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| 3GPP TR 28.843 V18.1.0 (2023-12) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Services and System Aspects;  Study on structure of charging for verticals  (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.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The present document studies the charging aspects to better support vertical scenarios, which is different with the existing customer charging baseline, specified in TS 32.240 [2], and makes the evolution of charging specifications clearer, which focuses on studying the charging principles and references of verticals charging, and aims to provides an guideline for other charging management TSs that specify the verticals charging.

All terms, definitions and abbreviations used in the present document, that are common across 3GPP TSs, are defined in the 3GPP Vocabulary, TR 21.905 [1].

# 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 32.240: "Telecommunication management; Charging management; Charging architecture and principles".

[3] 3GPP TS 32.254: "Telecommunication management; Charging management; Exposure function Northbound Application Program Interfaces (APIs) charging".

[4] 3GPP TS 32.257: "Telecommunication management; Charging management; Edge computing domain charging".

[5] 3GPP TS 28.201: "Telecommunication management; Charging management; Network slice performance and analytics charging in the 5G System (5GS); Stage 2".

[6] 3GPP TS 28.202: "Telecommunication management; Charging management; Network slice management charging in the 5G System (5GS); Stage 2".

[7] 3GPP TS 28.203: "Telecommunication management; Charging management; Network slice admission control charging in the 5G System (5GS)".

[8] 3GPP TR 28.828: "Study on charging aspects for enhanced support of non-public networks".

[9] 3GPP TR 28.839: "Study on time sensitive networking charging".

[10] 3GPP TR 32.847: "Study on Charging Aspects for Network Slicing Phase 2".

[11] 3GPP TR 28.827: "Study on 5G charging for additional roaming scenarios and actors".

[12] 3GPP TS 22.104: "Service requirements for cyber-physical control applications in vertical domains".

[13] 3GPP TS 28.533: "Management and orchestration; Architecture framework".

[14] 3GPP TS 22.115: "Service aspects; Charging and billing".

[15] 3GPP TS 32.255: "Telecommunication management; Charging management; 5G data connectivity domain charging; Stage 2".

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in 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 TR 21.905 [1].

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

Nchf Service based interface exhibited by CHF

N40 Reference point between SMF and the CHF

N47 Reference point between SMF and the CHF

N2 Reference point between the (R)AN and the AMF

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 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 TR 21.905 [1].

5G LAN 5G Local Area Network

AMF Access and Mobility Management Function

API Application Programming Interface

B2B Business to Business

B2C Business to Consumer

B2B2X Business to Business to Everything

CCS Converged Charging System

CDR Charging Data Record

CEF Charging Enablement Function

CIoT Cellular Internet of Things

CSC Communication Service Customer

CSP Communication Service Provider

DDNMF Direct Discovery Name Management Function

EAS Edge Application Server

ECSP Edge Computing Service Provider

MNO Mobile Network Operator

MnS Management Service

MVNO Mobile Virtual Network Operator

NEF Network Exposure Function

NOP Network Operator

NPN Non-Public Network

NPN-SP NPN Service Provider

NSACF Network Slice Admission Control Function

NSSAAF Network Slice-specific and SNPN Authentication and Authorization Function

NSM Network Slice Management

NSP Network Slice Provider

NSPA Network Slice Performance and Analytics

SMF Session Management Function

SMSF Short Message Service Function

S-NSSAI Single Network Slice Selection Assistance Information

TSN Time Sensitive Networking

TS Time Synchronization

TSC Time Sensitive Communication

TSN-SP Time Sensitive Networking Service Provider

TS-SP Time Sensitive Service Provider

# 4 Background

## 4.1 General

For 5GS, there are several charging specifications focus on the charging aspects about wholesale and business to business for Industry verticals. Corresponding charging specifications needs to be studied on how it could be documented, including but not limited to the charging aspect of Network Slice, Non-Public Network, Time Sensitive Network, Edge Computing, and 5G LAN etc. The charging architecture and principles of vertical scenarios are different from those of subscriber charging scenarios which specified in the TS 32.240 [2].

