

# JD Edwards EnterpriseOne Wearable Technology

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## Introduction

Enterprise organizations around the globe are constantly searching for innovative technologies to enable them to reduce operational cost, increase revenue, and comply with regulations. Each improvement in these areas helps companies sharpen their competitive edge by utilizing optimal technology to empower their workforce to be more productive and effective when solving every-day business challenges.

Oracle JD Edwards has established leadership in enterprise mobility by creating entire suites of mobile applications in the areas of Capital Asset Management, Financials, Supply Chain Management, Order Management, and Order Fulfillment. Enterprise mobility has been a highly successful endeavor for customers who have adopted JD Edwards Mobile Applications to streamline their business processes by bringing the value of enterprise computing to the point of process in our customers' manufacturing operations, projects, services, and supply chain.

While mobility is a well-established success story, enterprise mobility is rapidly evolving into a force multiplier for businesses to help them achieve the innovative edge in their daily operations. Mobile devices provide instant access to information at the point of service by delivering the power of the enterprise back-end to where the work is actually performed. Mobile devices connect end users with information where and when it is needed resulting in an increase in user productivity. More and more enterprises are adopting enterprise mobility solutions to enhance their marketing channels, increase customer satisfaction, and, most importantly, improve work productivity.

A strategic goal for the Oracle JD Edwards product line is to constantly raise the bar in our drive towards the next frontier for simplifying, standardizing, and optimizing business processes. Innovation is not a buzzword but rather the key differentiator between the success and failure of many business models. The companies that embrace innovative technologies and processes have experienced the following benefits which are synergistic and amplify each other:

- » Increased user productivity and improved staff morale resulting in work satisfaction.
- » Optimized business process leading to cost reduction.
- » Insights into the operational effectiveness of the business, which impacts top line revenue.
- » Unobtrusive data collection and improvement in adherence to regulatory compliance.

The next innovation on the horizon and the natural extension to mobile computing is wearable computing.

## Wearable Technology – Definition and Social Acceptance

Wearables are miniaturized computing devices that can be comfortably worn or carried to automate or augment daily work or personal activities. These devices perform many of the same functions as existing mobile or desktop devices; however, they excel in simplifying the human-computer interaction by using natural gestures, voice commands, and other optimized interactions. Equipped with a useful array of sensors, both physiological and environmental, such as heart rate detectors, UV level detectors, GPS, accelerometers, compasses, voice-to-text recognition, optical character recognition, and Bluetooth, these devices detect, measure, and communicate information to provide a highly optimized human-computer experience.

Wearables are designed to make human interaction with technology more frictionless and seamless. This is not a new concept, and the use of wearable technology has been researched and discussed for several years. Now the technology has become available in designs that are smaller, more functional, and aesthetically pleasing. Wearables have a more sophisticated technology arc than hand-held mobile devices as they incorporate some unique capabilities, such as heads-up display (HUD), physiological sensors, and hands-free scanners. Augmented reality features provide a platform that is seamlessly immersive and contextually relevant. Wearable technology creates convenient, seamless, portable, and mostly hands-free access to information and assistance.

Today, mobile devices, such as tablets and smartphones, are ubiquitous but did not even exist just ten years ago; similarly, wearable technology will enter our technical space and social consciousness very rapidly and could very well change the nature of mobile devices and our interaction with them entirely. A recent study by Accenture indicates that consumers are gravitating towards new functionality enabled by wearable technology. Across the various countries that were surveyed, almost half of respondents expressed interest in buying the new smartwatch functionality. More than 40 percent are interested in smart eyeglasses. The interest in wearable technology underscores the growing consumer desire to be more digitally connected at all times. Early-adopter and early-majority consumers are particularly enthusiastic about the new functionality, available either as a wearable device or as an app. For these consumers, wearable technology epitomizes a complete digital lifestyle.

## Types of Wearable Devices

Wearable devices include smartwatches, smartglasses, activity trackers, smart fabrics, and more. Let's take a brief tour of the wearable devices on the market today:

- » Smartglasses: Two different categories of smartglasses are available for enterprise use:
  - » Monocular glasses like Google Glass™ or Vuzix M100™ provide at-a-glance information in the upper right part of a wearer's field of vision. By tapping the bezel and speaking commands, individuals can use a smartglass to search the Internet, take a picture, scan a barcode, get directions, send a message, make a voice call, and record a note. In an enterprise application, a monocular display might be appropriate for a retail salesperson to help customers check inventory while accessing information about their previous purchases and preferences. Likewise, monocular displays could be useful for package delivery workers who needs to use their hands to lift boxes while following the item pickup and drop-off routes shown on a wearable screen to help optimize delivery time.
  - » Immersive glasses like the Epson Moverio™ or Samsung Gear VR™ provide a true augmented reality display with a much fuller visual field than monocular glasses. Immersive displays may be better suited for manufacturing plant or shop floor environments or for industries where workers need to identify parts or follow step-by-step instructions. For example, construction workers could view blueprints or 3-D models to better understand the expectations for a finished real estate facility; medical practitioners working in remote locations could practice telemedicine and collaborate with other health professionals who could guide them through unfamiliar or complicated cases.

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- » Smartwatch: The Samsung Galaxy Gear™, AppleWatch™, Moto 360™ are some of the growing number of wrist-worn mobile devices. Smartwatches have the natural advantage of being socially acceptable and offering functionality suited to both workplace and social settings. Smartwatches have added benefits: They are strapped on and are thus harder to lose and less fragile than a tablet; notifications are easier to spot than on a smartphone that is out of sight in a purse or back pocket. Enterprises can cost-effectively use wrist-worn wearables in a range of environments: In industrial environments, such as mines or construction zones, to provide safety alarms and location-based alerts, in the hospitality industry as a quiet alternative to walkie-talkies, and in outdoor environments where waterproof displays are a requirement. Smartwatches based on Samsung Tizen, Google Android Wear, or Apple Watch OS can be used to display alerts that will prompt an immediate response.
  - » Ring: Smaller than other wearable devices, ring wearables like the MOTA Smartring™ are very useful for people who prefer a smaller wearable. These ring devices get your attention by vibrating whenever there is a notification, enterprise or social, which needs your attention. Worn on thumb or fingers, the smart ring presents a concise and sleek interface for scanning items, receiving notifications, and responding by voice or gestures. The NFCRing™ is another example of a smart ring.
  - » Garments: Smart garments can sense the current weather conditions and the technician's health, and feed status data in real time to the analytics engine. As a result, exposure to extreme weather conditions can be avoided, the risks of dangerous environments can be monitored, and alerts can be sent if the technician falls ill or stops moving. Market research indicates that the apparel industry will see a boom in smart-clothing fabrics and is expected to ship \$1.24 billion worth of garments by the end of 2015.
  - » Arm band: Companies like ThalmicLabs™ have developed Myo, a hand-gesture arm band that can manipulate computer applications, such as presentations, media devices, or menus, and sift through pages and charts that are visible on a traditional monitor or even other wearables like Google glass. Natural human gestures like squeezing your fist, spreading your fingers, waving left or right, or rotating your arm can be easily mapped to interactions on a desktop or mobile device thus allowing for non-touch interaction with existing applications and devices. These devices have many interesting applications in shop floor operations, industrial manufacturing, healthcare and other domains. Eurotech's Zypad™ delivers a wrist-mounted mini-PC to those needing high-tech mobility and connectivity in the field, such as emergency personnel, search-and-rescue teams, warehouse workers, and anyone on the move.
  - » Biometric identity device: These devices ensure secure access to enterprise applications or personal applications on many devices by using personal biometric signatures, such as heart beat, to function as a secure password. Wearable authentication technology helps maintain a secure access profile for your applications by converting your unique biometric signature to complex passwords and pins across multiple apps. Devices like Nymi™ are great examples of wearable authentication technology.

