

5G

telecommunication
management &
charging management

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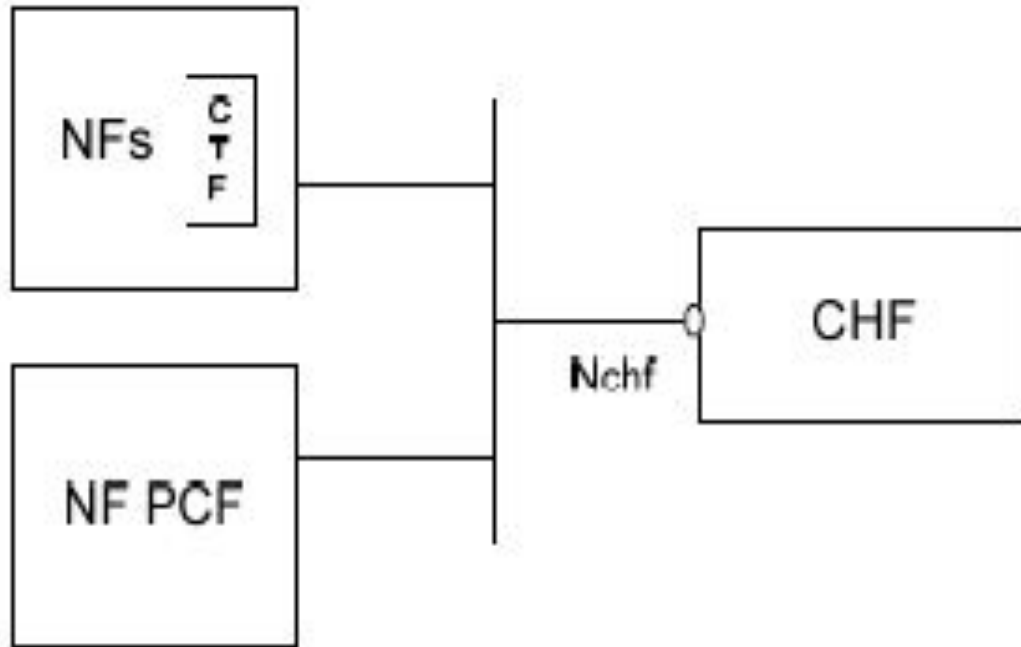
TELCOMA

5G telecommunication & charging management

Reference Architecture :

- The NF's with CTF interact with CHF using Nchf interface for converged online and offline charging.
- The NF PCF interacts with CHF using Nchf interface for spending limit control.
- The Nchf is a service based interface for NF and CHF.

Reference Architecture :



Charging function requirement :

- For charging scenarios, two basic scenarios are used :
Event based charging
Session based charging

Online charging scenario :

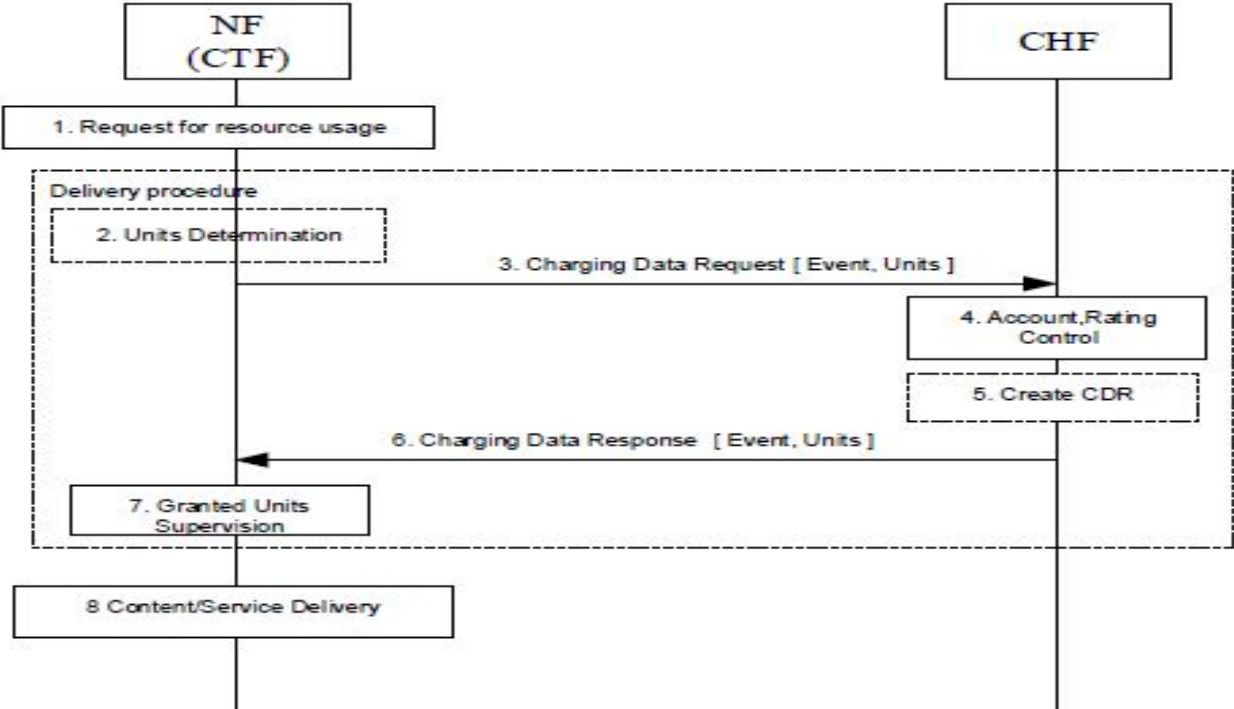
The following basic scenarios are used :