## 4.2 Charging specifications reference considerations

A set of charging specific TSs covers the 5GS domains and 5G service levels (e.g. Network slice, 5G LAN and TSN, etc.) respectively, in the TS 32.2xx and TS 28.2xx TS number ranges. These TSs describe the mapping of the common charging architecture, charging requirements and charging principles onto the specific services, scenarios, for converged online and offline charging. They are commonly referred to as the middle tier charging TSs.

The following charging technical specifications reference for vertical charging are:

- NEF Charging is specified in the TS 32.254 [3].

- 5G LAN Charging is specified in the TS 32.254 [3].

- Edge Computing is specified in the TS 32.257 [4].

- Network Slicing is specified in the TS 28.201 [5], TS 28.202 [6] and TS 28.203 [7].

- Data connectivity charging is specified in the TS 32.255 [15].

The following charging technical report reference for vertical charging are:

- NPN Charging is studied in the TR 28.828 [8].

- TSN Charging is studied in the TR 28.839 [9].

- Network slice charging is studied in the TR 32.847 [10].

- Wholesale charging is studied in the TR 28.827 [11].

A set of TSs in the TS 32.29x range covers common aspects, such as CDR parameter and syntax descriptions, online and offline charging applications, and the charging interactions within the network (CDR transfer) as well as between the network and the Billing Domain (CDR file transfer).

## 4.3 The concept clarification

The **vertical** domain is an industry or group of enterprises in which similar products or services are developed, produced, and provided, specified in the TS 22.104 [12]. For example, the typical vertical domains can be the factories of the future; electric-power distribution and central power generation; and connected hospitals or medical facilities.

The **enterprise** is an [organization](https://dictionary.cambridge.org/zhs/%E8%AF%8D%E5%85%B8/%E8%8B%B1%E8%AF%AD/organization), a [company](https://dictionary.cambridge.org/zhs/%E8%AF%8D%E5%85%B8/%E8%8B%B1%E8%AF%AD/company), or a [business](https://dictionary.cambridge.org/zhs/%E8%AF%8D%E5%85%B8/%E8%8B%B1%E8%AF%AD/business). For example, the typical enterprises can be the [manufacturing](https://dictionary.cambridge.org/zhs/%E8%AF%8D%E5%85%B8/%E8%8B%B1%E8%AF%AD/manufacturing)/[catering](https://dictionary.cambridge.org/zhs/%E8%AF%8D%E5%85%B8/%E8%8B%B1%E8%AF%AD/catering)/[farming](https://dictionary.cambridge.org/zhs/%E8%AF%8D%E5%85%B8/%E8%8B%B1%E8%AF%AD/farm) enterprise, a [large](https://dictionary.cambridge.org/zhs/%E8%AF%8D%E5%85%B8/%E8%8B%B1%E8%AF%AD/large)/[small](https://dictionary.cambridge.org/zhs/%E8%AF%8D%E5%85%B8/%E8%8B%B1%E8%AF%AD/small)/medium-sized enterprise.

The **Tenant** in 3GPP management system is a group of 3GPP management system users associated with the management capabilities they are allowed to access and consume, described in clause 4.8 the TS 28.533 [13]. The tenant in charging aspect can be the network slice subscriber, i.e. the party for which the network slice instance(s) is(are) created, satisfying the requirements of subscribed-to service(s), specified in the TS 28.202 [6].

The **Subscriber** is used to identify the enterprise based on the subscription relationship between enterprise and MNO, for example, which can be the Tenant id for the network slice charging.

# 5 Business Roles

## 5.1 General

To support the 5G and further service charging, the business roles for the current supported special service charging in the specifications which is related with the vertical charging are listed:

Network Slicing:

* Communication Service Provider (CSP): who provides the Provides communication services to Communication Service Customer (CSC). e.g. tenant, vertical.
* Network Slice Provider (NSP): The CSP or NOP who provides Network Slice as a Service.

