



Towards a Carrier Grade ONAP Platform

Multi Cloud (MC) Architecture for R2 & Alignment to S3P

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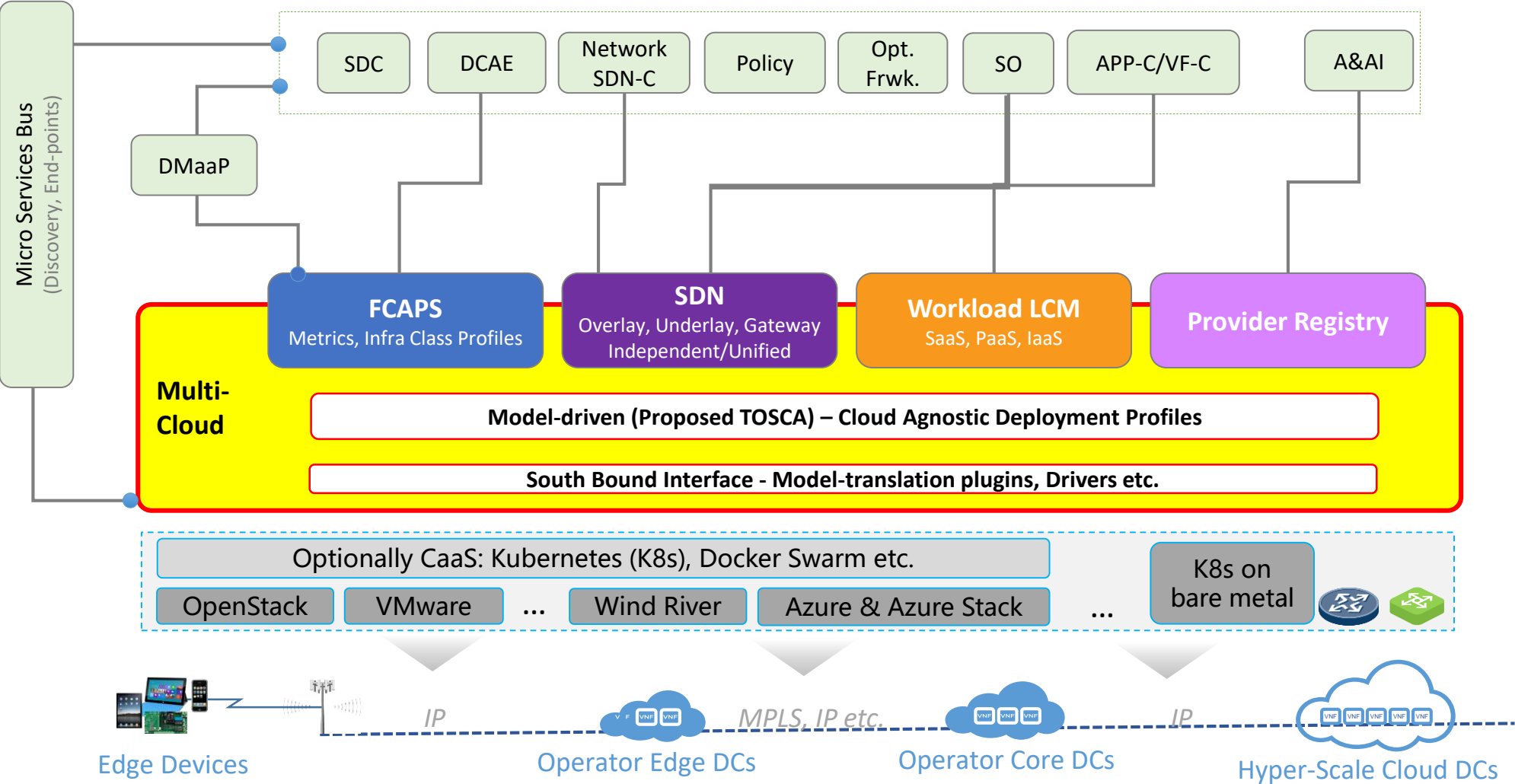
ONAP Paris Workshop on “ONAP Multi Cloud Architectural vision for R2 and beyond”

