Service Provider Enterprise Architecture Vision Project (SEAV)

Business Transformation of the Provisioning Process for Embedded Mobile

Enabling Highly Scalable Provisioning in the Embedded Mobile Market

Report

January 2011

Nokia Siemens Networks

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

Introduction

With a very wide variety of potential applications, the market for embedded mobile (EM) connectivity (sometimes referred to as EM or machine-to-machine) is one of the main growth areas in telecommunications and associated vertical industries. There are several major differences between the embedded domain and traditional subscriber-centric mobile communications. Chief among these is the way in which embedded services are provisioned (the process of connecting EM devices to wide-area wireless networks) and the life-cycle management of embedded mobiles.

This report describes the results of a project by Nokia Siemens Networks and the GSMA designed to identify how mobile operators need to transform the provisioning process to serve the emerging embedded mobile market. The project used the SEAV (Service Provider Enterprise Architecture Vision) methodology to map out the existing provisioning landscape and transformational requirements. SEAV, which is based on the generic Enterprise Architecture methodology, was developed by Nokia Siemens Networks as part of a previous research project.

The value of the SEAV approach lies in combining the findings from different stakeholder interviews to produce a holistic view of the business challenges and the organizing logic necessary to meet large-scale EM deployments. This approach is superior to traditional analyses in which only selective views of the issues are provided and discussed.

For this study, the project team conducted structured interviews with major stakeholders within the EM domain. These interviews were used to help develop an industry vision and strategy for the EM provisioning process, which is outlined in the executive summary below.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

Executive Summary

The joint GSMA – Nokia Siemens Networks project represents the first attempt to examine the requirements for a scalable and cost-effective EM (Embedded Mobile) provisioning process across multiple entities as distinct from taking the view of a single entity in the value chain.

The study was carried out using an Enterprise Architecture (EA) methodology in conjunction with interviews involving organisations from different parts of the EM value chain. The practical application of the methodology drew on some 275 observations from these interviews and other research sources.

The first finding from this work is that in the initial stages of deployment, EM services are expected to exploit synergies with existing processes and infrastructure. In the longer term, however, mobile operators will need to develop a dedicated provisioning process specifically designed to deliver large-scale EM services. This will entail a set of strategic transformations that will affect enterprise-level business processes, IT applications, data stores and infrastructure.

In order to define these transformations in a systematic manner, NSN applied a particular variant of the EA methodology – the Service Provider Enterprise Architecture Vision (SEAV) approach - to the findings of the interviews. Through this process, the following five initiatives for the transformation of the existing provisioning process:

- Provide open process interfaces enabling multi-party access and co-operation.
- Modularize processes.
- Automate and integrate process modules.
- Optimize process design to lower costs.
- Build governance concept for EM provisioning.

The findings of the study highlight the need for mobile operators and their partners to establish a clear governance framework to ensure the efficient collaboration of the various organizations in the EM value chain. This framework should define access rights to data and assets through all phases of the provisioning process. Security is a generic requirement for the provisioning process and should not be compromised at any stage of the transformation.

The new provisioning process will need to be modular so that component processes can be fully integrated across different supply-chain partners and are transferable from one industry vertical to another.

Finally, greater levels of automation and integration will also be necessary to minimize costs, especially if applications with low revenue per single device dominate the embedded mobile subscription mix.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

Table of contents

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

1. The market context

Daily life is being "digitized" at an ever increasing pace. We are increasingly making use of appliances, control elements, meters and other digital devices to enrich our lives and become more productive and efficient. Connecting these "smart objects" with each other and with computer servers will be one of the biggest areas of technical innovation in the near future.

As owners of the network infrastructure, mobile operators will have a central role in the development of this major growth area which is generally referred to as embedded mobile[1] or machine-to-machine (M2M)[1]. The process of connecting devices to cellular, or other wide-area wireless, networks and managing their life-cycle in a manner that minimizes the burden on end-users will be critical to the development of this market – we refer to this as the end-to-end provisioning process and this area is the focus of this report.

1.1 EM business is different from the traditional handset business

There are clear differences between the EM domain and traditional voice and data services consumed by human subscribers:

- **EM encompasses different sectors, each with its own specific requirements** - Embedded Mobiles can be used in many different ways across many different vertical sectors of the economy. Each vertical has specific requirements in terms of reliability, security, privacy protection, robustness, life-cycle, connectivity, traffic patterns, and data rates. Location independence, for instance, is required within the automotive or logistics industry, whereas it is less relevant in the utility sector.
- **Higher fragmentation of the value chain** - The complete EM value chain extends well beyond operation of a communications network and the supply of associated devices. Device applications, ongoing provisioning services, device management services, systems integration, logistics and other value-added services may be required for many EM applications.
- **Different user-to-device constellation** - Whereas conventional mobile subscriptions are bound to a person and are more or less device-independent, the constellation in the EM domain is in most cases quite different. A device might be owned and used by different persons, and the user might change without a corresponding change in the subscription. Furthermore, enterprise customers, who want to connect a large number of embedded modules, might require tailored Service Level Agreements from mobile operators in order to meet their industrial-grade operational requirements. These agreements will dictate the provisioning process.
- **Different lifecycle characteristics** - In some EM domains, an embedded mobile device, such as a smart meter measuring energy consumption, could remain in operation for 20 years or even longer. The device will have to remain compatible with the infrastructure and related protocols and processes over the duration of its lifespan. Therefore, the provisioning process has to support the management of the prolonged lifecycle.

[1] "Embedded mobile" (EM) refers to embedding cellular mobile technology into a diverse range of products and services, not only the traditional machine to machine (M2M) applications, but also beyond into new vertical services.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

1.2 Successful Embedded Mobile business calls for a new approach

Developing an efficient EM business will often require mobile operators to develop new business models for the following reasons.

- The number of connected devices is potentially much larger than the existing handset business. Mobile operators, therefore, may need to handle higher rates of growth, larger device populations (resulting in unusually concentrated volumes for initial provisioning and remote device management) and the absence of human intelligence at the device end to support troubleshooting.
- The average revenue per single embedded mobile is often far less than that generated by regular voice/ data services. To become economically viable, the cost of connectivity must remain modest and consequently, mobile operators must bring down their own operating costs.
- Mobile operators' EM customers are typically organizations, such as utilities or logistics companies, which are running specific applications, such as energy metering or traffic management. In these cases, mobile operators need to ensure their own business processes can work with the business processes of their EM customers in a flexible manner.
- Mobile operators' EM emerging business will co-exist with their well-established voice and data businesses and there must be scope for potential synergies between the traditional and the new business domains.

In order to address the ecosystem issues, mobile operators will need to undertake a thorough analysis and optimization of key business processes. This calls for a holistic approach towards business transformation to fully address the Embedded Mobile opportunity and the role of extended partners in the ecosystem.

1.3 The Embedded Mobile provisioning challenge

In most vertical industry sectors, services and component parts will be provided by an array of different stakeholders, requiring the responsibilities of the parties in the value chain to be clearly defined and accepted.

Moreover, mobile operators' EM services need to be able to address the diverse requirements of a range of heterogeneous vertical markets and devices, industries, which makes it difficult to create a cost-optimized and versatile provisioning process. Therefore, a key challenge is to:

Provide a high-level integrative visualization and description of the transformation requirements for the provisioning process in the EM domain, which can be used by all stakeholders participating in the value chain.

The Enterprise Architecture methodology, which is based on John Zachman's Zachman Enterprise Framework [1], can be used to meet this challenge. Designed to address co-operation, exchange and overall process optimization requirements, the Enterprise Architecture methodology has been widely adopted by the IT industry to analyze software systems with levels of complexity, which could not be handled by previously established methods, but required an over-arching structure and organizational logic.[2]

[2] Enterprise frameworks include TOGAF [2] , TM Forum Frameworx [3], DODAF [4], and Zachman Enterprise Framework [1]

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

2. The Enterprise Architecture approach

2.1 The Enterprise Architecture method can be used to develop a coherent IT strategy across the EM ecosystem

The Enterprise Architecture (EA) methodology is designed to capture business transformation requirements in a structured manner. EA's organizing logic for business processes is widely used in enterprises' IT departments as it facilitates the optimization of IT solutions to business requirements. EA also provides a complete framework under which an architecture and technical solution can be defined.

