MOTOROLA SOLUTIONS

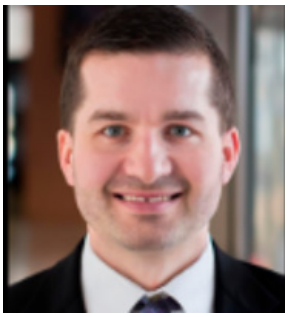
A Workgroup-Centered Perspective on Unified Communications

Enabling Revenue-Generating Workers by Unifying Applications, the Industrial Internet of Things, and Digital Voice Across Any Network and Any Device

Issue 1

Gartner

Welcome



Today, the power of unified communications is expanding beyond the traditional office space and into the industrial areas where the revenue generation for many enterprises actually takes place.

The employees in those areas – the production line worker, the hotel housekeeping and security staff, the short-haul truck driver, the warehouse manager, the utility linesman, and countless others – are critical parts of your enterprise, and their performance can make or break the success of your company.

These industrial employees use different devices on different networks and face far different challenges communicating than their counterparts in carpeted office spaces. Their preferred collaboration methods - radio, telephone, and even pager to resolve work tickets from dispatch or alarms from equipment – are focused on issue prevention or resolution, and optimized for their workflow and environment. The operator in the paint-spray booth at a manufacturing facility is not going to use Google Hangouts on a laptop to notify her supply team that she is out of paint. She will use a push-to-talk radio to say, "I'm out of paint at Sprayer 4." Instant, efficient, and done on a device that is purpose-built for her needs.

The need to connect these employees "outside the four walls" has never been greater. While these workers are not a traditional unified communications focus, they benefit from streamlined collaboration with their colleagues in the same way as their office counterparts, and often pose a greater challenge. In addition to one-to-one and one-to-many communications between employees, there are also person-to-machine and application-to-person communication streams to manage. Dispatch and work ticket management applications are commonplace, and critical for business success. In rare circumstances, front line workers may even need immediate guidance from an offsite supervisor, or a manager within the office environment, and must communicate quickly across devices and technologies.

In this newsletter, we will explain how new technologies applied to Unified Workgroup Communications carry the concept of Unified Communication and Collaboration into the industrial space. Offerings in this new space, like Team Communications from Motorola Solutions, allow workers outside the office area to communicate instantly, without boundaries, and with added intelligence across the entire enterprise. We will also review how some emerging technologies on Gartner's Hype Cycle for Unified Communications and Collaboration apply in the Unified Workgroup Communications space.

Finally, we will share a few case studies on enterprises, such as the MGM Grand Hotel, who have put Unified Workgroup Communications into action with tremendous results and unexpected benefits. Be sure to check these out to see how these industry leaders are taking their communications further.

Best regards,

John Kedzierski
Motorola Solutions Inc.
Corporate Vice President
North America Services and Commercial Markets

Contact Motorola Solutions today at **motorolasolutions.com/teamcommunications** to review your current communication systems and better understand how Motorola Solutions can help you take your communications further.

A Workgroup-Centered Perspective on Unified Communications

In the arena of Unified Communication and Collaboration (UCC), industry experts strongly recommend assembling a stable of best-in-class vendors to provide the critical elements of a UCC solution. The Gartner research provided later in this document: Hype Cycle for Unified Communications and Collaboration, 2016 helps IT leaders revisit whether well-established UCC solutions are sufficient to meet the growing imperative to engage workers. Innovations continue to emerge that challenge existing patterns for how UCC is procured, developed and consumed. The size and scope of the UCC environment make it unlikely to source the entire solution from a single mega-vendor; instead, enterprises must assemble a suite of trusted suppliers who best fit the needs of their particular business.

From carpet to concrete

A key employee segment often overlooked by enterprises when planning UCC strategies is, surprisingly, the team with a central role in generating revenue, driving efficiencies, and satisfying customers. Most UCC solutions providers focus on the carpeted areas of the business - the front office, the managerial suite, and the sales team. The solutions (web and videoconferencing, telephony, instant messaging, and presence) and preferred devices (desktop and laptop computers, smartphones) under discussion are appropriate to this traditional office environment.

However, once a transaction occurs - a sale is made, an order is placed, a room is reserved - the responsibility to successfully meet that commitment often shifts out of the carpeted area to the workers “on concrete” - on the shop floor, in the kitchen, or otherwise operating behind the scenes. Plant workers, delivery drivers, facilities managers, housekeeping teams, line operators, quality control technicians, security staff and other employees and partners outside of the traditional office environment ultimately own whether deliveries are made, revenue is generated, and customers are delighted.

The demands and challenges of this business-critical industrial environment are very different to those in the office area. Personnel are often in high-noise areas, or out in the elements. For durability, coverage, and audio quality, the devices used to communicate are often land mobile radios instead of smartphones. Group text messaging and one-to-many push-to-talk are optimal modes of communication. Dispatch and work order ticket management applications accessible on both radios and mobile devices are necessary to keep the entire team aligned and focused. Critical information arrives directly from the equipment, as the Industrial Internet of Things (IIoT) provides alerts, data, and notifications to workers directly. Without a communication and collaboration strategy for these industrial employees, the enterprise is at risk of not keeping business commitments and frustrating customers.

Extending the UCC concept to these industrial spaces with Unified Workgroup Communications can ensure that industrial workers are also able to share information quickly across disparate technologies and devices. There are three key aspects of a Unified Workgroup Communication solution, such as Team Communications from Motorola Solutions - communicating instantly; without the traditional boundaries inherent in certain networks and devices; and with added intelligence through workflow and safety applications, system monitoring and IIoT.

Communicate in an instant

When an answer is needed, an order is delayed, or a safety situation arises, nothing is faster than push-to-talk. Unified Workgroup Communications should provide the instant collaboration needed for high-performing teams. Team Communications

from Motorola Solutions supports one-to-one or one-to-many collaboration across radios in challenging noise environments, and across the WAVE™ broadband push-to-talk (PTT) application on smartphones, tablets, or laptops to expand the same conversation to wherever network connectivity exists. Employees who do not use a radio can contact those who do, and vice versa, instantly.

In an emergency, priority voice and data communications guarantee that critical information is heard by all, bypassing routine conversations. When your team can reach anyone necessary to resolve critical issues – regardless of device, or physical location – deadlines are met, promises are kept, and employee satisfaction improves.

Communicate without boundaries

Today, choices of communications devices and networks often impose limitations on who can be quickly reached. There may also be multiple dispatch focal points, specialized to the needs of a smaller group and the network (LMR, LTE, WiFi or LAN) they use to communicate. These limitations lead to delays and frustration when the right decisions must be made faster than ever before to be safe, successful, and efficient.

The core of Unified Workgroup Communications is linking industrial staff carrying radios or other devices with the team members using smartphones, tablets, or laptops as their preferred device back at the office. Team Communications from Motorola Solutions deploys the WAVE broadband PTT application on non-radio devices, so that team members scattered across the state or even the country can communicate as quickly and easily as if they were carrying a radio, leveraging the convenience of talkgroups and priority calling.

Using Unified Workgroup Communications, network, device, and geographic boundaries are overcome – your team members can connect from their preferred device to other team members, anywhere, anytime with business-critical information.

Communicate with added intelligence

Similar to the carpeted workspace, there are several purpose-built applications in the concrete environment to help employees be more successful, more efficient, or safer. These applications are often available for smartphone or desktop platforms, but they are also designed for use on digital mobile radios, reflecting the popularity of these devices in the industrial workspace. Work order ticket management, dispatch, and location tracking applications specialized to particular industry verticals are common, and provide optimized solutions to the unique challenges these employees face.

While technology has provided more operational visibility through SCADA (Supervisory Control and Data Acquisition) and IIoT, GPS location, alarms and sensors, and even video, this data is often stranded in different corners of the organization. But within these pools of information is the intelligence that separates the businesses that succeed from those that fail. A more efficient route. A root cause behind seemingly unrelated issues. A pattern of sensor trips indicating a larger issue. An inventory shortage that will impact the business. An alarm warning that someone is in the wrong place at the wrong time.

By connecting every member of the group regardless of device, Unified Workgroup Communications unlocks the potential of your company's data. The critical piece of intelligence needed to make your business safer, more successful, or more efficient can now be communicated – instantly – by the person who knows to the people who need to know.

Assure the safety and security of your staff

Keeping every member of the organization safe is the overriding responsibility of all businesses. Unified Workgroup Communications helps maintain the security of the entire team - both carpeted and concrete spaces - by enabling communication to all impacted employees. Whether the issue is an injury in the plant, a disgruntled employee growing belligerent in the HR department, or a suspicious package left in the lobby, resolving the situation quickly and safely relies upon instant, clear communications. In the event that local public safety agencies respond, the security team must be able to provide first responders with precise information about the incident and quickly direct them to the correct location.

Team Communications keeps all of your employees connected and ensures that critical emergency information is shared with everyone at the push of a button. With specialized radios for hazardous environments and Lone Worker and Man Down alerting, Motorola Solutions provides

an additional level of protection for radio users in challenging circumstances.

Unified Workgroup Communications Use Cases

British Airways

Canadian Pacific Railway Police Service

Connexus® Energy

MGM Resorts International® Case Study

Unified Workgroup Communications uses several technologies in the Gartner UCC Hype Cycle

While the modality and infrastructure of communications in industrial workspaces differ from an office workspace, there are enabling technologies in various stages of the UCC Hype Cycle that apply to the needs of the Unified Workgroup Communications space as well. Some of these include:

Virtual Personal Assistant (embryonic)

Industry-specific Virtual Personal Assistants provide clear benefits to workers outside a traditional office environment. While voice interaction is an emerging technology in all workspaces, it will be even more critical for the suitability of VPAs in the industrial space, as workers will be more likely to need their eyes and hands engaged with their activity to ensure safety and productivity. Given the availability of clear processes and procedures and high employee turnover in some roles, the VPA can play a vital role in ramping up new employees and smoothing transitions within the enterprise. The concept of "eyes up, hands free" is a foundational aspect of Motorola Solutions design and development in mission- and business-critical workspaces, and development of VPAs to serve the unique needs of our customer base is an area of focus for the company.

Spatial Audio (emerging)

Audio communications in the industrial workspace already provide unique challenges with respect to background noise and audio clarity. As the industry leader in mission-critical audio communications for public safety, Motorola Solutions brings unique technical expertise in the areas of noise cancellation, multiple microphone audio capture, and adaptive audio optimization.

The benefit of spatial audio to personnel in an industrial workspace is far more fundamental than the more engaging meeting experience it delivers in an office environment. Out on a plant floor, in a warehouse, or in the utility space of a large hotel, limited visibility and a high noise floor can quickly lead to disorientation, especially for new employees or those experiencing some sort of health emergency. The ability for a coworker to spatially orient to the plea "I need help over here" provides immediate safety benefits to the enterprise.

Conversational User Interfaces (emerging)

Just as a physical user interface benefits from being simple and intuitive, the adoption and application of vocal interfaces hinges on the ability of the user to speak in common, industry-specific terms that are recognized by the technology as audio cues. In the context of an industrial user, the same challenges referenced earlier with respect to audio apply here as well. The proven capabilities of Motorola Solutions to identify and isolate desired audio characteristics in high-noise environments bodes well for the utilization of CUI by workers in challenging audio workspaces.

This technology has a long history in the public safety space, most notably in the pioneering work of Project 54 at the University of New Hampshire. Launched in 1999 at the UNH Consolidated Advanced Technologies Laboratory, Project 54 focused on enabling a police officer to activate key capabilities of a patrol vehicle - lightbar, siren, radar, and radio - with voice commands. This team eventually formed a startup, 54ward, acquired by Motorola Solutions in 2013.

Communications Platform as a Service (cPaaS) (adolescent)

The cornerstone of the Unified Workgroup Communications offering from Motorola Solutions is WAVE, an application seamlessly connecting the land mobile radio systems favored in the industrial space with the commercial mobile and enterprise LAN technologies prevalent in office environments. Aside from breaking down communication barriers, WAVE also extends push-to-talk convenience and radio talkgroups and aliases to users on mobile devices, laptops, tablets, and desktop computers.

Motorola Solutions introduced WAVE OnCloud, a cloud-based, software as a subscription (SaaS) service, in March of 2017. Featuring the same capabilities of a WAVE on-premise deployment,

WAVE OnCloud offers monthly subscription pricing with competitive savings that scale dramatically with larger mobile radio deployments.

Truly Connect All of Your Workspaces

To be successful, many industries rely on business elements beyond the carpeted space served by traditional Unified Communications technologies. Team members on the industrial side of the value chain must be capable of collaborating with the front office, and vice versa, or else each group is operating in a vacuum. Unified Workgroup Communications offerings such as Team Communications from Motorola Solutions allow all aspects of the business to collaborate on the device they prefer to use, on the networks they have available, and ensure that critical intelligence from IIOT, SCADA, or other sources is shared immediately between those who know, and those who need to know.

With the introduction of WAVE OnCloud, the new cloud-based SaaS push-to-talk offering from Motorola Solutions, getting started on the path to Team Communications could not be easier or more cost effective. With a minimal investment, digital radio users will be able to communicate in talk groups with users of other devices, increasing collaboration and boosting efficiency and customer service.

Contact Motorola Solutions today at **motorolasolutions.com/teamcommunications** to review your current communication systems and better understand how Motorola Solutions can help you take your communications further.

Source: Motorola Solutions

Research from Gartner:

Hype Cycle for Unified Communications and Collaboration, 2016

The digital workplace compels IT leaders to revisit whether well-established UCC solutions are sufficient to meet the growing imperative to engage workers. Innovations continue to emerge that challenge existing patterns for how UCC is procured, developed and consumed.

Analysis

What You Need to Know

Enterprise unified communications and collaboration (UCC) solutions are based on familiar technologies, such as telephony, video, messaging and conferencing. They are increasingly being impacted by innovations coming from the adjacent markets of mobile, cloud and the digital workplace (see "Hype Cycle for Personal Technologies, 2016," "Hype Cycle for Cloud Computing, 2016" and "Hype Cycle for the Digital Workplace, 2016").

New technologies are emerging that augment and in some cases replace previously defined UCC platforms and services. For example, unified communications as a service (UCaaS), workstream collaboration services, freemium UCC and cloud-based video infrastructure change the paradigm for how people consume UCC. These innovations facilitate greater adoption of UCC by allowing quick use by end users to derive productivity benefits (see "Leverage Bimodal IT Methods to Advance UCC").

