**Before the**
**FEDERAL COMMUNICATIONS COMMISSION**
**WASHINGTON, D.C. 20554**

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| In the Matters of | |
| IP-ENABLED SERVICES | WC Docket No. 04-36 |
| E911 REQUIREMENTS FOR IP-ENABLED SERVICE PROVIDERS | WC Docket No. 05-196 |

# COMMENTS OF CISCO SYSTEMS, INC.


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August 15, 2005

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**COMMENTS OF CISCO SYSTEMS, INC.**

Cisco Systems, Inc. ("Cisco") is the world's leading manufacturer of IP networking equipment and voice over IP ("VoIP") hardware and software. Since the company's inception, Cisco's engineers have been leaders in developing IP networking technologies. The company's unrivaled tradition of IP innovation continues in its core areas of routing and switching, as well as in developing advanced technologies such as VoIP and other IP-based services. In short, Cisco's business depends on preserving and reinforcing the public's confidence in VoIP as a safe and reliable service. Cisco therefore welcomes the opportunity to work with the Commission to develop an E911 regulatory regime that will appropriately protect VoIP customers in times of crisis.

Regarding the Commission's specific questions about expanding the scope of VoIP E911 obligations, protecting customer privacy, and serving persons with disabilities,[1] Cisco fully concurs with the views and proposals entered into this docket today by the Information Technology Information (ITI) Council (of which Cisco is a

[1] *See IP-Enabled Services and E911 Requirements for IP Enabled Service Providers*, First Report and Order and Notice of Proposed Rulemaking, WC Docket Nos. 04-36 and 05-196, at ¶¶ 57-59, 62-63 (rel. June 3, 2005) ("*VoIP E911 Order*," "*Order*," or "*NPRM*").

member). Cisco files these separate and more technically detailed comments because of its expertise in and unique experience with IP services and technologies. These comments summarize the company's recent experience and latest thinking in the hope that this information will prove useful to the Commission and other interested parties.

## I. Different VoIP Technologies Call For Different E911 Solutions.

The great promise of VoIP technology is that it transcends the traditional boundaries between wireline and wireless, fixed and mobile, local and long-distance, national and international, and information and telecommunications services. So long as an end user has a working connection to the Internet, he or she will be able to seamlessly and securely connect to a VoIP service provider and, ultimately, to any other VoIP or PSTN end user. Indeed, the "layered" quality of IP-based communications makes it quite possible that a broadband provider may never know whether its customers are using their connections in order to conduct voice communications.

From a technical and regulatory perspective, however, layering presents two distinct challenges to providing VoIP users with 911 capabilities. *First*, the VoIP service provider is generally in a poor position to determine the geographic location of the broadband connection being used to initiate a VoIP call. Instead, it is the broadband service provider that will generally have direct knowledge of the location of the facilities the caller is using. Here, the challenge is for the VoIP service provider to develop a reliable and cost-effective way to gather location information from the broadband service provider and relay it to public safety personnel in the event of an emergency.

*Second*, layered IP technology allows VoIP customers to choose from a broad array of IP-enabled devices and to use these devices in a nearly infinite number of

geographic locations. For instance, the same VoIP account holder may conduct conversations using an ordinary telephone handset in the home, a wireless PDA in the car, or a laptop computer in a hotel room across the world. These multiple uses do not conform to traditional regulatory and engineering distinctions between wired/wireless, national/international, and information/telecommunications services. Here, the challenge lies in designing a set of rules and standards that are sufficiently flexible to encompass this multitude of devices and situations.

Cisco believes that the answer lies in developing a mix of distinct technologies that, in combination, can provide the same level of 911 coverage currently provided by the PSTN and CMRS emergency systems. Indeed, the appropriate universe and mix of advanced 911 technologies will undoubtedly change as VoIP and broadband service offerings continue to evolve. Any fixed technology mandate is therefore likely to become quickly obsolete and to burden future innovation.

