Hype Cycle for Frontline Worker Technologies, 2020

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A frontline worker's job tasks are often drastically different than those of a desk-based worker, requiring different and optimized solutions. I&O leaders responsible for mobility for frontline workers should evaluate the technologies in this Hype Cycle.

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Strategic Planning Assumption

Up to 70% of mobile and endpoint net new investments will be aimed at enabling frontline workers over the next five years.

Analysis

What You Need to Know

The COVID-19 crisis has led organizations to ask frontline workers to work in new ways or to perform new tasks. To optimize efficiency, organizations are investing in mobile technology, including wearable technologies, for frontline workers. These technologies transform the workflows in which these workers participate. Gartner predicts that up to 70% of new mobile and endpoint investments over the next five years will be for frontline workers.

For more information about how peer I&O leaders view the technologies aligned with this Hype Cycle, please see “2020-2022 Emerging Technology Roadmap for Large Enterprises.”

The Hype Cycle

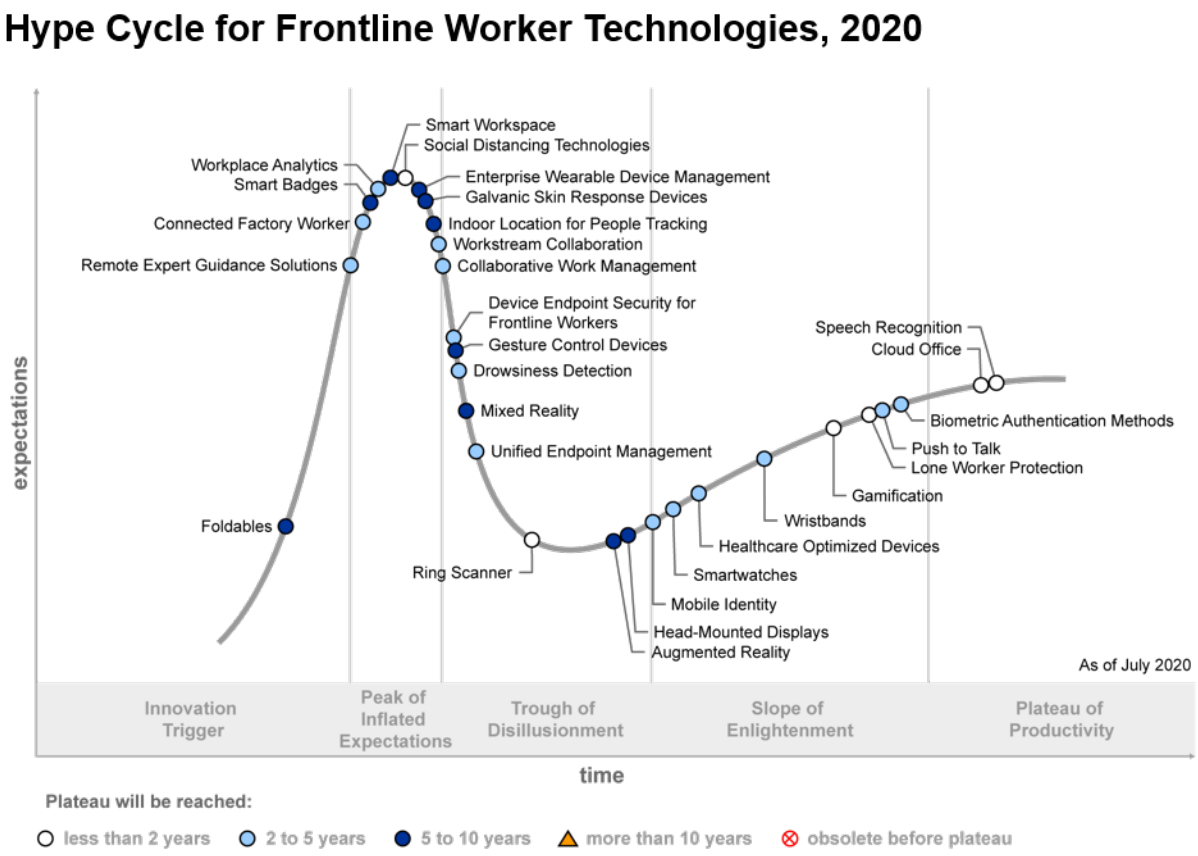
The global workforce can be broadly categorized into two segments: traditional desk-based office workers and frontline workers. Frontline workers can be segmented further into service and task workers. Service workers primarily spend their time performing client-facing activities. They typically represent the “face” of an organization to customers. Some examples of these roles are a delivery person or a retail salesperson. They need to consume information and to communicate transactional outcomes and client needs to others. Task workers are workers who primarily spend their time performing operational activities. They typically represent the “heart” of an organization. Some examples of these roles are a warehouse worker or someone who works on a manufacturing line. They need to consume information, report status and problems, access organizational knowledge, and interact with colleagues and business partners.

COVID-19 has impacted frontline workers, whether it’s understaffing; working longer hours; adapting to social distancing requirements, which may result in one engineer rather than a team of two working on a given task; or new processes for delivery drivers in which they do not collect signatures for deliveries.

Vendors are focusing on frontline workers as a growth segment, integrating frontline-friendly features into products designed with desk-based users in mind. These features include improved support for shared (shift-based) devices and more straightforward mechanisms for identity and access management, and team communication. All frontline workers share a core set of basic communication and collaboration needs but also participate in well-defined workflows specific to their role, industry, department, task and responsibility. These workflows demand extensive configurability of the line of business (LOB) apps, services and hardware they use.

The Hype Cycle contains technologies designed primarily for task workers, but it also includes some technologies designed for both service and task workers, such as Mobile Identity, Biometric Authentication Methods and Unified Endpoint Management.

Figure 1. Hype Cycle for Frontline Worker Technologies, 2020



Source: Gartner
ID: 448239

The Priority Matrix

Few technologies have a transformational benefit rating for frontline workers. Speech Recognition has improved performance and workflows for task workers, while the future of Smart Workspace with connected workers offers potential long-term benefits for both task workers and service workers.

Social Distancing Technologies and contact-tracing capabilities are likely to be requirements when frontline workers resume production and the world enters the “new normal” post COVID-19. Interest is growing in technologies that enable “no touch” experiences to reduce COVID-19 risks for frontline workers (for example, data entry [speech], access control [wireless badges and tags], hands-free UX and biometrics changing from fingerprint readers to facial recognition). However, these technologies may not deliver tangible business benefits using traditional measurements.

Cloud Office, Workstream Collaboration, Workplace Analytics and Mobile Identity are critical technologies for frontline workers. Task workers can see immediate benefits from employee augmentation through the use of wearables such as Smartwatches, Head-Mounted Displays and Augmented Reality.

In two to five years, Remote Expert Guidance Solutions will allow some service workers to achieve a wider range of capabilities, with less formal training required to do so.

Over the longer term, Smart Workspace will drastically improve performance by streamlining workflows and simplifying tasks for all frontline workers.

Figure 2. Priority Matrix for Frontline Worker Technologies, 2020

Priority Matrix for Frontline Worker Technologies, 2020

benefit	years to mainstream adoption			
	less than two years	two to five years	five to 10 years	more than 10 years
transformational	**Speech Recognition**	**Connected Factory Worker**	**Smart Workspace**	
high	**Cloud Office** **Lone Worker Protection** **Social Distancing Technologies**	**Collaborative Work Management** **Drowsiness Detection** **Healthcare Optimized Devices** **Unified Endpoint Management** **Workplace Analytics** **Workstream Collaboration**	Augmented Reality Head-Mounted Displays Indoor Location for People Tracking Mixed Reality Smart Badges	
moderate	**Gamification** **Ring Scanner**	Biometric Authentication Methods Device Endpoint Security for Frontline Workers Mobile Identity Push to Talk Remote Expert Guidance Solutions Smartwatches Wristbands	Galvanic Skin Response Devices Gesture Control Devices	
low			Enterprise Wearable Device Management Foldables	

As of July 2020

Source: Gartner
ID: 448239

Off the Hype Cycle

Smart Rings — This has had little exposure to typical frontline workers and is niche for most use cases.

On the Rise

Foldables

Analysis By: Rob Smith

Definition: Foldables are device types in which the device screen can fold at least once. Most devices have a single fold in half, so they can be used as phones and tablets or as compact devices. Devices may have large screens that fold to create two smaller screens on each side, or they could have smaller outer screens that open like books or flip upward (similar to a "Star Trek" communicator) to reveal a second larger screen. As the technology matures, Gartner expects to see devices that fold multiple times by different methods.

Position and Adoption Speed Justification: During the past year, foldables have experienced several high-profile technical issues and delays in availability. Foldables are available in limited quantities as high-end devices. However, numerous issues around screen reliability have been reported with basic use causing device failures affecting product availability to buyers. Inventories and access to reliable repairs in 2020 are limited.

User Advice: Through the next five years, foldable devices will remain a niche product due to several challenges. All challenges are pointing to limited product availability, and only then in the position of high-end/flagship devices by Tier 1 manufacturers. Users need to see a demonstrable difference in the user experience to eventually pay nearly twice the price they pay for smartphones today.

Avoid deploying any foldable device at scale until the technology matures further. Monitor device and screen improvements — specifically unboxing reviews where devices are put through extreme stress tests to determine if the device has matured enough to meet the required use case.

Business Impact: Offering a single device, instead of a smartphone and a tablet, offers the promise of lower capital and operating expenditures (opex and capex). However, a single, foldable device typically costs more than the combined costs of a high-end smartphone and a tablet. Future potential impact could be lower cost for equipment after the technology matures. The sole benefit to business today is by lowering device count to a single device from two. In the future, foldables can also be used for marketing purposes, with flexible displays attached to items such as clothing or bags for display as a user walks around.

Benefit Rating: Low

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Huawei; LG; Motorola; OPPO; Royole; Samsung

Recommended Reading: "Emerging Technology Analysis: Foldable Display Brings New Market Opportunity"

Remote Expert Guidance Solutions

Analysis By: Chris Silva

Definition: Remote expert guidance solutions provide two-way communication between a centrally located expert and workers in the field through mobile and wearable devices. Using a device camera, centralized personnel receive a live view of the field employee's environment and task being performed, allowing the expert to provide verbal guidance and visual cues that overlay the remote worker's view. Tools can capture sessions for training, post-task audit, and performance analysis.

Position and Adoption Speed Justification: Remote expert guidance is on a limited number of proven use cases that are driving wearables adoption, though the technology has been available as part of remote support and control tools for some time. An increase in imaging capabilities (simultaneous camera view, overall image and video quality improvements) along with the growth in availability and throughput of edge connectivity make the use case more approachable for more roles and for a growing number of devices. Gartner expects to see growth and evolution of this technology along the Hype Cycle to continue at a modest pace; the technology's uptake could be impacted as cost optimization measures take hold in organizations recovering from the impact of economic slowdowns due to the COVID-19 pandemic. At the same time, this technology could see broader use in more common place scenarios such as desktop and mobile device support as remote working remains in place or expands in many companies post-COVID-19.

Gartner has observed some consolidation of the enterprise wearables marked in the past 12 months, with a few notable vendors such as ODG, with a 20-year history in the wearables market, cease operations due to sustained but low-volume demand for hardware, this will dampen the growth in related software areas such as remote expert guidance, but will not materially change the future prospects of this technology given its potential for use on nonwearable devices. Growth in adoption of these tools will remain relatively modest and this will have a dampening effect on new interest driven by a need for hands-on support being delivered between employees that are distributed geographically.

User Advice: At present, use of these tools in enterprise is limited to supporting highly technical field service, manufacturing and inspection tasks driven by the high cost of maintaining expertise in the field and failures due to human error. In 2017, Gartner cited the cost and availability of upgrading hardware in the field to support this use case. With hardware more readily available, penetration remains low due to the relative lack of familiarity with remote expert guidance use cases. Adoption should remain relegated to drive one of two outcomes; increased utilization of scarce human resources and the extension of those resources' reach through the use of remote expert guidance for less technical field teams, or the reduction in time and cost.

Expanding the use of this technology as part of standard remote support may broaden its appeal when hands-on support for users and/or highly technically complex configurations must be supported remotely. Remote expert guidance capabilities of remote connectivity and control tools (RescueAssist, TeamViewer etc.) though these tools offer a subset of the interactive functionality of dedicated remote expert guidance tool.

Business Impact: Gartner lists the current benefit rating as moderate due to its potential to radically improve field service metrics, and a moderate improvement of support operations for end users amid a surge in remote working. The technology can drive cost avoidance through centralizing staff with skills in short supply allowing a less-skilled field force to conduct on-site work with central staff providing guidance using these tools. In cost-avoidance scenarios, Gartner has witnessed examples in highly technical, custom manufacturing where the use of expert guidance tools dramatically reduces the rate of errors that can halt production.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Fieldbit; Fujitsu; Google; Librestream; OverIT; Pointr; PTC; Scope AR; Ubimax

Recommended Reading: “Forecast Analysis: Wearable Electronic Devices, Worldwide”

“Use Wearable Technology to Enhance Frontline Worker Productivity: Field Service Management”

At the Peak

Connected Factory Worker

Analysis By: Simon Jacobson

Definition: Connected factory workers are capable of using various digital tools and data management techniques to improve and integrate their interactions with both physical and virtual surroundings. They are able to make faster and better decisions that enable and optimize a process or set of processes that they participate in.

Position and Adoption Speed Justification: The pandemic is casting light on the connected factory worker concept, raising its hype and accelerating the time to plateau. Factory staffing concerns and innovation opportunities have compelled organizations to pivot some investments toward the enhancing the operator experience. Lower staffing levels and social distancing rules accelerate the need to have factory workers better integrated with their physical and virtual surrounding. Removing manual processes and communications can create an awareness and continuity that improves knowledge management, flexibility and speed.

