

Mobile Enterprise Resource Planning: New Technology Horizons

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Abstract

Mobile ERP is not per se something new or even special. It is an issue growing to become more and more important and enabling mobility due to the technological revolution and more so due to the mobile users. Mobility is about how businesses can provide a better infrastructure through mobile applications and services. While ERP was an important step taken by many firms, provision of services through mobile technologies is now inevitable. Together with other trends that are changing the enterprise applications landscape, ERP systems have to support the mobile behavior of their users. The paper explores the mobile applications landscape and proposes an architecture model for the mobile services starting from the necessary functionalities for a portal of mobile services. Besides the general architecture of the portal, a set of minimal functionalities for implementation is proposed in order to ensure the promotion and use of services.

Keywords: ERP, Mobile Services.

1. EMERGING DIRECTIONS IN ERP EXPANSION

Consolidation is happening at all levels of the market, among those that serve the multinational and top companies around the world (e.g. Oracle and PeopleSoft, Retek, ProfitLogic and Siebel, then Oracle and Siebel; SAP and Business Objects), the mid-sized market (Lawson and Intentia; SSA; GEAC; Sage; Microsoft), and even those targeting the smallest customers.

Analysts expect consolidation to be an ongoing trend within the ERP landscape. Whether it's to gain customers and cross-sell, complete a technology portfolio, or simply to eliminate a competitor, consolidation will continue. However, acquisitions in enterprise or business applications in the future are likely to be more focused, such as adding to a CRM portfolio or rounding out a manufacturing effort with new capabilities (like PLM).

Another reason for consolidation is business complexity, due to outsourcing, partnering and increasingly complex channel strategies. As businesses become more complex, software vendors must offer solutions. Applications will reach further into supply chains, out toward customers, and within organizations to provide better information about its ongoing performance (http://www.berkerynotes.com/publication/publication/key_trends_in_ERP.aspx, 2007).

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Finally, it appears that geographic expansion – diversifying into new markets – has been a driver in the SMB space for ERP. Most application providers address **verticalization** in their offers. ERP vendors needed to tailor their software to the requirements of specific industry verticals. Verticalization means not just adding new functionality to a given industry solution, but adding vertical functionality to the horizontal functions within the ERP package. This actually means that workflows, supply chains, data warehouses, and analytical tools should all be vertical-specific. SAP is a leader here as they thoroughly understand and build to fairly deep levels in vertical markets. Oracle, however, has a more undeveloped technology approach to most vertical markets, and Microsoft tends to rely on partners for vertical specificity and customization.

Outsourcing of ERP operations is the next emerging trend as a company can typically save operational costs close to 50%. With the improvement in connectivity, the option of "ERP as a service" using the SaaS (Software as a Service) model is now proving to be viable. The current generation ERPs, which are based on web architecture, and uses technologies like Service Oriented Architecture can easily facilitate this distributed mode.

The Software as a Service global market reached \$6.3 billion in 2006 and is reckoned by \$19.3 billion by 2011 (<http://www.apptix.com/media/newsletters/saas/>, 2006). According to Gartner, by 2011, SaaS will represent 25% of the global business software revenue (<http://www.apptix.com/media/newsletters/saas/>, 2006).

As globally distributed communication networks become more and more reliable, the experience and satisfaction levels of end users in hosted applications will increase.

Diversification can be best illustrated in the SAP's move to become a platform provider through its ongoing development of the NetWeaver platform (now a 'Business Process Platform') and associated acquisitions (Top Tier, In-Q-My, A2i). Competitors are working in areas like web services development and management, enterprise information management and integration, analytics and business performance management, and business process management among others.

In concert with the above trends, diversification among other platform and IT operations oriented companies will continue as they move up the stack to meet growing demands for distributed and mobile management, security, asset management, and other areas impacted by the advent of component software and web services development (http://www.berkerynoyes.com/publication/publication/key_trends_in_ERP.aspx, 2007).

Other technological relevant issues in the ERP landscape are:

- open source expansion,
- web enabled ERP (based on XML), which makes the enterprise operations go online with Web 2.0 architecture promising a newer, more socially interactive Internet,
- wireless ERP, which helps organizations to make use of the communications channels effectively and efficiently by sharing enterprise information through mobile devices.

