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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

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1 presented to TSG for information;

2 presented to TSG for approval;

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Introduction

"The User Data Convergence concept supports a layered architecture, separating the data from the application logic in the 3GPP system, so that user data is stored in a logically unique repository allowing access from core and service layer entities, named application front-ends. Network elements and functionalities should be designed to access profile data remotely and without storing them permanently locally, i.e. the front-ends shall work in a user dataless configuration."

TR 22.985 and TS 22.101 provide the requirements for User data convergence so that user data can be moved from where it originated, to a facility called User Data Repository (UDR) where it can be accessed, stored and managed in a common way.

Convergence of user data unifies the user data access interface and its protocol. In addition, the logical centralization of user data implies the support of user data provisioning, that is, user data manipulation like creation, deletion, reading, modification and other operations.

In order to accommodate multiple applications and services, existing and new ones, a framework for model handling and management of the UDC has been developed including:

- UDC information model infrastructure
- UDC information model handling
- Application management
- Consolidated data model management.

1 Scope

The present document specifies the framework for overall management of the User Data Convergence.

In order to accommodate multiple applications and services, existing and new ones, the framework for model handling and management of the UDC as identified by TS 22.101 includes the following items:

- UDC information models:
    - UDC information model infrastructure containing the common baseline information model (CBIM), application information models (AIM), and the specialised information model (SIM). The CBIM is standardised in TS 32.cde [4].
- UDC information model handling:
    - provide a template and guidelines explaining the design of application information models to be used together with the common baseline information model to create the specialized information model
    - describe the process to combine the common baseline information model with application information models in order to produce an operator-specific specialised information model
- Application management data:
    - access control data for an application to UDC: identification and authentication
    - assignment to an application data model, including linkage to the consolidated data model
    - subscription rights for specific events on specific data of specific users
- Consolidated data model management
    - lifecycle management of the consolidated data model in the UDR and in the provisioning entity.
    - activation/deactivation of application adaptation

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TR 22.985: "Service requirement for the User Data Convergence (UDC)".

[3] 3GPP TS 22.101: "Service aspects; Service principles".

[4] 3GPP TS 32.182: "User Data Convergence; Common Baseline Information Model ".

[5] 3GPP TR 32.808: "Study of Common Profile Storage (CPS) Framework of User Data for network services and management"

[6] 3GPP TS 33.102: '3G Security; Security architecture'

[7] 3GPP TS 33.203: '3G security; Access security for IP-based services'

[8] 3GPP TS 23.335: 'User Data Convergence; Technical Realization and Information Flows;Stage 2'

[9] 3GPP TS 29.335: 'User Data Convergence (UDC); User Data Repository Access Protocol over the Ud interface; Stage 3'

[10] 3GPP TS 32.172: 'Subscription Management (SuM) Network Resource Model (NRM) Integration Reference Point (IRP): Information Service (IS)'

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Application Data Model : specific data model used by an application accessing the UDR. It is defined according to the UDC access protocol. It is related to an application information model.

Application Data View: a function of the UDR that enables and limits applications access to data within the UDR.

Application Information Model : specific information model used by an application accessing the UDR. It is defined with the same method as the common baseline information model. It is related to an application data model.

Common Baseline Information Model: basic structure of UDC IOCs, see also definition in 3GPP TS 32.182 [4]

Consolidated Data Model: Data model containing all data of the User Data Repository. It is the result of the implementation of the entire Specialized Information Model in the UDR for all applications.

Information Model: Information Model denotes an abstract, formal representation of entity types, including their properties and relationships, the operations (e.g. read, write…) that can be performed on them, and related rules and constrains. In the information model, entities might have network topology relationship with each other.

Specialized Information Model: Information model containing all information to be stored in the UDR. It is the result of operator specific specialisation of CBIM with addition of imported AIM.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

ADM	Application Data Model
AIM	Application Information Model
AKA	Authentication and Key Agreement
AMF	Authentication Management Field
CBIM	Common baseline Information Model
CDM	Consolidated Data Model
ISIM	IMS Subscriber Identity Module
SpIM	Specialised Information Model
UDC	User Data Convergence
UDR	User Data Repository
UICC	Universal Integrated Circuit Card
USIM	Universal Subscriber Identity Module

4 UDC Framework overview

4.1 General overview

TR 22.985 [2] and TS 22.101[3] request the baseline information model to be future proof and extensible, i.e. new applications and/or new service profiles can be added by the operator, if necessary. The flexibility shall also permit new data for existing applications to be introduced, or modified. For the actual information model of an operator Specialized Information Model is described in TR 22.985 [2].

For the above purpose this specification defines and describes the infrastructure of UDC Information Models in Clause 5.

The correlation and handling of the UDC Information Models is described in Clause 6.

4.2 Requirements coming from other Specifications

TR 22.985 [2] and TS 22.101[3] provide requirements for CBIM and SpIM . These documents also mention the Application Data Models for the Access Interface to the UDC.

Specification 23.335 [8] in Clause 5.2 defines the requirements for application access to the UDR including authentication and authorisation.

Specification 29.335 [9]: defines as Access Protocol over the Ud interface LDAP (Clause 4) and as Data Model on the interface LDAP Directory Schema (Clause 7).

4.3 Overview of UDC Data and Information Models

Figures Fig.4.3-1 and Fig.4.3-2 below show the data and information models contained in the UDC framework including the UDR and the Application Front Ends. Boxes outlined in black. connecting Information and Data Models represent the process steps needed to produce the output model (pointed to by an outgoing arrow) from an input model (shown by the source of an incoming arrow).As shown in these figures, the Specialized Information Model can be both an input and output model, i.e. its current version is used as an input model to a process that generates an enhanced version when an Application Information Model new to the UDR is integrated and consolidated.

Fig.4.3-1 below shows the case of internal integration model handling, where implementation of the Application is under responsibility of the operator . In this situation operator specification of the AIM leads to the Application Data Model (ADM), that gets implemented in the application FE and in the Application Data Model View in the UDR.

