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| Functional design of authorization, QoS, and policy control |
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Abstract

This document proposes text for the chapter 7.6 on Authorization, QoS and Policy Control. The text is based on the presentation omniran-16-0043-00-CF00, which introduced the basic concepts of the text proposal to the OmniRAN TG.

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# Functional Decomposition and Design

## Authorization, QoS, and policy control

### Introduction

The functional description of authorization, QoS, and policy control has several aspects to address:

* QoS models supported by IEEE 802
* Repository of QoS and policy parameters
* QoS policy control architecture

The following sections describe each of the aspects mentioned above

#### QoS models supported by IEEE 802

IEEE 802 supports both the prioritization of packets as well as resource reservation on communication links. These approaches are denoted in the IP domain as diffserv and intserv, respectively. As QoS mainly depends on the packet forwarding behavior across networks, the IEEE 802.1Q specification on bridging provides the foundations for QoS and policy control in IEEE 802 technologies. Part of the IEEE 802 specification are the priority marking of packets, which was initially introduced by IEEE 802.1p, as well as the resource reservation for particular service streams, which is supported by the Resource Reservation Protocol and was introduced into 802.1Q by the IEEE 802.1Qat. Both methods are widely supported in IEEE 802 technologies. An even stricter and more powerful method was recently introduced by the IEEE 802.3br, which provides means for even tighter controlling jitter and transmission delays for real time data.

Also the IEEE 802 radio technologies support both, the diffserv as well as the intserv QoS model. The technologies operating in unlicensed spectrum mainly deploy the diffserv model, as it is not feasible to guarantee transmission of data over spectrum which is not under full control and can be block by some other radio device at any time.

IEEE 802.11 was amended by comprehensive diffserv-based QoS support through IEEE 802.11e. As resource reservation is difficult in unlicensed spectrum, only the diffserv based EDCF is nowadays widely used in equipment.

IEEE 802.16, which is designed for operation in licensed spectrum, supports 5 different data delivery service not only following the diffserv model, but also providing the capabilities to reserve fixed bandwidth for particular service flows. As IEEE 802.22 inherits most of the MAC from IEEE 802.16, it also provides the QoS capabilities of IEEE 802.16.

#### Repository of QoS policy parameters

Another aspect for consideration is the repository of the QoS policy parameters. As provisioning of QoS is tightly coupled with the subscription, the obvious location for the repository is the Subscription Service. Providing subscribers individually assigned QoS profiles in the native task of the authorization signaling during session establishment. However, the subscription service provides authorization not only at the begin of a session, it has the possibility to change authorization parameters also during a session by invoking a change of authorization.

#### QoS policy control architecture

The architecture of QoS policy control in this specification for IEEE 802 access network follows the common approach of distributing the storage of the policies in a dedicated policy repository, processing the resource demands against the policy rules in a policy decision point, and enforcing the QoS settings at the various network elements through policy enforcement points. The following figure 7.6.1 shows the generic policy control architecture applied in this specification.

Generic policy control architecture



Figure 7.6.1: Generic policy control architecture

The generic architecture can be easily mapped to the NRM.

* The Policy data base resides in the Subscription Service.
* The Policy Decision Point is part of the Access Network Control
* The Policy Enforcement Points are the Node of Attachment as well as the Backhaul
* Resource Requests are forwarded either from the Terminal Control over R8 or the Access Router Control over R9 to the policy decision in the ANC.

### Roles and identifiers

#### Service Flow

The Service Flow is the basic means of QoS policy control. It defines a traffic forwarding class with defined QoS parameters, which is uniquely identified by an ID.

User datagrams can be assigned to Service Flows by filtering rules, which allows network elements to preferably process some user datagrams against some others.

Service Flows have operational states:

* Provisioned: Service flow parameters are provided by subscription service
* Permitted: Requested service flow parameters fit to allowed range defined by authorization
* Active: service flow is established in network elements

Service Flows can be either static over a session or dynamic

* Static flows keep same behavior throughout a session
* Dynamic flows change behavior during a session

Identifier: ServiceFlow-ID

#### Subscription

The subscription contains user specific QoS policy information, which consists of the permitted QoS parametes and some other information about the applicability of the policies

Identifier: NAI

#### SS

The subscription service acts as repository of QoS policies. It provides the QoS policies to the access network at the begin of sessions and initiate policy changes during sessions, it there is need for it, e.g. by expiring service credits.

The Subscription Service also provides the QoS parameters of the default service flow, which is established at connection establishment.

Identifier: see section 6.9

#### ANC

The Access Network Control contains the policy decision point, which decides about assignment of QoS settings to service flows based on available resources, the QoS policies provided by the Subscription Service and the demands for additional service flows or changes to service flow parameters coming from either the Terminal Control or the Access Router Control.

