THE WHITE BOOK FOR...

Mobilizing the Enterprise

The definitive guide to the mobility revolution

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Contents

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Preface

Mobilizing the enterprise is of great importance to businesses – it's potentially one of the key initiatives for businesses to modernize and innovate in the near future. Most organizations will have no choice but to develop multiple mobile policies and architectures, including customer and employee-facing strategies.

In the age of mobility, businesses utilizing the Cloud can expect to become more agile, reducing the costs of provision and support of IT infrastructure, increasing productivity and fostering better collaboration – both in and out of the office.

While mobile innovation in the consumer sector is leading the way, enterprise IT is lagging behind, with each part of the business often driving specific solutions to meet their particular needs. However, organizations are now starting to recognize that an enterprise-wide approach to mobility is required if they are to maximize their return on investment.

In order to benefit from the mobile revolution, businesses need to evaluate the risks, wants and needs of their employees, whilst striking a balance between individual convenience and corporate control, addressing issues such as: collaboration, enterprise applications, automation, consumerization, and connectivity.

In this new world SaaS is predicted to become the main source of application delivery; users want and need to access corporate apps and data from multiple devices – both corporate and privately owned. Virtual client technologies will provide an operating environment separate from the accessing device, giving employees access to all the business systems they require whilst storing corporate data safely behind a firewall. This removes any dependency on hardware and gives employees the freedom to use the device that suits them.

These trends will drive exponential growth of virtual workspaces usage, enabling device-independent productivity platforms to deliver a range of services. Companies are responding by migrating towards new application delivery and service models that emphasize consumerization and Cloud over traditional consulting and implementation services.

It's time for organizations to look at the bigger picture and think about their long-term mobility strategy. It's not a case of catering for the 'device of the moment', but rather adapting to better fulfill their business objectives such as driving down costs, improving customer service, and increasing revenues. If businesses don't adapt, then they risk being left behind.

CAMERON MCNAUGHT
EVP, SOLUTIONS
GLOBAL DELIVERY

1

What is the scope of Mobile in the Enterprise

1.1 What do we mean by Mobilizing the Enterprise?

When we refer to mobilizing the enterprise, we're not just talking about mobile devices. It's not just about the ability to enable remote and flexible working that frees employees from their fixed office and desk environments. And it's not even about accessing your corporate applications from any device type – it's much broader than that.

The rise of mobile

The explosion of available applications and collaboration tools, coupled with the powerful capabilities of mobile devices, means organizations can now mobilize their Line Of Business applications and workforce more easily, introduce new capabilities to their employees in the workplace, and provide new services to their customers. These services can also be extended to the wider organization, such as remote workers, to help improve productivity and competitiveness.

Mobilizing the organization, its processes and applications, along with introducing new and innovative technology will increase business efficiency and create opportunities to deliver new services for stakeholders and customers.

1.2 Trends and hype

My seven year-old son recently asked me why I call my smartphone a 'mobile.' When I explained that phones were once fixed, tethered things, he was incredulous. What on earth was the point of fixing a phone to a wall? His face contorted in horror with the realization that I had grown up in some kind of barbaric era.

I mention this because it belies how slowly our thinking adapts to major change. I use the word 'mobile' because to me it's descriptive of a particular type of device, which I use to differentiate from those that are not mobile, i.e. fixed. This differentiation was once useful to me and I continue to make it out of habit, as do many others. To my son, there is no such thing as a fixed technology device. He has grown up with smartphones, tablets and laptops. There is no 'place' you go to use technology – you just use it.

Of course, this is not to say that mobile technologies are passing unnoticed, but the point is that mobile is becoming the norm, to the extent that the word is losing its relevance. Technology has become mobile almost by definition. Meanwhile, enterprise IT still carries around assumptions that have grown up around the PC. It is these technologies that are slowly becoming the exception, while mobility powers ahead. For most enterprise IT organizations, there is still some way to go to fully exploit the technology.

Let's start by looking at mobile trends.

- Fast changing
- Pay for service
- Personalized
- Self help
- Low security conscious

- Responsive to change
- Pay for service
- Standardized for roles
- Full service
- Appropriate security

- Slow to change
- Pay for kit and solution
- Standardized
- Full service
- Highly security conscious

A different style of computing

Mobile has been driven not only by changes in technology, but also by a profound social change in the way people use technology. Anyone with a career of 15 years or longer will have started out at a time when business IT was at the cutting edge of innovation in computing. Today, innovation in the consumer sector leads the way, and enterprise IT is the late adopter.

This technology is being driven by mobile devices and the wireless networks that support them. Virtualization and the cloud have an important role to play in bringing functionality to each device, and these changes are having profound implications for how businesses architect their technologies:

- Client applications are freeing themselves from back office infrastructure, with many now accessed via a web browser without the need to install any client software.
- Software-as-a-Service (SaaS) is separating client and back-end architecture, and is predicted to become the main source of application delivery in a few years. As a result, the corporate footprint on a client device will potentially be much smaller and should require less expertise to manage.
- As more employees use their mobile devices outside their organization's perimeter, security boundaries will contract around back end systems as security focus shifts from the device of access to the point of access.
- Device choices used to be simple – desktop or laptop – but now the form factor and mobility options are many and varied. Where IT was originally intended for deskbound workers, anyone can now benefit from it: production line workers, drivers, construction workers, and so on.
- Users are now more comfortable making technology choices because they'll often be using more advanced technologies at home, and want to be self-sufficient without having to rely on corporate IT.

Against this backdrop, there are specific areas to think about in the end user space:

Bring Your Own Device and Personal Cloud

Bring Your Own Device (BYOD) is a major trend, and smartphones have been widely embraced by enterprise IT. Most IT departments provide a level of service for these devices, typically around email and device management. For the more traditional form factors, laptop and desktop, employee provided technology remains the exception.

As people use more devices, they are increasingly turning to personal cloud to store and share information. This makes it difficult for the enterprise to compete with. And as more devices are added – a smartphone here, a tablet there – it becomes more beneficial that software and personal information are virtualized and accessible. Dropbox and Apple's iCloud are popular because people realize how much easier it is to have a consistent experience across their devices. From an enterprise perspective, a personal, virtualized workspace makes a lot of sense – if it can be secured.

Enterprise application stores

One way in which businesses can take advantage of mobile is through enterprise app stores. The consumer world has come up with the most efficient way of provisioning apps, something that enterprises have been struggling with for years. With enterprise app stores the role of IT becomes one of enabling and regulating, ensuring that risk and business value are kept in balance and act as a broker between the business and third party app developers.

Differing strategies needed for B2E (employee) and B2C (consumer)

Strategically, mobile is of great importance to businesses – it's potentially the main channel with which to reach their customers. Most organizations will need to develop multiple mobile strategies and architectures, including an employee-facing strategy which addresses several separate issues, such as collaboration, enterprise applications, automation, consumerization, risk, and connectivity.

Virtualization

Breaking the tether between the business user and their data and applications in the old distributed computing model is key, and virtualization will ring-fence their legacy applications. IT operations and security will need to work closely to ensure the risks exposed by combining virtualization and mobile are mitigated.

The rise of Shadow IT

The combination of smartphones, app stores, social networks and cloud technologies provides a powerful and flexible working environment. New ways of doing things can be envisaged, trialed and rolled out without reference to central IT. Developing guidelines and educating the business on how to play safely in this new environment is a good place to start.

Waves of wireless

There have been many waves of wireless technologies: Bluetooth, 3G, 4G – and now 5G is planned. Governments around the world have recognized that an always-on, always-connected mobile population is a stimulus for economic activity, and are working to remove the barriers to funding. Faster versions of wireless are being developed and soon the only wire required for employee workspaces will be the power connector (and maybe not even that).

The next platform

We're on the cusp of a new class of computing, the so-called 'wearable technologies.' Glasses, watches and body monitors are all potential applications for the workplace. We will shortly see internet connected cars becoming commonplace, as well as a range of different sensors and intelligent objects that people can interact with.

With this rapid change in technology comes more choice. But does choice equate to value? For the individual or the consumer choice has some very tangible benefits: choice equates to freedom, and freedom implies the satisfaction of personal wants and needs. But for an organization – well, it's more complicated – an organization must respond to the needs of its workforce so they can perform their tasks. It must also operate within a set of business parameters. In the past, organizations have responded to the challenge of managing personal computers with standardization, the 'one size fits all model.' But there are now threats on so many fronts: to smartphones and tablets; on social media, SAAS, and app stores; and the desire of many employees to work where they want.

The contemporary enterprise needs to strike a balance between individual convenience and corporate control, evaluating the risks, wants and needs of its employees. In today's business climate the status quo can no longer be taken for granted, and languishing over past successes is commercial suicide. The pace of change – and particularly technological change – is accelerating. Product cycles are tumbling. Consumer preferences, and behavior, are evolving constantly. The enterprise needs to operate in a different way if it's to remain competitive. Accessibility, agility and consumability are key attributes to a successful business in today's information-centric world.

The enterprise needs to become dynamic, and fortunately there are some clear ways in which it can get the best from technology.

Exploit virtualized user environments

With virtual client technologies an organization can provide an operating environment that's physically and logically separate from the accessing device. It provides access to all the business systems an employee requires and stores corporate data safely behind a firewall. It removes any dependency on hardware and gives the employee freedom to use the device that suits them. Organizations can offset much of the support onto services chosen by the end user, effectively becoming an access management service for a virtualized environment and set Line-Of-Business applications. Such a solution delivers all the benefits of a Standard Operating Environment without the costly dependency on static hardware configuration.

Know your people

Understanding the needs of different types of worker enables an organization to target the right people with the right technology and the right policy. Some employees are required to carry out specific tasks with no deviation from a standard process. Others will be required to exert different levels of initiative or innovation on behalf of the organization. These people all require different approaches, and it begins with knowing who they are.

Know your systems and know the cloud

As IT moves to the on-demand consumption model of the cloud, it's crucial that organizations can make informed judgments about the most effective source of technology services. It may be that an in-house service is best for a given Line-Of-Business, but something could change in the market to destabilize this, such as a cloud provider announcing a major re-pricing. These are no longer static choices. The enterprise must be set up to consume its services from the optimum source at any given point in time. This means having a clear view of existing systems, what they cost and what their dependencies are, while continually keeping an eye on the market.

1.3 Strategy for mobilizing the enterprise - start with the business outcome, not the device

The mobile market comprises an array of devices, vendors and technologies, combining to make a fragmented and confusing landscape which changes at a rapid and unrelenting pace.

New employee expectations

For businesses today, it's vital to understand how to exploit the benefits mobile technology can bring. Because people use mobile devices in their personal lives, and can see the flexibility they afford, they are increasingly demanding mobile solutions at work. Consumers are also expecting a mobile channel for interacting with enterprises and public bodies, whether it's booking train tickets or requesting council services.

