commercializing NFV: vCPE as a first step

RAD
Your Network's Edge

amdocs

six things to keep in mind when transitioning to vCPE

Consider these key learnings from Amdocs and RAD's shared experience and expertise in deploying virtual customer premise equipment (vCPE):

1. **Standards provide a starting point**, but on their own are not enough to resolve the complexity of integrating multiple vendor solutions
2. **Technology is not enough on its own either**. The transition to network functions virtualization (NFV) and software-defined networking (SDN) requires organization structures and processes to evolve too. Without the commitment of senior management to make these changes, the transformation may remain a technical exercise without real business value
3. **Defining virtual network function (VNF) policies is essential**, but also complex and time-consuming. For example in a recent proof of concept (PoC) which was completed in seven weeks, 80% of the time was devoted to VNF onboarding and defining policies
4. **A phased approach makes sense**, particularly since hybrid solutions will most likely be the reality for some years to come, requiring the maintenance of existing processes and tools around the physical network while gradually evolving to a virtual network
5. **Real-time visibility of relationships** between customers, service and physical and virtual network resources is vital to real-time operations, including continuous fulfillment and assurance
6. Do not overlook the importance of business support systems **(BSS) integration and a top down, service-centric approach for monetization of NFV**

Read on for more detail on the drivers for and business value of vCPE, and how Amdocs and RAD are helping service providers address the challenges and opportunities of deploying vCPEs in a variety of scenarios for enterprise customers.

NFV transformation – the reality

The communications industry is transitioning from traditional static networks to the open, software-controlled and dynamic networks of the future. Views in the industry about how quickly networks will transform vary considerably. Service providers who are leading the charge expect networks to be predominately virtual in 5 years' time. Others believe that the process will take longer, and that it will be 10 years before networks are predominately virtual. Either way, the reality for some years at least is the hybrid network – a combination of physical, logical and virtual resources. And of course, this hybrid reality brings with it new challenges that impact service providers' ability to achieve service agility across operational processes of design, test, fulfill and operate.

challenges of the new hybrid network

NFV and SDN transformation is driving an unprecedented level of change. As service providers start to implement these new virtual network technologies, they face a number of challenges in rolling out and operating hybrid networks:

- **Increased complexity** because the network will comprise virtual, physical and logical resources that need to be managed
- **Traditional and new management** – orchestration must encompass traditional management solutions, as well as network function virtualization orchestration (NFVO) to support hybrid services and the increased volumes of VNFs that will need to be rapidly introduced and instantiated, and that will continue to change dynamically
- **Interoperability and predictability** – with NFV, VNFs from dozens of vendors could be downloaded from a virtual marketplace, presenting interoperability challenges as standards continue to evolve and mature
- **Organization and operations** – service providers need new organizational structures that bring together the network, IT and cloud. The DevOps approach is one solution to this, providing the flexibility to deploy VNFs while also incorporating existing operational tools for the traditional physical network

Complex software integration is needed to bring together physical and virtual networks, to manage the new network topologies, and to optimize operational processes for new virtual and hybrid services.

the business case for vCPE

Virtualization is highly disruptive and many in the industry are asking whether there is financial justification for the investment. Amdocs took up this challenge and commissioned the research firm, Analysys Mason, to develop a business case for vCPE, both enterprise and residential. The work was based on a series of interviews of approximately 20 service providers (mainly in Europe and North America) and aimed to look at their current processes, costs and ways of doing business. The results were significant indeed, particularly for the enterprise market, which typically has higher margins than the residential mass-market.

Cost savings through elimination of complex manual service delivery processes across supply management, order-to-cash and trouble to resolve are significant. There is also potential for a 5% uplift in revenue year-on-year through additional services over the virtual equipment installed.

For more information, download the **vCPE business case**.

