Technical Specification Group Services and System Aspects ***TSGS#12(01)0513***

Meeting #13, Beijing, China, 24-27 September 2001

Source: **TSG SA WG2**
Title: **CRs on 23.207**
Agenda Item: **7.2.3**

The following Change Requests (CRs) have been approved by TSG SA WG2 and are requested to be approved by TSG SA plenary #13.
Note: the source of all these CRs is now S2, even if the name of the originating company(ies) is still reflected on the cover page of all the attached CRs.

CR #	Rev	Rel	Title	cat	Ver in	Ver out	S2 Tdoc #	WI
003	1	R5	Session Flow: QoS Interaction Procedures	F	5.0.0	5.1.0	S2-012444	IMS-CCR
004	1	R5	COPS Usage for Go Interface	F	5.0.0	5.1.0	S2-012445	IMS-CCR
002		R5	Token generation at the PCF	F	5.0.0	5.1.0	S2-012104	E2EQoS
005	1	R5	P-CSCF and PCF Clarifications	F	5.0.0	5.1.0	S2-012334	IMS-CCR

3GPP TSG-SA2 Meeting #19 ***Tdoc S2-012104***
Sophia Antipolis, France, August 27 - 31, 2001

CR-Form-v4

CHANGE REQUEST

⌘ **23.207** **CR** **002** ⌘ ev **-** ⌘ Current version: **5.0.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Token generation at PCF
Source:	⌘	Nortel Networks
Work item code:	⌘	QoS
Date:	⌘	27.08.2001
Category:	⌘	**F**
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	The current functionality of the P-CSCF relative to the PCF as found in 23.207 does not explain which of the 2 functional entities is responsible for token generation. There is a choice between providing the authorisation token and thus intelligence: - in the P-CSCF which is only valid for SIP applications - in the PCF which can be used for SIP and non-SIP applications - in both It is proposed that the P-CSCF outsources the decision of policy control to the PCF. The P-CSCF needs to provide information to the PCF, and needs to send the token back to the UE in the SIP message, but the decision is left to the PCF. This keeps the PCF role a generic one.
Summary of change:	⌘	PCF is used rather than the combination for sections about token generation.
Consequences if not approved:	⌘	It will be more difficult to make the future work for P-CSCF to PCF interface possible.

Clauses affected:	⌘	5.2.1, 6.1.3, 6.2, 6.2, 6.3.1		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2.1 P-CSCF(PCF)

This clause provides functional descriptions of capabilities in P-CSCF(PCF). Determination of exactly which functions are required to support interoperator and multi-vendor aspects are not addressed in this clause.

Service-based Local Policy Decision Point

- Authorize QoS resources (bandwidth, etc.) for the session. The P-CSCF (PCF) shall use the SDP contained in the SIP signaling message to calculate the proper authorization. The authorization shall be expressed in terms of the IP resources to be authorized. The authorization shall include limits on IP packet flows and restrictions on IP destination address and port.
- The P-CSCF (PCF) shall be able to decide if new QoS authorization (bandwidth, etc.) is needed due to the mid-call media or codec change. A new authorization shall be required when the resources requested by the UE for a flow exceeds previous authorization, or a new flow is added, or when elements of the packet classifier(s) for authorized flows change.
- The PCF functions as a Policy Decision Point for the service-based local policy control.
- The PCF shall exchange the authorization information with the GGSN via the Go interface.
- The P-CSCF (PCF) provides final decisions on enabling and disabling the allocated QoS resources for the authorized media stream. The decision shall be transferred from the PCF to the GGSN.
- At IP multimedia session release, the P-CSCF (PCF) shall revoke the resources authorization for the session. In cases when the UE cannot perform this release itself (i.e., loss of signal from the mobile), the P-CSCF (PCF) shall provide indication to the GGSN that the previously authorized resource has been revoked.

Binding Mechanism Handling

- The ~~P-CSCF(~~PCF~~)~~ generates an authorization token for each SIP session and send the authorization token to the UE in the SIP message. The authorization token may contain~~s~~ information that identifies ~~the P-CSCF(PCF)~~ its generator. The authorization token shall be unique across all PDP contexts associated with an APN. The authorization token conforms to the IETF specification on SIP Extensions for Media Authorization.
- The ~~P-CSCF(~~PCF~~)~~ shall generate a new authorization token when a new authorization is required.

NEXT CHANGE

6.1.3 Procedures in the P-CSCF(PCF)

The QoS procedures in P-CSCF(PCF) are related to service based local policy control. The QoS resource authorization procedure is triggered by the P-CSCF receiving a SIP message with SDP. The SDP contains sufficient information about the session, such as the end-points, bandwidth requirements and the characteristics of the media exchange. The P-CSCF initiates a policy setup in PCF for the session. The PCF shall authorize the required QoS resources and install the IP bearer level policy for the session.
The Authorization-Token is generated by the ~~P-CSCF(~~PCF~~)~~ and sent to the UE. For the originating UE, the Authorization-Token shall be included in the SIP message (183) from P-CSCF to the UE. For the terminating UE, the Authorization-Token shall be included in the SIP Invite message from P-CSCF to the UE.

Upon receiving the bearer authorization request from the GGSN, the PCF shall authorize the request according to the stored service based local policy for the session.
Upon receiving the SIP 200 OK message, the P-CSCF provides final decision to enable the allocated QoS resource for the authorized media stream.
During the mid-call SIP signaling for media or codec change, the P-CSCF shall be able to decide if new QoS authorization is needed. A new authorization shall be required when the resources requested by the UE for a flow exceeds previous authorization, or a new flow is added, or when elements of the packet classifier(s) for authorized flow changed.
At session release, the P-CSCF shall disable the media stream and revoke the resource authorization for the session in the PCF.

