



**SOCIETY OF CABLE
TELECOMMUNICATIONS
ENGINEERS, INC.**

ENGINEERING COMMITTEE
Data Standards Subcommittee

AMERICAN NATIONAL STANDARD

ANSI/SCTE 24-19 2004
(Formerly DSS 02-18)

IPCablecom CMS Subscriber Provisioning Specification

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1 SCOPE

1.1 Purpose of document

IPCablecom 1.0 service provisioning can be viewed as two distinct operations: Multimedia Terminal Adapter (MTA) provisioning and Call Management Server (CMS) subscriber provisioning. This Recommendation defines the interface used between the CMS and Provisioning Server for the exchange of service provisioning information.

The interface employs a Web Service model. Specified in Web Service Description Language (WSDL 1.1) [9] the interface transports XML encoded objects within Simple Object Access Protocol (SOAP) 1.1 [10] encoded messages over an HTTP 1.1 transport. This interface is secured via IPSec.

The data model transported upon this interface is specifically designed to be extensible, allowing incorporation of as yet undefined IPCablecom features and specific vendor extensions.

1.2 Document Scope

The scope of this document is limited to the provisioning of an IPCablecom 1.0 CMS by a single service provider. Additionally:

- The CMS provisioning interface is limited to the exchange of service activation data between the CMS and the PS. The interface between the PS and the BackOffice Operations Support System (OSS) is out of scope.
- CMS element management and network element provisioning (dial plans, etc.) are out of scope.
- Customer record creation/billing is considered part of the back office OSS application and is currently out of scope.
- This specification serves as a framework for IPCablecom CMS subscriber provisioning. Implementations should adhere to this recommendation as appropriate but may not always support all elements, parameters and features as shown in the annexes.

1.3 Requirements

If this Recommendation is implemented, the key words “MUST” and “SHALL” are to be interpreted as indicating a mandatory aspect of this specification. The key words indicating a certain level of significance of particular requirements that are used throughout this Recommendation are summarized in the table below:

“MUST”	This word or the adjective “REQUIRED” means that the item is an absolute requirement of this specification.
“MUST NOT”	This phrase means that the item is an absolute prohibition of this specification.
“SHOULD”	This word or the adjective “RECOMMENDED” means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before choosing a different course.
“SHOULD NOT”	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should 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 truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

2 REFERENCES

2.1 Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

- [1] ANSI/SCTE 24-1 2001 (formerly DSS 00-02) – IP-Cablecom Part 1: Architecture Framework for the delivery of time critical services over cable television networks using cable modems.
- [2] ANSI/SCTE 24-5 2001 (formerly DSS 00-10) – IP-Cablecom Part 5: Media Terminal Adapter (MTA) device provisioning requirements for the delivery of real time services over cable television networks using cable modems.
- [3] ANSI/SCTE 24-10 2002 (formerly DSS 02-16) - IP-Cablecom Part 10: Security Specification.
- [4] ANSI/SCTE 24-13 2001 (formerly DSS 00-18) – IP-Cablecom Part 13: Electronic Surveillance Standard.
- [5] ISO 639-2:1998 - “Codes for the Representation of Names of Languages-Part 2: Alpha-3 Code”
- [6] IETF RFC 1123 - “Requirements for Internet Hosts - Application and Support”, Internet Engineering Task Force, October, 1989.
- [7] ANSI/SCTE 24-2 2001 (formerly DSS 00-01) – IP-Cablecom Part 2: Audio codec requirements for the provision of bidirectional audio service over cable television networks using cable modems.
- [8] ANSI/SCTE 24-3 2001 (formerly DSS 00-03) – IP-Cablecom Part 3: Network call signaling protocol for the delivery of time critical services over cable television networks using cable modems.
- [9] Web Services Description Language. <http://www.w3.org/TR/wsdl>
- [10] Simple Object Access Protocol. <http://www.w3.org/TR/SOAP>
- [11] XML Protocol. <http://www.w3.org/2000/xml>

2.2 Informative References

The following documents may provide valuable information to the reader but are not required when complying with this standard.