The concept of the connected factory worker is hyped, and no single dominant technology has emerged. Organizations are focusing on short-term, site and function-specific needs. These include using immersive experiences for quality and maintenance tasks, connecting with employees that are

not able to be on-site, or wearables for safety management. Digitizing gemba walks and capturing observations are also in scope. Immersive experiences, workflow collaboration tools, plus investments in mobility, various endpoints, and sensors all contribute to connecting workers and their surroundings. The long-term impacts and value of the connected factory worker through access to knowledge and automation are yet to come.

The pandemic has only exacerbated concerns of knowledge and skills erosion that have ebbed and flowed for the past 15 years. Also, the demand for factory skills and capabilities far outweighs supply. The positive is the groups interested in these technologies have widened from manufacturing functions to include HR, for example. Both, along with site management and IT, are working to fill glaring strategic gaps to onboard and upskill factory workers beyond their core skill set so they can fully exploit new tools and techniques as part their daily routines This presents opportunities for the provider market to create partnerships with customers and other vendors to create IP, widen platforms (inclusive partnering with industries), and integrate some point solutions.

User Advice:

- Achieve quick wins with remote expert guidance that accelerates the development of a broader skills arsenal through on-the-job training. Prepare to, over a longer time frame, allocate resources and partner with HR to successfully align desired competencies and skills requirements for both salaried and hourly workforces.
- Meet the diversity of skills and capabilities in factories by developing a broad array of use cases that tie to specific processes that are unstructured or previously executed based on tribal knowledge. Changeovers and equipment settings are an ideal starting point.
- Do not let data outweigh operator intuition. Keep the focus that the connected factory worker requires a solid foundation of lean and problem-solving skills.
- Develop and deploy specific metrics for labor productivity. Integrate these with the existing portfolio of metrics used for tracking manufacturing performance.

Business Impact: The fluctuations of labor availability and costs during the pandemic vary by market and are opportunities to integrate workers with both physical and virtual environments. This is also a big pivot too:

- **Risk: Medium —** Risk levels elevate when myopic planning and singular digital experiences are designed, and multiple personas are not considered. The level of risk also increases when providing operators tools to build their own experiences and redefine standard work without coordination.
- **Technology intensity: High —** Digitizing tacit knowledge and manual process might be the initial focus, but contextualized data, refocused integration strategies and investments in AI for technologies to adapt with the operator cannot be overlooked.
- **Process change: High —** Anticipate refactoring recruitment, retention and training programs. Also, cross-site collaboration will alter significantly. A streamlined approach to standard work should also not be overlooked.

- **Organizational change: High —** This is a fundamental change in behaviors and skills. It is more than using AR, for example, to augment the worker. The integration of information, data, people and processes demands individuals with specific IT and OT expertise. Ideally a blend of engineering and operations expertise is desired, along with an understanding of reliability, security and safety objectives.
- **Competitive Value: High —** Fluctuations in labor availability elevate the importance of retaining and harvesting the corpus of knowledge that can integrate workers with their surroundings to provide reliable output.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Sample Vendors: Augmentir; Bennit AI; Drishti; Microsoft; Parsable; Poka; PTC; Rever; Tulip; Webalo

Recommended Reading: "Survey Analysis: Know the Benefits at Different Phases of Digitizing Manufacturing Operations"

"Cool Vendors in Manufacturing Operations"

"Cool Vendors in Manufacturing Operations, 2017"

"Top 10 Strategic Technology Trends for 2020: Democratization"

"Use Gartner Scenarios to Tackle Culture Barriers in Manufacturing Organizations"

Smart Badges

Analysis By: Tracy Tsai

Definition: Smart badges are miniaturized integrated circuit cards, as well as wristbands or other wearable form factors, that have built-in sensors and the ability to transmit data wirelessly. Examples of sensors are infrared sensors, accelerometers, microphones and scanners. Unlike access management smart cards or smart IDs, smart badges are wearable devices that provide advanced features, such as location-based contextual services and analytics, to improve workplace communication and operational efficiency, and employee well-being and performance.

Position and Adoption Speed Justification: The adoption of smart badges continues to grow due to the benefits of customizable context, easy-to-see large display, added security functions and employee convenience. A common use case is security authentication for single sign-on (SSO) within organizations for access control. With E Ink's technologies, smart badges for event visitors can be repeatedly used with customizable context on smart badges' display. Other than identification and authentication, using smart badges for mobile payments provides added convenience to employees. Emerging organizational use cases focus on increasing efficiency, workplace accessibility, employee safety and improving employee performance. Smart badges

enhance employee experience at workplaces, which results in higher employee retention. Employees' user experience can be applied in many other situations, i.e., patient, customer, etc. Smart badges for employee analytics record and transmit data about employee movement, interaction with colleagues, communication patterns and how energetically employees are engaged in group discussion. Companies can analyze this data to propose improvements to organizational communication and to quantitatively evaluate efficiency. Employees can use the analytics to achieve their personal goals by comparing with benchmark levels. Another area of potential benefit (yet difficult) is the ability to easily integrate with sources of data across the enterprise, environment and third-party systems. To analyze employees' specific situation through multiple sources of data in real time, it will still take time for the innovation profile to become mainstream.

User Advice: IT leaders should evaluate smart badges to determine if they enable data analytics that improves organizational effectiveness. IT leaders should work with line of business (LOB) leaders to identify which of their issues and objectives can be assisted by apps for smart badges. Because badges are worn by employees in the workplace, they can be an effective endpoint device for tracking location, authentication, scanning product codes, checking information, monitoring task status and more. Examples of use cases are:

- **Restaurants —** POS systems require bartenders and waitstaff to swipe a card to access them but smart badges do not have to be swiped, thus saves time. Instead, the worker is identified when in close proximity. Choose smart badges that detect when they are being worn and require workers to reauthenticate themselves if the badge (or wristband instead of badge) is removed.
- **Healthcare —** Smart badges can provide location-contextual services to staff for improving quality care. For example, alerting the nearest available staff member on where to go when urgent help is needed.
- **Event management —** Smart badges give organizers a new level of insights about what occurs at their events, the attendees, and visitors and can provide more personalized experiences. For example, attendees can check the event schedule directly on the smart badges and the organization can change the display context for a notification or a new information update if there is any change in the meeting schedule. Smart badges can work seamlessly with event organizations' smart kiosks and smart devices, enabling consumers to log in and view meeting content that is customized for each person. Career Zoo's smart badging system allows delegates and exhibitors to share content with each other. Their data can be used for analysis that helps avoid crowds in certain areas for better safety and enhanced customer experience.
- **Retail —** Improve the customer experience by being able to immediately check price or inventory with the smart badge.
- **Construction —** Fall sensors can be integrated into the badge to alert management or monitoring services.

When implementing smart badges, clearly explain how employee privacy is protected. Companies need to let employees understand in advance what's being tracked and analyzed in order to maximize participation.

Business Impact: Smart badges are emerging as a new endpoint device for the connected worker. They not only provide value beyond authentication, making it easier for employees to access information, but can also be part of new approaches to increase digital workplace effectiveness and efficiency. The overall business impact can be high to transformational by enabling new ways of doing business across vertical industries.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: E Ink; Group Dynamics; Hitachi; Humanyze; Microchip Technology; Realtek Semiconductor; SoloProtect; Zebra Technologies

Recommended Reading: "Magic Quadrant for Indoor Location Services, Global"

"Market Guide for Indoor Location Application Platforms"

"Critical Capabilities for Indoor Location Services, Global"

"Digital Workplace Infrastructure and Operations Primer for 2020"

"Take a Human-Centric Approach to Empower the Workforce With AI"

"Operationalize an Instrumented Workplace With Analytics to Support Digital Business"

Workplace Analytics

Analysis By: Dan Wilson

Definition: Workplace analytics are aggregated insights derived by analyzing contextual data from applications, users, endpoint devices, processes and networks to improve technology usage/adoption, employee engagement, user experience, system performance and behaviors that promote collaboration and productivity. Data is collected through application APIs/SDKs, unified endpoint management (UEM) tools and specialized agents installed on endpoints.

Position and Adoption Speed Justification: Workplace analytics remains in the Peak of Inflated Expectations and is growing in availability from feature inclusion in UEM and similar tools. While mostly used by IT and HR, line of business leaders are now using workplace analytics to measure and improve teamwork and overall performance. Workplace analytics tools can provide insights at various levels — device, employee, team/department and organizationwide. Key challenges are the heterogenous mix of data sources, inconsistent data aggregation methods, differences in metric definitions and calculation methods, varying expectations by role, and compliance with privacy norms and regulations.

Prepandemic, Gartner saw steady interest in an objective approach to measure and improve the related categories of employee experience, engagement, collaboration and productivity. The shift to

mandatory remote work increased interest in providing insights into employee sentiment, but staff and budget limitations will delay adoption.

User Advice: Although most tools currently use basic email/calendar metadata, integration with UEM and digital experience monitoring (DEM) tools are driving additional workplace analytics capabilities. These include executing synthetic transactions, measuring application execution time, collecting event logs from endpoint devices and pulling customer satisfaction data from IT service management tools. Gartner anticipates continued expansion into enterprise social collaboration platforms, conferencing and collaboration tools, license management tools, and SaaS management platforms. Large enterprises with broad technology portfolios see the most value in gaining visibility into data that has traditionally been difficult to gather without advanced scripting, remote controlling into devices or pulling reports from multiple consoles. The most common requirements include:

- Monitoring the adoption of technology, practices or new ways of work
- Measuring the organizational and technical impact of major changes (move to remote work, major application upgrades, cloud office migrations, allowing BYOD, etc.)
- Collecting events, logs, telemetry from devices, aggregating the data and applying AI/ML to spot anomalies and trends
- Highlighting widespread issues, and helping to prioritize resolution and prevent recurrence
- Optimizing costs by better aligning technology (software entitlements) to use case

To maximize the benefits of workplace analytics, application, digital workplace, HR and I&O leaders must:

- Consolidate and align requirements to corporate objectives.
- Minimize potential legal and compliance issues by involving those departments in plans to implement tools.
- Investigate capabilities that are available or on the roadmap of already-owned DEM, UEM and other monitoring tools, and partner with strategic vendors to expand capabilities before buying other tools.
- Avoid comparing scoring/progress with other companies and across tools; rather, establish and measure changes internally.
- Clearly communicate to employees that these are not surveillance tools.

Business Impact: Workplace analytics help aggregate disparate data sources (input) and the use of AI/ML to generate meaningful decisions (output). For example, with workplace analytics, it is possible to identify a collaboration and employee satisfaction issue caused by meetings being repeatedly scheduled outside of working hours for one or more parties in a remote workforce that crosses multiple time zones. Workplace analytics enable organizations to:

- Measure teamwork and collaboration at and across various organizational levels

- Personalize services and technology to different worker segments
- Identify gaps and opportunities in process, skill set and technologies to establish an instrumented workplace
- Measure employee engagement by analyzing work patterns between teams on cloud office and workstream collaboration platforms
- Extend the digital workplace to frontline workers with added transparency into device and application experience

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: 1E; Aternity; B2M; GSX; Lakeside Software; Microsoft; Nexthink; StatusToday; SWOOP Analytics; VMware

Recommended Reading: "Getting Value From Employee Productivity Monitoring Technologies for Remote and Office-Based Workers"

"Use DEM to Understand and Enhance Your Employees' Work-From-Home Experience"

"Operationalize an Instrumented Workplace With Analytics to Support Digital Business"

"Eight Steps for Modernizing Employee Communications in the Digital Workplace"

"Enablement Mindset Is the Missing IT Ingredient to Improve Workforce Digital Dexterity and the Employee Experience"

Smart Workspace

Analysis By: Gavin Tay; Annette Jump; Rashmi Choudhary

Definition: A smart workspace exploits the growing digitalization of physical objects brought about by the Internet of Things (IoT) to deliver new ways of working, scheduling resources, coordinating facility services, sharing information and collaborating. The programmability of physical environments enables smart workspaces to work contextually with mobile devices, software applications, enterprise social graphs and artificial intelligence (AI) to improve workforce efficiency and effectiveness. Any location where people work can be a smart workspace.

Position and Adoption Speed Justification: Digital workplace strategies that focus on facilities modernization, more agile work environments and the value of employee experience continue to shape interest in smart workspace technologies. We see synergies between 10 trends:

1. The IoT
2. AI-related technologies

3. Digital signage and electronic whiteboards
4. Indoor mapping
5. Smart buildings, including trends in integrated workplace management systems (IWMS)
6. IWMS platforms (as they move into IoT-based services)
7. Remote working/collaboration and virtual workspaces
8. Motion sensors
9. Wearables
10. Facial recognition

A smart workspace is a key aspect of a digital workplace initiative, as it includes strategists involved in facilities and real estate as key stakeholders. It applies to physical environments such as:

- Building and campus environments, including in-building open spaces
- Co-working spaces
- Office and desk spaces
- Conference rooms
- Huddle rooms (small spaces where people congregate)
- Retail and shop floors
- Manufacturing assembly lines
- Home spaces (workspace resulting from instituted remote work given COVID-19)

“Things” participate in a smart workspace. Examples include applications and devices such as electronic whiteboards, building interfaces (HVAC), large digital displays, smart badges, workstations, mobile devices and wearables.

As workers return to work post-COVID-19, we’ll expect organizations to take full advantage of a smart workspace. It will require organizations to revisit design strategies to include methods for gaining a better understanding of how people participate in physical spaces or adhere to social distancing. Such insight can create new capabilities related to seating and room allocation, access management and wayfaring.

Adoption rates will vary based on organizations’ requirements to support flexible work models that optimize the physical and interactive aspects of places and things (as well as employees’ privacy concerns).

