Abstract — This paper describes business cases where EMA provisioning uses CAI3G interface. CAI3G follows the standards used for web services technology, i.e. SOAP and XML, enabling quick upstream integration to Business systems and Portals for both User and Service provisioning with low cost.

Keywords — CAI3G, EMA, Service provisioning, User provisioning.

I. INTRODUCTION

The purpose of this paper is to describe business cases where CAI3G interface is used for both service and user provisioning through Ericsson Multi Activation (EMA) system. With the powerful XML document structure, CAI3G is a flexible protocol that can easily adapt to complex data models and integrate aggregation functions. So not only Network Element Function but also Mediation Function can implement this interface for more complicated data model with a lower cost and effort in the service network domain as well as the core network domain.

The Network Element Function provides services to end-users. It implements interface for provisioning from Business System and Mediation Function. The Mediation Function is a gateway between Business System and Network Element Functions, which provides a common provisioning interface to Business System probably with some extra services. The Mediation Function consumes interface to provision Network Element Functions when implementing interface for Business Systems. The Business System handles the billing, provisioning and customer relationships, which consumes either interface to provision Network Element Functions directly or interface to provision Network Element Functions via Mediation Function.

Building a service network by just adding new features to existing architecture will not do the trick. Lot of effort must be put in defining a good architecture to get good scalability and availability. The mindset must be thousands of services and millions of users in a dynamic environment changing every day. More and more operators are looking for multi-national service networks that put even higher requirements on the architecture.

Performance is not the only issue. Operators have to follow latest trends and technologies in mobile industry in an efficient way. It is very hard to cover all possible applications in the most quality way. Therefore they must open their network and offer basic services to external partners that are going to bring new value added service.

The network architecture, aside being available and scalable, has to be open and flexible to allow easy integration with multitude of external application systems. Network architecture should also be able to enable those external partners to discover and combine in appropriate way services they offer.

II. SERVICE NETWORK FRAMEWORK (SNF)

The Service Network is an open, IP based application environment that allows and supports integration of applications and enablers. This environment encourages innovation and simplifies fast and easy implementation of ideas as services available for the end-users in the mobile network. This is very important for the operators to stay competitive in the, for example, Mobile Internet market.

The provisioning performed within the Service Network domain is based on Ericsson Service Network Framework (SNF) Data Model, which sets the logical relationship between entities such as Users, Subscribers, Customer Segments, Service Packages and Offered Services.

The Ericsson architecture for a service network provides:

- High Scalability
- High Availability
- Manageability
- Standards alignment
- Openness
- Interoperability
- Security
- Flexibility

SNF Data Model as a foundation for the service network will:

- Contain information about all users, services and subscriptions in the service network
- Provide the necessary foundation for all deployed applications and enablers to efficiently integrate and cooperate.
- Supports the integration of other data models by the concept of affiliation

Therefore existing Data Models need not to be adapted to the SNF Data Model. Legacy Integration is supported. The SNF Data Model remains relatively insulated from change as customisations and new implementations of
affiliates models become available. It is possible to use different Data Access technologies in affiliate data models.

III. EMA AND COMMON DIRECTORY

The EMA version Personal Service Environment Manager (Service Provisioning) product combines the flexible provisioning capabilities of EMA with the storage capabilities of a Common Directory. The EMA, version Service Provisioning, gives to an operator’s service network one single point of access to data and thereby relieve services from dependencies and complexity. It provides one single point of provisioning for the Service Networks users and services, expandable to cover Core Network as well.

EMA version Service Provisioning implements business logic based on the data model defined in Service Network Framework (SNF), giving one provisioning interface for Business Systems, customer self care and other types of Business systems. It is an essential cornerstone in Ericsson Service Delivery Platform (SDP), which is a pre-verified system solution that provides common functions defined by the SNF architecture. This system solution enables the operator to shift from heterogeneous vertical solutions to a horizontal Service Network based on SNF. The SNF architecture is built on the idea that its systems will offer common services used by all applications and support reuse of design. Thereby a competitive advantage is created for the operator with reduced application life cycle costs and improved time to market for new applications.

EMA version Service Provisioning is designed to seamlessly fit into Ericsson 2G and 3G mobile systems and reuses the function/hardware of already deployed Multi Activation solutions in the operator’s network. This enables the convergence of the provisioning functions for both Core Network and Service Network.

The Common Directory (CD) is a central global user information model with loose coupling to affiliate data models, ensuring consistency as well as flexibility in the service provisioning procedure. The information stored in CD is described in the figure 1.

![Common Directory](image)

Fig. 1. Common Directory content

EMA and its Common Directory subsystem implements the SNF Schema where one user corresponds to one entry in the Directory Information Tree.

EMA supports CAI, CAI3G and LDAP as downstream interface for provisioning towards external SNF compliant applications and enablers.

IV. LDAP IMPLEMENTATION

The LDAP Model has been optimized for achieving good performance in a Directory server. Its structure has been optimized for reading/searching operations because the LDAP model is based on the single-entry for user’s and subscriber’s object.

The LDAP model provides atomicity for all the read/write operations related with user’s service provisioning; user’s data integrity is guaranteed.

