Hewlett Packard Enterprise

Business white paper

Rethink SDM in the era of NFV

Data Addressability is the key to capitalize on the benefits of virtualization

Table of contents

Introduction

The latest technology trends—network functions virtualization (NFV) and heterogeneous networking (HetNet)—open new business opportunities for virtual and traditional communications service providers. However, its arrival challenges fundamental concepts, subscriber features, and data management (SDM) used in core networks.

The approach and tools used by communications service providers (CSPs) continue to evolve to meet demands for enhanced individual subscriber customer models.

This white paper examines key considerations and requirements for CSPs that are transitioning their networks and operations to The New Style of Business. We also explore how Hewlett Packard Enterprise (HPE) can help during this transition, including NFV capabilities and SDM architecture.

Persistent Data Addressability

Transition to an NFV architecture also brings opportunities to rethink the role of SDM within customer network environments.

When using NFV, many virtual network functions (VNFs) can be scaled within the network. Orchestration and service chaining provide necessary coherence between VNFs to maintain smooth service delivery. However, when instances of the VNFs are scaled, the generated customer and application data are saved.

For example, IMS applications require access to customer features, such as call-forwarding preferences, call routing rules, and some transaction history. When an IMS function scales up and defers execution to a new instance, the attached data moves along with it. When an instance scales down, the same data moves into a new instance. Multiplied by hundreds of VNFs, managing the lifecycle of the customer data becomes a critical aspect of NFV operations.

So beyond the need for application and data separation—which is driven by business imperatives—VNFs also need data federation.

Using consolidated customer data from a single, logical repository lets applications retrieve information necessary to execute network functions as they scale up or down. If instances are terminated, the data is saved, or if instances are moved between operating environments, data consistency is ensured.

Subscriber data management has evolved, becoming a “network brain” for authentication and authorization at a core network level. The development of 3GPP releases 9, 10, and 11 focuses on core network data, authentication, and authorization processes, attached to the network. NFV drives the need for data federation, making SDM the point of consolidation for subscriber data, across CSP operations components.

SDM architecture feature requirements

Maintain availability
Keeping billable services available is the lifeblood for carriers’ bottom line. Availability means that carriers find ways to maintain full mobile services through network failures, traffic surges, and natural disasters. Service availability is more than recovering from failed network components or server complexes. It’s measured by the up time and seamless experience of the subscriber.

Industry news articles demonstrate the damage done to company reputations when devastating outages occur, including strong customer dissatisfaction or defection, negative press, and significant out-of-pocket recovery expenses.

In real-time mobile telecommunications environments, CSPs can't risk their mobile solutions to high-availability designs because downtime costs are too large and business impacts are too great. Those designs are well suited for commercial applications where certain levels of downtime can be rationalized. For that reason, Hewlett Packard Enterprise (HPE) bases its mobile solutions on proven, fault-tolerant, and 100 percent availability designs. We support the most important environments in the world: telecommunications, capital markets, emergency 911 systems, patient care applications, and more.

Synchronize customer data

Through NFV, network elements are implemented on top of virtual servers. These virtual servers are abstracted from their physical environment, which means their functionality is independent from the hardware plane. Traditionally, subscriber data management (SDM) network functions were implemented as centralized nodes—attached to and servicing their network. They were implemented as appliances located in multiple, geographically dispersed data centers, with some sites delivering SDM functionality—HLR, HSS, AAA, and UDR—to the whole nationwide network.

NFV enables new ways to implement SDM nodes, which potentially leads to new topologies for deployment. For example, functional instances of core network elements can be deployed at the edge of the network, which is closer to their attach points and to mobile radio networks. CSPs considering this configuration expect to give their customers better quality services with less signaling traffic traveling into the core. By using this approach, CSPs enable faster service delivery.

Distributed architectures—often referred to as "cloudified"—have more database-related traffic traveling between the distributed instances, with less traffic in the core network. SDM application instances deployed in the edge keep a physical copy of the data records it updates. These local updates of customer data must be synchronized across instances to keep a single, logical-updated copy for individual subscriber data.