User Advice: Enterprise strategists focusing on a digital workplace strategy and digitalized business processes should follow smart workspace trends and look for deployment opportunities, such as meeting rooms, huddle rooms and in-building open spaces. Emerging applications will

expand beyond traditional productivity scenarios to include situations that are more industry- and process-specific. Examples derived from COVID-19 include: an insurance professional using a remove digital pen that interacts directly with back-end processing systems; or a patient being remotely monitored via a wearable interface in their home that interfaces with diagnostic systems and advises healthcare professionals to improve care delivery. IT organizations will need to work much more closely with real estate and facilities teams, and vice versa. Identity, access management, privacy and security teams will also play a critical role. Anonymizing data is key to safeguard privacy expectations and help promote adoption of new services.

Additionally, electronic whiteboards are becoming integrated with traditional collaboration and content software systems, providing more opportunities for experimentation. Meeting artifacts can be better captured and connected to digital workplace graphs, to become more widely searchable. Beacons and sensors placed in key locations within a workplace can interact with mobile apps to deliver personalized information to workers, based on proximity. These can be used to improve employee learning, provide relevant information on products, or communicate safety procedures based on employee location. As workers return to work post COVID-19, contactless authentication using facial recognition and QR code scanning will become the norm.

The smart workspace will emerge at an uneven pace as organizations prioritize potential solutions independently of one another. For instance, building upgrades may take longer than expected, and some market sectors will be laggards in terms of smart workspace adoption. Localization needs will also influence smart workspace adoption.

Business Impact: Instituted remote working resulting from COVID-19 has diversified smart workspaces even further. They now span home spaces, to improved employee productivity and cultural perception of the workplace by workers, to improved customer experience as employees make better use of smart workspaces to serve clients. The results of these changes will often be a reduction in cost because office utilization data will guide decisions about what types of workspace are most conducive to employee effectiveness.

The digitalization and programmatic evolution of places and things will impact IT methodologies related to system design, requiring new skills for design teams to understand how people use places and things. Smart workspaces will also have organizational impacts as traditional software teams now need to work with facilities management teams in ways not previously envisioned. The digitalization and programmability of the workplace will create new integration opportunities. For instance, smart workspace activities will signal information to digital workplace graphs and smart machines, and vice versa.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AgilQuest; Condeco; Estimote; Eutech Cybernetic; Microsoft; Oblong; Planon; PRYSM Group; Spacewell; Trimble

Recommended Reading: “Top 10 Strategic Technology Trends for 2019: Smart Spaces”

“Crafting Workspaces That Enhance the Employee Experience”

“Market Guide for Integrated Workplace Management Systems”

“Market Guide for Resource Scheduling Applications for the Workplace”

“Emerging Technology Analysis: Building Successful Solutions for Smart Spaces”

“Market Insight: Choose the Right Technology to Dynamically Track People Within a Smart Space”

Social Distancing Technologies

Analysis By: Leif-Olof Wallin; Nick Jones

Definition: Social distancing technologies help to encourage individuals to maintain a safe distance from each other. Some of these technologies and solutions also provide contact tracing capabilities if an individual is discovered to be infected. They can be implemented in many ways, including an app on a smartphone, as a feature of a location tracking system, a dedicated wearable device or using observational tools such as video analytics.

Position and Adoption Speed Justification: Social distancing technologies have emerged as tactical solutions to help organizations and individuals deal with the COVID-19 pandemic. Many of these technologies use wireless systems for proximity detection, but in principle, any technology that can measure location or proximity can be used to support social distancing. All such systems are imperfect, and face challenges such as accuracy, reliability, user acceptance, privacy concerns and, in the case of smartphone solutions, the challenges of supporting an app on a very wide range of consumer devices. However, despite these challenges, we expect them to be a useful tactic to reduce risk in the pandemic. As most such systems are based on modifications of existing technologies, we expect rapid maturity — within two years.

User Advice: Organizations that need to manage risk as staff return to work after the pandemic should consider social distancing technologies because, despite their limitations, any form of risk reduction is better than none. Industrial, construction and blue-collar workers who may not carry smartphones in their normal working environment may benefit from dedicated proximity-warning devices, or equipment such as smart hard hats that have been modified to track proximity. Staff in office-based environments may benefit from app-based solutions. Organizations with comprehensive endpoint management in place will be best equipped to rapidly deploy these tools onto users’ devices with minimal friction, as they typically have UEM technologies and a well-defined hardware base. Most organizations will use social distancing technologies in conjunction with processes such as reducing the number of employees in offices and establishing behavior and visual guidelines. Some app-based solutions may be superseded or augmented by national social distancing app initiatives, or apps from megavendors such as Google and Apple.

Social distancing technologies cannot provide a guarantee against infection, so organizations should set realistic expectations for the effectiveness of such tools. All are likely to generate false negatives and positives. It’s likely that app-based systems will be less accurate than dedicated wearables. Those deploying the technology should also be transparent about what personal data is

stored, collected and retained by such systems and how it will be used for tasks like contact tracing. However, despite the technologies' limitations, we expect many organizations will feel that some support for social distancing is better than none, and additionally some may find their lawyers recommend them to reduce potential liability.

Business Impact: It's easier to apply social distancing technologies in situations where the organization, sometimes in cooperation with a union, can influence individuals and the equipment they use, e.g., by providing smart badges or standard smartphones. Situations include factories, warehouses and some offices. Effective application of social distancing technologies is much more difficult when dealing with a wide range of individuals in the general population, e.g., customers at retail outlets or in showrooms, or visitors to venues such as museums. Challenges in the latter area include privacy, convincing individuals to adopt a solution, and supporting apps on a wide and uncontrolled range of smartphones. Social distancing technology will be one part of a multidimensional strategy that will include tactics such as behavioral guidelines, new working practices and controlling the number of visitors to venues. Some of these solutions can be used for additional use cases, like hand-washing compliance. In some situations, investment in social distancing technology can also be part of a mitigation strategy against future litigation for not taking proper care of employees and customers.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: AiRISTA Flow; Apple; Estimote; Fujitsu America; Google; Kiana; Radiant RFID; Samsung Electronics; Sonitor Technologies; Zebra

Recommended Reading: "Manage Social Distancing and Contact Tracing With Location-Aware Technologies and Devices"

Enterprise Wearable Device Management

Analysis By: Chris Silva

Definition: Enterprise wearable device management is the set of management functions to centrally monitor, update and configure wearable devices, such as head-mounted displays (HMDs), VR headsets, smartwatches and other body-worn sensors. These tools are commonly used by end-user computing (EUC) teams and exist as a subset of management capabilities in unified endpoint management (UEM) tools, although some devices require proprietary or stand-alone tools for management.

Position and Adoption Speed Justification: Gartner has witnessed continued and gradual growth in enterprise interest in wearable device hardware. Rollouts remain isolated to specific roles or tasks, and are often small when compared to other endpoint classes such as PCs and mobile devices. Many of the current use cases are driven by efforts to modernize the tools with which frontline workers are equipped, with wearables being a central component of modernizing those tools for such roles. Apart from devices based on existing and widely supported OSs like Android

and Windows, there has been little growth in device- or vendor-specific management capabilities by the UEM vendors, due to low demand. Gartner sees the enterprise wearable device market as one that is not yet at a maturity level where centralized management of wearables represents large operational savings.

An expected focus on cost optimization in the latter half of 2020 informed the decision to slow the movement of this technology on the Hype Cycle to a five- to 10-year window. This reflects the potential dampening effect that cost controls may have on wearable deployments.

User Advice: As wearables enter the business, the endpoint computing teams are the ideal group to manage these devices, ideally using existing UEM tools. Use of incumbent management tools will drive rapid time to benefit for wearable deployments by minimizing the overhead cost of maintaining multiple consoles to manage wearables alongside PCs and mobile devices. In cases where a proprietary or stand-alone management tool is offered, due diligence on the solution vendor's stability is recommended, along with consideration of existing tools' capabilities to manage these devices, as Gartner sees organizations beginning to do today.

Business Impact: Deploying wearable technology to frontline workers has the potential to drive benefits that far exceed the incremental improvements achieved by modernizing client computing technology for knowledge workers. Due to the continued evolution of this market — where vendors and hardware can change with little notice — and the immaturity of wearable deployments in enterprises, it is critical to maintain a central, aggregated view of the devices to track performance and usage. It is also critical to maintain a set of analytics data on each device type or class. Invest in a UEM tool capable of managing wearables to drive better reporting of elements of device health (such as battery levels, to drive optimal device rotation across a fleet of devices). This will minimize the operational overhead of multiple management tools and the cost of duplicative device management licenses. Tap into the analytics potential resident in an increasing number of UEM tools to better understand emerging wearable use cases and drive continual improvement.

An increasing number of wearable devices support direct management, not requiring the conduit of a tethered device to access the wearable. While direct management is not the only construct for managing wearables, Gartner expects it to emerge as the primary and preferred method for management of devices, replacing management via tethered device. Gartner expects this trend to mirror the direct, wireless sync capabilities of smartphones and tablets that evolved away from requiring tethered synchronization and backup.

Benefit Rating: Low

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: 42Gears; Augmate; BlackBerry; Microsoft; MobileIron; Samsung SDS; SOTI; VMware

Recommended Reading: "Forecast Analysis: Wearable Electronic Devices, Worldwide"

“Use Wearable Technology to Enhance Frontline Worker Productivity: Field Service Management”

“Peer Connect Perspectives: Implementing Wearables Within an Organization”

Galvanic Skin Response Devices

Analysis By: Anshul Gupta; Roberta Cozza

Definition: A galvanic skin response (GSR) device, also known as electrodermal activity (EDA), is used to measure electrical conductivity of the skin to help understand a user’s physiological and psychological condition. The electrophysiological signal is generated by the sweat glands and sweat may cause measurable variations in conductivity and resistance, though vascular dilatation and constriction may also contribute. These sensors differ from perspiration analysis patches, which use different hardware and are exclusively focused on sweat analysis.

Position and Adoption Speed Justification: GSR sensors alone can only track emotional arousal but tracking degree of emotions or quality of emotion requires combination with other complementary technologies like EEG (electroencephalography), ECG (electrocardiogram), EMG (electromyographic) sensors, audio and video sensors. New use cases beyond emotion tracking, lie detection and facial expression are possible with the integration of GSR sensors with other technologies. Fatigue and stress levels can be measured by integrating GSR sensors with heart rate, temperature and respiration rate sensors. Similarly, integrating with audio- and video-based emotion tracking sensors will help measure effectiveness of marketing campaigns.

Though GSR sensor’s size continues to contract, their adoption in the mobile and wearable devices remains limited due to reluctance to use multiple sensors and lack of general-purpose use case. GSR sensor as a technology continues to evolve but struggles to match user’s expectations leading to limited adoption.

User Advice: GSR sensors evolved from two electrode form factors to small sensors easily integrated into a small form-factor-like ring to bring new use cases supporting more natural, mobile and wireless applications. However, need of a combination of sensors to build effective use cases adds challenge of integrating data and interpretation. Multimodel technology solution also raises costs and impacts device size expectation in case of wearable devices. GSR sensors measure skin conductivity so effectiveness is dependent on placing sensors on the tip of fingers, between the fingers, palm or bottom of the feet.

Business Impact: Given the placement of GSR sensors, requirement of multimodel technology, their applications or uses cases are more in the areas of health-related benefits, treating patients and assistive care. However, a GSR-sensor-equipped device will also find use cases in the areas of emergency services, professional sports and public transportation. GSR-sensor-equipped devices could be used within healthcare to monitor and treat patients suffering from trauma, depression, phobia or mental health problems. Understanding what causes a person to feel happy or sad can be used during treatment or aftercare. GSR sensor equipped devices can be used monitor, manage and prevent epileptic seizures.

GSR sensor equipped devices could also find use cases for emergency responders, fire personnel and police/law enforcement officers to enhance performance and safety. Employees working within public transportation, such as airlines, trains and buses, could also use GSR sensor equipped devices to be alerted for stress and fatigue levels to better serve and maintain public safety. Similarly, GSR sensors can be used to monitor stress, fatigue and performance in professional athletes. Other use cases include tracking of emotional responses to assess interactions with consumer product for marketing, usability testing purposes.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Empatica; Mindfield Biosystems; Moodmetric; NeuLog; Sentio Solutions; Shimmer

Recommended Reading: "Market Trends: How AI and Affective Computing Deliver More Personalized Interactions With Devices"

"Competitive Landscape: Emotion AI Technologies, Worldwide"

Indoor Location for People Tracking

Analysis By: Tim Zimmerman; Annette Zimmermann

Definition: Many enterprises need to track employees for safety or productivity purposes. Vertical market indoor requirements for people tracking also include applications for customers, employees, infants or eldercare and, depending on the required outcome, each use case may require a different technology to achieve the goal.

Position and Adoption Speed Justification: Tracking people is different from tracking "things." When a tag is close to the human body, the energy necessary to "excite" a passive tag or to "beacon" from an active tag may not be enough to communicate. Depending on the position of the human body or the proximity of the tag to the body, the energy used for communication may be absorbed or blocked. The "tag" can be in many different shapes or sizes including wristbands, fobs, badges or smartphones. Depending on the frequencies used, which can range from 125 kHz to ultrawideband, the application may actually "lose track" of a person if the right technology is not selected.

While healthcare is a high-visibility market for people-tracking solutions to track patients, doctors and nurses, industrial markets including factories or construction sites are looking at this technology for employee safety and anti-collision purposes (with equipment such as forklift trucks). People-tracking solutions can also be used for process optimization when employees are performing identified tasks.

