Enterprise mobility solutions in potentially explosive atmospheres – applications and requirements

The use of mobile terminal equipment has arrived in the chemicals industry, the oil and gas industry and in other sectors with potentially explosive atmosphere. The benefits are plain to see, yet the selection and implementation process needs to be carefully thought through. What do solutions and applications need to do to economically and sustainably achieve the desired improvements regarding productivity, efficiency and safety?
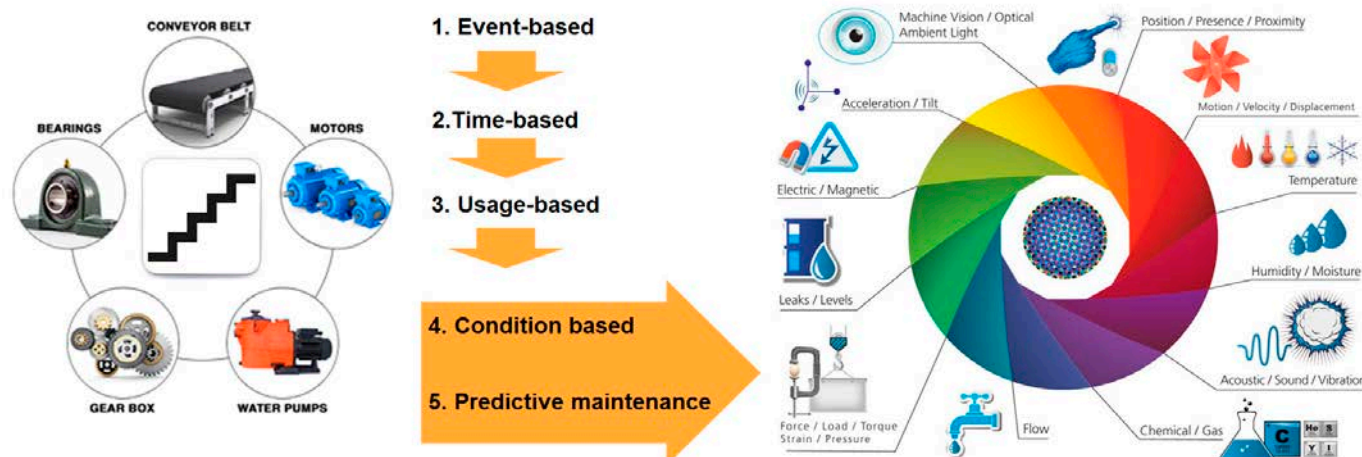
Contents:

· Why enterprise mobility solutions in potentially explosive atmospheres?
· What applications are there and what benefits result from them?
· Selection criteria for hardware, software and infrastructure?
· Requirements for hardware manufacturers
· What are the critical success factors?

Whether oil and gas production, refineries, the chemicals and pharmaceuticals industry, mining, energy generation, the food industry or automotive sector – mobile work in potentially explosive atmospheres is becoming ever more important.

With a shortage of specialists, it ensures the necessary transfer of knowledge and boosts efficiency through paperless processes and mobile offices.

Advanced functions of data capture and communication for Industry 4.0 applications make it easier to achieve important objectives of integrated digitalisation, such as condition monitoring and predictive maintenance.

The digitalisation and automation effects of a well-integrated enterprise mobility solution produce greater transparency together with a higher safety standard for installations and improved protection of people and the environment.


Predictive and condition-based maintenance. (Source: BARTEC, POSTSCAPES. https://www.postscapes.com/trackers/video/the-internet-of-things-and-sensors-and-actuators/)

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IoT and Industry 4.0 at the focus of investment

Studies such as the "Digital Trends Survey"[1] by Accenture and Microsoft demonstrate, using the example of the upstream oil and gas sector, that companies have clearly recognised the added value of digital technologies including enterprise mobility. They see it as an opportunity to reduce costs, make faster, better and more reliable decisions and to increase the productivity and safety of employees.
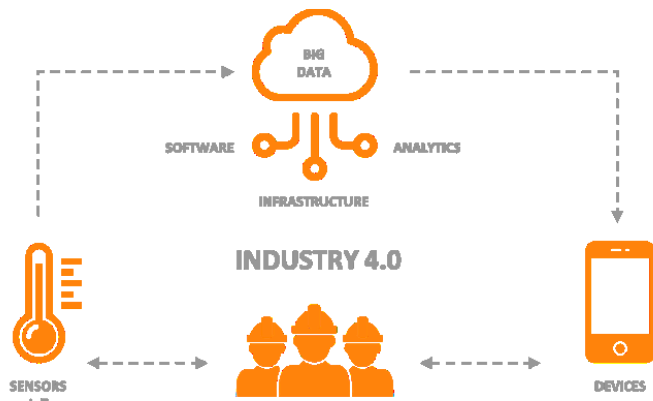
Most companies will invest more strongly in Industry 4.0 and IoT solutions over the next five years. An integrated approach is an important factor for success. (Source: BARTEC)

The majority of oil and gas companies will consequently continue to invest the same amount or more in digital technologies over the coming three to five years – with a focus on mobility and the Internet of Things (IoT). According to a market survey by Zebra Technologies[2], 64 percent of the production, supply chain and employees in the industry will be fully networked by 2022 - 21 percent more than today.