NEXT CHANGE

6.2 IP Bearer Level / Application Level Binding Mechanism

The *binding mechanism* associates the PDP context bearer with policy information in the GGSN to support service based local policy enforcement and QoS inter-working. The policy and QoS decision information in the GGSN is based on IP media flows. The binding mechanism identifies the IP media flow(s) associated with a PDP context bearer and uses this information in selecting the policy information to apply.
The UE shall be able to include binding information in PDP Context Activation or Modification messages to associate the PDP context bearer with policy information . The PDP Configuration Options parameter shall be used for this purpose. The PDP Configuration Options parameter is one of the optional parameters signalled in PDP Context Activation/Modification. The binding information includes 1) an Authorization Token sent by the P-CSCF(PCF) to the UE during SIP signaling, and 2) one or more Flow Identifiers which are used by the UE, GGSN and PCF to uniquely identify the IP media flow(s). If the session has only one IP flow, then the Flow Identifier may not be needed.
The authorization token shall be unique locally. The Authorization Token conforms to the IETF specification on SIP Extensions for Media Authorization.
A Flow Identifier identifies an IP media flow associated with the SIP session. Flow Identifiers are based on the sequence of media flows in the SDP. A Flow Identifier combined with the Authorization Token shall be sufficient to uniquely identify an IP media flow.
In order to allow QoS and policy information to be "pulled" from the PCF, the authorization token shall allow the GGSN to determine the address of the PCF to be used.
When the SDP changes during a SIP session, the ~~P-CSCF(~~PCF~~)~~ shall generate a new authorization token to be used by the UE in subsequent PDP context activation/modification requests.

NEXT CHANGE

6.3 Session Flow : QoS Interaction Procedures

This section highlights possible additions to the GPRS bearer establishment procedures specified in TS23.060 for support of IM Services, and describes the QoS interactions involved within the sub-procedure blocks for Authorize QoS Resources, Resource Reservation, and Approval of QoS Commit in Chapter 5: 'IP multimedia subsystem procedures' of TS23.228. The possible additions refer to procedures on the use of Service-based Local Policy, RSVP Signalling, and RSVP Sender/Receiver Proxy, as well as the allowed combinations.

It shall be possible according to operator choice to use solely the GPRS bearer establishment procedures specified in TS23.060 without the additions described in this section.

For cases where Service-based Local Policy is not used, the Authorize QoS Resources and the Approval of QoS Commit sub-procedure blocks are effectively non-existent in TS23.228.

For the flow sequences involving RSVP, the following are assumed:

- the successful setup of RSVP signalling.
- bi-directional PDP contexts are being set up.

For the flow sequences involving Authorize QoS Resources and Approval of QoS Commit, the following are assumed:

- the successful authorization of QoS resources.
- the successful approval of QoS commit.

~~Note: The exact functional split (e.g., which entity generates the authorization token) between the P-CSCF and PCF, and whether this shall be standardized in R5 is FFS.~~

Note: Whether 'gate' corresponds to a single IP flow or multiple IP flows is FFS.

Note: 'Activate (Secondary) PDP Context' here means that either Primary or Secondary PDP context may be activated.

Note: When necessary, it is assumed that there is an existing PDP context that carries signalling (e.g., RSVP) between the UE and GGSN.

6.3.1 Authorize QoS Resources

The Authorize QoS Resources procedure is triggered by the P-CSCF receiving a SDP message. The SDP message contains sufficient information about the session, such as the end-points, bandwidth requirements, and the characteristics of the media exchange.

The PCF shall authorize the required QoS resources for the session and install the IP bearer level policy based on information from the P-CSCF. In order to ensure that the IP bearer flow correlates to the one approved during the SIP session establishment, the SIP extensions for media authorization proposed in IETF shall be used.

The Authorization-Token is generated by the ~~P-CSCF(~~PCF~~)~~ and sent to the UE. For the originating UE, the Authorization-Token shall be included in the SIP message (183) from P-CSCF to the UE. For the terminating UE, the Authorization-Token shall be included in the SIP Invite message from P-CSCF to the UE.

The PCF makes decision and communicates these decisions to the IP BS Manager in the GGSN, which is the Policy Enforcement Point (PEP) for the IP bearer service. The interface between the PCF and PEP is the COPS protocol defined by IETF.

For the purpose of the initial authorization of QoS resources the pull operation shall be used. (Reference Section 5.3 Go interface for details.)
The following figure is applicable to both the Mobile Originating (MO) side and the Mobile Terminating (MT) side.

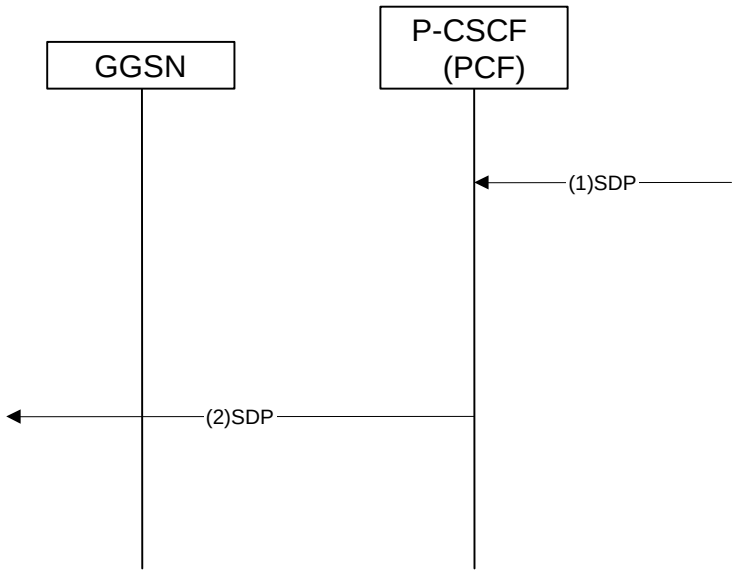

Figure 3: Authorize QoS Resources

1) The SIP "SDP" message is received by the P-CSCF. The PCF shall authorize the required QoS resources for the session and install the IP bearer level policy based on information from the P-CSCF.