For years, vendors have tried to use either the same technology to track people and things or use a specific technology for a siloed use case. Enterprises were forced to evaluate the risk associated with being able to track people at less than 100% of the time. Some applications were able to accept the risk, typically in noncritical scenarios where safety or loss of life were not part of the decision process. Others were required to implement separate overlay technologies dedicated to tracking people and some projects were deemed unable to be implemented either because of the cost or lack of ability to achieve necessary business outcome.

Today, advancements in technologies are dedicated to addressing the issues associated with people tracking as well as vendors aggregating the input from multiple technologies in an effort to eliminate redundant infrastructure requirements.

User Advice: Enterprises that need to use location information for people tracking including line-of-business vertical markets such as retail, healthcare and the service sectors such as real estate, should evaluate the indoor positioning technology capabilities and business cases. Safety use cases in manufacturing factories or distribution centers may require granular location as well as movement (direction) data in order to prevent collisions.

Enterprises must identify the use case including the environment and the specific outcome that is needed. The selection of the right technology is imperative to ensure that the application does not "lose track" of the person before they are out of range of the technology to reestablish the location within the environment. Technologies such as Wi-Fi are used for proximity tracking where the use case does not require granularity. Frequencies such as 13.56 MHz, passive UHF, BLE or UWB are often used for zonal tracking when they are integrated into ID tags, wristbands or security badges that detect where employees are at a specific time and date. Other frequencies such as 433 MHz will go through the human body and are best when maintaining contact is imperative.

Business Impact: Surveyed end users reported that 95% of enterprises looking to track assets also wanted to track people as part of a cohesive solution. From a safety standpoint, not being able to track people in dangerous situations or environments results in not only avoidable injuries but also loss of life. In the U.S., some states are adopting personnel emergency notification or location requirements for industries such as hospitality and healthcare to ensure worker safety. From a location standpoint, retailers want to know where customers are going within the store environment, while manufacturing and traditional office environments are using the information for process optimization.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: AiRISTA Flow; Gozio; GuardRFID; HID Global; Juniper Networks (Mist Systems); Quuppa; Zebra Technologies

Recommended Reading: "Magic Quadrant for Indoor Location Services, Global"

"Critical Capabilities for Indoor Location Services, Global"

“Market Guide for Indoor Location Application Platforms”

“When and Why Enterprises Should Implement RFID to Track Critical Assets”

Workstream Collaboration

Analysis By: Mike Gotta

Definition: Workstream collaboration tools create a persistent chat-based workspace that helps groups coordinate shared work activities. Tools integrate direct and group messaging, alerts, activity streams, files, tasks, bots, search, meetings (audio, video) and applications into a channels-based experience.

Position and Adoption Speed Justification: Workstream collaboration (WSC) tools are best used to coordinate project- or process-related teamwork. Business use cases include project management, service and support, sales, marketing, and operational scenarios. Workstream collaboration improves team communications and coordination using channels to unify interaction with applications, tasks and content. As products include AI-related services, greater levels of collaboration automation and a broader set of use cases will emerge.

User Advice: Evaluate workstream collaboration technology for use by groups and teams whose work activities are conversationally driven, with dynamic workflows and that are geographically dispersed. Growing adoption of WSC tools can lead to ill-suited use cases, creating change management burdens and weakening business results. While a strong solution for remote work in response to COVID-19, organizations should provide contextual training and information on how to use WSC tools for their particular role and work activity (versus generic tech learning). Add-on apps can also help with team creation, usage, and task coordination as third-party vendors fill tool gaps. Adopters of workstream collaboration solutions report that onboarding new team members is relatively easy; however, etiquette takes time to establish and effective use can require team members to work in new ways, which can require a range of enablement services to improve adoption.

Business Impact: Workstream collaboration tools improve teamwork across a variety of business activities. With the rise in remote work, there has been significant acceleration to deploy these tools to create a common activity hub. WSC tools will become as vital to employees as email. As WSC tools are used more to automate work activities, the operational and logistical benefits will continue to broaden as well.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Cisco; Google; Mattermost; Microsoft; Slack

Recommended Reading: “Market Guide for Workstream Collaboration”

“Adoption of Meeting and Workstream Collaboration Solutions Spikes in Response to Coronavirus (COVID-19) Pandemic”

“Forecast Snapshot: Workstream Collaboration, Worldwide, 2019”

“A 6-Step Checklist for Effective Deployment of Microsoft Teams in the Digital Workplace”

“Embrace Workstream Collaboration to Transform Team Coordination and Performance”

Collaborative Work Management

Analysis By: Nikos Drakos

Definition: Collaborative work management tools support business users in work planning and execution. They combine task, timeline, resource, workflow and project planning with conversations, content publishing, reporting, analytics, dashboards and automation.

Position and Adoption Speed Justification: Collaborative work management (CWM) tools focus on planning and work modeling via tasks, timelines, and workflows. But they also support conversations, notifications, dynamic reports and information sharing, to ensure that every participant has an up-to-date view both of plans and the state of execution. This is suitable for an agile and iterative approach to work execution that is accessible to teams of business users.

Vendors such as Asana, Atlassian, Hive, monday.com, Smartsheet, Workfront and Wrike provide specialist CWM products. In addition, vendors of conventional and adaptive project management and business process management products are adding more flexible, dynamic and collaborative capabilities. However, these tools for the most part target professional planners and process modelers. CWM tools often lack the sophistication that such professional users require (e.g., resource and budget management or process modeling). This trade-off, however, is the defining characteristic of CWM tools that makes them accessible to general business users.

User Advice: The business impact of collaborative work management can go beyond the efficiency gained from either managing or executing preplanned work. Application leaders can work with business colleagues to address one of the key problems of the modern workplace: Easing the burden of managing nonroutine work, especially when carried out by workers often working remotely and acting with a degree of autonomy.

Application leaders should anticipate and address challenges from culture, behavior and skills requirements by starting with deployments where working transparently and collaboratively are already the norm. Where transparency and collaboration do not yet happen naturally, CWM deployments should be part of a broader digital workplace program. In this way, it is possible to deal systematically with work design and change management issues.

Collaborative work management also raises new governance questions including access rights to work management capabilities in order to ensure consistency, quality and reuse. From a governance perspective, CWM should be treated as “citizen development.”

CWM tools are proliferating through discretionary spend in different departments raising questions about technology redundancy and the need to embark on application rationalization and consolidation as their use expands. At the same time, customers that enjoyed low-cost entry pricing need to keep control of their costs as vendors modify their pricing models under pressure from their own investors. Market consolidation is likely, and not all CWM vendors will survive, but rather, will be acquired by larger enterprise software vendors or will reach a plateau in business growth.

Business Impact: Collaborative work management technology can potentially be used by everyone. It can empower them to collaboratively carry out the planning, execution, optimization and, increasingly, automation of day-to-day work. At the same time, it provides transparency for oversight, as well as the ability to define and fix "guardrails" that represent constraints on outcomes, timelines, budgets or resources. The core value proposition of collaborative work management is to improve activity coordination in a flexible and agile manner.

The introduction and use of collaborative work management practices will be an important contributor to increasing business agility. These tools are particularly effective in supporting work and activity coordination among distributed teams and so they will have an increasingly important role to play as remote work becomes more prevalent.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Asana; Atlassian; Clarizen; Hive; monday.com; Mavenlink; Microsoft; Smartsheet; Workfront; Wrike

Recommended Reading: "Collaborative Work Management in the New Work Nucleus"

"Market Guide for Collaborative Work Management"

"Toolkit: Collaborative Work Management Vendor and Product Data"

"How to Select Collaboration Technology Using Gartner's ACME Framework"

"Market Guide for Adaptive Project Management and Reporting"

"Marketing Work Management: How to Control Chaos, Streamline Workflow and Gain Efficiency"

Sliding Into the Trough

Device Endpoint Security for Frontline Workers

Analysis By: Patrick Hevesi

Definition: Device endpoint security for frontline workers includes a set of technologies that provide protection for purpose-built devices and their users. Depending on the industry and use cases of the frontline worker, devices may need to be physically secured to permanent stations, tracked and checked out for use during a shift, or possibly used by multiple users in a particular area.

Position and Adoption Speed Justification: Many frontline workers have fully managed, purpose-built, locked-down, ruggedized mobile devices tailored to their job. These devices come at a premium and can cause challenges for keeping the devices up to date and patched to maintain their security. This has led to some organizations and vendors to explore personal devices with protection around the mobile applications, but this provides less control than a fully managed device and can open up the organization to data leakage or other malicious attacks. More companies have also begun to enable frontline workers with access to cloud SaaS applications, which exposes organizations and workers to additional cloud security risks.

User Advice: For company-owned and managed devices where more specialized devices are required:

- Evaluate and deploy specialized devices for purpose-built frontline worker use cases.
- Fully manage and lock down the devices with UEM/MAM, and ensure that mobile OS security settings, updates and patches are applied.
- Ensure physical security for mobile devices, including cables for kiosks, geofencing/geolocation for on-the-move devices, and check-in and check-out processes for multiuse devices.

For personally owned or consumer-grade devices, where LOB and other corporate collaboration apps are allowed to run:

- Use UEM tools to apply mobile application management (MAM) policies to add layers or encryption, MFA and time-based lockout on frontline worker apps.
- Look to mobile threat defense vendors for device-based risk attestation integrated with the applications managed by MAM.

For custom-built frontline worker apps:

- Ensure LOB applications are engineered with secure design principles and custom-built multiuser authentication.
- Employ MAST and MARS for assessing mobile apps for risks, such as for the purpose of mobile app catalog vetting in EMM.
- Use app shielding, app wrapping and in-app MTD (or more generally, “in-app protection”) for protecting your IP within binaries, and also protecting apps in runtime on a given device.

If cloud-based applications are used, we recommend using CASBs for threat and data protection, as well as adaptive access control for frontline users and devices when they consume external SaaS services.

Business Impact: Frontline mobile devices will, in many cases, be off-premises and possibly handled by customers, contractors, temporary staff and employees. Frontline scenarios often involve access to sensitive and critical systems, such as industrial controls, which raises the risk profiles and the related precautions.

IT security will have to deploy a combination of multiple solutions to mitigate all the possible use cases and security risks. As some of the solutions are built for traditional mobile management scenarios and not frontline workers, custom development work may be required to meet the security requirements.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: CommuniTake; Imprivata (GroundControl); Lookout; Microsoft; Samsung; SOTI; Symantec; Veracode; Zebra; Zimperium

Recommended Reading: "Protecting Web Apps and APIs from Exploits and Abuse"

"Market Guide for Mobile Threat Defense"

"Mobile OSs and Device Security: A Comparison of Platforms"

"Advance and Improve Your Mobile Security Strategy"

Gesture Control Devices

Analysis By: Roberta Cozza

Definition: Gesture control devices are either wearables or devices held by the user in order to capture body movements, gestures and expressions. Gestures with specific semantic content can be interpreted by devices and software applications to enhance the human-machine interface (HMI).

Position and Adoption Speed Justification: The market for gesture devices remains niche and mainly driven by interest from specific verticals such as education, medical, military and manufacturing. Development has been mostly driven around gesture control devices as companion accessories in VR simulations to enhance users immersive experience. For example, gesture devices have been used in VR simulation environments for rehabilitation and surgery in the healthcare. Companies like Xsens produces gesture sensing devices from athlete analysis to drone control. Gesture control devices have taken different form factors like electromyography (EMG) armbands, straps, rings and gloves.

While adoption so far has been limited to niche and customized solutions, more recently the bigger trend toward smart spaces and improvement in computer vision and ML technology has enabled the extrapolation of better analytics around gesture using existing and new sensors. This reignited interest in gesture analytics. At the same time, the UI paradigm is evolving where gesture control

becomes a capability integrated into computing devices, smartphone, smart cameras, in wearables like smartwatches, smartglasses/HMDs, smart display/surfaces and things as well as being enabled by dedicated additional gesture device. Short range radar technology for example is being already embedded in smart mobile devices, Google's Pixel 4 smartphone Motion Sense chip enables the user to manage music, alarms, calls with gestures. Embedded short range systems can help in several scenario like assisted living, and industrial environments where touchscreens are challenging. The effects of COVID-19 are pushing for more touchless interactions around interactive kiosks, public touching screen/surfaces, elevators, office and factories premises, touch displays in medical settings. This will accelerate gesture recognition as an embedded capability in a number of user and workers settings.

User Advice: Providers of personal technologies should implement gesture control in its various forms to augment the HMI of their products, for a natural, intuitive use model. They should assess whether the pain point for a customer is better addressed by a customized gesture control device or if alternatives via other embedded technologies in existing devices would deliver more usability value. Providers should consider investing or partner to include intelligence and analytics linked to their gesture control devices and solutions and going beyond just gesture "control" to recognition, inference, prediction and understanding to create more customer value.

Business Impact: Vendors of applications in productivity software, gaming, AR/VR simulations, smart spaces, automotive, robotics, can leverage gesture control and gesture control devices to enhance the user experience and differentiate. However, when delivering dedicated gesture control devices wearability, robustness, quality of materials, ergonomics, form factor and connectivity are key considerations. Predefined gesture sets must be intuitive and as little complex as possible to reduce initial learning curve and respond to real deployment usability challenges.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Tap Systems; Tap Systems Inc; Xsens

Recommended Reading: "Top 10 User Experience Technologies That Will Drive Innovation"

"Plan Your Hardware Product Roadmap Around Top 5 UX Trends and Technologies"

Drowsiness Detection

Analysis By: Leif-Olof Wallin

Definition: Drowsiness detection devices use different technologies to determine whether a person is starting to experience fatigue and is falling asleep while operating a vehicle or a heavy or potentially dangerous equipment or performing vital tasks that require full concentration. The most common technologies assess heart rate, head position, eye movement, steering pattern, brain activity, skin conductance and muscle activity. The detection technology could be embedded, e.g., in a car, or as a separate device.

