

# DYNAMIC ASSURANCE FOR NETWORK AND SERVICE EVENT MANAGER

ABSTRACTION, AUTOMATION AND ANALYTICS

STRATEGIC WHITE PAPER

Network functions virtualization (NFV) and software-defined networking (SDN) are transforming the implementation of IP networks, particularly related to the cloud. To remain competitive, communications service providers (CSPs) need unified, top-down, real-time service views across all domains.

Motive Dynamic Operations provide key features for managing customer experience and service quality as technologies evolve. Abstraction, automation and analytics are the foundation, with innovations that include dynamic identification and tracking of service resources; automated, programmable OSS; and self-healing environments for big data. With Motive Dynamic Assurance, CSPs can provide smooth customer- and service-centric management of services and networks without increasing operations effort.

The Motive Service Event Manager (SEM) is an end-to-end integrated service-assurance solution that enables proactive problem handling, enhances marketing and sales, and maximizes automation while reducing OPEX. A user portal and the SEM Service Operator Dashboard provide unified views.

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# INTRODUCTION

The transition toward an all-IP network is resulting in the evolution of new technologies and protocols to deliver customer services more economically and dynamically. The next steps in this evolution are software-defined networking (SDN) and network functions virtualization (NFV).<sup>1</sup> These promising technologies will transform the cost profile and flexibility of IP networks with more flexible business models, higher revenue, greater network efficiency and control, and lower CAPEX/OPEX. With vendor-agnostic links between the control and data planes and a centralized orchestrator, SDN-controlled networks with NFV provide capabilities for multivendor implementations.

The required service assurance tools must monitor the network and IT infrastructure and report to a single dashboard. By analyzing the collected information, communications service providers (CSPs) can investigate the root causes of hardware problems, poor application performance or difficult end-user experiences. With the removal of monitoring from specific infrastructure elements, such as networks, storage, servers, virtual machines and databases, CSPs can examine the interdependencies among these systems and their end users.

Managing all-IP networks is challenging because of the nature of virtualization, connectionless IP and the need to continue the support of legacy services. This complex hybrid — virtualized and non-virtualized services — world needs holistic service-assurance solutions based on a service-orientated architecture.

Current Operations Support Systems (OSSs) cannot address these management challenges. CSPs typically operate a number of assurance systems that have been developed in-house, purchased from equipment vendors or independent software suppliers, or inherited as a result of acquisitions. In addition, many people, processes and OSSs are strongly attached to current CSP operations. The most challenging consequence for CSPs is the linking of service quality and customer experience with underlying network or infrastructure issues.

SDN and NFV are creating additional management challenges that cannot be addressed with current OSSs. SDN and particularly NFV — which is emerging as the larger “umbrella” concept — are therefore encouraging new companies, with new network-management models, to enter the market. Established players are therefore reconsidering their OSS approaches, systems and entire architectures. SDN and NFV are disruptive from a management perspective because they require change at every level: in employee skill sets, process reengineering and automation, and new OSS capabilities.

## CHALLENGES FOR CSPS AND OSS VENDORS

SDN changes the demarcation between the OSS and the network by driving the operational intelligence that is currently fragmented within multiple OSSs into a single, centralized control plane. Network abstraction approaches that support the SDN concept of network programmability by automating configuration may be more OSS-friendly. However, network abstraction provides a similar centralized, near-real-time point of contact with the network.

<sup>1</sup> Margaret Chiosi et al., *Network Functions Virtualisation: An Introduction, Benefits, Enablers, Challenges & Call for Action*. SDN and OpenFlow World Congress, Darmstadt-Germany, October 2012. [http://portal.etsi.org/NFV/NFV\\_White\\_Paper.pdf](http://portal.etsi.org/NFV/NFV_White_Paper.pdf)

NFV requires that CSPs implement a completely new level of management of the cloud infrastructure and its virtual compute, storage and network resources as well as the consumption of these resources by individual virtualized network functions (VNFs).

Vendors recognize that technologies are quickly evolving, particularly related to the cloud. To create the required management architectures, vendors need to gather OSS, cloud management and network knowledge and skills that have previously existed in separate domains. Because there are many unknowns in migrating network functions to the cloud, vendors also need to address issues such as:

- How far and fast CSPs will move toward radical approaches for operationalizing the network
- Which management functionality will be embedded in VNFs rather than in an external management system
- How to avoid introducing new levels of operational cost to the network

## MEETING CUSTOMER EXPECTATIONS

Today's customers expect secure, high-quality access to the network as well as rapid access to network-based data and diverse applications from any device or access medium, no matter how many networks or partners are involved. If customers are dissatisfied with paid services or products, they will immediately switch to different CSPs. The resulting competitive pressure is forcing CSPs to focus on their customers' experience by taking a customer-centric view of the services provided and by managing the required service quality.

