InformationWeek analytics

Analytics.InformationWeek.com

July 2011
$99

Analytics Report

Desktop Videoconferencing:
Ready for Its Close-Up

The advent of Scalable Video Coding (SVC), which enables the use of the Internet for high-quality desktop videoconferencing, means enterprises can deploy videoconferencing to a majority of workers. Companies that value face-to-face communications can make it happen without breaking the bank.

By Phil Hippensteel

Report ID: R2950611

TABLE OF CONTENTS

© 2011 InformationWeek, Reproduction Prohibited

TABLE OF CONTENTS

© 2011 InformationWeek, Reproduction Prohibited

Phil Hippensteel
InformationWeek Analytics

Phil Hippensteel teaches information systems at Penn State University. He is also an industry consultant and trainer, and has written extensively on technology for *Network Computing* and *InformationWeek*.

© 2011 InformationWeek, Reproduction Prohibited

EXECUTIVE SUMMARY

Desktop videoconferencing is becoming a more feasible option for organizations that want to improve collaboration among employees and business partners while also cutting travel costs. More than one-third of enterprises have desktop videoconferencing products deployed to their users today, according to our *InformationWeek Analytics* Desktop Videoconferencing Survey, and an additional 10% plan to roll them out in the next 12 months.

Thanks to technology developments such as H.264 SVC (Scalable Video Coding), high-definition videoconferences can be conducted over the Internet rather than through dedicated connections. SVC is more resistant to network congestion and packet loss than its predecessor, H.264 AVC, making it possible to conduct quality videoconferences wherever a user might be: a home office, a WiFi hotspot or on the corporate network. And desktop videoconferencing can be less expensive to deploy than traditional room-based conference systems and high-end telepresence suites.

In this report, we'll dive into the differences between H.264 AVC and SVC. We'll also discuss the impact that desktop videoconferencing is having on vendors of unified communications and collaboration systems. For instance, HP and ShoreTel are both licensing technology from an SVC pioneer, Vidyo, to roll video collaboration capabilities into their product lines. Industry leaders Polycom and Cisco are grappling with the challenge that SVC presents to their high-end videoconferencing products. Microsoft has doubled down on desktop video. Its Lync Server 2010 offers the ability to set up desktop videoconferencing, and this spring the company announced its $8.4 billion acquisition of Skype, the popular Internet-based videoconferencing service. We'll share results from an *InformationWeek Analytics* survey on IT's perception of the Skype acquisition.

Finally, we provide pricing details on small and large desktop videoconferencing deployments and discuss baseline requirements for Web cameras and audio equipment.

© 2011 InformationWeek, Reproduction Prohibited

RESEARCH SYNOPSIS

Survey Name: *InformationWeek Analytics* Desktop Videoconferencing Survey
Survey Date: May 2011
Region: North America
Number of Respondents: 463

Purpose:
To determine desktop videoconferencing adoption plans and strategies in the enterprise and gauge perception of Microsoft's acquisition of Skype.

Methodology:
InformationWeek Analytics surveyed business technology decision-makers at North American companies. The survey was conducted online, and respondents were recruited via an email invitation containing an embedded link to the survey. The email invitation was sent to qualified *InformationWeek* subscribers.

ABOUT US | ***InformationWeek Analytics'*** experienced analysts arm business technology decision-makers with real-world perspective based on a combination of qualitative and quantitative research, business and technology assessment and planning tools, and technology adoption best practices gleaned from experience.

If you'd like to contact us, write to managing director **Art Wittmann** at *awittmann@techweb.com,* content director **Lorna Garey** at *lgarey@techweb.com* and research managing editor **Heather Vallis** at *hvallis@techweb.com*. Find all of our reports at *www.analytics.informationweek.com.*

© 2011 InformationWeek, Reproduction Prohibited

Mass Communication

Desktop videoconferencing will play a significant role in business collaboration and unified communications. Skype demonstrated that video could be done over the Web for the consumer market. Now a new codec and compression technology, H.264 SVC (Scalable Video Coding), makes high-definition videoconferencing over the Web feasible for business use.

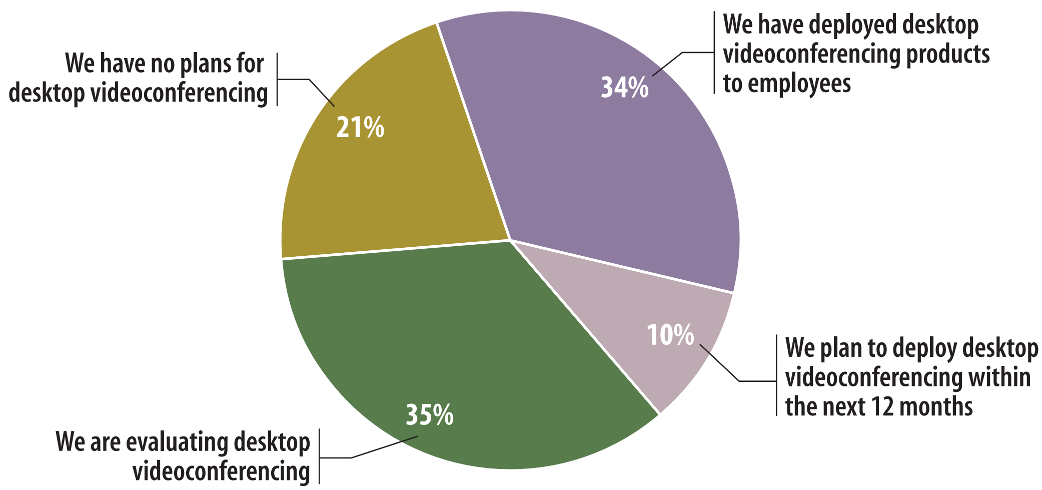
According to our 2011 *InformationWeek Analytics* survey of 463 business technology professionals, 34% of the respondents already have desktop videoconferencing in place (see Figure 1, below). Another 10% say they plan to deploy the technology within the next 12 months.

What's the appeal of desktop videoconferencing? Improving employee collaboration was the top answer in our survey, closely followed by a desire to reduce travel costs (see Figure 2, next page). The higher costs of business travel force managers to rethink the number of face-to-face meetings they schedule, increasing the appeal of videoconferencing. Desktop videoconferencing

Figure 1

Desktop Videoconferencing Plans

Is your organization using, planning to deploy or evaluating desktop videoconferencing?



Data: *InformationWeek Analytics* Desktop Videoconferencing Survey of 463 business technology professionals, May 2011

R2950611/1

© 2011 InformationWeek, Reproduction Prohibited

can also be used for training, corporate communication and classroom instruction.

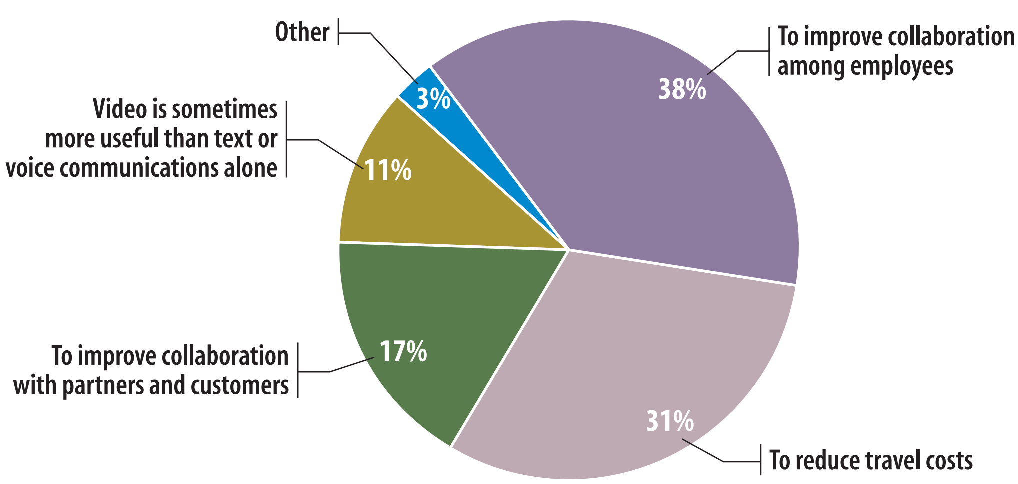
Desktop videoconferencing lags behind conference room-based videoconferencing: According to our survey, 78% of the respondents say they have conference room systems in place (see Figure 3, page 9). However, desktop videoconferencing has advantages over room-based videoconferencing and telepresence. Rooms need to be scheduled, call set-up often requires a knowledgeable administrator, cameras are expensive and multiparty calls require scheduling a bridge. By contrast, desktop videoconferencing requires nothing more than the computer, a good Web cam, and either a headset or a microphone or echo-cancellation speaker phone. Starter options using hosted services are available for small companies, while other deployment options can handle thousands of endpoints.

One of the major differences between desktop and room-based videoconferencing is the type of endpoint that can be used. Room systems usually require a codec about the size of a network

Figure 2

Primary Reason for Using Desktop Videoconferencing

What is the primary reason your organization is using or evaluating desktop videoconferencing?