Position and Adoption Speed Justification: Drowsiness detection can prevent loss of life and the techniques have matured significantly, resulting in fewer false positives. There is still no recognized standard, and the accuracy varies a great deal among the potential technologies. Machine learning is increasingly being used to help calibrate solutions. Some vehicles now have drowsiness detection fitted as standard, such as Ford Driver Alert, Mercedes-Benz ATTENTION ASSIST, Nissan Driver Attention Alert and Volvo Driver Alert Control. It is becoming a standard feature in retail cars.

User Advice: Organizations that have employees (or partners) operating vehicles or dangerous and heavy equipment on a large scale, (e.g., buses, trains, taxis, airplanes or trucks) should investigate this technology as a mean to reduce fatal accidents among their employees, as well as customers or third parties. Pilot these solutions extensively prior to adoption, because there's a learning curve for some of these devices to be able to adequately assess a driver's level of alertness. These technologies can also be used to optimize shift patterns.

Business Impact: This technology is highly relevant for organizations in the transportation and logistics vertical industries. It has the potential to be mandated by regulatory authorities.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Audi; BMW Group; Bosch Group; Ford; Fujitsu; Mercedes-Benz; Volvo Car Group

Recommended Reading: "Operationalize an Instrumented Workplace With Analytics to Support Digital Business"

"Identify Innovative Opportunities for Wearables in Your Organization"

Mixed Reality

Analysis By: Tuong Nguyen; Marty Resnick

Definition: Mixed reality (MR) is the merging of real and virtual worlds, where physical and graphical objects appear to interact and integrate naturally. MR, in concept, is a single technology. However, MR includes an underlying group of technologies encompassing the spectrum of immersive displays and interactive systems that spans from the digitization of real environments to augmented reality (AR) and virtual reality (VR).

Position and Adoption Speed Justification: MR is an overarching technology that includes all immersive displays (mainly, head-mounted displays [HMDs]) and combines functionality that spans from the displaying of fully immersive virtual worlds to ones that are augmented with matching graphics and overlays. MR's position on the Hype Cycle curve is roughly similar to AR and VR technologies, but earlier in its maturity due to its more sophisticated capability and wide-ranging use cases.

In some respects, MR devices will be the ultimate AR/VR systems, but the most sophisticated ones are still years away from being produced. However, MR's advanced capability means it is not as mature as its component technologies and likely won't be adopted at mass-market levels for five years due to limits of the technology and the lack of popular apps. Leading startup Magic Leap's decision to reduce headcount in response to the COVID-19 impact will have limited impact on the progress of MR IP development due to the long maturity horizon of MR. Furthermore, new vendors such as Nreal and ThirdEye Gen are gaining press and traction in the marketplace. Microsoft continues to empower the ecosystem with advancements introduced by HoloLens 2 as well as enterprise partnerships through its Mixed Reality Partner Program. Minecraft Earth has brought significant exposure to MR experiences. Finally, technology improvements and advancements such as object occlusion provide the steppingstones to more sophisticated experiences. The combination of these developments continues to move mixed reality along the Hype Cycle at a steady pace.

User Advice: Apply MR technology to enable new types of experiences and interactions; more personal and contextually relevant for the user to:

- Assess the tactical value of MR. While it may be the culmination of AR and VR technologies, MR will demonstrate more value in scenarios that will benefit from digital objects being aware or interacting with the physical environment. For example, fitting new surgical equipment into dimensional constraints of an operating room
- Evaluate ROI potential by focusing on a small number of pilots benchmarked against traditional, non MR experiences as well as AR and VR experiences
- Build in-house expertise for MR experiences by hiring developers with immersive skills (such as gaming engine, 3D modelling and UI design)

Business Impact: During the next 10 years, MR and the user experiences that it enables will undergo a fundamental change above and beyond the capabilities of AR and VR. Today, MR capabilities focus on optimizing "hands-busy" work environments such as maintenance and repair. Over time, MR will expand to include many types of experiences that can visually enhance everyday objects. New business models will emerge that change how customers buy products using MR or how they conduct operations by visually connecting the user's view of the real world with their data-driven virtual world counterparts such as for rapid prototyping and testing of products and marketing.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Adolescent

Sample Vendors: Google; Magic Leap; Microsoft; Nreal; ThirdEye Gen

Recommended Reading: "Venture Capital Growth Insights: Immersive Technologies"

"Emerging Technology Analysis: Augmented and Mixed Reality Opportunity for 3D Design Software and Vertical ISVs"

"Quality Is the Key to Avoiding 'Digital Distortion' With Your Augmented Reality Strategy"

"Top 10 Strategic Technology Trends for 2020: Multiexperience"

"Gartner's 2020 Strategic Technology Trends for Product Leaders"

"Forecast Analysis Wearable Electronic Devices, Worldwide"

"Competitive Landscape: Head-Mounted Displays for Augmented Reality and Virtual Reality"

"3D Design and Device Convenience Hinder AR and VR Adoption"

"Market Insight: Mixed-Reality Immersive Solutions Are the Ultimate User Experience for Everyone"

"Competitive Landscape: Augmented Reality Tools for Enterprise, 2018"

Unified Endpoint Management

Analysis By: Dan Wilson; Chris Silva

Definition: UEM is a set of offerings that comprise management of mobile devices (MDM) and personal computers via traditional client management technology (CMT) or modern OS management. This is through a single console that combines the application of data protection, device configuration and usage policies. UEM tools use analytics and telemetry from users, apps and devices to inform policy and related actions; and integrate with unified endpoint security (UES) tools to enhance policy management and enable frictionless authentication.

Position and Adoption Speed Justification: Gartner has long described the evolution to UEM as a journey through three waves:

1. Using separate tools for PCs and mobile devices (traditional management).
2. Using the same management product, but different processes, for PCs and mobile devices.
3. True convergence — PCs and mobile devices are managed through the mobile device management (MDM) APIs provided by the OS, whether it's Apple iOS or macOS, Google Android, or Microsoft Windows.

Now we are seeing UEM expand beyond the management of PCs and mobile devices to offer deeper insights through endpoint analytics and deeper integration with identity and access management and unified endpoint security tools. In addition to the base UEM capabilities, many vendors are expanding their offering to differentiate. While Gartner is seeing some clients embrace UEM tools and modern OS management, most organizations are still seeing UEM as a roadmap item to be addressed in the next few years. In preparation for UEM, organizations must:

- Modernize application stacks, removing dependencies of critical apps on a specific platform or a specific browser/runtime environment

- Consolidate mobile and endpoint management teams to eliminate political barriers to UEM adoption
- Upskill staff to understand how to address the critical functions of CMT with UEM techniques

Hype is moving toward the trough. Interest in UEM remains strong and use-case-driven, yet many organizations revealed the significant processes and technology changes that are required for modernizing management.

User Advice: Clients should stop procuring and consider not renewing licenses for disparate MDM, EMM and CMT tools. They should review existing entitlements to determine the most cost-effective and best fit UEM solution to adopt to replace those tools in the next year. They should investigate the potential to embrace modern OS management using the UEM products in the next two years.

Business Impact: Taking full advantage of UEM disrupts long-standing traditional processes, tools and organizational designs. It will require a new approach, consolidated organization and significant process reengineering, but has several benefits:

- Simplifies management of continuous OS updates.
- Enables management of devices regardless of their connection (on LAN, VPN, or Internet connected).
- Support a wider range of devices and operating systems.
- Enables internet-based patching, policy, configuration management.
- Reduces the total cost of ownership (TCO) of managing endpoint devices by simplifying device management and support processes.
- Supports tool portfolio rationalization and reduction efforts.
- Establishes a baseline for integrated unified endpoint security tools to provide continuous, contextual authentication and controls.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: BlackBerry; Citrix; IBM; Ivanti; ManageEngine; Matrix42; Microsoft; MobileIron; Sophos; VMware

Recommended Reading: “How to Keep End Users Connected to the Digital Workplace During Disruptions”

“Essential Considerations When Choosing Separate PC and Mobile Management Tools”

“Adopt Continuous Endpoint Engineering and Modern Management to Ensure Digital Workplace Success”

“Prepare for Unified Endpoint Management to Displace MDM and CMT”

“Magic Quadrant for Unified Endpoint Management Tools”

“Solution Criteria for Unified Endpoint Management Systems”

Ring Scanner

Analysis By: Leif-Olof Wallin

Definition: This small bar code scanner can be worn as a ring on top of one or two fingers. Its placement enables workers to use both hands and to scan at the same time. The scanner uses a laser scanner or imager, and is connected through wires, or wirelessly using Bluetooth, to a handheld or mobile computer.

Position and Adoption Speed Justification: Ring scanners have been around for a long time. Recent developments in LED and low-power Bluetooth technology have improved capabilities and battery life significantly and have opened up new opportunities for the technology. Ring scanners can be used independently, replacing conventional scanning, while increasing in multimodal use when they’re combined with technologies such as voice or smartglasses.

User Advice: Ring scanners have been around for a long time. Recent developments in LED and low-power Bluetooth technology have improved capabilities and battery life significantly and have opened up new opportunities for the technology. Ring scanners can be used independently, replacing conventional scanning, while increasing in multimodal use when they’re combined with technologies such as voice or smartglasses.

Business Impact: The technology is highly relevant for organizations with warehousing and logistics operations, such as pick/pack/ship, as well as those with select use cases in travel, transportation and hospitality that involve scanning.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Datalogic; Eurotech; Honeywell; Zebra Technologies

Augmented Reality

Analysis By: Tuong Nguyen

Definition: Augmented reality (AR) is the real-time use of information in the form of text, graphics, audio and other virtual enhancements integrated with real-world objects and presented using a mobile, head-mounted-type display or projected graphics overlays. It is this “real world” element that differentiates AR from virtual reality. AR aims to enhance users’ interaction with the environment, rather than separating them from it.

Position and Adoption Speed Justification: Current technology is best suited for purpose-built, specialized solutions. As such, position and adoption speed will vary by vertical and industry. Current horizontal tasks seeing the most traction are task itemization, visual design and context-based work instruction. This profile represents a homogeneous view of AR implementations across market segments.

Market interest is growing steadily, but AR continues to struggle with mismatched expectations (vendors promising solutions beyond current capabilities) and poor implementations (for example, solutions delivered without immersive development [3D design and interface] knowledge or workflow integration, or not mapped to business value or need). Current solutions are better described as AR-inspired solutions — experiences that contain elements of AR to offering limited, purpose-built capabilities. AR adoption continues mainly in enterprise applications. Consumer-facing implementations are still struggling to show consumers consistent value. Better hardware, coupled with more compelling use cases, is needed before further progress can be made.

Based on Gartner inquiry (25% increase in inquiries in 2019 over 2018) and industry news, B2B AR continues to gain traction as more enterprises are seeing the value of using AR in their workflow. Moreover, a Gartner 2020 CIO survey indicates that 27% of respondents are currently using, or evaluating/exploring AR. HMD sales reflect the burgeoning pilot deployments. Advancements in HMD hardware (lighter, more durable, safer, etc.) will provide more compelling hands-free use cases for AR as well.

User Advice: Organizations looking to implement AR experiences should:

- Decide on the audience for your AR experience. Internal- and external-facing solutions are not transposable.
- Restrict initial trials to a specific task or goal. Set benchmarks against unaugmented solutions to understand risks and benefits.
- Set the business goals, requirements and measurements for your AR implementation before choosing a provider.
- Rich and robust offerings can bring value only if you have a clear intention for the deployment. For external-facing implementations, use AR as an extension of your brand and experience. For internal-facing implementations, use AR as a tool that will enhance employee job function.

This could include, for example, delivering context-specific information at the point of need for mobile workers, better leveraging experts (using one-to-many video support) in plant and maintenance operations, or enhancing business processes via AR-based training and instruction.

Business Impact: AR bridges the digital and physical world and provides cognitive augmentation for user. AR provides a digital filter to enhance the user's surroundings with relevant, interesting and/or actionable information. This has an impact on both internal- and external-facing solutions. For example, internally, AR can provide value by providing checklists for training and maintenance or for remote telestration in see-what-I-see video collaborations. Externally, it offers brands, retailers and marketers the ability to seamlessly combine physical campaigns with their digital assets. As such, AR is broadly applicable across many markets, including gaming, industrial design, digital

commerce, marketing, mining, engineering, construction, energy and utilities, automotive, logistics, manufacturing, healthcare, education, customer support, and field service.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Apple; Atheer; Google; Librestream; Microsoft; PTC; Scope AR; Ubimax; Upskill; Wikitude

Recommended Reading: "Venture Capital Growth Insights: Immersive Technologies"

"Emerging Technology Analysis: Augmented and Mixed Reality Opportunity for 3D Design Software and Vertical ISVs"

"Quality Is the Key to Avoiding 'Digital Distortion' With Your Augmented Reality Strategy"

"Competitive Landscape: Head-Mounted Displays for Augmented Reality and Virtual Reality"

"3D Design and Device Convenience Hinder AR and VR Adoption"

"Augmented and Virtual Reality in the Digital Workplace: Top Use Cases"

"Market Opportunity Decision Framework for Tech CEOs: Augmented Reality and Virtual Reality Use Cases"

"Competitive Landscape: Augmented Reality Tools for Enterprise, 2018"

"Market Guide for Augmented Reality"

"Market Trends: Advancements in Immersive See-Through Technologies Will Differentiate Augmented Reality Glasses"

Head-Mounted Displays

Analysis By: Tuong Nguyen

Definition: Head-mounted displays (HMDs) are small displays or projection technology integrated into head-worn devices. They are worn or mounted on or near the head so their displays can be seen by the wearer at an ideal viewing distance. Additionally, aspects of the visual content will be contextual information that translates the wearer's state into visual cues.