The “Anytime, anywhere, any device” slogan has emerged from the recent explosion of innovations in devices, applications and technologies. This slogan matches customer expectations about the availability of the provided services. Customers expect high service quality and prefer to ignore underlying complex technologies or processes. CSPs must therefore hide this complexity by simplifying the required user interactions to an intuitive level.

## PROVIDING COMPLEX, CONVERGING SERVICES WHILE PROTECTING OSS INVESTMENTS

Customer expectations are requiring a paradigm shift toward a customer- and service-centric view. The resulting complex, converging services require intensive manual effort, many tools and unwieldy administration.

Network convergence has simplified lower network levels — for example, at the IP transport layer — but has increased complexity at higher, customer-oriented layers. As a result, services that span disparate multivendor networks with multiple technologies are often deployed to satisfy customer demands. Service-oriented OSSs must therefore become more complex to handle the seamless virtualization and abstraction of future network functions based on NFV and SDN.

Current service assurance systems focus more on network resources than on services or customers. The main objective is to monitor the network environment based on a certain healthy status with a predefined availability, without an end-to-end service view. Most

service assurance systems are expensive and complex to configure, with solutions that cover only a narrow view of performance, faults and the resulting statistical availability.

With increasing demands to extend their customer-experience knowledge, CSPs are implementing additional systems to collect the required information. An end-to-end service or customer view is often achieved manually because the integration of numerous deployed tools is costly and impractical. A manual approach to service assurance cannot be retrofitted to effectively serve the demands of the dynamic, virtualized and scalable NFV and SDN environments. A unified, top-down, real-time service view across all domains is required to manage all these demands and fulfill customer and business expectations. For a CSP, a unified service-assurance approach can cover the increasing convergence of its IT and OSS organizations as well as its customer-focused business.

CSPs do not want to discard significant investments in their current OSSs. The expected solution — to operate existing networks and services together with new technologies and products — cannot replace an entire existing OSS. Complementary and enhanced functionality as well as transitional capabilities must fulfill all demands.

## MOTIVE® DYNAMIC OPERATIONS

“Dynamic Operations” refers to next-generation operations and IT management and the related OSS software components. The Motive Dynamic Operations portfolio comprises Motive Dynamic Assurance and Motive Dynamic Fulfillment. For Dynamic Assurance, unified service assurance products must manage virtualized and non-virtualized network functions, service-centric end-to-end views of services and applications, and network and data-center infrastructure.

With this focus on customers and their services, CSPs can achieve increased revenues from loyal, delighted customers; higher labor productivity and fewer human errors from increased automation; and improved mean time to repair (MTTR) from accurate data and analysis of customer and business impacts. The end-to-end process and required functions are covered by the Dynamic Operations “three As”: Abstraction, Automation and Analytics, as shown in Figure 1.

Figure 1. The three As of Dynamic Operations



### Abstraction

An abstracted view of the entire network and IT topology that lays the foundation for the shift to a dynamic and ever-changing NFV and SDN model



### Automation

Closed-loop automation of the fulfillment and assurance functions, resulting in improved time to market and time to service



### Analytics

Shift to an analytics-driven customer experience to reduce costs to service by simplifying manual and service-intensive processes