Base: 366 respondents using, planning to deploy or evaluating desktop videoconferencing
Data: *InformationWeek Analytics* Desktop Videoconferencing Survey of 463 business technology professionals, May 2011

R2950611/3

© 2011 InformationWeek, Reproduction Prohibited

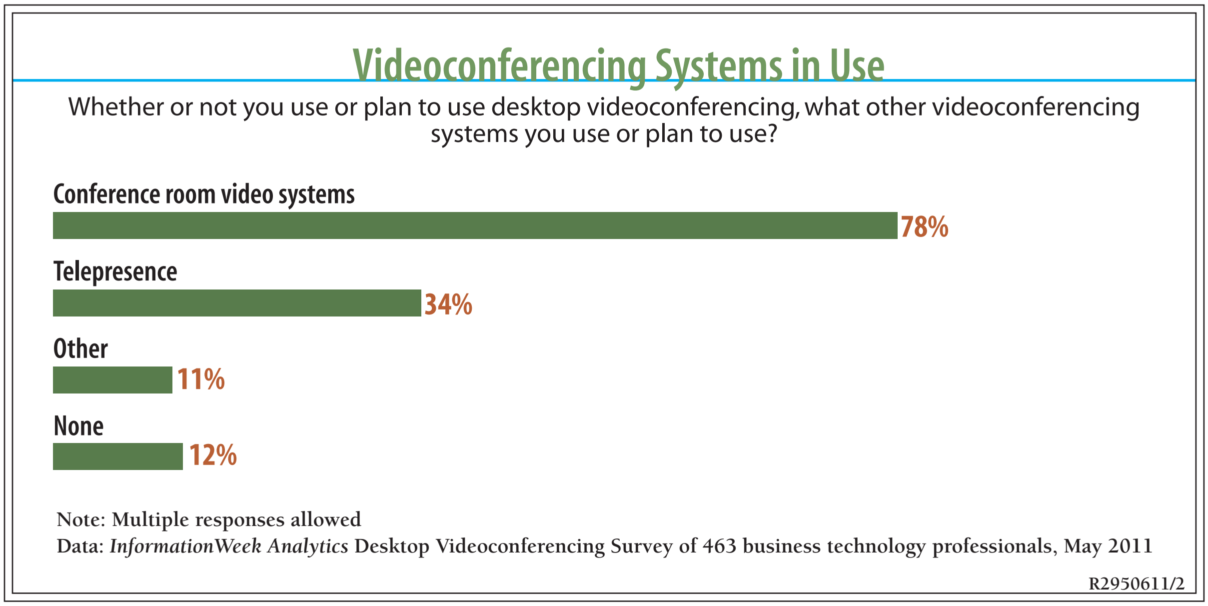
switch, a large camera and a good digital TV. Desktop systems will work with PCs, notebooks, netbooks and mobile devices such as tablets (see Figure 4, page 10). For example, HP has an executive product line specifically designed for higher-quality tablets. Also, the iPhone's FaceTime and Cisco's Cius demonstrate that phones and tablets are being used for videoconferencing. At present, IT is most focused on desktop videoconferencing for PCs—96% of respondents run or will run desktop videoconferencing on Windows PCs (see Figure 5, page 11). In a distant second place, 39% of respondents run desktop videoconferencing on iPads.

With the new systems and H.264 SVC in place, high-quality conferences are possible with a typical broadband connection, your notebook and a relatively inexpensive Webcam. We'll discuss SVC in detail later. The newer implementations don't use less bandwidth; however, they do use the bandwidth much more effectively, and that's important.

H.264 Evolves for the Internet

In a point-to-point videoconference, the key components are the display device, camera, microphone and the codec. The codec handles the analog-to-digital conversion, compression and packetization of the digital audio and video streams. It also sends and receives the packets. In

Figure 3



 © 2011 InformationWeek, Reproduction Prohibited

the past, videoconferencing systems used codecs from the H.320 family of standards, such as H.262. They worked well on dedicated circuits such as T-1s.

However, quality was definitely an issue over the public Internet. Packets carrying video are extremely time-sensitive because a single frame of video may be represented by hundreds of packets. While packets may be sent with equal time spacing between them, they often arrive erratically due to congestion and queuing in the network routers. This variable arrival time, called jitter, requires a receive buffer to smooth out the video.

With H.264 AVC, also known as MPEG-4 Part 10, the industry believed it had the answer to delivering video via IP to new and varied endpoints. With profiles that allowed bandwidths from 56 Kbps to 27 Mbps, vendors thought they could handle everything from mobile clients to broadcast studio cameras. One problem remained: packet loss.

With H.264 AVC compression, even networks with loss rates of 1% to 2% had a devastating effect on video quality. This is because it often takes a hundred or more packets to represent a single video frame. In MPEG compression, only about every twelfth frame, called a key or index frame, actually contains enough information to decode an entire picture. The remaining 11 frames are derived from information in the key frame. If some of the packets for the key frame are lost, the reconstruction of the key frame is affected, as well as that of the next 11 frames.

Vendors scrambled to find a way to conceal errors. The resulting solutions generally involved a form of forward error correction (FEC). In these techniques, a few extra bits were added to the payload to allow the receiver to accumulate an error correction code. In video FEC, the sending station splits the code and transmits it by placing one or two bits in each byte or block of data. But extra bits means extra bandwidth. And, getting enough packets accumulated means additional delay. So, while the techniques generally work, they come at the cost of using more bandwidth.

Figure 4

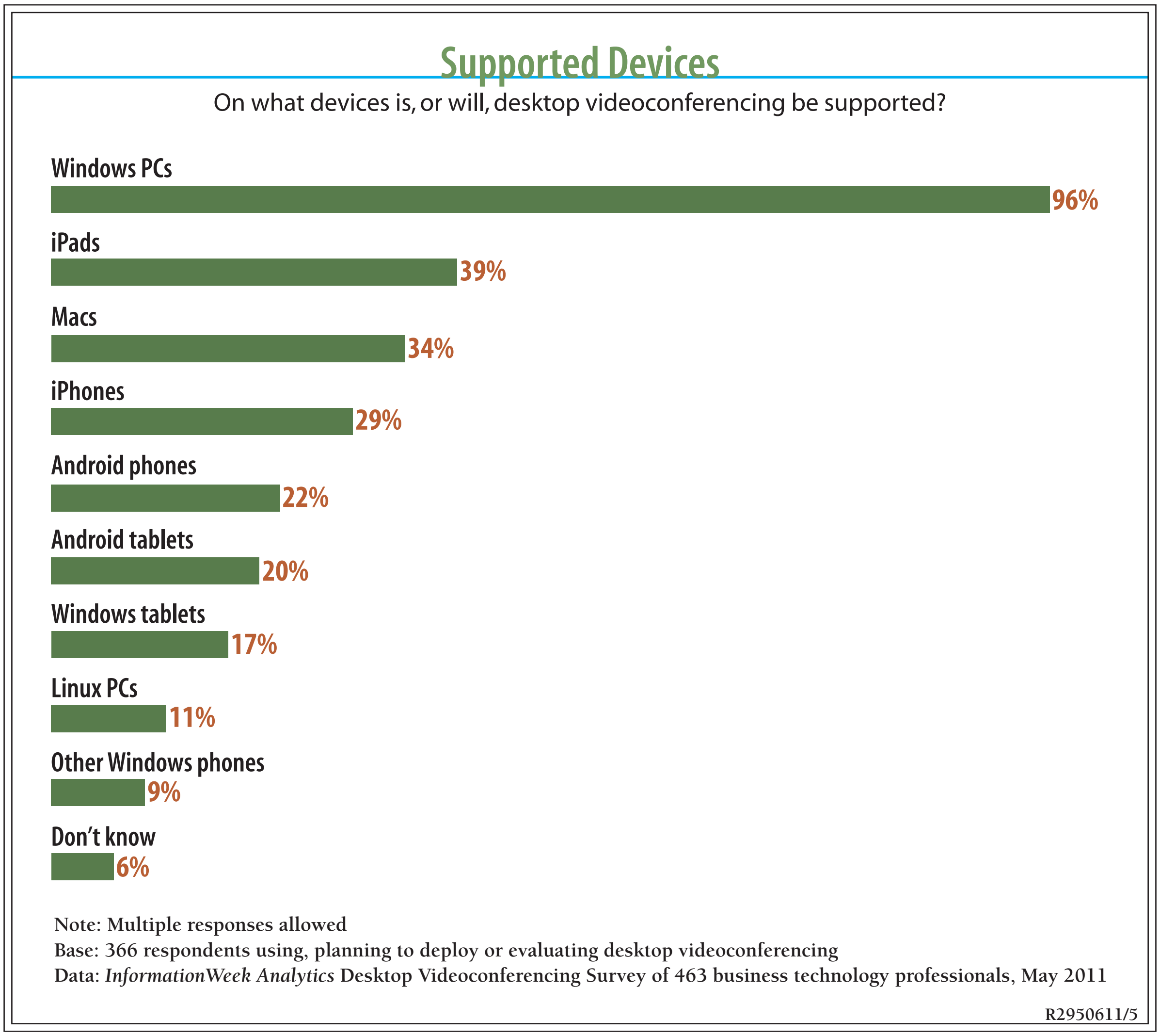
Desktop vs. Room-Based Videoconferencing