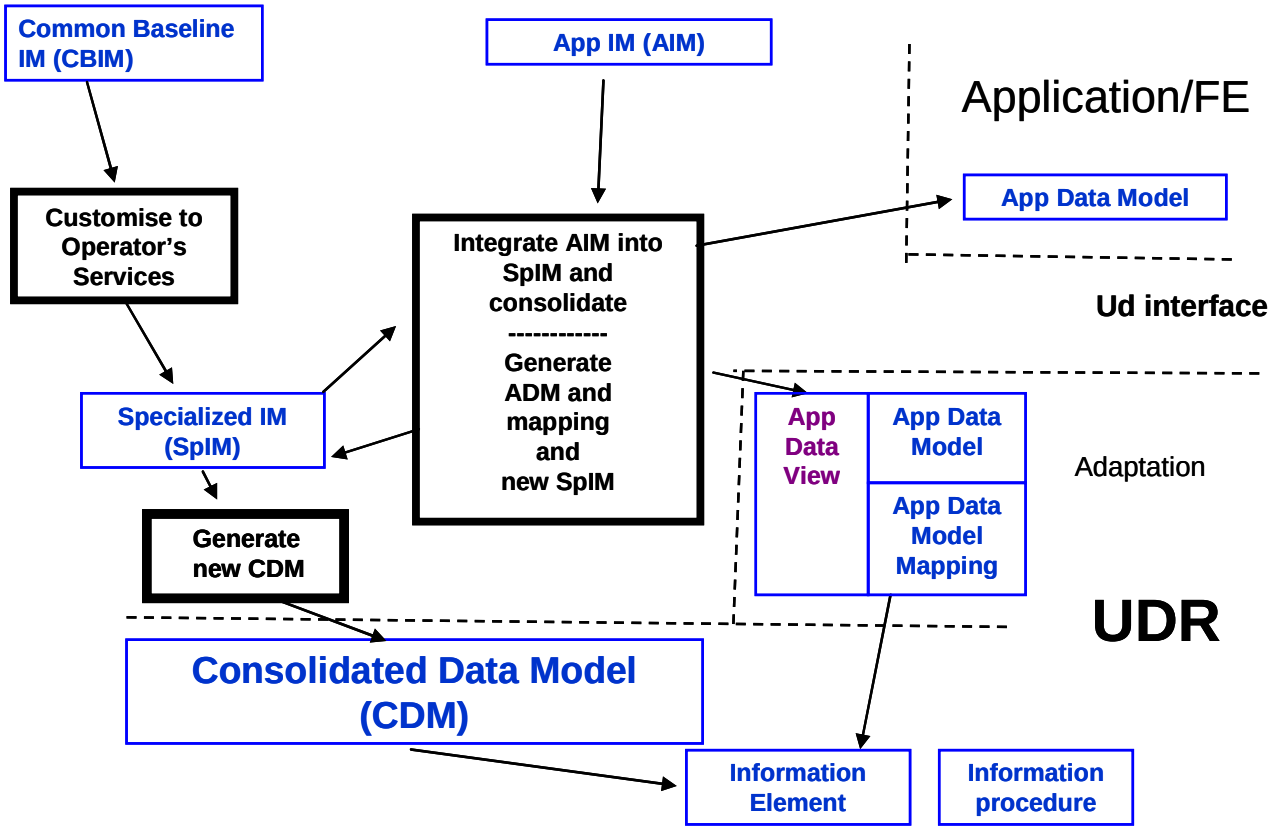

Figure 4.3-1 UDC Data and Information Models Overview with Operator integration model handling

Figure 4.3-2 below shows the case of generation of the Application Data Model (ADM) for an Application/Front-End when the development of the application is not the responsibility of the operator. In this situation, both the CBIM and the AIM of the application are used to generate the ADM being implemented in the Application/Front-End.

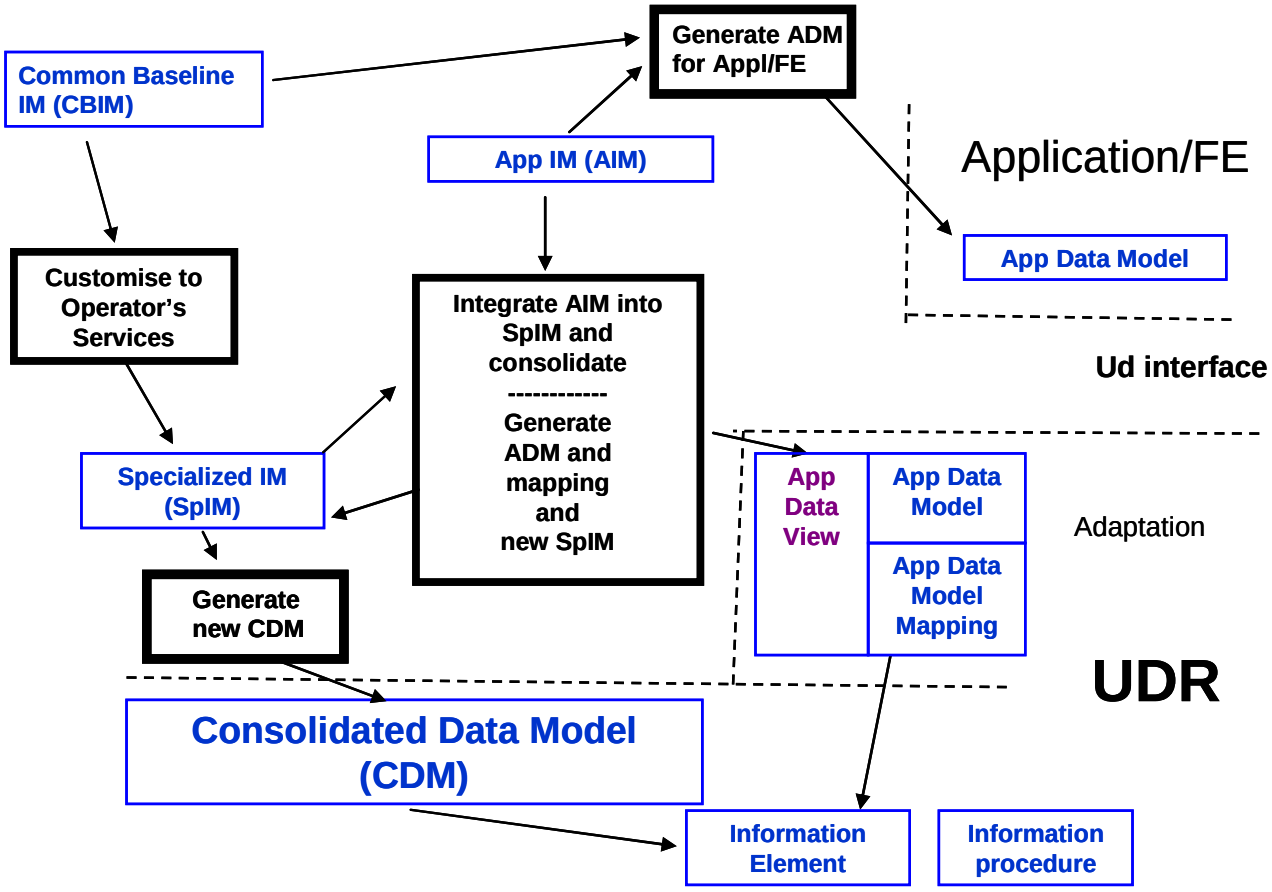

Figure 4.3-2 UDC Data and Information Models Overview with separate ADM generation for the Application/Front-End

5 UDC information model infrastructure

5.1 Common Baseline Information Model (CBIM)

CBIM provides the basic structure of UDC IOCs. It shall enable an operator to integrate the user data to be stored in the UDR.