2. THE MOBILE ERP

There are some arguments in support of the mobile ERP – the primary is related to the growing mobile workforce, while others consider the interaction with the customers and existing business applications (service improvement), or the ROI of mobile applications implementation (Lee, 2004).

In the US more than 50 million workers are considered mobile, being away from their primary workspace at least 20% of the time (Palumbo 2008). In Europe the number is lesser, but we consider that the mobile workforce is growing. Enterprises must deploy solutions that provide the mobile employees with access to back-end resources beyond e-mail,

such as databases and applications in the ERP system.

"Mobility doesn't support service businesses, it changes them", "Put your business in motion", or "Mobilize your ERP system today" are new mottos (<http://www.abakus.fi>, <http://www.smithsconsulting.co.uk>, <http://www.microsoft.com/technet/solutionaccelerators/mobile/plan/mobilerp.msp#EOLAC>) in a dynamic and on the move world. It is estimated that 25% of the workforce is traveling one or more days a week (http://www.pocketpcmag.com/_top/, 2003). While away, many are supported by e-mail, calendar, and contact information, but very few are supported by information from their ERP/CRM system. Hence, mobile ERP/CRM is relevant to a large number of professionals and that could be the reason why many analysts predict very high growth in the mobile computing industry.

In addition, the emergence of sophisticated mobile devices, such as smartphones or pocket PCs, has added a new element into the enterprise, as they can enable mobile workers to remotely access e-mail and mission critical line-of-business applications.

In the simplest approach, mobile ERP is about having access to a software that allows a mobile device (portable computer, phone, Tablet PC, PDA) to be connected to the ERP system of an organization through a mobile net of communications and transmission of data GPRS/UMTS.

Mobile services are opening the real-time access to corporate operations to personnel on the move.

One of the most valuable benefits that motivates the users to decide on for this option is the possibility to access in real time to all the related data for a distinct operation or any other corporate applications of ERP (<http://www.exforsys.com/tutorials/erp/erp-and-the-future-mobile/1.html>, 2007).

Organizations will sense such positive effects as significantly lower transaction cost, improved cash flow, fewer disagreements with existing customers, and, last, but not least, more satisfied employees.

Studying the **mobility** trend, we came across many companies offer services and software that extend existing or deliver new end-to-end ERP solutions to mobile devices. We determined large ERP software vendors and niche solution providers underway in "mobilizing" ERP solutions or providing middleware applications. This new market has created opportunities for niche players, those small firms that set up innovative mobile systems. New partnerships will emerge, involving ERP vendors, mobile application developers, telecommunication firms, consulting services providers and middleware developers.

However, we consider the mobile ERP still being in its early development. Companies are just beginning

to completely understand remote access solutions for laptop computers. Now, with the rise of smart phones and other handheld devices, organizations are largely unaware of the similar technologies available to these edge endpoints and their ability to significantly improve mobile workforce efficiency and productivity.

In the following paragraphs, we will analyze the functionalities that an enterprise mobile service provider must offer and we will propose a generalized architecture within which the transactions can take place.

3. NECESSARY FUNCTIONALITIES FOR A MOBILE SERVICES PORTAL

Taking into account that the mobile services for companies emulate the “physical” services of the provider to the client, we can consider that the relation that is established between the client and the provider is similar with the one of face-to-face type. As a result, in the simplest variant, a client will use the services of a client, upon payment eventually. Nevertheless, there are several aspects and work hypotheses taken into account by both parties involved in such a process:

- the client does not always know the provider before appealing to his services;
- the client needs only a certain service or range of services;
- a mobile service provider cannot satisfy all the potential clients’ requests (for reasons of services, cost, response time etc);
- between the client and the provider there can be cultural differences regarding the language, awareness of contract terms, expectations regarding the partner;
- the provider must obtain from the client the payment for the services provided.