Potential benefits through enterprise mobility

According to a survey conducted by Zebra Technologies, 62 percent of companies questioned still used pen and paper to follow critical production steps. Whilst 50 percent do at least use mobile computer systems, data collection is manual using Excel spreadsheets, and is therefore time-consuming and error-prone. Mobile terminal equipment, by contrast, can record data much more easily and reliably, can visualise them directly in the field and accelerate decision-making when problems arise. According to a study by PROFION, the Dutch organisation for professional industrial maintenance, "mobile workers" are 14 percent more efficient than traditionally equipped employees.

In order for an enterprise mobility project to enjoy lasting success, people must be at its centre right from the start. The project will be doomed to failure if employees are not brought on board. And because paper cannot be replaced in one fell swoop, success and feasibility should be demonstrated in manageable projects that convince sceptics quickly. A suitable solution in terms of infrastructure, software and hardware must be found once use cases and pilot projects have been defined.

» **Mobile staff work 14 percent more efficiently than traditional employees.**
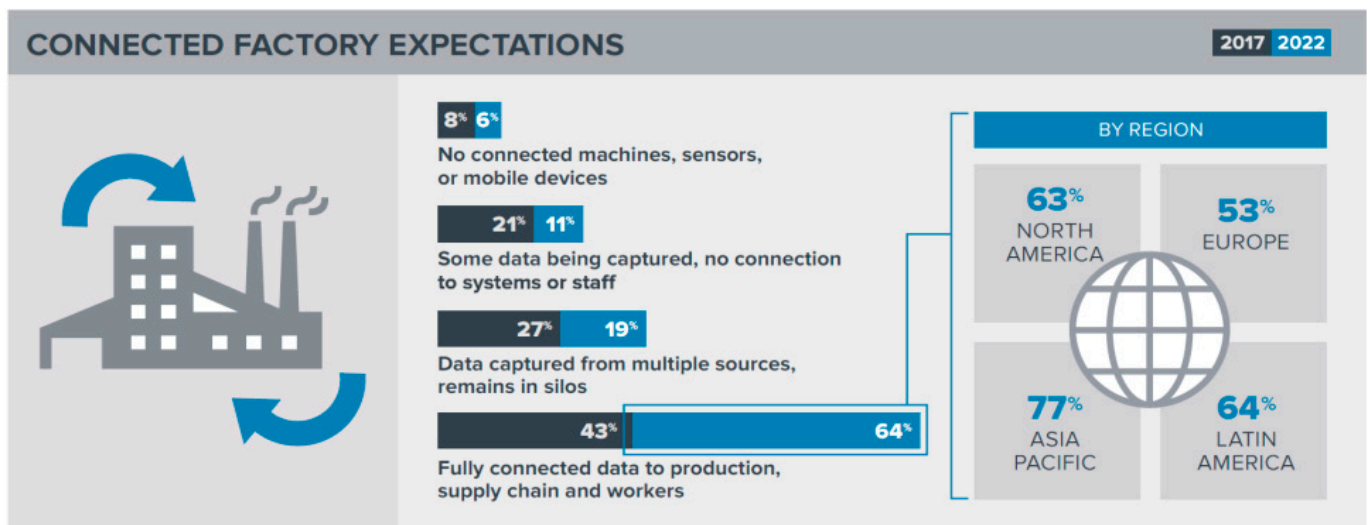
The share of fully networked production, supply chain and employees will strongly increase in future. (Source: Zebra Technologies Market Survey 2017)

1 https://www.accenture.com/us-en/insight-2016-upstream-oil-gas-digital-trends-survey
2 Zebra 2017 Manufacturing Vision Study, http://online.zebra.com/mfgvisionstudy

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Applications for mobile terminal equipment

The most important use cases and potential benefits range from simplified maintenance tours and service deployments with remote support from the control room or external experts via asset tracking and the recording of data for condition-based maintenance, to the localisation and monitoring of personnel safety. An overview of the chief application fields and benefits is shown below:

Application fields and benefits: how enterprise mobility in a potentially explosive atmosphere reduces operating costs and increases safety. (Source: BARTEC)

1. IMPORTANT SELECTION CRITERIA

Explosion protected mobile equipment differs fundamentally from that in the consumer sector due to special statutory and functional requirements. In order to avoid taking wrong decisions whose consequences result in liability risks for the operating company or frustration for users which ultimately jeopardise the success of the project or endanger life and limb, the most important selection criteria are set out below:

1.1. Device hardware

Smartphones, handheld computers and tablets are the most common hardware form factors used today in a production environment or are the ones planned for future use[3].