The methodology used in this study is called the Service Provider Enterprise Architecture Vision (SEAV). It is inspired by Massachusetts Institute of Technology's (MIT) Core Diagram concept [5] and is compliant with the industry standard TOGAF framework [2]. SEAV is both a facilitating guide to capture the transformation drivers and a way to encapsulate these drivers in the form of goals and objectives. The SEAV methodology provides a comprehensive and stable overall picture and a common guide for aligning the efforts of the different stakeholders. Details about the methodology are provided in Annex A of this report.

The SEAV methodology is typically used to identify, analyze, define and describe the full logical path from vision and strategy to deployment and business execution. The method starts with a set of structured interviews with management level stakeholders in order to discuss and develop an over-arching and common-held vision of the proposed enterprise. It continues with the definition and analysis of a suitable strategic transition, presenting the results in the form of a set of concise reference diagrams.

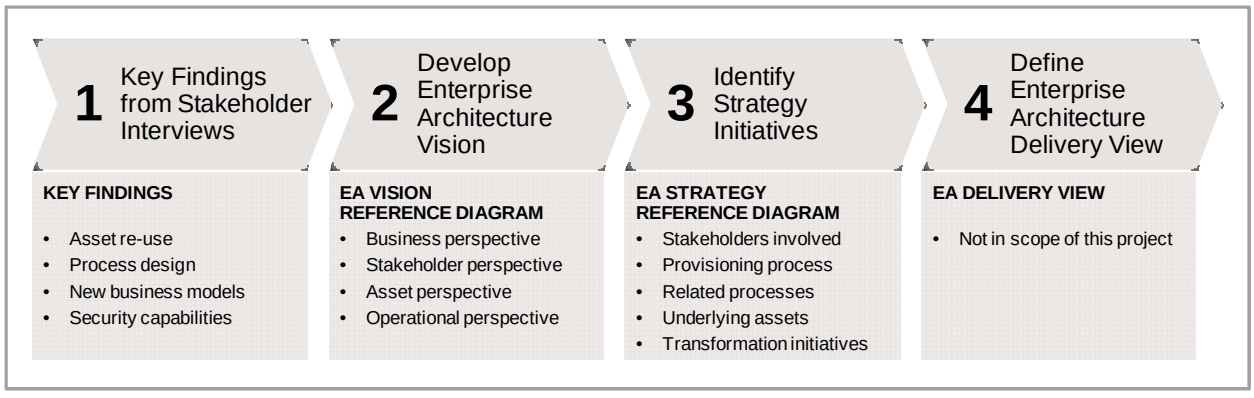

Figure 1 Overview of Enterprise Architecture work-plan

The SEAV methodology generates an Enterprise Architecture Vision Diagram that consolidates key perspectives on business, stakeholder, asset and process issues. The EA vision can then be translated into an Enterprise Architecture strategy, which specifies a set of key transformation initiatives that take into account the stakeholders, processes and assets involved. The transformation initiatives can then be used to develop a "delivery view" which depicts the logical arrangement of run-time processes and respective applications, data storages and infrastructure.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

2.2 The objectives and scope of this study

The objective of this study is to apply the full SEAV methodology to generate initial business transformation recommendations. The study does not extend to all stages of the design and implementation process, as it focuses on the requirements capturing phase of the EA methodology, encompassing the vision and strategy views, but not the delivery view (see Figure 1).

The inputs to the study draw on Nokia Siemens Networks' internal operational and network infrastructure expertise as well as information gathered through interviews with several stakeholders in the EM value chain. The questionnaires used in the interviews were each customized for the specific role (function) of the interviewee and their position in the value chain. Interviews were conducted with:

- A supplier of provisioning solutions and related software products.
- A UICC/SIM manufacturer and EM/M2M solution provider.
- EM/M2M business managers and provisioning technical specialists in mobile operators.

The scope of the interviews was intentionally limited to the end-to-end provisioning process and to suggested optimizations of the corresponding business processes as described below.

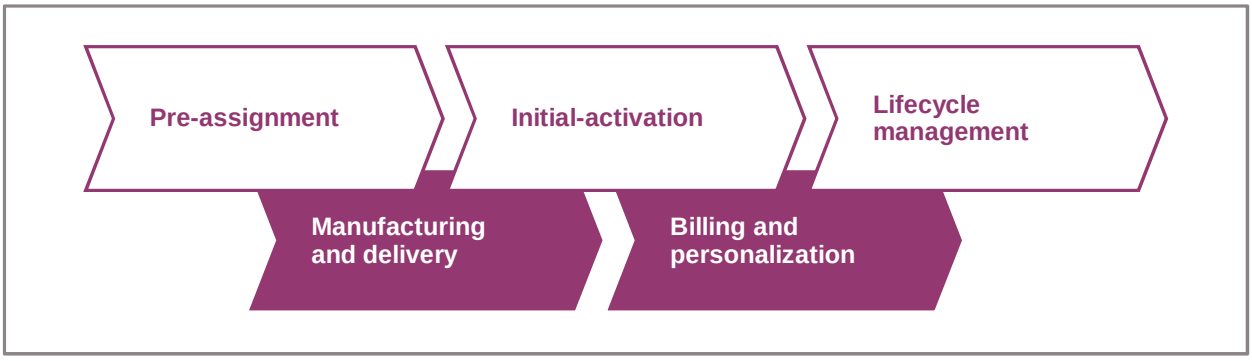

Figure 2: Scope of End-to-End Provisioning Process

As shown in Figure 2, the end-to-end provisioning process consists of three native elements which correspond to the Pre-Provisioning, Provisioning, and Lifecycle phases, as defined in the Embedded Mobile Guidelines Rel1 published by the GSMA EMP program [6]:

- **Pre-assignment:** Preparing the device with integrated Universal Integrated Circuit Card (UICC) and configuring the network so they are ready for activation and operation.
- **Initial activation:** First time assignment of all parameters necessary to put the device into a commercial service.
- **Life-cycle management:** Managing the subscription profiles and the device and UICC configuration during the full life-cycle, right through to de-activation.

These phases interact with two other phases of the device provisioning process - **manufacturing and delivery** and **billing and personalization**. In Figure 2, the gaps between the phases highlight how each phase is triggered by independent events rather than the previous phase.

This description of end-to-end provisioning is not only relevant to mobile operators, which need to adapt their processes to the specifics of the EM business, but also to other members of the value chain, such as application providers or module vendors, whose business processes need to seamlessly interact with those of a mobile operator.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

3. Key findings from interviews with stakeholders

The findings from the interviews can be summarized as follows:

- **Promotion of asset re-use:** In the initial phase of the EM market's development, existing provisioning processes should be reused as far as possible. This approach enables synergies with the underlying infrastructure environment and applications to be leveraged.
- **Modular and flexible process design:** Analysts' forecasts for the EM market point to a sizeable opportunity. As demand grows and the EM market gains scale, the provisioning process needs to be transformed into a cost-optimized flexible process, providing a higher degree of agility. Access to data and control of functions needs to be both time and location independent.
- **Application of new business models:** The business model for EM services is typically a Business-to-Business-to-Consumer (B-to-B-to-C) model. As the provisioning process involves an extended value chain, it needs a clean governance model and potentially a new approach to partnering (e.g. with support for automated SLAs).
- **Continue to leverage existing security capabilities:** Tamper-proof security is required throughout all phases of the provisioning process. The level of security achieved in networks based on 3GPP standards serving individual subscribers should be maintained.

We'll now look at each of these findings in more detail.

3.1 Promotion of asset re-use

The huge expectations around the EM market are accompanied by significant uncertainties due in part to the relatively high degree of fragmentation in the EM value chain.

In order to mitigate the risks and uncertainties in the early phase of the development of the EM market, mobile operators should reuse their existing IT infrastructure as far as possible. In general, best practices and learning from the current cellular ecosystem should be applied.

Reusing existing assets and processes lowers risk exposure by requiring only a marginal investment in new equipment, while sustaining a high level of security for EM. This aspect is addressed in section 3.4 in more detail.

In general, mobile operators will need to maintain the same data models for subscription profiles, attributes, and other parameters relevant to the provisioning process for EM connections as they do for conventional subscribers. Potential extensions of the data structures will depend on additional attributes related to services and solutions specific to industry verticals, such as e-Health or others.

A mobile operator's customer relationship management (CRM) database, which currently has the role of a master database, should also be used to serve EM subscriptions with related data structures. It should be kept as the master database.

By utilizing the existing equipment and infrastructure, which in most cases is already quite evolved and integrated into the process and application landscape, a mobile operator can enter the EM business with marginal cost exposure. At the same time 3GPP's proven and standardized security mechanisms, such as GBA/GAA, can be leveraged.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

3.2 Modular and flexible process design

Since in some vertical domains the revenue per single device (EM) will be significantly lower, it requires very efficient solutions that have much lower operating costs than existing processes. The key to cost optimization is the ***flexibility, integration and automation of the provisioning process***.

