

# The Emergence of the Mobile Enterprise: A Value-Driven Perspective

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## Abstract

*The mobile enterprise is an emerging organizational form that has resulted in a paradigm shift of how business is done. However, only little theoretical work has been done to explore what actually constitutes a mobile enterprise. This article addresses this definitional issue by exploring the salient value propositions that drive the emergence of the mobile enterprise, identifying categories of workers that can benefit from mobile ICT, reviewing what current solutions support the mobile workforce, identifying the challenges of adopting and implementing these solutions, and providing propositions for future theoretical and empirical research.*

## 1. Introduction

The logic for enterprise adoption of mobile information and communication technologies (ICT), such as laptops, smart phones and other handheld devices, is well recognized. Any technology that can deliver a tangible business benefit, by making information more accessible, is a good thing. The promises of mobile ICT certainly fall into this category [2, 21, 28]. However, this was not always the case. In early 2000, when enterprises first began to evaluate and adopt mobile ICT, the technology was still fairly immature and often failed to deliver on the expected benefits [34]. The predictable outcome was widespread disappointment. Many considered mobile ICT to be another hyped up technology with only little substance.

Today, much has changed. The underlying technology has improved significantly. The central pieces of the mobile data equation, which the author refers to as the mobile DNA (devices, networks and infrastructure, and applications), are all falling into place: devices are becoming more suited for mobile data use, wireless networks are maturing and becoming increasingly ubiquitous and capable of

handling higher data throughput, and value-added mobile applications are rapidly emerging [9]. While the initial adoption growth of mobile ICT has primarily occurred on the consumer side, a similar trend is increasingly seeping into the enterprise domain [6, 23, 31]. More and more organizations are realizing the tremendous potential that mobile ICT can offer [1]. Despite an increasing amount of published material [12, 27], most of which is practitioner oriented, there remains a lack of agreement of what a mobile enterprise is, what (real) value proposition it offers, and how an appropriate strategy should be developed. The lack of uniform definition and approach can be attributed to where one places their view of the mobile enterprise on the continuum (see Figure 1) [11].

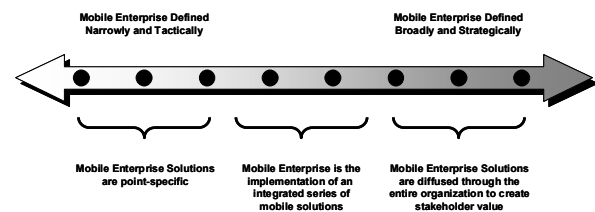


Figure 1. The mobile enterprise continuum

Some define the mobile enterprise narrowly and tactically, where point-solutions dominate. These projects tend to focus on productivity improvements and costs savings (e.g. email). Others define the mobile enterprise more broadly and strategically. In this instance, the focus is on strategic and large-scale enterprise wide implementations (e.g. mobile CRM) that enable organizations to create new core competencies, gain and sustain competitive advantages, and define new markets.

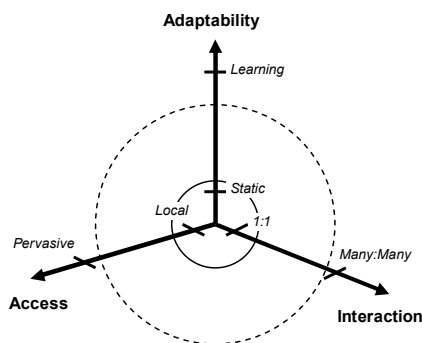
The purpose of this article is to address the definitional issue, identify the value propositions that drive a mobile enterprise and support the mobile workforce, and provide propositions for future

research. More specifically, the contributions of this article are:

- To define what salient characteristics constitute a mobile enterprise
- To identify value propositions that drive and enable the mobile enterprise
- To identify categories and profiles of mobile enterprise users
- To identify what current solutions support mobile enterprise users
- To identify the challenges of adopting and implementing mobile enterprise solutions

## 2. Defining the mobile enterprise

What constitutes a mobile enterprise? Simply deploying mobile ICT, such as laptops, so employees can perform work in the field or take work home does not constitute a mobile enterprise. Pundits have argued that a slight increase in mobility that a laptop affords amounts to little more than a very small geographic extension of the existing static enterprise. Similarly, a mobile enterprise is not merely a collection of people with handheld devices, smart phones, tablet PCs, and pagers. Many enterprises already have such workforce, however, it often does not change how those people work with each other and the rest of the organization. Therefore, bolting a group of mobile workers onto an organizational chart does not create a new organization and often does very little to enhance the existing one.



