WHITE PAPER

5G is Coming. Are You Ready?

What's Ahead, What's Required and What You Can Do About it Today

Affirmed Networks, Inc., 35 Nagog Park, Acton, MA 01720 USA

affirmed®

YOUR WORLD IS ABOUT TO GET A WHOLE LOT BIGGER/FASTER/SMARTER

Over the next five to ten years, we'll see a quantum leap in technology. Delivery trucks will be replaced by flying drones. Physicians will examine patients using high-definition video from halfway around the world. Household appliances will call in their own repairs. At the heart of this science-fiction future is the 5G network: the most powerful, efficient and intelligent network the world has ever known.

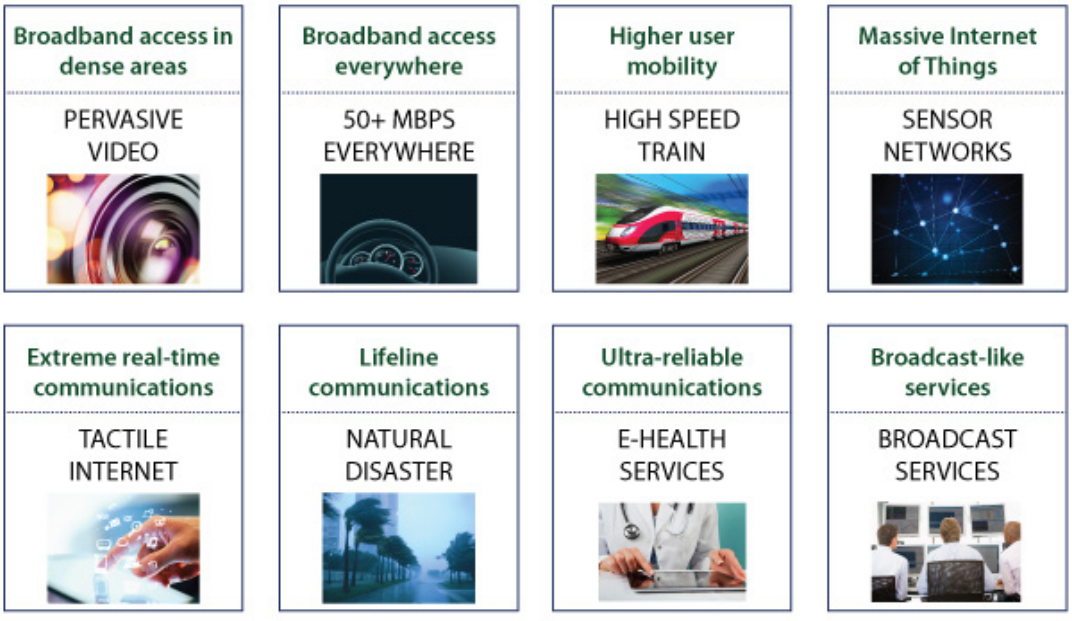
For consumers, it's an exciting future. For the communications service providers (CSPs) that are expected to deliver this experience, however, the future is daunting. After all, many CSPs are still struggling with the demands of 4G/LTE build outs that are pitting the demands for more capacity against a backdrop of shrinking customer revenue and increased competition from "free" applications, such as Skype, WhatsApp and FaceTime. 5G sounds exponentially more expensive as it is expected to support 1,000 times more devices than 4G with 100 times faster speeds and 10 times lower latency.

That's a far cry from where most service provider networks are today, right? Perhaps not. As we'll explore in this paper, many of the requirements for 5G are already addressed in current-day network initiatives, such as network functions virtualization (NFV), software-defined networking (SDN), service orchestration/automation and probeless network analytics. In other words, many CSPs may be further along the 5G migration path than they realize.

5G: WHAT IS IT AND WHEN WILL IT GET HERE?

There's already a good deal of confusion around what really constitutes a 5G network, so it's helpful to go back to the source: the Next-Generation Mobile Network (NGMN) Alliance. According to the NGMN Alliance, 5G networks will be able to support a variety of new mobile communications use cases including:

FIGURE 1: NGMN ALLIANCE USE CASES



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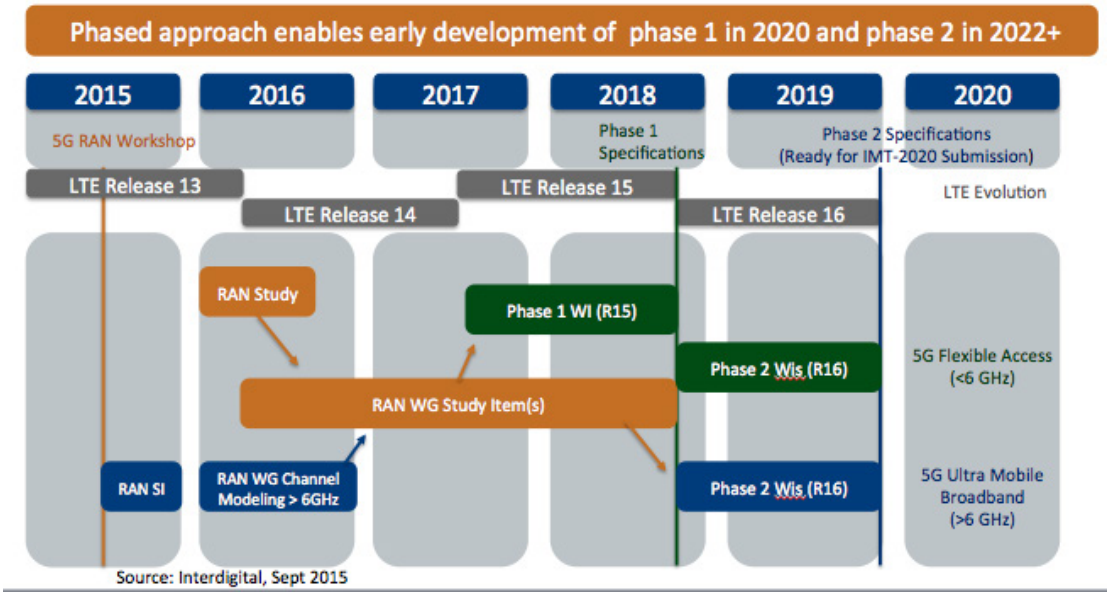
SHOULD YOU BE INVESTING IN 4G OR 5G?

Service providers are clearly thinking about 5G today. But should they be investing in it right now? Yes. Even though 5G won't officially arrive for a few years, service providers need to begin transforming their networks today for the 5G future. Fortunately, service providers don't need to wait to begin seeing a return on those investments. Many of the requirements for 5G networks can benefit current 4G/LTE network by reducing opex, eliminating capex and driving more innovative (and faster) services.

But isn't it risky to invest in 5G before all of the standards are finalized? No. A lot of the core technologies of 5G—network element virtualization, network orchestration, service automation, network intelligence, real-time analytics, etc.—have already been developed, tested and successfully deployed in many of the world's largest networks. The real risk is making 4G/LTE investments that may not align with a 5G strategy.

5G trials are already underway, with some CSPs planning to deploy 5G-compatible services as early as 2017—three years before the industry expects to release its standards for 5G communications. In these early stages, the first 5G initiatives will likely be built mostly around the use case of faster mobile broadband access, with speeds in excess of 20 Gbps. It's important to remember that 5G, like 4G before it, will arrive in iterative steps and continue to evolve over its expected 30-year lifespan.

FIGURE 2: 5G TIMELINE



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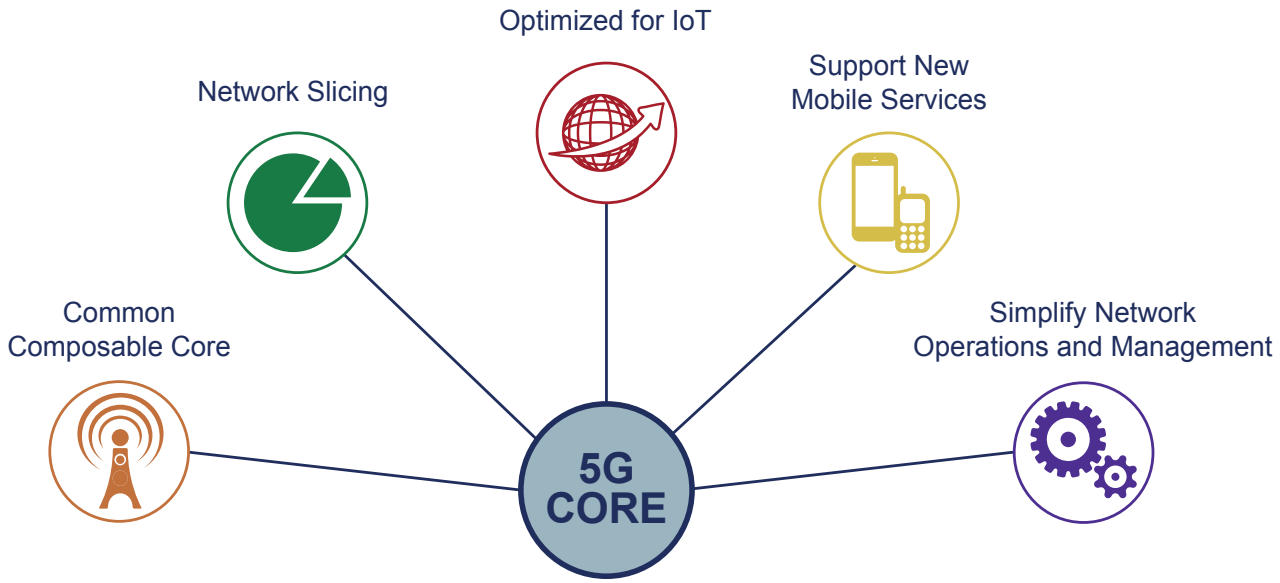
THE FIVE REQUIREMENTS OF 5G NETWORK TRANSFORMATION

