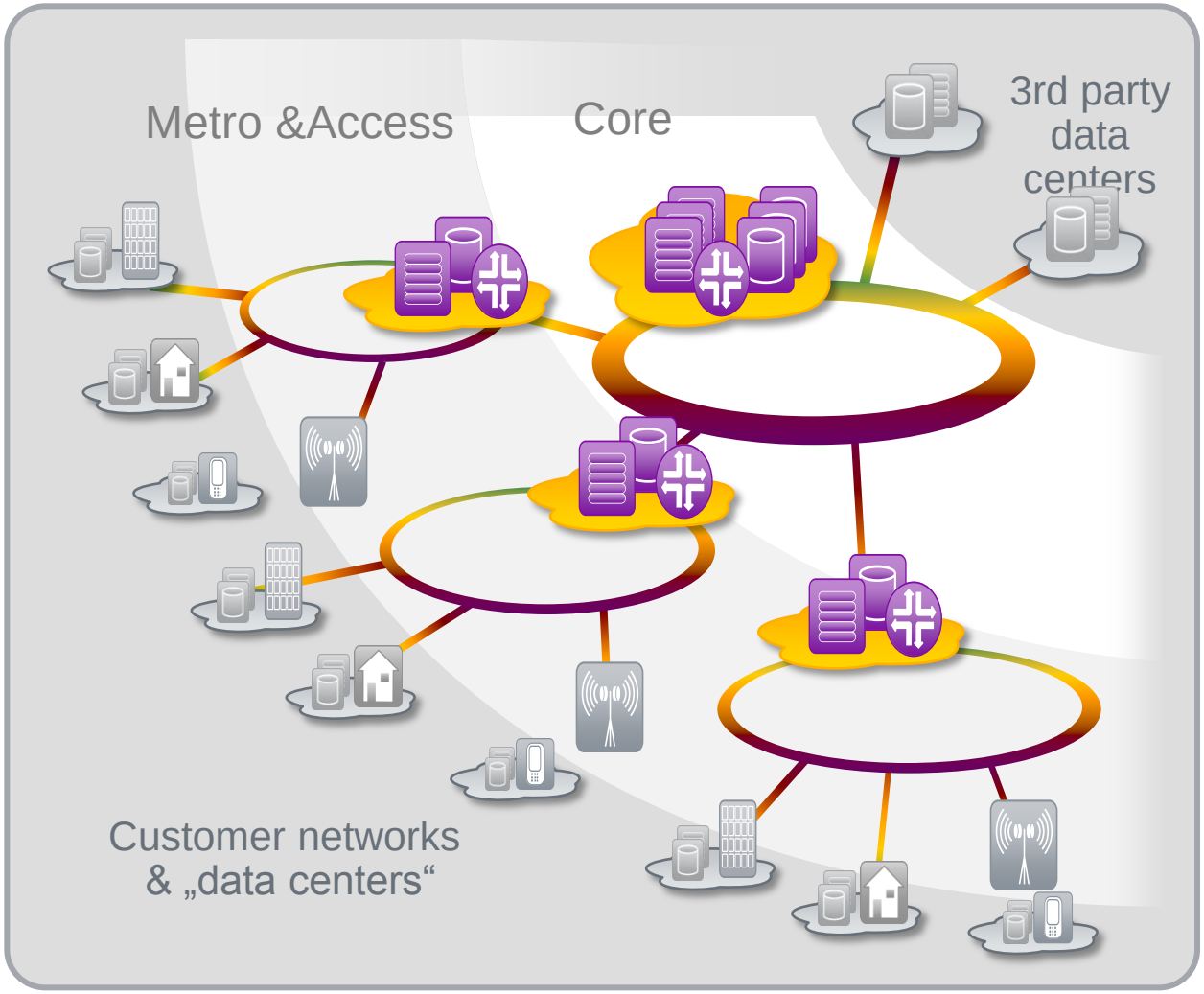
Liquid Net:
A new way to deliver broadband on demand.



Allows the network to self-adapt to meet capacity and coverage requirements based on demand.

Heterogeneous broadband access & smart agile transport

Central data centers for efficient network control / operation and XaaS offerings

Flexibility & scalability through virtualization and automation

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Nokia Siemens Networks actively researches the foundations of network virtualization:

GLab
www.german-lab.de

German government funded.
Focus on architectural aspects and pilot implementation

ARD 4W

EU funded .
Concurrent IP networks on same physical resources.

SAIL

EU funded .
Network virtualization, NaaS,…

4CaaSt

EU funded .
APIs for IaaS, NaaS, etc.

MEVICO
Mobile Networks Evolution for Individual Communications Experience

Europ. governments funded.
Mobile network arch., virtualization/cloud networking

fi-ware

EU funded .
M2M research with NaaS and virtualization aspects.