The bigger picture

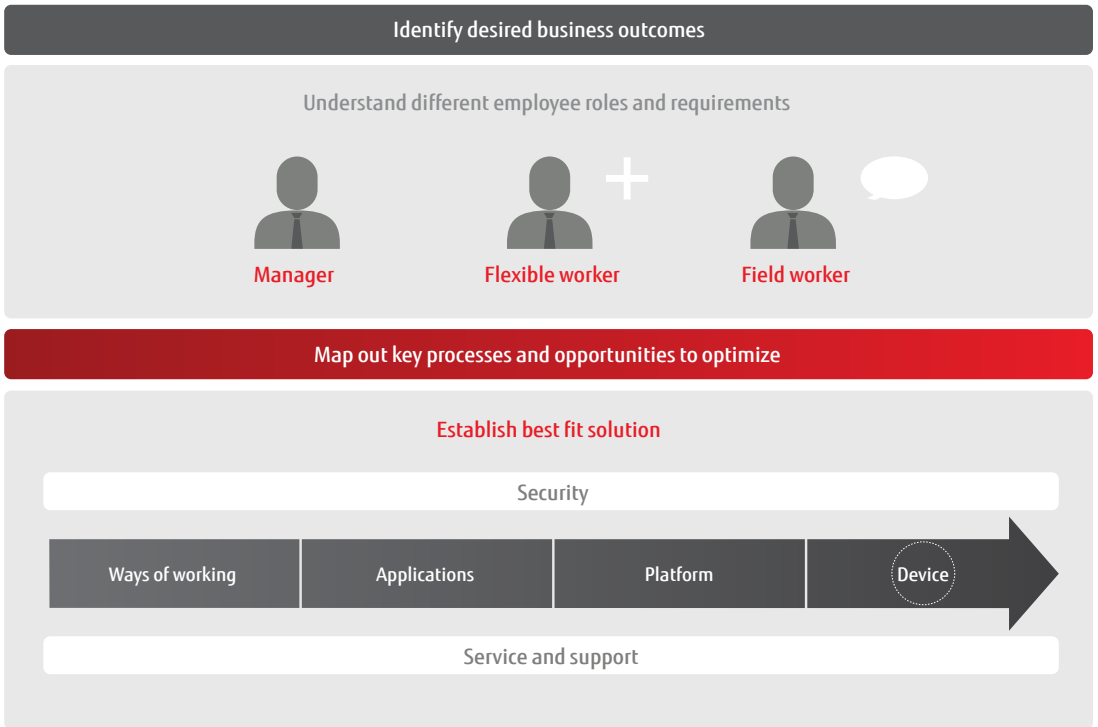
Although the business benefits of mobile are well documented, many organizations are seeking to understand exactly how these benefits can be realized in practical terms. Simply responding reactively to mobility opportunities on a case-by-case basis is commonplace and the full potential benefit has not been realized.

It's time for organizations to look at the bigger picture and think about their long-term strategy for mobile – the starting point being the business outcome, not the specific 'device of the moment.'

A mobile strategy can contribute to delivering key business objectives such as increasing revenues, driving down costs and improving customer service.

ORGANIZATIONS ARE FACING QUESTIONS SUCH AS:

- How can I deliver the maximum business benefit while addressing usability, security and avoiding lock-in to solutions which may become obsolete?
- How can I plan when the world is changing so rapidly and it's almost impossible to keep up to date?
- How do I respond to increasing demands from the business when there is a limited amount of funding and resource?



CUSTOMER CASE EXAMPLE #1

A government department recognized that although they had some successes with mobile working, their approach was minimal, siloed and fragmented, and no overall strategic-wide capability existed across the organization. They decided to build a case for change that covered the whole organization, working collaboratively with suppliers and IT. Significant business engagement took place using workshops, surveys and 'day in the life' scenarios, together with an analysis of the current provision of facilities and associated costs. Significant benefits were discovered and a strategy was formulated across people, process, organization and technology.

1.4 Cultural change and demographics

In order to realize the benefits of mobilizing the enterprise, it's not sufficient to just deliver a robust technology solution; many organizations face significant cultural change.

Working is something you do, not a place you go

Some companies have fully embraced flexible working; others like government departments and some financial services companies may still expect employees to be in the office, tethered to their desks from 9-5. Significant benefits from flexible working include reduced property costs associated with hot-desking and staff working from home and other locations, but not all parts of the organization are ready to embrace new ways of working. Senior management may be in favor of it because they are keen to promote a healthy work-life balance, but often middle management (the 'marzipan layer') are reluctant as they are used to having a direct line of sight to employees during the day. Flexible working requires a cultural change where management trust staff and manage by outputs (e.g. deliverables produced) and outcomes (e.g. sales made); managers need the training, support and tools to work in this new way.

Mobilizing the business process

For field workers, such as police officers or central heating engineers, the situation is slightly different. In this case the mobile solution can fundamentally change their way of working – effectively 'mobilizing the business process.' There are several areas to address here: the change to working practices and impacts on roles, staffing levels, and the adoption of the mobile solution. For any given role, e.g. an engineer, there may be a number of different groups with a different propensity towards technology and change, or specialist needs, e.g. Generation Y or those with disabilities. It's paramount to include those workers early on and throughout the mobile project.

Going the extra mile

Most enterprises have embarked on consumer mobility, but many are in the early stages, which usually involves creating a mobile app that mimics their website. Often, organizations have a limited uptake of these apps and, while this may be partly explained by the demographics of their customer base, there is more often the lack of perceived value from the customer. To be successful, customer mobility must go beyond ease of use and convenience for information, embracing transactions (i.e. payment) and adding additional value such as offers and promotions for products.

CUSTOMER CASE EXAMPLE #2

A public sector authority wished to improve the productivity of its property maintenance field workers in a geographically challenging area. A mobile solution was implemented that enabled centralized job planning & dynamic scheduling.

Field workers were engaged early on and throughout the project, and once implemented, clinics were held to improve the take-up of the solution.

The result: the cost of property maintenance was driven down (by up to 30%) and it delivered vast improvements in customer service and satisfaction.

1.5 Technologies

The innovation and introduction of new technologies over recent years has significantly changed the way enterprises embrace and adopt a mobility strategy. Let's look at some of the technologies that enable an enterprise to adopt a mobility strategy.

Virtualization and centralization

From an infrastructure perspective, it's obvious that a traditional workplace approach to mobility – with a strong interdependency of hardware, operating systems, applications and user environment – is not suitable. However, virtualization makes the individual components independent from each other and enables IT to move applications, data, the user environment or even entire workplace environments from the device into the data center. The user's device will then just serve access to the data center. The only thing that is needed on the device is a virtualization client or just a browser. As the virtualization client is from a major vendor and web browsers run on any device platform, a centralization approach is device-agnostic.

"In a few years from now, the majority of mobile devices will be tablets or smartphones. We need to be prepared that new talents and employees joining our company expect easy access to the business applications on those devices as they consume and experience it today in their private life."

Benno Zollner,
CIO, Fujitsu

By having corporate applications and data in the data center, a separation of the business from the private environment is achieved. Management is simplified for the IT department as their focus is no longer on the device, but just on the corporate applications and data over which they have full control. Software can be easily deployed and updated, and patches become effective without touching end user devices or disrupting the end user. The level of application and workplace availability is significantly increased; even disaster recovery concepts can be applied.

By having all the data hosted in the data center the risk of data theft is minimized. To achieve this, encrypted communication, firewalls, anti-malware and granular role-based access controls are applied to applications and data. Data backup no longer depends on whether the device is turned on or whether it's connected, and compliance requirements are more easily managed and satisfied.

Centralization enables end users to access their applications and data anywhere from any device – applications and data follow the user, which is helpful when individuals are using more than one device.

Workplace delivery options

When it comes to centralization, there's not just one optimum concept for every situation. User types, their requirements and economic aspects are also important.

Hosted Shared Desktop

This is ideal for workers who use and share the same limited set of applications every day on a terminal server, and provides a very low Total Cost of Ownership. But its restrictions – multi-user capable applications, limited individuality and separation from other users – mean it's not applicable for real knowledge workers who need the highest levels of flexibility and individuality.

Hosted Virtual Desktop

VDI or Virtual Desktop Infrastructure is the best solution for knowledge workers. It features individual desktops with different types of operating systems run as virtual machines on servers in the data center. They are isolated and protected from each other, and can be personalized to each user's needs. Unlike the 'Hosted Shared Desktop,' applications don't need to be adapted.

Central Hosted Desktop

If centralization is demanded for power users with extremely high demands in terms of graphics performance, the Central Hosted Desktop with graphics workstations in the data center is the only useful alternative.

Local Virtual Desktop

All delivery options discussed by now require a connection from the access device to the data center. With a Local Virtual Desktop even mobile users can be involved who occasionally have no network connection but want to work offline. By running a hypervisor on their local device users have access to exactly the same virtual desktop locally which is centrally used in a Hosted Virtual Desktop scenario. This means the IT department can manage these mobile users in the same way as stationary workers. The virtual desktop is delivered once from a central image to the mobile device. All work done offline will only have an impact on local copies. Once connected to the corporate network, updates are automatically synchronized with the data center's virtual desktop environment. Synchronization eliminates the need to backup mobile devices, and automatic updates ensure users always work with the latest software and security patches.

Virtual desktops are encrypted and fully isolated from each other and the private host environment, while additional security ensures policies can be put in place. For example, if a device hasn't re-connected to the corporate network for a certain period of time the image will lock itself down. Likewise, data leakage can be prevented by disabling printing or access to local disk drives and USB storage. If the device gets lost or stolen, the corporate virtual desktop can be remotely wiped.

Local Streamed Applications

An alternative for offline usage is Local Streamed Applications in which business applications are downloaded to the mobile device and run in a sandbox. Data used or generated by the applications can be totally isolated and separated from whatever else is on the device. The rest of the security mechanisms from the Local Virtual Desktop are also available.

Web Desktop

In the last couple of years the internet has become the main workspace for many users as more and more applications become web-based or at least accessible through the web. The Web Desktop becomes the aggregator for these applications, and to access them a HTML5 compatible browser is needed, which is available on any device no matter which operating system is deployed.

The Web Desktop is most suited to task workers, but knowledge workers and to a certain extent, even power users can take advantage of it. This is true for both stationary and mobile. Due to the local caching feature, minor disruptions of the connection can be bypassed, but this might not be the optimum approach for mobile users, who can have no network connection for any length of time.

The new formula: EMM = MDM + MAM + MIM + TEM

While accessing the web, devices can get infected by malware, which exploits vulnerabilities and then looks for security holes in other systems or business-related containers on the private device. It's true that for all delivery options discussed before, there are solutions in place that protect corporate applications and data. However, it's likely that attempted attacks generate traffic on the network and use up significant system resources of the device itself, in turn causing a negative impact on end user productivity.

Mobile Device Management

This can be significantly reduced by deploying anti-virus/anti-malware software and by running the latest security patches. With a Mobile Device Management (MDM) service all necessary security software and the virtualization client can be provisioned, monitored and regularly updated over the air, without disrupting the end user.

MDM can be used to enforce device passwords, application blacklists or whitelists, jailbreak and rooting detection, remotely wipe all critical contents in the event of theft or loss, and helps IT organizations to meet regulatory compliance.

Mobile Application Management and Mobile Information Management

Certainly more important than having a defined level of control over end user devices is the control over corporate applications and data. This is what experts denote as Mobile Application Management (MAM) and Mobile Information Management (MIM). By separating business-related content from private content on the device, business content can be secured and controlled without having to interact or interfere with private content. This means things like business emails and attachments can be restricted from being sent from personal email accounts.

MAM and MIM include the automated enforcement of usage policies based on a number of factors that include the type of device, the type of network and user, and a selective lock and wipe of the isolated, secured environment, without touching the private sphere of the user. Enforcing a password for the container could, from a company perspective, even make the device password superfluous. This might improve the user experience and acceptance in many cases, as not every user is happy if their smartphone needs to be unlocked every time they want to take a picture.

Telecom Expenses Management

Telecom Expenses Management (TEM) is used for managing connectivity, data volumes and time to optimize communication costs. Alongside MDM, MAM and MIM, TEM is another important building block for a comprehensive Enterprise Mobile Management strategy.

1.5.1 Collaboration and productivity tools

Enterprise collaboration is defined as processes, tools and capabilities to help business users interact, share and co-operate to produce business value and product. We achieve this through employing collaborative tools for email, voice and video communication, document sharing and synchronization, application sharing, presence awareness and social networking.

New ways to consume content

Desktops and laptops have traditionally been used as the main devices for collaboration and productivity, with mobile devices limited to email and voice calls. More recently, mobile devices have proven to be excellent tools for consuming content, with content creation and collaboration performed on traditional PCs.

New devices reaching the market

Newer, more powerful devices, when combined with updated mobile productivity applications, can enable efficient content creation and collaboration in the field. This is the next fundamental shift for enterprise collaboration and Gartner predicts that "by 2016 most collaboration applications will be equally available on desktops, mobile phones, tablets and browsers."[1]

This creates a challenge for businesses as many users now perform all of their day-to-day collaborative and creative activities via mobile devices. How can the enterprise adapt and facilitate a mobile workforce without losing control of content storage, security and business continuity?

