Chapter 2

IP Phones, Software VoIP, and Integrated and Mobile VoIP

Abstract

In order to establish their technical, communication, and service affordances, this chapter explores and three types of VoIP tools: 1) IP Phones, 2) software VoIP, and 3) mobile and integrated VoIP.

Type 1: IP Phones

Another reply to my e-mail list call-out came from consultant Susan Knoer, who reflected:

> VoIP is an old technology now, and many people didn't even realize that their "new" phone lines are VoIP. Even the smaller corporations I work with have gone over. . . . It might be more interesting to talk to campuses that don't have VoIP and find out why.[1]

Excellent point, Susan. The first VoIP type I explore is the most institutionally established yet least obvious form of networked calling: the mass-market carrier IP phones sitting inconspicuously on desks at a growing number of offices and homes. Digital voice is becoming standard for schools, organizations, and business, which still tend to rely on fixed-location communication. As IP phones are bundled with high-speed Internet and television subscriptions, individual consumers still interested in landline service are steadily adopting them, as well.

Figure 5
Cisco IP phone handset.

User Experience

The most mature form of Web calling in terms of technical stability, pervasiveness, and government regulation, IP phones also most closely approximate the traditional calling experience. Due to their fixed nature and use of hardware externals they are also virtually indistinguishable from older phones (figure 5). Broadband IP calls are initiated with either specially made IP handsets or headsets or with existing handsets converted with adapters. Unlike the small-scale startup culture of software VoIP, IP phones tend to follow a more traditional provider-subscriber customer service model. These characteristics make IP calling an easier conceptual leap for users who might find other Web-based calling tools less accessible.

Infrastructure and Benefits

IP phones differ from their analog counterparts in underlying connection infrastructure, provide additional features (transcribed voicemail to e-mail, SMS messaging and emergency notifications) and are typically less expensive

to operate. At the same time, IP phones are intricately interconnected with the existing telephone infrastructure, often using older-generation phone lines to initiate and terminate calls.

Residential and office IP phone service has been widely available since the mid 2000s. While home subscribers have likely made a conscious switch away from analog phone service, landline VoIP in an office context is often not obvious to those who use it. Despite this, at the institutional level VoIP presents a paradigm shift to the extent of becoming a bellwether technology. In order to support digital voice, an organization must have a robust data infrastructure and be comfortable with change in a core communications area. IP phones unify data, voice, and video services, reducing costs and centralizing control with local IT instead of external companies.[2]

A 2009 study of communications in higher education found higher employee satisfaction with digital voice, which led to higher evaluations of campus IT competence.[3] Cost savings can also be significant. The University of Louisville, which by 2007 had transitioned completely to IP phones and emergency notifications, estimates that after an initial network upgrade it saves roughly $1.5 million annually on 10,000 broadband IP lines.[4]

Digital telephony's high-speed network requirements often necessitate a considerable front-end investment of resources and strategic planning.[5] *Spreading the Word: Messaging and Communications in Higher Education,* the 2009 ECAR study cited above, characterizes VoIP as a "revolution . . . in the realm of two-way audio communication," so much so that if an organization hasn't yet or isn't planning to switch to IP phones, it is likely held back either by technological conservatism or degraded data infrastructure (copper cabling that needs to be replaced by fiber optic, etc.), or it is considering foregoing desksets completely in favor of all-mobile communications (although likely still using IP networks for video conferencing).[6] Higher education has lagged at developing comprehensive mobile strategies and fixed-location phones are still dominant among staff, meaning that nonadoption of VoIP at the campus level may indicate financial, technical, or cultural barriers.[7] Students are trending in the opposite direction, preferring mobiles over fixed-line or software IP phones.

