Toward an Integrated

Electronic Messaging System

Santa Clara County ARES®/RACES

Revised: 25-Jan-2014 (print)

Our Mission

- Provide Santa Clara County emergency communications responders with a reliable, efficient and effective digital messaging environment that meets the needs of our served agencies.
  - Reliable – a system that will stand the test of an infrastructure-impacting event
  - Efficient – optimize the digital messaging environment within the constraints of the technologies used
  - Effective – enhance our served agencies' ability to focus on the job of disaster stabilization and recovery

Mission Scope: Intra-city

Message Flows

- CERT neighborhoods/zones/Arks → City EOC
- Shelters → City EOC
- School Districts → City EOC

Message Types

- Forms (Damage assessment, logistics requests, ICS-213 messages, …)
- Structured text (lists, addresses, tables, …)
- Unstructured text

Mission Scope: Intra-agency

- **Message Flows**
- Schools → School Districts
- Red Cross shelters → Red Cross EOC
- Water infrastructure sites → Water District DOC
- Hospitals → Medical Health Operations Center (MHOC)

Message Types

- Forms (hospital, status, logistics)
- Structured text (lists, addresses, tables, …)
- Unstructured text

Mission Scope: Intra-county

Message Flows

- City EOC → County EOC
- Agency EOC → County EOC
- Remote ICPs → County EOC

Message Types

- Forms (ICS-213 messages, logistics, …)
- Structured text (lists, addresses, tables, …)
- Unstructured text

Mission Scope: Regional

Message Flows

- County EOC to Coastal Region EOC
- County EOC to surrounding counties
  - May or may not be strictly ICS compliant, but a reality nonetheless

Message Types

- Forms (ICS-213 messages, …)
- Structured text (lists, addresses, tables, …)
- Unstructured text

Mission Scope: 3rd Party

Message Flows

- Health & Welfare
  - 1st responder/DSW and family
- Logistics
  - Equipment and supply vendors

Message Types

- Health and welfare: unstructured text
- Logistics: Structured text (orders, status updates, …) and Unstructured text

Requirements

Capability / Requirement
Client: station is easily deployable (portable, battery, …)
Client: software is easy to install, set-up, use
Client: software supports multiple message types (incl. forms)
Client: software automates tasks, reduces human errors
System: multiple sites with redundant functionality
System: all sites have UPS and generator power
System: network capacity is sufficient for text message traffic levels
Connect: from anywhere in SCCo / send to anywhere in SCCo
Connect: to more than one system site in case main site is down
Communicate: with stations in Santa Clara County, no Internet req'd
Communicate: with regional stations, no Internet req'd
Communicate: with 3rd party stations (e-mail, SMS, …)

2009 Electronic Messaging Situation

- A working system based on packet radio. However …
- Each city had separate systems
- A single county system – single point of failure
  - Aging HW; unsupported SW
  - RF channels were overloaded
  - Limited geographic coverage
- No automation; many manual processes
- Client software was advanced, but could be better
- No integration
  - City systems not networked to county system
  - County system not connected to any other networks/services

Requirements Scorecard: 2009

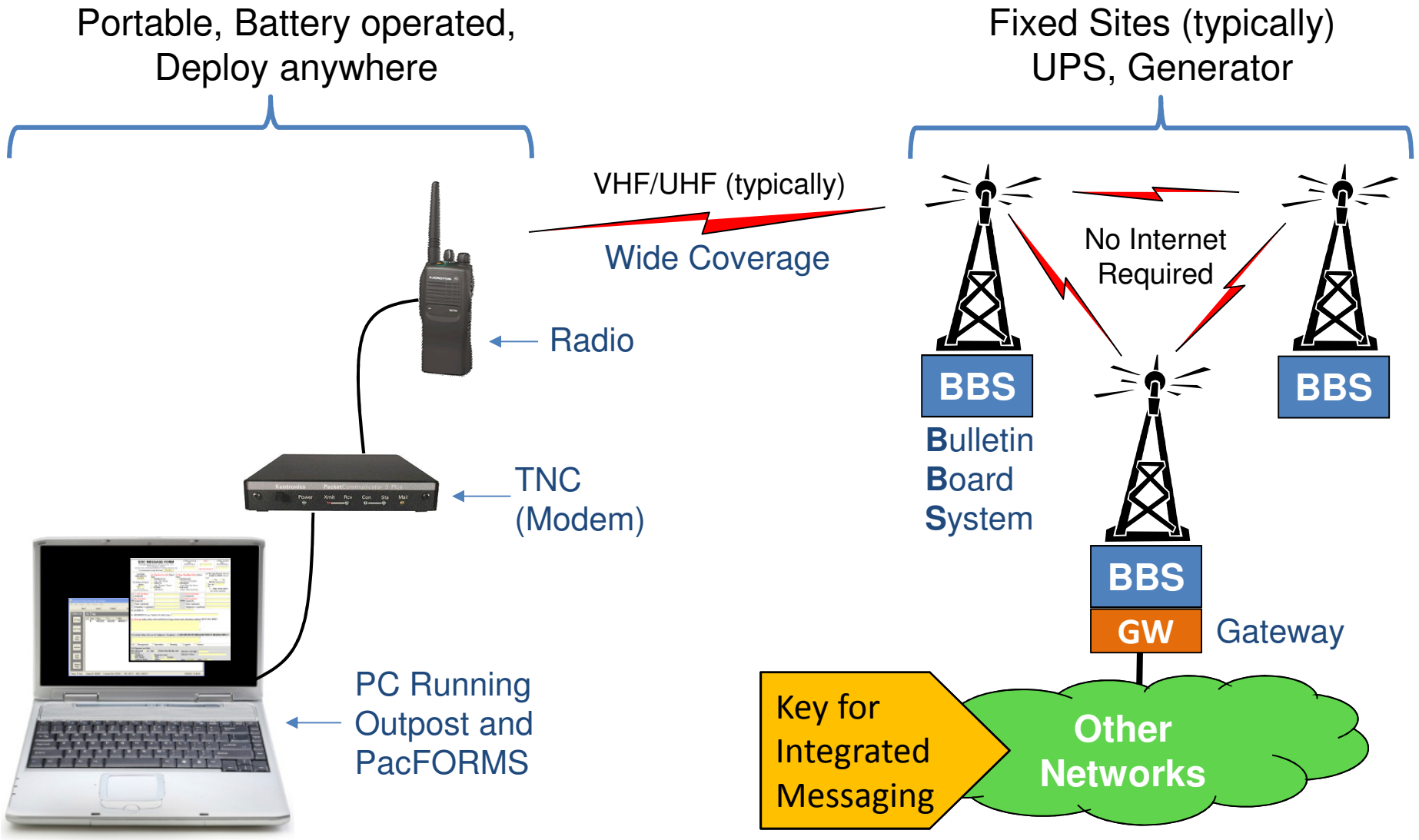
Capability / Requirement	2009
Client: station is easily deployable (portable, battery, …)	☑
Client: software is easy to install, set-up, use	☐
Client: software supports multiple message types (incl. forms)	☑
Client: software automates tasks, reduces human errors	☐
System: multiple sites with redundant functionality	☐
System: all sites have UPS and generator power	☑ 1
System: network capacity is sufficient for text message traffic levels	☐
Connect: from anywhere in SCCo / send to anywhere in SCCo	☐
Connect: to more than one system site in case main site is down	☐
Communicate: with stations in Santa Clara County, no Internet req'd	☑
Communicate: with regional stations, no Internet req'd	☐
Communicate: with 3rd party stations (e-mail, SMS, …)	☐

2009 PLANNING ACTIVITIES

Electronic Messaging Technology Tradeoffs

- Public Internet (Mbps)
  - Including: hard-wired connections, public WiFi, wireless carriers, …
  - If you have it, use it. But …
  - Local outages occur even under normal operating conditions
  - “Emergency” comms must operate even without Internet connectivity
- Private WiFi (Mbps)
  - Crowded band, extremely line-of-site limited
  - Ubiquitous deployment not possible without enormous costs
  - OK for point-to-point and short-range, hot spot scenarios
  - Most implementations are less reliable than existing commercial nets
- HF Digital Modes (100bps)
  - Slow, large antennas, noise, propagation issues (skip)
- VHF/UHF Packet (Kbps)
  - VHF frequencies allow ubiquitous deployment throughout county
  - Slower speed partly mitigated by smart software, ops procedures

