

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Y.2025

(07/2012)

SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
AND NEXT-GENERATION NETWORKS

Next Generation Networks – Frameworks and functional
architecture models

Functional architecture of the next generation network service integration and delivery environment

Recommendation ITU-T Y.2025

ITU-T Y-SERIES RECOMMENDATIONS

GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

GLOBAL INFORMATION INFRASTRUCTURE

General	Y.100–Y.199
Services, applications and middleware	Y.200–Y.299
Network aspects	Y.300–Y.399
Interfaces and protocols	Y.400–Y.499
Numbering, addressing and naming	Y.500–Y.599
Operation, administration and maintenance	Y.600–Y.699
Security	Y.700–Y.799
Performances	Y.800–Y.899

INTERNET PROTOCOL ASPECTS

General	Y.1000–Y.1099
Services and applications	Y.1100–Y.1199
Architecture, access, network capabilities and resource management	Y.1200–Y.1299
Transport	Y.1300–Y.1399
Interworking	Y.1400–Y.1499
Quality of service and network performance	Y.1500–Y.1599
Signalling	Y.1600–Y.1699
Operation, administration and maintenance	Y.1700–Y.1799
Charging	Y.1800–Y.1899
IPTV over NGN	Y.1900–Y.1999

NEXT GENERATION NETWORKS

Frameworks and functional architecture models	Y.2000–Y.2099
Quality of Service and performance	Y.2100–Y.2199
Service aspects: Service capabilities and service architecture	Y.2200–Y.2249
Service aspects: Interoperability of services and networks in NGN	Y.2250–Y.2299
Numbering, naming and addressing	Y.2300–Y.2399
Network management	Y.2400–Y.2499
Network control architectures and protocols	Y.2500–Y.2599
Packet-based Networks	Y.2600–Y.2699
Security	Y.2700–Y.2799
Generalized mobility	Y.2800–Y.2899
Carrier grade open environment	Y.2900–Y.2999
FUTURE NETWORKS	Y.3000–Y.3499
CLOUD COMPUTING	Y.3500–Y.3999

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T Y.2025

Functional architecture of the next generation network service integration and delivery environment

Summary

Recommendation ITU-T Y.2025 defines the functional architecture of next generation network service integration and delivery environment (NGN-SIDE), which includes the definition of functional entities, reference points, service procedures and interconnection between different NGN-SIDEs.

This Recommendation builds on the NGN-SIDE framework, general requirements, capabilities, and requirements related to service interfaces described in Recommendation ITU-T Y.2240.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Y.2025	2012-07-29	13

Keywords

Functional architecture, functional entities, NGN, NGN-SIDE, reference points, resource adaptation, service creation, service delivery management, service execution, service integration.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2013

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Table of Contents

Page

1	Scope	1
2	References.....	1
3	Definitions	1
3.1	Terms defined elsewhere	1
3.2	Terms defined in this Recommendation.....	2
4	Abbreviations and acronyms	2
5	Conventions	3
6	Overview of NGN-SIDE	4
6.1	NGN-SIDE general characteristics.....	4
6.2	Position of NGN-SIDE in NGN architecture	4
6.3	Introduction to NGN-SIDE functional architecture	5
7	Functional architecture of NGN-SIDE	7
7.1	NGN-SIDE service creation functional group related functional entities.....	9
7.2	NGN-SIDE service execution functional group-related functional entities...	12
7.3	NGN-SIDE service delivery management functional group related functional entities	19
7.4	NGN-SIDE adaptation functional group related functional entities	24
8	NGN-SIDE reference points.....	26
8.1	NGN-SIDE internal reference points	26
8.2	NGN-SIDE external reference points.....	29
9	NGN-SIDE service procedures.....	30
9.1	Resource registration procedure	30
9.2	Application development procedure.....	31
9.3	Application provisioning procedure	32
9.4	Resource triggering procedure	34
9.5	Context information-based service procedure.....	36
9.6	Charging procedure	37
9.7	Application triggering procedure	39
9.8	Procedure related to accessing resource in another NGN-SIDE	40
10	Security considerations	42
	Annex A – Interconnection between different NGN-SIDEs	43
	Appendix I – APIs for the NGN-SIDE functional architecture	45
	Appendix II – Mapping between NGN-SIDE functional entities and NGN functional entities.....	46
	Bibliography.....	48