Most IT leaders are actively evolving their UCC strategies as many of the required technologies are reaching maturity in the near term and as deployment risks are better understood. The growing influence of digital workplace initiatives such as man-machine dialogue and consumer-oriented mobile applications ensure that existing enterprise communications paradigms will continue to be transformed.

The Hype Cycle

Enterprises have long sought tools and capabilities for unifying disparate communication technologies in consistent ways to enhance employee collaboration, increase productivity and improve customer service engagement.

UCC solutions are increasingly driven by enterprises seeking to go beyond the basic voice, video and IM functionality, delivering innovative technologies that enable screen and document sharing, enterprise video content management and spatial audio, as well as persistent conversations through new workstream collaboration services such Cisco Spark, Unify Circuit and Slack.

Additionally, the rise of cloud consumption models has created opportunities for enterprises to rethink their deployment strategies to best address their business needs, budgets and IT skill set. Besides the traditional on-premises, self-managed approach, enterprises are deciding on pure cloud approaches, referred to as UCaaS, or perhaps a combination of the two approaches, which is referred to as hybrid UCC.

The 2016 UCC Hype Cycle reflects an established yet still vital market with relatively few transformational technologies, but many incremental technologies that seek to extract full value from established investments.

- Nearly 80% of the technologies on this Hype Cycle will be mainstream within the next five years.
- Nearly half of the UCC technologies are in the Trough of Disillusionment phase of the Hype Cycle curve. This suggests that the overall UCC market is in the early stages of mainstream adoption, and that many organizations are likely realizing that the implementation is not as easy as initially planned. As deployment and end-user adoption best practices become more widely known, these technologies will climb the Slope of Enlightenment and lead to the productivity enhancements envisioned.
- Growing usage of communication platforms as a service (CPaaSs) and WebRTC will increasingly invoke communication applications such as voice, video, messaging and conferencing from desired web pages and mobile applications, rather than purpose-built devices.

- Longer term, digital workplace initiatives such as virtual personal assistants and conversational user interfaces are evolving our understanding of how communications can be leveraged in the enterprise to drive greater productivity through man-machine dialogue and automation.

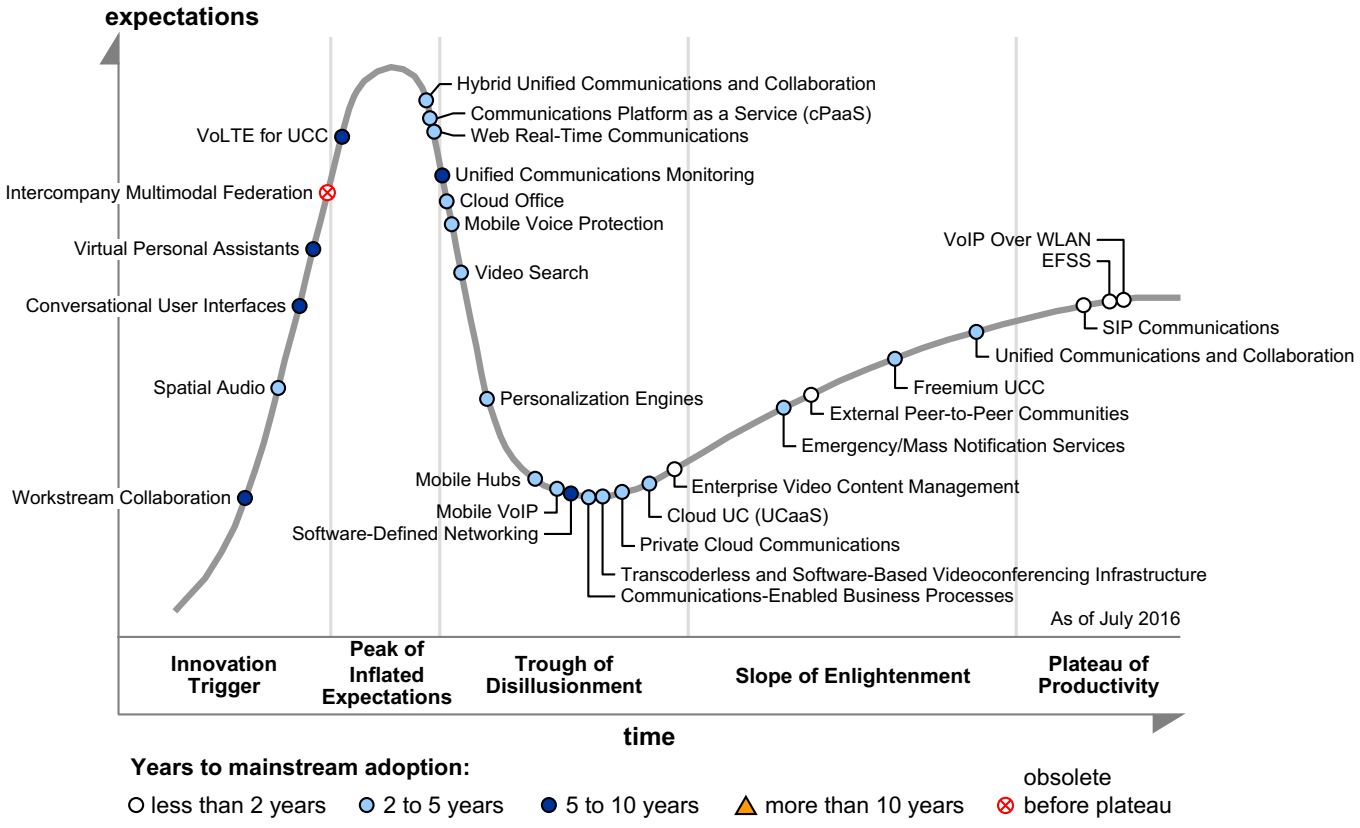
The Priority Matrix

Several of the technologies discussed in this report are already in the market and delivering tremendous business benefit to the early adopters in the enterprise, public-sector and higher education communities. For example, SIP communications is a rapidly maturing technology that is available for enterprises to deploy today to drive cost savings versus traditional telephony services.

Another UCC service that has seen innovation and evolution in the past few years is videoconferencing. Video has become a far more pervasive offering by enterprise IT as video image resolution has improved, endpoint pricing has dropped and end users find the video services easier to use. The growing influence of software-based video infrastructures has allowed cost-effective, dynamic-scaling opportunities and given rise to video-as-a-service offerings. As an enhancement to videoconferencing and persistent virtual meeting spaces, enterprise video content management is being leveraged as an adjunct set of capabilities to record, archive, search, share and play back video content from these UCC services, to facilitate distribution of this valuable enterprise asset.

When needing to collaborate with people and organizations outside of the enterprise, external peer-to-peer communities of partners, customers and suppliers are utilized to generate ideas, solicit feedback and provide support. Typically based on social software tools, these peer-to-peer community technologies have recently begun

FIGURE 1 Hype Cycle for Unified Communications and Collaboration, 2016



Source: Gartner (July 2016)

leveraging WebRTC as well to allow escalation of user engagement from text-based communications to voice and video when quicker resolution of a problem is desired.

Given the short time frames for many of the UCC technologies to reach maturity, infrastructure and operations leaders should be planning now to evaluate and invest in the technologies shown in the UCC Priority Matrix that will be mainstream within the next few years.

Off the Hype Cycle

Six technologies have been removed from the Hype Cycle this year:

- "Rich Presence" – Matured in the market and off the plateau
- "Continuous UCC" – Replaced by "Workstream Collaboration," which contains a broader suite of capabilities and players than previously described in the continuous UCC technology.

FIGURE 2 Priority Matrix for Unified Communications and Collaboration, 2016

benefit	years to mainstream adoption			
	less than 2 years	2 to 5 years	5 to 10 years	more than 10 years
transformational		**Personalization Engines** **Web Real-Time Communications**	Conversational User Interfaces Virtual Personal Assistants	
high	**EFSS** **External Peer-to-Peer Communities** **SIP Communications**	Cloud Office Cloud UC (UCaaS) Communications Platform as a Service (cPaaS) Communications-Enabled Business Processes Emergency/Mass Notification Services Mobile Hubs Unified Communications and Collaboration	Software-Defined Networking	
moderate	Enterprise Video Content Management VoIP Over WLAN	Freemium UCC Hybrid Unified Communications and Collaboration Mobile Voice Protection Mobile VoIP Private Cloud Communications Spatial Audio Transcoderless and Software-Based Videoconferencing Infrastructure Video Search	Unified Communications Monitoring VoLTE for UCC Workstream Collaboration	
low				

As of July 2016

Source: Gartner (July 2016)

- "Context-Enriched Services" — Replaced by "Personalization Engines," which encompasses a broader set of capabilities, including context-enriched services.

- "Intercompany Multimodal Federation" — Obsolete before plateau as this is no longer a discrete technology but a feature of collaboration platforms.

- "3D Video Telepresence" — Removed as the market supply and demand did not materialize as projected.

- "Collaborative Authoring Tools" — No longer considered a hyped technology as it is now available as a standard feature of document creation tools.

On the Rise

Workstream Collaboration

Analysis By: Adam Preset; Mike Fasciani; Mike Gotta

Definition: Workstream collaboration creates a persistent, shared conversational workspace that helps groups initiate, organize and complete work. It integrates direct and group messages, alerts, notifications, activity streams, files, tasks, bots, and real-time audio and video into searchable groups or channels.

Position and Adoption Speed Justification: Workstream collaboration is an immersive, rapid-response collaborative work model to improve team agility and effectiveness by encouraging greater self-organization, self-management and localized decision making. Today, developers, engineers, operational groups and creative teams are the most common users of these tools. Group members can work independently yet maintain situational awareness, share information and self-synchronize as work progresses.

Products in this space often have plug-in models that allow for codeless integration with a wide variety of prosumer and business applications, enabling employees to build custom, cross-application workflows. Conversational interaction with bots extends the ability of these applications to handle a greater number of business-centric use cases and point to future integration with algorithmic systems. Communications-enabled business process (CEBP) can leverage a specific implementation of workstream collaboration whereby external business applications control the context and interactions based on defined processes and roles. The rising interest in this type of conversational work model is a response to the emergence of more nonroutine work, and an example of extreme collaboration.

Vendors from different market segments compete for share and approach their solution design based on their heritages and strengths:

- Emblematic and notable options such as Slack, Atlassian HipChat and Kore are specialized for this scenario.

- UC vendors such as Cisco with Spark, Unify with Circuit and RingCentral with Glip have also entered the space.

- Project-focused offerings such as Redbooth have similar attributes, accomplishing real-time interactions via integrations.

- Social software vendors such as Jive (with Chime and Daily) are evolving toward a workstream collaboration solution.

- Microsoft, Google and IBM are likely to be players in the market as well.

The market is highly volatile with over 60 vendors identified so far. As workstream collaboration continues to evolve, it will become a mainstream collaborative work model used by high-performing teams to self-organize and self-manage nonroutine work.

User Advice: Evaluate workstream collaboration for use by groups and teams whose work activities are nonroutine, dynamic, geographically dispersed, or require continuous interaction across group/team members to keep people on track to deliver a collective result (often quickly). Although it is too early for organizations to think about standardization or even enterprisewide deployments, IT decision makers can use this technology's malleability to their advantage in selecting pilots. It can provide channels for open-ended social collaboration for internal and external groups, and indeed may already serve that purpose in some organizations for teams that have unofficially adopted free options.

It also suits developer, engineer, operations, crisis management or other scenarios where people need to come together rapidly in a virtual, rapid-response workspace. Early adopters

of these solutions report that onboarding new team members is easy and that their intrateam email volume may be reduced, since content and interactions are stored so that meeting minutes, action items and updated documentation don't have to be circulated. However, there are also reports of failures with the signal-to-noise ratio due to poor design and poor behavior on the part of participants, when etiquette is not part of the onboarding process.

Business Impact: Use workstream collaboration services to improve teamwork, decision making and content sharing, as well as drive higher levels of productivity from your workgroups. Workstream collaboration services are adopted initially by small groups or lines of business within the larger enterprise. Their user-centric design and persistent interaction capabilities will appeal to agile work teams that desire the ability to coordinate and stay connected at all times.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Atlassian; Avaya; Cisco; Kore; RingCentral; Slack; Unify

Spatial Audio

Analysis By: Steve Blood

Definition: Spatial audio is a technology that enables multiple participants of the same audioconference session to separate connections with a three-dimensional effect, eradicating cross talk and enabling clearer and more-engaging conversations.

Position and Adoption Speed Justification: Spatial audio is a niche but proven technology that offers conference participants a vastly superior audible experience to the traditional PSTN experience of most web-conferencing services on the market today. The technology is proprietary and requires either smart devices – smartphones, tablets or PCs – utilizing client applications, or embedded technology in WebRTC to deliver the spatial audio experience.

For optimum effect, it also requires participants to use stereo headphones. Each participant is connected to the conference session in an individual stereo audio channel. This means that when more than one person speaks at the same time, all can be heard by participants in much the same experience as during a live meeting. This is very different from the cross talk experienced in traditional web conferencing, which makes the collective output unintelligible. Utilizing smart devices with powerful processing capabilities means vendors can deliver additional capabilities not possible with traditional web conferencing.

Dolby has developed a unique noise reduction capability in its Dolby Voice product to limit the impact of background noise in public environments. Voxeet has created the ability for two participants to have a private conversation (Whisper Mode) while still listening to a multiparty conference session. Spatial audio could achieve rapid market adoption as an add-on to conferencing services – for example, Dolby Voice is embedded in BT's MeetMe service, which leverages Cisco WebEx for web conferencing.

The biggest challenge is reliability of the Internet Protocol connection between the smart device and the service platform. In most cases, users will likely be relying on internet connections over wireless networks. While these connections are subject to continuous improvement in quality and speed, and vendors have designed their applications to cope with the nuances of the internet, for many organizations the more consistent experience will be the PSTN connection – even if it is inferior. However, greater utilization of IaaS for compute enables vendors to scale and expand their services quite rapidly. As more access points to spatial audio services are made available, the expectation of service reliability improves and more organizations can consider moving groups of users to spatial audio services.

Another key challenge is that the spatial effect diminishes as more participants are added to the conference connection. The optimal number to appreciate the quality of spatial audio is 10 users. This means that the service will not satisfy the needs of all users, and especially of IT organizations looking to adopt a one-size-fits-all approach.