Typical Packet Network Components



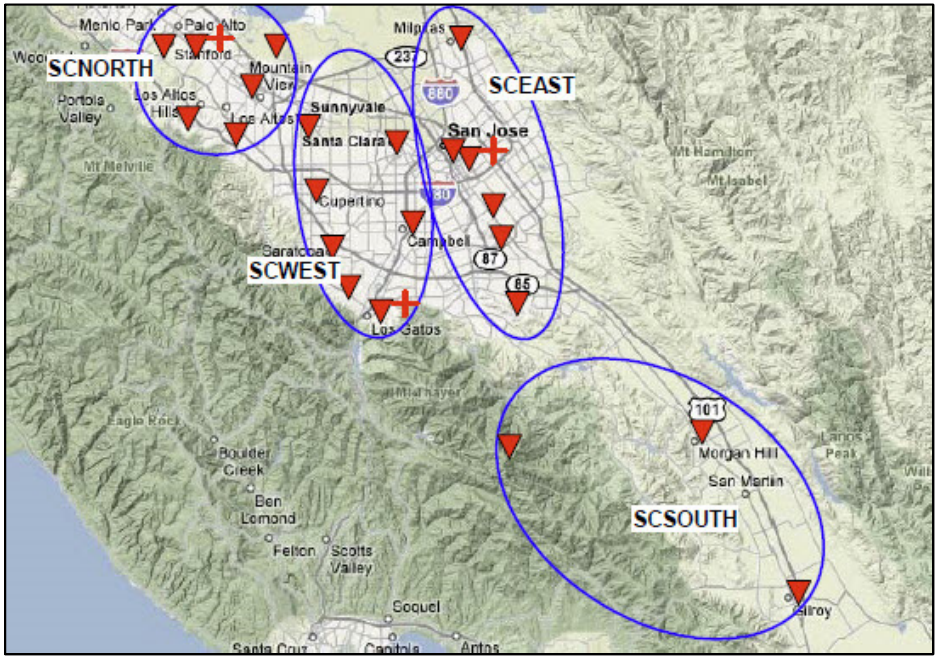
2009 Plan

- Four-site network
- Presentation to SVECS October 2009

County Packet Network
System Description

Prepared for:
County Packet Committee
Santa Clara County RACES

Author: Jim Oberhofer KN6PE
Date: May 2009
Vision: V0.5, WORK IN PROGRESS

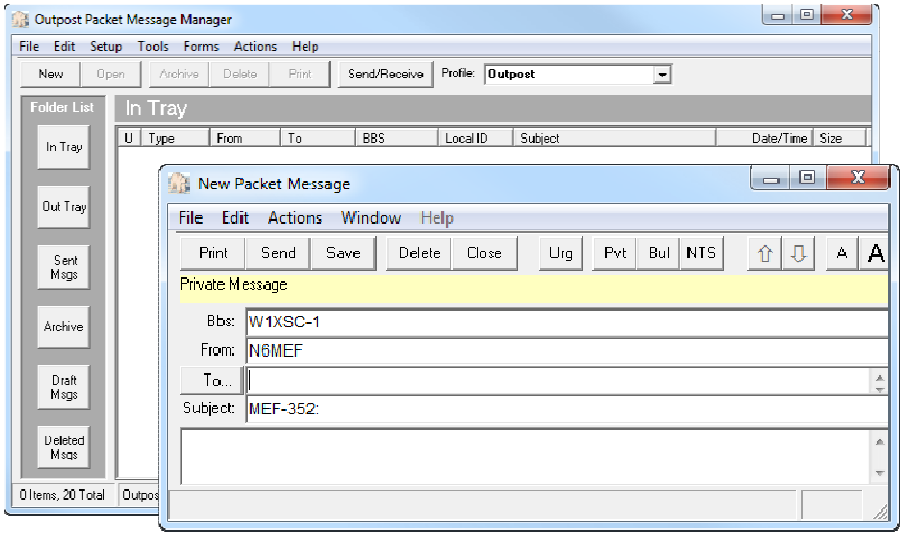


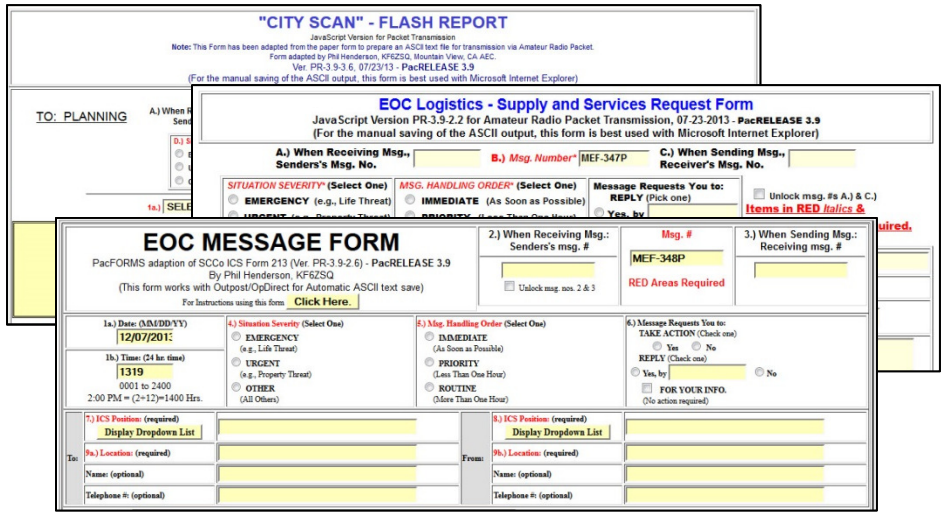
2010 - 2013

CLIENT SOFTWARE IMPLEMENTATION

Ease of Use

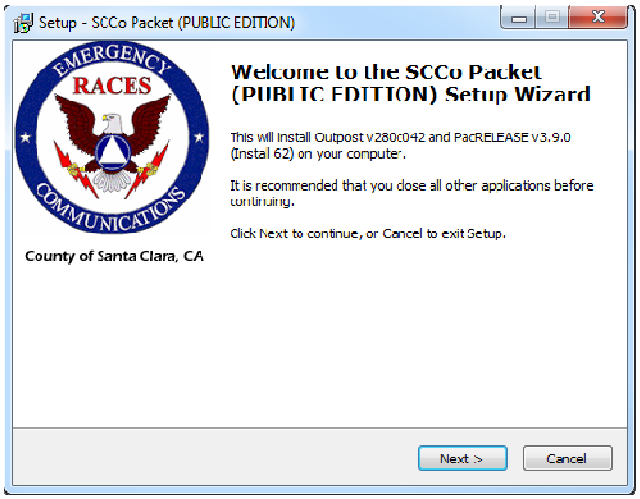
- Outpost: Simple e-mail like client interface
- PacFORMS: Simple web-based interface for forms
- Automatic default browser detection
- Tactical Calls: Cities, agencies can create their own
- Automatic forwarding to primary BBS for tactical calls