TYPE	EQUIPMENT	USE	COST	MOBILITY
Desktop	PC, Web cam, mic	Ad Hoc	$	Yes
Room-based	TV, video camera, codec, speakerphone	Scheduled	$$$	No

© 2011 InformationWeek, Reproduction Prohibited

About a decade ago, a small group of vendors decided to take a different approach. Adding an extension to the H.264 standard, they proposed SVC. It's a compromise that usually promises high quality. It is based on finding the middle ground between no error concealment and aggressive error concealment. In this technique, the original video stream is divided into three substreams of video (see Figure 6, page 11). The base stream provides enough information to the receiver to present an acceptable low-resolution image. It is protected by aggressive error

Figure 5



© 2011 InformationWeek, Reproduction Prohibited

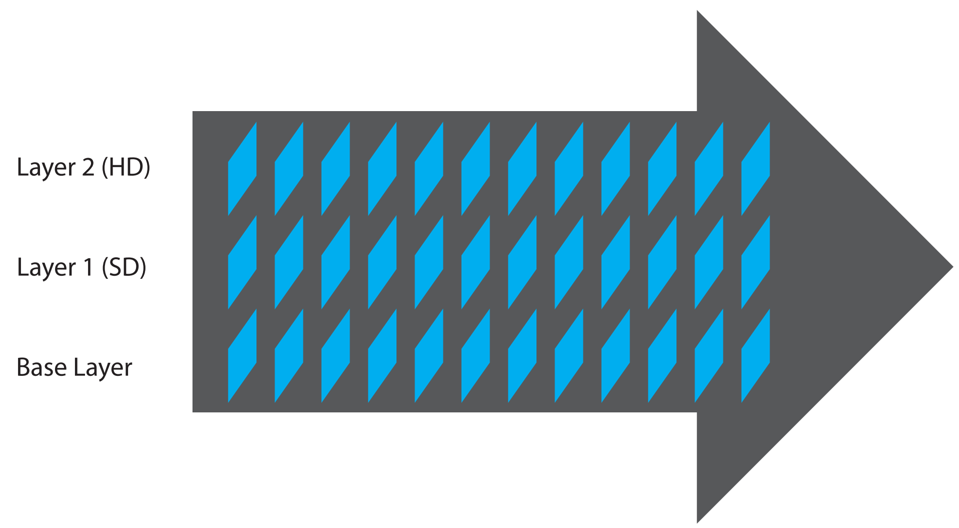
protection. Retransmissions are not possible due to the sensitivity to time. In most cases, this stream will be delivered even if the network is suffering 3% or more packet loss.

A second stream contains the information to raise the presentation to the level of standard definition and has minimal loss protection. The third stream is the data necessary to present an HD video experience but has little or no error protection. The systems work because most of our networks have loss only for very short periods of time, such as 10 ms to 20 ms. When a brief period of loss occurs, the receiver is presented with a lower-resolution image. These periods tend to be so brief that the typical user doesn't even perceive them.

SVC is important enough that vendors including Avaya, HP, LifeSize, Polycom, RadVision and Vidyo have delivered products or announced their intention to deliver products based on the standard. Companies that have a large embedded base of H.264 AVC systems will need to use gateways to integrate the newer SVC systems. This gateway is most often a hardware device,

Figure 6

H.264 SVC Video Stream



Scalable Video Coding (SVC) divides a video signal into 3 layers. The base layer provides the minimum number of packets needed for a low-resolution image. As network conditions permit, two more layers can send additional data to boost the image to standard- and high-definition quality

© 2011 InformationWeek, Reproduction Prohibited

although some vendors implement it in software by adding it to the server that acts as the call setup device.

Note that traditional H.264 AVC systems can also handle network problems. Polycom has a technique called Lost Packet Recovery (LPR), which uses FEC. LifeSize incorporates SVC encoding and hidden methods of FEC and adjustments in its technique, branded Adaptive Motion Control. By dynamically decreasing the bandwidth used for both audio and video during the session, they can maintain the same frame rate. This will eliminate the jerky motion often experienced in some older systems.

One debate surrounding the use of H.264 SVC is whether it also requires the use of multipoint control units (MCUs). Traditional vendors such as Polycom, Cisco/Tandberg and Sony have based conferences of three or more endpoints on MCUs for years. The MCU accepts audio/video signals from each endpoint, combines them into a single signal and distributes that signal to all devices. The signal is transcoded from the form in which it is received to the form the receivers can understand. For example, if one endpoint is a high-definition endpoint and others are desktop PCs, the signal may need to be changed from 720p HD at 30 frames per second to CIF at 15 frames per second. (CIF is very nearly VHS-quality video.) Such transcoding can require significant processing power and can possibly add delay because the MPEG compressed video must be decoded, modified in format and recompressed. MCUs typically handle this processing.

Vidyo, one of the pioneers of SVC, says that the use of SVC eliminates the need for an MCU, thus cutting delay and expense because an MCU can cost several thousand dollars. Because the H.264 SVC encoder creates three or more levels of compressed video, the endpoint can be sent only the part of the stream that it is able to process. Vidyo say its technology is protected by patents but it is able to combine the signals from the endpoint within 12 ms to15 ms. Such delay would never be perceived by an end user.

Desktop Video and Collaboration

Nearly every vendor selling a collaboration product is also driving desktop videoconferencing. For instance, Polycom's Converged Management Application (CMA) uses a Windows client and CMA server. It features HD video, wideband audio and presence based on Windows LDAP directory services. Desktop and document sharing are available as well. Polycom has also

© 2011 InformationWeek, Reproduction Prohibited

joined with Microsoft in a joint marketing campaign. However, Polycom has been late to move into desktop videoconferencing, though it has announced its intention to support the SVC extension to H.264.

As mentioned earlier, HP entered the fray by incorporating Vidyo's SVC technology with a bundled package for executives. Like Polycom, HP provides HD, high-quality audio, and document and desktop sharing.

What of the traditional PBX vendors such as Avaya and ShoreTel? Avaya is partnering with vendors such as LifeSize and Polycom. For customers with a large imbedded core of H.323 devices, such as Polycom endpoints, Avaya's Aura management system will handle set-up and configuration of calls by the end user. On the other hand, Avaya's partnership with LifeSize allows it to integrate SIP endpoints. A software gateway makes it possible for both kinds of devices to be on a call. While Avaya was a late entry into video, its large installed base of telephony and unified communications customers gives the company considerable influence in the market. During 2011, Avaya also has committed to integrating with other vendors such as Cisco/Tandberg, and to include other features such as desktop sharing to all participants.

ShoreTel has incorporated desktop video on a point-to-point basis. To add video to a call, the user clicks on an icon. According to ShoreTel, the resulting video session on the phone is high quality because of the SVC codec. The underlying H.264 SVC codec is powered by an engine from Vidyo.

And don't forget Microsoft. It has announced its Lync effort to replace OCS. Lync Server 2010 promises to provide the unified communications features such as IM, presence and conferencing as well as integration with Office and SharePoint. Both audio and video conferences can be set up ahead of time. Then, admission to the call can be based on Active Directory authentication or with the use of a PIN.

In the current version of Lync, Microsoft says that two-party videoconferences will support HD. However, calls that incorporate more than two parties will be below standard definition. This is likely because the software hosting the bridge services is capable of combining inputs into only the lowest resolution output. This may be the reason that Microsoft decided to announce support for third-party videoconferencing products that have achieved HD in multiparty calls. Conferences that have missing participants can be recorded into a wmv file for later viewing.

© 2011 InformationWeek, Reproduction Prohibited

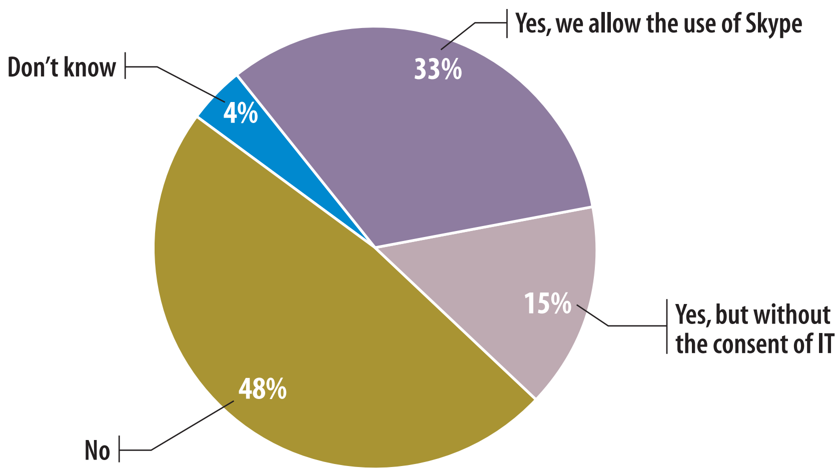
However, viewing the conference will require Internet Explorer and Silverlight. Since Silverlight looks for video that has been created with standard codecs, the implication is that the video is H.264 AVC.

