PoC Proposal

1 PoC Project Details

1.1 PoC Project

PoC Number: *(assigned by ETSI)*	1
PoC Project Name:	ServoCloud
PoC Project Host:	Amazon Web Services
Short Description:	ServoCloud: efficient lifecycle and element management automation at scale

1.2 PoC Team Members

	Organisation name	ISG ZSM participant (yes/no)	Contact (Email)	PoC Point of Contact (*)	Role (**)	PoC Components
1	EnterpriseWeb	Yes	dave@enterpriseweb.com	x	Supplier	Interoperability and Automation Platform
2	Deutsche Telekom	Yes	KlotzM@telekom.de		Network Provider	
3	Sprint	Yes	Serge.Manning@sprint.com		Network Provider	
4	Amazon Web Services	No	sschakra@amazon.com		Service Provider	Cloud hosting NFVI
5	Amdocs	Yes	alla.goldner@amdocs.com		Supplier	OSS/BSS
6	EXFO	Yes	yvon.rouault@exfo.com		Supplier	Service Monitoring and Assurance
7	InfoSim	Yes	hock@infosim.net		Supplier	Resource Monitoring and Assurance
8	Fortinet	No	nthomas@fortinet.com		Supplier	VNF(s) - Security
9	Metaswitch	No	Martin.Taylor@metaswitch.com		Supplier	VNF - IMS

(*) Identify the PoC Point of Contact with an X.
(**) The Role will be network provider, service provider, supplier or other (please specify).

All the PoC Team members listed above declare that the information in this proposal is conformant to their plans at this date and commit to inform ETSI timely in case of changes in the PoC Team, scope or timeline.

1.3 PoC Project Scope

1.3.1 PoC Topics

PoC Topic Code	PoC Topic Description	Related WI	Expected Contribution	Target Date
PT01	Demonstration of ZSM Scenarios	ZSM-001 Requirements based on documented scenarios and use cases	Technical report explaining what aspects of automation and means were used to support the PoC and how they helped	Aug/Sept

1.3.2 Other topics in scope

PoC Topic Code	PoC Topic Description	Related WG/WI	Expected Contribution	Target Date
PTA	Multi-vendor eco-system viability		A working presentation that demonstrates viability based on multi-vendor eco-system and shares learnings	Aug/Sept

1.4 PoC Project Milestones

PoC Milestone	Milestone description	Target Date	Additional Info
P.S	PoC Project Start	June	
P.D1	PoC Demo 1	9-12 Jul	ZSM-Interim F2F Kista
P.C1	PoC Expected Contribution 1	Aug/Sept	Technical report addressing PoC Topics in scope (PT01, PTA)
P.D2	PoC Demo 2	8-12 Oct	Layer 123 The Hague
P.D2	PoC Demo 2	22-26 Oct	F2F ZSM #4 meeting.
P.R	PoC Report	Nov	Intermediate/Final Report
P.E	PoC Project End	Open	If successful, intent would be to continue, expand and refine scope for extended PoC with new objectives and contributions and possibly participants

NOTE: Milestones need to be entered in chronological order.

1.5 Additional Details

The Team can promote, with advance permission and coordination with the ZSM ISG Leadership, the ISG ZSM and the PoC at industry events and conferences, including ETSI NFV meetings and plugtests. If approved, the team members may agree to develop a public website (EnterpriseWeb has secured http://www.servocloud.org) and publish papers, articles and blogs.

The following Project Phases are foreseen:

Project Phase 1:

- Review and confirm scope/scenario/use-case(s)
- Elaborate roles of PoC Team members
- Confirm hosting environment(s)
- Engineering calls to discuss interface requirements

Project Phase 2:
- In parallel with project integration – group discussions on Faults, Accounting, Performance and Security modeling

Project Phase 3:
- Rehearse internal demo and prepare slides/materials and develop contribution re: learnings and proposed Metadata/Metrics specifications
- Demonstrate and contribute

2 PoC Technical Details

2.1 PoC Overview

Servo: "a device used to provide control of a desired operation through the use of feedback" (https://en.wikipedia.org/wiki/Servo)

ServoCloud is a Cloud-native implementation of ZSM principles, as articulated in the original ETSI ZSM whitepaper, demonstrating model-based, event-driven, policy-controlled automation of network and service management. The objective of the PoC is to make specific, targeted, implementation-independent contributions to the ISG ZSM that help enable efficient end-to-end automation of Network Services at scale (reduce OpEx), which assures customer Quality of Experience (improve customer retention), while optimizing the utilization of network resources.

