Scaling of Diameter Peers in NFV environments using virtual Diameter Signaling Controller

Alcatel-Lucent and **Tieto®**, a CloudBand™ Ecosystem Program member, have worked together in a use case to demonstrate how to load balance Diameter control traffic. By exploring the concept of virtual network function (VNF) service chaining, in combination with the load balancing capabilities of Tieto's scalable virtual Diameter Signaling Controller (vDSC), remote peer nodes (for example, PCRF and HSS VNFs) are allowed to scale, to be taken into and out of service in a seamless manner, without any need for reconfiguration at originating peer nodes. This proof of concept explains how carriers in a controlled way can manage Diameter signaling traffic between Diameter peers in a dynamic cloud environment while also getting essential key performance indicator (KPI) data for network monitoring of Diameter traffic.

Challenge

To fully embrace the concepts of Network Functions Virtualization (NFV), mobile operators will look for deploying virtual, scalable, and elastic IP Multimedia Subsystems (IMS) and Evolved Packet Core (EPC) networks with high availability and built-in dynamics to manage network resources in a controlled manner. To successfully scale up and down IMS and EPC VNFs, managing and load balancing of Diameter control signaling traffic is a must.

Solution components

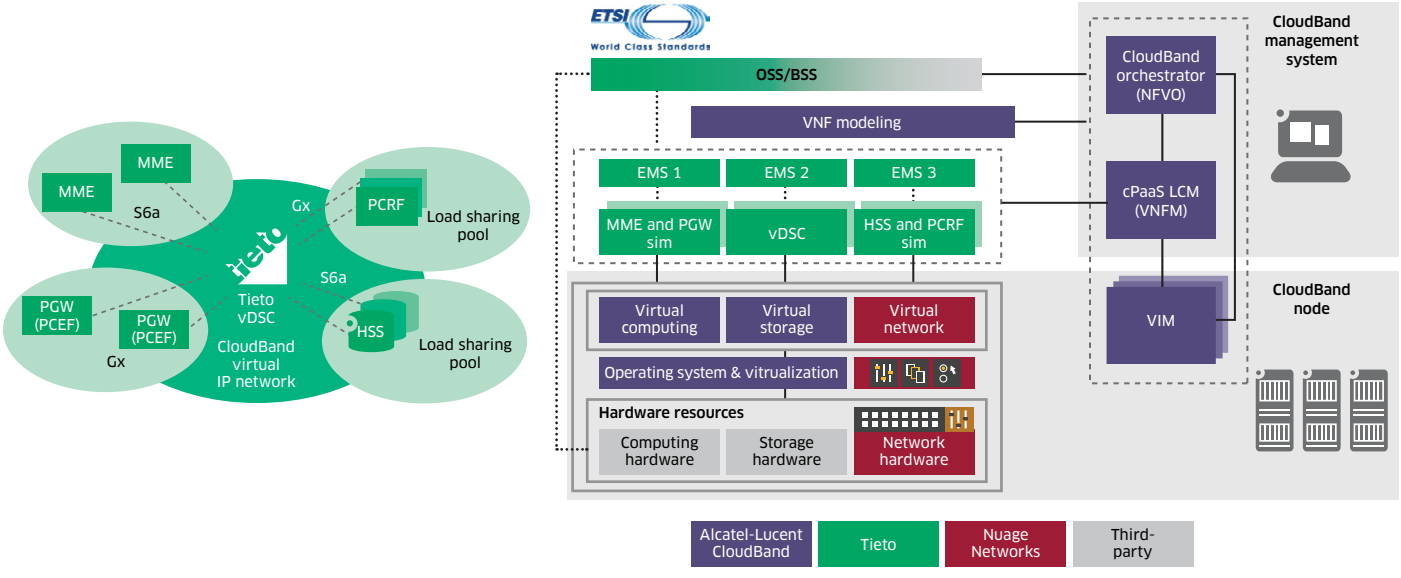
Working together on advancing NFV, Alcatel-Lucent and its CloudBand Ecosystem members can help accelerate any operator's cloud-based services through orchestration for deployment of virtual IMS and EPC solutions.