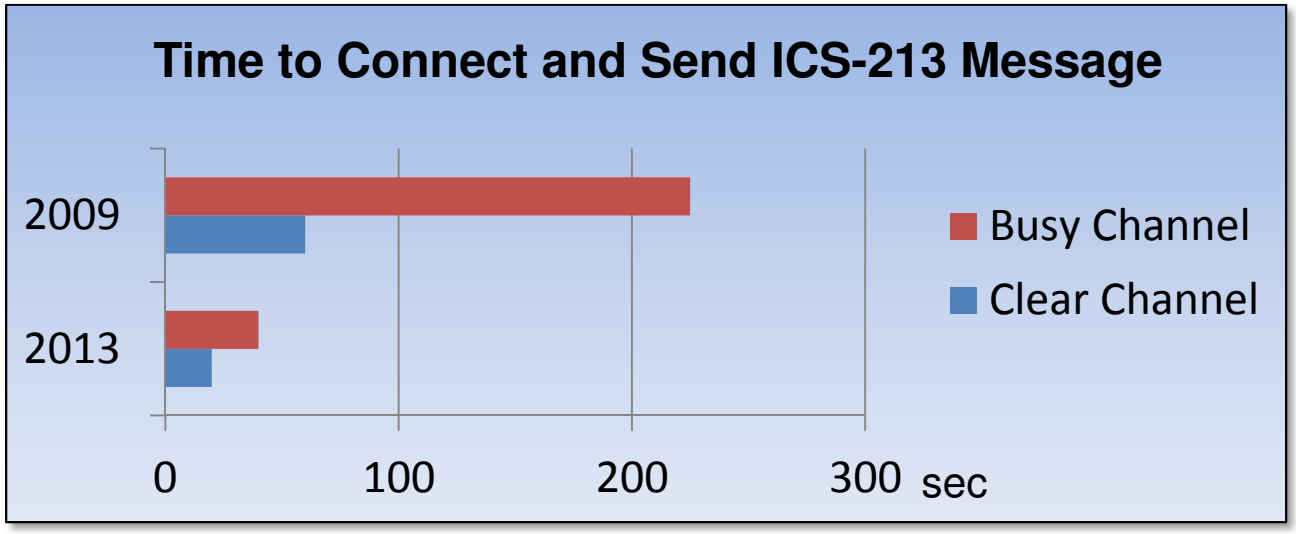
Installation, Configuration

- Integrated Outpost/PacFORMS installer
  - Compatible with Windows 2000, XP, Vista, Win7, Win8
  - Configures dozens of Santa Clara County preferred options
  - Optimized TNC settings for all popular TNCs
- Enhanced support for USB-to-serial adapters
- Outpost Profiles allow switching configurations easily



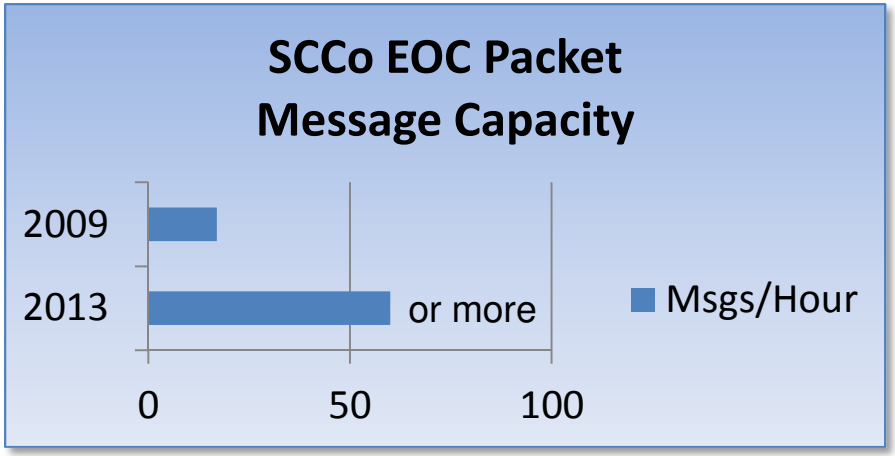
Performance and Optimization

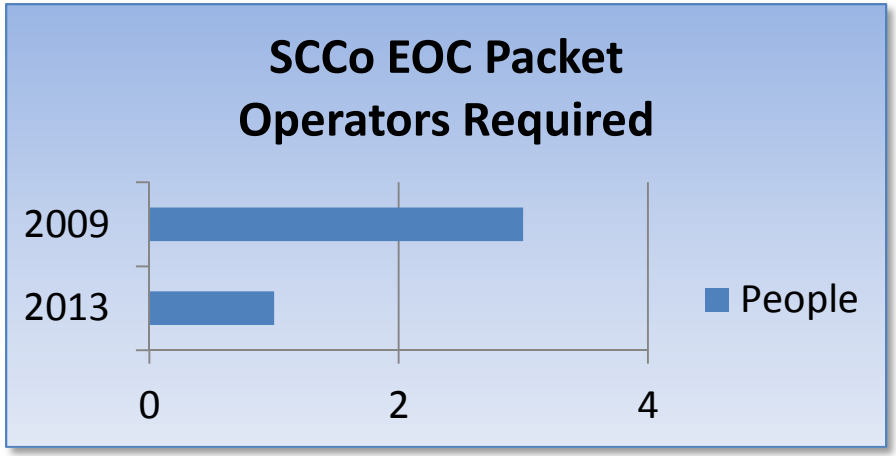
- TNC setting optimizations reduced number of packets by 80%
- PacFORMS: already reduced message size by 97%; enhanced to further reduce message size by another 30%!
- Outpost: duplicate bulletin downloads are avoided; BBS interactions optimized to minimize commands
- More frequencies greatly reduces congestion



Automation

- Sent and received message numbers auto-assigned, unique
- Delivery receipts automatically generated
- ICS-309 Comm Log automatically generated, can be automatically printed
- PacFORMS auto-fills: date, time, message number, call sign, method, …
- Weekly check-ins automatically error-checked, totaled, reported
- At SCCo EOC, advanced logger automatically receives, logs, prints multiple copies with unique footers, and backs up data





Integration with Multiple Messaging Systems

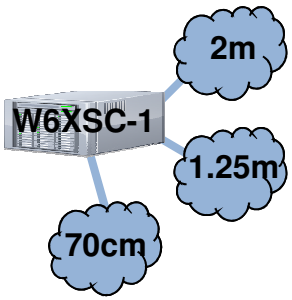
- Multiple networks, address formats supported
  - Local user: w6xrl4
  - Local tactical: xndeoc
  - AMPRnet: w6xrl4@w2xsc.ampr.org
  - BBS network: w6xrl4@w4xsc.#nca.ca.usa.noam
  - Winlink: w6xrl4@winlink.org
  - E-mail: herman@the-munsters.org
  - SMS/Text: 6508675309@someserviceprovider.com

- PacFORMS is now 7-bit compatible; can be sent/received via packet or e-mail, from/to PCs, tablets, smart phones

2010 - 2013

NETWORK IMPLEMENTATION

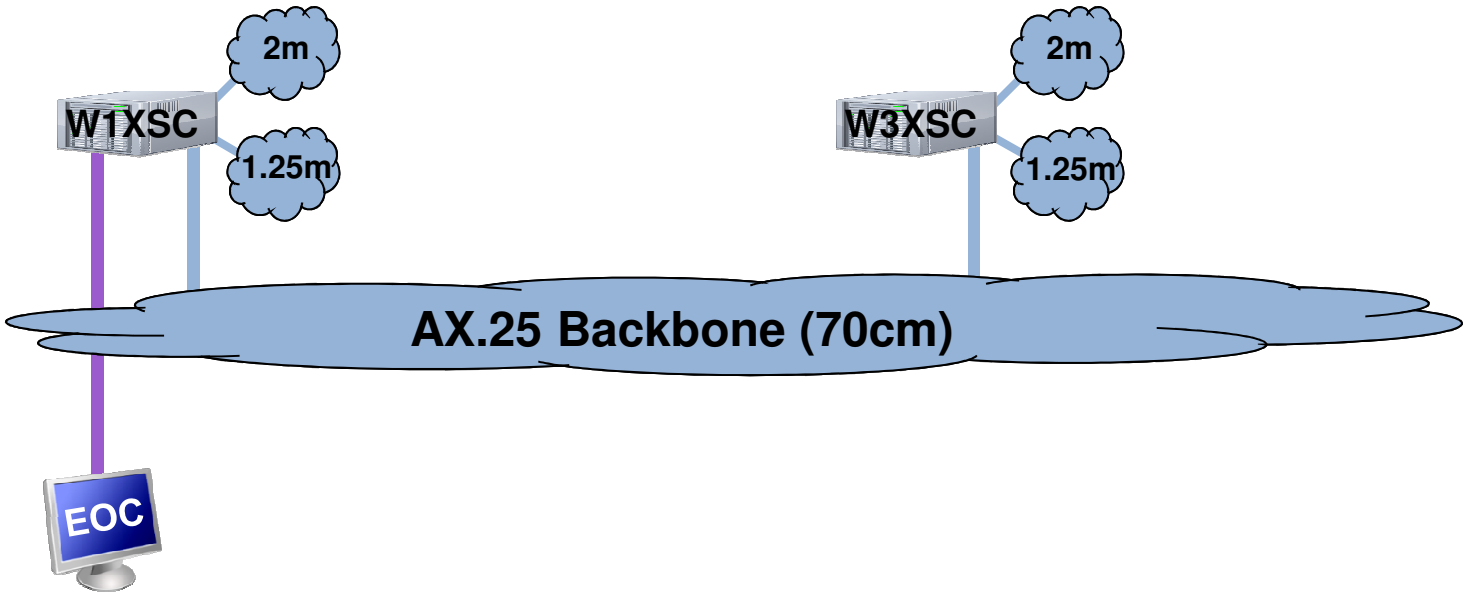
2009
Starting Point



- Single BBS
- Three frequencies
  - Heavy congestion
  - Huge message backlogs during drills
- x386 hardware
- DOS operating system
- AA4RE BBS software
  - Supported tactical calls
  - Numerous problems
  - Developer no longer supporting it