2) Upon successful authorization of the session, the P-CSCF forwards the SDP message to the UE for the originating side. For the terminating side, the P-CSCF forwards the SDP message to the terminating S-CSCF.

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CHANGE REQUEST

⌘ **23.207** **CR** **003** ⌘ ev ⌘ Current version: **5.0.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Session Flow: QoS Interaction Procedures
Source:	⌘	Nokia
Work item code:	⌘	IMS-CCR
Date:	⌘	22.08.2001
Category:	⌘	**F**
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
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D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘ To clarify the signalling flows of ~~the Approval of QoS Commit and~~ the Revoke Authorization for UMTS and IP Resources interaction procedures.

~~In section 6.3.3 regarding the Approval of QoS Commit procedure is shown that the P-CSCF must wait the COPS report message from the GGSN before to forward the 200OK message (step 4), which may cause unnecessary delay of the session set up. The included note gives the option, the P-CSCF to forward the 200OK message without waiting the confirmation from the GGSN.~~

In "Revoke Authorization for UMTS and IP Resources" section of the Annex B the signalling changes are made regarding clarification of the separate GGSN functional steps concerning closing the gate and deletion of the PDP context.

Summary of change: ⌘ Clarifications on the signalling flows of ~~the Approval of QoS Commit and~~ the Revoke Authorization for UMTS and IP Resources Session flow: QoS interaction procedures

Consequences if not approved: ⌘

Clauses affected: ⌘ ~~6.3.3 and~~ B.2 Annex B

Other specs affected: ⌘
☐ Other core specifications ⌘
☐ Test specifications
☐ O&M Specifications

Other comments: ⌘

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6.3.3 Approval of QoS Commit

The Approval of QoS Commit procedure is triggered by the P-CSCF receiving a 200 OK message.

The following figure is applicable to both the Mobile Originating (MO) side and the Mobile Terminating (MT) side.

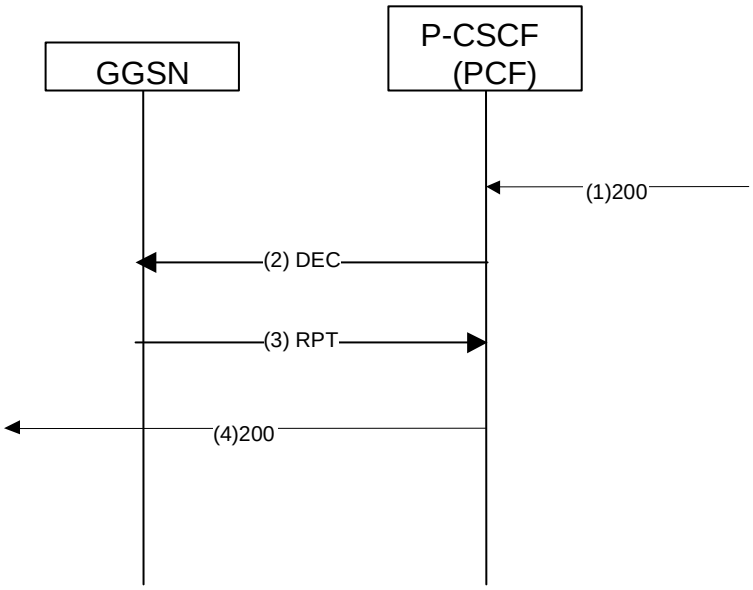

Figure 11: Approval of QoS Commit

1. The P-CSCF receives the 200 OK message. P-CSCF(PCF) approves the QoS Commit.
2. The PCF shall send a COPS DEC message to the GGSN to open the ‘gate’.
3. The GGSN receives the COPS DEC message and opens the ‘gate’ and sends a COPS RPT message back to the PCF.
4. The P-CSCF forwards the 200 OK message to the next hop.

~~Note: Step 4 may also occur at the same time or before step 3.~~

Annex B (Informative): Session Flow: QoS Interaction Procedures – Disabling media stream, Revoke Authorization for UMTS and IP resources, Indication of PDP context release

[Editors note: The consistency of the sub-procedure blocks presented here and session flows in TS23.228 shall be taken into account before moving text to the normative part.]

SKIPPED TEXT

B.2 Revoke Authorization for UMTS and IP Resources

The “Revoke Authorization for UMTS and IP resources” procedure is used e.g. upon session release. The PCF decision of “Revoke Authorization for UMTS and IP Resources” shall be sent as a separate decision to the GGSN corresponding to the previous “Authorize QoS Resources” request.

The following figure presents the “Revoke Authorization for UMTS and IP Resources” procedure.