- [12] “Basic Residential Feature Descriptions for IP-Cablecom-Based VOIP Services”, PKT-TR-VoIPBRF-R01-000608, Cable Television Laboratories, Inc., June 8, 2000.
- [13] “Enhanced Residential Feature Descriptions for IP-Cablecom-Based VOIP Services”, PKT-TR-VoIPERF-R01-000831, Cable Television Laboratories, Inc., August 31, 2000.
- [14] “PacketCable Electronic Surveillance Call Flows Technical Report”, PKT-TR-ESCF-V01-991229, Cable Television Laboratories, Inc., December 29, 1999.
- [15] IETF RFC 2139, RADIUS Accounting, April 1997.
- [16] COMMON LANGUAGE(R) General Codes – Telecommunications Service Providers IAC Codes, Exchange Carrier Names, Company Codes - Telcordia and Region Number: BR-751-100-112. Issue date: 2000/07/31.
- [17] Telcordia Local Exchange Routing Guide (LERG). Telcordia Technologies, Inc.
- [18] IETF RFC 3588, Diameter Base Protocol, September 2003.

2.3 Reference Acquisition

IETF RFCs:

- Internet Engineering Task Force (IETF) Secretariat c/o Corporation for National Research Initiatives, 1895 Preston White Drive, Suite 100, Reston, VA 20191-5434, Phone 703-620-8990, Fax 703-620-9071, Internet: www.ietf.org/

ISO Standards:

- International Organization for Standardization (ISO) 1, rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland, Phone 41-22-749-01-11; Fax 41-22-733-34-30, Internet: www.iso.org/

Telcordia Documents:

- Telcordia Technologies, 445 South Street, Morristown, NJ 07960-6438, Phone 973-829-2000, Internet: www.telcordia.com/

3 TERMS AND DEFINITIONS

This document defines the following terms:

Active	A service flow is said to be “active” when it is permitted to forward data packets. A service flow must first be admitted before it is active.
Endpoint	A Terminal, Gateway or Multipoint Conference Unit.
Gateway	Devices bridging between the IP/Cablecom IP Voice Communication world and the PSTN. Examples are the Media Gateway which provides the bearer circuit interfaces to the PSTN and transcodes the media stream, and the Signaling Gateway which sends and receives circuit switched network signaling to the edge of the IP/Cablecom network.
Header	Protocol control information located at the beginning of a protocol data unit.
Key	A mathematical value input into the selected cryptographic algorithm.
Key Management	The process of distributing shared symmetric keys needed to run a security protocol.
Pre-shared Key	A shared secret key passed to both parties in a communication flow, using an unspecified manual or out-of-band mechanism.
Public Key	The key used in public key cryptography that belongs to an individual entity and is distributed publicly. Other entities use this key to encrypt data to be sent to the owner of the key.

4 ABBREVIATIONS

This Recommendation defines the following abbreviations.

AAA	Authentication, Authorization and Accounting
BPP	Basic Port Provisioning
CFP	Call Feature Provisioning
CID	Circuit ID (Pronounced “kid”). This uniquely identifies an ISUP DS0 circuit on a Media Gateway. It is a combination of the circuit’s SS7 gateway point code and Circuit Identification Code (CIC). The SS7 DPC is associated with the Signaling Gateway that has domain over the circuit in question.
CM	DOCSIS Cable Modem
CMS	Cryptographic Message Syntax
CMS	Call Management Server. Controls the audio connections. Also called a Call Agent in MGCP/SGCP terminology. This is one example of an Application Server.
CMTS	Cable Modem Termination System. The device at a cable head-end which implements the DOCSIS RFI MAC protocol and connects to CMs over an HFC network.
Codec	COder-DECoder
CSR	Customer Service Representative
DOCSIS™	Data-Over-Cable Service Interface Specifications
DQoS	Dynamic Quality-of-Service. Assigned on the fly for each communication depending on the QoS requested.
ESP	IPSec Encapsulating Security Payload. Protocol that provides both IP packet encryption and optional message integrity, not covering the IP packet header.
FQDN	Fully Qualified Domain Name. Refer to IETF RFC 821 for details.
HTTP	Hypertext Transfer Protocol. Refer to IETF RFC 1945 and RFC 2068.
IC	Inter-exchange Carrier