The first iteration of this PoC skips on-boarding and deployment of Network Services to focus on a range of practical lifecycle management concerns that must be addressed by a ZSM framework – the continuous monitoring (passive and active) and closed-loop autonomic control (e.g. self-healing; self-configuring; self-scaling) of complex, multi-vendor services across network domains and layers, partners and technologies.

The PoC Team seeks to promote open interoperability and will consider requirements and gaps in industry standards for observing, interpreting (correlating and classifying) and responding to events (including human and system requests). These foundational concepts are necessary for any such autonomic system, though the challenges of complex event processing for ZSM are compounded by the dynamic, diverse and distributed nature of a virtualized carrier environment.

ServoCloud represents a reference architecture for dynamic services, providing the foundation for a new lightweight, distributed and highly-dynamic OSS, which can work across domains to eliminate siloed OSS implementations, synchronize operations and rationalizing IT software systems

Anticipated outputs would help advance the development of the ZSM Framework and in turn, accelerate the industry transformation journey.

Future iterations of this PoC may explore the inclusion of AI and ML for predictive maintenance and continuous improvement, as well as the automation of DevOps processes for Continuous Integration and Continuous Delivery.

Zero-touch Scenario: Network and service management for 5G slices with end-to-end SLAs

Use-case: Secure voice and data services provided over 5G slices with service monitoring/assurance and closed-loop control for performance, security and billing events

Standards enabling common governance across:

- Multi-vendor
- Multi-VNF
- Multi-VNFM

- Multi-NFVO
- Multi-VIM
- Multi-SDN Controller
- Multi-Cloud
- Multi-Domain (core-to-edge)

Incorporating ETSI NFV, MEF LSO, TMF OpenAPIs and 3GPP concepts.

Working with PoC Team members, both Vendors and Network Operators, the intention is to demonstrate how common Lifecycle Management operations and Element Management policies can be abstracted out of Network Services to eliminate silos and enable consistent and virtually centralized end-to-end management and control across use-cases.

This will require an evaluation of existing ETSI standards relative to ZSM requirements and the identification of gaps. It is expected that the PoC Team will jointly develop and propose new Metadata and Metrics specifications for modeling Faults, Accounting, Performance and Security events that a ZSM Framework-based solution can use to trigger automated operations implemented by the NFVO, VNFM, SDN Controller and other Controllers and Network Elements as part of a modular and federated solution.

Standard Metadata and Metrics, not just pass-through interfaces, would allow the ZSM Framework to query and 'understand' State and Telemetry data reported from the Application, Compute and Network layers. It would enable Network Operators to instrument their infrastructure so faults and alarms can be raised across domains, correlated by ZSM solutions, ensuring end-to-end SLAs. Standard Metadata and Metrics help advance automation objectives, improve operational efficiency and realize new management capabilities.

Without standard Metadata and Metrics, closed-loop controls would be manually coded and siloed, which would inhibit global transparency, re-use, IT productivity; precluding the broad objectives of Zero-touch Network and Service management.

The PoC team recognizes that in certain cases, the sharing of State and Telemetry will be limited by National regulation or by partner/affiliate agreements. However, this should not be an excuse for maintaining silos.

Similarly, geographic distribution and high-level analytic processing of aggregated source data will introduce latencies that would constrain real-time or near real-time responses from a Zero-Touch Automation (ZTA) Framework-based solution. While this would suggest certain critical decision-making remain under domain control (e.g. "local optima"), it doesn't diminish the value of higher-level analysis, which can provide valuable inputs (i.e. "global optima") to domain decision-making on a different time cycle. Overtime, with improvements of networks and processing, it's reasonably anticipated that latencies will be reduced.

The work of this PoC will necessarily begin a practical exploration of domains vs central management and automation.

It is likely that Domains remain responsible for the "last mile" of implementing local control of thier Application, Compute and Network layers. However, when otherwise not restricted, a central ZSM Framework-based solution should be able to subscribe to domain state and telemetry data. That data driving both "local" (domain) and "global" (end-to-end) decision-making, enabling higher-level programmability and control.