User Advice: IT organizations looking to provide an enhanced and potentially more cost-effective alternative to traditional web-conferencing services for group collaboration should investigate the benefit of using spatial audioconferencing services. Trial services with key groups of employees to understand how the superior quality enables stronger employee engagement

in virtual meetings. Survey users to understand if this technology would enable similar levels of collaboration to those of physical meetings, and if it offers an alternative to displacing some of these.

Business Impact: The objective of spatial audio from a business perspective has to be to create more-engaging meeting experiences beyond what is currently offered by traditional web conferencing. A higher level of engagement should result in better collective output of employee groups and better engagement with customers. This is difficult to measure in the short term of a technology trial, so evidence will rely on user feedback and technology adoption statistics.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: BT Global Services; Voxeet

Conversational User Interfaces

Analysis By: Tom Austin; Van L. Baker; Magnus Revang

Definition: Conversational UI (CUI) is a high-level design model in which user and machine interactions primarily occur in the user's spoken or written natural language. Typically informal and bidirectional, these interactions range from simple utterances (as in "Stop," "OK" or "What time is it?" "12:24") through highly complex interactions (collecting oral testimony from crime witnesses) and highly complex results (as in creating an abstract image for the user). As design models, CUI depends on implementation via applications and related services.

Position and Adoption Speed Justification: Vendor and open-source activity has been growing, making it easier to develop CUIs. More is promised to come in both CUIs and new business models that will shake up control of new UI paradigms to partly replace and supplement apps and APIs.

Recent CUI-relevant activity includes Alexa Skills Kits, better IBM Watson natural-language capabilities, Facebook's Messenger Platform, Microsoft Cortana Intelligence Services and numerous cloud-based natural-language processing (NLP) services and frameworks (such as Google's SyntaxNet).

Most CUI implementations are still primitive, selecting responses via pattern matching and simple decision trees. Increases in capabilities are largely due to improvements in natural-language understanding (NLU) and speech recognition that make matching user input to the appropriate output more effective. Leading bots today use human fallback to handle edge case queries. The potential for CUI is enormous, although at present the hype is definitively higher than the capabilities of actual implementations.

User Advice: Imagine the ultimate "clean screen" approach (or a no-screen approach as with Amazon Echo and skill kits) — workable on a desktop, a large screen, tablet, phone or watch — a blank screen with only one blank dialogue box to which the user can type or talk. It responds meaningfully, retaining and reusing previous information from earlier dialogs with this user and often asking qualifying questions before responding substantively to the user's wants or needs.

The need for literacy-related training and tools will significantly diminish during the next decade. Plan on CUIs becoming the dominant model. By 2020, at least 40% of people working in new applications will primarily interact with CUIs there, removing much of the perceived need to invest further in improving "computer literacy."

Be wary of overcommitting to CUIs too deeply. Conversational interfaces can make machines smarter and improve the ability of people to handle novel situations (people and machines collaborating will be better than either alone). But they carry an extra burden as well. For well-developed, repetitive skills that can be performed almost effortlessly, injecting conversation can degrade performance unless the technology is able to recognize the repetitive patterns and able to invoke many steps of a routine process with a single, user-generated command. We believe this autoprogramming capability will be one of the most critical — but last to emerge — in conversational interfaces.

(Avoid retrofitting CUI front ends to existing applications unless it improves usability and user delight.)

Business Impact: This approach will appear primarily in new applications. Enterprise IT leaders should be on the lookout for (and biased toward) CUIs to improve employee (and customer)

effectiveness as well as cut operating expenses and time spent learning arcane computer semantics.

There will also be some retrofitting. Over the next five years, we do not expect large enterprises to invest heavily in retrofitting existing systems of record where the employee base is experienced and stable and the feature set well known to the user base. However, where there is employee turnover, significant rapid changes in feature sets, or where enterprises face a continuing burden of providing computer literacy training, enterprise IT leaders need to consider creating people-literate front ends to make it easier for employees to adapt and excel.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Amazon; Baidu; Facebook; Google; IBM; IPsoft; Microsoft; Next IT; Salesforce

Virtual Personal Assistants

Analysis By: Tom Austin; Van L. Baker

Definition: A virtual personal assistant (VPA) performs some of the functions of a human assistant. With a user's permission, it:

- Observes user content and behavior
- Builds and maintains data models (drawing inferences about people, content and contexts)
- May predict users' needs
- May act autonomously on the user's behalf
- Gradually learns from user behavior and as a result builds trust

VPAs make everyday tasks easier (by prioritizing emails, for example), and its users more effective (by highlighting the most important content and interactions).

Position and Adoption Speed Justification: VPA adoption grows as users get more comfortable with them, as the technologies improve and as the variety of approaches multiply:

- Unobtrusive VPA-like features such as Gmail's Smart Inbox, embedded in existing products, are growing, as are narrow-purpose VPAs (such as personal financial advisors, health and wellness coaches, and calendaring agents).
- VPAs are becoming centerpieces of cross-platform platforms (such as Microsoft's Cortana Intelligence Suite).
- General-purpose VPAs (such as Siri, Google Now, Alexa and Cortana) have room to grow and evolve. Today, they deliver only a fraction of what we expect by 2020.
- VPAs act on behalf of both consumer and business users, but more enterprise-oriented VPAs are now also emerging (such as Openstream's EVA).

Virtual customer assistants (such as IPsoft's Amelia and Go Moment's Ivy, which is a virtual hotel concierge) are similar to VPAs, but they serve, first and foremost, as agents of the businesses that employ them.

User Advice: IT leaders should:

- Anticipate that many different types of VPAs will be available and that a single "winner take all" success is unlikely to happen. Individuals may use several VPAs with different specializations, such as:
- Health-related VPAs to help with diet, exercise, the quantified self, relationships and psychological well-being
- VPAs to serve as personal shoppers
- Personal-career development and financial-management VPAs
- VPAs for office-specific tasks like calendar management, email handling and external information monitoring
- Encourage experimentation while creating opportunities for employees to share experiences and recommendations. Lead by doing.
- Prepare for mail-centered VPAs first, followed by blossoming of the full range of capabilities.

- Recognize that privacy, security and innovation are at odds, but encourage experimentation with guardrails. Imposing too many controls too soon due to a lack of trust in your employees could eliminate the opportunity to outflank competitors.

- Look for opportunities to leverage VPAs to improve the appeal of business apps for users especially in the mobile app segment.

- Carefully measure the impact of VPAs on people's behavior and performance. Use an ever-evolving set of metrics, identified by observation and crowdsourcing.

Business Impact: VPAs have the potential to transform the nature of work and structure of the workplace. They could upset career structures and enhance workers' performance, but they have challenges to overcome beyond simply moving from research labs to functional products. It is far too early to determine whether or how they will overcome privacy concerns (although opt-in requirements make sense). Individuals will think long and hard about what they want each VPA to see and who else might view that information. Similarly, enterprises will be concerned about employees exposing confidential information via VPAs and should determine the extent to which information is retained by VPA providers.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Apple; Google; IBM; Microsoft; Nuance; x.ai

Intercompany Multimodal Federation

Analysis By: Steve Blood

Definition: Intercompany multimodal federation enables users in one organization to seamlessly collaborate using IM, audio, video and web conference sessions with users in another organization, independent of the technology platforms selected by their respective IT departments.

Position and Adoption Speed Justification: Unified communications and collaboration (UCC) offers employees multiple modalities for communicating in IM, voice, video and web conferencing, but the ability to switch seamlessly between modalities is largely only available from a single vendor platform. This limits the extent to which one organization could collaborate with another. The greatest barrier to multimodal federation has been industry competition between vendors such as Microsoft, Google, Cisco and Avaya, all of which had limited commercial interest in achieving interoperability with each other.

A market opportunity was created for vendors to provide "middleware" that would link collaboration between competing platforms. These are presented as either premises-based or cloud-based services. As federated collaboration has matured, middleware has become a legitimate adjacency for collaboration vendors to secure greater share and revenue in a consolidating market. The acquisition of Acano by Cisco and Esna by Avaya are examples of this. As leading vendors in this space acquire middleware as part of their product portfolio, the opportunity to interoperate between competitors becomes more realistic and the technology becomes obsolete before the plateau.

User Advice: Organizations should evaluate the benefits of federating multimodal UC beyond their own enterprise networks as a discrete intercompany exercise. This should be with a limited number of partners to assess user adoption and value to the organization. This could also be an exercise inside a large organization that has multiple buying centers and between different UC technology providers. Federation between organizations using the same technology platforms, either as an enterprise capability or as a cloud service, could be a useful place to start, avoiding integration challenges and costs of integrating mixed vendor environment.

As well as using embedded capabilities from leading collaboration vendors, an emerging option is to consider the range of freemium to premium cloud-based web-conferencing services to avoid the increased risk associated with security and privacy of enterprise federation. In some cases, this may be integrated into your corporate UC solution. Most support WebRTC as an emerging capability for browser-based communications.

Business Impact: Intercompany federation of UC modalities offers the opportunity to extend the operational and agility benefits identified with UC inside the enterprise to customers, partners and suppliers. The immediacy of agile collaboration can

improve the speed of decision making, engaging a select group of users at an optimum time to reach a better collaborative output.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AT&T; Avaya; BlueJeans Network; Cisco; NextPlane

At the Peak
VoLTE for UCC

Analysis By: Bill Menezes

Definition: Voice over Long Term Evolution (VoLTE) enables cellular voice over internet Protocol (VoIP) voice calls over 4G LTE networks, providing faster call setup, higher voice quality, cross-device video support and better spectrum utilization than calls using legacy 2G/3G circuit-switched networks. VoLTE also enables uninterrupted handoff of cellular calls to an authorized Wi-Fi hot spot or wireless LAN (WLAN).

Position and Adoption Speed Justification: Growing availability of VoLTE service, which the industry group 5G Americas reports was operating in 157 countries as of 2Q16, will enable more seamless integration of cellular devices with enterprise unified communications and collaboration (UCC) platforms that already widely support mobile VoIP. Gartner rates this technology as adolescent, although adoption will continue growing slowly because even in developed markets with VoLTE carriers, such as the United States, Germany and the U.K., 4G LTE and VoLTE service may not be pervasive. Further, as of 2Q16 most carriers have not reached the interoperability agreements needed for customers on one network to make VoLTE calls to those on another network. Both sending and receiving devices must be VoLTE-enabled or the call defaults to a 2G/3G circuit-switched network. The latest versions of the Apple iPhone, plus numerous high-end Android phones, support VoLTE.

Enterprise user migration and adoption will be the default over the next five to 10 years, as carriers continue expanding VoLTE coverage and support for the technology is standard in new handsets. VoLTE will compete with over-the-top (OTT) applications that natively run voice, video and messaging applications over IP with no direct links to the traditional public switched telephone network (PSTN). These include OTT solutions driven by Web Real-Time Communications (WebRTC) that can integrate voice into web and mobile applications on smart devices.

User Advice:

- Enterprises should include VoLTE capabilities in their mobile and UCC strategies, for example, by quantifying how VoLTE UC functions will provide significant advantages and by considering carriers with more advanced VoLTE if those advantages are compelling.
- Enterprises should start planning to reduce or retire wired desktop phones because VoLTE and WebRTC solutions provide a high-quality, low-cost alternative where there is sufficient network coverage from in-building cellular or the wireless LAN.
- The No. 1 reason that users say they desire a desktop phone is the quality of the voice experience. As all voice moves to IP, roaming between mobile and Wi-Fi networks will become seamless, multichannel functionality will become more seamless, and mobile call quality will improve.
- VoLTE advantages include optimization of the mobile telephony user, including use of the native dialer and quality of service (QoS) built into the mobile service provider network to ensure better call quality than for OTT voice solutions. VoLTE also supports emergency service calling features. WebRTC advantages include support across any smart device, a larger developer ecosystem than VoLTE and lower cost given it utilizes best-effort IP networks.

Business Impact: As VoLTE hits critical mass in some markets such as the U.S. in the next two to five years, it will make the smart device a more viable option for replacing wired desktop phones that enterprise users now rely on for toll quality voice and reliability. As the cellular versus wired voice quality difference diminishes, the mobile, multichannel, integrated experience that users get from their smart devices will entice them to live without their desktop phones.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AT&T; kt; Orange; T-Mobile US; Verizon Wireless; Vodafone

Hybrid Unified Communications and Collaboration

Analysis By: Megan Marek Fernandez

Definition: Hybrid unified communications and collaboration (UCC) enables organizations to operate UCC through blended cloud and premises-based deployment models. Unified communications (UC) solution configuration can be based on functionality, geography or use case.

Position and Adoption Speed Justification: A growing number of organizations are utilizing a mix of cloud and premises-based approaches to acquire UC functions. Hybrid UCC is typically provisioned in one of three ways:

- **Functional hybrid provisioning** – Features certain UC functions (such as web conferencing or videoconferencing) delivered via the cloud while other UC functionality (such as telephony) is obtained via premises-based solutions.
- **Geographical hybrid provisioning** – Features UC elements delivered in different ways, depending on the location of users. For example, users in a branch office site could obtain telephony functionality via the cloud while users in a different site could obtain functionality via a premises-based solution.
- **Use-case hybrid provisioning** – Delivery is based on the UC use case, such as supporting a volume threshold or meeting certain requirements for quality. For example, conference calls for up to six people or informal ad hoc web sessions could be obtained through a premises-based solution, but conferencing requirements growing beyond six users or requiring a professional-grade service level could be obtained via the cloud.

Organizations employ hybrid UCC procurement for reasons relating to flexibility, costs, business requirements and organization structure. For example, an organization can use an existing Internet Protocol PBX with remaining useful life for voice functionality while obtaining web conferencing capabilities via the cloud. Hybrid can also be appealing for planners concerned with adhering to regulatory or internal-communications requirements. For example, email functions can be delivered via a premises-based solution to retain control of sensitive content while communications elements with fewer regulatory or security requirements (such as conferencing) could be obtained via the cloud. Furthermore, some organizations have customization requirements or cultural preferences that demand on-premises functionality for certain UCC elements while being open to cloud provisioning for other elements.

Some forms of hybrid UCC are more common than others. Functional hybrid approaches that feature premises-based telephony and voice/unified messaging but utilize cloud-based conferencing services are somewhat common. Use-case hybrid provisioning, in which internal ad hoc conferencing sessions are supported using a premises-based approach but conferencing sessions requiring greater scalability or reliability are provisioned via the cloud, is increasing in frequency.