Typical use case and results

The following example demonstrates what is required of a typical enterprise mobility solution: the main requirement is to collect data and for a direct bidirectional transfer of the data to the ERP system (view / measure / scan). Further requirements are as follows:
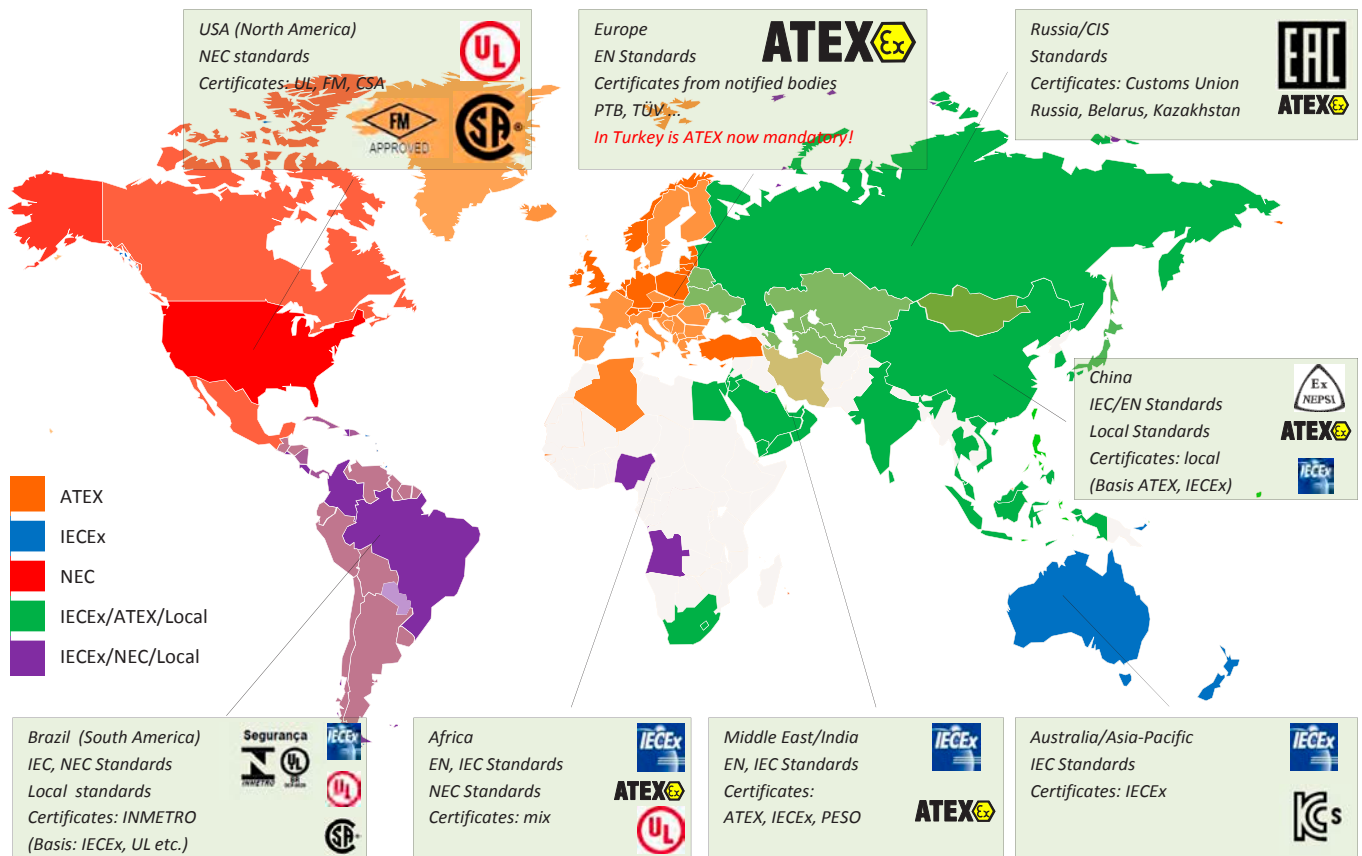
- To send and receive emails via Outlook (company standard)

- Online access to company guidelines, data sheets, in-structions etc., e.g. using Microsoft Azure

- Document inspections with photos and videos

- Communicate with colleagues in real time, e.g. via Skype for Business (virtual conference rooms)

- Open and close work orders

- Create a time stamp, map audit trails, communicate current position (personnel safety)

- Create reports as DOC or PDF files based on templates in order to share them with teams

- Inventory tracking and direct ordering of spare parts and materials, e.g. using SAP connection

Results:

-> Greater efficiency and transparency
-> Less downtime
-> Improved productivity
-> Greater safety

The complete range of mobile devices for industrial use also includes classic mobile computers with and without scanning function, industrial mobile phones and intrinsically safe smartphones, as well as touchscreen computers, industrial tablets and tablet PCs for multifunctional use. The prerequisite for use in a potentially explosive atmosphere is certification in accordance with the applicable standard (see Fig. and box). In some countries local certifications are also required, which must be taken into consideration with respect to worldwide service and maintenance requirements.
Detailed information on standards and certification is available for download at www.bartec.de/safety-academy.

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USA (North America)
NEC standards
Certificates: UL, FM, CSA

Europe
EN Standards
Certificates from notified bodies
PTB, TÜV ...
In Turkey is ATEX now mandatory!

Russia/CIS
Standards
Certificates: Customs Union
Russia, Belarus, Kazakhstan

China
IEC/EN Standards
Local Standards
Certificates: local
(Basis ATEX, IECEx)

ATEX
IECEx
NEC
IECEx/ATEX/Local
IECEx/NEC/Local

Brazil (South America)
IEC, NEC Standards
Local standards
Certificates: INMETRO
(Basis: IECEx, UL etc.)

Africa
EN, IEC Standards
NEC Standards
Certificates: mix

Middle East/India
EN, IEC Standards
Certificates:
ATEX, IECEx, PESO

Australia/Asia-Pacific
IEC Standards
Certificates: IECEx

Use and acceptance of international certifications (Source: BARTEC)

Mobile equipment must furthermore be designed for every-day use in harsh environmental conditions – which includes falls, impact or the influence of dust and liquids. Moreover their safe operation demands special functional features that usually only experienced providers with their expertise are able to comply with. These include special displays that can be easily read during rain and bright sunshine or hot swap enabled batteries that can be changed without interruption and safely in the field. Features such as these ultimately enable the operator to define the pace rather than the mobile device. The following matrix is a decision-making aid when selecting the form factor:

Decision-making aid: which is the right form factor?
(Source: BARTEC)