Recommendation ITU-T Y.2025

Functional architecture of the next generation network service integration and delivery environment

1 Scope

This Recommendation defines the functional architecture of NGN service integration and delivery environment (NGN-SIDE), which includes the definition of functional entities, reference points, service procedures and interconnection between different NGN-SIDEs.

The Recommendation builds on the NGN-SIDE framework, general requirements, capabilities, and requirements related to service interfaces described in [ITU-T Y.2240].

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 Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of next generation networks*.
- [ITU-T Y.2221] Recommendation ITU-T Y.2221 (2010), *Requirements for support of ubiquitous sensor network (USN) applications and services in the NGN environment*.
- [ITU-T Y.2233] Recommendation ITU-T Y.2233 (2010), *Requirements and framework allowing accounting and charging capabilities in NGN*.
- [ITU-T Y.2240] Recommendation ITU-T Y.2240 (2011), *Requirements and capabilities for next generation network service integration and delivery environment*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 application [b-ITU-T Y.2261]: A structured set of capabilities, which provide value-added functionality supported by one or more services, which may be supported by an API interface.

3.1.2 application network interface [ITU-T Y.2012]: Interface which provides a channel for interactions and exchanges between applications and NGN elements. The ANI offers capabilities and resources needed for the realization of applications.

3.1.3 application programming interface [b-ITU-T I.312]: An API provides a set of interfaces from an application environment to an execution environment. The execution environment provides services to the application environment.

3.1.4 functional architecture [ITU-T Y.2012]: A set of functional entities and the reference points between them used to describe the structure of an NGN. These functional entities are separated by reference points, and thus, they define the distribution of functions.

3.1.5 functional entity [ITU-T Y.2012]: An entity that comprises an indivisible set of specific functions. Functional entities are logical concepts, while groupings of functional entities are used to describe practical, physical implementations.

3.1.6 next generation network (NGN) [b-ITU-T Y.2001]: A packet-based network able to provide telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. It enables unfettered access for users to networks and to competing service providers and/or services of their choice. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users.

3.1.7 NGN service integration and delivery environment (NGN-SIDE) [ITU-T Y.2240]: An open environment in NGN integrating resources from different domains and delivering integrated services to applications over NGN.

NOTE – These domains include, but are not limited to, telecommunication domain (e.g., fixed and mobile networks), Internet domain, broadcasting domain and content provider domain.

3.1.8 NGN service stratum [b-ITU-T Y.2011]: That part of the NGN which provides the user functions that transfer service-related data and the functions that control and manage service resources and network services to enable user services and applications.

3.1.9 NGN transport stratum [b-ITU-T Y.2011]: That part of the NGN which provides the user functions that transfer data and the functions that control and manage transport resources to carry such data between terminating entities.

3.1.10 reference point [ITU-T Y.2012]: A conceptual point at the conjunction of two non-overlapping functional entities that can be used to identify the type of information passing between these functional entities.