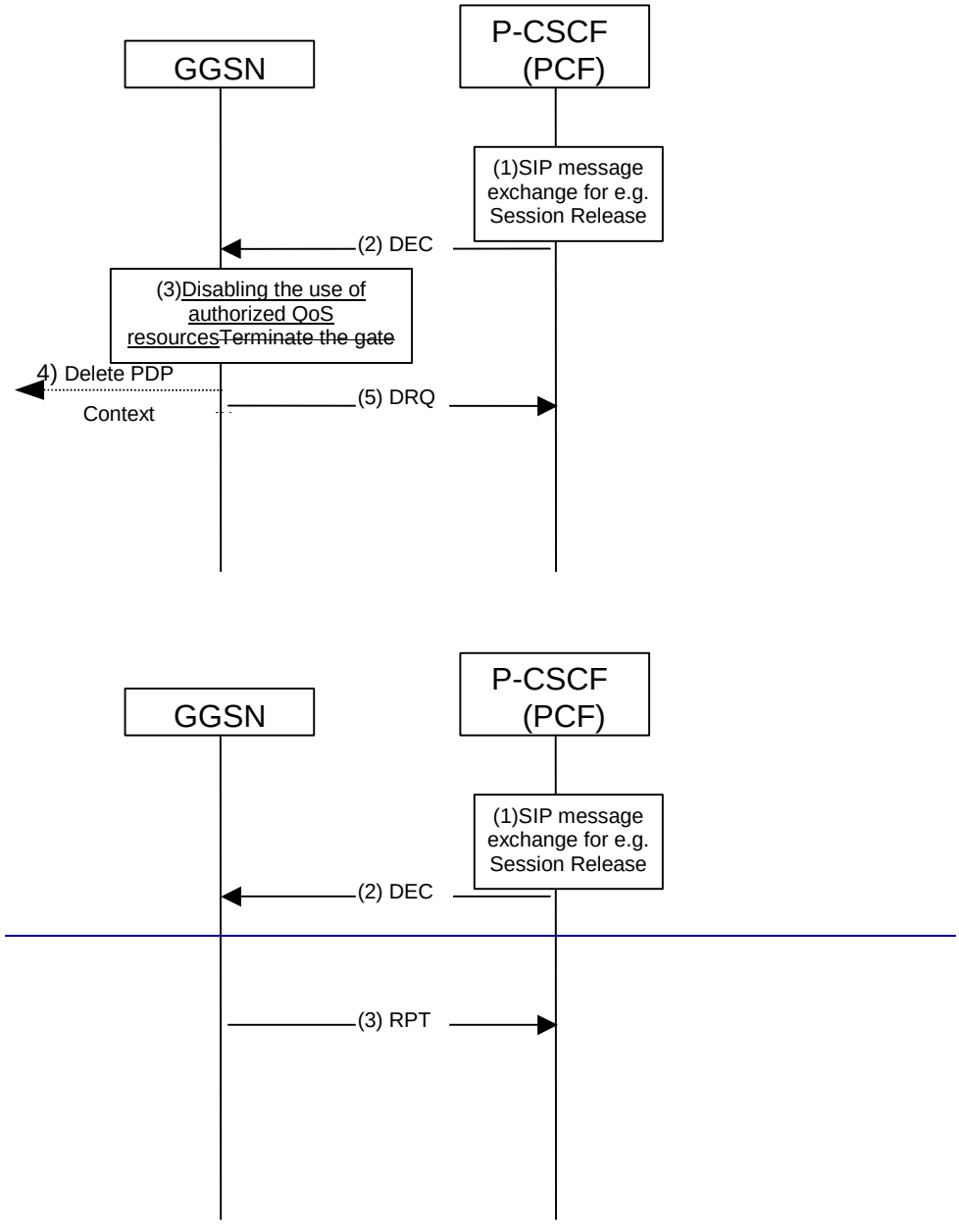

Figure B.2: Revoke Authorization for UMTS and IP resources

1. SIP message exchanges for e.g. session release are carried out.
2. The PCF shall send a COPS DEC (Decision) message to the GGSN.

3. The GGSN receives the COPS DEC message, and disables the use of the authorized QoS resources. ~~may deactivates the gate..PDP context used for the IP multimedia session and sends a COPS RPT message back to the PCF~~.

4. The GGSN initiates ~~may~~ deactivatione of the PDP context used for the IP multimedia session, in case the UE has not done it before. ~~used for the IP multimedia session~~

5. The GGSN sends a COPS DRQ (Delete Request State) message back to the PCF.

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CHANGE REQUEST

⌘ **23.207** **CR** **004** ⌘ ev ⌘ Current version: **5.0.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	COPS Usage for Go Interface
Source:	⌘	Nokia
Work item code:	⌘	IMS-CCR
Date:	⌘	22.08.2001
Category:	⌘	**F**
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
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R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	During the last editorial clean up round before TS 23.207 to be approved as v.2.0.0 some inconsistencies in chapter 5.3.2 regarding the description of the COPS commands were identified. However, they couldn't be corrected due to their non-pure editorial character. The intention of the changes is to avoid misinterpretation and contradiction of the COPS terminology within the 5.3.2 chapter as well as in the entire document.
Summary of change:	⌘	Clarifying the usage of the COPS commands
Consequences if not approved:	⌘	Inconsistencies in the COPS terminology would cause difficulties in the stage 3 work.

Clauses affected:	⌘	5.3.2
Other specs Affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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5.3.2 Information Elements Exchanged via Go Interface

The COPS protocol supports several messages between a client and server. These messages consist of the following operations that may be performed:

- Client-Open/Client-Accept/Client-Close
- Request
- Decision
- Report State
- Delete Request State
- Keep Alive
- Synchronize State Request/Synchronize State Complete

Additional UMTS-specific information elements must be included in COPS messages to support the policy and QoS inter-working functions identified in Section 5.3.1. Consistent with the COPS framework, the Go interface is identified by a "client type" allocated for a UMTS COPS client (GGSN).

All of the information described in the remainder of this section applies specifically to the GGSN COPS client type. The events specific to the UMTS or IP bearer service would trigger the request messages from the UMTS PEP to the PCF. The information elements specific to UMTS would be standardized and carried in the UMTS specific interactions between the PCF and the GGSN.

A **Request** (REQ) message from the GGSN to the PCF shall allow the GGSN to request policy and QoS inter-working information for an IP flow identified by binding information (described below).

