TECHNICAL REPORT

TR-262
Femto Component Objects

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Issue Date: November 2011

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Issue History

Issue Number	Issue Date	Issue Editor	Changes
1	November 2011	Klaus Wich, Nokia Siemens Networks	First version of Femto specific component objects.

Comments or questions about this Broadband Forum Technical Report should be directed to info@broadband-forum.org.

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Executive Summary

TR-262 defines Femto specific components which are used to define common functions independent of the Femto devices' radio technologies.

The additional components defined in TR-262 include the following:

FAP – A container for the Femto specific components

GPS - This object contains the parameters relating to the GPS scan.

Tunnel – The definition of transport tunnels, protocols and security settings used to connect to the Femto Security Gateway.

Performance Management – General control parameters for the performance measurements.

Femtozone Application Platform – These objects contains parameters needed to support Femtozone Applications.

1 Purpose and Scope

1.1 Purpose

The purpose of TR-262 is to provide common Femto components, defining non radio functions to be used for Femto devices.

These components were created because the FAP Service model defined in TR-196 Issue 2 allows flexible modeling of multiple Femto radio technologies either as a single FAPService instance or multiple FAPService instances with different usage of the common components. Therefore it is possible to use one or several instances of the components in defined in TR-262, which can either span multiple FAPService instances or there could be multiple instances of the objects in these components for a single FAPService instance, of one instance per FAP Service.

1.2 Scope

TR-262 defines Component Objects for use in CWMP managed devices together with Femto Services (FAPService:2) defined in TR-196 Issue 2 [7] for all root data models.

The current root data models are InternetGatewayDevice:1 defined in TR-098 [3], Device:1 defined in TR-181 Issue 1 [5], and Device:2 defined in TR-181 Issue 2 [6].

2 References and Terminology

2.1 Conventions

In this Technical Report, several words are used to signify the requirements of the specification. These words are always capitalized. More information can be found be in RFC 2119 [1].

MUST	This word, or the term “REQUIRED”, means that the definition is an absolute requirement of the specification.
MUST NOT	This phrase means that the definition is an absolute prohibition of the specification.
SHOULD	This word, or the adjective “RECOMMENDED”, means that there could exist valid reasons in particular circumstances to ignore this item, but the full implications need to be understood and carefully weighed before choosing a different course.
SHOULD NOT	This phrase, or the phrase "NOT RECOMMENDED" means that there could exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications need to be understood and the case carefully weighed before implementing any behavior described with this label.
MAY	This word, or the adjective “OPTIONAL”, means that this item is one of an allowed set of alternatives. An implementation that does not include this option MUST be prepared to inter-operate with another implementation that does include the option.

2.2 References

The following references are of relevance to this Technical Report. At the time of publication, the editions indicated were valid. All references are subject to revision; users of this Technical Report are therefore encouraged to investigate the possibility of applying the most recent edition of the references listed below.

A list of currently valid Broadband Forum Technical Reports is published at www.broadband-forum.org.

Document		Title	Source	Year
[1]	**RFC 2119**	*Key words for use in RFCs to Indicate Requirement Levels*	IETF	1997
[2]	**TR-106 Amendment 5**	*Data Model Template for TR-069-Enabled Devices*	Broadband Forum	2010
[3]	**TR-098 Amendment 2**	*Internet Gateway Device Data Model for TR-069*	Broadband Forum	2008
[4]	**TR-157 Amendment 5**	*Component Objects for CWMP*	Broadband Forum	2011
[5]	**TR-181 Issue 1 Amendment 1**	*Device Data Model for TR-069 (Device:1)*	Broadband Forum	2011
[6]	**TR-181 Issue 2 Amendment 4**	*Device Data Model for TR-069 (Device:2)*	Broadband Forum	2011
[7]	**TR-196 Issue 2**	*Femto Access Point Service Data Model*	Broadband Forum	2011
[8]	**SSIG-APIREQ-R01** *(non public document)*	*Femtozone Services API (Release I) – Operational Specifications*	FemtoForum	

2.3 Definitions

The following terminology is used throughout this Technical Report.