IETF	Internet Engineering Task Force. A body responsible, among other things, for developing standards used on the Internet. See www.ietf.org for details
IKE	Internet Key Exchange. A key-management mechanism used to negotiate and derive keys for SAs in IPSec.
IP	Internet Protocol. An Internet network-layer protocol.
IPSec	Internet Protocol Security. A collection of Internet standards for protecting IP packets with encryption and authentication.
ITU	International Telecommunications Union
ITU-T	International Telecommunications Union–Telecommunications Standardization Sector
LNP	Local Number Portability. Allows a customer to retain the same number when switching from one local service provider to another.
MC	Multipoint Controller
MG	Media Gateway. Provides the bearer circuit interfaces to the PSTN and transcodes the media stream.
MGC	Media Gateway Controller. The overall controller function of the PSTN gateway. Receives, controls and mediates call-signaling information between the IP/Cablecom and PSTN.
MGCP	Media Gateway Control Protocol. Protocol follow-on to SGCP. Refer to IETF 2705.
MIB	Management Information Base
MTA	Multimedia Terminal Adapter. Contains the interface to a physical voice device, a network interface, CODECs, and all signaling and encapsulation functions required for VoIP transport, class features signaling, and QoS signaling.
NCS	Network Call Signaling
OSS	Operations Support Systems. The back-office software used for configuration, performance, fault, accounting, and security management.
PCM	Pulse Code Modulation. A commonly employed algorithm to digitize an analog signal (such as a human voice) into a digital bit stream using simple analog-to-digital conversion techniques.
PCSP	IP/Cablecom CMS Subscriber Provisioning.
PS	Provisioning server.
PSTN	Public Switched Telephone Network
QCIF	Quarter Common Intermediate Format
RAS	Registration, Admissions and Status. RAS Channel is an unreliable channel used to convey the RAS messages and bandwidth changes between two H.323 entities.
RFC	Request for Comments. Technical policy documents approved by the IETF which are available on the World Wide Web at http://www.ietf.cnri.reston.va.us/rfc.html
SDP	Session Description Protocol
SNMP	Simple Network Management Protocol
SOAP	Simple Object Access Protocol
STP	Signal Transfer Point. A node within an SS7 network that routes signaling messages based on their destination address. This is essentially a packet switch for SS7. It may also perform additional routing services such as Global Title Translation.
TD	Timeout for Disconnect
TFTP	Trivial File Transfer Protocol
TLV	Type-Length-Value. A tuple within a DOCSIS configuration file.
UDP	User Datagram Protocol. A connectionless protocol built upon Internet Protocol (IP).
VoIP	Voice over IP

5 BACKGROUND

5.1 Service Goals

5.2 IPcablecom Reference Architecture

Figure 1 shows the reference architecture for the IPcablecom 1.0 Network. Refer to the IPcablecom Architecture Document [1] for more detailed information on this reference architecture.

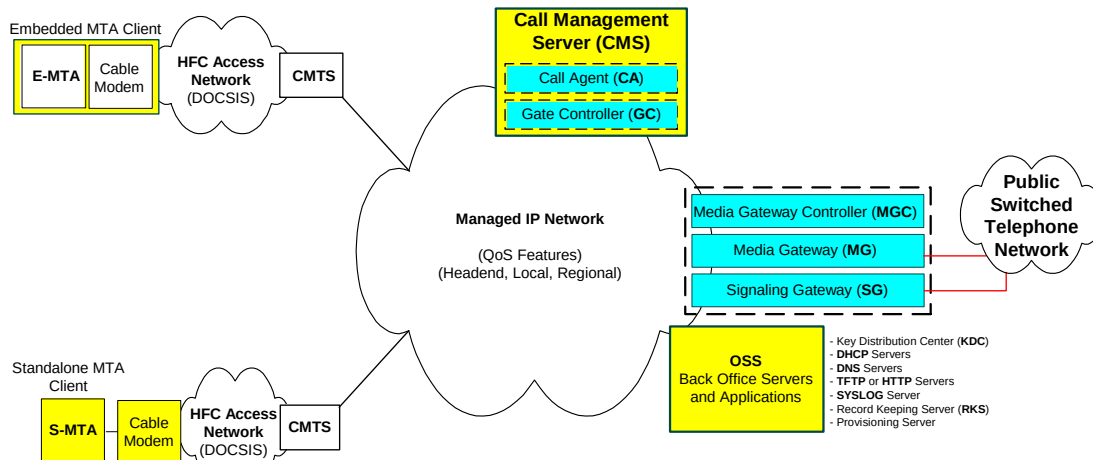


Figure 1. IPcablecom 1.0 Network Component Reference Model (partial)