In order to create a 5G network, three areas of the network need to be transformed: the radio access network (which will encompass heterogeneous wireless access technologies, including Wi-Fi), the core network and the service creation layer. Radio access standards and available spectrum are still a work-in-progress. We do have a good understanding of the core network and service creation requirements for 5G, based on the types of use cases being considered. These requirements can be divided into five main categories, as follows.

FIGURE 3: 5G CORE REQUIREMENTS



1. CREATE A COMMON COMPOSABLE CORE.

The 5G core requires a significantly more flexible core network than the 4G/LTE core. It needs to deliver a controlled and secure experience across heterogeneous access technologies and manage connectivity/mobility for a dizzying array of mobile devices. The 5G core also needs to scale dynamically to account for highly-variable application and traffic types, preserve identity and security end to end and support legacy interworking, while reducing cost and complexity. 5G will rely upon NFV and SDN to create a composable core that decouples the user and control planes, moving services and applications closer to the network edge. The inherent flexibility of the network architecture willl enable CSPs to affordably achieve high bandwidth, low latency requirements with unlimited scale and flexibility.

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2. "SLICE" THE NETWORK TO SUPPORT DIFFERENT SERVICES.

The concept of *network slicing* has captured a lot of attention in the industry because 5G mobile networks will need to be many things to many different types of endpoints and sessions. HD videoconferencing in a telemedicine application will have very different session requirements than a wireless machine-to-machine (M2M) device communicating its hourly status. In a 5G network, CSPs will need to slice their network resources into many different types of services, each with unique requirements around quality of service, security, latency, etc. With a NFV/SDN architecture, CSPs can support network slicing on-demand on a per-customer or per-application/use case basis.

3. OPTIMIZE THE NETWORK FOR THE INTERNET OF THINGS.

One of the most compelling use cases for 5G technology is the Internet of Everything, which will bring with it billions of connected wireless sensors that will share space on the same communications network as more profitable consumer and enterprise data traffic. This creates a conundrum: how to prevent millions of M2M devices—which are expected to run the gamut from low-revenue services like connected homes to high-revenue services like connected cars—from negatively impacting subscriber services, such as high-definition voice communications and streaming video? The answer lies in creating a network architecture that can efficiently handle different categories of traffic, specifically high-bandwidth downloads (e.g., video gaming), high-bandwidth uploads (e.g., cloud backup services) and high-density/delay-tolerant communications (e.g., connected appliances).

4. SUPPORT CREATION OF NEW MOBILE SERVICES.

5G will improve the revenue flow to service providers—provided they can identify and create those services that will drive business decisions and improve the overall subscriber experience. In order to do this, service providers will need to increase their network intelligence and implement analytics. Real-time insights can be gleaned from session control, subscriber events and subscriber data to drive smarter network planning and provisioning. The use of analytics tools will expose actionable information within the granular data capture.

5. SIMPLIFY NETWORK OPERATIONS AND MANAGEMENT (AND REDUCE COSTS).

5G networks will have to do a lot more, but they shouldn't cost a lot more. One of the biggest challenges that CSPs will face in the future is how to build more intelligent networks that handle more traffic volume (and more different types of traffic) without escalating their capex/opex costs. On the wireless access side, the ability to leverage existing Wi-Fi networks and deploy short-range, high-bandwidth access points instead of radio access network (RAN) towers will go a long way toward mitigating the cost of ubiquitous mobile broadband. Within the network, CSPs will look to virtualization and the cloud as central to reducing capex costs, while service automation/orchestration and network analytics will help to drive opex costs down.

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SAY "YES" TO 5G WITH AFFIRMED NETWORKS