5.2 Application Information Models (AIM)

NOTE: The present clause introduces AIM. AIM may be imported from existing applications or may be generated from information elements already existing in the UDR.

An AIM should contain IOCs for

- the Service Profile(s) of the particular application,
- Identifier(s) used by the application

and additionally, if needed, any other IOC defined in CBIM. E.g. related End Device, if such is to be connected to one or more identifiers within the application.

5.3 Specialised Information Model (SpIM)

NOTE: The present clause describes building the SpIM from CBIM and AIMs with consolidation of semantically identical data.

SpIM is the Information model containing all information to be stored in the UDR. A Specialized Information Model is operator specific. An implementation of the entire Specialized Information Model in the User Data Repository for all the applications leads to the Consolidated Data Model.

6 UDC information model handling

6.1 General

The relations of the UDC information models are depicted in Figure 6.1-1 below.

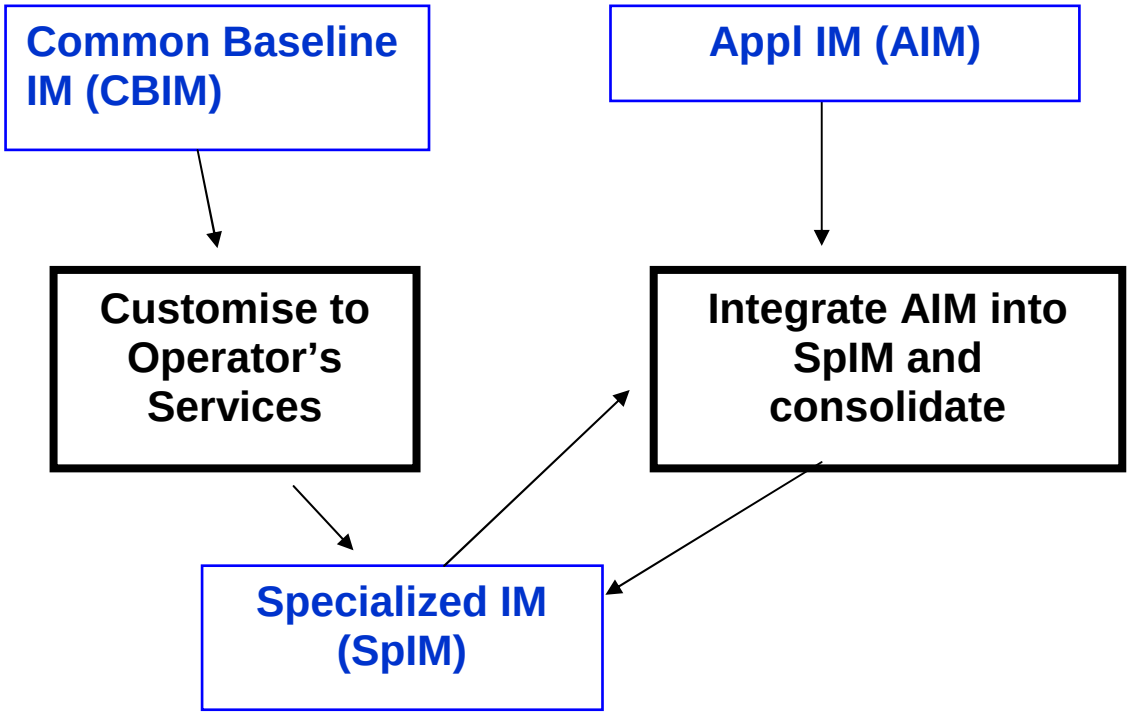

Fig. 6.1-1 UDC Information Models

Figure 6.1-2 below shows the process that leads to integrating and consolidating data for a given operator from the UDR perspective.

Initially the Common Baseline Information Model (CBIM) is specialised according to the service and user structure of the given operator resulting in the initial version of the operator"s the Specialized Information Model (SpIM).

The actual version of the operator"s Specialized Information Model (SpIM)) is combined together with one or more Application Information Models (AIMs) to form a new version of the Specialized Information Model (SpIM) of the operator. The SpIM represents and considers all the data of all converged services offered by the operator.

It is the decision of the operator, when a new actual version of the SpIM is implemented into the UDR. An implementation of the actual version of the SpIM into the UDR leads to the Consolidated Data Model (CDM), which is representing the actual implementation of the UDR.

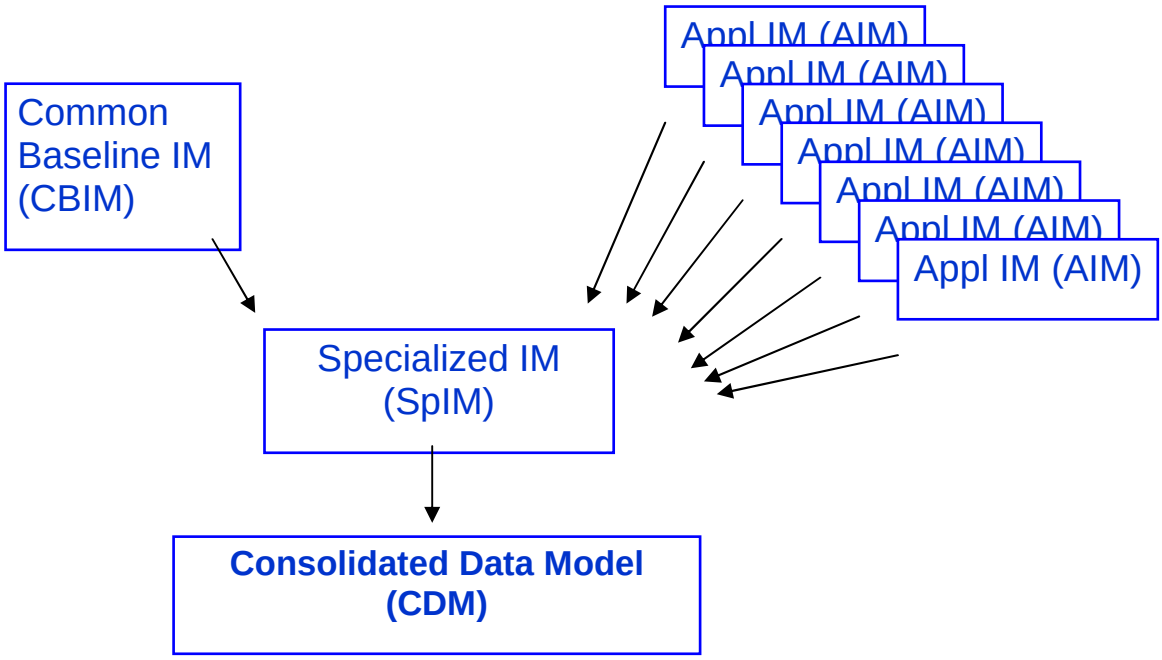

Figure 6.1-2: UDC Information and Data Models in the UDR

Consider now integration for a given application. An Application Data Model (ADM) has to be developed both for the UDR and for the Application/Front-End to be used on the Ud interface.

