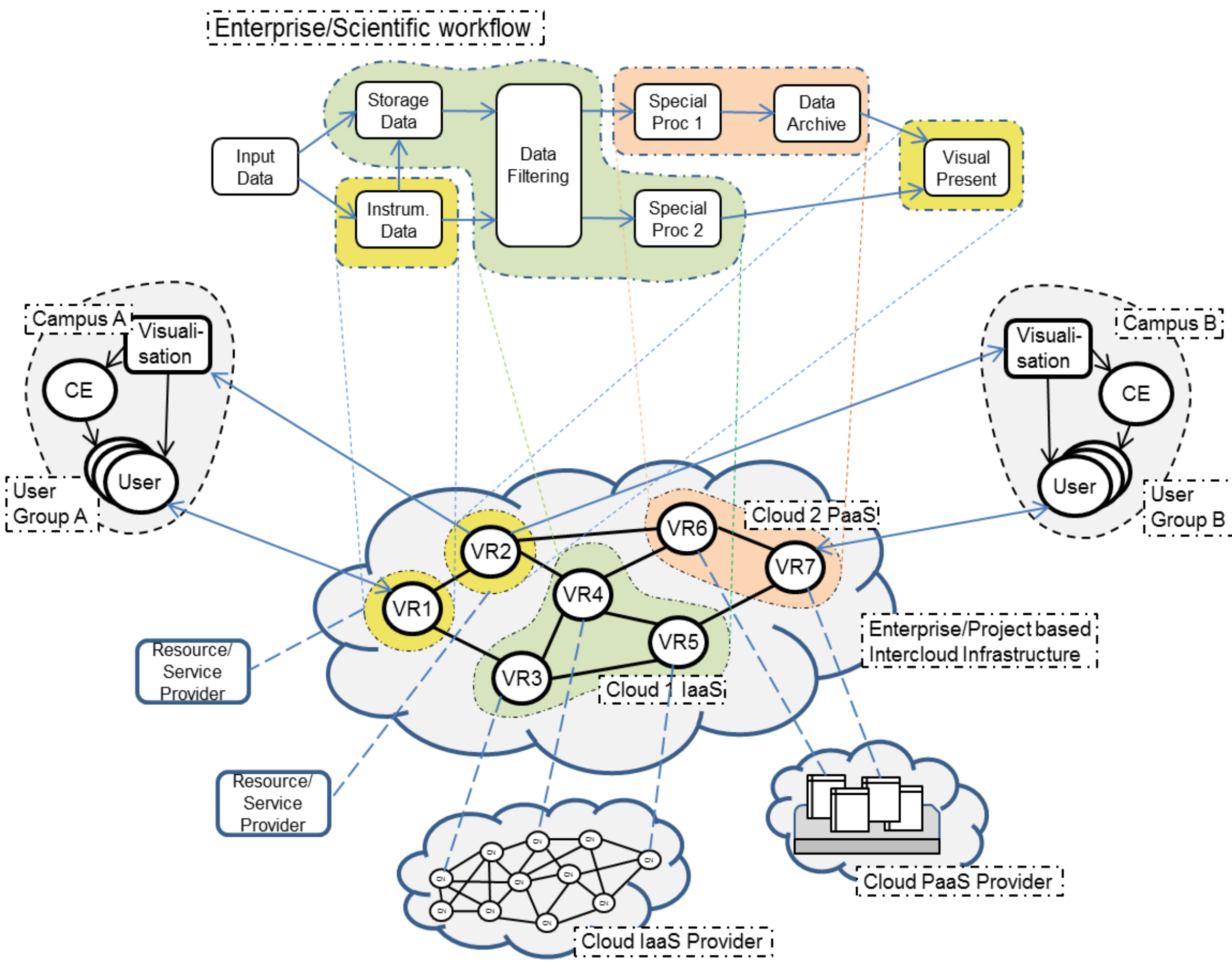


# Intercloud Architecture Framework for Interoperability, Federation and Management

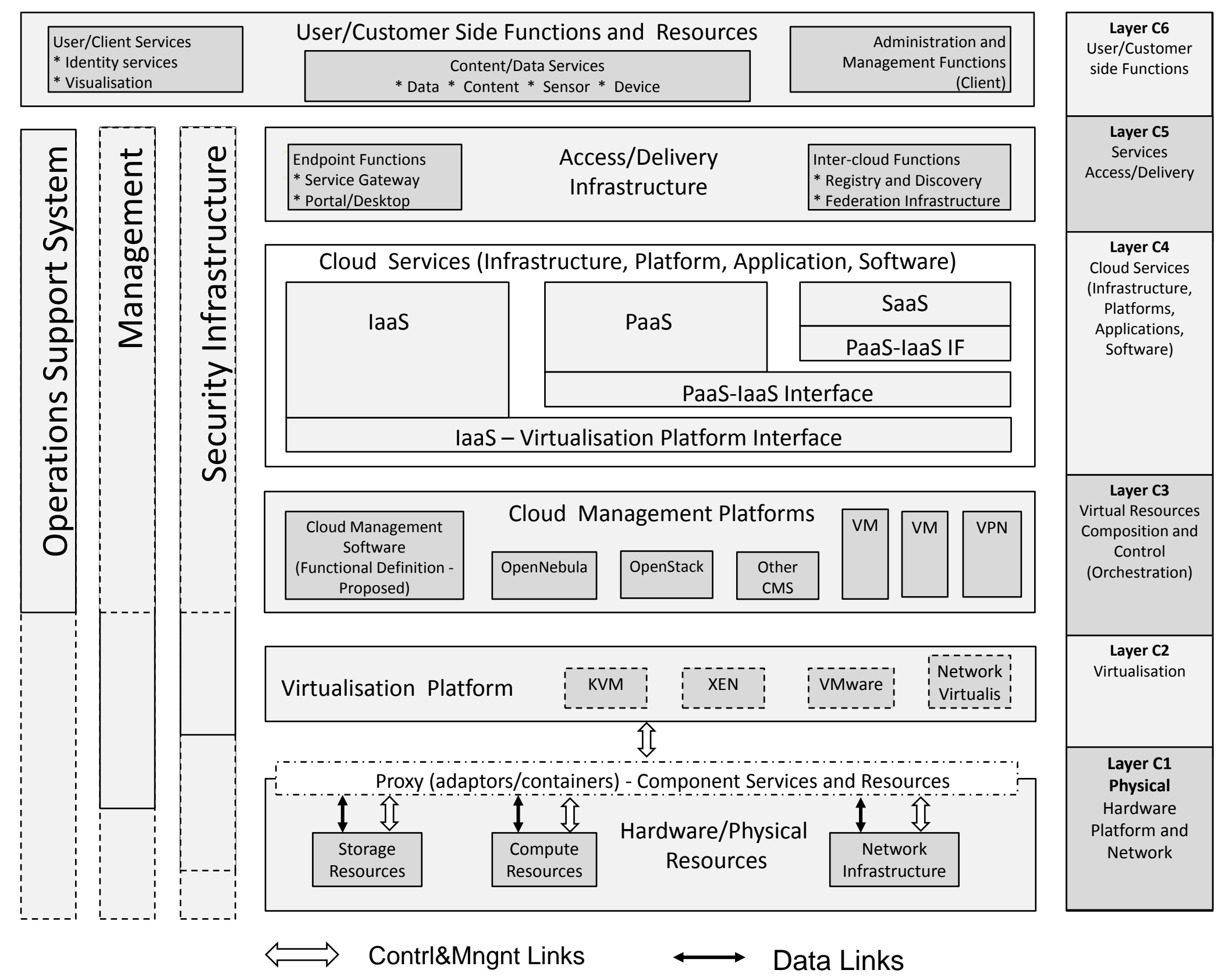
Yuri Demchenko, Rudolf Strijkers, Marc X. Makkes, Canh Ngo, Cees de Laat

## Intercloud Infrastructure/Services Provisioning

(General use case: Enterprise/Scientific Workflow deployment on heterogeneous cloud infrastructure)



## Multi-layer Cloud Service Model (CSM)



### Cloud Services Model Layers

- Layer C1 - Physical platform (PC hardware, network, and network infrastructure)
- Layer C2 - Cloud virtualisation layer (e.g. VMware, Xen, KVM or Hyper-V virtualisation platforms)
- Layer C3 - Cloud virtual resources composition and orchestration layer that is represented by the Cloud Management Software (such as OpenNebula, OpenStack, or others)
- Layer C4 - Cloud services layer that may include different type of cloud services IaaS, PaaS, SaaS
- Layer C5 - Access/Delivery infrastructure hosting components and functions to provide access to cloud services/resources and interconnect multiple cloud domains
- Layer C6 - User/customer side resources and services