While each domain may take responsibility for handling "local" faults and alarms, the end-to-end is responsible for correlating faults and alarms across domains. Without this lower level visibility, the end-to-end cannot observe anything directly and it is limited to the interpretation of the Domain, which does not have the benefit of the top-level view.

Solely automating each domain does not and cannot resolve end-to-end management and automation problems. It does not provide a path to the new OSS. There would be no common means for raising alarms and detecting faults and enforcing cross-domain lifecycle management concerns like FCAPS.

User Story

As a Business person I want my CSP to be competitive in emerging Cloud, 5G, Mobile Edge Computing, and Internet-of-Things use-cases so that we can offer value-added new services to attract and retain customers.

As an Operations person I need to support Service Level Agreements for Network Services to provide good customer experiences and comply with regulations. While the mechanisms for service delivery may evolve with technology and new capabilities may be enabled, this basic requirement doesn't change.

As an Architect responsible for designing next generation networks, I need to consider the impacts of virtualization and distributed computing on Network and Service Management. Cloud, 5G, Mobile Edge Computing, and Internet-of-Things scenarios pose particular challenges as the delivery of a Network Service may need to be coordinated across multiple domains, in ad-hoc heterogeneous networks over diverse environments requiring application, service and network integration. I want to leverage standards for an open multi-vendor environment, but I recognize that this cannot be done manually, on a one-off basis, in production systems, so it must be automated to scale operationally.

Assumptions

Maintaining an end-to-end Service Level Agreement requires operational visibility across domains to support informed decision-making

If I want to automate management for a Network Service delivered via several domains (e.g. a 5G Slice Scenario), some higher-level entity or system controller must take responsibility for coordinating the overall service. Important Note: Sharing across domains doesn't suggest the centralization of all control for a variety of reasons, including regulatory concerns, processing latencies and specialization. Domain controllers will remain responsible for implementing plans decisions even when informed or directed from above.

To coordinate activity the higher-level system controller will need to interoperate with domain controllers

Interoperability across domains requires standard metadata and metrics so that state and telemetry are communicated consistently so that events (faults, performance issues, etc.) can be observed, allowing alarms to be raised and correlated, so that decisions can be made and actions taken. Without standards-based visibility each domain would remain a silo and high-level programmability would be near impossible.

If standard Metadata and Metrics are captured in a machine-readable model that provides relationships to standards-based concepts and types (i.e. "semantics") then Lifecycle Management and Governance functions can be automated (n.b. the model defines the scope of automation). Given speed, scale and complexity of Telecom operations, automation is a necessity; humans simply cannot keep up or scale with the demands for next gen services.

Test-Cases

Once formally approved, the PoC Team will come together to work out details of the 5G Scenario, the roles and test-cases relative to the User-Story.

Test-cases from ETSI NFV are directly applicable to ETSI ZSM. In ETSI NFV they were considered outside of the application layer and real-world network operations, which led to most initial deployments being siloed. In ETSI ZSM, these same Test-cases can be revisited in the context of extreme automation.

