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Study on 5G Networks Providing Access
to Localized Services;

Stage 1

(Release 18)

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# Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

# 1 Scope

The present document intends to capture the outcome of the study on use cases and potential new requirements for 5G networks providing access to localized services. The study aims to cover:

* use cases for enhanced 5G system support of a hosting network providing users/devices access to specific services, offered by the hosting network operator, other mobile operator(s) or 3rd party provider(s). Including scenarios where:
	+ Access to services through the hosting network could be on demand, temporary and/or cover specific location(s);
	+ The operator of the hosting network, or other mobile operator offering services to users, can be a PLMN or NPN operator;
	+ Different RATs (3GPP or non-3GPP) and spectrum (licensed or unlicensed) could be considered;
	+ The hosting network can also provide specific network services, e.g., location-based service, time synchronization etc.
* Investigate potential new service requirements, including:
	+ Enabling users/UEs to discover availability of specific target networks and specific services through a hosting network;
	+ Network functionalities to negotiate and configure access and requirements for a specific service (e.g., QoS, network slicing, charging, onboarding etc.);
		- Can include policy management, service/QoS monitoring, and interaction between the hosting network and other mobile operator or 3rd party (offering the service) e.g., via API or other standard mechanisms
	+ Enabling users/UEs to concurrently use specific target services offered through a hosting network and the regular services offered by the HPLMN of the user/UE;
	+ Enabling access to the hosting network and specific services for users/UEs without previous relationship with the hosting network;
	+ Consideration of regulatory and security aspects.
* Gap analysis between potential new requirements and existing requirements and functionalities supported by 3GPP, e.g., VIAPA, NPN, slicing, QoS, etc.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.261: "Service requirements for the 5G system".

[3] 3GPP TS 22.263: "Service requirements for Video, Imaging and Audio for Professional Applications (VIAPA)".

[4] 3GPP TS 22.278: "Service requirements for the Evolved Packet System (EPS)".

[5] 3GPP TS 22.011: "Service accessibility".

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

**example:** text used to clarify abstract rules by applying them literally.

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

<ACRONYM> <Explanation>

# 4 Overview

## 4.1 General

The use cases contained in this technical report consider several service aspects. This study focusses on each of the concepts introduced in the next subclause, “Business Model for Providing Access to Localized Services,” to some extent. The primary consideration, from which potential requirements are derived are how to set up services, ensure that users find, get access to and obtain services with proper control, and the scenarios and constraints that pertain to hosting networks.

Key aspects that are addressed are how hosting networks are configured and what policies are applied to the services they offer. These networks are only available within a limited span of time and physical extent. The use cases consider how to allow flexibility to establish such networks easily, while still offering security and access to regulatory mandated services. Use cases balance the ability of users to discover and select access to hosting networks with the policies of their home network provider, as some services will be home routed, while others provided locally. The hosting network itself may use resources in a very controlled manner in some of the scenarios explored in the use cases in clause 5.

Another key aspect of this study is the interaction with third parties who can request, configure and remain informed of the services provided by the hosting network.

## 4.2 Business Model for Providing Access to Localized Services

The following figure is a ‘business model canvas’ depicting a number of relevant aspects of the business model. The model is not meant to exhaustively list all aspects. Rather it draws out key elements of the goals study intends to achieve.

Figure 4.2-1: A Business Model Canvas for Providing Access to Local Services

Key Partners include Network Operators (MNOs, NPN operators, fixed operators, etc.), Local service providers, individuals (users), owners of facilities or proprietors of business in which the local access will occur and third party service providers. These stakeholders will work together to provide local access to services.

The main activities that we will be concerned with in this study are first how to commission and decommission access, as including the relevant services. The access is not merely to a *network* but to a set of *services* offered by local service providers, the network operator and third parties. Since the access is *local* and may be bounded in time and space, the effort to de/commission accesses and services will have to be very light-weight (not requiring lots of lead-time, complexity, in-person consulting and customization, etc.)

Secondly, from a user perspective, the user must become aware of access and local services, to choose to access them. The process by which the user and their equipment gain access to the network, use it and terminate access (and service) will be efficient, simple and result in a user experience that seems convenient and to offer resources and services that cannot be accessed any other way.

Providing access to local services results in four distinct opportunities for users and service providers. First, access can be provided that is sufficient in areas that otherwise would lack them, for example, on a fairground established far from other infrastructure. Second, the access to local services will be simpler than access would be without this service. For example, obtaining network access may result in associated local service configuration and effortless presentation to the user. Third, the access and local services operation can be established as needed, without the need for long term business relationships such as facilities, permanently installed equipment, etc. (Of course this advantage does not remove the need for such to be established on a *short-term* basis.)

To establish the complex set of business relationships and arrangements from the perspective of all the involved key partners, business processes will have to be automated, or at the very least available for self-service. This may have standards implications, to the extent that interaction with different stakeholders can proceed using electronic data interchange. These standards may be out of scope of 3GPP.

The customer segments listed are meant to be examples. The use cases in this study will elaborate specific applications of this feature to different users in business relevant cases.

The resources that must be brought to bear to provide access to local services are of two kinds. First, the network operator must have (or be able to make use of others’) network infrastructure, both for mobile access and for configuration of services, authorization and other aspects. Second, the service providers (local service providers, third party service providers and the network operator provided services) need to be able to arrange for their services to be offered via the local access. For this purpose, a set of service set-up processes are in place.

These local service access can be promoted and arranged through different channels. Principally the local service operators (e.g. brick and mortar businesses, entertainment venues, construction contractors, first responder agencies, etc.) will provide information and proper incentive or instructions to potential users so that they will seek to access the local services. Third party service providers, e.g. an athletics association, a regional corporation or national agency, can inform, motivate and prepare their users to expect local access to services (in a particular place, at a particular tome.)

While cost structures, billing and revenue models are out of scope of 3GPP, some consideration of the business approach is relevant to this study. The key partners need to either charge or be charged for their part in the service, or to make use of the local services without charge, if that is possible. Two models of revenue are considered in the table – usage based, in which either the user or a service provider is charged for that usage. The other revenue model is through the service providers that establish and configure both the access and their particular service offerings over that access. Here it is envisioned that the service provider is charged.

# 5 Use cases

## 5.1 Providing localized service over unlicensed band

### 5.1.1 Description

3GPP has introduced several features using unlicensed band for 3GPP RATs. As allocated amount of radio spectrum for unlicensed band increases, this will provide new opportunities for the increased usage of 3GPP RATs and further connectivity opportunities for users.

Because this unlicensed band can be used by any technology and any user as long as certain requirements are met, and because the coordination between the users in this spectrum are week, the QoS may not be equal to that can be provided over licensed band. Thus, the connectivity service provided over this band may be applicable to some applications, if provided with right usage policies.

### 5.1.2 Pre-conditions

Operator Universal owns a licensed spectrum. Also, in the region where Operator Universal operates, huge amount of unlicensed spectrum is available. Thus, the operator Universal decides to upgrade some of its NG-RANs to support both the unlicensed spectrum and the licensed spectrum.

Charlie has subscription with Operator Universal with certain monthly data quota. Due to heavy watching of online streaming service, Charlie almost used up his monthly data quota. Charlie’s smartphone is advanced one which also supports NR operation over unlicensed band.

### 5.1.3 Service Flows

Following is service flow for this use case:

- Charlie is a fan of pro-baseball. One day, he goes to nearby stadium to directly watch one of pro-baseball games.

- At the pro-baseball stadium, due to huge demand for connectivity, the Operator Universal already upgrades the NG-RAN equipment to support also unlicensed spectrum.

- The Operator Universal decides to allow some of its customers to use connectivity service over unlicensed spectrum.

- Charlie finds out that the Operator Universal provides connectivity service over unlicensed band within the stadium. He configures his smartphone to use unlicensed band only when he is located within this stadium, because his monthly quota has almost run out. This configuration information is also shared to the Operator Universal.

- The Operator Universal approves the connectivity over unlicensed band. Except some essential operator service such as IMS, all the other the user traffic for Charlie is delivered only using the unlicensed bands.

- Finally, the pro-baseball game ends.

- Charlie leaves the stadium. Outside of the stadium, the Operator Universal does not provide connectivity service over unlicensed spectrum. Thus, the Charlies smartphones are served by the NG-RAN of the operator using licensed bands.

### 5.1.4 Post-conditions

The Operator Universal gathers charging information related to the use of connectivity service over unlicensed band.

### 5.1.5 Existing features partly or fully covering the use case functionality

N/A

### 5.1.6 Potential New Requirements needed to support the use case

Following new requirements can be derived from this use case:

[PR.5.1.6-1] 5G system shall be able to support for a UE to be provided with the temporary connectivity service over unlicensed spectrum at specific locations and specific period.

[PR.5.1.6-2] 5G system shall be able to support to transport user traffic using unlicensed spectrum based on e.g. user preference or operator policy and so on.

[PR.5.1.6-3] 5G system shall be able to support to transport specific service flow over unlicensed spectrum, licensed spectrum, or both based on operator policy or user preference.

[PR.5.1.6-4] 5G system shall be able to gather charging information for the traffic transported over unlicensed spectrum.

## 5.2 New Use case for roaming service

### 5.2.1 Description

When the user visits a foreign country for a few days, the user may want to have access to temporary mobile data service and prefer to have an arrangement directly with a local provider for the temporary mobile data service, while keeping an arrangement with its home provider for other services.

The use case in this section assumes that the UE uses the credential of the home provider also for the temporary mobile data service, though the subscription for the temporary mobile data service is bound to the local provider. The case where the local provider uses a separate independent credential for the temporary mobile data service is not in the scope of this use case.

### 5.2.2 Pre-conditions

Lily is traveling around the world. She has no strict schedule and always wanders off on her own. Sometimes she stays in a new place for several days if she likes there. In some place where Lily decides to buy the roaming data service provided by a local network e.g. via an app that she has obtained from a 3rd party data service provider.

### 5.2.3 Service Flows

1. Lily turns on her smartphone to see what networks and what data service plans are available.

2. the step 1 leads to a mobile data service shop which is displayed on the mobile screen, wherein there are several data combo services, each service is labelled with (network identifier, price, valid duration, valid location, data volume, type of service [e.g. data, voice etc] and optionally the mobile technology, e.g. 4G or 5G) and if there are anything that needs to be satisfied for that plan e.g. watching some advertisement may be required. Or, only foreigner is eligible for the service.

3. according the time that Lily plans to stay at current location, Lily chooses to buy the most cost-effective data combo service. For example, if Lily plans to stay there for one day, she buys the one-day data combo service; if Lily plans to stay there for one week, she buys the seven-days data combo service; if Lily just stay at the transfer airport for several hours and the WLAN connection is under bad condition, she buys the 1G data combo service.

4. Lily pays the bills for the data service she chooses at step 3. After a few seconds, Lily’s mobile phone has download necessary information and is ready to provide temporary mobile data service to Lily. Since then, Lily becomes a temporary subscriber of the VPLMN for that temporary mobile data service.

5. Lily may activate the mobile data service immediately or Lily may decide to activate the mobile data service when she lost WLAN connection. While this temporary subscription is valid, the UE selects and camps on the selected network providing the temporary local service.

### 5.2.4 Post-conditions

Lily can access to the internet and use apps via the mobile data service of the network where she is temporary subscriber now or can temporarily use the service during the validity period of the service within the valid location using the subscribed RAT, until the maximum data quota is reached.

Lily uses her normal phone number for making and receiving calls or SMS over the VPLMN by means of traditional roaming and charging information per the roaming agreement is reported to Lily home operator.

### 5.2.5 Existing features partly or fully covering the use case functionality

Existing specifications support the home-routed traffic service and local-breakout traffic service for roaming cases. For the local-breakout service, even if the traffic does not traverse the home network, the service is associated to the subscribed service toward the home network. In this use case, the temporary data service is different from the local-breakout service, because it is not the subscribed service toward the home network.

