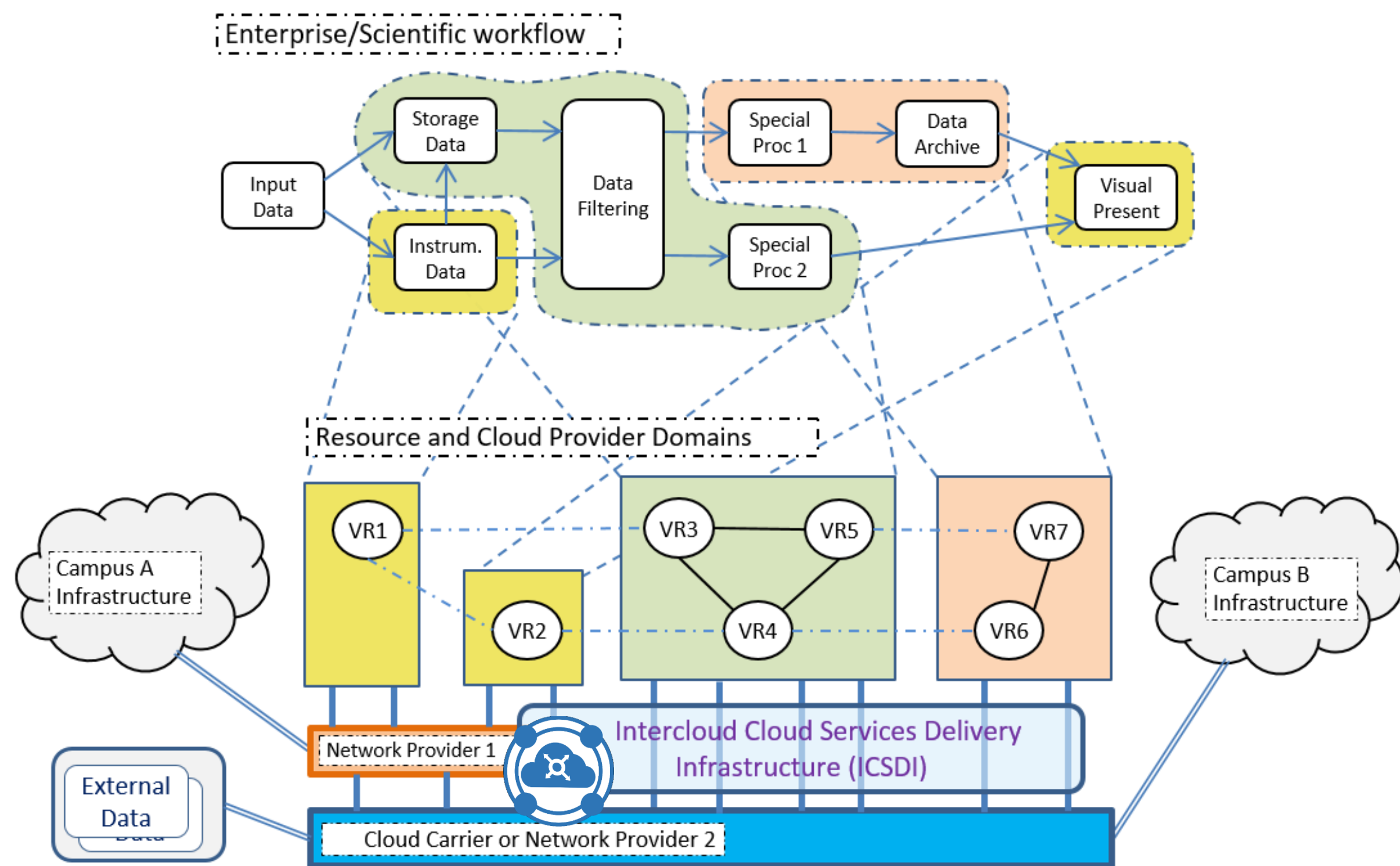


Zero Touch Provisioning, Operation and Management Architecture (ZTPOM)

