

Control Loop Automation Management Platform (CLAMP)

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AT&T is embarking on an exciting journey to revolutionize its network by transforming itself into a software company running the largest and most intelligent programmable cloud on the planet. Indeed, the network of Domain 2.0 (D2) will be intelligent software systems and applications operating on general-purpose commodity hardware [1]. This transformation will not only drive down CAPEX, OPEX and help to configure our network with less human intervention, but it will also create significant opportunities to scale and monetize existing and new intelligent services. This transformation will enable AT&T's D2 to establish a new services ecosystem equivalent in concept to the application ecosystem adopted by the Apple iOS and Android. D2 will facilitate mass marketing existing and new services, and lower the barrier to entry for enterprise and small business customers to create new innovative services.

This abstract provides an overview of how intelligent services can be realized within the D2 architecture. An intelligent service collects information about resources (users, devices, networks and applications) used to deliver the service and about the environment in which it operates. It then makes decisions based on this information and domain knowledge which includes adapting and personalizing the service for the users consuming it. An intelligent service receives feedback on its performance and learns. There are primarily three attributes that characterize an intelligent service, known as

PAD (personalized, adaptive, and dynamic). A predictive personalized service is one that anticipates a user's need and proactively takes intelligent actions and recommends valuable and timely personalized information. An adaptive service learns from its past actions of all users and adjusts its behavior to provide superior service quality. A service that is dynamic is one that is robust and is able to survive and self-repair or self-organize itself from possible service interruptions.

In this extended abstract we provide an overview of the Control Loop Automation Management Platform (CLAMP) being developed in AT&T. Control loop systems play a vital role in delivering operational cost savings. Control loop automation can be categorized into open loop or closed loop systems. Open loop systems capture telemetry and diagnostics information from the underlying cloud infrastructure (e.g. syslog, SNMP, fault and performance management events), perform a set of analytics and provide reporting or alarms to the operations team. Closed loop systems continuously monitor the system for fault, performance, security, etc. related problems and compute a set of signatures based on the detected anomalous condition. These signatures are then interpreted and appropriate corrective actions are recommended to repair the system. Once the system has been repaired, a monitoring application checks the status to see if the system responded to alleviate the detected problem. In previous efforts, several

independent applications of closed and open loops have been implemented to support fault management. In this effort, we seek to develop a cohesive platform that will enable faster development of scalable control loop systems using ECOMP (see Figure 1) [2].

CLAMP, in its basic form, includes three components. (a) A portal which is essentially a web browser that enables authentication, construction, configuration, certification, testing, governance approval and distribution of control loop templates. (b) A work-flow engine that enables translation of the design template into an executable data model. The work-flow engine communicates with ECOMP through a set of well defined ECOMP-specified APIs. (c) A monitoring dashboard that enables telemetry data capture relevant to the performance of the control loop, status update and diagnosis of failures.

Closed Loop modeling and template design: During the design phase, models for Network Function Virtualization (NFV) and ECOMP platform elements are retrieved from a catalog and composed to create a service chain. This

facilitates rapid service composition in a manner that is verifiable at different stages of the software lifecycle. We are creating an ecosystem which will provide readymade templates (e.g. VM restart, VM migrate, VM rebuild, VM evacuate, etc.) that can be customized for different services.

CLAMP system architecture: The CLAMP architecture uses all the relevant ECOMP components to realize a closed loop in action (See Figure 2). We will provide a demonstration of CLAMP where an anomalous condition of a virtualized firewall will be detected and automatically restarted to correct the problem. CLAMP will utilize both the design time and runtime phases of ECOMP.

References

- [1] Chiosi M., "AT&T Domain 2.0 Vision White Paper", http://www.att.com/Common/about_us/pdf/AT&T%20Domain%202.0%20Vision%20White%20Paper.pdf, Nov. 13, 2013.
- [2] AT&T Inc., ECOMP white paper, <http://about.att.com/content/dam/snrdocs/ecomp.pdf>, Mar 16, 2016.