In the integrated model handling environment under responsibility of the operator implementation of the SpIM and the AIM of the application leads to the Application Data Model (ADM), this is depicted in Figure 6.1-3. The ADM gets implemented in the application FE and in the Application Data Model View in the UDR.

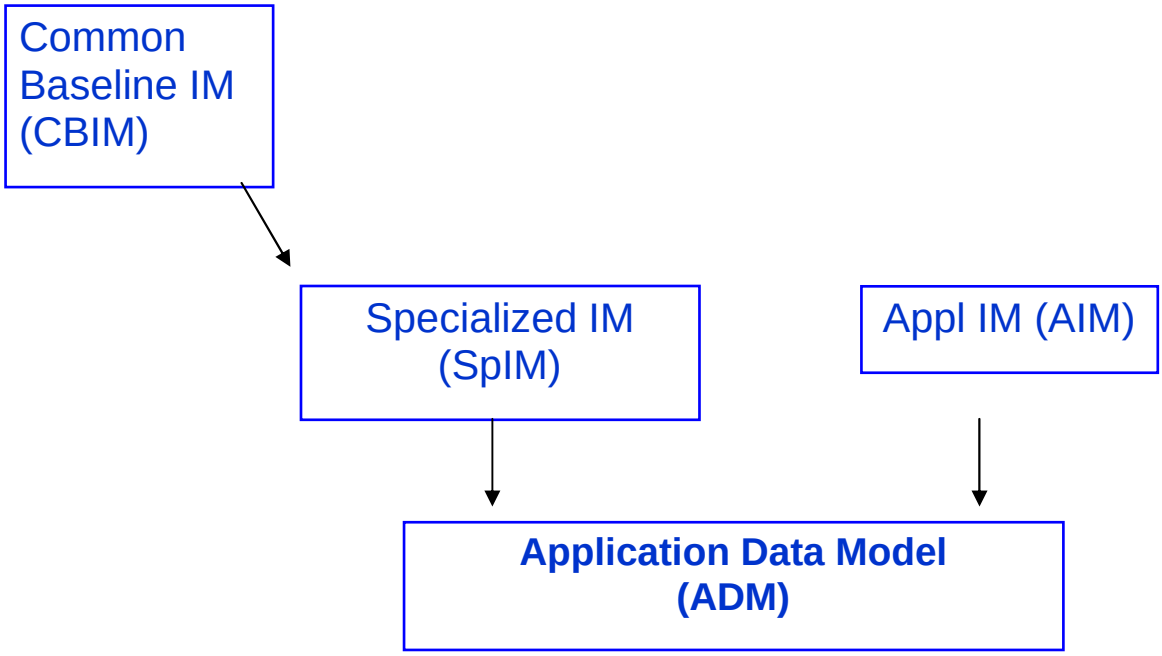

Figure 6.1-3: UDC Information and Data Model handling for an Application Type in an integrated Operator environment

In the case of separate development of the Application Data Model (ADM) for an application on the Application/Front-End side, implementation of the CBIM and the AIM of the application leads to the ADM being implemented there. This is depicted in Figure 6.1-4.

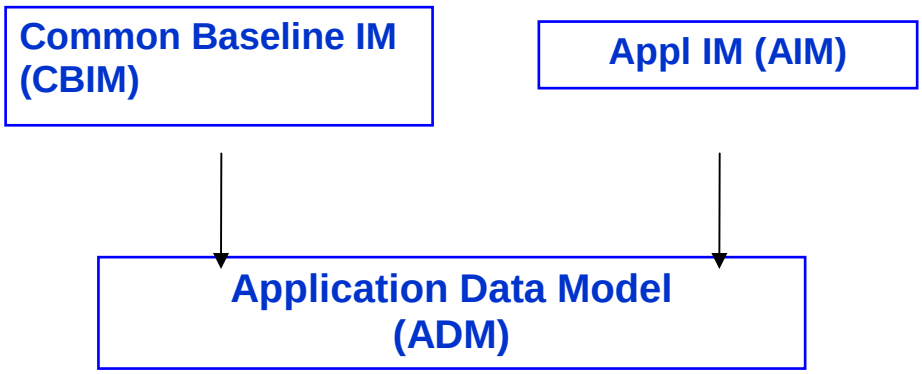

Figure 6.1-4: Separate Information and Data Model handling for an Application Type for Application Front-End

6.2 Initial SpIM Creation from CBIM

The Specialized Information Model is initially generated through operator specific specialisation of CBIM e.g. through definition of the operator-specific End-User groupings.

6.3 AIM Integration into SpIM

After the initial SpIM has been created, AIMs are imported and consolidated into it. The SpIM takes into account the specific applications, the functionality included and the relevant business information.

6.4 Consolidation of User Data in the SpIM

6.5.1 Example of consolidation of data in the SpIM using aggregation

The Figure 6.5.1-1 below provides an example of building the SpIM by aggregating semantically identical data. Attributes that are common to at least two different service profiles are defined in IOCs that are then aggregated to these service profiles. For example, the Roaming1 IOC contains roaming data that is common to GPRS, EPS and CS service profiles, ODB3 contains operator determined barring data that is common to both GPRS and EPS service profiles and Trace contains data that is about subscriber and equipment trace common to all GPRS, CS, EPS and IMS profiles. Using aggregation means that the attribute value will be always same in each of the service profile that has aggregated the IOC where the attribute is defined. Note also that this example only shows how a portion of the data can be consolidated using aggregation.

