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Technical Report

Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Analysis of protocols for customer networks connected to TISPAN NGN

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

1 Scope

The present document contains informative text for analysing the set of protocols that can be used in the Customer Premises Networks (CPN) on the interfaces defined by stage 2 documents TS 185 003 [8] and TS 185 006 [7] related to service and transport layers. It will constitute a basic document produced by WG5, with a strong collaboration with WG3, to be used as the starting point for future technical specifications on that field.

2 References

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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

Not applicable.

2.2 Informative references

[1] DSL Forum TR-069 Amendment 1: "CPE WAN Management Protocol".

[2] HGI: "Home Gateway Technical Requirements Release 1".

[3] IETF RFC 3361: "Dynamic Host Configuration Protocol (DHCP-for-IPv4) Option for Session Initiation Protocol (SIP) Servers".

[4] IETF RFC 1433: "Directed ARP".

[5] ETSI ES 283 003: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Call Control Protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP) Stage 3".

[6]	ETSI TS 185 005: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Services requirements and capabilities for customer networks connected to TISPAN NGN".

[7]	ETSI TS 185 006: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); TISPAN Customer Devices architecture and interfaces".

[8]	ETSI TS 185 003: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Customer Network Gateway Architecture and Reference Points".

[9]	ETSI TS 183 019: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Network Attachment; User-Network Interface Protocol Definitions".

[10]	ETSI ES 282 001: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture".

[11]	IETF RFC 1661: "The Point-to-Point Protocol (PPP)".

[12]	IETF RFC 4058: "Protocol for Carrying Authentication for Network Access (PANA) Requirements".

[13]	IEEE 802.1x: "IEEE Standard for Local and metropolitan area networks - Port-Based Network Access Control".

[14]	IETF RFC 3748: "The Extensible Authentication Protocol (EAP) specification".

[15]	ETSI TS 183 065: "Telecommunications and Internet converged Services and Protocols for Advanced Networks(TISPAN); Customer Network Gateway Configuration Function; e_3 Interface based upon CWMP".

[16]	DSL Forum TR-098: "DSLHomeTM Internet Gateway Device Version 1.1 Data Model for TR-069".

[17]	IEEE 802.11: "IEEE Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[18]	ETSI ES 282 004: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture; Network Attachment Sub-System (NASS)".

# 3	Definitions and abbreviations

## 3.1	Definitions

For the purposes of the present document, the following terms and definitions apply:

CPN Device: device physically installed in the CPN allowing user access to network services; this can be a Customer Network Gateway with gateway functionalities towards the NGN, or a Customer Network Device being the end user terminal

Customer Network Device (CND): CPN device enabling the final user to have direct access to services through a specific user interface

NOTE:	CNDs can be dedicated to the internet, conversational and audio-video services. But they could be also Consumer Electronics equipment and other devices which may have nothing to do with these premium services (e.g. services performing a content sharing within a CPN, typically between a PC and a music system).

Customer Network Gateway (CNG): CPN device acting as a gateway between the CPN and the NGN

NOTE: CNG is able to perform networking functions from physical connection to bridging and routing capabilities (L1-L3), but also possibly implementing functions related to the service support (up to L7).

Customer Premises Network (CPN): in-house network composed by customer network gateway, customer network devices, network segments, network adapters and nodes

NOTE: Network segments are physical wired or wireless connections between customer premises network elements); network adapters are elements performing a L1/L2 conversion between different network segments; nodes are network adapters with L3 routing capabilities.

