Communications Service Providers (CoSPs) see software enablement of the network as critical to the development of innovative 5G niche services, speeding time to market and new revenues.

“New business opportunities are now on the horizon for CoSPs thanks to developments in NFV which are enabling 5G technology.”

Telecommunication is evolving at software-enabled speed

Communications Service Providers (CoSPs) have seen international voice and SMS text messaging revenues decrease as innovative Over The Top (OTT) services from Cloud Service Providers (CSPs) claim a greater share of consumer spend.

Although CoSPs know they need to innovate to recover those lost revenues, communications service innovations have historically been restricted by the inflexibility and long development timescales of new hardware-based products from Network Equipment Providers (NEPs).

CoSPs now recognize that Network Functions Virtualization (NFV) enables them to deliver customer value and increase revenues from inside their networks as well as offer software-based services from a much wider range of sources. In late 2017 STL Partners reported that 32 leading operators in Europe and North America had 125 completed and planned NFV deployments, reflecting this global trend¹.

New business opportunities are now on the horizon for CoSPs thanks to developments in NFV which are enabling 5G technology. In ETSI's 2017 white paper, 23 leading CoSPs proposed that NFV technical features should be adopted to accelerate progress and avoid duplication across the industry to deliver the 5G vision².

To remain competitive, CoSPs must transition to a Software-Defined Infrastructure (SDI) running on Commercial-Off-The-Shelf (COTS) hardware. Leading CoSPs are using NFV to get ready for the software-enabled 5G future, and to deliver innovative and differentiated services now, as shown in Figure 1.

Software network functions are enabling better business

Using classic fixed function hardware appliances presents two service innovation challenges for CoSPs. Firstly, when new hardware features are needed, implementation of these into the vendor’s product development program is time-consuming. And once implemented, the hardware becomes available to
other CoSPs, minimizing differentiation. Secondly, as the procurement lead times for low volume telecommunications appliances can be long, CoSPs need to allocate resource to understanding where the devices sit in the supply chain if they are to effectively meet future traffic-handling requirements.

Fixed line CoSPs have experienced the flexibility offered by enterprise networks using NFV applications on virtualized Customer Premise Equipment (vCPE) products. Through virtualization, multiple functions can be remotely loaded onto servers located in enterprise branches. In addition to classic routing and firewall products, Software Defined Wide Area Network (SD-WAN) architectures can include traffic steering and additional security functions to quickly enable access to third party cloud services over Internet connections. This meets the business process demands for hybrid cloud IT systems.

IHS research identified that 81 percent of the leading CoSPs would be deploying NFV services by the end of 2017³, calling out vCPE as the top NFV use case for new revenue generation. In December 2017, IHS also forecast revenue from the SD-WAN equipment market could reach USD3.3bn in 2021⁴.

Meanwhile, mobile wireless CoSPs have been considering NFV for virtualization of IP Multimedia Subsystem (IMS) call servers and the mobile packet core. The IMS is key to introducing new, revenue-generating services. Virtualizing the IMS increases business agility and leads to greater revenue potential. In 2015 Vodafone Italy* deployed the world’s first cloud-based Voice over Long-Term Evolution (VoLTE) network⁵. Velcom, the Belarusian subsidiary of the Telekom Austria Group then claims to have implemented the first fully virtualized commercial core network at the beginning of 2017. According to the company’s annual report “this resulted in a decrease in Velcom’s total costs of ownership of more than 50 percent. The new technology provides more flexibility and newer functions for voice telephony and internet customers.” In an Intel Case Study report, Christian Laqué, Velcom’s Senior Director of Technology said, “launching new services is easier and faster than ever before. We were able to upgrade for narrowband IoT by just adding some software.”⁷

**Network transformation and business innovation**

While CoSPs continue to evolve through re-engineering, attention is turning to innovative 5G services that could be formed by hosting software applications at the edge of the network close to the customers. Using this edge computing approach, new services can be enabled that would otherwise not be technically or commercially viable, presenting an opportunity for CoSPs to diversify and increase revenue streams.

This also gives CoSPs sustainable differentiation from classic cloud services, such as improvements in general response time by avoiding international links, and the reduction in costs by moving video traffic processing from the core network to the edge.

Placing content delivery network nodes inside CoSP networks for video streaming has been possible for some time. However, recent trials in smart stadium technology have proved the customer experience can be improved further⁸. Trials have shown that streaming videos in real-time is viable. At concerts, 4G wireless small cell nodes have provided video streaming coverage locally without core network traffic. At sporting events, a terabyte of volumetric data has been rendered from multiple camera inputs, displaying key moments of action in HD. The arrival of 5G will further enhance these user experiences.

Video surveillance is another edge application that uses local Artificial Intelligence (AI) to process streams from nearby...
IP cameras to conduct targeted searches. It can detect, recognize, count and track pedestrians, faces, vehicles, license plates, abnormal events and behaviors. Analysis and processing happen closer to the point of capture, thereby conserving video transmission bandwidth and reducing the amount of data routed through the core network.

“Over the last decade, Intel has progressively evolved its microprocessor architecture to handle traffic speeds compatible with carrier grade networking.”