Virtual Network Function and Platform Vendor solution components

Tieto contributes with a vDSC, its virtual appliances, and cloud-enabled Element Management System (ELM). In addition, the proof of concept uses Tieto testing scripts and emulators, which generate the Diameter signaling traffic load and node simulations for MME, HSS, PWG and PCRF Diameter control signaling peers. The simulators and the Tieto vDSC are running on the Alcatel-Lucent carrier-grade NFV platform – CloudBand – installed on the Cloudband node, integrated with CloudBand Orchestration, and controlled by the CloudBand application lifecycle manager (vDSC life cycle management).

The elements of the NFV solution are illustrated in Figure 1, where the vDSC provides topology hiding and load balancing of Diameter traffic toward peer nodes (VNFs). The virtual

Figure 1. Solution architecture and Diameter network overview



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Diameter Signaling Controller is capable of acting as DRA, DEA, Relay, Proxy and Translation agent for performing advanced load balancing of Diameter signaling traffic, including overload protection and content-based routing while maintaining Diameter sessions. The vDSC VNF is deployed in several virtual machines (as Virtual Network Function Components [VNFCs]) and CloudBand services to allow in and out scaling. The VNF scaling criteria and thresholds are based on real-time Diameter traffic loads using both default (CPU load) and custom metrics (for example, active number of sessions toward peer). The vDSC metrics are presented in the cPaaS Manager Dashboard and may also serve as an input for both orchestrator decisions and carrier monitoring of the Diameter network. Simulators are used for the Diameter Gx interface (PGW – PCRF) and S6 interface (MME – HSS).

During the proof of concept the vDSC scales in and out when thresholds are met and new remote peer nodes (VNFs) can be automatically added to the Diameter network, allowing the network to scale out during peak periods of traffic. VNF service chaining is deployed between the different VNFs and load balancers, allowing the vDSC to take the VNFs automatically in or out of service without traffic disruption. Traffic distribution is rebalanced according to defined policies in the vDSC element management system (EMS) and selected distribution algorithms such as weighted load sharing.

VNF's can be taken out of service, allowing the network to scale down during periods of less traffic. Disabled nodes are removed from load distribution in a controlled way and traffic is rebalanced accordingly.

CloudBand

The Alcatel-Lucent CloudBand Management System performs VNF life cycle management and considers factors such as server load, network congestion, and latency to ensure service-level agreements are met. The CloudBand Node, as a set of computing, storage, virtualization and cloud management components, hosts the VNFs for each cloud facility in the network. With these CloudBand components, operators can establish nodes near the edge of their networks. This process gives customers quicker access to cloud resources, thus minimizing network load by shortening the distance to the subscriber and by offloading traffic as early as possible.