Yuri Demchenko, Cees de Laat (UvA), Migiel de Vos (SURFnet), Damir Regvart (CARNET), Tasos Karaliotas (GRNET), Sonja Filiposka (UKIM) Kurt Baumann (SWITCH), Daniel Arbel (IUCC),

Intercloud Cloud Services Delivery Infrastructure (CSDI)

(Interconnecting distributed cloud based applications in heterogeneous multi-cloud environment)



Open Cloud eXchange (OCX) provides a number of functionalities for intercloud network connectivity establishing, cloud services and API brokering

- Supported by Cloud Services Clearinghouse and Marketplace
- Pivotal part for CSDI and multi-provider cloud services delivery

SC15 Demo: Enabling CSDI and OCX with SDN/NFC

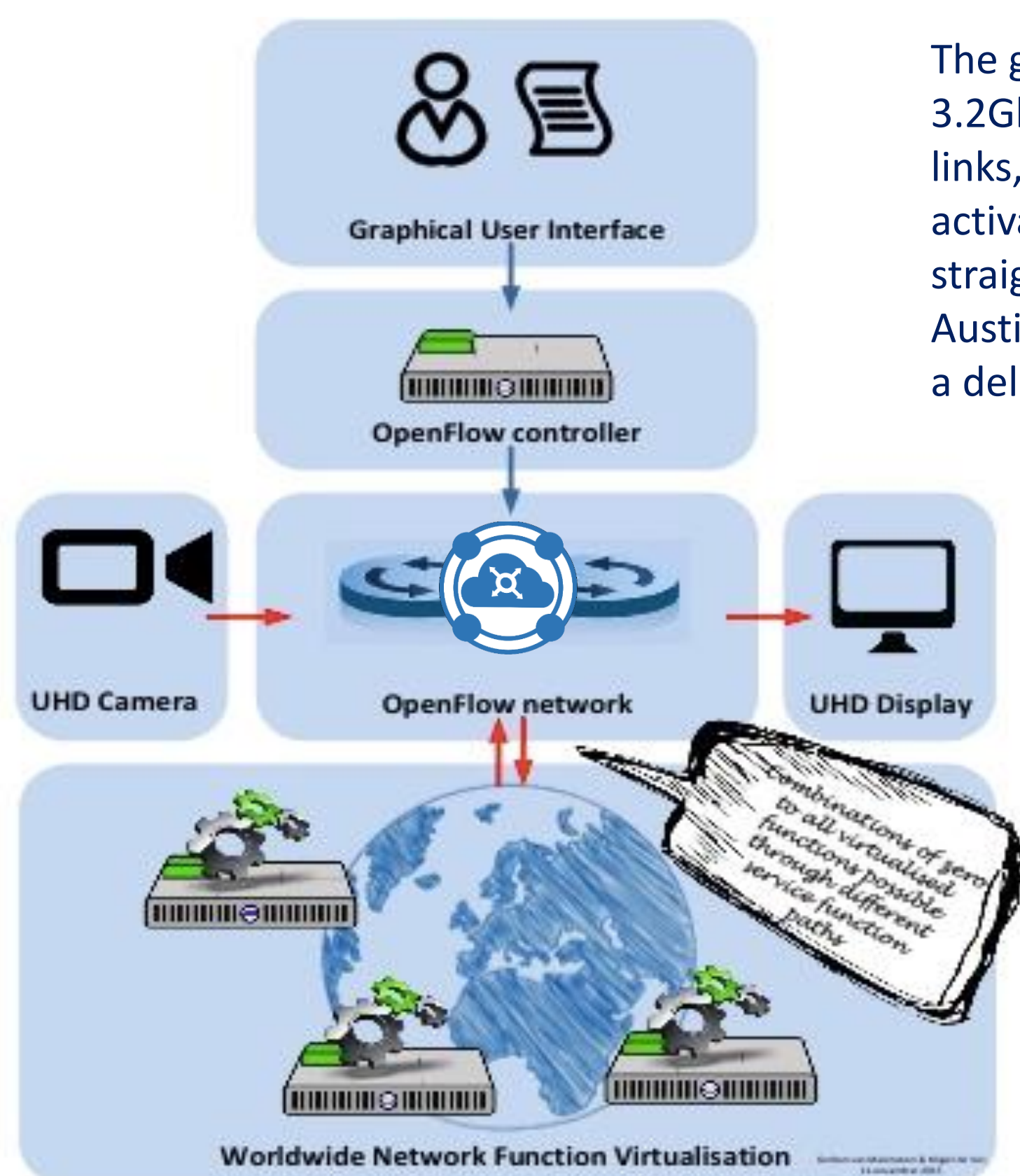
SC15 demo goal: Investigate suitability of NFV/SFC and SDN as a basis for network programmability in the CSDI and OCX ecosystem