Edge Computing:

* ECSP (Edge Computing Service Provider) who provides edge data network environment.

Network Exposure Charging:

* External 3rd party service provider: Who hosting an Application(s) and consumers the services provided by 3GPP network via Network Capability Exposure, such as the 5G LAN.

NPN Charging:

* NPN Service Provider (NPN-SP): a Communication Service Provider (CSP) which provides communication services for non-public use, e.g. vertical, tenant, NOP.

TSN Charging:

* TSN Service Provider (TSN-SP): provides communication services for TSN Bridge use, e.g. enterprise.
* TS Service Provider (TS-SP): provides communication services for time-sensitive communication and time synchronization, e.g. enterprise.

Wholesale charging:

* Additional actor: This is a retailer or a wholesaler of mobile services but does not own licensed radio spectrum, an additional actor that is a retailer is often referred to as Mobile Virtual Network Operator (MVNO).

## 5.2 High level business roles

Based on the investigation of business roles and charging scenarios for existing 5G and further service charging in the clause 5.1, the high-level business roles can be categorized to the B2B (Business to Business), B2C (Business to Customer) and B2B2X:

- The B2B (Business to Business) describes a type of business relationship in which businesses provide goods or services to other businesses.

- The B2C (Business to Consumer) describes a type of business relationship in which businesses provide goods or services to consumer. e.g. individual subscriber.

- The B2B2X is the combinations of the B2B and B2C which will not be described in more details.

The first Letters in the "**B**"2B and "**B**"2C is the charging party, the MNO.

The second letters in the B2"**B**" and B2"**C**" is the charged party, e.g. the network slice tenant or the individual subscriber.

## 5.3 Business relationship based on business roles

To support the 5G services charging, the relationship based on business roles for example is described as the following. The following examples are targeting a particular business model in order to describe the business relationship based on whether inter-providers or end user as charged party. Potential business relationship may be involved multiple business models at the same time, both B2B and B2B2C, which is not described in the document.

The B2B is applicable but not limited for:

- Network exposure domain charging: NEF charging per API invocation/notification.

- Data connectivity domain charging: SMF charging per S-NSSAI for network slice and SMF charging for usage reporting of Edge computing/CIoT.

- Connection and mobility domain charging: AMF charging for registration, location, N2 connection.

- Short message charging: SMSF charging for IoT.

- Prose charging: ProSe Function or DDNMF for prose discovery and prose communication charging.

- Edge charging: CEF based charging and EAS deployment charging.

- 5G LAN charging: NEF charging/CEF based charging for 5G LAN management and configuration.

- Network slice charging: NSPA, NSM, NSACF and NSSAAF charging per S-NSSAI for network slice.

- NPN charging: SMF and AMF charging for the inter-provider charging of NPN.

- TSN charging: NF charging for TSN Bridge management and configuration, NEF charging for the enabler of TSC and TS.

- Wholesale charging: Wholesale charging between MNO and MVNO.

The B2C is applicable but not limited for:

- Short message charging: SMSF charging per UE for short message.

- Edge charging: SMF charging for 5GS capability usage charging for edge computing.

- Network slice charging: SMF charging for network slice per UE per PDU session per S-NSSAI.

- NPN charging: SMF and AMF charging for the subscriber-based charging or NPN.

- TSN charging: SMF charging for the TSN communications per UE.

In deployments, there could be business scenarios where one or more of the business relationships based on business roles are supported by a single enterprise. The present document does not impose any restrictions to the possible deployment scenarios.

# 6 Key issues

## 6.1 Key issues and solutions mapping

The high level of key issues for the vertical charging covers the following:

**- Key Issues-01:** Clarify the charging principles for vertical-oriented charging.

**- Key Issues-02:** Determine the charging architecture mapping for vertical-oriented Charging.

The mapping between the key issues and the potential solutions are present as shown below.

