Converged Personal Network Service Requirements

Approved Version 1.0 – 23 Oct 2012

Open Mobile Alliance

OMA-RD-CPNS-V1_0-20121023-A

Contents

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1. Scope (Informative)

This Requirement Document (RD) contains use cases and defines the requirements for the Converged Personal Network Service-CPNS.

The CPNS Enabler enables CPNS entities in a personal network (PN) to consume services within that PN, services from and to other PNs, and services provided by service providers outside the PN.

2. References

2.1 Normative References

[RFC2119] "Key words for use in RFCs to Indicate Requirement Levels", S. Bradner, March 1997, URL:http://www.ietf.org/rfc/rfc2119.txt

2.2 Informative References

[OMA – CPNS] Converged Personal Network Service (CPNS) BoF - 27 Mar 2008
URL: http://www.openmobilealliance.org/

[OMADICT] "Dictionary for OMA Specifications", Version 2.7, Open Mobile Alliance™, OMA-ORG-Dictionary-V2_7, URL:http://www.openmobilealliance.org/

[OMA – Presence] "Presence", Open Mobile Alliance™, OMA-TS-Presence_SIMPLE-V2_0-20081223-C
URL: http://www.openmobilealliance.org/

[OMA – Privacy] "Privacy", Open Mobile Alliance™, OMA-RRP-Privacy-V1_0-20070807-A
URL: http://www.openmobilealliance.org/

[3GPP TS 22.004] 3GPP TS 22.004 V8.0.0 (2006-12) "General on supplementary services (Release 8)"

[3GPP TR 21.905] "Vocabulary for 3GPP Specifications"
E.g. 3GPP TR 21.905 (Release 9)
http://www.3gpp.org/ftp/Specs/html-info/21905.htm

[3GPP TR 22.944] "Report on service requirements for UE functionality split".
E.g. 3GPP TS 22.994 (Release 8)
http://www.3gpp.org/ftp/Specs/html-info/22004.htm

[3GPP TS 22.004] "General on supplementary services"
E.g. 3GPP TS 22.004 (Release 8)
http://www.3gpp.org/ftp/Specs/html-info/22004.htm

[3GPP TS 22.101] "Service aspects; Service principles"
E.g. 3GPP TS 22.101 (Release 9)
http://www.3gpp.org/ftp/Specs/html-info/22101.htm

[3GPP TS 22.105] "Service aspects; Services and service capabilities"
E.g. 3GPP TS 22.105 (Release 9)
http://www.3gpp.org/ftp/Specs/html-info/22105.htm

[3GPP TS 22.259] "Service requirements for Personal Network Management (PNM); Stage 1"
E.g. 3GPP TS 22.259 (Release 9)
http://www.3gpp.org/ftp/Specs/html-info/22259.htm

[3GPP TS 23.259] "Personal Network Management (PNM); Procedures and information flows"
E.g. 3GPP TS 23.259 (Release 9)
http://www.3gpp.org/ftp/Specs/html-info/23259.htm

[3GPP TS 24.259] Personal Network Management (PNM); Stage 3
E.g. 3GPP TS 24.259 (Release 8)
http://www.3gpp.org/ftp/Specs/html-info/24259.htm

3. Terminology and Conventions

3.1 Conventions

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in [RFC2119].

All sections and appendixes, except “release description”, “Scope” and “Introduction”, are normative, unless they are explicitly indicated to be informative.

The definitions from OMA CPNS partly overlap the definitions in other standards bodies, in particular the 3GPP PNM work (as defined in 3GPP TS 22.259, TS 23.259, TS 24.259). A mapping of the OMA definitions to the definitions in 3GPP can be found in Appendix C.

3.2 Definitions

CPNS Device	A Device [OMADICT] which embeds CPNS Entity(ies). CPNS Devices are assumed to have capabilities to process, store and/or render content, as well as to have communication interfaces that enable them to perform in different Modes in Personal Networks.
CPNS Server	Is a functional entity that provides resources to CPNS entities either in response to requests or in a Push mode. In addition, it interacts with other external entities, such as Content Provider Server etc., for the purpose of service provisioning.
CPNS User	The CPNS User is the person who uses CPNS Service using PNE(s)
External Entity	An entity not specified by the CPNS Enabler
Interactive Service	Interactive Service is the Service in which the user continuously interacts by providing inputs in order to change the content in real time
Mode	There are three identified Modes for CPNS Devices: PN GW, PNE and BOTH. The Modes that CPNS Devices can operate in depend on their capabilities, user’s configuration, or Operator’s policies.
Overlay Network	A virtual network which is built on top of an existing underlying network. Nodes in an Overlay Network can reach each other through multiple physical or logical links in the underlying network.
Peer-to-Peer Network	A network of connected PNE(s) where: • The PNE(s) form an Overlay Network, and • The process of establishing and maintaining connectivity between PNE(s) is handled mainly by the PNE(s) themselves, and • The PNE(s) can both offer and receive Services.
Personal Network (PN)	A collection of devices available to a CPNS User to consume and produce Services. All devices within a PN can be linked to a PN GW. A PN is a non-static collection and will vary over time. A PN consists at a minimum of a device acting in PN GW mode and another device acting in PNE mode.
Personal Network Element (PNE)	A functional entity making up a Personal Network. It may be used either to consume or provide content and/or Services (simultaneously or separately).
Personal Network Gateway (PN GW)	A functional entity which by interconnecting entities that reside in personal networks and wide area networks, instantiates a converged network that provides CPNS services. A PN GW at the device level enables a PNE to connect to a CPNS Server as well as other PNE in a same or another PN. This implies using a global network, such as a mobile network. At the service level, the PN GW manages the service access to and from PNEs, and the communication of capabilities information and statistics to the CPNS Server.
PN Inventory	List of PN(s) and devices belonging to a PN or multiple PNs

Service	See [OMA-DICT] A selection from the portfolio of offerings made available by a Service Provider.
Service Group	A set of PNEs and/or PNGW(s) that share the same service, data and applications between themselves and which can stretch over multiple Personal Networks
Zone	Specific geographic area
Zone based service	The certain CPNS service to be provided in a specific zone where the zone PN GW covers
Zone PN GW	The PN GW which provides a unique service/content in a zone

3.3 Abbreviations

CPNS	Converged Personal Network Service
ME	Mobile Equipment
MT	Mobile Termination
OMA	Open Mobile Alliance
PLMN	Public Land Mobile Network
PNE	Personal Network Element
PNM	Personal Network Management
TE	Terminal Equipment
UE	User Equipment
USIM	Universal Subscriber Identity Module
PAN	Personal Area Network

4. Introduction (Informative)

Users are increasingly connecting their devices to short-range Personal Networks (PNs) such as home networks, in-car networks and body area networks. Connecting these PNs to other networks can greatly extend the accessibility of the devices, or *Personal Network Elements* (PNE(s)), in the PNs, enabling a number of compelling Services, including access by PNE(s) to Services outside the PN (e.g. a Bluetooth-connected Personal Media Player (PMP) uses your cell phone's WAN connection to receive a video streamed from the Internet).

The goal of the OMA Converged Personal Network Services (CPNS) enabler is to provide application-layer support for ubiquitous access to Services in a *converged network*, which is a collection of individual networks that are interconnected by means of *PN Gateway* (PN GW) devices (in the example above, the cell phone assumes the role of a PN GW that converges the Bluetooth and cellular networks to enable video to be streamed to the PMP from a network server).

The CPNS Enabler facilitates access by devices in a PN to application or content Services that are available either locally in one or more other PNE(s), or residing in other networks, including other PNs or network elements accessed via a cellular or other WAN technology. The main objective of the enabler is to allow the PNE(s) that are part of the PN to access Services outside of the PN and for those PNE(s) to offer Services to PNE(s) in other networks. The CPNS Enabler provides a wide range of functionality to support converged-network Services, including (but not limited to) end-to-end management of Service sessions, Service publication and discovery, tailoring of Service characteristics based on PNE capabilities, remote management of PNE configuration data and firmware/software, collection of CPNS usage statistics, security and charging.