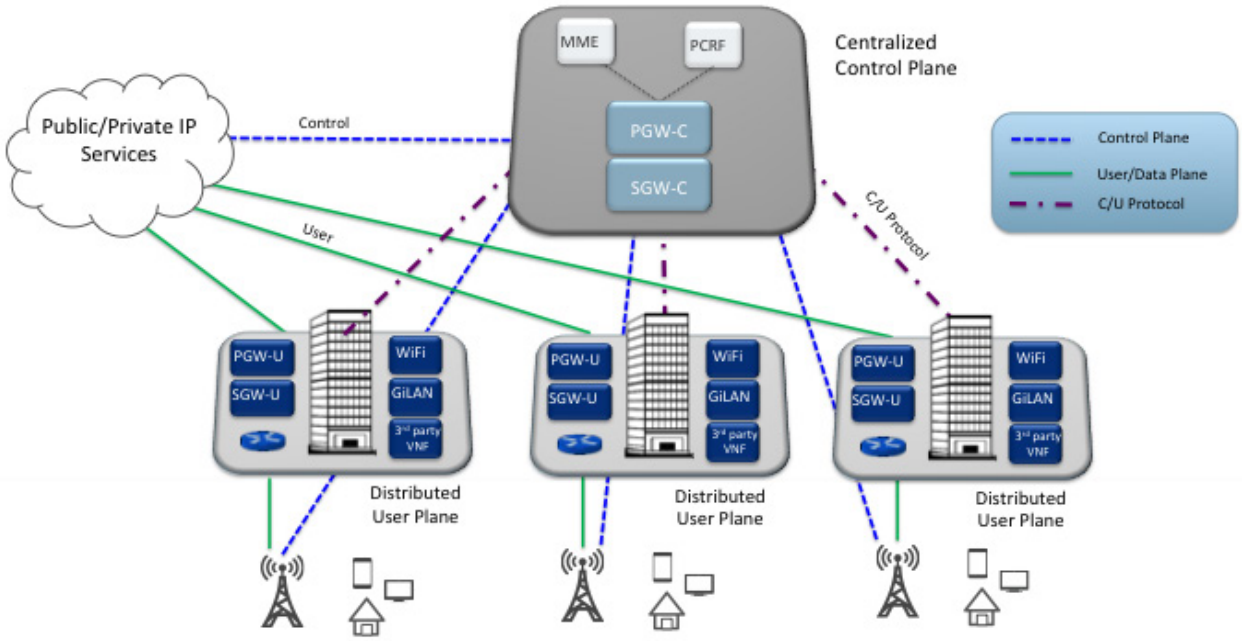
Although 5G won't officially arrive for a few years yet, we know it's coming. We also know that 5G networks will have different requirements than 4G networks. They'll need to be more flexible, more scalable, more intelligent and less expensive to operate. Those same benefits can also help mobile service providers reduce costs and accelerate revenue opportunities today. At Affirmed Networks, we built our solutions with the future in mind to provide a seamless continuum that allows mobile CSPs to solve the challenges of today and seize the opportunities of tomorrow. In other words, you're not just building a better 4G/LTE network with Affirmed; you're building the foundation for your 5G network.

This is a very different approach than most network equipment vendors can offer. So-called "virtualized" solutions on the market today are often little more than software-based versions of legacy hardware appliances. While these solutions can reduce capex and, in some cases, opex as well, they are ultimately temporary solutions that have not been designed to support a 5G environment. As a result, mobile service providers will need to replace these virtualized solutions with actual 5G-compatible functions when they finally decide to move to 5G, leading to more cost, complexity and disruption.

AFFIRMED MOBILE CONTENT CLOUD VIRTUAL EVOLVED PACKET CORE (vEPC)

✓ **It's a common composable core.**

FIGURE 4: COMMON COMPOSABLE CORE



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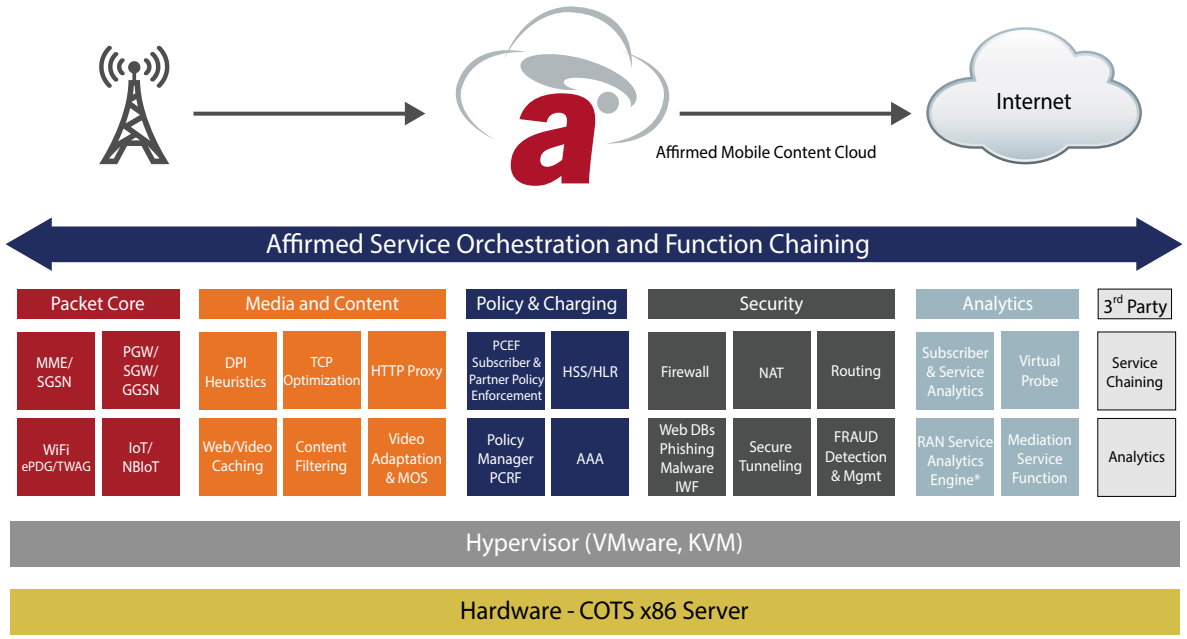
Affirmed's Mobile Content Cloud solution is a complete 5G-ready vEPC that meets the requirements for a common, composable core network:

- The core architecture is natively decomposed, separating the user and control planes so virtual network functions (VNFs) can be scaled independently.
- It supports two separate hierarchical layers so service providers can deploy and manage multiple, distributed data centers, and support an unlimited number of virtual machines within each data center for maximum scalability, security (e.g., topology hiding) and flexibility.
- User planes can be distributed across data centers and specific VNF instances can be deployed to support mobile edge computing, GiLAN services, Wi-Fi access and more.
- It supports a common core for both radio and Wi-Fi access networks through virtualized instances of both trusted (TWAG) and non-trusted (ePDG) Wi-Fi gateways. This enables mobile service providers to address the issue of preserving identity as subscribers move between different mobile access networks as well as end-to-end security across these networks.

FIGURE 5: AFFIRMED MOBILE CONTENT CLOUD



✓ **It simplifies creation of new mobile services with service chaining.**

- Affirmed supports service function chaining that provides subscriber classification and functions chaining, allowing Mobile Network Operators to "stitch together" subscriber specific services in minutes.
- The Affirmed Workflow GUI is easy to use and allows services to be created with just a few clicks and drag-and-drops to segment the subscribers, select the appropriate control profile, and chain the desired functions.

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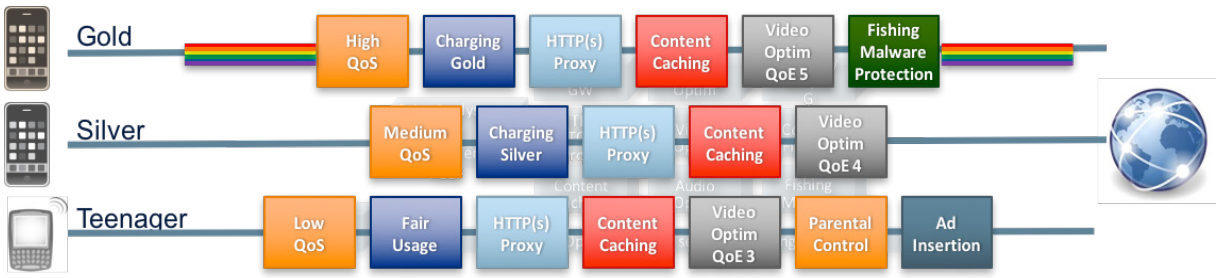
FIGURE 6: SERVICE FUNCTION CHAINING



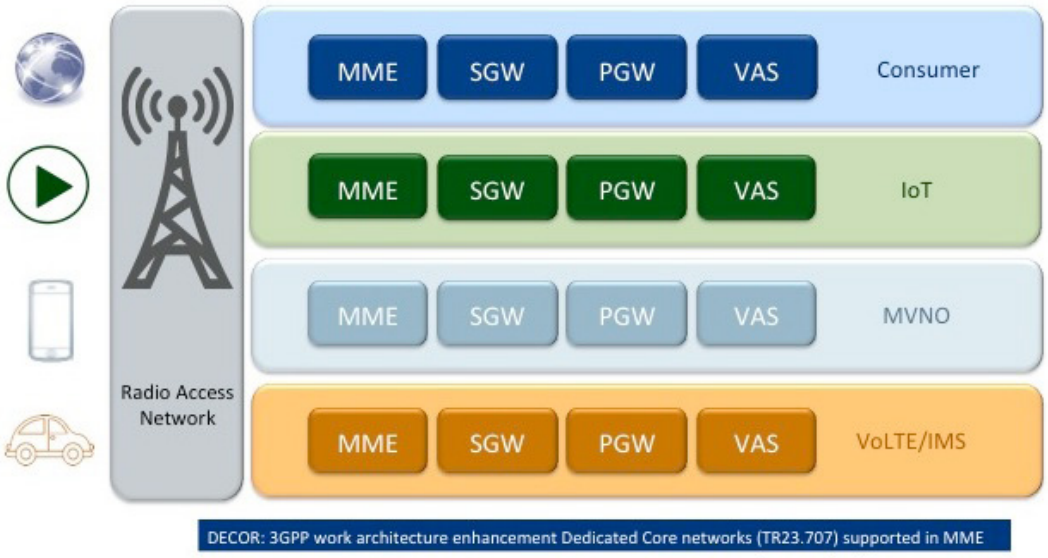
✓ **It supports network slicing.**

» While network slicing has become more visible with the imminent arrival of 5G, it has been a part of Affirmed's solutions for years. Affirmed's Mobile Content Cloud allows service providers to pursue three different paths to network slicing:

- Group multiple virtual machines into a cluster and assign them to a single gateway, then partition the network using multiple access point names (APNs);
- Assign multiple gateway instances to a single cluster, and route traffic accordingly, in effect creating dedicated cores for each application or set of applications;
- For maximum isolation, each cluster can have a dedicated gateway with multiple APN support of each gateway/cluster.

» Affirmed's virtualized packet gateways will also support 3GPP dedicated core feature (known as Décor) for network slices that allow the MME to redirect traffic to another mobile core.

FIGURE 7: NETWORK SLICING



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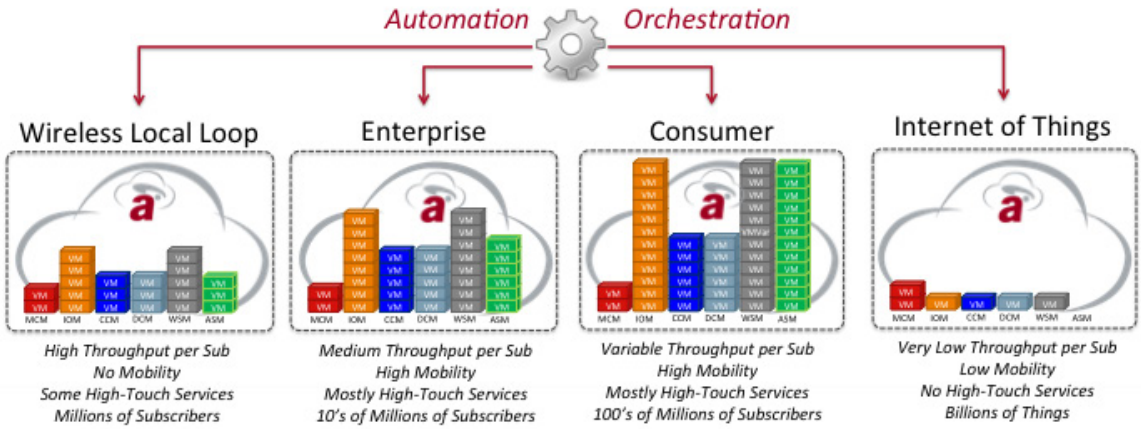
✓ **It can be optimized for Internet of Things (IoT).**

» IoT and the wave of M2M communications that it brings will place new demands on mobile networks to handle traffic sessions with widely different characteristics, from low-latency, high-bandwidth traffic to delay-tolerant, low-bandwidth traffic. Affirmed's cloud-native, stateless architecture will allow mobile service providers to scale and slice their networks to meet the demands of IoT in a cost-efficient and effective manner.

» Affirmed offers a flexible architecture that also allows for targeted scaling to increase capacity per call model dimension. CSPs can accommodate changing workloads without having to over-invest in capacity. Different elements like signaling, proxy, content and other service VMs can scale independently as needed, and per service function.

FIGURE 8: INTERNET OF THINGS



✓ **It reduces network cost and complexity.**

» Affirmed offers the lowest total cost of ownership (TCO) on the market today. A TCO study conducted by ACG Research found that Affirmed's NFV-based solutions saved mobile network operators an average of 68% in capex reduction and 67% in opex reduction, and yielded over a 90% reduction footprint and cooling costs.

» The same study found that Affirmed's solutions reduced new service creation and turn-up time by 10 months.

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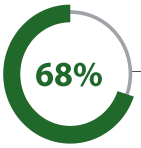
FIGURE 9: vEPC REDUCES COST AND COMPLEXITY

Capex



68% lower Cumulative CAPEX
1. No over-investment in capacity
2. Scale dimensions independently

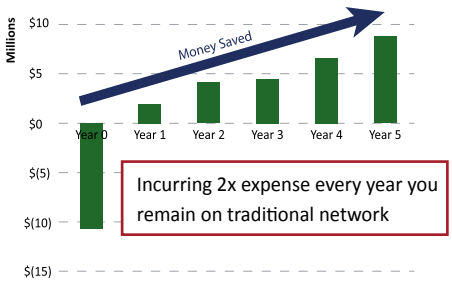
Opex

67% lower cumulative OPEX
1. Large environmental savings (power, cooling, and floor expense)
2. Service contract savings

Revenue

- Bring new services to market faster.
- Bring innovative and differentiated services to market by reducing the cost of creating and launching new services.
- Improve customer quality of experience with right-sized capacity in the network.