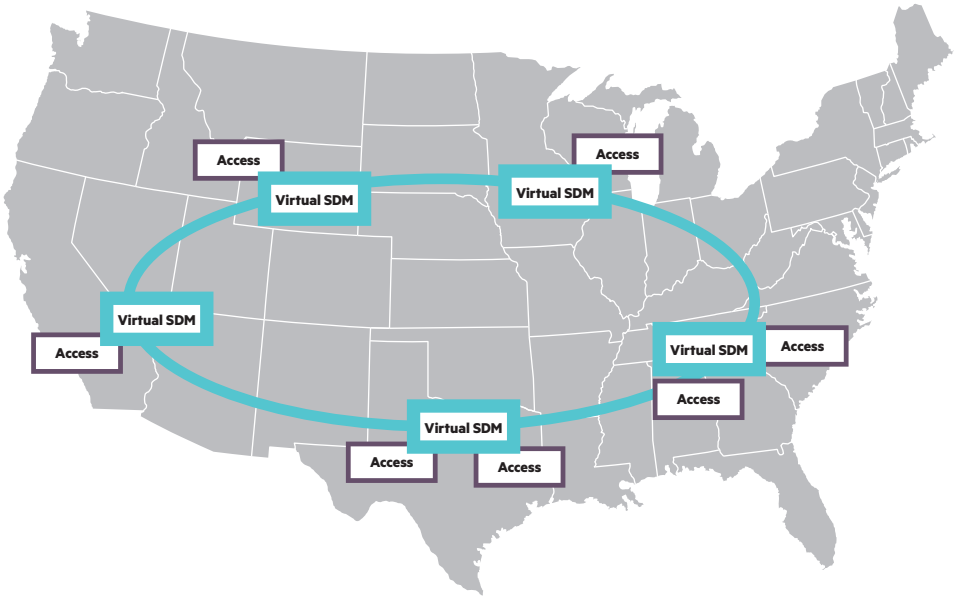

Figure 1: Impact of SDM architectures in cloud networks

In these new topologies, data repository synchronization protocols are put under significantly more pressure than in traditional implementation topologies. The number of nodes to be synchronized can increase by hundreds, and they can be spread out physically for thousands of miles. But this isn't the only challenge, since the underlying infrastructure can also be implemented with virtual routers and floating IP addresses. This adds further overlay to the intra-data center IP traffic. Thus, it results in lower quality bandwidth for the transmission network.

Our SDM technology is built into the core of our general purpose computing. This means we designed SDM synchronization protocols from the beginning—which are independent processes from the application itself and independent from the protocols used in the data repositories. These synchronization technologies have been implemented in regions physically separated by more than 6000 miles, requiring different instances to be synchronized. In these implementations, local copies of database instances embedded in the SDM were synched in real time—less than a millisecond between updates across the nationwide network.

Using our principle designs—in use for almost a decade—we built synchronization as a separate process, while continuing to use our principle designs that have been used for nearly a decade. This, makes virtual instances of SDM easy to export into a Linux® environment.

Unbundle data for open design

Our traditional approach to SDM was built over NonStop operating systems, which provide real, 100 percent fault tolerance to the network functions. Beyond that, this architecture also provided us with a library of tools, processes, databases, and administration capabilities that enable our new SDM products.

HPE SDM products are built to leverage existing libraries and tools. Per design, we implemented separation between the application and data planes, which contain processing costs in these systems. To reduce total cost of ownership for HPE solutions, we offer our SDM products as independent processes that can run in a multi-threaded software environment.

The result is data provisioning that's split from the application. Different application front-ends operate separately, but use one logical database on the back-end. This unique repository is extended to accommodate all supported application front-ends, including HLR, EIR, HSS, AAA, and more.

Unbundled designs are ported and replicated into virtualized Linux environments that are well-suited to NFV attributes.