A **Decision** (DEC) message from the PCF to the GGSN ~~shall include the following *commands* :~~contains decision objects. A Decision object shall include one of the following *commands:*

- NULL Decision (No configuration data available)
- Install (Admit request/Install configuration, Commit)
- Remove (Remove request/Remove configuration)

These commands are used to:

- Authorize QoS/Revoke QoS authorization for one or more IP flows
- Enable/Disable forwarding for one or more IP flows

The **responses** from the PEP to the PCF include an acknowledgement and/or an error response to commands received by the PEP. The following response messages shall be supported:

- Report State (Success/Failure/Accounting) (RPT)

~~The **Authorize QoS command** contains the following policy and QoS inter-working information associated with an IP flow:~~ The Install command used for Authorize QoS contains the following policy and QoS inter-working information associated with an IP flow:

- UMTS specific Binding information (e.g. Token)
- Packet classifier (e.g. RSVP filterspec)
- Authorized flowspec
- Packet handling action

- DSCP
- Event generation information

Binding information associates the policy and QoS inter-working information in the message with a PDP context. The binding information includes 1) an authorization token sent by the P-CSCF to the UE during SIP signaling. , and may include 2) one flow identifier used by the UE, GGSN and PCF to uniquely identify an IP media flow.

The authorization token shall be unique locally. The authorization token conforms to the IETF specification on SIP Extensions for Media Authorization.

A flow identifier identifies an IP media flow associated with the SIP session. Flow identifiers are based on the ordering of media flows in the SDP. A flow identifier combined with the authorization token shall be sufficient to uniquely identify an IP media flow.

The packet classifier includes the standard 5-tuple: (source IP address, destination IP address, source port, destination port, protocol), identifying a set of packets associated with a unidirectional flow. Elements of the 5-tuple may be wild-carded.

The authorized flowspec provides an upper bound on the resources that can be reserved or allocated for an IP flow. The authorized flowspec is expressed as an Intserv-style flowspec .

The packet handling action defines the packet handling that should be accorded to in-profile and out-of-profile packets matching the packet classifier. In-profile traffic is defined to be traffic that is within the authorized flowspec.

The DSCP from the PCF shall determine the highest QoS class that can be applied to this IP flow.

Event generation information contains opaque information that the GGSN includes in usage records (e.g. CDR)associated with the authorized UMTS bearers. The event generation information includes information identifying the authorized IP flow. It also includes information used to correlate usage records from the GGSN with SIP session records from the P-CSCF.

The Install and Remove commands used for **Revoke QoS Authorization**, **Enable Forwarding** and **Disable Forwarding** ~~commands~~ provide only the information that is needed to perform the action (e.g., the COPS handle element, which is used as a way of identifying the installed decision information).

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Sophia Antipolis, France, August 27 - 31, 2001

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CHANGE REQUEST

⌘ **23.207** **CR** **005** ⌘ ev **-** ⌘ Current version: **5.0.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	P-CSCF and PCF Clarifications
Source:	⌘	Lucent Technologies, Nortel, Motorola
Work item code:	⌘	IMS-CCR
Date:	⌘	28.08.2001
Category:	⌘	**F**
Release:	⌘	REL-5

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R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	The current functionality of the P-CSCF relative to the PCF as found in 23.207 is unclear.
Summary of change:	⌘	Where possible, either P-CSCF or PCF is used rather than the combination. Further explanation of the role of the PCF in policy based control of the QoS resources is added.
Consequences if not approved:	⌘	Incorrect implementations and interoperability problems will result if this is not clarified.

Clauses affected:	⌘	Existing sections 5.1.1.2, 5.1.1.3, 5.2.1, 5.2.3, 5.3.1, 5.3.2, 6.1.3, 6.2, and 6.3.3.
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

First Section Changes

5.1.1.2 IP BS Manager Functionality in the GGSN and the UE

The following capabilities of the IP BS manager support applications that require stringent IP quality of service (e.g., carrier-grade telephony),

1. Existing QoS management mechanisms in 23.107 with any required extensions, e.g., binding mechanism.

2. The IP BS manager in the GGSN acting as an RSVP endpoint towards the external network, generating and responding to per-flow RSVP messages.

Use of RSVP is intended to enable the external network provider to support traffic engineering, efficient resource management, and call blocking if needed to handle temporary overload conditions.

It is also desired to allow endpoints to use Diffserv or RSVP to indicate their QoS requirements to the MT. The requirements on the IP bearer service manager in the UE and GGSN to support this functionality are FFS.

At PDP context setup the user shall have access to one of the following alternatives :

- Basic GPRS IP connectivity service: The bearer is established according to the user's subscription, local operator's IP bearer resource based policy, local operator´s admission control function and GPRS roaming agreements. In this case, IP bearer resource based local policy decisions may be applied to the bearer.

- Enhanced GPRS based services : The bearer is used to support an enhanced application-layer service, such as IM. In this case, service-based local policy decisions (e.g., authorization and policy based ~~gating~~ control ~~of the bearer by a proxy CSCF)~~) may be applied to the bearer.

5.1.1.3 Interaction to External Networks

Within the UMTS network, there is resource management performed by various nodes in the admission control decision. The resources considered here are under the direct control of the UMTS network.

In IP Networks, it is also necessary to perform resource management to ensure that resources required for a service are available. Where the resources for the IP Bearer Service to be managed are not owned by the UMTS network, the resource management of those resources would be performed through an interaction between the UMTS network and that external network.

In addition, where the UMTS network is also using external IP network resources as part of the UMTS bearer service (for example for the backbone bearer service), it may also be necessary to interwork with that network.

The GGSN shall support DiffServ edge functionality and be able to shape upstream traffic. There are a number of other mechanisms provided to support interoperator interworking, some of which are given below.

Note: This list is not exhaustive. Other options are possible.

