

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Y.2233

(06/2010)

SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
AND NEXT-GENERATION NETWORKS

Next Generation Networks – Service aspects: Service
capabilities and service architecture

Requirements and framework allowing accounting and charging capabilities in NGN

Recommendation ITU-T Y.2233

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For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T Y.2233

Requirements and framework allowing accounting and charging capabilities in NGN

Summary

Recommendation ITU-T Y.2233 specifies the technical requirements and framework which allow for accounting and charging capabilities in NGN. It is intended to aid in standardizing protocols and mechanisms to enable accounting and charging for NGN.

In order to support advanced accounting and charging capabilities in NGN, it is important to support policy-based accounting and charging and its associated extensions in terms of requirements, architecture, scenarios and capabilities. Extensions are also needed in other areas in order to support advanced requirements such as dynamic rating, supporting hierarchy of customer accounts, and online and offline inter-provider settlements. This Recommendation provides such extensions to the previous ITU-T Y.2233 (2008) version.

Non-technical aspects of charging in NGN and management aspects of accounting and charging in NGN are out of the scope of this Recommendation.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Y.2233	2008-01-25	13
2.0	ITU-T Y.2233	2010-06-13	13

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation ITU-T Y.2233

Requirements and framework allowing accounting and charging capabilities in NGN

1 Scope

This Recommendation specifies the technical requirements and framework which allow for accounting and charging capabilities in next generation networks (NGNs). It is intended to aid in standardizing protocols and mechanisms to enable accounting and charging for NGN.

In order to support advanced accounting and charging capabilities in NGN, it is important to support policy-based accounting and charging and its associated extensions in terms of requirements, architecture, scenarios and capabilities. Other areas needing extensions are requirements in order to support advanced requirements such as dynamic rating, supporting hierarchy of customer accounts, and online and offline inter-provider settlements. This Recommendation provides such extensions to the previous ITU-T Y.2233 (2008) version.

Non technical aspects of charging in NGN (which are under the responsibility of ITU-T SG 3) and management aspects of accounting and charging in NGN (which are under the responsibility of SG 2) are out of the scope of this Recommendation.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of next generation networks*.
- [ITU-T Y.2111] Recommendation ITU-T Y.2111 (2008), *Resource and admission control functions in next generation networks*.
- [ITU-T Y.2701] Recommendation ITU-T Y.2701 (2007), *Security requirements for NGN release 1*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 settlement [b-ITU-T Q.1741.2] and [b-ITU-T Q.1741.3]: Payment of amounts resulting from the accounting process.

3.1.2 usage metering [b-ITU-T Q.825]: The abstraction of activities that monitor the utilization of resources, for the purpose of accounting and controlling the recording of usage data.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 accounting: The process of collecting and analysing NGN service and NGN resource usage metrics for the purposes of capacity and trend analysis, cost allocation, auditing, billing, etc. Accounting management requires that resource consumption be measured, rated, assigned, and communicated between appropriate business entities.

3.2.2 bidirectional flow: A bidirectional flow is a flow which is composed of packets sent in both directions between two endpoints. A bidirectional flow is composed from two unidirectional flows.

3.2.3 billing: The process after rating in which the NGN transactions of NGN event usage are compiled and bills are produced.

3.2.4 billing domain: Part of the operator network, which is outside the NGN, that receives and processes charging information from the NGN charging functions. It includes functions that can provide billing mediation and billing or other (e.g., statistical) end applications.

3.2.5 chargeable event: Activity utilizing NGN network resources and related services for:

- user-to-user communication (e.g., a single call, a data communication session or a short message); or
- user-to-network communication (e.g., service profile administration); or
- inter-network communication (e.g., transferring calls, signalling, or short messages); or
- mobility (e.g., roaming or inter-system handover); and
- any other types of service activities the network operator may want to charge for.

As a minimum, a chargeable event characterizes the resource/service usage and indicates the identity of the involved end user(s).

3.2.6 charged party: User involved in a chargeable event who has to pay parts or the whole charges of the chargeable event, or a third party paying the charges caused by one or all users involved in the chargeable event, or a network operator.

3.2.7 charging: Function within the NGN network and the associated offline charging, online charging, and billing domain components whereby information related to a chargeable event is collected, formatted, transferred and evaluated in order to make it possible to determine usage for which the charged party may be billed (offline charging) or the subscriber's account balance may be debited (online charging).