Quality, Security, and Stability

Among all forms of Web calling, broadband IP phones are regarded as the most stable, secure, and best in terms of voice quality, and are sometimes used by the same institutions that ban Skype and other types of software VoIP. Although emergency 911 service was not initially available to IP phone users, the FCC issued a series of regulations that mandated extended emergency coverage to residential users in 2008.[8] On the security side, firewalls, anti-spam measures, and other well-established network security approaches can protect IP systems. Power loss can cause total service outage; if an electrical problem occurs or an external device fails, it can render IP phones unusable unless secondary power is available.[9] While many organizations plan for this eventuality, some home Web phone users cannot. Therefore, it is inadvisable to use a home IP phone without backup power or an alternative communication source.

IP Phone Carriers

Vonage

www.vonage.com

Asterisk/Switchvox (open source)

www.switchvox.com

AT&T

www.corp.att.com/voip

Sprint

http://shop.sprint.com/en/solutions/voip

Cisco

www.cisco.com/en/US/products/sw/voicesw

ShoreTel

www.shoretel.com

Speakeasy

www.speakeasy.net

Carriers

There are many local and national IP phone carriers. The gray box contains a brief list of the more widely recognized enterprise and residential providers, which are generally representative of typical rates and features across the spectrum.

Type 2: Software VoIP

Unlike IP phones, software VoIP is best known by its most recognizable brand: Skype. Already well established, software VoIP use has increased during the global recession.[10] The desire to reduce costs and cut back travel has motivated many consumers to choose free or inexpensive calling and conferencing applications, most of which

integrate voice, video, text chat, and additional options such as file or screen sharing. If a technology is judged "disruptive" based on how significantly it upends the market share and modus operandi of the technology that came before it, software VoIP was as disruptive to traditional telephony as the mobile shift is to fixed-location computing, for two reasons:

- Software VoIP is not controlled by the industry giants that held sway over communication for a century, the same companies that largely still dominate mobile telephony. Instead, it was pioneered by startups like Skype and Jajah.
- Software VOIP transformed two of the most expensive forms of interaction—international and video calling and conferencing—to among the least expensive. This has had a transformational effect on communication and collaboration across distances.

Audio/Visual Externals

Software voice and video calls are almost always made from personal desktops, laptops, and other portable platforms using Web-based or downloadable applications. Software VoIP users rely on built-in or external audio and visual devices, or, less frequently, plug-in adapters that convert legacy handsets. While many laptops, notebooks, and tablets feature built-in voice and video components, most desktop computers still tend to require external webcams, microphones, headsets, earphones, or speakers, most of which are available from a base price of $30–$50 per item. Recent advances include high-definition and motion-tracking webcams, some of which have experienced notable problems (several Hewlett Packard models notoriously failed to track faces with dark complexions).[11] Apple has also applied for a screen-embedded camera patent that could address the eye contact problem in webcam communication, a topic I revisit in chapter 6.[12]

Classes of Software VoIP

Because software VoIP spans many subtly different applications, my approach is to present it in three subcategories and highlight a few products in each: *Web calling* (Skype, VoxOx, and Jajah), *voice and video instant messaging* (Google services, iChat, Windows Live Messenger, Meebo, and TokBox), and *Web conferencing* (Dimdim and Adobe Connect).

Web Calling

These cross-platform (Mac, Windows, or Linux) multifunctional programs enable free user-to-user voice or video calling and conferencing via personal accounts. They tend to display screen names and presence data (available/not available), and often facilitate in- and outbound calling to a from landlines and mobile phones.

Skype

Operational since 2003, Skype is now the de facto program for calling over the Internet. Skype's unique peer-to-peer architecture provides greater stability as more users log on, and it can be operated from a USB drive as well as a computer and many smart mobile devices. Skype-to-Skype calls are free, and for modest fees users can establish traditional phone numbers (SkypeIn) or call out mobiles and landlines at competitive rates (SkypeOut) using a subscription or prepaid balance (figure 6). Skype also enables SMS and text messaging for a flat fee, browser extensions and conference calling with up to 25 participants, and screen and file sharing as well as text chat during voice and video calls.