This enabler considers the interfaces and interactions between the key entities of the CPNS Enabler.

The main CPNS Enabler entities are:

- CPNS Server
- PN GW
- PNE

CPNS Server is an entity of CPNS Enabler that replies to requests from PN GW and ensures that the appropriate application is selected and appropriate content is provided to the PNE(s)

PN GW serves as an intermediary entity between the PNE(s) and other networks that forwards the requests from the PNE(s) to the other networks and the other way around

PNE(s) are connected to the PN GW and are used for rendering the content received from the PN GW or from each other. PNE(s) can also offer content and other Services to PNE(s) in the same PN and to entities in other networks.

The CPNS Enabler will support both the PN-to-cellular/WAN model and the Peer-to-Peer model.

Note: It is relevant to emphasise that the CPNS Enabler entities are described here more in the context of functionality than as physical network elements. For example, the CPNS Service discovery functionality could reside in the CPNS Server in PN-to-WAN/Cellular implementations, and in the PN GW in Peer-to-Peer implementations

4.1 Relevant Actors in the context of CPNS

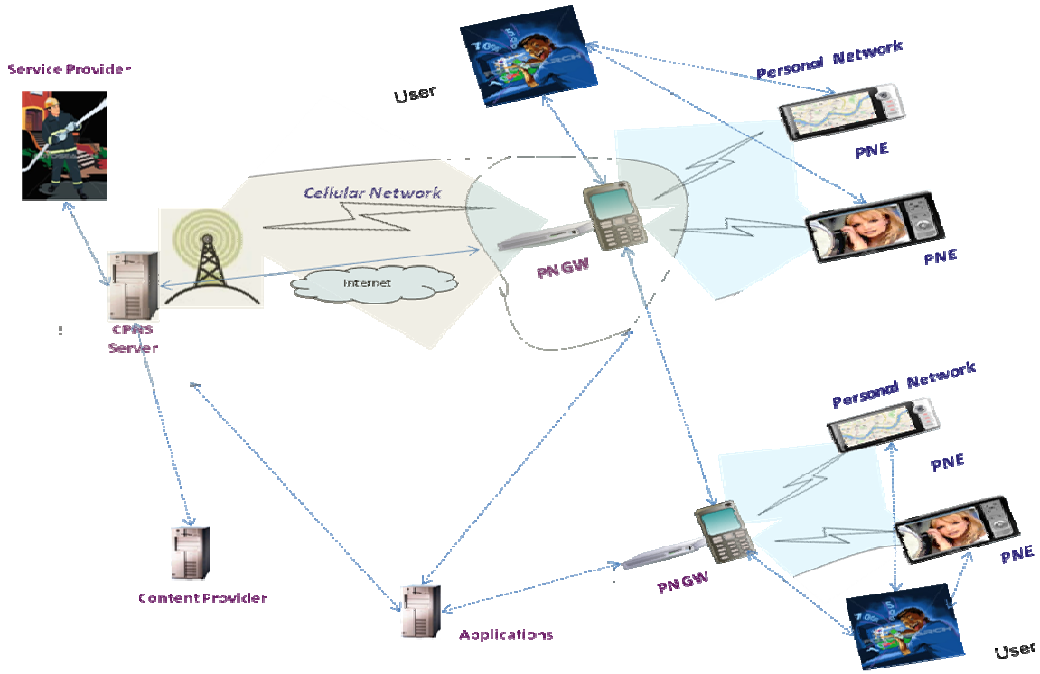

Figure 1 CPNS Enabler- Actors diagram

The Content Provider provides content to CPNS Users via the CPNS Enabler.

The Service Provider provides the CPNS Service to CPNS Users. Service Provider manages the CPNS Enabler User Profile data, based on different information, such as user related, device related and Service related information. Service Provider configures and maintains the CPNS Enabler and may have some other roles such as providing billing Service, subscription etc.

The Applications which may reside on the device and on the network provide functions to support the CPNS.

The CPNS User consumes the content provided by the Content Provider. The CPNS User exposes, modifies his/her CPNS User information, device information, context and preferences.

5. Release description (Informative)

5.1 Version 1.0

This first version specifies the CPNS requirements and describes some Use Cases.

The CPNS Enabler facilitates access by PNE(s) to services/contents that are available either locally or residing in other networks, including those offered by other devices or network elements accessible via a cellular or other WAN technology.

This first version introduces the CPNS Enabler, specifies the definitions of each actor and specifies the main Requirements (High-Level Functional requirements, Security, Charging, Administration, Configuration, Usability, Interoperability and Privacy).

6. Requirements (Normative)

6.1 High-Level Functional Requirements

Label	Description	Release
CPNS-HLF-001	The CPNS Enabler SHALL be able to assure that multiple delivery of services are supported by CPNS entities in parallel.	CPNS 1.0
CPNS-HLF-002	The CPNS Enabler SHALL enable the CPNS User to manage these different multiple services, i.e. to stop, start and switch between them.	CPNS 1.0
CPNS-HLF-003	The CPNS Enabler SHALL enable a CPNS entity to advertise the Services it offers, and discover and access the Services that are offered by other CPNS entities which belong to the same or different PNs.	CPNS 1.0
CPNS-HLF-004	The CPNS Enabler SHOULD allow CPNS Devices for changing Modes (e.g. in case that they are behaving as PNE(s) or PN Gateways) adaptively in terms of performing functions for the efficient use of device resources. **Informational Note**: In the context of this requirement, a CPNS Device is considered capable of changing Modes.	Future Release
CPNS-HLF-005	It SHOULD be possible for the CPNS Enabler to be informed about the current operational Mode of the CPNS Devices (e.g. behavior as PNE or PN Gateway) so that the network resources can be utilized more efficiently.	CPNS 1.0
CPNS-HLF-006	The CPNS Enabler SHALL support the functionality for managing the Service history of the PNE(s) (e.g. used for charging, resuming, and gathering statistics of Services).	CPNS 1.0
CPNS-HLF-007	The CPNS Enabler SHALL find out the device capabilities of the PN GW(s) and PNE(s).	CPNS 1.0
CPNS-HLF-008	The CPNS Enabler SHALL be able to provision the PN gateway and the PNE(s).	Future Release
CPNS-HLF-009	The CPNS Enabler SHALL be able to request application, content and Services from the content provider or Service provider based on capabilities of PN GWs and PNE(s).	CPNS 1.0
CPNS-HLF-010	The CPNS Enabler SHALL be able to specify the destination of Services when using CPNS Service (e.g., requesting, transmitting).	CPNS 1.0
CPNS-HLF-011	The CPNS Enabler SHALL be able to create a Service Group for the PNE(s).	CPNS 1.0
CPNS-HLF-012	The CPNS Enabler SHALL be able to invite the PNE(s) for a Service Group.	CPNS 1.0
CPNS-HLF-013	The CPNS Enabler SHALL enable PNE(s) to provide data during the Interactive Service.	Future Release
CPNS-HLF-014	The CPNS Enabler SHALL support aggregation and distribution of message(s) for multiple PNE(s).	CPNS 1.0
CPNS-HLF-015	The CPNS Enabler MAY use the work of other standards organisations when relevant for CPNS, as appropriate.	CPNS 1.0
CPNS-HLF-016	The CPNS Enabler SHALL support the PN to make its status (including willingness, reachability etc) available to other interested CPNS entities.	CPNS 1.0
CPNS-HLF-017	The CPNS Enabler SHOULD have the ability to utilize the capabilities of a Presence Enabler for status information (including willingness, reachability etc).	Future Release
CPNS-HLF-018	The CPNS Enabler SHOULD support subscription to the status (including willingness, reachability, etc) of other users' PNs and be notified about status changes of those PNs.	CPNS 1.0
CPNS-HLF-019	The CPNS Enabler SHALL be able to support simultaneous delivery to different PNEs	CPNS 1.0
CPNS-HLF-020	CPNS Enabler SHOULD enable seamless switching of PNE(s) while providing or consuming Services. The switching can be triggered by events like (not limited to) battery exhaustion, user willingness.	Future Release