- Immediate event charging
- Event charging with unit reservation
- Session charging with unit reservation

Converged charging scenario :

- When offline charging and online charging are both applicable to service delivery, the charging information of both offline and online charging can be provided in a single command , upon any triggers of the offline charging or online charging is occur.
- Two scenarios are used : converged event based charging , converged session based charging

Event based charging :



Session based charging :

For converged session based charging , the following cases are supported :

- SCUR
- ECUR

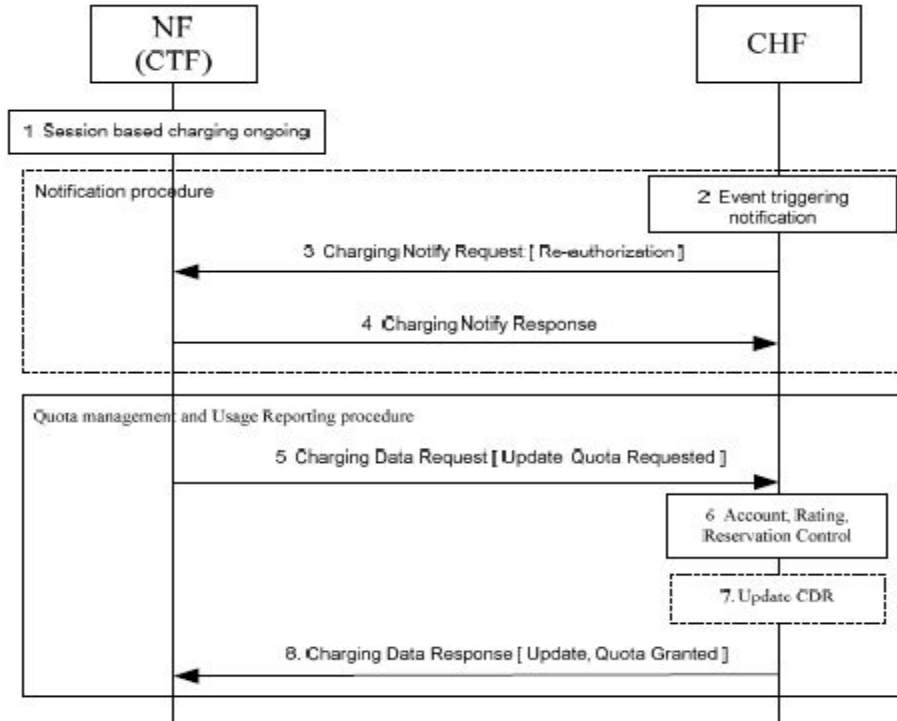
Session based charging :

- Scenario for session based charging (SCUR) with : Unit Reservation , Decentralized and Centralized Rating configuration , user's account deduction , where the NF (CTF) invokes a converged charging service towards the CHF.

Charging notification :

- The CHF can in Converged session based charging provide notifications to the NF (CTF), the NF (CTF) implicitly subscribes to these when it sends a charging data request i.e there is no separate subscription request from the NF for notification.

Charging notification :



Session based charging :

- Session based charging ongoing
- Event triggering notification
- Charging notify request
- Charging notify response
- Charging data request
- Account , rating, reservation control
- Charging data response

Other functionalities

Re-authorization :

- The CHF (NF Service Producer) may trigger a re-authorization request and the NF service consumer shall report quota usage.

Threshold based re-authorization triggers :

- The CHF (NF service producer) may optionally include an indication to the NF service consumer of the remaining quota threshold that shall trigger a quota re-authorization.

Termination action :

- The CHF (NF service producer) may specify to the NF service consumer the behavior on consumption of the final granted units, or zero units granted in the first place , this is known as termination action.

Service termination :

- The CHF may determine that a service requires termination. The NF service producer may perform this termination synchronously if it has a request pending processing by returning response.

Trigger mechanism :

- There are a number of mid-session service events (triggers), which could affect the rating of the current service usage e.g end user QoS changes or location updates.

Categories of chargeable events :

- Immediate report
- Deferred report

Error handling

Failure handling :

- CTF detected failure
- CHF detected failure
- Retry handling

Service definition

NF service framework :

- CHF registration
- CHF update
- CHF deregistration
- CHF discovery by CHF service consumer
- Range(s) of SUPIs
- Range(s) of GPSIs
- Range(s) of PLMNs