TS 22.261 has following requirements:

- The 5G system shall enable users to obtain services from more than one network simultaneously on an on-demand basis. For a user with a single operator subscription, the use of multiple serving networks operated by different operators shall be under the control of the home operator.

Thus, following requirement is covered by above requirements:

- 5G system shall be able to provide the UE simultaneously with both the temporary local services subscribed to the local hosting network and the services subscribed to home operator.

- The 3rd party service provider shall be able to agree the details of a temporary subscription for local services (such as validity period, location, QoS, services etc.) with a local hosting network.

- The 5G system shall allow a UE to present available local hosting networks to the user, which the user is allowed to use.

### 5.2.6 Potential New Requirements needed to support the use case

[PR.5.2.6-1] The 5G system shall support a mechanism to allow a user to manually select a specific local hosting network.

NOTE: This allows the hosting network and home network to provide necessary information to the user to determine which network to select.

[PR.5.2.6-2] The 5G system shall be able to authorize a UE to make use of a specific local hosting network

## 5.3 Use Case for UEs using home network services via hosting networks

### 5.3.1 Description

Given the main objective of the study that UEs and their service providers are without previous relationship to the hosting network, automatic e-agreement mechanisms are needed to allow network operators to build short term relationship using application layer approaches. The e-agreement mechanisms allow the automation of multi-step processes in telecommunication domain to establish service level e-agreement among network operators for enabling the 5GS to facilitate the sharing of services and resources of the networks among network operators and to configure their networks and UEs accordingly at specific occasion, e.g. time and location.

The application layer approaches require 5G network to expose network capabilities. For example, as shown in Figure 5.3.1-1, the e-agreement is established among service operators, e.g. SP-A, SP-B, and SP-C have no SLAs in place for the services provided by SP-A’s hosting network-A.



Figure 5.3.1-1: diagram for building relationship between network operators using application layer approach

The SP-A operator creates an e-agreement which provides the localized service configuration. The SP-B and SP-C operators can subscribe this localized service with required service policies for their UEs. The SP-B and SP-C can then configure their UEs for localized service.

Based on the e-agreement, the hosting network can be configured with localized service at a specific time and location for its subscribers (other network operator), e.g. localized service policies of time, location, network-A access parameters, including spectrum, access technologies (3GPP or non-3GPP), network slice, charging policies, and subscriber’s network policies for authentication, and routing.

Based on the e-agreement, the hosting network configuration creation and termination can be performed by SP-A or a trusted third-party application of the subscriber representing other network operator. With the application layer approach, the localized service can be used by authorized UEs of SP-A, SP-B, and SP-C which subscribes the service.

Note: the application approach for automatic e-agreement is an example that provides some insights for what the suitable APIs would be required for localized service enabler in 5GS.

### 5.3.2 Pre-conditions

At the Monster theme park built with genetically engineered living monsters on an island having a surface of 30 square miles, which only opens once a year to allow visitors to onboard and enjoy three days adventures. From the lessons learned from disaster happened in Jurassic park in 1993, the Monster park management as SP-A decides to replace the wirelines with 5G networks around the island for better network coverage and advanced and secure 5G features.

For the past few years, the visitors had tons of service complains about the network connectivity for the availabilities of their home operators on the island. This year, SP-A decides to use their 5G network to offer a hosting network-A providing access to localized service for sharing this service using blockchain technologies with other service providers, e.g. SP-B, and SP-C, in which SP-B’s network is not available in the whole island and SP-C’s network is very spotty and available at some zones. Both SP-B and SP-C subscribe the localized service from SP-A for their UEs.

When the schedule event is started, the network-A starts to provision localized services based on service contract with SP-B and SP-C and to broadcast related information via hosting networks on the island.

Lexi and Timmy are Dr. Hammond's grandchildren who invited them to attend this annual event this year, and they have UEs, UE-C1 and UE-C2, with SP-C’s subscriptions. The SP-C (NPN or PLMN) subscribed to SP-A’s localized services configures their UEs with localized service provided by SP-A.

### 5.3.3 Service Flows

Step1: When Lexi and Timmy arrive the island, Lexi wants to use her UE-C1’s home network service to call her Mom.

Step2: Her UE-C1 configured with localized service found that only SP-A network is available.

Step3: Her UE-C1 then selects and requests to register hosting network-A.

Step4: Hosting network-A knows that UE-C1 has been configured to use localized service by its SP-C which has subscribed to localized service for their UEs but UE-C2 seems not being configured to use localized services by its SP-C. The Hosting network-A can authenticate the UE-C1 and UE-C2 based on UEs’ credentials.

Step5: Lexi happily finds that her UE-C1 which has been pre-configured with localized service can get connection from hosting network-A to call her Mom and grandfather for their safe arrivals. In the meantime, Timmy’s UE-C2 has his UE-C2 configured for localized service on the spot via hosting network-A and then Timmy successfully gets data connection via hosting network-A automatically.

Step6: Lexi and Timmy don’t feel any differences on the user experience of applications (e.g. social media, streaming music, text messages) of UE-C1 and UE-C2 via hosting network-A or their home SP-C network when touring around the park with their grandfather to watch live monsters in different zones and continue service seamlessly even with spotty network coverages provided by different network operators (PLMN or NPN). Well, their new friend met on the tour Jeep was upset for not having connections from his UE-X of SP-X which does not subscribe the localized service from SP-A. He decides to switch to SP-C subscription after going home.

### 5.3.4 Post-conditions

The SP-A provides the localized service to authenticated and authorized visitors whose UEs’ service providers subscribe the localized service based on the service contract. Lexi and Timmy enjoy good user experience on using their home network service of SP-C via network-A in the remote island.

### 5.3.5 Existing features partly or fully covering the use case functionality

The existing service requirements for roaming users assume that roaming policies are in place for UEs to use their home network services.

The UE is able to access visited network using UE’s credential on UICC/eSIM based on its home network’s subscription.

### 5.3.6 Potential New Requirements needed to support the use case

[PR.5.3.6-1]: The 5G network shall support suitable mechanisms to allow automatically establishing localized services agreements for a specific occasion (time and location) and building temporary relationship among a hosting network operator (NPN or PLMN) and other service operators including network operators (NPN or PLMN) or third-party content service providers.

NOTE: Both the hosting network and the home network can be a PLMN or NPN but only subscribers of a public network can roam to a PLMN.

[PR.5.3.6-2]: Subject to regulatory requirements, the 5G system shall support suitable mechanisms to allow another network operator to automatically negotiate roaming policies with the hosting network for allowing their subscribers to connect at a specific occasion, e.g. time and location, for their home network services.

[PR.5.3.6-3]: Subject to localized services agreements, the 5G network shall enable a home network operator to authorize a UE for using its home network services via a visited hosting network for a certain period of time and/or location.

[PR.5.3.6-4]: The 5G network shall be able to configure a UE with home operator policies on what services are preferred to be used from the home network for home routed services via authorized hosting networks.

[PR.5.3.6-5]: Subject to localized services agreements between the hosting network operator and home network operator, for UE with only home network (NPN or PLMN) subscription and with authorization to access hosting networks (NPN or PLMN), the 5G system shall support:

* access to the hosting network and use home network services or selected localized services via the hosting network.
* seamless service continuity for home network services or selected localized services when moving between two hosting networks or a host network and the home network.

## 5.4 Use Case for UEs using localized services via hosting network

### 5.4.1 Description

This use case assumes that network operators can build short term relationship using application layer approach, e.g. using smart contracts based blockchain technologies, for offering localized services provided by different service providers via a hosting network.

The application layer approaches require 5G network to expose network capabilities for the localized service. For example, for the automatic e-agreement mechanism deployed by SP-A for a localized service at a specific occasion (starting time, duration and location), which allows localized services to be shared among service providers. In addition, the e-agreement can also allow the hosting network to accommodate temporary localized services provided by different service providers.

Based on the e-agreement, the hosting network can be configured with localized service at a specific time and location for its service subscribers (other network operator), e.g. localized service policies of time (including duration, starting time), location, network-A access parameters, including spectrum, access technologies (3GPP or non-3GPP), network slice, charging policies, and subscriber’s network policies for authentication, and routing. In the meantime, the SP-A and SP-B can further offer localized services via hosting network.

The 5G network provides suitable mechanisms to allow establishing automatic roaming (e)-agreements for a specific occasion (time and location) and building temporary relationship among hosting network operator (NPN or PLMN) and other service operators including network operators or third-party content service providers. The localized service configuration can be provisioned in the hosting network based on the e-agreement. For example, SP-C can subscribe SP-A’s localized service of the hosting network and SP-B’s localized service based on e-agreement for their UEs and configures their UEs with localized service. When a UE configured with localized service connects to hosting network SP-A which can present available localized services provided by different service providers for UEs configured with localized services to select any one of them. When using SP-B’s localized service, the SP-C’s UEs can be charged by their home network.

Note: the application approach for automatic e-agreement is an example that provides some insights for what the suitable APIs would be required for localized service enabler in 5GS.

### 5.4.2 Pre-conditions

At the Monster theme park on an island hosting three days adventures for visitors, the park has SP-A network coverage for a hosting network-A providing access to localized service which has been subscribed by SP-B and SP-C for their UEs based on e-agreement established by SP-A for sharing this localized service. In the meantime, SP-B’s network is not available on the island and SP-C’s network is very spotty and only available at some zones.

For the on-demand dedicated services, SP-A deploys localized services on its owned Service Hosting Environment-A for streaming live video and immersive media in different monsters’ zones. SP-B also provides localized services on its Service Hosting Environment-B connected to the hosting network for superhero interactive game via hosting network-A. SP-D is a content service provider which offers localized services on its application platform-D for streaming movies. The SP-C subscribes SP-A’s and SP-B’s localized services for their UEs attending adventures on the island. In addition, the SP-C rents the resource from the SP-A for providing localized services for interactive Monster hunting games on its owned Service Hosting Environment-C connected to the hosting network.

When the scheduled event is started, the network-A starts to provision localized services as well as the temporary localized services provided by different service providers.

Lexi and Timmy visit their grandfather and attend this annual event. Their UEs, UE-C1 and UE-C2, are both with SP-C’s subscriptions. The SP-C subscribed SP-A’s localized services configures their UEs with information of hosting network identity for selecting hosting network and credentials for accessing localized services via hosting network.

### 5.4.3 Service Flows

Use Case A: use of home network service and localized services when both networks are available

Step1: When visiting the genetic engineering center where both SP-A and SP-C networks are available, Lexi’s UE-C1 and Timmy’s UE-C2 configured with localized service can select and connect to hosting network-A and its SP-C’s network simultaneously. The hosting network-A authenticates the UE-C1 and UE-C2 and both UEs use their configured user credentials for accessing to localized services via hosting network.

Step2: UE-C1 and UE-C2 present available on demand dedicated services to Lexi and Jimmy.

Step3: Jimmy selects the superhero interactive game provided by SP-B and chooses to be the Spiderman playing with holograms of live monsters at the park (which enables specific hosting network-A 5G services). In the meantime, Lexi selects one immersive media provided by SP-A to watch the live monsters running around the park. The hosting network-A gets localized service authorization from service providers and creates the service session for the authorized UEs

Step4: Both Lexi and Jimmy can share live videos with their friends on social media using home network services via SP-C network.

Use Case B: use of local SP-A’s localized services and SP-D’s localized services via hosting network

Step1: after one day’s fun adventure at the park, Lexi is lying on the bed at the cabin where her UE-C1 finds only SP-A is available. Because the conditions (e.g., time, location) for selecting the SP-A are met according to the policy provisioned from SP-C, Lexi’s UE connects to the hosting network.

Step2: Lexi scrolls the localized services menu and determines to select an on demand movie, [Jurassic Park](https://smile.amazon.com/dp/B009CGKW10?tag=amz-mkt-chr-us-20&ascsubtag=1ba00-01000-org00-win10-other-smile-us000-pcomp-feature-epcomp-wm-6&ref=aa_epcomp) (1993), provided by SP-D.

