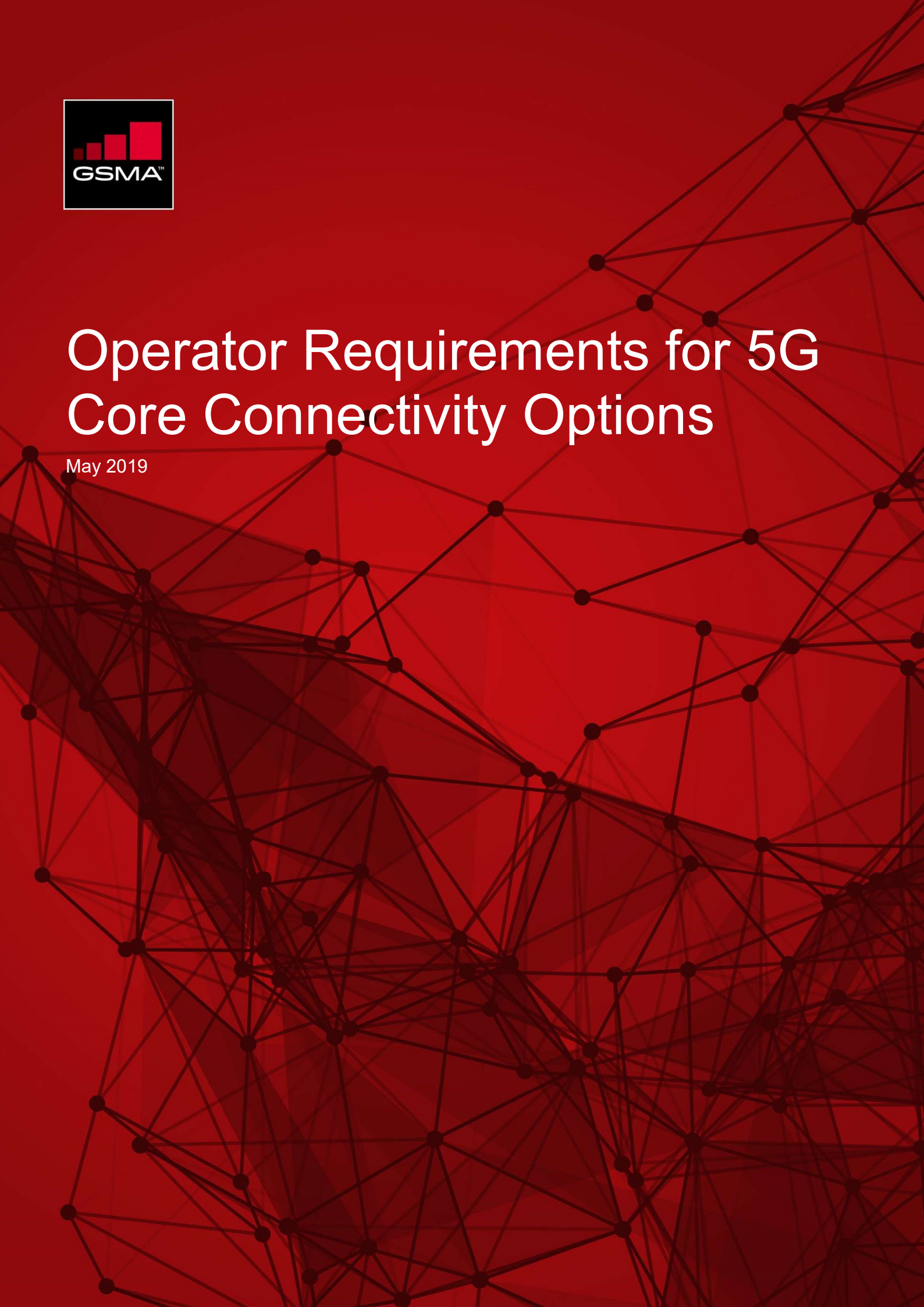

Operator Requirements for 5G Core Connectivity Options

May 2019

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Introduction

For the introduction of 5G, 3GPP has specified 5 possible configurations or 'Options' for connecting to an EPC or new 5G core network (6 if the current 4G system is included).

