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Multi-dimensional Analytics: Why Real-Time is Critical

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Software Defined Networks (SDN) and Network Function Virtualization (NFV) promise to dramatically lower both CAPEX and OPEX for Communications Service Providers (CSPs), while at the same time providing their customers with new, innovative services faster and more reliably. Any one of these benefits would be a tall order to fulfill. Addressing all of them, at the same time, is clearly a challenge; especially if the CSP is still relying on traditional methods.

To address this opportunity, forward thinking service providers are automating as much of their back-office as possible. Traditionally complex and time consuming functions like network optimization, network element configuration, service provisioning and troubleshooting can now being done with little or no human intervention. The key to unlocking this potential is an analytics solution that provides the system with the right information at the right time.

It's not just about the network any more

To achieve these lofty goals, service providers need to focus on three aspects of their business: customers, services and network. While managing each of these in isolation is possible, it will likely not bring about the desired outcome. Optimizing the entire solution is a more complex, multi-dimensional problem involving trade-offs between these three concerns so that the best overall outcome is achieved.

For customers, the CSP needs to focus on Quality of Experience (QoE) metrics such as throughput, latency and packet loss. If the customer is not happy with their experience, then they are more likely to leave. Customer churn impacts not only revenue. Landing or replacing customers represents a significant cost to the business as well. Issues in the network impacting customer QoE can have immediate and lasting repercussions. Ideally these issues need to be uncovered and dealt with before the customer notices. Real-time or near real-time KPIs are a must for managing customer QoE.

For services, SDN and NFV have enabled a DevOps approach to introducing new services to customers, where services can be created and deployed in hours or days rather than months. This ability is expected to drive significant innovation and competition for CSPs. At the same time,

customers will still expect these new services to perform flawlessly from the outset. Being able to generate service level KPIs, such as dropped calls, authentication failures, and key resource exhaust is critical for managing the introduction and ongoing support for these services, otherwise customer QoE will suffer and customer churn will result. Consequently, these KPIs must also be real-time or near real-time.

For the network, there are two primary needs: addressing changes in the demand on the network and addressing failures within the network. Issues involving changes in demand can be as simple as the introduction of a new, popular service which drives additional traffic through the network to something short-lived but highly visible, such as a major social media event, like the Super Bowl, which can drive enormous amounts of traffic instantaneously. Demand changes can also be periodic in nature, like daytime versus nighttime demand or weekday versus weekend demand. While not addressing these types of issues will eventually lead to lower QoE, and, therefore, customer churn, the KPIs associated with demand changes do not, typically, need to be real-time. On the other hand, addressing failures in the network absolutely requires real-time KPIs, both for the detection of the failure and the assessment of the fix. The industry norm for 50 mSec recovery from a failure remains a necessity, even in the virtual world.

Closing the loop

If automation is the key to unlocking the value of SDN and NFV-based networks, then feedback is the key to automation. Automation works as a closed loop control system, continually generating Key Performance Indicators (KPIs) from the network, comparing these indicators to reference values and adjusting the network to compensate for differences between the reference and actual values.

There are five major building blocks in this closed-loop system:

1. **Collection**: Gather data from the network to evaluate performance. Must include customer experience metrics, service data, network data and external event data;
2. **Modeling**: Managing reference models of the network and all services, including rules to detect when the actual network and the reference models are not aligned;
3. **Analysis**: The engine that takes in the real-time and historical multi-dimensional KPIs (customer, service, network) to compare against the reference models to predict service issues;
4. **Advisement**: Developing recommendations for changes to be made to the network to address predicted service issues; and
5. **Adjustment**: Making the accepted change recommendations to the network. In the SDN/NFV network, this is the role of the Orchestrator.

As you might expect, the frequency at which this control loop operates can have a significant impact on the intended result. Imagine if this loop only operated once a day, which is essentially the way network operations work in traditional networks – gather data, generate reports, analyze the reports daily. At this rate, it may take days to detect and fix a service issue! Speeding up this loop, through the gathering of real-time KPIs fed into an analytics engine to produce recommended changes which can then be acted upon by the orchestrator will clearly improve the time to detect and correct, hopefully to the point where the customer doesn't even notice the issue.

However, this speed needs to be managed properly or else the system runs the risk of becoming unstable. Consider a hypothetical system where service KPIs are generated every 1 mSec and fed to an analytics engine which generates recommendations every 10 mSec. These recommendations then get fed to the Orchestrator which issues prioritized changes every 10 mSec and those might take 5 mSec to be implemented. This means that the length of time it takes from detecting an issue to implementing the change may be as much as 26mSec. In that time, our hypothetical system has generated 26 new KPI values along with 2 more recommendations for changes and 2 more sets of changes implemented. In a worst-case scenario, the orchestrator may push up to 2 additional requests for resources to the network before seeing the impact of the first request. This would then require additional changes to take back some of the additional resources leading to an inefficient use of the network resources.

But equally important is the task of understanding which information to act upon first. In our multi-dimensional analytics model, with customer service and network KPIs, the analytics engine must be able to prioritize all the KPIs from the different dimensions to understand the true root cause and recommend the appropriate action. A failure in the network of a key piece of equipment may lead to degraded KPIs for a set of specific services, which may in turn lead to degraded KPIs for certain customers. While it might, on the surface, appear that the right thing to do would be to modify each of the impacted services, it would, in fact, be more appropriate to modify the network itself to deal with the outage; for example, spin up a new virtual router or move certain VNFs to another server or data center. If the analytics engine does not have real-time visibility to the customer, service and network KPIs, then it is likely to produce inappropriate recommendations to the orchestrator.

As Service Providers continue to be driven to reduce OPEX, become more service agile and provide their customers with the highest QoE possible, and all at a scale that will drive growth and innovation, the role of automation driven by Real-Time, Multi-Dimensional Analytics becomes the critical piece of this puzzle. Having access to the right information at the right time means better decisions are being made, fewer resources are being used, and customers are getting what they purchased.