Table 6.1-1: Mapping of Potential Solutions to Key Issues

|  |  |  |
| --- | --- | --- |
| Solutions | Key Issues | |
| 1 | 2 |
| Solution #7.1 New TS for the charging architecture and principles | √ |  |
| Solution #7.2 Restructure for the charging principle | √ |  |
| Solution #7.3 Converged charging architecture |  | √ |
| Solution #7.4 Network slice tenant charging architecture |  | √ |
| Solution #7.5 Converged tenant charging architecture |  | √ |
| Solution #7.6 NF to CHFs communication |  | √ |
| Solution #7.7 CHF to CHF communication |  | √ |
| Solution #7.8 Separated charging architecture |  | √ |

## 6.2 Key issue #1: Clarify the charging principles for vertical-oriented charging

### 6.2.1 Use Case Description

#### 6.2.1.0 General

The high-level requirements for charging are specified in TS 22.115 [14] and the common charging architecture and framework are specified in the TS 32.240 [2]. The detailed requirements for service charging (e.g. network slice charging) and service specified charging architecture are specified in the service charging specifications, such as the TS 28.201 [5] and TS 28.202 [6], The charging principles on the basis of the charging architecture and framework and charging requirements are present.

#### 6.2.1.1 Use Case #1.1 Charging Principle Applicability

The common charging principle specified in the TS 32.240 [2] is designed for legacy charging system, i.e. online charging system and offline charging system in 2G/3G/4G, and is also used for the enhanced charging system, i.e. converged online and offline charging system in 5G or future). With the development of the 5G or future advanced network, the B2B and B2C charging scenarios focus on the special requirements from the vertical (various industries) in the charging principle, for example, the CHF selection options.

The consistent charging principle template which is applicable to the different 5G or future services charging should be investigated, based on the all the existing charging principles in the separated charging service TSs (e.g. TS 28.201 [5], TS 28.202 [6]) and common.

Describe the charging principles template to apply to B2B and B2C separately and structure the document outline to understand the reference the of charging principle in the multiple services TSs and common, that will help internal and external stakeholder to find the information about the charging principle they need in the common and special.

The corresponding key issue for this use case is the key issue #1.

### 6.2.2 Key issues description

The following key issues are identified:

- Investigates the existing charging principles for the vertical-oriented charging.

- Determine the documents structure of charging principles for the vertical charging.

## 6.3 Key issue #2: Determine the charging architecture applicable for vertical-oriented Charging

### 6.3.1 Use Case Description

#### 6.3.1.0 General

The high-level requirements for charging are specified in TS 22.115 [14] and the common charging architecture and framework are specified in the TS 32.240 [2]. The detailed requirements for service charging (e.g. network slice charging) and service specified charging architecture are specified in the service charging specifications, such as e.g. the TS 28.201 [5], TS 28.202 [6] and TS 28.203 [7].

#### 6.3.1.1 Use Case # 2.1 Charging Architecture Applicability

The charging architecture specified in the TS 32.240 [2] is the common and applicable for the legacy and enhanced charging system. With the development of the 5G or future advanced network, the B2B and B2C charging scenarios focus on the special requirements from the vertical (various industries) in the charging architecture, for example, the separated UE CCS and Tenant CCS charging architecture for the network slice charging.

The description of multiple charging architecture should be investigated, based on all of the existing charging architectures in the TS or TR, to clearly describes which charging architecture is applicable for B2B or B2C separately, structure the document outline to understand the relationship among the different charging architecture options in the single TS or clause, that will help internal and external stakeholder to find the information about the charging architecture applicability they need.

The corresponding key issue for this use case is the Key issue #2.

### 6.3.2 Key issues description

The following key issues are identified:

- Investigates the existing service specified charging architecture for vertical-oriented charging.

- Determine the currently defined charging architecture applicable for vertical-oriented charging.

- Determine the document structure for the common charging architecture for vertical-oriented charging.

# 7 Solutions

## 7.1 Solution #1: New TS for the charging architecture and principles

### 7.1.1 Solution description

#### 7.1.1.1 General

The potential solution #1 solves the key issues #1.