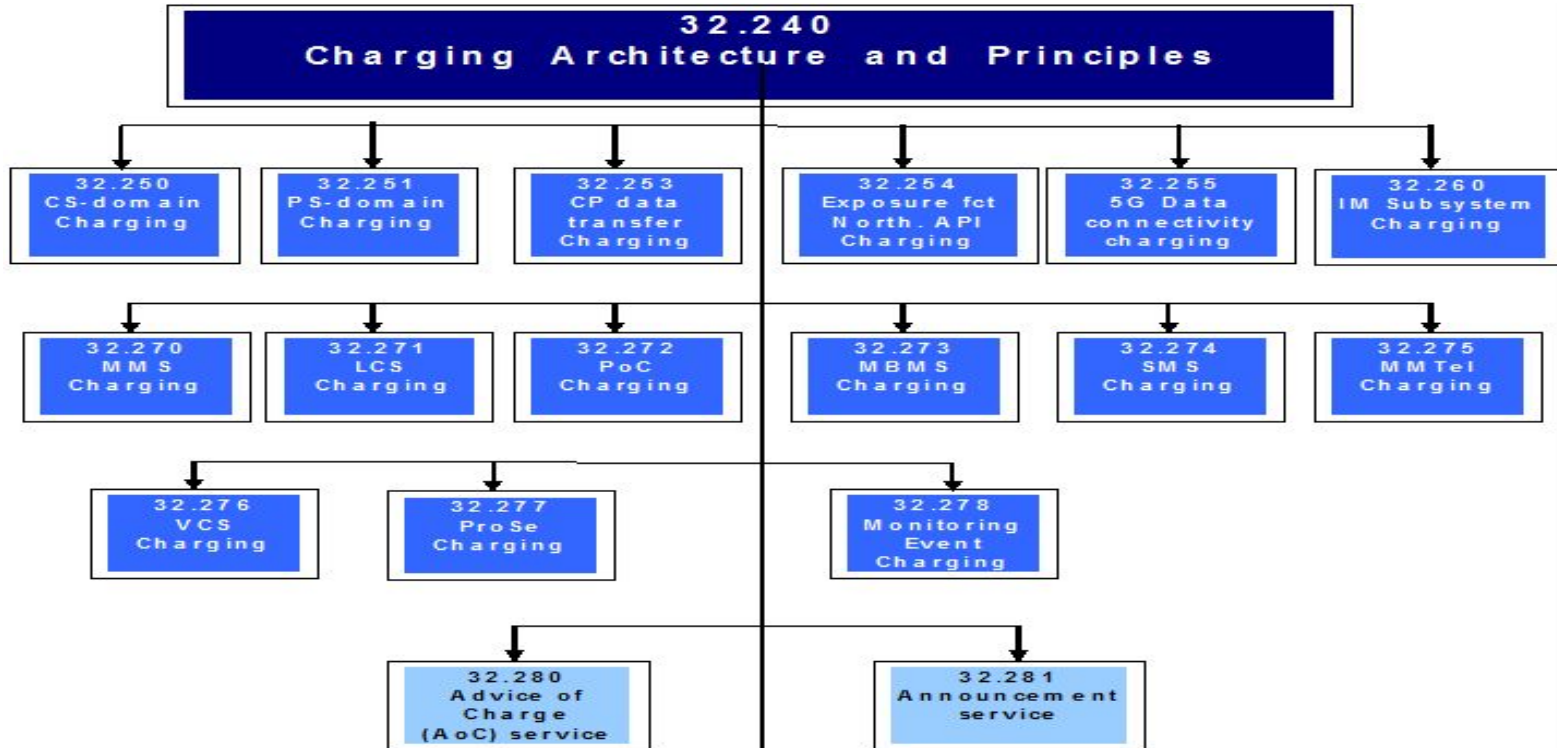
Nchf_ Converged Charging service :

Service description : the converged charging service provides charging for session and event based NF services. This Converged charging service offers charging :

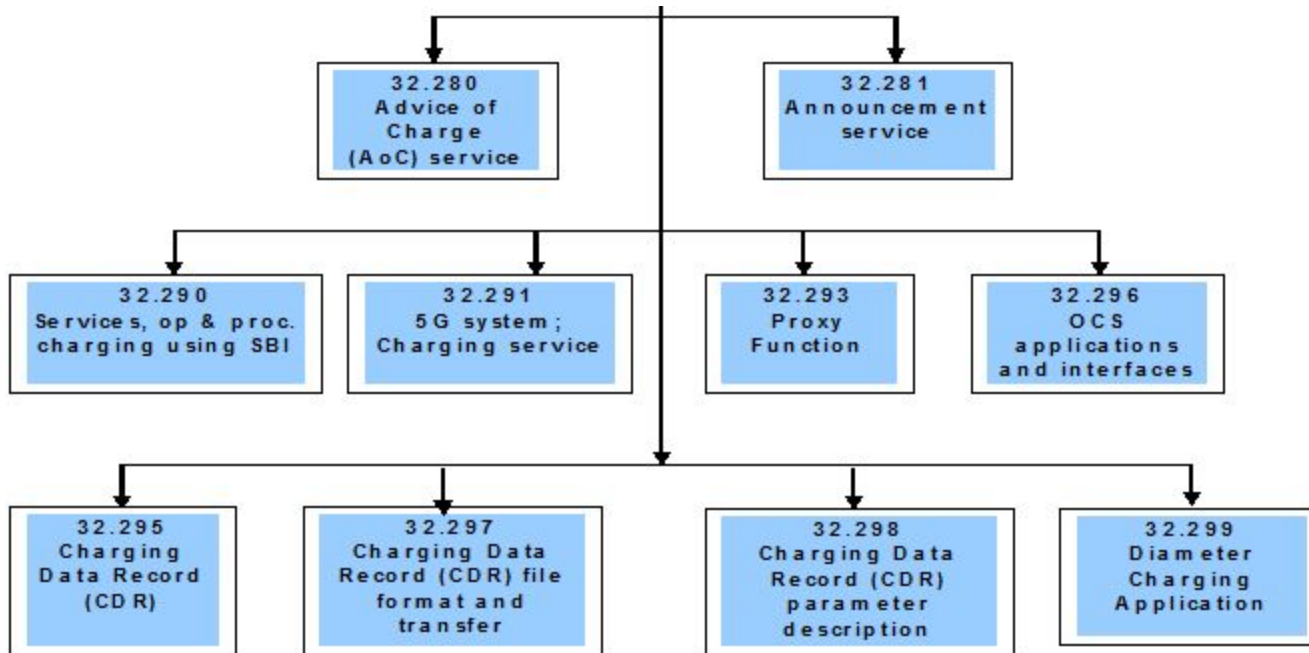
- With quota management (support for blocking & non-blocking mode)
- Without quota management
- Charging information record generation