Step2: in the meantime, she selects another localized services provided by SP-A to monitor live monsters night life in Zone X.

Step3: The hosting network-A establishes required IP connections for two localized services and routes the UE-C1’s traffic locally at SP-A’s hosting network and to SP-D’s network, respectively.

### 5.4.4 Post-conditions

Use Case A: Lexi and Timmy enjoy the adventure and good network services using their UE-C1 and UE-C2 for SP-A’s and SP-B’s localized service via hosting network, respectively. In the meantime, their UEs can connect SP-C networks and use home network services. Since SP-C subscribes to SP-A’s and SP-B’s localized service, the localized services charge will be in the next month statement from their SP-C’s home network operator.

Use Case B: Lexi needs to pay for the localized service provided by SP-D using online payment method before enjoying the movie. Lexi is happy to continue fun experience at night using her UE-C1 for localized services provided by SP-A and SP-D via SP-A’s hosting network, respectively.

### 5.4.5 Existing features partly or fully covering the use case functionality

The existing service requirements for roaming users assume that roaming policies are in place for UEs to use their home network services or localized services provided by other service providers.

### 5.4.6 Potential New Requirements needed to support the use case

[PR.5.4.6-1]: The hosting network shall provide suitable APIs to allow a trusted third party application (other service providers) to provision their localized services policies (e.g. network slice, required IP connectivity, QoS) and routing policies for the application of the localized services to the hosting network.

[PR.5.4.6-1A]: The 5G network shall provide capability to allow a trusted 3rd party to provision its UE with localized service policy (e.g. QoS, network slice, service restriction such as time and location) via the hosting network or the UE’s home network.

[PR.5.4.6-2]: The hosting network shall be able to allow a UE to manually/automatically select localized services which are provided via local breakout at the hosting network.

NOTE: localized services are provided via local breakout at the hosting network based on interworking scenarios for hosting network owned/collaborative services as indicated in Annex A.

[PR.5.4.6-2A]: The 5G network shall be able to allow a UE to automatically select a hosting network with the desired localized services which are provided via local breakout at the hosting network, based on the policy provisioned by its home network.

[PR.5.4.6-3]: The hosting network shall be able to provide required connectivity and QoS for a UE connected to the hosting network to simultaneously use its home network services and localized services.

[PR.5.4.6-4]: A UE shall be able to connect to the hosting network for using home network service and localized services at the same time.

[PR.5.4.6-5]: A UE shall be able to simultaneously connect to its home network and to a hosting network if both networks are available, e.g. to use its home network services and localized services at the same time.

[PR.5.4.6-6]: The 5G system shall be able to collect charging records for the use of localized services via local breakout at the hosting network and provide the charging records to UEs’ home operators based on service and charging policies provided by the localized service providers.

[PR.5.4.6-7]: The 5G system shall enable a UE to be able to use hosting network provided user credentials for authenticating the UE to make use of localized services via the hosting network with a certain time (including starting time and the duration) and location validity.

[PR.5.4.6-8]: A UE shall be able to select and connect to authorized localized services via a hosting network based on configured user credentials.

## 5.5 (E-)Sports events at different venues: Hosting Network and 3rd Party Provider service negotiation via standard mechanisms

### 5.5.1 Description

Network A infrastructure is deployed in multiple sport venues., e.g. from October 2020 to May 2021. Network A may be a PLMN or and NPN. The (e-) sports games are scheduled one month in advance throughout the season and may be subject to reschedule for different reasons. The venues are decided between the 3rd Party Provider B and venue owners. Once the venue and time are scheduled, the 3rd Party content provider needs to negotiate with Network A to set-up access to the 3rd party provider’s services during the event and at the venue location, and for Network A to manage resources for that service.

In order to facilitate such negotiation, Network A offers standard mechanisms for 3rd Party Content Provider B to request specific configuration of access to the service during the (e-)game event.

Via the standard mechanism, the 3rd Party Content Provider may request one or more of the following:

- Service area / location (e.g. venue)

- Time period for service (e.g. game time)

- Service requirements (including QoS requirements, slicing information)

- Potentially different QoS requirements for different users (e.g., depending on pricing such as gold, silver, bronze)

- Discovery information (dependent on other use cases) if needed, e.g. event name, 3rd party provider name, etc.

- 3rd Party Portal information (e.g., for access to 3rd Party Content Provider Portal for online sign-up)

- Expected or maximum number of users that will be accessing the service during the event.

Network provider A then creates policy rules and performs network configuration accordingly.

Network A confirms the accepted service set-up, including one or more of the following:

- Confirmation of location/date/time.

- Accepted QoS to be provided.

- Network slicing information.

- Limitation in number of subscribers to access the event.

- Specific access/discovery information.

The 3rd Party Content Provider may request to modify the previous request at any time (e.g. in case of game reschedule, change in expected number of spectators, etc).

NOTE: User /UE discovery of the service and UE access are not covered in this use case and depends on other use cases.

### 5.5.2 Pre-conditions

Network A and 3rd Party Content Provider B have a service pre-agreement for 3rd Party Content Provider B to offer \ service(s) for Game events at different venues, via Network A’s access for a whole season. Specific location and times to be determined as season progresses.

### 5.5.3 Service Flows

1. 3rd Party Content Provider B confirms venue and time for a game event.
2. 3rd Party Content Provider B requests via standard mechanism to establish a service via Network A’s access at the specific time and location. The 3rd party provider provides various service requirement requests, including QoS, expected/maximum number of users, event information for discovery, etc.
3. Network A performs service authorization for the time and location, creates policies for the event and configures the network accordingly.
4. Network A provides a confirmation of service including accepted QoS, slicing information if needed, maximum number of users allowed, and potentially other information for discovery.
5. The 3rd Party Provider B may provide information to game event participants for accessing their services via Network A.

NOTE: User discovery and access are not part of this use case and are dependent on other use cases.

6. Network A activates the resources for 3rd party content provider’s service at the agreed time period and location.

### 5.5.4 Post-conditions

E-game event participants are able to access 3rd Party Content Provider’s services via Network A’s access during the game at the specific location.

### 5.5.5 Existing features partly or fully covering the use case functionality

[FFS]

### 5.5.6 Potential New Requirements needed to support the use case

[PR.5.5.6-1] The 5G system shall support means for a 3rd Party Provider to request a Hosting Network via standard mechanisms to provide access to 3rd party provider services at a specific time and location.

[PR.5.5.6-2] The 5G system shall support means for the 3rd Party Provider to request various service requirements, including QoS, expected/maximum number of users, event information for discovery, network slicing, etc.

[PR.5.5.6-3] The 5G system shall support means for a hosting network to create policies and configure resources for the requested time and location for the 3rd Party Provider services based on the received request.

[PR.5.5.6-4] The 5G system shall support means for a hosting network to notify the 3rd Party Provider of the accepted service parameters, including QoS, maximum allowed number of users, event information for discovery, network slicing, etc.

## 5.6 (E-)Sports events at a venue: Automatic discovery and selection of 3rd party provider services over Hosting network access.

### 5.6.1 Description

Network A infrastructure is deployed in multiple sport venues. Network A may be a PLMN or an NPN. A 3rd Party content provider negotiates with Network A to set-up access to the 3rd party provider’s services during the event and at the venue location, and for Network A to manage resources for that service.

The 3rd party provider services are offered to people attending and/or participating in the event, without any previous subscription to Network A. The users have a previous relationship with the 3rd party provider. Neither the 3rd party provider nor Network A has relationship with the home network of the UE.

During the event service negotiation between 3rd party provider and Network A, the Network A provides discovery information to 3rd party provider. The 3rd party provider configures the UE with event service discovery, which may contain Network A’s information and the event service information, and time validity (e.g. starting time, duration).

During the time validity the UE searches for Network A and event service based on configuration from the 3rd party provider. If the UE finds a suitable cell from Network A offering the event service, the UE notifies the user who can manually initiate access to Network A. The UE requests to connect to 3rd party event service(s) access, Network A validates with 3rd party provider that the UE is authorized to access content for event.

If necessary, the UE is provisioned temporary access credentials for Network A. The UE then accesses Network A for 3rd party event service(s) with the temporary credentials.

During registration Network A may provide UE with configuration based on negotiation with 3rd party, e.g. slicing configuration.

Automatic selection of Network A is possible if the UE is capable to maintain two separate registrations, one with configured credentials to access Network A, and an independent registration using a USIM. In that case, if the UE was already registered to a PLMN when identifying the Network A, the UE may initiate access and registration to Network A with the configured credentials while maintaining the access to the registered PLMN independently.

### 5.6.2 Pre-conditions

Network A and 3rd Party Content Provider B have a service pre-agreement for 3rd Party Content Provider B to offer exclusive service via Network A’s access during the game event at the event location.

The 3rd party service is meant to be offered to event participants that may not have any subscription to Network A and have prior service agreement with 3rd party provider for the event service.

### 5.6.3 Service Flows

1. A user is made aware of the 3rd party service being offered via Network A’s access. This may be done either offline (e.g., in ticket, flyer, posters) or online (e.g. Internet advertisement.)
2. During the event service negotiation between 3rd party provider and Network A, the Network A provides configuration information to 3rd party provider.
3. The 3rd party provider provides the UE with Network A’s information, configuration (e.g. slicing configuration) for the event service and the event service information, and time validity. This is sent over any access.
4. During the time validity the UE searches for Network A.
5. If the UE finds a suitable cell from Network A, the UE notifies the user who can manually initiate access to Network A. The UE indicates request to access to 3rd party event service(s) access.
6. Network A validates with 3rd party provider that the UE is authorized to access content for event.
7. If necessary, the UE is provisioned temporary access credentials for Network A. The UE then accesses Network A for 3rd party event service(s) with the temporary credentials.
8. The UE may if capable maintain two separate registrations, one with configured credentials for access to Network A, and an independent registration using a USIM. In that case, if the UE was already registered to a PLMN when identifying the Network A, the UE may initiate access and registration to Network A with the configured credentials while maintaining the access to the registered PLMN independently.

### 5.6.4 Post-conditions

The user is able to enjoy the e-game event services provided by 3rd party provider via Network A’s access.

### 5.6.5 Existing features partly or fully covering the use case functionality

From TS22.101:

Note that Multiple USIM requirements apply in case credentials for hosting network access are from a USIM.

### 5.6.6 Potential New Requirements needed to support the use case

[PR.5.6.6-1] The 5G system shall support means for a hosting network to provide a 3rd party with configuration information for automatic discovery of the hosting network and available access to specific 3rd party services.

[PR.5.6.6-2] The 5G system shall enable a UE to be able to use the 3rd party provided configuration to discover, select and access to a hosting network, and configuration and/or credentials to access for specific services with a certain time (starting time and duration) and location validity.

[PR.5.6.6-3] The 5G system shall be able to inform a UE about available 3rd party services and hosting network the UE can use at a given point in time (starting time and duration) and location.

## 5.7 (E-)Sports events at a venue: User selection of 3rd party provider services over Hosting network access.

### 5.7.1 Description

Network A infrastructure is deployed in multiple sport venues. Network A may be a PLMN or an NPN. A 3rd Party content provider has negotiated with Network A to set-up access to the 3rd party provider’s services during the event and at the venue location, and for Network A to manage resources for that service.

The 3rd party provider services are offered to anyone attending and/or participating in the event, without any previous subscription to Network A and without a previous service agreement with the 3rd party provider to access the event services.

The user discovers the service when attending the event.

Two main discovery possibilities are considered:

1. Offline user awareness: The user is notified offline of the available service provided by the 3rd party provider during the event, e.g. this information is included in the event ticket, event flyers or posters.
2. Online user awareness: The user discovers directly the available service based on information provided by network A. In this case, Network A provides 3rd party / event information, and (potentially on-demand) a human readable advertisement of exclusive content.

The event information as provided by Network A is displayed to the user. A user interested in receiving the 3rd party services during the event selects a certain service. The UE then indicates the desired 3rd party provider service for the event to Network A.