3.2.8 charging information record (CIR): Formatted collection of information about a chargeable event (e.g., time of call set-up, duration of the call, amount of data transferred, etc.) for use in billing and accounting. For each party to be charged for parts of or all charges of a chargeable event a separate CIR is required to be generated, i.e., more than one CIR may be generated for a single chargeable event, e.g., because of its long duration, because more than one charged party is to be charged, or because more than one content-type is to be charged.

NOTE – The charging information record (CIR) is also known as charging data record (CDR), as defined in [b-ITU-T Q.1741.2].

3.2.9 charging event: Set of charging information forwarded by the charging trigger function (CTF) towards the charging collection function (CCF) (offline charging) or towards the online charging function (OCF) (online charging). Each charging event matches exactly one chargeable event.

3.2.10 correlation: Capability to generate an aggregated charging information record (CIR) by combining and analysing charging events collected from the same transport/service session.

3.2.11 flow: A flow is defined as a set of IP packets passing an observation point in the network during a certain time interval. All packets belonging to a particular flow have a set of common properties. Each property is defined as the result of applying a function to the values of:

- 1) One or more packet header fields (e.g., destination IP address), transport header fields (e.g., destination port number), or application header fields (e.g., RTP header fields).
- 2) One or more characteristics of the packet itself (e.g., number of MPLS labels).
- 3) One or more fields derived from packet treatment (e.g., next-hop IP address, output interface).

3.2.12 metering: See usage metering.

3.2.13 near real-time: Near real-time charging and billing information is to be generated, processed, and transported to a desired conclusion in less than 1 minute.

3.2.14 offline charging: Charging mechanism where charging information does not affect, in real-time, the service rendered.

3.2.15 online charging: Charging mechanism where charging information can affect, in real-time, the service rendered, and therefore a direct interaction of the charging mechanism with resource/session/service control is required.

3.2.16 policy-based charging and accounting: Charging and accounting capability based on different factors or factor group (e.g., access-specific characteristics, QoS provided by the transport for the service, specific service types, time, user subscription information, etc.).

3.2.17 rating: The process of calculating the charges for an NGN transaction.

3.2.18 real-time: Real-time charging and billing information is to be generated, processed, and transported to a desired conclusion in less than 1 second.

3.2.19 session: Logical connection between parties involved in a packet-switched based communication.

NOTE – This term is used for IP connections rather than the term "call" that is normally used for a connection over conventional (circuit switched) systems. A session can be composed of one or more unidirectional and/or bidirectional flows.

3.2.20 unidirectional flow: A unidirectional flow is a flow which is composed only of packets sent from a single endpoint to another single endpoint.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

ABMF	Account Balance Management Function
AOC	Advice of Charge
AS	Application Server
ATM	Asynchronous Transfer Mode
BD	Billing Domain
CAF	Charging and Accounting Function
CCF	Charging Collection Function
CDMA	Code Division Multiple Access
CDR	Charging Data Record
CGF	Charging Gateway Function

CIR	Charging Information Record
CS	Circuit Switched
CTF	Charging Trigger Function
DS	Directory Service
DSL	Digital Subscriber Line
GSM	Global System for Mobile communication
FE	Functional Entity
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IPCGF	Inter-Provider Charging Gateway Function
IPTV	Internet Protocol Television
LAN	Local Area Network
MPLS	Multiprotocol Label Switching
NE	Network Element
NGN	Next Generation Network
NMS	Network Management System
OCF	Online Charging Function
OS	Operating System
PD-FE	Policy Decision Functional Entity
PE-FE	Policy Enforcement Functional Entity
PS	Packet Switched
QoS	Quality of Service
RACF	Resource and Admission Control Functions
RADIUS	Remote Authentication Dial In User Service
RF	Rating Function
RMR	Resource Modification Request
SCF	Service Control Function
SMS	Service Management System
SUP-FE	Service User Profile Functional Entity
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
WLAN	Wireless LAN

5 Conventions

For unique and convenient identification of requirements, the following abbreviations and conventions are used in clauses 6 and 7:

A-B-R-0nn:

A: Type of requirements (e.g., H: high-level requirements, F: functional requirements).

B: Subsystem functional requirements (e.g., M: Metering functional requirements, C: Charging functional requirements, Pr: Protocol requirements, I: Information model related requirements, Po: Policy and rules requirements, Null: If not applicable).

R: Stands for requirement.

0nn: A requirement serial number.