The provisioning process, and other processes in the EM domain, need to be flexible in terms of integration over a relatively fragmented value chain, and in terms of the design, test, deployment and launch of new EM services.

To achieve this flexibility it is necessary to follow design principles similar to the ones used for the development of software, such as modularity and reusability.

The provisioning process also needs to be flexible enough to handle high volumes of subscriptions as well as small-scale entry deployments cost efficiently. Peak load scenarios, such as the mass activation of SIM cards, have to be supported.

The second major requirement is that the provisioning process should be ***completely-integrated*** ("straight through processing") and ***automated*** ("zero touch"). Furthermore, it should be structured into appropriate phases, providing defined entry and exit points, so as to ease the integration with the related business processes of different parties in the value chain. Again, this can be achieved by building the provisioning process using independent and reusable modules.

For example, embedded mobile services will need to be easily integrated into industrial product manufacturing, both at a production process level and at a technical level. The provisioning process should enable the automated testing of the SIMs (i.e. network access), the modules (i.e. data bearer services), and the final product testing (i.e. system applications) at various stages of the product process. Many industrial customers also require mobile operators to provide exact on-time billing for the activated services, as there can be several months of delay between setting up an embedded mobile subscription and finally taking the product into service.

One of the proposals raised in the interviews was the development of a standardized and open provisioning process framework and standardized modules, which would enable even more flexibility between companies as well as cost savings. These modules could be pre-packaged, requiring only a small degree of customization for particular application cases.

Another major requirement is the so-called late binding of data and attributes to a particular resource, which has several benefits. This approach ensures that resources are used efficiently when the provisioning workflow is distributed (by time and location) across different contributing parties. For example, it is more efficient to associate a device's IMSI to a SIM card towards the end of the manufacturing process, when the final destination countries for the devices are known.

The mobile operator also needs to be able to expose dedicated views and access rights to profile data and attributes to support additional roles and stakeholders in the value chain.

Finally, there also needs to be scope for a EM service to be transferred from one mobile operator to another without the need to manually interact with the related devices.

3.3 Application of new business models

The EM market is typically structured differently to the traditional mobile subscriber market, in which the subscriber owns the device, and pays the mobile operator for the related service. In some EM scenarios, the end user might not have a relationship with the mobile operator or

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

even be aware of the operator's contribution to the service delivery (for example, in the case of a remote metering reading service provided by a utility).

A mobile operator's EM customers are typically enterprises, such as application service providers (ASPs) or device manufacturers, leading to a B-to-B or B-to-B-to-C business model, where the first B represents the mobile operator, the second B stands for the ASP or device manufacturer and the C represents the end user of the service.

The EM ecosystem is more complex than the conventional cellular ecosystem across two dimensions:

Firstly, the B-to-B-to-C business model leads to a fragmentation of the value chain and introduces new roles and parties. This fragmentation requires an appropriate governance model defining the distribution and allocation of processes and capabilities, as well as "the rules of engagement" among the partners. In this context, innovative approaches, such as pre-agreed or even automated service level agreement (SLA) management, will play an increasingly important role.

Secondly, EM services and solutions span many diverse industries, such as healthcare, energy and the automotive industry. Each of these verticals is likely to adopt an array of different EM services delivered by an array of different providers, so partnering and collaboration will play an important role in the EM ecosystem.

In order to support the different roles and players in the value chain, mobile operators will need to provide third parties with access to EM subscriber profile databases, depending on the design of the provisioning process.

3.4 Continue to leverage existing security capabilities

Throughout the interviews, security was consistently mentioned as a high priority requirement.

In the conventional mobile phone business, existing SIM cards provide a robust security mechanism that has been developed and proven over many years. The interviewees stated the need to maintain a high level of security, reusing as much as possible the existing and well established processes and applications, which are typically security "hardened". Existing provisioning mechanisms are field proven and operationally stable. Moreover, they are compliant with legal regulations and privacy requirements.

Still, the complexity of the EM value chain has security implications. The more players that have a stake in the EM value chain the more complex compliance with security requirements will be. Thus security always has to be considered from a holistic perspective covering all processes and applications provided by different players and partners.

The Open Mobile Alliance Device Management (OMA DM) standards, which are protocols for software upgrades of mobile terminals and data synchronization applications and mobile terminals, are not yet widely accepted as they do not provide the necessary level of security, lacking end-to-end security in the access channels to devices and SIM. Moreover, there are already established and standardized protocols fulfilling these requirements, such as the ETSI/3GPP OTA protocol.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

4. The Enterprise Architecture Vision and Strategy

This chapter describes how the Enterprise Architecture methodology was applied to identify the transformation requirements necessary to implement scalable EM provisioning processes.

An important feature of the methodology is that it takes a holistic view of the business challenges, looking beyond the boundary of a single firm in the value chain, to focus on the organizing logic that binds different organizations in the service delivery value chain.

The first two steps in applying this methodology involve the development of the Enterprise Architecture Vision and the Enterprise Architecture Strategy viewpoints to analyze the way an enterprise conducts its business and operations.

- The Enterprise Architecture Vision is presented as a Reference Diagram that considers the Business, Stakeholder, Asset and Process perspectives in order to define a set of business objectives and key performance indicators (KPIs).
- The business objectives that result from the Enterprise Architecture Vision are then translated into a set of Enterprise Architecture Strategy Initiatives (SI) and Business Directives (BD) which can be attained through delivery-oriented transformation initiatives.

These viewpoints form the basis for designing transformation initiatives that are linked in a logical and coherent manner to the business processes, IT applications, data stores and infrastructure of a given enterprise.

The practical application of the Enterprise Architecture methodology for this study involved an examination of some 275 observations noted during the course of the structured interviews with cross-industry stakeholders and other research sources. From this analysis, the following five transformation initiatives were distilled:

Initiative #1: Provide open process interfaces for multi-party access and co-operation

The provisioning process needs to expose its capabilities and the underlying enabling services to third-parties via well defined interfaces, thereby enabling the provisioning process to be extended to address a diverse range of EM services.

Initiative #2: Modularize processes

The provisioning process needs to be structured in modular, independent and reusable building blocks with lean interfaces, enabling a high level of scalability and performance. For example, there should be distinct modules for SIM provisioning or device deactivation. It should also be possible to manage service and subscription profiles and associated attributes in a flexible way, for example, with regard to binding of this data to particular resources.

Initiative #3: Automate and integrate process modules

The degree of automation and integration of processes is frequently used as a KPI to reflect the maturity of the Enterprise Architecture of a particular company. Ideally, manual intervention of dedicated modules and functions should be minimized ("zero touch").

To achieve "straight through processing" or complete integration, the provisioning process needs to be integrated with other process steps both inside and outside the mobile operator, so that provisioning can automatically trigger billing, charging, barring and SLA management, for example. The provisioning process could also trigger the automated testing of devices.

Conversely, the provisioning process might be automatically triggered (auto-provision) by external processes such as the manufacturing/testing process.

Copyright 2011 Nokia Siemens Networks. All rights reserved.

Initiative #4: Optimize process design for lower costs

Reflecting the low revenue per single device generated by EM services, the provisioning process needs to be designed to minimize operating costs. One way to meet this requirement is to use mainly COTS (commercial off-the-shelf) products with open and standardized interfaces which can be adapted and upgraded cost-effectively and typically perform better than specific and proprietary solutions. Automation and integration, as described above, will also reduce the operating costs associated with the provisioning process.

Initiative #5: Build governance concept for EM provisioning

Since the integrated provisioning process needs to span several stakeholders in the value chain, there is a need for clear definitions of roles, responsibilities and duties. These definitions should encompass which entity owns the control over the process, access to data, and hand-over of control between stakeholders depending on state of the process and time. For example, there needs to be clear definitions of the policy, rules and roles for specific access to embedded SIMs and devices.

In the following sections, we provide additional detail for each of the analytical steps and how the findings from each step culminate in the five key transformation initiatives and the respective Enterprise Architecture Vision and Strategy reference diagrams.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

4.1 Enterprise Architecture Vision View Reference Diagram

A combination of four perspectives, derived from our analysis of the stakeholder interviews defines the Enterprise Architecture Vision. For each perspective, we define a specific goal, a business objective and an associated key performance indicator (KPI).