ACS	Auto-Configuration Server. This is a component in the broadband network responsible for auto-configuration of the CPE for advanced services.
CPE	Customer Premises Equipment.
Femtozone	An area mapping to the coverage footprint of a one of more Femto Access Point (FAP) clusters that presents allowed users with Femtozone Services capabilities
Femtozone Services	Value-added services (in addition to voice and data) that are delivered within a Femtozone
Femtozone Application	Software application that implements **Femtozone Services**
Femtozone Application Platform	An additional layer of functionality provided in the Femto Access Point, which enables Femtozone Applications.

2.4 Abbreviations

This Technical Report uses the following abbreviations:

API	Application Program Interface
CWMP	CPE WAN Management Protocol
DM	Data model
FAP	Femto Access Point
GPS	Global Positioning System
HTML	Hypertext Markup Language
IPv6	Internet Protocol Version 6
LAN	Local Area Network
SMS	Short Message Service
TR	Technical Report
WAN	Wide Area Network
WG	Working Group
XML	Extensible Markup Language

3 Technical Report Impact

3.1 Energy Efficiency

TR-262 has no impact on Energy Efficiency.

3.2 IPv6

TR-262 has no impact on IPv6.

3.3 Security

TR-262 has no impact on Security.

4 Femto Component Objects Definitions

The normative definition of the Femto Component Objects is done with its own DM Instance documents (see TR-106 [2] Annex A). Table 1 lists the DM Instances documents that had been defined at the time of writing and gives links to the associated XML and HTML files.

Note that, because new minor versions of the Device:1 data model can be defined without re-publishing this Technical Report, the table is not necessarily up-to-date. An up-to-date version of the table can always be found at http://www.broadband-forum.org/cwmp.

Table 1 – Femto Component Objects versions

Version	DM Instance	Technical Report	XML and HTML[1]
1.0	tr-262-1-0.xml	TR-262	http://broadband-forum.org/cwmp/tr-262-1-0.xml
			http://broadband-forum.org/cwmp/tr-262-1-0.html

[1] For a definition of the naming conventions used in the XML and HTML files refer to TR-106 [2].

The next table shows the usage of the component objects in the different root models:

Table 2 – Femto Component Objects usage

TR-262 Version	DM instance	Root model	Used components
1.0	tr-098-1-4.xml	InternetGatewayDevice:1.10	FAP
			FAP.GPS
			FAP.Tunnel
			FAP.PerformanceMgmt
			FAP.ApplicationPlatform
1.0	tr-181-1-2.xml	Device:1.9	FAP
			FAP.GPS
			FAP.Tunnel
			FAP.PerformanceMgmt
			FAP.ApplicationPlatform
1.0	tr-181-2-4.xml	Device:2.4	FAP
			FAP.GPS
			FAP.PerformanceMgmt
			FAP.ApplicationPlatform

Annex A Queuing Model for an IGD:1 based FAP

Figure 1 shows the queuing and bridging model for a CPE based on the InternetGatewayDevice:1 root data model defined in TR-098 [3]. The FAPService:2 utilizes the QueueManagement and Layer3Forwarding framework as defined in the root data model in order to apply QoS differentiation to packets before and after applying IPsec encapsulation.

The elements of this model are described in the following sections.

Note – the queuing model described in this Annex is intended only to clarify the behavior of the related data objects. There is no suggestion that an implementation need be structured to conform to this model.