Position and Adoption Speed Justification: HMDs were subject to significant hype, and as a technology it is maturing. Industry efforts indicate positive momentum in this market, key factors include:

- Growing popularity, availability and success (for example, Oculus Quest) of all-in-one VR HMDs; creating a midtier category of product that's more user-friendly
- More accessible and usable devices driven by all-in-one VR HMDs
- Growing landscape of mixed reality (MR) HMDs
- Steady enterprise adoption of augmented reality (AR) HMDs
- Continued technology improvements across the spectrum of HMDs such as 6DOF, field-of-view, and interfaces have made experiences much more immersive

Despite sales growth in 2019, HMD sales (dominated by VR) continue to be modest, with indications that sales have slowed in 1Q20 (even prior to the pandemic). While industry interest in the potential of virtualized interactions for consumers is high, that impact and investment is more likely to be seen in the enterprise; where the value proposition is still much stronger. Mass-market penetration won't be achieved until key elements such as content availability and device usability and accessibility are vastly improved. Apple's rumored head-worn device currently has a limited impact on the pace and trajectory of HMDs, but will likely accelerate adoption as the launch date draws near and details are confirmed by the company. In the meantime, prosumer devices such as Vuzix Blade and Focals 2.0 by North will improve visibility and acceptance among the broader market.

User Advice: Use HMDs as an extension of your current endpoint devices (laptops, smartphones, tablets, monitors) spectrum and also:

- Evaluate AR/MR HMDs for situations where the user's hands are occupied with a task or when the user is moving while accessing information — for example, to review work instructions, schematics or customer data.
- Assess the cost of VR experiences against the benefits. The cost of service and customization for VR experiences can come at a high cost, but there are also barriers around user interfaces (how to interact with virtual, 3D objects) and user experience (motion sickness and other adverse, physical reactions due to sensory mismatch).
- Adopt HMDs tactically — current devices are purpose built hardware with rapid (yearly) product release cycles.
- Evaluate ROI potential by monitoring HMD advancement such as improvements in display resolution, expanded fields of view, better battery life, comfort and lower cost.

Business Impact: HMDs can provide an immersive and potentially hands-free, intuitive way to interact with the physical and digital world. Large enterprises are seeing value in using AR HMDs for use cases such as first-time fix reduction, increase in productivity and work order completion, and improved safety. Value from VR HMDs is mostly for entertainment, but businesses are seeing more adoption for training and product design and reviews. MR HMD use cases are further down the timeline and technology intersects with usability and use cases that benefit from digital interaction with physical objects such as combining physically accurate dimensions and measurements for large equipment, or facilities to visualize architectural fit.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Adolescent

Sample Vendors: Epson America; Facebook; Google; HTC; Microsoft; Nreal; RealWear; ThirdEye Gen; Varjo; Vuzix

Recommended Reading: "Venture Capital Growth Insights: Immersive Technologies"

"Top 10 Strategic Technology Trends for 2020: Multiexperience"

"Gartner's 2020 Strategic Technology Trends for Product Leaders"

"Competitive Landscape: Head-Mounted Displays for Augmented Reality and Virtual Reality"

"Market Trends: Advancements in Immersive See-Through Technologies Will Differentiate Augmented Reality Glasses"

"Forecast Analysis Wearable Electronic Devices, Worldwide"

"3D Design and Device Convenience Hinder AR and VR Adoption"

Mobile Identity

Analysis By: Rob Smith; Ant Allan

Definition: Mobile identity supports the trusted identification of the devices people use to access the corporate network, cloud resources or other assets, as well as the users themselves. Mobile identity is typically a capability of mobility management tools, rather than a discrete solution. It puts public-key credentials (a digital certificate and keys) on the device. It supports the recognition of corporate-authorized devices and adds confidence to user identity claims.

Position and Adoption Speed Justification: Enterprises increasingly look to defend against phishing and other account takeover (ATO) attacks, especially for users connecting remotely and from mobile devices. This generally drives investment in multifactor authentication (MFA) solutions. However, at the same time, enterprises are looking to improve user experience (UX), especially in the context of employee experience (EX) in the digital workplace. Thus, there is a strong focus on methods that enhance authentication, without adding additional friction and eroding UX, which is where mobile identity adds value. Mobile identity based on X.509 credentials increases the confidence in device ownership and elevates trust during authentication steps, compared with noncryptographic methods for endpoint device identification. This is a cornerstone of zero-trust network access (ZTNA), for example.

Mobile identity is well-established in most enterprises that have implemented unified endpoint management (UEM) or mobile device management (MDM) tools. This enables enterprises to allow access to corporate networks, without having to invoke orthodox MFA every time.

In addition, some vendors such as Microsoft and VMware bundle access management (AM) capabilities (e.g., single sign-on [SSO] and authorization) with their UEM tools, enabling tighter integration of mobile identity in a broader access context. AM tools are typically able to consume mobile identity as part of evolving adaptive access approaches.

User Advice: Exploit mobile identity as a way to recognize when a corporate-authorized device is being used to access the corporate network and as a way of increasing confidence in the identity of the user. In conjunction with UEM/MDM policies that enforce a passcode policy or use of device-native biometric authentication (e.g., Apple Touch ID), mobile identity might provide sufficient confidence for baseline (lower risk) access. However, take a risk-averse approach and combine mobile identity with legacy passwords or other orthodox authentication methods when a higher level of trust is required.

Consider investment in PKI tools offering certificate services that can integrate with most modern UEM and MDM tools, or work directly with the mobile devices.

As part of a broader authentication and access strategy, use mobile identity as an input to AM tools as a potential way of skipping MFA prompts to improve UX. For example, in Microsoft Azure AD Premium, a Microsoft Intune managed device is a “trusted device” that can satisfy the strong authentication requirements of a conditional access policy without an explicit MFA challenge to the user. (MFA would still be required when enrolling a new device or when accessing assets from untrusted devices.)

Explore more-generic tools that implement more-robust software cryptographic tokens (which always include user certificates, rather than device certificates) on managed or unmanaged devices. These include proprietary solutions, from vendors such as Beyond Identity or Entrust Datacard, and Fast IDentity Online (FIDO) 2 authenticators. Note that FIDO protocols also establish device identity, as the credentials are unique to each combination of relying party, user and device.

Prefer mobile identity implementations (or alternative cryptographic tokens) that embed keys in a trusted execution environment (TEE) or secure enclave on the device.

Business Impact: In some circumstances, mobile identity can enable passwordless access to corporate networks for users employing corporate-authorized devices. More generally, it provides additional confidence in a claimed user identity. It can enable access without the friction of orthodox MFA, especially when integrated with AM tools implementing adaptive authentication in line with continuous and adaptive risk and trust assessment (CARTA) principles. In general, the net benefit is enhanced UX, improving EX for remote work among other use cases.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: BlackBerry; Citrix; DigiCert; Entrust Datacard; IBM (MaaS360); Microsoft; MobileIron; Okta; Sectigo; VMware

Recommended Reading: "Magic Quadrant for Unified Endpoint Management Tools"

"Market Guide for Zero Trust Network Access"

"Passwordless Authentication Is Here and There, but Not Everywhere"

"Transform User Authentication With a CARTA Approach to Identity Corroboration"

Climbing the Slope

Smartwatches

Analysis By: Annette Zimmermann; Roberta Cozza

Definition: A smartwatch is a device that resembles a traditional watch and serves as either an extension of the smartphone screen (for alerts, calls and voice commands) or a stand-alone smart device with Wi-Fi or cellular connectivity. It must be able to transmit an electronic signal, for example, to control an external app or device, or transmit voice or biometric data from built-in sensors.

Position and Adoption Speed Justification: The position of this technology is stagnant in the post-trough segment of this Hype Cycle as we have seen little progress in adoption and deployment. On the supplier side there has been a bit of movement. Apple, Samsung, Huawei and the Fitbit brand (now owned by Google) are the leading vendors in this market. Apple has the widest smartwatch portfolio that can address different price, style and gender preferences. Therefore, the vendor continues to be the most successful vendor in this space. Several startups are also coming out with medical-grade products and services. Samsung has been able to demonstrate more differentiation in usability with its Tizen-based smartwatches, and the company has been integrating other useful features such as payment and enterprise security features.

User Advice: For IT leaders that require enterprise mobile manageability (UEM) software and security solutions in order to adopt smartwatches can leverage Samsung Knox for Tizen Wearables.

Other use cases emerging in the enterprise for smartwatches are voice-enabled note taking, task management and invoicing. Furthermore, smartwatches can interface with software and apps to provide alerts and reminders about key customers.

We recommend:

- IT leaders should consider offering smartwatches connected to personal mobile emergency monitoring services to ensure safety for lone workers, such as real estate agents or taxi drivers. There is an emerging use case to call for emergency help via a cellular-connected smartwatch for children, the elderly and others who are concerned about safety.
- Another opportunity is fatigue tracking to help with employee safety using the sleep tracking functions of smartwatches. Here, measuring the "fatigue risk" of someone who is unwell and needing to operate critical equipment could be useful.

- Provide workers with the convenience to make work-related purchases from retailers, at the cafeteria or during business travel using the smartwatch in place of a corporate credit card. Vendors such as FitPay provide a secure payment solution and work closely with several hardware vendors and credit card issuers to push wearables payment in the market.
- Healthcare providers are exploring smartwatches for remote health monitoring of patient exercise and sleep and heart rates, especially after being discharged from the hospital.
- Since the COVID-19 outbreak, several personal health apps have started to leverage their integration with third-party smartwatches like Apple Watch to perform symptom monitoring. The Cardiogram app is an example. The other use case in this context is social distancing alerts being extended to smartwatches, which may also become a requirement for "return to work" after lock-down.
- There is some interest by retailers to provide smartwatches to in-store staff to provide notifications that less intrusive than the PA system.

Business Impact: In the enterprise environment, until IT leaders see a necessity to proactively provide smartwatches to staff, smartwatches will take time to impact business. Nevertheless, smartwatches will find their way into enterprises as consumers will want to connect them to their work phone to receive messages and for calendar functions on their watch.

As many organizations planning "return to work" scenarios after shelter at home mandates are lifted, employee health monitoring receives rising interest. This has security and privacy implications.

App developers now have a chance to expand their distribution on different screens even further by adding apps for Wear OS watches and Apple Watch. By doing so, they will have to follow a new paradigm, where the app function centers on "glanceable" content.

Consumers who purchase smartwatches will want the convenience of wearing them for work as well. Therefore, IT leaders should include smartwatches in their corporate policy for the use of personal mobile devices at work.

Enterprise organizations may encourage the use of smartwatch and associated apps to monitor symptoms of COVID-19, however it should be left to the employee to use such technology.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Apple; Fitbit; Fossil Group; Huawei; Lenovo; LG; Misfit; Samsung; Withings

Recommended Reading: "Forecast Analysis: Wearable Electronic Devices, Worldwide"

"Treat Wearable Investments as Tactical, Not Strategic"

Healthcare Optimized Devices

Analysis By: Leif-Olof Wallin

Definition: Healthcare optimized devices are ruggedized, typically handheld devices that are manufactured with special plastics, anti-microbial plastics/coatings, that can be sanitized with aggressive detergents typically used in a healthcare environment. Special care has also been given to ensure there are no slips or cracks where germs or viruses can "hide" and that the device can be operated with gloves on.

Position and Adoption Speed Justification: Gartner does not normally introduce an innovation profile for a technology that is this mature. However, given the strong increase in interest for handheld devices in healthcare we felt obliged to add this profile to assist customers in their device choices. There has been a long tradition in healthcare to prefer "shiny" COTS (commercial off-the-shelf) devices that are difficult to sanitize in a professional way without degrading/destroying the exterior. This introduces a risk for spreading infection as usage of mobile devices in healthcare increases.

User Advice: Many healthcare organizations have invested in new electronic health record (EHR) systems. In order to reap the expected benefits around increased compliance, quality and productivity, staff is increasingly equipped with handheld devices capable of presenting information, scanning patient bracelets, medication and inventory levels. These devices will be moving from bedside to bedside together with the staff and will need to be regularly sanitized to help spreading infection. By buying ruggedized healthcare optimized devices, healthcare organizations ensure they can sanitize the devices as frequently as needed without degrading the functionality nor look and feel of the device. The healthcare optimized devices typically include any special security features needed for HIPAA or similar compliance.

Business Impact: Although healthcare optimized devices are more expensive as compared to COTS devices, the total cost of ownership (TCO) will be lower as they typically last more than five years. They have enough battery capacity to last a full shift (much longer than a typical COTS device) and don't degrade when sanitized frequently which leads to a higher propensity to sanitize.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Mature mainstream

Sample Vendors: Honeywell; Spectralink; Vocera Communications; Zebra Technologies

Wristbands

Analysis By: Roberta Cozza

Definition: Wristbands are electronic devices that have band or bracelet designs, with or without displays. Wristbands have a two-way wireless connectivity and are used for collecting data about the wearer's physical activity biometrics, the ambient environment or nearby objects, and for other

purposes, including fitness, safety, access, payments, data sharing, monitoring personal health and well-being. Examples of wristbands include the Fitbit Charge series, Garmin Vivofit and Xiaomi Mi Band.

Position and Adoption Speed Justification: Wristbands respond to the increasing desire of people with less sedentary lifestyles to improve their fitness, well-being or monitoring overall health. The wristband market is expected to show just a 6% compound annual growth rate (CAGR) through 2023, further decelerating from prior years. Providers will struggle because of the appeal of smartwatches and as more value vendors enter the smartwatch market increasing competition and more decline in smartwatch ASP with time.

User engagement with wristbands will be helped by their simpler UIs, lower costs and efforts increasing in more countries as employers, healthcare providers and insurance companies offer incentives for sending data from wristbands. More value will be delivered to users when apps and services will evolve using artificial intelligence to provide deeper insights by combining data from wristbands with information from other sources to deliver more personalized advice. Additional onboard sensors, new processors, better connectivity and displays are enabling use cases for wristbands include more functionalities, however user and enterprise interest will continue shift toward smartwatches as development efforts will focus in this device category.