Charging specifications structure

Charging architecture & principles :



Charging architecture & principles :



Terms :

- Accounting
- Accounting meter record
- AoC
- AoC service
- ABC
- Billing
- Billing domain
- CAMEL
- CAMEL subscription information

Chargeable event :

Activity utilizing telecommunications network resources and related services for :

- User to user communication
- User to network communication
- Mobility
- User to application/service communication

Terms :

- Charged party
- Charging
- Charging data record
- Charging event
- FQPC

Charging mechanisms

General :

- 3GPP networks provide functions that implement offline and/or online charging mechanisms on bearer domain, subsystem and service levels.
- In offline charging, the resource usage is reported from the network to the BD after the resource usage has occurred.
- In online charging, a subscriber account, located in an OCS or CCS is queried prior to granting permission to use the requested network resources.

Offline charging :

- It is a process where charging information for network resource usage is collected concurrently with that resource usage.
- At the end of this process, CDR files are generated by the network , which are then transferred to operators BD for the purpose of subscriber's billing or accounting.

Online charging :

- It is a process where charging information for network resources usage is collected concurrently with that resource usage in the same fashion as in offline charging.
- Authorization is granted by the OCS or CCS upon request from the network.

Converged charging :

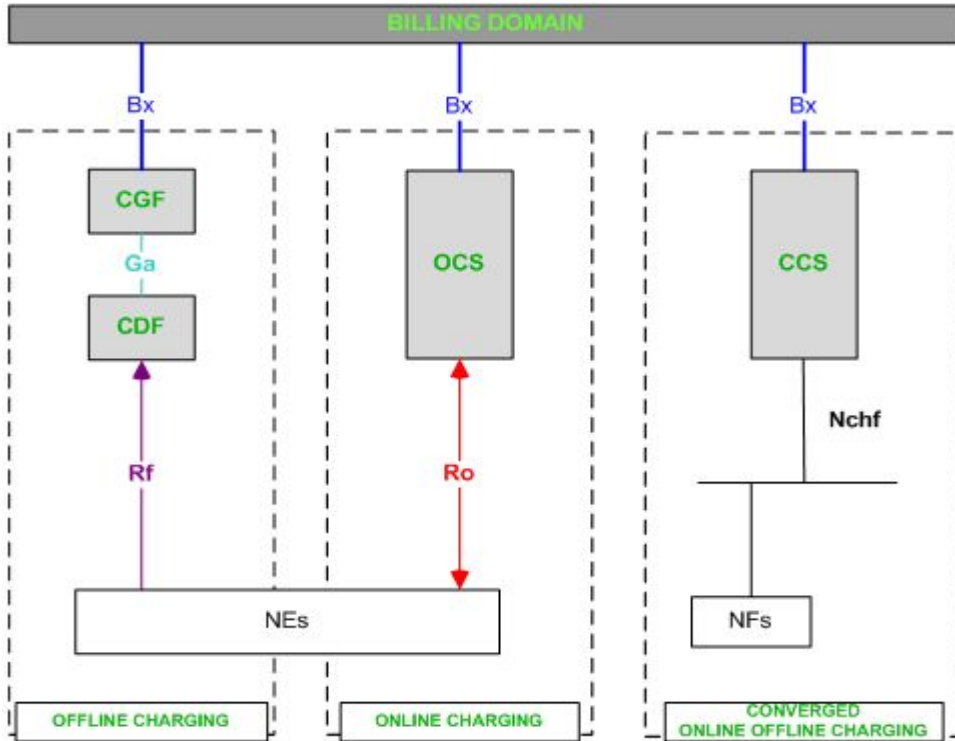
- It is a process where online and offline charging are combined.

High level common architecture

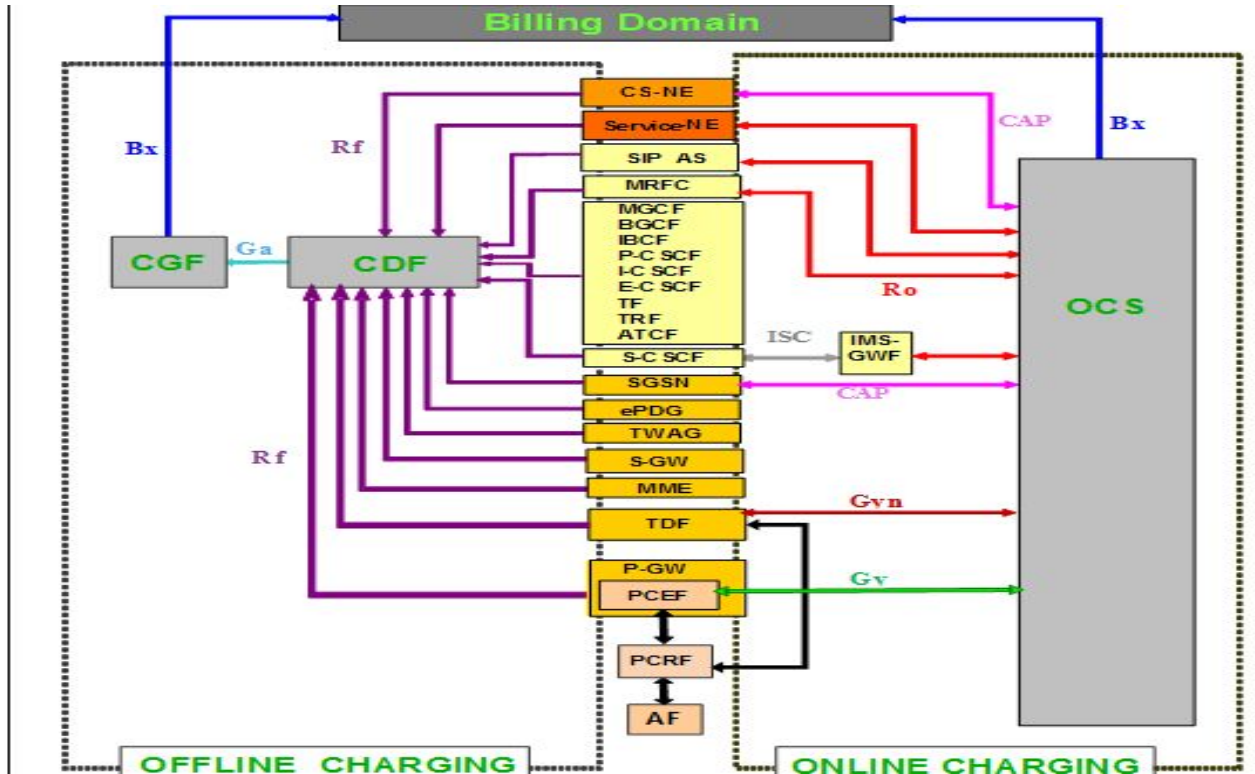
General :