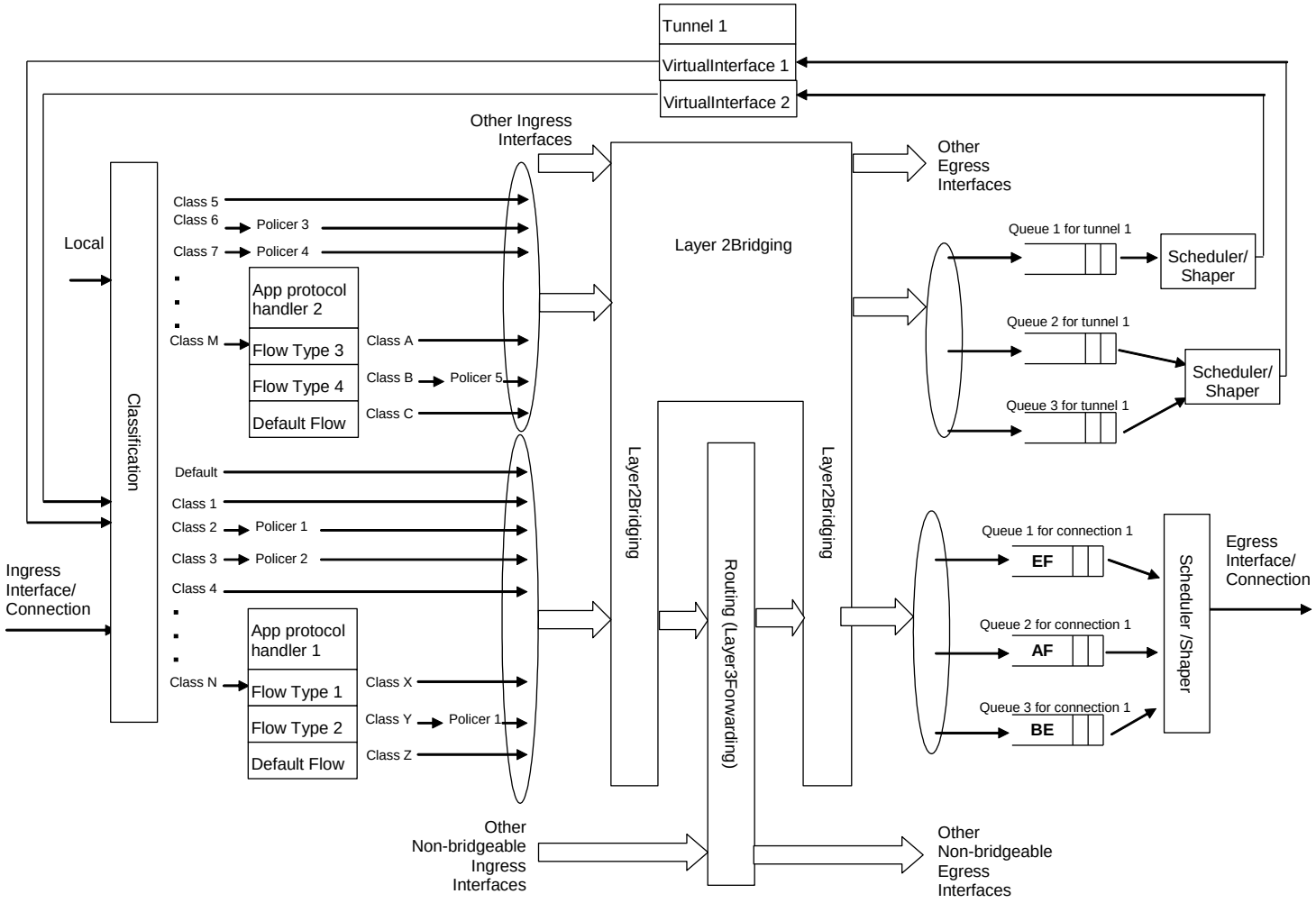

Figure 1 – Queuing Model for an Internet Gateway Device Supporting FAPService:2

A.1 Upstream Packet Classification

There is a single classifier object that is used both before and after packets are sent to the VirtualInterface object that represents the IPsec tunnel(s). (As can be seen in the Figure, packets can be viewed as passing twice through the entire QoS management framework.)