6 High-level requirements for mechanisms allowing accounting and charging capabilities in NGN

- H-R-001: NGNs are required to support an architecture with open-standard interfaces to provide charging and accounting capabilities for NGN release 2 services.
- H-R-002: NGNs are required to support various charging policies (e.g., fixed-rate charging and usage-based per-session charging).
- H-R-003: NGNs are required to support accounting and charging functionality associated with the provision of both unicast- and multicast-based services. The accounting system is required to capture user information and resources used. Specifically the accounting system is required to identify which user used resources and the start and finish times associated with the use of the resources.
- H-R-004: NGNs are required to support appropriate charging arrangement models for NGN release 2 services. It is required to consider multi-service environment in NGNs including international interconnection. This may require a settlement between different types of service providers, for example, NGN network operators, content service providers, and/or application service providers. It includes transfer of accounting and charging information among them.
- H-R-005: NGNs may support flow-based accounting and charging functionality for various NGN release 2 services. Such functionality must be accurate, reliable, and scalable. Some examples of the functionality are:
 - accounting and charging for unidirectional flow resource usage;
 - accounting and charging for bidirectional flow resource usage;
 - accounting and charging for session resource usage.
- H-R-006: NGNs are required to support interfaces and protocols between network elements and accounting elements and between accounting and charging elements to collect and transport resource usage data (e.g., accounting metrics and CIRs, etc.). These interfaces and protocols are required to comply with clause 7.
- H-R-007: NGNs are required to support management functionalities for the seamless operation of the accounting and charging functional elements.
- H-R-008: NGNs are required to support policy-based charging, accounting and control for NGN services.
- H-R-009: NGNs are required to support an architecture with open-standard interfaces to provide policy-based charging and accounting capabilities and coordination with resource control, including RACF, for NGN release 2 services.

- H-R-0010: NGNs are required to support interfaces and protocols between policy control functional entities and charging and accounting functional entities.
- H-R-0011: NGNs are required to support management functionalities for the seamless operation of the policy-based accounting and charging and its associated control functional elements.
- H-R-0012: NGNs are required to support secure, reliable, and scalable operations of policy-based charging and accounting for NGN services.
- H-R-0013: NGNs are required to support high availability architecture for seamless operations in case of any hardware and software failures.

7 Functional requirements for mechanisms allowing accounting and charging capabilities in NGN

7.1 Metering functional requirements

- F-M-R-001: NGN network elements (NEs) are required to support capabilities to collect resource-usage related data in real-time.
- F-M-R-002: NGN NEs are recommended to support capabilities to collect resource-usage related data without any loss and duplication.
- F-M-R-003: NGN NEs are required to support capabilities to collect resource-usage related data based on different QoS levels.
- F-M-R-004: NGN NEs are required to support metering of resource usage with two types of units, packet count and byte count, and resource-usage duration; and may support other units.
- F-M-R-005: NGN NEs are required to support metering of resource usage with various types of granularity such as 5-tuple flow count, content-aware count, message count (e.g., e-mail messages), content count (e.g., music, movies, etc.), and may support other granularity types.
- F-M-R-006: It is recommended that metering be able to differentiate traffic flowing inside an NGN provider domain and traffic flowing between two or more NGN provider domains.
- F-M-R-007: NGNs are recommended to support per-medium metering in the context of multimedia services.
- F-M-R-008: NGNs are recommended to support interim metering, which is a snapshot of metering.
- F-M-R-009: NGN NE metering is recommended to be fault-tolerant, that is, it should be recoverable as much as possible when NE failure occurs.

NOTE – "Fault-tolerant" does not mean 100% recoverability.

- F-M-R-010: NGNs may support a non-NE-resident metering mechanism (e.g., metering by stand-alone metering device).
- F-M-R-011: NGNs are recommended to support metering policy configuration by its users (e.g., NMS, SMS or other application entities).
- F-M-R-012: It is recommended that NGN resource-usage related data captured from NEs be held in a standard accounting metric.
- F-M-R-013: NGNs are required to support transfer of accounting metric to the charging functional entities in a secure, reliable, and efficient manner.

NOTE – Other requirements on transfer of accounting metric to the charging functional entities are contained in clause 7.3.

