

Management Systems in the 5G Era

Opportunities and Challenges

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1 Introduction

1.1 5G Overview

The International Telecommunications Union (ITU) has defined three main focus areas for the enhanced capabilities of 5G:

- **eMBB** (enhanced Mobile Broadband). Faster connections, higher throughput, and more capacity. Possible speeds are up to 10 to 100 times faster than 4G, enabling a better and richer streaming experience for video applications of all kinds, not just movies.
- **URLLC** (Ultra Reliable Low Latency Communications). Using the network for mission critical applications that require uninterrupted and robust data exchange. Short-packet data transmission will be used to meet both reliability and latency requirements leading to new applications such as connected cars.
- **mMTC** (massive Machine Type Communications). Will allow a large number of devices to be connected. For example, 5G technology is expected to connect some of the 50 billion connected IoT devices all the way from drones, cars, trash cans, smart meters, haulage trucks, to machines in farms and factories.

5G networks operate on up to three frequency bands – low, medium, and high. The ability to operate in a wide variety of frequency bands gives 5G networks enormous flexibility. At high frequencies, they can operate at high speeds but within a short range. At lower frequencies, 5G networks have a longer range but operate at a lower speed. In the high frequency bands 5G networks have a shorter range which results in smaller cell coverage area. Therefore, more cells are needed to provide coverage over a geographic area resulting in more devices. Managing more devices puts additional burden on the management system.

It is important to note that, architecturally, 5G is not limited to supporting just voice and data. It could also support other applications leading to additional services.

1.2 Technology shifts

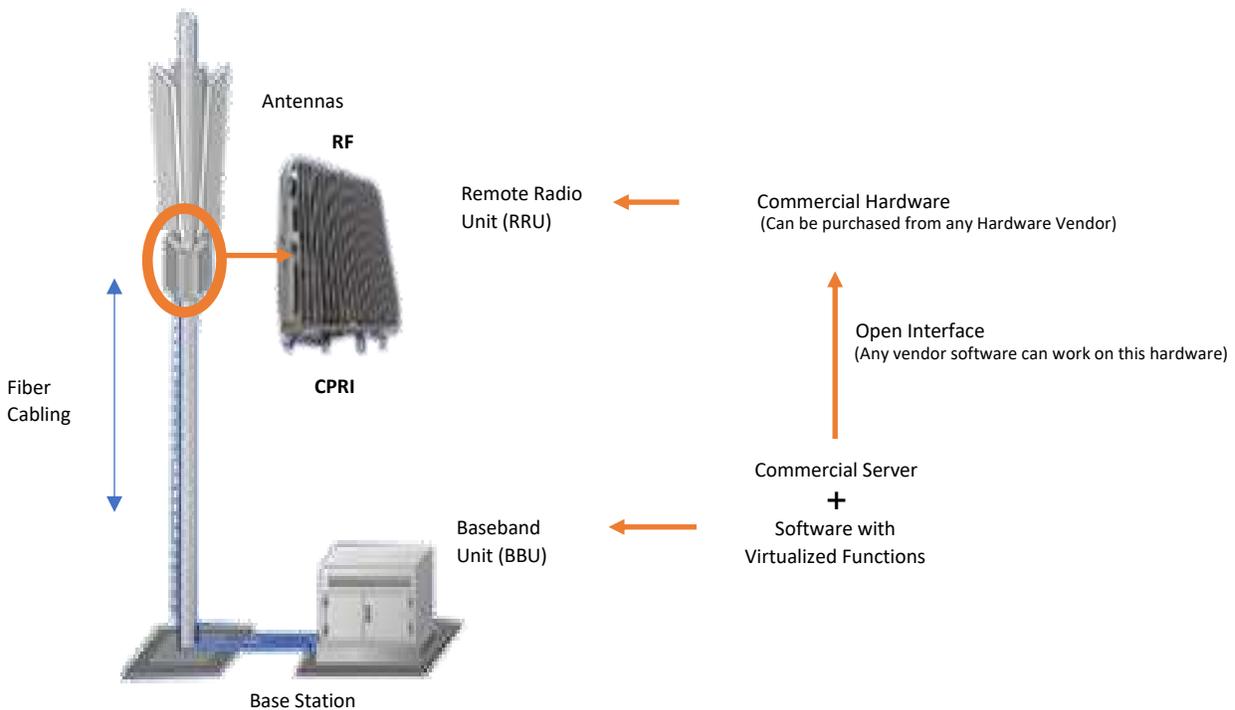
Current RAN technology consists of an integrated hardware and software platform which is proprietary to each and every network and device manufacturer.

While much of the network has already benefited from a wave of disaggregation and virtualization in support of 4G/LTE, the RAN is the last piece of the network to be disaggregated. Three important elements of a fully disaggregated RAN have begun to emerge: the Centralized Unit (CU), the Distributed Unit (DU), and the Radio Unit (RU). This disaggregation has made possible a multi-vendor solution, facilitated by open interface specifications such as O-RAN from the O-RAN Alliance. This multi-vendor approach allows operators to mix and match best-of-breed components from multiple vendors and also helps them to drive down the costs.