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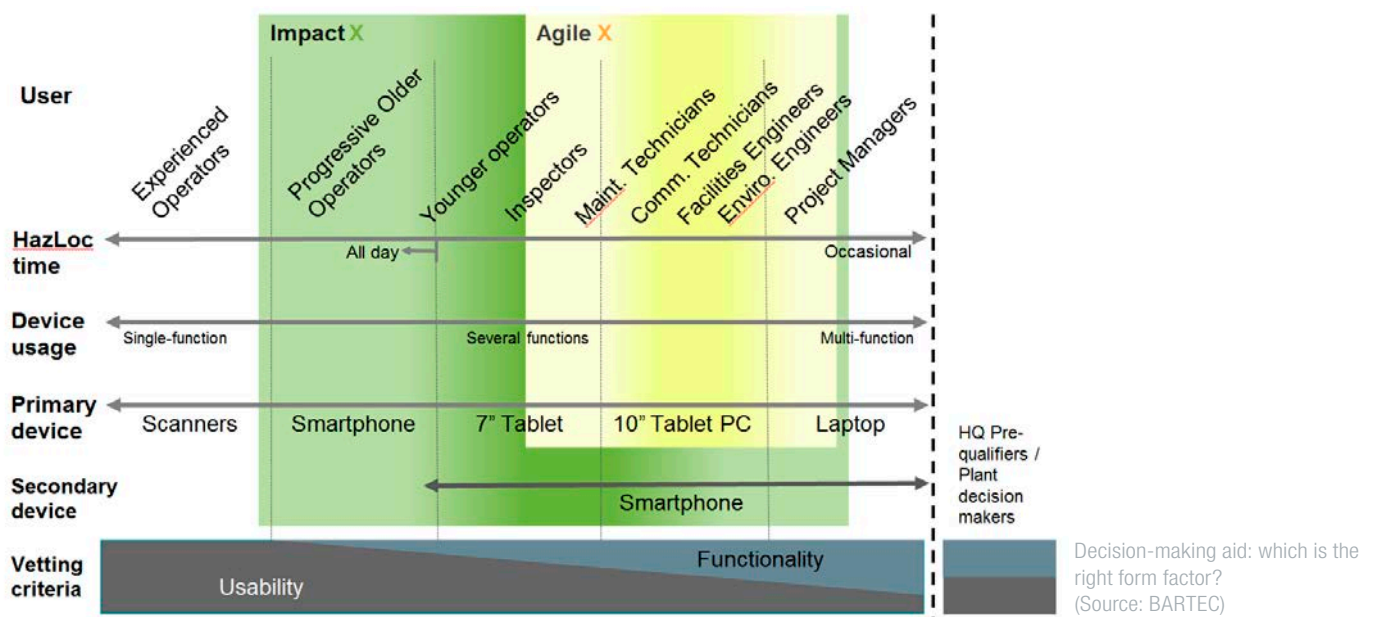
» Mobile terminal equipment must meet special requirements in terms of certification, design and function.

Caution when purchasing equipment

The plant operator and not the manufacturer is responsible for the safe operation of mobile equipment (German Ordinance on Industrial Safety and Health). Device specifications and certification verifications alone are therefore not enough when selecting hardware. To avoid risks regarding liability, acceptance and personal safety, a manufacturer should be selected that has experience in products for potentially explosive atmospheres and can support the user extensively with safety-related know-how before, during and after implementation. Indications of professional expertise are longstanding experience in the industry with global references and international test certificates (ATEX, IECEx, NEC) based on current EN, IEC or NEC standards.

Users are additionally well advised to critically examine the test centre and to closely compare the requirements specified in the documentation for safe operation of the device in potentially explosive atmospheres with those set out in the certificates. The following can also be helpful for project success: expert support with integration of the mobile devices in company networks or the selection of appropriate software, practical training courses and a global services network for the prompt maintenance and repair of the devices at short notice.

1.2. Accessories for system solutions

The ability to expand functions using appropriate accessories is also decisive for versatility, the level of potential benefit and future viability of a mobile solution in potentially explosive atmospheres. In addition to integrated 1D/2D scanners or RFID readers, these include data capture devices such as the cable-free and wired BARTEC BCS hand-held scanner series or the BARTEC RFID X hand-held reader.

HD compact cameras and helmet cameras are another category and enable employees working in places that are hard to reach to take handsfree photos and film or use support conferences. Orbit X, currently the smallest explosion protected Wi-Fi camera, likewise comes from BARTEC.

Further accessories for complete system solutions are carrying systems for working safely in the field, vehicle mounts or docking stations. The latter, for example, turn a tablet PC like the BARTEC Agile X into a complete PC work station that can replace a stationary computer.

Various use cases in and between different potentially explosive and non-hazardous areas. (Source: BARTEC)

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Various use cases in and between different potentially explosive and non-hazardous areas. (Source: BARTEC)

1.3. Data capture

There are different ways of digitally capturing data for paperless processes and optimised inspection rounds, depending on the complexity of requirements. The simplest way of identifying plant and machine parts, products, tools or people is by scanning a bar code or QR code (1D or 2D). Contactless identification by radio is possible using RFID (Radio Frequency Identification) for objects fitted with an RFID transponder. Near Field Communication (NFC) based on RFID, by contrast, permits contactless data exchange across a distance of a few centimetres using electromagnetic induction. The maximum transmission rate is 424 kBit/s. Bluetooth-based transmitters such as those used in beacons or IoT sensors are considerably more powerful.

Various identification options. (Source: BARTEC)

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1.4. Connectivity

If mobile devices are to be a part of Industry 4.0 and IIoT concepts, they must have corresponding communication technologies. These include Wi-Fi for wireless communication with the back end in addition to NFC, RFID or Bluetooth.