For CoSPs, a key feature of software-enabled services is the ability to transform and accelerate service innovation. With NFV, CoSPs have a platform where new services can be trialed to evaluate their value in the market without additional hardware deployment. If successful, they can be integrated into production systems with faster time to revenue than hardware based services. If there is little demand for the service, the initiative can be “failed fast” and the infrastructure reused immediately to test another innovation. Due to the low overhead involved, services can also be introduced for niche markets such as customized solutions for large enterprise clients. The outcome for CoSPs is improved customer responsiveness and differentiation in a crowded telecommunications market.

Transforming the network with software, however, needs two enabling developments. First, the network infrastructure needs to have server features embedded to host the application software, in addition to their associated cloud management tools. Secondly, the operational network management processes must handle a higher rate of change in line with IT practices.

The original concept of hosting NFV applications on standard rack mounted IT servers in data centers or central offices is still valid. However, with increased understanding, there is also the option of locating software at the network edge on smaller nodes such as Mobile Wireless Basestation Street Cabinets or CPE. At these sites, alternative packaging is needed to suit the environment, and current devices are being re-engineered to include server functions. Intel has a broad portfolio of Intel® Xeon® processors to suit the various equipment types, with a key feature being the software compatibility across the range.

For NFV, this means that workloads can be orchestrated to be hosted on the most appropriate nodes. This enables scalability in line with traffic demands, relocation as network traffic evolves, and migration to backup facilities when maintenance and business continuity are needed. The forward compatibility of Intel® processors also enables use of next generation machines without requiring recompilation of existing software.

Organizational change is also needed. The IT and Network Operations teams must align closely to handle rapid service innovation and associated network changes.

The IT team is experienced in virtualization from enterprise server rationalization, and as more companies turn their data centers into private clouds, the IT team will become increasingly familiar with cloud management tools. The culture within IT operations is also changing - DevOps practices are being deployed. This means the IT Development and Operations teams must jointly manage the frequent deployment of small incremental changes to the production systems.

The Network Operations approach differs to this, because it has generally been reliant on infrequent major software upgrade initiatives. Leading CoSPs report a need for increased software skills in the network operations center, and some domain expertise to handle Virtualized Network Functions (VNF) software and orchestration.

Procurement must also change to handle the variety of software vendors, and integration into the production network. Use of COTS servers also enables competitive supply, reducing equipment delivery timeframes. This gives CoSPs flexibility and scalability compared to traditional telecommunications procurement cycles.

In the longer term, further automation of operational processes is expected to handle the complexity and variety of niche services without manual intervention. The TMForum and ETSI are progressing standards initiatives looking at Zero-touch network and service management, and also exploring AI techniques to optimize the use of the infrastructure and minimize the associated energy needs⁹.

How Intel is enabling transformation

Over the last decade, Intel has progressively evolved its microprocessor architecture to handle traffic speeds compatible with carrier grade networking. It has also undertaken a range of collaboration initiatives to help CoSPs deploy this technology. New Input/Output (I/O) technologies have been developed, and the costly processing overheads historically experienced with virtualized communications applications have been eliminated.

To simplify evaluation and procurement for CoSPs, Intel has produced optimized reference designs for standard Network Functions Virtualization Infrastructure (NFVI) servers, including the hardware options and software stack configurations needed to support the leading operating systems. Intel has also published the resulting performance specification as the Intel® Select Solution for NFVI, and verifies vendors’ products against that benchmark. Currently, two versions are provided for CoSP NFV workloads, covering a “base” configuration optimized for mainstream price-performance, and a “plus” alternative for high workload density and performance. Products meeting the specification will be available from leading IT hardware vendors from
Intel is collaborating with over 260 companies in the Intel® Network Builders ecosystem to ensure that their products can use the latest silicon features. Many of the members are software vendors providing VNFs, alongside testgear suppliers and systems integrators. The end result is that complete NFV systems can be assembled from Network Builders members' components listed in an online catalog along with solution briefs, reference architectures and solution designs.

For CoSPs looking for further resources for network transformation, Intel® Network Builders University program provides tutorials, training and other skills-related resources.

**Solution summary**

CoSPs can take the first step towards the software-enabled future today. By putting processing capability into CoSP network nodes close to the customers, new edge services innovations and revenues will be enabled.

Intel Xeon processors handle NFV workloads across the range of CoSP network locations. From the data center and central office to customer premises, there are now software-compatible, future-proof infrastructure products using Intel® technology inside, available from industry vendors. When coupled to the available management and orchestration systems, this forms a telco cloud environment that, in addition to NFV applications, can also handle other CoSP workloads, including Operations Support Systems (OSS) and Business Support Systems (BSS) and value added services requirements as shown in Figure 2.

![Figure 2. Telco Cloud](image-url)
Intel has the technology and ecosystem partners available to help transform CoSPs’ networks with NFV now, and build an application environment across the entire telco cloud, from CPE through the network edge to the data center.

**Intel® technology foundation**

Intel Xeon processors form a key foundation for NFV systems, being incorporated in all forms of network nodes from CPE and data center, and with software from the hundreds of partners in the Intel Network Builders community.

**Find the solution that is right for your organization.**

Visit [https://intel.com/network](https://intel.com/network) to learn about the path to 5G, or [https://networkbuilders.intel.com/](https://networkbuilders.intel.com/) to get started with NFV now.