Solution Brief

Communications Service Providers
Network Slicing

Amdocs Offers Network Function Placement in 5G Slice Manager

Amdocs 5G Slice Manager feature discovery function utilizes Intel's Converged Edge Reference Architecture (CERA) for optimal network function placement using Intel® software and hardware technologies

5G network slicing allows communications service providers (CoSP) to create isolated, virtualized networks with optimized capabilities and policies to support different 5G service categories. Creating 5G slices can involve discovering hardware and software features in servers throughout the network and assigning network functions (NF) to servers with specific capabilities for maximum performance.

Without access to hardware features, the slice management orchestrator must use other parameters to place the NF, or the CoSP must deploy the same hardware everywhere, which is not efficient. Amdocs has developed its 5G Slice Manager to enable 5G slice creation and has adopted Intel's Converged Edge Reference Architecture (CERA) and Open Network Edge Services Software (OpenNESS) feature discovery capabilities to optimize slice creation.

Supporting 5G Service Categories and Slices

5G network services can be configured with varying levels of latency, throughput capacity, and support for high volumes of users. These services fall into three categories:

- Enhanced mobile broadband (EMBB)
- Ultra-reliable, low-latency communications (URLLC)
- Massive machine type communication (mMTC)

Each of these service categories relies on different technology enablers provided by the 5G network (see Figure 1).

Built into 5G is a multiplexing capability that can create fully isolated network slices that combine multiple virtualized and logical networks on the same physical network infrastructure. These slices can be tailored to deliver a set of performance parameters customized for EMBB, URLLC, or MMI services.

Network functions (NFs) are an important part of the performance needed for each of the 5G service categories. A server with a high-speed network interface card (NIC), for example, is key to provisioning the throughput needed for an EMBB service. A server with fully redundant power supplies, cooling, and server blades is needed for a URLLC slice. Thus, it's important for 5G network slicing orchestrators to be able to expose special server hardware features or platform software features to the virtual network functions (VNFs) in a network slice to help improve or otherwise deliver the required performance and capabilities.

Intel® Network Builders partner Amdocs has adopted CERA functionality into its 5G Slice Manager automation software to access enhanced platform awareness (EPA) functionality that enables optimized NF placement.

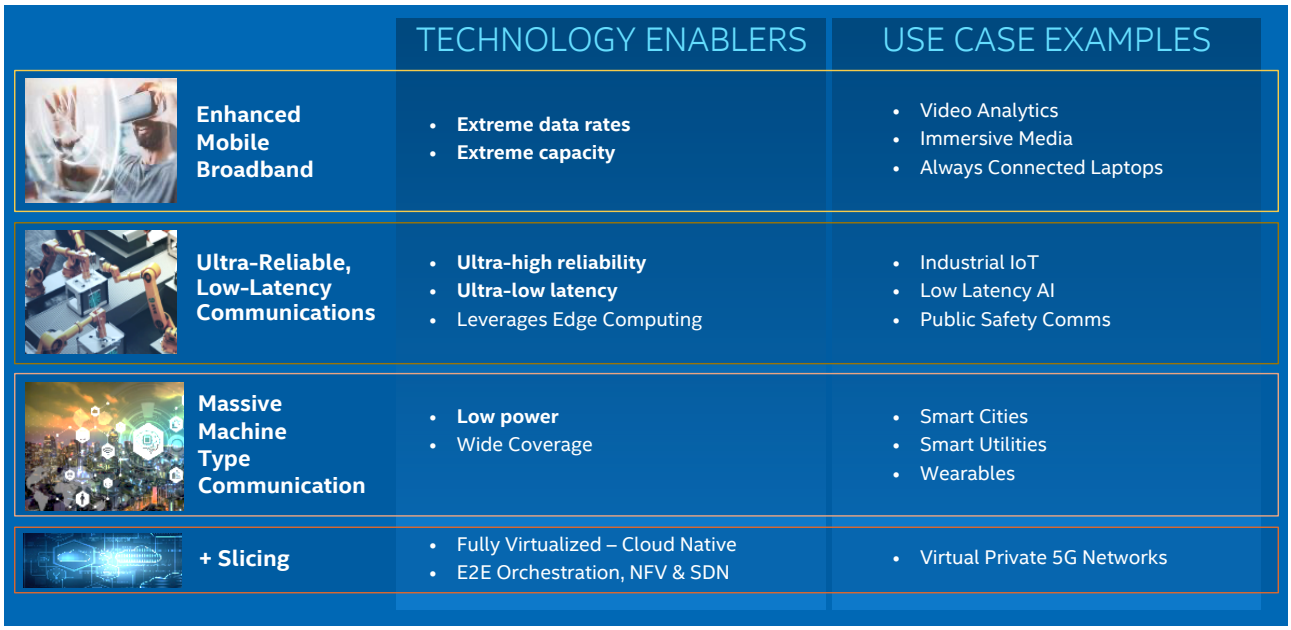

Figure 1. 5G service categories, technology enablers, and use cases.