V. CAI3G PROVISIONING INTERFACE

CAI3G is an activation interface aiming for providing a simple, up-to-date and unified provisioning interface for the network elements in telecommunication or IT networks or both. CAI3G is evolution of existing CAI protocol. It is there to support SNF model and to provide programmatic means for communication with Common Directory. It is a web service interface based on SOAP standard (XML/HTTP). Web service orientation enables easy integration by use of API that hides network complexity. CAI3G is capable of managing complex data models through use of provisioning templates and XML schemas. For complex business model CAI3G supports notification mechanism.

CAI3G is an RPC-like interface so the focus is on an API level. A provisioning operation is initiated from the CAI3GManager to CAI3GAgent after CAI3GManager has created a session. CAI3GAgent generates the notification to CAI3GManager after CAI3GManager subscribed the notification service.

The CAI3GManager is the system sending CAI3G Request, subscribing Notification to CAI3GAgent and receiving responses for the CAI3G operation and CAI3G Notification from CAI3GAgent. An example of CAI3GManager is a business system or a Portal.

The CAI3GAgent is the system receiving CAI3G Request from CAI3GManager and responding to CAI3GManager. It also accepts Notification subscription from CAI3GManager and sends the Notification to CAI3GManager. Both a Mediation Function and a Network Element Function can be a CAI3GAgent.

The CAI3G Manager (Client) does not have to know the actual SOAP message that will be sent over the line to the CAI3G Agent (Server). A CAI3G WSDL file is provided for easy integration. The WSDL file together with a SOAP client software will provide the CAI3G API. A wide range of SOAP clients for most programming languages and operating environments are available.

A. CAI3G protocol stack

CAI3G protocol stack, figure 2, can be analyzed from several angles and we can see following layers:

- Layer defined by human readable documents and XML schemas
- Layer defined by WSDL file
• Presentation and Application Layer
• Transportation and Session Layer

Transportation and Session layer are based on well proven and well known SOAP and HTTP protocols. On top of these two we have what is called generic CAI3G protocol. This generic part has been referenced as CAI3G operations. It has been designed to have a simple interface with very few operations divide in 3 subgroups:
• Session Control (Login, Logout)
• Provisioning (Create, Get, Set, Delete)
• Notification (Notify)

B. CAI3G operations

Having such interface, one that has only primitive operations, is what makes CAI3G to be flexible and usable in diverse environments. More complex operations may be expressed as a combination of primitive ones. All entities within CD are represented as Managed Objects (MO) and they can be described by XML schemas. All this is an entry point for easy adaptation of CD model to comply with Operator needs.

CAI3G operations and XML descriptions enable EMA to go far beyond simple provisioning functionality and to be enabler for future services. WSDL file has been provided for easier integration and is used with other 3PP tools to get API, figure 3.

C. CAI3G informational model

The model is based on three important elements, figure 4:
• MOType – identifies the type of MO
• MOId – identifies particular instance of MO (XML fragment)
• MOAttributes – attributes of MO instance (XML document)

Elements are described with MO XML schema. The CAI3G MO schema is the main part of the provisioning template. XML schema is uniquely designed for each MO. It defines the structure for MO Identifier and the MO Attributes and unique target namespace for each service. This enables to validate attributes by 3PP tools. All attributes inherit from abstract attribute types defined in generic part of CAI3G protocol.

Fig. 2. CAI3G Communication Protocol Stack

Fig. 3. CAI3G operations

Fig. 4. CAI3G information model

Schema is used to define:
• Attribute name
• Data type
• Allowed value range
• Default values
• Key attribute
• Multiplicity

This can be used to support visualization for GUI application. The text a self-provisioning application shall display for an input parameter, multiple language support.

CAI3G implementation can be either static or either dynamic, figure 5.

For static implementation, knowledge of all the services and their related attributes are hard-coded in the business systems from the start. Such approach gives best read/write performance, but its fixed nature of data structure is not suited for flexible environments. Any adaptations are practically impossible without rewriting large portions of code and very often this is what we want to avoid. Of course, the business system has detailed logic about the services to provision and can for example have dedicated business logic dealing with different error codes from network elements which can have it own advantages.

Dynamic provisioning is SNF compliant solution and is done in two steps. First, provisioning meta-information (XML schema) is read, and then the provisioning command is generated based on this information. It is clear that this approach may have performance issues because of the step where aggregated XML schema is to be created. In most cases the gain in the flexibility overcomes these issues.

New network elements can be supported without any integration business system and service dependency is automatically handled. It is easy to imagine a scenario where new service templates have been added and fields for provisioning are automatically rendered based on their XML schemas.
Common Directory acts as mediator here. It is storage and reference to all entities (affiliate data) that can exist in network and applications. If we combine this with set of simple operations and flexible mechanism to describe how and what is needed to provision particular service/user we have powerful tool for building future networks.

VI. CONCLUSION

As the Mobile market is getting more and more competitive, the operators have to be agile and add new values to their core networks. They have to offer more appealing, more flexible and more exciting services.

On the other hand, timeframe for creation and delivery is getting smaller. Therefore, operators are in constant search for partners with fresh ideas, capable of creating those new services.

Service creation is most important part of this symbiosis, but end users are able to take advantage only of those services that are published and deployed in the operator’s network.

A common playground for deploying and discovery of offered services is possible only through open, but standardized, and transparent service network frameworks. EMA together with Common Directory are offering such environment. They are based on existing standards and if used properly can be seen as mediators for both Service Providers and End Users. And not only that, Service Providers are enabled to communicate as equal peers and to build new values upon each others existing services.

REFERENCES

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