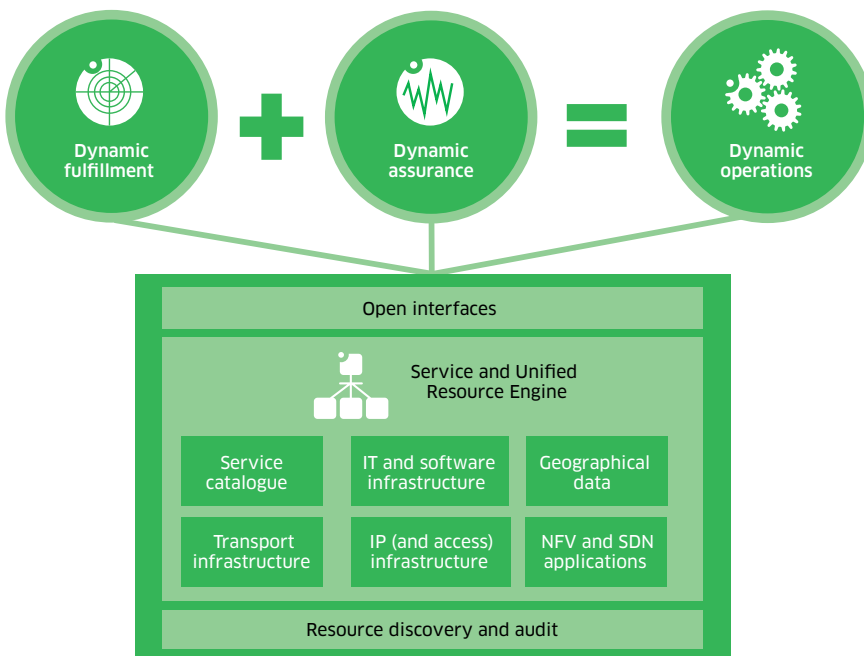
This new generation of Dynamic Operations requires powerful innovations to move from today’s world of too many OSSs, too many alarms, and very few automated assurance procedures.

## Innovation 1: Dynamic identification and tracking of service resources

The Dynamic Operations foundation can dynamically identify and track all service resources. The data model covers service and network topology end-to-end from devices to applications and from customer to resource levels. This model contains a service catalog that can match a product catalog, IT and software resources and applications, transport and IT infrastructure, geographic and other attributes for resources, and cloud-computing resource details.

The federated service data model forms the core of the new OSS, linking Dynamic Fulfillment and Dynamic Assurance to create an efficient operations environment, as shown in Figure 2.

Figure 2. Dynamic Operations: Federated service data model



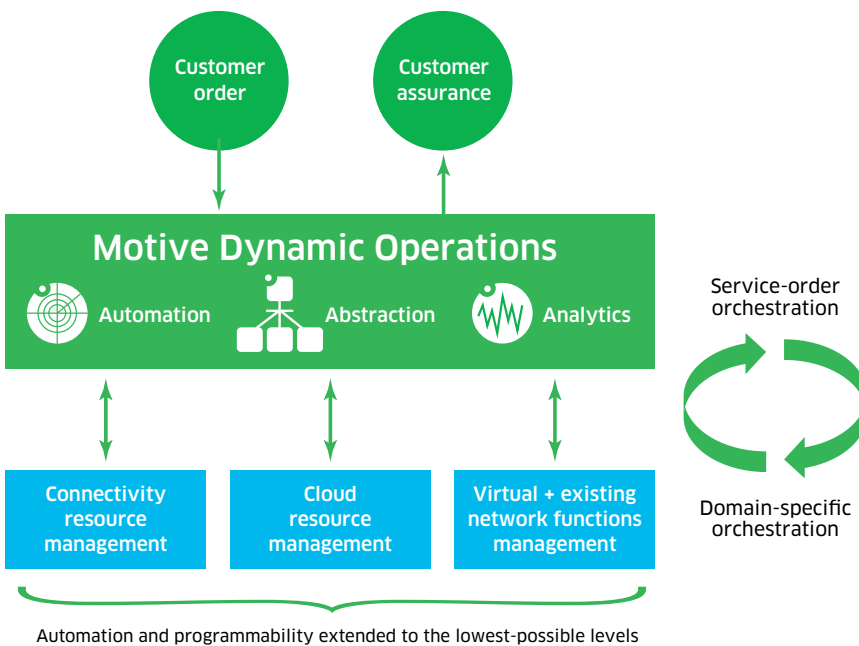
## Innovation 2: Automated, programmable OSS

A highly automated, programmable OSS closes the loop between fulfilling the customer and service order and assuring the service, as shown in Figure 3. In the past, assurance and fulfillment systems maintained different or limited views of real service models and did not provide sufficient programmability. CSPs are now starting to design systems that can automate many assurance functions and offer advanced correlation across many technologies. Automation logic for assurance includes:

- Multidomain, multisystem correlation rules
- Constant autodiscovery and reconciliation
- Operational knowledge incorporated in algorithms that save staff time and effort to spot, categorize and eliminate troubles

Based on existing customer project data, automation can result in reductions of 30 percent to 50 percent in time to market and 50 percent to 70 percent in time to service.