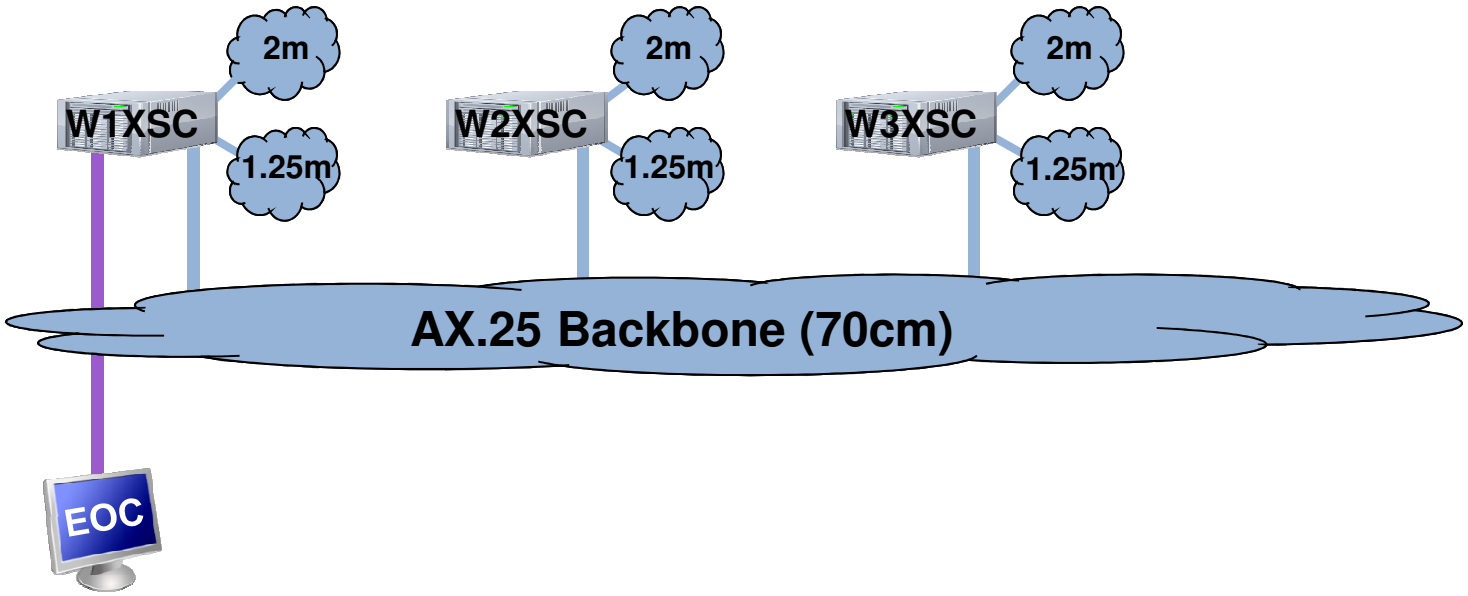
Convert Existing BBS, Add Second BBS, Move County EOC to LAN Connection