CPNS-HLF-021	CPNS Enabler SHOULD enable seamless switching of PN-Gateways. The switching can be triggered by events like (not limited to) battery exhaustion, user willingness.	Future Release
CPNS-HLF-022	The CPNS Enabler SHALL support deployment of applications relevant to CPNS.	CPNS 1.0
CPNS-HLF-023	The CPNS Enabler SHALL support the registration of PN and devices and Services in the PN.	CPNS 1.0
CPNS- HLF-024	The CPNS Enabler SHALL support storing and maintaining the information of Services and PN Inventory.	CPNS 1.0
CPNS- HLF-025	The CPNS Enabler SHALL support delivery of the information of devices and PN Inventory, when requested.	CPNS 1.0
CPNS- HLF-026	The CPNS Enabler SHALL support the zone based Service.	CPNS 1.0
CPNS- HLF-027	The CPNS Enabler SHALL support the periodic search to discover the PNE(s) in a zone if the CPNS User has opted in to be discovered by Zone PN GW.	CPNS 1.0
CPNS- HLF-028	The CPNS Enabler SHALL enable the zone PN GW to advertise its existence and Service to PNE(s), when entering the zone.	CPNS 1.0
CPNS- HLF-029	The CPNS Enabler SHALL enable to provide Service(s) through the zone PN GW without request from the PNE.	CPNS 1.0
CPNS- HLF-030	The CPNS Enabler SHALL provide mechanisms to share Services, data and applications only among members of the Service Group.	CPNS 1.0
CPNS- HLF-031	The CPNS Enabler SHALL be able to remove a PNE from a Service Group.	CPNS 1.0
CPNS- HLF-032	The CPNS Enabler SHALL be able to remove a Service Group.	CPNS 1.0
CPNS-HLF-033	The CPNS Enabler SHALL be able to support forwarding of content from one PNE to another or to multiple PNE(s).	CPNS 1.0
CPNS-HLF-034	The CPNS Enabler SHALL support device management functionalities for PNE and PN GW by interacting with device management server, in collaboration with CPNS Server.	Future Release
CPNS-HLF-035	The device management for PNE(s) SHALL be performed through PN GW.	Future Release
CPNS-HLF-036	The CPNS Enabler SHALL be able to identify CPNS entities, PN(s) and Service Group(s).	CPNS 1.0
CPNS-HLF-037	The CPNS Enabler SHOULD support delivery of copyright-protected contents to PNE(s).	CPNS 1.0
CPNS-HLF-038	The CPNS Enabler SHALL provide data to the specified PNE(s) in the same Service Group.	CPNS 1.0

Table 1: High-Level Functional Requirements

6.1.1 Security

Label	Description	Release
CPNS-SEC-001	The CPNS Enabler SHALL support secure delivery of application and/or content Service data to the PNE(s).	CPNS 1.0
CPNS-SEC-002	The CPNS Enabler SHALL support various security mechanisms for each PNE and for each Service.	CPNS 1.0
CPNS-SEC-003	The CPNS Enabler SHALL be able to use keys needed to support confidentiality, integrity protection, and authenticity.	CPNS 1.0
CPNS-SEC-004	The CPNS Enabler SHALL support secure storage of data (e.g., validated user properties).	Future Release

Table 2: High-Level Functional Requirements – Security Items

6.1.1.1 Authentication

Label	Description	Release
CPNS-AUC-001	The CPNS Enabler MUST be able to support the authentication of CPNS Users, CPNS entities and/or External Entities which request access to CPNS related information and/or Services.	CPNS 1.0
CPNS-AUC-002	The CPNS Enabler MAY support validation of certificates for certain use cases, such as the attestation of personal user information.	Future Release

Table 3: High-Level Functional Requirements – Authentication Items

6.1.1.2 Authorization

Label	Description	Release
CPNS-AUZ-001	The CPNS enabler SHALL be able to authorize the CPNS Users and CPNS Entities, e.g. PN gateways, PNEs etc, when requesting access to CPNS services.	CPNS 1.0
CPNS-AUZ-002	The CPNS enabler SHALL be able to authorize the CPNS Users and CPNS Entities, e.g. PN gateways, PNEs etc, when requesting access to CPNS services	CPNS 1.0

Table 4: High-Level Functional Requirements – Authorization Items

6.1.1.3 Data Integrity

Label	Description	Release
CPNS-DIT-001	The CPNS Enabler SHALL support integrity of data.	CPNS 1.0
CPNS-DIT-002	The CPNS Enabler SHALL support data integrity in protecting against accidental or intentional changes to CPNS-related data transmission, by ensuring that changes to the data are detectable.	CPNS 1.0

Table 5: High-Level Functional Requirements – Data Integrity Items

6.1.1.4 Confidentiality

Label	Description	Release
CPNS-CON-001	The CPNS Enabler SHALL support encryption of messages.	CPNS 1.0
CPNS-CON-002	The CPNS Enabler SHALL support decryption of messages.	CPNS 1.0
CPNS-CON-003	The CPNS Enabler SHALL support data confidentiality that ensures transmitted information is not made available to unauthorised individuals or entities.	CPNS 1.0

Table 6: High-Level Functional Requirements – Confidentiality Items

6.1.2 Charging

Label	Description	Release
CPNS-CHG-001	The CPNS Enabler SHALL support means to charge differently for Service usage (within the same Service Group or individually; this also applies for simultaneous Service delivery), based on, for example, user identity, the users Service subscriptions, device type or capability, provided Service quality, and the type of the consumed Services; and for acting in different roles, such as PN Gateway or PNE.	Future Release
CPNS-CHG-002	The charging MUST use standardized mechanisms.	Future Release
CPNS-CHG-003	The CPNS Enabler SHALL enable the charging for delivery of information to third parties.	Future Release

Table 7: High-Level Functional Requirements – Charging Items

6.1.3 Administration and Configuration

Label	Description	Release
CPNS- ADM-001	The CPNS Users SHALL have the possibility of multiple subscriptions with different Service providers. For example, a CPNS User may own a mobile phone subscription with Service provider A, while the in-car communication unit has been supplied as part of an agreement of the car manufacturer with operator B, and the family's broadband access Services are delivered by operator C.	Future Release
CPNS-ADM-002	The CPNS Enabler SHALL be able to respond to queries for information about capabilities and usage statistics of PN(s) and PNE(s) from a Content Provider.	CPNS 1.0
CPNS-ADM-003	The CPNS Enabler SHOULD support collection of usage data from the CPNS Users and specific devices for the purpose of creating statistics.	CPNS 1.0
CPNS-ADM-004	The matching of PNE and PN capabilities and required capabilities MAY be automated, to facilitate the delivery of Services.	Future Release

Table 8: High-Level Functional Requirements – Administration and Configuration Items

6.1.4 Quality of Service

Label	Description	Release
CPNS- QoS-001	The CPNS Enabler SHOULD provide mechanisms to ensure that the quality of the user experience is maintained.	Future Release

Table 9: High-Level Functional Requirements – Quality of Service Items

6.1.5 Interoperability

Label	Description	Release
CPNS- INT-001	The CPNS Enabler SHALL allow CPNS Users to access any suitable Service (i.e. user-managed or operator-managed Services as well as 3rd party Services) on any suitable device (i.e. a device matching the capabilities required to consume the Service) and within any network island (e.g. home, car, hotspot, hotel, friend's place or office).	CPNS 1.0

CPNS- INT-002	The CPNS Enabler SHALL be able to interoperate with consumer electronics devices, which are using well-established and widely deployed standards other than those specified in the CPNS Enabler for device discovery, device profile, and multimedia Service delivery; and deliver multimedia Services to and from them. **Informational Note**: This requirement will be further detailed as the interoperability functionality is defined during the technical specification phase.	CPNS 1.0