The general and common charging principle for charging are specified in the TS 32.240 [2], the service specified charging principle for the vertical are specified in the service specifications.

The charging specifications structure specified in the Figure 1.1 in clause 1 the scope of TS 32.240 [2] is outlined for the complete document structure for the set of domain/subsystem/service specific charging TSs, crossing the 2G, 3G, 4G and 5G and covering the customer charging per UE (e.g. 5G data connectivity) and vertical charging (e.g. network slice performance charging).

The umbrella for the better reference of the common charging principle and service specified charging principle is present.

#### 7.1.1.2 Solution

The new TS in the range of TS 32.24X specifies the common architecture and principle for the vertical charging as the umbrella.

A set of charging specific TSs covers the 5GS domains and 5G service levels (e.g. Network slice charging, 5G LAN, Edge computing charging, TSN charging,) respectively, in the TS 32.2xx and TS 28.2XX TS number ranges. These TSs describe the mapping of the common architecture onto the specific services, scenarios, and charging information for converged online and offline charging. They are commonly referred to as the middle tier charging TSs.

A set of TSs in the TS 32.29x range covers common aspects, such as CDR parameter and syntax descriptions, converged online and offline charging applications, and the charging interactions within the network (CDR transfer) as well as between the network and the billing domain (CDR file transfer).

The complete document structure for these related vertical TSs is outlined in figure 7.1.1.2-1.



Figure 7.1.1.2-1: Charging specifications structure

## 7.2 Solution #2: Restructure for the charging principle

### 7.2.1 Solution description

#### 7.2.1.1 General

The solution #2 solves the key issues #1.

Compared to the general and common charging principle for subscriber charging specified in the TS 32.240 [2], the service specifications provide the detailed service specified charging principle for the vertical charging, including the Edge Computing Charging, TSN charging and so on.

Provide the unified document structure for charging principle is suggested.

#### 7.2.1.2 Solution

The suggested document structure for charging principle is present.

Add the new chapter for the charging principle in the TS 32.240 [2].

Clause X or Annex Charging Principle

*X.1 General*

*The high-level service description for charging are specified in the clause 6:*

*- 5G LAN Charging*

*- Edge Computing Charging.*

*- Network slice charging (To be added)*

*…*

*X.2 Charging principle and reference*

*The following details the example of charging principles on the basis of the common architecture and framework and should be adapted in the corresponding charging service specification in respect of:*

*- General:*

*- Charging data generation and quota supervision.*

*- Aspects of charging information transfer:*

*- The charging information is transferred for the B2B.*

*- Charging levels and charging data correlation:*

*- Charging levels on B2B.*

*- Charging data correlation for internal relationship.*

*- Charging requirement (Optional).*

*- Charging information utilization:*

*- The subscriber id for the B2B charging, e,g. tenant id.*

*- CHF selection.*

## 7.3 Solution #3: Combined charging architecture

### 7.3.1 Solution description

#### 7.3.1.1 General

This solution #3 resolves the key issues 2. Based on network slice performance and analytics charging architecture and network slice management charging architecture, UE charging and network slice tenant charging are combined in one Converged Charging System (CCS). Based on the edge computing charging, the subscriber based charging and inter-provider based charging are in the converged charging.

#### 7.3.1.2 Solution

Figure 7.3.1.2-1 is the general high-level charging architecture from the NSPA, NSM converged charging architecture and other service specification, specified in the TS 28.201 [5], TS 28.202 [6] and TS 32.257 [4]:

- Figure 4.2.2-1 specified in the TS 28.201 [5] and figure 4.2.2.2 specified in the TS 28.202[6], present the interaction between CEF and CHF.

- Figure 4.2.2.1 specified in the TS 28.202 [6], present the interaction between MnS (embedding with CTF) and CHF.

- Figure 4.2.3-1 specified in the TS 32.257 [4], present the interaction between NF (embedding with CTF) and CHF.