***Level of Coverage.*** One threshold question is to how to conceptualize the level of 911 coverage that VoIP service providers must offer. For non-nomadic services – such as replacements for residential or business PSTN service – the answer seems clear: these services should provide public safety personnel with the address of the home or business from which the VoIP customer is calling. The Commission's existing VoIP E911 rules fully accomplish that task.

For nomadic services, however, the question is thornier. Cisco agrees with the Commission's view that, as a general matter, the VoIP service provider should supply public safety personnel with the location information that PSTN and CMRS service providers currently supply. However, Cisco also believes that for nomadic VoIP services

– unlike for fixed wireline PSTN services – the Commission must separately consider whether additional VoIP-specific 911 capabilities are necessary, or instead whether existing PSTN, CMRS, and non-nomadic VoIP services already provide appropriate coverage. For instance, with some VoIP applications, the VoIP end-user will always be near a PSTN or non-nomadic VoIP connection (*e.g.*, Wi-Fi hotspots in restaurants, coffee shops, or airports) or the VoIP service will always be bundled with CMRS service (*e.g.*, PDAs and other mobile handheld VoIP devices). In these contexts – and perhaps others – specific additional VoIP-based E911 capabilities may be redundant.

***Breaking Down the Technical Problem.*** To be fully understood, the problem of providing automatic geographic location identification must be broken down into its two constituent sub-problems. The first problem is to ensure that the VoIP service provider is aware of the end-user's location. Cisco believes the proper technical solution to this problem is likely to vary depending upon the type of broadband connection (wireline, Wi-Fi, or WiMAX) and type of device (indoor or outdoor). For instance, at present an access point inventory approach appears to be the most promising solution for both wireline and Wi-Fi technologies (which are likely to represent the bulk of VoIP applications in the near future). In contrast, some devices on the technological horizon (*e.g.*, the base stations in a multiple access point Wi-Fi network or WiMAX-based devices designed to be used primarily outdoors) may be most appropriately served by GPS technology or by bundling with CMRS service. Cisco discusses these solutions in greater detail below and outlines the important progress that standard-setting bodies have made in developing protocols to assist device manufacturers and service providers.

The second problem in providing E911 service – even after the service provider is aware of the end user's location – is to communicate this information to the appropriate PSAP through existing channels. This too presents significant technical issues because PSAPs were originally configured simply to accept the caller's incoming telephone number and to cross-reference this information against a static Automatic Location Information (ALI) database.[2] But with nomadic VoIP customers (as with CMRS users) the location associated with a particular incoming telephone number will, by definition, change regularly. As discussed below in greater detail, standard-setting bodies are nearly finished with developing solutions to this issue as well.

## II. Private Industry and Standard-Setting Organizations Are Making Great Strides in Developing Automatic Geographic Location Sensing Protocols.

As noted above, an appropriate VoIP E911 solution requires (1) apprising the service provider of the end user's location, and (2) communicating that information to the appropriate PSAP. The following section discusses the specific engineering and technical issues raised by each of these sub-questions in greater detail, as well as the progress that standard-setting bodies have made in resolving them.

***Wireline Access Point Inventory.*** Cisco believes that the most promising automatic geographic location sensing approach for wireline VoIP services is for the end user device to receive location information from the broadband access provider (*i.e.*, the "Layer 2" provider).[3] This solution takes advantage of the fact that Layer 2 providers –

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[2] *See generally id.* at ¶ 15.

[3] The Open System Interconnection (OSI) reference model describes how information from a software application in one computer moves through a network medium to a software application in another computer. The OSI reference model is a conceptual model composed of seven layers, each specifying particular network functions. The model was developed by the International Organization for Standardization (ISO) in 1984, and it is now considered the primary architectural model for

as builders, owners and operators of physical infrastructure – are capable of recording and transmitting the location of each access point. This approach would work as follows:

1. Each broadband user will, when initiating a 911 call from a VoIP device, automatically contact his or her Layer 2 provider (most often a DSL or cable modem service provider) via a standard protocol.