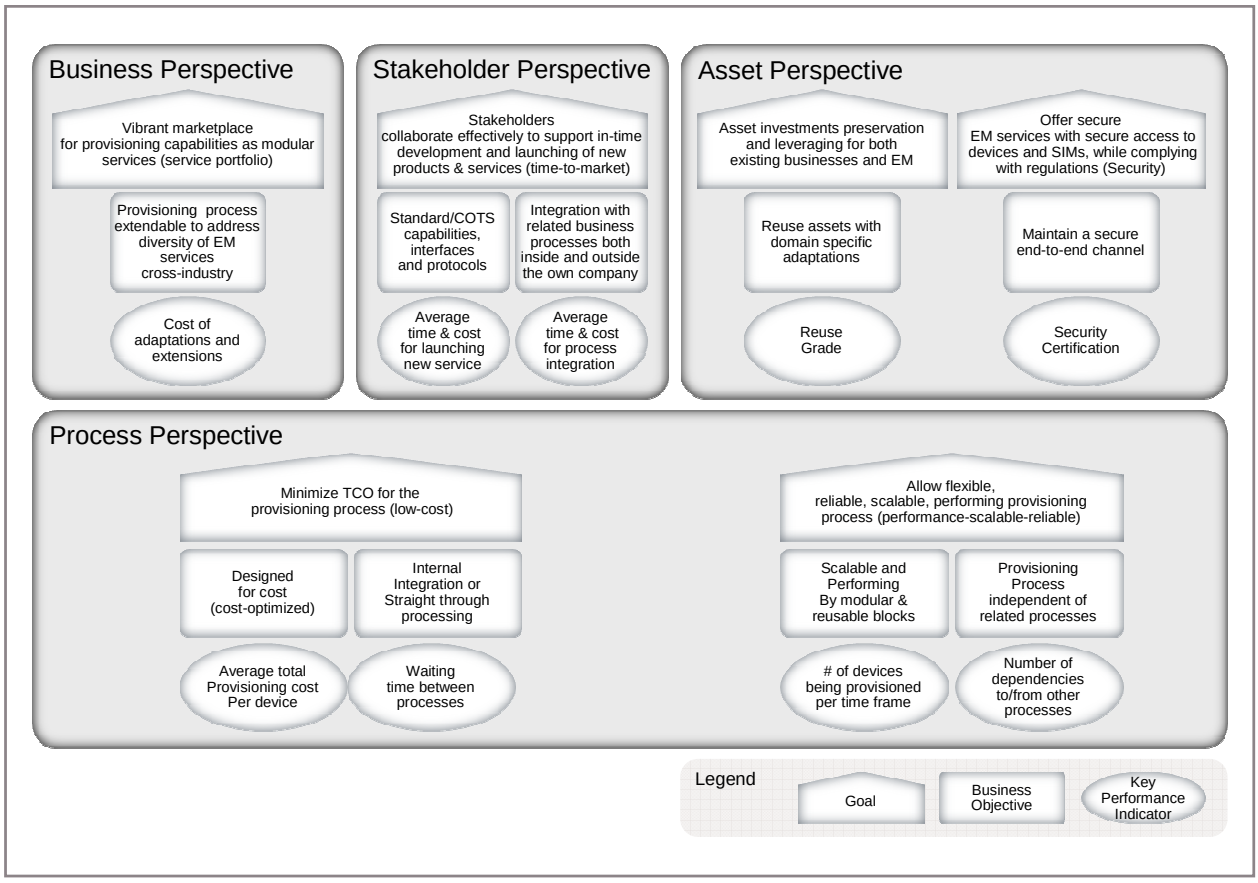

Figure 3 Vision View Reference Diagram

Figure 3 should be interpreted as follows:

Business Perspective

Goal: Establishment of a vibrant business ecosystem for provisioning capabilities as modular services

The provisioning process should enable the development of a marketplace for EM services specific to different industry sectors. Above all, this goal requires a flexible and extendible provisioning process in order to address the different requirements of different vertical sectors at low cost.

A good approach for achieving such a marketplace is to analyze both the business models and the constraints of the industrial sectors to be addressed. The identification of their requirements and differentiating features will help to form the provisioning process with appropriate requirements and priorities.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

Stakeholder Perspective

Goal: Stakeholders collaborate efficiently to support short-cycle development and the launch of new products & services

The goal is to achieve an efficient collaboration between the business partners in the EM value chain to minimize the time to market for new services. This can be done on the basis of already existing capabilities, interfaces, protocols and other standards, together with the timely and cost-efficient integration of the provisioning process with internal and external business processes.

EM providers should also factor in the end-to-end time to launch a product or service into its design decisions/IT architecture/operational processes, as well as the necessary interactions with the process partners. Consequently, the relevant KPIs are the time-to-market for new services and the time needed to integrate a process for automated operation.

Asset Perspective

Goals: Preserve the value of existing assets and leverage these assets to support existing and emerging EM lines of business. EM services should also adhere to proven SIM-management standards and comply with relevant regulations.

The re-use of existing assets can be achieved by exploiting synergies with deployed systems and applications complemented by domain-specific extensions. The degree of asset re-use is the KPI for this business objective. As a first step, mobile operators should review their existing process for provisioning embedded mobiles: What already works in an optimal way and where are the synergies with existing processes?

Existing security capabilities and mechanisms are the second big asset that mobile operators need to consider in the provisioning process. Security needs to comply with regulations and has to support the entire service delivery, from the actual service through to the device and the SIM. This goal can be achieved by maintaining the high level of existing security standards within the new embedded mobile segments, while accommodating their special characteristics. The level of security should be measured by dedicated security approvals and related certifications.

Process Perspective

Goals: Allow flexible, reliable, scalable, performing provisioning process. Minimize costs for the provisioning process.

From an operational point of view, a highly cost-effective provisioning process is one of the key goals. The corresponding business objectives are to achieve the highest possible level of automation and a cost-focused approach to process design, combined with “straight through processing” (end-to-end process integration and automation). The KPI should be average cost of provisioning of an embedded module.

Moreover, modularity is key to enabling scalability. Location independence (independence from a specific mobile operator’s network) and flexibility is also important. It should be possible to trigger the different states of a device in the process at any time. Modeling in advance of the whole process, and potential variants, using an appropriate software tool helps to identify relevant cost factors very early and improve optimization.

The provisioning process has to support all kinds of devices, all kinds of SIM card form factors, and the bulk activation of devices over a short period of time. The corresponding KPI is the number of devices that can be provisioned during a specific period of time.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

4.2 Enterprise Architecture Strategy View Reference Diagram

The Vision View described above feeds into the Strategy View Reference Diagram (shown in Figure 4). The main purpose of the strategy view is to visualize the strategy initiatives necessary to achieve the business objectives summarized in the Vision view. By adding information on how the business objectives can be achieved and on the areas on which stakeholders need to concentrate, the required initiatives and actions, which form the overall strategy, become clearly visible. The strategic transformation initiatives are shown in the left-hand box of the diagram.