Table 10: High-Level Functional Requirements – Interoperability Items

6.1.6 Privacy

Label	Description	Release
CPNS-PRIV-001	The CPNS Enabler SHALL ensure user privacy.	CPNS 1.0
CPNS-PRIV-002	The privacy requirements in [OMA-Privacy] SHALL be applied to the CPNS Enabler.	CPNS 1.0
CPNS-PRIV-003	The CPNS User SHALL be able to configure privacy policies for the management of data pertaining to user's Personal Network.	CPNS 1.0
CPNS-PRIV-004	The CPNS Enabler SHALL support the CPNS Users to verify whether they accept the collection of their usage data.	CPNS 1.0
CPNS-PRIV-005	The CPNS Enabler SHALL support the CPNS Users to cancel the collection of their usage data.	CPNS 1.0
CPNS-PRIV-006	The CPNS Enabler SHALL be able to protect personal user information when transmitting and performing a test on it.	CPNS 1.0

Table 11: High-Level Functional Requirements – Privacy Items

6.2 Overall System Requirements

Label	Description	Release
CPNS-SYS-001	It SHALL be possible for CPNS Enabler to be deployed in Peer-to-Peer Networks.	Future Release
CPNS-SYS-002	The CPNS Enabler SHOULD support aggregation and reporting of the CPNS Users' usage data into anonymized usage statistics at predefined intervals and/or asynchronously.	Future Release
CPNS-SYS-003	The CPNS Enabler SHOULD support reporting of statistics to authorized receiving parties.	Future Release

Table 12: Overall System Requirements

Appendix A. Change History (Informative)

A.1 Approved Version History

Reference	Date	Description
Approved Version OMA-RD-CPNS-V1_0	23 Oct 2012	Status changed to Approved by TP: TP ref#: OMA-TP-2012-0390-INP_CPNS_1_0_ERP_for_notification.zip

Appendix B. Use Cases (Informative)

B.1 Multiple delivery content channels from a PN GW (Mobile Handset) to a PN Device

B.1.1 Short Description

A PN GW (Mobile Device) can serve as a hub that aggregates different types of content, such as data, video, audio etc as shown in the figure below and delivers via different Delivery Channels to a PN Device which supports more than one rendering application. An example would be, a PN Device in a car that can be used as a navigation system, an MP3 player, digital frame etc.

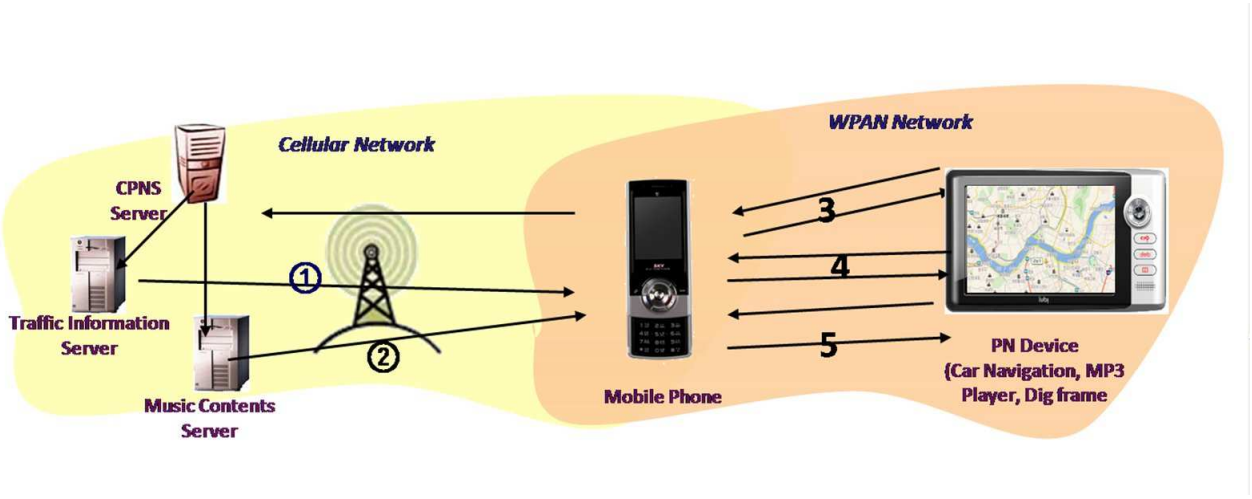

Figure 2: High level diagram showing the flow between cellular network and WPAN using multiple channels

Normal flow:

1. Jane is driving and suddenly hits the traffic. She has a navigation system, which is quite rich in features, thus supporting GPS, MP3 player, digital frame etc, but Jane does not have the traffic data Service as part of the GPS

2. She contacts the CPNS Server from her mobile to get the traffic data onto the PN Device (Navigation System in this case)

3. She got the traffic data, but congestion is so bad that she will be stuck in the traffic for a while

3. At the same time she wants to listen to some music downloaded on the same PN Device

4. While she is stuck in the traffic and can't do much she also wants to use the same PN Device as a digital frame to render some photos from her last holiday that she has in her Mobile Device. Please note that MP3 and Digital Frame can run both in parallel, or the PN Device can also split the display in half, to have one half for photo display and the other half for maps as part of the navigation system.

Actors:

- CPNS User
- CPNS Service Provider/Mobile Operator
- PN Device

- PN GW/Mobile Device
- CPNS Server

B.1.2 Market benefits

Devices today are very rich-featured devices and support a number of applications and different rendering capabilities. Given this it is very important for the CPNS to support multiple content channels from a PN GW (Mobile Device) to a PN Device. Supporting this capability would enable the CPNS Users of a Personal Network to make use of the Service and PN Device more efficiently and seamlessly. In addition, this would also improve the user experience and the revenue range for the Service provider/mobile operator as well as for PN Device vendors.

B.2 Extended Personal Area Networks

This use case demonstrates the ability to network together a number of personal devices and allow authorized CPNS Users anytime, anywhere access to these devices.

B.2.1 Short Description

A CPNS User owns a number of devices such as a mobile phone, a PC, a music player, and an IP-enabled set-top box. These devices may be able to communicate among themselves without relying on a centralized infrastructure for orchestrating communications. The CPNS User can create a Personal Network of all his devices, add and remove devices from this network, securely access and control these devices from anywhere, and allow other CPNS Users access to his network. Communications among the devices can happen across multiple radio interfaces, multiple IP subnets, and multiple Service providers.

For instance, the CPNS User should be able to create a network consisting of his mobile phone, home PC, networked set-top box, and networked media player. He should be able to stream music from his media player to his mobile phone, and from all locations where the phone is connected to the Internet. He should be able to control his set-top box from his mobile phone. He should be able to view photos that reside on his mobile phone from his PC. All this may happen in a decentralized fashion.

B.2.2 Market benefits

The main benefit of an extended personal area network is that CPNS Users now have access to all their personal devices, regardless of their location. As CPNS Users increasingly own multiple, Internet-enabled devices, this functionality can significantly enhance user experience. It is desirable to realize this in a decentralized fashion to reduce infrastructure and bandwidth costs that centralized architectures typically incur. By giving CPNS Users more control over how to connect their devices together, we encourage experimentation, which can be expected to lead to greater innovation

B.3 Content Delivery to a PN device

B.3.1 Short Description

A PN GW (mobile phone) which is located between the cellular network and WPAN receives a request for a certain Service from a PN device and conveys it to the CPNS Server. CPNS Server asks for the appropriate content to the application server considering the device information of PN device. Application server sends the content to the PN gateway (mobile phone) and it is delivered to the PN device.