2. The Layer 2 provider will reply to the VoIP device with the civil or geographic coordinates of the host the end user is currently using, again via a standard protocol.

3. The end user VoIP device will then automatically transmit its location coordinate information to the VoIP service provider at the outset of the 911 call.

In order to facilitate hardware and software manufacturers' implementation of this approach, the Internet Engineering Task Force (IETF) has developed a protocol that will allow Layer 2 providers to communicate civil or geographic address information to VoIP end user devices. Specifically, RFC3825 is an IP-based standard that allows communication of a geographic location to a VoIP device using Dynamic Host Configuring Protocol (DHCP).[4] The IETF is also close to completing a document outlining a comparable protocol for civil address information (also applicable to DHCP networks).[5] Along similar lines, the Electronic Industries Alliance and Telecommunications Industry Association is in the process of finalizing the ANSI/TIA-

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intercomputer communications. Layer 2 refers to task of encoding and decoding data packets into bits. *See generally* http://www.cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/introint.htm#xtocid5.

[4] *See* http://www.ietf.org/rfc/rfc3825.txt?number=3825.

[5] *See* http://www.ietf.org/internet-drafts/draft-ietf-geopriv-dhcp-civil-06.txt. In most cases, a geographic coordinate can be converted into a civil location using mapping software. However, such mapping software can easily misidentify locations that are adjacent to each other (*e.g.*, an outdoor shopping center with many small stores). In addition, some PSAPs are not equipped to receive geographic location information at this time. The use of civil address information also presents problems for international use and in places where no such addresses exist (*e.g.*, on the side of a highway or in a national park). Thus, a gradual shift to use of geographic identification may be beneficial in the long-run, though Cisco believes that for now the VoIP E911 regulation should follow the U.S. convention of relying on civil address identification. In any event, the problem of civil address identification is common to all E911 situations, not just interconnected VoIP services, and will need to be solved in a larger context than this proceeding.

1057 standard that will allow the same information to be passed to the VoIP end user device. This standard differs from the IETF standards only because it specifically addresses IEEE 802.x applications such as Ethernet and Wi-Fi, rather than all IP-based applications.

***Wireless Access Point Inventory*.** Cisco believes that the wireline access point inventory solution discussed above will also solve the problem of automatic geographic location identification for Wi-Fi-based VoIP devices. Due to the nature of the technology, Wi-Fi devices will always operate within a few hundred feet of a wireless access point. Indeed, since Wi-Fi uses the same frequencies and power limits as cordless telephones, virtually all end users will be no farther from a wireless access point than cordless phone users are from their wired PSTN base station. Thus, if the Wi-Fi based device transmits to the service provider the location of the wireless access point, in virtually all applications it will provide public safety personnel the same degree of accuracy that the PSTN system currently provides.[6]

In the future, service providers may also offer mobile wireless broadband services that use WiMAX and other technologies to provide service at greater distances from a base station than the few hundred feet that Wi-Fi permits. For such applications, the location of the base station may be insufficient to locate the end user. One promising solution is to bundle such products with CMRS technology, which will eliminate the need to provide additional VoIP-based 911 capabilities. Other solutions – discussed below – may involve the use of GPS or triangulation using signals from multiple WiMAX base

[6] In addition, as noted above, it is also likely that Wi-Fi devices will be used either in homes (where there is likely to be a PSTN or wireline VoIP connection) or businesses open to the public (*e.g.*, coffee shops, restaurants, or airports, where there are likely to be other people, including employees, as well as a PSTN or wireline VoIP connection). Wi-Fi-specific VoIP 911 capacity may thus be redundant.

stations. In any event, these issues are not pressing today because (1) there are currently few, if any, devices being offered that use mobile WiMAX to provide voice services and (2) the individuals that are likely to use such services in the near future are generally technically sophisticated early adopters who will be well aware of the limited 911 capabilities of such devices. Accordingly, the Commission should encourage industry to develop technical solutions to the challenge of WiMAX-based VoIP services, but does not need to establish specific rules or technological mandates at this time.