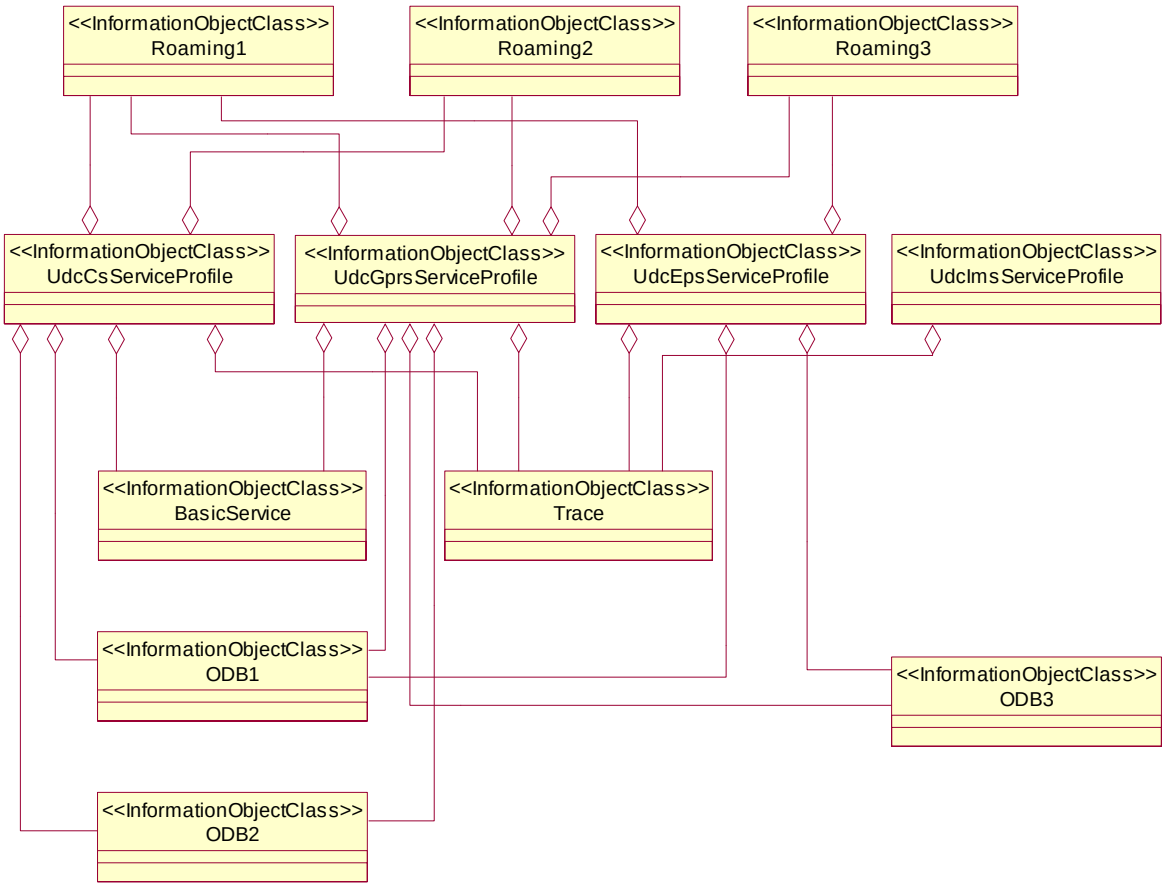

Figure 6.5.1-1: Consolidation of data in the SpIM using aggregation.

6.5.2 Example of specialization for authentication methods

Figure 6.5.2-1 shows an example of how the CBIM can be further specialized for the purpose of considering different authenticatio-n methods.

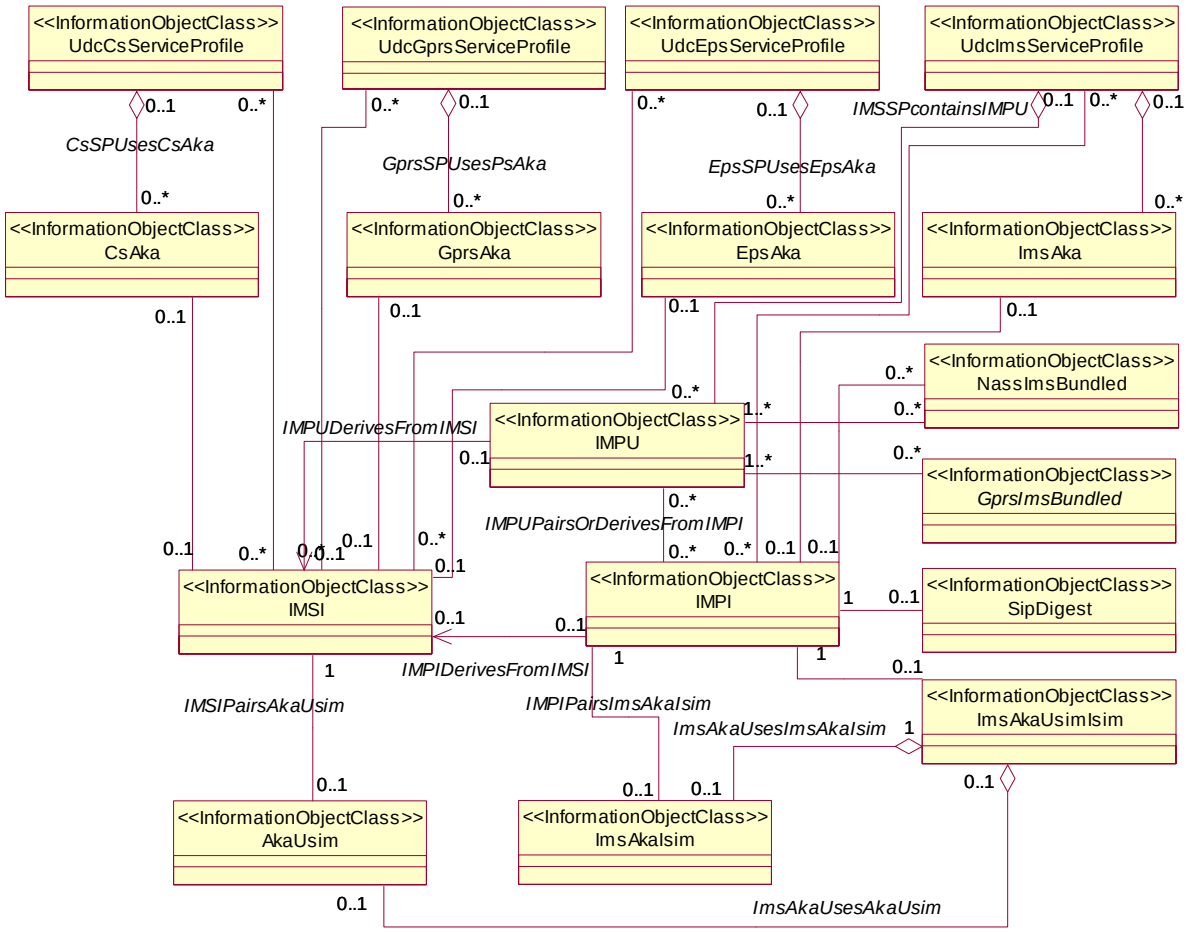

Figure 6.5.2-1: Authentication methods

6.5.3.1 AkaUsim

6.5.3.1.1 Definition

This object class represents data that is required to perform Authentication and Key Agreement (AKA) when the UE is equipped with a USIM. For details of AKA see subclause 6.3 in 3GPP TS 33.102 [6]. For example, an encrypted subscriber key and the AMF can be attributes of this object class.

