Homeland Security

Science and Technology

Bridging Systems Interface Introduction

Issue Background

What is Voice over Internet Protocol?

Voice over Internet Protocol (VoIP) is a broad, emerging technology area that allows for the transmission of real-time voice services through Internet Protocol (IP)-based networks, including most corporate networks and the Internet. Because VoIP represents a broad area of technology, the term is often used in different—and sometimes inconsistent—ways. Consumers are most familiar with VoIP telephone services that are available through Internet or cable service providers. Businesses are more familiar with VoIP-based telephone systems that are installed in office buildings, or with the network-based systems that provide communications among remote sites. Communications equipment manufacturers, on the other hand, view VoIP as a communications protocol to be included in their equipment. Because VoIP is available in multiple forms—as a service, a system, or a communications protocol—discussions about this emerging technology often lead to confusion.

Why is VoIP significant?

The core feature of VoIP is that it allows for the transmission of real-time voice services over IP-based networks. Using IP networks as the transport mechanism enables significant flexibility in call placement options, device addressing, and device placement. For example, calls between devices can be created "on demand" or as "nailed-up" connections. "Nailed-up" connections are permanent connections that are always available, but only send data when voice information is being transmitted. Implementing "nailed-up" voice connections using VoIP is significantly cheaper than providing the same capability as a traditional telephone service.

Additional flexibility is achieved because devices can connect by directly addressing each other over any network without the burden of the switching, routing, and billing infrastructures that are typically used for telephone services. In fact, the use of IP-based networks enables voice transport between any two devices connected to the network—provided the security policies allow access and VoIP has been implemented in an interoperable manner. This capability allows for significant flexibility in device placement as well; for example, devices can operate in the same manner whether they are 100 feet or 100 miles apart.

Due to these advantages, public safety radio manufacturers have begun to implement VoIP in bridges, consoles, radios, and other equipment that forms a radio system's infrastructure.

Public Safety VoIP Working Group

When and how did the Working Group begin meeting?

As manufacturers have begun implementing VoIP in their products, confusion has been growing around the use of the term in public safety communications. To address this problem, the U.S. Department of Homeland Security (DHS) and the U.S. Department of Commerce (DOC) have gathered key stakeholders from the public safety and industry communities. Led by DHS's Office for Interoperability and Compatibility and DOC's Public Safety Communications Research Program, this newly created Public Safety VoIP Working Group works to define and clarify the expectations for VoIP in the public safety environment.

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The Working Group held its first roundtable discussion in August 2006 in Washington, D.C. At this meeting, the working group discussed VoIP's strengths and limitations, defined the requirements for its effective use, and recognized the need for specifications to improve VoIP's value in public safety communications.

How is VoIP used in public safety communications?

VoIP technologies are still relatively new in the public safety community. While VoIP has merit in public safety communications, the Working Group and additional relevant public safety stakeholders are still determining how and where VoIP will provide the greatest benefit the public safety community.

By limiting discussions to agency-to-agency communications, working group members were able to develop a list of nine application areas in which VoIP could improve public safety communications. Each of these application areas occurs as an interface, or connection, between pieces of communications equipment. The practitioners participating in the VoIP Working Group selected the following five VoIP interfaces as their current priorities:

- Radio System Interface – an interface that enables VoIP communication to radio system infrastructure
- Dispatch Interface – an interface to a dispatch console
- End Unit (Software Device) Interface – an interface that allows a network-connected computing device to connect into a radio system using a software implementation
- Radio Site Interface – an interface to a base station or similar device
- Bridging Systems Enhanced Interface – additional functions of the BSI Core Profile, an interface between bridging or gateway devices

How is the working group addressing the need for VoIP interface specifications?

After identifying potential VoIP interfaces, the working group developed a number of general principles that VoIP-based public safety communications systems should meet to ensure acceptance within the public safety community. According to the working group, all public safety VoIP interfaces should meet a series of qualitative requirements.