The QueueManagement Classification, App and Flow tables are used to select different classes of traffic. For example, FAP's conversational and streaming traffic can be associated with one or two QueueManagement.Queue instances and other FAPs' QoS classes can be associated with a 3rd Queue. Classification outcome alternatives are identical to the root data model.

Since the CPE might have LAN interfaces that receive additional traffic, the VirtualInterface can be associated with a 2nd layer of Queues so that the IPsec traffic receives the appropriate QoS with respect to other application traffic. It is also possible to direct all the IPsec packets through a PPPoE interface.

A.2 Policing

Policing is configured as defined for the root data model. Policing can be performed on FAPService packets both before and after IPsec tunneling.

A.3 Queuing and Scheduling

Queuing and scheduling is configured as defined for the root data model except that a *.FAP.Tunnel.VirtualInterface* instance can be used as an egress interface.

In the upstream direction, FAPService packets can first be queued and scheduled before IPsec tunneling. A different set of queues and schedulers can be employed for the packets after they have received the tunneling IP header.

A.4 Tunnel

The policies governing establishment of the IPsec tunnel are provisioned in crypto profiles stored in the *.FAP.Tunnel.CryptoProfile.{i}* object table and secret objects stored in the *.FAPService{i}.Transport.Security.Secret.{i}.* object table. The crypto profile determines which ciphering and hashing algorithms are employed for the tunnel. Each crypto profile instance defines a separate tunnel (IKE instance). The Secret objects define credentials to be used to authenticate the tunnel setup. The *.FAP.Tunnel.VirtualInterface* object is employed as an egress interface for Queue objects (one or more queues may be associated with a VirtualInterface instance) and ingress interface for Classification objects (encrypted packets can be reclassified to differentiate QoS treatment from packets arriving over LAN interfaces).

The *.FAP.Tunnel.IKESA* and *.FAP.Tunnel.ChildSA* objects provide information about currently established tunnels. This information is not retained beyond the lifetime of the tunnel.

In order to set up tunnel objects, first a Secret or Pkey object is created Thereafter one or several CryptoProfile instances are defined (typically one) and associated with an authentication scheme (Pkey and/or Secret) using the AuthMethod parameter. Thereafter one or several VirtualInterface instances are created and associated with a CryptoProfile instance. In order to create two ChildSA pairs with different outer DSCP marking, two VirtualInterface instances are created, both are associated with the same CryptoProfile instance and the MaxChildSA parameter is set to at least 4. (If the MaxChildSA parameter is set equal to 2, there will instead be separate IKE sessions for each VirtualInterface.) DSCP marking policy can be configured for the outside IPsec tunnel header.

The association of a Queue object with a VirtualInterface instance creates a packet processing association for the WAN-facing direction. The device automatically creates the corresponding Layer3Forwarding rule for the reverse direction.

The current version of the data model is intended to support tunneling of traffic to/from the local interface.

A.5 Layer3Forwarding

Layer3Forwarding is envisioned to be configured on the upstream-side of the tunnel object. Implementations and those configuring devices should be careful to avoid associating the Layer3Forwarding object with traffic both before and after the IPsec tunnel, as this could allow undesired packets to traverse the tunnel.

Appendix I. Femtozone Applications

I.1 Background – Femtozone Applications

Femtozone Applications are services that can be provided by a Femto Access Point, in addition to "traditional" voice and data access services. These Femtozone Applications take advantage of certain unique characteristics of the Femto Access Point, such as its strong notion of presence, or its ability to create local direct connectivity between a mobile handset and other devices in the LAN. As their name suggests, Femtozone Applications typically use the notion of a mobile handset entering or exiting the Femtozone as a trigger or a qualifier for their operation, and they are often local in nature.