6.5.3.2 CsAka

6.5.3.2.1 Definition

This object class represents data that is required to perform AKA when accessing Circuit-Switched services, such as the sequence number used for AKA authentication to access CS services. For details of AKA see subclause 6.3 in 3GPP TS 33.102 [6].

6.5.3.3 GPRSAka

6.5.3 3.1 Definition

This object class represents data that is required to perform AKA when accessing GRPS services such as the sequence number used for AKA authentication to access GPRS services. For details of AKA see subclause 6.3 in 3GPP TS 33.102 [6].

6.5.3.4 EpsAka

6.5.3.4.1 Definition

This object class represents data that is required to perform AKA when accessing Evolved Packet-Switched services, such as the sequence number used for AKA authentication to access EPS services. For details of AKA see subclause 6.3 in 3GPP TS 33.102 [6].

6.5.3.5 ImsAkaIsim

6.5.3.5.1 Definition

This object class represents data that is required to perform IMS AKA for accessing IMS services when the UE is equipped with a UICC that contains an ISIM, for example, the encrypted subscriber key and AMF that is used for accessing IMS services. For details of IMS AKA see subclause 6.1 in 3GPP TS 33.203 [7].

6.5.3.6 ImsAka

6.5.3.6.1 Definition

This object class represents data that is required to perform IMS AKA when accessing IMS services, such as the sequence number used for AKA authentication to access IMS services. For details of IMS AKA see subclause 6.1 in 3GPP TS 33.203 [7].

6.5.3.7 ImsAkaUsimIsim

6.5.3.7.1 Definition

This object class represents the data that is required to perform IMS AKA for accessing IMS services when the UE is equipped with either a USIM or an ISIM, for example, the realm. It aggregates one of the AkaUsim or ImsAkaIsim object classes, depending on whether the UE is equipped with a USIM or an ISIM, respectively. For details of IMS AKA see subclause 6.1 in 3GPP TS 33.203 [7].

6.5.3.8 GPRSImsBundled

6.5.3.8.1 Definition

This abstract object class represents the data that is required to perform GPRS-IMS bundled authentication. For details of the GPRS-IMS bundled authentication see 3GPP TS 33.203 [6] Annex T.

NOTE: This object class is set to be abstract because it does not need any new particular data. The GPRS-IMS bundled authentication requires the IPv4 address or Ipv6 prefix allocated by GPRS to the UE, therefore, data that is stored elsewhere. This object class is merely here for completeness, but need not be implemented.

6.5.3.9 NassImsBundled

6.5.3.9.1 Definition

This object class represents the data that is required to perform NASS-IMS bundled authentication, such as the line identifier. For details of the NASS-IMS bundled authentication see 3GPP TS 33.203 [6] Annex R.

6.5.3.10 SipDigest

6.5.3.10.1 Definition

This object class represents the data that is required to perform SIP Digest authentication for accessing IMS services. For example, it includes the H(A1) parameter of HTTP Digest, the realm, QoP, and Algorithm directives in HTTP Digest authentication. For details of the SIP Digest authentication see 3GPP TS 33.203 [6] Annex N.

6.5 Construction of AIM

An AIM comprises all the information required by an application. In the construction of an AIM, the following possibilities exist with respect to the current version of the SpIM:

- AIMs may be constructed from new information not yet present in the current version of the SpIM.

- AIMs may be constructed by using information that already exists in the current version of the SpIM.

- AIMs may be constructed requiring both new information and information that already exists in the current version of the SpIM.

7 Application management

7.1 Application Access Control Data

Specification 23.335 [8] in Chapter 5.2 defines the requirements for application access to the UDR including authentication and authorisation.

To be able to authenticate an application and to provide it access data in the UDR the following have to be stored:

- identity of the application including additional access protocol dependent authentication information (e.g. password)

- type of the application with associated Data Model

To be able to authorise an application for access to data in the UDR the following have to be stored:

- allowed PLMN-Id(s)

- allowed operations with the associated Data Model

- restrictions on operations possibly at information element level.

7.2 Application Data Model and Mapping to Consolidated Data Model

7.2.1 Application Data Views

Different applications have different needs when accessing the data. Consider a piece of data: some applications may need to read and write that data; other applications will only need to read the same data; and a third group of applications should not be able to access that data at all. Since the UDR implements the CDM, there must exist a mechanism to control the access of data per application, so that only the authorised subset of the CDM is exposed to that application with the correct access permissions, details on primary access control are to be found in Chapter 7.1 of this specification.

Access only to the authorised subset of the CDM is achieved by implementing Application Data Views in the UDR connected to the different application types. The concept is illustrated in Figure 7.2.1-1 in a simplified way. A detailed

figure is given in Figure 7.2.1-2, and a more developed concept (considering different vendors) is provided in Figure 7.2.1-3.

According to Figure 7.2.1-1 , the UDR implements the CDM. Application Data Views are implemented for each application type accessing its specific user data within CDM in the UDR. The Application Data View is responsible for enabling and limiting applications access to data within the UDR.