## Work Metaphors in the Post-PC Era Optimized by Device

If you stretch your imagination and go back a few decades, mainframe computers were the dominant form of enterprise computing and occupied the physical space of a room. During the next stage of the computer evolution, mainframes evolved into a client-server architecture, with clients running as desktops and servers running as towers or domes. Following Moore's Law, computers have become smaller while providing the same or greater computational and memory capability. Today's tablets and smartphones can fit inside a purse or pocket while providing greater capability than the desktop computers of yesteryear.

This process is comparable to the evolution of timekeeping devices, which advanced from community-wide clock towers to pendulum clocks to pocket watches to wrist watches to a point where many carry no watch at all, but rely on mobile technologies. The success of each version was judged by how well each device helped users tell time. Just as clocks shrank from giant towers to smaller devices on our wrist or phone, computers have evolved from colossal size to a wearable design. This unrelenting march towards miniaturization provides us with a new platform aiming to provide us with the most pleasing and intuitive design to make our interaction with the computer seamless. This is the advent of wearable computing.

Thus, as we enter the post-PC era, we must define user interaction metaphors for our various platforms. Let us examine a day in the life of a field technician who has a list of work orders that he or she must complete.

- » In the office: The desktop application provides the full-strength functionality of the field work order application with a large screen to display the full application footprint of all features and actions to take on the work orders.
- » In transit from the office to the point of service: The field technician now relies on a tablet or smartphone app, which provides just the essential information on the nearest geographical location and details of the next service appointment. A tablet provides key details and notes for the task at hand available at a glance for quick action while a smartphone application offers more targeted functionality like notifications and alerts, indicating, for example, whether the field technician is approaching the work site or whether he or she is likely to miss subsequent appointments.
- » At the point of service: When the technician arrives at the point of service, the traditional mobile paradigm becomes a hindrance. At this point, the ideal computer would provide information and assistance in an intuitive and unobtrusive manner. It is here that wearables shine—by providing contextual information without requiring the technician to manipulate a traditional mobile device. A wearable device at this point makes workers more productive and enables them to perform their services easily and safely. Points of service can be a challenging space; easy and intuitive access to information and assistance should be hands-free, using gestures and voice control. Augmented reality can provide an empowering and delightful experience for personnel to perform the tasks at hand.

Additionally, as a post-PC device, a wearable computer or device is not merely a platform for consuming information; it also becomes an active accessory for its human operator to display and record relevant information.

Consider the field service story where the final act of completing a field work order involves getting a confirmation of the services provided. A wearable device can take continuous pictures and videos while the technician is performing the service, and record voice-driven notes. This real-time record of activity along with location-tracking reduces the need to record post-work notes and confirmations.

By using the appropriate platform in each phase of the work order process, the field technician is empowered to be a more productive and effective resource, thereby improving efficiency and customer satisfaction with a positive impact on the company's bottom-line.

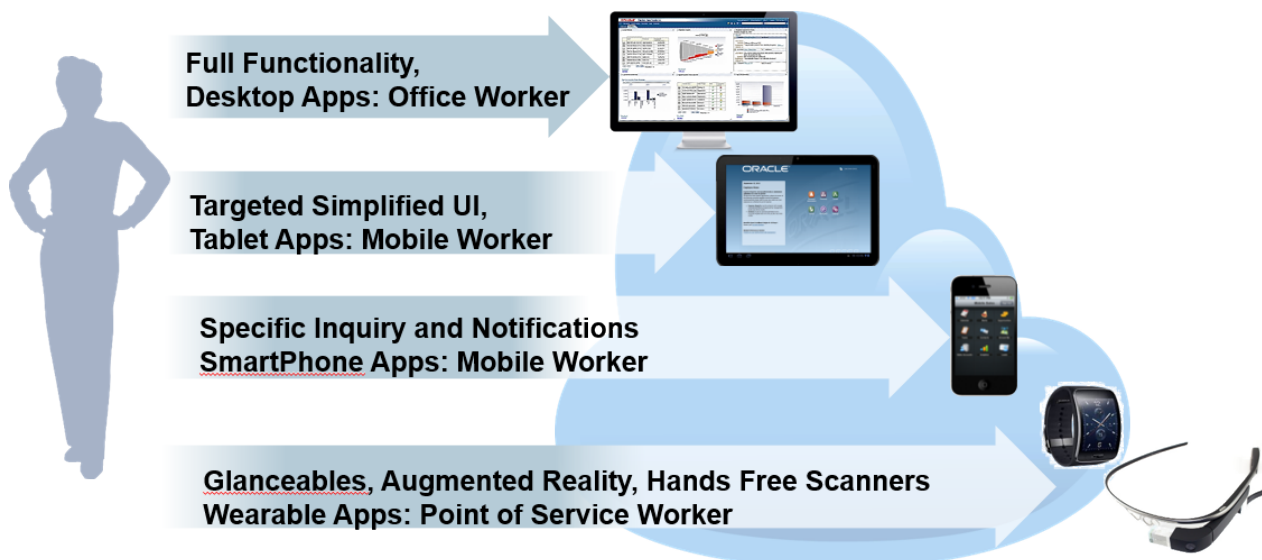


Figure1: Work metaphors optimized by device



## Wearables as an Intuitive Extension of Mobile Devices

Wearables are always-on, connected computing displays that are worn or carried for easy, hands-free access to display contextually relevant information. This functionality makes it possible to support, augment, and optimize workforce performance—especially for employees who are always on the move and need the ability to do hands-free computing and to access to real-time information. Broadly, wearables can facilitate collaboration between supervisor and personnel through voice, video, messages, and alerts.