- The architectural differences between the domains affect the way in which the charging functions are embedded within different domains , services and subsystems.
- This common charging architecture provides only a common logical view.

Architecture :



Common architecture - reference points:

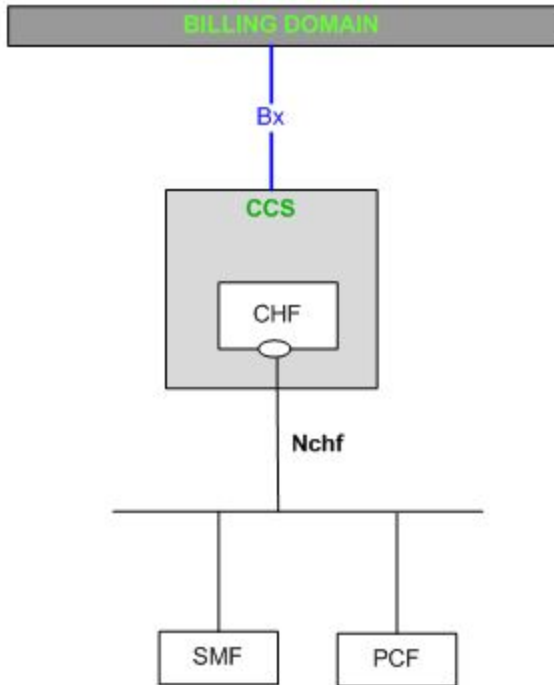


Explanation :

- Reference points : Rf, Ga, Bx, ISC , Ro, CAP, Gy and Gyn
- The logical ubiquitous charging architecture and the information flows for offline and online charging applied to the convergent scenario owned by a single operator with PCEF located in fixed broadband access.

Common architecture - service based interface

Service based interfaces :

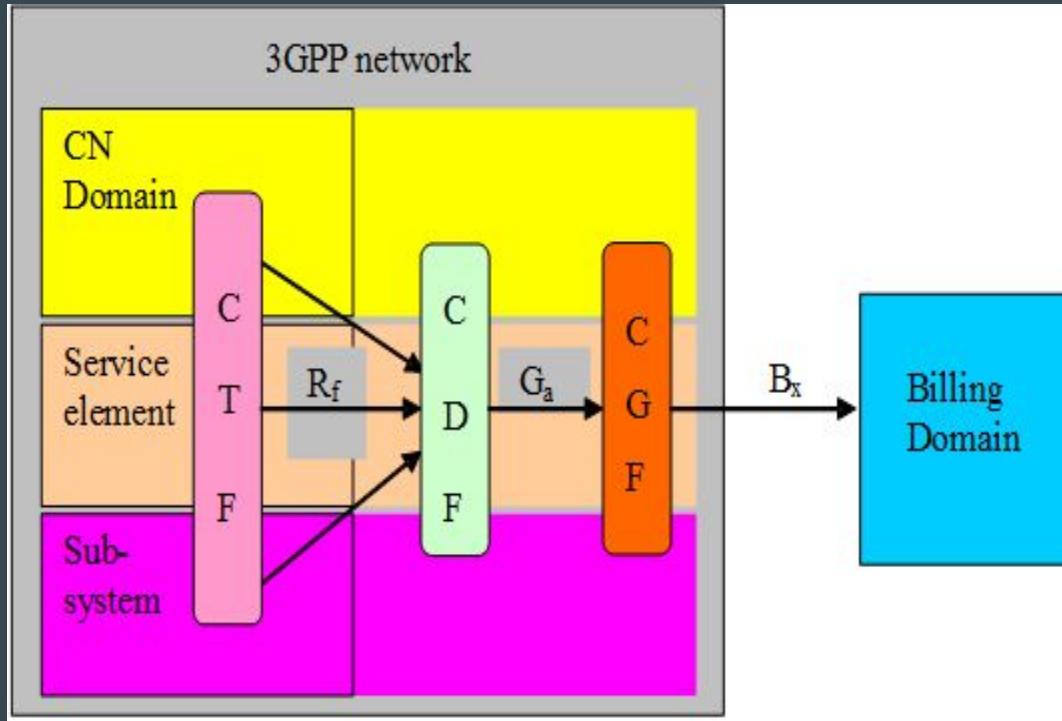


Charging functions

Offline charging functions :

- It provides an overview of the offline part of the charging architecture.