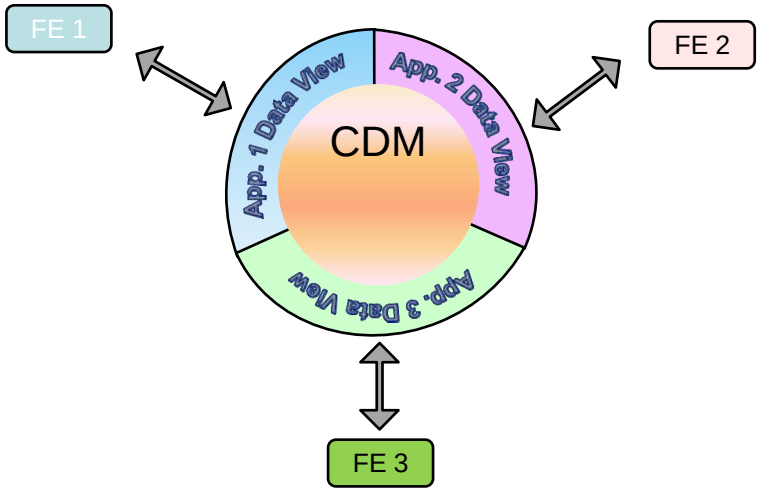

Figure 7.2.1-1: Application Data Views in the UDR (simplified)

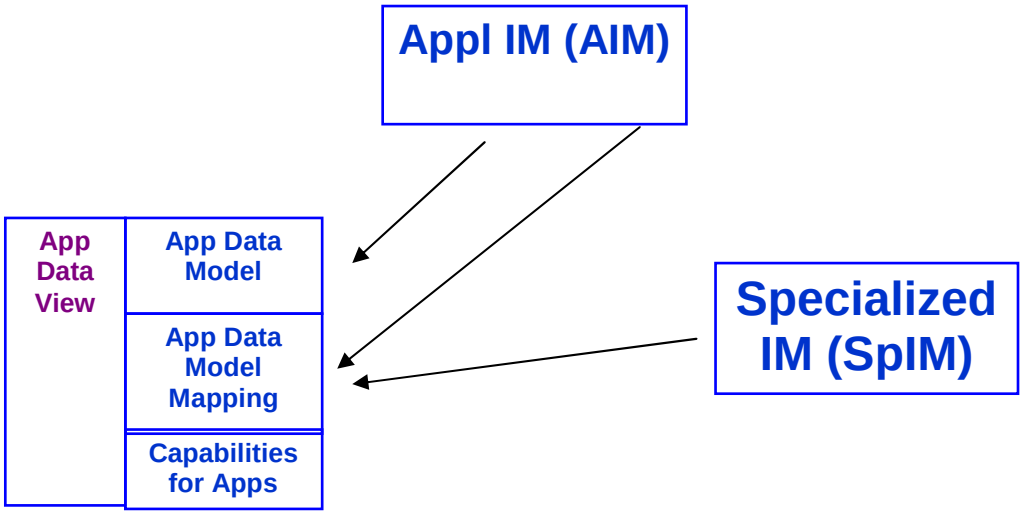

Figure 7.2.1-2: Correlation of IM and Application Data View for a single Application type in the UDR

In a multi-vendor scenario, for a given application type, each Front End vendor and application version may implement their own data model. Therefore, data models for the same application need not be equal across different vendors or release of the software. This scenario conceptually requires a different application data model mapping for each application and vendor. The concept is illustrated in Figure 7.2.1-3. For each application type, there can be a number of Application Data Views, each one handling the mapping to the particular data model of the vendor of the Front End. For example, for Application type #1, there can be three Front End vendors, named $FE1_1$, $FE1_2$, $FE1_3$, respectively. Each of these front ends implements its own data model. A different Application Data View handles the correct mapping to each data model. In Figure 7.2.1-3, Application Data View 1_1 manages $FE1_1$, Application Data View 1_2 manages $FE1_2$, Application Data View 1_3 manages $FE1_3$, and so on.

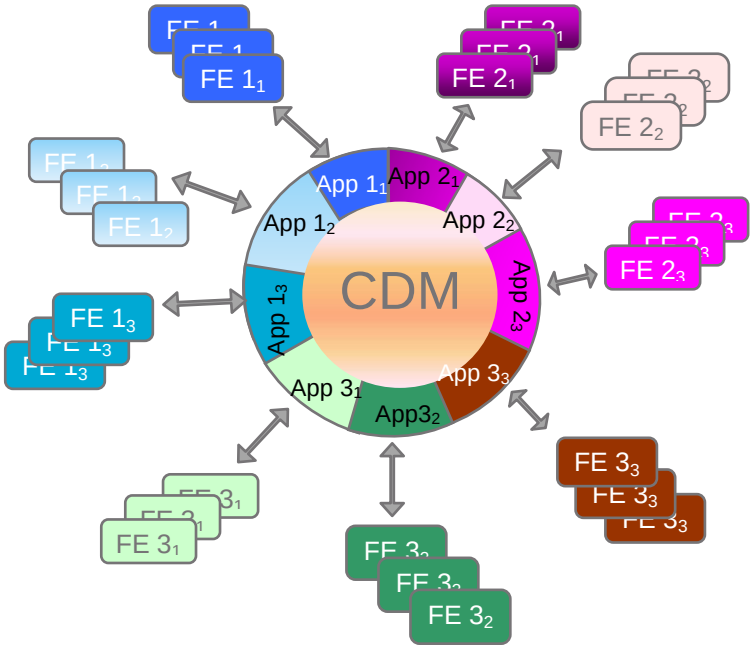

Figure 7.2.1-3: Application Data Views in the UDR

7.3 Subscription and Notification Related Data

Specification 23.335 [8] in Chapter 5.7 and 5.8 defines the procedure of subscription and notification. Specification 29.335[9] in Chapter 6.6, 6.7 and Annex A defines the content and format of the subscription and notification messages.

Subscription can be done by subscription message (dynamic) or configuration of the UDR (permanent). To support both kinds of subscription and to allow authorised unsubscribe operations, the following information should be stored in the UDR:

- type of subscription, dynamic or permanent
- user identifier, e.g. IMSI, MSISDN, IMS public user identity or IMS private user identity, if not specified the subscription is applicable to all users" data of the application in the UDR.
- information on the data requested to be observed
- identity of the original (originating) subscribing entity identity, this item indicates the original entity which sent the subscription request message to the FE in order to subscribe to the notification of the specific events of the data requested to be observed
- notification condition(s), this item indicates the specific events on which the notification shall be triggered. The triggering events shall consist of one or more of the following: the addition of the observed data, the deletion of the observed data or the changes of the observed data.
- type of notification, this item indicates whether this subscription request should lead to a notification to any FE of the application type or cluster identifier, or to a notification to the FE requesting the notification.to originating entity or to an FE/application based on actual selection

To support dynamic subscriptions the following information has to be stored in the UDR:

- the subscription expiry time
- the identifier of the FE or the FE Cluster which sent the subscription message (conditional, if the notification type indicates that the notification is to be sent to the FE requesting the subscription, this item is needed.)

To support the notification of data modification, the following information should be stored in the UDR:

- additional data to be sent to the application in the notification when the notification condition is met
- the FE selection algorithm (conditional, if the notification type indicates that the notification is to be sent to any FE of the application type or cluster identifier, this item is needed. This is only the identifier of the selection algorithm, not the algorithm itself.)