The chief value proposition of wearable devices is that users can access and update information easily without directly manipulating a handheld device. Let us examine how wearables can help field service technicians and logistics clerks on a manufacturing shop floor:

Currently, field service technicians use their mobile devices for real-time direction to their destination. Calls are optimized based on their current location, skills, and required qualifications, urgency of the call, contract service level, and expected transit time based on current traffic conditions. The greatest advantage of wearable technology is the extent to which it integrates seamlessly with the environment in which operators find themselves. Technicians wearing gloves and operating heavy machinery are not as likely to pull a phone out of their pocket. They are more likely to respond to a subtle vibrate alert (haptic feedback) on their smartwatch or a voice or visual alert on their heads-up display device. Therefore the “organic” or frictionless usage under challenging field conditions is going to dictate the optimal use of technology, leading to higher productivity and compliance with established procedures.

The logistics clerk in the warehouse currently uses scan guns to scan barcodes or QR Codes, accept purchase orders, determine the inventory on hand, perform shipment confirmations, move items from aisle to aisle, or signal work order completion. However, having to scan items with one hand using a scan gun, especially when manipulating heavy or bulky objects, is a cumbersome experience compared to using a wearable device to perform this operation and having both hands available.

It is quite obvious that a robust application built for wearable technology, for example a smartglass or a smartring, will provide a distinct advantage to a shop floor operator over traditional scanners.

These examples clearly demonstrate the superiority of wearables in a point-of-service environment. Traditional mobile devices require direct manipulation using icons and pointers, resulting in a high cognitive and perceptual load that causes distractions for the human operator and makes these devices less than optimal for point-of-service settings.

Wearables represent the dawn of ambient intelligence which is embedded, context-aware, personalized, adaptive, and anticipatory. Devices which support ambient intelligence work together to support people in their work and personal activities. Wearable devices provide information which is contextually relevant and over time can anticipate users’ needs so that the technology fades into the background with only the useful effects of technology remaining in the foreground.

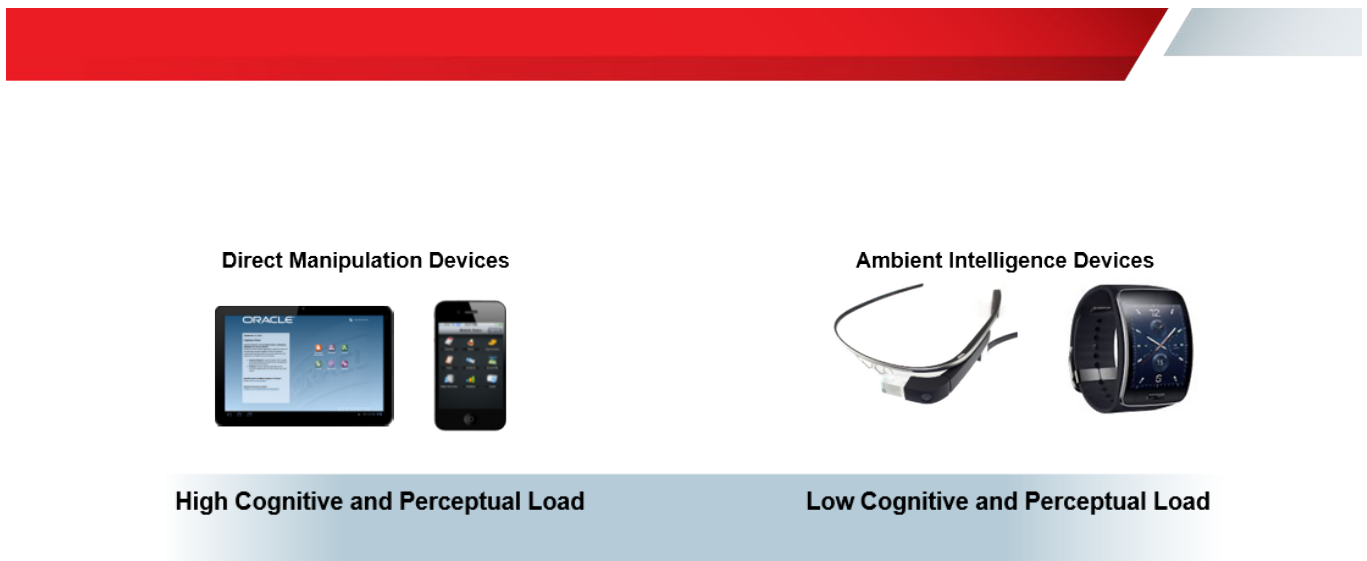


Figure 2: User attention metaphors of devices requiring direct manipulation vs. ambient intelligence devices

## Business Value of Wearables to the Enterprise

Unlike in the consumer space, where the awkwardness of wearing an external device and the need to re-charge it frequently may impede the adoption of wearables, in the workplace, wearables will be just another tool for the job. They could be worn or attached to uniforms, gloves, boots, overalls, or hard hats. Wearable devices can seamlessly fit with other tools needed to perform daily work activities. Critically, wearable devices offer an optimized user experience for a single source of truth of enterprise data, be it in the cloud or on premise, which can be manipulated by other devices, depending on the task and the context.

The three characteristics of wearables that enhance user productivity and interaction are:

- » Always on and mobile: Wearables by definition must go where the wearer goes; they are generally always on, which makes them suitable for handling the consumption of information.
- » Augmented reality: Wearables can provide information in the context of the environment and from its operator's perspective to enhance and annotate the information about the real environment.
- » Context sensitivity: Wearables sense the user's surroundings and the impact of the wearer's presence in that location, creating an intimacy of interaction between the person, the computer, and the environment.

One can envision many ways in which wearables can be used not only to enhance productivity but also to improve worker safety and compliance with rules. Wearables can be deployed for industrial applications with specific, well-defined use cases that have clear performance metrics and goals. Some of the enterprise use cases of wearables are described below.

### Warehouse Management

The warehouse presents many opportunities to make workers more productive through the use of wearables. Wearables can augment workers' ability to fulfill orders by providing levels and location of inventory, guide workers to the physical location of the items, or take pictures of the items before shipping. These capabilities enable workers to do their work more effectively than by marking clipboards. Currently, data capture and inquiry rely on clipboards or hand held scanners – all of these operations can be streamlined by using smartglass or smartwatch wearable devices in the following use cases:

- » Receive and inspect items, scan invoices, track supplier performance.
- » Capture lot and serial number when receiving items.
- » Receive products based on supplier delivery time and track supplier reliability.
- » Support warehouse putaway by gathering putaway locations from the system.

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- » Support picking and replenishment including RFID and license plate capabilities.
  - » Support an advanced task framework for streamlining material putaway: Streamline material flow, minimize travel time, and increase operational efficiency.