A maximum of 24 Mbit/s can currently be transmitted by Bluetooth Low Energy over distances of a few metres (in the case of visual contact up to 50 m). The new Bluetooth 5 standard achieves a fourfold range with double bandwidth, which means up to 200 m with visual contact and around 40 metres inside buildings. Long-distance transmissions can either take place using mobile telephony (3G, 4G and soon 5G) or long distance protocols such as NB-IoT, LOHRA or MIOTY.

BARTEC is working on new solutions with partners in these areas. The BARTEC Agile tablet PC series offers especially high connectivity. As a system solution and multifunctional tool, the platform offers diverse interfaces and connectivity options including integrated scan engine, Bluetooth and Wi-Fi support and optional RFID and mobile phone modules.

A specially developed add-on module to HART communication turns the BARTEC Agile tablet PCs into a multifunctional tool for parameter assignment, set-up, diagnostics and the management of field devices. In addition the temporary storage of data on the mobile device (offline) is important to guarantee data integrity and security.

» **Connectivity is the foundation stone for wireless data capture in the field. Local temporary storage on the mobile device is equally important. BARTEC enables both.**
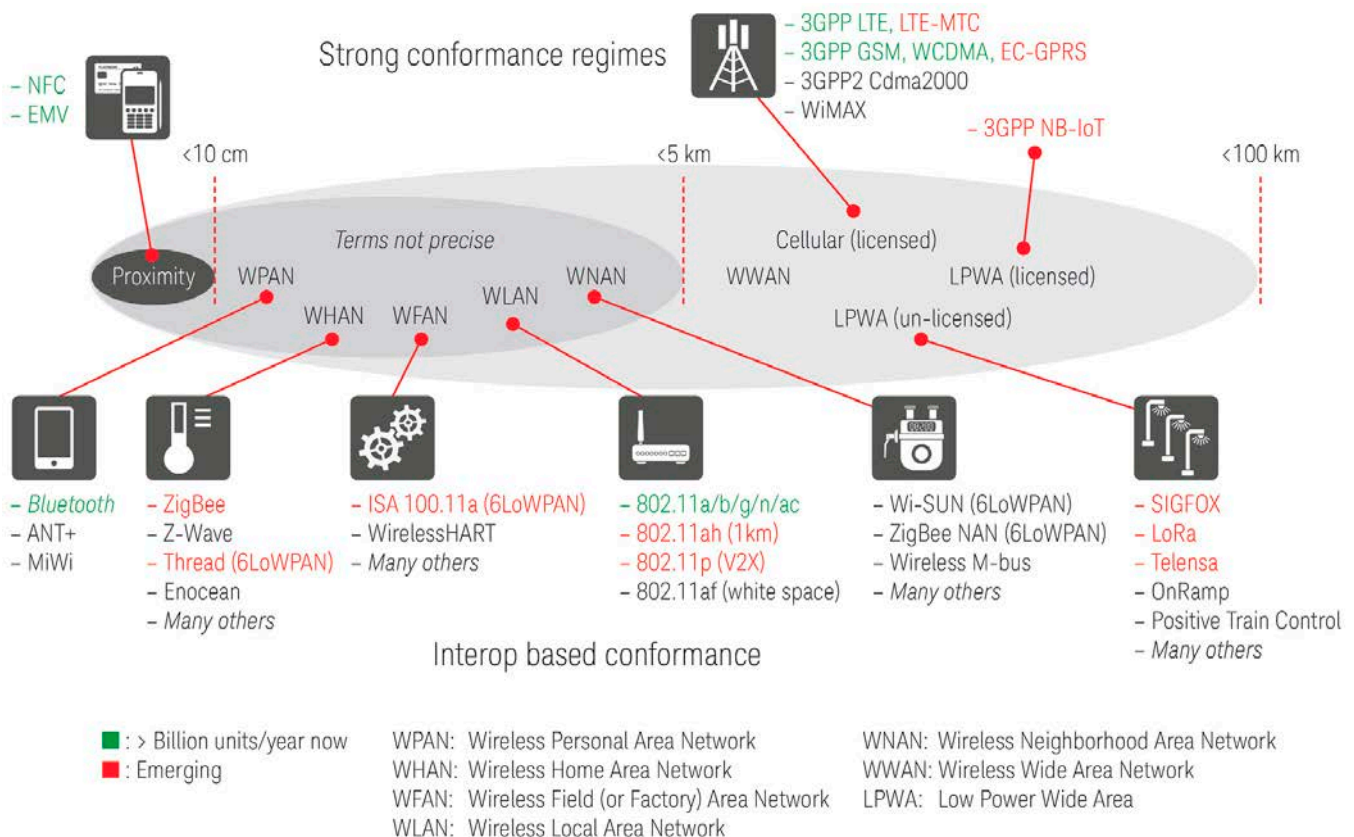
Protocols for wireless data transmission. (Source: www.testandmeasurementtips.com)

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1.5. Certification and intrinsic safety

In addition to the respective explosion protection certificates such as the EU type examination certificate in accordance with Directive 2014/34/EU, several suppliers of mobile devices advertise with the term "intrinsically safe". However this particularly demanding type of protection requires a special device design. Among other things this includes intrinsically safe circuits which, due to low voltage and current values are not able to cause potentially explosive atmospheres to ignite. For safe applications in potentially explosive atmospheres, an intrinsically safe mobile device should also have the appropriate integrated interfaces, e.g. to be able to assign parameters on field equipment using Wi-Fi or Bluetooth or to operate and control entire machines. With intrinsically safe peripherals such as USB sticks, scan engines and cameras, mobile equipment becomes a true enabler for mobile work and for communication in process plants in Zone 1/21.