Identifier: see section 6.9

#### NA, BH

Node of Attachment and Backhaul are the network elements enforcing the QoS parameters to the user datagrams traversing the data path. They both act as policy enforcement points.

Identifier: see section 6.9

#### TEC, ARC

Terminal Control as well as Access Router Control are the entities requesting for the establishment of new service flows during ongoing sessions, or for the change of QoS parameters of active service flows. They negotiate with the ANC whether the resource requests are permitted.

Identifier: see section 6.9

### Use Cases

#### QoS policy provisioning to AN Control

The initial use case is the provisioning of the subscription specific QoS policy to the policy decision point at session begin, which is denoted as authorization in the AAA procedures.

#### Default service flow creation, modification and deletion

The default service flow is the initial service flow established by the access network to initiate communication between terminal and access router. This default service flow has to be established at session begin, and has to be teared down as last service flow at the session end. It is possible, but not very common to change the QoS parameters of the default service flow during an ongoing session.

#### Change of authorization by Subscription Service

The subscription service has the possibility to change the authorization for a particular subscription and terminal at any time during a session. Such change may be required, when service periods or service credits for a particular subscription expire.

#### Access router initiated service flow creation, modification, and deletion

Access router control can request the establishment of new service flows, the change of the QoS parameters of existing service flows, or the termination of service flows, when the service flow is not required anymore. The ARC forwards the request for creation, modification, or deletion to the policy decision point in the ANC.

#### Terminal initiated service flow creation, modification, and deletion

Terminal control can request as well the establishment of new service flows, the change of the QoS parameters of existing service flows, or the termination of service flows, when the service flow is not required anymore. The TEC forwards the request for creation, modification, or deletion to the policy decision point in the ANC.

### Functional Requirements

The following requirements apply to the QoS policy control:

* QoS policy control should support subscriber specific QoS parameters
* QoS policy control should allow for both intserv and diffserv QoS models
* QoS policy control should support static and dynamic service flows
* QoS policy control should allow Subscription Service to change active service flows
* QoS policy control should allow for dynamic service flow creation on request from terminal or access router
* QoS policy control should create static service flows based on the authorization information delivered in the admission accept message
* QoS policy control should be able to handle any number of terminals, any number of access routers and any number of subscription services.
* QoS policy control should support the resource reservation protocols specified by IEEE 802

### QoS policy specific attributes

#### Service flow parameters

* Datagram filter
* Priority
* Bandwidth
* Delay
* Jitter

#### Policy rules

* Traffic specification
* Priority
* Usage limits (time, volume)

###  QoS policy control specific basic functions

#### Provisioning of authorization information to policy decision point at session begin

The subscription service provides at session begin the authorization information through the AAA protocol to the ANC, which contains the policy decision point.

#### Change of authorization during session

During an ongoing session, the subscription service can update the authorization by issuing a Change of Authorization, which is a function of the AAA protocol. The new authorization will be immediately applied by the policy decision point, and when the new authorization does not permit for ongoing service flows, such service flows are either terminated or modified to the new authorization.

#### Provisioning of QoS parameters to policy enforcement points

The policy decision point in the ANC derives from authorization and resource requests the QoS related configuration parameters for both the NA and BH, and forwards the parameters over R5 and R7, respectively.

#### Request of service flow by terminal

When required, the Terminal Control can request the allocation of new service flows, the modification of the QoS parameters of active service flows, or the termination of service flows not needed anymore through issuing a Resource Request to the policy decision point in the ANC

#### Request of service flow by access router

When required, the Access Router Control can request the allocation of new service flows, the modification of the QoS parameters of active service flows, or the termination of service flows not needed anymore through issuing a Resource Request to the policy decision point in the ANC

### Detailed procedures

#### Pre-provisioned service flow establishment

>> tbd <<

#### Service flow initialization by terminal

>> tbd <<

#### Service flow initialization by access router

>> tbd <<

#### Service flow modification by terminal

>> tbd <<

#### Service flow termination by terminal

>> tbd <<

#### Change of authorization by subscription service

>> tbd <<

### Mapping to IEEE 802 Technologies

#### Overview

While the generic QoS policy control architecture is applicable to all the IEEE 802 access technologies, differences exist in the capabilities of the access technologies in supporting various QoS models and parameters. In the introduction to this chapter main differences between IEEE 802 technologies were already mentioned. This section provides more details about the capabilities of the IEEE 802 technologies to support the concepts presented above.

#### IEEE 802.3 specifics

#### IEEE 802.11 specifics

#### IEEE 802.16 specifics

#### IEEE 802.22 specifics