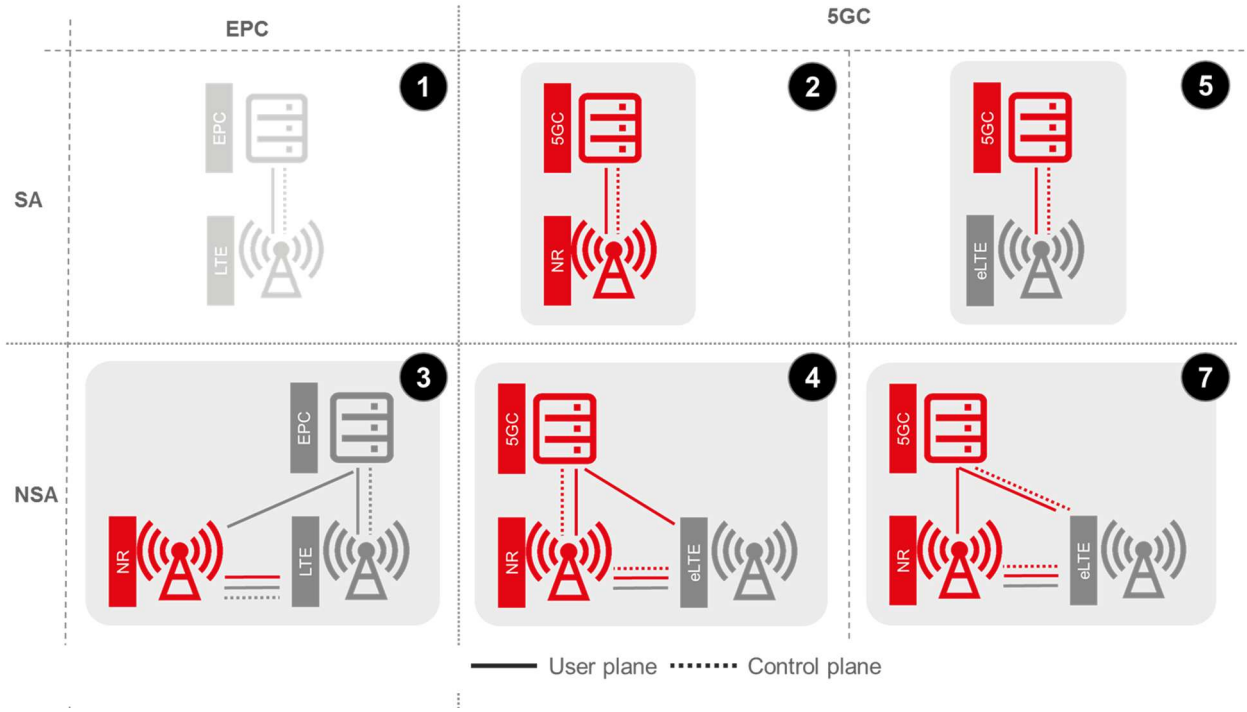

Figure 1: 3GPP defined options for 5G deployment

These configurations are depicted in Figure 1.

The features that distinguish each Option are:

- Use of Dual Connectivity;
- Radio Access Technology acting as master node
- Core Network used.

The Options using Dual Connectivity are grouped together under the term "Non-standalone" (NSA) to indicate that 5G radio access technology (NR) and LTE are used simultaneously to provide radio access. Options where only one radio access technology is in use are referred to as "Standalone" (SA).

It is widely expected that mobile operators will initially deploy 5G using Option 3 allowing the re-use of existing EPC Core functionality. Option 3 has been fully specified in an early drop of 3GPP Release 15.

The other deployment Options already fully specified by 3GPP are Option 2 and Option 5, both standalone options differing in the type of radio access technology connected to the new mobile core network 5GC. These options were completed in June 2018 (ASN.1 in September 2018).

In addition, 3GPP has finalized the two remaining Options, Option 4 and Option 7, completed in March 2019 (ASN.1 in June 2019).

Operators have planned their network deployment strategies based on what is included in the 3GPP specifications, and therefore reduction of the support of these options after standardization is not feasible.

Support for option 2 will be delivered with the initial industry support for standalone connectivity to the 5G Core. The aim of this paper is to provide the supplier ecosystem with a view of Operators' requirements for the support the 5G Core connectivity options beyond option 2, i.e. options 4, 5 and 7.

To support this GSMA conducted some initial interviews with 20 Operators (and Operator groups) who are planning to launch 5G in the next 2 years to understand which of the 5 Options they are considering for their deployment plans. The results of this initial survey clearly indicated the Operators have a strong requirement for the additional support of Options 4, 5 and 7. In addition Operators require that Option 2 introduction is not delayed.