Figure 3. Automated, programmable OSS



### Innovation 3: Self-healing environment for big data

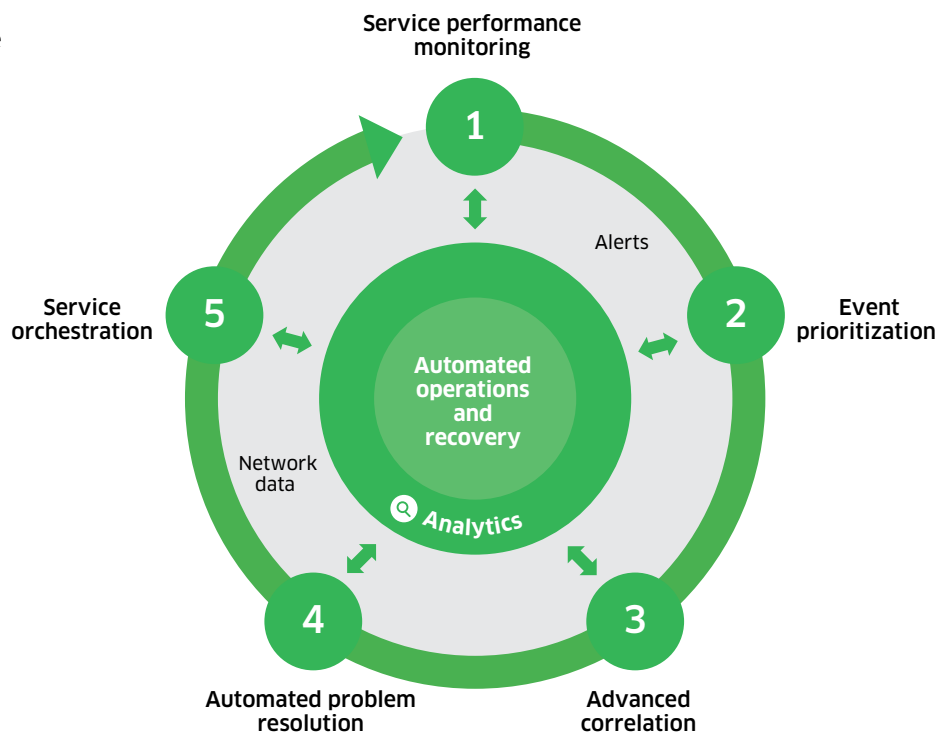
A self-healing operations environment, driven by big data and analytics, includes automated recovery and predictive management, as shown in Figure 4.

Open-source structure and non-structure storage reduces costs. Capabilities for the analytical treatment of big data also reduce costs and enable CSPs to deal with large masses of data.

In a software-driven Telco environment, new approaches are needed to correct problems automatically. The scale and diversity of network and service events and situations often require new compartmentalized management approaches. Software rules that can automatically predict health, annotate and avoid problems are critical.

Implementation of an automated operations and recovery environment can result in a 25 percent to 50 percent reduction in direct costs, with an additional 10 percent cost reduction in support areas. The number of alarms can be decreased by 70 percent, with approximately 20 percent of alarms closed automatically.

Figure 4. Automated operations and recovery environment



### Dynamic Assurance

Assurance is no longer just the provision of 99.999 percent network availability. Based on feasible network models, overall end-to-end service performance and availability must be managed. Dynamic Assurance management is needed across services, devices, networks and topologies from different vendors and across different domains. A technology- and product-centric perspective must shift to a business approach that includes customer- and service-centric views.

Dynamic Assurance incorporates a broad range of opportunities to:

- Enable the management of complex CSP operations
- Reach the required assurance maturity
- Guarantee appropriate service levels that can be measured, managed and reported
- Adopt a holistic solution approach for service assurance with consideration for OPEX and CAPEX
- Establish a unified, prioritized end-to-end view of problems, including simple access to supporting details
- Implement predictive analytical capabilities and operational intelligence

# END-TO-END SERVICE OPERATIONS

Dynamic Operations provide the most important functionalities for managing customer experience and service quality based on a comprehensive, pre-integrated feature set. With an end-to-end service view, CSPs can focus on issues that impact their customers and business rather than on technologies.

Supported by Dynamic Assurance, operations teams can respond in real time and with corresponding priority to network issues that might impact customers. Critical for certain levels of service quality, the real-time prediction and detection of problems must be performed without manually analyzing and correlating data from diverse tools.