The user is directed to a 3rd party provider portal to subscribe to the event service, e.g. pay for the service, agree to terms and conditions, etc. The UE is then authorised to access the desired 3rd party provider service via Network A. The UE then accesses the 3rd party provider services via Network A’s access at the event location.

### 5.7.2 Pre-conditions

Network A and 3rd Party Content Provider B have a service pre-agreement for 3rd Party Content Provider B to offer exclusive service via Network A’s access during the game event at the event location. Network A is configured accordingly.

The 3rd party service is meant to be offered to event participants that may not have any subscription to Network A or prior service agreement with 3rd party provider for the event service.

### 5.7.3 Service Flows

1. A user is made aware of the 3rd party service being offered via Network A’s access. This may be done either offline (e.g., in ticket, flyer, posters) or provided online by Network A.
2. The user manually selects 3rd party provider service.
3. UE indicates the selected 3rd party provider service to Network A.
4. The user is directed to a portal to receive the authorisation to use the event service of a 3rd party provider, e.g. pay for the service, agree to terms and conditions, etc.
5. The UE is then authorised to access the 3rd party provider service via Network A.
6. UE accesses the 3rd party provided service via Network A based on the received authorisation.
7. The user is able to enjoy the e-game event services provided by 3rd party provider via Network A’s access.

### 5.7.4 Post-conditions

The user is able to enjoy the e-game event services provided by 3rd party provider via Network A’s access.

### 5.7.5 Existing features partly or fully covering the use case functionality

From TS 22.261, clause 6.14.2:

Based on operator policy, the 5G system shall support a mechanism to provision on-demand connectivity (e.g. IP connectivity for remote provisioning). This on-demand mechanism should enable means for a user to request on-the-spot network connectivity while providing operators with identification and security tools for the provided connectivity.

Note that this use case may require enhancements to allow access for the purpose of subscribing to specific 3rd party provider event services via the hosting network access. See [PR.5.7.6-1] below.

From TS22.011, clause 3.2.2.2:

Text on “restricted local operator services” may partly cover the use case functionality.

### 5.7.6 Potential New Requirements needed to support the use case

[PR.5.7.6-1] The 5G system shall support means for a UE to access via a hosting network, with no prior subscription to that hosting network or to a 3rd party provider, for the purpose of making use of specific 3rd party provider service via the hosting network.

## 5.8 Hosting network deployment for a temporary event

### 5.8.1 Description

A temporary Hosting Network A is set up at the mountain pass Col du Tourmalet in the French Pyrenees to support completion of the 14th stage of Tour de France. Hosting Network A is set up as a Standalone Private Network. A 3rd party service provider can lease this hosting network to provide the service (e.g. streaming video) to its users. The owner and operator of Hosting Network A can also be the operator of PLMN Network B, or the owner/operator of Hosting Network A can have a service agreement with PLMN Network B operator. According to the service agreement, PLMN Network B operator allows Hosting Network A operator to advertise services in the PLMN and solicit PLMN users to access the services provided by the hosting network for the temporary event. PLMN Network B’s billing infrastructure can be utilized to charge the users for the service and the two operators can share the revenue generated by the service.

The users in PLMN Network B receive service advertisement over the PLMN, e.g. via SMS or broadcast information. If the users are interested and consent to use the service, they can request, over the PLMN, a temporary subscription to the hosting network and acquire network discovery/selection information (e.g. network identifier of the hosting network) and temporary credentials for accessing the hosting network. Based on the user’s subscription and credit information with the PLMN Network B, the PLMN network can specify relevant service requirements, like QoS requirements and charging information (e.g. monetary or volume credit), for the service usage in the Hosting Network A. When the users are within the service area, the user can manually or automatically select the hosting network according to the acquired network discovery/selection information and access the network using the acquired temporary credentials in addition to the existing PLMN connection, or manually select to leave the existing PLMN connection to connect to the hosting network.

### 5.8.2 Pre-conditions

The operator of Hosting Network A has a service agreement with the operator of PLMN Network B.

The users of PLMN Network B don’t have any subscription or configuration data for the temporary Hosting Network A.

### 5.8.3 Service Flows

1. A PLMN user receives over its serving PLMN network a service advertisement of the event completion of the 14th stage of Tour de France. The service advertisement is broadcasted in the PLMN in a variety of ways such as SMS and system information.

2. The user consent to use the service and submit a request over the PLMN to obtain a temporary subscription to the Hosting Network and the service.

3. The PLMN network and the Hosting Network coordinate to generate the network access information and the temporary credentials for the user. The hosting network access information and the user’s temporary credentials is delivered to the UE over the PLMN network.

4. During this process, the Hosting Network obtains the service requirements suggested by the PLMN and execute the requirements accordingly (e.g. selecting the proper slicing information and QoS rules) and also obtains the user’s information for charging so it can charge the user through the PLMN.

5. During the time period that the service is available, and if the user is within the area where the service is available, the user can manually or automatically select the hosting network and access the hosting network using the obtained temporary credentials in addition to the existing PLMN connection, or manually select to leave the existing PLMN connection to connect to the hosting network.

### 5.8.4 Post-conditions

The user is able to enjoy the service provided by the hosting network.

The user device automatically discards the hosting network access information and temporary credentials after the event is over.

### 5.8.5 Existing features partly or fully covering the use case functionality

Providing information to the user can be done on user plane with SMS, MMS etc.

From 3GPP TS 22.261 [2], clause 6.14.2:

Based on MNO and NPN policy, the 5G system shall support a mechanism to enable MNO to update the subscription of an authorized UE in order to allow the UE to connect to a desired NPN. This on-demand mechanism should enable means for a user to request on-the-spot network connectivity which is authorized by its MNO.

From 3GPP TS 22.261 [2], clause 6.18.2:

The 5G system shall enable users to obtain services from more than one network simultaneously on an on-demand basis.

For a user with a single operator subscription, the use of multiple serving networks operated by different operators shall be under the control of the home operator.

From 3GPP TS 22.263 [3], clause 5.6:

The 3GPP system shall be able to enable a UE to receive low-latency downlink multicast traffic from one network (e.g. NPN), and paging as well as data services from another network (e.g. PLMN) simultaneously.

### 5.8.6 Potential New Requirements needed to support the use case

[PR.5.8.6-1] The 5G system shall allow a network to coordinate with a hosting network to create temporary credentials for a subscriber for accessing the hosting network.

[PR.5.8.6-2] A UE shall be able to automatically discover a hosting network based on received network access information. If the UE is able to obtain services from two networks simultaneously, it may automatically additionally select the hosting network. If the UE cannot maintain the connection to the PLMN while selecting the hosting network, the selection shall only be done on request by the user, i.e. using manual selection.

[PR.5.8.6-3] The 5G system shall allow a UE to manually or automatically be disconnected from the hosting network and discard the hosting network access information and temporary credentials.

[PR.5.8.6-4] The 5G system shall enable a mechanism for a hosting network to receive service requirements from the home PLMN network

## 5.9 Regulatory requirements in a network providing access to localized services

### 5.9.1 Description

This use case describes how a hosting network will have to provide regulatory services such as PWS, LI and emergency calls. Even though the hosting network may be a Non-Public Network, from a regulatory point of view it will be seen as a telecommunications network that provides services to the public.

### 5.9.2 Pre-conditions

A football stadium is equipped with a hosting network. The network can support all kinds of services for spectators, fans, media production, security et cetera. Visitors to the stadium are provided with access to the network to get access to a host of different localized services aimed at fans/spectators. The hosting network with its excellent coverage and capacity in the stadium also provides access to non-localized operator services

### 5.9.3 Service Flows

The popular band, V3 is on a worldwide tour. One of the venues on their tour is the Acme Arena, a football stadium that can hold 50.000 spectators. The concert is sold out, 50.000 fans are enjoying the show. They are also enjoying the localized services provided in the stadium. Via their mobile phones, they can receive an enhanced audio experience, get song text and other additional information, and chat with other fans in a fan-oriented social media application.

Unfortunately, there is an attempted terrorist attack during the pop concert. A member of the audience notices suspicious behaviour and makes an emergency call. The audience is then warned using PWS to evacuate part of the stadium. Because one of the terrorists was already a target for lawful intercept, law enforcement quickly found out that this terrorist was coordinating the attack with other persons, who were quickly apprehended.

### 5.9.4 Post-conditions

The situation in the stadium comes back to normal, thanks to timely response by law enforcement. This was made possible through the use of regulatory services (emergency calls, PWS, and LI).

### 5.9.5 Existing features partly or fully covering the use case functionality

PWS, LI, and emergency calls are already defined for PLMNs.

### 5.9.6 Potential New Requirements needed to support the use case

[PR.5.9.6-1] A hosting network using the 5G system shall be able to support regulatory services (e.g. PWS, LI, and emergency calls) when Providing Access to Localized Services to the public, based on regional/national regulatory requirements.

## 5.10 Proximate Resources Use Case

### 5.10.1 Description

This use case explores the need to constrain both the location of network services for localized access as well as the timing of these services. The justification for the network is an ‘event’ which occurs in a particular place for a limited duration. What is more, the event offers different services which have different requirements, as there is more infrastructure involved than just the telecommunications network.

For this use case, we consider a fairground that includes an indoor and outdoor amphitheater. The events offered at this complex can include multimedia performances, with different events occurring at the same time at the two venues.

Figure 5.10.1-1: The Proxima Performing Arts Complex

### 5.10.2 Pre-conditions

The Proxima Performing Arts Complex offers network infrastructure that can be used to host events. One network covers the entire facility, including the entry road (in case there is heavy traffic), the parking lot, registration pavilion and the two amphitheaters. The amphitheaters can be configured to allow specific network services in the immediate locality. The use for this specific spatial configuration will be illustrated in the use case below. Another resource provided by the Proxima Performing Arts Complex is a data center (with easy extensibility for customer equipment.) This allows the deployment of a Service Hosting Environment on the premises to enable low latency communication if needed by the performance technology.

This use case assumes interaction with the event organizers – to arrange specific space and time constraints, as well as procedures for allowing UEs of registered (paying) guests to gain access to the network. This could occur for example in the Pavillion – as one purchases a ticket, one is assisted with registration on the Proxima Performing Arts Complex network. Some specific equipment for spectators of the multimedia events is also supplied by the Arts Complex for use during the event.

### 5.10.3 Service Flows

Arnold parks his car and enters the Pavillion. As he pays for admission, he is able to configure his UE to gain access to the whole Proxima Performing Arts Complex. Arnold is issued a multimedia headset.

Arnold attends the Outdoor Amphitheater for a musical and dance performance. The audience can experience the dancers’ performance as if each were in the front row. The realistic experience is only possible through the ultra-low latency communication between the audience members’ devices and the servers in the Service Hosting Environment in Amphitheater 1.

At the same time, the indoor amphitheater provides a virtual pageant, where all the guests appear to be in costume (through augmented reality), roaming in a fanciful virtual architecture. There are separate smaller ‘stages’ in this amphitheater – depending on where the audience walks, they hear the performance of the musician they approach close enough to.

These two programs are extremely network intensive, with a sophisticated data center backstage. They operate simultaneously.

Later, performers are split between both stages and combined into a single concert for each amphitheater. This particular performance requires a single network to extend over both Amphitheaters with significant resources.

As Arnold leaves the event, he can continue to listen to the extended encore from his UE, as he returns to his car and exits the parking lot.

### 5.10.4 Post-conditions

For Arnold, the event provided a set of unique localized experiences, lasting for as long as the performance. For the performers, the network enabled them access to all the resources they needed (especially important in the later event, where the musicians performed on different stages in different buildings). The network reconfigured localized services according to the schedule.

### 5.10.5 Existing features partly or fully covering the use case functionality

### 5.10.6 Potential New Requirements needed to support the use case

[PR5.10.6-1] The 5G System shall support a mechanism to enable configuration of a network that provides access to localized services such that the services can be limited in terms of their spatial extent (in terms of a particular topology, for example a single cell), as specified by a third party.

