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Why Operators Must Simplify Network Configuration

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Impediments for speed and accuracy

Communications service providers (CSPs) need to continually provision, de-provision and reconfigure both services and network elements to optimize network performance, reliability and security as well as sell business services to their customers. For those who manage this process the job is demanding, time-sensitive and prone to human error. Their ability to perform these continual and often manual configuration tasks affects both revenue and expenses.

What CSPs need is a way to automate the process in a way that optimizes speed, accuracy and reliability for all services and network elements. This need gets harder each passing day as network elements multiply, services become more complex, trends such as virtualization, cloud and mobility make networks highly dynamic, management struggle to maintain adequate staffing levels, and economic pressures require operations to do more with less. For these reasons CSPs need a solution that automates and simplifies the configuration of network elements.

Some point solutions exist for specific services but those are usually vendor-specific. What is needed is a solution that is as simple to implement as point solutions, but deliver on the promise of custom developed, full spectrum solutions. A model-driven approach with the primary goal of guaranteeing network consistency provides this solution. This simplification of network configuration management can deliver increased service velocity and operational excellence while at the same time reducing operating expenditures.

Today CSP's networks and services are complicated, flexible, and offer customers a range of differentiated products. Operations and marketing must liaise over what could be ordered by the customer, based on what service they already had, based on the network they would use, based on current available resources. Networks have grown up as stovepipe offerings with their own vendor- and service-specific management capabilities. Customers now demand one-stop shopping for all of their networking needs but the underlying legacy systems cannot provide that type of agility.

Given the upside of increasing service velocity and operational excellence, most network operations organizations have reviewed the bottlenecks and sought to automate service delivery. Many process improvement projects seem to start at the business processes and work through the various BSS and OSS systems. Unfortunately, this top-down focus on service process improvement has left a deficit in the actual deployment of configuration changes to the network elements. Current methods for this include some variation of manual work, ad hoc scripts or adapters deployed through extensive consulting projects. All of these current methods have limitations.

The most critical areas for review are in parts of the network where service deployments require frequent and/or complex chain of changes to multiple network elements, e.g. VPNs for enterprises. These are expensive to fail because they are difficult to rollback to the original state. A typical example of frequent configuration management is when new network elements are required to keep up with explosive traffic demand. All of these configurations are time consuming and could have dramatic service level agreement (SLA) charges to the CSP if there is a failure. Compounding the problem, network engineers routinely access individual network elements and manually change the configuration to update the network or troubleshoot problems. This unsystematic change is typically done without documentation thereby making it impossible to maintain accurate inventory systems. Rollbacks are based on attempting to manually back-step the initial fix. Inventory systems with inaccurate information prevent true automation of service orchestration because there is a breakdown in the view of how the network elements are configured.

Key challenges:

- Services are defined in specific locations of the network and are tied to specific network elements
- Lack of standards adoption prevents true multi-service and multi-vendor capabilities
- Writing network element configuration to network elements is an after-thought
- Accurate configuration inventories and rollback policies are currently seen as nearly unobtainable

Architecting a new approach:

Starting fresh with brand new network architecture is a luxury that few established CSPs can afford. Nor does it make sense to adopt a single-vendor solution. Any network configuration management solution must be able to easily fit into the existing network and take advantage of existing northbound interfaces to the BSS/OSS system as well as leverage the existing southbound interfaces for managing the current and future network elements. This enables current staff to quickly adapt to the new technology as well as taking advantage of existing capital investments by leveraging network elements.

As we have seen, the breakdown in the service delivery process often occurs at the last step of fine-grained network configuration. Any new approach must dramatically reduce complexity and ensure that the entire process is fail-safe. This focus on detail must start at the network element itself to ensure service delivery integrity.

What CSPs need is a way to automate the process in a way that optimizes speed, accuracy and reliability for all services and network elements.

Many attempts and even highly successful products have been created for a service at a single network segment by a specific vendor. However, these point solutions fail to provide a unified toolkit for a multi-vendor environment, which may lead to vendor lock-in. The goal of any new approach must provide an extensible solution. It must be architected in a manner that can be used in any area of the network and capable of managing any network element that can be remotely configured – either physical or virtual. There must be a way to handle the complexity of each service, existing or future, that is delivered and of each network element that is management in a scalable, rule-based fashion.

New approach expectations:

- Leverage the existing network and OSS/BSS infrastructure, including existing northbound and southbound interfaces
- Reduce complexity and make it fail-safe--solve it in the right location, i.e. in the network (not in the higher-layer workflows)
- Provide an extensible solution, i.e. no hard-coded knowledge of network elements or services

A logical approach to network configuration

Beginning with the end in mind establishes the key criteria for success in advance. Computer science principles have been used extensively in other industries such as banking and transportation for decades. This logical approach to solution design is new to the network industry. A logical approach is the key to making CSP's networks behave as reliably as commercial banking systems. This paradigm shift can offer great benefits regarding how to manage networks.