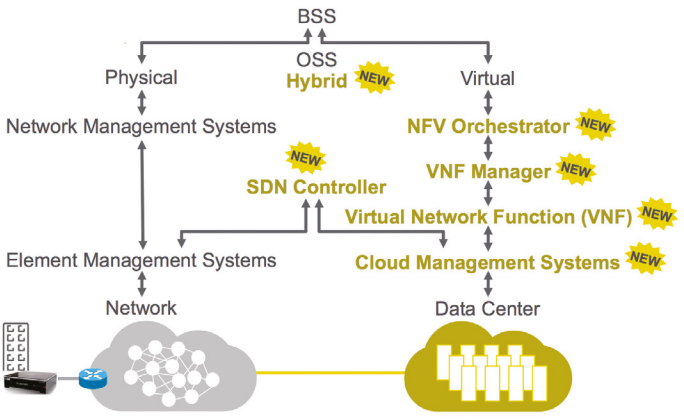

Figure 1. The NFV-enabled Network

vCPE deployment

Today we see three approaches to vCPE deployment: centralized, distributed or a mixture of both.

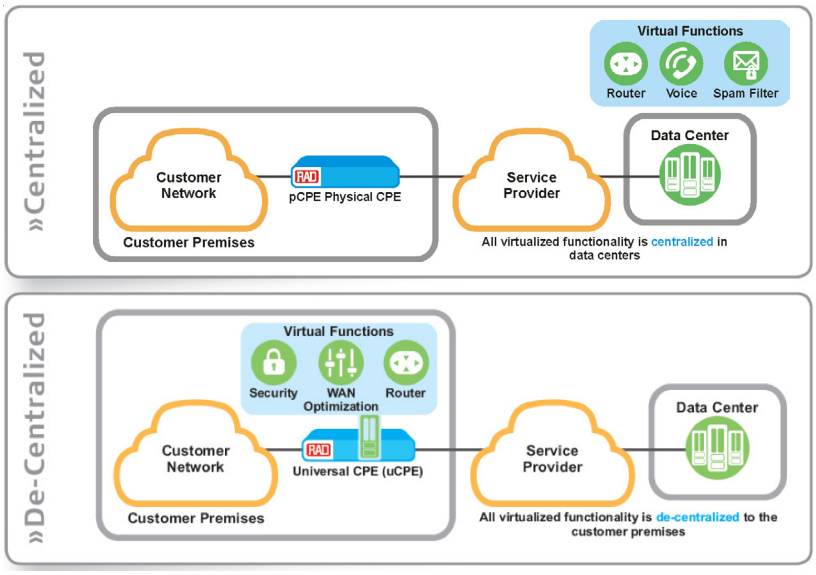

Figure 2. Approaches to vCPE deployment

The centralized approach retains most VNFs in data centers and uses physical customer premises equipment (pCPE) to deliver services to the customer premises. By sharing compute resources between customers and centrally introducing new value-added network services as VNFs without involving the CPE installed base, the key benefit of this approach is economy of scale. The economic trade-off, however, is the high initial investment required for the data center long before the service provider collects revenues from its new offerings. There will also be a need to invest in upgrades as the extra traffic generated by virtualization grows due to the constant data transfer from the core to the edge and back. Finally, the service provider has to keep in mind that some functions, for example loopbacks, will have to be retained at the edge for the very simple reason that they work only there.

The distributed approach places VNFs at the customer premises, either by using common servers or by deploying CPEs with built-in servers known as universal CPEs (uCPEs). This approach requires relatively low upfront capital investment in data center infrastructure. Capital expenses are reduced even further because it is unnecessary to deploy multiple appliances, each one dedicated to a different network function (router, firewall, WAN optimization, etc.). Moreover, existing equipment is leveraged because it continues to be used during the long migration to complete virtualization. Operational costs are also lower since software-based applications can be activated without sending a technician to every customer premises. Finally, the distributed approach also allows for a flexible "pay-as-you-grow" business model because it requires the installation of server capabilities only when a customer buys new value-added services.

The mixed approach varies depending on the customer's specific requirements. A bank, for example, might want a firewall to be located in its branches instead of a carrier-managed, centralized firewall service. Other customers may need a mix of WAN optimization, link encryption and SLA monitoring, combined with network address translation (NAT) and distributed denial of service (DDOS) prevention, a combination that would require virtualized services at both the customer premises and central data center.

addressing the challenges of vCPE deployment

While evolving their networks to deliver more services with better agility through virtualization, service providers must maintain a uniform level of carrier-grade service performance to compete with their global competitors. Central sharing of compute resources, however, hampers end-to-end visibility of service quality and, therefore, requires advanced monitoring of network performance, delay and jitter, as well as every customer's quality of experience (QoE) for each application. For that reason, it is crucial that vCPE-based services maintain or improve current SLA characteristics. In particular, virtualized services activated over shared virtualized infrastructure require established and new methods to assure service quality. Since future network services will be IT-oriented – mixing networking with value added applications – service providers will need tools that provide deep, comprehensive, end-to-end visibility throughout both the transport and application layers.

amdocs and RAD's solution for vCPE

This pre-integrated, end-to-end, automated and programmable solution enables service providers to orchestrate and manage the NFV service lifecycle from VNF onboarding and service design through order-to-cash to operations.

