

Open Cloud eXchange (OCX) Draft Proposal and Progress GN3plus JRA1 Task 2 - Network Architectures for Cloud Services

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- GN3+ JRA1: Network Architectures for Horizon 2020
- General use cases and scenarios for Cloud services delivery to NRENs and universities
 - Cloud and Intercloud Infrastructure and Services
- Open Cloud eXchange (OCX)
 - Requirements to OCX
 - OCX design principles and suggestions
- Pilot implementation by SURFnet
 - GreenQloud and OneXS
- Topics for discussion
- Additional information
 - Intercloud Architecture Framework (ICAF) and Intercloud Federation Framework (ICFF)



- Task 0: Activity Leadership
- Task 1: Future Network Architectures
- Task 2: Network Architectures for Cloud Services
- Task 3: Network Architecture for Aggregating High-Speed Mobile Networking



JRA1 Goals and Tasks

- Network Access and Delivery Network Infrastructure (NADI) plays important role in delivering cloud services to campuses and research organisations and includes 3 parts/layers
 - The user access network, which connects users to applications.
 - Extreme high-speed networks, which interconnect physical servers and the movement of their virtual machines (VMs).
 - Mega pipe networks, interconnecting storage tiers.
- JRA1 Task2 and Task 1 will investigate and propose the best architecture for practical NADI implementation
 - To support cloud-based services, including the distribution of very large scientific data
 - Pilot implementation and demonstration of few use cases
- JRA1 and JRA2 will cooperate on multiple topics
 - Network virtualisation and automation to deliver Performance on Demand by automating the allocation of shared network resources among data centres on behalf of cloud operations
 - JRA1's focus on the network elements to support cloud-based services interconnection and integration, with focus on the southbound elements of the management and related control plane when interworking with the software-driven network elements
 - JRA2 will research true software-driven networking for cloud-based services, with automated resource orchestration and provisioning that yield reduced network capacity requirements, predictable service performance, and simpler operations



Use Cases for delivering Cloud services to campus based users

- Scientific application and scientific data
 - LHC/HEP, genomics, astronomy, climate, video, etc. (+long tail science)
- Streaming high-speed high volume experimental data to labs in campus location
 - Direct links through campus network
- Distributed (Big) Scientific Data processing with MPP tools on distributed facilities
 - Data distributed between few locations next to local datacenters
- CSP and campus L0-L2 (L3) network peering
 - Dark fiber with termination as campus network or as CSP network
- VoIP SURFnet approach with mobile data access
 - Support mobile access network (LTE) and tunnel access to campus network

General use case for infrastructure provisioning: Workflow => Logical (Cloud) Infrastructure



Multi/inter- cloud infrastructure provisioning: => ICADI and OCX functions



Multilayer Cloud Services Model (CSM)

http://www.ietf.org/id/draft-khasnabish-cloud-reference-framework-05.txt



Open Cloud eXchange (OCX)

General use case for infrastructure provisioning: Logical Infrastructure => Network Infrastructure (2)



OCX Definition and Operational Principles

Direct service/inter-member peering

- Re-use and leverage Internet eXchange
- Open collocation services
- Scalability for growing number of members
- Controlled network parameters/QoS

No third party (intermediary/broker) services

- Transparency for cloud based services
- No involvement into peering or mutual business relations

• Trusted Third Party (TTP)

- To support dynamic service agreements and/or federation establishment
- Trusted Introducer for dynamic trust establishment
- May include other special services to support smooth services delivery and integration between CSP and Customer
 - E.g., Local policies, service registry and discovery

OCX Topological model and Connectivity



Nodes: Providers and customers

OCX Facilities

OCX backbone links/connectivity (Lo-L2)

OCX L0-L2/L3 topology

- Any-to-any
- Distributed or collapsed backbone
- Hierarchical
- Topology information exchange L0-L2 + L3? between members
- SDN control over OCX switching

QoS parameters

- Bandwidth
- Speed, latency
- Jitter, impairment



OCX

OCX Trusted Third Party services



Pre-established trust relation with OCX as TTP

 Trust relations established as a part of dynamic federation between OCX members

- TTP goals and services
- Enable dynamic federations establishing
- Trusted Certificates and CA's Repository
 - Similar to TACAR (TERENA Academic CA Repository)
- Trusted Introducer Service
 - Trusted Introduction Protocol
- Service Registry and Discovery
- Intercloud policy clearinghouse
 - Repository of CSP policies
 - Common policy template
- SLA repository and clearinghouse

OCX location options: GN3, NREN (+University?)