[PR5.10.6-2] The 5G System shall support a mechanism to enable configuration of a network that provides access to localized services such that the services can be limited in terms of the resources or capacity available, to correspond to requirements that apply only to the locality of service delivery, as specified by a third party.

[PR5.10.6-3] The 5G System shall support a mechanism to enable configuration of a network that provides access to localized services such that the services can be limited in terms of timing, as specified by a third party. This timing shall be flexible, so that a change in service provision can be decided at any time (e.g. to cancel or prolong local services in the locality of service delivery.)

[PR5.10.6-4] The 5G System shall support a Service Hosting Environment in a network that provides access to localized services.

## 5.11 Use Case of home network steering UEs to different localized service networks

### 5.11.1 Description

There can be different local host networks in one location with overlapping coverage but for different localized services. A home network may establish business agreements with some or all of those local hosting network providers in that location, based on different user demands or other business considerations. Therefore, it can be desirable for the home network to be able to steer its UEs in certain location to different local host networks.

### 5.11.2 Pre-conditions

Network A (NW-A) has a long-term business agreement with a local network B (NW-B) in city named Boring. Normally, when NW-A’s UEs visit Boring, they connect to NW-B for connectivity service. In order to change the impression of being a boring city, Boring’s city council decides to have a big city fair in their football stadium for 4 days. There will be multimedia shows and some famous internet video games being hosted locally in the stadium. Visitors can use their mobile devices to access those local services. The stadium decides to open-up its 5G private network as localized service network (NW-C) for that period of time to allow the authorized visitors to access those shows and games, as well as provide connectivity for other networks’ UEs in that location. NW-C solicited the localized services to NW-A. Therefore, NW-A reaches agreement with this NW-C to have an option to allow its UEs to use NW-C’s network in order to access the fair applications as well as other the connectivity service provided by NW-A during the period when NW-C provides localized service. NW-A may offer new subscription option to allow user to access the localized services provided by its partner.

### 5.11.3 Service Flows

Step 1: Before the fair starting, NW-A’s UEs only roam into NW-B automatically when they are in Boring.

Step 2: When the fair starts, NW-A finds that the number of its UEs in Boring increase significantly and most of them are concentrating in that stadium area. This causes NW-B to be overloaded, which leads to the QoS deterioration of the NW-A’s UEs in NW-B.

Step 3: Because NW-A has signed e-agreement with NW-C to enable NW-A’s UE to get connected to NW-C during this fair period, NW-A decides to steer some UE with the new localized service agreement from NW-B to NW-C.

Step 4: NW-A selects and steers some of its UEs in the coverage of NW-C to switch from NW-B to NW-C. NW-A may have the capability to only steer the UEs which are in the good coverage of NW-C and also subscribed to use the localized services (e.g., playing the games in the stadium) in NW-C. For those NW-A UEs, which are in Boring city but not near the stadium or even in the coverage of NW-C but considered not suitable to steer to NW-C by NW-A (e.g., without the needed subscriptions), will continue to use NW- B.

Step 4a: Jacob of NW-A who has subscribed the localized service is in the fair and playing an internet game with his friends using the game edge server in Boring. He found out that the game is also hosted locally in the fair, and his friends are connecting to the local server to get better performance. Therefore, even he may not get steering instruction from NW-A, Jacob decides to switch from NW-B to NW-C. After connecting to NW-C, Jacob’s IP connection with the game edge server in Boring has been seamlessly moved to the local server in the stadium associated with NW-C.

### 5.11.4 Post-conditions

Some of NW-A’s UEs in the stadium leave NW-B and connect with NW-C per the instructions from NW-A, without any user involvement and the services being interruption. NW-A’s users who are in the fair are enjoying the multimedia shows and games using their smartphones connecting to NW-C, while other NW-A’s UEs who are not in the fair or not interested in the fair will continue to access other services via NW-B with good QoS quality.

After the fair completes, all NW-A’s UEs will continue to automatically select and use NW-B’s network in Boring, even if stadium NW-C is still operating for its own users.

### 5.11.5 Existing features partly or fully covering the use case functionality

The existing service requirements for roaming users assume that roaming policies are in place for UEs to use their home network services.

TS22.011 [5], 3.2.2.8:

Steering of roaming allows the HPLMN to steer a UE to a VPLMN on which the HPLMN wants the UE to register, when the UE registers on another VPLMN. This capability may be needed for reasons e.g., reselection to a higher priority PLMN based on business arrangements.

### 5.11.6 Potential New Requirements needed to support the use case

[PR.5.11.6-1]: The 5G network shall be able to allow the home network to steer its UE(s) to a hosting network with the consideration of the location, times, coverage of the hosting network and services offered by the home network and hosting network.

NOTE: Both the home and the hosting network can be a PLMN or NPN, but only subscribers of a public network can be steered to a PLMN

## 5.12 Use case for Network selection based on application for localized services

### 5.12.1 Description

A live concert with high-resolution video application service is provided with service provider A. A local hosting network A (e.g., NPN) is available and provides localized services for high-resolution video service of the concert. The high-resolution video streaming service of the live concert is only available to be accessed from the local edge server which can only be connected via the local hosting network A while a PLMN network B can offer the connection to normal video application service provided by the service provider A. Hosting network A and PLMN network B are two separate networks with no roaming agreement. The service provider A and the hosting network A can be the same party or they have a service agreement. Hosting network A can have a service agreement with PLMN Network B operator. According to the service agreement, PLMN Network B operator can configure the UE with a policy (e.g., UE policy) in order to allow the UE to connect to the hosting network A with high resolution video if the user selects high resolution video from the start. Alternatively, with the service agreement, PLMN Network B operator can instruct the UE to connect to the hosting network A with the exclusive access to the high-resolution video if the user selects high resolution video from normal video service. Charging of the service can be done via the PLMN Network B’s billing infrastructure and the two operators can share the revenue generated by the service. The UE mentioned in the use cases below is a single radio UE without specific capability required.

The user may select to have the high-resolution video service from the start. The UE can be configured by the PLMN to have a UE policy (e.g., including a predefined time and a defined area) that instruct the UE to connect to the hosting network A for high-resolution video application service. The trigger for the UE policy configuration can be initiated by the service provider A who receives the request from application level that the user wants to watch high resolution video of the live concert. The user can watch the high-resolution video of the live concert after the UE automatically connect to the hosting network A.

Alternatively, the user may select the high-resolution video service while watching normal video service at the concert. The UE can be instructed by the PLMN to switch to hosting network A for the high-resolution video service. The instruction can be initiated by the service provider A who receives the request from application level that the user want to watch high resolution video of the live concert. The user can watch the high-resolution video of the live concert after the UE automatically connects to the hosting network A.

### 5.12.2 Pre-conditions

The service provider A has a service agreement with the operator of PLMN network B and the hosting network A.

The operator of hosting network A has a service agreement with the operator of PLMN network B.

The users of PLMN Network B have the subscription for the hosting network A.

### 5.12.3 Service Flows

Use case A: User selects the high-resolution video application service from the start.

1. A number of users use their UEs (e.g., smart phones) to buy tickets to the concert through the portal provided by service provider A before the concert.

2. The service provider A triggers the PLMN to configure the UE with a UE policy for the network selection for the high-resolution video application service of the concert.

3. After the start of the concert, users select to watch high-resolution video of the concert when they arrive the venue.

4. The UE identifies the information of hosting network A based on the mapping relation between the application service information and the network information (e.g., the identity of hosting network A) in the UE policy and search for the broadcasting message from the hosting network A.

5. UE connects to the hosting network A upon the receipt of the broadcast information, which contains the identity of hosting network A, from the hosting network A and gets access to the high-resolution video service of the concert.

Use case B: User firstly watches normal video application service and triggers to watch high resolution video service.

1. A number of users buy tickets to the concert through the portal provided by service provider A before the concert.

2. After the start of the concert, user watches the normal video of the concert through PLMN and triggers to select the high-resolution video (e.g., with different selectable view angle of the concert) because the user may not satisfy with the normal video service of the concert.

3. The service provider A triggers the PLMN to instruct the UE to get connected to the hosting network A in order to get access to the high-resolution video service which is only available through the hosting network A.

4. UE connects to the hosting network A and gets access to the high-resolution video service of the concert.

### 5.12.4 Post-conditions

Users who select the high-resolution video service can enjoy their desired high-resolution video service of the live concert.

### 5.12.5 Existing features partly or fully covering the use case functionality

N/A

### 5.12.6 Potential New Requirements needed to support the use case

[PR.5.12.6-1] The 5G system shall enable a service provider to request the home network to instruct a UE under which conditions (e.g. predefined time, location) it could select a certain hosting network.

[PR.5.12.6-2] 5G system shall enable the home network to instruct a UE to automatically select a hosting network for accessing localized services when specified conditions (e.g. predefined time, location) are fulfilled.

## 5.13 Broadcast and Multicast Local Service Use Case

### 5.13.1 Description

This use case describes a local service network that provides numerous spectators with simultaneous media services in an efficient manner. As a scenario, we consider a stadium, that periodically hosts events that can benefit from multicast and broadcast services for the benefit of spectators.

### 5.13.2 Pre-conditions

Rajesh is big fan of Cricket and he loves watching Cricket matches in Stadium. Cricket matches are typically long e.g. about 7 hrs for one day matches and 3-4 hours for T20 matches. Rajesh looks forward to the variety of streaming videos / informative content for replays, scores and statistics that the organizers promise to provide to the spectator present.

Rajesh has his ticket and thereby the event organizers have some information about Rajesh and can provide information to Rajesh.

Commercial advertisements and other services in stadium e.g., related to food services etc. can be promoted via the communication services and may bring revenue generation options for host venue, host network and service providers.

Arrangements between the commercial advertisers and service providers in the location have been established before the event.

### 5.13.3 Service Flows

Rajesh avidly watches a video streamed program using broadcast services provided by his home (or serving) PLMN.

When Rajesh enters the stadium, he obtains access to the hosting network.

Rajesh’s broadcast service from his home (or serving) PLMN continues – with service continuity. While at the stadium, Rajesh continues to have access to the services in his home (or serving) PLMN, *including multicast and broadcast services* from his home network.

Rajesh obtains access to the services provided in the stadium. This access includes a clear directory of services available, so that Rajesh can tune to different content. Some local services are provided using multicast and broadcast. These include different views of the play (from different perspectives), continuously updated scores and statistics and commentary by professional announcers on site.

Both the streamed action and information may come with localized advertisement – included in the media stream as part of the content.

The content delivery is itself may be a service for which Rajesh will be charged. This charging may take different forms: permission to access to the content or use of the content (e.g., pay per minute of use, etc.)

Since Rajesh will access streamed services for long periods of time, it is extremely important that these services can be delivered in an energy efficient manner. Otherwise, Rajesh’s UE will run out of batteries long before the exciting conclusion of the match.

### 5.13.4 Post-conditions

Rajesh’s services (including multicast and broadcast services) functioned with continuity, from before he entered the stadium, even as he accessed the local service network. While at the stadium, Rajesh still was able to receive calls and access other services of his home network.

He was able to access streaming and informative services at the stadium subsequent to getting access to the local service network. The costs of these services were either included in the cost of admission, covered by advertising or arranged for separately specifically for the services and content that Rajesh accessed. After hours of use, he had not drained his mobile device’s battery due to the excellent energy efficient delivery of service.

Rajesh is impressed with the congestion free reception of services (without lags and delays) and excellent responsive ness of network services in the stadium environment. While in the stadium, Rajesh continued to use services from his home network. As he leaves the stadium, there is a seamless transition, as these services continue, using the macro network. Rajesh returns home happily.

### 5.13.5 Existing features partly or fully covering the use case functionality

Support for Flexible broadcast/multicast service as per TS 22.261 [2], clause 6.13.