A wide variety of Femtozone Applications have emerged, and they may be further categorized based on their functionality and on the specific unique characteristic(s) of the Femto cell used as a basis for the application. Broadly speaking, Femtozone Applications can be classified in three classes:

- *Presence-Based Femtozone Applications*. These applications use Presence information from the Femto Access Point to build the desired service. An example of applications in this class is an application that automatically sends an alert (e.g., an SMS) to a pre-configured remote handset as a specific mobile user enters or leaves the Femtozone.
- *LAN-Interactive Femtozone Applications*. These applications, in addition to the presence information, use the capability of the Femto Access Point to create direct connectivity between a mobile handset in the Femtozone and other devices in the LAN. An example of applications in this class is an application that, as a mobile user enters the Femtozone, automatically displays pictures stored in that handset on another device connected to the LAN (say, a Picture Frame).
- *Advanced Femtozone Applications*. These applications may use information from more than one Femto Access Point to offer unique services. A representative example is an application capable of pinpointing the location of a handset with great accuracy (say, a couple of feet) in a store by using triangulation from three or more access points.

Femtozone Applications may comprise local Application Clients that may run directly on the Femto Access Point or on the home gateway connected to the Femto Access Point via the LAN.

In both these scenarios, in order to enable Femtozone Applications, a [thin] layer of functionality needs to be provided in the Femto Access Point. This additional layer of functionality is referred to as the *Femtozone Application Platform*.

I.2 Femtozone Application Platform Functionality

The Femtozone Application Platform enables Femtozone Applications and is implemented as a layer of functionality on top of for the existing functionality already defined in the Femto Access Point to provide "traditional" voice and data access services. The purpose of the Femtozone Application Platform is twofold:

I.) Expose the desired Femto Access Point functionality *at the application layer* through a set of APIs, accessible *locally* by Femtozone Application Clients running in the Femto Access Point itself, or, more commonly, on the home gateway or other local gateway; and

II.) Implement any additional required functionality at the application layer not already provided by existing Femto Access Point functionality (Note: by ""Existing Femto Access Point Functionality" we refer to the functionality that has been defined and is commonly provided in the Femto Access Point to support "traditional" voice and data access services).

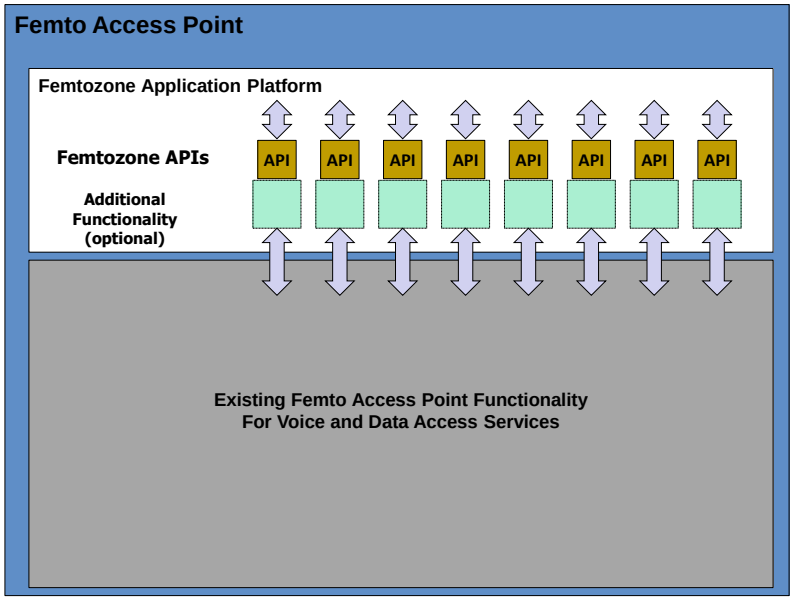

Figure 2 - Femto Access Point with Femtozone Application Platform.

Specifically:

- The set of *Femtozone APIs* exposes certain functionality of the Femto Access Point to the Femtozone Application platform running either locally on the Femto Access Point, or on the home gateway connected to the Femto Access Point, or on the core network.

  Each Femtozone API exposes a given set of functionality, organized by functional blocks (for a representative list of APIs, see below).