"We asked people to consider different working patterns. For example, we gave them the technology to be able to work from home. This showed us that we don't need to be tethered to our desks from nine to five... We want to build on that experience and formalise a mobile and remote working policy that will enable us to meet civil service reform plans while making our people more productive."

HM Revenue & Customs Mobile, Remote and Flexible Working Lead

The strategic concerns for mobile enterprise collaboration include:

1. How to facilitate a secure, user-centric, mobile workspace
2. How to synchronize and secure content produced on mobile devices

Mobile collaboration?

A Mobile Workspace must allow the end user to create, consume, store and share content, as well as initiate and execute business processes. Businesses need to create a strategic vision for their mobile collaboration and productivity workspaces to achieve this.

There is now a trend of individual users turning more and more to consumer-based solutions to help them work. This phenomenon of Shadow IT is a risk to businesses and many enterprises are investing heavily into tactical solutions for mobile collaboration technology to address this issue. But time is needed to choose the right solutions, otherwise the problems can be exacerbated.

According to Portio Research, messaging applications are the 2nd most popular application category on mobile devices, following gaming, which demonstrates the desire for rich mobile collaboration using instant messaging, conferencing and file sharing.[2]

Enterprise options for the Mobile Workspace include Virtual Desktop, Local Streamed Applications, or Device Installed, Network Connected applications. The Virtual Desktop is ideal for heterogeneous environments where users have a combination of mobile and fixed devices that require a similar user experience. Local Streamed Applications are best for lightweight deployments of enterprise collaboration applications to business or personal devices.

With a mobile workspace for collaboration and productivity, several questions are raised:

- How to store and access content?
- How to share it?
- How to make it available on other devices and locations?

Content and Collaboration

Most enterprise users have more than one mobile device they use for the same task. According to Gartner, "the average personal cloud will synchronize and orchestrate at least six different device types by 2016."[3] This poses an interesting capacity problem for IT: previously, typically one device synchronized content, i.e. a laptop, but now each user has multiple devices. This significantly increases the capacity and performance requirements for an organization's IT infrastructure, and businesses that host their own infrastructure need to plan now for this rise in connected devices.

[1] http://www.gartner.com/resId=2572317
[2] http://www.portioresearch.com/en/blog/what-apps-are-people-using.aspx
[3] http://www.gartner.com/resId=2572317

Enterprise file synchronization strategies

Users need to move and share files across multiple mobile devices, PCs, network drives and other storage repositories. Depending on the sensitivity of the content, the strategy employed for file synchronization can involve a private on-premise service, a secure hybrid service, or a public service incorporating external file synchronization providers.

With the right mobile collaboration solution in place, businesses can achieve significant productivity enhancements. An example of a mobile collaboration scenario may go as follows:

CASE EXAMPLE

John's manager sends him an email asking for details of a particular customer's sales for the month. John receives the email on his smartphone while on the train. He pulls out his tablet and opens the secure container application. Once started, John accesses the sales information from the company's sales tool, exports it and creates a spreadsheet. John is not sure about the sales numbers so he sends an instant message to his finance colleague Alice to ask. Alice is online, so she initiates a video call with John to discuss this further. John shares his screen with Alice to show her the spreadsheet and they agree on the changes. John saves the spreadsheet to his personal cloud, shares the document with his manager and using his tablet, sends an email back to his manager with a link to the file.

This scenario is very real and demonstrates how productivity can be achieved in otherwise idle time.

The rise of social networks

Rising adoption rates of social networking tools in the enterprise demonstrate how businesses are embracing the concept of communities and blogs for both internal and external use. Social technologies are enhancing, and in some cases, replacing traditional messaging and document-based work methods. Well-connected businesses can leverage the move towards social media to interact with partners and customers as well as accumulate information on competitors. This type of social collaboration is fairly unstructured but can be very powerful in industry verticals such as IT and Retail.

Security

The last thing to discuss (but one of the first to be considered) is security. Corporate content outside business IT boundaries is at a higher risk of loss or leakage, from lost, stolen or compromised mobile devices. Enterprises need to develop a strategy and policies for data protection and compliance in the mobile world. Content needs to be secured by focusing on the content source rather than the device, which can be achieved with a comprehensive digital rights management solution.

"The overall trend for mobilization and the consumerization of IT required an internal review of all relevant business areas and the real need for support.
In consequence we needed and still need to improve the awareness about information & data ownership as well as the related security aspects.
As an outcome, first positively challenged mobilized business processes have been enabled and more are to follow."

Marcus Frantz
CIO, OMV AG

2

Business and IT change through Mobilizing the Enterprise

2.1 Delivering business benefits

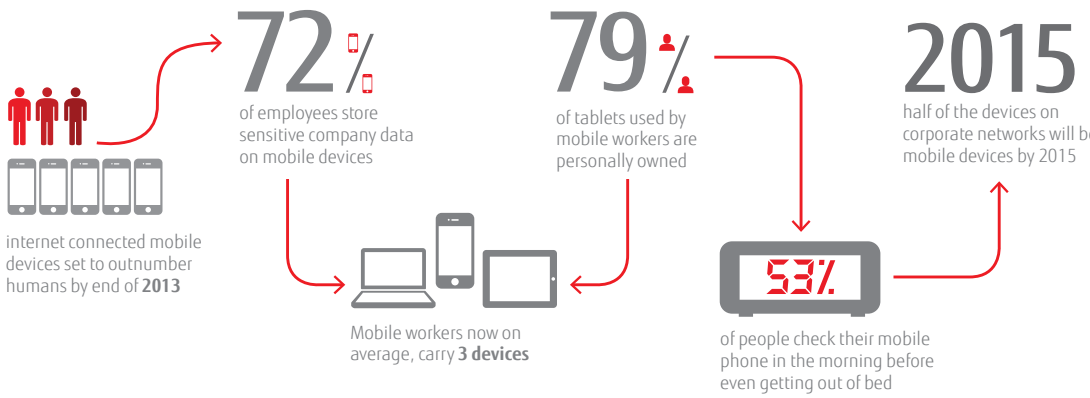
Technology, and mobility in particular, is changing the way we live our day-to-day lives:

- Smartphones have a 58% penetration in the UK (2013) and this is due to rise to 81% by 2016
- Tablets are overtaking PCs and laptops as the consumer device of choice
- 80% of people 'second screen' – using a smartphone/ tablet when watching TV
- Enterprises are supporting multi-device customer journeys, e.g. purchases that start with a smartphone and finish with a PC/laptop
- Social media is growing – there's more engagement across all social platforms, with Twitter the fastest growing of all, especially on mobiles

Against this backdrop, businesses are requiring more flexibility to respond to new demands amid continued economic uncertainty. For many, it's about getting their business in shape: to do more, faster and better, with less. But in doing so, they raise a number of issues:

- How can we improve the efficiency of our employees, wherever they are working?
- How can we be more efficient and streamline our key processes?
- How can we deliver a better service to our customers?
- How can we be more agile in the way we operate?

Mobility is changing the way we live and work

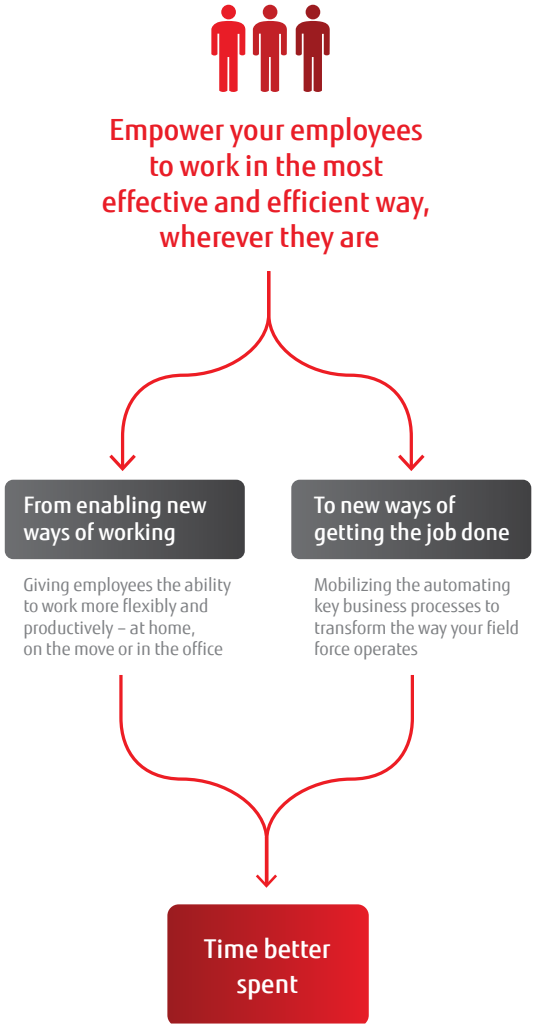


Sources: iPass, Cisco, Ernst & Young, Gigaom

Enterprise mobility can make a positive impact on business performance in a number of ways, as the diagram and the table demonstrate.

MOBILITY BENEFITS	DESCRIPTION	EXAMPLE
Workforce productivity	Making the best use of employees' time, wherever they are – reducing dead time, decreasing travel time/ costs, and eliminating the re-keying of data.	A government agency involved in protecting vulnerable children used mobile solutions to maximize their advisors' time when visiting homes and courts. This helped to avoid 'dead-time' while waiting for appointments and the re-keying of handwritten data. Productivity was boosted and it contributed to a better work-life balance for the advisors.
Transform the customer experience	Better engagement with the customer – through assisted sales (sales advisors with mobile solutions) and using mobile as a customer channel to drive revenues and increase satisfaction.	An automotive retailer used mobility to deliver a new retail customer experience that allowed dealerships to engage with customers in new ways to enhance the sales experience. The tablet-based solution meant sales advisors could illustrate features and options directly with customers and complete specifications more easily. It improved the quality of customer service and revenues.
Streamline key processes and boost efficiency	Re-engineering processes using mobile solutions to provide information at the point that it's needed – eliminating redundant steps (e.g. travel) and speeding up processing times.	A local authority wanted to upgrade its outdated system for managing building maintenance and introduce a flexible, mobile way of working for increased efficiency and lower costs. It provided mobile solutions for its workers, which enabled them to receive and manage jobs on the move, reducing the need to return to the office and optimizing the scheduling of work.
Being far more agile	Allowing the organization to better respond to business changes at the micro level (customer requirements within an existing business) and the macro level (changes in the market which require repositioning).	A local authority wished to make its property maintenance team more agile in response to changing customer requirements and circumstances. The team covered a wide geographical area with challenging terrain and a mobile solution helped them best react and re-plan when access to property couldn't be obtained.
Enable more flexible working	Giving employees the ability to work more flexibly and productively wherever they are, be it at home, while travelling, in a public space (e.g. coffee bar) or in another office.	A large bank needed to drive down its costs and implement changes to allow their staff to work more flexibly, creating substantial property rationalization, user productivity and cost savings.
Delivering specific business outcomes	Delivering or contributing to the organization's business objectives. These could be sector/customer specific, e.g. closing the tax gap, catching criminals, or increasing public safety.	A government agency wanted to improve its success rate in removing illegal immigrants from the country. A mobile solution was used to identify individuals and verify their status, improving the success rate of operations and allowing staff to be focused on front line activities.

Not all of these benefits will be relevant to every organization, but the majority will be able to achieve a subset dependent on the nature of their workforce and engagement with customers.



We would summarize the benefits of mobilizing the enterprise, from an employee perspective, as 'time better spent' – that is, employees spending time on the things that really matter, rather than on activities that add little or no value.

2.2 Changing the business approach

Businesses benefit from enterprise mobility in both expected and unexpected ways. Of course, different working styles exist in different industries, different cultures and different nationalities, but the benefits they see are remarkably similar; in short, businesses that embrace enterprise mobility can expect to see:

- Increased business agility
- Reduced costs of provision and support equipment
- Increased productivity
- Better collaboration, especially for travelling or remote staff

Indeed, a recent Cisco study puts the value of a comprehensive BYOD strategy at up to $3,150 per employee per year[4]. In our wider view of enterprise mobility the value is likely to be even higher.

But we do need to remember that businesses (and especially IT functions) will need to adapt to these changes, often in fairly fundamental ways.