TS 22.261 [2], 5.1.2.1

The 5G system shall support a UE with a 5G subscription roaming into a 5G Visited Mobile Network which has a roaming agreement with the UE's 5G Home Mobile Network.

The 5G system shall enable a Visited Mobile Network to provide support for services provided in the home network as well as provide services in the visited network. Whether a service is provided in the visited network or in the home network is determined on a service by service basis.

TS 22.261 [2], 6.13.2

The 5G system shall support operation of downlink only broadcast/multicast over a specific geographic area (e.g. a cell sector, a cell or a group of cells).

TS 22.261 [2], 6.25.2

Subject to an agreement between the operators and service providers, operator policies and the regional or national regulatory requirements, the 5G system shall support for non-public network subscribers:

- access to subscribed PLMN services via the non-public network;

- seamless service continuity for subscribed PLMN services between a non-public network and a PLMN;

- access to selected non-public network services via a PLMN;

- seamless service continuity for non-public network services between a non-public network and a PLMN.

Service delivery and continuity of applications over unicast and multicast, as controlled by the application, as described (without naming these modes) in TS 22.468 GCSE\_LTE, more explicitly in TS 23.468 and TS 29.468. Also related are TS 26.346 Multicast operation on Demand and northbound APIs TS 26.348 (Northbound Application Programming Interface (API) for Multimedia Broadcast/Multicast Service (MBMS) at the xMB reference point).

### 5.13.6 Potential New Requirements needed to support the use case

[PR5.13.6-1] The operator of a hosting network shall support a mechanism allowing different local service providers and content providers to disseminate their services and content over broadcast/multicast transport. This mechanism should also provide a means to include diverse content in the same transmission, e.g., to include advertisements with other content, or to include multiple content in the same media delivered to the user.

[PR5.13.6-2] A hosting network shall provide multicast and broadcast services in an energy efficient manner to UEs receiving this service.

[PR5.13.6-3] A hosting network shall support resource efficient content delivery through multicast/broadcast and intelligent caching of contents at UEs.

NOTE1: The intent of this requirement is to effectively achieving higher resource efficiency for service delivery.

[PR5.13.6-4] A hosting network shall support a mechanism to provide low latency signalling for efficient delivery of content to the UE.

NOTE2: Signalling may include many operations including session management and radio communication.

[PR5.13.6-5] Subject to home operator policy, a hosting network shall be able to prioritize specific services for local access over home routed access, even if the same service is available in both networks.

NOTE3: This requirement differs from the text in 22.261, 6.18 “In the event of the same service being offered by multiple operators, unless directed by the home operator's network, the UE shall be prioritized to receive subscribed services from the home operator's network.” This is intended to permit low latency access to certain content and services in the hosting network.

## 5.14 Use case: managing a high number of UEs returning from a local hosting network to home network

### 5.14.1 Description

This use case describes a scenario where a local hosting network has provided event-based temporary local services to PLMN users to enjoy during either a live event such as a sport game, concert or a several days long event such as industry fairs or conferences. Once the event is over, the PLMN users who have accessed and enjoyed the event-based local service(s) will no longer need to use these services and therefore wish to terminate the services. Therefore, a high number of users (e.g. thousands in stadium venues) are likely to want to terminate their access/service to the local hosting network and attempt a fairly simultaneous registration back to their home PLMN. The hosting network operator may also decide to switch off the local network while there still are many UEs that are connected to the local network. This may lead to a signaling peak in the home PLMN and result in longer time scales for users to re-register to/re-select their home PLMN. Therefore, it is desirable that user registrations are managed by spreading out the registration attempts over time and limiting the number of users attempting to register simultaneously, to avoid signaling overload and unnecessary waiting times for the returning users.

### 5.14.2 Pre-conditions

The following pre-conditions and assumptions apply to this use case:

* Hosting network and PLMN have an agreement (either short-term or long-term).
* PLMN users are aware of the local services provided by the hosting network.

### 5.14.3 Service Flows

1. Before the event, PLMN users start to access the local services occasionally at different times.

2. During the event, PLMN users consume the local services provided by the hosting network.

3. When the event is over:

a) the PLMN users terminate their access to the local services and attempt registration back to their home PLMN;

b) the PLMN users leave the venue and attempt registration back to their home PLMN; or

c) the hosting network is switched off and the PLMN users are forced to attempt registration back to their home PLMN.

4. PLMN users register back to their home PLMN.

### 5.14.4 Post-conditions

The PLMN users who have temporarily accessed the local services of the hosting network return to their home PLMN without causing signaling overload/congestion and within the shortest possible time scales.

### 5.14.5 Existing features partly or fully covering the use case functionality

There are existing features that may support management of simultaneous registration attempts from a high number of users:

3GPP TS 22.011 [5], clause 4.3.1: Access Class Barring

* The serving network shall be able to broadcast mean durations of access control and barring rates (e.g. percentage value) that commonly applied to Access Classes 0-9 to the UE.

3GPP TS 22.011 [5], clause 4.3.2: Service Specific Access Control

* The serving network shall be able to indicate (as specified in clause 4.3.1) whether or not a UE subject to SSAC shall also apply Access Class Barring.
* The UE determines the barring status with the information provided from the serving network, and perform the access attempt accordingly.

3GPP TS 22.011 [5], clause 4.3.4: Extended Access Barring

* Extended Access Barring shall be applicable regardless of whether the UE is in a Home or a Visited PLMN.

3GPP TS 22.261 [2], clause 6.22.2: Unified access control: Requirements

* The UE shall be able to determine whether or not a particular new access attempt is allowed based on barring parameters that the UE receives from the broadcast barring control information and the configuration in the UE.
* The unified access control framework shall be applicable to inbound roamers to a PLMN.

3GPP TS 22.261 [2], clause 6.19.2: 3GPP access network selection: Requirements

* The 5G system shall support, subject to operator policies, a User Controlled PLMN Selector list stored in the 5G UE, allowing the UE user to specify preferred PLMNs with associated RAT identifier in priority order.

3GPP TS 22.261 [2], clause 6.31.2.3: Minimization of Service Interruption: Requirements: Disaster Roaming:

* Disaster Inbound Roamers shall perform network reselection when a Disaster Condition has ended.
* The 3GPP system shall minimize congestion caused by Disaster Roaming.

It is worth to note that the given existing features in 3GPP TS 22.261 [2] clause 6.31.2.3 are only applicable in case there is a Disaster Condition. Specific procedures are followed to notify Disaster Condition and identify Disaster Inbound Roamers. Thus, the noted features above cannot be applied to any use case that is not in Disaster Condition.

### 5.14.6 Potential New Requirements needed to support the use case

[PR 5.14.6-1] The 5G system shall provide mechanisms to mitigate overload caused by UEs returning from a temporary local access of a hosting network to their PLMN network.

[PR 5.14.6-2] The 5G system shall provide mechanisms to minimize the impact on the UEs communication e.g. due to outages when returning to a PLMN after terminating their temporary local access to a hosting network.

5.15 Localized 5G network access on a cruise ship

### 5.15.1 Description

Cruising has become a major part of the tourism industry, serving more than 13 million passengers worldwide. Cruise ships typically embark on round-trip voyages to various ports-of-call, where passengers may go on tours known as "shore excursions". Alternatively, cruise ships may also make two to three night round trips without visiting any ports of call, spending multiple days and nights in the sea. Telecommunication is one of the services offered onboard of the cruise ships enabling internet services for the passengers.

In this use case Truman, a tourist, is embarking on a round-trip voyage in a 5G PALS enabled cruise ship called SeaQueen. The SeaQueen will voyage across the Pacific Ocean and is intended to make three different shore excursions before returning to its port of embarkment. Truman has a 5G enabled mobile phone and has subscribed for the premium 5G telecommunication services offered by the SeaQueen’s parent company “Royalty cruises”. Being a regular customer of the SeaQueen and its sister ships operated by “Royalty cruises”, Truman has provided some personal identification information (e.g. passport, picture, biometrics) and his personal preferences while making the booking to allow for fast automatic check-in and to quickly gain access to the premium 5G telecommunication services.

On the day of embarkment, Truman arrives at the port of embarkment. Upon entering the SeaQueen, Truman receives an invitation to an access portal on his mobile phone. The portal allows him to gain access to the SeaQueen’s 5G system. Since Truman is a well-known customer, he does not fill in lengthy registration forms or fill in a user name and password. Instead, Truman identifies himself via a biometric scanner in his mobile phone to the access portal of the 5G system. Upon identification by the SeaQueen’s 5G system, a network profile containing the necessary credentials and personalized network & device configurations for Truman (based on his premium service and personal preferences known to “Royalty cruises”) is automatically provisioned in his 5G device. Truman’s mobile phone can now obtain PALS services which, among others, are superfast 5G internet access (via backend satellite connection), access to premium video and payment services, and automatic access to specific locations in the ship (e.g. through ranging service). In addition, one or more profiles may be provisioned to Truman’s mobile phone to allow 5G network access during activities on shore, for each country that they intend to visit, without having to worry about buying a local SIM card or identifying a roaming plan according to his personal preference during the excursion.

At the end of the cruise voyage the 5G system on board of the SeaQueen decommissions the network profile of the local 5G network from Truman’s device (e.g. based on a trigger, such as a timer expiring at the end of the trip or location of the user, e.g. the gangway to exit the ship).

### 5.15.2 Pre-conditions

Truman has a 5G enabled mobile phone UE with an eSIM.

Various personal details of Truman, including some biometric identity information, are pre-shared with SeaQueen’s parent company “Royalty cruises” in accordance with GDPR and other privacy regulations.

The SeaQueen’s 5G system has a direct satellite link for 5G services and may have contractual agreements with the local 5G network operators on shore (for each country that they plan to visit).

The SeaQueen’s 5G system may be an NPN or a PLMN.

### 5.15.3 Service Flows

* Upon arrival at the port of embarkation, Truman receives an invitation to an access portal on his 5G mobile phone.
* Since Truman is a known customer, Truman can identify himself via the biometric sensor of his mobile phone.
* The identity service of the SeaQueen 5G system identifies Truman based on his biometric identity data that he provided beforehand.
* Upon identification the corresponding network profile is generated, which contains the necessary credentials, and personalized network and device configurations for Truman, based on his premium services and his personal preferences known to ”Royalty cruises”.
* The personalized network profile is securely downloaded to his mobile phone via the SeaQueen 5G system.
* Truman can now make use of the superfast 5G network connection and localized services onboard the SeaQueen vessel are enabled in alignment with his profile. This includes premium video services, automatic access to specific locations on the ship, and also includes getting 5G service on shore during the excursions in each country that they will visit.
* Truman completes the trip and returns to the port of origin, which automatically triggers the de-registration of Truman from the SeaQueen 5G system and the SeaQueen’s 5G network profiles are automatically decommissioned from Truman’s mobile phone and his own network profile is enabled.
* Thanks to the 5G PALS system, Truman has truly carefree experience during his cruise trip.

### 5.15.4 Post-conditions

5G device of Truman is decommissioned from the 5G system of SeaQueen. Truman continues to enjoy 5G services with his personal subscription with his home network operator.

### 5.15.5 Existing features partly or fully covering the use case functionality

From Section 8.3 of TS 22.261 [2]: “The 5G system shall support an efficient means to authenticate a user to an IoT device (e.g. biometrics)”. However, it is not clear if this requirement also applies to UEs in general or only to a particular subset of UEs, and it is also not clear whether this requirement holds before the IoT device has a network profile for the hosting network installed on that device, i.e. to enable easy provisioning and installation of the respective network profile.

Section 26a of TS 22.101: requirements related to user identity management.

### 5.15.6 Potential New Requirements needed to support the use case

[PR.5.15.6-1] The 5G system shall support a secure means for a UE with no prior subscription to the hosting network to receive human readable information on how to gain access to the hosting network (which may PLMN or NPN).

[PR.5.15.6-2] The 5G system shall support a secure means to authenticate a user of a UE to a hosting network, including cases in which a UE has no subscription to the hosting network yet and still needs to get authorized to gain full access to the hosting network and its services.