Skype Features: voice and video calling and conferencing, text chat, file sharing, SMS, screen sharing, Skype In/Out, call recording, voice mail.

VoxOx

VoxOx is a more recent Web communication startup that has set out to become the first "universal communicator." It allows users to combine all of their social media and communication channels, from e-mail to IM to Web voice and video and Facebook, into a single interface and address book. VoxOx freeware is interoperable with Windows XP and higher and Intel Macs running Leopard 5. VoxOx users are numbers with unlimited free call-in time and can charge funds to an account to make outbound calls. The service's "any to any" capability reroutes incoming VoIP or analog calls to cell phones and translates voice messages to SMS or e-mail. VoxOx gained notice in February 2010 when it released the Universal Translator, a real-time translation app for email, chat, and SMS.

Web Calling Carriers and Startups

Skype

www.skype.com

VoxOx

www.voxox.com

Jajah

http://jajah.com

ooVoo

http://oovoo.com

Figure 6
Skype for Mac interface.

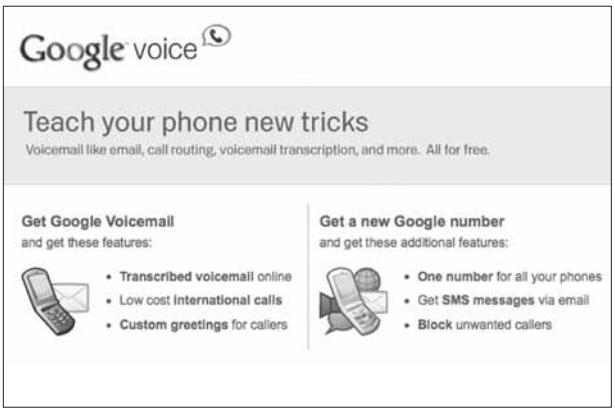

Figure 7
Google Voice options.

Voice and Video Chat Carriers and Startups

iChat

www.apple.com/macosx/what-is-macosx/ichat.html

Windows Live Messenger

http://windowslive.com/desktop/messenger

Gmail

http://mail.google.com/mail/help/intl/en/about.html

Google Talk

www.google.com/talk

Meebo

www.meebo.com

TokBox

www.tokbox.com

VoxOx Features: voice and video calling and conferencing, IM, file sharing, e-mail, SMS, screen sharing, call in and out, social media.

Jajah

Jajah offers a range of individual and enterprise Web calling products. Its most popular service, Jajah Web, connects traditional landlines and mobile numbers for free and also facilitates free online calling between subscribers. Jajah does not require a download to operate, but instead uses the existing telephone network to connect calls placed through a browser. Jajah also allows websites to embed "click-to-call" buttons for visitors to place direct calls to a designated VoIP, mobile, or landline number.

Jajah Features: voice calling and conferencing, SMS, screen sharing, call in and out, call recording, voice mail, embeddable calling widgets.

Voice and Video Instant Messaging

Instant messaging applications with integrated voice and video operate similarly to Web calling programs, but are more focused on connecting internal users than they are on external communication. Some products are single account (Google Talk) while others are multiaccount

