Technical Disclosure Commons

Defensive Publications Series

October 2020

CONTROLLING CHANGE CONDITION (CC) TRIGGERS AT A GRANULARITY OF ONLINE VERSUS OFFLINE SERVICES

Mukesh Yadav

Ravi Shankar Mantha

CONTROLLING CHANGE CONDITION (CC) TRIGGERS AT A GRANULARITY OF ONLINE VERSUS OFFLINE SERVICES

AUTHORS:
Mukesh Yadav
Ravi Shankar Mantha

ABSTRACT

Presented herein are techniques to provide a mobile network operator with the control to enable triggers at a granularity of online versus offline services and, thus, provide for the ability to control reporting based on demand. The techniques presented herein can help to reduce signaling in that, if a requirement of trigger reporting is for online services, an operator can disable such reporting for offline services. Thus, techniques presented herein will help to make the migration from Fourth Generation (4G) to Fifth Generation (5G) easier for mobile network operators without involving large changes for the mobile network charging subsystem.

DETAILED DESCRIPTION

In a Third Generation Partnership Project (3GPP) 5G mobile network, 5G charging involves a Charging Function (CHF) arming a Session Management Function (SMF) to report events via triggers associated with Rating Group (RG) and Session level. Such triggers may include, but not be limited to: Volume/Time thresholds triggers; quota related triggers; and change condition triggers, such as AMBR_CHANGE, QOS_CHANGE, RAT_CHANGE, etc.

Since these triggers are enabled at the RG or the Session level, the SMF can't control their applicability for online versus offline services. It should be noted that within the same RG there can be different charging services, which can be online, offline, or both. Within Session level, obviously, different services can be offline, online, or both.

Further note, that with a 4G mobile network architecture there are two different interfaces – i.e., Gy (Online) and Gz (Offline) – for charging control. Within the 4G architecture, an online charging system (OCS) server is used to arm a Packet Data Network (PDN) Gateway (PGW) for online triggers and Gz (offline) triggers are configured on

PGW locally, if required. Hence, on the PGW for a 4G architecture, it is possible to control enabling/disabling of triggers between offline and online services.

In absence of such control in a 5G architecture, if a trigger is armed at the RG or Session level, the SMF will have to enable it for both types of services. However, a network operator may not always desire to have a trigger armed for both types of services. For example, the occurrence of some events (e.g., a Radio Access Technology (RAT) type change, a Public Land Mobile Network (PLMN) change, etc.) might demand some action at the 5G charging server (i.e., CHF) in order for the network operator's reporting make sense for online service. The same might not be always true for offline service, and vice-versa. Additionally, many operators that are transitioning from 4G to 5G may desire charging domain in parity with 4G, in which they may have current 4G features/billing scenarios for which that may be able to control triggers between online versus offline services.

Techniques herein provide for the ability to control the enabling/disabling of triggers at the granularity of service type, in particular, for offline versus online services. In particular, these techniques propose to add extra information into the 3GPP-defined data model for Trigger data type structures in order to enable control of trigger applicability at the granularity of offline versus online services.

As noted above, within the 5G architecture, the CHF arms the SMF for triggers at the RG/Session level. 3GPP Technical Specification (TS) 32.291, Section 6.1.6.2.1.8 provides that for the RG level, the CHF can update a set of triggers that are to be enabled utilizing the data type: 'MultipleUnitInformation->Triggers'. 3GPP TS 32.291, Section 6.1.6.2.1.2 providers that for the Session level, the CHF can update a set of triggers that are to be enabled utilizing the data type: 'ChargingDataResponse -> Trigger[]'. Various Trigger definitions are provided via 3GPP TS 32.291, Section 6.1.6.2.1.7, in which a Trigger Type may include triggers such as Volume_LIMIT, RAT_CHANGE etc. and a Category may include Immediate/Deferred.

Consider an example Trigger data structure in which new information elements (IEs) may be incorporated in accordance with the techniques of this proposal in order to provide online versus offline control for trigger applicability, as follows:

```
Type Trigger {
        triggerType //Existing
        Category TriggerCategory //Existing
        … //Existing
        … //Existing
        …. //Existing
        offline bool // New proposed IE
        online bool // New proposed IE
        offlineCategory TriggerCategory // New proposed IE
        onlineCategory TriggerCategory // New proposed IE
}
```

For the above data structure, the 'online' IE or the 'offline' IE, or both can be set. Utilizing the above data structure, the SMF can enable triggers accordingly. In one instance, if neither 'online' nor 'offline' are set, this can be interpreted by the SMF as meaning that a trigger is enabled for both types of service within the scope of RG or Session level triggers.

The 'offlineCategory' IE and 'onlineCategory' IE can be used to control the category of a trigger for online versus offline. If differentiation is not needed, either the same can be set in both or none can be set and the category can be set in the original one that will be applicable for both types of services. Thus, either category shall be set or one/both of offlineCategory/onlineCategory can be set.