- Signalling along the flow path: In this scenario, resource requirements are explicitly requested and either granted or rejected through the exchange of signalling messages between network elements along the path of the IP packet flow. Signalling may be performed on a per-flow basis (e.g. using end to end RSVP) or it may be performed for an aggregate set of flows. In the latter case, it is expected that signalling exchanges would only be required when there are changes required in the resources allocated to an aggregate set of flows.

- Interaction between network management entities: In this scenario, resource requirements need to be explicitly negotiated and provisioned through network management entities. The results of this exchange are then enforced in the border nodes separating DiffServ administrative domains.

- Service Level Agreements enforced by the border routers between networks: In this scenario, resources are allocated along the path based on agreements between the network operators. The border routers along the path flow are provisioned with the characteristics of the aggregated traffic that is allowed to flow between systems.

Next Section Changes

5.2.1 GGSN

This clause provides functional descriptions of capabilities in GGSN. The capabilities are part of IP BS Manager (see 5.1.1.1) or corresponding user plane functions. Determination of exactly which functions are required to support interoperator and multi-vendor aspects are not addressed in this clause.

The **DiffServ Edge Function** shall be compliant to the IETF specifications for Differentiated Services. The IETF Differentiated Services architecture will be used to provide QoS for the external bearer service.

RSVP/IntServ Function

[Editors note: Detailed functional description of RSVP/IntServ Function is FFS]

The **RSVP Sender/Receiver Proxy** uses information derived from the Go interface and acts as an RSVP endpoint towards the external network, generating and responding to per-flow RSVP messages on behalf of the UE. In the uplink direction, the RSVP Sender Proxy originates the Path message on behalf of the UE. It must also periodically refresh the Path message and correctly terminate the Resv, ResvTear and PathErr messages for the session. In the downlink direction, the RSVP Receiver Proxy terminates the Path message and generates the Resv message on behalf of the UE. A Resv Proxy state is installed which act as if the proxy has received a Resv from the true endpoint UE. This involves reserving resource, if required, sending periodic refreshes of the Resv message and tearing down the reservation if the Path is torn down.

[Editors note: Detailed functional description of how GGSN identify that RSVP SenderRreceiver Proxy shall be activated is FFS]

The **Service-based Local Policy Enforcement Point** controls the quality of service that is provided to a set of IP packets (or IP "flow") defined by a packet classifier. The policy enforcement function includes policy-based admission control that is applied to the IP bearers associated with the flow, and configuration of the packet handling and policy based "gating" functionality in the user plane. Service-based local policy decisions are either "pushed" to or requested by the GGSN via the Go interface.

Policy-based admission control ensures that the resources that can be used by a particular IP flow are within the "authorized resources" specified via the Go interface. The authorized resources provide an upper bound on the resources that can be reserved or allocated for an IP flow. The authorized resources may be expressed as an Intserv-style Flowspec. This information is mapped by the translation/mapping function in the GGSN to give the authorized resources for UMTS bearer admission control.

In the user plane, policy enforcement is defined in terms of a "gate" implemented in the GGSN. A gate is a policy enforcement function that interacts through Go interface with PCF as the Policy Decision Point for QoS resource authorisation at the IP BS level for a unidirectional flow of packets. ~~"Open"/"Close" gate~~ Gate operations as defined in TS23.228 are to ~~enable/disable~~define the control and to manage media flows based on policy, and are under the control of ~~P-CSCF (~~PCF~~)~~. A gate operates on a unidirectional flow of packets, i.e., in either the upstream or downstream direction. A gate consists of a packet classifier, a traffic metering function, and user plane actions to be taken for the set of packets matching the classifier. When a gate is enabled, the packets in a flow are subject to the Diffserv edge treatment (policing or marking) as determined by traffic metering and user plane actions. When a gate is disabled, all of the packets in the flow are dropped.

The packet classifier associated with a gate is a micro-flow classifier including the standard 5-tuple: (source IP address, destination IP address, source port, destination port, protocol), identifying a set of packets associated with a unidirectional flow[1].

Elements of the 5-tuple may be wild-carded. This is FFS in Stage 3 work. It is possible for a set of packets to match more than one classifier. When this happens, the sequence of actions associated with the gates are executed in sequence. Packets that are marked by a gate may not be (re)marked by a subsequent gate to a Diffserv Code Point corresponding to a better service class.

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[1] This packet classifier should not be confused with the Traffic Flow Template (TFT), which serves a different purpose from the gate.

The **Binding Mechanism Handling** associates the PDP context bearer with one or more IP flows in order to support service-based local policy enforcement and QoS inter-working. Binding information is included in PDP Context Activation or Modification messages to associate the PDP context bearer with QoS and policy decision information provided by the PCF and associated with IP flows. The PDP Configuration Options parameter shall be used to carry the binding information. The PDP Configuration Options parameter is one of the optional parameters signaled in PDP Context Activation/Modification messages. In order to allow QoS and policy information to be "pulled" from the PCF, the binding information shall allow the GGSN to determine the address of the PCF to be used.

Next Section Changes

5.2.3 P-CSCF(PCF)

This clause provides functional descriptions of capabilities in P-CSCF(PCF). Determination of exactly which functions are required to support interoperator and multi-vendor aspects are not addressed in this clause.