Dynamic Assurance is designed to work with other building blocks of a Dynamic Operations software suite — standalone or as an enhancement of a CSP's existing OSS environment. With Dynamic Assurance, CSPs can achieve the following main business requirements for end-to-end service operations:

- Significantly reduce the complexity of operations and customer care
- Provide an immediate, interactive and secure user experience
- Protect vital revenue streams
- Enhance customer loyalty

## DYNAMIC OPERATIONS: FOUNDATION FOR SUCCESS

With Dynamic Operations, an innovative approach to end-to-end service operations enables CSPs to enhance their business. Three main focus areas for business success are:

- Clear business objectives
- Service operational principles
- Resolution of architectural constraints

### Clear business objectives

Responding to dynamic market changes and high competitive pressures, most CSPs have implemented rigorous cost-improvement programs, based mainly on work force reductions and restraint in new technology investments. With the evolution to data-driven communications, CSPs must now introduce the required technologies to fulfill their customer demands and expectations.

Transformation to an all IP-network and virtualization lead to lower equipment costs but dramatically increase complexity and the effort to provide end-customer services. An appropriate Dynamic Assurance solution is therefore required to ensure that CSPs can provide smooth customer- and service-centric end-to-end management of the provided services and the related network without increasing operations effort. The solution must also support CSPs in reaching such business objectives as:

- Profitability
- Efficiency
- Growth
- On-time delivery
- High-quality products
- Execution excellence
- Operational excellence
- High-quality user experience



## Service operational principles

Silo-based network management and over-customized umbrella management systems are still common in daily network operations. In some cases, service management has been implemented together with customer experience views. In the past, operators viewed alarms and performed analyses to add information to alarms before building a resolution plan.

With the new Dynamic Assurance solution, the paradigm for network assurance is changing to monitor the success of the alarm management process. The operator needs to intervene only when the process does not work.

Dynamic Assurance displays the impacted service of an alarm immediately after it has been reported. The root cause is automatically determined, followed by automatic resolution or repair by the related Automated Operations and Recovery function. If the problem is not successfully resolved, an automatic service trouble ticket must be created. Typical Network Operations Center (NOC) alarm-driven operations are transformed to a Service Operations Center (SOC) employing SOC service-ticket management.

The alarm resolution process can be shown on a service-assurance process dashboard.

Reports related to this process can show:

- Ratio of the number of alarms to tickets
- Speed of determining the root cause after a service impact alarm
- On-time resolution of problems based on the agreed Service Level Agreement (SLA) or Operational Level Agreement
- Total number of tickets

Typical key business objectives and the resulting benefits of Dynamic Assurance are shown in Table 1.

**Table 1. Dynamic Assurance: Business objectives and benefits**

BUSINESS OBJECTIVE	BENEFIT
Transform operations from managing alarms to managing trouble tickets	Fewer incorrect tickets caused by faulty root cause analysis (RCA)
Ensure effective trouble-ticket generation and enrichment	Increased operator efficiencies
Reduce alarms with effective correlation and elimination of duplication	Reduced MTTR (cumulative with the realization of domain-based benefits)
Automate the processing of all alarms through to root cause	Minimized uncorrelated alarms
Achieve service impacts across domains	Proactive customer care and better communication

## Resolution of architectural constraints

The introduction of new technologies and services can introduce constraints in architectural requirements as well as in predefined deployment and integration processes. The Dynamic Operations suite provides proven concepts and procedures for the analysis and optimization of planning, implementation and operational processes.

Risks are minimized in an open architecture by providing:

- Representational State Transfer (RESTful) interfaces
- Unlimited scalability using open-source technology
- Web design principles
- Loosely coupled components

Operational constraints are minimized with Dynamic Operations abstraction, automation and analytics, which leverage cloud technology and span from devices to applications and from customers to resources. The three As can help CSPs realize the benefits of enhanced operations and prepare for the cloud. Table 2 lists examples and benefits of each concept.