Consider various example use cases that illustrate various features of this proposal. For a first use case, consider a configuration involving triggers at the RG level, which may be configured as follows:

```
MultipleUnitInformation
[
        RatingGroup: 10
        Trigger [
                triggerType : RAT_CHANGE
                online: True
                category: Immediate
        ]
] //Trigger is enabled for online Service with Category as Immediate
[
        RatingGroup: 11
        Trigger [
                triggerType : RAT_CHANGE
```

```
                offline: True
                category: Immediate
            ]
    ] //Trigger is enabled for offline Service with Category as Immediate
    [
            RatingGroup: 12
            Trigger [
                triggerType : RAT_CHANGE
            category: Immediate
            ]
    ] //Trigger is enabled for both online and offline Service with Category as Immediate
    [
            RatingGroup: 14
            Trigger [
                triggerType : RAT_CHANGE
                online: True
                offline: True
                onlineCategory: Immediate
                offlineCategory: Deferred
            ]
    ] //Trigger is enabled for both online and offline Service with different Category for both
```

For a second use case, consider a configuration involving triggers at the Session level, which may be configured as follows:

```
    ChargingDataResonse
    [
            invocationResult
            invocationSequenceNumber
            trigger
            [
                triggerType : RAT_CHANGE
                online: True
                offline: True
                onlineCategory: Immediate
                offlineCategory: Deferred
            ] //Trigger is enabled for both online and offline Service with different Category.
            [
                triggerType : PLMN_CHANGE
                online: True
                offline: True
```

category: Immediate
] //Trigger is enabled for both online and offline Service with Category as Immediate
[
triggerType : USER_LOC_CHANGE
category: Immediate
] //Trigger is enabled for both online and offline Service with Category as Immediate
[
triggerType : AMBR_CHANGE
offline: True
category: Immediate
] //Trigger is enabled for offline Service with Category as Immediate
[
triggerType : UE_TIMEZONE_CHANGE
online: True
category: Immediate
] //Trigger is enabled for online Service with Category as Immediate
]

Accordingly, with this proposal an operator can control all triggers at the RG and/or Session levels in order to configure their applicability for online versus offline services as well as their category for online versus offline. This will provide 4G parity for network operators in which there were two interfaces in order to support transitions to 5G where converged charging is used. Thus, the same charging model as used in 4G can be re-used in a 5G architecture. Aside from ease of operation for migration from 4G to 5G, techniques of this proposal further provide control to a network operator over services and reporting.

For example, Figure 1 below illustrates current behavior in a 5G network architecture without utilizing techniques of this proposal. As illustrated in Figure 1, the Policy Control Function (PCF) activates charging services, Srv1 and Srv2, for RG10 in which Rg10-Serv1: Online and RG10-Serv2: Offline. In the flow illustrated for Figure 1, the CHF arms RG10 for triggering on a Rat_Change, which means that both Online+Offline Service is enabled for the Rat_change trigger.