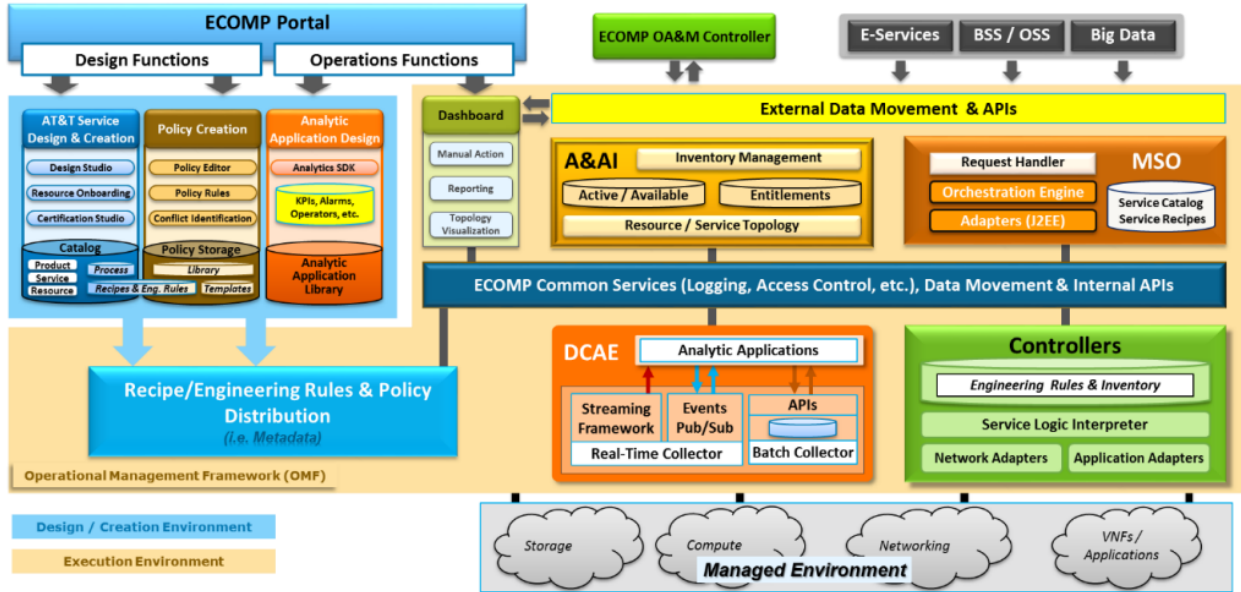


Figure 1 – ECOMP Platform Components

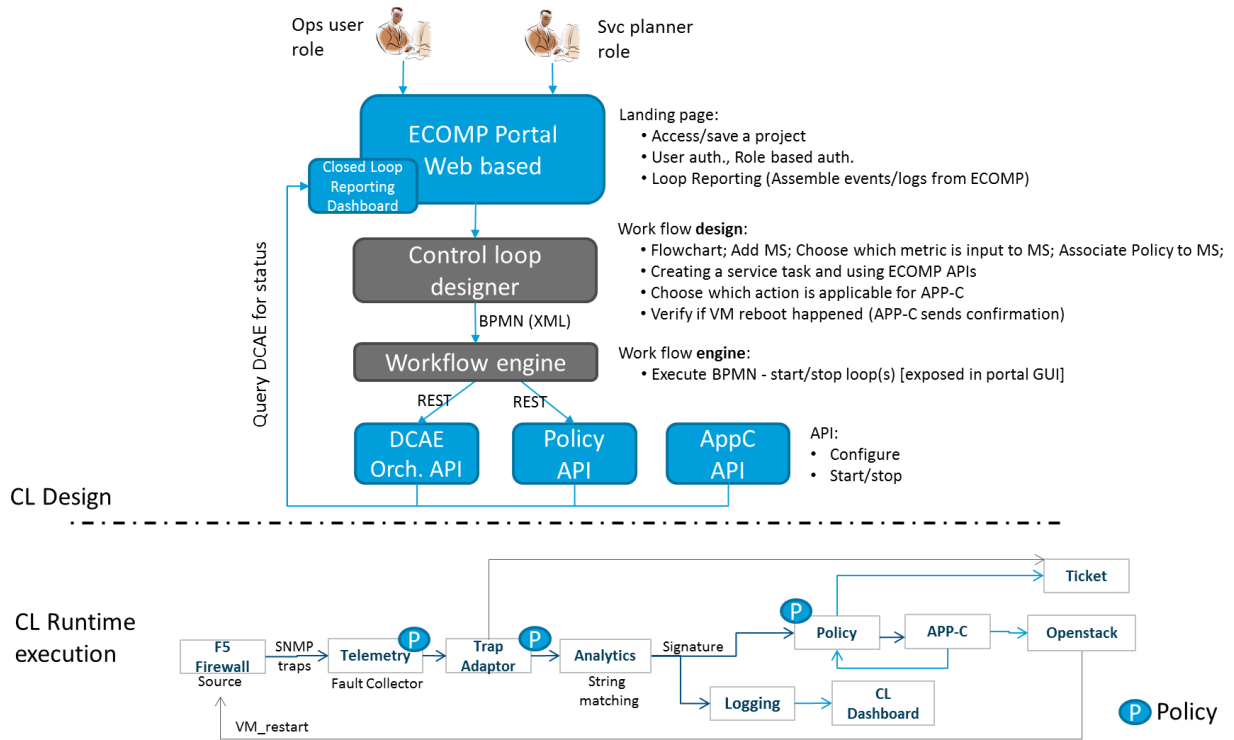


Figure 2 - Closed loop Design and Runtime in ECOMP