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AND NEXT-GENERATION NETWORKS

Next Generation Networks – Frameworks and functional
architecture models

Converged services framework functional requirements and architecture

ITU-T Recommendation Y.2013



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ITU-T Recommendation Y.2013

Converged services framework functional requirements and architecture

Summary

This Recommendation provides the high-level requirements and functional architecture for the converged services framework (CSF). The CSF defines an architectural framework to provide a seamless user experience across multiple networks.

Source

ITU-T Recommendation Y.2013 was approved on 14 December 2006 by ITU-T Study Group 13 (2005-2008) under the ITU-T Recommendation A.8 procedure.

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Converged services framework functional requirements and architecture

1 Scope

One objective of NGN is to enable seamless delivery of services across users' multiple devices served across different environments (home, cellular, enterprise, etc.) that are connected across multiple access networks in one operator domain or different operator domains. As users move across different environments, their services are managed and delivered to them seamlessly and with ease. The converged services framework (CSF) is designed to provide a common point of coordination for services, mobility, preferences, resources and the state of users on a per-user basis.

This Recommendation defines the high-level requirements and functional architecture for the CSF. In addition, this Recommendation provides example use case scenarios (see Appendix I) to highlight the functionality of the CSF.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T M.60] ITU-T Recommendation M.60 (1993), *Maintenance terminology and definitions*.
- [ITU-T Y.2012] ITU-T Recommendation Y.2012 (2006), *Functional requirements and architecture of the NGN release 1*.
- [ITU-T Y.2021] ITU-T Recommendation Y.2021 (2006), *IMS for Next Generation Networks*.
- [ITU-T Y.2091] ITU-T Recommendation Y.2091 (2007), *Terms and definitions for Next Generation Networks*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 service: [ITU-T Y.2091] A set of functions and facilities offered to a user by a provider.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 application: A software entity residing on an application server that contributes to the delivery of an end user service.

3.2.2 application server: A physical network element that provides computing resources that are applied to the delivery of services to end users through the execution of applications.

3.2.3 policy: An ordered combination of policy rules that defines how to administer, manage and control access to resources. This function is responsible for policy access, policy condition matching and corresponding policy decisions according to matched conditions.

3.2.4 policy management: This provides the functions for describing, creating, updating, deleting, provisioning and viewing of policies.

3.2.5 service convergence: The coordination of a set of services such that the end user's view is that of a single service. The component services may have different providers.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

a.k.a.	also known as
AAA	Authentication, Authorization and Accounting
AM	(PCMM) Application Manager
AS	(IMS) Application Server
AS-FE	Application Support Functional Entity
CSF	Converged Services Framework
CC-FE	Convergence Coordination Functional Entity
CLS-FE	Client Support Functional Entity
CP-FE	Convergence Policy Functional Entity
DRM	Digital Rights Management
ES-FE	Edge Support Functional Entity
FE	Functional Entity
GPS	Global Positioning System
HSS	(IMS) Home Subscriber Server
iFC	initial Filter Criteria
IMS	IP Multimedia Subsystem
ISC	IMS Service Control
ISDN	Integrated Services Digital Network
NGN	Next Generation Network
NS-FE	Network Support Functional Entity
OSA	Open Service Access
OSE	OMA Service Environment
OSI	Open Systems Interconnection
PCMM	PacketCable Multimedia
PIEA	PSTN/ISDN Emulation Architecture
POD	Point Of Display
PS	(PCMM) Policy Server
PSTN	Public Switched Telephone Network

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RKS	(PacketCable) Record Keeping Server
SCP	Service Control Point
SIP	Session Initiation Protocol
SLF	(IMS) Subscription Locator Function
SPT	(IMS) Service Point Trigger
SSP	Service Switching Point
STB	Set Top Box
STP	Signalling Transfer Point
SUP-FE	Subscriber User Profile Functional Entity
UE	User Equipment
UPnP	Universal Plug and Play
VoD	Video on Demand
WMAN	Wireless Metropolitan Area Network

5 Overview and high-level requirements

5.1 Introduction

The main goal of the 'converged services framework' (CSF) is to provide the experience of a service that operates smoothly and consistently when crossing the boundaries of multiple access and core networks, or when service interaction events occur. To enable this, the framework should support features common to many applications. These include tracking the user state and profile, device identity, state and profile, session state and location across multiple NGN and non-NGN networks.

Another key element of the CSF is that it will allow advanced services to be made available to legacy terminals.