5.3 Components and Interfaces

Provisioning is defined as the operations necessary to provide a specified service to a customer. IPcablecom service provisioning can be viewed as two distinct operations: MTA provisioning and CMS subscriber provisioning. Figure 2 presents the provisioning related interfaces maintained by the PS to various IPcablecom elements. Interfaces not explicitly labeled are undefined and out of scope for IPcablecom.

This document is intended to set the requirements for the provisioning interface between the CMS and the PS (Pkt-prov-p1).

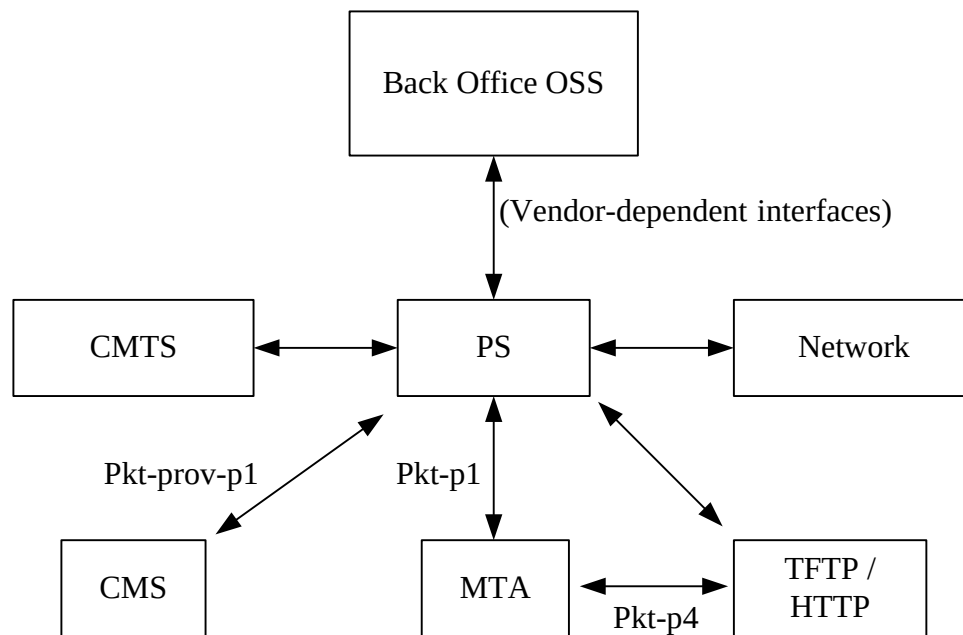


Figure 2. Provisioning Component Interfaces

5.4 Components

5.4.1 Back-office OSS (Service Provider Business and Service Management Systems)

These are the Operations Support Systems (OSSs) that a service provider uses to manage customers and other components that make up their business. These systems provide the IPCablecom provisioning process with service orders to activate services for customers. These systems may also receive accounting or usage data used to create customer-billing events.

5.4.2 Provisioning Server

This system forms the interface between the provider's OSSs and the IPCablecom elements. IPCablecom does not address the implementation of this system or its relationship to other OSSs that a service provider might employ.

The Provisioning Server is defined in [2] as consisting of a provisioning application that contains provisioning logic and a provisioning SNMP entity that provides access to active components. Here we will refer to the Provisioning Server without distinguishing between these two entities.

5.4.3 CMS

The Call Management Server component is described in [1]. This component provides call control and signaling-related services for the MTA and CMTS components in the IPCablecom network.

5.4.4 MTA

A Media Terminal Adapter is an IPCablecom client device that contains a subscriber-side interface to the customer's CPE (e.g. telephone) and a network side signaling interface to call control elements in the network. This component is described in [1].

5.4.5 TFTP

A configuration file service that is the basis for most device configuration in an IPCablecom network. This could be a standalone TFTP Service that delivers statically-defined files to devices or a dynamic service that creates configurations on-the-fly from other data sources.