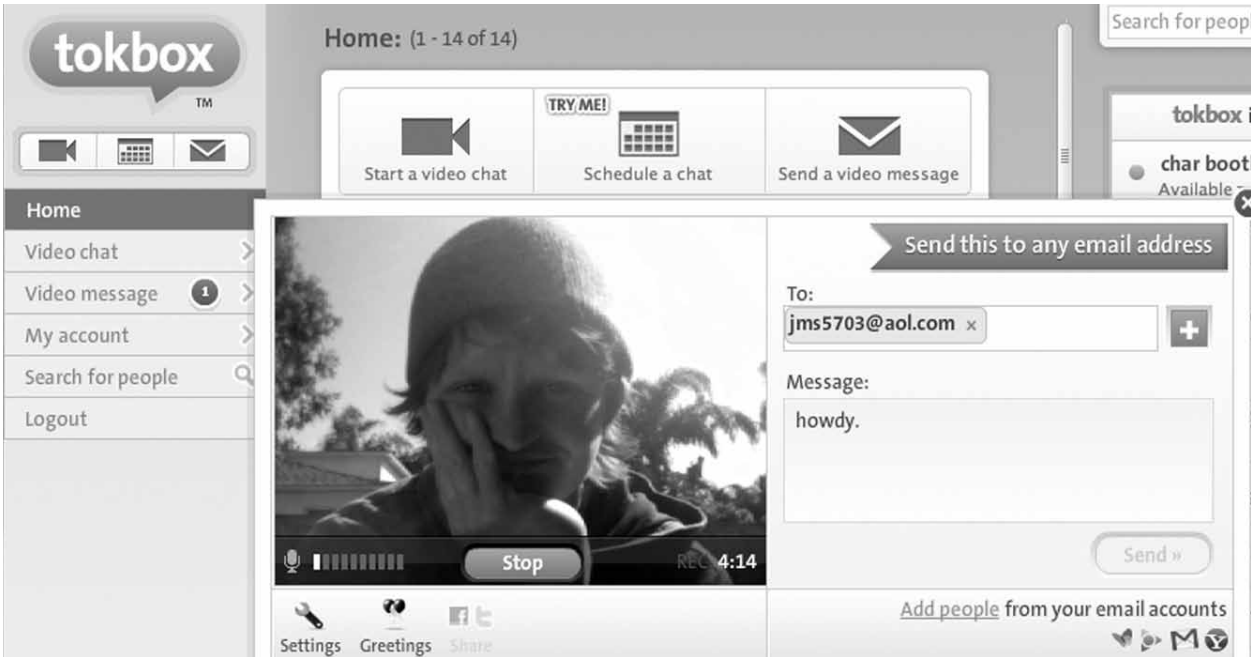

Figure 8
Tokbox video messaging.

(iChat, Windows Live Messenger) standalone applications or Web-based multiaccount applications (Meebo, TokBox).

Google Talk, Gmail Video Chat, and Google Voice

Google provides voice and video chat and calling, but distributed accross three services: Google Talk (voice and text chat) Gmail (video chat), and Google Voice (voice calling, voice mail, and SMS via a dedicated number). While Google Talk and Gmail have featured voice and video chat (respectively) for years, Google Voice is a recent addition that differs from Skype by providing a digital gateway that routes calls to all of your phones simultaneously through a universal "Google number" (figure 7) and offers additional features like transcribed voice mail. Google Voice remained invite-only as I was writing this report, but Google's late 2009 acquisition of VoIP startup Gizmo5 not long after a failed attempt to purchase controlling interest in Skype signals that Google is positioned to compete with other Web calling apps.[13]

Features: voice calling, voice mail, text chat, file sharing (Google Talk), video chat (Gmail), call in and out, call recording.

iChat and Windows Live Messenger

Apple's proprietary IM application, iChat, comes as a standard feature on the OS X operating system. It works with built-in and external webcams and uses Apple's signature "chat bubble" interface display. The application allows text chat, audio, video, and screen-sharing functionality and can be used with instant messaging services AIM, ICQ, MobileMe, and XMPP. iChat does not feature computer-to-phone calling.

The PC equivalent of iChat, Windows Live Messenger, uses a feature known as Windows Live Call to allow computer-to-computer voice and video calling or computer-to-mobile or -landline calling. It can also double as an IP phone with handset.

iChat Features: text, voice, and video chat.

Windows Live Messenger Features: voice and video calling, text chat, file sharing, user-to-user calls, user-to-phone calls, external handset.

Meebo and TokBox

TokBox and Meebo feature similar functionality to application-based chat, but in Web-based form. Meebo is a multisignon text IM client that allows voice or video during an interaction, while TokBox is a video-focused chat application that allows you to record and e-mail video messages of up to 10 minutes (figure 8), conduct video chat with up to 12 participants and 200 viewers, or embed video chat windows in other pages and applications.