**Figure 2. The dimensions of a mobile enterprise**

However, the more mobile workers an organization has, the greater will be the need to transform at least part of that company into a mobile enterprise. More specifically, it will require a rethinking of how business is organized, how people interact and collaborate, how corporate resources are

accessed, and how adaptable an enterprise is [1, 8, 11, 16, 25, 33].

Figure 2 shows a conceptual illustration of key characteristics of static and mobile enterprises [4]. Static enterprises tend to exist in spheres closer to the origin. The further the sphere is from the origin, the higher the level of enterprise mobility. In other words, mobile enterprises tend to exhibit higher levels of access, interaction, and adaptability than their static counterparts do.

Based on this idea, we propose the following overarching definition of the mobile enterprise:

### Proposition 1:

*The mobile enterprise is built on a foundation of processes and technologies allowing full access and instrumented insight to all organizational resources, resulting in improved adaptability, access, and interaction among employees, customers, partners, and suppliers, independent of location.*

## 3. The driving and enabling value propositions of a mobile enterprise

The ability to access the corporate network and resources anywhere and anytime is clearly one of the main benefits and key drivers to adopting mobile enterprise solutions [2]. Field workers are no longer tied to desktop computers to check mission- and task-critical data. The use of mobile ICT enables workers to receive timely answers, which in turn can lead to timely decisions [18]. Enterprise mobility solutions also offer the potential of achieving significant cost savings. Expensive computing equipment can be replaced with smaller, more portable, and less expensive handheld devices. Field workers can use these devices to be immediately connected to all the sources they need. Furthermore, replacing paper-based processes with mobilized applications reduces the potential for errors in transferring information to a call report or clinical chart, leading to a higher level of data accuracy and integrity, which in turn can be harvested for overall business intelligence use [19]. Collecting data in real-time and transmitting it sooner to a back-office system can improve many processes like order shipping. Downstream benefits can be realized in areas like lower inventory and carrying costs; more efficient routing of multi-drop deliveries; and greater customer satisfaction, leading to overall business process improvement. Better access to corporate resources – both data and people – naturally leads to a higher level of productivity, as mobile workers are able to view data that allows them to respond and execute faster to changing market conditions [19].

An equally important value proposition of mobile ICT is its ability to provide greater insight and visibility into enterprises' resources and assets, creating an instrumented enterprise [35]. Using RFID, GPS, and Wireless sensor technologies, for example, enterprises are able to monitor and manage a large number of assets and products. RFID tags can be used to improve the efficiency of supply chain or the reliability of baggage handling at airports. Even pharmaceutical companies are considering "tagging" drugs and apparel makers are "tagging" shirts to reduce counterfeits and illegal distribution. GPS can be used to monitor vehicle usage and manage fleet maintenance or to track workers' locations and enhance service technician scheduling. Wireless Sensor Technologies are used to rapidly detect or preempt failures and promptly schedule maintenance, as British Petroleum for example does for its pipeline operations [18].

The near-term benefits that mobile ICT can provide to enterprises are often labeled as convenience, efficiency, productivity, decision-speed, and process improvement [4]. However, there are also several long term, strategic benefits that organizations can realize through mobile ICT [4]. This leads to the following proposition:

***Proposition 2:***

*Strategic implementation of mobile ICT can lead to new competitive advantages and core competencies that will fundamentally transform organizations, business models and strategies.*

The reader should be cautioned that the mere adoption and implementation of mobile ICT does not necessarily lead to increased levels of value. There are some tasks that are more suitable than others for enablement through mobile ICT [22]. Indeed, mobile ICT implemented in the right enterprise functions and processes, and made available to the right set of users, will provide the greatest value. The implementation of mobile ICT, hence, requires a detailed understanding on which types of tasks, functional areas, and users will benefit from it.