These use cases have been put into practice by Tesco, a grocery and merchandise retailer which has been using wearables in 300 locations in the UK since 2004 to aid its workers in picking, putaway, and order fulfillment with feedback to ensure the accuracy of orders and to support other warehouse activities. The efficiency gains from using this solution have been significant: From 2007 to 2012, the number of full-time employees needed to run a 40,000- square-foot warehouse dropped by 18%.

## Manufacturing

Augmented reality supported by wearable devices could be used to train workers, give them information about potential delays along the assembly line, and give them feedback about their productivity. Wearables, which could easily replace the traditional bar code scanner, can be used to check on-hand inventory. They can also be used to perform functions such as checking the status of raw materials and work-in-process (WIP). Wearables can enable personnel to operate a piece of equipment remotely.

In a busy manufacturing facility, employees can wear smart wristbands that are location-aware. As employees enter the building, the wristband automatically punches them in for the day and gives specific work instructions; for example, directing them to the work center to which they are assigned that day.

Production managers and supervisors can use wearable technology to quickly access vital labor information in real time. Managers use their wearable devices to monitor many other important metrics, such as the total volume of goods produced, rework requirements, and the amount of scrap. Managers can also quickly dispatch maintenance workers to repair equipment, as needed. Employees can receive notification on their own device, such as a smartphone, and quickly move to where they are needed, minimizing downtime and maintaining productivity.

In a company implementing the Toyota Production System (TPS), the act of alerting the supervisor is similar to pulling the Andon cord, which initiates corrective action. Throughout this process, the wearable device tracks workers' locations, knows that they have moved to a new production line, creates a job transfer, assigns a new work order, and automatically starts tracking their work. There is no need for employees to interact with a computer or time clock. The technology has already taken care of that for them so they can focus on what's really important—the work at hand.

Collectively, all employees' wearable devices provide managers with real-time, actionable information about their employees' work: What they are working on, whom they are working with, whether there are productivity issues, and whether they are on schedule. With complete visibility into these metrics and more, management can quickly correct hidden bottlenecks or product quality issues. In turn, this information helps the entire company to react in real time to optimize business outcomes.

## Engineering and Construction

Wearables can facilitate easy time entry for users working on a job site. To optimize operations, the time spent on each project must be tracked; however, time tracking is often perceived as a cumbersome and undesirable activity by the workers actually performing the activity if it involves manually entering time or scanning barcodes. Instead of having to manually enter time, wearables using Bluetooth low energy devices, such as Bluetooth Smart or iBeacon, can seamlessly record time for workers when they enter the construction zone. These beacons act as long-range badges which can track users over a geographical area called "geo-fence". Entering the geo-fence is the equivalent of clocking in, whereas exiting the geo-fence equals clocking out. Beacons also can be switched on or off within the geo-fence to indicate clocking out for activities such as lunch or meeting breaks. This highly flexible and powerful



system based on wearable beacons eliminates the need to manually enter time or walk to a kiosk to tap the badge or scan barcodes, thus optimizing operations by capturing data without interrupting work activities. These wearables can track the utilization of labor, equipment and IoT-enabled machinery by recording:

- » Time worked for HR Payroll.
- » Time by work center for the project where the technician or equipment is spending time.
- » Time by work center and per work order for the project.

### Field Services

Wearables, especially smartglasses, offer many promising use cases for the service industry. Wearables can provide faster, more dynamic intelligence that is not available from paper manuals which are outdated the moment they are published. While mobile devices eliminate the need to review paper-based notes, the hands of field workers are still tied to their mobile devices. Instead of accessing information about the task at hand seamlessly, the worker must switch between performing work tasks and accessing or updating the information on mobile device. Wearables can augment the worker's ability to work seamlessly, safely, and without disruptions. Some use cases for wearables in field services are:

- » Display on-screen tips related to service issues, parts diagrams.
- » Use voice assistance to perform field services with assistance from remote technician.
- » Use screen assistance to perform warranty checking.
- » Seamlessly Initiate depot repair for an item, parts replenishment, and part shipment or drop shipment.

## A Real-Life JD Edwards Customer Wearables Scenario

An interesting and very practical use case for wearable technology was presented by a JD Edwards Enterprise One customer. This real-life scenario describes an opportunity to optimize the picking and packing operations, improve the tracking of inventory, and increase the productivity of the employees in the warehouse. The customer is a multinational manufacturer of sports and recreational equipment. To protect the customer's privacy, the scenario below makes reference only to "Customer X".

Wearable technology can be deployed for Customer X's warehouse operations as follows:

1. Customer X's employees can wear devices such as smartglasses, smart wristbands, or smartwatches that are location-aware. As employees enter the building, their wearable devices automatically punch them in for the day and give work instructions, for example, directing them to a specific work cell to which they are assigned that day. The actual work hours can be tracked after the punch-out in the time-entry system within JD Edwards Time and Labor or other time tracking system.
2. In the warehouse, the order picking process is initiated when an order picker gets one or more empty boxes from the conveyor belt and places these boxes on the picking trolley. This trolley can carry 4-6 boxes of different sizes. The picker identifies the box by its bar code label, using a smartglass such as Vuzix M100™, and places the box on the trolley. Once all the boxes are placed on the trolley, the order picker can confirm, using the smartglass, that all boxes have been placed on the trolley.
3. The JD Edwards Warehouse Management System then sends information on the first picking line to the order picker through the glass display via the at-a-glance information in the upper right part of the wearer's field of vision.
4. The picker then identifies his or her location through voice activation by tapping the bezel of the Vuzix M100 glass and speaking appropriate commands. The glass provides directions for picking the item in the field of vision until the picker zeroes in on the exact location of the item. The display provides information on the item name, item number, and quantity to be picked. The picker confirms that the item has been picked via a voice confirmation and walks back to the packing location guided by the navigation system.

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5. Once the item is taken back to the trolley, the glass suggests the box where the item should be placed.
  6. The picker can request multiple cartons and perform the picking process until the batch is complete. If the worker needs additional boxes, he or she can call for a new box, making sure to identify the barcode label for every box added. After completing the picking operation the worker can indicate through the glass that the activity has been completed and record notes or special instructions.
  7. After picking all lines that the picker was assigned to, the picker can return the boxes to the conveyor and confirm this action using the glass.

Warehouse operations presents many opportunities to make workers more productive through the use of wearables. While performing the activities the worker can collaborate with other workers, take a picture, send a message, make a voice call, or record a note by tapping the bezel and speaking commands through the glass. One major advantage of using a smartglass for picking operations is that the picker can avoid over-picking the items and avoid loss of productivity due to subsequent putaway activities.

