Delivering Dynamic Programmable End-to-End Orchestration for Cloud, WAN, NFV and SDN with Amartus Chameleon SDS™

Today Service Providers are facing an ever-increasing demand for high-quality, elastic, pay-per-use Cloud & WAN services. Some applications claim to be able to offer carrier-grade reliable, scalable services to meet this requirement, but they do not solve the issue of long delivery cycles, which prolong time-to-market and negatively impact Service Providers’ ROI. The new virtualization technologies (NFV, SDN, Cloud Computing) provide the flexible infrastructure needed for on-demand service provisioning, but the existing static OSSs are too slow and cumbersome to support them. The present brief addresses this common problem by proposing an innovative solution, and presenting a practical example of its implementation.

Prolonged Service Design and Integration Cycles & Ad Hoc, Manual Service Provisioning and Operations Are Common Industry Pain Points

The ability to streamline the design and rollout of new end-to-end (E2E) cloud and network Services and accelerate their provisioning and operation has become imperative for Service Providers to monetize their cloud and network infrastructure and accelerate ROI. Traditional OSSs are hardwired for specific technologies and services, they are network & resource-centric and lack service awareness. The majority of processes are manual, which negatively impacts the quality of services and their delivery time. The multiplicity of disparate, stovepipe management application prolongs the time-to-market even more through inevitable and expensive integration.

To overcome these common industry pain points Service Providers need to a completely new Service Management & Orchestration software systems architecture, one that is optimized for rapid introduction of any type of service across all domains & technologies, including Cloud (storage, compute, Data Center network), NFVs, SDNs and traditional WAN networks (e.g. Carrier Ethernet, IP / MPLS, Optical). This solution must eliminate the primary problems of current OSSs, including the need for multiple stovepipe management applications, as well as lengthy software development and integration cycles. It must be fully customizable and extensible ‘on-the-fly’ at run-time without the need for new code or extensive testing.

New Breed of Innovative, Model-Driven & Dynamically-Programmable Software Architecture Solves Service Providers’ Issues

The solution offered by Amartus and presented in Figure 1 has been carefully designed to resolve the above challenges. It demonstrates the power of a unique, lean, dynamic, real-time OSS to automate E2E Service Delivery for combined Cloud, WAN, NFV and SDN services. At the core of the solution lies Amartus Chameleon SDS™, a new breed of run-time programmable, meta-model driven, multi-vendor Service Management and Orchestration software that supports the full service life-cycle on a single unified platform and takes advantage of the massive scaling offered by Cloud Computing.

In the solution, Chameleon SDS™ acts as an umbrella E2E Service Manager and Orchestrator for each of the following technologies:

- **Cloud/SDN**: it integrates with OpenStack for orchestrating infrastructure resources in data centers via RESTful JSON APIs exposed by OpenStack modules.
- **NFV**: it acts as NFV Orchestrator and (optionally) VNF Manager to orchestrate and manage Virtual Network Functions lifecycle (including on-boarding via OpenStack).
- **WAN / SDN**: it can integrate with **any** WAN or Carrier SDN Controller via its Network Services API (e.g. RESTful XML or JSON, etc.).

The key characteristics of the solution are:

- **Clear separation between the core orchestration application and the underlying systems** that maximizes the solution efficiency and speed.
- **Generic, standards-based models** that ensure high-quality and reliability of services.
- **Dynamic modelling technology**, which boosts service velocity and allows much-desired service agility. The singular model-driven architecture makes it a very generic and flexible solution that can be applied to ANY technology for ANY vertical market, not limited to IT & Communications.
- **Revolutionary, run-time programmable architecture**, which completely eliminates the need for additional code development work and costly testing cycles.
- **Auto-rendered, model-driven REST API** that exposes all supported service / resource management & orchestration and core platform capabilities without any coding.

**Benefits of Simplified and Accelerated Service Design and Provisioning**

Chameleon SDS™ dynamically programmable applications presented in the solution are built by defining policies that instruct pre-built orchestration modules to manage various parts of the service (Service Components & SAPs) via common information module. These orchestration modules (discovery, inventory, provisioning, fault, performance, usage, diagnostics, etc.) are completely abstracted from technology, service, or vendor-specific models and the transformation and communication to third party specific models and APIs exposed by external systems is done via adapter plug-ins. New and updated
models of services and technologies only require updating of the metadata and mediation (i.e. XML descriptors and mapping rules), which is done at run-time. This means that new services and technologies can be rolled out within days and weeks, without any code written, changed or tested.