- Multi-Cloud Architectural Vision Introduction - <https://wiki.onap.org/download/attachments/11928197/ONAP-mc-intro.pdf?version=1&modificationDate=1506518564000&api=v2>
- Performance & Isolation - "Towards a performance-aware and portable cloud-agnostic Infrastructure" - <https://wiki.onap.org/download/attachments/11928197/ONAP-mc-performance-isolation.pdf?version=1&modificationDate=1506518613000&api=v2>
- "Architectural options for Multi-vendor SDN Controller and Multi Cloud Deployments in a DC" - <https://wiki.onap.org/download/attachments/11928197/ONAP-mc-sdn.pdf?version=1&modificationDate=1506518708000&api=v2>
- FCAPS Telemetry - "Standardized Infrastructure Class statistics Model" - <https://wiki.onap.org/download/attachments/11928197/ONAP-mc-fcaps.pdf?version=2&modificationDate=1506519214000&api=v2>
- Minutes on Multi-Cloud follow up and R2 scope discussion (09/28/2017): <https://wiki.onap.org/download/attachments/11928197/Multi-Cloud%20follow%20up%20and%20R2%20discussion.pdf?version=3&modificationDate=1506961823000&api=v2>

Agenda

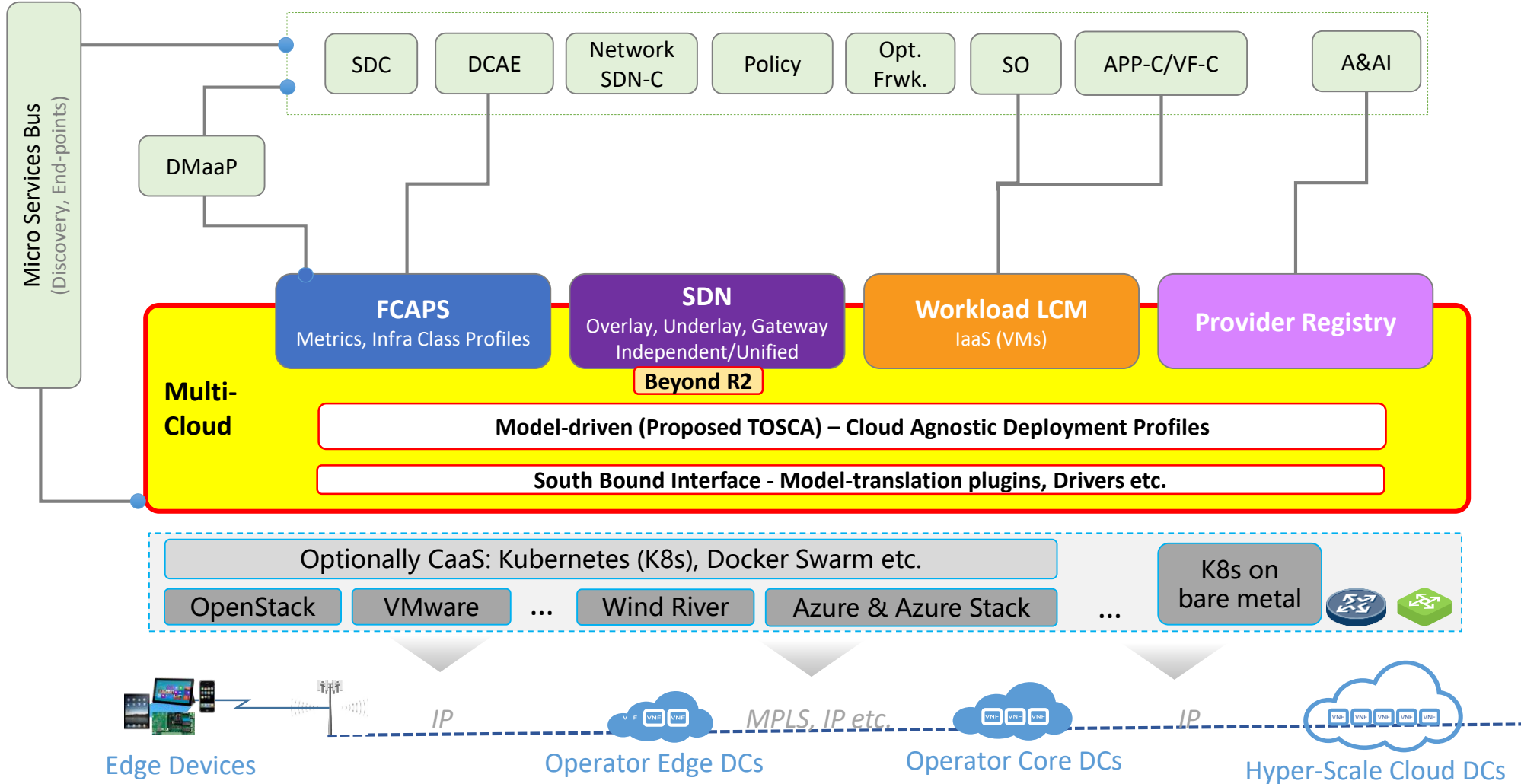
- MC Reference Architecture for R2
- MC High Level SW Architecture for R2
- ONAP R2 Platform S3P Alignment
 - Stability
 - Standardized Data Model for Objects, Capabilities, External Interfaces & Logging
 - Consistent intent-driven APIs for accessing data stores aka “Data Microservices”
 - Scalability for Data Management
 - Push Aggregate Data through Asynchronous Methods