1.6. Operating systems

A further selection criterion is the software running on the mobile equipment. In terms of operating systems, Windows-based systems such as Windows IoT have the greatest standardisation potential in view of the uniform management, administration and maintenance of various platforms in potentially explosive and non-hazardous areas.

So that users do not have to switch device when changing zone, BARTEC has developed the Agile X series of Windows-based tablet PCs as a systematically integrated mobility platform that is available with an identical IT structure from Zone 1 to non-hazardous areas.

The advantages of Android as operating system include the multitude of mobile apps, integrated use and simple porting. Android is predominantly used in smaller industrial tablets such as the BARTEC Lumen X series and in touchscreen computers such as the BARTEC TC 75ex. These achieve high usability in the field because most users are familiar with operation from private use, and because they provide a wide range of apps for the industrial environment.

1.7. MDM and Cloud-Access

Mobile Device Management (MDM) is an important requirement on the part of IT management. MDM solutions on which all mobile devices irrespective of operating system can be administered and managed efficiently, securely and simply from a distance are especially advantageous. A special "fleet benefit'" for IT is where device and security updates can be sent "over the air" (OTA). BARTEC already offers this service throughout for its Impact X, Gravity X und Orbit X smartphone and camera series and is currently expanding it into an all-encompassing solution.
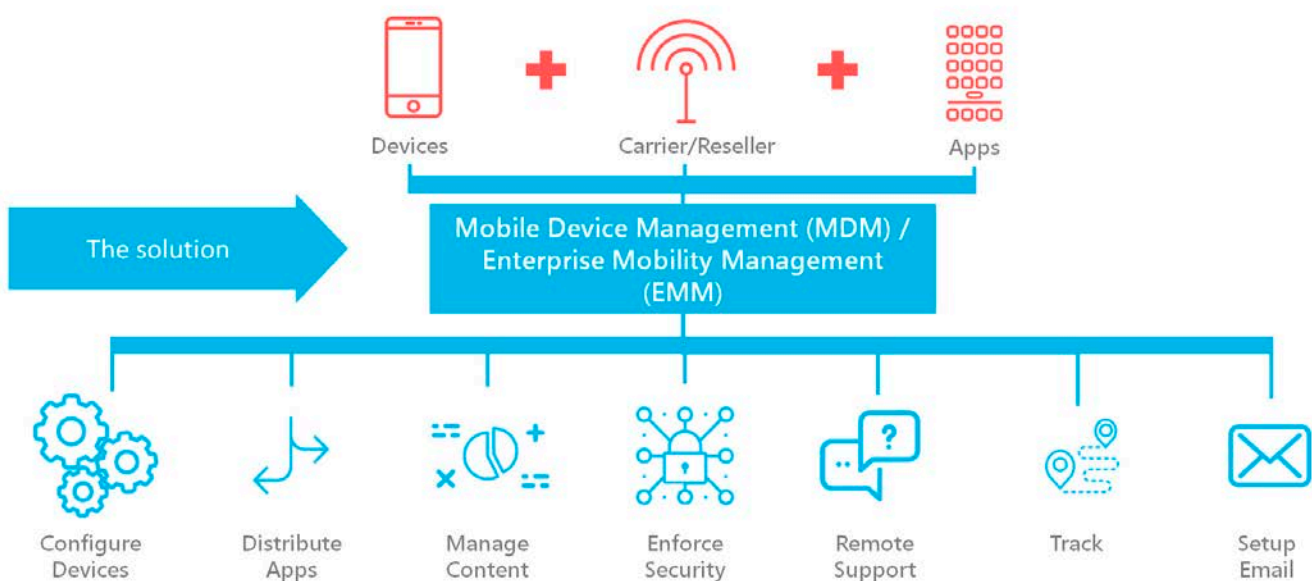
Example of an MDM system (Mobile Device Management). Source: www.SOTI.com

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The BARTEC enterprise mobility portfolio.

Solution providers also need to ensure a seamless connection to cloud services such as Microsoft Azure or IBM Cloud for real-time analyses and big data analyses. This is because the amount of data will increase immensely due to the thousands of sensors and actuators that will be networked in the field in future. Photos and videos that, for example, can be captured automatically in HD quality by BARTEC's Orbit X helmet camera during an inspection round must also be securely saved in the cloud.

> » **Mobile Device Management and cloud access will become ever more important to guarantee IT security.**

1.8. Integration of software solutions

By itself a mobile device is not a solution. A solution is only created through the application including software, infrastructure and service. BARTEC works closely with various software partners and system integrators to bring about innovative solutions quickly. Examples of successful projects include the integrated scan engine on Agile X devices or the optional add-on module for reading out HART-compatible field devices, something that is highly valued by customers such as ABB. The result of a cooperation with system integrator eVision is that its mobile control-of-work applications support all features of modern BARTEC technology, including barcode and RFID scanning.

The SIEMENS Mobile Operation Concept (MOC) uses the BARTEC Agile platform with integrated RFID reader for intelligent and secure visualisation in conjunction with the SIMATIC PCS 7 process control system. The Austrian system provider Augmensys deploys the Agile X tablet PCs in combination with wireless sensors and its augmented reality and data capture solution UBIK® to digitally support and simplify maintenance rounds.