Figure 2. Use case flow

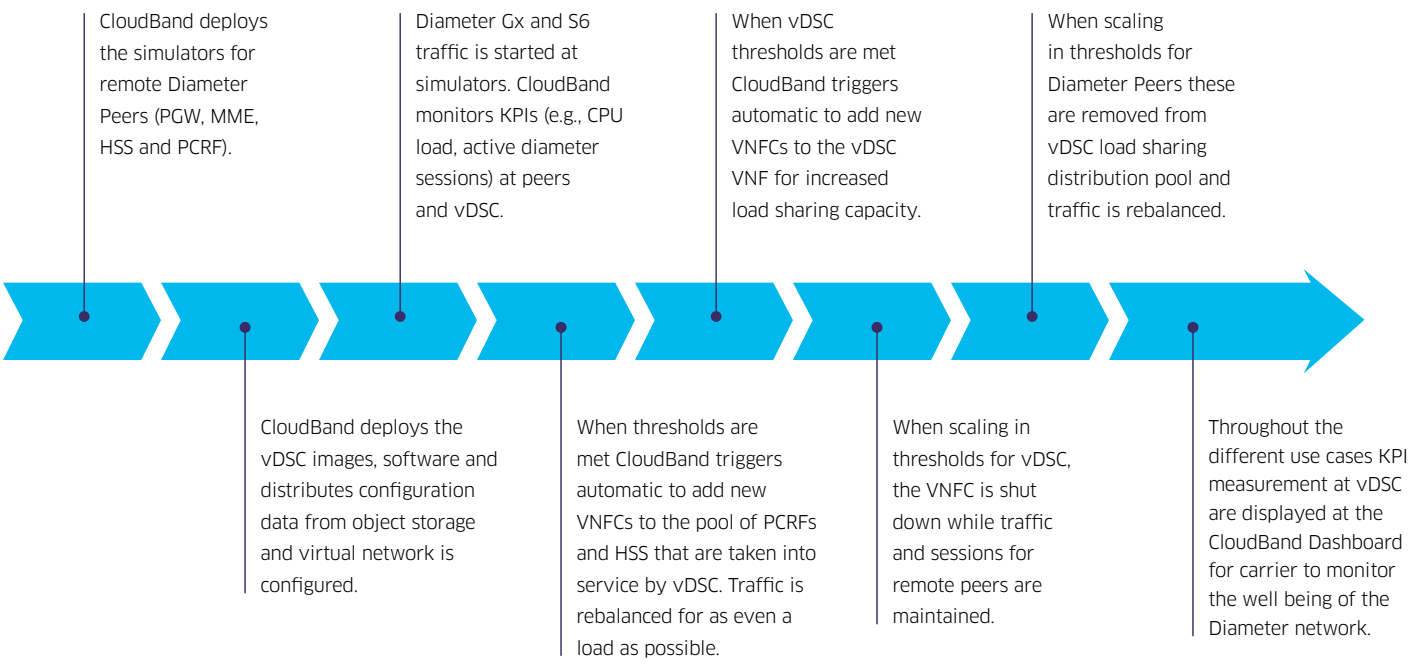

Table 1. Key benefits of each solution

CLOUDBAND ECOSYSTEM PARTNER SOLUTIONS	KEY BENEFITS
Alcatel-Lucent CloudBand and CloudBand nodes	• Enhances automation • Improves operations • Scales on demand for simplicity and speed • Hosts and orchestrates multiple VNFs contiguously • Enables automatic or manual scripting of business logic • Provides resiliency • Delivers scale-out/scale-in logic • Self-heals in case of failure • Manages distributed resources
Tieto	A leading R&D service and technology provider for NFV and telecom solutions for LTE RAN, IMS and EPC. The next-generation control signaling solutions portfolio includes vDSC which supports, but is not limited to: • DRA, 3GPP TS 29.213 • DEA, GSMA IR.88 • Diameter relay, proxy and translation agent with configurable dictionary and AVP content routing • Diameter interface support for S6, S9, S13, Gy, Gx, Gxx, Rx, Ro, Rf, Sh, and more • Transport and routing protocols – SCTP, TCP, IPv4, IPv6, TLS, IPSec, and DNS • Protocol interworking and mediation – Diameter, SS7 3GPP TS 29.305, Radius, LDAP, HTTP (SOAP, XML), JMS, and more • Load balancing, overload and congestion protection with traffic flow control • Statistic and performance counters for KPIs, CDR generation or network monitoring

Summary

Diameter Signaling Controllers, in front of IMS and EPC network nodes, provide operators with a network solution that through topology hiding and intelligent load balancing simplifies their network configurations and protects nodes from changes in network configuration settings, overload, and traffic distribution as remote peer nodes scale up or down. Additional network nodes can also be seamlessly deployed to cater for peak periods of network traffic, hence embracing the nature of the cloud and providing elastic networks. Load balancers, for example DSCs, also serve as an important source of information for providing a key network performance indicator of the operator that may serve as input for improved orchestrator decisions.

To learn more about the CloudBand Ecosystem Program or to become a member, visit:
http://ecosystem.cloud-band.com

For more information about the participants in this use case, visit:
Tieto and **Tieto control signaling solutions**

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