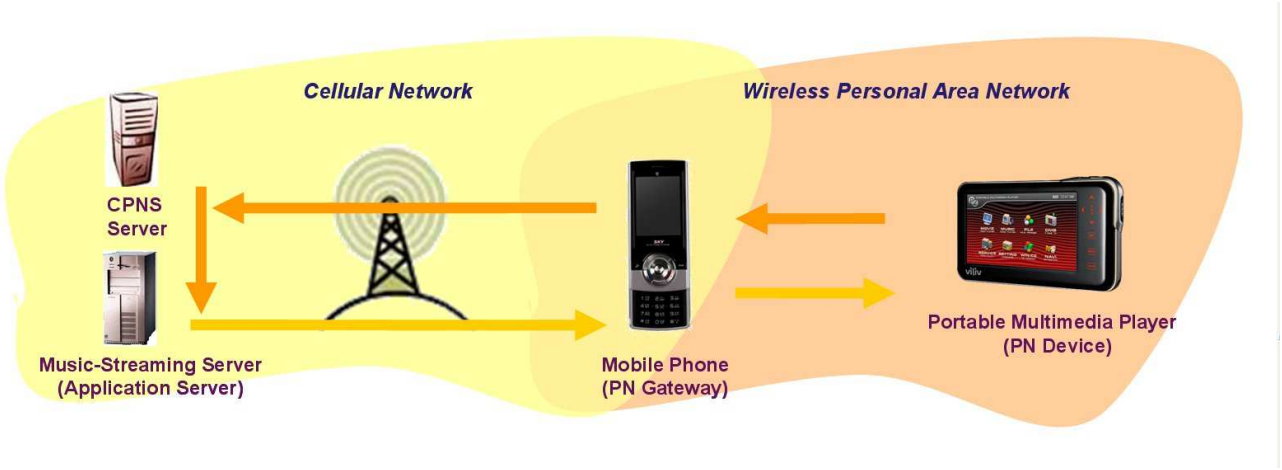

Figure 3: High level diagram showing the flow for contents delivery between cellular network and WPAN

Normal flow:

1. John wants to download high-quality music from music streaming server to enjoy. He has a PMP (Portable Media Player) which can not connect to the streaming server directly as it has no cellular communicating functionalities. And he has a mobile phone which can connect to the music server but with low-quality environments (ex. codec, speaker and memory..) to enjoy the music with.

2. The PMP sends a request for the music to a mobile phone and the mobile phone receives and checks its availability of the Service.

3. The mobile phone transfers a request to the CPNS Server. The CPNS Server asks music streaming server of the proper content considering the capabilities of the PMP.

4. The music streaming server sends the music to the mobile phone and the mobile phone transfers it to the PMP.

Actors:

- CPNS User
- CPNS Service Provider/Mobile Operator
- PN Device
- PN GW/Mobile Phone
- CPNS Server

B.3.2 Market benefits

- The CPNS User can extend the kind of Services to enjoy even if his personal device can't directly connect to the cellular network (WAN).
- The operator can improve the quality/quantity of Service as well as increase the revenue from data Services.
- The content/Service provider can enlarge the targeted devices and Services.
- The vendor can increase the volume of sales taking in the CPNS functionalities which can add new features.

B.4 Providing Multiple Services Simultaneously for Multiple PN devices

B.4.1 Short Description

A PN GW (mobile phone) which is located between the cellular network and the WPAN is connecting to the multiple PN devices at the same time. The PN gateway receives different kinds of Service requests from multiple PN devices and sends it to the CPNS Server. The CPNS Server distinguishes the source between the data received and provides Services/contents connecting appropriate application servers. The PN gateway delivers the received data to the different destinations (PN devices).

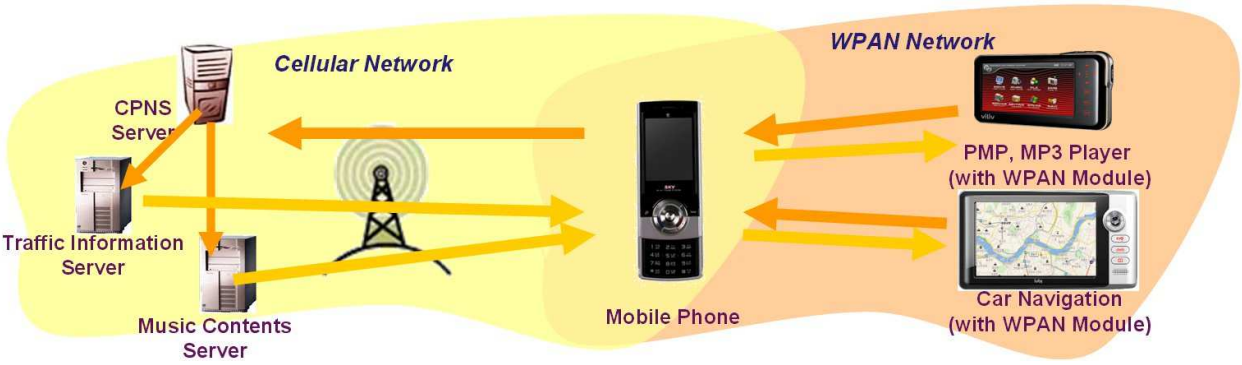

Figure 4: High level diagram showing the flow for simultaneous multiple Services between cellular network and WPAN

Normal flow:

1. Steve's PN device (Car Navigation System) sends a request for the traffic information to the PN gateway (mobile phone) and Jane's PN device (MP3) sends a request for the music download to the same PN gateway (mobile phone).

2. The PN gateway checks received requests and transfers it to the CPNS Server.

3. The CPNS Server finds out the appropriate application servers and requests proper contents/Services considering the capabilities/specifications of targeted PN devices.

4. The respective application servers send the contents to the PN gateway. The PN gateway delivers the traffic information to the Steve's PN device and delivers the music to the Jane's PN device simultaneously.

Actors:

- CPNS User
- CPNS Service Provider/Mobile Operator
- PN Device 1
- PN Device 2 (for different Service from PN device 1)
- PN GW/Mobile Phone
- CPNS Server

B.4.2 Market benefits

- The CPNS User can enjoy various Services in the different devices at the same time with only one PN gateway (mobile phone).
- The operator can improve the quality/quantity of Service provided as well as increase the revenue from those data Services. This scenario can decrease the amount of traffic in the network.
- The content/Service provider can enlarge the targeted devices and Services.
- The vendor can increase the volume of sales taking in the CPNS functionalities which can add new features.

B.5 Service Group

B.5.1 Short Description

A PN GW (mobile phone) which is located between the cellular network and the WPAN receives a request for a certain Service Group from a PN device. The centred mobile phone requests for the Service Group to the CPNS Server while the two devices (PN gateway and PN device) constructing a group. The CPNS Server asks for the Service Group connecting to the application server considering the device information of those two devices. Application server will provide the proper Service Group/contents to the PN gateway (mobile phone) and it will be delivered to the PN device which is in a same Service Group.

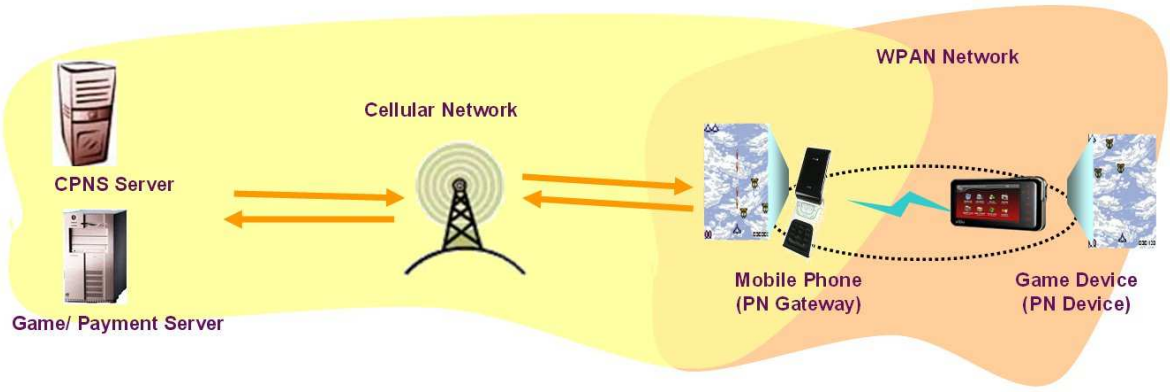

Figure 5: High level diagram showing the flow for the Service Group between cellular network and WPAN

Normal flow:

1. John and Steve want to play the same mobile network-game as a team using their own device respectively. So John creates a game and using his mobile as a PN GW.