- Updated hardware
- Linux Operating System
- JNOS BBS server software

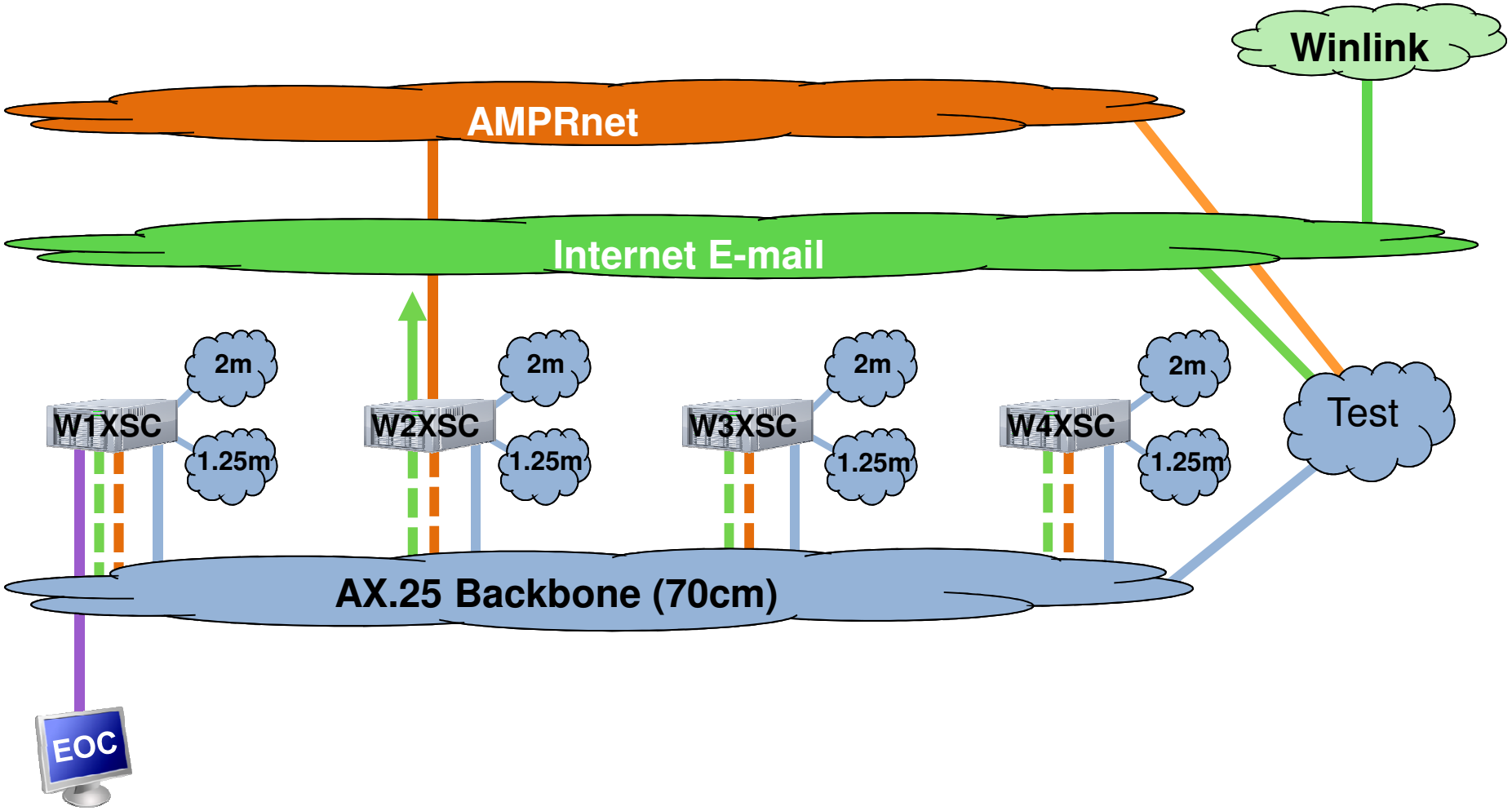


Scripted BBS Configuration, Third BBS

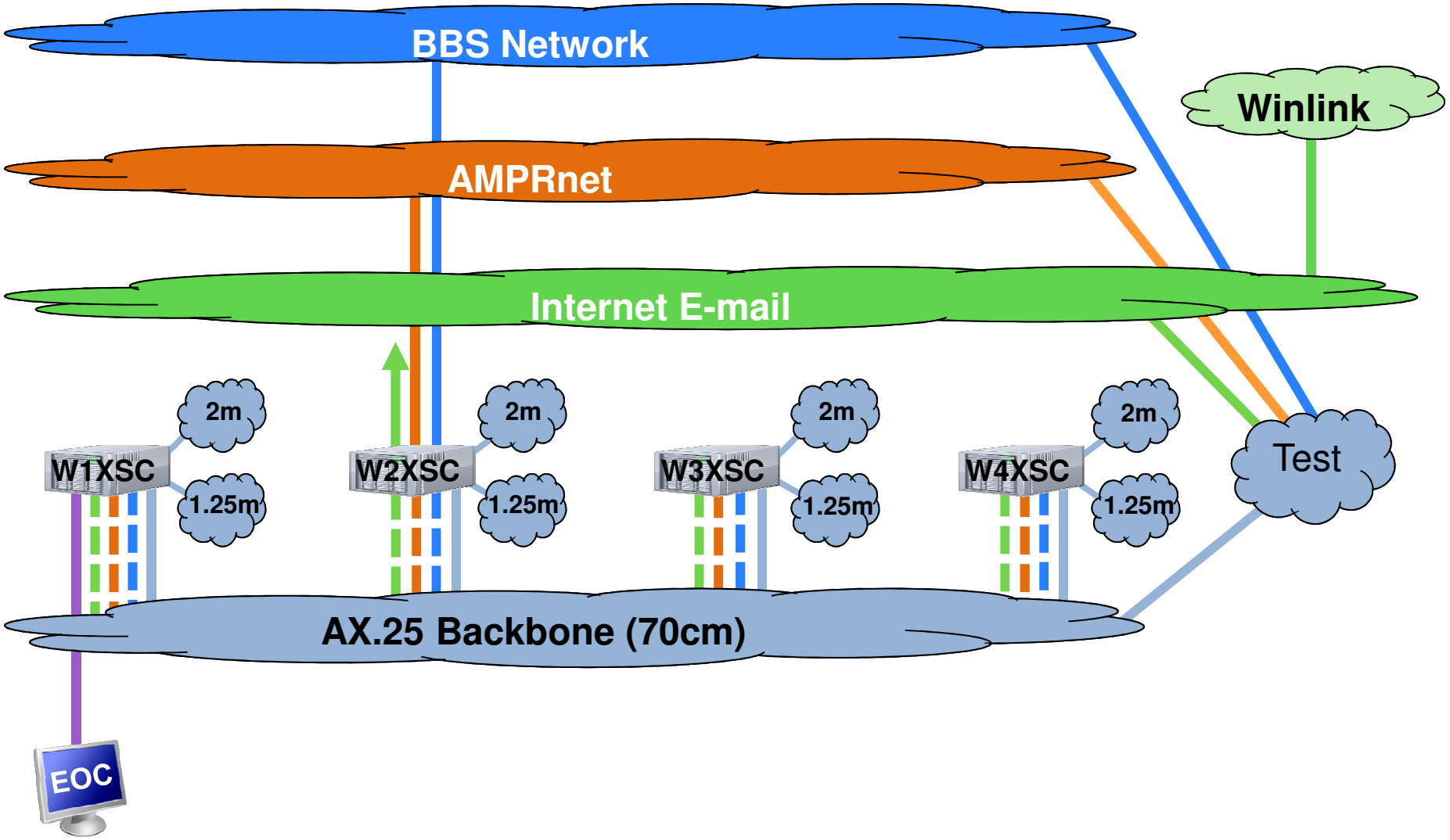
- Auto-generated configuration files specific to SCCo
- 100s of parameters across multiple files, zero errors



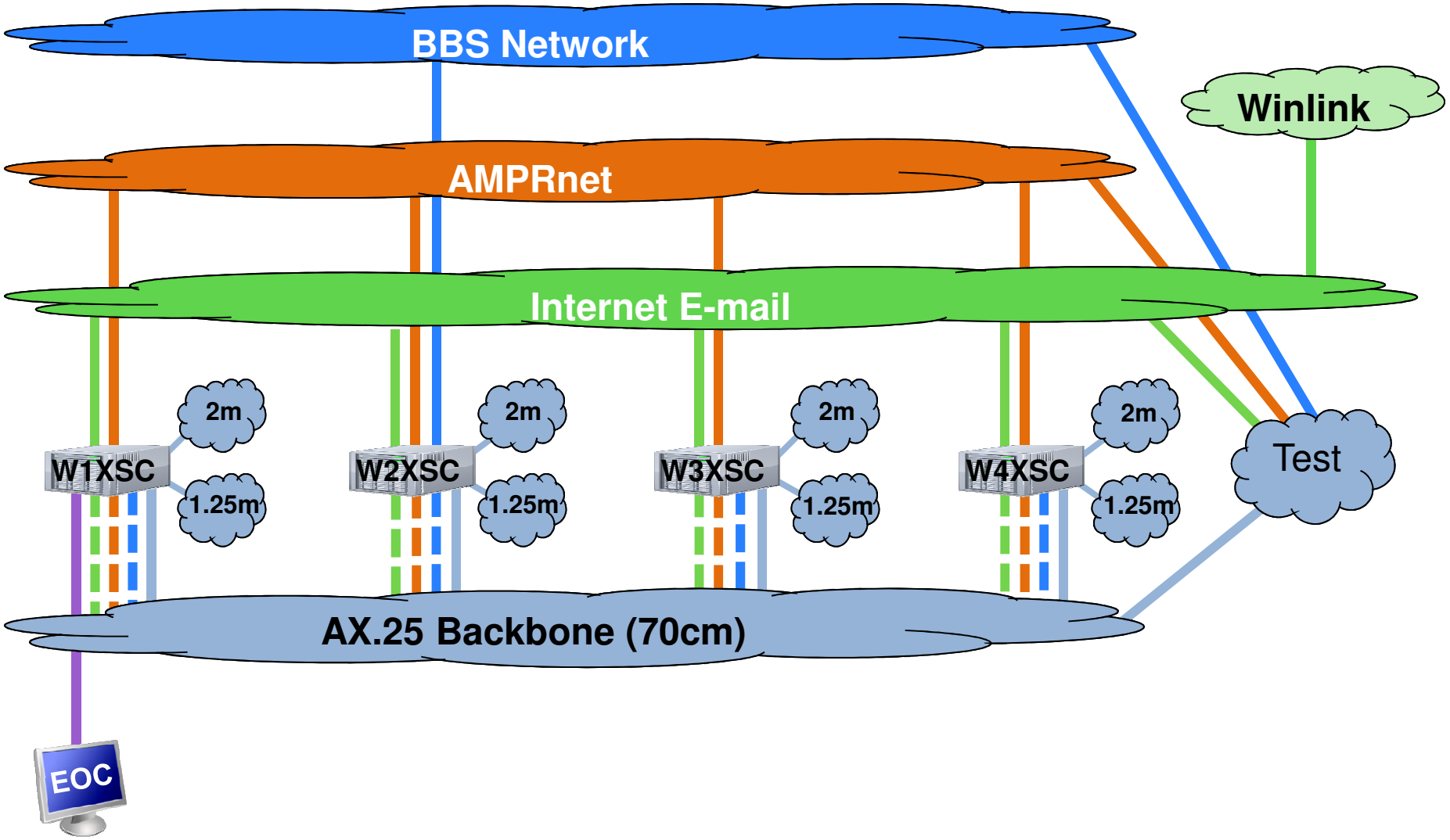
Fourth Server, AMPRnet, Outbound E-mail, Test Environment