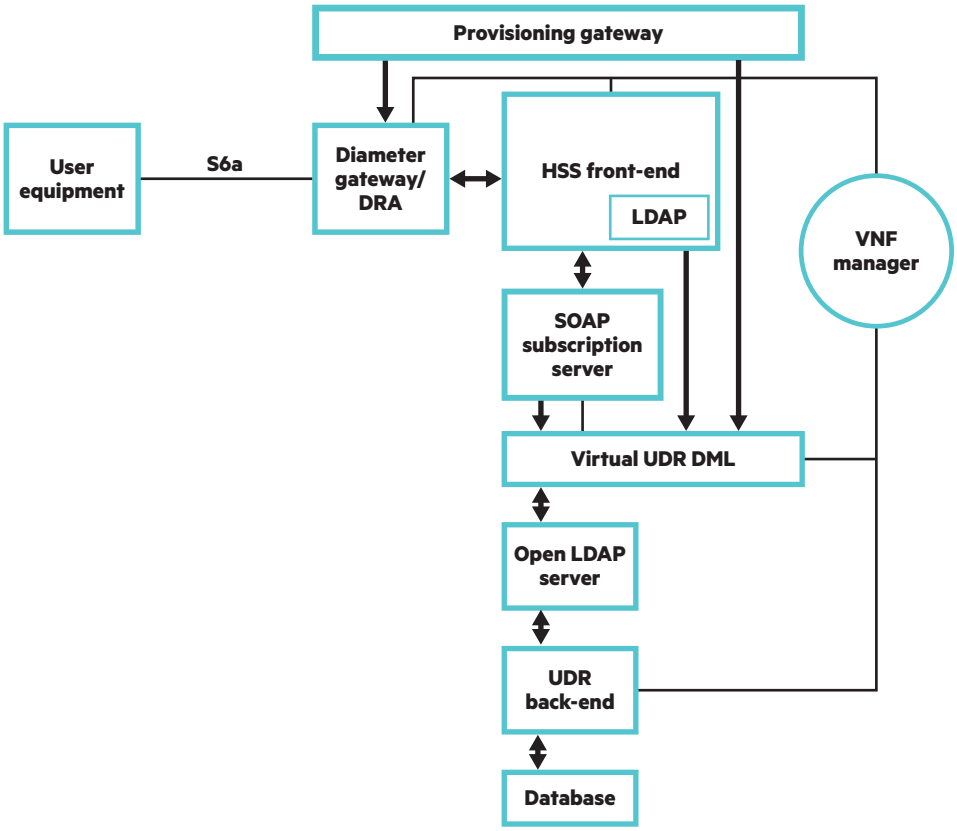

Figure 2: Open design SDM reference architecture

Splitting application data from customer data is the foundation of NFV. And, within SDM environments, it lets you scale solution transaction capacity and data records at different paces. An example is machine to machine (M2M) scenarios where some devices registered within the SDM generate very little traffic—a few syncs per month. There can be millions of connected, stationary devices, such as vending machines that generate low traffic volumes.

In contrast, connected cars generate network traffic similar to how people produce network traffic with their mobile phones. For example, both move around, sometimes traveling long distances, and they transmit large volumes of data. In this scenario, traffic volume per subscriber requires a high-processing front-end with a small database in the back-end. In a third example, smart meters generate low-traffic volume but need more capacity in its databases.

HPE architecture for SDM

To enable our vision, HPE invests in developing its SDM architecture to facilitate data federation. Our architecture investments' three main categories:

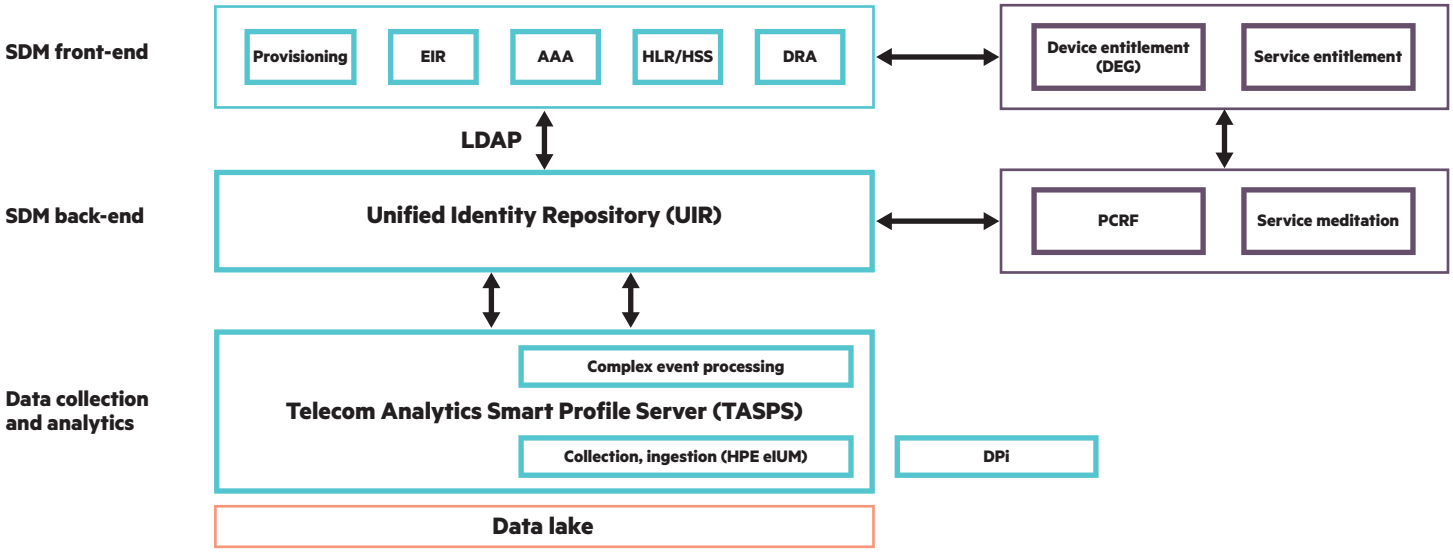

Figure 3: HPE SDM reference architecture

Schema modeling

Our new generation SDM product—HPE Universal Identity Repository (HPE UIR)—is a schema modeling tool. It ensures that third parties can design their data model within the common UDR (user data registry). The data model used by third-party vendors is mapped onto the HPE data model that supports the HLR and HSS applications. Commonalities are reused, and extensions of the data model are added to the database structure of the UDR. This way third-party applications are exposed to data abstraction required.

Open interface

HPE UIR offers a user data (Ud) interface that is flexible. It lets any third-party vendor connect through LDAP and SOAP. Multiple Ud interfaces are considered to be standardized. However, our experience shows that different implementations can vary widely. HPE Ud interface is flexible and programmable. Additionally, it can accommodate the different versions of SOAP and LDAP requests generated from third-party front-ends.

Clusterization

For the UDR to be the point of consolidation, data clustering is necessary. Service providers use NFV operations as a tool to segregate traffic from data across dedicated instances of their network applications.

For example, when CSPs lease part of their network to a mobile virtual network operator (MVNO) that operates its own mobile core, the solution is a dedicated mobile core instance with embedded SDM capabilities. With it, the MVNO benefits from NFV with fully orchestrated scalability.

HPE created a clustering tool within its UIR product. This tool lets CSPs run dedicated database instances embedded in the UIR. Each of these instances can be dedicated to a single customer or partner.

SDM and NFV leadership

Since HPE first introduced virtual home subscriber server, it's been used commercially across large customer groups. Today, it supports hundreds of thousands of subscribers. Drawing on our experience with virtualized environments, HPE can help clients with their evolution of SDM, guiding you with operational transformation and migration services.

Through experience, we have learned:

- Clients shouldn't underestimate internal requirements needed to transition to NFV-based environments. With NFV, CSPs need to adopt to a cloudified style of operation. For many CSPs, this shift requires a new organizational domain, processes, and operational measures. Additionally, new organizational domains come with specific requirements for operating SDM.
- You must design new processes when adding new hardware with a virtualization layer—even simple tasks such as hardware maintenance, software deployments, testing, and validation. HPE SDM applications have auto-discovery mechanisms built in. These enable automated traffic handover when nodes are down or when operations are moved to NFV management.
- High availability, for example, can be managed by deploying active/active nodes, and by recreating them automatically. When a node goes down, you can apply affinity/anti-affinity rules to maintain solution redundancy.