OCX Hierarchical Topology Model



OCX Extended Backplane Topology Model



Pilot OCX Concept Implementation by SURFnet

- NetherLight as an Open Lightpath Exchanges (OLE) operated by SURFnet
 - To Bandwidth on Demand, Virtual Networking
 - 100G transatlantic trials, and
 - Open Cloud eXchange (OCX) pilot/prototype
- Since 2012, SURFnet and NetherLight have been performing pilots with cloud providers that want to offer their services with lightpath characteristics to SURFnet connected institutions
- GreenQloud (Iceland) offers service delivery over lightpaths via NetherLight/SURFnet with advantages above the regular IP services
 - Guaranteed bandwidth and latency
 - Protected from the external Internet
 - Possibility of domain extension (VM's appear as if inside campus network)
 - Cost reduction due to offloading of traffic
- Pilot since 2012 between OneXS and Windesheim University of Applied Sciences to deliver unified services of fixed and mobile telephony
 - Guaranteed bandwidth and latency
 - Protected from the external Internet
 - Protected from DDOS attacks



General SURFnet Lightpath interconnection



- GeenQloud: cloud services
- OneXS: unified services of fixed and mobile telephony



- First public draft 12 September 2013
- GN3plus inter-activities discussion and feedback
 - 17 May 2013 First draft published
 - June 2013 First round of comments and update
 - Sept 2013 Second round of comments and update
 - Sept Oct 2013 External comments and community feedback
- Design and implementation Starting November 2013?
 - SDN based control and management over OCX
- Standardisation contribution OGF, IETF, ITU-T, IEEE, NIST
 - IEEE Intercloud Testbed Initiative as a dissemination and validation channel -



- Network for Clouds or for future Big Data applications (cloud based)?
 - eScience use cases need to be analysed and new requirements identified
 - Trends in university's and research services use
- SDN vs Software Defined Infrastructure
 - Big Data data-centric applications will require data structures and processing workflow to be mapped to infrastructure
 - Distributed storage, distributed processing, security, lifecycle/staging, etc.
- Lower layer infrastructure virtualisation

Gartner Technology Hypercycle



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Open Cloud eXchange (OCX)



Gartner. Priority Matrix

years to mainstream adoption



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Improved: 5+1 V's of Big Data



Generic Big Data Properties

- Volume
- Variety
- Velocity

Acquired Properties (after entering system)

- Value
- Veracity
- Variability
 Commonly accepted

3V's of Big Data
 Perabytes
 Records
 Transactions
 Tables, files
 Batch
 Near time
 Streams
 Structured
 All the above
 Vertei



From Big Data to All-Data – Paradigm Change



Big Data Ecosystem: Data, Transformation, Infrastructure



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Big Data Infrastructure and Analytic Tools



http://mattturck.com/2012/10/15/a-chart-of-the-big-data-ecosystem-take-2/



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Additional Information



Initiatives by the major CSP

- Amazon Direct Connect
- Google patent US 2012/0151057 A1 (January 2012)
 Virtualised Connectivity in a Cloud Service Environment
- Microsoft Azure campus PoP (Point of Presence)

New Service: Amazon Direct Connect



- AWS Direct Connect links customer internal network to an AWS Direct Connect location over a standard 1 Gbps or 10 Gbps Ethernet fiber-optic cable
 - One end of the cable is connected to customer router, the other to an AWS Direct Connect router
 - Allows creating virtual interfaces directly to the AWS cloud (Amazon EC2, S3) and to Amazon Virtual Private Cloud (Amazon VPC), bypassing Internet service providers in your network path
- Access is limited to Amazon Web Services in the region



InterCloud Architecture Framework (ICAF)

- Multi-layer Cloud Services Model (CSM)
 - Combines IaaS, PaaS, SaaS into multi-layer model with inter-layer interfaces
 - Including interfaces definition between cloud service layers and virtualisation platform
- InterCloud Control and Management Plane (ICCMP)
 - Allows signaling, monitoring, dynamic configuration and synchronisation of the distributed heterogeneous clouds
 - Including management interface from applications to network infrastructure and virtualisation platform
- InterCloud Federation Framework (ICFF)
 - Defines set of protocols and mechanisms to ensure heterogeneous clouds integration at service and business level
 - Addresses Identity Federation, federated network access, etc.
- InterCloud Operations Framework (ICOF)
 - RORA model: Resource, Ownership, Role, Action
 - RORA model provides basis for business processes definition, SLA and access control
 - Broker and federation operation
- Intercloud Security Framework (ICSF)
 - Dynamic Security Infrastructure provisioning and protocols

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General use case for infrastructure provisioning: Workflow => Logical (Cloud) Infrastructure



General use case for infrastructure provisioning: Logical Infrastructure => Network Infrastructure (1)



General use case for infrastructure provisioning: Logical Infrastructure => Network Infrastructure (2)



Intercloud Applications Interaction (1) - ICCMP



Intercloud Applications Interaction (2) - ICFF



Intercloud Federation Infrastructure and OCX



Intercloud Applications Integration (3) - ICOF

