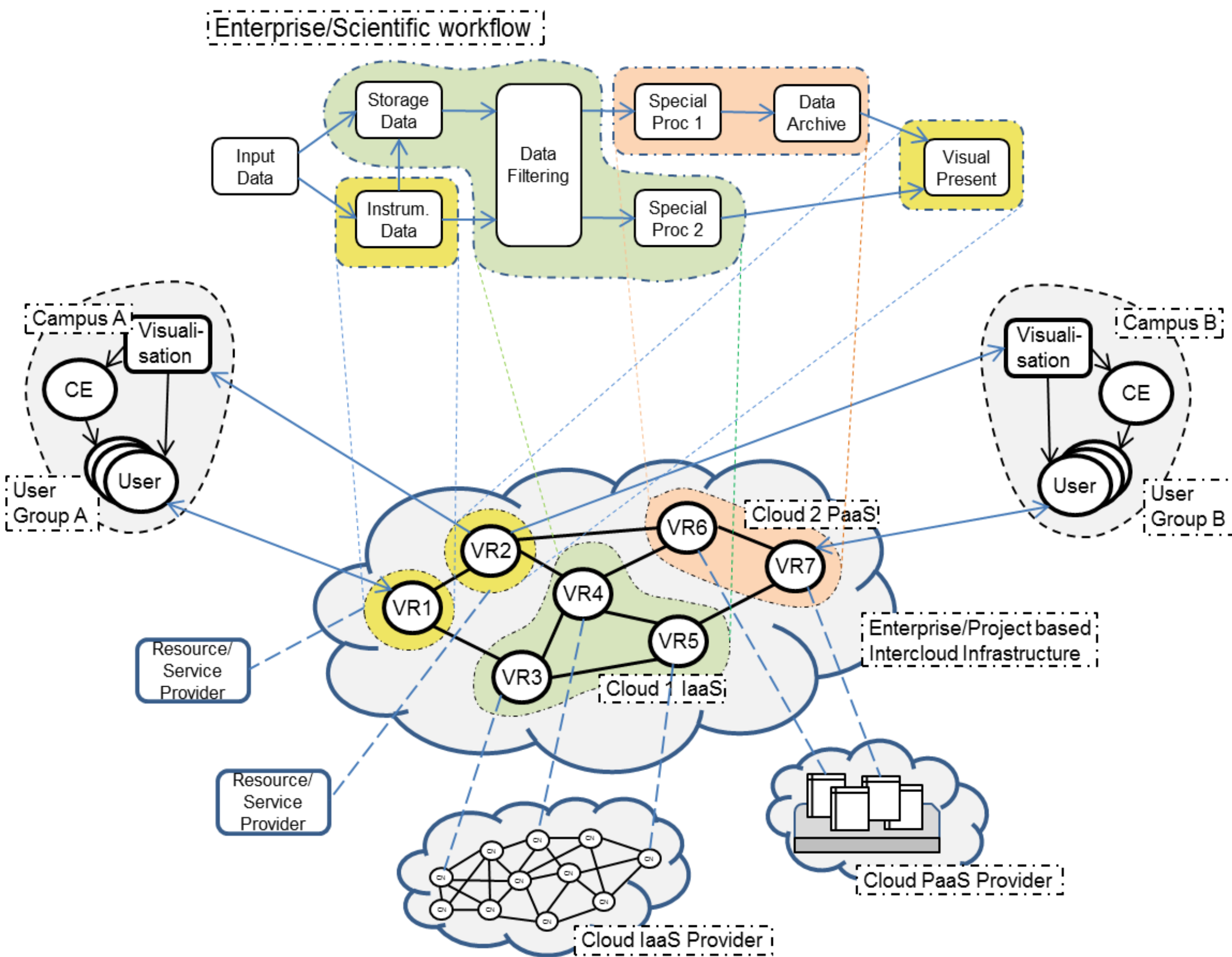# Intercloud Federation Framework: Basic Operational Models and Architecture Patterns