  The functionality that these APIs expose to the Femtozone Applications includes existing functionality that is already defined in the Femto Access Point to provide voice and data

access services. In this case, these APIs simply expose such existing functionality *locally at the application layer*, so that it can be used by Femtozone Applications.

Clearly, since a major role of the Femto Service Platform is to expose certain Femto Access Point functionality locally at the application layer, the Femtozone APIs are intrinsically related to the rest of the Femto Access Point functionality, and the data model defining the Femtozone APIs should be thought as an addition to the data model of the Femto Access Point.

- The Femtozone Application Platform includes Application layer functionality to support the management and deployment of Femtozone Applications, and additional application layer functionality to support specific applications.

  Examples of such functionality include: layer security mechanisms, LAN device discovery mechanisms, notification mechanisms, policy mechanisms, application management mechanisms, etc. When this functionality is present, it is exposed locally to the Femtozone Applications via the Femtozone APIs described above. (The details of this optional additional functionality are outside the scope of this document.)

I.3 Femtozone Application Platform Data Model

This document defines the data model of the Femtozone APIs specified in the Release 1 Operational and Implementation Specifications [8] described above.

In this document a new component *FAP.ApplicationPlatform* is specified, which defines the Femtozone Application Platform and contains the parameters needed to support Femtozone Applications.

It is important to note that Femtozone Applications are agnostics of the air interface of the Femto Access Point. In other words, the operation of the Femtozone Application Platform and Femtozone APIs in particular do not depend on the specific radio technology used in the Femto Access Point.

In fact, the Femtozone APIs refer to functional services and their operation should be thought as occurring entirely at the service/application layer. Therefore, they are radio-technology independent.

Of course, when the Femtozone APIs are applied to a Femto Access Point using a specific radio technology, they expose functional services as implemented in that technology, with the assumption that one or more implementation for that functional service is available or will be developed at the lower layers or at the application layer (In case of multiple radio technologies offering for a functional service, the Femtozone APIs expose the functional service implemented in the specific FAP for all radio technologies. In other words, the Femtozone APIs apply in identical fashion to functional services implemented in the FAP of any radio technology, and can not be restricted to only one radio technology or radio technology instance).

As such, the data model objects described in this document does not modify any existing Femto Access Point Data Model objects described in TR-196 Issue 2 [7].

It is important to note that in the case of existing functionality defined in the Femto Access Point, the *FAP.ApplicationPlatform* component only defines the *Femtozone API(s) that expose that functionality*, while the definition of the actual functionality remains unchanged.

I.4 FemtoApplicationPlatform component definition

The *FAP.ApplicationPlatform* component is defined as a new object alongside the existing FAPService.{i}.object defined in TR-196 Issue 2 [7], which is left unperturbed.

Having a single object to define the data model of the Femtozone Application Platform and all the Femtozone APIs reflects the fact that it is desirable for Femtozone Applications to see the Femtozone APIs as a single family of APIs used to access all the desired functionality in the femto cell. Indeed, the single object reflects the typical implementation of the Femtozone Application Platform, which as mentioned above, consists of a self-contained layer of software on top of the rest of the Femto Access Point functionality.

The component comprises the following objects:

- FAP.ApplicationPlatform.Control
- FAP.ApplicationPlatform.Capabilities
- FAP.ApplicationPlatform.Monitoring

The component defines the data model for the four Femtozone APIs defined in the Release 1 API Specifications of the Service SIG in the Femto Forum:

- **Femto Awareness**. Provides a subscription service that notifies applications when users enter, exit, transition within a Femtozone. Also allows application to query users in the Femtozone.
- **SMS**. Send SMS messages to one or more devices when in the Femtozone. Provides awareness of sent SMS message delivery status and incoming SMS messages.
- **MMS**. API to send MMS messages to one or more devices when in Femtozone. Provides awareness of sent MMS message delivery status and incoming MMS messages.
- **Terminal Location**. Supports queries for the location of UE(s) camped on a Femto Access Point.

End of Broadband Forum Technical Report TR-262