NOTE – A reference point may correspond to one or more physical interfaces between pieces of equipment.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

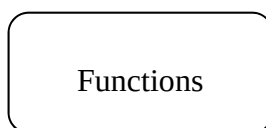
ANI	Application Network Interface
API	Application Programming Interface
BPEL	Business Process Execution Language
CDR	Call Detail Record
CP	Content Provider
CPU	Central Processing Unit
CSN	Converged Service Network
FE	Functional Entity
FTP	File Transfer Protocol

GUI	Graphics User Interface
HTTP	Hyper Text Transfer Protocol
IdM	Identity Management
ISDN	Integrated Services Digital Network
NGN	Next Generation Network
NGN-SIDE	NGN Service Integration and Delivery Environment
NNI	Network-Network Interface
OSE	Open Service Environment
PLMN	Public Land Mobile Network
POJO	Plain Old Java Objects
PSTN	Public Switched Telephone Network
QoS	Quality of Service
REST	Representational State Transfer
SLA	Service Level Agreement
SMS	Short Message Service
SNI	Service Network Interface
SOAP	Simple Object Access Protocol
SP	Service Provider
UNI	User Network Interface
USN	Ubiquitous Sensor Network

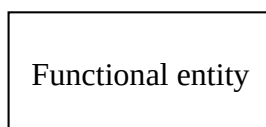
5 Conventions

In this Recommendation:

Functions: In the context of NGN-SIDE architecture, "functions" are defined as a collection of functionalities. It is represented by the following symbol:

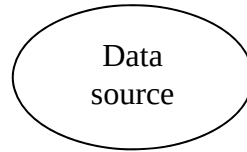


Functional entity: In the context of NGN-SIDE architecture, a "functional entity" is defined as set of one or more functions. It is represented by the following symbol:



Functional group: In the context of NGN-SIDE architecture, a "functional group" is defined as a group of related functional entities. It is represented by the symbol as "functions" shown above.

Data source: In the context of NGN-SIDE architecture, "data source" is defined as particular source of local storage of data (e.g., repository specific to some functional entity). It is represented by the following symbol:



6 Overview of NGN-SIDE

6.1 NGN-SIDE general characteristics

NGN-SIDE [ITU-T Y.2240] provides an environment for service creation, service execution, and service delivery management in order to support the integration of capabilities from different domains over NGN. NGN-SIDE also provides resource brokering and resource adaptors capabilities.

The general characteristics of NGN-SIDE are described as follows:

- 1) NGN-SIDE provides exposure of resources (including service enabler, content, applications and virtualized resources) from different domains (NGN, fixed networks (e.g., PSTN/ISDN), mobile networks (e.g., PLMN), Internet, content providers, broadcast networks (e.g., cable networks, etc.) to applications in a secure and controlled way.
- 2) NGN-SIDE provides a service creation environment including capabilities for application development, resource repository, and testing environment.
- 3) NGN-SIDE provides a configurable, scalable, reliable and virtualized service execution environment including capabilities for resource registration, access control, static and dynamic service orchestration capability, resource manager, and service dispatching.
- 4) NGN-SIDE provides a manageable and configurable service delivery management environment including capabilities for the management of role related information, charging, context management, content management, policy management, application provisioning.
- 5) NGN-SIDE provides capabilities for resource brokering and resource adaptor including adaptors for NGN and adaptors for non-NGN.
- 6) NGN-SIDE provides mechanisms to support USN applications [ITU-T Y.2221].

6.2 Position of NGN-SIDE in NGN architecture

Figure 6-1 shows position of service integration and delivery environment in NGN functional architecture [ITU-T Y.2012].