Offline charging function :



Charging Trigger function

CTF :

- The CTF generates charging events based on the observation of network resource usage.
- In every network element and service element that provides charging information , the CTF is the focal point for collecting the information pertaining to chargeable events within the network element , assembling this information into matching charging events, and sending these charging events towards the CDF.

CTF :

Accounting metrics collection :

- The process that monitors signalling functions for calls, service events or sessions established by the network users , or the handling of user traffic for these calls, service events or sessions, or service delivery to the user via these calls, service events or sessions.

Accounting metrics collection :

- Trigger conditions for collection of charging information.
- Information elements to collect
- Which service events , signalling or user traffic to monitor
- Relationship to services / bearers / sessions.

Accounting data forwarding :

- This process receives the collected accounting metrics and determines the occurrence of chargeable events from a set of one or more of these metrics.
- The charging events provide information pertinent to the charging event i.e characterising the network resource usage together with an identification of the involved users.

Charging data function

CDF :

- The CDF receives charging events from the CTF via the Rf reference point.
- This procedure is characterised by various conditions as:

Conditions :

- CDRs may be constructed from single charging events
- CDRs may be constructed from a set of several charging events
- Each charging event is used for exactly one CDR
- Multiple charging events that are used to create a single CDR may not necessarily be of the same type.
- The relationship between CDF and CTF may be 1:1 or 1:n.
- All charging events used to build a CDR must originate from the same NE i.e there is no cross-NE or cross-NE-type correlation of charging events in the CDF.

Charging Gateway function

CGF :

- The CDR's produced by the CDF are transferred immediately to the CGF via Ga reference point.
- The CGF acts as a gateway between the 3GPP network and the BD.

CGF functions :

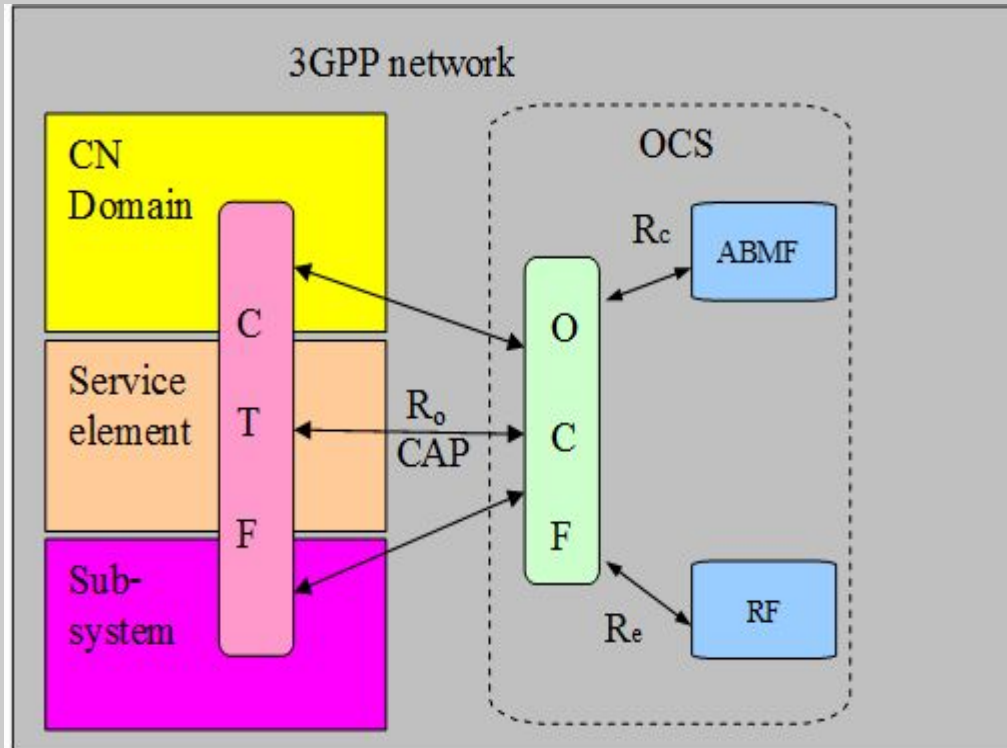
- CDR reception from the CDF via the Ga reference point in near real time.
- CDR pre-processing
- CDR error handling
- Persistent CDR storage
- CDR routing and filtering
- cDR file management
- CDR file transfer to the BD

Offline charging system :

- The OFCS is a grouping of charging functions used for offline charging.
- It collects and processes charging events from one or more CTF's , and it generates CDR's for subsequent offline downstream billing processes.

Online charging architecture

Online charging architecture :



Online charging functions :

- CTF : charging trigger function
- OCF : online charging function
- ABMF : account balance management function
- RF : rating function

Online charging functions

Charging trigger function :

- The information collected for and included in , the online charging events is not necessarily identical to the offline charging case.
- The charging events are forwarded to the OCF in order to obtain authorization for the chargeable event/network resource usage requested by the user.
- The CTF must be able to delay the actual resource usage until permission by the OCS has been granted.

CTF :

- The CTF must be able to track the availability of resource usage permission during the network resource usage.
- The CTF must be able to enforce termination of the end user's network resource usage when permission by the \ocs is not granted or expires.

Online charging function :

The OCF consists of two distinct modules :

- SBCF : session based charging function
- EBCF : event based charging function

S-CSCF online charging / IMS gateway function :

- The S-CSCF does not trigger any online charging events and thus does not include the CTF online charging enhancements.
- The ISC interface is employed by the S-CSCF online charging, implying that online charging is transparent to the S-CSCF and appears like any other service logic controlled by a SIP application server.