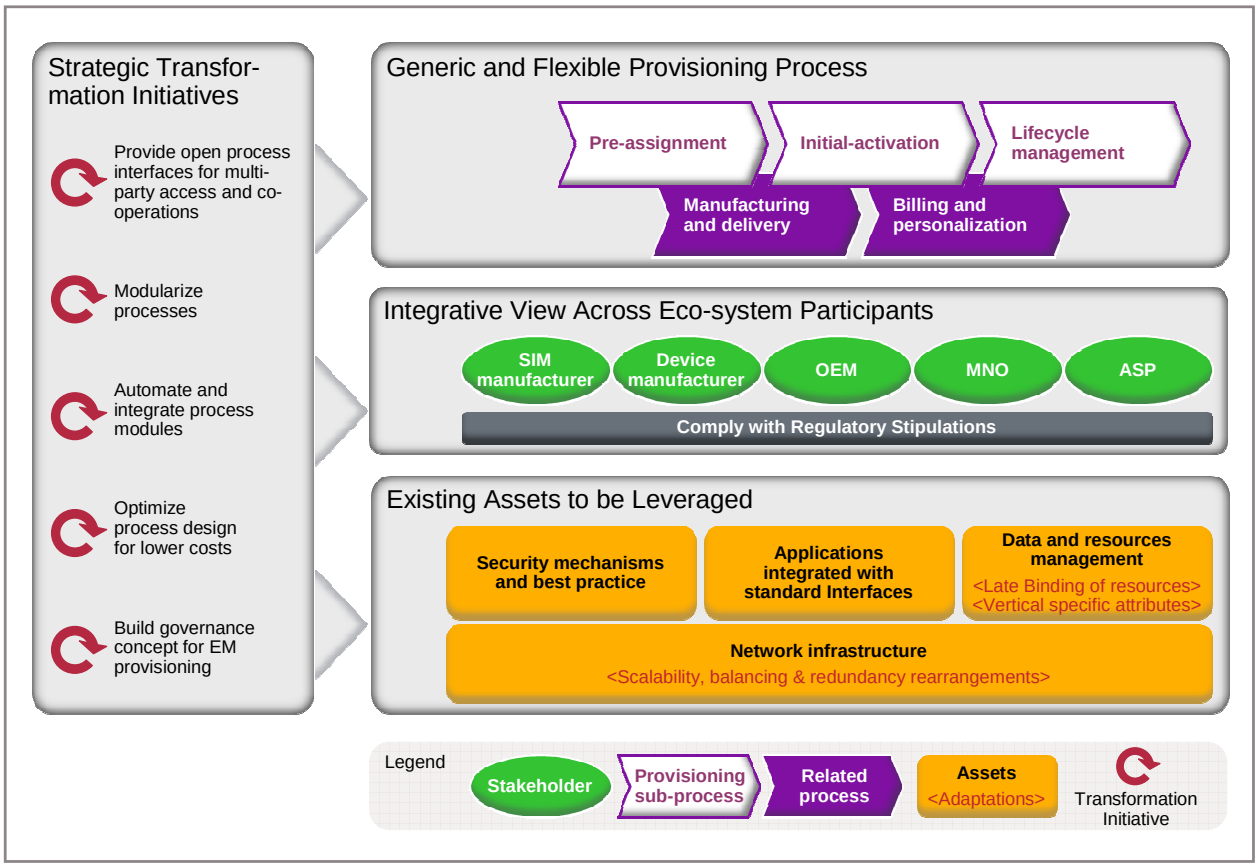

Figure 4 Strategy View Reference Diagram

The application of the SEAV method to the findings from the structured interviews has led to the development of five strategic transformation initiatives. The strategic transformation initiatives are intended to realize the goals of the vision as described in Table 1.

There are certain dependencies between the *transformation initiatives*, e.g. the *automation and integration* initiative typically requires the *modularization* as a prerequisite, whereas the *automation and integration* initiative makes an important contribution to cost optimization.

The concrete definition and design of the strategic transformation initiatives are addressed in the Enterprise Architecture Delivery View.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

4.3 Relation of the two views

The table below (Table 1) summarizes the findings at each step in the process – EA Vision and EA Strategy – culminating with the key transformation initiatives. This table represents the result and the relations in one view, while the derivation of these relations is described in another table in the annex (A.1.3.2).

Enterprise Architecture Vision		Enterprise Architecture Strategy	
Key Perspectives	**Goals**	**Strategy Initiatives & Business Directives**	**Visualization in Strategy View Diagram**
Business perspective Reflects overall industry expectations for the provisioning process in order for the EM business to mature more quickly.	**Service portfolio** Vibrant business ecosystem for provisioning capabilities provided as modular services	**SI -** Provisioning process extendable to address diversity of EM services across industries	**Initiative # 1**: Provide open process interfaces for multi-party access and co-operations
		BD - flexible support of business models, especially B-2-B-2-C	**Initiative # 2**: Modularize processes
		BD - Look for open technology ecosystem	**Initiative # 1:** Provide open process interfaces for multi-party access and co-operations
Stakeholder perspective Participants in today's fragmented value chain comment on the importance of collaboration.	**Time to market** Stakeholders collaborate effectively to support in-time development and launching of new products & services	**SI -** Standard/COTS products capabilities, interfaces and protocols.	(Implicitly reflected in the asset box of strategy view)
		SI - Integration with related business processes both inside and outside own company	**Initiative # 2:** Modularize processes
		BD - Build governance concept for EM provisioning	**Initiative # 5:** Build governance concept for EM provisioning
	Regulations Regulatory Compliance	**BD -** Regulatory stipulations compliance	Explicitly reflected in the integrative view of the diagram.
Process perspective Addresses EM provisioning operations with particular emphasis on boundaries implied by "internal processes". This perspective also highlights quality aspects that support the capitalization of EM services and the demand for QoS.	**Performance**, **scalable and reliable** Allow flexible, reliable, scalable, performing provisioning process	**SI -** Scalable and high performance modular & reusable blocks	**Initiative # 2:** Modularize processes
		SI - (Operational Flexibility) Activation independent of time and location	
		SI - Provisioning Process independent of related processes	
		BD - Flexible service profile attributes and	Explicitly reflected in the data and resource management

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

Enterprise Architecture Vision		Enterprise Architecture Strategy	
Key Perspectives	**Goals**	**Strategy Initiatives & Business Directives**	**Visualization in Strategy View Diagram**
		decoupled binding of resources	box
	Low cost Minimize total cost of ownership for the provisioning process	**SI** - Designed for cost (cost-optimized)	**Initiative # 4**: Optimize process design for lower costs
		SI - Consolidated and minimal manual interventions (automated)	**Initiative # 3**: Automate and integrate process modules
		SI - Internal integration or Straight through processing	
Asset perspective: addresses current and future asset investment requirements.	**Investments** Asset investments pre-served and leveraged for both existing businesses and EM	**SI -** Reuse assets with domain specific adaptations	Implicitly reflected in the asset box of strategy view
	Security Offer secure EM services with secure access to devices and SIMs, while complying with regulations	**SI -** Maintain a secure end-to-end channel	Implicitly reflected in the asset box of strategy view
		BD - Role specific access rights	Implicitly reflected in the asset box of strategy view

Table 1: Relationship of Vision and Strategy elements

4.4 Enterprise Architecture Delivery View

The steps we have followed in applying the EA methodology to the EM provisioning process have considered a generalized end-to-end process. In this study, we have stopped short of defining a delivery view and changes to specific processes, network elements and IT infrastructure.

Still, by combining all elements of the reference diagrams, the strategy to transform the provisioning process according to the emerging requirements of the embedded mobile domain can be summarized by the following overarching delivery principles:

- Start with a generic and reusable provisioning process, supported by the existing process and infrastructure, enabling the exploitation of synergies.
- Lower cost of provisioning through automation and standardization. Provide the ability to integrate the provisioning process with related processes across the value-chain through a modular design and well-defined interfaces. This approach enables collaboration across the value chain to build a commonly-supported process that enables in-time development and the launch of new products and services.

Copyright 2011 Nokia Siemens Networks. All rights reserved.

- The provisioning process needs to be guided by a governance structure that organizes the interaction of the partners. Ensure that cross-industry and diverse requirements for provisioning are satisfied.
- Preserve the level of network access security by relying on existing assets and address industry sector-specific demand for higher security levels.

Of course, the actual validation of the transformation initiatives and these delivery strategy principles will involve the application of the SEAV methodology to a specific vertical segment and groups of eco-system partners.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

5. Conclusion

This report identifies the necessary transformation requirements for the provisioning process for a mobile operator to successfully enter the emerging embedded mobile market segment. A key tool in achieving this objective was the application of the SEAV (Service Provider Enterprise Architecture Vision) methodology in order to map out the existing provisioning landscape and transformational requirements.

While the particular business objectives and requirements depicted in the reference diagrams in this report are not necessarily new, ***the value of the SEAV approach lies in combining the findings from different stakeholder interviews to produce a holistic view of the business challenges and the organizing logic necessary to deliver scalable EM services***. We believe this approach is superior to traditional analyses that only provide and discuss selective views on the issues.

The Enterprise Architecture Vision and Strategy reference diagrams can be used as navigation and organizing guidelines for the coordinated implementation of an effective provisioning process in the EM ecosystem.

Through the structured interviews with the stakeholders, the following four key findings concerning the provisioning process were identified:

1. Leverage synergies with existing processes and infrastructure in the early market phase.
2. Prepare and implement the transformation of the provisioning process towards a cost-optimized, scalable, and agile process.
3. Draw up a common governance model and partnering approach to facilitate the process interaction between the stakeholders in the EM value chain.
4. Sustain security at high level for all phases of the EM process.

By applying the SEAV methodology, the following five initiatives for the transformation of the provisioning process have been defined:

- Provide open process interfaces to enable multi-party access and co-operation
- Modularize processes
- Automate and integrate process modules
- Optimize process design for lower costs
- Build governance concept for EM provisioning

Although the delivery view was out of the scope of this generic project, it would be helpful to build the delivery view for specific implementations. To that purpose, the Enterprise Architecture Delivery View Reference Diagram can be used to present the case-specific contextualization of the transformation, defining what tangibles to consider and what changes are required. Moreover, the delivery view is useful to identify the time frame for the transformation implementations.