5.2 High-level requirements

The CSF is required to support the following high-level requirements:

- 1) Function across various transport and control networks.
- 2) Integrate user preferences and current state for each active user identifier such that the user is not required to explicitly initiate session mobility.
- 3) Collect user-related information from services, core networks, access networks, devices and applications, subject to privacy and security considerations.
- 4) Process user- and service-related information about a particular user across multiple networks, devices and applications.
- 5) Distribute processed user-related information to services, core networks, access networks, devices and applications, subject to privacy and security considerations.
- 6) Respond to service requests by end users or applications with responses that consider the processed information about a user and his/her state (for example, multiple networks, devices, applications).
- 7) Provide network-specific, application-specific or device-specific translated service requests on behalf of a received service request to allow an end user or network-agnostic application to achieve consistent behaviour across service provider domains.

- 8) Integrate end user identifiers and preferences to create appropriate services' behaviour for the currently "in use" identifier.
- 9) Enable services that allow an end user to cause their current session to be transferred from one device to another, by user profile preference or user action.
- 10) Enable services to be converged across various transport and control networks.
- 11) Support both network-operator-specific and third-party services.
- 12) Support management of user profile, location, presence, availability, preference and service subscription information that spans different networks and devices, subject to privacy and security considerations.
- 13) Provide controlled access to information from services enablers (such as presence, availability, location, registration status, QoS options, media resources, billing) irrespective of the access network, application server and device to create enhanced integrated services on a per-user basis.
- 14) Be compliant with policy-based service management.
- 15) Support policy management of service convergence that is independent of the implementation method of the service.
- 16) Support digital rights management (DRM) and allow service providers to enable DRM when sharing content across multiple devices owned by the same user, across multiple access networks and across multiple identities of the same user.
- 17) Support the use of network adapters which allow information to be successfully delivered across an interface between systems using different data formats and protocols.
- 18) Support a flexible trace mechanism in order to locate service faults effectively.
- 19) Coordinate between services provided to a user, possibly by different service providers, such that their delivery to the user is in compliance with service provider policies and user preferences.

Additionally, the CSF:

- 1) should operate over access networks and NGN domains that are not controlled or managed by the CSF; and
- 2) should provide controlled access to network resources when the business agreement permits, regardless of which network the resource resides within.

6 CSF functional architecture and functional entities

Figure 6-1 shows the CSF functional architecture, comprised of the CSF functional entities, reference points among the CSF functional entities and between CSF and the converged services/applications that rely upon CSF.

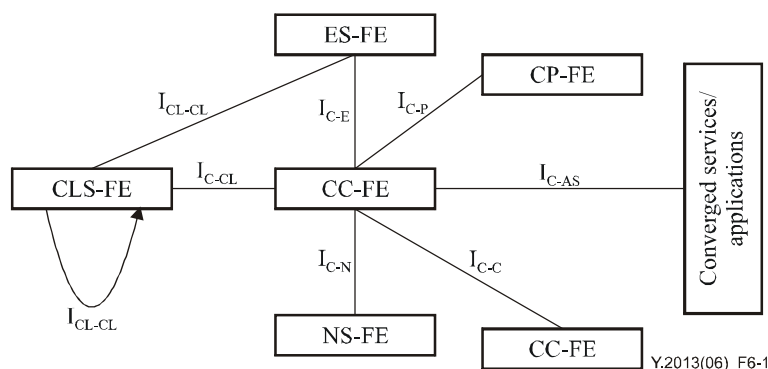


Figure 6-1 – CSF functional architecture

NOTE 1 – The "converged services/applications" box is representing the collection of FEs in support of services and applications provided to the end user. Typically, these would correspond in an NGN environment to the FEs defined in clause 9.3.4 of [ITU-T Y.2012] ("Application support functions and Service support functions").

NOTE 2 – The I_{C-AS} reference point is meant to represent the individual reference points between the CC-FE and any of the FEs pertaining to the "converged services/applications" box (also referred to as the "AS-FE (and similar FEs)" in this Recommendation).

The CSF functional entities identified in Figure 6-1 are individually described in the following sub-clauses in terms of supported functions, supported reference points, actions performed as well as supported information.

6.1 Convergence coordination functional entity (CC-FE)

The convergence coordination functional entity (CC-FE) provides coordination of information about: users, devices, service subscriptions, session management and resource capabilities. The CC-FE takes input from service provider application servers/databases, profile information and/or from the network, edge, client and policy support functional entities in a single network domain or over multiple network domains.

6.1.1 Reference points

The CC-FE supports the following CSF reference points:

- I_{C-AS} , with respect to the AS-FE (and similar FEs). This reference point provides a communication path between the application server and the CSF. Some candidate protocols for this reference point are, for instance, Parlay X and SIP. If I_{C-AS} is based on the IMS services control (ISC) SIP messaging set, SIP messages arriving from the AS-FE (and similar FEs) or the NS-FE are evaluated against the CC-FE user preferences for possible action.
- I_{C-CL} , with respect to the CSF client support function (CLS-FE). This reference point should provide a communication path between the end user device and the CC-FE. I_{C-CL} may transfer client environment information to CC-FE, such as the location of the device. In addition, other CSF-enabled devices with which the client device has communications, and other sessions the client device is participating in, may effect the CC-FE's service coordination decisions. For example, multi-interface devices may be participating in more than one session at a time, so there may be separate CC-FEs (or equivalents) for each session, see I_{C-C} below.
- I_{C-N} , with respect to the CSF NS-FE. This reference point should provide a communication path between a supporting underlying network and the CC-FE. I_{C-N} is the main connection to the "enabling" services of the network, for example location, session control and user

data (as stored in the HSS). I_{C-N} will be implemented over several existing interfaces to existing "enablers" such as ISC to the session control.