5.4.6 CMTS

The Cable Modem Termination System provides modem control and packet delivery in and out of an RF network. The CMTS also provides data connectivity to wide-area IP networks. This component is described in [1].

5.4.7 Network

The collection of network elements that may be required to deliver IPCablecom signaling, management, and transport packets to and from service provider networks.

5.5 Interface Descriptions

5.5.1 Pkt-p1

This interface is defined in [2].

5.5.2 Pkt-p4

This interface is defined in [2].

5.5.3 Pkt-prov-p1

The interface defined in this document.

6 ASSUMPTIONS

- The BackOffice OSS is responsible for coordinating endpoint updates with affected network entities (MTAs, CMTSs, etc.) and the CMS.
- CMS will not play a manager role nor does it specify SNMP communications to an MTA during CMS provisioning.
- The CMS and PS reside in the same secure provisioning domain. Security related information will be outlined in the IPCablecom Security Specification [3].

7 SUBSCRIBER PROVISIONING

Subscriber provisioning consists of:

- Customer record/billing support.
- Equipment setup/configuration.

7.1 Customer Records (Billing)

Establishment of a customer record that contains the information needed to deliver service, bill, and collect payment from a customer. Customer record creation/billing is considered part of the back office OSS application and is currently out of scope for IPCablecom.

7.2 Equipment Setup and Configuration

This may include physical installation and/or connection of equipment as well as any software and/or database updates necessary to actually deliver the service to the customer. Equipment setup affects two major components in an IPCablecom environment.

- Customer premises equipment. For IPCablecom, this is the MTA. The provisioning for the MTA is defined in [2] and will not be discussed in this document.
- Call Management Server. Provisioning of the CMS itself can be broken down into two main areas: basic POTS provisioning and call feature provisioning.

7.2.1 CMS Basic POTS Provisioning (BPP)

BPP provides the CMS with the minimal set of data necessary for routing of simple telephony service (POTS) in the IPCablecom network. This minimal set of data consists of a telephone number mapped to its associated MTA's FQDN and NCS endpoint identifier. This data will be used to setup translation tables enabling the CMS to route calls to the appropriate device/port given a specific telephone number. BPP provisioning for each customer is required before that customer can receive any calls in an IPCablecom network.

7.2.2 CMS Call Feature Provisioning (CFP)

In addition to BPP, CFP is performed to provide call features to a customer. CFP is more complicated than BPP as the parameters passed may vary on a feature-by-feature basis and may also be dependent on vendor specific implementations. Additional detailed CFP analysis is considered for future releases.

7.3 Static Versus Dynamic Subscriber Provisioning Data

Data required by the CMS for subscriber provisioning falls into two classifications:

1. Static, billed, permanently assigned service state. This data does not change call to call. Examples would be DQoS settings, call feature subscribed/non-subscribed states, caller ID information, etc.
2. Dynamic, non-billed, semi permanent service state. Often this information is subscriber alterable, either at an endpoint via *XX key code or via a web interface into the CMS. An example would be the user settable parameters of a call feature, such as Call Forward Busy Line (CFBL). The CFBL forwarding number is dynamic, non-billed service state. The subscribed/non-subscribed state of CFBL is static data maintained by the PS.

In the IPCablecom CMS/PS scope, the PS owns all static provisioning state, and the CMS owns all dynamic provisioning state.

8 REQUIREMENTS

8.1 General Requirements

- The interface MUST make no assumptions regarding PS and CMS implementation technologies.

Multiple partnering vendors will undoubtedly provide CMS and PS implementations on various hardware, software, and development language platforms. A platform and language neutral interface is required.

- The interface MUST support Basic POTS Provisioning.

The interface's data model MUST include the minimum amount of information required to support basic POTS service.

- The interface MUST support Call Feature Provisioning.

The interface's data model MUST support subscription to any IPCablecom call feature as defined in [12] and [13].

3. The interface's data model **MUST** be extensible.

The present focus of the interface is telephony data. However, to the extent possible, the interface should be extensible for future IP-Cablecom Multimedia services. It is desirable to have a single, extensible provisioning data model and transport to support all IP-Cablecom features and capabilities, some of which are not yet defined.

