Packet Updates in Santa Clara County

SVECS – Silicon Valley Emergency Communications System

Santa Clara, CA

24 October 2009

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Agenda

1. Why do we still talk about packet? Why use it?
2. Where are we today?
3. The Enhanced County Packet System
4. Other changes

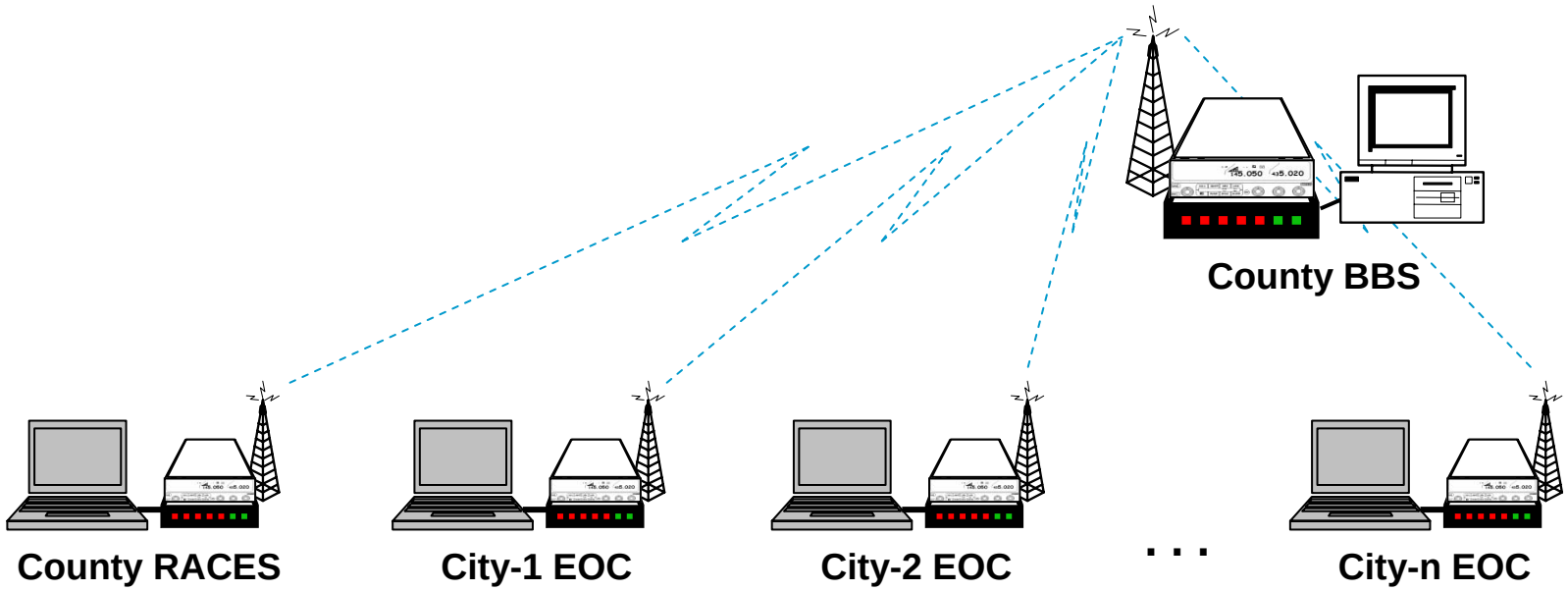
Why use Packet Radio?

Why use Packet Radio?

The case for packet radio

1. **Message Store and Forward**

- BBSs allow messages to be stored, retrieved, or forwarded throughout the connected BBS network.
- The recipient does not need to be on line to get the message, meaning that messages can be retrieved at the recipient's convenience.