Amdocs' Holistic Approach to NFV Service Lifecycle Management

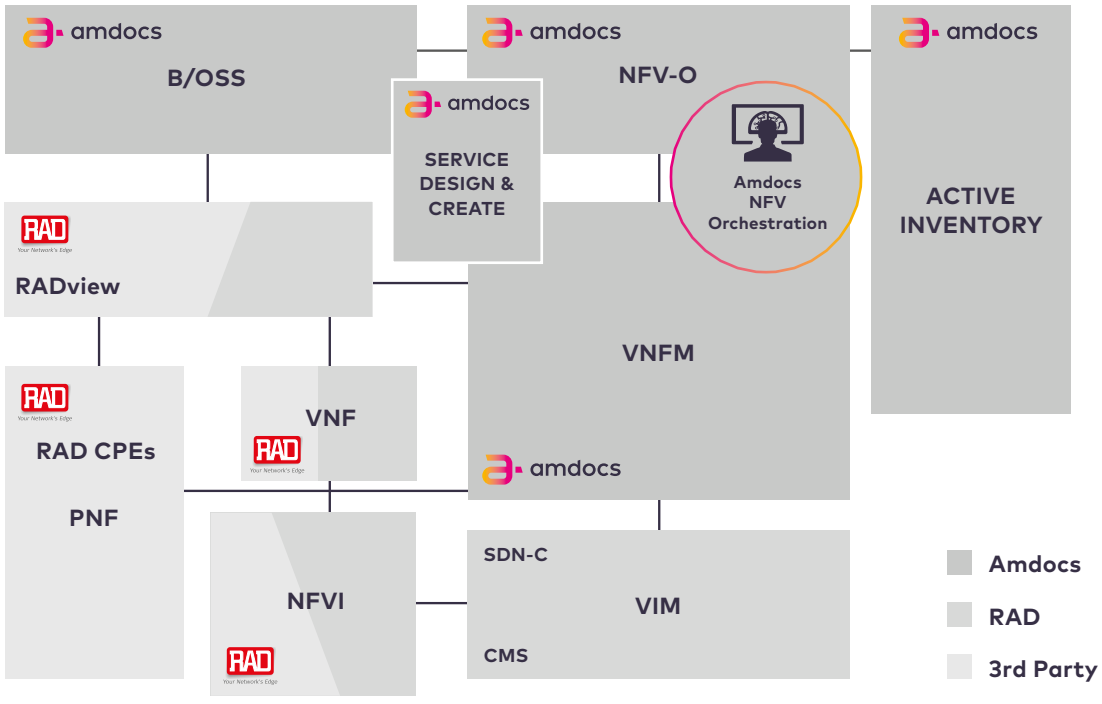

Figure 3. Amdocs and RAD's pre-integrated, end-to-end vCPE solution

RAD's vCPE – any deployment mode, any access, assured service

RAD, the industry pioneer of network edge virtualization, provides flexible vCPE platforms for the customer edge to fit diverse deployment scenarios. RAD's portfolio is specifically designed to help service providers with their transition to assured virtualized services by including the following:

- Open NFV/SDN architecture, together with support for NETCONF YANG, REST and ETSI standards, which facilitate integration with network-wide orchestrators and controllers, as demonstrated with the Amdocs NFV Orchestrator
- Pluggable, modular x86 compute resources enable flexible deployment models. Service providers can start with a centralized deployment model and move later to distributed and mixed models by shipping a pluggable x86 module to the customer; services can be installed and managed remotely using a central controller and an orchestrator; a powerful, open vCPE-OS for any server allows service providers to control all devices and functions, regardless of VNF location
- Wide array of WAN options allows fast roll out of premium, virtualization-based services while utilizing existing network connections to lower investment risks
- Hardware acceleration of forwarding plane delivers consistent and predictable service performance
- Built-in L2 and L3 service assurance tools allow service providers to maintain operational practices and assure user experience when moving to virtualized services by separating transport and service performance
- Physical network functions (PNFs) such as routing, tunnelling, MEF-certified L2 NID and L2/L3 performance assurance tools can be activated on demand to improve performance
- Built-in timing and synchronization services for LTE/LTE-A RAN deployments
- Third-party VNF hosting allows service providers to select their preferred applications and avoid vendor lock-in