Cash Flow



Cash flow impact of transitioning to NFV solution

Service Turn Up Time

✓ **It is a comprehensive solution from an industry leader.**

» The Affirmed vEPC features a complete virtualization of the core network elements—2G/3G/4G/5G gateway, Wi-Fi gateway, policy control, Mobile Management Entity, vProbe, Service automation and GiLAN service—in a highly scalable and carrier-class NFV/SDN architecture. The Affirmed vEPC is already deployed in over 38 customer networks.

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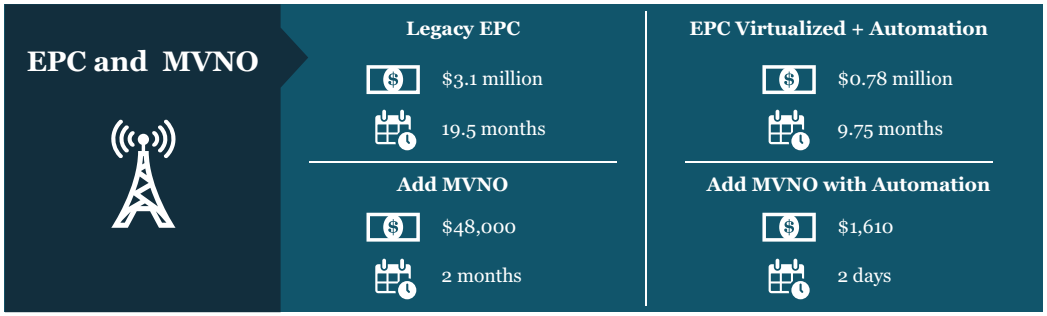
FASTER SERVICE CREATION WITH AFFIRMED SERVICE AUTOMATION PLATFORM (ASAP)

✓ **It helps you create and launch new mobile services faster.**

» The Affirmed Service Automation Platform (ASAP) solution is a next-generation automated service creation and orchestration platform that revolutionizes the way mobile services are created, tested and deployed. ASAP, together with Affirmed's simplified NFV/SDN architecture and probeless network analytics, can dramatically accelerate the service creation process, reducing the cost and time required to launch new mobile services by as much as 97%. This is a game-changer that allows mobile service providers to adopt the same "fail fast, succeed faster" approach as over-the-top (OTT) providers in order to increase revenue more quickly and compete more effectively.

- Supports seamless service configuration across multivendor legacy and virtual network elements;
- Accelerates and simplifies service creation with GUI-based drag-and-drop screens;
- User of ASAP is freed from the tyranny of custom-built connectors and static service models. (i.e., Roll-your-own service models and roll-your-own connectors).

FIGURE 10: IMPACT OF AUTOMATION AND VIRTUALIZATION



✓ **It simplifies network management and operations.**

» ASAP is a network-wide service automation and orchestration platform that radically simplifies service creation, service provisioning and turn-up of new virtual network function (VNF) instances in the mobile network. ASAP provides broad service automation and orchestration across a wide range of standard network element interfaces, including SOAP, REST, NETCONF/YANG and CLI. ASAP goes beyond traditional service orchestration, automation and flow-through provisioning tools to provide complete configuration management across multi-vendor virtual and physical network elements and network-wide service instances.

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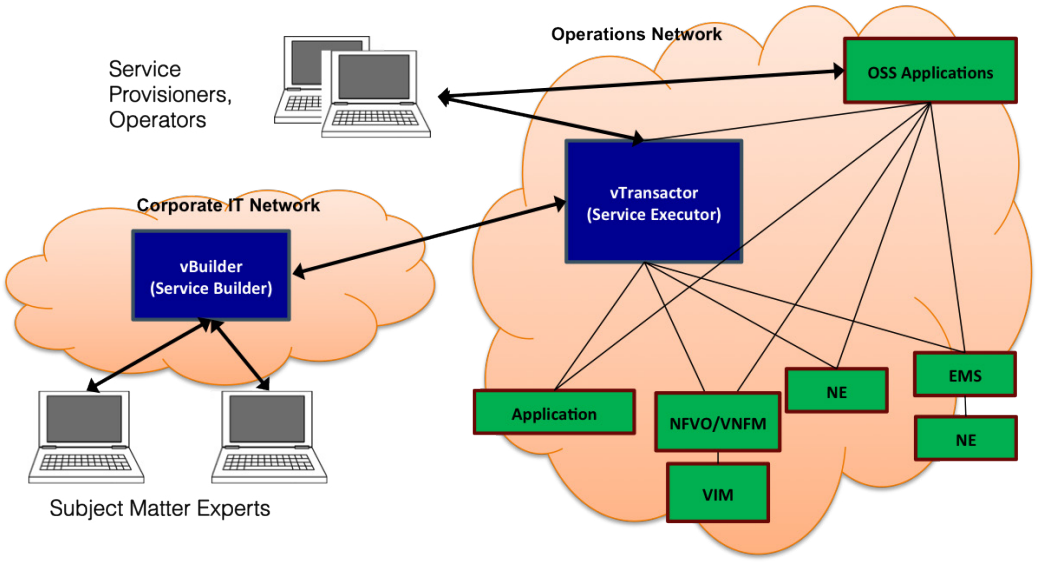
FIGURE 11: SERVICE AUTOMATION PLATFORM