Multi-Cloud Reference Architecture – R2 & Beyond



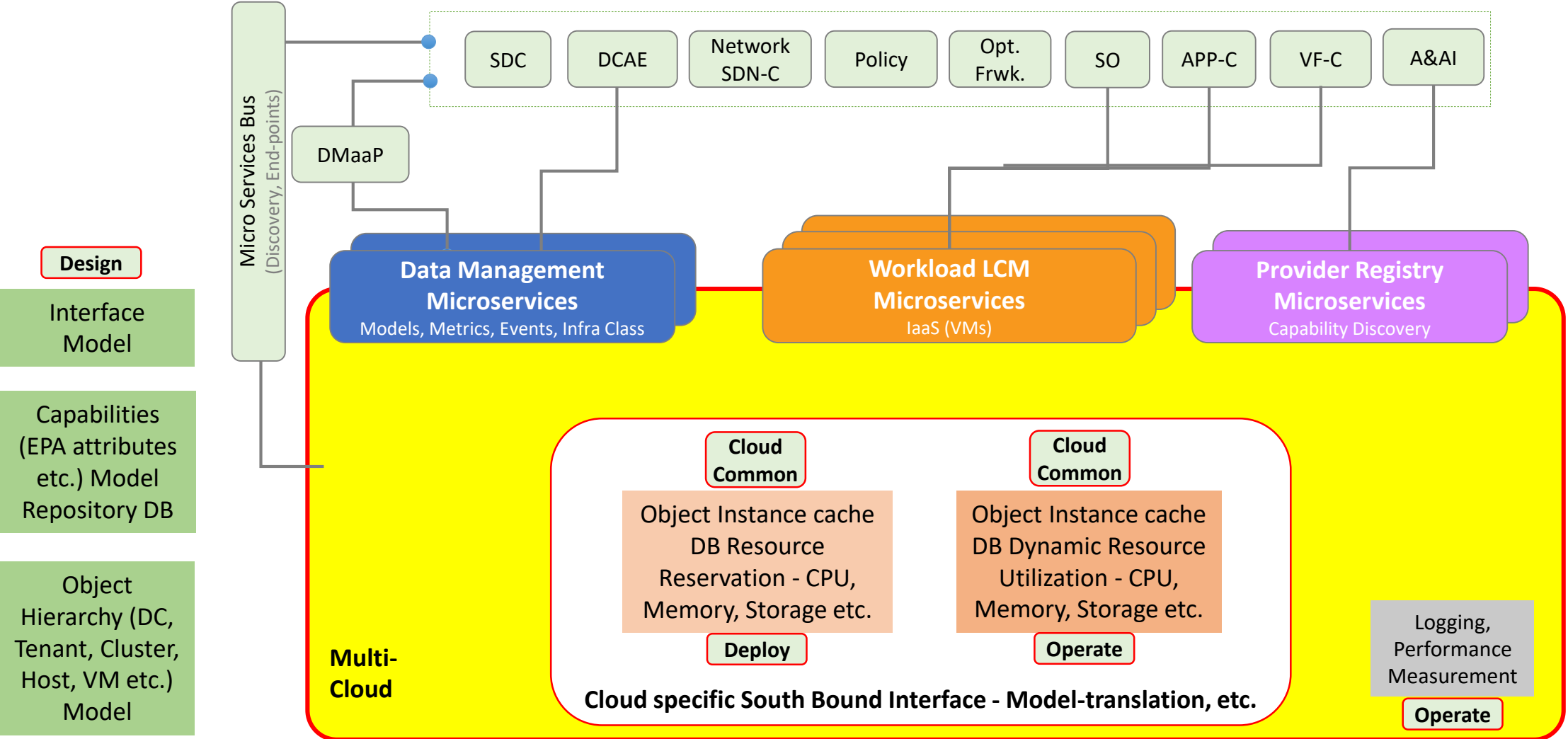
Adapted from ONAP Paris MC Workshop Introduction : <https://wiki.onap.org/download/attachments/11928197/ONAP-mc-intro.pdf?version=1&modificationDate=1506518564000&api=v2>

