Wirelessly Enabling Legacy Sensor Systems For Rapid Deployment And Monitoring

Presentation for

Science and Technology for Chem-Bio Information Systems Conference

Ricciardi Technologies, Inc (RTI)

Agenda

- Introduction
- The Problem
- Identified Challenges
- A New Solution
- Results Achieved
- What's Left?
- Open Discussion

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RTI The Company

- **Incorporated in 1992**
  - Woman-Owned Small Business
  - Under 50 Employees
  - Employee Stock Ownership Program
  - Profitable Since Inception and Debt Free
- **Headquartered in Virginia with key clients**
  - SPAWAR
  - DHS-HSARPA
  - Sandia National Labs
  - RDECOM - Edgewood
  - PEO-CBD
  - DTRA
- **Core Competencies**
  - HW/SW Design & Development
  - Mgmt/Technical Services
- **SensorView® Product Suite**

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RTI CBRNE Experience

- Joint Biological Point Detection System (JBPDS) EMD
- JBPDS Block II Briefing
- Multi-Purpose Integrated Chemical Agent Detector (MICAD)
- Biological Aerosol Warning System (BAWS 97/98)
- Biological Agent Warning System (BAWS III)
- Automated Carrier Quality Control System (ACQCS)
- Joint Warning and Reporting Network (JWARN) Prototyping
- Joint Service Installation Pilot Project (JSIPP)
- JPEO-CBD CBRNE Sensor Sim. Suite for Generic Sensor Emulation

JBPDS

BAWS 97/98

MICAD

BAWS III

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The Problem

- **Massachusetts National Guard 1st WMD Civil Support Team deployed several GID-3 CWA point detectors to aide first responder security during special events.**
- **Operators had to be collocated with sensors to report sensor information to command post via radio. This is inefficient and puts our national guardsmen in harm's way.**
- **The CST desired a low-cost solution to wirelessly network the GID-3 in order to remove the human-in-the-loop requirement.**
- **The solution had to allow for the addition of future sensors as CST resources are expanded based upon mission requirements.**

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Identified Challenges – High Level

- **Rapid Deployment – The CST required a system to be mobile and transportable to multiple event locations. The system must be automated and deployable by a small team within a half hour.**
- **Battery Powered – Without fixed installations, wired power cannot be guaranteed. The remote devices must operate on battery power for at least 8 hours.**
- **Data Response Time – With CWA, seconds mean lives. Data must be presented to the operator quickly via an event-driven interface.**
- **Data Precision – All data provided by the sensor interface must be presented to the operator in a clear and concise manner, preferably in the same manner that the sensor itself uses.**

SensorView™

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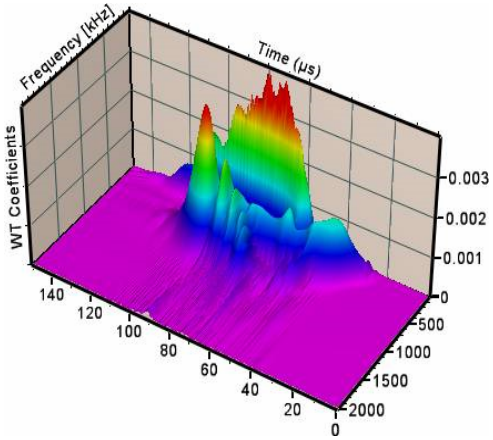
Identified Challenges – Issues

- **Bandwidth Utilization – Most native sensor protocols are not compact enough to support efficient radio communications with repeaters in the loop. A compressed protocol is required to maximize bandwidth usage.**
- **Radiated RF Power – To increase range and reliability, configuration must be set to provide the maximum RF power per transmitted bit of data possible. This suggests even lower data transmission rates. 9600 bps is ideal.**
- **Size and Weight – Long range radios require quite a lot of power when transmitting and sealed lead batteries are heavy. Need to minimize radio duty cycle and transmit times in order to minimize battery size and weight.**
- **Network Range – Line-of-site cannot be assumed for deployments within city environments. The radio network must include multiple repeaters capable of multi-hopping to allow for complex deployments.**