To summarize, the benefits of using wearable technology for warehouse operations are as follows:

- » Smartglasses free the user's hands to lift boxes while following the item pick-up and drop-off routes shown on a wearable screen to help optimize delivery time.
- » Smartglasses can provide direction to employees to help them quickly identify the location of items and the quantities that need to be retrieved.
- » Smartglasses can help with the packing process by providing guidance on which items go into which box.
- » Smartwatches can guide worker to the physical location of the items or take pictures of the items before shipping, for audit purposes. These capabilities enable workers to do their work more effectively than by marking clipboards only.

## Integrating Wearable Devices with JD Edwards EnterpriseOne Applications

Oracle JD Edwards EnterpriseOne applications are well positioned to leverage the capabilities of wearables and offer highly differentiated solutions to its customers. The Oracle JD Edwards architecture is based on a unified data model and a metadata-based technology layer which supports a complete suite of applications. This layered architecture enables the underlying foundation to leverage new capabilities supporting the rapid infusion of new technologies and business applications. For example, applications can be easily extended with the use of smartglasses, smartwatches, and other wearable devices.

Oracle's JD Edwards provides a modern platform for partners and other specialized service providers for integrating information from the wearable devices into their existing and new JD Edwards applications. The building blocks of this platform are:

- » JD Edwards integration components: The two modern interfaces for integration offered by JD Edwards are REST-based Application Interface Services or Web Services via BSSV Interface. The Application Interface Services are lightweight JSON interactions which can perform any of the Create, Read, Update, Delete activities for all the thousands of JD Edwards applications. This capability supports the extension of the traditional JD Edwards applications to any platform or device of choice. Wearables developers can use this feature to extend an application to the wearable device of choice.
- » JD Edwards server-side components: The highly scalable JD Edwards EnterpriseOne server architecture has everything needed to interface either directly with machine sensors or with the client gateway components to process incoming data, store and analyze the information, and trigger actions in the application business processes configured for an industry and user task. This component is transaction-aware and processes the data for urgent notifications, usage patterns, or long term datastorage.

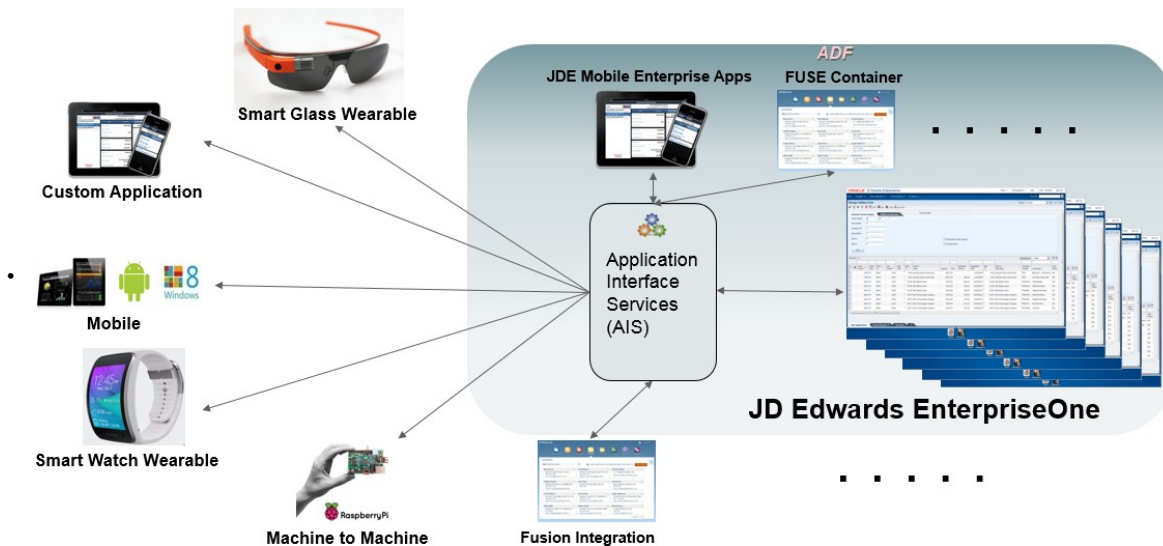


Figure 3: Integrating JD Edwards Enterprise One applications with wearable devices

Canon Information and Imaging Solutions, a JD Edwards partner, worked with the JD Edwards Strategy team to create three functional smartglass applications based on existing JD Edwards Warehouse Management applications:

- » Item Quantity and Location Inquiry
- » Item Ship Confirmation
- » Item Cycle Count

Information about the functionality and availability of these applications can be obtained by contacting the JD Edwards Strategy Team or JD Edwards’ partner CIIS.

The illustrations below show the deployment of wearables as part of an overall Warehouse Management solution.

The first illustration shows how wearable devices can be used in the JD Edwards EnterpriseOne Warehouse Management solution.

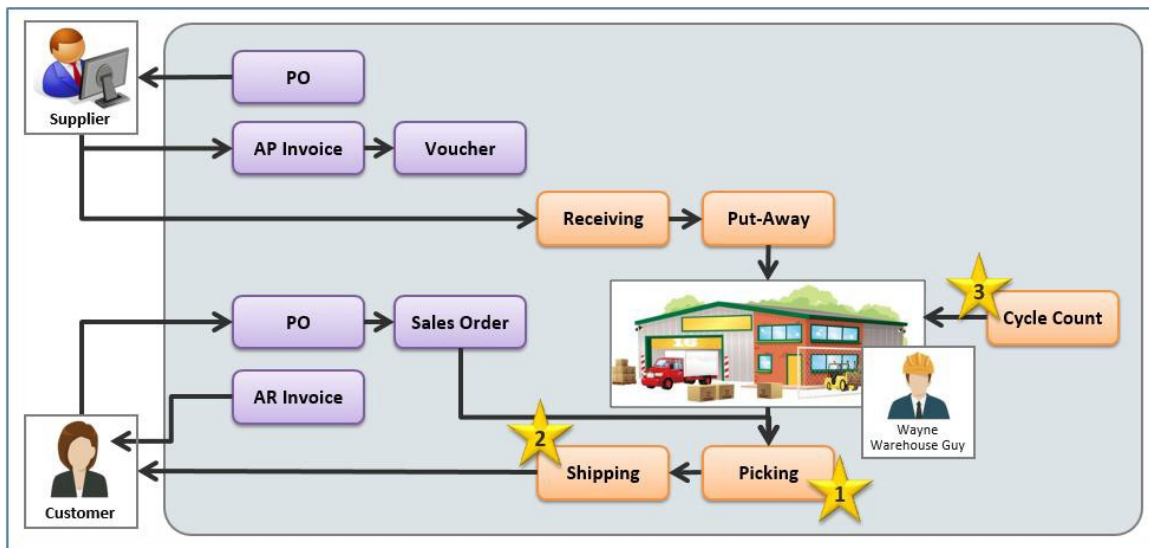


Figure 4: Integrating JD Edwards Warehouse Management with wearable devices

The following illustration outlines how users can perform an item quantity and location inquiry using a Google Glass application.