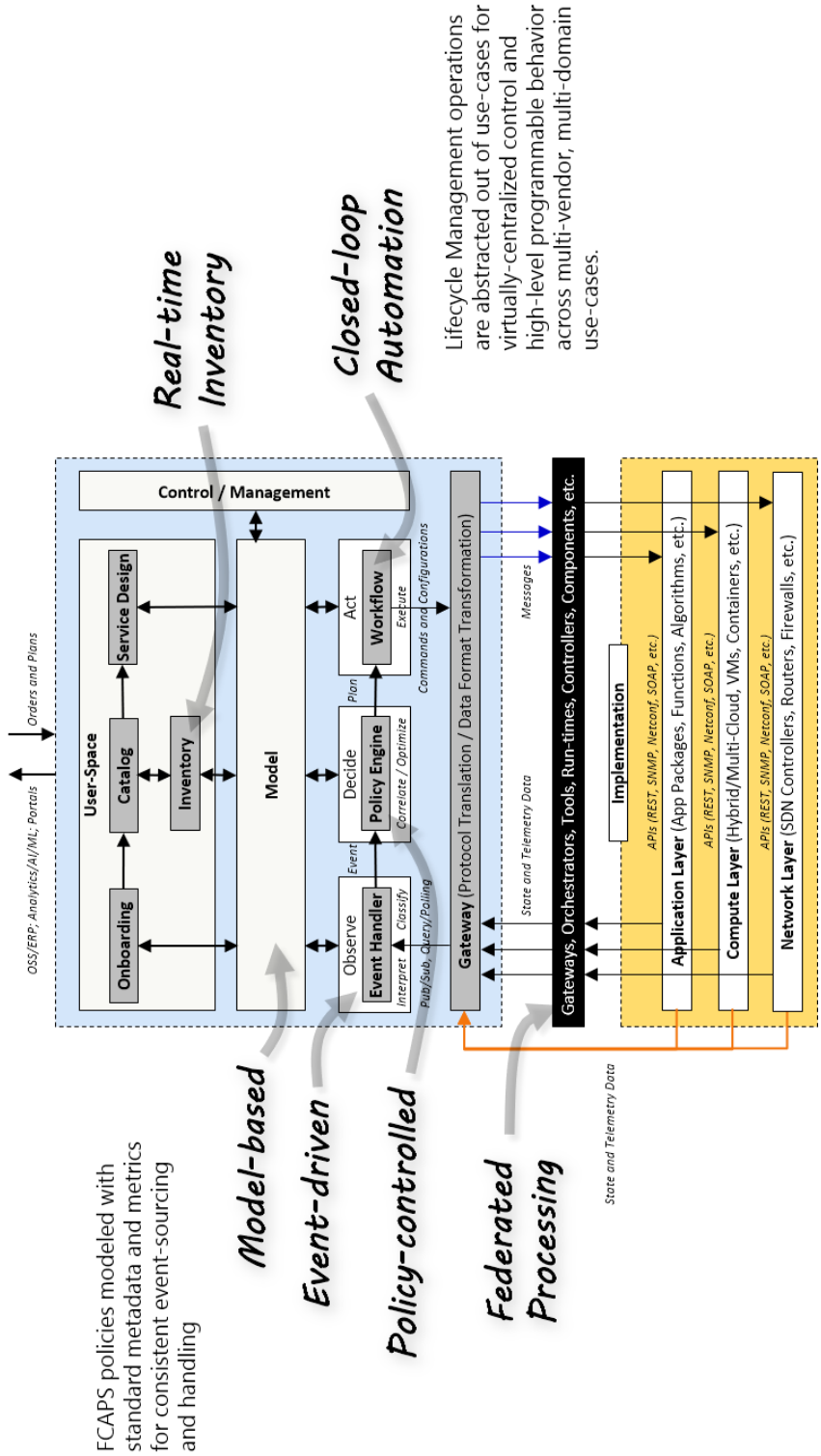
To that end, initial Test-cases include, but are not limited to: Fault Handling; Performance Management; Disaster Recovery and Dynamic Billing all in an end-to-end context with each modeled on the same basic patterns and enabled by the same pool of metadata/metrics.