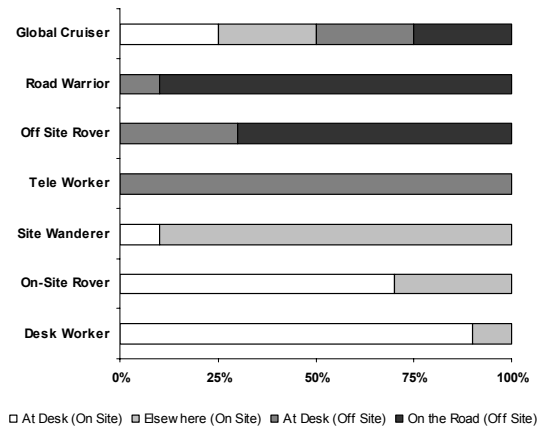
**4. Categories and profiles of mobile enterprise users**

The mobile enterprise ultimately serves the mobile user. Users of mobile enterprise applications tend to be workers whose jobs intrinsically require them to be out of the office or away from their desk and conduct work in at the point of action. Previous studies distinguish between (a) field workers and (b) information users [35]. Examples of field workers tend

to be traditional field service engineers to delivery drivers to government inspectors. For these professionals, access to information systems, such as real-time task scheduling or emergency response, improves their effectiveness and productivity; but even without such access, they would still need to be in the field. The business case for mobile worker applications typically revolves around readily measurable benefits, including productivity, accuracy, and process improvement [8, 16, 33].

Unlike the field worker, the information user is more dependent on information than on mobility. Whereas enabling the "mobile" field worker typically focuses on creating specific line-of-business applications relevant to the task at hand, enabling the information user focuses on taking existing information needs and making them mobile [20]. Many enterprises have several types of information users characterized by distinct patterns of mobile work - with distinct technology and support needs.

While a previous study identified four different activities/categories of mobile work [5], this paper argues that generally six mobility "profiles" in two broad categories (on-site vs. off-site) can be found in a typical enterprise (see Figure 3).



**Figure 3. Enterprise user mobility profiles [35]**

The first category consists of enterprise users working mainly *on-site*. This includes:

1. **Desk workers**, who work mostly behind their desks (e.g., software designers, operations, accounting).
2. **On-site rovers**, who work mainly at their desks, but sometimes roam in the company (e.g., administrative assistants).
3. **Site wanderers**, which are desk-less people who typically spend most of their time roaming on-site (e.g., IT troubleshooter).

The second category consists of enterprise users working mainly *off-site*. Profiles include:

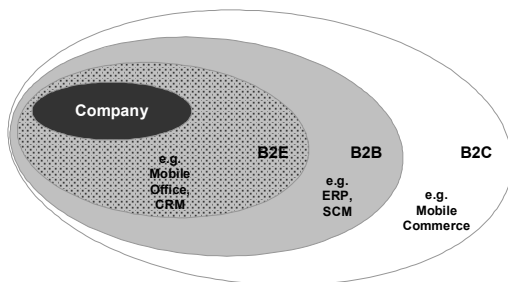
4. **Tele workers**, who work remotely (from home or from a location away from the office) most of the time.
5. **Off-site rovers**, who work off-site mainly away from their offices, but sometimes at their desks (e.g., consultants).
6. **Road warriors**, who work mainly outside the company (e.g., account executive).
7. **Global cruisers**, who often travel between different companies, customers, and locations (e.g., corporate executive).

## 5. Mobile ICT-enabled and supported work processes: Current solutions

While an understanding of the different categories and profiles of mobile enterprise users is important to successfully pursue mobile enterprise initiatives, an equally critical step is to identify the right enterprise functions and processes that are valuable and necessary to mobile enterprise users [19]. Several previous studies have shown that tasks and processes constrained and driven by time and location context tend to be prime candidates for mobilization [13, 19, 26].

Early mobile enterprise solutions were simply transcoded applications of existing corporate data for use on mobile devices [7]. Today's mobile enterprise solutions, however, take the user, task, device, and use context into consideration [18, 19].

In the broadest sense, today's mobile enterprise solutions can be categorized as business-to-commerce (B2C), business-to-employee (B2E), and business-to-business (B2B), as shown in Figure 4.



**Figure 4. Categories of mobile enterprise solutions**

Mobile B2C applications tend to fall under the m-commerce umbrella, where products and services are offered to consumers using mobile devices [17, 30].