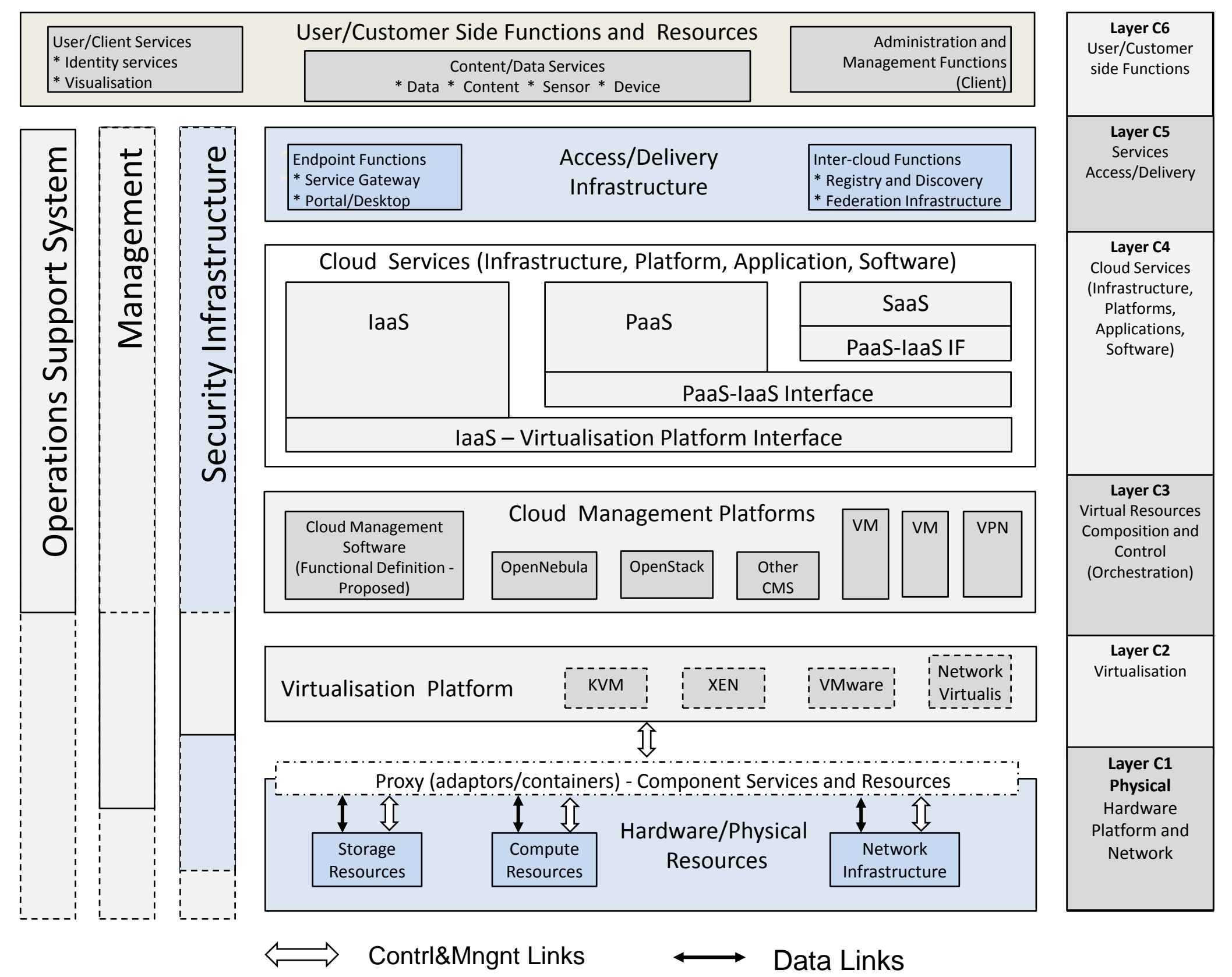
Yuri Demchenko, Migiel de Vos, Canh Ngo, Marc X. Makkes, Cees de Laat