- The interface **MUST** not impact any MTA operations in progress.

Endpoint specific data may be added, deleted, or modified on the MTA without affecting other MTA endpoints or sessions in progress. CMS endpoint provisioning scenarios that would result in an endpoint/MTA to be taken out of service must be carefully documented.

- The interface **MUST** be capable of accommodating present (NCS) and future signaling protocols.

8.2 Transport Requirements

- The transport **MUST** make no assumptions regarding the physical networking infrastructure between a PS and a CMS.

It is anticipated that multiple service providers will be interoperating over a single managed network. Thus, multiple enterprises will be communicating, potentially using CMS and PS implementations from various vendors, over various network infrastructures (firewalls, proxies, etc.). The CMS/PS transport protocol should facilitate the ability to penetrate arbitrary network infrastructure.

- The transport **MUST** support unidirectional transfer of single data model objects from the PS to the CMS.
- The transport **MUST** support efficient transaction of multiple data model objects from the PS to the CMS.
- The transport **MAY** support unidirectional transfer of single data model objects from the CMS to the PS.
- The transport **MAY** support efficient streaming of multiple data model objects from the CMS to the PS.
- The transport **MUST** include semantics to support new, updated, and removed data model objects.
- The transport **MUST** support informational requests between PS and CMS.
- The transport **MUST** handle conditions such as CMS busy, errors etc.
- The transport **MUST** provide positive/negative acknowledgement of operation received.

The transport **MUST** implement an at-least-once type of message semantics. The sender **MUST** not discard its request until the receiver acknowledges it (acknowledgements are not acknowledged.) The transport must be able to detect data corruption during transport, etc. and notify the sender of such conditions.

- The transport **MUST** provide positive/negative acknowledgement of operation handled.
- The PS **MUST** be able to initiate a transfer of data model objects.
- The transport **MUST** be secure.

9 DATA MODEL

This section provides a high level description of the PCSP data model and its XML encoding. The normative, authoritative definition of the data model and its encoding is found in the PCSP XML schema in Annex A.

9.1 Overview

The data model for IPCablecom CMS provisioning is displayed in Figure 3. It consists of two categories of entities:

- Objects
- Relations between objects

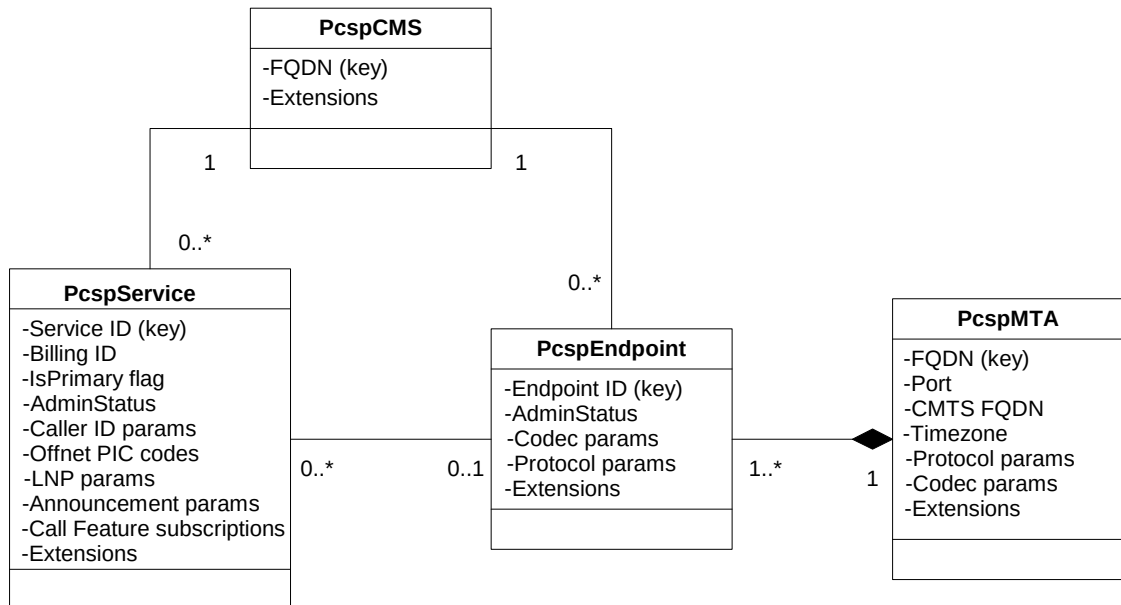


Figure 3. CMS Provisioning Data Model¹

The following entities MUST be supported:

- The PcspService object is the entity to which an IPCablecom 1.0 customer subscribes. It represents a phone number and all related functionality (call features, etc).
- A PcspMTA object represents a Media Terminal Adapter, which aggregates one or more endpoints physically contained within the MTA.
- The PcspEndpoint object represents a physical endpoint on an MTA/Gateway.
- A PcspCMS object maintains associations between endpoints/CMSs and services/CMSs.
- PcspRelations represent associations between objects. In Figure 3, they are presented as connections between objects.

PcspService and PcspEndpoint are distinct objects in order to support multiple services (phone numbers) per endpoint. Distinct PcspMta and PcspEndpoint objects allow an MTA's endpoints to be managed by different service providers. The PcspCms object essentially maintains a collection of endpoints and services.

All objects are extensible.

9.1.1 PcspService Object

The service object is the entity to which an IPCablecom 1.0 customer subscribes. It represents a phone number and all related functionality. The data model allows more than one service to be provisioned to a single endpoint.

The PcspService object contains the following generic information (for complete details, see the PCSP XML schema):

¹ Note, a project contain one or more activities, the "1..*" and other strings attached to on the project and activities association is called the *multiplicity* of the activity class within the relationship. See a Unified Modeling Language (UML) reference for additional detail.

- ServiceId - a unique identifier for the service.
- BillingId - the identifier of another service, which will be billed for activity on this service.
- IsPrimary flag - with multiple services provisioned upon an endpoint, one service MUST have this flag set to indicate the default service to use for outgoing calls.
- PrimaryRingPattern - index into MTA cadence table, selecting a ring pattern for this service.
- Administrative status of this service (suspended, enabled, number has changed. etc.)
- DisplayName - the display information used for Call Name Delivery feature (CNAM)
- DisplayNumber - the display information used for Call Number Delivery feature (CND)
- Announcement settings (enable, language, time zone, etc.)
- Carrier codes (long distance carrier code, intra-lata carrier code, international carrier code)
- Local number portability control (porting status, STP lookup flag, etc).
- Call features. A service includes a list of subscribed call feature objects (as described in [12] and [13])
- Extensions. This object is extensible in two locations: the main body of the object, and the call feature list.

9.1.2 PcspMta Object

A Media Terminal Adapter aggregates one or more endpoints (physically contained within the MTA). It contains the following generic information (for complete details, see the PCSP XML schema):

- MTA's FQDN, uniquely identifying this MTA.
- MTA's NCS listener port (default: 2427)
- FQDN of controlling CMTS.
- Time zone within which this MTA is physically located.
- Signaling protocol designation. This is the default protocol selection for all contained endpoints, unless overridden by an individual endpoint.
- Codec designation - default codec selection for all contained endpoints, unless overridden by an individual endpoint.
- A single point for extension.

9.1.3 PcspEndpoint Object

An endpoint is a physical port on a MTA/Gateway. It contains the following generic information (for complete details, see the PCSP XML schema):

- EndpointId - uniquely identifies this endpoint.
- Signaling protocol selection. Optionally overrides MTA setting.
- Administrative status of the endpoint (disconnected, normal service, test mode, etc.).
- Codec selection. Optionally overrides MTA setting.
- A single point for extension.

9.1.4 PcspCMS Object

This object maintains associations between Endpoints/CMSs and Services/CMSs. It contains the following generic information (for complete details, see the PCSP XML schema):

- FQDN uniquely identifying this CMS.
- A single point for extension.

9.1.5 Inter Object Relationships

Within Figure 3, the lines connecting the classes represent object "relations" (sometimes called associations). The relations depicted in Figure 3 MUST be supported:

- Service/CMS. A typical CMS will own a block of phone numbers.
- Endpoint/CMS. An endpoint requires a CMS for signaling purposes.