The unique feature of Chameleon SDS™ is its dynamic programmability: the platform supports RUNTIME introduction of ANY new technology, vendor, or service through meta-data driven management and orchestration (xml configuration). This feature is a game-changer and will have a huge impact on the industry, as it offers Service Providers the service velocity and automation they need to orchestrate and automate today’s and tomorrow’s very dynamic and constantly changing ecosystem of traditional and virtualized networks and services at real time.

Chameleon SDS™ supports full policy-based service discovery, and service inventory combines service repository, advanced browsing capabilities, physical topology and transport reconciliation, service topology, and service inventory reporting. Services are provisioned upon a single click, based on customizable, technology-agnostic templates and definitions. The comprehensive provisioning state engine offers feasibility check, planning and resource pool reservation options. Service Assurance capabilities include fault, monitoring, performance and test management, service OAM, service analysis with topology and service SLA compliance reporting.

Chameleon SDS™ is commercially available today for Management and Orchestration of WAN Services and is now being extended to support E2E services that encompass also NFV, SDN and Cloud.

**Key Ingredients:**

**End-to-End Service & Resource Management Orchestrator, Chameleon SDS™**

A Chameleon SDS™ instance is used here as overall Manager and Orchestrator of E2E Services that encompasses and combines Cloud infrastructure and traditional WAN and/or virtualized (NFV and SDN) services. As an example, the components of such E2E Service would include Compute, Storage and Network in the Data Center, some VNFs (e.g. Clearwater IMS) and connectivity to remote customer offices, so that customer staff could use the service to access cloud resources (applications, storage, etc.) and multimedia services (voice, video, instant messaging etc.).

At this layer the solution provides:

- Dynamic Service Catalogue so that new E2E Service Types can be designed and on-boarded at run-time through Modelling and Configuration
- Management and Orchestration of the full service lifecycle of any E2E Service

It integrates with OpenStack modules to manage and orchestrate the Cloud infrastructure resources, including VNFs Lifecycle and SDN within the data centers. On the WAN side it integrates with a WAN or Carrier SDN Controller to provide the end-to-end connectivity between the cloud resources and VNFs in a data center and remote customer / users locations and/or other data center’s resources and VNFs.

**Cloud Management, OpenStack**

This is a cloud computing platform integrated with Carrier Ethernet services through Chameleon SDS™ MANO (Management & Orchestrator). The compute, storage & network cloud capabilities are implemented using Nova, Cinder and Neutron modules. Statistics are collected via the Ceilometer.
module. The discovery, registration and delivery image services are delivered through the Glance component, and Chameleon SDS™ is using Keystone for server authentication.

The Neutron API provides the abstraction of network services within the data centers. The network services are provided through a Neutron Plugin, popular implementation include Open vSwitch and OpenDaylight for SDN.

**NFV, Clearwater IMS VNF**

Clearwater IMS VNF (an open source IP Multimedia Subsystem) was chosen as an example to show Chameleon SDS™ in the role of NFV Orchestrator and VNF Manager to orchestrate and manage Virtual Network Functions lifecycle in conjunction with OpenStack.

In this example the system orchestrates the on-boarding, instantiation, scaling and termination of VNFs over the Cloud infrastructure managed through OpenStack.

**Wide Area Network or Carrier SDN Controller**

Here an instance of Chameleon SDS™ acts as a Wide Area Network Controller that provides MEF-based Metro Carrier Ethernet services, but it can support any other network services, including IP / MPLS, MPLS-TP and Optical Transport. The solution provides full network service design, discovery, inventory, provisioning and assurance capabilities for the traditional and virtualized networks. The service design is driven by a service catalogue with central management of service definitions, specifications and templates.

Note that any third party WAN or Carrier SDN Controller can replace Chameleon SDS™ in this role, for example OpenDaylight providing Carrier SDN services in the WAN (as illustrated in Figure 1). For the End-to-End Service & Resource Management Orchestrator at the ‘umbrella’ layer it would just be a matter of dynamic runtime updates to the service meta-data and mappings (XML descriptors and configuration) to match the other Controller API (e.g. OpenDaylight’s RESTful API).

Chameleon SDS performs best on carrier-grade, best-of-breed, physical & virtualized platforms, which benefit from the latest Intel micro-architecture enhancements and maximize their performance leveraging Intel Hyper-Threading and Virtualization Technologies.

As a future enhancement, Amartus will explore the possibility to expose the new Intel’s OpenStack contributions for NFV and SDN (Enhanced Platform Awareness, DPDK Open vSwitch, etc.) through policy configuration at the umbrella MANO Layer, for example via OpenStack API extensions as they become available.


**Additional Materials**

**Video Link** – the video shows a demo of orchestration of end-to-end Cloud & WAN Service, now being extended to NFV and SDN.