These requirements specify that each VoIP interface is:

- Compatible and interchangeable
- Reliable
- Affordable
- Scalable
- Manageable

In addition, the Working Group required that all VoIP interfaces include a common security framework, possess a minimum set of standards and features, and leverage commercial off-the-shelf products. Above all, the Working Group agreed that the ability to interoperate must be maintained in any new device using a VoIP interface.

However, interoperability is not guaranteed for all VoIP implementations, as it can be obstructed by competing standards or differing ways to implement standards. With so many approaches, there is a need to standardize the implementation of each of the potential VoIP interfaces to ensure interoperability.

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What does the Working Group produce?

Given the need for standardized implementations, the Working Group is producing specifications, or implementation profiles, for each of the potential VoIP interfaces. When a specification borrows parameters and values from existing standards and combines them into one document, the final product is called an *implementation profile*. When developing implementation profiles for the potential VoIP interfaces, the Working Group's goal is to select the minimum set of standards, parameters, and values that are required to define a fully interoperable implementation. In other words, the goal is to define the minimum elements required to create an interoperable environment. This is to ensure that the implementation profile is as easy to implement as possible.

In addition to implementation profiles for the potential VoIP interfaces, the Working Group is producing best practices for VoIP systems as well as reports and presentations for various external groups.

VoIP Standards

There are many different standards that apply to VoIP communications. Two competing standards come from the International Telecommunications Union (ITU) and the Internet Engineering Task Force (IETF); these standards are used extensively in VoIP implementations today. The ITU-based implementations are widely deployed among service providers while the IETF-based implementations are widely deployed in corporate and end-user environments.

The First Interface: Bridging Systems

To begin work on the implementation profiles, the Working Group prioritized the potential VoIP interfaces with regard to how each interface would:

- Further interoperability between disparate agencies
- Benefit multi-agency, multi-jurisdictional responders
- Provide the greatest impact in minimal time
- Allow for easy adoption without substantial investment of resources

The ***Bridging Systems Interface (BSI)*** emerged at the top of the priority list. The BSI is the interface between two bridging or gateway devices that can be used to connect disparate radio systems, typically through the use of an audio connection from a donor radio. These devices have been available for several years for interconnecting radio systems and are widely deployed in public safety agencies. As such, they are a powerful tool for providing interoperability between disparate systems.

However, even newer bridges and gateways based on digital VoIP technology must either connect to bridging systems from the same manufacturer or drop to a "lowest common denominator" connection. These connections hamper communications as they are prone to latency problems and do not support common features such as caller ID and encryption.

For the BSI to support the features required by the public safety community, and to adhere to the VoIP requirements set above, manufacturers must agree to use a common specification in their VoIP-based bridging devices. To enhance interoperability among these devices, the working group created an implementation profile for the BSI.

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The first version of this implementation profile, known as the BSI Core Profile 1.0, was drafted and demonstrated to support basic voice interoperability for the public safety community. Because the BSI is based on the implementation profile technique mentioned previously, the BSI Core Profile 1.0 was developed in months instead of years. As a result, manufacturers were able to implement the profile earlier and with greater ease.

Next Steps

The BSI Core Profile 1.0 was published in September 2008 and is currently being implemented in bridging devices. The Working Group continues to improve the Profile by publishing subsequent releases. In addition, the Working Group is creating a set of best practices to accompany the Profile that will assist users in implementing the BSI Core specification. The Working Group is also beginning development of Profiles for other VoIP interfaces, in the priority order indicated above.

While the Working Group's creation and dissemination of these interface specifications alone will not solve the interoperability problem, they will allow VoIP-based devices and standardized computer networks to further enhance public safety communications. Ultimately, this will allow manufacturers to create VoIP-based communications equipment that can interoperate across all interfaces of a communications system.

How can stakeholders become involved in this effort?

The Public Safety VoIP Working Group consists of an open group of approximately 100 industry representatives, public safety practitioners, and Federal Government employees. Currently, more than 15 manufacturers are participating in the Public Safety VoIP Working Group; additional manufacturers and public safety practitioners are encouraged to join. More information about the group and its VoIP efforts is available at www.safecomprogram.gov.