> » **A mobile device is initially just a product. Only in combination with software, infrastructure and services does it become a beneficial solution.**
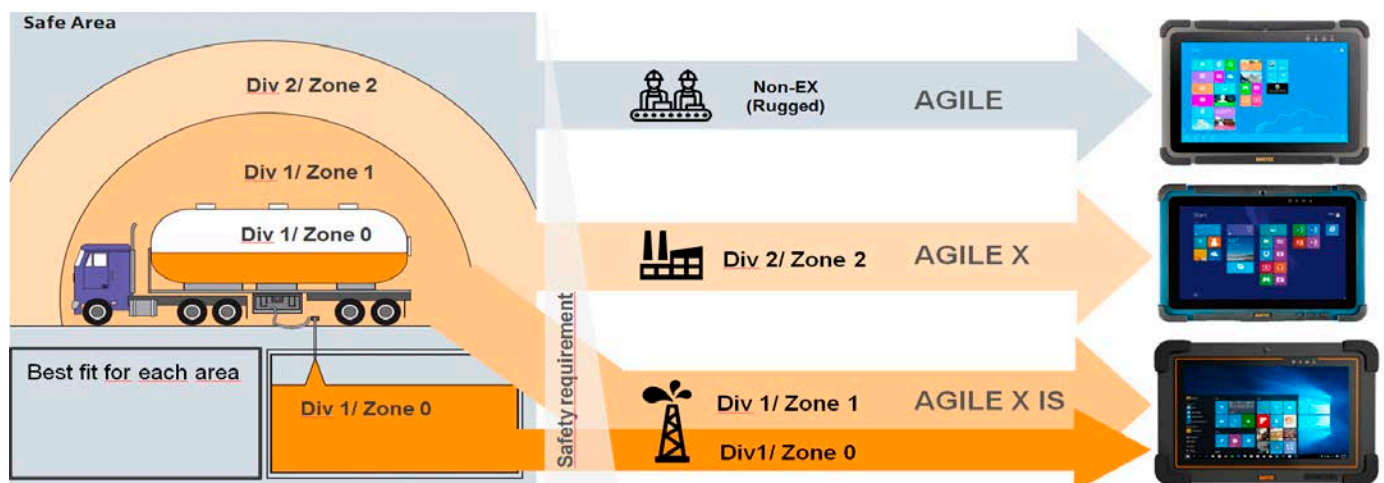
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2. SUCCESS FACTORS

The greatest hurdles to the successful implementation of enterprise mobility projects in potentially explosive atmospheres are unresolved cost and technology acceptance issues and, in some companies, a certain internal resistance to the impending change process[4]. The most important success factors are set out below:

2.1. Impressive solution design

A well-conceived, modular and thus scalable solution concept that also incorporates corresponding certified peripherals is particularly important for economic viability, efficiency gains and the crucial user acceptance for the solution.
Important for acceptance by the IT department are standardised solutions such as the Agile tablet PC series which, as a uniform platform for potentially explosive and non-hazardous areas, minimises project and IT management costs.


Low total costs through standardisation: the Agile tablet PC platform from BARTEC for use across zones.

2.2. Complexity versus efficiency

Project experience and the integrative know-how of the provider are key to striking the right balance between complexity and efficiency. Greater complexity may initially increase the error rate, however when combined with a high level of transparency it is possible to achieve greater efficiency.

An integrated enterprise mobility solution has the right hardware and software tools as well as communication protocols for this in order to link sensors, actuators and machines – and ultimately mobile workers – together seamlessly, taking account of data security. Mobile terminal equipment is used as portable HMIs for monitoring, maintenance and other tasks.
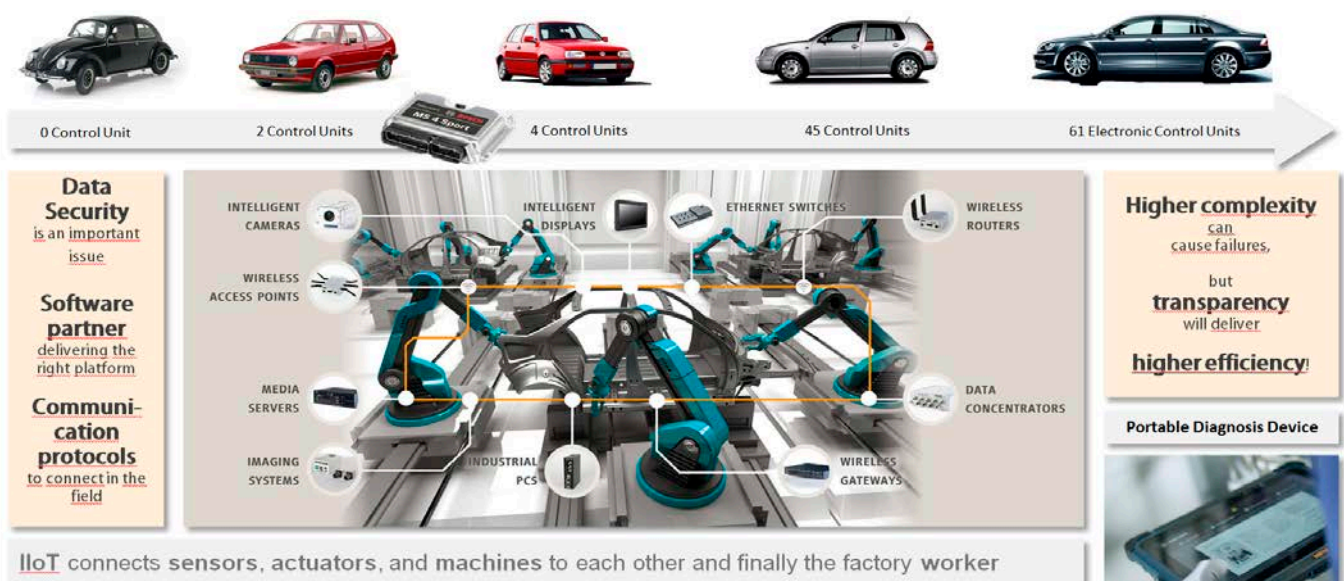
As with automotive development, production complexity is growing. Digital networking boosts transparency and efficiency, and mobile terminal equipment simplifies monitoring and maintenance. (Image source: www.ELTEC.de/ BARTEC)