Rating function :

- The RF determines the value of the network resource usage on behalf of the OCF.
- Rating of data volume
- Rating of session/connection time
- Rating of service events

Account balance management function :

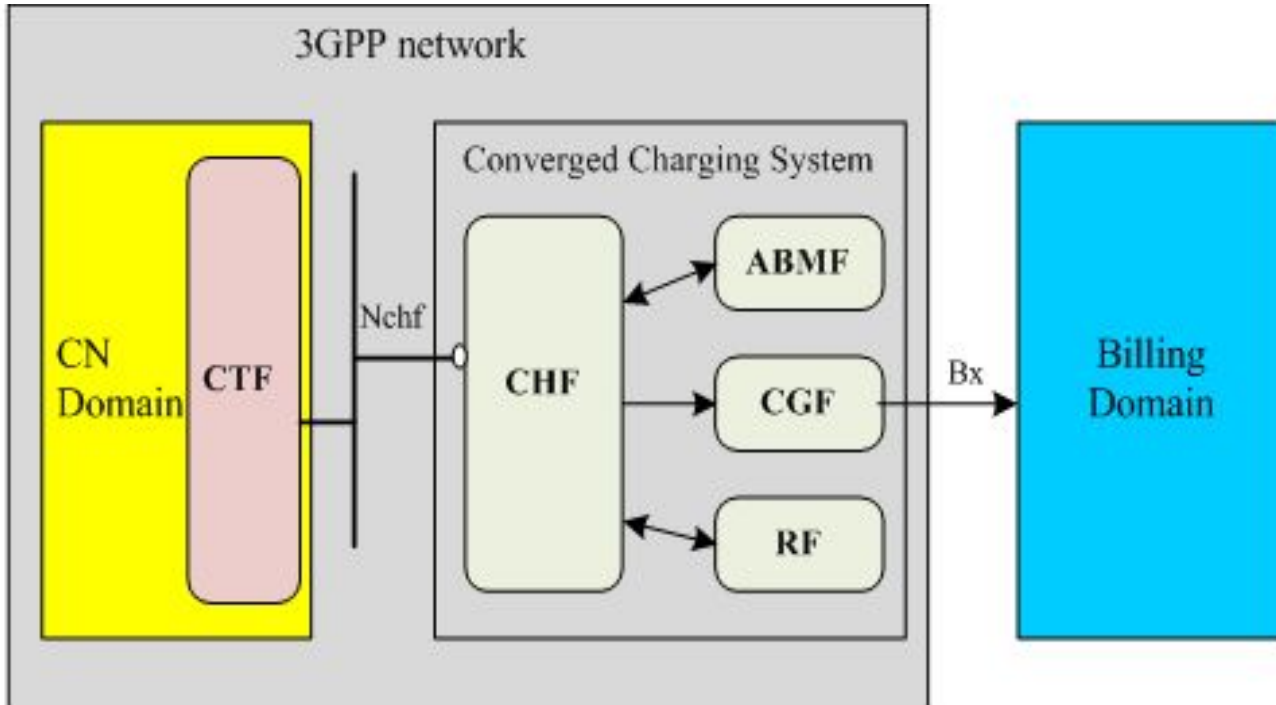
- ABMF is the location of the subscriber's account balance within the OCS.

CDR generation for online charged subscribers :

- In offline charging, CDRs are generated in the network and forwarded to the BD for further processing.
- In online charging, network resource usage is granted by the OCS based on a subscriber account on the OCS.

Converged charging functions

Architecture :



Converged charging system :

- This system consists of four distinct modules, CTF, ABMF , CGF and RF.
- The charging function includes online charging function (OCF) and charging data function (CDF).

Offline charging Reference points

Rf :

- It supports interaction between a CTF and a CDF.
- Charging events for offline charging from the CTF to the CDF.
- Acknowledgements for these events from the CDF to the CTF.

Gz :

- This reference point is functionally equivalent to Ga for legacy PS domain and to Ga or Rf for evolved PS domain, and hence is replaced by Ga or Rf within the common charging architecture.

Ga :

- CDRs are sent from the CDF to the CGF
- Acknowledgements for these CDRs are returned from the CGF to the CDF.

Bx :

- This point supports interaction between a CGF and the BD.
- The information crossing this reference point is comprised of CDR files.
- A file transfer protocol (FTAM, FTP) shall be used, including the transport mechanisms.

Gzn :

- This point is functionally equivalent to Ga or Rf in PS domain, and hence is replaced by Ga or Rf within the common charging architecture.

Online charging Reference points

Ro :

- Charging events for online charging from the CTF to the OCF.
- Receive acknowledgements from these charging events from the OCF to the CTF.
- Protocols should support real-time transactions , stateless and statefull mode of operation.
- Protocol should support changeover to a secondary OCF if in case the primary is not reachable.

CAP :

- The CAP reference point provides similar functionality for online charging as Ro, however it is based on CAMEL techniques.
- It is kept within the overall charging architecture as CAMEL may be used in the CS and PS domains.

Gy :

- The Gy reference point is equivalent to Ro within the common charging architecture.

Re :

- It supports interaction between the OCS and rating function in order to determine the value of chargeable events in terms of monetary or non-monetary units.

Rc :

- It allows the interaction between the OCF and an ABMF in order to access the account of the subscriber on the OCS.

Gyn :

- This reference point is equivalent to R_o , and hence is replaced by R_o within the common charging architecture.