More than that, it is very possible that, temporarily, for different reasons, a service offered by a certain provider is not functional for technical reasons (the unavailability of resources, temporary stop for technical interventions) or even the provider in itself is not available (too many requests from clients, the interruption of connections for technical reasons).

Taking into account the elements mentioned previously, we consider that within an architecture based on mobile services for companies the following functionalities must be available:

- the client’s possibility to look for the provider which can offer mobile services he needs, eventually in certain conditions of quality and price;
- the client obtaining a “list of reserves” with the providers and services that can be appealed to in the

case that the provider or initial service become unavailable temporarily;

- the possibility of the provider to accept/reject the requests of a client regarding a certain service;
- the client sending the firm request to the provider, by offering the necessary data and elements for carrying out the service;
- the possibility of money transfer in the conditions established through the contract between the two partners: before carrying out the service, simultaneously with carrying out the service or after providing the service;
- in the case that a client chooses a mobile service provider, he should be sure of the fact that the eventual cultural differences between them will affect the contractual relation to the smallest extent possible.

In the literature it is considered that the Internet may allow companies to turn on its head the old pattern of culture creation. The role of the center becomes that of setting standards and of establishing a framework for the culture (Cairncross, 2002).

4. MOBILE SERVICES ARCHITECTURE PROPOSAL

In order to take the opportunity to exploit all the advantages of the mobility, organizations should demand services of mobile architecture to ensure the link between the wireless initiatives and their business objectives. Different solutions are available.

Starting from the necessary functionalities for the mobile services for companies, we propose an architecture based on the general concept of services portal. In fact, this portal accomplishes the role of broker, both for the client and for the provider.

It is considered that the most common software functions that portal software solutions need to support include: data points and integration, taxonomy, search capabilities, help features, content management, process and action, collaboration and communication, personalization, presentation, administration and security (Collins, 2001).

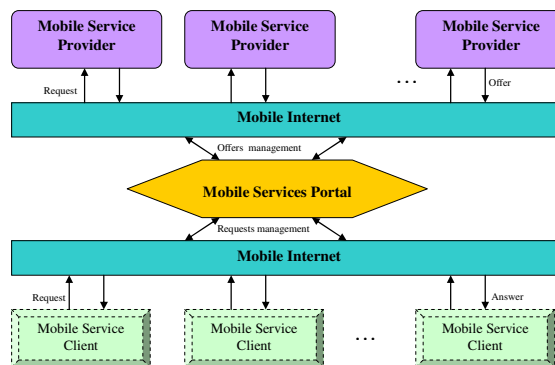


Figure 1 –The architecture based on portal for enterprise mobile services

We consider that the architecture proposed (Figure 1) can be divided in two distinct components, according to the entity that the mobile services portal interacts with: the interface with the clients and the interface with the providers. Based on the identified functionalities, the portal must support several types of orders presented in Tables 1 and 2.

Table 1. Orders in the "Requests management" category

Order type	Explanation
<i>Find a service</i>	The portal will search in the list of mobile services available the one that corresponds with the criteria specified by the client: quality, price, execution time etc. It is also returned a "list of reserves" with the services that can be appealed in the case that the first becomes unavailable for several reasons.
<i>Request connection</i>	The portal will connect the client with the provider chosen after an order "find a service". The portal can offer the client identification data or can demand the service in his own name, continuing to provide the client transparently.
<i>Execute service</i>	The portal will request the execution of the service by the provider, under the conditions established after the "request connection" order.
<i>Execute next service</i>	This order should be executed under the conditions in which the initial service or provider temporarily becomes unavailable.

Table 2. The orders in the "offers management" category

Order type	Explanation
<i>Register the service in the list</i>	The portal will register in the list of available services the new service offered by the provider who executes the order. This order will have the parameters that will describe the service name, its type, the service, the costs, the execution time and other technical data, which would be of interest for the client.
<i>Accept connection</i>	As in the case of the order „Request connection”, the provider will accept the transaction either directly with the client or with the portal as intermediary of mobile services for the company. In the first case, the payment will be received from the client, and secondly from the portal as intermediation agent.
<i>Execute service</i>	The portal will request the service execution by the provider, under the conditions established by the successful execution of the order "request connection".