Select examples of current m-commerce applications are the use of mobile wallets to make purchases, the use of mobile coupons for tailored marketing purposes, or mobile banking to check account status. However, since the focus is on enterprise adoption of mobile ICT, we do not further discuss the implications of m-commerce as it is outside of the scope of this article. Readers interested in m-commerce applications are referred to [17, 18, 29].

While the consumer market demand for mobile ICT solutions has seen tremendous growth in various global regions, a growing area of demand is coming from the enterprise side [9, 34]. In this section, we focus on mobile B2E and B2B applications; more specifically we highlight what mobile office and enterprise applications have been mobilized and how they help the mobile enterprise users today.

### 5.1. Mobile office and personal information management

As more work is completed outside the office, the boundaries of the enterprise extend well beyond the desktop. One of the fastest growing and also first mobile enterprise application that has gone mainstream is the mobilization of e-mail, personal information management (PIM) tools, such as calendar and contacts, and schedule management, the wireless Internet, and enterprise portals [10, 19]. In fact, many of today's employees expect to have access to e-mail and their PIM data, wherever they are and whenever they need it. The rise of mobile office adoption has increased over the past few years as handheld manufacturers and middleware providers have made significant advancements in delivering and synchronizing e-mails and PIM for mobile device use. Using mobile office applications, employees have instant access to e-mails as soon as it reaches their inbox. Mobile workers are no longer tied to their offices for communication as they can be notified via e-mail, short text messaging, and more recently instant messaging, as soon as new information arrives. Today's mobile professionals, in particular consultants, sales people, and executives, heavily rely on their e-mail capable smart phone or PDA. The explosive growth of Blackberry users is a prime example of the need, and to certain extent "addiction" to have immediate access and the ability to respond on e-mails.

The ability to retrieve, check, and respond to e-mail messages has enabled users to take advantage of down, waiting, or traveling time to catch up on correspondences and become more responsive to both customer and the organization. More recently, major software vendors offer mobilized version of their productivity tools to enable users to create, edit, and

view documents and presentations on the go [4, 17, 18].

Currently, many workers are using mobile devices primarily for email [15, 19]. However, it is important to note that the impetus behind mobile ICT goes far beyond email. Companies are also seeking to connect their workforce to business-critical data and processes [35]. Access to back-end system information, enterprise data and process infrastructure is essential to enabling competitive differentiation, increased productivity and greater efficiency. The most common enterprise applications mobilized today are enterprise resource planning (ERP), customer relationship management (CRM), supply chain management (SCM), and knowledge management (KM) [14, 18, 35]. These are highlighted next.

## 5.2. Mobile enterprise resource planning

An ERP solution is an integrated suite of applications that manages an organization's back-office activities, such as finance, manufacturing, purchasing, distribution, and human resources. Due to the relative complexity and size of ERP software solutions as well as varying needs of organizations, they are generally implemented in modules and integrated with, ideally, a single enterprise-wide database in order to minimize duplicate data.

It is clear that the ability to view inventory levels, order parts, perform invoicing, access pricing schemes, and perform order entry – all functions of an ERP solution – is a desirable functionality for mobile users, such as sales and field force personnel. Indeed, most leading ERP vendors offer a mobilized version of commonly used modules today. Using a mobile ERP solution, enterprises provide its sales and field force the ability to view and act upon real-time information such as inventory stock levels and customer orders with their mobile handheld devices regardless of location. A sales representative, for example, visiting a potential customer can monitor the product inventory level and inform the customer immediately if and when the product is available for delivery. Using mobile ERP, sales representatives are also capable of reviewing the history and situation of their customer, arming the sales representative with customer-specific information, and placing orders at the point-of-action.

Another compelling aspect of mobile ERP is the ability for management to have a real-time management reporting, or “dashboard” tool which provides time-critical information about the key figures of the company. As an example, executives of major retail providers know exactly how much inventory they currently have and view the financial performance of that particular store. Extending the

concept of a mobile executive dashboard based on ERP data, management and decision makers can then implement an automated alert system to receive instant messages when inventory levels are low, orders are backlogged, or other key performance levels are met or not met.

## 5.3. Mobile customer relationship management

Another commonly deployed enterprise application suite is a CRM solution. A CRM solution is an integrated set of front-office applications designed to help organizations understand and manage their customers [18]. A CRM solution contains a large customer database that includes critical customer data, such as contacts, history, ratings, and personal interests. Using a CRM solution, management and sales force are able to make informed and customized decisions about suitable products and service offerings.