Microsoft's recent $8.5 billion acquisition of Skype also promises to extend its desktop video capabilities. It certainly gives Microsoft control over a popular consumer videoconferencing platform, but the company will likely work to bring more enterprise features to Skype. Microsoft also entered a partnership with Polycom, clearly to get access to both a wide variety of endpoints and strong video engineering. Between the Skype acquisition and Polycom partnership, Microsoft has a complete package: videoconferencing over the Internet from Skype on one hand, and a host of endpoints and strong video skills necessary to incorporate SVC from Polycom on the other. With all of this technology in place, Microsoft should be well positioned against major competitors. No one else will have the combination of UC, collaboration and the ability to connect over the enterprise or Web.

Figure 7

Use of Skype

Does your organization use Skype?



Data: *InformationWeek Analytics* Desktop Videoconferencing Survey of 463 business technology professionals, May 2011

R2950611/7

© 2011 InformationWeek, Reproduction Prohibited

That said, Microsoft will have to work to overcome enterprise ambivalence about Skype: 48% of survey respondents say their organizations don't use Skype; an additional 15% say Skype is used without IT's blessing (see Figure 7, page 15). As to whether the acquisition will be good or bad for Skype, IT seems to be one the fence: 39% say Skype will be worse off, but 32% say Skype will fare better (see Figure 8, page 17).

Cisco is trying to find a direction in desktop videoconferencing after its acquisition of Tandberg. Cisco's launch of the Cius tablet, which it positions as a business collaboration device that includes video, is a clear indication that it plans to compete on more than just high-end telepresence systems. What it may not have anticipated is the difficulty of servicing the large base of embedded systems that used conventional TDM and H.263 technology. In the VoIP revolution, Avaya, Nortel and Lucent had a similar problem with not abandoning the previous generation of PBXs. The situation now is very similar for video. Companies such as Cisco that sell videoconferencing systems based on H.263 and H.264 AVC are now trying to decide how to migrate to a new generation of technologies that uses SVC, low-cost cameras and software codecs.

Google's direction relative to video collaboration is somewhat more difficult to assess. Google is an active participant in the WebM Project, an attempt to promote a new video codec. The project claims that the codec will have very high quality and run on low power processing units, apparently targeting mobile devices. While the Project's website seems to indicate an orientation toward streaming video, several vendors of videoconferencing products said they were following this effort. Could it be that WebM finds a home in Google desktop video?

SVC Pricing

Prices for an SVC-based desktop conferencing system depend on a variety of factors, including the number of employees you want to use the system, the quality of the cameras and microphones, and the cost of the software and hardware that runs the desktop videoconferencing system. We solicited pricing details from Vidyo, a vendor that has pioneered much of the H.264 SVC approach to desktop videoconferencing. The company offers hosted and premises options for customers.

On the hosted side, a company could equip 10 employees with HD desktop videoconferencing for $1,600 for 720p cameras and microphones. The fee to host its VidyoRouter, which handles

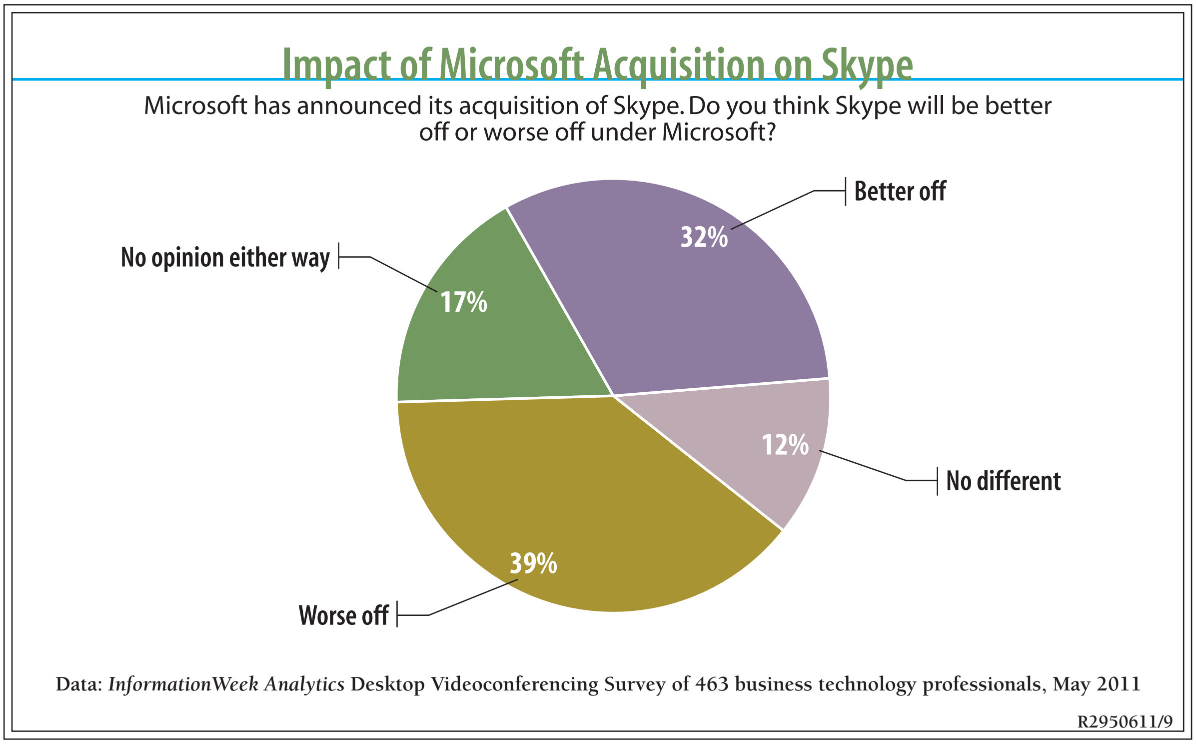
 © 2011 InformationWeek, Reproduction Prohibited

the conferencing set-up and connections, is $700 per month, based on one of Vidyo's service providers. Thus, the first-year cost would total $10,000. All 10 employees can be in conference simultaneously.

For an on-premises system, the desktop software, VidyoRouter and VidyoPortal server software for 10 concurrent users is $9,500. Add $1,425 for first-year maintenance and the same $1,600 for the cameras and microphones, and the total becomes $12,525. At present, Vidyo can only support 10 concurrent users. The company says it will be able to support more concurrent users with future product upgrades. When it does, customers will have to pay more to support more concurrent users.

Both the hosted and on-premises offerings are less expensive than conventional room-sized systems, which can cost tens of thousands of dollars, or telepresence, which can amount to hundreds of thousands of dollars.

Figure 8



© 2011 InformationWeek, Reproduction Prohibited

Users can effortlessly connect to business partners and customers who also use Vidyo. They can also conference with non-Vidyo systems, but that requires a Vidyo Gateway at $5,950. The gateway negotiates with the third-party systems and does any necessary transcoding of video formats. This is how every major vendor handles this connectivity problem.

Adding video to the phone system can be inexpensive as well. ShoreTel told us that the cost of adding to their phones is $80 per unit. Note that you won't be able to make multi-party calls until later this year, when MCU capability is expected to be added.

Audio and Camera

Audio technology plays an important role in videoconferencing. Systems that use the G.711 codec for voice, such as Skype, have 3 KHz bandwidth, which is not friendly to higher-quality sound or to techniques such as echo cancellation. Other vendors use the G.722 codecs, which increase the band carried to 7 KHz while keeping the same 64 Kbps of digital bandwidth. This allows for a much clearer sound. Polycom raised the bar even higher a few years ago when it made it possible to carry 22 KHz audio. With 22 KHz of bandwidth, even music played during a presentation will have an acceptable sound. We recommend that you invest in microphones or telephones that can support a minimum of 7 KHz.

The camera can also make a significant difference in a videoconferencing experience. Some can zoom onto the speaker and some can pan across the room to find the current speaker. While such features may not be necessary for desktop videoconferences, it's important to choose good-quality cameras that support HD video. If the picture is poor, users will be less inclined to take advantage of the system and your investment will be wasted. The market is well stocked with HD desktop cameras. For example, Logitech cameras in the $40 to $100 range support 720p resolution and tend to be popular. Many smart phones and tablets also include a built-in video camera.

What's Next?

We anticipate gradually escalating adoption of desktop videoconferencing based on H.264 SVC as the market becomes aware of its capabilities and compelling price points. As with VoIP and telephony in 2000, few thought the Internet could be used to connect video devices for high-quality conferencing. Now that it is feasible over the Web, it should spread rather quickly.