2. It sends messages to invite the Steve's game device. And Steve executes the same game connecting to the PN gateway using WPAN techniques.

3. PN gateway connects to the CPNS Server to make up a group to start. The CPNS Server connects to the game server to provide proper group game Service.

4. The PN device transmits its game data to the PN gateway. And the PN gateway adds on its own data together and transmits to the CPNS Server at the same time.

5. The PN gateway receives the game data of a group from the CPNS Server, and takes the data designated to itself and forwards the data designated to the PN device to its destination.

6. During the game, Steve and John can use several charging options with the help of the CPNS Server.

Actors:

- CPNS User
- CPNS Service Provider/Mobile Operator
- PN Device
- PN GW/Mobile Phone
- CPNS Server

B.5.2 Market benefits

- Two CPNS Users seating beside can enjoy the same Service Group forming PAN, only using a one mobile connected to the cellular network.
- The operator can implement the effective way for the Service Group which can reduce the amount of traffic in the network. Also this will increase the revenue taken from data Services.
- The content/Service provider can enlarge the targeted devices and Services.
- The vendor can increase the volume of sales taking in the CPNS functionalities which can add new features.

B.6 Local-Area Peer-to-Peer Networks

This use case demonstrates the ability to connect a number of devices that can communicate with each other over a short range using a Peer-to-Peer Network. The use case can also be extended so that the Peer-to-Peer Network is formed over a wide-area network.

B.6.1 Short Description

A number of CPNS Users come together at a particular location. They own devices that are equipped with one or more local-area networking technologies (e.g., 802.11 or Bluetooth). The devices form a Peer-to-Peer Network using these technologies so they can talk to one another. Even if all the devices are connected to the Internet, it is possible that they may be unable to reach each other over the Internet. Also, even if they can reach each other over the Internet, it may be beneficial to “offload” traffic to the local networks.

A Service or an application running on a device can discover and access Services running on other devices. For instance, all the devices should be able to run a ToDo list application that lets users share and modify a distributed ToDo list. Or, a CPNS User should be able to discover another CPNS User’s videos and stream the videos over the Peer-to-Peer Network that is composed of local-area network technologies, without going over the Internet.

B.6.2 Market benefits

The benefits of Peer-to-Peer Networks are:

- Peer-to-Peer Networks enhance user experience by allowing CPNS Users to offer and access CPNS Services in a quick, easy-to-use fashion.
- Peer-to-Peer Networks increase the capabilities of local-network technologies. Because both these technologies are now very much widespread, enabling richer applications and Services over them is beneficial to the CPNS User and thus to the device manufacturer and application developer.
- Peer-to-Peer Networks can offload traffic from a wide-area network to local-area networks, reducing operational costs for an operator, and helping bring down tariffs for CPNS Users.

- Peer-to-Peer Networks do not require centralized entities, and therefore incur lower infrastructure and bandwidth costs.
- Local-area Peer-to-Peer Networks enable useful communications between devices and CPNS Users when Internet access is unavailable or is insufficient.

B.7 User Statistics

B.7.1 Short Description

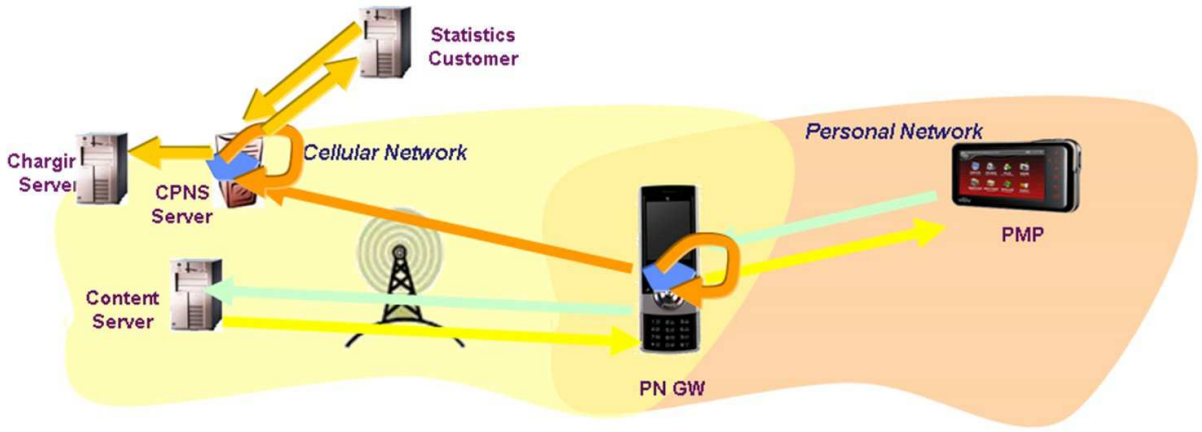

Figure 6 User Statistics

- Alice has signed up to provide statistics about her media usage in her PMP. She explicitly has to accept that statistics are collected, and can determine when it should be terminated herself, through a simple operation in the PN GW.
- When she uses the PMP to access media, the PN GW registers her usage.
- The PN GW only registers the usage of her PMP, not other devices.
- The PN GW reports the statistics once a month to the CPNS Server.
- The CPNS Server anonymizes the data and aggregates it with all other statistics from other CPNS Users
- An interested party wants to get information about the PMP usage.
- The interested party (Statistics Customer) is authenticated and authorized by the CPNS Server when it receives the request for information.
- The CPNS Server provides the statistics to the Statistics Customer when it has been authenticated and authorized.
- The Statistics Customer is charged for receiving the statistics
- The Statistics Customer uses the information to build a better PMP which Santa Claus gives to Alice next Christmas, if she has been a nice girl during the year.

B.7.2 Market benefits

Collecting and disseminating statistics in a secure way leads to a new sales object for operators, better ability for consumer electronics providers to create more appropriate devices, and CPNS Users to get greater satisfaction in their media consumption.

B.8 Attestation of Personal User Properties

B.8.1 Short Description

A CPNS Enabled Personal Network equipped with WPAN technology, cellular technology, and short range connectivity is ideally suited to deliver a common platform for attestation purposes (e.g. in a shop or towards a vending machine).

Attestation, in the context of CPNS, provides a method to selectively disclose personal user properties for secure submission from one PNE to another PNE and a mechanism to validate the personal user properties in the receiving PNE. The personal user properties are attested by an Attestation Service Provider. The messages exchanged between the PNE(s) are digitally signed by an Attestation Service Provider.

Attestation functionality may be required by law for certain types of purchases or for public administration in some countries. In the following an example is given in which a shop owner can easily check if the customer in front of him who is carrying a CPNS equipped cell phone with attestation capabilities is at least 21 years of age.