Meebo Features: text, voice, and video instant messaging.

TokBox Features: video chat, scheduled video chat, and video messaging.

Web Conferencing

Web conferencing platforms are used for rich, configurable synchronous distance instruction, presentations,

meetings, and collaboration. They typically operate either through free Web-based interfaces (Dimdim) or licensed Web interfaces or software packages (Adobe Connect). Other Web conferencing services include WebEx, GoToMeeting, and LearningTimes.

Dimdim

Most Web conferencing involves hosting or software fees, but Dimdim is among the few free options. For up to 20 remote participants, Dimdim features shared audio, video, chat, screen sharing, and whiteboard tools (figure 9). More participants and "webinar" features can be added for a fee. Dimdim is also available as an open source API, which lifts the simultaneous users limitation and allows enhanced customization. In March 2010, Dimdim released a Google app for embeddable hosting and meeting participation in compatible collaboration or course management platforms.

Dimdim Features: voice, video, and text chat; screen sharing; whiteboard and annotation; surveys and polls; record and share meetings; custom meeting URLs.

Adobe Connect Pro

Adobe Connect Pro is among the most popular hosted Web conferencing services, is available in both individual and professional versions, and is one of the largest in terms of simultaneous viewers or participants (up to 80,000). Connect is Flash-based and features a highly configurable interface. A related product, Adobe ConnectNow, offers free online meetings for up to four participants, and a mobile app accessible from iPhones and iTouches.

Adobe Connect Pro Features: voice, video, and text chat; interface customization; surveys and polls; screen sharing; whiteboard and annotation; record and share meetings; custom meeting URLs.

Quality, Security, and Stability

Whether you are using Web calling, chat, or conferencing, you may experience the same usability and quality issues as any other form of VoIP—delay, jitter, and echo. These problems can be exacerbated, however, when vying for network space with other Web users. Security and privacy are notable concerns with Skype, which has been banned by local governments, institutions, and even entire nations (South Korea and the United Arab Emirates) as a potential risk and resource monopolizer.[14] Its peer-to-peer architecture can make bandwidth-hogging "supernodes" out of user computers, an issue Skype has attempted to address with a security section on its website.[15] Despite more acceptance in recent years, software VoIP continues to be contentiously viewed in some educational circles—many primary and secondary schools prohibit Skype, while the

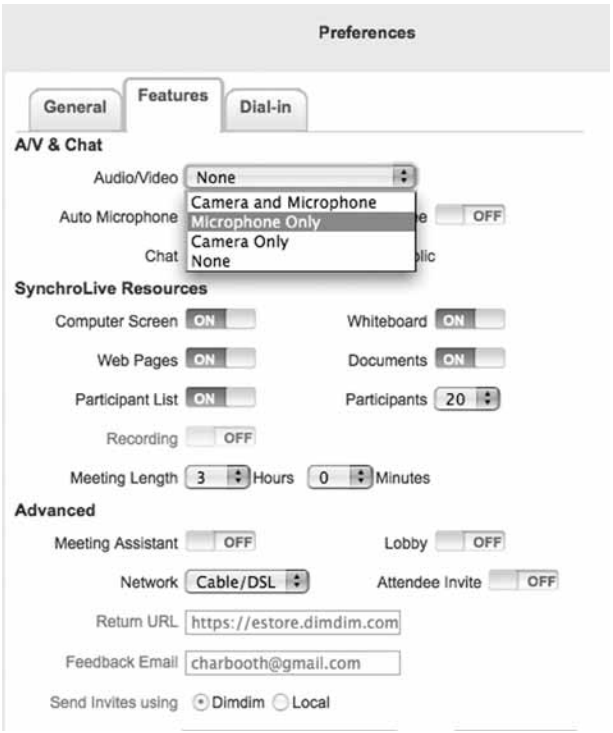

Figure 9
Dimdim Web conference preferences.