Figure 7.3.1.2-1: Combined charging architecture

## 7.4 Solution #4: Network slice tenant charging architecture

### 7.4.1 Solution description

#### 7.4.1.1 General

This solution #4 resolves the key issues #2. Based on the network slice tenant charging, the separated UE converged charging and network slice tenant converged charging are present.

#### 7.4.1.2 Solution



Figure 7.4.1.2-1: Network slice tenant charging architecture option

Two types of subscribers are considered in the context of network slice tenant charging:

- The Tenant the Network Slice is assigned to, which is referred to as "NS-Tenant", which can be considered as the charged party of B2B.

- The individual end-user "UE" served under the Network Slice, which can be considered as the charged party of B2C.

Each type of subscriber is handled under a separated Converged Charging System (CCS): "Tenant CCS" and "UE CCS" respectively.

"UE CCS" performs charging functionalities for individual UEs (i.e. B2C), see the clause 6.3.2.1 General description in TR 32.847 [10].

"Tenant CCS" performs charging functionalities for NS-Tenant (i.e. B2B), see the clause 6.3.2.1 General description and clause 6.6 in TR 32.847 [10].

The Nchf exposed by the CHF (Tenant CCS) is defined for enabling two cases:

- Association between individual UE charging and NS tenant charging. This association is achieved by UE CCS responsible for individual UE charging consuming the Nchf exposed by the Tenant CCS.

- Charging for the NS Tenant charging only.

## 7.5 Solution #5: Converged tenant charging architecture

### 7.5.1 Solution description

#### 7.5.1.1 General

This solution #5 resolves the key issues #2. Based on the possible solutions #4 network slice tenant charging architecture in clause 7.4, NF(CTF) interacts with the UE CCS and NF (CTF) interacts with the Tenant CCS separately, and the UE CCS interacts with the Tenant CCS solution #3 Converged charging architecture in the clause 7.3, CEF and NF (CTF) interact with the UE CCS, the converged tenant charging architecture is present to combined all the architectures into one in figure 7.5.1.2-1.

#### 7.5.1.2 Solution



Figure 7.5.1.2-1: Converged tenant charging architecture option in reference point representation

Two types of charging are considered in the context of converged vertical charging architecture:

- The subscriber-based charging (i.e. B2C) via NF(CTF), e.g. SMF.

- The inter-provider charging (i.e. B2B) via NF(CTF)/MnS and/or CEF, e.g. EES.

- Interaction between UE CCS and CCS supports the B2B charging scenarios, which provides the interaction between CHFs, including but not limited to support the UE converged charging impacted by vertical charging.

The Tenant CCS supports the B2B charging scenarios can be applicable in the following different charging scenarios:

- Network slice charging: The CCS is the Network slice Tenant CCS.

- NPN Charging: The CCS is the NPI-NPN/SNPN Tenant CCS.

- 5G LAN Charging: The CCS is the LAN Tenant CCS.

- Edge Computing Charging: The CCS is the ECSP Tenant CCS.

- TSN Charging: The CCS is the TSN Tenant CCS.

## 7.6 Solution #6: CHF-to-CHF Communication

### 7.6.1 Solution description

#### 7.6.1.1 General

This solution #6 resolves the key issues #2. Based on the study about wholesale and roaming charging, CHF-to-CHF communication is supported.

#### 7.6.1.2 Solution



Figure 7.6.1.2-1: CHF to CHF communication for MVNO Charging

Two types of charging are considered in the context of vertical charging:

- the retail charging (i.e.B2C) by A-CHF is out of 3GPP SA5 scope, the Ny reference point is in the scope;

- the wholesale charging (i.e.B2B) by CHF for MVNO, see the details of solution #4.3 in the TR 28.827 [11].

## 7.7 Solution #7: NF to CHFs communication

### 7.7.1 Solution description

#### 7.7.1.1 General

This solution #7 resolves the key issues #2. Based on the MVNO (owning a CHF referred to as A-CHF) non-roaming scenario, the N40 reference point is defined for the interactions between SMF and CHF owned by MNO, the N47 reference point is used for the interactions between SMF owned by the MNO and A-CHF owned by the MVNO, NF‑to-CHF communication for MVNO charging.