- I_{C-E} , with respect to the CSF ES-FE. This reference point provides a communication path between a supporting edge device or network and the CC-FE. Edge devices are those network components between a customer premise and an access network.
- I_{C-C} , the reference point between CC-FEs in different domains. This reference point provides a communication path between CC-FEs, each of which covers and coordinates different service providers or administration domains, etc. With this reference point, it is possible to provide coordination of multiple services of various integration types, such as hierarchical, master-slave and peer-to-peer coordination models. The examples for each model are described in Appendix IV.
- I_{C-P} , with respect to the CP-FE. This reference point provides a communication path between policy functionality and the CC-FE to enable describing, creating, updating, deleting and provisioning.

6.1.2 Actions

CC-FE's actions on receipt of stimulus across one of the reference points that it terminates can be complex and extensive. CC-FE's response to stimulus is related to the following areas of concern:

- Active-sessions-related change.
- Client location change.
- Network equipment state or informational change.
- Session initiation or termination change.
- User preference change.
- Policy change.

Actions associated with active sessions are signalled to the CC-FE from the serving network through the NS-FE over I_{C-N} or from the AS-FE (or similar FEs) over I_{C-AS} . In response to stimulus, the CC-FE will adapt the arriving information to the appropriate form, add or remove information as required of the recipient and forward the information along another of its reference points.

Client location changes will be detected by enablers (such as a location server) in the NS-FE set or by reports from CLS-FE or ES-FE that the end user's device is present within a well known network. If there are any registered applications for location changes of the type reported, those applications will be notified. The user's presently reported location will also be updated.

Network equipment state or informational change would be reported to CC-FE over the I_{C-N} reference point. These might represent user-initiated session-related signalling (i.e., SIP session control to S-CSC-FE) or a user registration with the HSS. The CC-FE would evaluate the report based on the user's preferences for actions, and the network's rules as expressed by network policies. An end result would be appropriate messaging to applications to report session or user registration changes.

In all cases, the CC-FE complies with both user preferences as recorded in the CC-FE user profile and operator policies as directed by CP-FE.

The CC-FE takes simple actions when stimulated. Examples include:

- Notify application of actions (under policies).
- Inform applications of environmental changes.
- Adapt "next application" selection based on information returned by prior application.

For example, on receipt of "new node in local environment" information from an ES-FE (resident within a subnetwork, such as a household wireless network) the CC-FE would consult the

user-preferred response, note the transfer of voice call services to the household fixed network and send a "location update" information to a "call forward" application to place the necessary subscriptions to the user's cellphone to activate the services.

6.1.3 Information

The CC-FE's information contains application, network, device and user-specific entries.

The CC-FE application information model (see [ITU-T M.60]) contains at least the following information for each application that is registered with the CC-FE:

- Identity – how to refer to the application.
- Address – how to contact the application.
- Security – how to verify the application.
- Signalling type (some applications may be non-ISC).
- Priority/sequence within applications using the same ISC message type.
- Required information to be passed to application.
- Allowed actions by the application.

The CC-FE network information model contains at least the following information for each network that CC-FE interacts with (represented by another CC-FE):

- Identity – how to refer to the network.
- Address – how to contact the network's CC-FE.
- Security – information and methods to authenticate this network to the network's CC-FE.
- Signalling type.
- Network allowable requests of this network.
- Network allowable requests of the other service provider networks.

The CC-FE user information model contains the following user profile information:

- Identities – user's identifiers or pseudonyms in all known service provider networks.
- Devices – the users devices and the network(s) providing access ability.
- Access preferences by service type – what device or service provider network is preferred for which type of service.
- Transfer preferences – which service-initiated transfers of session types the network should make for the user (by well known location).
- Well known locations – physical locations that have special meaning to the end user (e.g., their place of residence (home), their place of employment (work), others may be added by the system or end user, as needed).

The CC-FE device information model contains the following information for devices:

- The devices capabilities (a device may be an assembly of several attached devices, each with different capabilities, so device capability may be nested down to non-expandable devices).
- User identifiers associated/registered to this device. The device may be shared between multiple users (e.g., household land line phone and number, TV screen, etc.).