Service-based Local Policy Decision Point

- Authorize QoS resources (bandwidth, etc.) for the session. The P-CSCF (PCF) shall use the SDP contained in the SIP signaling message to calculate the proper authorization. The authorization shall be expressed in terms of the IP resources to be authorized. The authorization shall include limits on IP packet flows and restrictions on IP destination address and port.
- The P-CSCF (PCF) shall be able to decide if new QoS authorization (bandwidth, etc.) is needed due to the mid-call media or codec change. A new authorization shall be required when the resources requested by the UE for a flow exceeds previous authorization, or a new flow is added, or when elements of the packet classifier(s) for authorized flows change.
- The PCF functions as a Policy Decision Point for the service-based local policy control.
- The PCF shall exchange the authorization information with the GGSN via the Go interface.
- The ~~P-CSCF (~~PCF~~)~~ provides final policy decisions ~~on enabling and disabling~~controlling the allocated QoS resources for the authorized media stream. The decision shall be transferred from the PCF to the GGSN.
- At IP multimedia session release, the ~~P-CSCF (~~PCF) shall revoke the QoS resource~~s~~ authorization for the session. ~~In cases when the UE cannot perform this release itself (i.e., loss of signal from the mobile), the P-CSCF (PCF) shall provide indication to the GGSN that the previously authorized resource has been revoked.~~

Binding Mechanism Handling

- The P-CSCF(PCF) generates an authorization token for each SIP session and send the authorization token to the UE in the SIP message. The authorization token contains information that identifies the P-CSCF(PCF) . The authorization token shall be unique across all PDP contexts associated with an APN. The authorization token conforms to the IETF specification on SIP Extensions for Media Authorization.
- The P-CSCF(PCF) shall generate a new authorization token when a new authorization is required.

5.3 Go interface (PCF – GGSN)

5.3.1 Go Functional Requirements

The Go interface allows service-based local policy and QoS inter-working information to be “pushed” to or requested by the GGSN from a Policy Control Function (PCF). The Go interface provides information to support the following functions in the GGSN:

- Control of Diffserv inter-working
- Control of RSVP admission control and inter-working

- Control of service-based policy -"gating" function in GGSN
- UMTS bearer authorization
- QoS charging related function

The Common Open Policy Service (COPS) protocol supports a client/server interface between the Policy Enforcement Point in the GGSN and Policy Control Function (PCF). The Go interface shall conform to the IETF COPS framework as a requirement and guideline for Stage 3 work.

The COPS protocol allows both push and pull operations. For the purpose of the initial authorisation of QoS resources the pull operation shall be used. Subsequently the interactions between the PCF and the GGSN may use either pull or push operations.

Policy decisions may be stored by the COPS client in a local policy decision point allowing the GGSN to make admission control decisions without requiring additional interaction with the PCF.

5.3.2 Information Elements Exchanged via Go Interface

The COPS protocol supports several messages between a client and server. These messages consist of the following operations that may be performed:

- Client-Open/Client-Accept/Client-Close
- Request
- Decision
- Report State
- Delete Request State
- Keep Alive
- Synchronize State Request/Synchronize State Complete

Additional UMTS-specific information elements must be included in COPS messages to support the policy and QoS inter-working functions identified in Section 5.3.1. Consistent with the COPS framework, the Go interface is identified by a "client type" allocated for a UMTS COPS client (GGSN).

All of the information described in the remainder of this section applies specifically to the GGSN COPS client type. The events specific to the UMTS or IP bearer service would trigger the request messages from the UMTS PEP to the PCF. The information elements specific to UMTS would be standardized and carried in the UMTS specific interactions between the PCF and the GGSN.

A **Request** message from the GGSN to the PCF shall allow the GGSN to request policy and QoS inter-working information for an IP flow identified by binding information (described below).

A **Decision** message from the PCF to the GGSN shall include the following *commands* :

- NULL Decision (No configuration data available)
- Install (Admit request/Install configuration, Commit)
- Remove (Remove request/Remove configuration)

These commands are used to:

- Authorize QoS/Revoke QoS authorization for one or more IP flows
- ~~Enable/Disable~~Control forwarding for one or more IP flows

The **responses** from the PEP to the PCF include an acknowledgement and/or an error response to commands:

- Report State (Success/Failure/Accounting)

The ~~Authorize QoS command~~messages to authorize QoS contain~~s~~ the following policy and QoS inter-working information associated with an IP flow:

- UMTS specific Binding information (e.g. Token)
- Packet classifier (e.g. RSVP filterspec)
- Authorized flowspec
- Packet handling action
- DSCP
- Event generation information

Binding information associates the policy and QoS inter-working information in the message with a PDP context. The binding information includes 1) an authorization token sent by the P-CSCF to the UE during SIP signaling. , and may include 2) one flow identifier used by the UE, GGSN and PCF to uniquely identify an IP media flow.

The authorization token shall be unique locally. The authorization token conforms to the IETF specification on SIP Extensions for Media Authorization.

A flow identifier identifies an IP media flow associated with the SIP session. Flow identifiers are based on the ordering of media flows in the SDP. A flow identifier combined with the authorization token shall be sufficient to uniquely identify an IP media flow.

The packet classifier includes the standard 5-tuple: (source IP address, destination IP address, source port, destination port, protocol), identifying a set of packets associated with a unidirectional flow. Elements of the 5-tuple may be wild-carded.

The authorized flowspec provides an upper bound on the resources that can be reserved or allocated for an IP flow. The authorized flowspec is expressed as an Intserv-style flowspec .

The packet handling action defines the packet handling that should be accorded to in-profile and out-of-profile packets matching the packet classifier. In-profile traffic is defined to be traffic that is within the authorized flowspec.

The DSCP from the PCF shall determine the highest QoS class that can be applied to this IP flow.

Event generation information contains opaque information that the GGSN includes in usage records (e.g. CDR)associated with the authorized UMTS bearers. The event generation information includes information identifying the authorized IP flow. It also includes information used to correlate usage records from the GGSN with SIP session records from the P-CSCF.

The **~~Revoke QoS Authorization, Enable Forwarding~~** ~~and~~ **~~Disable Forwarding~~** ~~commands~~ messages which revoke QoS authorisation or remove configuration information ~~-~~provide only the information that is needed to perform the action (e.g., the COPS handle element, which is used as a way of identifying the installed decision information).

