

# Advanced Voice and Multimedia Communications System for the ODOT ITS Network

**The Oklahoma Department of Transportation (ODOT) and the University of Oklahoma Intelligent Transportation System (ITS) Laboratory Unveil a New ITS Network Capability**  
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## Introduction

Across the State of Oklahoma there are a multitude of agencies, at the federal, state, and local levels, all responsible for responding to emergency situations. Many of these agencies have a presence on the private ODOT ITS Network; however, these ITS console operators, heretofore, relied on public switched telephone network (PSTN) communications for coordination activities. In addition, many of these agencies use shortwave radios as a means of internal agency communication. Due to the independent nature of these agencies they are unable to communicate with each other using their agency specific radios. The goal of this project is to determine how these communication issues can be resolved by utilizing the large private ODOT ITS Network connecting these agencies. This work addressed both the ITS Network inter-console communication and the inter-agency radio voice bridging. In both cases, a low cost solution, as well as, preservation of the ITS Network integrity and security were primary considerations.

## VOIP and Text Messaging

ODOT ITS consoles are standalone computers connected to the ITS Private Network. All consoles run the *Statewide* application software developed and maintained by the University of Oklahoma ITS Laboratory. *Statewide* is a distributed application that allows users, with proper permissions, to control any ITS Network asset, such as pan-tilt-zoom (PTZ) cameras, dynamic message signs (DMSs), etc. *Statewide* consists of a MySQL database and a set of VB .NET, C++, JavaScript, PHP, and MapServer GIS libraries. Via the *Statewide* software, ITS consoles automatically communicate between themselves using the Microsoft Message Queuing (MSMQ) service, which allows them to be updated and synchronized without the need for a central server. Through MSMQ each console is immediately aware of any change or event occurring in the network such as another console dropping off-line or a PTZ being seized and controlled by a user. If the network

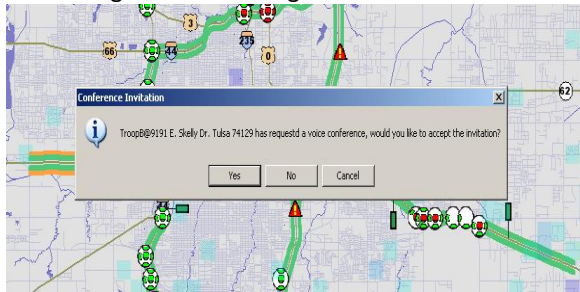
is severed, each remaining leg of the network remains operational and available assets, cameras, DMSs, etc. are available to the users. This capability is unique among ITS networks throughout the country.

In the event of an emergency, responding agencies, such as fire, EMSA, and enforcement, may require a coordinated effort that relies on the ODOT ITS Network. Previously, ITS Network console operators were required to use telephones for this coordination and communication. In a severe disaster these public communication resources become scarce or unavailable. To insure that communications are available, a voice and text messaging capability was developed for the ITS Network by the OU ITS Lab. Both peer-to-peer and conference calling capabilities are provided for each ODOT ITS console.

Research into VoIP capabilities meeting our objectives revealed that commercial VoIP applications, such as the Polycom products, were expensive and generally priced on a per PC basis, which would require a large license fee for the 50+ ITS consoles. Evaluation of custom software and/or open source software revealed that, in general, these packages relied on a central server for call setup, signaling, call teardown, conference call voice mixing, etc. *The central server requirement means that there exists a single point of failure, which is contrary to basic design principles for the ITS Network and its inherent distributed control capabilities.*

Two solutions are provided for VoIP and media communications. Both solutions are available and meet the non-centralized control requirement. The first is based on the freely available Ventrilo [1] VoIP software. This package was integrated as an ITS application and can be initiated by the *Statewide* software. Capabilities provided include peer-to-peer calling, conference calling, and instant text messaging. (In addition, the Ventrilo software is used

to support inter-agency radio bridging. (See below.) Figure 1 shows the called ITS request window seen by the called ITS console. Once a call is initiated and accepted, the calling console functions as the control server. Additional ITS consoles added to the call are considered as clients to the calling console. Unlike other VoIP software, Ventrilo offers this unique capability, making it acceptable for use in the Oklahoma ITS Network. ITS console users can also select other ITS consoles for reception and interchange of text messages.



**Figure 1. Conference Call Request Window**

The oVoIP software offers some advantages and additional capabilities over the Ventrilo-based software, namely the ability to send documents and utilize the Polycom PVX for video conferencing. The oVoIP software does not rely on a central server for coordination. The ITS console that initiates calling, messaging, etc. functions as the central server. Figure 2 shows the oVoIP application initiating a conference call. Available conferences are also viewed by selections in this menu. Any ITS console user can select to join an existing call at which point the controlling ITS console (call initiator) will see the request window. The controlling console can accept or deny the join request. In addition, the software permits all ITS consoles to quickly view which consoles are active and the users logged-in.



**Figure 2. oVoip Call Initiation Menu Selections**

### Inter-Agency Radio Bridging

This portion of the research investigated methods for bridging state agency radio systems. Most all state agencies, fire, OHP, county sheriffs, local police, and EMSA operate radio systems that utilize different frequencies. Consequently, any inter-agency communication takes place through agency

dispatchers that have both radio systems; otherwise, the cellular telephone system must be relied upon. Both of these options slow the voice traffic interchange between responders, which could be critical in an emergency coordination effort. It is much more desirable to permit responders to communicate directly, if needed.

By comparison other radio bridging systems were considered. Most bridging systems are very expensive and rely on a centralized control module or switch. Again, a distributed solution is desirable for the ODOT ITS network. A low cost solution was developed that leverages the Ventrilo [1] VoIP software. By adding a Signalink [2] SL-1 module to interface an ITS console to any agency radio (typically co-located with the console), two ITS consoles can provide inter-agency communications utilizing the Ventrilo VoIP software. In this arrangement, the ODOT private ITS network is carrying the voice traffic via a VoIP connection. Typical connections include highway patrol to local police or sheriff, 911 center to local fire, EMSA, and/or police. The solution is very low cost, easy to install, and provides a distributed capability with no single point of failure.

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### References

- [1] Ventrilo VoIP Software, [www.ventrilo.com](http://www.ventrilo.com)
- [2] Signalink Model SL-1, [www.tigertronics.com/sl+main.htm](http://www.tigertronics.com/sl+main.htm)

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