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The End

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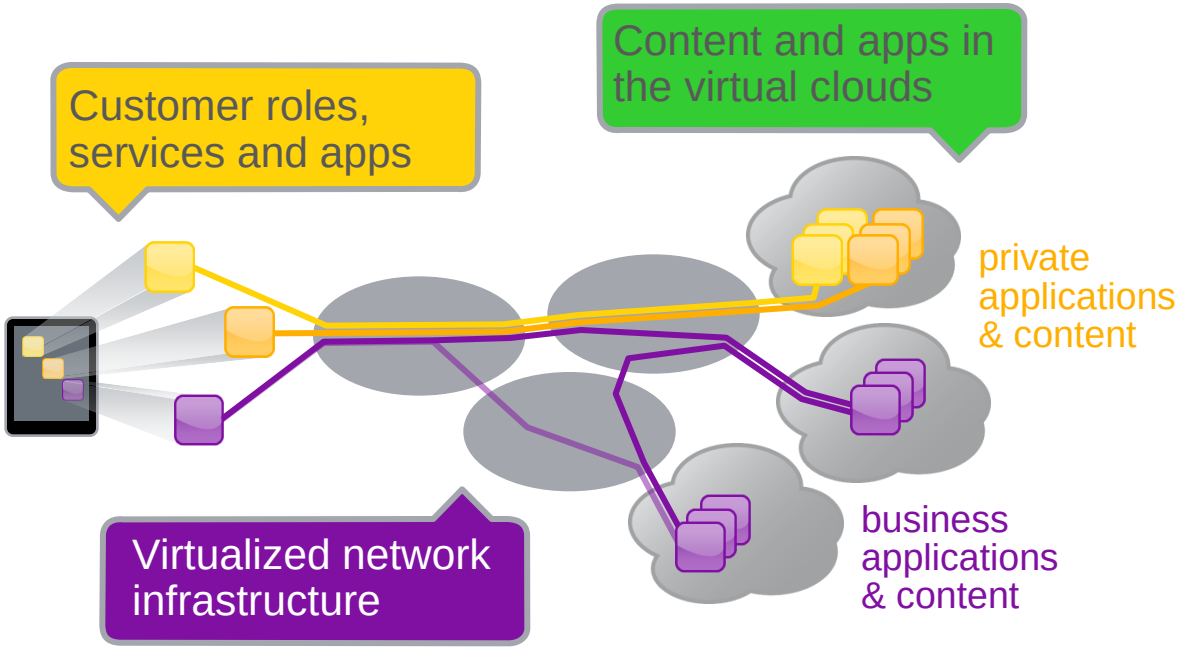
Network virtualization can provide the solution: Efficient, diverse, agile connectivity on demand



Self provisioning of user specific connectivity profiles

Fast adapt to growing traffic load and fast changing traffic patterns

Multi tenant operations with separated and secured services

Agile cloud computing on distributed virtual infra structure for enhanced SLA

Network virtualization business
Agile business process are a must!

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evolved NaaS

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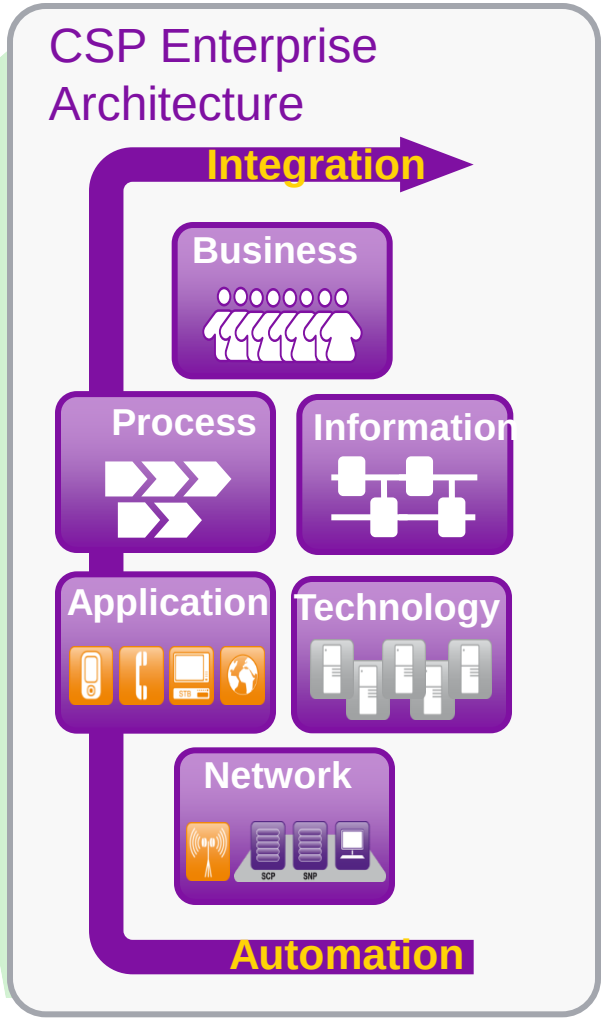