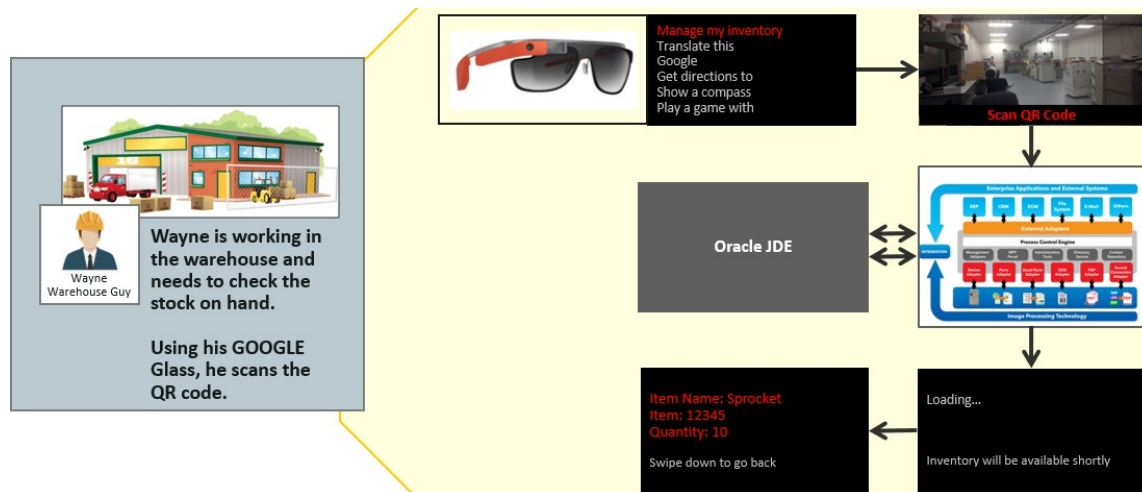


Figure 5: D Edwards Item Quantity and Location Inquiry on a Google Glass application

This graphic shows the shipment confirmation process performed on a Google Glass application.

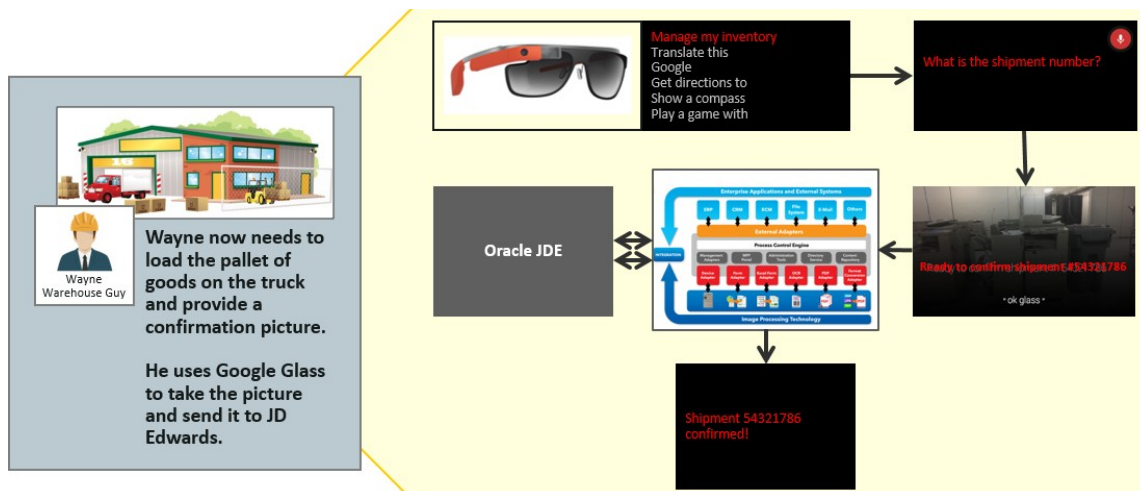


Figure 6: JD Edwards Item Shipment Confirmation on a Google Glass application

An item cycle count can also be done using a Google Glass application.

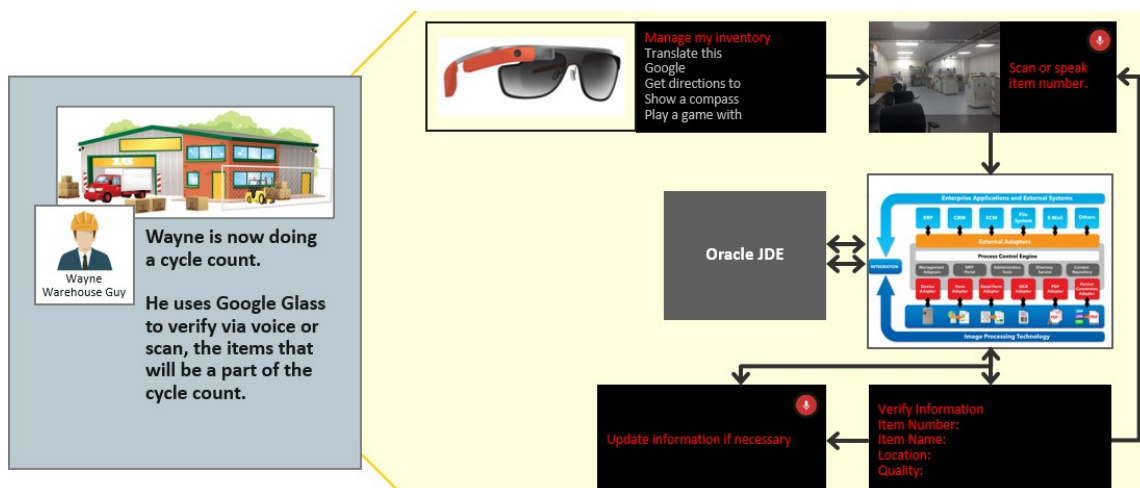


Figure 7: JD Edwards Item Cycle Count on a Google Glass application

## Extending JD Edwards Applications to the Smartwatch Platform

While the illustrations above show how JD Edwards applications would work on a Google Glass platform, the JD Edwards Labs team can demonstrate the ability to extend existing JD Edwards applications to the smartwatch platform. The following scenarios examine the extensibility paradigm by showing which device platform is best suited for the environment in which the user is operating. Each of these scenarios use the same JD Edwards application that is used for running scripts for troubleshooting or maintaining compliance for various service orders or work orders.

### Scenario 1

In this scenario, the environment is the office where an office worker uses a desktop browser. In this case the "classic" representation of the application is the most appropriate version of the application offering ease of use and the most extensive functionality.