#### 7.7.1.2 Solution



Figure 7.7.1.2-1: NF(V-SMF) to CHF communication for MVNO Charging

N47 used by A-CHF owned by an additional actor (i.e. MVNO) to perform retail charging for its own subscribers is operator specific, specified in the TS 32.255 [15].

## 7.8 Solution #8: Separated charging architecture

### 7.8.1 Solution description

#### 7.8.1.1 General

This solution #8 solves the key issues #2. The separated charging architecture for B2B, B2C and the internal relationship are described in the different causes.

In the charging architecture for B2C, the interaction for the NF and UE CCS is present, and the related NF (e.g. SMF) and the corresponding reference (i.e. TS 32.255 [15]) will be detailed.

In the charging architecture for the B2B, the interaction for the NF and Tenant CCS is present, and the related NF (e.g. NWDAF) and the corresponding reference (i.e. TS 28.201 [5]) will be detailed.

In the charging architecture for the internal relationship, the interaction for the UE CCS and Tenant CCS is present, and the related scenarios (e.g. SMF for the volume based charging impacted by the tenant charging) and the corresponding reference (i.e. TS 32.255 [15]) will be detailed.

#### 7.8.1.2 Solution

The suggested separated charging architecture and document structure for charging principle is present.

Add the new chapter for the charging principle template and charging architecture in the TS 32.240 [2].

Clause X or Annex X

*X.1 General*

*The high-level service description for charging is specified in the clause 6:*

*- 5G LAN Charging*

*- Edge Computing Charging.*

*- Network slice charging (To be added)*

*…*

*X.2 Charging principle and references (Proposed in the solution 7.x Restructure for the charging principle)*

*X.3 Charging architecture and references*

*X.3.1 General*

*In the charging architecture, the CCS may be described in the Tenant CCS and UE CCS from the view of business charging scenario support, for B2B or B2C or B2B2X.*

*X.3.2 Business to Business Charging*

*In the charging architecture for the B2B, the interaction for the NF and Tenant CCS and the interaction for the UE CCS and Tenant CCS are present, and the related NF and the corresponding reference will be described as following.*





*Figure X.3.2-1: High Level charging architecture for the B2B*

*X.3.3 Business to Consumer Charging*

*In the charging architecture for B2C, the interaction for the NF and UE CCS is present, and the related NF and the corresponding reference will be described as the following.*



*Figure X.3.3-1: High Level charging architecture for the B2C*

## 7.9 Solution Evaluation

The Solution #1 and #2 solve the key issue #1:

- Solution #1 proposed to create the new TS for the business to business charging scenarios which can provide the umbrella clearly for the vertical charging. In that way, B2B and B2C are separated which brings some trouble for the internal and external stakeholder to search required information and the internal relationship between B2B and B2C is difficult to covered.

- Solution #2 proposed to add the new clause in the existing TS 32.240 [2], which can present the charging principle for the B2C and B2B in the same TS. In that way, understand the common charging principle as the whole charging system and the special charging principle for the certain services in the charging service specifications.

The new annex also can include the charging architecture applicability for B2B, B2C.

The Solution #3, #4, #5, #6 #7 and #8 solve the key issue #2:

- Solution #3 about existing converged charging architecture is applicable for the general charging capabilities and B2B charging scenarios, which distributed in the different charging service TSs.

- Solution #4 about existing network slice tenant charging architecture is applicable for the network slice charging, can support the B2B, B2C charging,

- Solution #5 about existing converged tenant charging architecture merged the solution #x for network slice tenant charging and solution #x converged charging architecture is applicable for all the charging scenarios, can support B2B and B2C charging.

- Solution #6 about the existing NF to CHFs communication is applicable for roaming and MVNO charging, can support B2B and B2C charging, which distributed in the different charging service TSs.

