June 2021

SIMPLIFIED PARAMETER SELECTION FOR ENTERPRISE PRIVATE 5G NETWORK PROVISIONING

Vijay Marthi

SIMPLIFIED PARAMETER SELECTION FOR ENTERPRISE PRIVATE 5G NETWORK PROVISIONING

AUTHORS:
Vijay Marthi

ABSTRACT

For enterprises having multiple locations, potentially across the world, deploying private 5G networks across these locations can be cumbersome. Techniques herein provide for the ability to simplify the process of 5G network provisioning utilizing a centralized system that interacts with various enterprise locations to deploy an enterprise private 5G network with minimum required parameters.

DETAILED DESCRIPTION

A 5G network can involve multiple components, each having multiple configurations with multiple parameters. When an enterprise that may have multiple locations across the world desires to deploy an enterprise private 5G network, the deployment process can be cumbersome such that tracking the configurations and parameters of multiple network components can be a tedious and error-prone task. Thus, it would be advantageous to simplify the 5G network deployment process to enable enterprise administrators to deploy an enterprise private 5G network with minimal parameters. However, since not all 5G network components, such as control plane components and user plane components, may not run on one version of software, choosing the correct software version for network components is important when deploying a 5G network.

Techniques herein provide for the ability to simplify the process of 5G network provisioning utilizing a centralized system that interacts with various enterprise locations to deploy an enterprise private 5G network (sometimes referred to as 5G-as-a-service (5GaaS)) with minimum required parameters. Consider an architectural diagram of a

centralized system (e.g., private cloud), as shown below in Figure 1A, through which various features of this proposal may be implemented.

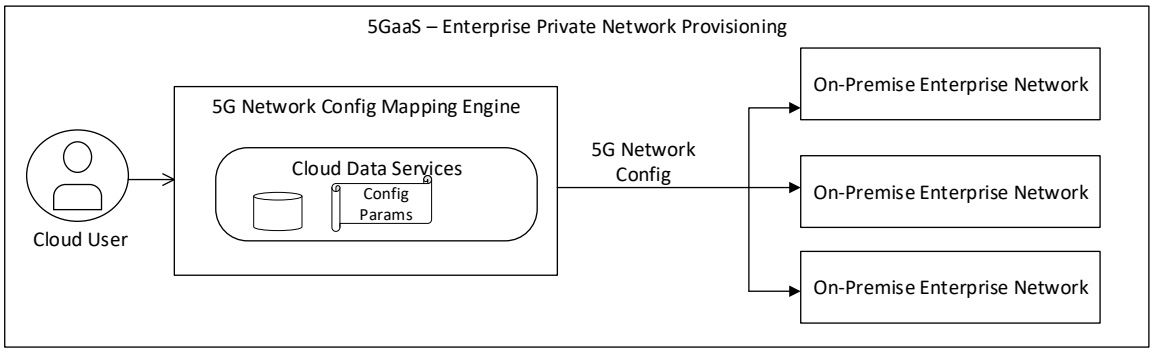

Figure 1: Example System Architecture

Consider various pre-requisites for operation of the system of Figure 1A. For example, it is assumed for the operation of the system that various configuration parameters are provided (e.g., by a cloud user) for each enterprise site for which an on-premise enterprise private 5G network is to be implemented. Various site-specific configuration parameters that may be provided for the system are shown below, in TABLE 1.

TABLE 1: Site Specific Configuration Parameters

Config Params	Description
Customer Identifaiton	Customer location
Site Location	Location of the Network
Software Release Number	Release Number maps to appropriate versions for User Plane and Control Plane 5G network components
Size of the Network	Small or Medium or Large
Action	Deploy

Further, it is assumed that all enterprise sites for which an on-premise enterprise private 5G network is to be deployed is configured with all the hardware required to implement a 5G network and that each site is registered in the centralized system along with private and public security keys. The centralized system maintains the default values for various 5G network elements, such as an Access and Mobility Management Function (AMF), Session Management Function (SMF), User Plane Function (UPF),Unified Data Management (UDM) entity, etc. along with various infrastructure configuration parameters,

such as AMF Internet Protocol (IP) address, SMF IP address, UPF IP address, download and upload thresholds, Quality of Service (QoS) options, etc. Various default configuration parameters that may be maintained within the system for the various 5G network components for each enterprise site are shown below in TABLE 2.

TABLE 2: Network Component Configuration Parameters

Default Configs	
Config Parameters	**Description**
IPv4 Address	IPv4 Address
IPv6 Address	IPv6 Address
UCS Server Serial Numbers	UCS Server Serial Numbers
DNN	Data Network Name which user equipment (UE) will use to access the 5G Data Network
ipam	This will have the list of IPv4/IPv6 address range from which the Network will be allocated to UEs, for more details
PLMN	Public Land Mobile Network including Mobile Country Code and Mobile Network Code
SUPI Start and End Range	Subscription Permanent Identifier start and end range for Ues
UCS Service Serial Numbers	
VLAN Range for IPv4	
UPF Node address and port	
AMF Node address and port	
SMF Node address and port	

Thus, an account owner can initiate the deployment of a 5G network on the centralized system to configure the various parameters (e.g., network size, QoS, etc.). After 5G network hardware is deployed for a given enterprise/customer site, the enterprise/customer can be notified regarding various information, such as: site details, available software versions, allowed network sizes (e.g., small, medium, large, extra-large, etc.), QoS, etc.