Multi-Cloud Reference Architecture – R2



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Multi-Cloud High Level SW Architecture for R2



Multi-Cloud High-level SW Architecture for R2 – Details (1)

- Align with factory microservice constructs
 - Capability/Provider Registry (Catalog); Capacity/Reservation (Inventory); Workload LCM (Request)
 - Data Management - Significant change in resource usage (Publish)
 - Data Management - Bulk data such as Infrastructure Class statistics, Logs (Publish)
 - Data Management - External events (Subscribe)
- Consistent intent-driven APIs for accessing data stores aka “Data Microservices” – goal is to decouple function from type of data store
- Standardized Interface, Object Hierarchy, Capability Models stored in SDC and published through DMaaP
 - Leveraged by consumers such as Multi Cloud, DCAE, APP-C, Policy, OF, SO, A&AI etc.
 - SDC to provide consistent APIs for models data store – have the flexibility of different data stores based on data longevity – e.g. object hierarchy is more likely to change than capability
- Supported Capabilities per Cloud Provider Instance & Capacity/Reservation per object per Cloud Provider Instance stored in A&AI and published through DMaaP
 - Leveraged by consumers such as OF to determine appropriate Multi Cloud instances for homing
 - A&AI to provide consistent APIs – current APIs are graph database centric and may be need to be replaced by a NoSQL database for performance reasons

Multi-Cloud High-level SW Architecture for R2 – Details (2)

- Transaction Logging for Performance Baselineing & Troubleshooting
 - Multi Cloud Mediation Layer (plugin independent)
- Workload LCM, e.g. Tenant create
 - If needed, Object instance cache DB (resource reservation) dynamically created in Multi Cloud Plugin
- Data Management subscription for Infrastructure Class, e.g. Tenant utilization monitoring
 - If needed, Object instance cache DB (resource utilization) dynamically created in Multi Cloud Plugin
- Data Management subscription for significant change in resource usage (Publish)
 - If needed, Object instance cache DB (significant change) dynamically created in Multi Cloud Plugin
- State reconciliation following temporary interruptions to the master data store, e.g. A&AI goes down temporarily and gets restarted (edge case which is not handled through HA)
 - Modules such OF which use A&AI can leverage to Multi Cloud object instance cache in Multi Cloud Plugin to make progress
- Objects instances DB cache classified based on functionality and data longevity
 - Object instance resource utilization cache DB is typically long-lived