© 2011 InformationWeek, Reproduction Prohibited

As desktop videoconferencing matures, a feature that needs to be included is the ability to make one-to-many calls. Product announcements, university classes, customer updates and similar occasions require a video delivery method that's better than the current webinars or Adobe Connect sessions, which frequently have audio issues. In addition, when such presentations are conducted on the company network, the delivery should use multicast addressing to conserve bandwidth. But these added features will have to wait for more complete integration of video into collaboration tools and unified communications.

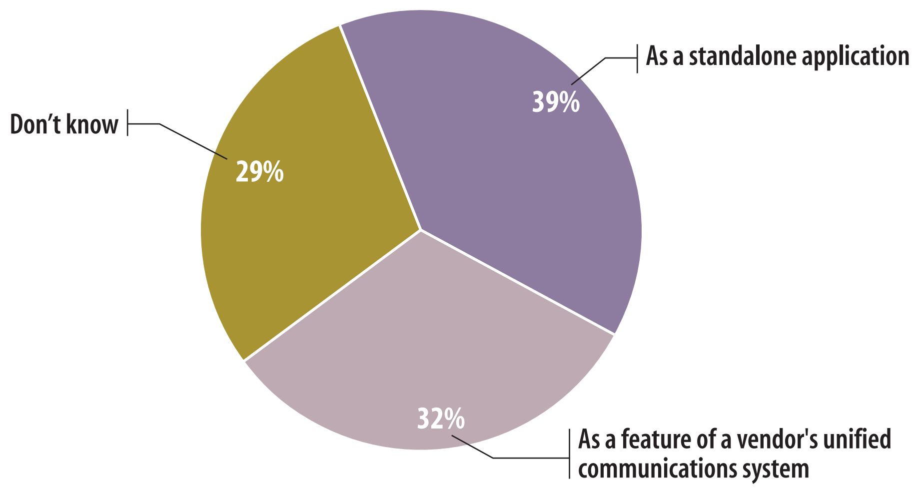
© 2011 InformationWeek, Reproduction Prohibited

APPENDIX

Figure 9

Mode of Deployment

How is, or will, desktop videoconferencing be deployed in your organization?

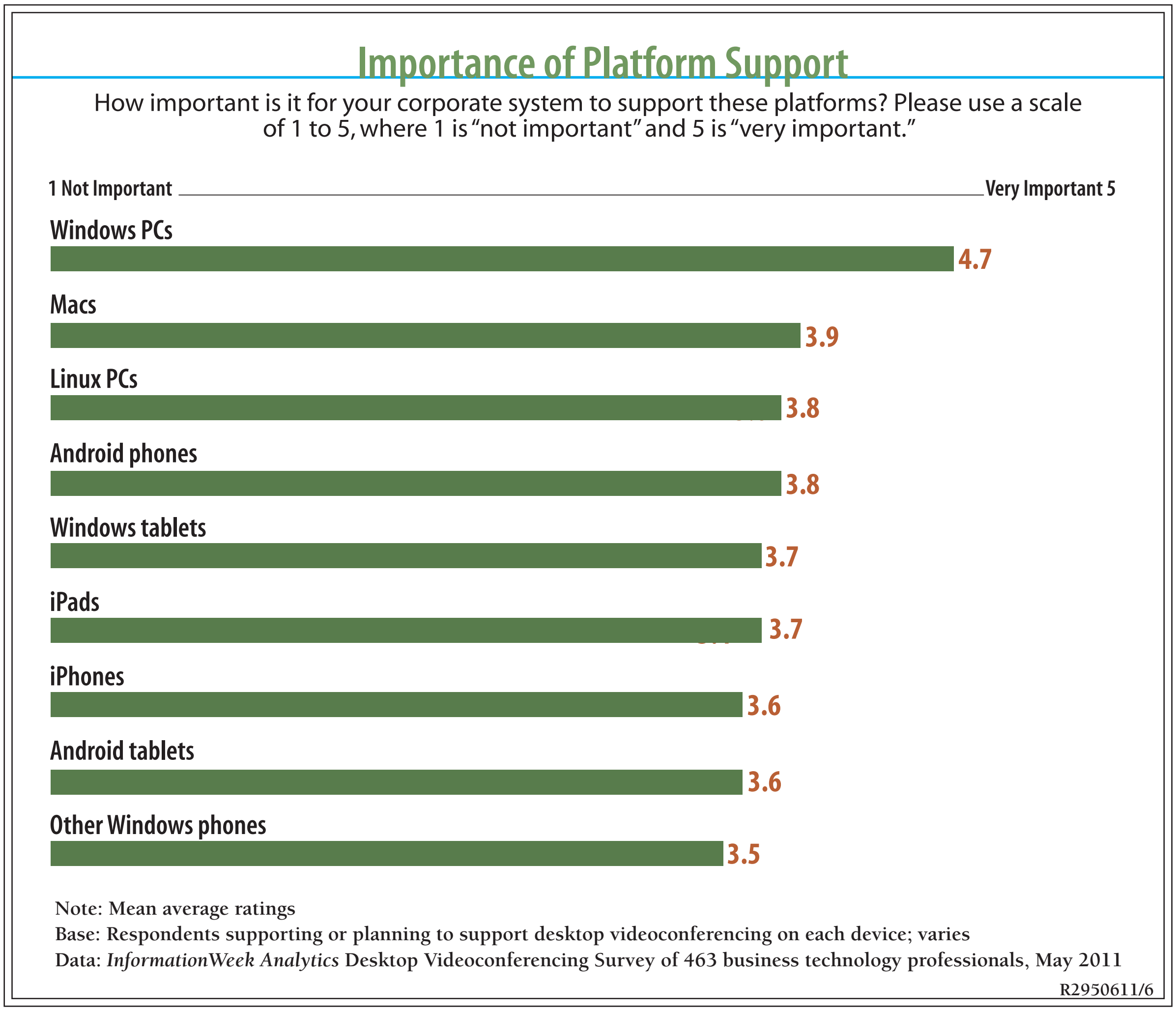


Base: 366 respondents using, planning to deploy or evaluating desktop videoconferencing
Data: *InformationWeek Analytics* Desktop Videoconferencing Survey of 463 business technology professionals, May 2011

R2950611/4

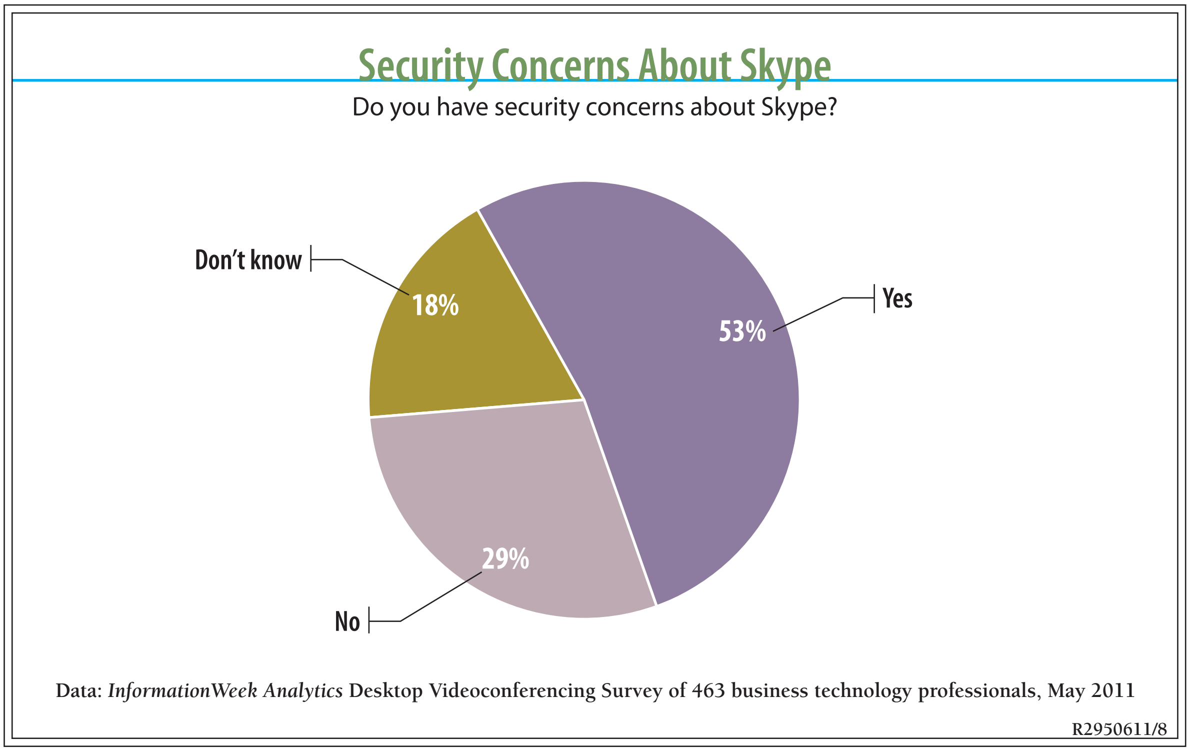
© 2011 InformationWeek, Reproduction Prohibited