User Advice: Wristbands still remain an alternative to smartwatches or sports watches because most are lower priced and generally have a smaller range of functions and longer battery life. Consider offering subsidies for fitness wristbands through wellness programs for employees and customers as a way to encourage them to get more exercise. When offered with wellness programs, consider increasing engagement solutions that include group activities or access to personal coaches, additional time off, gift certificates or other financial incentives such as a lower contribution to health insurance set by target fitness goals.

IT leaders may use wristbands in the enterprise in place of, or in addition to, corporate badges for access to buildings and information. Analysis of biometric data from wristbands may be used to authenticate the identity of the wearers through gait or voiceprint. They can also be used to receive alerts from apps or about incoming calls or texts, and to detect falls and contact help in case of an emergency. Wristband can be explored as customized solutions to enforce new social distancing measures in factory settings or for human position tracking.

Fitness gyms, weight-loss clinics, physiotherapists, and health and life insurance agencies are using wristbands as a way to extend engagement with customers outside of a brick-and-mortar shop by gathering data on exercise outside of the facility. Theme parks, resorts, sports stadiums and entertainment venues are using wristbands with patrons for access, on-site purchases, pedestrian traffic analysis and deeper engagement. Make privacy a priority by asking for permission to collect data in apps and giving wearers the option to opt out of sharing their data with third parties.

User cases for wristbands likely to gain traction beyond fitness monitoring include:

- Sleep, stress and heart rate monitoring and insights
- Mobile payments

- Monitor health
- Interact with apps and virtual personal assistants using voice commands
- Alerts, notifications and microinteractions
- Remote worker safety, proximity alerts, site access, location and authentication

Business Impact: Wristbands provide businesses with a way to engage employees and customers. Employer wellness programs are using wristbands to improve the well-being of employees. They serve as relatively more simple endpoint devices for connected workers to monitor activity and ergonomics. Wristbands enable businesses to learn more about their customers who wear them, particularly those who agree to share their activity and biometric data. Consumer-facing enterprises may gain insights due to wristbands that lead to more effective marketing, more personalized offerings and increased customer engagement.

The data from wristbands is increasingly being used by healthcare organization to enhance healthcare services by:

- Providing holistic care through a more accurate understanding of a patient's activity levels
- Identifying certain health conditions earlier, such as heart arrhythmia
- Resulting in shorter rehabilitation time after surgery
- Help managing chronic health conditions

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Fitbit; Garmin; Huawei; Polar; Samsung; Striiv; Xiaomi

Recommended Reading: "Forecast Analysis: Wearable Electronic Devices, Worldwide"

"Treat Wearable Investments as Tactical, Not Strategic"

"Plan Your Hardware Product Roadmap Around Top 5 UX Trends and Technologies"

Gamification

Analysis By: Brian Burke

Definition: Gamification is the use of game mechanics and experience design to digitally engage and motivate people to achieve their goals. It is important to distinguish gamification from video games and loyalty programs as gamification uses techniques from behavioral science to "nudge" people into achieving their goals.

Position and Adoption Speed Justification: According to Google Trends, interest in gamification peaked in April 2013 but has remained relatively stable over the past two years. Gartner inquiry on gamification has increased 47% over the past year. The focus of client inquiries is on gamification to coalesce around a much narrower set of use cases that dominate inquiry volume, including online learning and employee training — particularly security awareness; employee performance — mainly in sales and customer service organizations; engaging employees in innovation. This narrower set of use cases is due to repeatable paths to success and move gamification onto the Slope of Enlightenment. Clients are also interested in using gamification in customer engagement, collaboration, change management and wellness, among others. Given the impact of COVID-19, there have been several inquiries on leveraging gamification to engage employees working remotely to ramp up adoption of collaboration and social tools. China has launched the "Health Code" app which provides red, amber and green QR codes that enable access to buildings and services — a form of gamification. Singapore, India and the UAE are set to follow suit.

User Advice: Gamification builds motivation into a digital engagement model and can be used to add value to products and to deepen relationships by changing behaviors, developing skills or driving innovation. Gamification is much more than simply slapping badges onto activities; rather, it leverages behavioral science to engage and motivate people. The target audiences for gamification are employees, customers and communities of interest.

Organizations planning to leverage gamification must clearly understand the goals of the target audience they intend to engage, how those goals align with organizational goals and how success will be measured. Since gamification focuses on providing feedback to help people achieve their own goals, it engages people on an emotional level, rather than on a transactional level.

Organizations must recognize that simply including game mechanics is not enough to realize the core benefits of gamification. Making gamified solutions sufficiently rewarding requires careful planning, design and implementation, with ongoing adjustments to keep users interested. Designing gamified solutions is unlike designing any other IT solution, and it requires a different design approach. Few people have gamification design skills, which remains a huge barrier to success in gamified solutions. Organizations often benefit from working with digital agencies that employ behavioral scientists and have experience designing solutions focused on digital engagement.

Business Impact: Gamification can increase the effectiveness of an organization's digital business strategy. It provides a means of packaging motivation and delivering it digitally to add value to products and relationships. While many of the concepts in gamification have been around for a long time, the advantage of a digital engagement model provides scale with very low incremental costs. Its use is relevant to human resources, sales, marketing and customer service whose aim is to bring about longer-lasting and more meaningful interactions with customers, employees or the public.

User engagement is at the heart of today's "always connected" culture. Incorporating game mechanics encourages desirable behaviors, which can, with the help of carefully planned scenarios and product strategies, increase user participation, improve product and brand loyalty, advance learning and understanding of a complex process, accelerate change adoption, and build lasting and valuable relationships with target audiences.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Betterworks; Bunchball; Capita-G2G3; Centrical; Checkmarx; CloudApps; Pluralsight; SAP

Recommended Reading: "Motivate and Engage Learners With Gamification"

"Use Gamification to Flatten the Curve of COVID-19 Infections"

"Gamification Is Key for CIOs Transforming the Automotive Sector"

"Toolkit: Use 'Red Team, Blue Team' Gamification to Make Smarter Decisions"

"Assessing Online Learning Platforms for Technical Skills Development"

"Magic Quadrant for Security Awareness Computer-Based Training"

Lone Worker Protection

Analysis By: Leif-Olof Wallin

Definition: Lone worker protection (LWP) devices use technologies that determine whether a worker is in distress and notify a service center, which assesses the situation. Basic devices can be activated by the user pressing a button or a cord being ripped. More complex devices may include fall detection, lack-of-motion detection and sudden vertical movement detection. The location is usually transmitted, and the service center typically establishes voice communication. Most of these devices operate over a mobile voice and data network.

Position and Adoption Speed Justification: LWP devices have been available for a long time, and recent advancements in sensor technology and mobile network technology have made it possible to improve their battery life, as well as to reduce their size and weight. This will be further accelerated by the introduction of narrowband Internet of Things (NB-IoT) in networks.

User Advice: Organizations employing large number of field workers who work alone in potentially threatening or dangerous environments can deploy this technology to reduce loss of life and more quickly and effectively assist staff in distress. LWP devices are increasingly being mandated in some regulated industries. Some devices are capable of detecting whether a worker is suddenly hanging upside down (e.g., from a utility pole) while climbing. GPS technology is less than optimum if the worker is indoors, and, for these use cases, in-door location technology may need to be leveraged. Where security requirements are not as stringent or the ability to trigger an alarm covertly or automatic is not deemed necessary, these use cases may use an app on a smartphone instead of a dedicated device.

Future products are likely to include warnings for proximity to dangerous objects and to monitor for dehydration and stress. Some specific functionality, such as man down and gas spectrometry, is available in purpose-built smartphones.

Business Impact: The technology is highly relevant for organizations with field service organizations that handle hazardous products/technologies, such as energy or gas; civil servants that may be exposed to agitated members of the public. This also includes healthcare professionals making house calls in less safe areas; manufacturing staffs that handle hazardous materials or gases; and lone workers handling cash or theft-prone products.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: ecom; MSA Safety; SoloProtect; Sonim Technologies

Push to Talk

Analysis By: Leif-Olof Wallin; Stuart Downes

Definition: Push to talk (PTT) as a concept has been around since the first voice capable radios. After pushing the button, some or all endpoints on that channel/frequency/group can hear what that person says until they release the button again. In this context, PTT refers to applications or network-based services (PTT over cellular/Wi-Fi) delivering PTT on modern handsets/smartphones.

Position and Adoption Speed Justification: Front-line use cases are leveraging apps on smart handsets that use alternate communication networks (Wi-Fi and cellular) to provide communications including PTT, audio broadcasts, and messaging. These devices provide communications and apps for specific business use cases and will allow enterprise clients to consolidate devices for frontline workers and reduce costs.

User Advice: PTT functionality on a mobile device eliminates the need for a second device in those scenarios where voice is being used to coordinate the activities of a team. PTT works best when the groups are relatively small and communication isn't constant. Advanced PTT systems offer the ability to control open handsets for control room to user conversations as well as enabling working groups to communicate openly without disrupting those outside of that working group. Mission-critical PTT over LTE was introduced in release 13 of the 3GPP standard back in 2016. In a lot of use cases, voice communication is being replaced by sending the relevant information to the recipient directly and await a confirmation (e.g., dispatch).

Business Impact: PTT has its biggest advantage when the use case requires command and control or urgently reaching out to a group of people simultaneously and ensure everybody gets the same verbal information. Typical use cases include first responders, security, transportation and building sites.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Motorola Solutions; Spirent; Zebra

Biometric Authentication Methods

Analysis By: Ant Allan; Tricia Phillips

Definition: Biometric authentication methods use unique morphological or behavioral traits to corroborate a person's claim to an identity previously established to enable access to an electronic or digital asset. A biometric authentication method is typically used in one-to-one comparison mode (biometric verification) to support an implicit or explicit identity claim. Rarely, a method is used in one-to-many search mode (biometric identification): the person simply presents a biometric trait and the system determines the identity from a range of candidates.

Position and Adoption Speed Justification: Biometric authentication is increasingly used across a variety of use cases, especially in mobile banking and, more recently, in enterprises rolling out Windows 10 with Hello for Business. Drivers for adoption are improved user experience (UX) and increased trust and accountability. However, concerns about privacy and presentation attacks inhibit forward movement and still create disillusionment with these technologies.

Usability and reliability issues with fingerprint modes have inhibited adoption for workforce use cases and negatively influence buyers' attitudes toward all modes, client interest has continued to grow due to Microsoft's support for face and other modes in Windows Hello for Business.

Vendors increasingly support Fast IDentity Online (FIDO) authentication protocols that can simplify implementation through standardization. W3C Web Authentication browser support for FIDO2 will likely speed up adoption and increase penetration over the next two years.

Clients' privacy concerns tend to focus on data security issues, but the main hurdle is privacy regulations' demand to be able to justify the use of biometric methods. Clients also worry about biometric methods' vulnerability to presentation attacks and other potential compromises even though these are far less likely than password compromises.

User Advice: Biometric methods are a viable alternative or adjunct to passwords and tokens across a variety of use cases. However, trust, TCO and UX vary between modes, and their viability varies by use case. Biometric methods can provide greater individual accountability than alternatives and should be favored when this is paramount.

The utility of biometric authentication depends on effective presentation attack detection (PAD) or liveness testing. Carefully evaluate vendor claims and favor methods tested in conformance with ISO/IEC 30107-3:2017. However, successful presentation attacks are rare. Evaluate how vendors can mitigate replay and injection attacks, which are more scalable and thus a more significant risk.

As with any authentication method, poor exception handling (in the event that the biometric method is unavailable) and identity recovery processes give attackers an easier path to account takeover.

Most modes can provide better UX for most people than nonbiometric alternatives, and this benefit is particularly relevant to mobile use cases. Banks commonly integrate device-native modes in

mobile banking apps, but third-party face and voice are emerging as the modes of choice. Favor modes that can make use of standard inputs (camera and microphone) and offer multiple benefits over device-native methods.

Consider migrating to biometric authentication for Windows PC and network access, but recognize the limitations of Windows Hello for Business (e.g., biometric methods cannot be mandated). Evaluate vendors that offer broader endpoint and use-case support and choice of biometric modes, including those that combine biometric modes with phone-as-a-token methods for mobile multifactor authentication.

Weigh the pros and cons of local vs. centralized data storage; comparison and matching; and PAD. Favor centralized architectures:

- To more readily support multiple digital (and other) channels and devices and, especially in banking, to exploit biometric data captured during identity proofing.
- To provide more direct control over data security, PAD and functional integrity.

Architectures differ in the effort needed to comply with privacy regulations, but the architectural choices cannot avoid the general justification requirements set out in the EU General Data Protection Regulation (GDPR) and similar privacy mandates.

Business Impact: Because biometric traits cannot easily be shared, biometric methods with effective PAD and functional integrity can provide increased trust and accountability over other credential-based methods. They also provide improved UX for most people.

Biometric methods suit mobile use cases, where users — especially retail customers — resist having to use any kind of discrete token. Biometric methods may be integrated within mobile apps (as they are in mobile banking), apps for mobile push authentication and so on.

Biometric methods can be used for PC and network login. Proprietary solutions offer broader endpoint and use-case support and choice of biometric modes and thus provide more value than device-native biometric methods supported by Windows Hello for Business.

Active and passive voice modes, which are increasingly used in contact centers as a welcome alternative to the abysmal standards of knowledge-based verification (KBV), are a natural fit for virtual personal assistant (VPAs or “smart speakers”).