Stability

- Standardized Data Model for Objects, Capabilities, External Interfaces & Logging
- Generic Data Models which can cover current & future Cloud implementations

Data Model Standardization Scope & Alignment

- Scope

- Object – DC, Tenant, Cluster, Host, VM etc.
- Capabilities – Affinity/Anti-affinity, EPA attributes such as NUMA, CPU Pinning, Deployment Template (Heat, ARM etc.) etc.
- Basic lifecycle operations - create VM (Server), delete VM etc. excluding networking - resource reservation (capacity) for Objects
- Data collection & management – Resource reservation & Dynamic resource utilization for Objects

- Alignment

- Beyond ONAP - ETSI NFV/OSM

Lifecycle Operation – Create VM (Server) example

Exemplary
VM
Compute/
Storage
TOSCA
Model

```
node_templates:  
  VMD1:  
    type: toasca.nodes.nfv.VMD.xxx  
    properties:  
      image: cirros-0.3.5-x86_64-disk  
    capabilities:  
      compute:  
        properties:  
          disk_size: 40 GB  
          mem_size: 4096 MB  
          num_cpus: 4
```

Smooth Transition from current OpenStack Heat, Azure & Azure Stack ARM Template – MC Southbound Plugin

- *SO -> MC* - Create VM model instance with compute/storage params
- *MC -> SO* - New VM Model instance ID
- *SO -> MC* - Create EPA Model instance
- *MC -> SO* - New EPA Model instance ID
- *SO -> MC* - Pass Heat or ARM Template with VM & EPA model instances
- *Retrieve VM Model & EPA Model instance data*
- OpenStack
 - *Map to appropriate Flavor (represents size & EPA)*
 - *Populate Heat Template & call OpenStack to create VM*
- Azure & Azure Stack
 - *Normalize and Round up to appropriate VM size (Ref. 1)*
 - *Intent-based mapping of EPA parameters*
 - *Populate ARM Template & call Azure/Azure Stack to create VM*
- *MC -> SO* – Delete VM/EPA model instances, Send successful create VM (Server) response

Ref.1: <https://docs.microsoft.com/en-us/rest/api/compute/virtualmachines/virtualmachines-list-sizes-region>

VM (Server) EPA Asymmetric NUMA example

Exemplary
VM EPA
(Asymmetric
NUMA)
TOSCA
Model

```
VMD1:
capabilities:
compute:
  properties:
    mem_size: 4096 MB
    num_cpus: 4
    numa_nodes:
      node0:
        id: 0
        vcpus: [0,1]
        mem_size: 1024 MB
      node1:
        id: 1
        vcpus: [2,3]
        mem_size: 3072 MB
```

