WHITE PAPER

Communications Service Providers
Service Assurance

Accenture* Integrates a Platform Telemetry Solution for OpenStack*

Using open source software and Intel® Xeon® processor-based servers, Accenture Cloud Innovation Center has created a service assurance solution that meets the needs of a tier one communication service provider.

Introduction

Communications service providers (CommSPs) are transitioning to virtual services based on network functions virtualization (NFV) and software defined networking (SDN). Virtualized services based on virtual network function (VNF) software can be deployed locally or in the cloud, and redeployed when it makes sense. The transition has progressed through the proof of concept and trial phases where CommSPs developed the network architecture and the initial orchestration mechanisms and processes. These functions need to be managed and monitored, as do the underlying hardware and virtualization resources hosting the new virtual services. The ability to manage and operate virtual networks in the same manner as physical network technologies is an essential requirement to realize full operational efficiency benefits.

These management and operational needs are becoming more critical as these services are entering the production phase. Intel® Network Builders ecosystem partner Accenture* developed a service assurance system based on open source software that delivered dynamic and comprehensive Intel platform telemetry data for virtual network infrastructure.

Adapting Service Assurance to Virtualized Networks

Telecommunications service assurance systems provide insights into service utilization and malfunctions that can cause disruptions to service levels. Typically, the scope of these service assurance systems covers fault, capacity, accounting, performance, and security (FCAPS) attributes of the network. Network engineers can use the data from service assurance systems to promptly resume operation in the event of a failure. While bringing many benefits, transformation to the virtualized network paradigm increases general platform complexity by introducing additional virtualization-related layers. The health and available capacity status of various hardware and software platform components is likely to have a direct effect on the quality of service delivered by the entire NFV solution. Delivering a comprehensive set of platform statistics is essential to operating a telecommunications service with the performance and network uptime that customers expect.

Communications services providers utilize long-established service assurance methodologies with multiple systems to collect data at intervals and provide it to a reporting framework. These systems typically come from multiple vendors and are configured in a defined service chain and based in a central office. These frameworks have worked well for legacy services, but they need to evolve to match the decentralized and dynamic nature of NFV/SDN-based virtualized services.

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NFV orchestrators and SDN controllers used in virtualized networks can relocate virtual network functions (VNFs), re-route data traffic, or reconfigure services on demand. Service assurance systems must also be configurable and adaptable to continue to measure the health of these virtualized services. Systems have to be aware of the operating status of the underlying hardware infrastructure hosting the virtual services in order to give an accurate assessment of what is going on in the network.

To offer complete service assurance, service assurance tools must provide the following:

- Automated service optimization and remediation
- Closed loop feedback to assure service integrity
- Dynamic service level agreement (SLA) management to monitor SLAs in real time even as the service evolves and changes

All of these features must tie into analytics capabilities that include performance roll-ups and trend analysis as well as snapshots of the service at any point in time.

For its NFV deployments based on OpenStack* virtualization technology, Accenture integrated a Collectd*/Graphite*/Grafana* stack to provide infrastructure service assurance with a single integrated solution.

Accenture's Integrated Service Assurance Solution

As a first step Accenture outlined its service assurance solution features, in accordance with most common customers' needs collected during the NFV journey, as follows:

- Adjustable and granular sampling intervals: The services being monitored need frequent data samples (a sample less than every 20 seconds) to ensure that service issues are exposed as early as possible.
- Comprehensive set of metrics: The system needs to capture a set of metrics large enough to provide insight into the performance of both physical and virtual servers.
- Customizable visualization: Assurance dashboards need to be flexible and enable the building of new dashboard graphs and metrics to reflect new monitoring needs for services.
- No vendor lock in: This was accomplished by the use of open source software for key parts of the solution.