**Table 2. Abstraction, automation and analytics examples**

ABSTRACTION	AUTOMATION	ANALYTICS
<ul style="list-style-type: none"> <li>• Accurate IT, network and services abstraction model</li> <li>• End-to-end service modeling across network and IT</li> <li>• NFV and SDN resource-manager adapters (multivendor)</li> <li>• Logical and physical data points, including GPS</li> <li>• Software, servers and applications</li> </ul>	<ul style="list-style-type: none"> <li>• Orchestration of new service offerings: IaaS, PaaS, SaaS'</li> <li>• Fulfillment that leverages VNF Forwarding Graph, service chain, service options, SDN</li> <li>• Assurance, fulfillment and recovery workflows and policies</li> <li>• Resource dynamics</li> </ul>	<ul style="list-style-type: none"> <li>• New approaches to collection for new sources of alarms and data</li> <li>• New correlation rules and automated recovery rules that leverage self-healing</li> <li>• Handling of large volumes and high frequency</li> <li>• Fast notification and reporting</li> </ul>

## MOTIVE SERVICE EVENT MANAGER

Motive Service Event Manager is part of the Motive Dynamic Operations portfolio. With Service Event Manager, CSPs can manage their wireless, wireline and applications-based end-user services with more focus on service operations compared to a traditional OSS context. Service Event Manager incorporates the three As, with a service- and network operations-oriented approach that uses analytics-driven assurance and restoration functions. Service Event Manager enables end-to-end services operations across multivendor technologies and across the network and IT.

With this approach, operators treat customers and their related services as an asset. The functions enable CSPs to manage and assure services from the customer's perspective, similar to how a NOC manages resources and technologies. Assuring customer experience reduces churn and increases loyalty and service uptake.

### Proactive problem handling

Dynamic Assurance moves beyond reactive and corrective operational modes to proactive problem handling that is prioritized by business and customer impacts and enables proactive customer notification. Predictive analysis determines which services and customers are affected by network problems, what the problems are, and when they will be resolved.

### Enhanced marketing and sales

Dynamic Assurance can also enhance marketing and sales by analyzing data for network events, logs and related Key Performance Indicators (KPIs)/Key Quality Indicators. Business transformation and customer experience management are enabled with proactive assurance that service levels are being met while reducing OPEX. Processed with customer experience data, results can identify customers who are likely to switch carriers as candidates for a churn prevention campaign. In addition, early adopters can be identified based on their usage behavior and can be targeted for new services to maximize monetization.

## Maximized automation and reduced OPEX

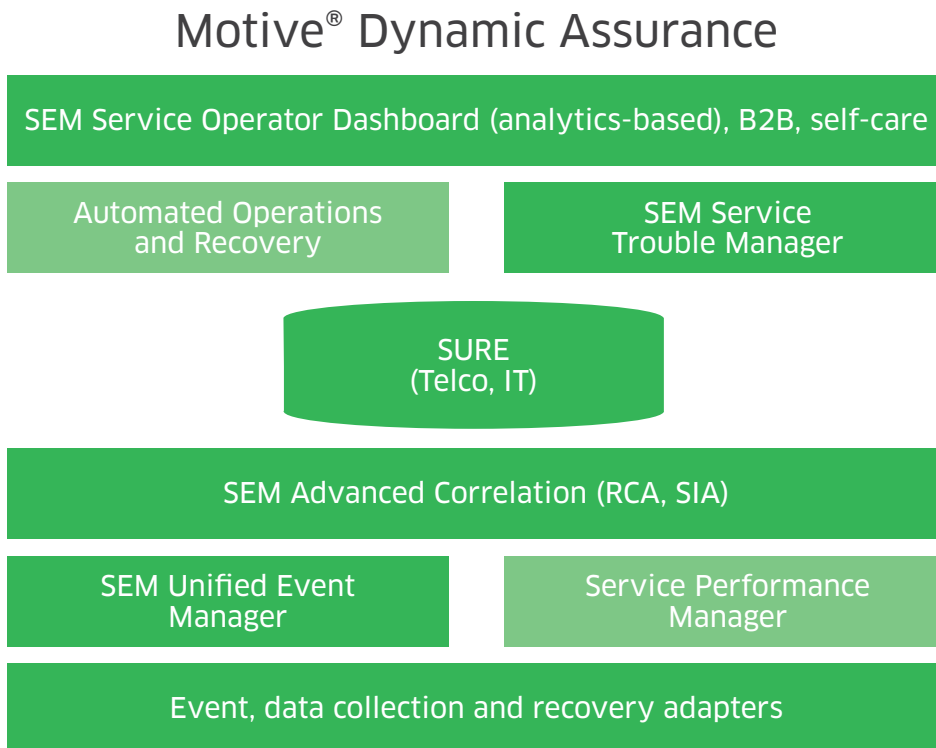
Dynamic Assurance leverages programmability and rules-based technology at all levels to maximize automation and related OPEX reductions. Operational efficiency is improved within and across CSP operations, engineering and maintenance teams and is achieved with:

- Service Operations Operational Excellence Curve: Alcatel-Lucent has defined the Motive Dynamic Assurance maturity model to support CSPs in their evolution from a reactive fault-management environment to full proactive and service-oriented operations.
- Unified service and network information: A real-time service-information platform is available as a bridge between traditional network- and resource-oriented operations and customer-experience and business management.