CSM is compatible with the NIST Cloud Computing Reference Architecture (CCRA, NIST SP 800-282), ITU-T FG-Cloud Cloud Reference Model and IETF I-Draft Cloud Reference Framework

### General requirements to Intercloud Architecture Framework (ICAF)

- ICA should address the interoperability and integration issues in the current and emerging heterogeneous multi-domain and multi-provider clouds, in particular:
- ICA should support communication between cloud applications and services belonging to different service layers (vertical integration), between cloud domains and heterogeneous platforms (horizontal integration).
- ICA should provide a possibility that applications could control infrastructure and related supporting services at different service layers to achieve run-time optimization (Intercloud control and management functions).
- ICA should support cloud services/infrastructures provisioning on-demand and their lifecycle management, including composition, deployment, operation, and monitoring, involving resources and services from multiple providers.

### The Intercloud Architecture Framework components

- Multilayer Cloud Services Model (CSM)** for vertical cloud services interaction, integration and compatibility that defines both relations between cloud service models (such as IaaS, PaaS, SaaS) and other required functional layers and components of the general cloud based services infrastructure.
- Intercloud Control and Management Plane (ICCMP)** for Intercloud applications/infrastructure control and management, including inter-applications signaling, synchronization and session management, configuration, monitoring, run time infrastructure optimization including VM migration, resources scaling, and jobs/objects routing.
- Intercloud Federation Framework (ICFF)** to allow independent clouds and related infrastructure components federation of independently managed cloud based infrastructure components belonging to different cloud providers and/or administrative domains; this should support federation at the level of services, business applications, semantics, and namespaces, assuming necessary gateway or federation services.
- Intercloud Operation Framework (ICOF)** includes functionalities to support multi-provider infrastructure operation including business workflow, SLA management, accounting. ICOF defines the basic roles, actors and their relations in sense of resources operation, management and ownership. ICOF requires support from and interacts with both ICCMP and ICFF.

### Basic Use Cases for Intercloud Interoperability and Integration

Use Case 1: Enterprise IT infrastructure migration to cloud and its evolution

- Integration of the cloud based components and legacy infrastructure
- Evolution from general cloud infrastructure services to specialised proprietary cloud platform services

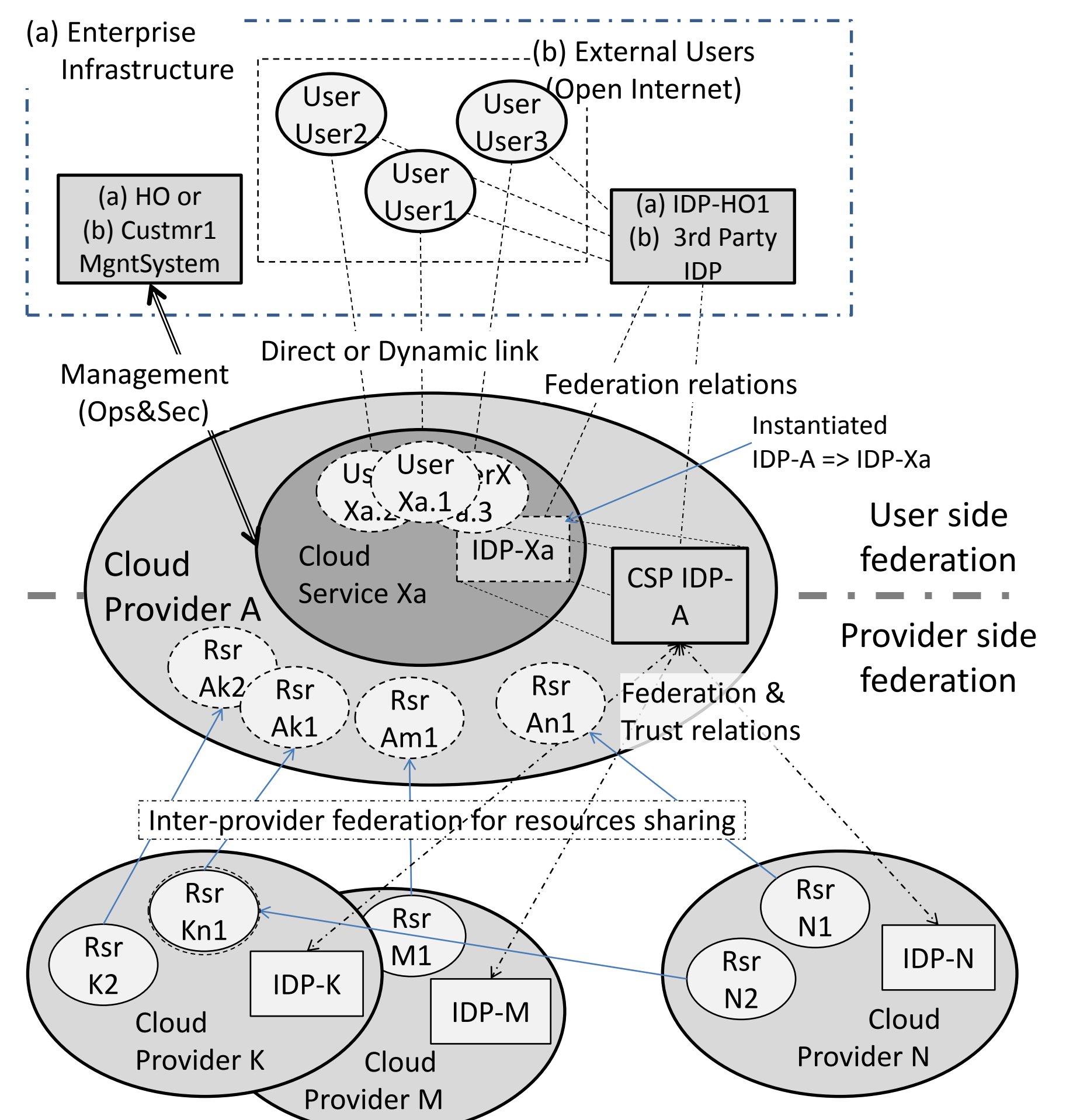
Use Case 2: Large project-oriented scientific infrastructures including dedicated transport network infrastructure that need to be provisioned on-demand