Architecture mapping

Offline mapping :

- CTF is a mandatory component of all NE's that have offline charging capabilities.
- CDF and CGF may be implemented in any of the following ways:
 1. CDF and CGF integrated in the NE.
 2. CDF integrated in the NE, CGF in a separate physical element.
 3. CDF and CGF in two separate physical elements.

Offline mapping :

- CDF and CGF in the same separate physical element.

Online mapping :

- CTF is a mandatory integrated component of all network elements that are involved in online charging with the exception of S-CSCF.

Service based interfaces

Nchf :

- This interface supports interaction between a CTF and the charging function.

Charging principles

General :

Sub-clauses that detail the charging principles on the basis of architecture and framework in respect of :

- Charging data generation & quota supervision
- Aspects of charging information transfer
- Charging levels and charging data correlation
- Charging information utilisation

Charging data generation & quota supervision :

- The CTF embedded in all charging relevant network elements collects charging information within the NE concerning the use of network resources by the mobile end users.
- While the collection of charging information used for the CDRs occurs during the network resource usage, there is no impact of offline charging on the use of resources.

Charging data generation & quota supervision :

- The purpose of offline charging is to transform the charging information into CDRs that are post-processed within the BD e.g for the purpose of generating bills.
- The purpose of online charging is to furnish charging information to the OCS in order to perform credit - control before the network resource usage is permitted.

Charging data supervision & quota supervision :

- For each chargeable event, a matching charging event is formed and immediately sent to its destination i.e the CDF in offline charging or the OCF in online charging.

Event based charging :

- The event is recognised in the NE that handles it, based on e.g signalling exchange between the UE and the NE.
- The event is then mapped onto a single charging event that applies to that NE.

Session based charging :

- The start of the user session is recognised by the NE that handles the session, based on e.g signalling exchange between the UE and the NE.
- The chargeable events are then mapped onto a charging event that applies to NE.

Charging data transfer

Charging data transfer in offline charging :

- In offline charging, charging events mirroring the resource usage request of the user are transferred from the CTF to the CDF via Rf reference point.
- The CTF determines whether the request corresponds to an event or whether a session shall be started (session based charging).

Transfer of charging events via Rf :

- In event based charging, a network /user event corresponds to a single chargeable event.
- In session based charging, at least two chargeable events are needed.
- The CTF transforms each each chargeable event into a charging event and forwards these charging events to the CDF in real time.

Transfer of charging events via Rf :

- If charging events are generated for unsuccessful resource usage attempts, the charging event must describe the reason and circumstances of the failure.

Transfer of CDRs via Ga :

- Upon receiving a charging event, the CDF uses the event to create/open a CDR or to add information to an existing open CDR.
- As there is a 1:1 mapping between charging events and CDRs in event based charging, CDRs are created promptly after receiving and processing the event, and are then ready for transfer on to the CGF via Ga reference point.

Transfer of CDR files via Bx :

- The CGF is responsible for persistent CDR storage, for preparing CDR files and transferring them to the BD via the Bx reference point.

Charging data transfer in online charging

Charging data transfer in online charging :

- In online charging, charging events mirroring the resource usage request of the user are transferred from the CTF to the OCF via Ro reference point.
- The CTF determines whether the request corresponds to an user / network event or whether a session shall be started.

Charging data transfer in online charging :

- For event based charging, the credit-control procedure in the OCS may or may not involve reservation of units from the subscriber account.
- In case of event based charging without reservation (IEC) :

Charging data correlation

General :

- The charging data correlation combines charging events generated by CTF while they are belong to the same bearer/session / service resource usage.
- The correlation provides an association of charging information for the mobile subscriber's resource usage.

Charging level correlation :

- Intra - level correlation
- Inter - level correlation
- Inter - network correlation

Intra - level correlation :

- The intra-level correlation aggregates the charging events belonging to the same charging session e.g over a time period and implies the generation of interim charging records.

Inter - level correlation :

- The inter - level correlation combines the charging events belonging to the same service but generated by different CTFs e.g for PS access control via IM subsystem.

Inter - network correlation :

- IOI allows operators involved with session signalling to identify each other by exchanging operator identification information within SIP signalling.
- In IOI composition there is one pair of originating IOI and terminating IOI.
- IOI concept may help to support inter-operator charging.

Inter - network correlation :

IOI identities shall be included within SIP signalling :

- When a SIP request is passed out of an IMS network the IOI identity of that IMS network shall be included in the SIP signalling.
- When a SIP response is returned the IOI identity of that responding IMS network shall be included in the SIP signalling.

Determination of completeness of charging information in IMS

General :

- The completeness of charging information is determined within the BD which itself is out of scope of 3GPP standardization.

Tracking of IMS NE's generating charging information :

- Based on operator policy, each IMS NE for which the CTF is generating charging events, shall include its own address or specific NE identifier into the initial SIP request to be sent out within trust domain.

Tracking of applications generating charging information :

- Each application for which the hosting AS CTF is generating charging events on its behalf, shall include the address or identifier of the AS and its application identifier into the initial SIP required to be sent out within the trust domain.

Charging information utilisation

General :

- The MSC server and gateway MSC server are responsible for the collection of all charging relevant information for each MS and PSTN connection & for the storage of this info in the form of CDRs.

Subscriber charging :

- The charging data collected from the HPLMN , interrogating PLMN and/or VPLMN network element is employed to determine the network utilization charges for the basic and supplementary services utilized by the home subscribers of the PLMN.

Subscriber charging :

- Calling party charging
- Alternate party charging for IMS

General :

- The MSC server and gateway MSC server are responsible for the collection of all charging relevant information for each MS and PSTN connection & for the storage of this info in the form of CDRs.