- Solution #7 about the existing CHF to CHF communication is applicable for roaming and MVNO charging, can support B2B and B2C charging, which distributed in the different charging service TSs.

- Solution #8 about existing separated charging architecture describes the different business relationship for B2B, B2C, which can clearly present the charging architecture applicability in the different charging scenarios via the different NF referred to the different special charging service specifications. In that way, the internal and external stakeholder can understand the charging scenarios and reference for the NF charging in the common way, which is easy to find the required information distributed in the multiple TSs.

# 8 Conclusions and recommendations

For key issue #1, the solution #2 proposed to add the Annex (Normative) in the existing TS 32.240 [2] should be selected to the normative work.

For key issues #2, the solution #8 proposed to add the Annex (Normative) in the existing TS 32.240 [2] for the separated charging architecture should be selected to the normative work.

Annex A:  
Change history

| **Change history** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Date | Meeting | TDoc | CR | Rev | Cat | Subject/Comment | New version |
| 2023-02 | SA5#147 | [S5-232497](https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_147/Docs/S5-232497.zip) |  |  |  | Initial skeleton | 0.0.0 |
| 2023-03 | SA5#147 | S5-232840 |  |  |  | Update of the Skeleton | 0.1.0 |
| 2023-03 | SA5#147 | S5-232841 |  |  |  | Update of the Scope | 0.1.0 |
| 2023-03 | SA5#147 | S5-232842 |  |  |  | Update of the Reference | 0.1.0 |
| 2023-03 | SA5#147 | S5-232843 |  |  |  | Addition of Charging Specification Reference Consideration | 0.1.0 |
| 2023-03 | SA5#147 | S5-232844 |  |  |  | Addition of General description for background | 0.1.0 |
| 2023-03 | SA5#147 | S5-232845 |  |  |  | Addition of the Business Roles | 0.1.0 |
| 2023-03 | SA5#147 | S5-232917 |  |  |  | Addition of the key issue for consideration | 0.1.0 |
| 2023-04 | SA5#148e | S5-233437 |  |  |  | Addition of solution in the skeleton | 0.2.0 |
| 2023-04 | SA5#148e | S5-233438 |  |  |  | Addition of the Terms | 0.2.0 |
| 2023-04 | SA5#148e | S5-233708 |  |  |  | Addition of the Key issues about architecture mapping | 0.2.0 |
| 2023-04 | SA5#148e | S5-233709 |  |  |  | Addition of the Key issues about charging principles clarification | 0.2.0 |
| 2023-05 | SA5#149 | S5-234451  S5-234633  S5-234634  [S5-234198](https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_149/Docs/S5-234198.zip)  S5-234635  S5-234636  S5-234637  S5-234638  S5-234639  S5-234640  S5-234641  S5-234642 |  |  |  | Clarification on the concept  Clarification on business roles  Addition of the solution about new TS for the charging architecture and principles  Addition of the solution about restructure for the charging principle  Addition of the solution about converged charging architecture  Addition of the solution about network slice tenant charging architecture  Addition of the solution about converged tenant charging architecture  Addition of the solution about CHF to CHF communication  Addition of the solution about NF to CHFs Communication  Addition of the solution about separated charging architecture  Addition of the use cases for architecture and charging principle investigation  Addition of mapping, evaluation and conclusion | 0.3.0 |
| 2023-06 | SA#100 |  |  |  |  | Presented for information | 1.0.0 |
| 2023-08 | SA5#150 | S5-235888 |  |  |  | Clarify the concept and business roles | 1.1.0 |
| [S5-235459](https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_150/Docs/S5-235459.zip) |  |  |  | Update references and terminologies |
| 2023-09 | SA#101 | SP-230934 |  |  |  | Presented for approval | 2.0.0 |
| 2023-09 | SA#101 |  |  |  |  | EditHelp review and change control version | 18.0.0 |
| 2023-12 | SA#102 | SP-231494 | 0001 |  | F | Editorial correction | 18.1.0 |