The Delivery View Reference Diagram also enables the transition to the design and implementation phase by identifying distinct specifications for the architecture for business processes, for information, for applications and for integration.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

A ANNEX

A.1 SEAV Reference Diagram method

The Service Provider Enterprise Architecture Vision (SEAV) is a method to identify, analyze, define and describe the full logical path from vision and strategy to deployment and business execution. The method starts with a set of interactions with management level stakeholders in order to discuss and build an overall and common picture of the envisioned enterprise. And it continues with the analysis and definition of the suitable strategic transition, presenting the results in the form of a set of concise reference diagram views.

In sum, the SEAV method is a facilitator for applying an enterprise view to the EM problem and defining the architecture that will consolidate the range of solutions as a synergetic working foundation. Without an Enterprise Architecture approach, the set of solutions built to address the EM provisioning problem would probably lack completeness and coherence.

Thus, the SEAV method is a valuable tool for addressing problems, such as EM provisioning. SEAV is a facilitating guide to capture the transformation drivers and a way to emphasize these in the form of goals and objectives. This provides an overall picture that is both comprehensive and stable and is a common guide for aligning the efforts of the different stakeholders. In addition, it helps to have full visibility of the linkages between the vision and the set of strategies that will be used to achieve the vision. It does this by utilizing the concept of “strategic initiative”, which enables the path from vision to strategy execution. Each view summarizes a large amount of information used to make decisions and guide the actions of stakeholders at different enterprise levels. And as a whole, the set of reference diagram views help bring together the entire enterprise (in our case the EM domain) as an efficient and effective working unit, with a coherent and synergetic set of transformation projects.

> ***Strategic initiative*** *is a strategic transition topic that concretely specifies the changes required in core business processes and key assets to contribute to a business objective, in order to respond to an underlying business issue or opportunity.*

This logic is detailed in this annex, which is structured in three sections.

- The first section explains further the reference diagram views and their value for addressing the EM provisioning problem statement.
- The second section describes the considerations and adaptations required for applying the SEAV method to this case.
- The third section details further how the SEAV method was followed to build EM provisioning reference diagrams.

A.1.1 What are SEAV and Reference Diagrams?

“SEAV is the overall organizing logic for the Enterprise Architecture model for a business issue.” Harald Bender, Nokia Siemens Networks

The SEAV method covers the different aspects of the transformational business challenge, from the different architectural dimensions and stakeholder viewpoints. It follows a logical set of steps to unfold the underlying transformation drivers, the envisioned state of the enterprise, the corresponding strategies and the strategic transitions to drive the strategy execution.

The steps are organized in three main phases - Vision, Strategy and Delivery. Each phase will result in a corresponding reference diagram view.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

Typically, each phase undergoes a number of iterations and the phases overlap in time, providing feedback and alignment to the work done in the previous phase. Additionally, a number of supporting artifacts are used to build each view and they are all organized using a structured repository tool. A specification document consolidates these artifacts and the views. This constitutes the end result of the SEAV method, concisely explaining the overall logic and intermediate steps. The three views are depicted in the graphic below, followed by an explanation of their purpose, value and applicability to the EM provisioning process.

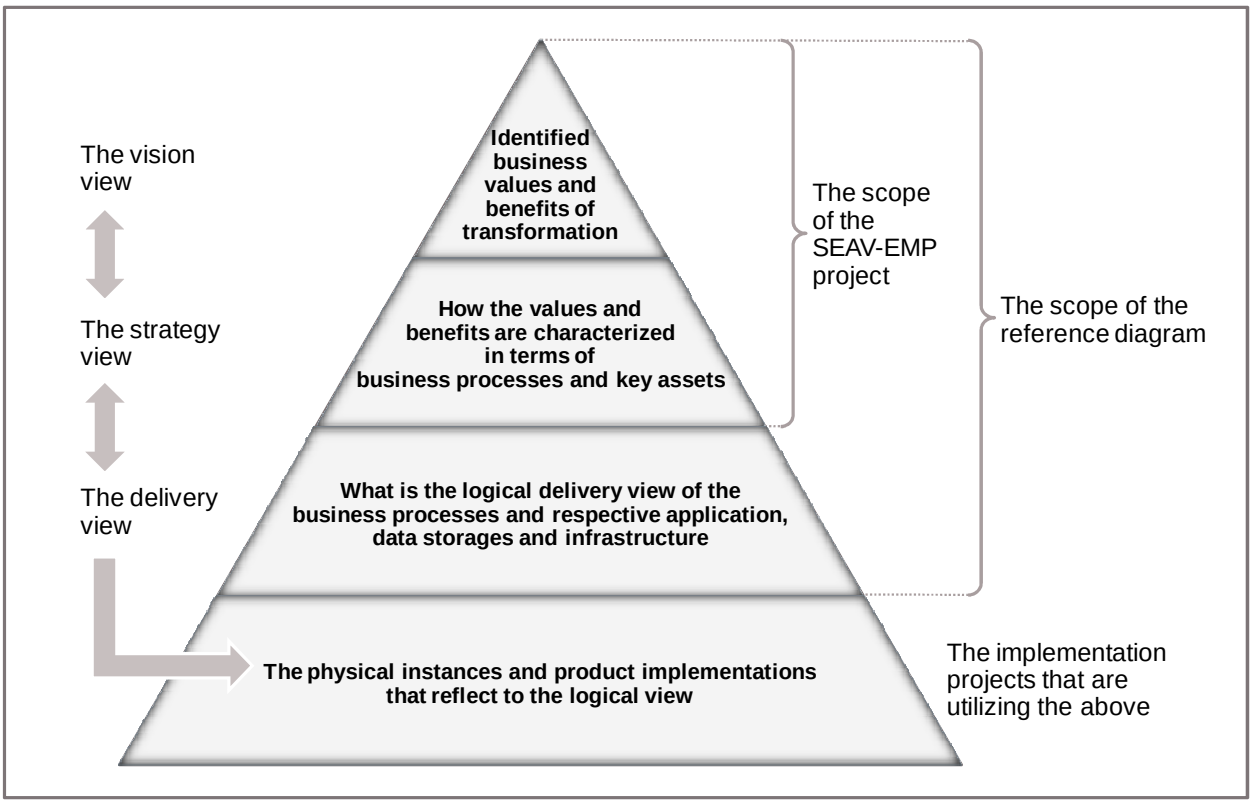

Figure 5 Main elements of the Reference Diagram

As a whole, three diagram views provide an overall view of the way an enterprise is conducting its business and operations. They are a vehicle for opportunity characterization and they evolve during the execution of the EA transformation. Individually, each EM provisioning reference diagram view has its own value as well:

a) Vision View
The vision view states the core content and motivation for transformation, consisting of the identified business values and benefits of transformation. The main audience of the vision diagram are the executives in charge of business management and strategy development. In the case of the EM provisioning problem, the vision view depicts the envisioned changes needed to meet the new provisioning requirements. It does that from a neutral perspective, reflecting the goals of the different participants of the EM provisioning process.

b) Strategy View
The strategy view indicates how the values and benefits are characterized, through strategic transitions, in terms of business processes and key assets. The main audience is business development, operations management, product owners and process owners.

Copyright 2011 Nokia Siemens Networks. All rights reserved.

In the case of the EM provisioning problem, the strategy view highlights the quality attributes that the provisioning process and supporting assets need to have to achieve the vision. Moreover, it helps to identify the most effective strategic initiatives, which are the bridge towards alignment of strategy and its execution.

c) Delivery View
The delivery view depicts the logical arrangement of run-time business processes and respective applications, data storages and infrastructure. It serves as the framework for describing what the relevant aspects are when the strategic transformation projects are to be undertaken. The audience is usually the process owners and solution development teams, which are in charge of implementing the required transformation. The delivery view was out of the scope of this project, however it would be useful to build this view to present the case-specific contextualization of the transformation, defining what tangibles to consider and what change is required. Moreover, this view is useful to identify the time frame for the transformation implementations.

To facilitate the construction of the reference diagrams, the SEAV method includes a template for both a specification document and the reference diagram views. The first one is a guiding document with a set of placeholders for the different artifacts that are used during each of the three phases. The later ones are examples of what a reference diagram can look like; they present placeholders for the different diagram elements to consider in an instantiated diagram.