Actors (depending on use case):

- Shop Owner (here: *Bob*) / Vending Machine,
- Citizen / CPNS User / Cell Phone Owner (here: *Alice*),
- Attestation Service Provider (ASP) / Mobile Network Operator (MNO),
- Personal Network Gateway (PN GW)

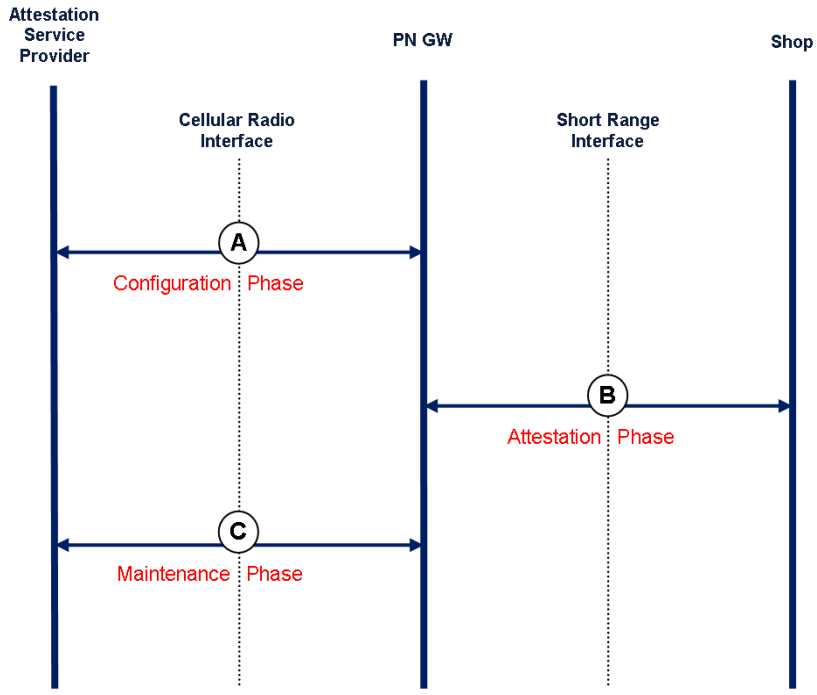

Figure 7 Example Message Transaction Flow

Step A - Configuration Phase:

The Attestation Service Provider stores validated user properties securely in one of *Alice*'s Personal Network Elements.

Step B - Attestation Phase:

Customer *Alice* enters a shop with the intention to buy some alcoholic beverages that are sold under age restriction. The Personal Network Element *Alice* is carrying (e.g., her cell phone) is supportive of the CPNS attestation capability. Shop owner *Bob* uses a cash desk that also has CPNS attestation capabilities. Both devices (*Alice*'s Personal Network Element and *Bob*'s point-of-sale (POS) terminal) advertise their CPNS attestation capabilities in the PN. At check-out *Bob* specifies 'age ≥ 21' as *Alice*'s property he requests to be validated. *Alice* is prompted on her cell phone whether she wants to authorize the response to this specific attestation request. *Alice* agrees and types in her PIN into her cell phone in order to authenticate herself. Calculations are initiated in (e.g. a trusted execution environment of) one of *Alice*'s Personal Network Elements (e.g. her cell phone) and a reply is send back to *Bob* via *Alice*'s Personal Network Gateway indicating either a digitally signed 'yes' or 'no'; no further personal details of *Alice* are disclosed. *Bob* can proceed with the check-out procedure based on the reliable age attestation he has received from *Alice*'s Personal Network Gateway.

Step C - Maintenance Phase:

The CPNS User's properties, keys or certificates stored in a Personal Network Element may be updated. Also changes to protocols and algorithms used during the attestation process may be made by the Attestation Service Provider via the Personal Network Gateway.

B.8.2 Market benefits

The CPNS User has control over the information she gives away and the Attestation Service Provider may choose to charge his customers (i.e. consumer and/or shop) for providing this special CPNS Service.

Example 1: A shop owner may perform checks (assisted by a mobile network operator) if someone who wants to buy liquor at a shop is old enough to do so ("local age verification").

Example 2: A web site owner may perform checks (assisted by a mobile network operator) if someone who wants to join an online community with access rights restricted to girls is indeed a girl ("remote gender verification").

Example 3: A citizen may proof her gender, marital status, etc. remotely via the Internet towards municipal authorities when applying for a new passport.

B.9 Remote PNE connection

B.9.1 Short Description

A CPNS User may have multiple Personal Networks and own a PNE in a Personal Network and another PNE in different Personal Network. These devices belonging to different Networks respectively may need to be connected between themselves using centralized device list information stored in CPNS Server for the delivery of contents. Upon initiation CPNS, a PN GW should register with the PNE information to the CPNS Server. The PN GW receives device information which the CPNS Server maintains and which is allowed to the CPNS User. Provided the device information, the CPNS User can create connection between the PNE(s).

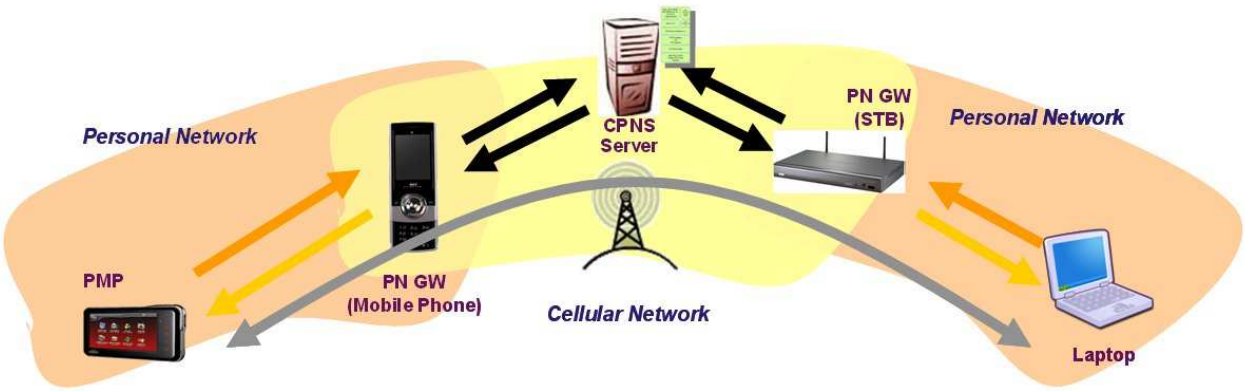

Figure 8: High level diagram showing Remote PNE connection

Pre-condition

1. Alice's laptop discovers and connects to a STB acting as PN Gateway.
2. The STB starts to use CPNS with registering to CPNS Server with laptop information.
3. CPNS Server stores the registration information on the STB with laptop information.
4. Alice buys a new PMP in the circuit city. The PMP does not have any music file or video clip.
5. Alice's PMP discovers and connects to a mobile phone acting as PN GW.
6. The mobile phone starts to use CPNS with registering to CPNS Server with PMP information.
7. CPNS Server stores the registration information on the mobile phone with PMP information.
8. CPNS Server manipulates the registration information on the PN GWs with PNE(s) information.

Normal flow:

1. Alice wants to download video clips from her laptop located in Home Network to the new PMP which she bought just before.
2. The PMP requests the device list to the CPNS Server through the mobile phone acting as a PN GW, in order to see which devices are available to communicate with.
3. The PMP receives the device list.
4. Alice selects her laptop, if available.
5. The PMP establish connection to Alice's laptop.
6. The PMP downloads some video clips.
7. Alice enjoys the video clips in the new PMP.

Actors:

- CPNS User
- CPNS Service Provider/Mobile Operator
- PN Device

- PN GW/Mobile Phone, STB
- CPNS Server

B.9.2 Market benefits

- The CPNS User can connect a device to other devices located in different Personal Network in order to download contents or request Services.
- The operator can improve the quality/quantity of Service as well as increase the revenue from data Services.
- The vendor can increase the volume of sales taking in the CPNS functionalities which can add new features

B.10 Zone Based Service

B.10.1 Short Description

A PN GW searches its zone regularly to find out if some PNE which had been located outside of PN enters in. After entering into the coverage of that PN GW, the connection will be initiated by the PN GW to provide a certain Service/content selected from contents provider or Service provider.