Amdocs 5G Slice Manager

Amdocs 5G Slice Manager is based on Amdocs NEO, its cloud native, open, and modular service and network automation platform. The platform provides end-to-end service lifecycle management of hybrid networks and cloud services, from design and creation to orchestration, continuous monitoring, and operation.

Amdocs NEO is a unified, yet modular, platform that encompasses traditional service activation and fulfillment functionality, along with cloud and NFV orchestration and advanced network automation capabilities. Leveraging ONAP components and service modeling practices, as well as TM Forum open APIs, Amdocs NEO empowers service providers to rapidly define, launch, fulfill, operate, assure, and monetize new offerings that combine organic capabilities (for example, connectivity) with ecosystem elements while simplifying their operations complexities.

Amdocs 5G Slice Manager includes functionality for slice design, instantiation, and performance management:

- **Slice design:** Supports network slice modeling by chaining various network functions, links, and connection points to create specific network slice services. This includes specifying slice parameters, policy, and resource dependencies (for example, throughput, latency, mobility, reliability, isolation, and volume and number of users) across all the resources that support the slice and detailing other parameters for the end-to-end instantiation of network slices.
- **Slice automation and orchestration:** Instantiates network slice instances and the associated network functions by interacting with the different domain controllers to configure all the resources necessary to create network slices and ensure a link between instantiated slice resources and the end-to-end designed slice.
- **Slice operation:** Monitors and assures the behavior and performance of various slices through collecting network function and infrastructure data, analyzing performance data and events, and triggering the appropriate actions for resource scaling, elasticity, and automatic healing to meet slice requirements. The solution's closed-loop service automation approach ensures the slice will scale on demand to accommodate changes in service and performance requirements.

Amdocs 5G Slice Manager helps service providers maximize the monetization of 5G networks through automated and streamlined management of innovative services that are based on 5G network slicing.

CERA Adds NF Placement and Other Features

The CERA architecture unifies and converges all of the new edge workloads into a common platform and also enables IoT with 4G/5G wireless infrastructure technology. CoSPs can use CERA to densify their wireless networks, and it also enables enterprises to build private cellular networks using a cloud native architecture. CERA abstracts network complexity and streamlines the solution development process, thereby accelerating time to market (TTM) for service providers innovating their services infrastructure on Intel® architecture platforms.

Amdocs has adopted the architecture into its 5G slice management architecture to provide NF placement using enhanced platform awareness (EPA) functionality. The architecture includes the following components:

- 5G and/or LTE access and core network components, including Intel's FlexRAN software reference architecture for L1 combined with third-party L2/L3 plus enhanced packet controller (EPC) functionality. Combined, these elements deliver a 3GPP-compliant solution that services remote radio heads (RRHs) at the front haul and delivers SGi connectivity onto the platform.

- OpenNESS software that directs traffic to edge services co-located on edge nodes and manages the lifecycle of these services.
- Intel® Distribution of OpenVINO™ toolkit framework and sample applications that deliver edge inferencing services.
- SD-WAN xNF to provide more secure IPsec-enabled backhaul functionality.

This architecture is hosted on an Intel® Xeon® Scalable processor - or Intel Xeon D processor-based server.

Figure 2 shows NF placement by Amdocs end-to-end orchestration based on CERA-enabled EPA functionality within a specific edge location/node.