Nevertheless, the reference diagrams are case-specific; not only the elements, but also the layout and appearance are customized to the particular problem and context at hand. Thus the templates are mere facilitators for the actual consultative work, and they have to be tailored. For this purpose, it should be taken into consideration the characteristics of the problem, context and stakeholders as described in the next section.

A.1.2 Considerations for adapting and applying SEAV for the EM provisioning problem

The SEAV method was tailored to be used in addressing the EM provisioning problem. Since the EM provisioning problem involves different value chain players and it is closely related to other processes, such as testing and billing, the definition of enterprise and the architecture scope were customized. In addition, the method phases and corresponding artifacts were customized according to the availability of project resources and time, as well as the targets and objectives of the project. These adaptations are detailed below:

- **The definition of enterprise**
  The enterprise refers to the different value chain stakeholders that participate in the EM provisioning process - the whole EM domain. This enterprise view includes cross-industry participants, such as manufacturers, operators, vendors, service providers and subscribers.
- **The scope of the architecture segment**
  To keep it manageable, the scope of the architecture is focused on the provisioning process, its participants and supporting assets. Thus topics related to the overall EM business and architecture dimensions of business services and infrastructure technology are excluded.
- **The data collection approach (interviews)**
  For this project, the most suitable and manageable approach for interacting with the relevant stakeholders was to use a number of structured interviews, as opposed to undergo a larger number of individual interactions.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

- **The target audience and context of the problem**
  The resulting reference diagrams served as input for this report, which is intended to be used by the mobile industry and other parties interested in the SEAV approach to provisioning. Thus, when building the reference diagrams it was important to keep the terminology understandable, to take a neutral perspective (as opposed to the perspective of a value-chain player) and to define a neutral level of granularity and abstraction.

A.1.3 Building the Reference Diagrams

While taking into account the considerations of the previous section, the project spanned three phases: the interview work, the vision view work and the strategy view work phases. The phases overlapped in time, following an iterative approach with intermediate quality assessments for ensuring clarity and coherence.

In the interview phase, the main requirements and transformation drivers were gathered. This is a critical success factor in the SEAV method, the involvement and input from the relevant stakeholders is used as the main input for building the reference diagram views. The vision view work phase consists of defining the goals and objectives, inducted from the transformation drivers. The strategy view work defines the transition from vision to the visualized target state. The following concept map depicts the workflow of the three SEAV phases of this study. Finally, the last part of this section details the work done in each of these phases.

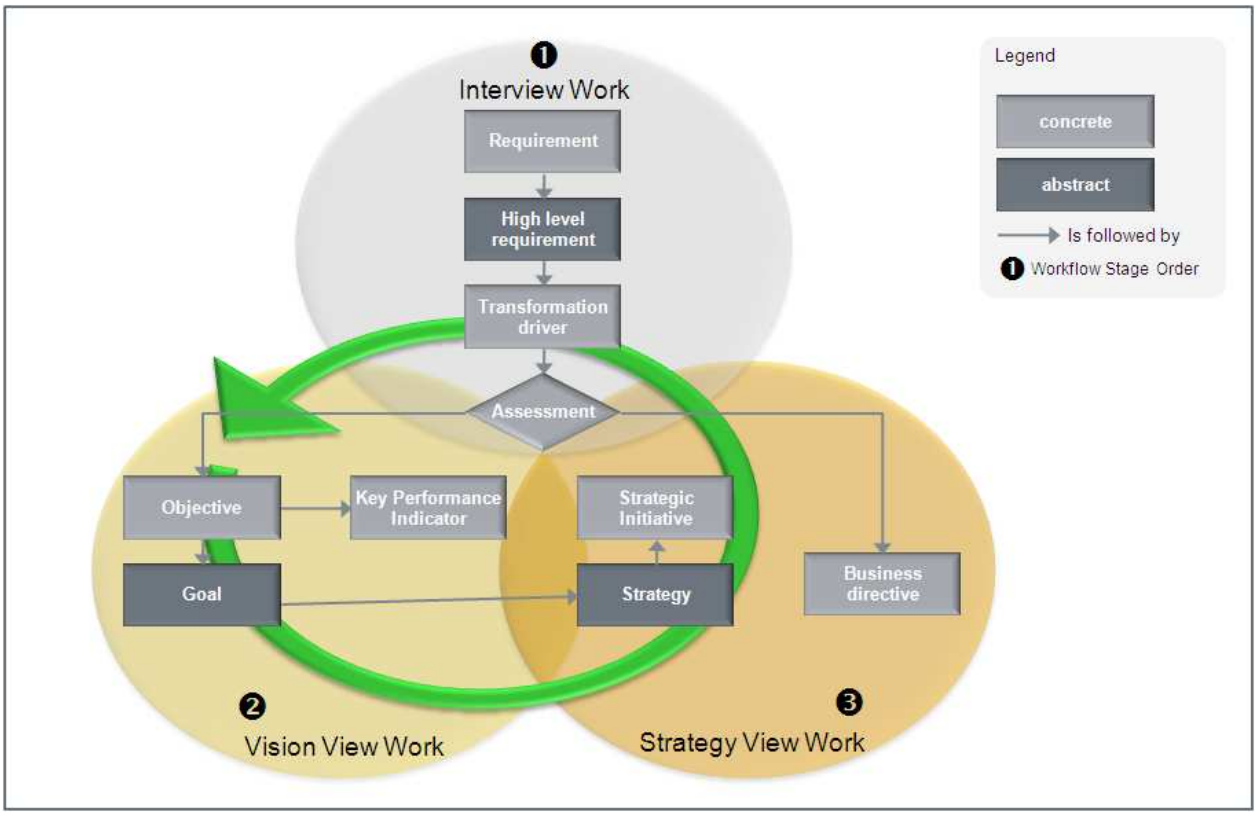

Figure 6 Concept Map (Sub-set of concepts used in the SEAV method)

Copyright 2011 Nokia Siemens Networks. All rights reserved.

A.1.3.1 How the interviews were carried out

Executives from several mobile operators and vendor organizations were interviewed for this study. In each interview, colleagues of the organization participated in an open dialog, guided by a moderator from the SEAV team, with the support of a secretary and an EM expert. The secretary made the annotations and asked for clarifications when required. The EM expert asked more specific questions to obtain complementary information. Furthermore, to better support the SEAV method, an interview framework was built to capture the main requirements and transformation drivers for EM provisioning. The framework consisted of a generic questionnaire, four tailored questionnaires and two tables for consolidating the interview results and aggregating them into requirements and high-level requirements. All the three components were managed with a knowledge base repository in a structured fashion.

First, preparation work was carried out to capture the problem statement aspects and to build a generic questionnaire that spanned three main dimensions:

- the different steps of the EM provisioning process,
- the relevant set of supporting assets,
- and, the different perspectives of the stakeholders involved.

In addition, the questions were cross-checked to be relevant for the purposes of SEAV method and the topics discussed within the GSMA.

Second, the customized questionnaires were built by extracting and adapting a set of 10 to 15 questions from the generic questionnaire, tailored to the company value chain role and interviewee role. The criteria for this selection included keeping balance and relevancy of topics, and optimizing the time available to perform the interview. Following the first interview, subsequent interviews considered the lessons learned from previous interviews, reflecting the iterative and incremental approach of the SEAV method.

And third, the procedure for analyzing the interview results was supported with two tables. One table kept the statements that were captured during the interview, this served to make sure all the information was considered. This table included a total of 275 entries, with references to the interviewee and the question that was asked to be able to trace back the corresponding source. The second table aggregated the rows in the first table in the form of requirements and furthermore in high-level requirements. This table included a total of 30 requirements that were further aggregated into 18 high-level requirements, which are presented as part of the next section.

A.1.3.2 How the vision view was built

The SEAV vision view work is based on best practices from strategic alignment [8] and modeling [7]. It uses a categorization based on four perspectives. These key perspectives are defined below:

- **Business perspective**: this reflects overall industry expectations for the provisioning process in order for the EM business to mature more quickly.
- **Stakeholder perspective**: participants in today's fragmented value chain comment on the importance of collaboration.
- **Asset perspective:** addresses current and future asset investment requirements.
- **Process perspective**: this addresses EM provisioning operations with particular emphasis on boundaries implied by "internal processes". This perspective also highlights

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

quality aspects that support the commercialization of EM services and the demand for QoS.