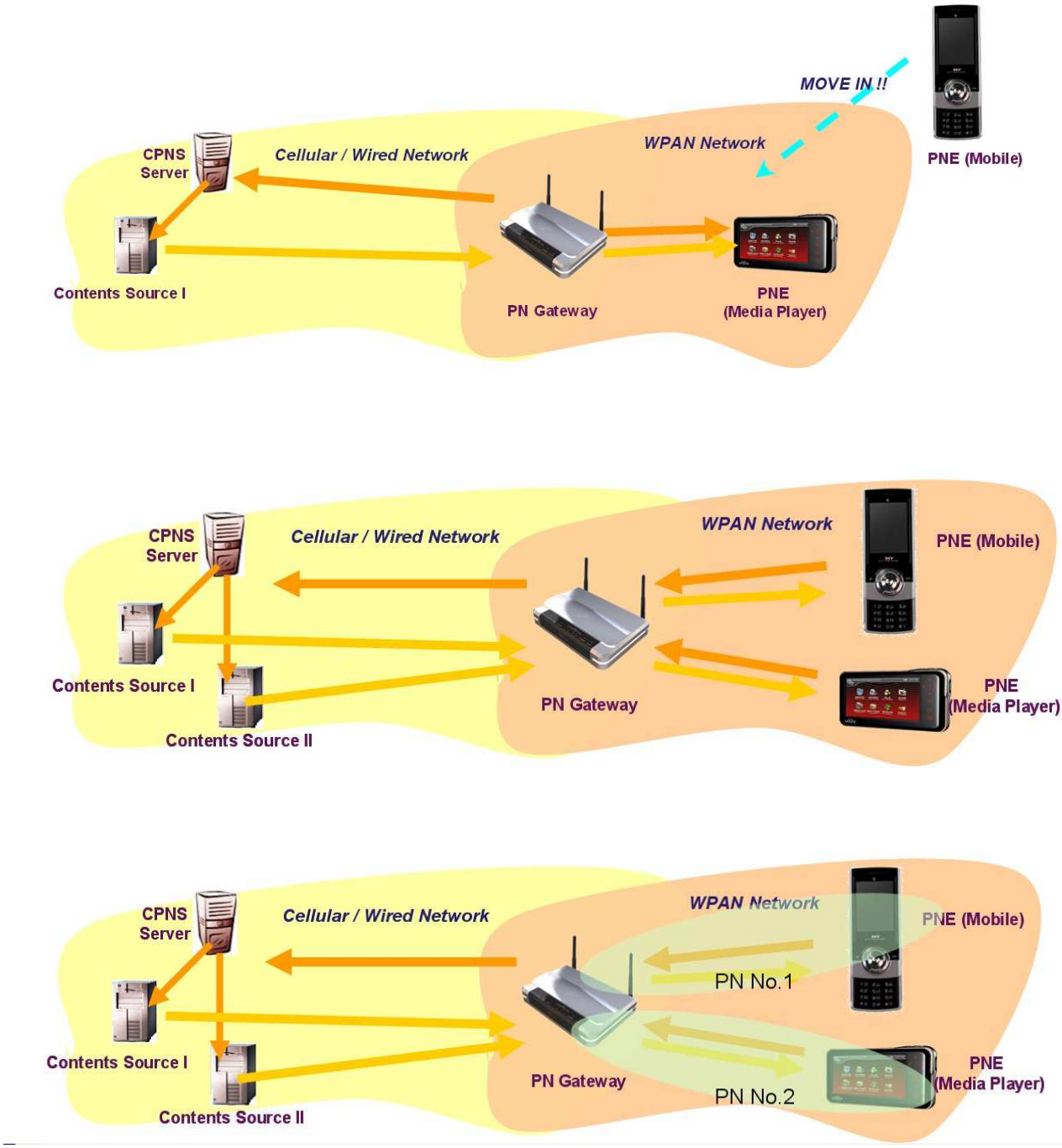

Figure 9 High level diagram showing the flow for Zone Based Service

Normal flow:

1. There is a PN gateway in a restaurant. The PN gateway has its own zone determined by its signalling abilities (e.g. 10~100m for Bluetooth) and searches it regularly to find a new customer enters.

2. When a new PNE is detected, PN GW and PNE make a connection and authenticate each other for a CPNS. CPNS Server also gets information about the CPNS User and device of the new PNE through the PN GW.

3. The CPNS Server and PN GW will check if the new PNE be available to be provided a new Service. (e.g. status of the device – on/off, being served other Services, resource availabilities, S/W dependencies..).

4. When it is available, the CPNS Server sends a request to the source of Service/content to send data to the PN GW which will be delivered to the PNE. (e.g. English/Korean/Spanish menu of the restaurant for a specific person)

Actors:

- CPNS User
- CPNS Service Provider/Mobile Operator
- PNE
- PN GW
- CPNS Server

B.10.2 Market benefits

- The content/Service provider can enlarge the targeted devices and Services. Also they can provide targeted Service focusing only on a certain areas/zones/places in easier and cheaper ways.
- The CPNS User can extend the kind of Services to enjoy without connecting to the WAN or paying for it.
- The operator can improve the quality/quantity of Service as well as increase the revenue form data Services.
- The vendor can increase the volume of sales taking in the CPNS functionalities which can add new features

Appendix C. Mapping of definitions

In 3GPP PNM, similar terms to those used in CPNS are used. The terms used in TS 22.259 map to the CPNS definitions as follows.

Definition	OMA CPNS	3GPP PNM	Scope overlap
Personal Network	**Personal Network (PN):** A collection of devices available to a CPNS User to consume and produce Services. All devices within a PN can be linked to an individual. A PN is a non static collection and will vary over time. There are two levels of a PN: 1. The device level, meaning all devices to which one person has access on a certain given time. 2. The Services level, meaning all Services that can successfully be delivered to a certain PN consisting of owned devices. A PN can be queried for available devices and their capabilities at a given moment.	Personal Network: A Personal Network (PN), in the context of Personal Network Management, consists of more than one Personal Network Element under the control of one PN-User providing access to the serving PLMNs. There shall be at least one Personal Network Element with a USIM subscription in a PN. Authentication of the user for each PLMN access is based on the USIM(s) of the PN. The Personal Network Elements are managed in a way that the user perceives a continuous secure connection regardless of their relative locations. The Personal Network Elements belonging to the PN-User's PN maybe registered to different PLMNs at a time. The PN-User controls the PN using facilities provided by the Personal Network Management (PNM).	Concepts overlap, but the CPNS Personal Network is wider in scope.
Personal Network Element	**Personal Network Element:** A Personal Network Element (PNE) is the basic component making up a Personal Network. A Personal Network Element can be handled as a single entity but physically it may be either a single device or a group of devices.	Personal Network Element: A Personal Network Element (PNE) is the basic component making up a PN-User's Personal Network. A Personal Network Element is handled as a single entity in PNM but physically it may be either a single device or a group of devices. The Personal Network Element may be a TE, MT, ME or even a complete UE.	Concepts overlap, but OMA definition does not contain 3GPP terminology.
Personal Network Gateway	**Personal Network Gateway (PN GW):** A Personal Network Gateway at the device level connects a PN to another PN. This may imply using a global	N/A	The UE in 3GPP corresponds to the PN GW in CPNS, although the UE does not have the interaction with the PN that the PN GW has.

	network, such as a mobile network. At the Service level, the PN GW manages the Service access to and from PNE(s), and the communication of capabilities information and statistics to Service Providers.		
CPNS User	**CPNS User:** The CPNS User is the person who uses the CPNS Service using PNE(s).	PN-User: For the purpose of Personal Network Management the PN-User is the person who owns the Personal Network Elements with respective subscriptions at one Service provider.	Concepts overlap
Personal Area Network	N/A	Personal Area Network: A Personal Area Network (PAN) is a local network of the PN-User. In the context of Personal Network Management, the PAN consists of at least one UE and may additionally comprise a number of MEs/MTs, with own radio access means that allow them to directly access the PLMN of the UE. The UE and locally connected additional MEs/MTs are the PNE(s) of the PAN. Alternatively the UE components, i.e TEs and MT, may be handled as separate PNE(s). The UE contains the single active USIM of the PAN.	The 3GPP PAN represents one aspect of the PN as defined in OMA (the Device Level).