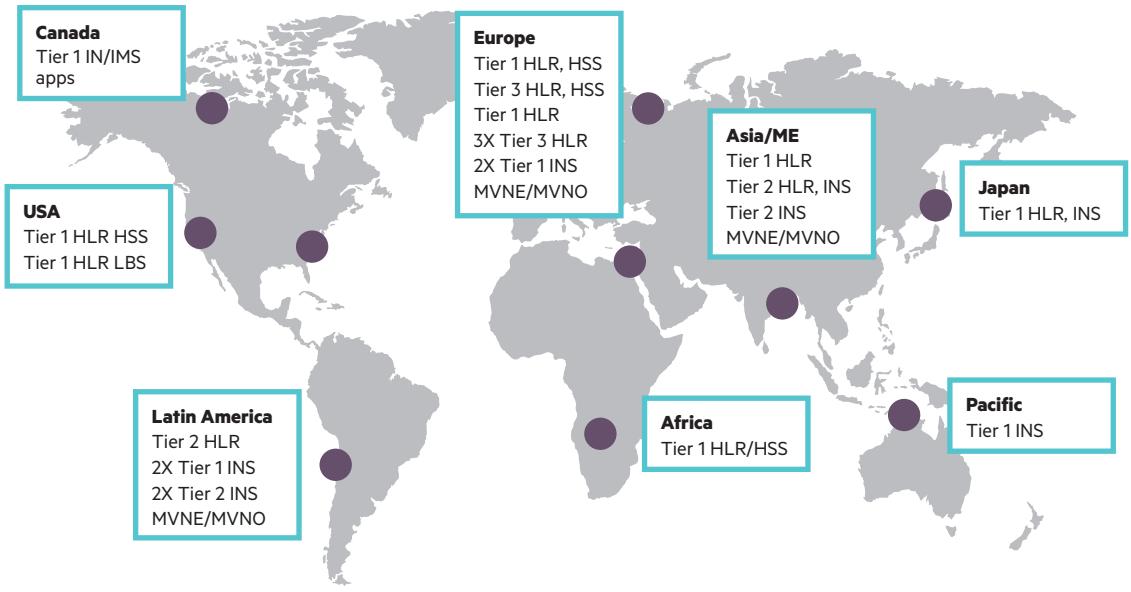

Figure 4: HPE SDM presence worldwide

NFV is central to our approach

Our experience as a leading global IT provider lets us leverage our strengths, scalability, and expertise to NFV. Using NFV as our central strategy is demonstrated by:

- Our proven experience and products address quality of service (QoS) requirements, and meet stringent specifications for latency, scalability, high availability, and real-time performance. These include our HLR, routers, and switches deployed in core network applications.
- Leadership in Software Driven Networking (SDN) with the largest portfolio of OpenFlow standard compliant switching products, including our OpenFlow controller.
- Our focus on carrier-grade infrastructure, such as our Helion Carrier Grade OpenStack.
- We offer infrastructure orchestration, which offers open middleware platforms. Our NFV Orchestrator delivers the NFV functions defined by European Telecom Standards Institute (ETSI). We deliver key components enabling orchestration of the world's cloud infrastructures.

Help when you need it

HPE is uniquely positioned to help companies move to NFV environments. Use our experience, infrastructure layer skills, and SDM domain expertise to make the shift. We have a repository of skills to help you enable NFV, including developing products as needed to addresses evolving market needs.

Additionally, HPE and its ecosystem partners deliver added value. As a network virtualization platform provider, HPE builds on its position as the largest provider of standards-based computer platforms deployed in telecommunications. We established this position by leveraging our IT product base, methodologies and practices into the telecom market. This combination of products and skills significantly reduces costs for many CSPs.

HPE enables your transition to NFV

- We support standardization of core platforms and future advancements to support more demanding networking-specific applications, including bearer control applications.
- HPE introduced MoonShot servers that are designed to enable operational cost savings and integration of specialized technology. These technologies—DSP pools, specialized processing cards, virtual switches, virtual routers—can be managed as regular, general purpose infrastructure.
- Our software portfolio includes industry-leading fault, event management, performance management, configuration and compliance, and security tools that monitor, visualize, manage, secure, and configure the NFV infrastructure.

As an infrastructure orchestration provider, we offer Open Middleware platform, NFV Orchestrator to deliver the NFV functions defined by ETSI. The world's cloud infrastructure is enabled by HPE orchestration capabilities.

Additionally, HPE is a lead contributor to industry organizations, such as OpenStack. We recognize that openness in the orchestration level of NFV is critical. We are vendor neutral when working with orchestration capability providers.

We leverage our telecommunications experience, middleware ecosystem, and many HPE products to give the industry a diverse, rich set of carrier-grade NFV orchestration capabilities. Our core platform lets carriers choose their infrastructure orchestration solutions.

Our approach to NFV infrastructure relies on sound architecture and an extensive portfolio.

- HPE Converged Infrastructure, Converged Cloud, and SDN are part of our open technologies and services that support deployment of NFV applications. All are developed by our experts or our partners—network equipment providers (NEPs), or independent software vendors (ISVs). We bring IT strength and volume to NFV through our diverse infrastructure offerings.
- We provide NFV applications and deliver telecommunications-based applications on industry-standard computer systems, while continuing to offer them in the NFV ecosystem. In addition, HPE has a rich set of networking and security products delivered as NFV applications. For CSPs, or potentially NEPs, we offer a range of virtualized network applications available now, including HSS, Network Interactive Voice Response (NIVR), Virtual Customer Premise Equipment (VCPE), Virtual Service Router (VSR), virtual switches, CDN, and Virtual Firewall (VFW). The HPE NFV infrastructure architecture and portfolio support core roles operating within the NFV ecosystem.
- We recognize strengths of existing vendors, understanding that close collaboration is required to fully realize the value NFV brings to CSPs. HPE aims to be the provider of choice to our clients, whichever combination of technologies they choose to implement.

To summarize

As CSPs shift to subscriber-centric models that are less network dependent, SDM is gradually taking the role as the "brain of service." As such, it's more critical than ever to provide top-level availability, openness, flexibility, and scalability.

For more info

hpe.com/CSP/SDM

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