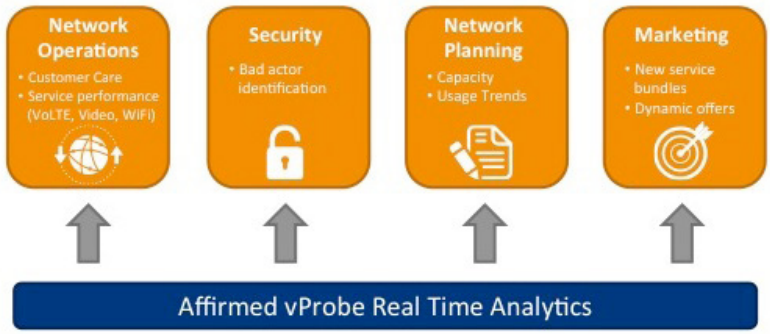
AFFIRMED'S VIRTUALIZED PROBE (VPROBE) AND ANALYTICS

✓ **It improves your mobile services.**

vProbe delivers embedded network probe and monitoring capabilities that result in several immediate benefits to mobile service providers:

- » Improves network quality of service (and, by extension, customer satisfaction);
- » Reduces network support costs through proactive network management;
- » Provides real-time network analytics that allow service providers to better target new services to their customers.

FIGURE 12: vPROBE REAL-TIME ANALYTICS



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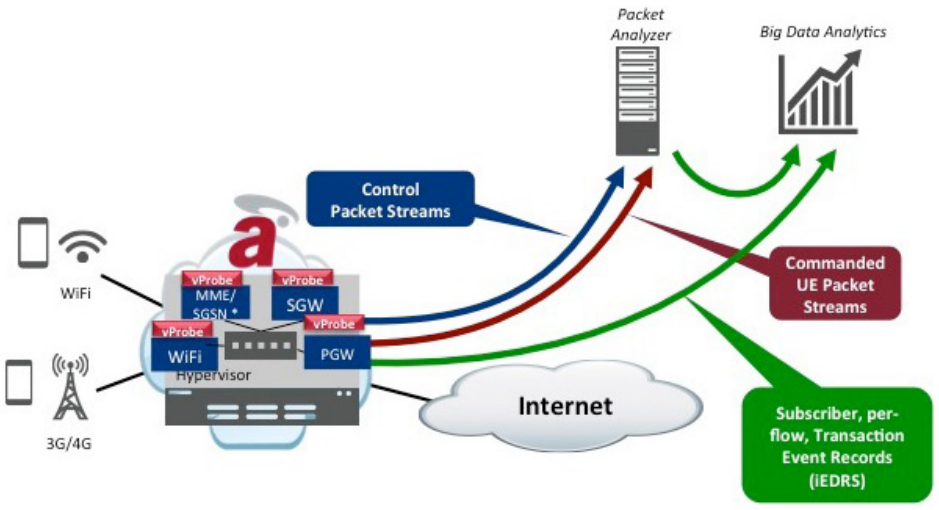
✓ **It's a more efficient way to monitor and manage your network.**

- » Only Affirmed offers a probeless network monitoring and analytics solution that is natively co-located with mobile network functions. This approach reduces cost by more than 50%.
- » vProbe also addresses the issue of probing virtualized functions, which is impossible with physical probes because of the absence of demarcation points.
- » vProbe meets the need for low-cost, real-time, pervasive network intelligence—a key requirement for 5G networks, particularly as service providers look to enforce SLAs across a myriad of network slices, from M2M communications to vertical industry solutions.

FIGURE 13: vPROBE



GET THE BENEFITS OF 5G TODAY

You don't need to wait for the 5G revolution to experience the freedom of network virtualization, network orchestration, service automation, seamless mobility and pervasive network intelligence. And you don't need to make short-term network investments that don't align with your long-term plans. You can meet the challenges of today and tomorrow with Affirmed Networks—and enter the 5G future with a competitive advantage (and new revenue momentum). To learn more about our portfolio of 5G-ready solutions, visit us at affirmednetworks.com.

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