Intercloud Infrastructure/Services Provisioning

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

Multi-layer Cloud Services 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**

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.

Intercloud Federation Infrastructure

- Part of the Intercloud Access and Delivery Infrastructure ICADI (CSM Layer C5)
- Federation Infrastructure services can be a part of the Open Cloud eXchange (OCX) defined to support multi-provider services integration and delivery
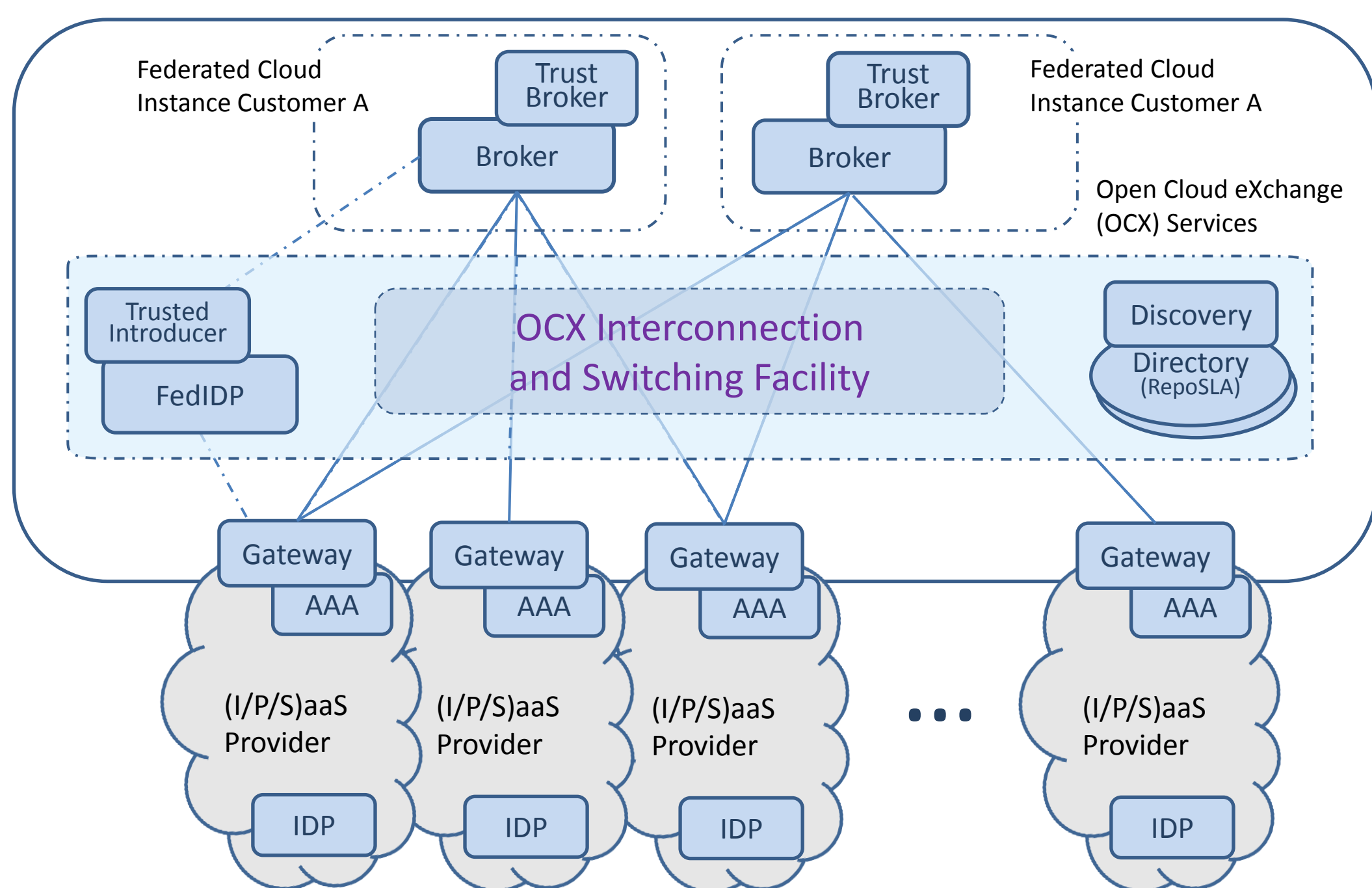
General Model and Actors in (Inter)Cloud Federations
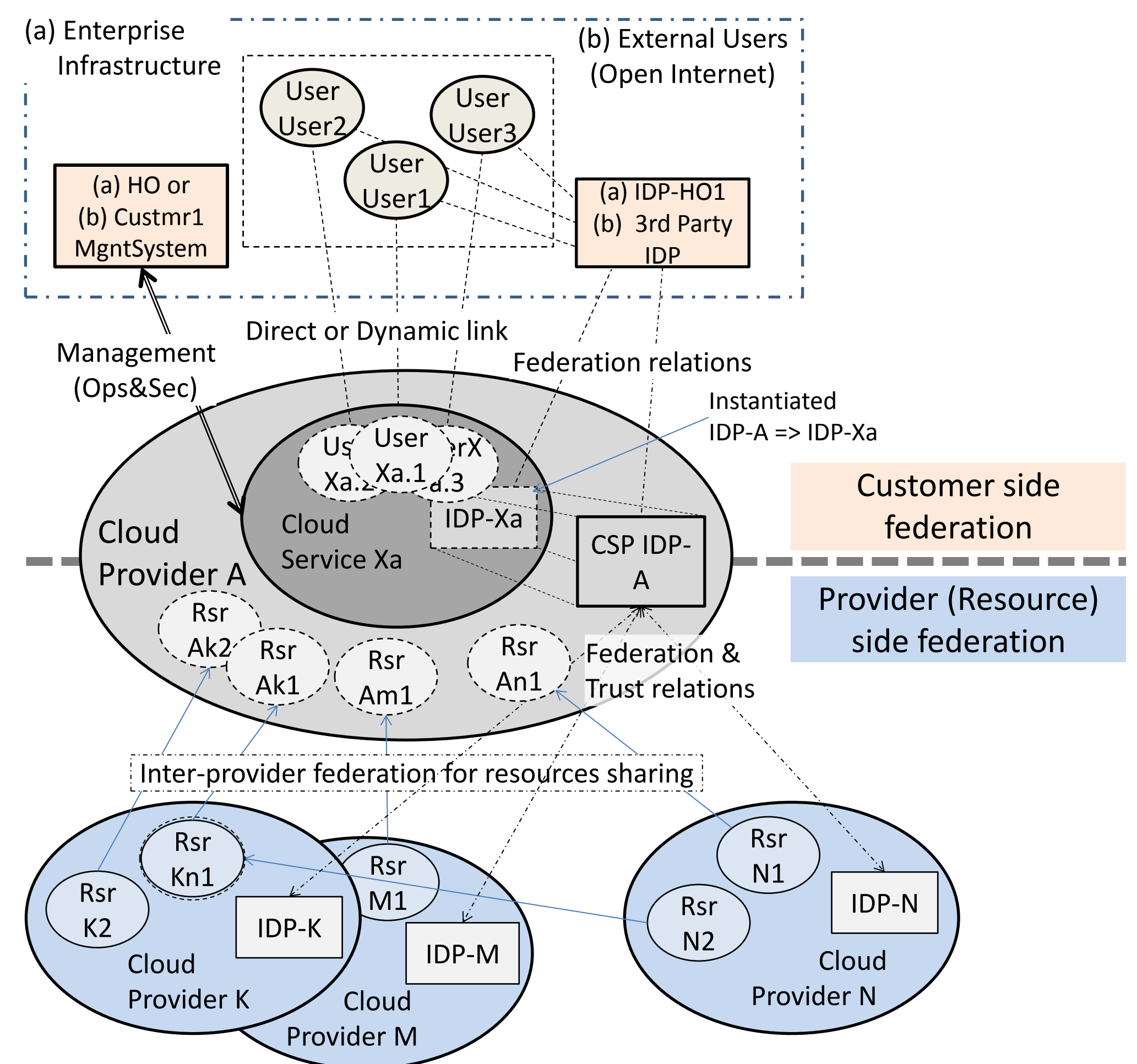
Main Actors in Cloud/Intercloud Federation

- **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 by 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

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

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