Use Case 3: IT infrastructure disaster recovery that should include both data and supporting infrastructure backup and recovery on possibly new computer/cloud platform

### Related links

- Intercloud Architecture Framework for Interoperability and Integration, Draft version 0.6, 15 Feb 2013. SNE Technical Report. <http://staff.science.uva.nl/~demch/worksinprogress/sne2012-techreport-12-05-intercloud-architecture-draft06.pdf>
- Cloud Reference Framework. Internet-Draft, version 0.4, December 27, 2012. <http://www.ietf.org/id/draft-khasnabish-cloud-reference-framework-04.txt>
- On-Demand Infrastructure Services Provisioning Best Practices, Version 1.3, 15 February 2013 (OGF ISOD-RG Deliverable) <https://forge.ogf.org/sf/docman/do/downloadDocument/projects/isod-rg/docman.root.drafts/doc16538>
- NIST SP 500-292, Cloud Computing Reference Architecture, v1.0. <http://collaborate.nist.gov/twiki-cloud-computing/pub/CloudComputing/ReferenceArchitecture/Taxonomy/>
- NIST SP 500-292 - 090611.pdf

### General Model and Actors in (Inter)Cloud Federations



### Main Actors in Cloud/Intercloud Federation

- Cloud Service Provider (CSP)** is an entity providing cloud based services to customers, on their request and based on the business agreement or SLA, with high degree of self-service and self-management
- Customer** is an entity that requests, creates, deploys and manages cloud based services
- User or consumer** is an end-user consuming cloud based services
- Cloud Broker** is an entity that plays a role of the third party in offering cloud service, adding value of negotiating with CSPs, optionally operating complex multi-provider services
- Identity Provider (IDP)** is an entity providing information about identities of all actors in cloud services provisioning,
  - IDP-HO – by User Home Organisation
  - IDP-CSP by Cloud Service Provider

### Contributing Projects

- GEYSERS – Generalised Architecture for Infrastructure services - <http://www.geysers.eu/>
- GEANT3 JRA3 Task 3 – Composable services (GEMBus) - <http://www.geant.net/>
- COMMIT Project - <http://www.commit-nl.nl/>

Credits: Yuri Demchenko, Rudolf Strijkers, Marc X. Makkes, Canh Ngo, Cees de Laat  
Contact: Yuri Demchenko <y.demchenko@uva.nl>