[4]http://blogs.cisco.com/news/new-analysis-comprehensive-byod-implementation-increases-productivity-decreases-costs/

2.2.1 Changing workstyles

The arc of changing workstyles has been a long time coming. Five years ago a mobile worker might conjure up images of lugging a laptop between different offices on a daily basis. Today, enterprise mobility, at its heart, is about supporting the change in workstyles to make staff more effective.

Studies have shown that even providing employees with email and phone access outside of the traditional office environment brings significant benefits in responsiveness and productivity. As this is extended from communication tools to collaboration suites, so the effectiveness of new workstyles will grow.

This 'always-on' concept is challenging, but in reality it's becoming the new normal – enterprise mobility lets people 'time slice' quickly and easily between 'work' and 'home' styles. This is only possible due to the efficiencies gained in moving seamlessly between different devices. Users can take notes on their tablet during a meeting, turn them into a presentation on their laptop over lunch, and securely share them with a colleague on their smartphone on the journey home.

“Flexible working isn’t just about working from home occasionally. Nor is it about giving everyone an iPad. Flexible working is about changing the way everyone works and providing tools that can help transform our business. We can ensure our inspectors in the field have real-time access to the right

information that will help them be more effective in their roles. Offering more flexible working options can also help improve the work-life balance of employees."

HM Revenue & Customs Mobile, Remote and Flexible Working Lead

Anytime, anywhere access also changes the nature of the office environment: staff are more likely to use IT in meetings and work more collaboratively in flexible environments – with staff across different sites, on the road, and at home through unified communications and enterprise social networks. Perhaps, along with the change of workstyles, we can thank enterprise mobility for the end of the anodyne cube.

2.2.2 Business processes anywhere

Increased productivity for the knowledge worker, no longer tied to their desk and headset, may be fairly evident, as are the savings for the transformed IT department that no longer tries to create one-size-suits-all solutions. But what about those who use legacy Line of Business, CRM and ERP applications? This is possibly the most challenging, but also the most valuable enterprise mobility nut to crack.

Many organizations have mobilized their legacy systems by using allied technologies such as Mobile Backend-as-a-Service, Integration Platforms-as-a-Service, and Application Virtualization. When successful this can lead to huge productivity gains: removing the need for back-office functions, reducing admin time for field-staff and improving customer response time from days to minutes.

2.3 The changing role of the IT function

Recently at a conference a CTO asked in rather stark terms: 'are IT departments Communist?' He was challenging the assumption that the IT function should own rather than govern the provision of services. Kit Colbert, CTO of VMware, put this more gently in his article 'Who Feeds Paris,' but makes the same fundamental point that the IT function needs to be the curator of IT services and not necessarily the provider.[5]

The rise of BYOD is one of the first battles to open up in the curator vs. supplier mindset, and the move to BYO Application and BYO Identity is surely coming soon. This is making many who work in IT quite nervous and in some cases with good reason, and we will address this in a later chapter.

As Millennials (those who reached young adulthood at the turn of the Millennium) become an increasingly integral part of the workforce, the expectation of IT in the workplace is changing. Consumer-grade is the new enterprise-grade, so much so that 'enterprise' has almost become a dirty word. Enlightened IT departments can prove their value by meeting and exceeding their expectations. By supporting a range of devices through BYOD and MDM policies, users will have devices they are more comfortable with and more motivated to use. This relieves IT of the burden of procuring devices, and leads to a lower number of support calls and increases user satisfaction.

This BYOD example is just the start. The more users are able to choose and use the applications that meet their immediate needs, the less IT has to focus on complex requirements for an enterprise-wide deployment that suits no-one, and the more they can focus on the governance role that adds value. Users are happier and more productive, the business is more agile and capital costs have shrunk.

[5]http://cto.vmware.com/who-feeds-paris-changing-the-mindset-of-it/

2.3.1 The IT role: An evolving challenge

As technology becomes cheaper, more reliable and more widely available across the globe, significant expectations are being placed on traditional IT functions, with IT consumerization being a major contributor. As a result, the way IT departments support and add value to the business is evolving, and this is equally so with enterprise mobility.

When employees have easy-to-use and rapidly evolving mobility solutions in their personal lives, IT functions are often accused of blocking change and being slow. That may be true, but those who are responsible for IT must ensure compliance and standardization while maintaining security around its assets. This can be a challenge however when users are demanding to use their own mobile devices and business areas are creating their own mobile apps in response to the absence of perceived support from the IT department. This potentially creates a great deal of tension as IT often puts itself in opposition to those calling for rapid change.

In an era where the skill and investment required setting up basic technology services is at an all-time low, do we need to redefine the role of the IT function and how it creates value for the business? And in mobilizing the enterprise, can IT really maintain control and meet all the business' needs?

"Evolving from a 'company centric IT' to a 'user centric IT' requires a good understanding about the mobile work style of the business users and their requirements. The value to the business comes with the satisfaction of the user, increase of the flexibility and productivity and the ease of use of IT services. The challenges are related to the infrastructure, the integration in the enterprise environment and the governance to manage the variety of related services inside the budgetary and corporate security frameworks."

Benno Zollner,
CIO, Fujitsu

2.3.2 The IT world of tomorrow

In the future, enterprises will be able to leverage their employees' desires to take the concepts of self-service and ownership further towards how they work and consume IT.

We predict that:

- There will be much more flexibility in the working patterns of the general population, with the majority of employees not being desk-bound from 9-5
- Most of the working population will use mobile devices in their working life, including some that are personally owned. Based on their preferences, employees will have at least two devices with different operating systems or platforms (Windows, iOS, Android, etc.)
- Employees will self-select mobile apps from a corporate 'appstore' in a way that they are used to in their personal lives, thus promoting 'agile self-service' in the workplace
- Employees will be sufficiently IT-literate to work with most applications – any residual training that's needed will be delivered via their mobile device

2.3.3 What this means for the IT function

These developments imply that IT will be much more deeply incorporated into the DNA of the business, and to meet these requirements the IT function needs to evolve.

Security

IT must ensure that those accessing company information have a right to do so and in a way that doesn't compromise the integrity of the enterprise. This is particularly important given that access could come from multiple locations, including public spaces where someone could be looking over an employee's shoulder. Many organizations are concerned about data being compromised when devices are lost and solutions exist which either avoid any data being stored on the device in the first place (e.g. thin client approach) or protect and wipe the device should it be lost (e.g. mobile device management).

It's also noteworthy that people are increasingly trusting identities within social networks, and they are using devices that have GPS technology embedded. Bringing these two things together allows for some very refined discrimination. There are thousands of John Smiths, but only one of them will be in one particular location at a given time.

Information assets

IT must support the enterprise in the creation and management of its information assets. Any solution should meet the needs of the user and the environment in which they work. IT must adopt a more iterative and incremental approach to the development of mobile solutions as they are often used in ways which couldn't have been predicted. Using a 'deploy and evolve' approach is much more likely to lead to a usable system that's adopted by the users and allows benefits to be realized. In addition, we're in the age of machine-to-machine data exchange and the 'Internet of Things,' where huge amounts of data and information will be persistent and transitory as well as available either by subscription or for free. The challenge for the IT function is to manage that flow in and out of the enterprise.

Business services

IT must provide employees with the business services they need, when and where they need them. Too often in the past these services weren't available in the office due to security, connectivity or interoperability challenges. But with the advent of ubiquitous Wi-Fi and increasing high speed mobile services (such as 4G) this is becoming a reality.

Legislation and regulation

IT must demonstrate to the appropriate authorities that the enterprise conforms to legislation and regulation. Security is a still a concern in particular for government organizations, but even there we're seeing progress as security accreditors and suppliers are working together to address potential security weaknesses.

In light of these redefined requirements, the IT function will look like a very different beast from its previous incarnations. In the future, IT will be less of a 'doing' function and more of a management function, bringing together services from different sources and providing an environment where the business can securely and flexibly support its employees, customers and business partners – wherever their location is.

"If we enable our users to work efficiently in their business context, have access to all relevant information at the time of decision, business will see IT as an enabler. Mobilizing end users is essential. The challenges are to enable this securely and to create exactly the needed level of awareness for this topic with the end users. Too often this topic is not taken seriously enough; the threats for the organization are underestimated while expecting only the most convenient way of working."

Marcus Frantz
CIO, OMV AG

3 Delivering Enterprise Mobility

3.1 Adoption approach
3.1.1 How to approach adoption

To date, the adoption of mobility in most organizations has been a step-by-step process, with each part of the business driving specific solutions to meet their particular need. Organizations are now starting to realize that an enterprise-wide approach is needed if they are to maximize their return on investment.

It's important that mobilizing the enterprise is not seen purely as the responsibility of IT – it needs sponsorship and participation from the rest of the organization, particularly from the Business Units and HR.

There exists a close relationship between an organization's mobility strategy and the strategies for workforce planning and estates: mobility can be both an enabler and requirement for different workstyles and accommodation approaches, such as remote working and hot-desking. What's needed is appropriate governance, with representatives at a senior level, to ensure all complementary strategies are aligned to create real benefits to the organization. For example, it's no good delivering excellent mobility technology when the workforce strategy is to locate staff to regional hubs.

3.1.2 The executive view – what does it mean to them?

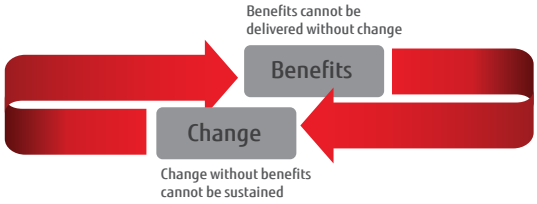
The executive view of mobility varies enormously, with some being evangelists, some being far more skeptical and potentially writing it off, and others who have a narrow interpretation of it as home working. Opinions differ across demographics and across business functions:

- The HR executive may see mobilizing the enterprise as an enabler to broader flexible working strategies and as a means of attracting and retaining talent in the organization. They may also see if from the employee's perspective – where mobility can provide an enhanced work-life balance and better staff engagement and enablement.
- The executives running lines of business may see mobility as a better way to boost the efficiency and effectiveness of their employees.
- The CIO may see mobility either as a good opportunity to demonstrate what IT can do, or as a potential headache as they grapple with the number of demands, technologies and security issues.
- The Sales and Marketing executive might believe mobility to be a great way of engaging customers through a multi- or omni-channel approach to help drive better customer loyalty and advocacy.

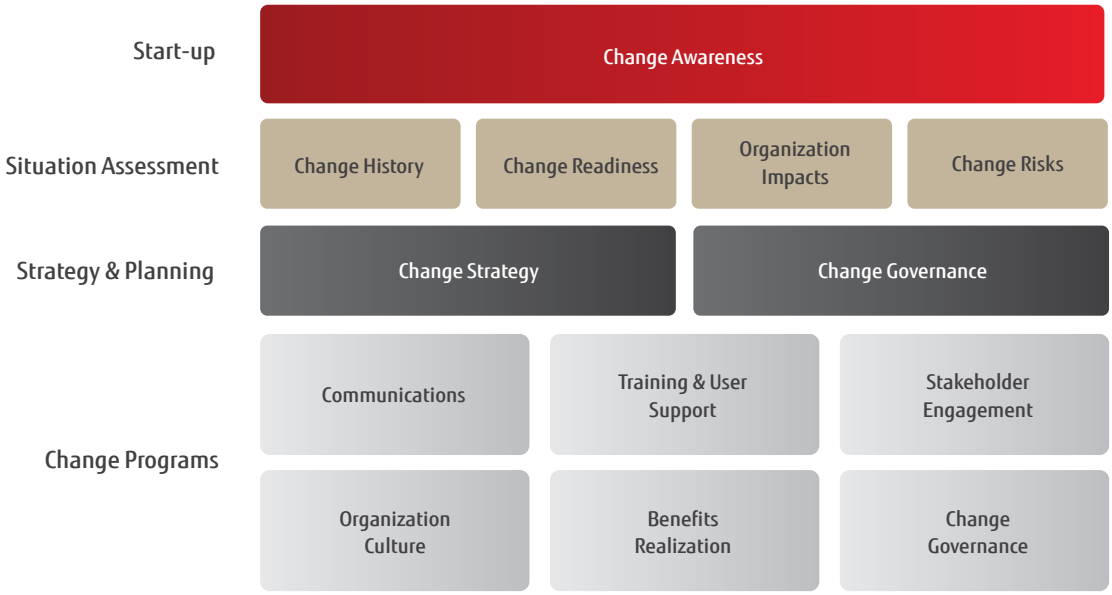
Whatever the view is across the executives, sponsorship and clarity about the business objectives are key considerations in ensuring a successful mobility strategy.