PoC Demos

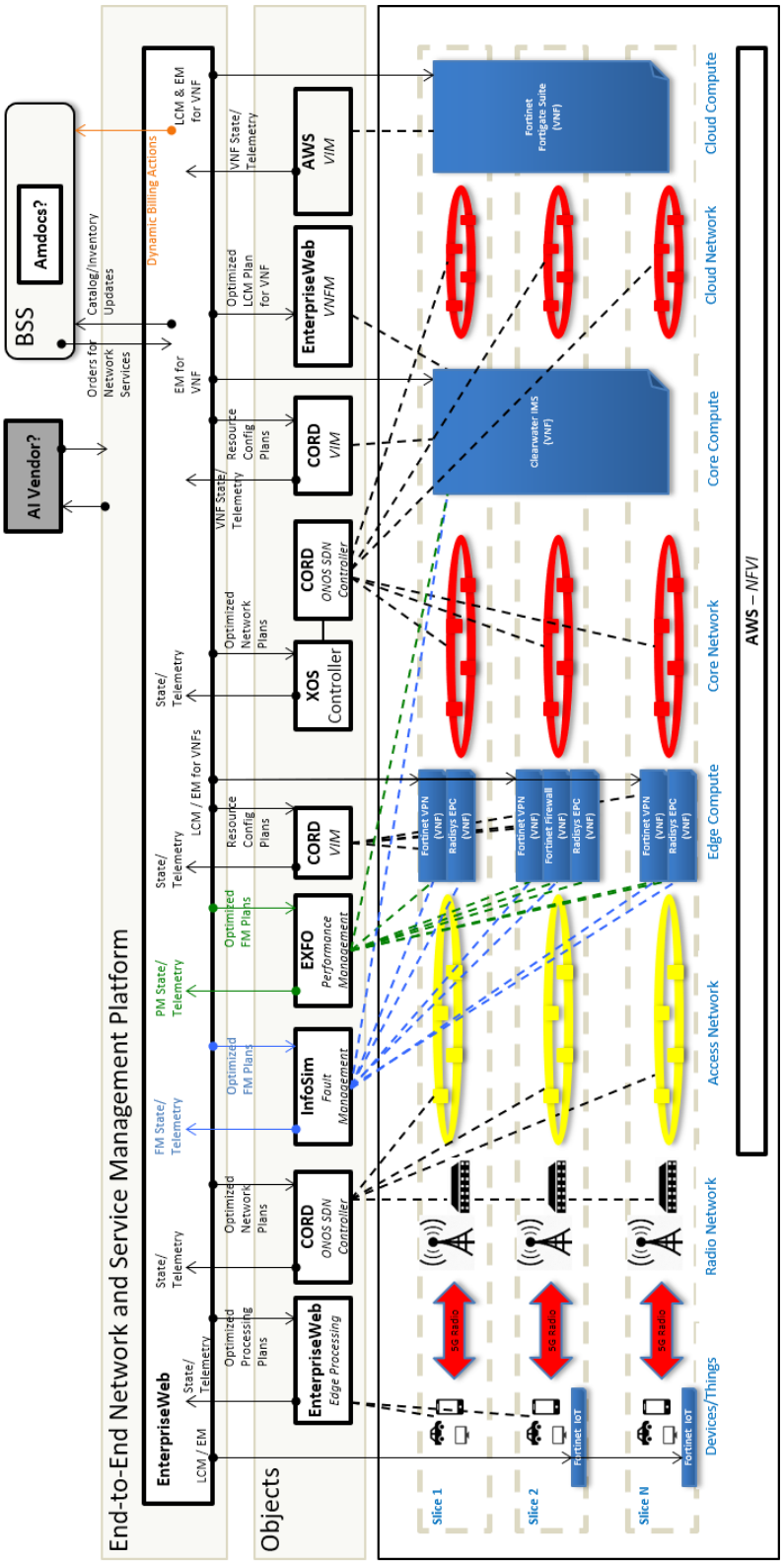
The ZSM ISG and the ServoCloud PoC team are committed to implementation-independent standards. The PoC demonstrates a model-based, event-driven, policy-controlled approach.

2.2 PoC Architecture

PoC Conceptual Architecture (implementation-independent)



5G Slice Scenario with PoC Team member roles



2.3 Additional information

As the industry has learned over the last five years, dynamically coordinating heterogeneous application packages, which are composed in arbitrary service designs that run over diverse environments, is hard – it is the crux of the Carrier Virtualization problem (and more generally, distributed app problem). To date, the few existing implementations have generally been siloed, use-case specific, vendor-centric, manually-integrated and one-off. As a result, early implementations of NFV MANO, based on vendor and open-source solutions, have fallen short of expectations.

While many SDO activities are producing useful standards and APIs that help frame NFV, none of these efforts individually or collectively solve the end-to-end automation and management problem. The tendency has been to focus on the discrete interfaces of individual elements or pass-through interfaces between domains, not on the interaction between elements. This is why ETSI ZSM work is so important – the industry needs a coherent framework for automation at scale.

ETSI ZSM's work is not at odds with the work of ETSI NFV or other SDOs, rather it is complimentary.

Bottom Up: Standard interfaces for open interoperability (Supplier-centric)
Driving transparency (and disaggregation) in lower-level elements so they are not just black-boxes, but expose interfaces that increasingly enable higher-level programmability that customers need to automate their operations at scale with agility

Top Down: High-level abstractions for unified, consistent automation and management (Consumer-centric):
Establish generalized operations, states, metadata and metrics that provide the framework (concepts, capabilities, principles, relationships, etc.), which consumes the interfaces for network and service management

EnterpriseWeb, which led ETSI NFV PoC #1, has consistently noted the need for high-level abstractions to help connect standards-based and proprietary interfaces, promoting API interoperability and evolution at the application layer (consumer-centric).

These two views reinforce one other, and we need to push standards from both directions to realize our goals, recognizing it will be a journey and that capabilities will evolve over-time.