2009 ECAR study *Spreading the Word: Messaging and Communications in Higher Education* found that among the third of college and universities that had a specific software VoIP policy, almost 40 percent either discouraged or prohibited its use. Conversely, less than 3 percent encouraged or required the use of software VoIP.[16]

Type 3: Mobile and Integrated VoIP

Mobility and Adaptation

By 2013 there will be more smartphones than personal computers as more users bypass landlines and wired Internet in favor of Web-enabled mobile devices.[17] This is more than a simple matter of preference: in developing nations, towers that broadcast 3G cellular Internet signals are cheaper to construct and maintain than other forms of wired or satellite broadband.[18] In another demonstration of its adaptability, VoIP is now available on many smartphones and Web-enabled handhelds, meaning that users of even non-"phone" portable Internet devices like iTouches and iPads can make free calls and send text messages over 3G or WiFi (figure 10). Scaling back on minutes and text plans with the help of mobile VoIP is

Figure 10
YouTube video on Skype over iPod Touch.

becoming an increasingly mainstream cost-cutting strategy—the Skype iPhone app was downloaded over a million times the week it was released.[19]

Adoption (and Resistance)

In 2009 the Federal Communications Commission Chair Julius Genachowski called for the principle of "network neutrality," or greater openness and competition in all things Web-accessible, to extend to the telecommunications industry.[20] In response, a few major telecom companies began to open their phones and devices to third-party Web calling.[21] Mobile VoIP use increased by more than 40 percent in the second half of 2009, noticeably affecting carrier profits.[22] The global research firm In-Stat estimates that by 2013, 300 million mobile users will use VoIP via smartphones, creating a market in excess of $35 billion.[23] Mobile VoIP apps are either smartphone of software VoIP providers like Skype or mobile-specific services like Fring and Nimbuzz. Because they allow users to bypass minutes and roaming charges by using their data plans to make and receive calls, send text messages, and (eventually) video chat, mobile VoIP is banned by some major telecoms, while others offer scaled-down or "light" applications that allow only user-to-user calls and chat or outbound calls and SMS messages for a fee.

In February 2010, Verizon Wireless announced that it would offer Skype Mobile and Google Voice out of the box on BlackBerries and Androids. While Skype-to-Skype calls might be "free" for Verizon users, they are still required to buy a data plan, and SkypeOut calls are deducted from a user's balance of minutes. In early 2010, AT&T and Apple opened their services to VoIP over 3G, giving mobile device owners the ability to download popular apps Nimbuzz and Fring or subscribe to Vonage World Mobile. Skype Mobile has been available in the United States for iPhone and iPod users since mid-2009 and is slated for the iPad as well. Users can make free user-to-user and SkypeOut calls or send text messages over WiFi, but the app is not yet compatible with slower 3G mobile data networks due to "contractual restrictions" (figure 11). SkypeLite is also available to those without Apple or Verizon mobile devices, although with less functionality.

Benefits and Issues of Mobile VoIP

Like software Web calling and home or office IP phones, mobile VoIP offers savings particularly for international voice communication—one can avoid steep per-minute charges while traveling or collaborate free across borders. Mobile VoIP can also eliminate the need for domestic text messaging and cellular plans, but this may become less viable as carriers adopt service models tailored towards capitalizing on mobile VoIP. Call quality over 3G and WiFi networks is diminished from wired networks and is as inconsistent as the wireless network itself. With more of the broadcast spectrum being reserved for wireless and the 4G mobile Web upgrade slated in coming years, consistency and performance of Web calling applications via mobile should improve and incorporate more features. In addition to Web calling's limited availability and performance issues, the developing cellular VoIP marketplace itself remains unstable. For example, Skype discontinued its Windows Mobile and Java products in February 2010 in response to inconsistent performance and low popularity of these devices.[24]