3.1.3 Change management and user perception

It's important that mobility is treated as a change program that's enabled by technology, rather than a technology project – its success is determined by whether people's behaviors and working practices change after its adoption. As shown in the following diagram, change and benefits are inseparable:

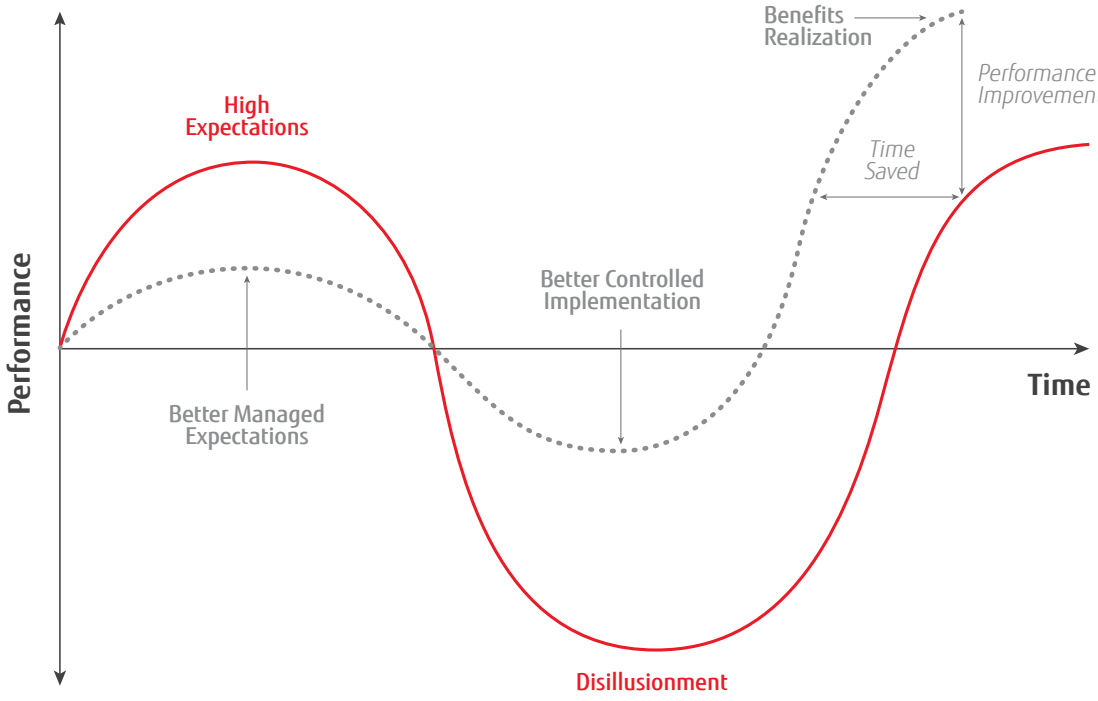


Mobility can have far reaching implications for people and it's imperative that a structured approach is taken to engage stakeholders and manage any resistance to change. This includes understanding the organization's readiness for change, creating a coherent framework, and selecting and deploying appropriate change interventions such as communications, training and incentives.



Structured approach to managing change

Taking a proactive approach to managing change helps manage user expectations so there's less frustration and benefits can be realized earlier and more successfully, as shown in the diagram below:



Change curve – adoption of Mobility

CHANGE APPROACH	DESCRIPTION
Establish a clear project structure	There's a need to set up a formal project structure with clearly defined roles and responsibilities for business change. For each affected business area there needs to be a credible Business Change Lead from the operational side of the business who can bridge the gap between the affected users and the project delivery team. The Business Change Lead will ensure that the users' needs are understood by the project and that any constraints/challenges are understood by the users, and will offer regular communications and training.
Involve and consult with the users	Changing working practices and introducing new mobile solutions require early and ongoing user involvement and consultation. An example of this is to run business workshops to understand their challenges and requirements for mobile solutions, and also to accompany their teams out in the field to understand their operational challenges. In addition, it's also vital to ensure the change has trade union support.
Use a pilot to get early feedback	An initial pilot is a way of reducing risk. It will help obtain some advocates for change – creating a first batch of evangelists who spread the message, especially if they can describe WIIFM ("What's in it for me") to their colleagues.
Set up a comprehensive training program	It's imperative that users are trained in both the new working practices and in how to use the technology. Our experience shows that some resistance to change is caused by users not understanding how to best exploit the technology, and this can be addressed by effective training. Also recognize that not everyone will adapt to the new technology quickly or easily and there's a need to allow time for 1-on-1 training sessions if necessary.
Listen to the adopters of change	Throughout the project ensure that you listen to the real adopters of this change (the operatives), through drop in and refresher training sessions. Allowing staff to air their concerns at various meetings is useful in focusing on stakeholder needs and picking up on teething issues with the roll out. Act on the feedback received, e.g. set up a series of User-Improvement-Group meetings.
Benefits Realization	To ensure new working practices are embedded, carry out health checks, additional training and support after 6 – 9 months of project closure. This is key to IT-led transformation programs where the IT teams work closely with the business teams to ensure the ICT benefits are realized to the maximum extent. By implementing this approach organizations can better manage expectations, deliver benefits earlier and avoid disillusionment.

3.1.4 Business benefits, business case, ROI and returned value – it's not just about reducing cost

Initial mobility benefits were typically based on user productivity improvements, such as avoiding unnecessary travel back to the office. While these benefits are applicable to most organizations and are still valid, mobility benefits are starting to go beyond user productivity to cover employee effectiveness, which contributes to real business outcomes like increased revenue and better customer service.

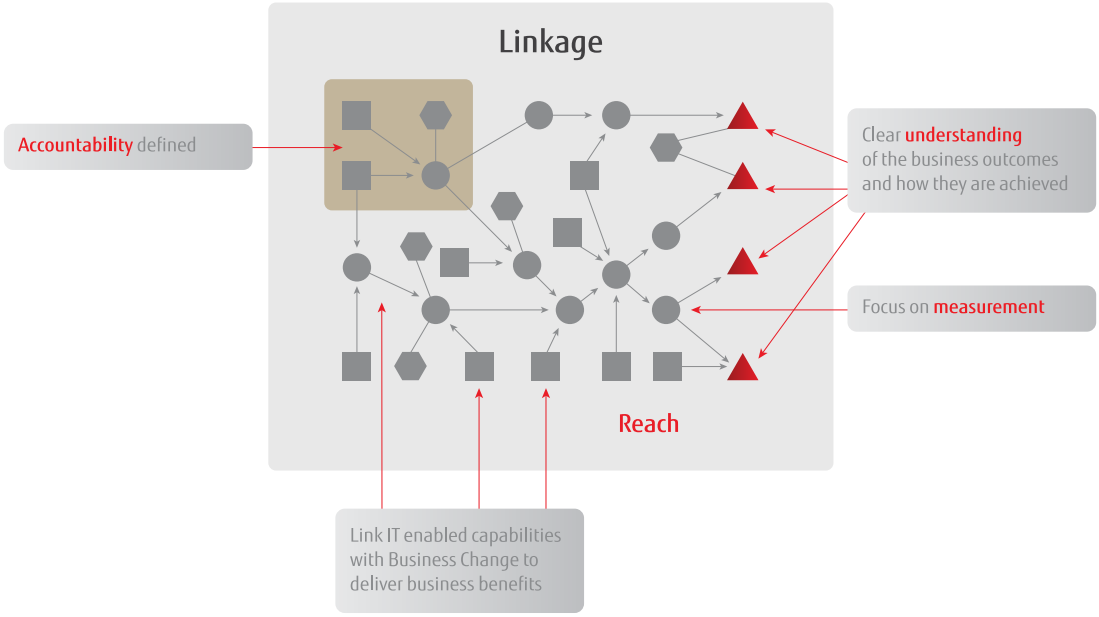
Clearly, these will be dependent on the business that is using the mobility solution and it's important to show the link between the solution and its outcomes.

3.1.5 How we build the business case

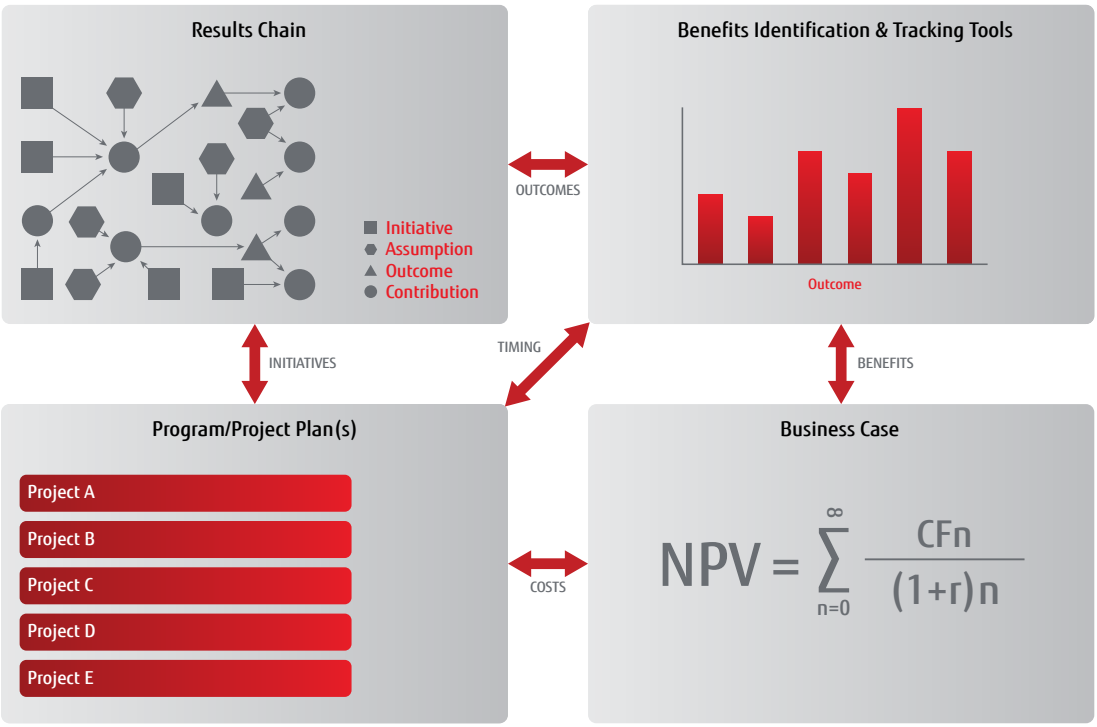
An organization should start by creating a benefits map of the outcomes from mobility solutions, one that shows a 'line of sight' between the capabilities and the different categories of benefit. This defines each benefit and acts as a powerful communication mechanism between IT and the business.

Specifically, the benefits roadmap should show:

- The key strategic outcomes of the mobility solution and how it supports the aims of the organization, e.g. increasing revenues, improving market agility, decreasing costs
- The key business benefits sought and their linkages, e.g. increased worker mobility, decreased property costs, a smaller carbon footprint
- How the key technology capabilities will enable the business benefits, e.g. how remote access will reduce the need to travel
- The key initiatives that are necessary and sufficient for success across business, technology, people and process, e.g. remote access, management culture change
- The key assumptions regarding the success of the program, e.g. the realization of benefits, technology maturity, union position



The benefits map provides the starting point for identifying and quantifying the benefits via tools such as benefits registers (giving the timing of benefits) and by sequencing the initiatives (giving the timing of investment cash flows). These feed together to allow a financial and strategic case for change to be built.