Overall, hybrid provisioning is growing in maturity but is not yet fully mature across all areas. Geographical hybrid models are the least mature of the three hybrid types, while functional hybrid approaches are the most mature. Across all areas, the costs associated with integrating UCC elements can be prohibitive. With the required professional services, costs for getting the cloud environment to work with the premises-based environment potentially destroy the business case. Additionally, complexity of management interface tools can lead to an awkward hybrid experience. We expect that inhibitors associated with provisioning hybrid UCC will gradually diminish over the next two years as UC providers expand their delivery approaches, providers enhance their license structures to accommodate flexibility, providers secure automated tools and APIs become available to support hybrid environments.

User Advice: Organizations considering migrating from a premises-based-centric approach to a cloud environment should evaluate hybrid UCC as an interim path. Perform a detailed asset assessment to determine the infrastructure with remaining useful life that should reside on-premises.

Determine regulatory, governance and security requirements that will impact UCC provisioning

model decisions. Proactively work with your provider to ensure that basic compliance with these requirements can be satisfied.

Consider hybrid UCC provisioning as a tool to fulfill peak demands for certain capabilities. For example, evaluate cloud-based conferencing for large-scale or external conferencing activities while utilizing premises-based conferencing for either internal or small conferencing sessions.

Evaluate the hybrid UCC capabilities and limitations of providers (technology providers, service providers and system integrators). Consider the integration capabilities (and costs associated with integration efforts) of various hybrid UCC elements. Define a roadmap that takes into account which party has responsibility for management and maintenance associated with various blended cloud/premises-based elements.

Business Impact: Hybrid UCC provisioning offers organizations flexibility (financial, use case and asset management) when obtaining UC functionality. Blended procurement allows planners to leverage premises-based infrastructure with existing useful life. Hybrid deployments can also ensure that compliance, security and regulatory requirements are fulfilled on the corporate journey to the cloud. IT planners should factor application use, existing investments, in-house IT staffing resources and other business requirements into their UC adoption, and use roadmaps instead of being restrained by the limitations that siloed premises-based and cloud-based provisioning may present.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AT&T; Avaya; BT; Cisco; Dimension Data; HP; Microsoft; Mitel; Orange; Verizon

Communications Platform as a Service (cPaaS)

Analysis By: Bern Elliot

Definition: Cloud platform services, known as platform as a service (PaaS), provide cloud-based middleware that enables applications, including SaaS applications, as well as application development, to run on a prebuilt infrastructure. When PaaS offerings are specifically oriented toward supporting communication functionality, these are called communications PaaS, or cPaaS. cPaaS solutions can run on customized standard infrastructure as a service (IaaS), such as Amazon Web Services (AWS), or a customized infrastructure service.

Position and Adoption Speed Justification: The cPaaS market is maturing rapidly though it currently remains at an early stage. The cPaaS approach is disrupting how established vendors deliver solutions and it is enabling new digital business opportunities. In the last year several established communication vendors have introduced cPaaS solutions in order to compete in this new market.

Functions offered by cPaaS solutions include SMS, Multimedia Messaging Service (MMS), speech recognition, mobile browsing, two-factor authentication, intelligent assistants, and other emerging options for fixed and mobile interactions.

cPaaS solutions require a developer community. They are intended to make development, testing and deployment of applications quicker, simpler and more cost-effective. PaaS offerings include life cycle management options, a broad range of APIs, support for multiple developer languages, and logging and reporting tools. They also offer flexible microbilling options so that SaaS and business applications using cPaaS resources only pay for the resources that they actually use.

User Advice: The cPaaS approach allows developers to take advantage of a native cloud communications ecosystem and to enable functionality at a much lower price point and with much lower upfront investment. Enterprises and communication providers can leverage cPaaS to rapidly develop, test and deploy new applications without having to provision any infrastructure. Large enterprises are finding that they can develop communication applications quicker, and cheaper, with cPaaS than by relying on the enterprise infrastructure. One example is in the U.S.: Standard long-distance and toll-free rates are less than one cent per minute without a commitment on volume and a rate of half a cent per minute with a commitment of 1 million minutes per month.

In a cPaaS model, enterprises do not have to worry about the infrastructure, while retaining ownership and control over the application code that provides the business value. cPaaS has seen early success

in SMS messaging, mass notification applications and voice response capability.

Business Impact: Today, complete SaaS solutions based on cPaaS include digital business applications, contact center, voice response, outbound dialing, call recording, speaker verification and unified communication functionality. Additionally, the approach is increasingly favored by enterprises' application developers who seek to create mobile, multimodal applications for a variety of clients (for instance, where the application simply wants to produce an SMS message within the context of a business process).

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Adolescent

Sample Vendors: Avaya; BroadSoft; Cisco; Cisco (Tropo); Genband; Infobip; Nexmo; Plivo; Plum Voice; Twilio

Web Real-Time Communications

Analysis By: Mike Fasciani

Definition: Web Real-Time Communications (WebRTC) is an open-source project that delivers voice and video communications directly to a browser and mobile applications using simple JavaScript APIs.

Position and Adoption Speed Justification: A primary goal of the WebRTC standard is to enable websites and web applications to deliver real-time communications, irrespective of the browser being used. The WebRTC groups in the Internet Engineering Task Force (IETF) and the World Wide Web Consortium (W3C) are working to define a set of protocols and standard codecs that provide real-time communications in web browsers and the associated set of JavaScript APIs for web integration. While there is consensus on which voice codecs will be supported in WebRTC, there has been some contention over which video codecs to utilize – VP8 and/or H.264. The latest draft of the standard mandates support for both, but this contention, along with the next generation of codecs – VP9 and H.265 – will impact the speed at which WebRTC will be adopted. Chrome, Firefox, and Opera have embedded WebRTC into their browsers and Microsoft launched object real-time communications (ORTC), a variant of the WebRTC definition, in the Edge browser in 4Q15. Microsoft has made no announcements about supporting real-time communications in the Internet Explorer browser, however. Apple has shown signs of supporting WebRTC in the Safari browser, but has not yet made an official statement on market availability. So the standardization activity continues and is not expected to be fully adopted in 2016.

The migration to WebRTC will be evolutionary over many years (versus revolutionary in one to two years). Many communications vendors have launched WebRTC functionality, including Cisco Spark, Unify Circuit and several web-conferencing services. Currently, enterprise adoption is occurring through the use of primarily web- and videoconferencing services from providers that have adopted browser-based delivery, as well as in-contact center solutions where agents are able to communicate with customers through their company's web page.

User Advice: Though not yet fully standardized, communications vendors are adding WebRTC into their suite of solutions. Contact center, web conferencing, and videoconferencing are the leading communications applications as the early adopters of WebRTC implementations. Contact centers that adopt the ability to extend interactive voice and video on their applications, will have a competitive advantage over those that require the customer to place a call from a phone without insight into the customer's browser history or an ability to provide a rich-media customer engagement. For enterprises who use web- and videoconferencing services regularly, it is desirable to use WebRTC-enabled conferencing services that allow attendees to join the meeting without having to download software to their PCs and mobile devices to join. When running these types of real-time applications in the browser, the feature set is not as robust as can be found in solutions with installed PC software; however, the convenience factor improves the ease of deployment for IT engineers and makes it easier for users to join the meetings. For enterprises looking to add WebRTC usage to reduce the cost of installing and managing softphones, E-SBC vendors have added mediation capabilities between WebRTC and SIP to allow endpoints of both types to network and interoperate for voice and video calling.

WebRTC will utilize G.711, G.722, iSAC, iLBC and Opus audio codecs. The wideband and adaptive

codecs will provide a high-quality user experience, delivered over best-effort networks, where end-to-end quality of service (QoS) cannot be guaranteed. Enterprises should expect that WebRTC will become robust enough in the coming years for general use in communication applications.

Business Impact: The benefit for enterprises of WebRTC is that voice and video interactions can occur natively within web applications versus a user having to open up a new communication application or call from a phone. With embedded voice and video, the application can add contextual information, enabling a richer communication experience. Click-to-call applications, for example, will migrate away from proprietary methods to the WebRTC standard, and contact center agents will be able to see exactly what callers are looking at on their screens. Within contact center operations and communications-enabled business processes, WebRTC can create browser pages as real-time communications objects to be used in workflow, e-commerce and business process applications. As such, WebRTC will potentially transform the communications industry since no specialized software is needed to access communications.

Traditional software vendors are utilizing WebRTC as a low-cost way of entering the real-time voice and video communications market, which will further drive new functionality, along with price competition. WebRTC enables over-the-top (OTT) voice and video operators to deliver their internet services at a lower cost, compared with the legacy public switched telephone network (PSTN). As WebRTC matures, the expectation is for high-quality voice and video communication to be tightly integrated with business applications that can be consumed by any smart device.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Aspect; Cisco; Firefox; Google; Opera; Oracle; Twilio; Unify; Vidyo; Zoom

Sliding Into the Trough

Unified Communications Monitoring

Analysis By: Vivek Bhalla

Definition: Unified communications (UC) monitoring tools collect and analyze information from vendor-supplied data sources including Call Detail Records (CDRs), quality metrics and overall system data. Some tools can use standard APIs, FTP and file copy, or can extract data from UC and VoIP vendor databases and repositories. Advanced tools have the ability to collect packet data, decode voice and video codecs, and employ synthetic call testing.

Position and Adoption Speed Justification: Although adoption is commonplace, tool maturity lags behind mainstream network performance monitoring and diagnostics (NPMD) and APM tools. The transient nature of VoIP/UC infrastructure and platforms challenges tool vendors to maintain support for the latest underlying technology, while pushing for improved and more sophisticated UI workflow and navigation.

Many vendors focus on broader monitoring use cases and are not VoIP/UC specialists, yet provide a UC-oriented component to augment their holistic monitoring product. Conversely, niche VoIP-/UC-dedicated vendor tools are solely focused on deeper VoIP/UC insight. However, their application to more widespread monitoring use cases is limited. Although the technology continues to mature, it does so less rapidly than originally anticipated, making the time to reach the plateau longer than expected. Hence, we now expect the plateau to be reached in five to 10 years.

User Advice: Vendors frequently present embedded synthetic testing agents, such as Cisco IOS IP SLA, as a suitable means for gaining performance insight into a VoIP/UC infrastructure.

These agents can simulate a VoIP call between two devices, where each device acts as either the endpoint or the initiating device. These testing agents should not be used to determine the actual quality or performance of the network, since they are executed at intervals and are not representative of real-user VoIP/UC sessions. Use agents to measure VoIP/UC availability, not performance. Additionally, be mindful that support for monitoring video and/or media streaming frequently lags behind compared to support for voice among most UCM tooling vendors. Should monitoring of desktop video or media streams be a requirement, ensure the chosen vendor can support whatever proprietary codecs are being employed.

Network conditions are continually changing, so collecting and analyzing packet and network health data provide a more accurate indicator

of real VoIP/UC session quality. Note that more complex solutions come at a significantly higher cost. More granular tools include packet acquisition, analysis and storage. Although in-depth tools are focused on monitoring VoIP/UC components, they may also be used for other NPMD and APM use cases. Explore these cases to ensure such investments are maximized.

Users should beware that often-superfluous functionality that vendors position as free or at no cost may introduce unnecessary complications to the solution. This adds a hidden cost that is absorbed into the overall pricing a vendor presents to an organization.

Organizations looking to deploy VoIP/UC services must understand that the technology is in a transient stage. So, it is crucial to balance any dedicated monitoring solution expenditure against a pragmatic perspective that recognizes that the demands and requirements surrounding this technology are likely to change in a comparatively short period of time.

Business Impact: Enterprises are migrating VoIP/UC services to the network team, and the shift is altering the focus of and demand for VoIP/UC monitoring and management needs. Regardless of whether a VoIP/UC environment is self-managed or maintained via a third party, VoIP-/UC-specific monitoring tools are a fundamental prerequisite to the success of any VoIP/UC project.

Maintaining acute awareness of latency, jitter and packet loss in a pre-emptive manner is essential to achieving end-user acceptance.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: AppNeta; Cyara; Empirix; Integrated Research; Micro Focus (NetIQ); Nectar; ServicePilot; Unify Square; Viavi; Voipfuture

Cloud Office

Analysis By: Jeffrey Mann

Definition: "Cloud office" refers to collections of the most broadly used SaaS-based horizontal workplace tools chosen by workplace managers. It generally includes email, IM, file sharing, conferencing, document management and editing, and collaboration. Microsoft Office 365 and Google Apps for Work are the primary examples. The broad term "cloud office" is a generic label. The term "Microsoft Office" refers to a specific range of products.

Position and Adoption Speed Justification: The Cloud Office technology profile is advancing along the Hype Cycle as the technology becomes more mature and enterprise adoption grows. Some large migrations are beginning to prove frustrating due to the complexities of making a move with such wide impact, which indicates the early stages of the Trough of Disillusionment.

Microsoft and Google have been investing heavily to attract enterprises to their cloud office offerings, and they are responsible for most of the enterprise deployments Gartner sees. Other vendor offerings, such as IBM Connections Cloud, Amazon WorkDocs and WorkMail, and Zoho Office Suite, also address this market.

Enterprises are making the move to the cloud because of pressure from vendors and the desire to reduce costs, redeploy IT staff, drive simplicity and provide more functionality to users more quickly. Vendors are increasingly providing their most attractive new features – such as mobile device support, smart virtual assistants and other smart technologies – from cloud deployments only.

Cloud office system adoption is accelerating. It will reach 30% of the market's total potential by the end of 2018, 60% by 2022 and 70% to 80% by the market's 20th anniversary in 2027.

User Advice: For IT workplace leaders:

- Be realistic about compliance and legal concerns. Do not assume that there is a rule preventing you from moving to a cloud office supplier without first investigating the matter by working with legal counsel. Gartner finds that many assumptions about legal restrictions are due to unnecessarily wide interpretations.
- Look beyond a "like for like" deployment that focuses only on re-creating previous on-premises functionality from the cloud. Although this can be a good initial step, investigate the unique capabilities of cloud products to improve efficiency and provide innovation.

- All organizations must have a position on cloud office deployment, even if it is a decision not to move, or not to move yet. An active decision is better than delay.

- Ignore self-serving vendor migration pressures, but develop plans based on enterprise requirements and strategies.