According to the degree of development of the portal, this should execute the orders of the type "find a service" trying to attenuate as much as possible the eventual cultural differences between the client and the provider. This would mean that in a list of available services that are identical, the

portal would firstly suggest the client the one that most resembles the client's culture.

Besides the orders presented in the previous lists, the portal can optionally implement orders of the type "bill" or "payment", according to the modality chosen for the transfer of money in the account of the service carried out. These options can be extended on a model of the type "subscription" in which a client makes a subscription to a portal of mobile services and can benefit in a period of time from several orders of the type "execute a service". We consider that for the increase of the flexibility of such a portal, the implementation of an order of the type "negotiated" which allows a client to negotiate different terms of the contractual relation (price, execution time, execution parameters etc.) with different providers would be indicated. In this case, supposing that the provider accepts the negotiation terms, a new service, which initially did not appear in the list of available services, would be available.

5. AN IMPLEMENTATION MODEL FOR EXPANDING NAVISION'S CAPABILITIES

We propose a special architecture in order to expand the capabilities of Microsoft NAVISION, which is one of the most important ERP products (<http://www.erpsoftware360.com/erp-software.htm>, accessed on November 2007; Navision ERP Solution has more than 83,000 customers) . Usually, this ERP system operates on desktops and servers, but we intend to improve its capabilities in order to be a mobile alternative for managers.

The servers that are designed in Figure 2 have different roles, from authentication to data transmission from database to the final mobile users. The vision to expand the capabilities of Microsoft NAVISION ERP system also includes the web services, implemented on .NET platform.

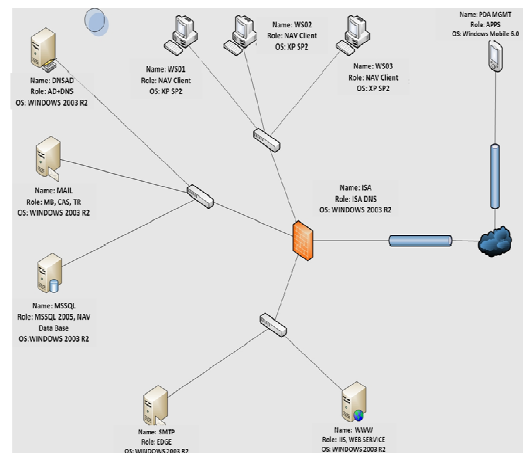


Figure 2. The main architecture for transforming a “desktop” ERP into a mobile ERP

These services offer to the mobile users (PDA, SmartPhone) the functionalities that are required in order to obtain reports about the state of the company. For example, the web service function `getCustomers()` provides the dataset containing the list of the customers. This function can be customized by the user with parameters (the best customer, the most important customer, the less important customer etc.).

```
Imports System.Web
Imports System.Web.Services
Imports System.Web.Services.Protocols
Imports System.Data.SqlClient
Imports System.Data.OleDb
<WebService(Namespace:="http://tempuri.org/")> _
<WebServiceBinding(ConformsTo:=WsiProfiles.BasicProfile1_1)> _
<Global.Microsoft.VisualBasic.CompilerServices.DesignerGenerated()> _
Public Class Service
    Inherits System.Web.Services.WebService
    '—the definition of getCustomers() function
    <WebMethod()> _
    Public Function getCustomers() As Data.DataSet
        Dim setDate As New Data.DataSet()
        Dim conexiune As New SqlConnection()
        Dim comanda As New SqlCommand()
        Dim adaptor As New SqlDataAdapter()

        conexiune.ConnectionString = "Data
Source=DOCTAV;Initial Catalog='Navision Demo
Database (4-0)';Integrated Security=True"
        comanda.CommandText = "SELECT [Name] AS
NUME from [dbo].[CRONUS Romania SRL$Customer]
AS CLIENTI ORDER BY [Name] DESC"
        comanda.Connection = conexiune
        adaptor.SelectCommand = comanda
        adaptor.Fill(setDate, "CLIENTI")

        Return setDate
    End Function
End Class
```

The web service can be invoked through a web browser or through another kind of client.