Another key shift that is currently underway is the shift towards virtualization, containerization and cloudification. This makes the operational support systems that are required to roll out new services

very versatile and capable of supporting advanced services and applications. Lastly the operators are embarking on software development either inhouse or using third party partners to unleash the power of automation which will enable them to deploy new services and applications sooner.

OPEN RAN: DISAGGREGATING HARDWARE AND SOFTWARE



1.3 New opportunities for telecom

The technology shifts discussed in the previous section will enable 5G networks to support a host of new applications and services. For service providers, there is a shift from offering just voice and data to a richer set of applications such as edge-based services that support autonomous driving, augmented reality, or any IoT application that requires low latency cloud processing. Enterprises are beginning to leverage 5G networks' speed, signal prioritization, and security to roll out private LTE/5G networks to drive automation in their factories and warehouses etc.

2 Management Systems in the 5G era

2.1 Key Requirements

Some of the key requirements that need to be considered when designing a management system in the 5G era are discussed below.

2.1.1 Multivendor device management with a unified management view

Due to disaggregation in the RAN network, and the core network being part of the complete system, a 5G solution will comprise devices from many different vendors. A 5G management system will have to manage these diverse devices. The system must support the following:

- **“Single Pane of Glass view”** of the entire network for seamless end-to-end management
- **Model-driven, standards-based** management to reduce the complexity and the cost of integration
- **Easy integration of new devices** to enable system integrators to rapidly develop solutions and to enable OEMs to integrate partners’ devices

2.1.2 xNF awareness

Network functions are increasingly getting cloudified, and hence the management system must be cloud (VNF/CNF) aware and have its own VNFM and orchestrators. It’s important to take into consideration that the deployment will be a mix of physical and virtual components.

2.1.3 Security

A chain is only as strong as the weakest link. With the proliferation of devices, all of them being interconnected, it is critical that the devices are protected and there are no weak links. In addition, the management system which can get access to and also configure the device needs to be very secure to prevent unauthorized access.

2.1.4 Scalability

By its nature, the number of devices and the data that a 5G system must handle will be significantly higher than what was ever managed before. The 5G management system must support this volume of data with modern data architecture principals.

2.1.5 Automation capable

A management system of 5G functions must support a high degree of automation, particularly taking into account that the functions are virtualized and the fact that number of devices could be very high.

2.2 5G Management systems for different market segments

The market for 5G management systems can be segmented into the following three categories.

- (i) Management system for enterprises rolling out private LTE/5G
- (ii) Management system for device manufacturers of 5G/LTE devices
- (iii) Management system for service providers

2.2.1 Private LTE/5G for enterprises

With 5G technology providing many benefits, private enterprises have embarked on deploying it in their businesses. Compared to service providers the management system needed to manage a private LTE/5G network in an enterprise need not be sophisticated. However, it will still require a management system with the following features:

- Simple and easy-to-use
- Easy troubleshooting with correlation etc
- End-to-end visibility

2.2.2 For 5G CNF/VNF device manufacturers

VNF/CNF vendors will want to focus on their core expertise – the networking stack – and in some cases, they may only have a part of the solution, since the RAN/Core is built using multiple components. These vendors will fill in the gaps using partner solutions, so it is logical for them to seek a multivendor management system which supports switching partners easily. Some of the desired features of this market are:

- Easy integration of partner devices
- Cost-effective customization
- YANG/Netconf agent