In addition to using benefits planning tools, we'd also recommend:

1. Running user workshops to understand the appetite for mobile working, its benefits, opportunities and blockers
2. Performing an analysis of the end user segments, their work styles (e.g. office based, field worker, flexible worker), personas (e.g. Generation Y, disabled, technophobe) and their current/potential use of technology
3. Running an online end user survey to assess current working practices and the likely take-up of mobile working

Both qualitative and quantitative input can be obtained for the business case, helping to make it robust and gain executive approval.

CUSTOMER CASE EXAMPLE #1

Following the introduction of flexible working during the London Olympics, and in response to Civil Service reform, HM Revenue & Customs (HMRC) wanted to undertake a thorough analysis of flexible, mobile and remote working.

The organization partnered with its IT suppliers to carry out the analysis of challenges and benefits, taking into account technology, people, processes and policies. This included running a number of business engagement workshops to identify the key opportunities, benefits and concerns of different stakeholders across the HMRC.

HMRC's Executive Committee is now considering the implications of this work and what the department might want to do in the future.

"The work Fujitsu has done has enabled us to look at how we can most effectively deliver a mobile, remote and flexible working strategy for the department."

CUSTOMER CASE EXAMPLE #2

A public sector body implemented a field force automation solution, which created the following benefits:

- Cashable savings
  - Reduced administrative and operational costs
  - Reduced workforce travel and downtime
  - Reduced cost of sub-contracting (a 32% reduction realized)
  - Reduced volume of paperwork and effort
  - Improved storage, issue and replenishment of materials
- Non-cashable savings
  - Improved information on repair progress
  - Improved recovery of income
  - Increased accuracy of data
  - Improved target repair timescales
  - Increased workforce productivity (a 14% increase realized)

3.2 User partitioning

User partitioning enables an organization to clearly structure its needs based on the role of each user in the business, the applications, services, and data they need to access to perform their role, and the locations they may need access from. All of this, coupled with BYOD or CYOD (Choose Your Own Device), brings the flexibility the organization needs, but the diversity needs to be managed. Coupled with user virtualization, user partitioning enables the organization to deliver the flexibility it demands, managing these diverse demands while keeping the business data and IP secure. The introduction of these two services is a fundamental part of enterprise mobility strategy.

3.2.1 What's the risk of anything, anywhere, anytime?

In our desire to assist user expectations in accessing corporate data anywhere, at any time, we need to be mindful of the risks that this can entail. These can be to the confidentiality, integrity, or availability of the data, and can arise either through malicious actors, by accident, or through inherent limitations of the services we provision.

It costs time

The most discussed concern in enterprise mobility is probably the risk of data breaches as a result of leaving a device in a public place. This risk is as old as laptops themselves and in most mature enterprises devices have been well protected with encryption, auto-lock and remote wipe technologies. The biggest issue with losing a device is the time is takes to report it.

Bring Your Own Device

Each connection point (whether manual or automatic) between apps adds another potential place for data compromise. This is of particular concern where an employee has approved corporate apps on their device that sit alongside personal or non-approved business ones, and is not restricted to the unauthorized use of File Sync and Share products. Employees can accidently share content on social networks or leak sensitive material via a travel application or third party calendar app.

No return to the days of old

The response to this threat cannot be to return to the days of siloed apps with limited functionality as this would undermine most of the gains brought by an enterprise mobility strategy. Instead, by carefully implementing Mobile Application Management solutions, organizations can control their application ecosystem to the highest level.

"Workshops are helping us understand the operational barriers to flexible working as well as the potential benefits. By involving the end-users we can better understand the challenges and opportunities."

HM Revenue & Customs Mobile, Remote and Flexible Working Lead

Untrusted networks

This is the final confidentiality risk and stems from public Wi-Fi or cell networks. Historically the implementation of corporate VPN solutions has been unwieldy for the users, expensive for the business and unsuited to non-laptop devices. Again, this is even more difficult in devices which share personal and corporate use. The latest solution for these types of problems is micro-VPNs, which allow app-level control when data is securely routed to the corporate network. Typically, these solutions are transparent to the user and in some cases can provide added capabilities such as geo-fencing to limit the risk of accessing data in unsafe areas.

Data integrity

This is partially a result of the greater focus on collaboration tools. However, the main challenge is due to the intermittent nature of connectivity inherent in a mobile environment. When users switch between online and offline modes, system designers must tread a tightrope between maintaining user satisfaction and maintaining data integrity. For example, it's especially disagreeable when somebody checks a document out of SharePoint for a week and the previous user is concerned they'll lose their edits after working on them during a twelve hour flight.

In the context of Electronic document and records management (EDRM) and Enterprise File Sync and Share (EFSS), this is becoming less of a problem if their conflict resolution tools and online/offline synchronization capabilities are both good. But depending on specific work patterns, these issues are still worth investigating. Potentially more problematic are Line of Business systems where data typically doesn't use file-based storage and needs different data integrity approaches to enable mobile and offline working. This has been the focus for suppliers of Mobile Application Development platforms.

Intuitive synchronization

Systems must have the ability to sync the correct data when connectivity is available in a way that is intuitive to the user and takes into account available storage space and bandwidth. For data that changes very rapidly (e.g. some CRM or LOB systems) or is very large in size (EFSS or EDRM) this is particularly difficult. In applications designed for use in VCS deployments, often only 'stubs' of files or other data are downloaded initially to maintain the speed of start-up/shutdown and to conserve bandwidth. Managing the cost of data availability for roaming users is also a considerable difficulty that often is not fully considered when designing systems (as these costs are frequently borne by a different department).

3.2.2 Identity and access management schemes

Mobility presents some specific challenges for these schemes. In addition to the widespread use of untrusted endpoints discussed before, users access far more services across a far larger number of networks. If an employee is frequently outside of their place of work, it can present management with challenges of distributing and maintaining IDs and passwords.

Authentication tokens

One challenge is the difficulty in using traditional two-factor authentication tokens on devices with no smartcard slot and where a rolling token would be cumbersome. Software tokens may help where a user has a smartphone and a laptop, but soft-tokens being used on devices do not clearly add value. We may in time start to see biometrics used for higher security applications, but in the interim we will continue to rely on complex passcodes and locking access to registered devices.

Cloud providers

The use of cloud providers for enterprise applications illustrates the difficulty in harnessing secure authentication without exposing an organization's Active Directory to the whole world. Advances in the ability to provide cross-domain single sign-on (SSO) or Identity Federation have been integral to allowing enterprise-ready cloud services to appear. These services can either be deployed in-house, via service providers, or through commercial identity brokers.

The rise of identity brokers?

At some point in the near future consumer focused identity brokers (such as Facebook or Google) may start making their presence felt in the enterprise, initially in SMB, following their similar trajectory in productivity suites. This trend will need careful examination if it becomes a reality, but will present many of the same challenges of permissions management that we face with traditional Active Directory based systems.

3.2.3 Write once, use many?

Life used to be simple: we deployed software that was installed on the standard corporate Windows build, or perhaps if we were feeling adventurous, via Internet Explorer 6. Things could be exhaustively tested and regression testing was fairly straightforward. Firefox, Chrome and newer versions of Internet Explorer complicated matters somewhat for browser-based tools, but this all changed with the rise of Enterprise Mobility (and especially BYOD).

Most organizations are now likely to have at least half a dozen operating systems in their environment: iOS, Android (two or three versions), Windows 8 (including RT), Windows 7, Windows XP, Windows Phone, OS X. On top of that there will be many form factors too: laptops, tablets, convertibles, phones, phablets. It's evident that no enterprise development team in their right mind would want to code native applications for all of these – the cost of development and maintenance would be prohibitive. So what are the choices?

- HTML5 – This should be the ultimate 'write once, run anywhere' approach, with the added benefit that HTML5 skills are plentiful and relatively low cost. However, this approach comes with drawbacks, including poorer performance, incomplete support for native device features, and inconsistent implementation across platforms. Bypassing the traditional app store can be considered either a blessing or a curse.
- Native – Didn't we just say that native was cost prohibitive? Well, Mobile Application Development platforms can provide cross-platform native development. The decision for which platforms to support is a compile time decision, and the better platforms come with contractual commitments to support all native functionality of the major operating systems. Typically, these platforms don't come cheap, but do drastically reduce development and support staff costs. While the apps might lack some of the finer User Interface (UI) details of true native applications, they perform to a much higher level and have few compatibility issues when compared with HTML5.
- Hybrid – Continuing the theme of cross-platform tools, hybrid HTML5 applications run in a native container. Unlike the fully native cross-platform apps, open source tools (such as Cordova/Phone Gap) can create hybrid apps at a compelling price/performance. Gartner has predicted that "by 2016, 'more than 50% of all apps deployed will be hybrid.'" Hybrid captures many of the cost and time-to-market benefits of HTML5 applications but with better cross-platform consistency and app store experience.
- Virtualized – Often not discussed in the Native/Hybrid/HTML5 trade-off but a valid consideration, app virtualization typically allows native desktop apps to run remotely via a virtualization gateway and a client on the mobile device. Key criticisms of this approach are the lack of appropriate UI support and the high dependency on network performance. However, for infrequently used applications this is a valid choice with low incremental costs to deploy.

APPROACH	DESCRIPTION	PROS	CONS	RECOMMENDATION
Browser	Use of the existing desktop application via a browser on the device	Ease of deployment Avoids the cost of developing additional application	User interface may not be suitable for an operational environment Requires LAN quality connectivity to be usable	May be suitable for deployment with good network connectivity (e.g. Wi-Fi)
Thick Mobile Client	Standalone application, written native API's	Rich functionality Speed of response	Device specific Hard to manage as it's a downloaded application	Rarely suitable, non-portable application
Hybrid	Web browser application (e.g. HTML) on the device	Application is predominantly device independent More usable over high latency, high congestion networks (e.g. 2G/3G)	Potential longer deployment timescales than browser (if there is no customization of the browser user interface)	Often best for usability and device independence
Virtualized	Native desktop apps running remotely via a virtual client on the mobile device	No additional application development needed	Lack of native User Interface support and high dependency on network performance	Good for when there's strong network connectivity

3.2.4 Form and function

One of the major changes brought on by consumer devices in the enterprise is the much greater expectation from users – principally centered on usability and intuitiveness. Nobody's ever said 'let me go on a half-day course on how to use my iPhone,' despite a similar, common approach once taken for training desktop users.

It's therefore important that as IT departments design or select applications for users, it's key to focus as much on the end user experience as the functional requirements. This is especially true if (in the case of File Sync and Share) highly usable consumer alternatives exist which users can and will turn to.

3.3 The rise of orchestration

The user has never demanded more in terms of how and where they can work. The challenge is to take advantage of these opportunities while protecting the business from any threats. This requirement to seamlessly enable mobility services and applications has led a strong demand for orchestration – and the more automated the better.

"With the 'user centric' IT approach we will set the foundation on data and Information management as well as the possibility to have secure, compliant and economic access to needed information anywhere anytime. This needs a global Mobile Strategy for all business divisions jointly developed with the business."

Benno Zollner,
CIO, Fujitsu

3.3.1 Integrating mobile devices into Line of Business applications

To enable LOB applications in an enterprise, a business needs to:

- Have control over who can use the application, with user accounts held in an identity store
- Decide which type of devices can be authorized to run what application
- Ensure the devices and users can be identified and secured
- Decide on the delivery mechanism for the applications
- Create management processes to maintain the application itself, control distribution, and maintain the correct versions for users based on their devices

The good news is that a mature enterprise-grade Mobile Device Management (MDM) solution will address these requirements, and a properly configured MDM service can fulfil the technical needs. Other considerations should be considered however to provide the type of service and security that the modern enterprise demands.

When integrating mobile device usage for LOB apps, our approach is to use the MDM service as the foundation. What's also required, and just as important, is the ability to manage the lifecycle of the application, which includes:

- Application testing
- Deployment services (including updates)
- Application packaging, incorporating certification (customer or industry specific)
- Termination

3.3.2 Self-service and automation

As described in the introduction to this section, efficient mobility services (cloud or on-premise) require a high-level of automation and self-service. Tasks like ordering a user account for a new employee can be completed via a web portal or an HR-tool; an automated provisioning platform creates the necessary account and user rights by adding the user to a specific group or groups. Such tools enable the integration of multiple systems so these types of routine task can be executed without user intervention. Automation is not the goal itself, rather the time and convenience of automating such tasks reduces the risk of human error and frees valuable IT staff for higher-value tasks.