Mobilizing CRM solutions makes intuitive sense, since sales and field force workers often deal with customers directly. Using mobile CRM, mobile professionals have the ability to immediately access all pertinent customer information at the point-of-contact. A mobile CRM solution enables the sales and field force to interact with and provide customers, supplier, and management with real-time information, provide on-site price quotes and take orders, conduct up-selling of products and services, confirm appointments, access and update sales information such as contacts, calendar, and lead management, and simplify and speed up daily reporting of tasks, expenses, and sales records.

Using a mobile CRM solution, sales forces can meet, maintain, and often exceed customer satisfaction by reducing the time it takes to sell and provision new products and services. Response and confirmation time is significantly shortened. A salesperson is able to close deals and place orders at the client site. Overall, order processing is streamlined and optimized for the various needs of the client organization.

While the previous examples largely apply to an organization's sales force, another large group of mobile professionals that can benefit from mobile CRM solutions are mobile field service workers [19, 24]. [17] aptly states that while traditional voice-based dispatch works in smaller companies, large corporations with a massive number of field workers are able to generate substantial cost savings by implementing mobile data solutions. Field workers receive updated information in the field, are dispatched more intelligently using a combination of GPS and GIS, and can update their work order more rapidly and accurately. Using a mobile CRM solution

for field work enables a faster response time, improves the overall dispatching process, streamlines the workflow, increases the efficiency of field workers, enables more accurate and faster billing, leads to less paper work, and less duplicated processes, improve communication, and provides more information and power to “edge” workers.

#### **5.4. Mobile supply chain management**

Many enterprises rely on a tightly integrated and efficient supply chain to provide their products and service offerings. However, uneven demand, need for shorter order-to-shipment times, emergence of new supply designs, and stricter compliance with supplier and customer requirements, requires enterprises to re-engineer their business processes to become more effective, flexible, and efficient. E-business solutions enabled enterprises to provide information to stakeholders across the supply chain and reducing potential inefficiencies. Integrating mobile ICT with SCM applications enables enterprises to further streamline their business processes and shorten lead time. For example, customers often demand greater visibility into the supply chain processes. By incorporating real-time asset tracking through RFID and other wireless solutions, customers gain real-time insight of the status of their order. Mobile ICT in the supply chain also enable enterprises to be more responsive to changing demands and manage warehouse and inventory more effectively [17]. Workers are equipped with wireless handhelds and truck-mounted readers to improve warehouse operations by minimizing inventory risk and out-of-stock situations [9, 22]. For example, when a product comes to a warehouse its barcode can be scanned on the spot. Information such as quantity, product description, origin, and pallet number are immediately captured. Home Depot for example uses a wireless inventory system to ensure adequate levels are available in each store.

Another prime example of the tremendous value of mobile ICT in supply chain management can be found in the transportation and logistics industry. UPS and FedEx are prime examples of how mobile ICT has transformed their operations [17]. Customers can track their packages with real-time information. Lost packages are a thing of the past. A similar application can be found in the airline industry, where electronic bag-tagging is emerging.

The health care supply chain also benefits significantly from the application of mobile ICT. Hospitals can now prepare themselves when certain medical supply inventory levels are running low.

In summary, the use of mobile SCM solutions enables enterprises to gain tremendous visibility into

their operations. With the advent and application of RFID in supply chains, this data information insight will grow exponentially.

#### **5.5. Mobile knowledge management**

A large group of potential users of mobile ICT solutions in the enterprise are information, or knowledge, workers. As such mobile access to a KM system makes intuitive sense. KM systems enable enterprises to share knowledge across functional boundaries, catalog best practices, and reduce the loss of “corporate” memory [32]. Since sales people, field and service workers, consultants, and traveling employees all need access to corporate knowledge; mobile KM solutions are an essential element of the mobile enterprise. Using mobile KM solutions, mobile users are able to retrieve documents, collaborate and share information, identify and find experts, advance their knowledge through learning tools, and capture their knowledge, at the place and time they need it. Particularly the ability to capture knowledge at the point-of-action is an important and extremely value aspect to enterprises that have customer-facing employees.