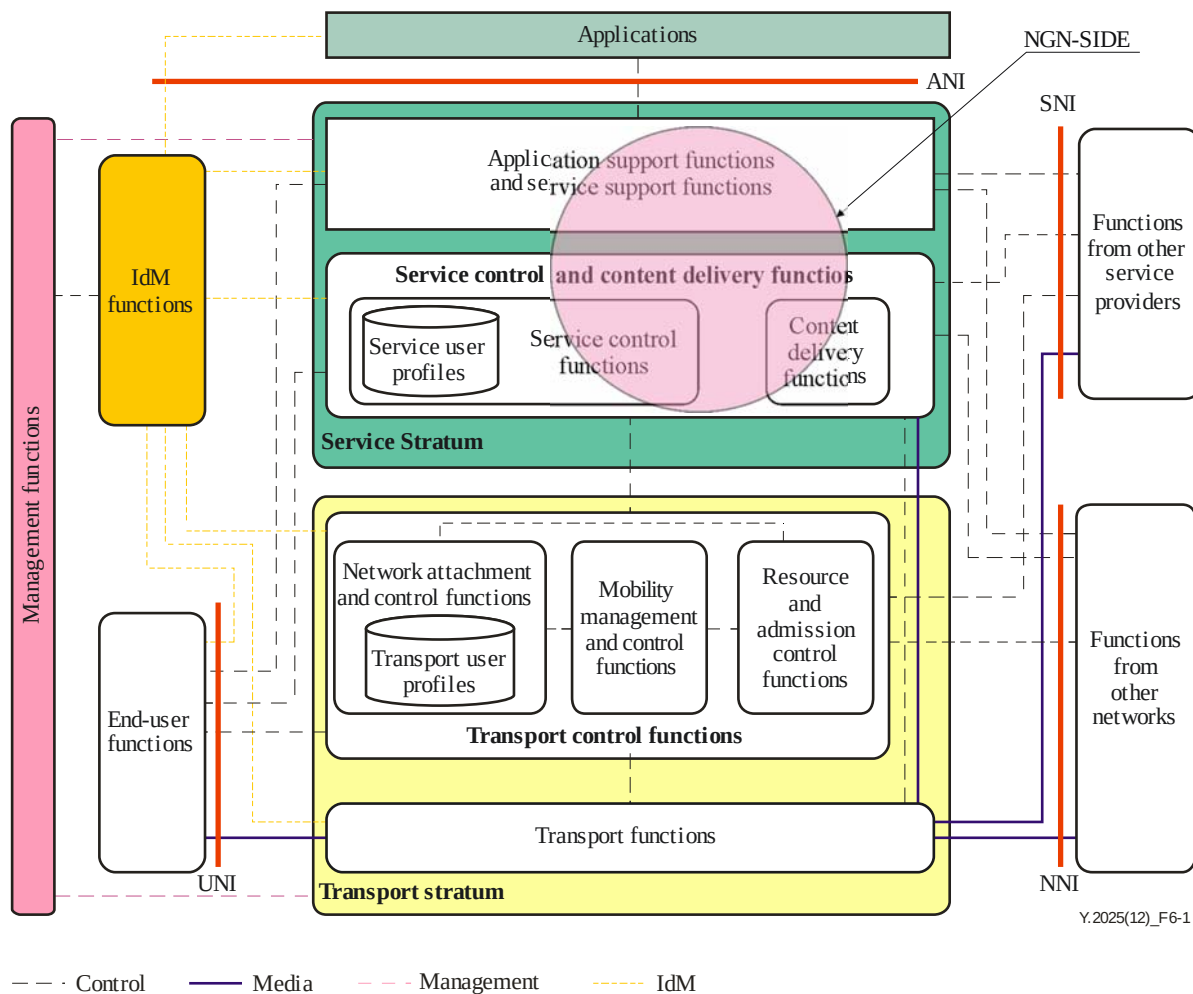


Figure 6-1 – The position of NGN-SIDE in NGN architecture

As shown in Figure 6-1, NGN-SIDE functions reside in the NGN service stratum [ITU-T Y.2012].

6.3 Introduction to NGN-SIDE functional architecture

Figure 6-2 shows the general architecture of NGN-SIDE. The detailed functional architecture is specified in clause 7.