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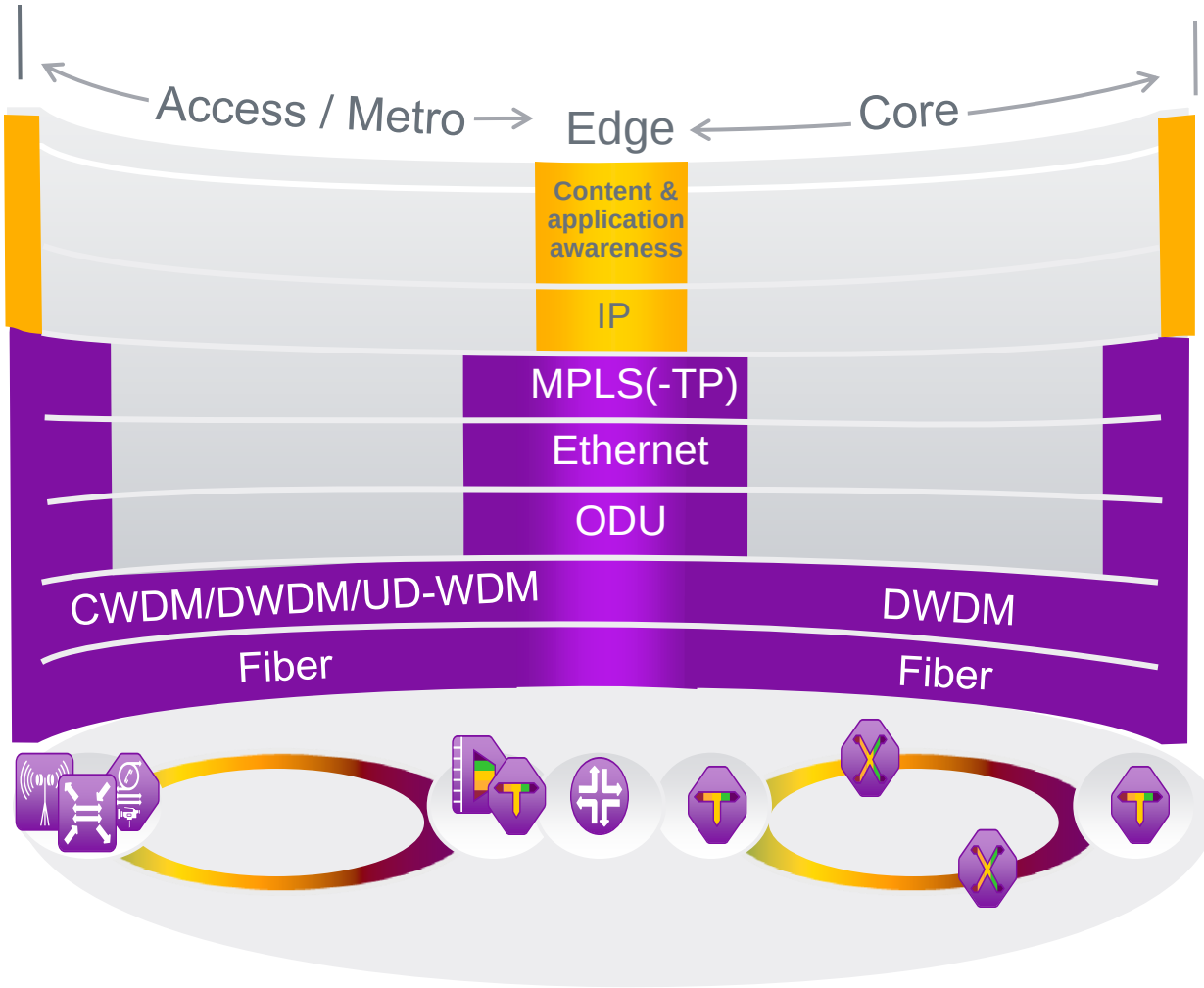
Liquid Net innovates today's network to meet the broadband wave

- Unleash frozen network capacity
- Fluidly adapt to meet unpredictable broadband demand
- Enhanced network capital efficiency
- Superior user experience and new revenues

Network virtualization in transport networks
Cross layer and e2e connectivity control



- Tight Packet / optical Integration
- Agile E2E path provisioning
- Lowest level user plane switching
- Single core control plane

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