NOTE: It can be assumed that a service provider deploying a hosting network has access to respective identification information about the user, e.g. through a separate registration process outside the scope of 3GPP.

[PR.5.15.6-3] The 5G system shall be able to authorize the UE of a user authenticated to a hosting network to access the hosting network and its localized services on request of the service provider.

[PR.5.15.6-4] The 5G system shall be able to withdraw the UE authorization based on certain conditions, such as time or location of the user.

## 5.16 Localized network for a mass casualty incident

### 5.16.1 Description

A mass casualty incident (MCI) describes an event in which the emergency medical services may get overwhelmed by the number and severity of the casualties.

In this use case, a massive terrorist attack has taken place in the capital of the country Haniti. One of the multistorey buildings in the central market area has collapsed with more than 100 victims injured, classifying it as a mass casualty incident (MCI). The public telecommunication services are majorly interrupted since everyone in the vicinity of the incident is trying to contact their families and to stream videos of the incident. A team of first responders has arrived at the MCI location with an ambulance, with a built-in 5G base station. The base station is connected to a 5G network called HanCel capable of supporting PALS. The base station has a total coverage area of 500x500 meters. Also a team of the local police department has arrived and has secured the boundaries of the MCI area, requesting everyone that is not injured to leave the MCI area.

As a feature of PALS, HanCel is capable to make a temporary network available with a delimited 5G service area, providing very good quality of service for the first responders, their devices (such as health monitors), for the injured victims trying to reach their families (using their own UEs) and for the (existing) wireless video surveillance cameras in the area.

One of the first responders can demarcate the boundaries/contours of the MCI area on a map, and provides e.g. a set of coordinates/dimensions of the MCI area to the HanCel network. The HanCel network configures the temporary network in such a way that only the 5G devices present in the MCI area are allowed to connect. The MCI area may be smaller than the coverage of a single cell. In case of larger MCI areas, more cells may be needed to cover the area. The 5G devices of the bystanders that are present outside the crash area, but still within the coverage area of HanCel are not allowed to connect. In order to provide very good QoS in the MCI area, HanCel can configure the use of dedicated spectrum access in the targeted area.

### 5.16.2 Pre-conditions

HanCel is an PALS enabled network in the country Haniti, and is the preferred operator for many first responder organizations in Haniti.

All the operators in the country Haniti have a roaming agreement with HanCel.

### 5.16.3 Service Flows

* A first responder configures the 5G system of HanCel with the dimensions/coordinates of the MCI area, which is a small area within the coverage area of the HanCel network.
* The 5G system of HanCel network configures a temporary network in such a way that only the 5G devices present in the MCI area are allowed to connect. Bystanders and everyone else outside the MCI area are not allowed to access the network.
* Thanks to the PALS ability to provide localized services in a targeted area within a larger coverage area, HanCel improved the communication and response time of the first responders in the MCI area, thereby reducing fatal casualties. Also, the victims were able to easily reach their families (using their own UEs), reducing the anxiety and stress of the victims, and the (existing) wireless video surveillance cameras in the area were able to capture all the details of the MCI event.

### 5.16.4 Post-conditions

### 5.16.5 Existing features partly or fully covering the use case functionality

### 5.16.6 Potential New Requirements needed to support the use case

[PR.5.16.6.-1] The 5G system shall be able to provide access to a hosting network only for UEs in a configurable targeted area within the coverage area in a privacy sensitive manner.

NOTE 1: the targeted area may be smaller than the coverage area of a single cell.

NOTE 2: determining location information related to a UE is subject to regional and national regulatory requirements, and is subject to authorization (e.g. of home network operator of a UE) and user consent.

## 5.17 Steering of UEs between hosting local networks and PLMNs

### 5.17.1 Description

A live concert with high-resolution video application service is provided by service provider A and made available in the concert arena both by a local hosting network A and a PLMN network B. The service is offered in PLMN B to users that have credentials to access PLMN B and, in addition, has subscribed to the service. The service is offered in hosting network A to users that have credentials to access the service through hosting network A. It is assumed that the service comes with access credentials through Hosting network A, irrespective of if a user also has access to PLMN network B. This means that there will be UE’s in the concert that can access the service either using PLMN network B or hosting network A.

Before or during the concert, service provider A identify a need to move users from hosting network A (e.g., due to capacity limits, expected or occurring service quality issues) and would then update policies (UE policies) for UEs in hosting network A that also has credentials to access the service through PLMN network B, to leave network A and continue the service in PLMN network B.

In the end of the concert, the situation in hosting network A may improve and the service provider A can then request PLMN network B to update UE policies for UE’s that are being served by PLMN network B to instead continue the service in hosting network A. When users are, via updated UE policies, instructed to continue services in other network, this can be done without user interaction as long as availability of other services are not impacted.

### 5.17.2 Pre-conditions

The service provider A has a service agreement with the operator of PLMN network B and hosting network A and provides the same service in both networks.

The operator of hosting network A may optionally have a (service or roaming) agreement with the operator of PLMN network B

### 5.17.3 Service Flows

1. Users use their UEs (e.g., smart phones) to buy tickets to the concert through the portal provided by service provider A. The service provider A provides the UE with credentials to access hosting network A and get the service. Additionally, the UE informs the service provider A about presence of credentials for PLMN network B.

2. The service provider A request PLMN network B to configure the UE with a UE policy for the network selection to receive the high-resolution video application service of the concert via hosting network A.

3. Service provider A identify a need to move users from hosting network A (e.g., due to capacity limits, expected or occurring service quality issues). Service provider A then request updates of the UE policies for UEs in hosting network A that also has credentials to access the service through PLMN network B, to leave network A and continue the service in network B.

4. The UEs that switch to PLMN network B connects to the network and start using the service from service provider A.

5. Service provider A identify that there are opportunities to move users into hosting network A for the service provided, and then trigger a request to PLMN B to update the UE policies for relevant users/UEs to instead continue the service in hosting network A.

6. PLMN network B may choose to change policies for some of the UE’s using the service in its network and subsequently, those UE’s will select hosting network A and continue the services from service provider A

### 5.17.4 Post-conditions

Users who select the high-resolution video service can enjoy the service of the live concert from either of the network which service provider A has agreement with and the UE has credentials to.

After the concert ends the UE will automatically select the best network according to normal network selection procedures.

### 5.17.5 Existing features partly or fully covering the use case functionality

N/A

### 5.17.6 Potential New Requirements needed to support the use case

[PR.5.17.6-1] The 5G system shall enable the home network to instruct a UE under which conditions (e.g. predefined time, location) it could select a certain hosting network based on the request from a service provider.

[PR.5.17.6-2] The UE shall be able to select a hosting network or change to another hosting network, using the corresponding credentials as may be indicated, without any additional user consent as long as the delivered services, including the localized services, are unchanged.

# 6 Consolidated Potential Requirements

NOTE  1: Both the home and the hosting network can be a PLMN or NPN.

NOTE  2: Only subscribers of a public network can roam into a PLMN.

## 6.1 Configuration of Localized Services in Hosting Network

Table 6.1-1 – Configuration of Localized Services in Hosting Network Consolidated Requirements

| CPR # | Consolidated Potential Requirement | Original PR # | Comment |
| --- | --- | --- | --- |
| CPR 6.1-001 | The 5G network shall support suitable mechanisms to allow automatically establishing localized service agreements for a specific occasion (time and location) and building temporary relationship among hosting network operator and other service operators including network operators or 3rd party service providers. | PR.5.3.6-1 |  |
| CPR 6.1-002 | The 5G system shall support means for the service operator to request the hosting network via standard mechanisms to provide access to 3rd party services at a specific period of time and location. This period of time shall be flexible, so that a change in service provision can be decided at any time (e.g., to cancel or prolong local services in the locality of service delivery) based on localized services agreements. | PR.5.5.6-1 |  |
| CPR 6.1-003 | Based on localized services agreements, the 5G system shall provide suitable means to allow the service operator to request and provision various localized service requirements, including QoS, expected/maximum number of users, event information for discovery, network slicing, required IP connectivity etc, and routing policies for the application of the localized services via the hosting network. | PR.5.5.6-2 and PR.5.4.6-1 |  |
| CPR 6.1-004 | The 5G system shall support means for a hosting network to create policies and configure resources for the requested time and location for the 3rd party services based on the received request. | PR.5.5.6-3 |  |
| CPR 6.1-005 | The 5G system shall support means for a hosting network to notify the service operator of the accepted service parameters and routing policies. | PR.5.5.6-4 |  |
| CPR 6.1-006 | Subject to regulatory requirements and localized service agreements, the 5G network shall allow a home network operator to automatically negotiate policies with the hosting network for allowing the home network’s subscribers to connect at a specific occasion, e.g., time and location, for their home network services. | PR.5.3.6-2 |  |
| CPR 6.1-007 | Subject to the automatic localized services agreements between the hosting network operator and home network operator, for UE with only home network subscription and with authorization to access hosting networks the 5G system shall support:- access to the hosting network and use home network services or selected localized services via the hosting network.- seamless service continuity for home network services or selected localized services when moving between two hosting networks or a host network and the home network. | PR.5.3.6-5 |  |
| CPR 6.1-008 | The 5G System shall support a mechanism to enable configuration of a network that provides access to localized services such that the services can be limited in terms of their spatial extent (in terms of a particular topology, for example a single cell), as specified by a 3rd party. | PR.5.10.6-1 |  |
| CPR 6.1-009 | The 5G System shall support a mechanism to enable configuration of a network that provides access to localized services such that the services can be limited in terms of the resources or capacity available, to correspond to requirements that apply only to the locality of service delivery, as specified by a 3rd party. | PR.5.10.6-2 |  |
| CPR 6.1-010 | The 5G system shall support means for a hosting network to provide a 3rd party service provider with information for automatic discovery of the hosting network by the UEs to allow access to specific 3rd party services. | PR.5.6.6-1 |  |
| CPR 6.1-011 | The 5G system shall support secure mechanisms to allow a home network to coordinate with a hosting network for a subscriber to temporarily access the hosting network (e.g., based on temporary credentials) at a given time (start time and duration) and location. | PR.5.8.6-1 |  |

## 6.2 User Manual Selection of Localized Services via Hosting Network

Table 6.2-1 – User Manual Selection of Localized Services via Hosting Network Consolidated Requirements

| CPR # | Consolidated Potential Requirement | Original PR # | Comment |
| --- | --- | --- | --- |
| CPR 6.2-001 | The hosting network shall allow a UE to manually select temporary localized services which are provided via local breakout at the hosting network.NOTE : localized services are provided via local breakout at the hosting network based on interworking scenarios for hosting network owned/collaborative services as indicated in Annex A. | PR.5.4.6-2 |  |

## 6.3 UE Configuration, Provisioning, Authentication and Authorization

Table 6.3-1 – UE Configuration, Provisioning, Authentication and Authorization Consolidated Requirements

| CPR # | Consolidated Potential Requirement | Original PR # | Comment |
| --- | --- | --- | --- |
| CPR 6.3-001 | Subject to localized services agreements, the 5G network shall enable a home network operator to authorize a UE for using its home network services via a hosting network for a certain period of time and/or location. | PR.5.3.6-3 |  |
| CPR 6.3-002 | The 5G network shall allow a trusted 3rd party to provide UEs with localized service policy (e.g., QoS, network slice in the hosting or home network, service restriction such as time and location) via the hosting network or the UE’s home network. | PR.5.4.6-1A |  |
| CPR 6.3-003 | The 5G system shall enable a UE to use credentials provided by the hosting network with or without coordination with the home network of the UE, to make use of localized services via the hosting network with a certain time (including starting time and the duration) and location validity. | PR.5.4.6-7 |  |
| CPR 6.3-004 | The 5G network shall be able to allow the home network to steer its UE(s) to a hosting network with the consideration of the location, times, coverage of the hosting network and services offered by the home network and hosting network. | PR.5.11.6-1 |  |
| CPR 6.3-005 | The 5G system shall provide support to enable secure means to authenticate and authorize a user of a UE accessing a hosting network~~,~~ including cases in which a UE has no subscription to the hosting network and still needs to get authorized to use localized services via the hosting network.NOTE : It can be assumed that a network provider deploying a hosting network has access to respective identification information about the user, e.g., through a separate registration process outside the scope of 3GPP. | PR.5.15.6-2  |  |
| CPR 6.3-006 | The 5G system shall be able to authenticate and authorize the UE of a user authenticated to a hosting network to access the hosting network and its localized services on request of a service provider. | PR.5.15.6-3 and PR.5.2.6-2 |  |