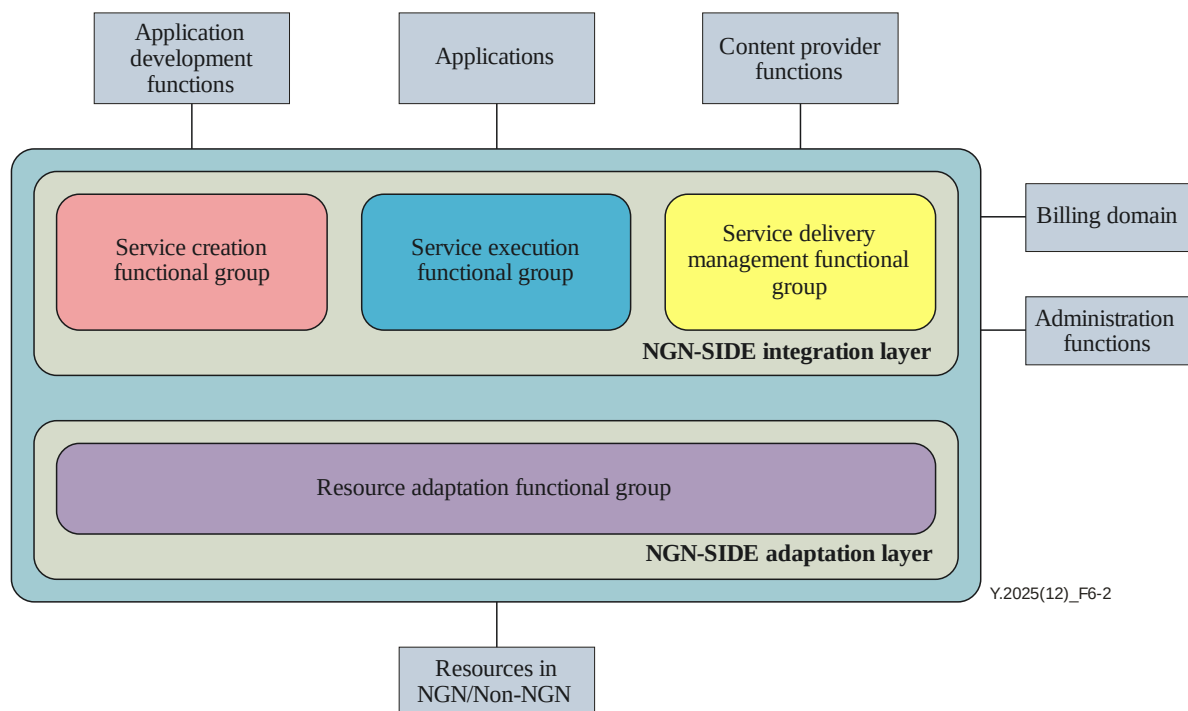


Figure 6-2 – NGN-SIDE functional architecture overview

As shown in Figure 6-2, applications, application development functions, content provider functions, billing domain, administration functions and resources in NGN/non-NGN interact with NGN-SIDE.

6.3.1 NGN-SIDE functions

In line with [ITU-T Y.2240], NGN-SIDE architecture is composed of two layers:

- NGN-SIDE integration layer
- NGN-SIDE adaptation layer.

NGN-SIDE integration layer supports the following functional groups:

- service creation functional group
- service execution functional group
- service delivery and management functional group.

The service creation functional group provides entities to realize an application development environment for application developers. Application developer interacts with service creation functional group to create applications.

The service execution functional group provides entities to support the service execution environment. Service execution receives requests from applications and executes service requests.

The service delivery management functional group provides management support for ensuring proper functioning of the service creation and service execution functional groups and providing associated delivery functionalities.

The NGN-SIDE adaptation layer supports resource adaptation functional group which provides entities to realize resource brokering and resource adaptors. The resource brokering function identifies the appropriate resources from the NGN-SIDE resource based on NGN-SIDE users' request and mediates among resources and applications. The resource adaptor function performs

adaptation of resources from the NGN-SIDE resource provider. The adaptation functional group interacts with different resources offered by NGN and non-NGN.

6.3.2 Functions external to NGN-SIDE

An application developer accesses the FEs in the service creation functional group via application development functions in order to create and test applications.

