Open Source SCADA

A Framework for the Connected World

Presented by:

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Overview

- Emergence of deeply embedded and connected SCADA
- A changing model for distributed SCADA systems
- Why conventional SCADA cannot respond
- How Open Source can and will fill the gaps
SCADA Revolutions - The Early Days

1930’s pneumatic and hardwire controls

1960’s mainframe’s and telecommunication

Late 80’s distributed workstation based SCADA and color vector graphics
Modernization of SCADA

Early 90’s Wonderware brings HMI to the PC

2000’s HMI Touch Panel PCs

Right Now - SCADA Mobile Access
The Next Revolution - SCADA Getting Connected

Microcontrollers with Displays GPIO

9/11/2014 Intel launches Edison super-micro controller with GPIO, integrated WiFi and bluetooth...

… wearable connected devices
The trend will continue into every (other) aspect of life

Commercial and Consumer Appliances

Health and fitness

Recreation and just plain fun
Wait, what about “Security”?  

- World is *not* waiting.  
- Convenience and ROI are winning people over.  
- The world wants to be connected and does not care about or understand security (yet).  
- Perception is still just about stolen celebrity nude photos and credit card numbers.
Let’s leave it at this for now:

Passwords, certificates, encryptions yada yada. It’s not working and won’t work for this new era but we are going to connect anyway.

A new “unified security” paradigm is needed. A topic for next year perhaps.
So, who is getting “Connected”? 

Cellular machine connections expected growth 2013-2017 across key vertical markets - from 177 to 366 million (excludes direct Internet connected devices!). 

Mike Bell - Intel: “expect the number of connected devices in the world to hit 50 billion by 2020, and that by 2018, there will be 320 million wearable devices”
Closed-Source SCADA Works Great Here

With limited or no mobile capabilities
A Cloudy Picture is Emerging However

Full featured SCADA inside stamp sized embedded machine controller
Don’t necessarily need server, PLC or even PC anymore!

- $25 TOUCH PANEL MODULE
- $35 LINUX MICROCOMPUTER
- ON BOARD IO
- INTERNET CONNECTION
- MACHINE
So there is nowhere for their closed-source software to run.
And even if you could, does it make sense on a $45 machine or on thousands of them?

Expensive per runtime licensing

Big and heavy install

Closed source roadblocks
Traditional SCADA vendors are not interested anyway. They are VERY comfortable in their current market.

$4B Factory and machine control market

Utilities have $1B in Smart Grid market alone

Expected growth to $11B by 2020

7% YoY growth over next 5 years
The New Connected Embedded SCADA... Can and will be distributed for DCS, M2M with centralized control and supervision in the cloud.

Many commercial or consumer machines

Hosted Supervisory SCADA in the cloud

Control Center

Mobile Users
Where does this leave System Integrators?

Many system integrations are left to roll their own!

An Open Source framework is needed
### Active Open Source SCADA Framework Projects:
None are based on the current web standards

<table>
<thead>
<tr>
<th>Project</th>
<th>Language</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eclipse SCADA (openSCADA)</td>
<td>Java</td>
<td>Good toolset but lacking a standards based HMI. Not stable. Custom HMI does not work in browsers or over Internet</td>
</tr>
<tr>
<td>pvbrowser</td>
<td>C++</td>
<td>Mature toolkit but uses custom client protocol. Meant for use with custom browser. Browser plugin is for PC Firefox only. Can import and animate SVG widgets</td>
</tr>
<tr>
<td>Mango</td>
<td>Java</td>
<td>As of version 2.0 no longer free open source. Uses AJAX, not real-time websockets.</td>
</tr>
<tr>
<td>ScadaBR</td>
<td>Java</td>
<td>Open source branch of Mango 1.11. Not translated to english.</td>
</tr>
</tbody>
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Solution: A New Open Source “Connected SCADA Framework”

Key factors for success:

● Use widely adopted standards for true real-time performance and portability across the web
● Use a maintainable modular “plug-in” architecture
● Design to run on small or big things that can be connected and scaled
● Security - leave it to middleware modules
● Tooling - Don’t do it, just support it. Framework should be code only!!!!!!!
Barriers: Successful Open Source must address:

- Monetization
- Support
- Quality
- Functional gaps
- Velocity of change
- Security
- Licensing caveats
Open Source - Is Proven and Growing
Open Source SCADA

SCADA is the easy part. Most of the hard work has already been done!

It has never been easier or more practical than now to solve this problem!
The Language(s) of the Web
No Apps, No Plugins Required

JavaScript
HTML
CSS
SVG
NodeJS real-time asynchronous JavaScript server runs on anything!
Socket.io “always connected” in real-time
(portable websockets)

Socket.IO 1.0 IS HERE
FEATURING THE FASTEST AND MOST RELIABLE REAL-TIME ENGINE

30,000 downloads per day
ExpressJS embedded web server

50,000 downloads per day
Inkscape open source SVG designer
Vytronics HMI pilot Project

● Proof of concept using these proven open source components.
● Can implement solutions with just text editor.
● Use Inkscape or any SVG graphics editor.
● Solves just the “SCADA” problem.
● Security, IDE, declarative configurations etc., left for other open source or commercial endeavours.
● Development Approach - “There is a module for that”
Framework

```javascript
let server = require('vytronics.html');

// Let clients connect via the web
server.addConnector(require('vytronics.web')).create({
    listen_ip: 'localhost',
    listen_port: 8000
});

// Add drivers and tags
server.driverdb.add({
    id: 'sim',
    module_name: 'sim.driver',
    config: {}
});

server.tagdb.addTag({
    id: 'tag1',
    driverinfo: {
        id: 'sim',
        Indexer: 'random_int:1000,0,0,1',
    },
    value_info: {
        type: 'discrete',
        map: ['OFF', 'ON']
    }
});

server.tagdb.addTag({
    id: 'tag2',
    driverinfo: {
        id: 'sim',
        Indexer: 'random_delta:1000,0,50,5'
    },
    value_info: {
        type: 'analog',
        min_val: 10,
        max_val: 225,
        convert_from: function(raw){
            return raw*10 + 15;
        },
        convert_to: function(val){
            return (val-15)/10
        }
    };
});

server.start();
```

vs

Solution
Demo: Setup, edit and run in the cloud in a few minutes for free!

Sign up for free at https://c9.io and clone a demo project:
Install dependencies

```
vytronics@arduino_scada:~/workspace (master) $ npm install
```
Browse to main app file and run
You are alive in the cloud!
Run in the cloud for just dollars a month!

Manage server on your iPhone
More demos

Wearable SCADA

Hosted SCADA and Edit live on the web

M2M in the cloud
Wrap-up

- An Open source framework is needed to power real-time Connected SCADA
- New widely adopted standards and open source components make this feasible today
- Vytronics HMI project offers proof of concept and much more
- Email support@vytronics.com for more info and to get involved
What’s next?

- Achieve first stable release
  - Code review and unit test coverage
  - Reference guide(s) and API docs
- Community recruitment: coders, candidate projects, corporate partners
- Increase general interest and visibility