SensorView™

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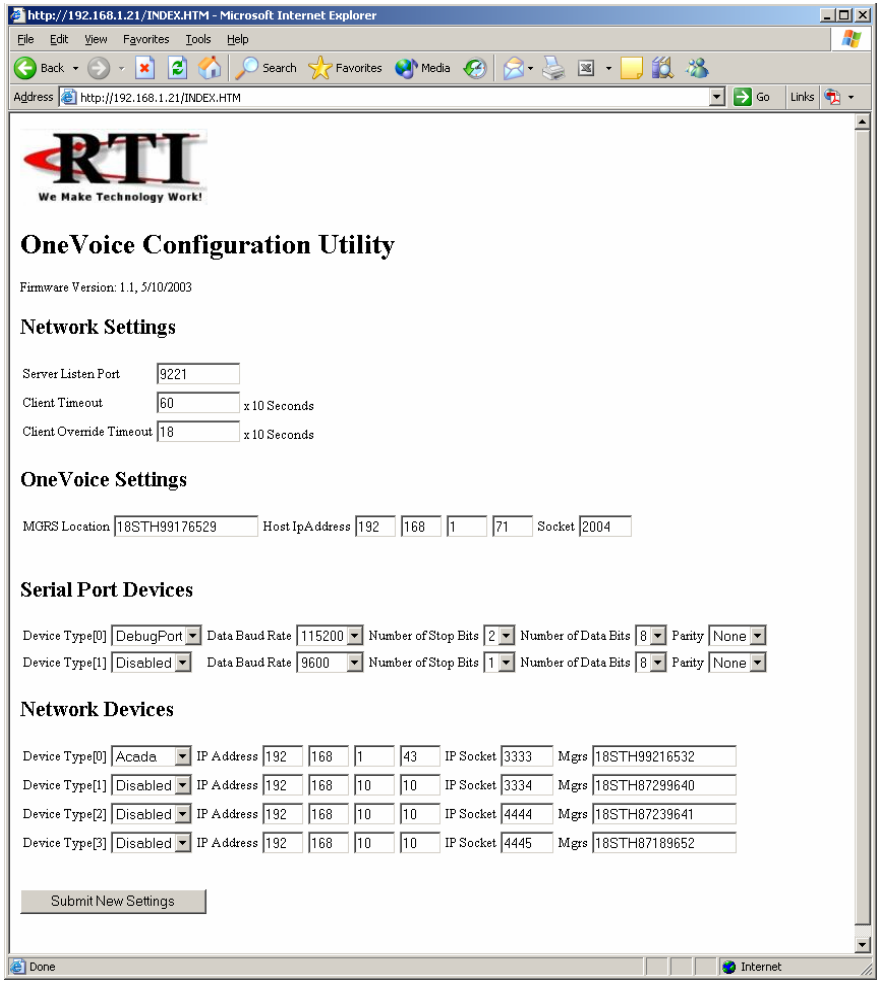
A New Approach – OneVoice™

Connects predefined Sensor Devices to the communication protocol of your choice in a low cost form factor.

Ability to pre-process Raw Sensor information to make it meaningful, secure and reduce the network traffic by providing application level data…..