When an (in-house or third party) application intends to consume the resources integrated in NGN-SIDE, the application sends a resource request to the service execution functional group. The service execution functional group interacts with the related FEs in the service execution functional group and service delivery management functional group to retrieve information related to the processing of request accessing resource in NGN and/or non-NGN.

The resource request is sent to the adaptation functional group to invoke the requested resource. The adaptation functional group brokers and adapts the appropriate resource.

After the resource execution is finished, the response is sent back to the application via the service execution functional group.

The content provider functions enable content provider to make available different types of content to NGN-SIDE.

The billing domain receives and processes charging information from the NGN-SIDE charging functions. As a business support function, the billing domain is outside the NGN-SIDE functional architecture.

The administration functions enable administrator to perform several functions including content management and application life cycle management.

7 Functional architecture of NGN-SIDE

This clause specifies the NGN-SIDE functional architecture with the description of the NGN-SIDE functional entities (FEs) being provided in the following sub-clauses. The description of the NGN-SIDE reference points is provided in clause 8.

The functional architecture of NGN-SIDE is shown in Figure 7-1.

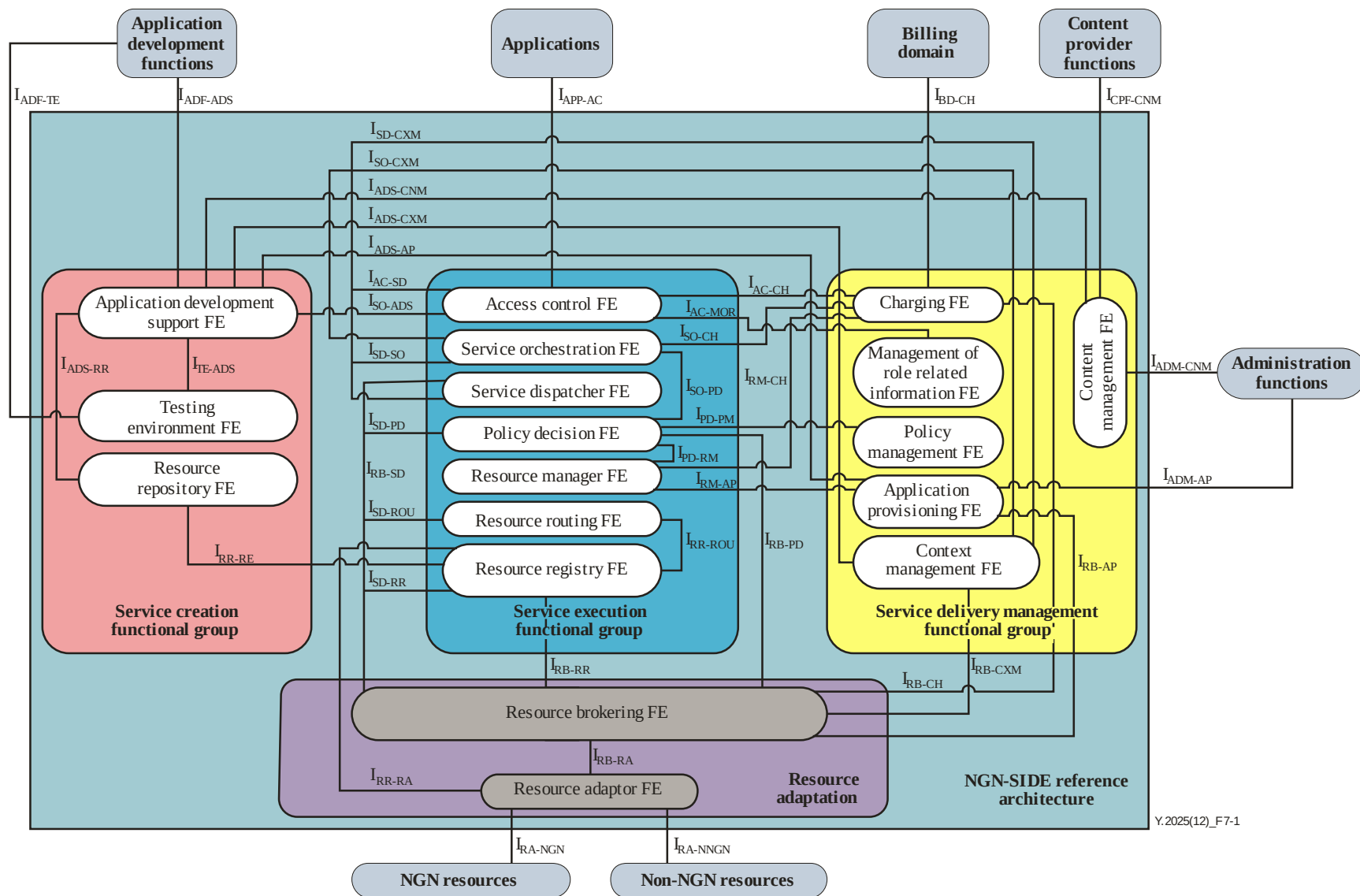


Figure 7-1 – NGN-SIDE detailed functional architecture

The service creation functional group enables application developers to create and test applications. The service creation functional group includes the following functional entities:

- application development support FE
- testing environment FE
- resource repository FE.

Service execution functional group enables applications to access exposed resources. Service execution functional group includes the following functional entities:

- access control FE
- policy decision FE
- resource manager FE
- service dispatcher FE
- service orchestration FE
- resource routing FE
- resource registry FE.

The service delivery management functional group supports service execution and service creation mechanisms. The service delivery management functional group interacts with different external functions such as content provider functions, administration functions and billing domain for content handling, administrative and billing, respectively. The service delivery management functional group includes the following functional entities:

- content management FE
- management of role related information FE
- policy management FE
- application provisioning FE
- charging FE
- context management FE.

The adaptation functional group performs resource mediation and adaptors function to access resource in different domains as well as enables different resources to interact with applications. Adaptation functional group includes the following functional entities:

- resource brokering FE
- resource adaptor FE

7.1 NGN-SIDE service creation functional group related functional entities

7.1.1 Application development support FE

The application development support FE enables application developers to develop applications using resources exposed by NGN-SIDE.

Figure 7-2 shows a functional view of application development support FE.

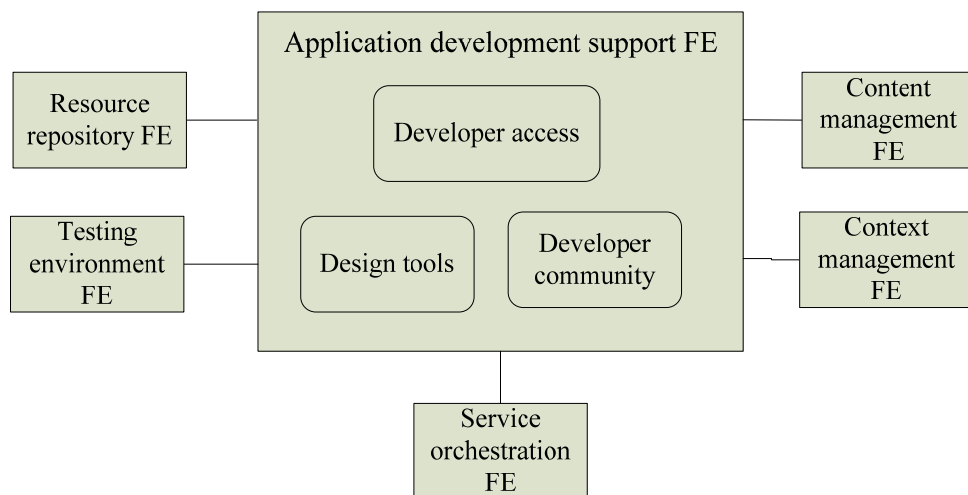


Figure 7-2 – Application development support FE functional view

Application developers can access this FE to develop applications using online and/or offline design tools. The design tools facilitate application development and provide functions including drag and drop, automatic code generation, etc. When developing an application, the application development support FE interacts with the resource repository FE to achieve the development interface information of the resources used in the application, and also interacts with the content management FE to achieve the information of the content used in the application.