The coordination challenge described above is exemplified by the problem of enforcing a common SLA over an end-to-end, multi-VNF, multi-vendor Network Service. Where each service can be composed of different VNF Packages being controlled by distinct VNFMs.

There are common lifecycle operations already defined by ETSI NFV ISG for VNFs – it is logical that we leverage and build upon that work and extend it for a ZSM Framework.

Application and Resource States, as well as Network Telemetry can be normalized at a high-level for disparate workloads, regardless whether they run on VMs, Containers or Bare Metal, in an Operator Data Center or in the Cloud.

The question then becomes: how does an operator issue common commands that transform state consistently across heterogeneous elements and environments to enforce common SLAs?

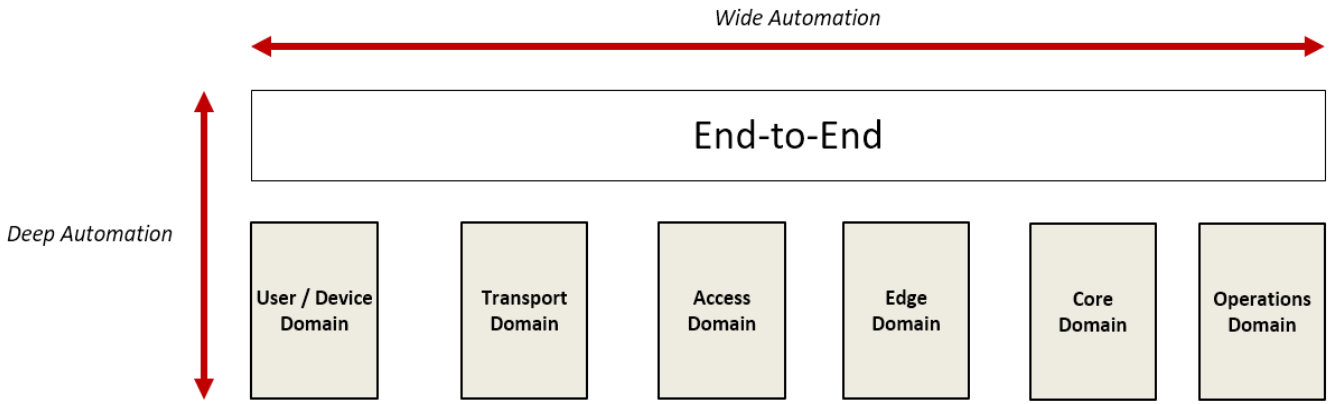
From the Operators perspective, treating everything as a snowflake clearly has no value. To scale operationally, a ZSM framework must provide a CSP with a common pattern for interpreting and responding to events in a closed-loop autonomic manner. This requires standard high-level normalized states (mappings to standard metadata/metrics) for interpreting events (faults, etc.) so a ZSM solution can trigger commands for standard lifecycle operations, which have common meaning to vendors, who implement those operations discretely so their products comply. There needs to be a "shared understanding" between participating actors in a service and the ZSM Framework-based solution responsible for global management. In other words, the scope of automation is inevitably bound by the scope of the model (breadth and depth) spanning the end-to-end solution. The coordination of multiple actors independently performing tasks to collectively realize a service is best described as "Choreography". Choreography has been long explored in Computer Science; it is a by-product of Coordination Theory, In the Standards community it has been superficially addressed by ISO/IEC (JTC 1/SC 38 - Standardization in the areas of Cloud Computing and Distributed Platforms). The Object Management Group (OMG) considered developing a Choreography Description Language (CDL), but it opted for the more conventional Business Process Execution Language (BPEL). BPEL is widely implemented as the underlying technology behind the Business Process Management Notation (BPMN) and is adopted directly or in some degenerate form in most orchestrators and automation tools. While a common element of middleware stacks, BPEL has proven sub-optimal for the more dynamic, loosely-coupled, late-bound, contextualized interactions that organizations seek today.

It has been suggested that activities of other SDOs could provide valuable inputs to this PoC, specifically the Open Group's Redfish and OASIS TOSCA, in addition to the work of the Open-Config group. As well, groups like QuEST Forum/TIA could provide a source of performance and quality metrics.

In any case, the ETSI ZSM ISG can bridge Lifecycle and Element Management, which remains a gap in NFV architecture and implementations, and provides an opportunity to advance Cloud architecture as well.