Product that is plug and play--Reality requires that the network configuration solution can be inserted into an existing complex network. Industry experience shows that there is much greater time to market and less risk of project failure if the solution is a standard product rather than an extensive project engagement. It should be critical that the product has interfaces that are familiar to network operations

today in order to avoid any extensive training. This can only be achieved by introducing an abstraction layer with standard interfaces to existing service workflow processes/OSS (northbound interfaces) and to existing network elements (southbound interfaces). It should be possible to use any northbound interface and have it translated into any southbound interface and vice versa.

Guarantee consistent network--It is a business imperative that operations has control and manageability of network reliability. In computer science, the transactional model is a set of properties that guarantee that changes are processed reliably. In the context of network management, this requires that all the multiple steps and various commands of a service or network change request are set-up as one single transaction. Therefore if any part of the process fails, the earlier steps are rolled back automatically to ensure a consistent state. Validation happens before activation, so plain invalid configurations never need to affect the live networks. If any part of the activation process fails, for example breaks in a SLA, the earlier steps are rolled back to ensure a consistent state. An example of a single transaction as defined by Tail-f's NCS would be increasing the allocated bandwidth across all connections on a VPN network.

Model driven--Building a product that has full transactional integrity and that is also highly extensible requires a model-driven approach. The constraint of not having the product itself filled with hardcoded knowledge of specific services and network elements requires that there are simple and powerful methods for adding that information on demand. Writing service models and network element models into a model-driven system can capture specific information necessary to manage unique services and network elements. The models must be written based on industry standards rather than on propriety vendor-specific approaches.

Computer Science Pillars of Network Configuration

Build a plug and play product – introduce an abstraction layer with standard interfaces

Guarantee a consistent network – full transactional integrity

Offer model-driven extensibility – meaning all information about services and network elements are specified in data models – open in standardized language and external to systems

Computer scientists tackle networking

Tail-f Systems has extensive background in Computer Science with multiple PhD degrees in computer science and networking. This logical approach to network management deriving from the field of Computer Science has advanced Tail-f product development in ways that offer extensive benefits to our customers.

Industry experience shows that there is much greater time to market and less risk of project failure if the solution is a standard product rather than an extensive project engagement.

Tail-f NCS--The Tail-f Systems product is an extensible network abstraction layer that easily fits into existing OSS/BSS systems or workflow applications through standard interfaces. The goal of the offering is to be up and running within a week of deployment using existing interfaces already familiar to operations. Many customers start by initially using the product to provide a multi-vendor CLI to manage the configuration of existing network elements such Cisco, Juniper, Ericsson and NSN in one unified interface. As operations becomes more familiar with the power of Tail-f's NCS product, the additional northbound and southbound interfaces can easily be implemented.

Network Consistency--Tail-f's Computer Science approach to network provides a logical method to reduce complexity by insisting on fail-safe transactions. As a result of this approach, Tail-f's NCS maintains a valid and accurate image of all network element configurations deployed in the network. Using this valid image, Tail'f's NCS can reconcile with the existing inventory database. Tail-f's NCS built-in automation toolkit speeds up the process of deploying new network services. Automation replaces the ad hoc manual configurations that are error prone and often result in service failures. The toolkit reduces the complexity of managing large complicated networks and enables new services to be quickly deployed without the stress of worrying about network consistency during the multiple-step provisioning and activation process.

Highly Flexible, Future Proof--Tail-f's NCS is a model driven product that leverages standard protocols for network configuration and service and network element modeling. Standards are becoming widely used and endorsed by leading network equipment providers in part as a response to CSPs demand for easier programmability of the network or software-defined networking (SDN). Leveraging these standards enables the product to be used in a wide

variety of services and network elements. This applies to any services that can be defined in a configuration workflow. Most new network services can be modeled within a week. Tail-f's NCS can manage any element that can be configured remotely, including cloud (virtual machines/hypervisors) making it truly multi-vendor. Models of new network elements can be modeled within two weeks. Tail-f's NCS offers pre-built models but provides an extensible framework.

Business Benefits

- Increased quality of service--reduced outages or downtime as a result of configuration mistakes
- Reduction in operating expenditures--significantly less staff required
- Increased service velocity--reduction in complexity and automation of the service and network element configuration can speed time to new services
- Increased freedom from specific technical competencies and vendor lock-in

Tail-f's NCS is a model driven product that leverages standard protocols for network configuration and service and network element modeling.

Conclusion:

Competitive pressures continue to escalate and new alternatives must be found. Tail-f believes that the logical model-driven approach to simplification of network configuration management offers a dramatic reduction in operational expenditures while also improving service velocity and operational excellence thereby increasing revenue.

This article is sponsored by Tail-f Systems.

About Tail-f Systems: Tail-f Systems is the leading provider of configuration management and network automation software. Service Providers use Tail-f's technology to quickly integrate powerful network abstraction layers to their OSS systems and benefit by bringing network services to market faster and more reliably. Seven of the ten largest global networking equipment providers are Tail-f Systems' customers.Network Equipment Providers use Tail-f's software to build on-device management systems and EMS/NMS platforms in less time and with differentiated capabilities. Tail-f Systems is one of Stratecasts' 2012 **Global OSS/BSS** *10 to Watch* Companies and a Red Herring Top 100 company. See www.tail-f.com.