Business Impact: The wide scope of cloud office workloads (especially email) means that this technology will potentially affect everyone in the organization. Those evaluating a cloud office migration have progressed from considering the potential benefits of such a move to weighing how painful it will be to remain on-premises as vendors shift their emphasis to "cloud first" and even "cloud only" policies for new innovations and developments.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Amazon; Google; IBM; Microsoft; Zoho

Mobile Voice Protection

Analysis By: Dionisio Zumerle

Definition: Mobile voice protection technologies ensure confidentiality and integrity of voice communications originating and/or terminating on mobile devices that travel over mobile and wireless networks. Tools that provide mobile voice protection typically come in the form of a stand-alone application residing on a mobile device. Some solutions leverage hardware (such as microSD cards with an encryption engine).

Position and Adoption Speed Justification: Mobile voice protection technology offerings have been around since well before the rise of smartphones, and they have always had clients that selected them due to specific security concerns. Mobile voice protection technologies can protect, for example, from eavesdropping and man-in-the-middle attacks.

The security protocols and algorithms that enable mobile voice protection are mature and have been used for years in other endpoint and network security solutions. However, not all implementations of these technologies are mature. Offerings that have appeared in the market vary in terms of network performance, battery consumption, efficiency in key management and encryption.

Recurrent revelations about pervasive surveillance and the uncertainty over privacy invasiveness of commercially available apps have raised awareness about the need for trusted communications. However, actual adoption has not followed this surge in awareness. Organizations that adopt this technology have extremely high security requirements and/or reasons to believe they are under a concrete threat from advanced attackers.

Several implementation considerations impact and sometimes hinder adoption:

- Some implementations are purely software-based, while others leverage hardware-based mechanisms, such as microSD cards or even purpose-built smartphones with dedicated encryption engines (such as the Blackphone by Silent Circle). Some of these devices, such as the CryptoPhone by GSMK and the devices provided by Kaymera, also offer hardening against physical or software attacks.

- Hardware-based mechanisms typically offer better performance, which is important for encrypting and transferring voice calls, as well as video calls (some solutions offer video). Hardware-based solutions are harder to implement across the entire spectrum of mobile devices of an organization: For example, for iPhones, microSD cards are implemented via a separate sleeve that attaches to the device.

- To guarantee performance, some solutions require traffic to travel through a server, either on the enterprise premises or at the vendor's premises. In most solutions, the protected voice stream traverses the data channel, rather than the cellular voice network, generating data charges.

- Voice protection technologies require the presence of the same solution on both devices involved in the communication. If only one device is enabled (for example, when calling from a smartphone to a fixed phone), the protection is enabled until the communication reaches the server; the communication is unprotected from then on. This can still be useful, for example, when employees travel to

untrusted countries and need a way to securely communicate with users in their home country.

User Advice: Organizations with higher-than-average security requirements and/or regulatory requirements should adopt mobile voice protection technologies. Clients in healthcare, finance, government and energy should consider such technologies. In some organizations, only a small number of users will need such a solution. Financial brokers or high-level executives of large organizations are typical examples of users who could use these technologies.

Applications that, once downloaded, are ready to operate will be the quickest and easiest to deploy for mainstream organizations with a need to secure mobile voice communications. Hardware-based solutions will serve well-defined use cases under strict security organizations (for example, organizations in the defense sector), but will prove difficult to deploy for organizations that want to allow a vast selection of devices (many of which do not allow for removable storage) to host the hardware for these solutions. Many of the freemium apps available on commercial app stores offer consumer-grade performance and protection. Enterprises that have identified a need for voice protection should deploy an enterprise-level security solution.

Many modern enterprise unified communications clients, as well as Web Real-Time Communications (WebRTC)-based solutions, use encryption by default for both voice and text communications, and can be an alternative for the right use cases (typically, they are not tailored for purely mobile scenarios).

Enterprises should trial the selected solution before proceeding to purchase in order to test out its performance over real-world situations (for example, battery consumption and network performance) in the location where the solution will be used.

Business Impact: Mobile voice protection solutions protect organizations against leaks of sensitive information from messages that can cause reputational damage to enterprises, as well as from interception of communication for industrial espionage and/or hacktivism.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Armour Communications; CellTrust; KoolSpan; Silent Circle

Video Search

Analysis By: Whit Andrews

Definition: Video search refers to the ability to search within a collection (or "corpus") of videos. Video search incorporates elements of social networking, social tagging, metadata extraction, audio transcription and enterprise search. Audio transcription or phonemic analysis is the most established means of achieving video search, but we expect other factors to become part of the technology set — which can come from multiple vendors — such as facial recognition and sentiment detection (voice recognition is already used in some cases).

Position and Adoption Speed Justification: Consumers using YouTube and similar products see the possibility for improved searchability in rich media. Some vendors still rely on human transcription or metadata, while others are adding speech-to-text facilities. Ultimately, enterprise search will subsume video search as simply another format, just as it did with audio and graphical media. Also, video search will become a presumptive feature in video content management and delivery systems.

Video search will not be fully understood or exploitable for another five years because, where textual search (and, to a lesser degree, audio search) came with vocabularies and grammar intact from conventional communication, video does not. Video talk tracks are an appropriate means of developing some searchability. However, the objects, people and actions presented in videos, as well as the relationships and action paths they follow, are not yet consistently identifiable or reliably describable either as content or query objects. Transcription works best where there is a definitive soundtrack from either a speaker, whose presentation is the point of the video, or a narrator elucidating what happens in it. Direct observation of human behavior in response to a stimulus is valuable for generating features for sentiment analysis applications. Videos without soundtracks — such as security videos, documents capturing behaviors and training videos without narration — obviously require more sophisticated ways of establishing their meaning, and these are still nascent.

User Advice: Only enterprises whose significant ambition is to include video in their operations should invest in video-specific search capabilities (example verticals are higher education, entertainment, law enforcement and corrections, and consumer goods, or business products manufacturers and service organizations). Others are more likely to turn to cloud vendors. Expect search to be a feature in a variety of formal and informal enterprise editions of video hosting from web conferencing vendors and others, including Google and Microsoft. Alternatively, others can wait for video search as an element of enterprise search or enterprise video content management.

Business Impact: Making a video easier to locate will boost the use of nontextual elements in training and communications in the enterprise. Video search enables use cases for analytic examinations of crowd dynamics and individual behaviors in retail, service and public locations. It improves the understanding of what a video is "about." It allows for the analysis of a video from public places to identify criminal and collective actions.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: 3VR; Flex Analytics; HP Autonomy; Jastec France (LTU Technologies); Koemei; Microsoft; Nexidia; Panopto; Ramp; Sonic Foundry

Personalization Engines

Analysis By: Penny Gillespie

Definition: Personalization engines are technology solutions that identify the optimum experience for an individual based on what is known about them. They can alter the online presentation layer for a customer, trigger an automated response to a customer, or pass on analyses to the seller or service personnel for action. These engines were initially used exclusively in digital commerce, but now include noncommerce content and functionality, having advanced from rudimentary segmentation to identifying and responding to customer preferences.

Position and Adoption Speed Justification: Although personalization engines are not new, many enterprises use them in a limited capacity. The capabilities of these engines continue to expand, but enterprises have been slow to embrace them, making the technology almost stagnant in its movement on the Hype Cycle. However, as the benefits of personalization start to become better known, the adoption of more sophisticated functionality is expected to grow exponentially.

Personalization engines identify customer intent and attributes, detect behavior patterns and discover correlations, which are used by organizations to tailor experiences for an individual (or group) to drive engagement, revenue and profitability. Using personalization engines for digital commerce can increase conversions, the number of items purchased and the average order value.

Today, personalization advancements hinge on enterprises' respect for their customers (or constituents) and how enterprises use their customers' data. If customers become concerned about privacy, they will monitor their data usage more closely so that they can quickly recognize privacy intrusions by sellers. Personalization that is not kept in context crosses the line to become "creepy" and will result in consumer distrust, which could thwart personalization initiatives or trigger government regulations regarding the use of customer data. Sellers must incorporate privacy regulations into their personalization strategies or run the risk of alienating their customers.

User Advice: As products and services become more ubiquitous – enabling the customer to find similar products at similar prices from multiple sellers, competition for customer acquisition and orders steadily increases, making experience the competitive arena. Customers also believe that they have a relationship with an organization once they have transacted with that organization and, therefore, expect to be recognized by the organization and provided with a tailored experience, thus making personalization an impending requirement.

IT leaders responsible for digital commerce should consider the following when selecting personalization technology vendors:

- **Data used** – Personalization engines that create more rich and detailed personalization profiles, using a rich array of data points and identified preferences, are likely to bring better results than those that create profiles with limited data points. Likewise, while personalization engines may quickly accumulate information on digital transactions

and content, customers are better served when their entire purchase history is known and incorporated into the personalization engine.

- **Frequency of profile and model updates** – Personalization engines that continually make customer profile changes and model updates in real time, followed by real-time presentation layer changes, are more effective.

- **Types of analytics incorporated** – Personalization engines package multiple types of analytics (such as predictive lifetime value, likelihood to engage, likelihood to buy, collaborative filtering, text analytics and smart machine learning) for the purpose of personalizing a customer's experience. Those using more sophisticated types of analytics typically provide better results.

- **Attribution capabilities** – Many personalization engines can monitor and identify results that stem from their usage by the organization (such as revenue lift, conversion rate and basket size increases), making it easier to understand correlations.

- **Multiple use cases** – Because a personalization engine is likely to serve multiple use cases and disciplines due to its underlying technology, consider consolidating personalization requirements across disciplines (marketing, sales and service) to leverage technology spending.

Business Impact: Digital personalization engines have moved from basic customer segmentation to being able to identify specific customers through site sessions, clickstream, browsing, historical transactions, geolocation, social, and other data points, thus raising the bar on personalization engine functionality. They can make continual, real-time changes on landing pages, in search results, search facets and filters, and to product recommendations and creative content. These engines also have the potential to provide results from other customer-facing operations such as traditional selling, marketing and service.

Today, these engines primarily serve consumer shoppers and are increasing customer acquisition and online sales. By 2018, organizations that have fully invested in all types of online personalization will outsell companies that have not by more than 30%. As business buyers start to seek the same rich experiences in their business buying that they experience in their consumer buying, these engines are expected to become prominent in B2B selling. By 2018, B2B sellers that incorporate personalization into digital commerce will experience revenue increases of up to 15%. In the future, these engines are likely to be used in other industries to improve their customers' and constituents' experiences.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Certona; Crayon Data; Dynamic Yield; Evergage; NGDATA; prudsys; Qubit; Reflektion; RichRelevance; Sailthru

Mobile Hubs

Analysis By: Monica Basso

Definition: Mobile hubs aggregate content and functions under a single pane of glass, in a mobile app; on the back end, they integrate with corporate systems through an intermediate server or cloud component. Their main focus is gathering content from multiple sources and aggregating them into a single view for a smarter user experience. In addition, mobile hubs also may aggregate communications content such as messages, email and presence; relationship data, such as contacts; or project activities and tasks.

Position and Adoption Speed Justification: Initially, mobile-messaging-centric clients were offered by manufacturers such as BlackBerry. Afterward, with the emergence of cloud storage and sharing services, content-centric hubs appeared, focusing on content aggregation, access, consumption and creation; these technologies provided aggregated views across multiple repositories, and offered content sharing, collaboration and editing functions. Today, a variety of products offer mobile front-end and integrate back-end repositories or other clouds. Often, analytics are used to contextualize aggregated views to user's behavior and preferences. Mobile hubs are different from other technologies such as "work stream collaboration" tools, which focus on delivering summarized and concise information to a specific role or process activity, rather than aggregation under a single pane of glass.

Obstacles may delay adoption of this technology (for example, a user's preference for known discrete apps of choice, instead of a new unique client app). Also, wearable notifications may be preferable to access collaboration tasks that are dispersed into different form factors and coordinated experiences, rather than a unique mobile hub app. This may call for smarter apps, such as virtual personal assistants, to provide contextualization.

User Advice: The wide availability of apps empowers individuals to be more productive and collaborative with their mobile devices. However, they struggle when mobile apps on their devices begin to proliferate. Even worse, when hundreds of apps, tens of cloud services, and tons of documents are all accessible through one device, the user experience degrades and complexity affects productivity and collaboration. This is the rationale for the emergence of mobile collaboration clients. Mobile collaboration hubs satisfy the needs of workers who prefer a role-specific, aggregated view of key information, communication and commitments, and is an alternative to context switching between separate, purpose-built apps that require context switching.

Organizations focusing on digital workplace strategies, aiming to make their mobile workers more productive and collaborative, should consider mobile collaboration hubs. They provide immediate and user-friendly experiences on mobile devices, optimized with content access and collaborative content creation. Through these capabilities on mobile devices, modern business processes and digital workplace scenarios can be implemented. Organizations must, of course, complement these technologies with appropriate controls to limit the risks of security breaches and data losses. Forms of interoperability between new mobile apps and services, and traditional desktop and browser-based applications used by workers in offices are also desirable, either via rich clients or browser-based applications.

Business Impact: This new generation of tools can progressively reduce fragmentation by converging multiple content collaboration capabilities under a unique "hub" available as a single mobile app. The availability of mobile collaboration hubs will raise mobile workers' productivity and engagement within the workplace, and externally with customers and partners. Optimization of user interactions will be possible by exploiting analytics of content consumption or collaboration patterns for each employee – for example, to create recommendations for content visualization and to personalize the application in real time.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AgreeYa Mobility; APPrise Mobile; bigtincan; BlackBerry; Colligo; harmon.ie; Infoteria; r-evolution; Showpad; Unify

Mobile VoIP

Analysis By: Bill Menezes

Definition: Mobile voice over Internet Protocol (mVoIP) enables packet-switched voice communications for mobile devices over a cellular, Wi-Fi or wired network. It can be integrated with other services or applications, or into websites. The typical enterprise implementation is within a mobile unified communications (mUC) client. Some vendors have integrated compatibility with voice over Long Term Evolution (LTE) or VoLTE, which enables better call quality and faster call setup than over-the-top VoIP into their mobile UC platforms.