Figure 10



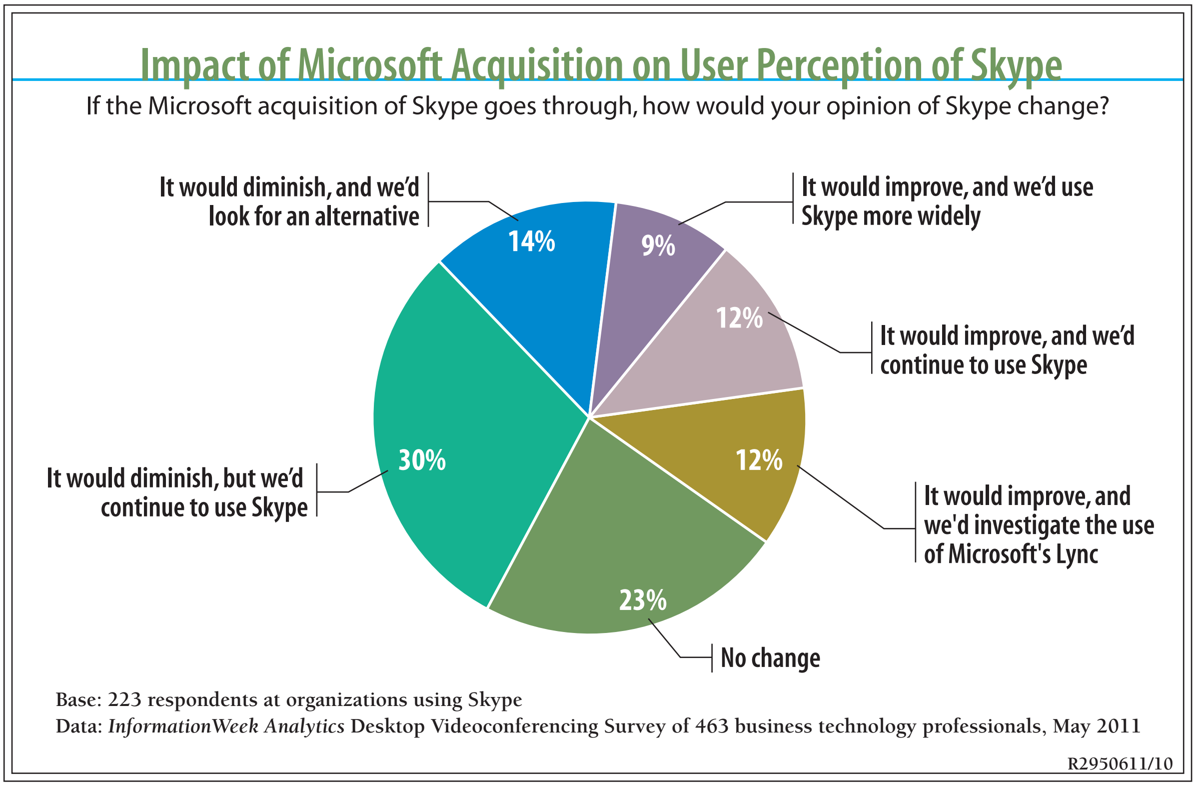
© 2011 InformationWeek, Reproduction Prohibited

Figure 11



© 2011 InformationWeek, Reproduction Prohibited

Figure 12

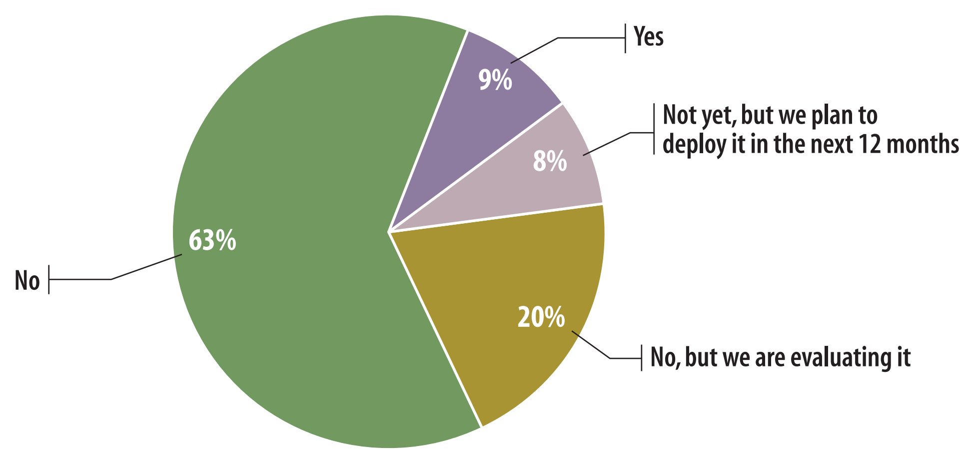


© 2011 InformationWeek, Reproduction Prohibited

Figure 13

Use of Lync

Does your organization use Microsoft's unified communications platform Lync?

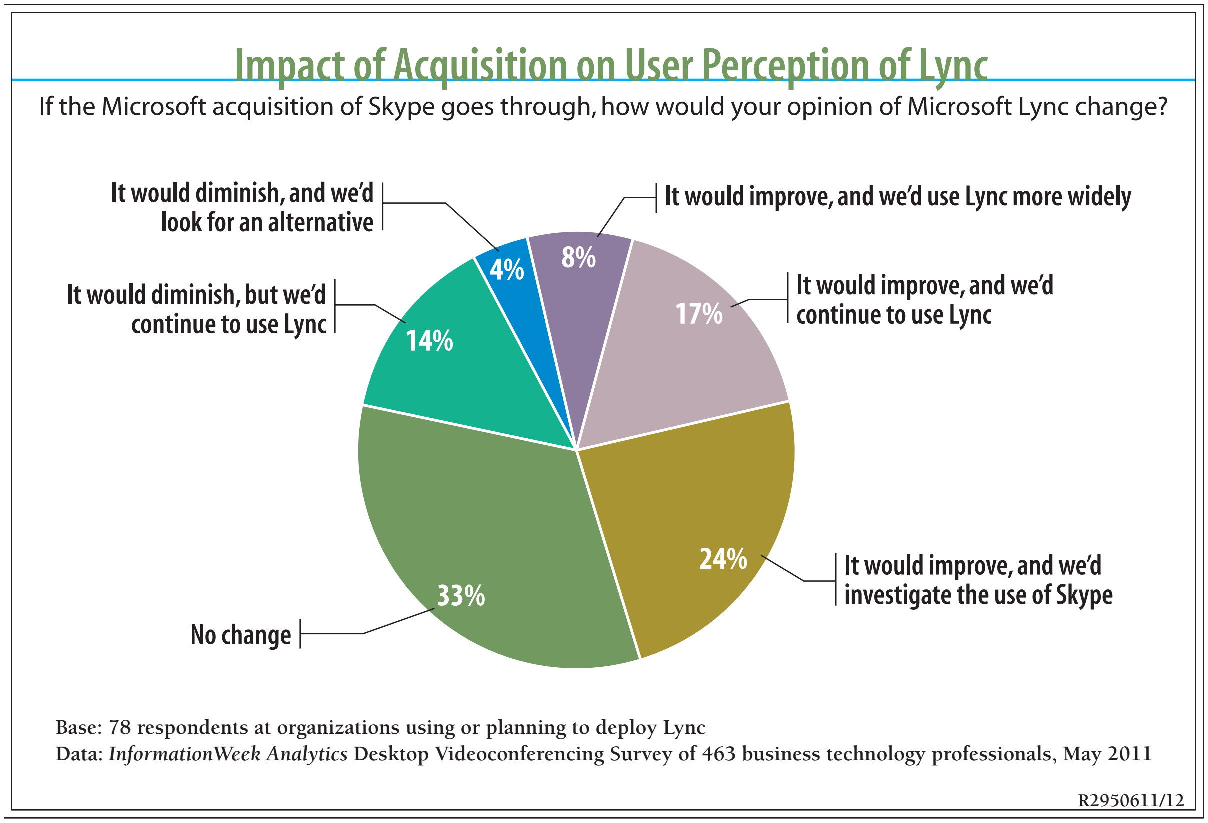


Data: *InformationWeek Analytics* Desktop Videoconferencing Survey of 463 business technology professionals, May 2011