- F-M-R-014: NGNs may support identification of a charging session by metered flow inspection without receiving charging start indication from an external associated functional entity such as a RADIUS server.
- F-M-R-015: NGNs are required to support either in-line or passive metering functionality. If in-line metering functionality is supported, metered traffic control may also be supported if such charging policy is applied.
- F-M-R-016: NGNs are required to support packet processing capabilities (e.g., correlation identification, call reference administration, or deep packet inspection) required to accurately identify a session.
- F-M-R-017: NGNs are required to support filtering capability to filter out a specific set of data packets based on a filtering rule (e.g., filtering based on terminal IP address or a range of IP addresses, service server IP address or a range of IP addresses, service server port numbers, and any combination of them).
- F-M-R-018: NGNs are required to support per-service metering (for example, voice service is metered per minute of use while data service is metered based on data volumes; standard data service is metered separately from premium data service).
- F-M-R-019: NGNs are required to support metering usage of payload only from service traffic.
- F-M-R-020: NGNs are required to support capabilities to identify service termination (e.g., normal termination by TCP FIN finish or abrupt termination by some network failure, etc.).
- F-M-R-021: NGNs are recommended to support activation and deactivation of QoS downgrade capabilities for certain types of traffic.
- F-M-R-022: NGNs are required to support metering the usage of customer traffic in terms of layers 3, 4, and 7.

7.2 Charging functional requirements

- F-C-R-001: NGNs are required to support off-line charging and online charging per user.
- F-C-R-002: NGNs are required to support off-line and online charging per service.
- F-C-R-003: NGN charging functional entities are required to be able to generate charging detail records for all charges incurred between the NGN customer and the NGN service provider and between NGN service providers. This includes different types of service provider relationships.
- F-C-R-004: NGNs are recommended to support both service-level and transport-level charging.
- F-C-R-005: NGNs are recommended to support both per-service charging (e.g., multimedia communications) and per-medium charging (e.g., voice, video, data).
- F-C-R-006: NGNs are recommended to support charging per flow direction. For example, incoming or outgoing flows of a particular session may be charged separately.
- F-C-R-007: NGNs are recommended to support charging for different levels of QoS (including network resource usage, e.g., bandwidth used) including when QoS is to be applied for each type of service or medium.
- F-C-R-008: NGNs are recommended to support per-service charging irrespective of the underlying technology used to deliver the service.
- F-C-R-009: NGNs are required to support per-service charging based on the underlying technology used to deliver the service.

- F-C-R-010: NGNs are recommended to support charging based on the use of extra resources.
- F-C-R-011: NGNs are recommended to support capabilities which allow for excluding charging for certain types of contents (e.g., advertisement).
- F-C-R-012: NGNs are recommended to support charging based on other criteria (e.g., location, presence, etc.).
- F-C-R-013: NGNs are required to support transfer of charging information to a billing domain with a standard-based protocol that satisfies the requirements specified in clause 7.3.
- F-C-R-014: NGNs are recommended to support AOC (advice of charge) (i.e., AOC prior to service/product consumption, AOC during service/product consumption, and AOC post service/product consumption).
- F-C-R-015: NGNs are recommended to support dynamic rating.
- F-C-R-016: NGNs are recommended to support customer account hierarchy.
- F-C-R-017: NGNs are required to support policy-based charging and its associated control on a per session basis.
- F-C-R-018: NGNs may support an adjustable charging rate during a session as a result of events related to the service.
- F-C-R-019: NGNs may support identification of charging event initiation and termination of a session without receiving information from application support functions.
- F-C-R-020: NGNs may support capabilities which allow for charging specific permitted services and blocking any other services with appropriate notice on the blocking.
- F-C-R-021: NGNs are recommended to support 3rd party charging for certain services.
- F-C-R-022: NGNs are recommended to support real-time credit refill for online charging either by user or service provider.
- F-C-R-023: NGNs are required to support real-time selection and modification of accounting policies according to customer requirements.
- F-C-R-024: A cache function is recommended to be supported. When the transfer link is broken, CIRs can be kept in the CCF. And when the link is restored, the CCF can resend CIRs to the CGF.

7.3 Accounting and charging protocol high-level requirements

- F-Pr-R-001: The NGN charging and accounting protocol is required to support a wide range of billing models (e.g., post paid, pre paid, pay per view, pay per click and sponsored campaigns).
- F-Pr-R-002: The NGN charging and accounting protocol is required to be efficient. For example, it should efficiently utilize the network bandwidth as well as introduce minimal processing and memory overheads to the network and service resources.
- F-Pr-R-003: The NGN charging and accounting protocol is required to support minimization of delays and latencies in the delivering and in the processing of the usage data.
- F-Pr-R-004: The NGN charging and accounting protocol is required to ensure that all usage records are reliably received.
- F-Pr-R-005: The NGN charging and accounting protocol is required to allow high availability of the data collection system.
- F-Pr-R-006: The NGN charging and accounting protocol is required to include or support integration of proper security mechanisms in order to avoid tampering and eavesdropping.