Key Benefits of 5G Core

A 5G Core offers substantial service benefits relative to a 4G EPC through native support of key capabilities such as:

- Network Slicing
- Mobile Edge Computing (MEC)
- Ultra-Reliable Low Latency Communications (uRLLC)

All these are under-pinned by a new security framework and new end-to-end QoS model enabling more granular end-to-end management and control of traffic flows and applications.

The 5GC has also been designed based on a fully modular Service Based Architecture providing a cloud-optimised framework for flexible service creation, automation, scalability and resilience.

For Operators deploying Fixed Services a 5GC will also provide an extended framework allowing a fully converged Core for Fixed and Mobile access bringing operational efficiencies and converged capabilities and services across both network domains.

First commercial 5GC products are expected from suppliers in 2019.

Deployment Options

This section outlines the key benefits of each Option enabling access to a 5GC as well as other considerations for the their deployment.

From a 5GC implementation perspective all Options are considered similar, the primary differences are in the Radio Access Network as outlined below.

Option 5 considerations

The key attractiveness of this option lies in the ability for an operator to rapidly roll out wide-area services that require 5GC capabilities (such as Mobile Edge Computing and Network Slicing) by fully leveraging existing LTE coverage and capacity.

By effectively increasing the utilization of 5GC services for customers over wider LTE coverage areas this will make early 5GC investments more attractive for Operators and minimize any incremental investments in legacy EPC functionality.

Another major advantage of this option is that the use of 5GC, for both LTE and NR radio access, removes the need to perform inter-system handovers at the boundary of NR coverage areas. That may happen frequently not only in the early phases of NR rollout (particularly for high band NR deployments) but also longer term as Operators suitably phase NR deployment over wider network

areas using low bands, hence easing pressure to deploy in these bands.

Other advantages of this option include:

- Avoids the cost, complexities and impact on LTE services of re-farming or operating Dynamic Spectrum Sharing on existing highly utilized low bands,
- Facilitates multi-vendor radio access networks due to the interworking between LTE and NR happening at core network level,
- Relatively low implementation complexity (no dual connectivity);

It is expected that no expensive upgrades of existing RF equipment are expected to support this Option.

Option 7 considerations

This option combines the advantages of Option 5 with the added benefit of Dual Connectivity allowing data aggregation with any co-existing 5G NR carriers to improve throughput.

Dual Connectivity also improves service continuity when moving between NR and LTE coverage by removing the need for Inter-RAT/Inter Core handovers which may be significant/frequent if 5G NR is deployed on higher bands such 3.5 GHz or millimeter wave bands.

Option 7 effectively forms the natural evolution of Option 3 (which many Operators will deploy for launch) so considered very important for maintaining network performance and coverage when connecting to a 5G core.

Option 4 considerations

This option is considered attractive by some operators as it allows connectivity to a 5GC with NR as the master cell (control plane anchor), and Dual connectivity (data aggregation) with any co-existing LTE carriers deployed on a site. Data aggregation with LTE carriers is important to ensure parity with LTE network speeds.

As the anchor of the control plane is NR, this option is more appropriate for deployments of low band NR, or, in scenarios where re-farming or dynamic spectrum sharing on existing low bands is feasible.

With Option 4 NR acts as the master cell, so this Option may be considered a different form of implementation relative to Options 5 & 7 (which share many features).

Conclusions

A 5G Core offers substantial capabilities and benefits (relative to EPC) and is essential to enable Operators' evolved wide-area service requirements and to enable new revenue streams through advanced 5G services.

Operators believe that support for additional Options 5, 7 & 4 (beyond Options 3 & 2) is essential to efficiently connect to these 5G Core services across their 4G and 5G network coverage areas and ensure seamless service connectivity between these areas.

Operators request network, chipset and device suppliers, as well as the wider industry eco-system, to support the development of these additional Options for commercial use. Operators will be available for further discussions with vendors to ensure these options are included in their roadmaps in a timely manner.

List of Supporting Operators

América Móvil, China Mobile, China Telecom, China Unicom, CK Hutchison, Deutsche Telekom, Etisalat, KDDI, KPN, KT Corporation, Maxis, NTT DOCOMO, Orange, SK Telecom, Softbank, TIM, Telenor, Telstra, Turkcell, Vodafone

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