R2950611/11

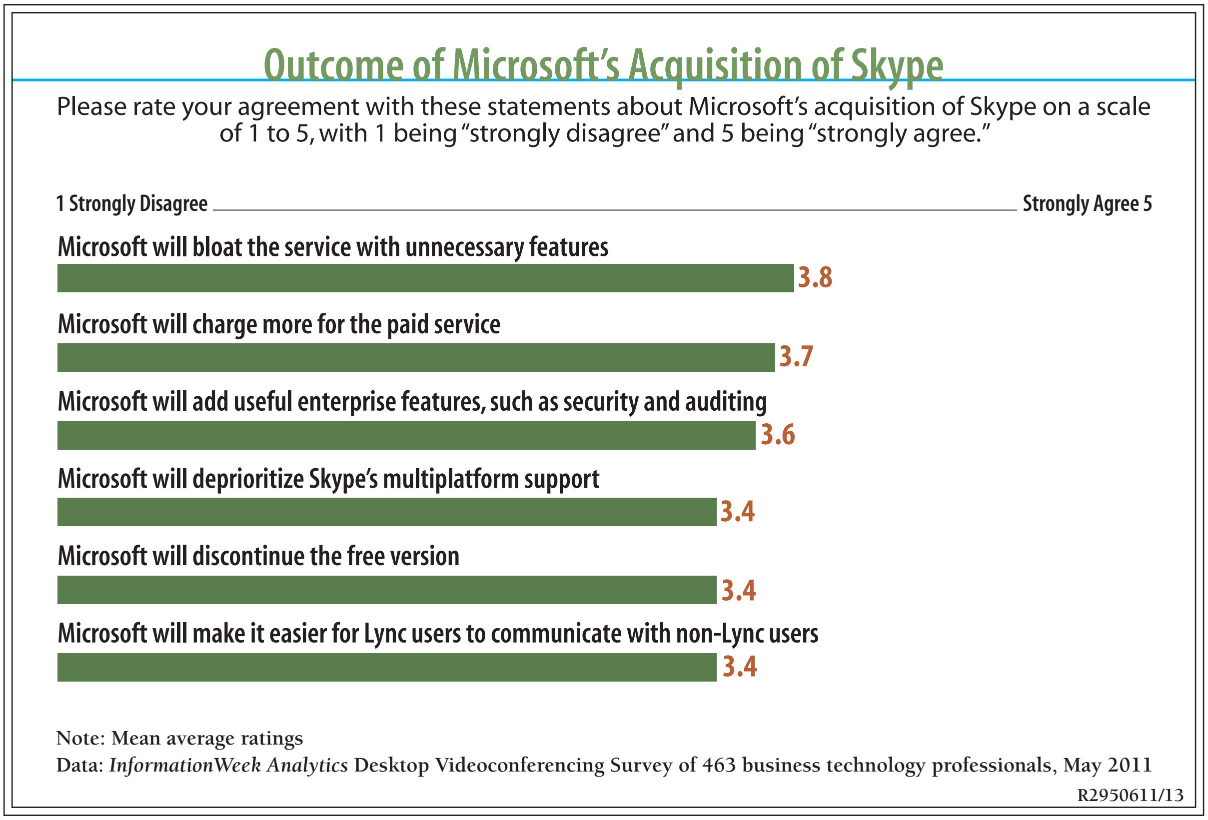
© 2011 InformationWeek, Reproduction Prohibited

Figure 14



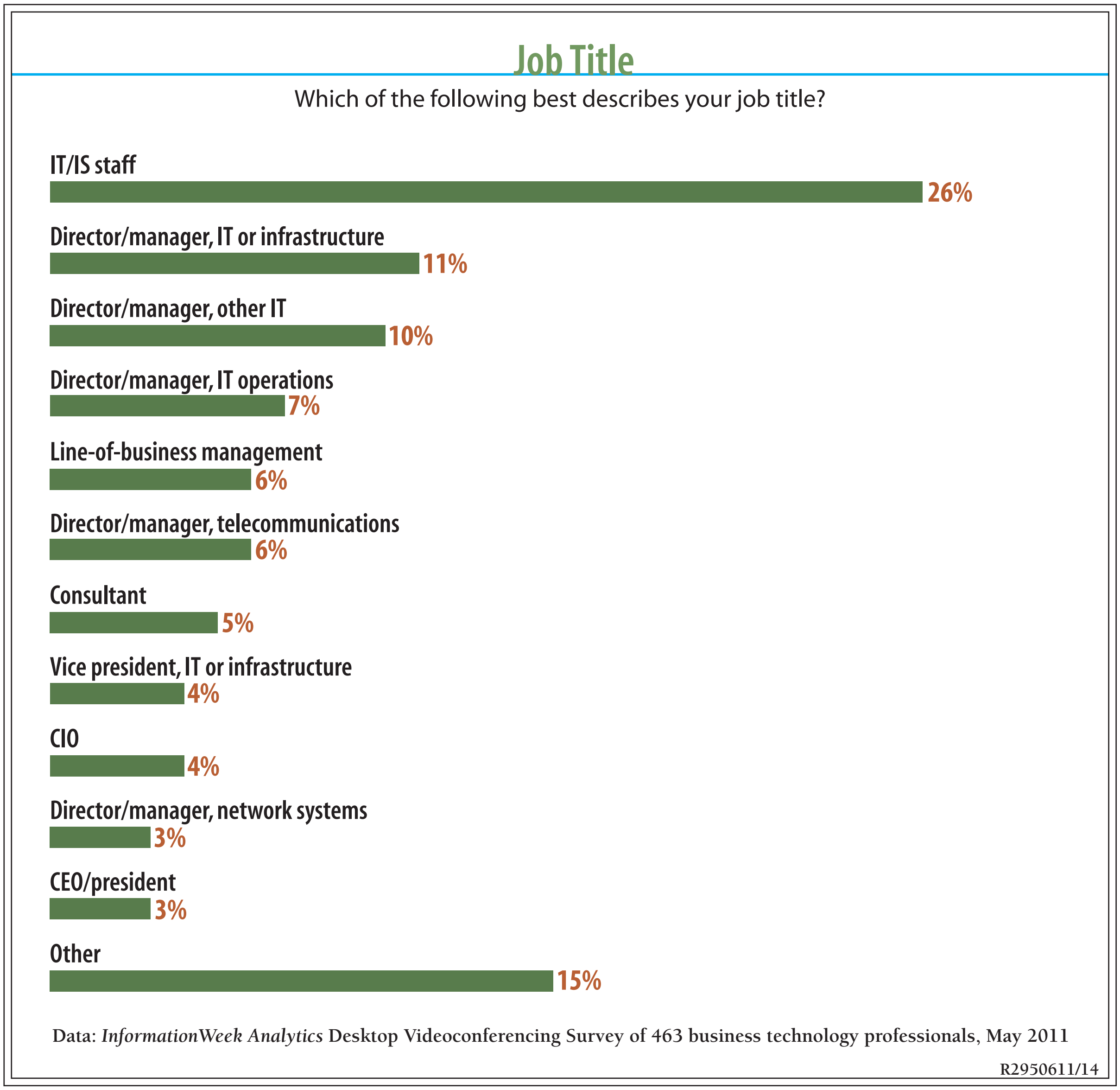
© 2011 InformationWeek, Reproduction Prohibited

Figure 15



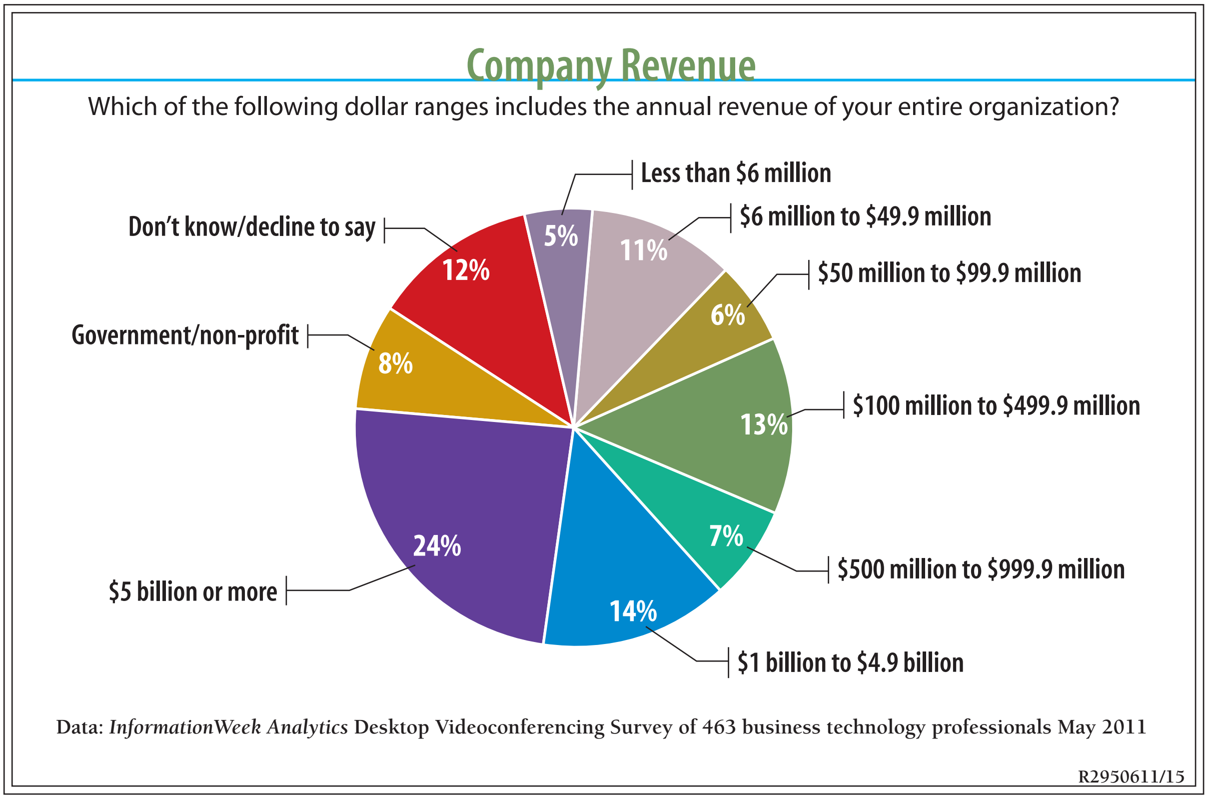
© 2011 InformationWeek, Reproduction Prohibited