3.4 Workflows, fulfilment, assurance and billing

By having solid processes and tools in place it's possible to automate workflows, deliver faster fulfilment rates and improve the quality of services.

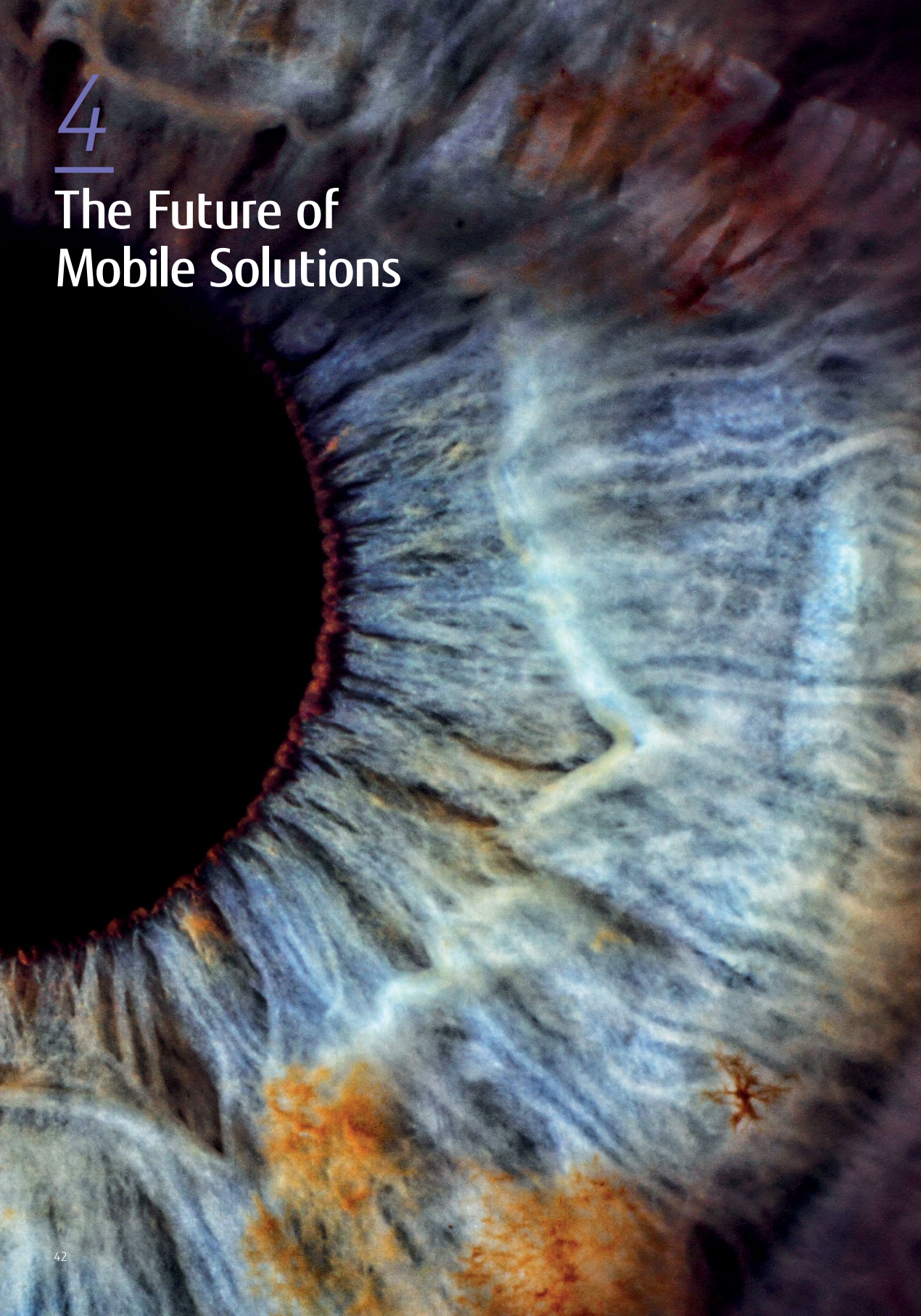
For accurate invoicing and revenue assurance, billing systems require tight integration with service tools, specifically the provisioning system. By automating billing and workflows, errors can be reduced and customer billing reports made 'on-demand' or as a routine.

Due to the nature of modern cloud services, many individual billing items can be very small and the volume high. Addressing these types of queries can end up costing many times more than the value of the invoice in question. Some considerations to reduce these occurrences are:

- Use flexible tools to enable integration between multiple data types and sources
- Shared infrastructure platforms provide an efficient means for low cost service delivery
- In combination, shared platforms and flexible tools enable the replication of best practices to address multiple system and customer needs, both from a technical and process perspective

4

The Future of Mobile Solutions



More and more, our notion of 'work' focuses on what people do, rather than on a place they go. In the future, we will spend less time commuting and more time with customers. There will also be more physical changes beyond the pervasiveness of the 'anywhere paradigm.'

Workplace sensors, location and presence awareness capabilities, and smart buildings are providing consistent, real-time feedback into processes and workflows. Digital surfaces and digital walls are replacing static flipcharts and white boards in a way that adds another dimension to the way organizations learn.

Interacting with the physical environment to gather, process and spread information will become as natural as using a computer keyboard is today. Ultimately, achieving such a high level of contextual awareness will reduce meeting inefficiencies by making it easier to share information.

Other virtual changes will influence how information finds employees who need it most, after it's been aggregated, analyzed and visualized. These shifts will use activity streams to break down silos of digital content. Increasingly, we will be presenting information as physical objects – to ease conceptualization and provide a better platform for collaboration.

Finally, as far as acting on that information is concerned, another significant trend – 'gamification' – will quicken progress by tapping into basic human motivations.

4.1 Will Mobilizing the Enterprise increase productivity?

What kind of environment fosters true productivity? Few companies think holistically about the workplace. As a result, misplaced priorities – whether due to outdated structures or a fundamental misunderstanding of what really matters – lead to lost potential. The focus needs to shift away from geographic locations and task-orientated processes and towards helping individuals gain valuable insights from tools that best suit their personal style and network.

4.1.1 Out with the old

Technology has removed our dependency on offices, meeting rooms, 9-5 schedules, mail delivery, basic secretarial services, travelling, and more. As a result, traditional corporate workplaces now seem like blackboards in schools – relics from a bygone age.

We no longer view open offices as a way to enhance the flow of information, foster communication and facilitate connections. Nor do we take advantage of those open floor plans to work on the most important things with the ideal people who can solve a problem at the optimal time. Instead, we work silently in 'libraries.' The air is dead, interruptions and a lively noise level are viewed as distractions, and closeness adds so little value that we opt to write emails across the office to each other.

4.1.2 In with the new?

In the early nineties, there was a strong movement away from working in office room and towards open offices, together with the broad adoption of using PCs and team collaboration tools. Twenty years later, technology now plays a far more significant role in how organizations work, yet it still has the same setup in physical office environments. Apart from being upgraded with data projectors in meeting rooms, they look and function much like they did twenty years ago. And one thing's certain – office spaces do not align with the mobile and social transformation taking place.

Are we really getting more done?

We often hear that colleagues have worked late into the evening on a presentation or a report. In addition, we get irritated because overcommitted, 'multi-tasking' colleagues are going through their emails instead of paying attention in a meeting, or because they were too busy to come prepared. Not only is their entire day full, but some of the time slots have been booked twice.

'Mobility has made us more productive,' we proclaim. 'And a growing number of mobile devices and applications will let us improve productivity even further.' Or at least that is what we say.

But being busy is not the same as being productive. Working late or responding to emails in a taxi doesn't boost productivity, it adds to the workload. We're not getting more done in the same amount of time; we're just cramming more working hours into the day.

In fact, there's no direct relationship between mobility and economic productivity. We can compare mobility with travel: economic productivity tends to increase when travel decreases; many companies experienced this recently after implementing stringent travel restrictions. One could easily make the case that – in most situations – mobility actually decreases productivity.

You won't find productivity on your sofa

What mobility does do is add input. Some research indicates that the flexibility we now have to balance our professional and private lives has added 38 working days per year. So the direct relationship is not between mobility and productivity, but between mobility and economic activity. Due to this confusion, the drive for mobility (read extra working days) is on the business technology agenda.

Nevertheless, businesses shouldn't fool themselves into believing that producing more equals being more productive. Productivity is an output-input ratio, a measure of efficiency per unit of input, and production – the amount of output reached – can increase even when productivity decreases.

Genuine mobile productivity does exist. You find it, for example, in manufacturing. Mobile materials management or quality control on production shop floors improves accuracy, efficiency and speed.

4.1.3 Where the value is generated

Technologies have of course provided everyone with more efficient ways to act. It's easier to check an email inbox from a smartphone than it is to boot up a corporate notebook, set up a VPN connection and open an email program.

Convenience and simplicity – effective implementations – do add to productivity. Unfortunately, mobility often gets undue credit for those advantages.

Workplaces and working styles need to mature and address real productivity. Common office tools, devices and applications are still task/process oriented, but now's the time to start innovating to build workflow automation tools for knowledge management, social collaboration, communication and information sharing.

In the future, the main resource shouldn't be a device, wireless network, or application, but time spent. Waiting is over. We are now running out of those unused units of 'an idle five minutes.' Rather than find ways to enable people to work more hours, we need to make them more effective during the hours they are already working.

4.1.4 A decoupling of old links

Workplace technology is becoming stateless. In other words, an organization's dependency on a physical hardware or platform is being transcended. Technology provisioning is moving out of the enterprise and into the on-demand consumer realm. In enterprises, the use of virtual workspaces will grow, and these spaces will offer device-independent productivity platforms for delivering collaboration, information, and office and business services.

In the future, CIOs will not select, buy or manage end-user devices – they will manage the enterprise-IT storefronts that control the usage of those devices. They will focus on establishing administration models, organizing and orchestrating services, governing identities, providing application and data services, and selecting service providers. Traditionally, such functions have been tied directly to hardware; now they are being liberated.

4.1.5 Bring your own productivity

Over the last three years, end-users' own IT has added more to productivity than corporate IT has. Why is it that we know more about where our friends are going out for dinner than about what's happening in our organization?

Up to 80% of IT-enablement opportunities relate to knowledge, collaboration, customer engagement and market intelligence. Such non-linear, user-driven workflows are not automated. People control them. Consequently, we need to focus our attention on helping those people get answers in this question-rich world.

The objective is to shorten working cycles and lead from the front. To succeed here, businesses must view both physical and virtual experiences holistically, as a single results-oriented platform that facilitates more efficient, productive, adaptive and human ways of working.

4.2 IT consumerization

Forward-looking companies must bridge the widening gap between consumer and corporate technology while maintaining enterprise-class capabilities and protection. One way to boost the quality of the user experience is to enable employees to take advantage of their own devices through a 'personal cloud.' At a more fundamental level, 'componentization' divides large applications into their constituent parts and then makes it easy to rebuild them in a modular fashion so they can be recombined quickly and flexibly for better usability. This freedom however reduces the control of those who manage that technology, so finding ways to maintain the balance will remain at the forefront of mastering this challenge.

People expect the ultimate user experience in everything they do.

Today, there are more than 500,000 applications in Apple's app store with over 25 billion user downloads – and Microsoft and Android expect to have similar levels in their respective stores in due course. Consumers of this technology – who are accustomed to the ease of downloading, integrating and operating mobile applications – not only accept these new standards, but always demand the ultimate user experience. CIOs who fail to recognize or actively participate in this reality will fall behind their competitors and take one step closer to insignificance.

The ease and flexibility of downloading applications for personal use contributes to the idea of a new enterprise imperative to seek this same convenience and flexibility in enterprise applications. As more companies embrace new means of accessing software, consumerisation guides them to new ways of establishing the work environment.