Smooth Transition from current OpenStack Heat Template

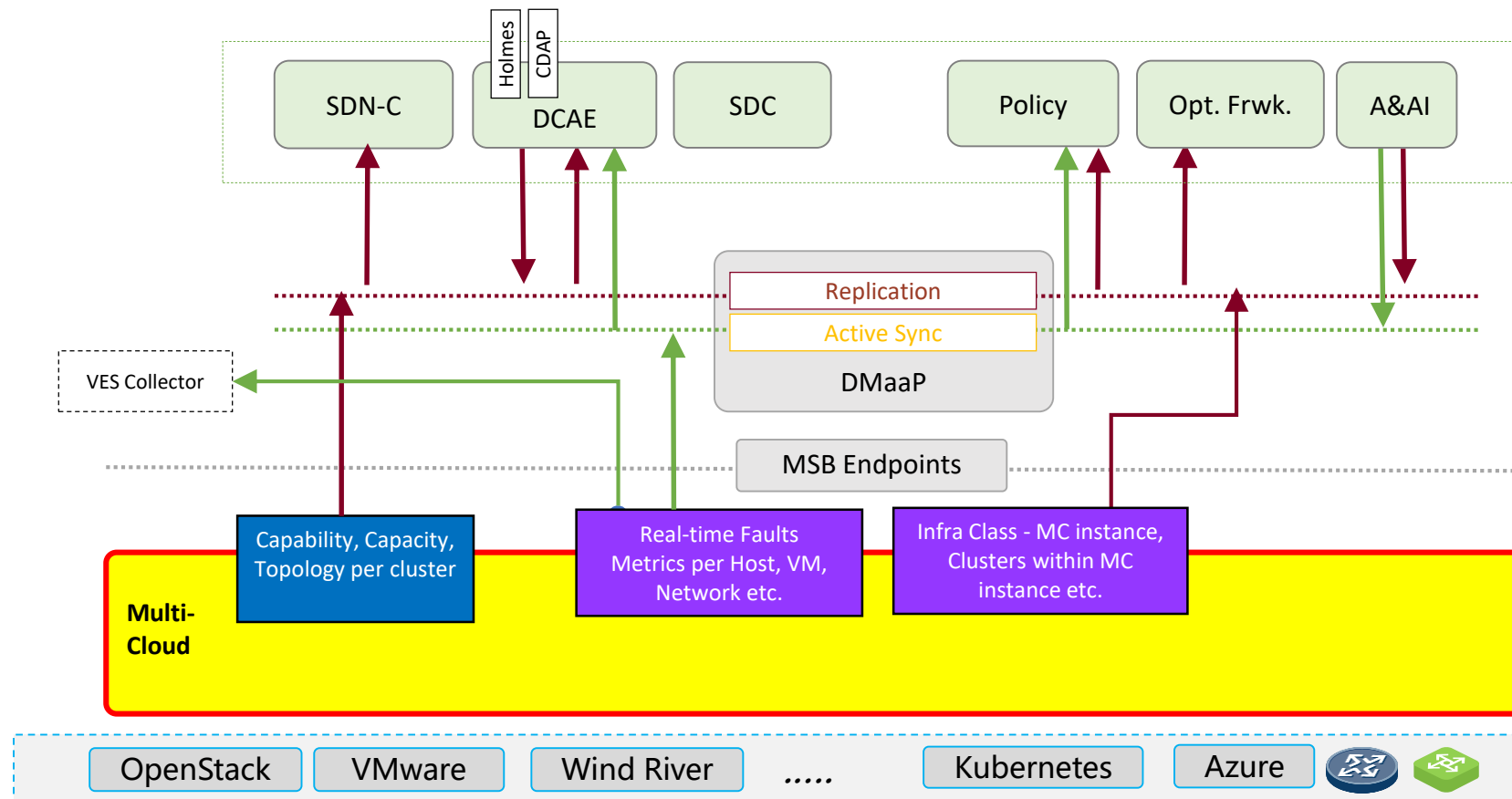
- ...
- *SO* -> *MC* - Create EPA Model instance
- *MC* -> *SO* - New EPA Model instance ID
- ...

Scalability for Data Management

- Push latest aggregate data through asynchronous methods

Multi-Cloud Data Management Architecture

- **Aggregate Data (Tenant, Cluster etc.)** is key to hierarchical multi-site VNF placement solutions driven by OF, DCAE etc.
 - Data at atomic level (VM, Host etc.) does not scale
- **Asynchronous Push Model for Latest Data** enabled by DMaaP pub-sub active-sync or lazy replication across WAN is key to scale
 - Synchronous Poll model for volumetric data does not scale and often lands up using stale data



Adapted from ONAP Paris MC Workshop FCAPS Telemetry:

<https://wiki.onap.org/download/attachments/11928197/ONAP-mc-fcaps.pdf?version=2&modificationDate=1506519214000&api=v2>

Next Steps

- Proposed presentation on standardized Information Model for Multi Cloud Objects and Capabilities in the upcoming ONAP modelling workshop
- Proposed talk on how standardized Multi Cloud Objects/Capabilities can be leveraged to drive consistent policies, analytics rules and optimization constraints in the upcoming ONAP developer forum
- Besides the common microservice design patterns, drive “data microservices” principles for accessing data stores through consistent intent-driven APIs in the community