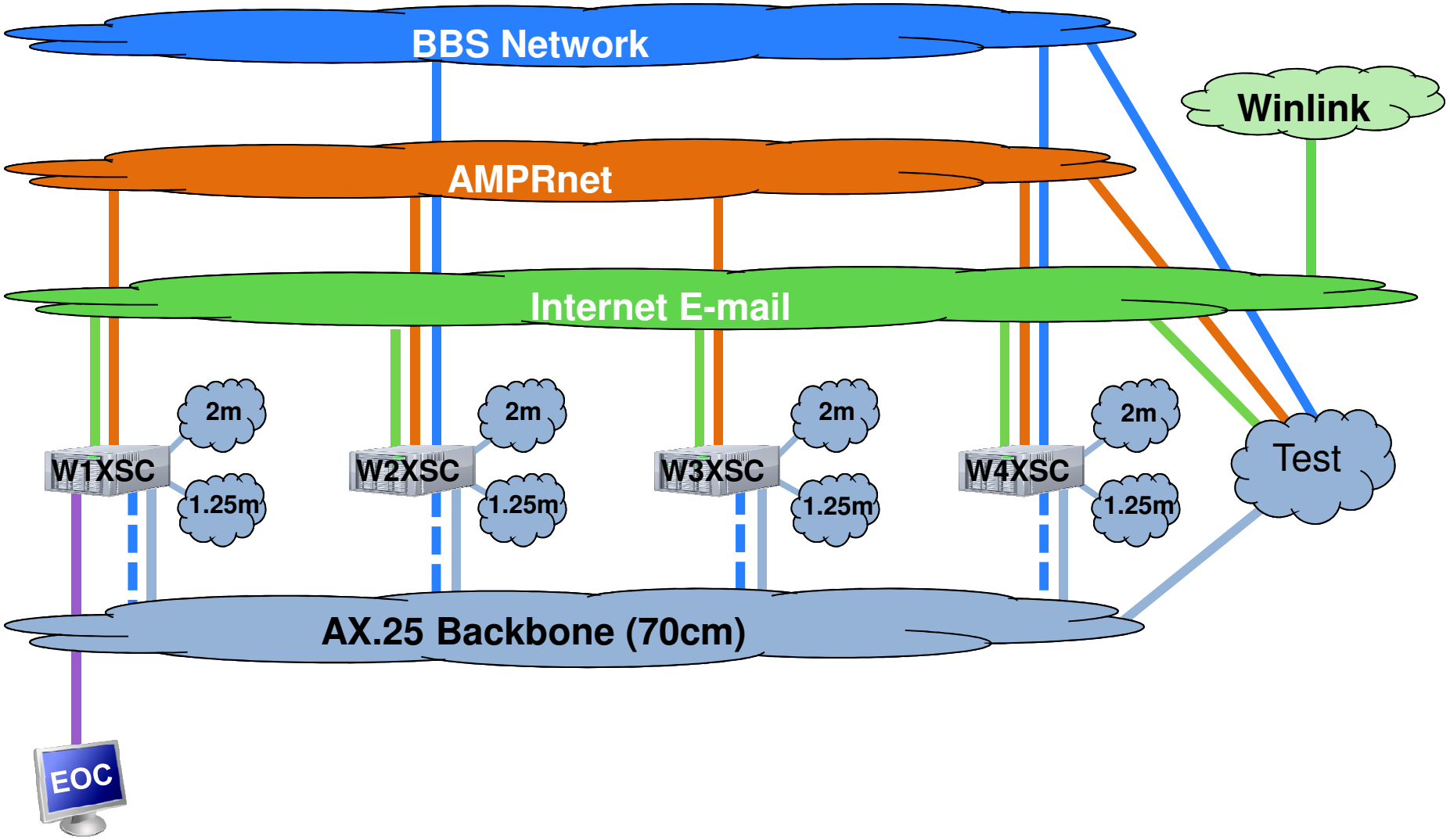
BBS Network



2-way E-mail, Distributed AMPRnet

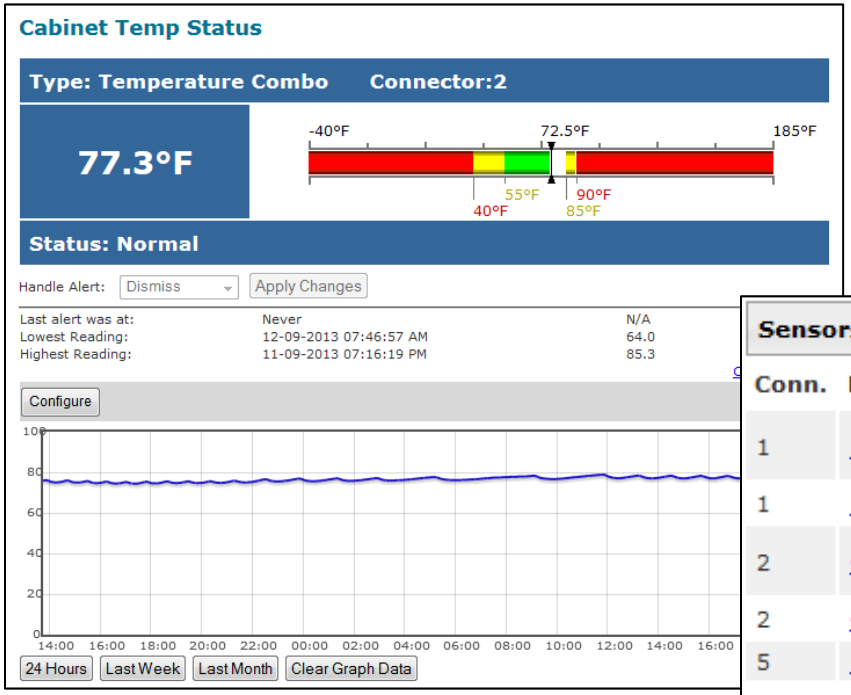


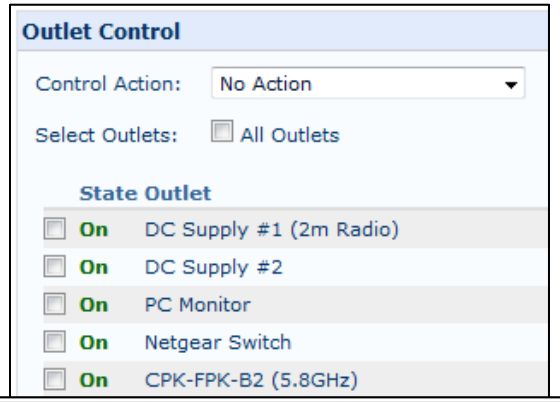
RF Connections to BBS Network

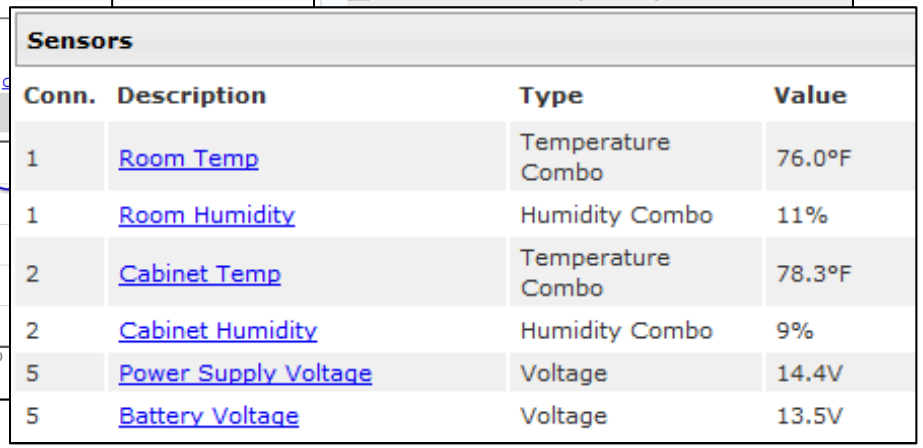


Quality Network Operations

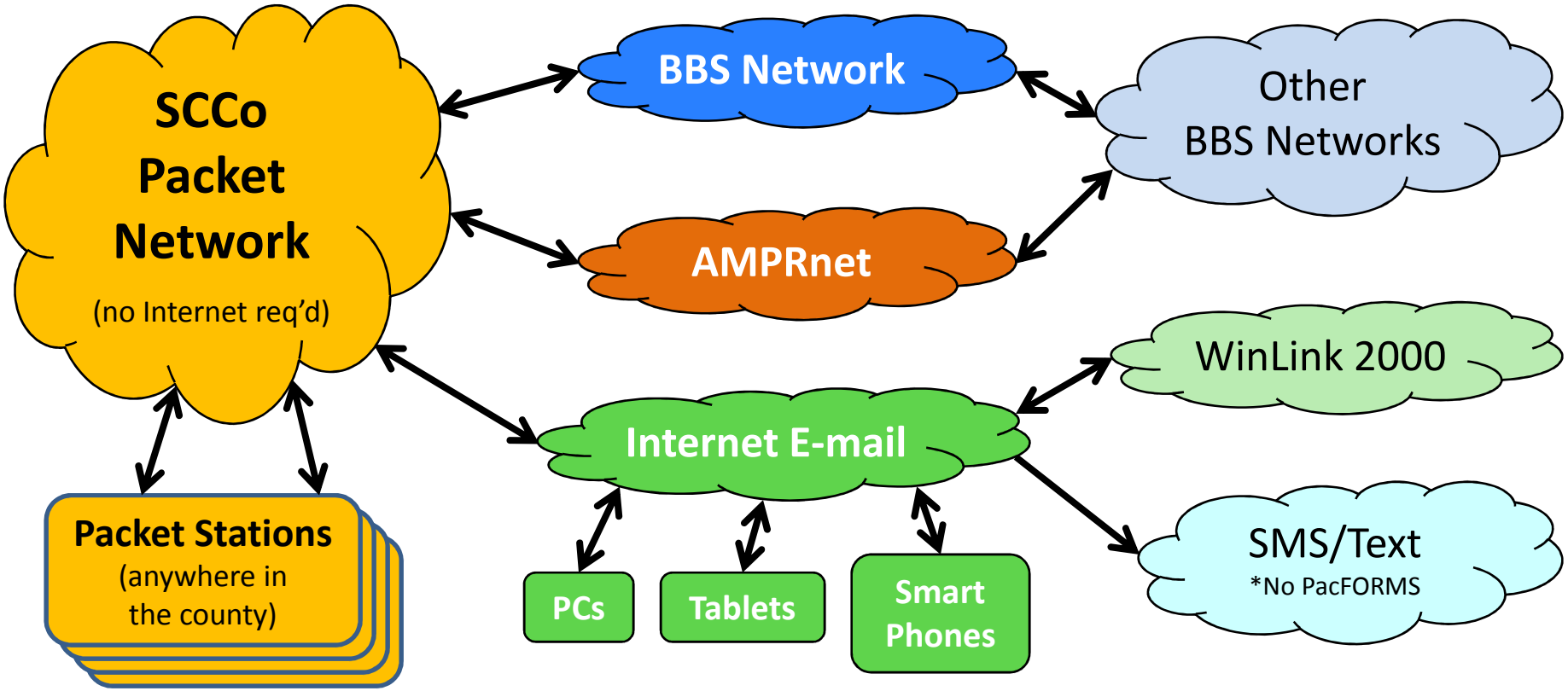
- All components on UPS with generator backup
- Remote monitoring and control; multi-level security