***Other Automatic Geographic Sensing Technologies.*** As noted above, some engineers have also discussed the use of GPS and/or triangulation approaches in order to provide VoIP devices with the ability to automatically sense their geographic locations. Cisco does not dismiss these technologies, but believes that they are likely to prove useful in only a limited number of applications.

GPS, for instance, is an ideal technology for obtaining geographic information by devices that have significant central processing capabilities and are located outdoors. However, it appears to have serious limitations for most indoor applications, as well as outdoor applications where sophisticated central processing capabilities are unavailable. In the CMRS context, service providers have had some success in addressing limited central processing capacity in the end user device by locating processing capacity in the network. But that solution appears to be unavailable in the VoIP context because in virtually all cases the VoIP service provider will not own the Layer 2 network being used. In other words, GPS technology seems promising chiefly for the subset of VoIP devices that will be used outdoors and that contain significant local processing capacity.

Triangulation has also been proposed as a method to determine location of wireless hosts. But there are also at least four apparent limitations of this approach. *First*, the coordinate location of the devices involved in the triangulation must be known and must be accurate. This information is easily obtained for tall, expensive cellular phone towers, but may be less available for smaller, easily moved, and easily deactivated wireless access points. *Second*, current triangulation techniques use communication among access points to determine the location of a host. This requires that all of the wireless access points involved in triangulation be part of the same administrative domain. One possible solution to this limitation is "cooperative triangulation," which would allow a host to determine its location by communicating to all of the nearby access points – but this technology is still in the very early stages of development. *Third*, triangulation requires simultaneous signal reception by multiple access points in order to be accurate. In many cases, only one or two signals are available. In addition, signal strength is often a poor indicator of proximity because it can be affected by trees, walls, rain, and other impediments. *Fourth*, triangulation – like GPS – also requires significant central processing capacity. Because the VoIP service provider will generally not own the Layer 2 network, this processing capacity will only be available if it is located in the end user device.

***Communication with PSAPs.*** The second technical issue in creating a properly functioning E911 system is to ensure that VoIP service providers are able to route 911 calls to the correct PSAP and are able to communicate the end user's geographic location to the PSAP. The IETF is currently working on making a database publicly available that

will allow service providers to route emergency calls to the appropriate PSAP.[7] And as the *VoIP E911 Order* explains, the National Emergency Number Association (NENA) "is expected to publish within the next few months an 'I2' standard designed to allow VoIP providers to deliver 911 calls through the Wireline E911 Network with call back numbers and location information."[8] The I2 standard will provide PSAPs with access to a dynamically updated database that identifies the current location of the user associated with a VoIP-based call back number.[9]

## III. The Commission Should Refrain From Setting An Unreasonable June 1, 2006 Deadline for Automatic Geographic Location Sensing.

While Cisco shares the Commission's sense of urgency about developing automatic geographic location sensing technology for VoIP devices, the company believes that setting an inflexible and unrealistic June 1, 2006 deadline would hinder rather than hasten the development of appropriate solutions.[10] There is simply no way that, in less than 10 months, companies can answer the fundamental technical questions that remain. Indeed, as the comments filed today by the ITI explain, a June 2006 deadline would force service providers to wed themselves to particular approaches before rationally assessing the pros and cons of each approach. The net effect will be a VoIP 911 system that not only fails to take full advantage of the opportunities offered by the IP platform, but that does not even measure up to the standard of the existing PSTN and CMRS 911 systems. The Commission should avoid a "ready, fire, aim" approach to this important and difficult issue.

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7 *See* http://www.ietf.org/html.charters/ecrit-charter.html.

8 *VoIP E911 Order* at ¶ 21.

9 *See id.* & n.69.

10 *See id.* at ¶ 57 (seeking comment on a June 1, 2006 compliance deadline).

Respectfully submitted,

By:_____/s/_____

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