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2.3. Future viability through Mobile Ex platform

For fully integrated solutions, companies need a complete portfolio of system solutions covering terminal equipment, infrastructure, services and appropriate expansion options, and not just individual products. The Mobile Ex platform created by BARTEC forms the basis for the joint development of targeted, integrated responses to mobile trends with customers and partners. The world market leader in explosion protection also supplies supplementary automation technology for extensive digitalisation projects from a single source, including HMIs, remote I/O and bus systems, as well as switching and control components. This overall platform is being constantly expanded in cooperation with other leading suppliers. Development work currently focuses on infrastructure solutions for efficient and secure wireless transmission in large areas and complex buildings, as well as access points, hubs, beacons and sensors with explosion protection certificates.

» **Mobile Ex platforms as foundation for future-proof solutions.**

Integrative system approach of a mobile Ex platform.

2.4. Consultation and project support

The process of qualifying and introducing an enterprise mobility solution is fairly laborious because the involvement of all concerned is necessary for later success - from the purchasing and IT department, occupational health and safety and the works council, through to management and employees in the field. The provision of practical support by the hardware supplier during the complex decision-making process enables the user to utilise the added value of the technology for the desired productivity increase faster and to exploit it for longer. To relieve companies of the work, BARTEC has all solutions offered verified in advance by software providers and also offers consultancy services, such as those regarding the special legal provisions and duties associated with explosion protection.

BARTEC is moreover a member of various committees aimed at optimising and standardising operating concepts for portable device used in industry and simplifying their integration.

2.5. Minimum total cost of ownership

The total costs of an enterprise mobility solution, its payback and the sustainability of cost reductions will always be dictated by the total package of hardware, software and supplementary services. These include training courses, but also financing and leasing models. Other factors to reduce the total cost of ownership are options for extending the standard hardware warranty, through complete service level agreements.

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BARTEC's "ALL-IN from the start service level" also includes a fixed turnaround time, projectable total cost of ownership including repair costs as well as insurance against damage due to normal use and accidental damage. BARTEC has developed the "Enterprise Mobility Configuration Tool" for a fast device selection and estimation of total costs; this also contains specific accessories and service options for the product and is available free on the provider's website.

» **Complete packages including service reduce the total cost of ownership.**

Conclusion

Enterprise mobility in potentially explosive atmospheres unleashes substantial potential for greater safety, lower costs and lasting efficiency gains, but also requires considerable care when selecting a solution. The safety of employees must always come first, followed by other criteria that are critical to success; in particular these are user-friendliness, infrastructure and costs. Users can expect the greatest added value from suppliers whose expertise extends across the three important disciplines of explosion protection, enterprise mobility and automation.
World market leader BARTEC also has a global presence, excellent consultation and integration know-how and a strong network of system integrators for customised software solutions. With this broad basis of support, sectors with potentially explosive atmospheres are able to achieve their goals as quickly and efficiently as possible for sustained improvements in the overall equipment effectiveness (OEE) of their plant and in the safety of their employees.
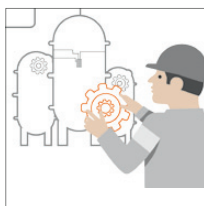
The process of selecting mobile equipment for companies with potentially explosive atmospheres is complicated:

· Safety first: Zone 1 / Zone 2 / Non-hazardous?

· Communication or data access?

· Which use case?

· Connectivity (3G, 4G, 5G, Wi-Fi etc.)?

· Which operating system?

· Battery life / battery change in the field?

· Access to existing infrastructure?

· Total cost of ownership (incl. training, service & repair, leasing etc.)?

· Which apps? (SAP etc.)

· System approach?

· How portable should the solution be?

· Certified accessories?

· Display size for use case / app?

· Global use -> certificates?

· GUI (standard or specific?)
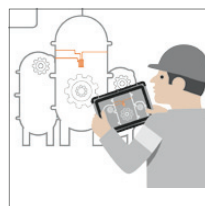
· Product availability / spare parts?

Direct help is provided by the BARTEC EM configuration tool at: www.bartec.de/config
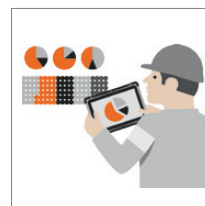

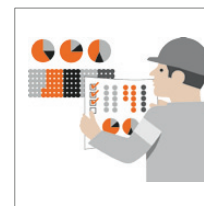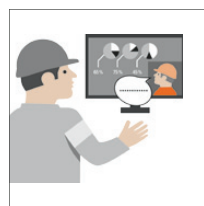|		
Routine Inspection	Preventive Maintenance	Routine Maintenance
Workflow Management/SAP	Diagnostics	Online/Offline Informationen
Ad hoc Inspection	E-Learning	Remote Visual Inspection
Emergency for Machinery	Inventory Control	Emergency for Personnel

Application examples of enterprise mobility (Source: BARTEC)

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