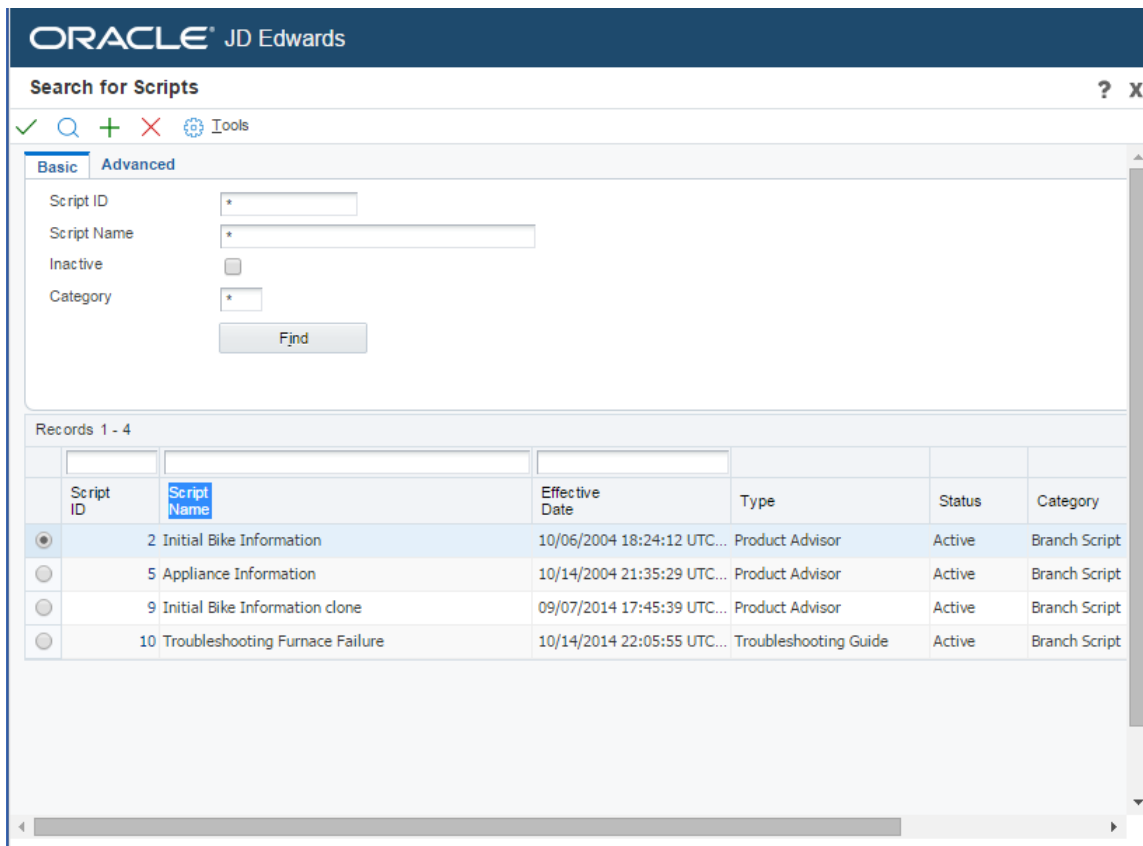


Figure 8: "Classic" display of the JD Edwards application

## Scenario 2

In this scenario, the user is out of the office, possibly in transit to another location. The user's device platform would be a mobile device, for example a smartphone or tablet. In this scenario, the user needs fast access to information, large, easy-to-click buttons, and intuitive flow. Therefore, a rendition of the application in Oracle MAF, Angular, JQuery, or Polymer framework is the most appropriate and productive form of the application. While the underlying logic and data remain the same, the application is now presented in a format that is more appropriate to the mobile environment and therefore more user-friendly.



### Initial Bike Information

1. What type of Bike are you calling about?

ROAD BIKE

MOUNTAIN BIKE

KIDS BIKE

2. What model of Road Bike do you have?

CROSSROADS

B418

IRON MAN

3. What year is your B418?

2004

2005

2006

2007

2008

4. What gender model is your B418?

MAN'S

WOMAN'S

Figure 9: Presentation of the application on a mobile device

### Scenario 3

In this scenario, the user is a service technician in a point-of-service environment using a wearable device, for example a smartwatch. The point-of-service environment is not conducive to the use of devices that are cognitively demanding, such as tablets or smartphones. However, the same application as in the previous scenarios can be used on a wearable device. In this environment, the wearable device offers the best platform to consume the data in the most intuitive format.

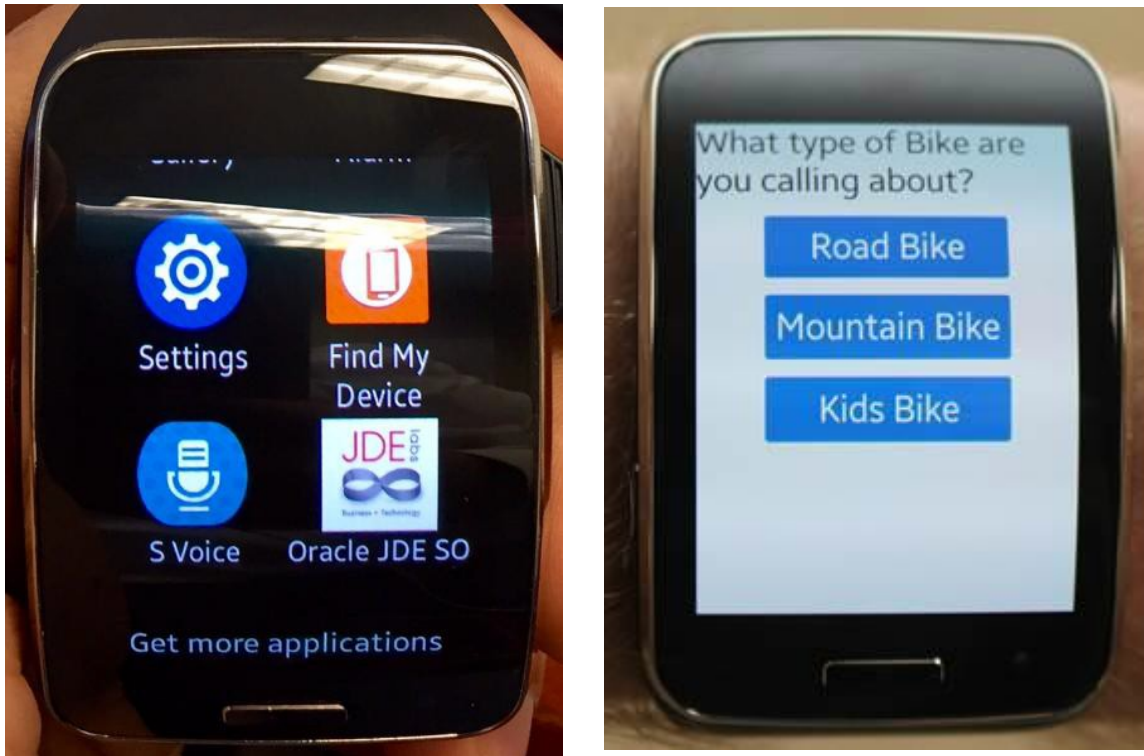


Figure 10: Representation of the JD Edwards application on a wearable Samsung Gear device

The sequence of these scenarios illustrates a progression of the presentation layer from desktop to tablet to wearable device to provide the user with the most appropriate application experience in a given environment.