#### **6. Challenges and inhibitors**

While the list of mobile success stories is growing, there are still several challenges and inhibitors that enterprises face when embarking on their mobilization initiatives. Despite the competitive imperative to be adaptive and flexible, few organizations have successfully integrated mobile ICT without any pain points. Similar to the beginnings of other ICT implementations, such as ERP, many mobile ICT adoptions and deployments have ended in unexpected or undesired results, and often failure.

Why is this the case? Previous studies have shown that Mobile ICT implementations generally tend to fail because few technology leaders truly understand that mobile computing is fundamentally different from traditional enterprise computing models [21]. Mobile ICT is characterized by a lack of consistent bandwidth, limited storage capacity, as well as physically constrained computing devices. In a highly disconnected and variable environment, data desynchronization is a complex and thorny problem. Not understanding the complexity of these issues often leads to failure. Other technology-related issues include the maturity of mobile ICT. The industry has certainly progressed tremendously over the past few years, but many issues still remain. Common standards are slowly being established, mobile networks are being upgraded to handle higher data throughput rates; enterprise-level devices capable of handling data

applications and providing ease of use are slowly emerging; and compelling mobile enterprise applications with a clear return of investment are appearing on the horizon only now.

Another major inhibitor to widespread adoption of mobile ICT solutions is the issue of security and information assurance, in general. Mobile data and devices are exposed to a number of security threats. How do you ensure that mobile data is securely transmitted? What encryption standards need to be in place? How do you keep mobile data and devices from being stolen? How do you ensure that the right person is using the mobile device? What happens if mobile devices are infected with viruses and what threat does it represent for the entire enterprise? Indeed, security has been cited as a major deterrent to adoption of mobile ICT by many leading ICT decision makers [9, 19, 29].

While it is easy to call technology challenges and inhibitors as the primary category for non-adoption and implementation of mobile ICT, they are certainly the easiest to address. In fact, the most complicated issues are related to managerial, strategic and organizational factors [4]. Lack of management awareness is a key inhibitor to mobile ICT adoption. As with most new ICT, top management vision, support, and execution are required to ensure the success of implementations. Alignment with strategic goals and a clear business case are also commonly cited as discerning factors in the mobile ICT adoption process. It is clear that enterprise mobility requires a huge cultural change for leadership, managers, and users. When looking at mobility, it is easy to start off in the technology space, focusing primarily on hardware issues while overlooking equally meaningful business areas such as human resources, facilities, and legal. The supporting organizational layer is critical to the success of mobility initiatives because the office paradigm of a highly structured business environment does not always translate smoothly into a mobile world.

The path to mobile enterprise success, and thereby value received and experienced, can thus be increased by matching mobile enterprise users to the right enterprise functions and processes (e.g. value) while taking all of the aforementioned challenges into account.

## 7. Conclusions and future research

The emergence of mobile ICT within the enterprise has resulted in a paradigm shift of how business is done. Business professionals can now remain as productive outside the office as they are within the office. Mobile enterprise solutions provide

users the means to access and utilize work-critical data and information wherever and whenever they need it.

This article provides several new insights and contributes to our understanding of the mobile enterprise. In particular, this article contributes by defining the salient characteristics that shape a mobile enterprise, identifying value propositions that drive and enable the mobile enterprise, describing categories and profiles of mobile enterprise users, identifying what current solutions support mobile enterprise users, and discussing specific mobile enterprise adoption and implementation challenges.

The discussion of a mobile enterprise sets the stage for numerous future research opportunities. While practitioners are aware of the potential value mobile ICT can provide to enterprises, only little theoretical research has been done to provide insight into why and how exactly enterprises adopt mobile ICT, what strategies succeed, how organizations can prepare themselves for enterprise mobility, and in what ways mobile ICT can and will transform them [3, 4]. Table 1 highlights some research questions of particular interest:

**Table 1. Future research questions**

1	What technological, organizational, and economic challenges will organizations face when pursuing enterprise mobility? And how can they be resolved?
2	How will mobile solutions transform the enterprise and its people, processes, technologies, and culture? What types and forms of organizations will emerge?
3	How can significant investments in a mobile enterprise be justified? What is the business value of enterprise mobility? How can it be measured?

A theoretical and empirical exploration of these issues will ultimately establish a much deeper and more complete understanding of the mobile enterprise phenomenon.

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