Integrated VoIP

Voice and video communication is becoming standard in more types of consumer products in response to user demand, notably in the XBOX and other gaming consoles since the mid 2000s, and in the Sony PSP and handheld

Mobile VoIP Applications and Startups

Fring

www.fring.com

Google Voice Mobile

www.google.com/mobile/voice

Jajah Mobile Web

http://jajah.com/products/mobile-web

Jajah Mobile Plug-in

http://jajah.com/products/mobile-plugin

Lingo

www.lingo.com

Nimbuzz

www.nimbuzz.com

Skype Mobile

www.skype.com/intl/en/mobile

TruPhone

www.truphone.com

Vonage Mobile

www.vonagemobile.com

Vopium

http://vopium.com

Vyke

www.vyke.com

devices since 2008. At the 2010 Consumer Electronics Show, Skype announced that voice would be available as a standard feature on new Samsung HDTVs for video conferencing and calling via television. This VoIP integration process is transforming the concept of the telephone as a standalone object—consider a few of the themes of eComm America 2010, one of the telecom industry's major conferences: "The End of Telephony and New Voice Enabled Platforms," "'Phones' Are Becoming General Purpose Always-On Computers," and "Telecom Is Becoming Software."[25]

Voice chat was an early addition to massively multiplayer online games (MMOGs) such as *World of Warcraft,* with up to 70 percent of users as far back as 2006 relying on voice communication tools to strategize with other players.[26] Avatars chat via VoIP in Second Life and other

Figure 11
Skype Mobile application on iPhone 3GS.

virtual worlds, and voice and video applications have been available in social networks for years. Online dating sites increasingly rely on VoIP to establish secure voice connections: Match.com and eHarmony both adopted Jajah in 2009 as their chat and messaging provider. The comparatively antisocial site ChatRoulette, which randomly pairs participants for up to sixty seconds, relies on webcam voice and video to help users cycle through, reject, and accept other players.[27] Voice and video over IP is also a growing feature of productivity and collaboration-oriented tools—in early 2010 Ribbit released synchronous voice conferencing gadgets for Google Wave.

Notes

1. Susan Knoer, "Re: Seeking Examples of Web-Based Voice or Video Calling (VoIP) in Libraries," e-mail to Library and Information Technology Association List (LITA-L), Dec. 14, 2009, http://lists.ala.org/sympa/arc/lita-l/2009-12/msg00061.html (accessed Feb. 2, 2010).
2. Robert Albrecht and Judith A. Pirani, "University of Louisville: Fulfilling the Promise of VoIP," Case Study 2 accompanying Mark C. Sheehan with Judith A. Pirani,