"Multiple" Play Services (can be: double, triple, quadruple etc.): Delivery by a single service provider of different types of concurrent services to one or multiple users within the same CPN. Services can be categorized in the following way: data (e.g. Web browsing, best effort traffic etc.), person(s) to person(s) communication, entertainment.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ACS	AutoConfiguration Server
ARF	Access Relay Function
ARP	Address Resolution Protocol
CND	Customer Network Device
CND-A	CND-Client Application
CND-AtF	CND Attachment Function
CND-CMF	CND Configuration and Maintenance Function
CND-CSMF	CND-Communication Services Media Function
CND-LAF	CND-Local Authentication Function
CND-NTF	CND-NAPT Traversal Function
CND-SIP UA	CND-SIP User Agent
CNG	Customer Network Gateway
CNG-ACF	CNG-Admission Control Function
CNG-AtF	CNG-Attachment Function
CNG-AuF	CNG-Authentication Function
CNGCF	Customer Network Gateway Configuration Function
CNG-CMF	CNG-Configuration and Maintenance Function
CNG-LF	CNG-Location Function
CNG-NFF	CNG-NAPT and Firewall Function
CNG-PCF	CNG Policy Control Function
CNG-PPF	CNG Plug and Play Function
CNG-UIF	CNG User reference point Function
CPN	Customer Premises Network
DB	DataBase
DHCP	Dynamic Host Configuration Protocol
EAP	Extensible Authentication Protocol
GUI	Graphic User Interface
HG	Home Gateway
IMS	IP Multimedia Subsystem
NAPT	Network Address and Port Translation
NTF	NAPT Traversal Function
PANA	Protocol for carrying Authentication for Network Access
P-CSCF	Proxy Call Session Control Function
PPP	Point-to-Point Protocol
RM	Remote Management
SIP	Session Initiation Protocol
WAN	Wide Area Network

4   Reference Architecture

The present document is based on the architecture defined in TS 185 003 [8] and TS 185 006 [7]. Figure 4.1 shows all the interfaces analysed in the present document.
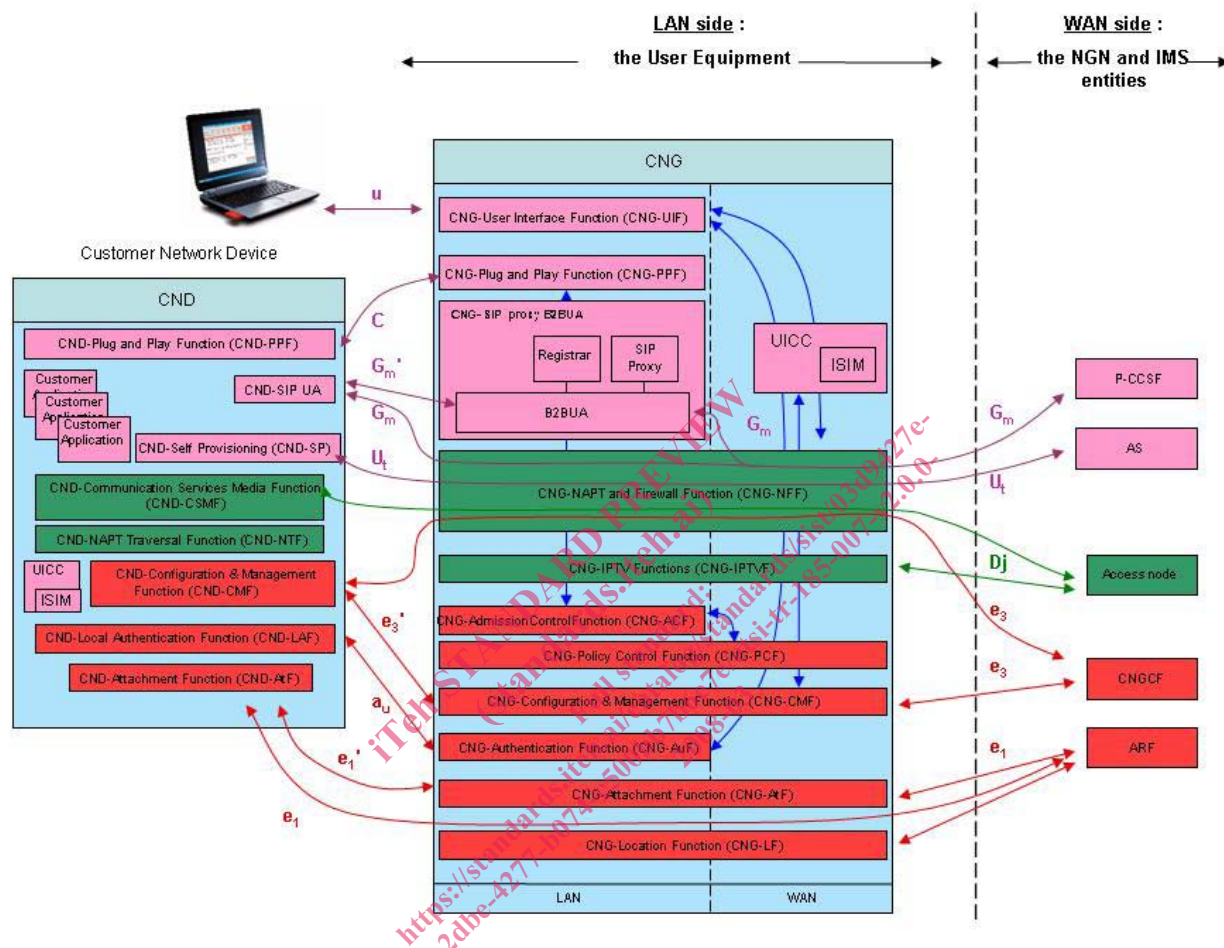