To develop the mobile application, we also used the .NET platform and we first test on pda emulators the connection with the web services. The main advantages of using the combination between web services and mobile PDA applications are:

- the final clients (PDA users) do not need extra power for querying or processing data, because the web services on the server side do that;
- if one client loses the wireless connection with the server, the others are able to use the services with their own connections;

- if it is necessary to adapt the data provided by Navision database, all we have to do is to modify only the web service, not the entire application;
- by implementing the security levels on the web services, every final client can invoke only the information it has access to.

```
Public Class frmClientiLista

    Private Sub btnListaCustomers_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnListaCustomers.Click
        Dim serviciu As New WebReference.Service()
        Dim dsClienti As Data.DataSet
        dsCustomers = serviciu.getCustomers()
        '—and from here the application uses the data set
        '—in the graphical user interface
    End Sub
End Class
```

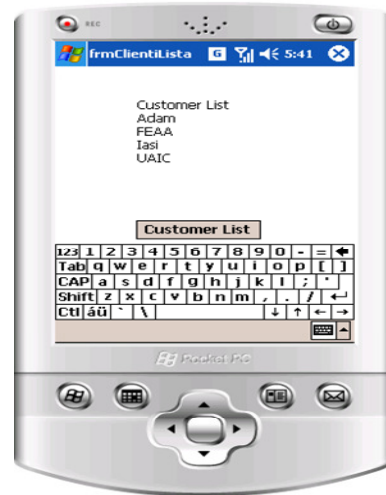


Figure 3. The final result

The client application installed on PDA devices uses the previous web services and produces results to the managers (Figure 3).

From now, it is very simple for employees to have access to their company’s data wherever they are. It is also very important to mention that the data are available as they are inserted, deleted or updated by the “normal” users (the users that populate the database through the NAVISION desktop applications).

8. CONCLUSIONS AND FURTHER RESEARCH

The paper's key results concerning the ERP trends and their impact for the organization include: (1) extending the core ERP functionality represents an inevitability for business survival, (2) the enterprise applications market evolves constantly and suffers a consolidation process, (3) we are in the middle of a

substantial disruptive revolution in ERP and the entire business applications, and (4) mobility integration turn out to be the major organizations' distress.

Application mobility surpasses the technology borders, becoming a paradigm that provides the enterprise with a clear strategic business advantage: the ability to do business in real time, in an event driven environment, and with reduced latency.

In the near future the mobile devices will experience a significant outbreak. A constant 30% annual growing rate is forecasted to take place in the near future, with well defined strategies focused on the specialization, geographical expansion and diversity of solutions.

Mobile device improvements, combined with increasing local and wide area wireless bandwidth, have opened a new door to additional productivity enhancements, cost reductions, and users satisfaction increases. Microsoft, one of the most important players on the mobile ERP market, powered mobile devices, such as Pocket PCs and Handheld PCs, offering them at a quarter of the cost of custom ruggedized mobile devices from just a few years ago. Utilizing the same development tools and technologies as the PC, these mobile devices make it easier and quicker to get ERP solutions into the hands of the mobile workforce.

The research in the present article does not propose to present the effective implementation of the portal functionality, but we consider that it could be achieved on a web-services type structure on a Java or .NET platform.

There are many promising investment opportunities in the mobile internet arena. The obvious lack of mobile service providers will be quickly eliminated because of the more and more obvious development of mobile technologies. As in the case of classic services, it is very important to create the premises for the actors involved in the transaction to be able to contact each other. In a world in which diversity of business and the cultural differences are an indisputable reality, the implementation of portals for the mobile company services will in fact represent the following step regarding the commercial relations based on the infrastructure of the virtual environment.

We believe it's time to say goodbye to the golden age of ERP systems. The old systems will be taken by more outwardly focused applications that not only give managers a see-through view of all enterprise functions, but also let them tie that information in a meaningful way to events happening in the outside world. Mobile services are opening the real-time access to corporate operations to personnel on the move. The way companies

acquire ERP services in the future will also change radically. We will closely research the upcoming ERP epoch and its manifestation in the Romanian enterprises.

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