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OneVoice™ Details

- **Multiple encryption options (N-Bit Key, SSL) keep sensor data secure**
- **Available interfaces for wireless Ethernet, wired Ethernet, Fiber Optic, or radio modem (Skyline or Freewave) communications links**
- **Sensor integration platform that supports multiple RS-232, -422, -485, Ethernet, and A2D/discrete (+/-) interface based sensors**
- **COTS parts that are readily available**
- **Low power for long battery life (5V DC at 480mA)**
- **Connects to individual sensors or networks of sensors**
- **Secure and web-accessible configuration**
- **Supports secure data access with an XML and SNMP interface**
- **Extremely small form factor for efficient integration into existing sensors**
- **Meteorological (Weather) and GPS Sensor Interfaces capable**

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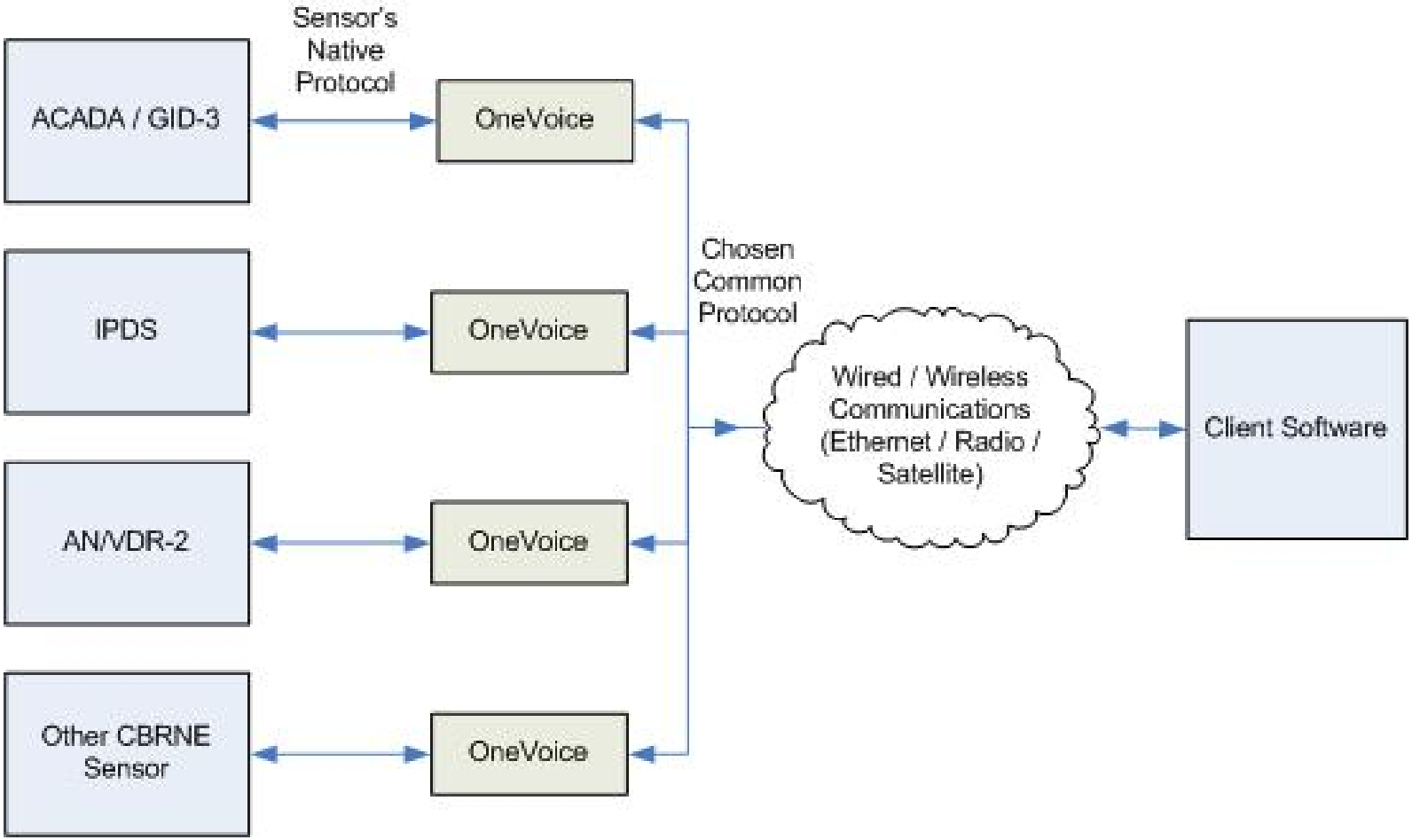
OneVoice™ Network Architecture