Position and Adoption Speed Justification: mVoIP clients continue descending the Hype Cycle curve as a readily available alternative to circuit-switched cellular voice service. This is driven by continued enterprise adoption of mVoIP-capable smartphones and other compatible mobile devices, such as tablets. By routing voice calls as data traffic, mVoIP clients enable many users to reduce spending on voice plan minutes, instead of relying on cellular data plans. mVoIP also may enable voice calls in locations where alternate data networks – such as a corporate wireless LAN (WLAN) or public Wi-Fi hot spots – provide in-building connectivity that the local cellular network does not. Also spurring adoption in some regions is continued growth of LTE cellular networks, which 5G Americas reports were operating in 157 countries as of the second quarter of 16. LTE improves the quality of mVoIP calls compared with using 3G networks, due to LTE's faster data throughput and lower latency. VoLTE is a carrier-provided mobile VoIP technology that offers superior voice quality to over-the-top (OTT) mVoIP clients due to quality of service (QoS)

priority given to VoLTE voice traffic. LTE growth remains slow in most regions, however, limiting the global benefit for enterprise mVoIP.

User Advice:

- Enterprise telecom managers must identify the business case benefits of supporting ad hoc mVoIP capabilities on corporate- and employee-owned devices, versus the cost of implementing and managing an mVoIP client standardized across all users. Standardizing on a platform the enterprise already is employing for mobile unified communications will be the most cost-effective option for most organizations, given that the mobile clients for fully featured unified communications (UC) platforms (e.g., Microsoft Lync, Cisco Jabber) support mVoIP. Wired and wireless communications service providers (CSPs) also may provide a standard mVoIP client to their subscribers for making on-net calls on the wired network account or cellular data calls on the wireless account, with the client serving as a complementary dialer to the native dialer of the device OS. Pilot mVoIP clients to ensure a consistently good user experience on different device OSs and networks, versus experiences with frequent client crashes or poor voice quality.

- Enterprises also should evaluate consumer-grade mVoIP clients to identify those with features suitable for corporate use, such as the end-to-end encryption WhatsApp began featuring in the first half of 2016. Consumer clients that number billions of users globally include Facebook Messenger, Facebook-owned WhatsApp, WeChat, KakaoTalk and Viber. Avoid clients that cannot provide enterprise-grade security for corporate contact information used by the client.

- Mobile CSPs should monitor the usage of mVoIP clients via deep packet inspection or other functionality to build a picture of consumer preferences and reactions to price changes. They need to know how price-sensitive their customers are, which will help them with pricing decisions and selection of their own future mVoIP functionality.

Business Impact: The impact of mVoIP on businesses will grow as more organizations rely on mobile devices as a primary communication tool, either heavily complementing or replacing wired desktop phones in the enterprise office. A primary impact will be reduced operating costs for international long distance calling, which can be four times more expensive on a cellular device than a landline phone. Another is usage when roaming in otherwise expensive destinations, plus the ability to make calls over a Wi-Fi or wired access network when a cellular network signal is unavailable. As cellular service providers increasingly bundle standardized mVoIP clients onto their handsets, enterprises also will be able to make greater use of their WLANs for in-building voice coverage instead of dealing with the lengthy, often expensive prospect of installing a carrier distributed antenna system (DAS) to improve the indoor cellular signal. Conversely, carriers deploying voice over LTE capability will realize network efficiencies by migrating customers to mVoIP as their primary voice platform, versus circuit-switched cellular voice.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Cisco; Facebook; Google; Microsoft; Rebtel; ShoreTel; Tencent; Viber

Software-Defined Networking

Analysis By: Mark Fabbi

Definition: Software-defined networking (SDN) is an architectural approach to designing, building and operating networks that delivers business agility and extensibility by abstracting the network topology and control plane. It's not an independent market, but an architectural enhancement to network design and operations. SDN decouples the control plane from individual devices to provide a single view, point of control and programmable interface to the network.

Position and Adoption Speed Justification: SDN is one of the most-talked-about technologies in the networking market today and represents a potential transformation in how the market will design, build, operate and procure network hardware and software. During 2015, we started to see production adoption of SDN solutions, though broad deployments are still relatively rare. A variety of both established vendors and startups continues to develop SDN technologies, but full, robust, end-to-end enterprise-ready solutions are not yet fully established on the market.

SDN solutions can be segmented into two broad solutions. In the first – device-based – switch and router control is centralized via an SDN controller. This requires infrastructure to support specific device control protocols – OpenFlow is the most notable example. In some cases, it will require hardware updates to migrate to SDN. The second approach is an SDN overlay, where endpoints (typically virtualized servers) run a vSwitch or vRouter that communicates to a central controller to create tunnels across the existing physical network.

User Advice: Don't get swept up in the massive hype surrounding SDN – focus on solving specific challenges within the network. Rather than deploying complete SDN solutions, we are seeing many enterprises take a more pragmatic approach in the data center by upgrading to an Ethernet fabric while continuing to monitor more comprehensive orchestration solutions. The most important action to take now is to develop cross-functional collaboration and investigate DevOps methodologies to better integrate server, virtualization, networking and application teams. These teams can then help identify key use cases – both short-term ones like network agility and longer-term goals to leverage SDN innovations. Decoupled hardware and software provide a way of establishing long-term operational models that are independent of the underlying hardware. In the short term, organizations should begin with non-mission-critical areas, such as testing and development, to get experience with new technologies and approaches to network design and operations. It is important to allocate time and resources to evaluate SDN technologies and all vendors – both incumbent and nonincumbent – because SDN can have a fundamental impact on vendor relationships and business models in networking and related markets.

Business Impact: SDN can increase network agility, simplify management, and lead to the reduction of operational and capital costs while fostering long-term innovation. The adoption of SDN has the potential to eliminate the human middleware problem that has plagued network operations for the past two decades. By bringing network operations into more streamlined and automated operational processes that are common in virtual environments, user organizations can bring application deployments in line with the increasing speed of business. As SDN matures, a significant boost in network innovation may occur as network features and applications become decoupled from the underlying network hardware. New markets will emerge, especially for SDN applications that have the potential to completely change physical network deployment and operational models for enterprise networks. New competitive environments will also evolve to change the networking landscape and financial models of enterprise networks.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Big Switch Networks; Brocade; Cisco; Hewlett Packard Enterprise; Juniper Networks; NEC; Nuage Networks; VMware

Communications-Enabled Business Processes

Analysis By: Mike Fasciani

Definition: Communications-enabled business processes (CEBPs) enable communication services to be integrated with IT applications to automate business transactions and reduce the time required to complete tasks. CEBPs raise alerts, initiate real-time communications, leverage presence status and identify when a nonstandard event requiring human intervention occurs.

Position and Adoption Speed Justification: CEBPs use notifications to automate the handling of exceptions, variations or interruptions to standard business processes when people are required for the process to advance. The goal of CEBPs is to reduce the amount of human latency, to get the right people involved, at the right time, with the right information.

XML-based web services are the most common way of integrating communication systems with business applications such as CRM, ERP, payroll, human resources, billing systems and others that were previously attainable by computer telephony integration (CTI). Newer CEBP developments now utilize popular unified communications (UC) suites such as Microsoft's Skype for Business, Cisco's Jabber or Avaya Aura Platform to develop mashups and tactical applications that facilitate and automate business processes. Different IT vendors have their own versions of CEBPs, with their own names for products, solutions and methodologies. The lack of industry standards between business process management (BPM) applications and communication systems has inhibited the adoption

of CEBPs. Communications Platform-as-a-Service (CPaaS) offerings will improve CEBP market adoption by providing a standard, cloud-based way of integrating a variety of communications services within enterprise business applications. WebRTC has emerged as one of the leading methods to deliver audio and video services using CPaaS offerings to embed real-time communications in standard browser web pages to be used in workflow, e-commerce and business process applications. The ease of integration and deployment of WebRTC-based services promises to amplify the usage and benefits of CEBP in the coming years.

User Advice: When evaluating "starter" CEBP projects, organizations that fit "mainstream" or "late adopter" profiles should target well-bounded pilot projects capable of giving measurable results. IT departments can test CEBP technologies on their own internal system management services to react to, and fix, IT infrastructure or application failures, thus proving value. Intensely competitive, high-volume and labor-intensive organizations have become the early adopters of CEBPs as a practice, since they can create significant measurable customer service, productivity and process performance improvements, rather than just minor incremental advantages.

Gartner recommends that enterprises view CEBPs as a set of technologies and best practices, rather than as a distinct product or solution set. Businesses will need to review their mix of IT platform providers and the communication infrastructure partners they expect to use in the long term, and evaluate their respective CEBP capabilities. Specifically, they should evaluate their partners' plans for providing communications natively from within IT applications. Professional services are often required to design, install, and test unified communications and contact center deployments with CEBP integrations.

While integrating real-time communications into business process through UCC software plug-ins has been a maturing technology, newer concepts created through Communications Platforms-as-a-Service (CPaaS) offerings have emerged. CPaaS solutions provide cloud-based access to communication services, including SMS, Multimedia Messaging Service (MMS), telephony, voice response, video and mobile web. These communication options can be embedded into favored applications and web pages to allow an easier, cost-effective integration through the use of web service calls.

Business Impact: CEBPs will deliver productivity improvements by automating the handling of exceptions to business processes and the associated human intervention required. Enterprises desiring to address unplanned events in a quicker, more effective and measurable way should utilize CEBPs.

The delivery of effective business processes is arguably the most powerful outcome that IT can bring to any organization. CEBPs will thrive where unified communications and collaboration (UCC) is broadly deployed and treated as an essential part of CEBPs. Best practices are beginning to emerge based on the use of CEBP component technologies, which include messaging, mobility, voice integration and alerts that can automate and tightly link IT and communication applications.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Mature mainstream

Sample Vendors: Avaya; Cisco; Genesys; Interactive Intelligence; InterCall; Microsoft; SAP; Unify

Transcoderless and Software-Based Videoconferencing Infrastructure

Analysis By: Tom Eagle

Definition: Alternative video infrastructure architectures use mechanisms to replace traditional hardware-based central infrastructure, particularly, multipoint control units (MCUs), in videoconferencing environments. Two main forms of alternative architecture exist:

- Software-based MCUs (softMCUs) replicate the function of dedicated hardware MCUs in software.
- Transcoderless infrastructures use switching and routing of a single codec – typically, H.264 SVC or H.264 AVC – to forward video traffic rather than process it, thus, avoiding MCUs altogether.

Position and Adoption Speed Justification: MCUs have long been a key component in enabling multiparty video calls. At a time when the cost per port of typical high-definition MCUs runs to thousands of dollars, these alternative

architectures offer dramatic cost reductions, which are a prerequisite for mass adoption of personal video (on unified communications [UC] soft clients, for example). Gartner inquiries have shifted extensively from discussions about group video to discussions about video-enabled UC environments and cloud-based video solutions.

Transcoderless solutions using the H.264 scalable video coding (SVC) standard have often been linked to softMCUs running regular H.264 advanced video coding (AVC) via a gateway. Both are being sold on the basis of software as a service, and both are suited to cloud deployments by service providers. Alternatively, premises-based server versions – such as Acano (now Cisco), Pexip Infinity and RealPresence Clariti from Polycom – have also gained some market interest and traction.

User Advice: As enterprises increase the reach of desktop and mobile video to more staff, prepare for a nonlinear increase in the use of video. Early adopters have a peak utilization level of about one in 50 end users actively involved in a video call at any given time. User organizations should expect this to rise to about one in 15 end users by 2018, and scale their infrastructures (or cloud-based video staff subscriber forecasts) accordingly.

Enterprises planning to expand their video infrastructure with softMCU or transcorderless infrastructure need to evaluate the implementation partner's capability to deploy, integrate, manage and provide support. Additionally, for softMCU deployments, seek assurances on how performance is affected in higher-latency environments or where multiple different codecs are in play.

Business Impact: Gartner expects video to become much more pervasive during the next two years. Businesses have already been shifting their focus away from capital expenditure on high-end systems. The widespread availability and use of much lower-cost infrastructure solutions, with their ability to enable internet-based video communications and to scale cost-effectively, will be critical to enabling this transition.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Blue Jeans Networks; Cisco; Lifesize; Polycom; Vidyo

Private Cloud Communications

Analysis By: Steve Blood

Definition: Private cloud communications have many of the attributes of public cloud services in that they are scalable and elastic, metered by use, and use internet technologies, but they are deployed and managed as dedicated services and are customizable.

Position and Adoption Speed Justification: Private cloud communications are aligned with Gartner's definition of cloud with the attributes of communications as a service (CaaS), but with some differences:

- Service can be provided by internal IT or outsourced; it can also be hosted by an external provider.
- Private cloud architecture is virtualized, but for only a single organization.
- Shared infrastructure supports multiple departments of a single organization, rather than multiple customers.
- Services consumed can be billed by internal IT as well as external providers.

Organizations will prefer private cloud where there are limits to the quality and coverage of public services, or where regulatory and security issues restrict use. Private cloud is also popular where public cloud is insufficiently mature to outsource management of applications and infrastructure. Private cloud is popular with IT management because ensuring security and controlling the infrastructure are key responsibilities that they carry out as internal service providers.

User Advice: The total cost of ownership is an important factor when evaluating which cloud route to take. IT planners should closely compare the cost of operating a private cloud with public cloud solutions, including the cost of administration, management and ongoing software support. While public cloud services generally have a lower cost of ownership in a direct comparison to private cloud, at scale (more than 20,000 users) a private cloud can offer better economies of scale.

Where there is a strategy to build private cloud and dedicated data center infrastructures, IT leaders should evaluate the benefits of adding communications. This is more relevant where organizations want to retain control over the speed at which they develop, deploy and customize communications services for their users.

Currently, suppliers of public cloud CaaS solutions that span multiple geographies are only just emerging. IT leaders with global user requirements may find that a private cloud deployment meets demand and their requirements for speed of implementation. This is relevant where organizations have already deployed their own internal networks to the majority of office locations and can consider a single-vendor approach.

Private cloud with utility consumption, in place of a traditional perpetual-right-to-use license, is now being offered by major infrastructure technology providers, which will fuel anticipation of wide availability. Organizations committed to private cloud infrastructures should review their choice of partners for this emerging consumption model.

Business Impact: Private cloud communications have similar attributes to public cloud communications, thus enabling organizations to implement and manage communications with greater agility, faster implementation, greater resilience and more effective use of capital with the utility model. We expect that the utility model will enable users to try new communications services and identify benefits as part of a business case for wider deployment. A utility license enables IT managers to move services between private and public clouds to accommodate business demands.