For the applications requiring context awareness information, the context management FE exposes the related context information which is used in the application creation procedure.

Developers also can develop composite resources with the application development support FE. Composite resources are stored in the service orchestration FE to be accessible as a resource for other applications.

The developer community function in this FE is an optional functionality which supports a developer forum to discuss and exchange their ideas, and support collection and exposure of customer feedback and ratings about applications, ratings about resources and tools, and provide self-service functions. Furthermore, the developer community provides an entrance for developers to NGN-SIDE. It supports functions of developer registration. In addition, developers can use it to download development documents.

NOTE – The capability of the developer community function can be offered by an independent web portal service. This Recommendation assumes this function is integrated into NGN-SIDE.

7.1.2 Resource repository FE

The resource repository FE provides functionalities for the storage of resource interface description information related to the resources. Application developers use the resource interface to create applications.

Figure 7-3 shows a functional view of resource repository FE.

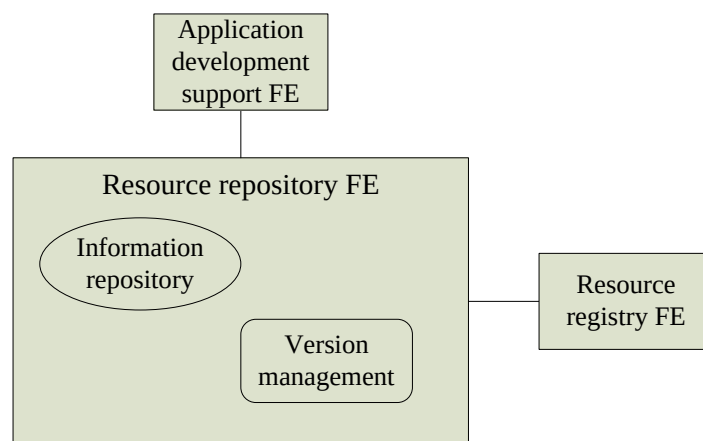


Figure 7-3 – Resource repository FE functional view

The resource repository FE interacts with the resource registry FE for getting resource interface description information.

When a resource is registered to the resource registry, the resource information related to application development such as resource interface description information is stored in the resource repository. The resource interface is exposed to application developers.

The resource repository FE also provides resource version management mechanism to keep synchronization of resource information registered at resource registry FE.

7.1.3 Testing environment FE

Figure 7-4 shows a functional view of testing environment FE.

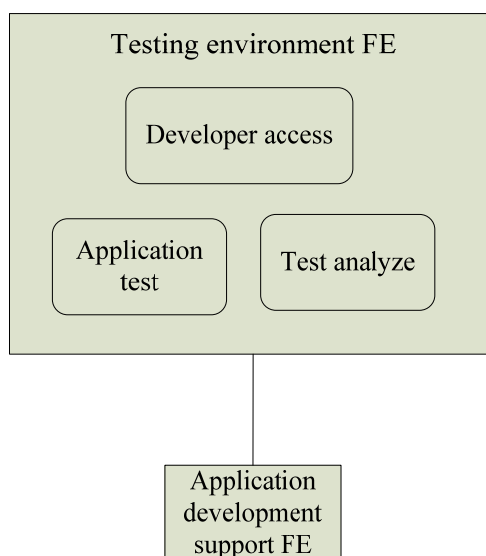


Figure 7-4 – Testing environment FE functional view

Application developers can access this FE to test the created application to ensure its normal running before the application is published. The testing operations include tracing and debugging.

The developer access function can check the developer's access permission and provide a GUI including an overview of the developer's own application such as latest test status.