In addition to the methods represented by this profile, passive behavioral modes (keyboard, gesture and handling dynamics) provide additional recognition signals that can add significant value to analytics-based tools, including online fraud detection (OFD) tools, elevating trust and improving UX by reducing false positives (i.e., bogus fraud alerts). In this context, these modes can also provide bot detection.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Auraya Systems; FaceTec; iProov; ImageWare Systems; Keyless Technologies; OneVisage; SensibleVision

Recommended Reading: "Best Practices for Selecting New User Authentication Methods"

"Technology Insight for Biometric Authentication"

"Technology Insight for Phone-as-a-Token Authentication"

"Market Guide for User Authentication"

"Predicts 2019: Identity and Access Management"

Entering the Plateau

Cloud Office

Analysis By: Gavin Tay

Definition: Cloud office, also known as the "new work nucleus," refers to a collection of the most broadly used SaaS-based personal productivity, horizontal collaboration and communication tools, combined into one product. It generally includes email, IM, file sharing, conferencing, document management and editing, search and discovery, and collaboration. Microsoft's Office 365 and Google's G Suite are the primary examples. The term "cloud office" is a general term. "Microsoft Office" refers to a specific set of products.

Position and Adoption Speed Justification: Cloud office continues to advance quickly along the Hype Cycle as enterprise adoption grows and the technologies become well-understood. In 2020, cloud office has reached the Plateau of Productivity as it becomes an accepted cornerstone of most organizations' collaboration and communications infrastructure.

Enterprise adoption has increased on account of a general preference for cloud deployments and the desire to reduce costs, redeploy IT staff, drive simplicity and provide more functionality to users. Vendors are also offering their most attractive new features — such as mobile apps, content discovery tools and artificial intelligence available through cloud deployments only.

User Advice: Application leaders responsible for digital workplace initiatives should:

- Look beyond a "like for like" deployment that focuses only on recreating previous on-premises functionality through the cloud. Although this can be a good initial step, investigate the unique capabilities of cloud office suites to improve digital dexterity, efficiency and innovation.
- Not assume that the chosen cloud office product will meet all collaboration and communication requirements. Look beyond cloud office to meet specific needs or user requirements.
- Monitor the cloud office vendor's roadmap and product announcements closely. The cloud model assumes almost continuous enhancement with new features and improvements coming

regularly. Assess these additions for their impact on your operations and how to take advantage of them.

- Plan specific efforts to address user adoption by focusing on user change management. It is usually not obvious how to use the new capabilities to increase effectiveness. Users will benefit from assistance and guidance, perhaps from more advanced colleagues, as a part of the digital dexterity initiative.
- Look to cloud office suites as a source for continuous innovation in a form that is relatively easy to adopt. Innovations like everyday AI, cross-tool integration, and better meetings are likely to come from cloud office products.

Business Impact: Cloud office solutions are so widely adopted that they are becoming the basis on which other vendors innovate, through add-ons and integrations. Cloud office is an important part of the emerging new work nucleus. These products support a wide variety of styles of collaboration including video, conversational, and social as well as the more conventional email and IM. Most organizations have made the move, developed a plan, or specifically decided to put off making a move that will be difficult to avoid in the longer term. Organizations that were adept at using cloud office prior to COVID-19 have had a much easier time pivoting to mandatory remote work.

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Google; Microsoft; Zoho

Recommended Reading: "Market Guide for Cloud Office Migration Tools"

"Create a Culture of Digital Dexterity With the 'New Work Nucleus'"

"Enable More Productive Meetings With Google G Suite or Microsoft Office 365"

"Maximize the Effectiveness of Office 365 and G Suite With Everyday AI"

"How to Organize IT to Support Office 365, G Suite and Other Digital Workplace Applications"

Speech Recognition

Analysis By: Anthony Mullen

Definition: Speech recognition technology translates human speech into text for further processing.

Position and Adoption Speed Justification: The position for speech recognition this year does not move forward. While adoption and performance has rapidly accelerated in recent years, the increased rollout of these services has shown that there is a gap in scaling these systems across languages and business domains. These problems are not intractable and are beginning to be tackled by using a variety of hybrid AI system (e.g., semantics + deep networks) and initiatives such

as transfer learning. Amazon recently demonstrated transfer learning between language models by bootstrapping a German model from a pretrained English model. Microsoft's new Conversation Transcription technology uses both audio and visual cues to improve real-time, multiperson, far field speech and speaker attribution.

While the core technology inches forward, enterprise vendors are beginning to expand services surrounding the core technology to include additional metadata from speech (e.g., emotion), multiparty authentication, talk over analysis, privacy and security features, compliance and more. Business functions enhanced by the technology are also expanding in areas such as the contact center, media monitoring, meeting room transcription and verticals such as finance, media, legal and communications.

In tandem with algorithmic advances, speech-to-text applications have been propelled by hardware progress, the adoption of conversational agents such as chatbots and virtual assistants by enterprises and consumer adoption of speech interactions on smartphones, game consoles and, in particular, services like Amazon Echo and Google Home. The use of speech-to-text technologies is also growing for connected home and automotive domains and embedded solutions running on edge devices without the need for cloud to create new usage scenarios.

User Advice: End users are rapidly adopting these technologies propelled by new natural language processing (NLP) applications. From a human computer interface standpoint, speech recognition is applicable and useful where users have:

- An interest or motivation, e.g., injuries or disabilities.
- Their "hands busy, eyes busy" and need data entry or system control performed via voice alongside other tasks, i.e., in warehouses, factories, hospitals, shop floors, cars or homes.
- A need for sustained, voluminous or repeated input such as office, medical and legal transcription, particularly in applications where speech shortcuts can be used to insert commonly repeated text segments.
- Domain knowledge but not system knowledge, i.e., interactions are expressed through natural speech, rather than proprietary system commands and interfaces.

Typical use-case scenarios of adoption include:

- **Supporting Users.** Consumer electronics providers should ensure speech recognition services for applications, smartphones, smart homes and cars, either licensing technology to work online/offline for their own devices or using cloud services to enrich the experience of services.
- **Supporting Customers.** Speech recognition for telephony and contact center applications enable enterprises to automate call center functions such as travel reservations, order status checking, ticketing, stock trading, call routing, directory services, auto attendants and name dialing. Further applications include the use of speech to text for marketing and commerce interactions.

- **Supporting Employees.** Existing enterprise application developers should consider the use of speech recognition and natural-language entry as a method of simplifying UIs and increasing productivity. There is an increasing amount of use cases for speech to text in the workplace from meeting room support and transcription, sales support, voice access to analytics and reports to hands-free warehousing and virtual employee assistant (VEA) use cases. Further, there are legal imperatives, such as General Data Protection Regulation (GDPR), compliance and redaction, that require businesses to be able to obtain transcripts of voice calls.

Vendors in this space can be split broadly into two categories — general-purpose platforms and specialists that provide a managed service. Generalist platforms tend to cover many languages and target general purpose speech. Specialists offer tailored solutions designed to perform well for a specific business context and lexicon using custom dictionaries and semantic tools to work with DNN models to improve disambiguation.

Making speech to text work for most organizations entails more than simply activating an off-the-shelf solution. Organizations should plan for an extended period of human involvement to monitor, train and improve performance — especially around modelling proprietary business terms, dialects and noisy/complex environments.

Business Impact: Unlike other elements of the natural-language processing chain, speech to text (and text to speech) can be considered as a stand-alone commodity where its modules can be plugged into a variety of natural-language workflows.

After a series of breakthroughs with the technology and while the rapid pace has eased, there is still a regular cadence of innovation and improvement in areas such as edge-based speech to text, hybrid models using semantic and deep neural network (DNN) techniques and GPU/TPU hardware. These gains were largely driven by deep learning.

Tech heavyweights like Google, Apple, Baidu, Tencent and Microsoft also collect large troves of training data from opt-in programs with consumers and this ongoing cycle of training data, and improved algorithms ensure the value of these systems. Specialist vendors with custom language models designed for verticals will continue to be essential to organizations looking to embed this technology deep into their business.

Benefit Rating: Transformational

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Amazon; Baidu; Cedat 85; Google; IBM; Intelligent Voice; Microsoft; Nuance; Speechmatics; Verint Systems

Recommended Reading: “Architecture of Conversational Platforms”

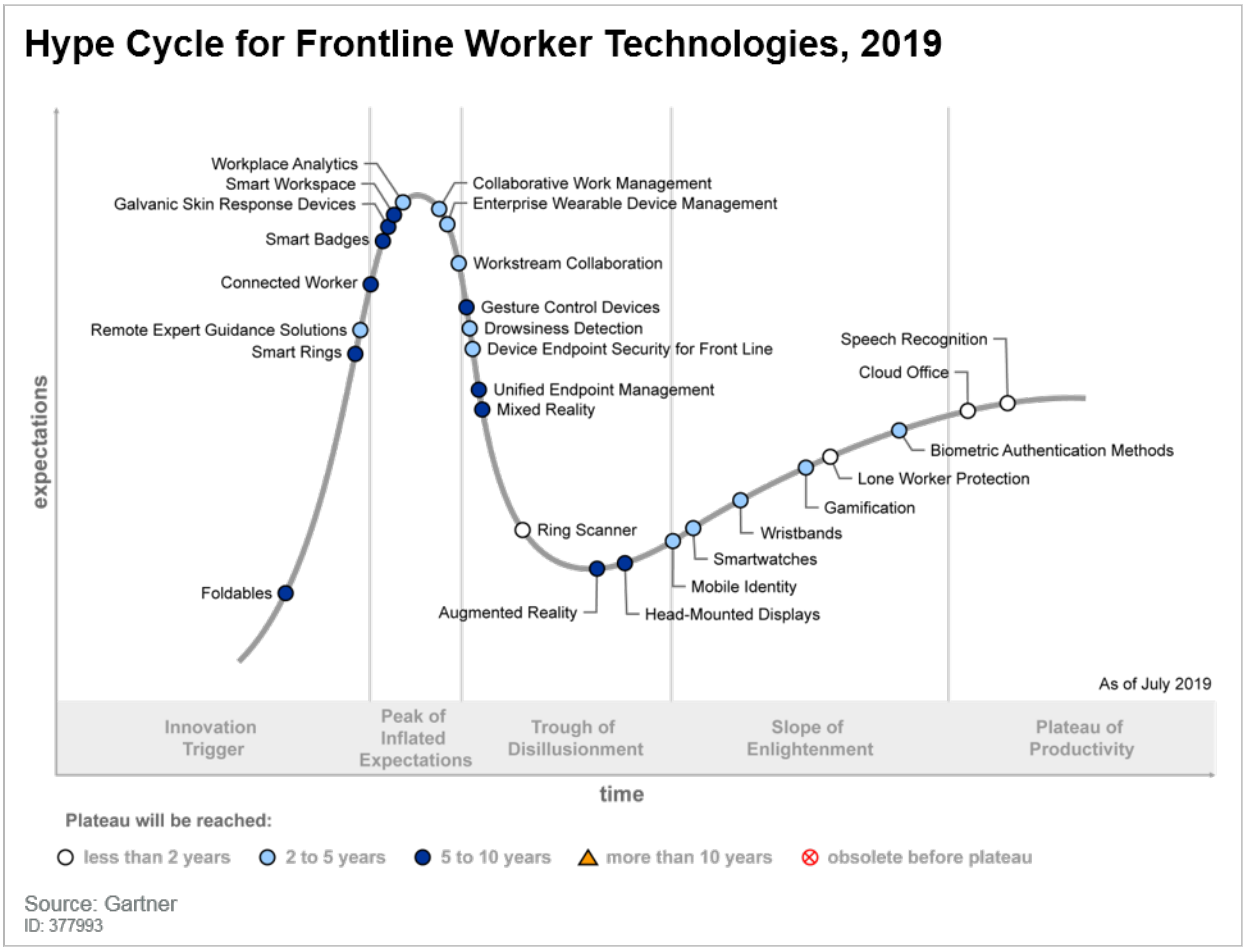
“The Future of Customer Self-Service: The Digital Future Will Stall Without Customer-Led Automation”

“Cool Vendors in Speech and Natural Language”

“Magic Quadrant for Cloud AI Developer Services”

Appendixes

Figure 3. Hype Cycle for Frontline Worker Technologies, 2019



Source: Gartner
ID: 377993

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 1. Hype Cycle Phases

Phase	Definition
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers.
Trough of Disillusionment	Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the technology's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the technology to reach the Plateau of Productivity.

Source: Gartner (July 2020)

Table 2. Benefit Ratings

Benefit Rating	Definition
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
Low	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2020)

Table 3. Maturity Levels

Maturity Level	Status	Products/Vendors
Embryonic	■ In labs	■ None
Emerging	■ Commercialization by vendors ■ Pilots and deployments by industry leaders	■ First generation ■ High price ■ Much customization
Adolescent	■ Maturing technology capabilities and process understanding ■ Uptake beyond early adopters	■ Second generation ■ Less customization
Early mainstream	■ Proven technology ■ Vendors, technology and adoption rapidly evolving	■ Third generation ■ More out-of-box methodologies
Mature mainstream	■ Robust technology ■ Not much evolution in vendors or technology	■ Several dominant vendors
Legacy	■ Not appropriate for new developments ■ Cost of migration constrains replacement	■ Maintenance revenue focus
Obsolete	■ Rarely used	■ Used/resale market only

Source: Gartner (July 2020)

Gartner Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

Understanding Gartner's Hype Cycles

Use Wearable Technology to Enhance Frontline Worker Productivity: Field Service Management

Transform Frontline Worker Computing With a Product-Oriented Focus

Technology Investments for Frontline Workers Will Drive Real Business Benefits

Solution Path for Expanding a Mobility Strategy Into a Unified Workspaces Strategy

More on This Topic

This is part of an in-depth collection of research. See the collection:

- 2020 Hype Cycle Special Report: Innovation as Strategy

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