Accenture developed its solution based on Collectd, Graphite, and Grafana, three open source tools that provide a framework for collecting, reporting, and visualizing time-series data such as service assurance data. Each of the tools provided a specific capability:

- **Data collecting:** The solution used an API-based customization for Collectd that ran on the hypervisor to gather metrics from the operating system of the virtualization platform, and enabled collection of VNF metrics without any kind of agent that runs on the guest VM. Data collection was extended also to external infrastructure and applications through Collectd distribution and configuration, which enabled a centralized visualization console for the entire stack. Collectd is a Unix* daemon able to store these metrics locally or make them available to a time series database, which is how Accenture configured the system. Data gathered by Collectd is used to monitor systems and provide performance analysis and capacity monitoring. Collectd can scale to handle hundreds of thousands of metrics and offers more than 100 plugins that give it flexibility in data gathering and display. Accenture made use of plugins from Barometer,* an open source project that provides a set of tested and validated plugins. Barometer, formerly known as Software Fastpath Service Quality Metrics, aims to let carriers enforce SLAs or detect violations, faults, or performance degradation of network functions virtualization infrastructure (NFVI) resources so that events and relevant metrics are reported to higher level fault management systems. Barometer is designed to add the ability to monitor traffic and performance of physical and virtual networking interfaces as well as to monitor key hardware platform performance levels, including CPU, memory, load, cache, thermals, fan speeds, voltage, machine check exceptions, etc.
- **Data storage:** Graphite is an enterprise-ready time-series database designed to make it easy to store, retrieve, share, and visualize time-series data.
- **Data visualization:** Grafana is an open source platform for analytics and monitoring of time series data. Grafana allows users to visualize and understand trends within vast amounts of metrics data. Visualizing data helps teams monitor their environment, detect patterns, and act when identifying anomalous behaviors.

In case of diagnostics and after-the-fact root cause analysis, visualizing performance data helps operators understand what happened at a given point in time on the entire infrastructure and find possible correlations.

Grafana has tools that allow the user to query data from a number of databases, then to create dashboards that can be shared to examine the trends in that data.

To build the fully integrated OpenStack service assurance program using these applications, Accenture had to first customize some Collectd plugin configurations provided by Barometer and build custom scripts to retrieve additional information from hypervisor CLI and ensure that data was stored in the correct format. That was necessary to improve data analysis capabilities through metric names display and object relationships. The Graphite database also needed to be configured to customize user credentials and specific retention/aggregation customer policies. Accenture also needed to develop drivers (variables, regular expressions, naming convention) that could be used with Grafana to enable the building of easy-to-use and fully parametric dashboards that enabled scaling without any reconfiguration as the number of monitored servers or VNFs expanded.

Usually siloed (one for each technology vendor or component) solutions require the use of multiple databases, agents, and consoles that limit hardware platforms statistics to counters available via simple network management protocol (SNMP) or intelligent platform management interface (IPMI), and granularity is usually set to 288 samples per day.

The Accenture solution, shown in Figure 1, includes a Collectd agent on each storage, compute, and controller/director element in the server. These agents provide the performance management information that is essential to service assurance applications. The design provides a complete undercloud/overcloud solution with a single database for metrics collection and a single console for graphing and data visualization. This solution maximizes information manageability and customization as metric sets can be expanded, if necessary, through Collectd plugins and visualizations/data aggregations are configurable in Grafana via Graphite REST API.