Spreading the Word: Messaging and Communications in Higher Education (Boulder, CO: Educause Center for Applied Research: 2009), www.educause.edu/ers0902 (accessed Jan. 17, 2010).
3. Mark C. Sheehan and Judith A. Pirani, *Spreading the Word: Messaging and Communications in Higher Education* (Research Study, Vol. 2), (Boulder, CO: Educause Center for Applied Research, 2009), www.educause.edu/ers0902 (accessed Jan. 17, 2010); Ibid.
4. Albrecht and Pirani, "University of Louisville," 4.
5. Sheehan and Pirani, *Spreading the Word*, 65.
6. Ibid., 66-67.
7. Ibid.
8. Federal Communications Commission, "FCC Consumer Advisory: VoIP and 911 Service," Sept. 17, 2008, www.fcc.gov/cgb/consumerfacts/voip911.pdf (accessed Feb. 2, 2010).
9. Sheehan and Pirani, *Spreading the Word,* 1-4.
10. Nick Farrell, "Skype's the Limit Thanks to the Recession," Fudzilla, Jan. 9, 2009, www.fudzilla.com/index.php?option=com_content&task=view&id=11338&Itemid=38 (accessed March 1, 2010).
11. Mallory Simon, "HP Looking into Claims Webcams Can't See Black People," CNN Tech, Dec. 23, 2009, www.cnn.com/2009/TECH/12/22/hp.webcams/index.html (accessed March 7, 2010).
12. Ayush Arya, "Apple Files Patent for an iSight behind a Display," MacUser, Jan. 12, 2009, www.macworld.com/article/138114/2009/01/apple_files_patent_for_an_isight_behind_a_display.html (accessed Feb. 5, 2010).
13. Brad Stone and Claire Cain Miller, "Ebay Is Said to Have Deal to Sell Skype," *New York Times,* Sept. 1, 2009, www.nytimes.com/2009/09/01/technology/companies/01ebay.html?_r=1 (accessed May 25th, 2010).
14. Nour Malas, "Skype CEO: U.A.E. Ban 'Short-Sighted,'" WSJ.com, March 11, 2010, http://online.wsj.com/article/SB10001424052748703625304575115031163473458.html (accessed March 12, 2010).
15. Skype, "Universities Section," Skype Security Resource Center, www.skype.com/security/universities (accessed March 20, 2010).
16. Sheehan and Pirani, *Spreading the Word,* 76.
17. Kevin J. O'Brien, "Skype in a Struggle to Be Heard on Mobile Phones," *New York Times,* Feb. 17, 2010, www.nytimes.com/2010/02/18/technology/18voip.html (accessed Feb. 21, 2010).
18. Yochai Benkler et al., *Next Generation Connectivity: A Review of Broadband Internet Transitions and Policy from around the World,* (Cambridge, MA: Berkman Center for Internet and Society, Harvard University, 2010), http://cyber.law.harvard.edu/pubrelease/broadband (accessed March 11, 2010).
19. James Falconer, "Skype iPhone App Downloaded 1 Million Times . . . and Counting!" IntoMobile, April 3, 2009, www.intomobile.com/2009/04/03/skype-iphone-app-downloaded-1-million-times-and-counting.html (accessed March 2, 2010).
20. Julius Genachowski, "Preserving a Free and Open Internet: A Platform for Innovation, Opportunity, and Prosperity" (speech, Brookings Institution, Washington, DC, Sept. 21, 2009), www.openinternet.gov/read-speech.html (accessed March 22, 2010).
21. Robert Peo, "AT&T's, Verizon's Mobile VoIP Moves Reveal Political Concerns," VoIP Evolution, Oct. 10, 2009, www.voipevolution.com/2009/10/atts-verizons-mobile-voip-moves-reveal-political-concerns.html (accessed Feb 19, 2010).
22. Kevin Fitchard, "YouTube Dominates Mobile Internet Traffic; Mobile VoIP on the Rise," *Connected Planet* Online, Feb. 9, 2010, http://connectedplanetonline.com/3g4g/news/youtube-dominates-mobile-voip-rises-0209/index.html (accessed Feb. 23, 2010).
23. Elaine Potter, "Mobile VoIP: Transforming the Future of Wireless Voice," InStat, March 4, 2010, www.instat.com/abstract.asp?id=231&SKU=IN0904428MCM (accessed March 6, 2010).
24. Marilyn, "Skype Pulls Out from Windows and Java Phones," Mobile News Direct, March 10, 2010, www.mobilemarketingnews.co.uk/Skype_Pulls_out_from_Windows_and_Java_Phones_43120417437.html (accessed March 12, 2010).
25. eComm America 2010 website, http://america.ecomm.ec/2010 (accessed March 13, 2010).
26. Nick Yee, "VoIP Usage," The Deadalus Project: Psychology of MMPORGs, March 20 2006, www.nickyee.com/daedalus/archives/001519.php (accessed March 19, 2010).
27. Alex Leavitt and Tim Hwang et al., "ChatRoulette: An Initial Survey," (Boston: The Web Ecology Project, 2010), www.webecologyproject.org/wp-content/uploads/2010/03/WEP-chatroulette.pdf (accessed March 8, 2010).