Automation Challenge

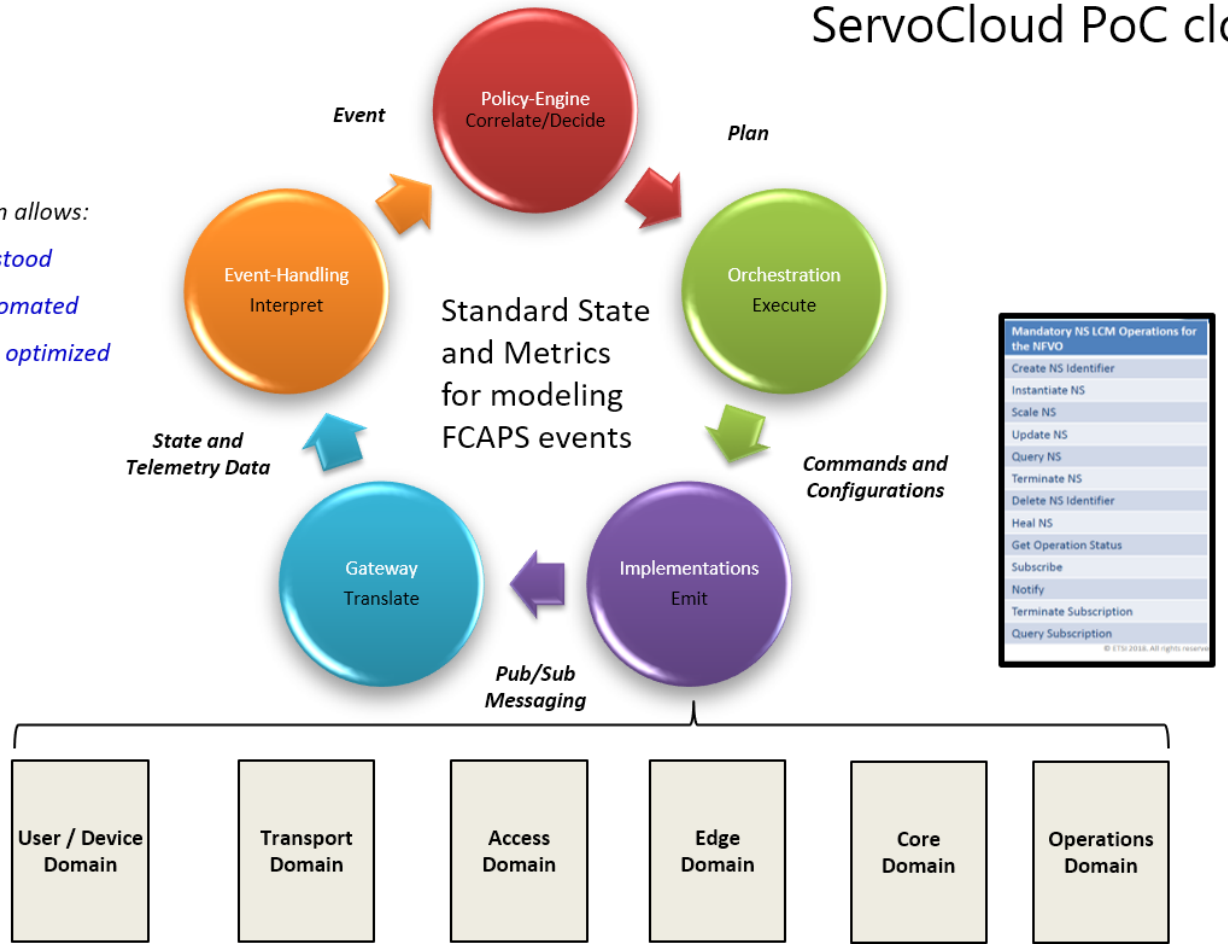
How do you achieve Zero-touch Network and Service Management across domains while maintaining an End-to-End SLA?



ServoCloud PoC closed-loop

The Shared Abstraction allows:

- *Events to be understood*
- *Decisions to be automated*
- *Management to be optimized*



Mandatory NS LCM Operations for the NFVO
Create NS Identifier
Instantiate NS
Scale NS
Update NS
Query NS
Terminate NS
Delete NS Identifier
Heal NS
Get Operation Status
Subscribe
Notify
Terminate Subscription
Query Subscription