## Security and Privacy Concerns with Wearables

A major concern regarding wearables is that these devices could pose a security threat, especially those devices that can collect and store data. Loss or theft of these devices could compromise the security of corporate data. Also, these devices are prone to hacking when connected to the corporate network. The ability to surreptitiously record audio and video could also lead to illicit dissemination of enterprise information and other intellectual property.

### Security and Privacy Solutions

It is important to note that many of the security and privacy concerns applicable to wearables are not new, but rather are extensions of existing security and privacy concerns from the pre-wearable era. For instance, a smartphone in an employee's pocket could easily be used to covertly record audio, either with or without the employee's knowledge. Covert video recording is also possible using legacy methods. With regard to data security, laptops, tablets, and smartphones have been holding confidential intellectual property for years, often in situations where the physical security of the device is far weaker than that of a wearable device, such as a wrist-watch that remains attached to the employee.

The good news is that for many of these security issues, mature security and privacy solutions are already tested and in place. Therefore, the first step in addressing both security and privacy concerns pertaining to wearables is to review existing corporate policies governing the use of devices and to make sure that these policies are adapted



and expanded to encompass wearable devices. Educating employees on the expanded policies will also be critical. Examples of how existing policies may be adapted include but are not limited to:

- » Clauses in employment contracts that should clearly specify appropriate restrictions regarding the recording of audio, video, and photographs in a hardware-agnostic way.
- » Existing best practices regarding data encryption, pass-code protection, and reasonable precautions regarding physical security of devices that should apply to all computing devices.
- » Employee education regarding proper etiquette when using mobile devices. For example, Google Glass might be prohibited in bathrooms, cafeterias, and research and development labs. Techniques such as geo-fencing may be used to help enforce these policies.

### Security Solutions Provided by Oracle

While some privacy and security policies must be created, disseminated, and enforced by the client corporation, Oracle takes its responsibility in designing secure wearable applications very seriously. Oracle's security strategy for wearable JD Edwards EnterpriseOne applications encompasses two high-level components:

First, the wearable applications currently in development rely on the Application Interface Services Server (AIS Server). This is the same server that is used for handheld mobile applications, and it works by providing a textual protocol for interacting with existing EnterpriseOne applications. It provides numerous security benefits automatically:

- » The AIS Server enforces the same user name and password authentication as other EnterpriseOne systems.
- » The AIS Server supports SSL encryption, rendering all upstream and downstream traffic effectively impervious to network snooping.
- » By providing a wrapper around existing EnterpriseOne applications, the AIS Server automatically enforces all existing EnterpriseOne security policies regarding applications, tables, and other objects.
- » The AIS Server automatically enforces the same session timeout used elsewhere in EnterpriseOne, generally rendering a wearable device left unattended useless to an attacker seeking to steal enterprise data.

The use of the AIS Server substantially mitigates any threat to data and integrity for all online-mode wearable applications and puts them on an equal footing with their mobile application cousins with regard to security.

Secondly, for disconnected-capable wearable applications, Oracle uses the same unified security model as for Oracle's disconnected-capable mobile applications in development. Security for disconnected applications is, by necessity, more complex because a disconnected application must keep sensitive information on the device itself, whereas a connected-only device need not store any such information between sessions.

As with Oracle's mobile disconnected JD Edwards EnterpriseOne applications, all data stored in non-volatile memory on the device (or on a tethered mobile device) is encrypted using a one-way cryptographic hash of the user's password as the key. Neither the key nor the clear-text password are ever stored on the device, and the business data can only be recovered upon entry of the correct password, even if an attacker has full access to the device's file system.

## Conclusion

Wearable Technology represents one of the major innovative technology trends in the recent times. Wearables, and especially smartwatches are unobtrusive and glanceable to an extent that is unparalleled. Thus, wearables provide even greater point-of-use access than mobile devices while at the same time liberating the user's hands, requiring low overhead, and giving the user the power to decide which alerts need immediate attention.

JD Edwards applications can be extended to a Wearable Platform for the next generation of mobile users. The following attributes of the JD Edwards architecture makes this new Wearable Platform ideally suited for JD Edwards:

- » Ease of extension of core JD Edwards transactions and data to the wearable devices using the lightweight framework of AIS (Application Interface Services or Web Services framework). This enables users to experience a continuum of functionality based on the same application and data from desktop to mobile to wearable devices.
- » Enterprise class security which is built into the JD Edwards and can be extended seamlessly to wearable devices, thereby simplifying the task of administering security roles for wearable users.
- » Integration with the rest of the Oracle stack which offers capabilities for best-in-class mobile device management and continuous improvements in security, scalability and user interface design.

Wearable devices are the perfect medium to provide a platform for our modern user interface which is based on a **Glance→Scan→Commit** paradigm. Wearables offer a platform which will afford users the ease of unobtrusive micro-interactions with their devices, allowing people to consume key information they need to make decisions and be more productive by accessing surface information with a flick of a wrist to determine which alerts to act on and which to defer for later.

Wearable devices promise numerous advantages:

- » Increased productivity: Wearables can reduce non-productive time and rework and shrink decision time-frames, thereby contributing to increased productivity of operations where the devices can be used.
- » Improved communication: Wearables, such as smartwatches and smartglasses, can facilitate communication between personnel and are being used in industries such as manufacturing, services and healthcare. Personnel are now able to connect remotely through video and can collaborate on specialized tasks with experts located in different parts of the world.
- » Increased efficiency while performing routine tasks: Wearables, such as smartglasses, can enhance efficiency for routine operations. The devices could be used for operations, such as or acting as digital badges for time entry, providing instructions while performing tasks, giving directions to a destination on a work task, training new workers, and so on.

To learn about how wearables can transform your business, contact your Oracle JD Edwards Sales Representative or Oracle JD Edwards Strategy contact.

## TERMINOLOGY

| Term              | Explanation                                                                                                                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Augmented reality | A live direct or indirect view of a physical, real-world environment whose elements are <i>augmented</i> (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. |
| Haptic feedback   | Tactile <b>feedback</b> technology which recreates the sense of touch by applying forces, vibrations, or motions to the user                                                                               |
| Andon cord        | Manufacturing term referring to a system to notify management, maintenance, and other workers of a quality or process problem                                                                              |

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