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The Sensor Radio Remote System

- **Integrated OneVoice™ module, radio, and long-life rechargeable battery.**
- **Measures only 5” X 9.5” X 6” and is less than 10 pounds – easily transportable with the sensor by one person.**
- **Converts the native GID-3 protocol from a constant 120 bytes per minute to only 5 bytes sent only when the data changes – an average of 5 bytes per minute.**
- **Each remote box can also act as a store and forward repeater for other units.**
- **Average battery charge of over 8 hours.**
- **Multiple antenna options to support rapid mobile deployments and long-range fixed site installations.**
- **Data is sent to the command post and displayed at near real-time -- the same time the information is displayed on the sensor itself.**
- **Open design supports possible addition of other sensors to the network in a similar fashion.**

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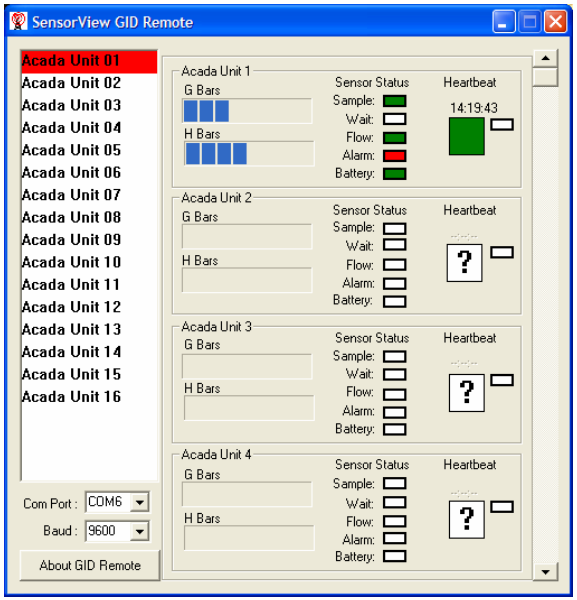

- Since all sensor data is multiplexed on one frequency, the command post is small and consists of a weatherized radio and laptop.
- Data is displayed to the operator using the same convention that the sensor uses, reducing training time and providing a case-complete view of sensor activity.
- Units are automatically detected and displayed on the screen.
- Communications link health is shown, providing the operator confidence in the network.
- Simple and automated startup requires no operator interaction.
- Alarms are displayed independent of current sensor state to provide the operator a clear view of the over-all operational picture and history.

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Conclusions

SensorView™

- **By utilizing the OneVoice™ product the CST was able to solve their immediate problem and allow for a scalable and modular solution for future mission requirements.**

- **By utilizing the latest commercially available embedded hardware, systems integrators can vastly reduce sensor integration issues by using small focused modules to allow sensors or sensor systems to communicate with a single desired protocol, such as EDXL, CAP, or the Joint CBRN Data Model.**

- **OneVoice™ devices are commercially available now and are inexpensive.**

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Future R&D

- Continue to reduce the size and weight of all system components.
- Integrate additional support sensors into the remote box, such as weather and GPS.
- Provide a hardware option to allow the SRR system to act as a Cross Domain Solution (CDS).
- Provide an integrated GIS toolkit to allow the sensor network to be shown on city maps for first responders.
- Integrated alarm notification via SMS or email to configured distribution lists for cell phones/PDAs.
- Reduce OneVoice™ hardware footprint onto a single DIP to provide easier integration options for sensor manufacturers to embedded protocol independence into their product lines.
- Enhance wireless options to provide interfaces to wireless Mesh networks and 1451 standards when adopted by DoD or Industry.

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Open Discussion

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