Figure 4. RAD's ETX-2i vCPE

The RADview management and domain orchestration system converges management of both physical and virtualized entities and can be used by customers or service providers for end-to-end control of multi-site, multi-customer networks. RADview's open application programming interfaces (APIs) facilitate automation with higher layer orchestration like the Amdocs NFV Orchestrator and Amdocs operational and business support systems (OSS/BSS).

RAD's service-assured vCPE portfolio was built based on the company's extensive expertise in designing solutions that provide carrier-grade performance and robustness and constantly measure service experience.

amdocs' holistic approach to NFV service lifecycle management

Key capabilities of Amdocs' award-winning approach to NFV service lifecycle management (see figure 5 below) include:

- Automated, off-line VNF onboarding and service design (with or without service chaining) for rapid, low-cost innovation – fully integrated with the Amdocs' Master Enterprise Catalog and vendor neutral for any VNF from any vendor
- Continuous real-time fulfillment to instantiate and assure a service throughout its lifecycle, fully integrated with backend monetization systems for rapid commercialization
- Active inventory supports real-time operations with near real-time visibility of services and network resources, and a unique service tree view that incorporates physical and virtual resources
- A key area of value is pre-integration with the BSS and OSS for true end-to-end management, including ordering, billing and a customer self-service portal
- Pre-integration with NFV partners – both Amdocs and RAD have extensive NFV partner ecosystems to support rapid multi-vendor service innovation. Specific VNFs and use cases are pre-integrated and certified by Amdocs and RAD, enabling service providers to introduce new value-added virtual network services, rapidly and cost-effectively
- Managed services and systems integration offerings for NFV transformation and operations

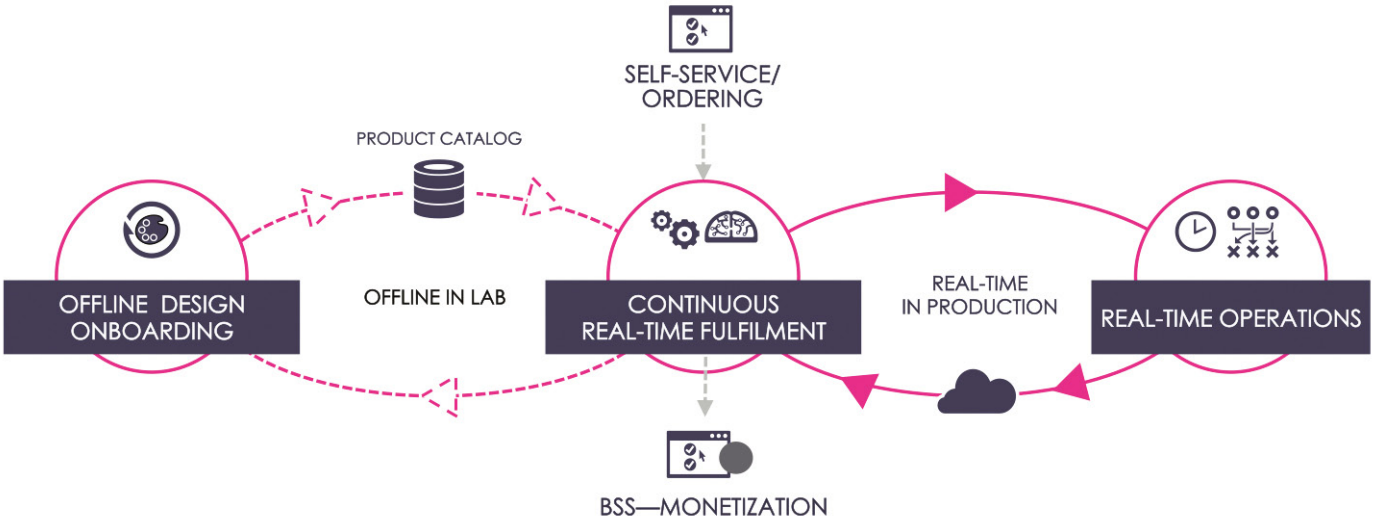

Figure 5. Amdocs' approach to NFV service lifecycle management, end-to-endand integrated with master catalog, BSS and the network

customer value

Our joint end-to-end NFV solution for vCPE is pre-integrated, automated and programmable to cut costs, deliver service agility and speed and de-risk innovation.