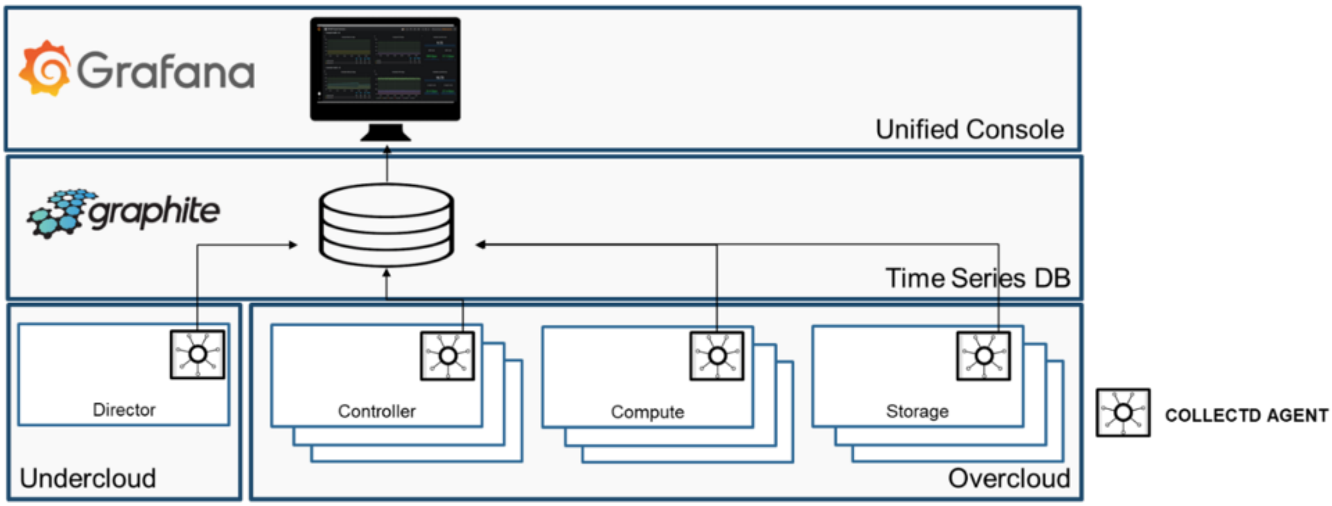

Figure 1. Accenture integrated service assurance platform*[1]

Figures 2 to 5 show the Grafana view of the hardware platform statistics (CPU, memory, and disk space) that are available after the new service assurance system is in place. These dashboards were built from scratch using Grafana web GUI. Each widget was configured specifying Graphite as data source and selecting specific Collectd metrics and statistic/temporal aggregations for series.

Figure 2. Hardware platform data visualization[2]

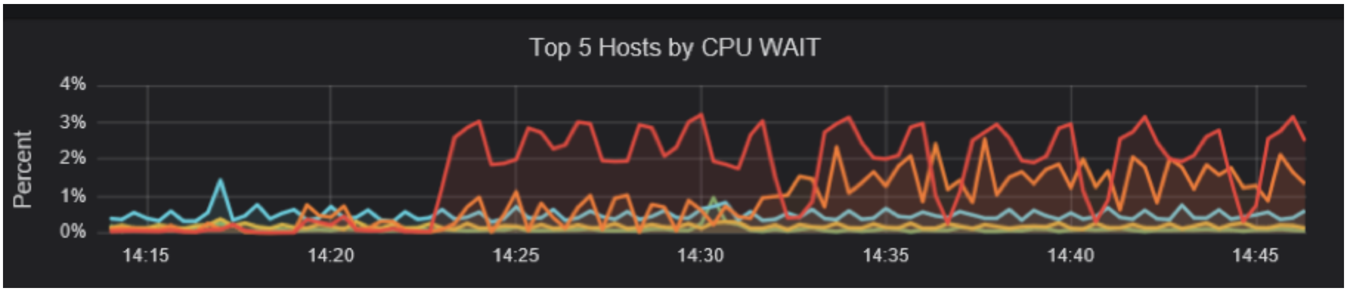

Figure 3. Hardware platform data visualization[2]

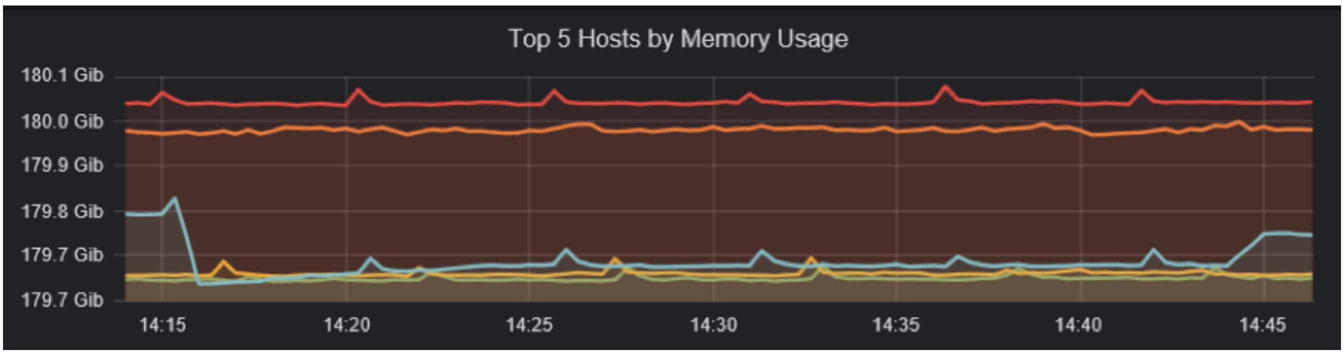

Figure 4. Hardware platform data visualization[2]