If the Notification Type indicates that the notification is to be sent to any FE, when the notification condition is met, the UDR should use the FE select algorithm to select a proper FE to notify. For example, the UDR may select to notify the application actually serving the user.

8 Consolidated data model management

8.1 Lifecycle Management of the Consolidated Data Model in the UDR

Figure 8.1-1 below shows the operational environment of UDC according to Figure 4.3-1. The Provisioning Gateway is an additional aspect which is essential for the operation of the UDR. The Provisioning Gateway provides a single logical point for consistent provisioning of user data for all services in the UDR. The mechanism used by the Provisioning Gateway to access UDR data using the CDM is outside the scope of the present document. The Application boxes denote Application Front Ends including Provisioning Front Ends according to 23.335 [8]. The Provisioning Front Ends access UDR data via the Ud reference point and are restricted by their Application Data Model.

Chapter 4.3 describes how AIM(s) may be added and consolidated into the SpIM and the generation of the Application Data Model and its mapping to the CDM. It is the decision of the operator when the newly added AIM(s) may become operational.

It is the decision of the operator, when a new actual version of the SpIM with the newly added AIM(s) is implemented into the UDR as actual version of the CDM.

The Provisioning Gateway provides a view of the actual version of the CDM to enable provisioning of all data stored by different applications in the UDR.

The CDM implementation into the UDR is an atomic operation.

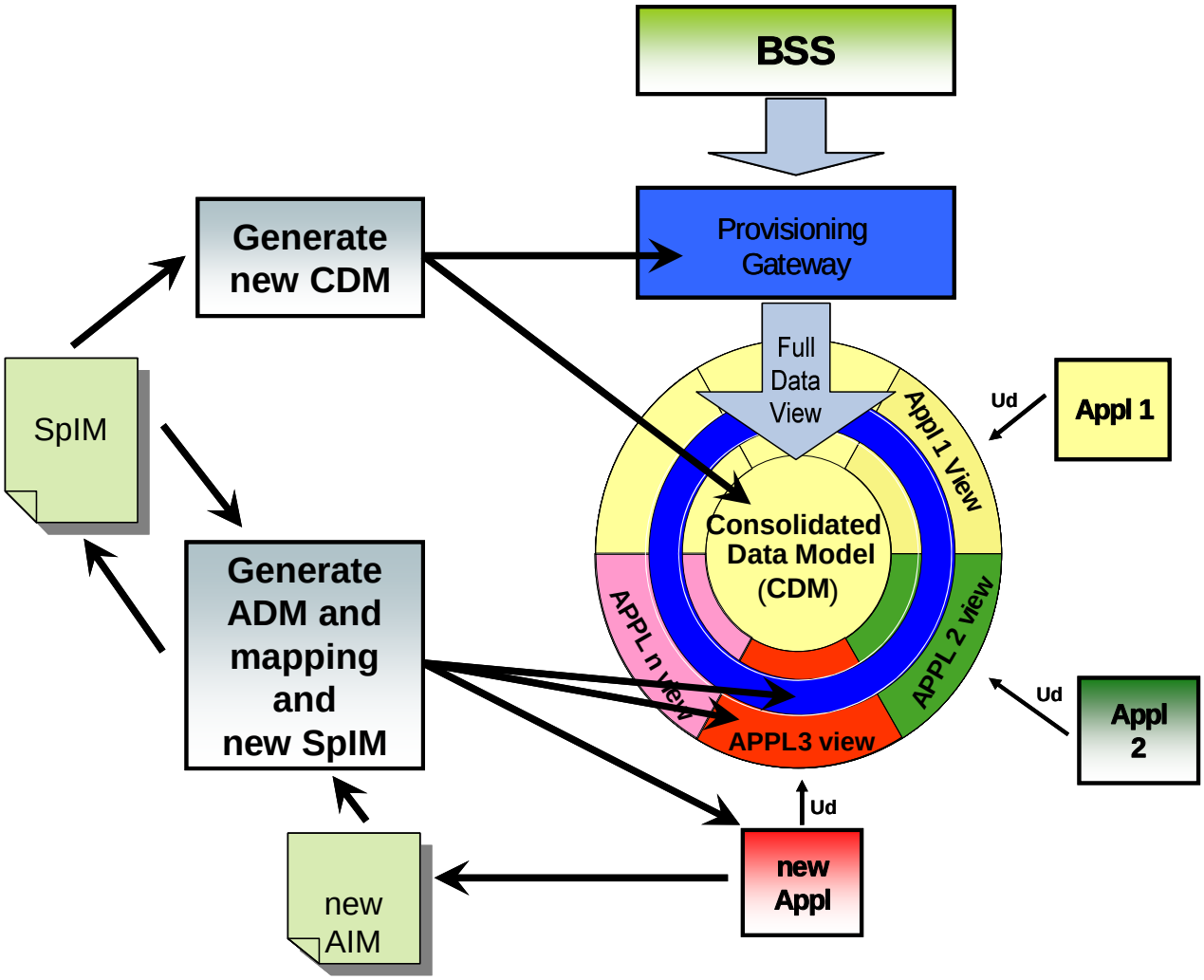

Figure 8.1-1: Evolution of the CDM in a UDR

8.2 Activation and Deactivation of Application Adaptation

As described above the operator shall be capable of

- adding new AIM to SpIM, described in Chapter 4.3

- adding ADM to UDR together with adaptation to CDM as described in Chapter 4.3 and 8.1.

- generate and activate new actual CDM based on the current SpIM as described in Chapter 8.1 above

- activate the access of the application to its data in the UDR which can only be done after the implementation of the CDM containing that data and is done by associating the proper Application Data View to the application.

- deactivate the access of the application to its data in the UDR which is needed when, for example, the data of the application have changed Deactivation is done by deleting the current association of Application Data View to the application.

9 Relation to other Information Models

9.1 Relation to SuM Network Resource Model

The 3GPP SuM NRM as defined in the TS 32.172 [10] contains the information model related to the provisioning of the data of 3GPP services stored in the UDR.

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2010-03	SA#47	SP-100066	--	--	Presentation to SA for information	--	1.0.0
2010-06	SA#48	SP-100372	--	--	Presentation to SA for approval	1.0.0	2.0.0
2010-06	SA#48	--	--	--	Publication	2.0.0	9.0.0
2010-09	SA#49	SP-100489	001	--	Correct inconsistency of PsAka with GprsAka	9.0.0	10.0.0
2012-09	-	-	-	-	Update to Rel-11 version (MCC)	10.0.0	**11.0.0**
2014-10	-	-	-	-	Update to Rel-12 version (MCC)	11.0.0	**12.0.0**

History

Document history		
V12.0.0	October 2014	Publication