2.2.3 For Service Providers

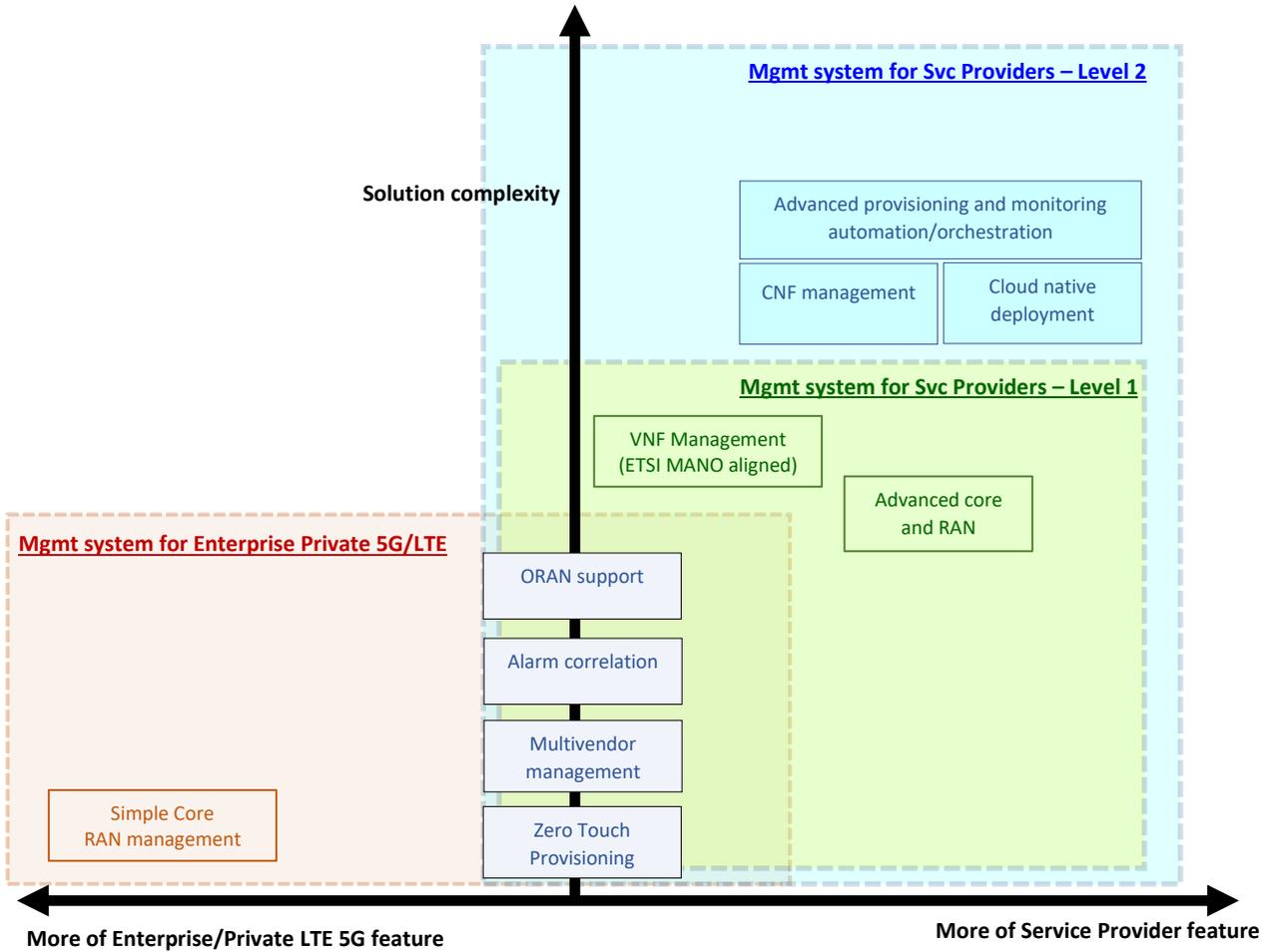
As previously discussed, 5G architecture and O-RAN unlocks the potential for disaggregation, driving service providers to assemble their own solution. Larger service providers have the capability to do this themselves whereas smaller service providers will look to system integrators to deliver a complete solution. Some of the desired features of a management system for this segment are:

- Rapid integration of new devices
- Rapid and cost-effective customization
- VNF/CNF aware management
- RAN/Core configuration, correlation and monitoring features available out of the box

In this discussion we will be focusing on the end-user market and therefore will not be discussing the management system for device manufacturers.

From the figure below, it can be seen that the 5G management system market for service providers can be segmented into “Mgmt system for Svc Providers – Level 1” and “Mgmt system for Svc Providers – Level 2”. “Mgmt system for Svc Providers – Level 1” captures the key requirements of Tier 2 service providers and “Mgmt system for Svc Providers – Level 2” captures the key requirements for Tier 1 service providers. As it can be seen the management system needed to manage the operations of a Tier 1 service provider is vastly more complex because of the size and scale of their operations. Most Tier 1 service providers end up building their own custom management system to suit their operations.

Management Systems in the 5G Era



Since the size and scale of a typical enterprise or a Tier 2 service provider is a lot smaller than a Tier 1 service provider, most likely an enterprise or a Tier 2 service provider could use a third-party management system. However, the third-party management system should be capable of being customized to suit their needs. Typically, a System Integrator (SI) takes on the responsibility of customizing the third-party management solution and integrating it with the devices to deliver a complete management solution to the enterprise or Tier 2 service providers.

3 Conclusion

The extra speed, throughput, capacity and reduced latency of 5G will enable a whole host of new applications far removed from the traditional voice and data of current networks. An explosion of video, mission-critical applications, and applications involving many of today's 50 billion connected IoT devices will become commonplace. The disaggregation of hardware and software, facilitated by open interfaces will create a market for vendors supplying individual components rather than complete solutions. This will give Service Providers more choice, but also more headaches having to ensure that components from different suppliers work together and adhere to standards such as O-RAN. The plethora of smaller devices will also mandate the need for an overarching management system with a unified view across the whole solution. VNF/CNF awareness will be critical, as will support for standards such as YANG/Netconf which decrease integration time for new devices and allow for more automation of routine tasks.

About Dhyan

For over 15 years, Dhyan has been at the forefront of device management software, providing core management functionality to many of the biggest device manufacturers. Dhyan's management system, NetMan® has been integrated with many devices, providing a complete management system (including configuration) and has the foundations of a world-class unified management system capable of managing a variety of devices, a key requirement in the 5G space.