Scenario: Multi-cloud real-time UHD distributed video editing

Real time data stream passes through custom defined series of video effects associated with the network elements and defined as the SFC workflow which is configured by the user via an intuitive drag and drop web interface

Implementation and results

- The SFC demonstration was implemented using VLAN stitching and MAC rewriting so that different paths and functions are kept separate.
- New protocol for identifying service function paths in the network called Network Services Headers (NSH).
- The SFC generated API calls to the gOCX programmable instance (implemented as an OpenDayLight controller in Amsterdam) in order to direct the traffic flow between the several CSPs, since each CSP hosted different types of video editing function.



The generated traffic flow was 3.2Gbit/s. Using mostly 100G links, with no video functions activated, the traffic came straight back to SC15 location in Austin, TX from Amsterdam with a delay of around 240ms.

- CSPs involved
- SURFsara, NL
 - Okeanos, GR
 - CloudSigma, CH

Acknowledgement

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Cloud Aware Networking Architecture (CANA)

CANA provides functionalities to support user applications and scientific workflows

- Exposes on-demand network provisioning functionality and services via Network as a Service (NaaS) model
- Uses Software Defined Networks (SDN) as networking layer technology

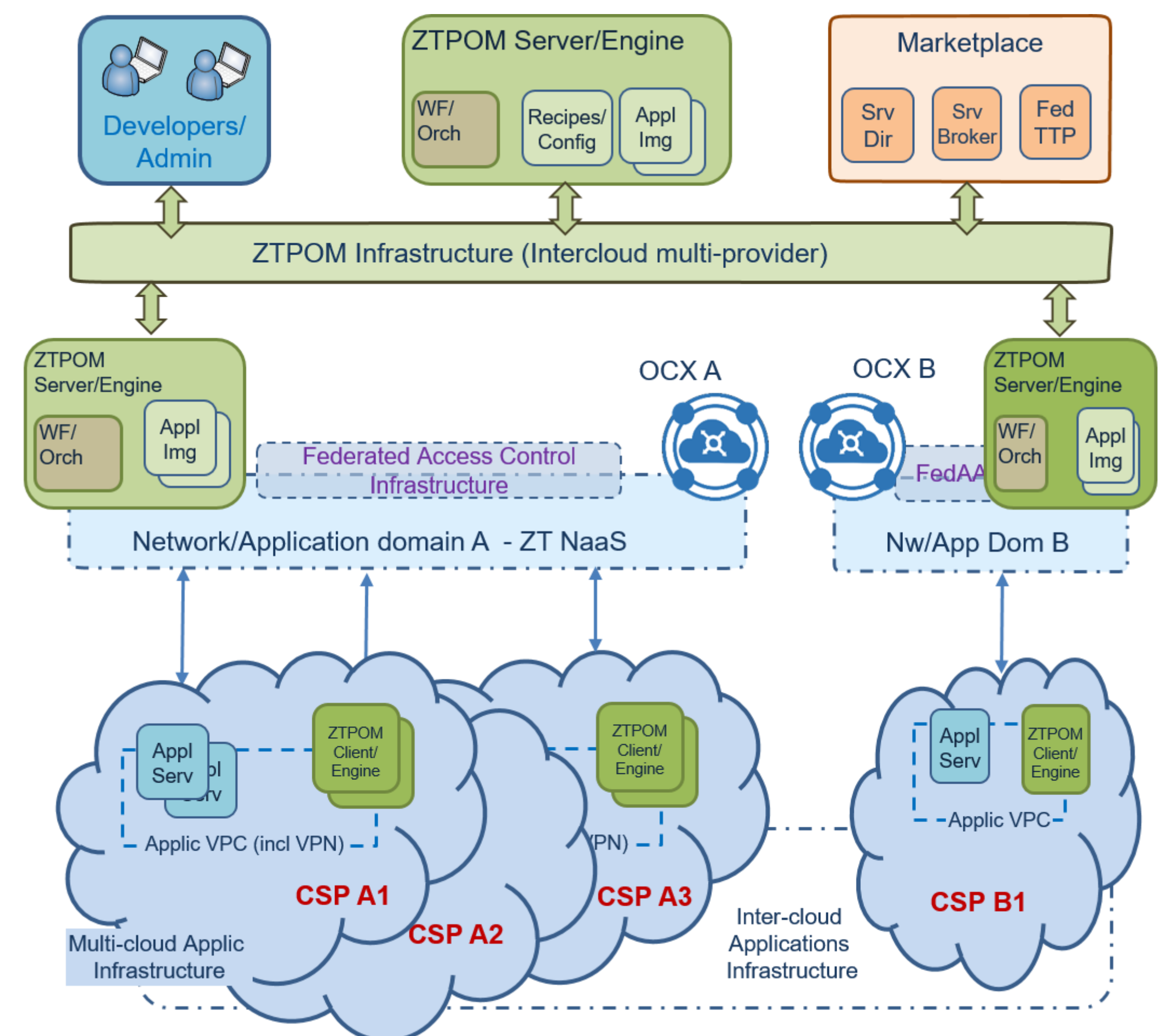
CANA enables an applications centric design environment that allows

- 1) Direct support for the network requirements and requests from the user applications, in particular, scientific workflows, and
- 2) Inclusion of network topology description and network QoS requirements into the applications topology/design description

The future envisioned CANA should integrate components and services available and being developed in the GÉANT community:

- 1) Inter-domain network connectivity/infrastructure control and management services such as BoD, Autobahn and PerfSONAR
- 2) Network Service Interface (NSI) and Network Markup/Description Language (NML/NDL) developed by OGF and implemented in GEANT network
- 3) Scientific and business workflow description languages and tools such as Kepler, Business Process Definition Metamodel (BPDM), etc.
- 4) OASIS Topology and Orchestration Specification for Cloud Applications (TOSCA) standard that immediately gained its acceptance by industry.

ZTPOM Architecture



Zero-Touch Provisioning, Operations and Management (ZTPOM) provides a framework for designing, deploying and monitoring the (multi-)cloud applications by enabling automated configuration and unattended deployment of different elements of the (distributed) applications infrastructure for the purposes of agile/continuous development and improvement and efficient management of the problem focused applications.

ZTPOM technological foundations

- Cloud based resources virtualization, pooling and on-demand provisioning that enables such new properties as scalability, load balancing, and portability
- Cloud deployment automation tools and DevOps technology integrating continuous applications development, deployment and operation
- Network programmability with the Network Functions Virtualization (NFV) and Software Defined Networking (SDN) and leveraging the Zero Touch Network (ZTN) concept being developed by network vendors and providers
- Open Cloud eXchange (OCX) provides a third party services and transparent infrastructure enables Intercloud ZTN federation infrastructure by leveraging NFV and SDN based network programmability for faster delivery of the user coordinated multi-domain multi-provider cloud services provisioning.

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