Following the configuration of various parameters and hardware deployment, the system of Figures 1A may broadly operate as follows:

1. Based on various user inputs, a centralized (Cloud) Network Configuration (Config) Mapping Service/Engine generates the necessary configuration parameters to initiate a 5G network. Various parameters are discussed in more detail below, but may include, for example, memory, capacity, Internet Protocol (IP) addresses, range of the edge device IP addresses, required hardware username and passwords, network speed, software/network agreement, etc. based on the size of various 5G network components (e.g., AMF, SMF, UPF, UDM, etc.);

2. The central cloud Network Configuration Mapping Service/Engine also maintains a catalog of software release versions to match to versions of the 5G network components; and
3. The version catalog is released to different on-premise networks to facilitate provisioning of the networks. TABLE 3, below, illustrates an example version catalog that may be released following on-premise provisioning.

TABLE 3: Example Version Catalog

5G Version	Component	Version	IP4 Address Ranges	IPV6 Address Ranges
1.0	AMF	2.1	10.X.X.X to 10.X.X.10	<IPV6> to <IPV6>
1.0	UPF	3.0	10.X.X.X to 10.X.X.10	<IPV6> to <IPV6>
1.0	SMF	3.5	10.X.X.X to 10.X.X.10	<IPV6> to <IPV6>
2.0	AMF	2.2	10.X.X.X to 10.X.X.10	<IPV6> to <IPV6>
2.0	UPF	3.0	10.X.X.X to 10.X.X.10	<IPV6> to <IPV6>
2.0	SMF	3.6	10.X.X.X to 10.X.X.10	<IPV6> to <IPV6>

Thus, the provisioning process may include various steps such that an account administrator can login to the centralized system to deploy enterprise private 5G networks on available locations and the system may help the administrator to choose the correct configuration for different sites by providing the administrator with the ability to select a corresponding location/site, select the software version(s) for the site, select the size of the network, and select QoS details for the site. Thereafter, the centralized network configuration mapping service/engine generates the necessary configuration parameters,

as discussed above, to initiate the 5G network for each of the one or more locations/sites and outputs parameters based on the selected network size, QOS, and capacity.

For example, if the network size small, a single range of the edge device IP addresses may be generated. However, if the network size is large, a group of edge device IP address may be generated. Similarly, network service agreements may impact the generated parameters based on network size.

Figure 1B, below, provides a more detailed illustration of the centralized network configuration mapping service/engine of FIG. 1A following the generation of parameters for one or more enterprise locations/sites.

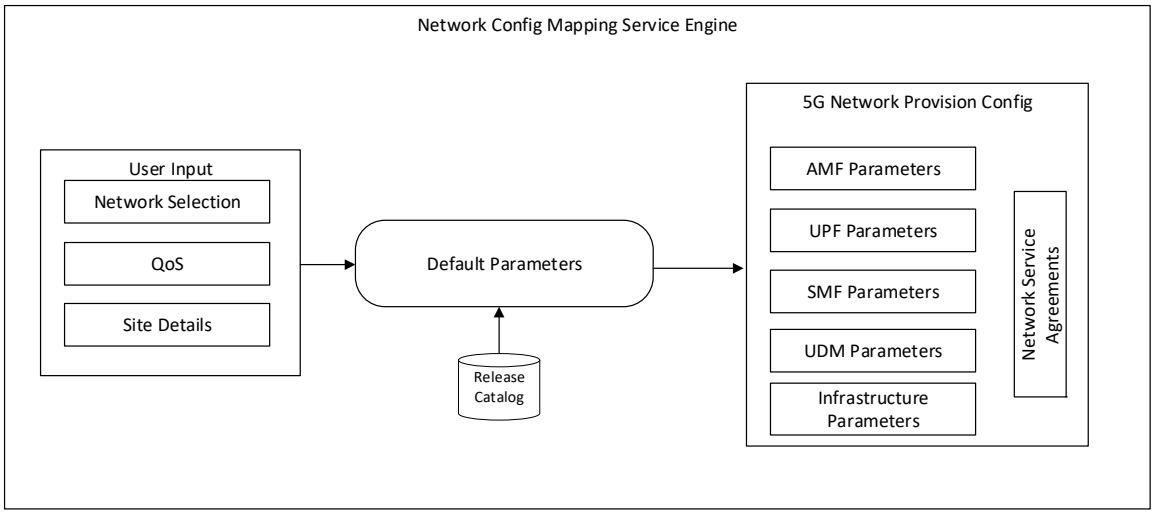

Figure 1B: Network Location/Site Parameter Generation Example Details

In summary, techniques of this proposal provide for the ability to simplify the process of 5G network provisioning utilizing a centralized system that interacts with various enterprise locations to deploy an enterprise private 5G network with minimum required parameters, which may be useful for instances in which an enterprise may seek to deploy 5G networks across multiple locations by simplifying and making the provisioning process less error-prone.