EPA offers the following services that assist with NF function placement:

- Node Feature Discovery (NFD): Detects and advertises hardware and software capabilities of a platform for possible use in scheduling a VNF.
- Single Root IO Virtualization (SR-IOV): SR-IOV divides a PCIe physical function into multiple virtual functions (VF), each with the capability to have dedicated bandwidth allocations. When virtual machines are assigned their own VF, they gain a high-performance, low-latency data path to the Ethernet controller.
- Non-Uniform Memory Architecture (NUMA): With a NUMA design, the memory allocation process for an application prioritizes memory that is local to a processor core because it is the highest performing. EPA is able to configure VMs and/or container pods to use CPU cores from the same processor socket and choose the optimal socket based on the locality of the Ethernet controller that is providing the data connectivity for the VM.
- CPU Pinning: Allows a process or thread to have an affinity configured with one or multiple CPU cores. When a 1:1 pinning configuration is established between virtual CPUs and physical CPUs, there is an increase in predictability because the host and guest schedulers are prevented from moving workloads around. Pinning can also help improve cache hit rates.
- Huge Page Support: Provides up to 1-GB page table entry sizes to reduce I/O translation look-aside buffer (IOTLB) misses, helps improve networking performance, particularly for small packets.

EPA facilitates the discovery of hardware features that would benefit a 5G slice as well as services that help improve performance. With this functionality, the 5G Slice Manager has the NF inventory information beforehand and can make an exceptional decision of where to place the VNF/CNF when it is instantiating a new network slice.

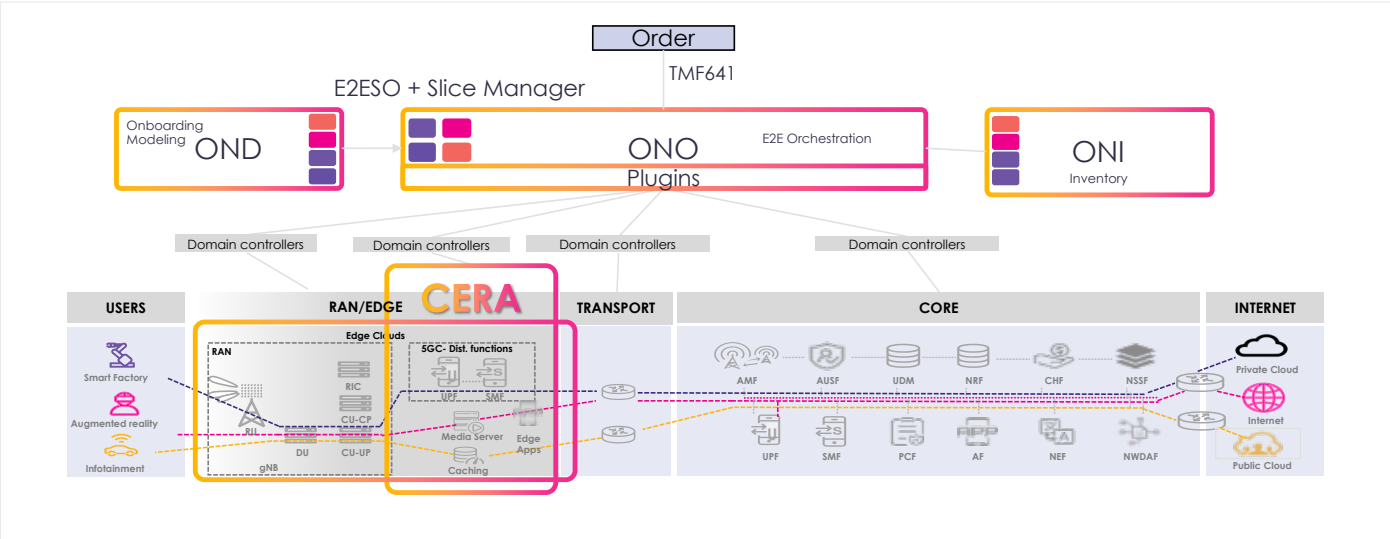

Figure 2. How CERA interacts with Amdocs 5G Slice Manager.

OpenNESS for NF Onboarding

A key function of CERA utilized by the Amdocs 5G Slice Manager is OpenNESS, an edge computing software toolkit that enables highly optimized and performant edge platforms to onboard and manage applications and network functions with cloud-like agility across any type of network. OpenNESS exposes features from the Intel® processor-based servers to the Amdocs Slice Manager to aid in feature discovery and to allow applications and network functions to fully take advantage of the Intel processor features.

OpenNESS takes care of the lower level primitives of platform feature discovery, application placement, and lifecycle management while Amdocs' 5G Slice Manager presents the next level of abstraction—slicing—and coordinates the logical mapping of these two abstraction layers. Ultimately this provides a more user friendly interaction for operators—they can design and create slices without having to concern themselves with the underlying complexity of interweaving platform features to achieve particular slice requirements.