6.2 Network support functional entity (NS-FE)

The network support functional entity (NS-FE) provides session, access and rights information to the CC-FE.

6.2.1 Reference points

The NS-FE supports the following CSF reference point:

- I_{C-N} (see clause 6.1.1)

I_{C-N} is the CC-FE to NS-FE reference point, allowing the CC-FE to interface with the network in which the NS-FE is embedded. Examples of such reference points may include ISC to IMS S-CSCF and Sh to HSS reference points in [ITU-T Y.2021].

NS-FE to network reference points

The NS-FE supports interfaces with the network in which the NS-FE is embedded. Interface candidates include ISC to IMS S-CSCF and Sh to HSS reference points in [ITU-T Y.2021].

6.2.2 Actions

The NS-FE is viewed as a transparent intermediary along the existing reference points available from the service control functions. NS-FE is an architecturally necessary function only when the underlying services layer/functions are not compatible with the CC-FE expectations of I_{C-N} .

6.2.3 Information

The NS-FE retains only the information necessary to connect with the CC-FE and the underlying services entities.

The NS-FE information model contains at least the following information for each network element that NS-FE interacts with:

- Identity – how to refer to the network element.
- Address – where to contact the network elements.
- Security – information and methods to authenticate with the underlying network elements.
- Signalling type.

6.3 Edge support functional entity (ES-FE)

The Edge Support Functional Entity (ES-FE) provides session, access, and rights information about itself and subtending devices to the CC-FE.

The ES-FE interfaces to some combination of the access networks and the customer local networks. It provides session, resource, and identity information about itself and subtending devices to the CC-FE.

The ES-FE is the CSF client in a set top box or similar device, non-mobile edge of an access network device.

6.3.1 Reference points

The ES-FE supports the following CSF reference points:

- I_{C-E} (see clause 6.1.1).

I_{C-E} is the CC-FE to ES-FE reference point, providing ES-FE a means to forward information about the "edge" of the access network to the CC-FE. The CC-FE may also use I_{C-E} to forward commands to the edge device related to CSF functionality.

- I_{CL-CL} .

I_{CL-CL} is a CLS-FE to CLS-FE or ES-FE reference point. I_{CL-CL} provides a means for a CLS-FE in one network domain (e.g., a mobile device) to determine the presence of another network endpoint in its local vicinity (e.g., a home set top box or an office WLAN-based VoIP system). This link might be implemented by a DLNA/UPnP interface across a WLAN or Bluetooth. The two endpoints may be serviced by the same network provider or by different network providers. The

reference point allows for the transfer of appropriate information to enable the two clients to notify their respective CC-FE of the other client's presence.

ES-FE to edge device reference point

The ES-FE interfaces with the edge device in which the ES-FE-enabled device is resident. Most commonly, it corresponds to an edge device API defined by the edge device vendor. The purpose of the reference point is to allow the ES-FE to interact with the underlying device.

In addition, the ES-FE may be given access to APIs that enable "out of box" experiences, allowing the ES-FE to monitor and report on changes to the "local environment" such as the entry or exit of a mobile device (laptop, handset, etc.). This API would be similar in structure and content to UPnP defined for discovery and communications between LAN resident functions.

6.3.2 Actions

The majority of ES-FE actions originate when a ES-FE experiences environment changes, such as detection of new CSF functions within its local environment (nominally wireless access is assumed).

ES-FE primarily reports on changes in the information it stores, for example it will:

- Establish communications with CLS-FEs in the local environment (interface restricted to short range RF) to determine their identity, capability and security authorizations.
- Initial report on entities and/or services available in the local environment or changes in the devices or capabilities in the local environment.
- It is likely that ES-FE will be required to somehow report on alternate paths to the entities in the local environment (or to itself in cases where one end user device can connect to more than one access network, such as cellular and WLAN).

6.3.3 Information

ES-FE stores information regarding:

- The local environment in terms of what networks and/or devices it can correspond with and the services available from them.
- The client's current location expressed as both a network address and (optionally) a physical location (the latter as an aid in emergency services dispatch, although this may be retrieved from the business management system (BSS) instead).
- The devices that are "resident" within the environment (loss of communications usually means that the devices have been moved out of range, powered off or failed).
- The devices that are transient within the environment (loss of communications indicates mobility, a normal event with respect to these devices).
- The current active session of the edge device.

6.4 Client support functional entity (CLS-FE)

The CLS-FE provides session and resource information about the client and the user to the CC-FE.

CLS-FE represents CSF within an end user device. Its role is twofold:

- End user interaction – prompts end users for information and collects their response (if necessary, the users will be prompted for additional information if their original preferences were not absolutely clear).
- End user device interactions – allows for the push or pull of information to and from the end user device (e.g., the cellphone). For example, CLS-FE might update the user's handset-based address book if one of their contacts adds a new contact mechanism to their global set.