Figure 16



© 2011 InformationWeek, Reproduction Prohibited

Figure 17



© 2011 InformationWeek, Reproduction Prohibited

Figure 18

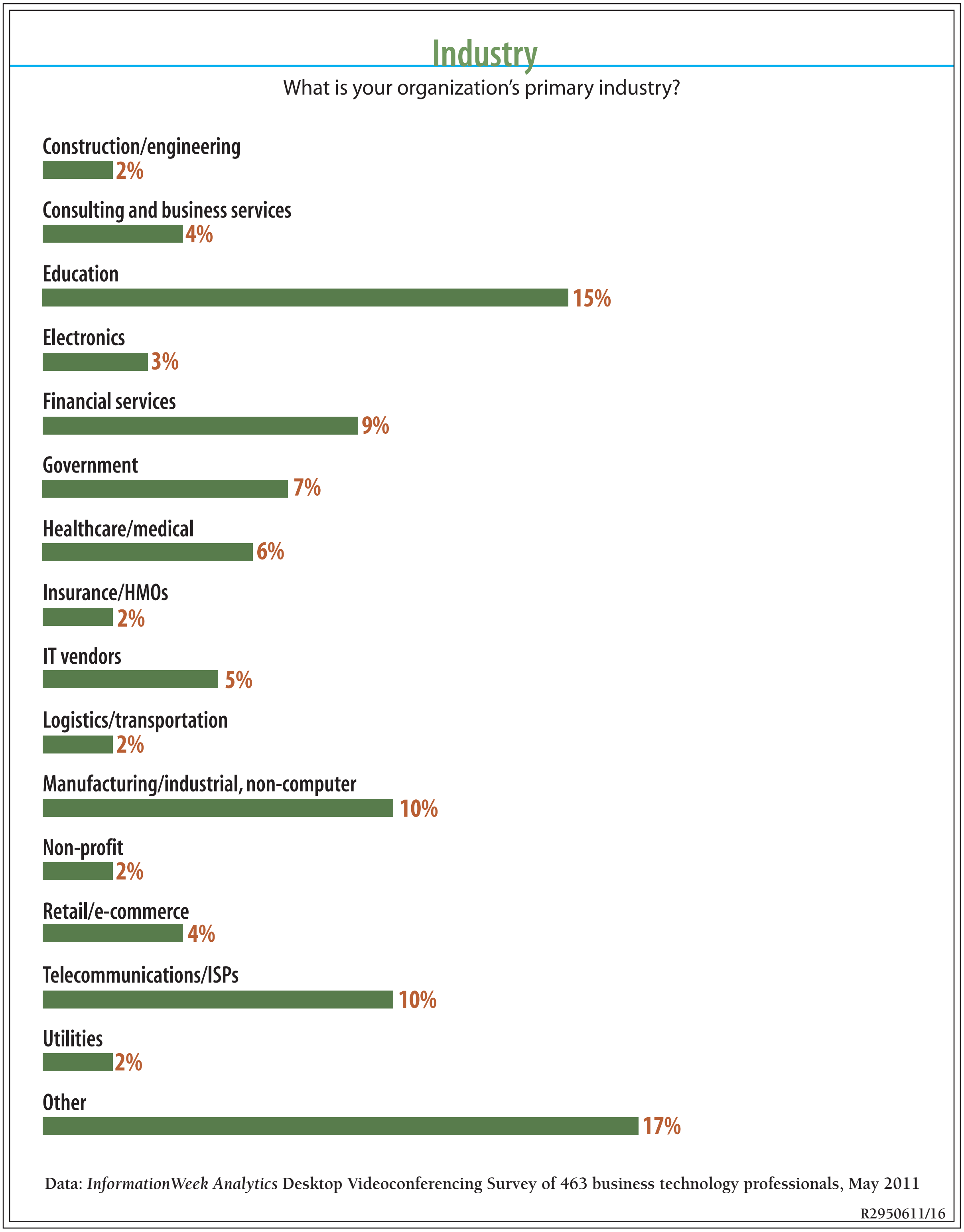
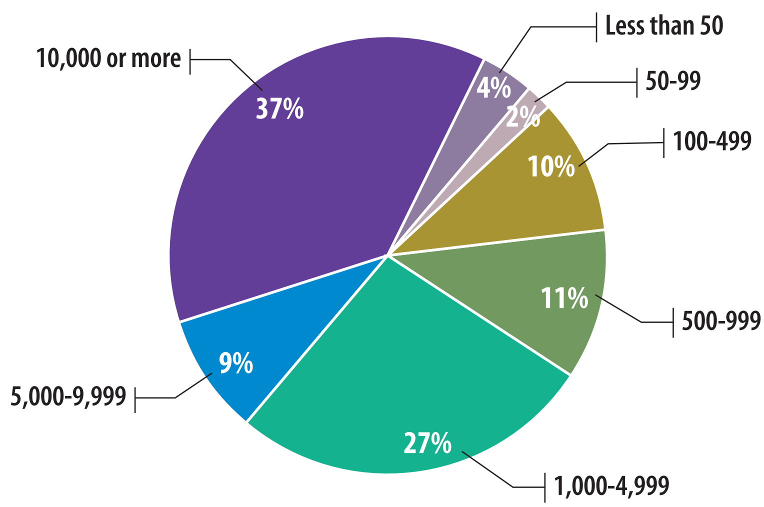

Industry
What is your organization's primary industry?
Construction/engineering
2%
Consulting and business services
4%
Education
15%
Electronics
3%
Financial services
9%
Government
7%
Healthcare/medical
6%
Insurance/HMOs
2%
IT vendors
5%
Logistics/transportation
2%
Manufacturing/industrial, non-computer
10%
Non-profit
2%
Retail/e-commerce
4%
Telecommunications/ISPs
10%
Utilities
2%
Other
17%
Data: *InformationWeek Analytics* Desktop Videoconferencing Survey of 463 business technology professionals, May 2011
R2950611/16

Figure 19

Company Size

Approximately how many employees are in your organization?



Data: *InformationWeek Analytics* Desktop Videoconferencing Survey of 463 business technology professionals, May 2011

R2950611/17

 © 2011 InformationWeek, Reproduction Prohibited

Want More Like This?

Making the right technology choices is a challenge for IT teams everywhere. Whether it's sorting through vendor claims, justifying new projects or implementing new systems, there's no substitute for experience. And that's what ***InformationWeek Analytics*** provides—analysis and advice from IT professionals. Our subscription-based site houses more than 800 reports and briefs, and more than 100 new reports are slated for release in 2011. ***InformationWeek Analytics*** members have access to:

Research: IT Pro Ranking: Enterprise 2.0 Applications: Social applications in the enterprise—business analogues of Facebook and Twitter—are beginning to move up the adoption curve. Will newcomers own the market at the expense of powerhouses Microsoft, IBM and Cisco?

Research: Unified Communications: Big Promise, Modest Movement: *InformationWeek Analytics* surveyed 406 business technology professionals about their unified communications plans.

Research: IT Pro Impact: Microsoft/Skype: In this IT Pro Impact report, we analyze responses by 463 business technology pros to our questions about the merger and share the one thing Microsoft must do to gain enterprise IT buy-in.

Best Practices: Telepresence: Living Like the Jetsons: Telepresence is turning video communications into a near in-person experience. For a price, it's the next best thing to being there. We identify best practices for selecting and implementing telepresence systems and examines bandwidth, interoperability and other problems that can trip you up.

Strategy: Into the Fold: Mobile Unified Communications Within Reach: Now that budgets are loosening, consider devoting some time and energy to bringing mobile devices into the UC fold. That's the only way to deliver full productivity benefits. Here's how.

PLUS: Signature reports, such as the *InformationWeek* Salary Survey, *InformationWeek* 500 and the annual State of Security report; full issues; and much more.

For more information on our subscription plans, please CLICK HERE.

© 2011 InformationWeek, Reproduction Prohibited