Figure 4.1: IMS CND connected to the NGN-IMS network through a CNG

5   Transport Layer

5.1   Attachment

5.1.1   Protocols on $e_1{}'$ Interface

The $e_1{}'$ interface is defined between the CND and the CNG-AtF. In comparison with e_1 interface, the $e_1{}'$ may implement only a subset of functionalities and due to the fact that $e_1{}'$ is inside the CPN some implementations can be excluded. In the following clause some examples of $e_1{}'$ usage are given.

The CNG-AtF provides IP addresses (IPv4 or IPv6 format) to the CND through the CND-AtF, it may also send some configuration information for the CND (typically through DHCP options).

The CNG-AtF gives private IP addresses to the CNDs if the CNG support NAT/NA(p)T function.

5.1.1.1 Hardware identities exchange

In order to mutually exchange hardware identities between a CND and the CNG, it is strongly recommended to implement the DSL Forum specification TR-069 Amendment-1 [1], Annex F (previously TR-111). This specification indicates the usage of the DHCP option 125 to exchange identities. If the CND support the TR-069 that means the CND implement the e_3 reference point also, it is possible apply the following implementation.

As defined in TR-069 [1] (Table 36) the hardware identity of any device, either CNG or CND, is represented by the DeviceId, that is composed by the following three parameters:

OUI Organizationally Unique Identifier of the device manufacturer. Represented as a six hexdecimal-digit value.

ProductClass Identifier of the class of product for which the serial number applies. That is, for a given manufacturer, this parameter is used to identify the product or class of product over which the SerialNumber parameter is unique.

SerialNumber Identifier of the particular device that is unique for the indicated class of product and manufacturer.

As specified in TR-069 (Annex-F Table 78):

- the CND provides its DeviceId to the CNG by using DHCP Option 125, Sub-Option codes 1 (OUI), 2 (SerialNumber), 3 (ProductClass);

- the CNG provides its DeviceId to the CND by using DHCP Option 125, Sub-Option codes 4 (OUI), 5 (SerialNumber), 6 (ProductClass).

5.1.1.2 Discovery of local SIP server within B2BUA

The CND device can discover the SIP server using DHCP option 120 "SIP Server DHCP Option" in case of IPv4 [3].

The CND device can discover the SIP server using DHCP option 21 "SIP Servers Domain Name List" or DHCP option 22 "SIP Servers IPv6 Address List" if using IPv6.

5.1.1.3 CND discovery

The CND discovery task is performed by the CNG and will discover CNDs in the CPN (for example through DHCP, UPnP). This data should be accessible to the CNGCF.