NF Placement In Action

Figure 3 show how the NF placement is done. 5G slices are set up to serve applications, including health care, AR/VR, computer vision, and others. Each application has different network needs. The slice supporting a health care NF, for instance, will need very high reliability, whereas the slice supporting an AR/VR application will need to have very low latency.

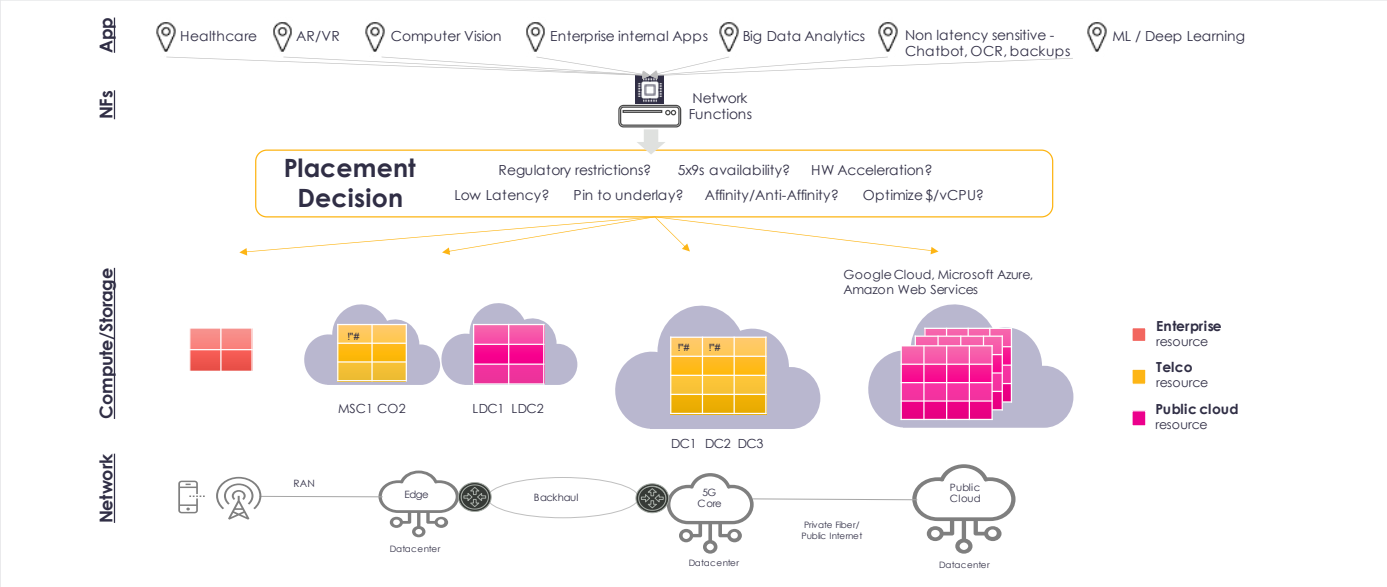

Figure 3. NF placement example.

When the slice is created, an NF will need to be placed on a server or servers in the network. There are a significant number of placement decisions, including:

- Regulatory restrictions
- High availability
- Hardware accelerations
- Cost-optimized CPU
- CPU affinity or anti-affinity
- Low latency

With EPA installed on the servers, the Amdocs 5G Slice Manager can compare the requirements with the capabilities of servers it has logged in its inventory. This server inventory can include enterprise data centers, telco data centers, and public data centers.

Conclusion

5G slicing is a key technology capability for maximizing monetization of the 5G network, enabling CoSPs to tailor network services to address specific use case and customer requirements. With its automated and adaptive network slice management functionality and business-focused slicing monetization, Amdocs 5G Slice Manager addresses the complexities of 5G network slicing.

Amdocs 5G Slice Manager is an open, standards-based, vendor-agnostic solution enabling service providers to adopt open, modular network capabilities, which remove the burden of vendor lock-in, and to avoid the high costs and inflexibility associated with monolithic, proprietary network infrastructures. The solution's user interfaces provide clear business visibility, enabling users to efficiently design and deploy slices for a wide range of market segments and customers via a single click. This complements CERA—a key enabler of intelligent NF placement—which provides key hardware and platform software resources required for optimized 5G network slice performance, in accordance with the needs of each individual customer.

Learn More

Amdocs 5G Slice Manager

OpenNESS edge platform

Intel® Network Builders program

Amdocs NEO Service and Network Automation Platform

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