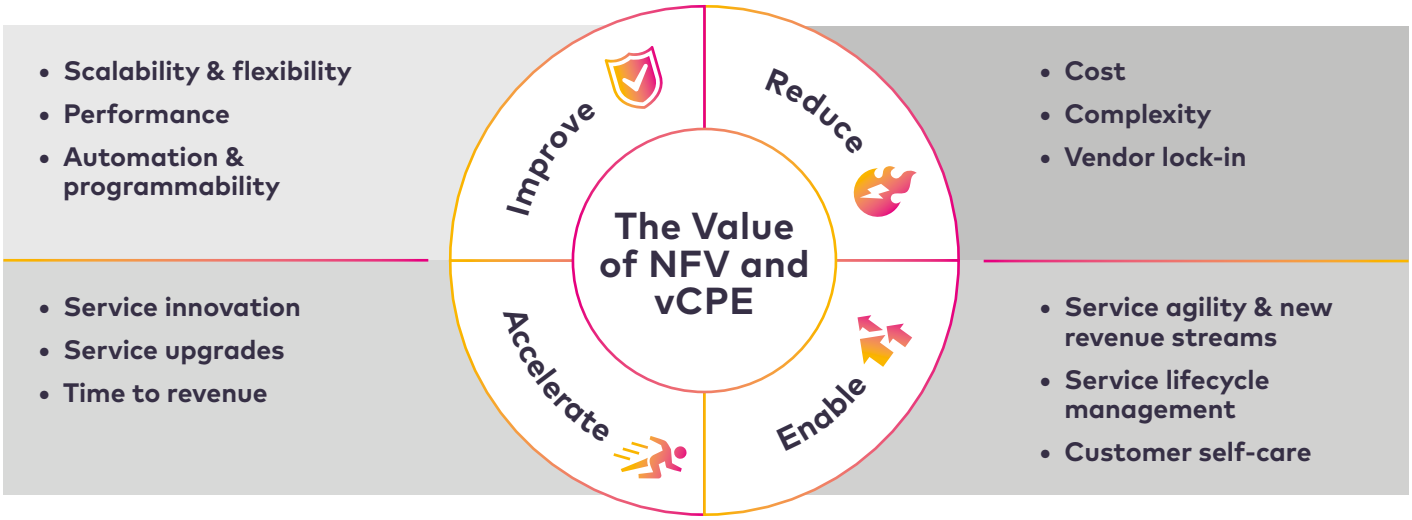

Figure 6. Value of the Amdocs-RAD vCPE solution

This fully integrated solution:

- Reduces the cost and risk of virtualization
- Provides zero-touch deployment through automated and programmable NFV orchestration
- Fits any vCPE deployment scenario, and reaches any business customer location with a universal service offering
- Delivers high performance and efficiency – more services with less compute capacity
- Offers a foundation for customer self-service to enhance the customer experience

- Design, test and create a new vCPE service **in weeks**, **not months**
- Deploy a vCPE-based service **in seconds**
- **Cut OPEX** through reduced truck rolls
- **Faster TTM and TTR** through pre-integrated, tested solution

example use case – distributed vCPE

This enterprise use case demonstrates how the Amdocs-RAD vCPE solution provides end-to-end orchestration with multi-domain service chaining for any network technology, incorporating centralized and decentralized vCPE scenarios that include:

- Any combination of CPE and access technology types for brown- and green-field
- Dynamic service and VNF placement and service chaining
- Pluggable x86 server for separate IT and networking migration
- Hardware acceleration to optimize CPU performance
- Wide platform selection to fit deployments at headquarters, branches, SMEs and aggregation sites with built-in security
- Embedded BSS-OSS-NFVO pre-integration to streamline deployment of new services and expedite monetization
- End-to-end order-to-cash solution