This model will be applicable to larger organizations with a large IT staff and strong service management skills. For smaller organizations, or those with fewer IT staff, the public cloud model will be cost-effective and provide a better service than trying to run a private cloud. Except for very large multisite organizations (those with more than 20,000 users), the cost of a private cloud is always likely to be higher than that of public services.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Altitude; Avaya; Collab; eZuce; mplsystems; Microsoft; Presence Technology; ShoreTel; Unify

Cloud UC (UCaaS)

Analysis By: Daniel O'Connell

Definition: Cloud unified communications (UC), also known as unified communications as a service (UCaaS), are provided over multitenant or virtualized infrastructure that is owned, maintained and hosted by the service provider. Users pay a subscription-based fee.

The core functions of UC include integrated:

- IM and presence
- Telephony
- Messaging (voice mail and email with unified messaging)
- Conferencing (web, audio and video)
- Mobility

Position and Adoption Speed Justification: Cloud UC functionality from application specialists (businesses solely focused on cloud UC) can be even more feature-rich in comparison to their premises-based counterparts. These cloud UC offerings possess strong mobility and user experiences, complemented with business analytics. They are targeted to small and midsize businesses (SMBs), though they are starting to win a small segment of enterprise accounts.

The larger enterprises prefer cloud UC from megavendors, such as Cisco, Microsoft, Google and Avaya. Functionality from these megavendor cloud UC offerings can be behind that of their premises-based counterparts. For example, the Microsoft Skype for Business Online (SfBOL) offering, part of Office 365, does not provide the full suite of voice features as does Microsoft's Skype on-premises version. In addition, the architecture of SfBOL makes it difficult to support businesses spanning multiple geographic regions. Nonetheless, cloud UC megavendors are investing heavily in their cloud offerings and should be better equipped to scale to large, complex deployments over the ensuing two or three years.

User Advice: SMBs with fewer than 1,000 employees should carefully evaluate cloud UC. The business case for SMBs can be compelling, given their limited IT skill set, the complexity of supporting remote sites, and the pace of new innovation that cloud UC vendors introduce each year. Many midsize businesses value the integrated contact center offered by selected cloud UC providers. SMBs are largely located in a single geographical region, making the deployments far simpler.

Cloud UC is also a viable option for enterprises with 1,000 to 5,000 employees, especially when their locations are concentrated in a single region. Many public-sector organizations fall into this category and are starting to adopt cloud UC with regularity. Enterprises in the 1,000- to 5,000-employee range may at times consider working with smaller application specialists, but in general, they prefer to work with a stronger brand.

Enterprises with over 5,000 employees represent the final frontier for cloud UC. Outside the public sector, large enterprises have personnel distributed across multiple global regions. They often have security, compliance or cultural biases that result in continued on-premises UC adoption. The early cloud UC providers began rolling out their first global solutions in 2013, and the solutions have slowly matured through 2016. Organizations of this size and scope often select a hybrid UC deployment, with a mix of cloud and on-premises delivery.

Business Impact: Cloud UC enables organizations to outsource the delivery of telephony, mobility, IM, presence, messaging and conferencing services.

CFOs are attracted to cloud UC because it:

- Transfers capital expenses to operational expenses
- Helps organizations become more agile as they grow, retrench or acquire
- Supports disaster recovery with replicated data centers

Businesses opting for cloud UC believe that UC functions are becoming commoditized and therefore suitable for cloud delivery. This enables them to reduce costs, focus on core competencies and reallocate IT staff to focus on competitive differentiation. The long-term view of cloud UC is positive, given how aggressively vendors are pivoting their R&D investment to the cloud.

The infrastructure-licensing policies of major vendors like Cisco and Microsoft favor single-vendor, or at least dominant-vendor, solutions. Cloud UC is therefore well-suited to organizations that are open to dominant-vendor solutions and have highly distributed workforces. Cloud UC users will need to undertake a process of vendor rationalization to streamline their suppliers.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: AT&T; BroadSoft; Cisco; Fuze; Google; Microsoft; Orange; RingCentral; Telefónica; Verizon

Enterprise Video Content Management

Analysis By: Whit Andrews

Definition: Enterprise video content management (EVCM) encompasses software, hardware or software as a service (SaaS) offerings. It may also include associated network services intended to manage and facilitate the delivery of one-to-any videos across internet protocols in an on-demand and (possibly) live fashion. It differs from digital asset management (DAM) in that DAM is used to manage videos (as well as other rich media) for use by creative professionals, whereas EVCM is intended to serve any or all workers and customers who need to watch videos.

Position and Adoption Speed Justification: Companies and governments are fascinated by YouTube, which captures the attention of consumers and leads the popular user-generated online video segment. Gartner sees growing interest in EVCM from organizations seeking to unify their video strategies for live and on-demand one-to-any capabilities. This interest is now significant, and consolidation is only just starting to bring together the various valuable areas of functionality. Functional extensions, such as search, event capture, editing and metadata development, are speeding up adoption.

User Advice: Organizations should embark on projects that enable them to explore ways in which

video can uniquely enhance communication, learning and training. Waiting until end-to-end solutions are commonly available will result in workers making their own decisions, without support, by turning to online video sharing to provide value to customers – which may be the best strategy for some projects. Enterprises express increasing interest in comprehensive solutions that can store, manage and stream video assets to meet use cases for both internal and external audiences.

Social features (such as those that allow users to sort videos by popularity and add comment streams, user ratings, and recommendations) make video-sharing tools attractive, but user uptake of such features is limited and often disappointing. In general, opt for short vignettes on video instead of standard lectures. Also, when capturing, presenting and archiving video or web conferences, you will find that saving videos as short, topical pieces will result in better viewing and long-term value.

Business Impact: Videos make highly effective vehicles for the communication of knowledge and emotion. They can improve audience empathy and sense of value. Video has value in its ability to transcend language and skills, and it narrows the gap between the novice and expert for visually complex tasks. Videos will be extremely important for customer service (and self-service) in a visually complex task communication and will prove increasingly valuable in providing a channel for emotional, impactful conversation. Some vendors may specialize in integrating with horizontal applications for tasks such as collaboration.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Brightcove; Kaltura; Kontiki; KZO Innovations; MediaPlatform; Panopto; Polycom; Qumu; Ramp; VBrick Systems

Climbing the Slope

Emergency/Mass Notification Services

Analysis By: Roberta J. Witty

Definition: Emergency or mass notification services (EMNS) automate the distribution and management of messages to an organization's stakeholders through multiple endpoints (for example, voice, email, SMS, digital signage, safety systems, public alerting systems, etc.). Use cases include emergency events, business operations notifications, IT service alerting and public safety.

Position and Adoption Speed Justification: EMNS vendors have been expanding their offerings to find new areas of growth and now support all use cases defined above. Restrictions on "emergency only" messaging have been lifted to include other operational events such as appointment reminders and important corporate events. The exception to this restriction lifting is for marketing campaigns. Innovation in EMNS continues with expanded support for client-side mobile device apps, situational awareness, group-based crisis communications, personal safety and integration with Internet of Things (IoT) devices (for example, temperature control and hazardous materials sensors, drones, digital cameras).

Some industries are fully saturated, such as higher education, while others are investigating a vendor switch due to product nonperformance or high pricing, especially for contact expansion. Challenges to the EMNS market are coming from new entrants leveraging communications platform as a service (CPaaS) offerings to build out their own EMNS offerings. These new entrants are usually integrating EMNS into a larger offering, for example, ServiceNow for IT service operations and LiveProcess for crisis management.

EMNS have moved up two levels in 2016 from 2015 due to more organizations realizing the benefits of using EMNS as part of the crisis management process, a discipline gaining higher adoption rates in most organizations. EMNS have attracted many specialty audiences, resulting in a large field of many small vendors and a few large multiproduct vendors. Consolidation is expected over the next three years.

User Advice:

1. Understand all the notification use cases and contacts needed by your organization to ensure that you are making the best use of your investment. Pricing is on a per-contact basis with typically no limit on the number of contact endpoints.

2. Choose a vendor that has experience in your vertical industry to better align its offering to your business operations.

3 Choose an EMNS vendor that has hosting data center operations located in different geographic locations from yours to prevent the same event from impacting you and the EMNS vendor and for privacy protection considerations.

4 Choose an EMNS vendor that has customer support services located in the same or adjacent time zones as your organization as well as language support for your operating locations.

5 Plan your workforce enrollment procedure to ensure that all needed people are included in the service, and that their contact information is up-to-date and complete.

6 Create templates for the types of events your organization may experience as well as templates that cover the timeline of the event from start to stand-down.

Business Impact: Stakeholder communication is critical during incidents ranging from localized events to regional and catastrophic disasters. In addition to preserving and enhancing the reputation of the organization during a crisis, the business benefits of using an EMNS tool are:

- Key personnel can be notified in minutes, and large numbers of affected personnel can receive critical information about the event.
- Management can focus on critical decision making and exception handling.
- Human error, misinformation, rumors, emotions and distractions — which are common during a crisis — can be better managed and corrected.
- A documented notification audit log can be provided for real-time and postevent management.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: BlackBerry; Desktop Alert; Everbridge; Global AlertLink; MIR3; Omnilert; Rave Mobile Safety; Send Word Now; Sungard Availability Services; xMatters

External Peer-to-Peer Communities

Analysis By: Jenny Sussin

Definition: External peer-to-peer (P2P) communities are virtual places for collaboration among people and organizations outside of the enterprise. They include prospects, customers, suppliers, partners, influencers and even competitors on occasion. External P2P community sites leverage social software tools that enable community members to interact online to share ideas, provide support for other members, offer suggestions and comment on others' ideas.

Position and Adoption Speed Justification: External P2P communities have showed a consistent increase in client interest over the past two years. Gartner has seen a resurgence among clients looking at communities for idea generation, advocacy and, most notably, customer support.

Common external community features include:

- Wikis
- Blogs
- Forums
- Analytics
- Ratings and reviews
- Q&A
- Moderation
- Member directories with profiles
- Polling
- Mechanisms for gamification

User Advice: Identify one or more business objectives to be achieved through the establishment of external P2P communities, focusing on one to get started. Recognize known constituent behaviors and set realistic expectations for activity, as well as for the level of activity that should be achieved to meet business goals. Pay extra attention to the value that the community will provide to each individual participant to attract that person and maintain engagement — especially when it is first set up.

Establish a clear marketing and communications plan around the introduction of the community/communities to your constituency. Assign a community manager and administrator to keep members continuously engaged in the community to sustain its business impact.

Business Impact: External P2P communities will have the most impact when they have clear associated objectives and a clear call to action for community members.

Customers' perceived success is typically defined by the ability to:

- Share ideas for new products and services, or update existing ones
- Ask questions and find answers
- Exchange knowledge with like-minded peers
- Network and/or compete with peers

Businesses' perceived success is typically defined by:

- Customer service savings from call deflections
- Decreased costs for traditional market research
- Increased customer satisfaction

Gartner has seen success with external P2P communities across the areas of marketing, customer service and market research/product development.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: inSided; Jive; Lithium; Salesforce; Vanilla Forums; Voycer

Freemium UCC

Analysis By: Mike Fasciani

Definition: Freemium is a business model that initially offers a free-to-use product option, and then relies on organizations upgrading to a paid-for premium option for a more robust, enterprise-grade feature set. Cloud-based unified communications and collaboration (UCC) vendors have used the freemium business model to drive quick adoption.

Position and Adoption Speed Justification: Several UCC vendors are offering basic UCC for free and charging enterprises a subscription fee for premium services. The objectives are to have the revenue that is generated from each paying user outweigh the cost of providing the minimally viable free service, and to generate revenue from other sources, such as advertising. One segment of the UCC cloud market that has adopted the freemium model is web conferencing. With the freemium model, web conferencing costs are significantly reduced allowing credible alternatives for a broad range of use cases. Service providers who have taken this licensing approach include LogMeIn, Google, and Zoom. More enterprises are offering a tiered conferencing strategy for their users and utilizing freemium as the baseline service for everyday intra-company conferencing and collaboration. UCC vendors wishing to gain quick market adoption of their platforms are utilizing the freemium business model for some of their services. Gartner sees this trend continuing as web conferencing usage continues to rise and enterprises are eager to find creative ways to reduce overall spending for this application.

User Advice: Freemium web conferencing solutions are often adopted by the end users directly as they can be procured at no cost and with no long-term financial commitment. Enterprises should embrace a multitier strategy for web conferencing, with a premium solution for critical conferences like investor relations, a standard conferencing platform, and freemium solutions for their more casual, internal conferencing requirements.

IT planners should limit the term or volume commitments for web conferencing services and evaluate freemium solutions for a subset of use cases before committing to a transition for existing UCC tools. Internal communications channels should be used to delineate clear policies for when and how to use freemium services. If such a solution is not offered, enterprises should expect end users to explore freemium options that offer well-designed user experiences without first validating their use with the enterprise.

Business Impact: Freemium solutions can reduce the cost of UCC services by over 50%. Enterprises with significant communication costs are using freemium services when they are a good fit for their overall strategy. Enterprise bimodal Type 2 IT practices allow the adoption of freemium UCC and deliver good business value by assisting dispersed, creative teams be more collaborative and always connected.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Mature mainstream

Sample Vendors: Cisco; FreeConferenceCall.com; Google; LogMeIn; Unify; Voxeet; Zoom

Unified Communications and Collaboration

Analysis By: Adam Preset

Definition: Unified communications and collaboration (UCC) describes an enterprise approach to combining asynchronous and synchronous technologies. Distinctions blur as communications and conferencing vendors try to penetrate into new markets, and collaboration and messaging vendors enhance their platforms with real-time communication services.

Position and Adoption Speed Justification: Because UCC represents the merging of a number of former distinct marketplaces, there are hurdles to overcome. Without UCC, enterprises have to blend and maintain portfolios of products from two or more vendors to provide the UCC experience. End users expect to shift their available media up and down as seamlessly as possible — from IM to voice to video, and among handsets, mobile devices, computers and video systems.

Vendors add functionality to their product suites that overlap or compete directly with other products purchased for different reasons. Real-time collaboration tools might include IM, voice, video and desktop sharing. "Good enough" peer-to-peer voice functionality may displace some traditional telephony, while web conferencing decreases the need for hardware video endpoints. While it is empowering and convenient for end users, the overlap can be confusing. Seamless UCC remains an aspiration.

Satisfying all application scenarios is so challenging that siloed, team-based approaches (such as Workstream Collaboration) are legitimate options when enterprise UCC cannot suit all. Cloud office bundles (such as Microsoft Office 365 or Google Apps for Work) are centered on collaboration, and have increasing appeal for buyers with modest and simple UCC needs.