## Service Event Manager components

Dynamic Assurance components are based on the operations knowledge that Alcatel-Lucent has built in implementing fault-management solutions for many telecommunications operators worldwide and as a thought innovator in leading the industry shift to cloud, with its Nuage Networks™ and CloudBand™ products. The new Service Event Manager product line features eight main service-oriented assurance building blocks, as shown in Figure 5.

Figure 5. Dynamic Assurance: Service Event Manager components



The main Service Event Manager components are:

- Motive Service Event Manager (SEM)
  - SEM Service Operator Dashboard: Monitors alarms and service levels, ensures trouble ticket resolution, tracks work in progress, performs network and service analysis
  - SEM Unified Event Manager: Collects and presents faults from a telecommunications network and cloud/IT infrastructure

- SEM Advanced Correlation: Performs more vigorous RCA and service impact analysis (SIA) than in traditional fault-management systems
- SEM Service Trouble Manager: Manages troubles if network- or service-related faults cannot be restored automatically and manual intervention is required
- Motive Service & Unified Resource Engine (SURE): Handles network and application data flow reconciliation and logical service/network abstraction

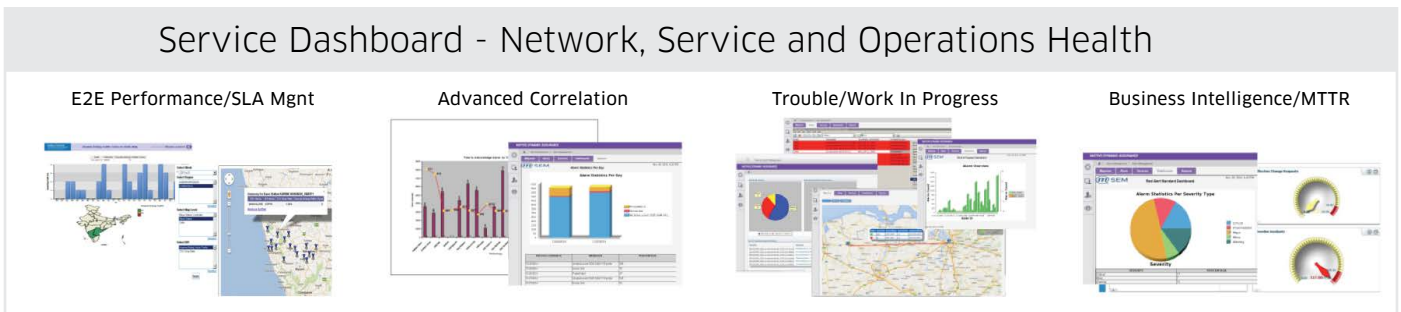
The Motive SEM exceeds typical assurance solutions by providing advanced features and functionality:

- Management of services and cloud events end-to-end in addition to the network or applications
- True SIA and advanced correlation
- Advanced topology-based root-cause correlation across all domain types
- Automation of trouble and problem ticket management
- Enabling of automation and recovery actions
- Provision of synthesized service-aware information to performance- and quality-management systems

## SEM SERVICE OPERATOR DASHBOARD: UNIFIED VIEW

The SEM Service Operator Dashboard is the most common component of Motive Dynamic Operations and is used for all variations of the suite. This approach ensures an easy-to-use and unified GUI, with sample screens shown in Figure 6.

Figure 6. SEM Service Operator Dashboard: Sample screens



In the past, infrastructure was managed based on technology domains or silos, with different operators and related GUIs. Service-focused operations require a top-down approach that unifies the infrastructure and service-level management processes. Traditionally, operators assumed that if network components were performing well, so would the services they supported. This assumption must be replaced with end-to-end visibility across disparate technologies, vendors and device types on a multitenant basis.