## 6.4 UE Discovery, Selection and Access

Table 6.4-1 – UE Discovery, Selection and Access Consolidated Requirements

| CPR # | Consolidated Potential Requirement | Original PR # | Comment |
| --- | --- | --- | --- |
| CPR 6.4-001 | Subject to operator’s policy and agreement between a 3rd party service provider and operator, the 5G system shall enable a UE to receive and use configuration provided by a 3rd party service provider to discover and access a hosting network and localized services, including the considerations of prior service agreement with a 3rd party service provider and no prior subscription to hosting network. If the UE is able to obtain services from two networks simultaneously, it may additionally select the hosting network. If the UE cannot maintain the connection to the home network while selecting the hosting network, the selection shall only be done on request by the user, i.e., using manual selection. | PR.5.6.6-2 |  |
| CPR 6.4-002 | The 5G system shall support secure means for a UE to select and access localized services which may be provided by a 3rd party service provider via a hosting network, independent of prior subscription to the hosting network or 3rd party service provider. | PR.5.7.6-1 and PR.5.4.6-8 |  |
| CPR 6.4-003 | The 5G system shall enable the home network to allow a UE to automatically select a hosting network for accessing localized services when specified conditions (e.g., predefined time, location) are fulfilled. | PR.5.12.6-2 |  |
| CPR 6.4-004 | The 5G system shall be able to prevent a UE to re-access the hosting network after the localized services were terminated if the authorization for the localized services is no longer valid (e.g., can be based on certain conditions such as time or location of the user). | PR.5.15.6-4 |  |
| CPR 6.4-005 | The 5G system may support means for a UE which may or may not have prior subscription to the hosting network to display human readable information on how to gain access to the hosting network and available 3rd party services. | PR.5.15.6-1 |  |
| CPR 6.4-006 | The 5G system shall support a mechanism to allow a user to manually select a specific local hosting network. | PR.5.2.6-1 |  |
| CPR 6.4-007 | The 5G system shall be able to limit access of specific UEs to a configurable area of a hosting network's coverage area. | PR.5.16.6-1 |  |
| CPR 6.4-008 | The 5G system shall be able to maintain privacy of a user against the hosting network while the UE does not make use of the hosting network, for example, to prevent tracking of UEs by hosting networks. | PR.5.16.6-1 |  |
| CPR 6.4-009 | The 5G system shall enable the home network to instruct a UE to select a hosting network with certain conditions (e.g., predefined time, location) based on the request from a service provider. | PR.5.17.6-1 |  |
| CPR 6.4-010 | The 5G system shall enable the home network to allow a UE to select a hosting network or change to another hosting network, without any additional user intervention as long as the delivered services, both localized services and home routed services, are unchanged. | PR.5.17.6-2 |  |

## 6.5 Hosting Network Localized Services and Home Operator Services

Table 6.5-1 – Hosting Network Localized Services and Home Operator Services Consolidated Requirements

| CPR # | Consolidated Potential Requirement | Original PR # | Comment |
| --- | --- | --- | --- |
| CPR 6.5-001 | The 5G network shall enable the home network operator to indicate to the UE what services are preferred to be used from the home network when the UE connects to a hosting network and the requested services are available from both the hosting and the home network. | PR.5.3.6-4 |  |
| CPR 6.5-002 | Based on localized service agreements, the hosting network shall be able to provide required connectivity and QoS for a UE simultaneously connected to the hosting network for localized services and its home network for home network services. | PR.5.4.6-3 |  |
| CPR 6.5-003 | A UE shall be able to connect to its home network via the hosting network, if supported by the hosting network and the home network based on localized service agreements. | PR.5.4.6-4 |  |

## 6.6 Returning to Home Network

Table 6.6-1 – Returning to Home Network Consolidated Requirements

| CPR # | Consolidated Potential Requirement | Original PR # | Comment |
| --- | --- | --- | --- |
| CPR 6.6-001 | The 5G system shall provide mechanisms to mitigate user plane and control plane overload caused by a high number of UEs returning from a temporary local access of a hosting network to their home network in a very short period of time. | PR.5.14.6-1 |  |
| CPR 6.6-002 | The 5G system shall provide mechanisms to minimize the impact on the UEs communication e.g., to prevent user plane and control plane outages when returning to a home network together with other high number of UEs in a very short period of time, after terminating their temporary local access to a hosting network. | PR.5.14.6-2 |  |

## 6.7 Charging

Table 6.7-1 – Charging Consolidated Requirements

| CPR # | Consolidated Potential Requirement | Original PR # | Comment |
| --- | --- | --- | --- |
| CPR 6.7-001 | The 5G system shall be able to collect charging information for the use of localized services at the hosting network and provide the charging records to UEs’ home operators based on localized service agreements and charging policies provided by the localized service providers | PR.5.4.6-6 |  |

## 6.8 Regulatory Services

Table 6.8-1 – Regulatory Services Consolidated Requirements

| CPR # | Consolidated Potential Requirement | Original PR # | Comment |
| --- | --- | --- | --- |
| CPR 6.8-001 | A hosting network using the 5G system shall be able to support regulatory services (e.g., PWS, LI, and emergency calls), based on regional/national regulatory requirements. | PR.5.9.6-1 |  |

## 6.9 Multicast/Broadcast

Table 6.9-1 – Multicast/Broadcast Consolidated Requirements

| CPR # | Consolidated Potential Requirement | Original PR # | Comment |
| --- | --- | --- | --- |
| CPR 6.9-001 | The operator of a hosting network shall support a mechanism allowing different local service providers and content providers to disseminate their services and content over broadcast/multicast transport. This mechanism should also provide means to include diverse content in the same transmission, e.g., to include advertisements with other content, or to include multiple content in the same media delivered to the user. | PR5.13.6-1 |  |
| CPR 6.9-002 | A hosting network shall provide multicast and broadcast services in an energy efficient manner to UEs receiving this service. | PR5.13.6-2 |  |
| CPR 6.9-003 | A hosting network shall support resource efficient content delivery through multicast/broadcast. | PR5.13.6-3 |  |
| CPR 6.9-004 | A hosting network shall support a mechanism to provide low latency signalling for efficient content delivery to many UEs. | PR5.13.6-4 |  |
| CPR 6.9-005 | Subject to home operator policy, a hosting network shall be able to prioritize specific multicast and broadcast services for local access over home routed access, even if the same service is available in both networks. | PR5.13.6-5 |  |

# 7 Conclusions and Recommendations

This technical report provides use cases and potential new requirements. The resulting service requirements have been consolidated in clause 6.

It is recommended to consider the consolidated requirements identified in this TR as the baseline for subsequent normative work.

Annex A: Interworking between Networks Operators and Application Providers for localized services

In TS22.278, Annex B1 [4] provides various scenarios applicable for interworking between mobile operators and data applications for EPS and 5GS including:

* Operator owned non-roaming scenario
* Collaborative non-roaming scenario
* Operator owned/collaborative roaming scenario – Home Routed
* Collaborative roaming scenario – Local Breakout

This clause extends the roaming scenarios applicable for interworking between hosting network operator (PLMN or NPN) and data applications based on service agreements for localized services among network operators and application/service providers:

* Hosting network operator owns the 5G network which provides access and IP connectivity to roaming UEs.
* Network operator owned application layer entities include Service Hosting Environment, and IMS network.
* Application platforms in third party domain can be owned by third party application/service providers, or home/other network operators.
* The Application platforms could be application servers (e.g. Video on Demand Server, Cloud gaming server, etc.), 3rd party software development platforms, and third party/operator Service Hosting Environments.

The following figures show the collaborative relationship in three domains including network operator providing access and IP connectivity, network operators providing services via IMS/application platforms, and application/service providers providing services via application platforms or applications. The dashed lines between visited hosting network operator and Home network operators are based on service level e-agreement and the horizontal line represents the demarcation between the network operator domains and the 3rd party domain. In an operator network, the application layer entities include IMS network, Application platforms, and API Gateway for third party applications developed using APIs (e.g. REST, GSMA OneAPI).

Figure A-1 provides the home-routed roaming scenario for collaborative scenarios where traffic is routed to home network operator and applications are delivered by the home operator owned IMS or Application platform via roaming agreements between network operators.



Figure A-1: Home Operator owned/collaborative roaming scenario – Home Routed

Note: The other network operators and service/application operators in 3rd party domain provides collaborative services in application platforms to Home operator. The arrow solid line represents the traffic routed over trusted domains within home operator network while the arrow dash line represents the traffic routed over untrusted domain outside of home operator network.

Figure A-2 provides the local breakout scenario for both owned and collaborative scenarios between visited hosting network operator and operators in 3rd party domains where traffic is routed to application from the hosting network to 1) hosting network owned application platforms, 2) collaborative home network owned application platforms, and 3) third parties via roaming agreements between visited hosting network operator and home/other network operators, and between hosting network operators and other application/service providers.



Figure A-2: Hosting Network Operator owned/collaborative roaming scenario – Local Breakout

Note: The other network operators and application/service operators in 3rd party domain provides collaborative services in application platform to hosting network operator. The arrow solid lines represent the traffic routed over trusted domains within hosting network while the arrow dash lines represent the traffic routed over untrusted domain outside of hosting operator network.

Other interworking scenarios are not excluded.

Annex B: Change history

|  |
| --- |
| **Change history** |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2020-11 | SA1#92e | S1-204336 |  |  |  | TR skeleton | 0.0.0 |
| 2020-11 | SA1#92e | S1-204349 |  |  |  | TR post-SA192e | 0.1.0 |
| 2021-03 | SA1#93e | S1-210315 |  |  |  | TR post-SA193e | 0.2.0 |
| 2021-05 | SA1#94e | S1-211311 |  |  |  | TR post-SA194e | 0.3.0 |
| 2021-06 | SA#92e | SP-210514 |  |  |  | Raised by MCC to v.1.0.0 for one-step approval | 1.0.0 |
| 2021-06 | SA#92e | SP-210514 |  |  |  | Raised by MCC to v.18.0.0 following one-step approval | 18.0.0 |
| 2021-06 | SA#92e | SP-210514 |  |  |  | Corrected logo (5G->5GA) | 18.0.1 |
| 2021-09 | SA#93e | SP-211047 | 0001 | 1 | F | FS\_PALS Update: Chapter 5.6.6 Requirement for User Awareness | 18.1.0 |
| 2021-09 | SA#93e | SP-211047 | 0002 | 1 | F | Miscellaneous corrections from pCR implementation | 18.1.0 |
| 2021-09 | SA#93e | SP-211047 | 0003 | 5 | F | Updating PALS Consolidated Potential Requirements | 18.1.0 |
| 2021-09 | SA#93e | SP-211047 | 0004 |   | D | Removal of Editor’s Note from Clause 5.10.5 | 18.1.0 |
| 2021-09 | SA#93e | SP-211047 | 0005 | 1 | F | Update of manual selection | 18.1.0 |
| 2021-09 | SA#93e | SP-211047 | 0006 | 1 | F | Clarification of use case 5.15 | 18.1.0 |
| 2021-09 | SA#93e | SP-211047 | 0008 | 1 | F | FS\_PALS TR Cleanup | 18.1.0 |
| 2021-12 | SP-94 | SP-211496 | 0009 | 1 | F | CPR# to PR# Mapping for PALS | 18.2.0 |