The following introduction to the CND discovery is coherent with the general architectural approach to management activities described in HGI Home Gateway Technical Requirements Release 1 [2] with some terminology modification in coherence with TISPAN terminology.

The CNG discovers the ID from connected CNDs by retrieving and combining information from its ARP [4] cache, DHCP repository, and UPnP Control Point cache. The ARP cache, DHCP repository and UPnP CP cache get their information from the various devices connected to the CNG. To avoid conflicts (arising because a device can be discovered by the ARP cache as well as the DHCP repository or the UPnP CP cache), a priority scheme is needed. HGI gives priority to the information retrieved from the DHCP repository.

The discovered ID information is used by the CNG to fill a Managed Devices Data Base that can be read by the CNGCF. In figure 5.1 the Managed Devices DB is given as a logically separate unit. However, it should be included in the CNG as an extension of the data model, for example extending the DSL Forum data model defined in TR-098 [16] specification as already proposed by HGI.
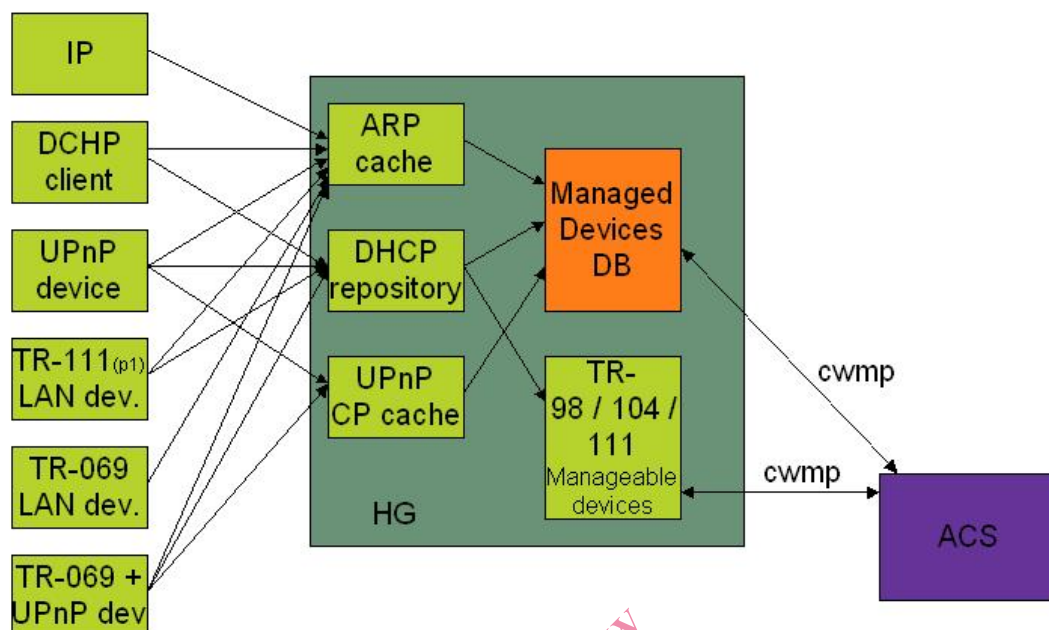
Figure 5.1: From HGI R1 spec - Device management and Discovery

The Managed Devices DB defined in HGI can be mapped in the CNG-CMF defined in TS 185 003 [8]. Note that in figure 5.1 HGI terminology is used. In this case ACS corresponds to CNGCF in TISPAN terminology and HG corresponds to CNG.

5.1.2 Protocols on a$_u$ Interface

The **a$_u$** reference point is defined between the Customer Network Device and the CNG-AuF. There may be two types of authentication/authorization, according to:

- CPN pairing based on specific CPN technologies (e.g. Wifi SSID, PLC technology).

- Access rights for some LAN services like the CNG Configuration (through the CNG-UIF).

In both cases the authenticated entity is a customer network device, while the authenticator is the CNG.

The following details are referred to the CNDs pairing procedures.

A typical scenario for mutual local authentication is shown on figure 5.2.