- Automated alerts





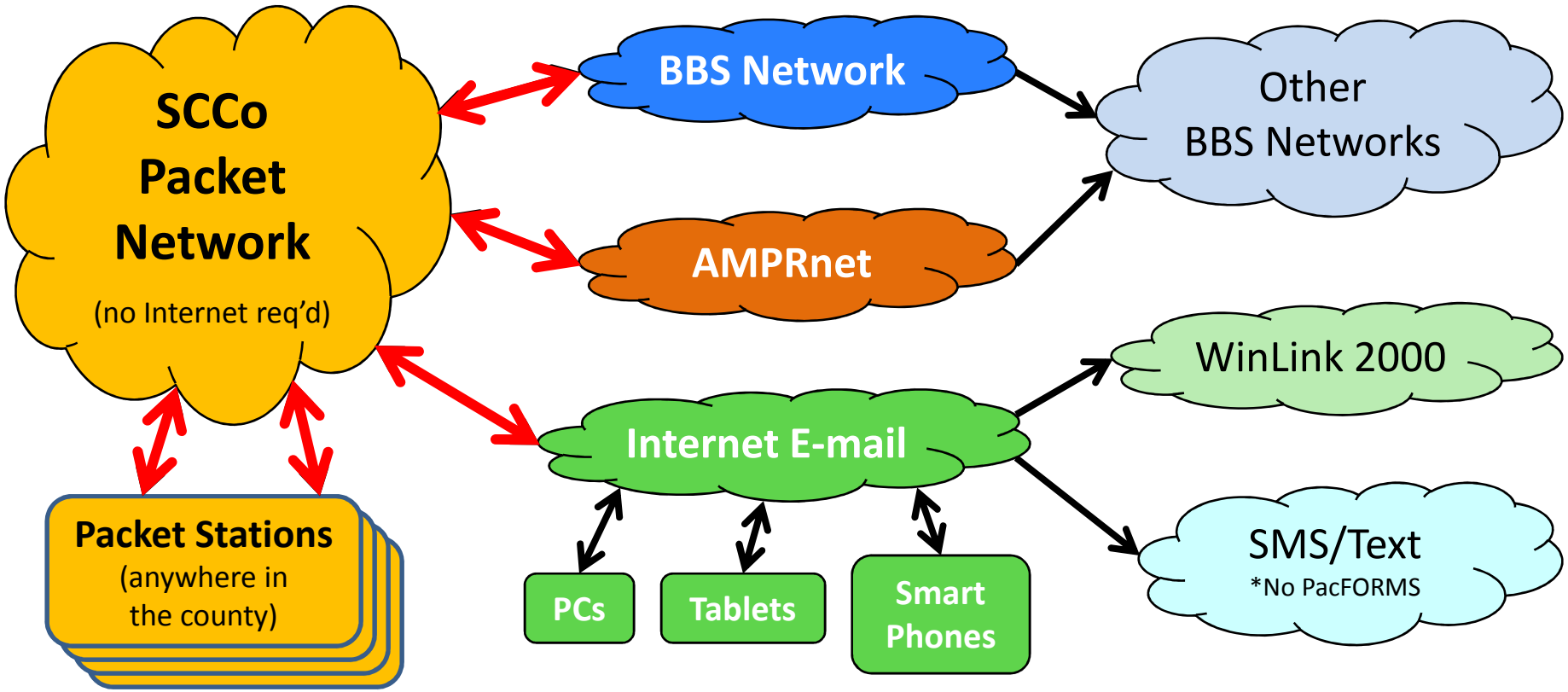


2013 Electronic Messaging Integration Status



- Gateways to BBS Network, AMPRnet, E-Mail
- 2-way text and PacFORMS* with virtually any networked device
  - Inbound from SMS/Text network is carrier dependent

Weekly Testing



- Each check-in acknowledged; receives automated feedback about errors
- Totals automatically reported