Using a bottom-up approach, the vision view work included the definition and alignment of the following type of concepts:

- **High Level Requirement -** Using the table of 18 transformation requirements, an assessment was made to decide whether it was a ***business objective***, defining the target state, or a ***business directive***, governing the strategic transition [7].
- **Business Objectives or Business Directive -** Business objectives were included in the vision view, and business directives were considered as part of the strategic transition in the strategy view.
- **Key Performance Indicator (KPI) -** A mechanism used for validating well defined business objectives was the definition of KPIs, which could also serve as a linking mechanism for ensuring that transformation projects contribute to achieving the objectives.
- **Business Goal –** The next step was to induct a reduced set of goals covered the complete set of objectives, and served as base to categorize them. These goals were the main themes for defining the strategy in the next SEAV phase.

The following table summarizes the result of the vision view work, organized by the key perspectives. The first column includes the set of business goals, indicating in parenthesis a key word that was used as short identifier. The second column shows the 18 high level requirements from the previous phase. These were analyzed and derived into business objectives as shown in the third column. Finally, a sanity check was performed on the objectives to define KPIs. Note, however, that some business directives do not have an associated KPI.

Business Goals	High Level Requirement	Objectives or Directive	KPI
Business Perspective			
Service portfolio	External integration with related business processes inside and outside the own company. (..)	**Objective -** Integration with related business processes both inside and outside the own company	Average time & cost for process integration
	Exposure of provisioning capabilities and their supporting services to third parties.	**Objective -** Provisioning process extendable to address diversity of EM services cross-industry	Cost of adaptations and extensions
	Ability to switch the network and operator without swapping the SIM	**Directive** - Look for open technology ecosystem	N/A
	Flexible support of business models, esp. B-2-B-2-C	**Directive** - Flexible support of business models, esp. B-2-B-2-C	N/A
Stakeholder Perspective			
Time-to-market	Standards and COTS of provisioning products, including their capabilities, interfaces and protocols.	**Objective -** Standard/COTS products capabilities, interfaces and protocols.	Average time & cost for launching new service

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

Business Goals	High Level Requirement	Objectives or Directive	KPI
Investments	Reuse of existing business process run-time environment with domain specific adaptations	**Objective -** Reuse assets with domain specific adaptations	Reuse grade
Regulations	Comply with (country-specific) regulatory requirements regarding privacy, role responsibilities and data protection.	**Directive -** Regulatory stipulations compliance	N/A
	Build governance concept for EM provisioning	**Directive** - Build governance concept for EM provisioning	N/A
Operational Perspective			
Low-cost	Automated: minimized manual steps by automated activation of services.	**Objective -** Consolidated and minimal manual interventions	Average total provisioning cost per device
	Designed for cost (cost efficient and optimized)	**Objective -** Designed for cost (cost-optimized)	
	Internal integration: segment wise integration of modules with defined entry- and exit points	**Objective -** Internal integration or Straight through processing	Waiting time between processes
Performance-scalable-reliable	Scalable and high-performance through modularity and optimized blocks (..)	**Objective -** Scalable and high performance by modular & reusable blocks	# of devices being provisioned per time frame
	Operational flexibility regarding time and location (..)	**Objective -** (Operational Flexibility) Activation independent of time and location	Number of dependencies to/from other processes
	Automated testing of devices and independent of subscription billing	**Objective -** Provisioning Process independent of related processes	
	Managing (flexible) service profile attributes and flexible binding of resources (..)	**Directive** - Flexible service profile attributes and decoupled binding of resources	N/A
	Configurable provisioning services: Have modular hierarchy or services, with their preconditions and restrictions. (..)	**Directive** - Standard set of optimized provisioning profiles and a configurable provisioning with simplified interfaces	N/A
Asset Perspective			
Security	Secure access to embedded devices and SIM cards for provisioning using standardized interfaces and protocols	**Objective -** Maintain a secure end-to-end channel	Security Certification
	Managing role specific access rights to embedded devices and SIM cards	**Directive** - Role specific access rights	N/A

Copyright 2011 Nokia Siemens Networks. All rights reserved.

Once all the information required to build the vision view had been obtained, the modeling task was straightforward. The main layout was designed using the four main perspectives and following a top-down approach, with the goals, objectives and KPIs placed in logical clusters as per the strategy themes. The resulting diagram was included as part of chapter four of this report, and it was the basis for the construction of the strategy view, as described below.

A.1.3.3 How the strategy view was built

For this study, the SEAV method ended with the strategy view phase and the corresponding diagram. The strategy view diagram is the logical continuation of the vision view. This is observed at two levels. On one hand, for each goal of the vision view diagram, one strategy was defined to individually contribute strongly to the achievement of the corresponding goal. The complete set of strategies (listed in chapter 4) constitutes the pillars of a consolidated foundation for executing business transformation in EM provisioning. On the other hand, strategic initiatives were drawn from the strategies, thus a strategy is a compound of more concrete initiatives. Finally, strategic initiatives have a strong binding to the specific business objectives, thus closing the loop as indicated by the green arrow in the concept map (at the beginning of this section).

Having defined the supporting information, the next step to build strategy view was creating a layout that reflected the strategy captured during this study, and described in chapter 4. For this purpose, an analysis of the envisioned operating model was the approach, proposed by Ross, J. et. al. [5]. As a result, the strategy view has two main sections, core processes and key assets. These sections reflect an operating model based on the coordination of stakeholders, to execute an integrated provisioning process, and to reuse the existing base of provisioning assets after making the necessary adaptations for EM requirements.

Next, a number of alternatives were proposed to produce an arrangement of processes and assets that best reflected the strategies and linked to the vision. This required several iterations to refine the strategy view elements, symbols, colors and terminology. The final version of strategy view diagram (included in chapter 4) was obtained taking into consideration criteria such as clarity, coherence and completeness. Finally, the strategy view diagram was completed by depicting each strategy initiative in the corresponding section, either explicitly or implicitly. The table included in chapter 4 summarizes the set of initiatives and how they are shown in the diagram.

Copyright 2011 Nokia Siemens Networks. All rights reserved.

B References

(Given web links were valid on January 5, 2011)

[1] Zachman Enterprise Framework. Available at http://www.zifa.com/

[2] The Open Group Architecture Framework. Available at http://www.opengroup.org/architecture/togaf9/downloads.htm

[3] TM Forum Frameworx. Available at http://www.tmforum.org/Frameworx/

[4] Department of Defense Architecture Framework. Available at http://cio-nii.defense.gov/sites/dodaf20/

[5] Enterprise Architecture as strategy: Creating a foundation for execution. Ross, Jeanne W., Well, Peter & Robertson, David C. Harvard Business School Press,2006. ISBN 1-59139-839-8.

[6] Embedded Mobile Whitepaper Embedded Mobile Guidelines,Version 1.0, GSMA, March 2010. Available at http://www.gsmaembeddedmobile.com/upload/resources/files/GSMA-Embedded-Mobile-Guidelines-Rel1-White-Paper.pdf

[7] The Business Motivation Model: Business Governance in a Volatile World. Release 1.3, The Business Rules Group, September 2007. Available at http://www.businessrulesgroup.org/bmm.shtml

[8] Strategy maps: Converting intangible assets into tangible outcomes. Kaplan, Robert S., & Norton, David P., Harvard Business School Press (2004). ISBN: 1-59139-134-2.

Copyright 2011 Nokia Siemens Networks.
All rights reserved.

C Abbreviations

3GPP	3rd Generation Partnership Project
B-2-B	Business-to-Business
B-2-C	Business-to-Consumer
BD	Business Directive
COTS	Commercial Off-The-Shelf
EA	Enterprise Architecture
EM	Embedded Mobile
EMP	Embedded Mobile Programme
GAA	Generic Authentication Architecture
GBA	Generic Bootstrapping Architecture
GSMA	GSM Association
IMSI	International Mobile Subscriber Identity
IT	Information Technology
KPI	Key Performance Indicator
M2M	Machine-to-Machine
NSN	Nokia Siemens Networks
OTA	Over the Air
QoS	Quality of Service
SEAV	Service Provider Enterprise Architecture Vision
SI	Strategic Initiative
SIM	Subscriber Identity Module
SLA	Service Level Agreement
TOGAF	The Open Group Architecture Framework
UICC	Universal Integrated Circuit Card

D List of Authors

Nokia Siemens Networks

Harald Bender, Gerald Lehmann, Janne Parantainen, Markus Staufer, Marcos Tong.

Review and comments provided by:

Ken Figueredo, **Ventura Team**

Svetlana Grant, **GSMA Association**