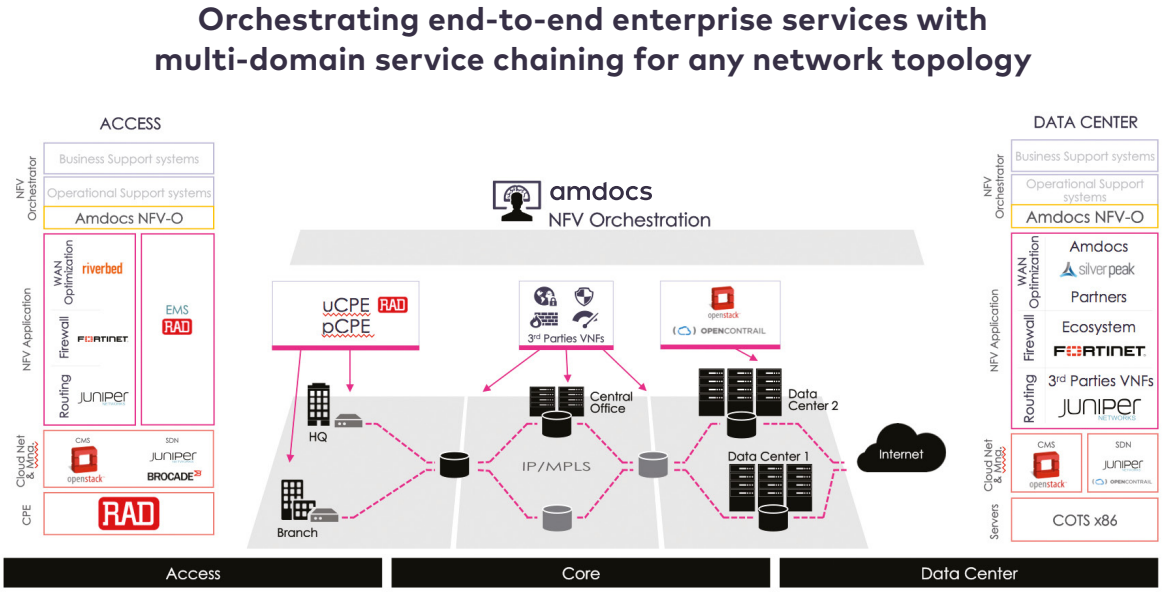

Figure 7. Distributed vCPE Use Case

summary: the amdocs-RAD partnership

This solution brings together two industry-leading players, each offering best-in-class NFV solutions and services. RAD and Amdocs share a vision for delivering flexibility, openness and innovation to Tier-1 operators across the globe. Together, we present service providers with the following advantages:

- A "one stop shop" for a complete vCPE solution, from the data center to the customer edge, and from VNF onboarding and service design through order-to-cash and operations
- A complete range of vCPEs to best fit the different types of customer edge requirements
- A common commitment to standards
- Extensive experience and expertise in software and services
- An open, vendor-neutral approach – any VNF, any network
- A focus on efficient NFV operations and service agility

about amdocs

Amdocs is a leading software & services provider to the world's most successful communications and media companies. As our customers reinvent themselves, we enable their digital and network transformation through innovative solutions, delivery expertise and intelligent operations.

Amdocs and its 25,000 employees serve customers in over 85 countries. Listed on the NASDAQ Global Select Market, Amdocs had revenue of $3.7 billion in fiscal 2016.

about RAD

RAD is a global telecom access solutions and products vendor. Since 1981, RAD has pioneered innovative technologies that are designed to boost performance and improve the way service providers compete. For mobile, business and wholesale service providers, RAD offers award-winning Service Assured Access solutions, delivering better QoE, service agility and complete visibility of network performance to reduce churn, minimize time to revenue and enable greater operational efficiency. Having run Distributed NFV (D-NFV) proof of concept (PoC) testing with major carriers since mid-2013, RAD has become the industry leader in virtualization at the customer edge, allowing fast provisioning of value added offerings and low risk, cost effective migration to programmable networks. RAD has an installed base of more than 15 million units, and works closely with Tier 1 operators and service providers around the globe. RAD is a member of the $1.25 billion RAD Group, a world leader in communications solutions.

For more information visit RAD.com

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