Requirements Scorecard: 2009

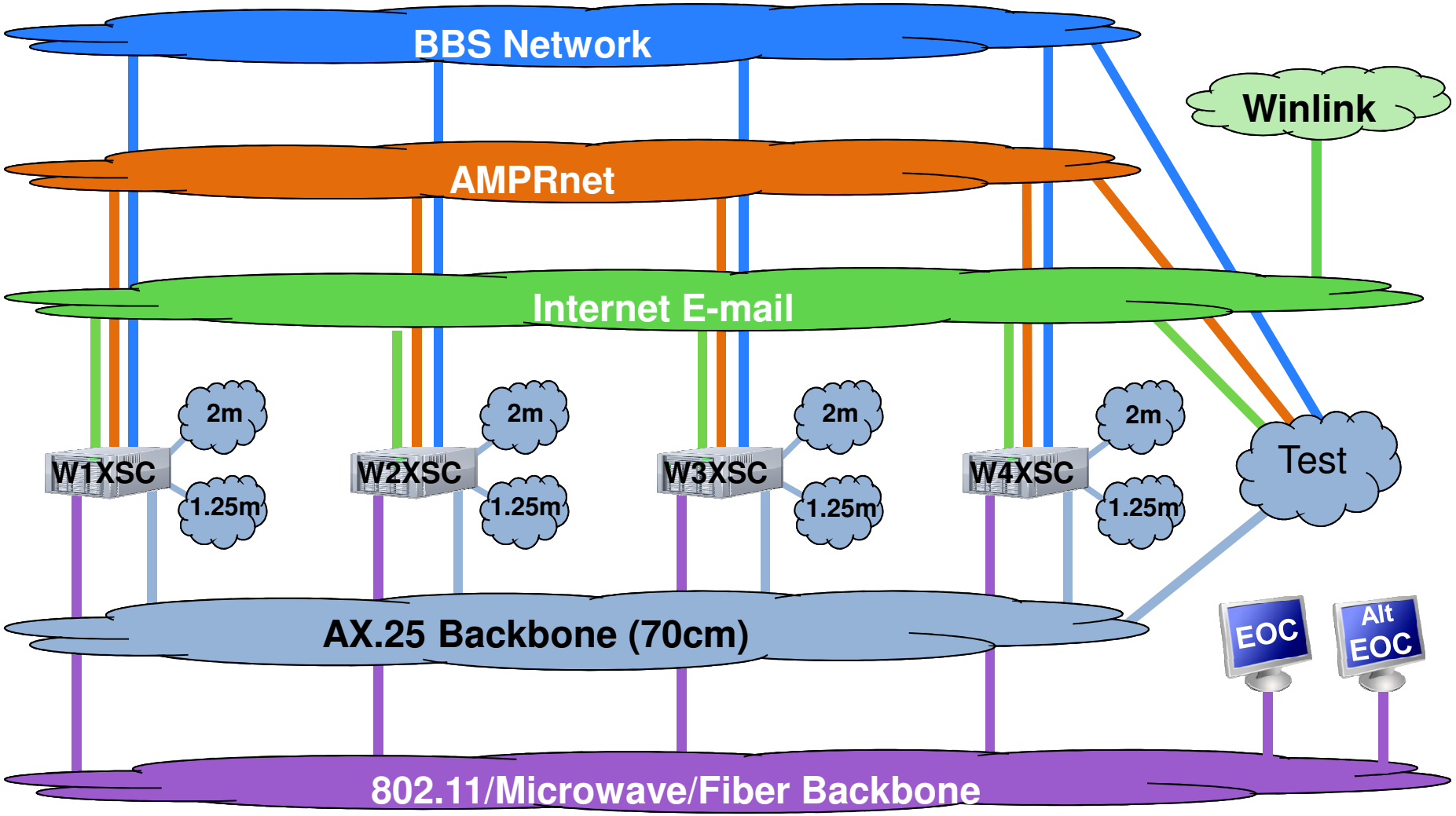
Capability / Requirement	2009
Client: station is easily deployable (portable, battery, …)	☑
Client: software is easy to install, set-up, use	☐
Client: software supports multiple message types (incl. forms)	☑
Client: software automates tasks, reduces human errors	☐
System: multiple sites with redundant functionality	☐
System: all sites have UPS and generator power	☑ 1
System: network capacity is sufficient for text message traffic levels	☐
Connect: from anywhere in SCCo / send to anywhere in SCCo	☐
Connect: to more than one system site in case main site is down	☐
Communicate: with stations in Santa Clara County, no Internet req'd	☑
Communicate: with regional stations, no Internet req'd	☐
Communicate: with 3rd party stations (e-mail, SMS, …)	☐

Requirements Scorecard: 2013

Capability / Requirement	2009	2013
Client: station is easily deployable (portable, battery, …)	☑	☑
Client: software is easy to install, set-up, use	☐	☑
Client: software supports multiple message types (incl. forms)	☑	☑
Client: software automates tasks, reduces human errors	☐	☑
System: multiple sites with redundant functionality	☐	☑ 4
System: all sites have UPS and generator power	☑ 1	☑ 4
System: network capacity is sufficient for text message traffic levels	☐	☑
Connect: from anywhere in SCCo / send to anywhere in SCCo	☐	☑
Connect: to more than one system site in case main site is down	☐	☑
Communicate: with stations in Santa Clara County, no Internet req'd	☑	☑
Communicate: with regional stations, no Internet req'd	☐	☑
Communicate: with 3rd party stations (e-mail, SMS, …)	☐	☑

LOOKING FORWARD

1H 2014:
Distributed BBS Net, Higher Speed Backbone



Are We Done?

- Is this sufficient for our needs?
- If not, then what do we need?
  - Lots of opinions
- So, what problem are we trying to solve?
  - … and how does that fit within our mission?

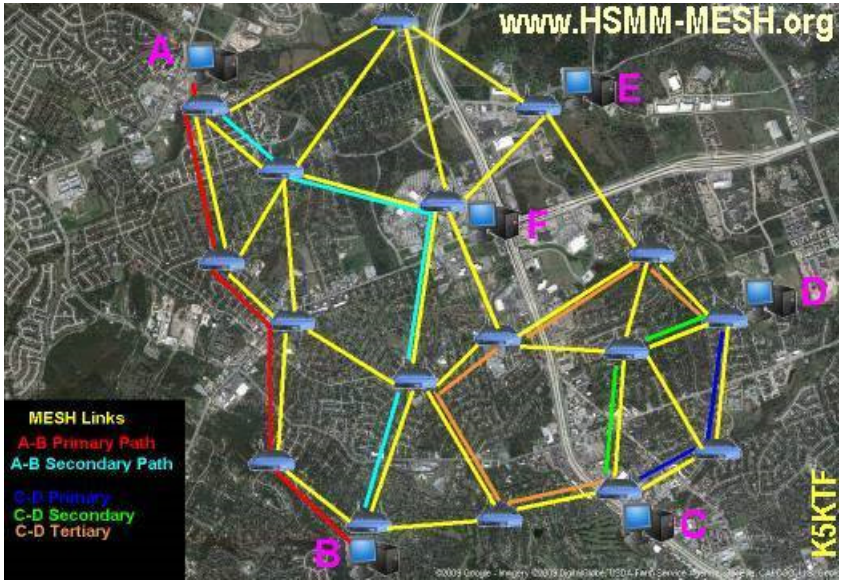
2014+ Ideas

- Some ideas for more integrated messaging
  - Support for more Internet message formats (MIME, base64)
  - Support binary attachments (spreadsheets, images …)
  - Possible integration with WebEOC?

- Some basic connectivity ideas
  - Hot-spot support at local command post?
  - Site-wide or even incident-wide LAN connectivity?
  - Public service event-wide LAN connectivity?
  - Flexible, ad hoc deployment – bring up network quickly, without the need for centralized design of addressing and routing

One Connectivity Idea: Mesh Networking

- Self-configuring, auto-discovering
- Can use 802.11 (WiFi) equipment
  - Low-cost H/W available on eBay
  - Limited distance, VERY line-of-site!
- We can operating under Part 97 rules
  - Better antennas, possibly more power
- Broadband-Hamnet group in Austin, TX
  - Amateur radio-optimized software
- Several experiments underway
  - Cupertino, Milpitas, individuals



- More info:
  - Website: http://www.scc-ares-races.org/packet/mesh.html
    - Links to: Broadband Hamnet website, scc-mesh Yahoo discussion group
    - More information as we develop it

Help Us Turn These Ideas Into Requirements

- Specifically, what problem needs to be solved?

- What are the usage scenarios?
  - Who needs to send the message? Who needs to receive it?
  - What type of message? What format? What content?
  - When do they need to send it?
  - Where is it coming from / going to? (physical location)
  - How is it going to get there? (proposed connectivity)

- Bring the details and discuss at the monthly SIG meeting
  - 7pm, 3rd Thursday of each month at the SCCo EOC

How to Get Involved

- Join the discussion groups
  - http://groups.yahoo.com/group/scc-packet
  - http://groups.yahoo.com/group/scc-mesh
- Get a station and use it
  - Check-in to Monday or Tuesday nets
  - Regularly verify connection via primary BBS, backup BBS, e-mail, …
- Come to packet training classes
  - There's new information every year
- Participate in drills, public service events
  - City or county EOC, field stations
- Investigate new electronic messaging requirements
  - Dig into the details, bring to the monthly SIG meeting
- Join or start a mesh networking experiment in your area

Packet Committee Members

- John Altieri, W6HW
- Jim Clark, N6JRC
- Bob Fishman, K6FSH
- Michael Fox, N6MEF
- Jerry Haag, K6GAC
- Phil Henderson, KF6ZSQ
- Tim Howard, KE6TIM
- Doug Kalish, KA3L
- Jim Oberhofer, KN6PE
- Andy Rose, KI6SEP
- Tom Smith, KD6SOJ
- Logan Zintsmaster, KZ6O

Everything we've discussed today is due to the efforts of these people!

Thank You!