Next Section Changes

6.1.3 Procedures in the P-CSCF(PCF)

The QoS procedures in P-CSCF(PCF) are related to service based local policy control.

The QoS resource authorization procedure is triggered by the P-CSCF receiving a SIP message with SDP. The SDP contains sufficient information about the session, such as the end-points, bandwidth requirements and the characteristics of the media exchange. The P-CSCF initiates a policy setup in PCF for the session. The PCF shall authorize the required QoS resources and install the IP bearer level policy for the session.

The Authorization-Token is generated by the P-CSCF(PCF) and sent to the UE. For the originating UE, the Authorization-Token shall be included in the SIP message (183) from P-CSCF to the UE. For the terminating UE, the Authorization-Token shall be included in the SIP Invite message from P-CSCF to the UE.

Upon receiving the bearer authorization request from the GGSN, the PCF shall authorize the request according to the stored service based local policy for the session.

~~Upon receiving the SIP 200 OK message, the P-CSCF provides~~ The PCF makes a final decision to enable the allocated QoS resource for the authorized media stream. This may be triggered by the receipt of the SIP 200 OK (Invite Response) message to the P-CSCF. Based on local policy, QoS resources may also be enabled at the time they are authorised by the PCF.

During the mid-call SIP signaling for media or codec change, the P-CSCF shall be able to decide if new QoS authorization is needed. A new authorization shall be required when the resources requested by the UE for a flow exceeds previous authorization, or a new flow is added, or when elements of the packet classifier(s) for authorized flow changed.

At session release, the ~~P-CSCF~~PCF shall ~~disable the media stream and~~ revoke the resource authorization~~. for the session in the PCF.~~

6.2 IP Bearer Level / Application Level Binding Mechanism

The *binding mechanism* associates the PDP context bearer with policy information in the GGSN to support service based local policy enforcement and QoS inter-working. The policy and QoS decision information in the GGSN is based on IP media flows. The binding mechanism identifies the IP media flow(s) associated with a PDP context bearer and uses this information in selecting the policy information to apply.

The UE shall be able to include binding information in PDP Context Activation or Modification messages to associate the PDP context bearer with policy information . The PDP Configuration Options parameter shall be used for this purpose. The PDP Configuration Options parameter is one of the optional parameters signalled in PDP Context Activation/Modification. The binding information includes 1) an Authorization Token sent by the P-CSCF~~(PCF)~~ to the UE during SIP signaling, and 2) one or more Flow Identifiers which are used by the UE, GGSN and PCF to uniquely identify the IP media flow(s). If the session has only one IP flow, then the Flow Identifier may not be needed.

The authorization token shall be unique locally. The Authorization Token conforms to the IETF specification on SIP Extensions for Media Authorization.

A Flow Identifier identifies an IP media flow associated with the SIP session. Flow Identifiers are based on the sequence of media flows in the SDP. A Flow Identifier combined with the Authorization Token shall be sufficient to uniquely identify an IP media flow.

In order to allow QoS and policy information to be "pulled" from the PCF, the authorization token shall allow the GGSN to determine the address of the PCF to be used.

When the SDP changes during a SIP session, the P-CSCF(PCF) shall generate a new authorization token to be used by the UE in subsequent PDP context activation/modification requests.

Next Section Changes

6.3.3 Approval of QoS Commit

The Approval of QoS Commit procedure is triggered by the P-CSCF receiving a 200 OK message.

The following figure is applicable to both the Mobile Originating (MO) side and the Mobile Terminating (MT) side.

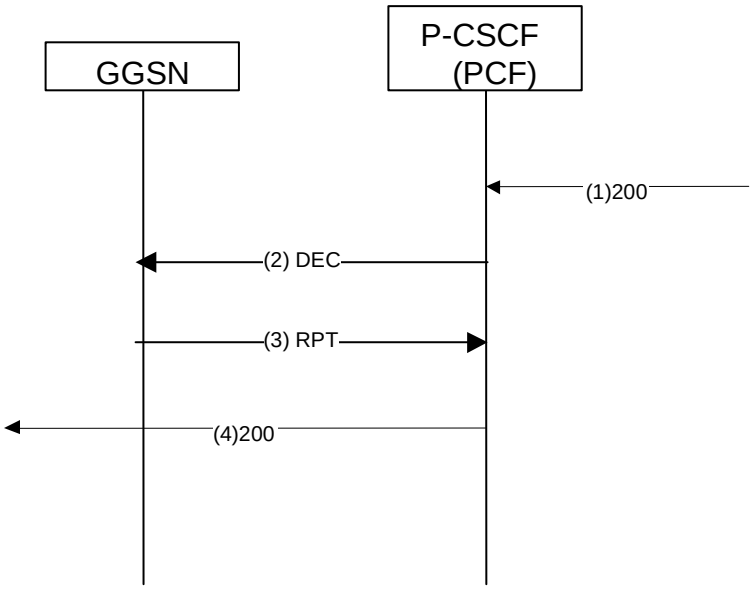

Figure 11: Approval of QoS Commit

1) The P-CSCF receives the 200 OK message. ~~P-CSCF(~~PCF~~)~~ approves the QoS Commit based on local policy.
2) The PCF shall send a COPS DEC message to the GGSN to open the 'gate' e.g., enable the use of the authorised QoS resources, unless this was done based on local policy at the time the QoS resources were authorised.
3) The GGSN receives the COPS DEC message, and opens the 'gate' e.g., enables the use of the authorised QoS resources,- and sends a COPS RPT message back to the PCF.
4) The P-CSCF forwards the 200 OK message to the next hop. ~~Note Step 4 may be done in parallel with Step 2.~~