### Unified user portal for information access

In our data-driven world, a huge amount of network and applications data must be collected from any protocol in any format or data feed, normalized, and stored in a unified data warehouse. Using this comprehensive data source and a range of Motive big data analytics applications, sophisticated thresholds, rules and policies can provide

the required useful information. The information and policies include performance metrics, correlation results, and complex filtering of events in near-real time or on demand. In addition, alert views and alarms must be immediately accessible and stored for historical reports.

A unified user portal must present this complex information in an easy-to-use and understandable format. This unified approach gives a complete end-to-end representation of the network infrastructure and the services it supports in real time.

## Powerful GUI views

Using maps or other widgets, the SEM Service Operator Dashboard GUI provides views of relevant events, such as alarms or alerts generated from data stored in the processing layer. Maps are geographical views that display the alarm information using topological — logical or geographical — data. From the graphical overview, users can drill down to specific elements of the impacted services, such as resources, termination points and paths.

We recommend that the SEM Service Operator Dashboard cover at least two topics, as shown in Figure 6:

- Geographical overview of service or network status: Users can select a preferred view, depending on their roles
  - Summary of the main services and network KPIs related to:
    - Availability
    - Performance
    - Utilization
    - Retainability
- Detailed overview of the most critical issues:
  - Impacted service list
  - Tickets that are critical or in jeopardy
  - Breaches to SLAs or Service Level Objectives between a CSP and a customer or between business entities

## MOTIVE SERVICE EVENT MANAGER: KEY FEATURES

Service Event Manager is an end-to-end integrated service-assurance solution that provides a range of features:

- Automation assurance capabilities with flexibility and predictability
- Dashboards based on a consistent set of data for real-time and historical information to support a variety of users
- Normalized data such as events, metrics, policies and topologies provided; rapid integration and development of adapters from a wide range of systems, applications, networks and devices
- Well-defined processes and solutions to automatically recover from common problems
- Incorporation of standards and frameworks such as the TM Forum Enhanced Telecom Operations Map (eTOM) Business Process Framework<sup>2</sup> and AXELOS IT Infrastructure Library (ITIL®)<sup>3</sup>

<sup>2</sup> TM Forum, Business Process Framework (eTOM). <http://www.tmforum.org/BusinessProcessFramework/1647/home.html>

<sup>3</sup> Axelos, Ltd., ITIL website. <https://www.axelos.com/itil>

## CONCLUSION

The Motive SEM provides a unified approach to service assurance and features an open software framework. The SEM incorporates current development principles such as automated testing and light, open APIs such as REST. The software is built on a single convergent database and presentation interface.

The SEM provides full-featured fault, performance, topology and service management accessed from an overall user portal with dashboards and proven scalability. Alcatel-Lucent provides a platform and tools that empower its customers, who can adapt and configure out-of-the-box best practices according to their specific needs.

The architectural evolution of the SEM to support CSP services has followed evolutions in other industries, such as customized software, middleware-powered systems, and best-in-class systems in customized architectures. Each evolutionary step has reduced implementation costs, time and risks.

Using the process-oriented SEM modules, CSPs can quickly implement and upgrade the SEM to complement, add to or replace existing management systems. The SEM decreases integration problems by simplifying the interfaces among different management domains and exposes only the service characteristics outside the NOC. The software provides a standard services view of operations from a single source, ensuring data consistency and decreasing redundancy.

The Motive Service Event Manager solution represents a profound evolution in the operations philosophy of today's CSPs: from "keep the network working" to "provide excellent customer experience".

For more information about Motive customer experience solutions, please visit <http://www.alcatel-lucent.com/solutions/motive-customer-experience>

## ACRONYMS

API	application programming interface	KQI	Key Quality Indicator
B2B	business-to-business	MTTR	mean time to repair
BSS	Business Support System	NFV	network functions virtualization
CAPEX	capital expenditures	NMS	network management system
CSP	communications service provider	NOC	Network Operations Center
E2E	end-to-end	OPEX	operating expenditures
EMS	element management system	OSS	Operations Support System
eTOM	TM Forum Enhanced Telecom Operations Map	PaaS	platform as a service
GPS	Global Positioning System	RCA	root cause analysis
GUI	graphical user interface	REST	Representational State Transfer
IaaS	infrastructure as a service	SaaS	software as a service
IP	Internet Protocol	SDN	software-defined networking
IT	information technology	SIA	service impact analysis
ITIL	AXELOS IT Infrastructure Library	SLA	Service Level Agreement
KPI	Key Performance Indicator	SURE	Service & Unified Resource Engine
		VNF	virtualized network function

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