4.2.1 One promising approach: The personal cloud

Cloud promises to deliver several of those answers, and companies are slowly responding by migrating towards new application delivery and service models that emphasize consumerization and cloud over traditional consulting and implementation services.

Today, we're delighted when an eBook reader finishes the last page on their smartphone; tomorrow, we will expect it – and a host of other seamless experiences from one device to the next.

To be sure, the expansion and variety of application delivery comes at a price. Companies are now being forced to rethink how they manage their applications, with both intellectual and emotional side effects as users demand ubiquitous connectivity. Intellectually, they have to re-examine how they manage risk (security, legal and reputational, to name a few), and source and govern as they execute new, consumerised models, particularly for companies that move to a BYOD platform. From an emotional point of view, hands-on company executives will have a particularly tough time giving up command of the environment, despite the evidence that their power over technology is both exaggerated and quickly slipping away.

4.2.2 A key discipline for overcoming dichotomy: Componentization

One central idea for achieving consumerisation of the enterprise is componentization – creating pieces of functionality that, when integrated, deliver flexible and agile ways of working.By combining a number of components, a vendor can provide a complete solution as a single-sourced offering. This dramatically reduces the number of providers directly involved without reducing the value of the solution, and helps the enterprise to quickly deliver benefits and use its applications the way they were intended.

The end of customized apps?

While customized applications will still exist and be managed internally or through proprietary arrangements, this will become the exception rather than the rule. Some core enterprise systems, though, will always be delivered traditionally until an opportunity to replace them makes functional and financial sense. So just because an application can deliver replacement functionality via the cloud doesn't mean it makes good sense for the user to consume it that way.

Complementary components

As traditional application service work erodes at the expense of investment in componentized solutions, and as the integration needs are done once and then sold many times (as opposed to sold many times, then each done once), companies will invest in the acquisition of complementary components that they can pre-integrate (done once) and then sell to many, or any. This 'volume' play helps retain revenue levels, and the consistency of an industrialized solution allows for better margins, because it's less expensive to service and maintain.

A new, collaborative approach

As a result, spending on IT services for designing, building and running enterprise applications will now move to spending on componentized solutions that are assembled, managed and delivered by providers that may or may not own any of the assets they produce. To embrace this idea, executives will have to give up legacy approaches to application management in favor of a less restrictive, collaborative approach.

Deliver new expectations

Bear in mind that users will also continue to expect more and more, particularly in those industries that are entrenched in the business of application design, customization and deployment. The goal, therefore, is not just to meet but to exceed typical expectations on how applications work together to deliver desired functionality. While the notion of making a one-click installation model effective in an enterprise may be a stretch, application developers must explore and target making that possible.

Business is the new consumer, app-wise

The more consumer technology penetrates the enterprise, the more companies will be forced into creating a user experience that exceeds anything an individual can come across in the app store. And over time, as technologies mature, the idea of a business app will change: an app might enable a security guard to make a geospatial log of his rounds, another could help a construction worker to know the exact strength of concrete as it sets; an app could do anything.

The idea, whether logical or emotional, that much of what we do today will happen outside of our immediate control is both scary and, at the same time, advantageous. Admittedly, a simplified explanation cannot account for the complexity and considerations that must be addressed before decisions are cast and actions are taken. That is not to say, however, that there is any alternative solution to the challenge. For better or worse, there is only one path forward to stay relevant, so companies are going to have to adapt quickly or die.

You can bet that the CIOs of the world are busy 'tinkering at their workbench,' devising a plan to catch up (or, at a minimum, blur the lines) with the inevitable shift to workplace consumerisation.

If we keep our heads in the cloud, we at least have a fighting chance.

"The modernization of our business application will provide new opportunities to expand mobile services and providing access to business information directly on the mobile devices. We have set the foundation and have gained great experience with our Managed Mobile and Virtual Client Services.
The transformation of our business applications into mobile applications will continue."

Benno Zollner,
CIO, Fujitsu

Mobile Speak

Application Virtualization

Application virtualization is a method of abstracting an application from the underlying operating system on which is it being used such that it is no longer installed on the end-user device, but instead delivered virtually to the end-user device.

App Store

An app store or application store is a virtual application storefront that is accessed across the internet or corporate intranet. Users can access the app store from mobile or desktop devices to manage their application subscriptions and/or to browse for new applications and self-select they need.

Bring Your Own Device

Bring your own device (BYOD) is an increasingly popular corporate policy and user movement that allows employees to bring personally-owned devices, such as laptops, tablets or smartphones, to the workplace and to access company information and applications via those devices.

Central Hosted Desktop

A Central Hosted Desktop is a desktop that is hosted and managed within a data center on virtualized infrastructure. Persons requiring a Central Hosted Desktop generally have requirements for high-end graphics applications, where the latency of other types of virtualized desktops provides and inferior user experience. As with other virtual desktops, the Central Hosted Desktop is also accessed remotely from a thin client access device.

Consumerization of IT

Consumerization of IT refers to the growing trend of new information technology that is consumer-driven rather than by technical IT Staff. This is a major shift in the IT industry, where large business and government organizations have long since dominated computer usage and development. The trend has developed and grown commensurate with the adoption of smartphones and tablet and the app stores that accompanied these innovations.

Dropbox and Dropbox Effect

Dropbox is a file hosting service operated by Dropbox, Inc. that offers cloud storage, file synchronization, and client software. Dropbox allows users to create a special folder on each of their computers, which Dropbox then synchronizes so that it appears to be the same folder (with the same contents) regardless of which computer is used to view it. Files placed in this folder also are accessible through a website and mobile phone applications. The Dropbox Effect relate to the concerns of business IT departments of data security of employees storing corporate data (sensitive or otherwise) on a public site that may or may not comply with security policy.

The high adoption rate of Dropbox and similar services has led to a rise of enterprise friendly services that preserves the functionality whilst complying with corporate security policies e.g. Citrix Sharefile.

Electronic Document and Records Management (EDRM)

Electronic document and records management aims to enable organizations to manage documents and records throughout the document life-cycle, from creation to destruction. Typically, systems consider a document a work in progress until it has undergone review, approval, lock-down and (potentially) publication, at which point it becomes a formal record within the organization.

Once a document achieves the status of a record, the organization may apply best-practice or legally enforced retention policies which state how the second half of the record life-cycle will progress. This typically involves retention (and protection from change), until some events occur which relate to the record and which trigger the final disposition schedule to apply to the record. Eventually, typically at a set time after these events, the record undergoes destruction.

Enterprise File Sync and Share (EFSS)

Enterprise File Sync and Share (EFSS) is a Fujitsu Mobility capability. It is managed by Fujitsu's Managed Mobile solution team. It provides on-premise and Fujitsu hosted storage options for synchronizing and sharing files to simplify staff collaboration, to provide access from various devices and to avoid data duplication. EFSS is Fujitsu's answer for an enterprise-friendly Dropbox capability.

Enterprise Mobility

Enterprise mobility refers to a shift in business practices, where more employees work outside the office and require secure access to corporate applications and data. This includes using mobile devices such as smartphones or tablets, as well as accessing cloud services, to conduct business. The aim of enterprise mobility is to enable employees to be fully productive regardless of their location.

Enterprise Mobility Management (EMM)

Enterprise mobility management (EMM) focuses on the management of the increasing number of employees using mobile devices, including smartphones and tablets, to conduct business. EMM can refer to best practices or technologies required to maintain enterprise security as more employees use mobile devices to access corporate data.

Generation Y

Millennials and Generation Y are those people who reached young adulthood at the turn of the Millennium.

GPS
The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information anywhere on or near
the Earth where there is an unobstructed line of sight to four or more GPS satellites.

Hosted Shared Desktop
In a Hosted Shared Desktop environment applications run on a central terminal server farm, and user data is also located on central data storage. Access devices are needed for interaction only.

Hosted Virtual Desktop
In a Hosted Virtual Desktop environment users access individual virtual desktops running in the data center from either thin clients or existing traditional PCs.

Hot-desking
Hot-desking is an office organization system which involves multiple workers using a single physical workplace during different time periods. In a Hot-desk office, no employee has specific or allocated workspace and instead, chooses a space based on the availability at the time and the type of work they need to complete.

HTML5
HTML5 is a markup language used for structuring and presenting content for the World Wide Web and a core technology of the Internet. It is the fifth revision of the HTML standard. Its core aims have been to improve the language with support for the latest multimedia while keeping it easily readable by humans and consistently understood by computers and devices regardless of operating system or screen size.

Internet of Things
The Internet of Things is a term that refers to uniquely identifiable objects and their virtual representations in an Internet-like structure. The theory is that if all objects and people in daily life were equipped with identifiers, they could be managed and inventoried by computers.

Application streaming
Application streaming is a form of on-demand software distribution. In these scenarios, only essential portions of an application's code need to be installed on the computer: while the end user performs actions in the application, the necessary code and files are delivered over the network as and when they are required.

Local Virtual Desktop
With a Local Virtual Desktop a hypervisor runs on mobile devices and gives users access to exactly the same virtual desktop locally which is centrally used in a Hosted Virtual Desktop scenario. The virtual desktop is delivered once from a central image to the mobile device. All work completed offline will only have an impact on local copies. Once connected to the corporate network, updates are automatically synchronized with the data center's virtual desktop environment.

Millennials
Millennials and Generation Y are those people who reached young adulthood at the turn of the Millennium.

Mobile Application Management (MAM)
Mobile application management (MAM) refers to software or services responsible for managing access to internally-developed enterprise mobile applications, which can be accessed on company devices or BYO devices, such as smartphones or tablets.

Mobile Device Management (MDM)
Mobile device management (MDM) refers to security software responsible for monitoring, securing and managing mobile devices, such as smartphones or tablets, deployed across the enterprise. MDM software is designed to optimize device functionality while protecting data across the corporate network.

Personal Cloud
A personal cloud is a cloud-based storage that makes software and personal information accessible from various personal devices.

Mobile Information Management (MIM)
Mobile information management (MAM) refers to software or services responsible for managing access to enterprise data, which can be accessed on company devices or BYO devices, such as smartphones or tablets.

Remote Access
Remote access is the act of connecting to IT services, applications or data from a location other than headquarters or other than that which is closest to the data center.

Sandbox
A sandbox is a security mechanism for separating running programs. It provides a tightly controlled set of resources for guest programs to run in. Network access, the ability to inspect the host system or read from input devices are disallowed or heavily restricted. Sandboxes are a specific example of virtualization.

Software-as-a-Service (SaaS)

Software-as-a-service (SaaS) refers to Web-based applications enabled for delivery as a subscription-based service to any user with a browser. SaaS also refers to hosted application services that may not have a web front-end but which might simply have APIs that can be 'called' remotely or which have a plug-in or installable component that is interacted with.

VPN

A virtual private network (VPN) is a private communication channelthat interconnects networks through primarily public infrastructures (e.g. the Internet).

Virtual Desktop

Virtual desktops may refer to any isolated desktop-class environment dedicated and provisioned for use by a specific user either as a virtual machine or as a session within a client-server environment.

Virtual Desktop Infrastructure (VDI)

Virtual desktop infrastructure (VDI) refers to the part of the IT environment dedicated to hosting desktop operating systems within virtual machines (VM). These virtual machines can run on a hosted, centralized or remote server or servers.

Virtual Machine (VM)

A virtual machine is an operating system environment that has been abstracted from its physical machine such that it can leverage an intermediate software layer to run on any physical hardware. Examples of virtual machines include virtual desktops, virtual servers and virtual appliances.

Web Desktop

A web desktop or 'webtop' is a desktop environment embedded in a web browser or similar client application. A webtop integrates web applications, web services, client–server applications, application servers, and applications on the local client into a desktop environment using the desktop metaphor. Web desktops provide an environment similar to that of Windows, Mac, or a graphical user interface on Unix and Linux systems. It is a virtual desktop running in a web browser. A web desktop is a virtual desktop running in a web browser. In a web desktop the applications, data, files, configuration, settings, and access privileges reside remotely over the network. Much of the computing takes place remotely. The browser is primarily used for display and input purposes.

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