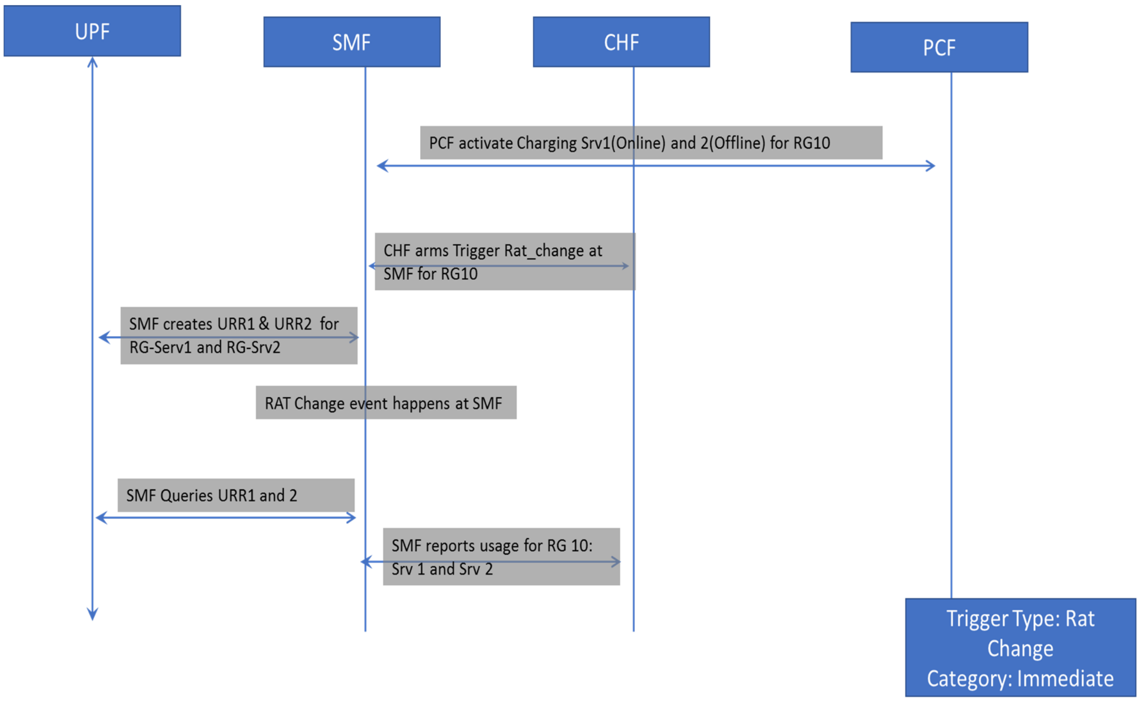

Figure 1: Current 5G Behavior

In contrast, consider Figure 2, below, which illustrates behavior in a 5G network architecture that may be realized by utilizing the techniques of this proposal. As illustrated in Figure 2, the PCF activates charging Srv1 and 2 for RG10 in which Rg10-Serv1: Online and RG10-Serv2: Offline. Thus, utilizing the techniques as presented herein, the CHF arms RG 10 -> Online for Rat_Change and arms RG 10 -> Offline for PLMN_Change thereby providing for the ability to control triggers at the granularity of online versus offline services.

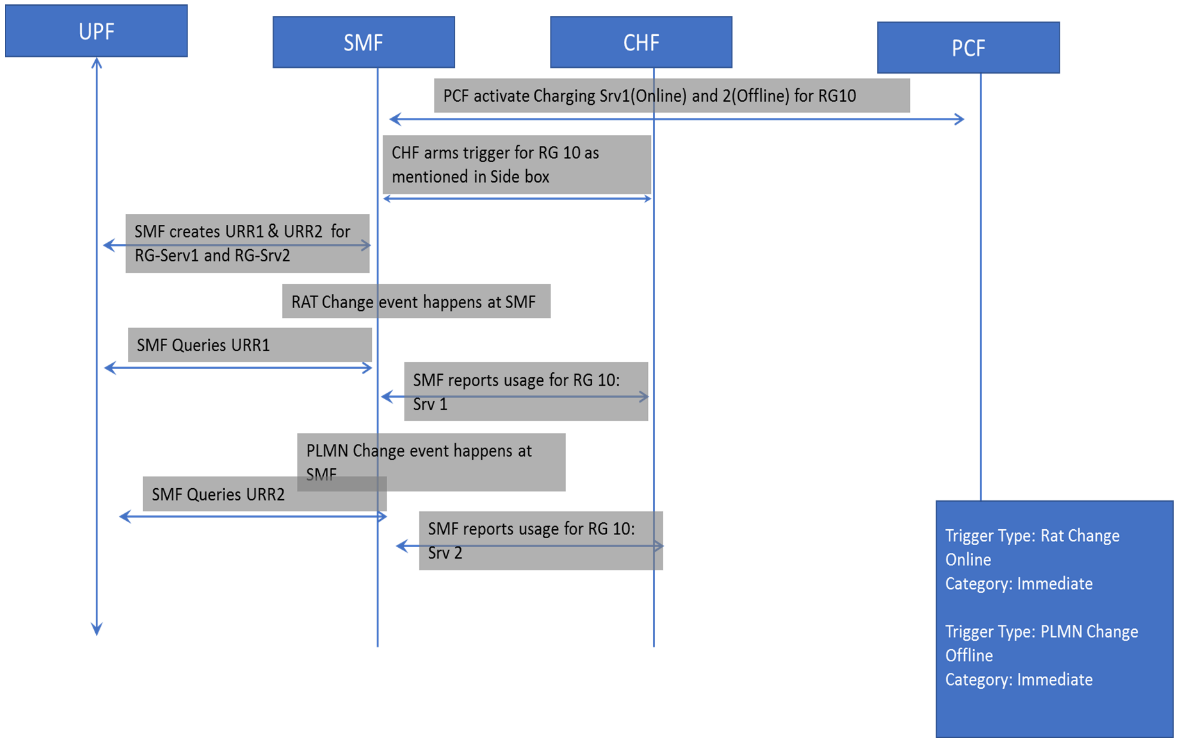

Figure 2: 5G Behavior Utilizing the Techniques of this Proposal

In summary, techniques herein provide a mobile network operator with the control to enable triggers at a granularity of online versus offline services and, thus, provide for the ability to control reporting based on demand. The techniques presented herein can help to reduce signaling in that, if a requirement of trigger reporting is for online services, an operator can disable such reporting for offline services. Thus, techniques presented herein will help to make the migration from 4G to 5G easier for mobile network operators without involving large changes for the mobile network charging subsystem.