Because UCC workloads take advantage of IP networks, organizations are — sometimes slowly — converging on staffing models in which collaboration teams and networking, telephony, A/V, and infrastructure groups work in the same reporting line.

End users depend on software clients and mobile apps as the unifying interfaces that hide back-end complexity. Increasingly, UCC solutions are being called upon to support communication between internal and external collaborators who may be using different systems, making federation capabilities essential.

User Advice:

Recommendations:

- Create a task force to develop a UCC strategy that is made up of lines of business as well as communications and IT specialists to reduce interdepartmental friction.
- Consider cloud options as seriously as on-premises solutions.
- Separate the organizational and budget politics from assessing the benefits of enhancing users' communication and collaboration capabilities.

A UCC project can produce benefits and unintended drawbacks. In some cases, it could needlessly disrupt work practices, add complexity, and be seen as unnecessary, costly and a waste of resources. In other cases, it can improve communications, augment work performance, increase effectiveness, and help virtual teams to excel. Some employees may do better with, and some do better without, UCC. It is not an all-or-nothing proposition for every user.

- Investigate needs in the context of specific use cases before attempting to deliver a solution.
- Allow some degree of solution overlap if it proves to be beneficial and be sensitive to user preferences and requirements, using shadow IT deployments to understand them.
- Provide guidance around use cases if appropriate.
- Determine the right capabilities roadmap for various user segments.

- Look for user segments that already understand the potential benefits and business cases that provide the clearest path to a measurable return.

These pilots can help build the case for more widespread deployment.

Business Impact: Users expect integrated tools, escalating to the highest-value combination of interactive services – both inside and outside the firewall – and including fixed, wireless and mobile devices. Presence services are a vital unifying tool. These capabilities are available as a complete stack from some vendors. Standards-driven integration will make even more combinations possible. Large enterprises will likely need a portfolio that covers "good enough for most" and "best of breed for a few" solutions.

Although there is generally an acceptance that UCC is necessary, organizations will struggle with quantifying the benefits and calculating return on investment (ROI). Enterprises may need to eschew traditional ROI mechanisms and seek alternative, less quantifiable means to justify UCC investments, such as process cycle acceleration, faster problem remediation, increased information awareness, and the inclusion of more internal and external resources as part of the planning processes.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Avaya; Cisco Systems; Google; IBM Collaboration Solutions; Microsoft; Mitel; Unify

Entering the Plateau

SIP Communications

Analysis By: Bern Elliot

Definition: Session Initiation Protocol (SIP) is a communication protocol that is specified by the Internet Engineering Task Force (IETF). It is the industry standard for multiple protocol (voice and video) signaling. SIP enables communication services across the internet, as well as over fixed and mobile Internet Protocol (IP) networks.

Position and Adoption Speed Justification: While there are some variations in how it is implemented, it is now clear that SIP is the default open protocol for communication, supplanting H.323, which was considered too complex. SIP is widely supported by leading communication vendors; however, some implementation differences remain, so portability is not ensured, and it must be validated. Many enterprise communication vendors and carriers prefer to offer variations of SIP. The use of a session border controller (SBC) between carriers, enterprises and different unified communications (UC) platforms enables protocol remediation, along with providing a demarcation point for security and support. SIP trunks are now being offered by most telecom providers. SIP is likely to be supported by the Web Real-Time Communications (WebRTC) standard, which further establishes its role as a key standard.

User Advice: SIP is a useful way to enable interoperability among communication platforms and services. It is useful in contact centers, and in UC deployments, where multiple vendor communication products must be integrated.

SIP trunking is effectively an IP replacement for public switched telephone network (PSTN) trunking that can be delivered over internet connections or private networks, such as Multiprotocol Label Switching (MPLS) and Ethernet. Service providers offer SIP trunks in more granular increments than ISDN Primary Rate Interface (PRI), requiring enterprises to subscribe only to the desired capacity of concurrent calls. A border element, such as an SBC, often resides between the enterprise and the service provider, as well as in the core of the service provider's voice over IP (VoIP) platforms. Although primarily used for voice, SIP trunks can also carry other media.

Ensure that vendors offer SIP as a contact control option in their platforms, and ask them to specify what interoperability testing they have performed. This will make it more likely that different vendors' SIP products will interoperate with each other, as well as with your service provider's.

Business Impact: SIP's greatest value is that it replaces proprietary, media-specific signaling with an industry standard for all real-time voice and video communication, and that it is easier and less expensive to implement than H.323. Additionally, the SIP session setup phase is completely separate from the media transmission, so the media does not have to follow the same path. As a result, after the session is set up, the media can flow directly between endpoints, which reduces costs and network congestion. Another feature of SIP is that it allows open information to be contained in the

setup packet header. This information is delivered at call setup and can have many uses, including replacing the need for separate computer-telephony integration (CTI) services in a contact center environment.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: AT&T; Avaya; BT; Cisco; Level 3; NEC; Orange; Verizon

EFSS

Analysis By: Monica Basso

Definition: Enterprise file synchronization and sharing (EFSS) refers to a range of on-premises or cloud-based capabilities that enable individuals to synchronize and share documents, photos, videos and files across mobile devices, PCs and servers. Sharing can happen within the organization or outside of it, with partners, customers or others. Security and collaboration are critical complementary features for enterprises adoption.

Position and Adoption Speed Justification: EFSS technology is relatively mature; its basic features include native mobile and web client apps, password protection and data encryption, and server integration (with SharePoint, for example), whereas its enhanced ones include content creation, collaboration, digital rights management, cloud encryption key management (EKM) and modern responsive user interface (UI). Leading vendors offer integration with Microsoft's Office 365. Over the past six years, EFSS adoption has grown rapidly to hundreds of users, thus driving progressive standardization. A variety of IT vendors in multiple markets (such as enterprise content management [ECM], collaboration, storage, backup and enterprise mobility management [EMM]) added file synchronization and sharing features as extensions to their offerings. EFSS puts pressure on traditional markets, such as ECM and storage, forcing an evolution in EFSS functionality to include cloud, mobile and analytics paradigms, to enhance user experience, IT administration and business support. Cloud storage providers such as Google, Microsoft and Amazon accelerate commoditization, bundling EFSS for minimal price into broader deals.

EFSS destination vendors are evolving in two different directions: data infrastructure modernization (that is, enterprise systems/ resources integration and management with support for federation, e-discovery, data governance and security); or modern content collaboration and business enablement. Despite concerns that security and compliance may slow down adoption, EFSS investments continue to grow as organizations must balance IT control over bring your own (BYO) cloud services with users' demand for modern productivity tools. Adoption of Microsoft Office 365 has driven significant interest into OneDrive for Business, but Dropbox and Box Enterprise continue to be users' preferred options and Google offers the best alternative for real-time document collaboration.

User Advice: IT leaders responsible for digital workplace initiatives must consider EFSS. To work more effectively, organizations must explore potential security risks of personal cloud services, as well as users' requirements for modern productivity tools. They should evaluate EFSS options and capabilities to enable secure mobile content sharing, collaboration and productivity, thus reducing potential risks. If email or legacy FTP services are used for file transfers, organizations should consider EFSS as an efficient and potentially more secure way for employees to share data, rather than using personal services. Organizations looking for secure alternatives to personal cloud while preserving user preferences, and those that are especially focusing on external collaboration, should consider public cloud offerings such as Box Enterprise or Dropbox. Organizations with tighter data control requirements, or with a large storage infrastructure, should focus on hybrid solutions (such as Citrix, Syncplicity and Egnyte) that allow the organization to maintain more control over where data is housed and leverage existing storage investments. Organizations with strong requirements for data protection, or organizations that have strict regulations about data location and residency or complex data manipulation requirements, should focus on private cloud or on-premises EFSS deployments.

Business Impact: Enterprise file sharing will enable higher productivity and collaboration for mobile workers who deal with multiple devices, and lead to a more agile and connected workforce. Organizations investing in such capabilities will enable a more modern and collaborative real-time workplace, while reducing or avoiding the

inherent security/compliance threats of personal cloud services. Business benefits include increased productivity and cost savings.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Accellion; Box; Citrix; Ctera Networks; Dropbox; Egnyte; Google; Intralinks; Microsoft; ownCloud

VoIP Over WLAN

Analysis By: Bill Menezes; Tim Zimmerman

Definition: VoIP over WLAN enables voice over IP (VoIP) calls to be made over wireless LANs (WLANs). The technology may be implemented in various mobile devices, including smartphones, tablets, PCs or purpose-built cordless VoWLAN handsets.

Position and Adoption Speed Justification: VoIP over WLAN technology enables seamless voice calls from mobile devices attached via the WLAN to gateways using the enterprise PBX. This capability includes smartphones with native Wi-Fi calling capability, which (with carrier support) may provide seamless handoff of a voice over LTE cellular call to a Wi-Fi hot spot or WLAN. Enterprise implementation of VoIP over WLAN is approaching the Plateau of Productivity because the medium is stable and the solution offers flexible deployment options, including soft clients, and LAN infrastructure vendors are focused on measuring and reducing latency to support landline quality calls. Vendors also provide network management features such as QoS for packets associated with specific softphone clients, such as Skype for Business, to address user complaints about mediocre call quality.

User Advice: Telecom and network managers should consider voice over WLAN (VoWLAN) when wireless is the first connection to the enterprise network and as part of strategies to migrate to an all-wireless office, retiring wired IP desk phones. Be aware of the minimum hardware support (such as codec) in the mobile client to ensure meeting the required mean opinion score (MOS) or Rating Factor (R-Factor) score for acceptable call quality. Specify 802.11ac WLAN technology for new deployments, to take advantage of its significant increase in performance compared with earlier generation 802.11 technology. VoWLAN cannot completely replace wired phones until Wi-Fi locations provide better granularity for emergency requirements, such as E-911 calls.

Business Impact: Enterprises should use VoIP over WLAN as part of any enterprise connectivity strategy when deploying a WLAN as the first hop onto the infrastructure. “Greenfield” and “brownfield” (technology refresh) access layer connectivity projects should factor in VoWLAN savings for cabling and switch ports.

Benefit Rating: Moderate

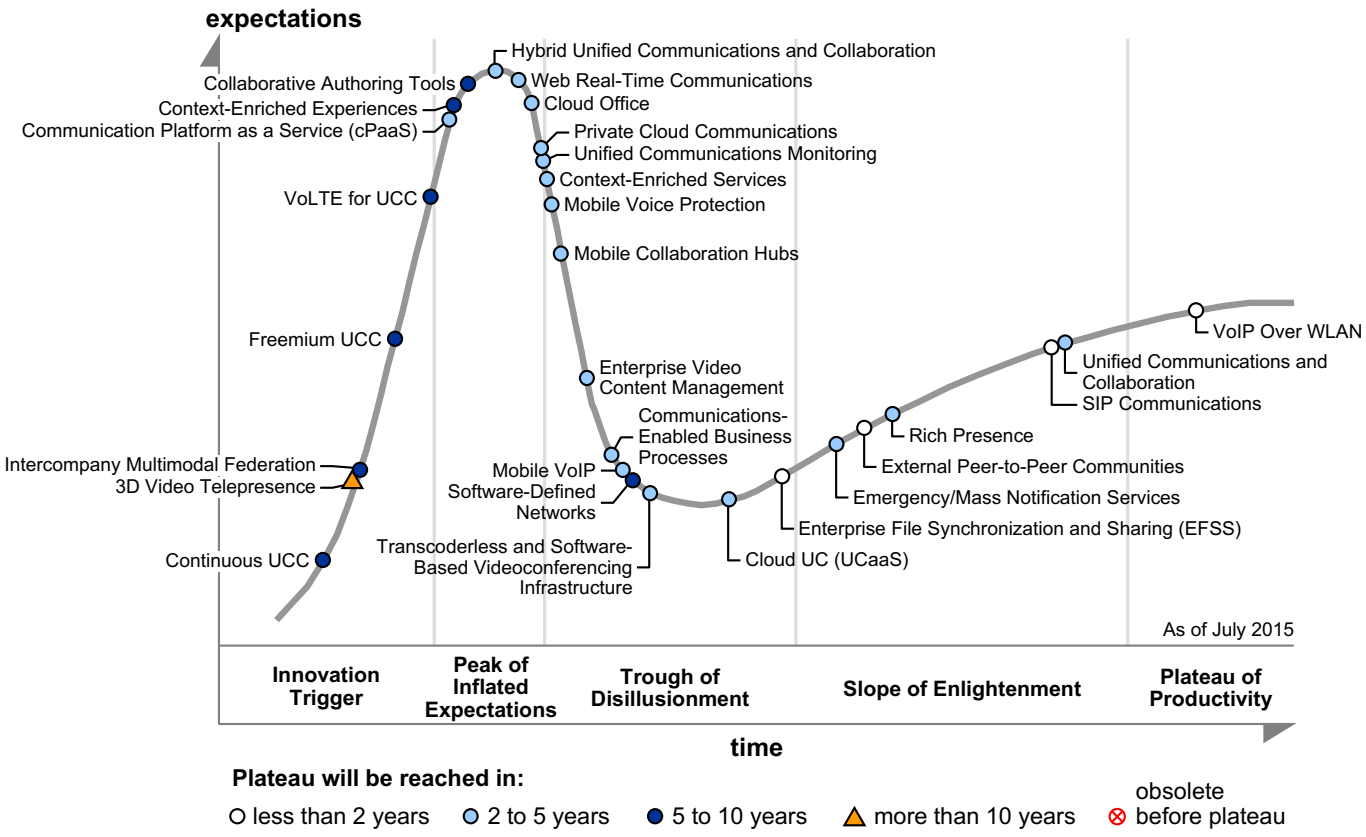
Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Alcatel-Lucent; Avaya; Cisco; Microsoft; Mitel; ShoreTel

Appendixes

FIGURE 3 Hype Cycle for Unified Communications and Collaboration, 2015



Source: Gartner (July 2015)

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 2016)	

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 2016)	

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 2016)

Evidence

Each technology analysis given in this Hype Cycle has been prepared by subject matter experts who have drawn on the body of research published in their discipline as Gartner research deliverables, and also used external, related secondary research sources.

For the most forward-looking technology analyses, analysts have typically drawn on their ongoing monitoring and research interest in new intellectual property developments, and the work of numerous vendors' research and development teams as they participate in global standards-setting institutions.

Source: Gartner Research, G00290214, M. Fasciani, 21 July 2016

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