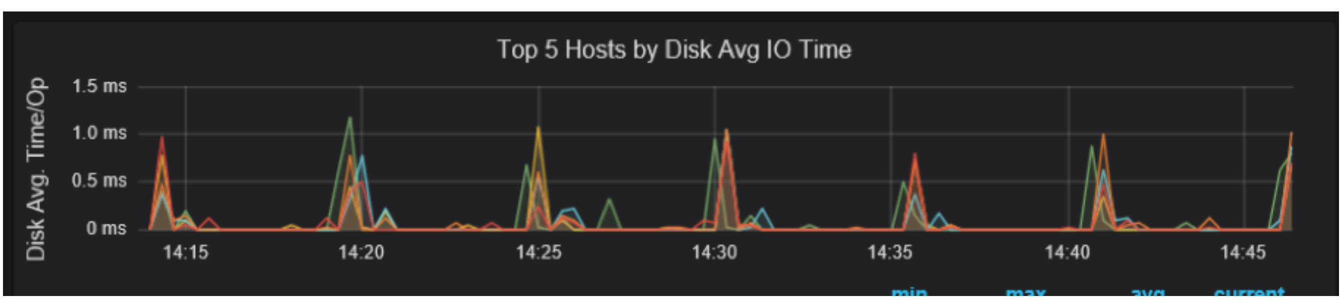

Figure 5. Hardware platform data visualization[2]

Accenture Solution Powered by Intel® Xeon® Processors

As a result of successful collaboration with Intel Network Builders, Accenture developed the service using servers powered by Intel® Xeon® processors E5-2600, using multiple generations of the processors in its work. Critical to the choice of these CPUs were both the CPUs' high performance and Intel-provided Collectd plugins available as a part of OPNFV* Barometer that made available Intel platform-specific telemetry data essential for the platform health and performance. Intel is active in open source community enabling service assurance features via its open source contributions to Barometer.

Intel is actively developing and contributing new plug-ins to enable an increasingly rich set of system resource data for use in network management and service assurance. The latest Intel® Xeon® Scalable processors are available with up to 28 cores. The CPUs feature Intel® Virtualization Technology (Intel® VT), a portfolio of technologies that provide hardware assist to virtualization software, such as OpenStack, to minimize virtualization performance overhead in cache, I/O, and memory. Each generation processor will typically offer new metrics capability, and Intel provides the plug-ins to enable these for service assurance usages.

Conclusion

Service assurance is a critical part of the service provider network that is just now becoming important for virtualized services. Accenture, using Intel Xeon processor-based servers, has integrated a carrier-grade solution from open source components that is able to proactively show a unique trend of resource usage, provide information about resource allocation and support decision making about capacity change and network troubleshooting for a live virtualized network service.

About Accenture

Accenture is a leading global professional services company, providing a broad range of services and solutions in strategy, consulting, digital, technology, and operations. Combining unmatched experience and specialized skills across more than 40 industries and all business functions—underpinned by the world's largest delivery network—Accenture works at the intersection of business and technology to help clients improve their performance and create sustainable value for their stakeholders. With 459,000 people serving clients in more than 120 countries, Accenture drives innovation to improve the way the world works and lives. Visit us at www.accenture.com.

About Intel® Network Builders

Intel® Network Builders is an ecosystem of infrastructure, software, and technology vendors coming together with communications service providers and end users to accelerate the adoption of solutions based on network functions virtualization (NFV) and software defined networking (SDN) in telecommunications and data center networks. The program offers technical support, matchmaking, and co-marketing opportunities to help facilitate joint collaboration through to the trial and deployment of NFV and SDN solutions. Learn more at http://networkbuilders.intel.com.

[1] Figures provided courtesy of Accenture.

[2] Testing completed by Accenture. Configurations: CPU for the compute server was an Intel Xeon CPU E5-2660 v2 at 2.20GHz; CPU for the controller server was an Intel Xeon CPU E5-2670 v3 at 2.30GHz; CPU for the Neutron-Ceph server was an Intel Xeon CPU E5-2680 v4 at 2.40GHz. The compute server featured 192 GB of RAM and the other servers had 130GB of RAM. Each server had 500GB hard drive (MM0500GBKAK).

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