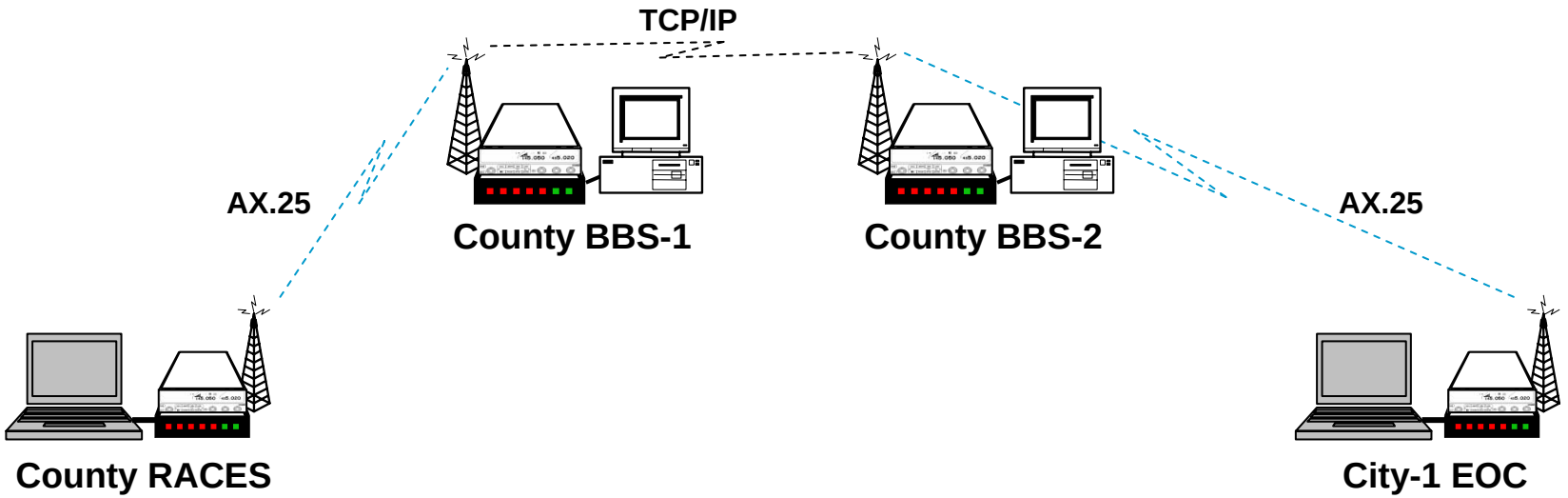


Why use Packet Radio?

The case for packet radio

2. Communications Protocol

- Packet uses a protocol called AX.25. This is based on the ITU X.25 protocol for networked packet communications.
- AX.25 supports error correction and control that guarantees that all packets (and subsequently messages) are delivered correctly.
- TCP/IP is also used to support interlinking BBSs together



Why use Packet Radio?

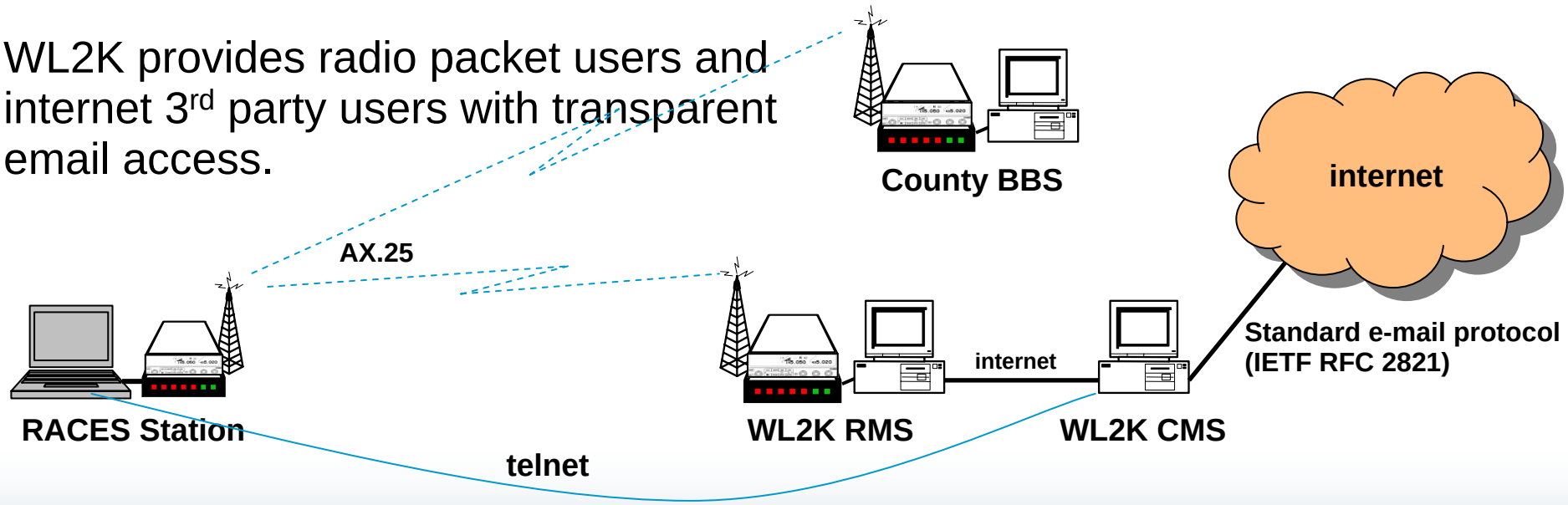
The case for packet radio

3. Interoperability

- DHS suggested to the ARRL that the Amateur community should design and maintain a national digital network for emergency communication purposes**.**
- Winlink 2000 (WL2K) was adopted as that solution.
- WL2K provides radio packet users and internet 3rd party users with transparent email access.

Definition: **RMS – Radio Message Servers**, provides an RF gateway from packet users to the WL2K system.

Definition: **CMS – Common Message Servers**, coordinates message traffic between RMS stations and the internet.

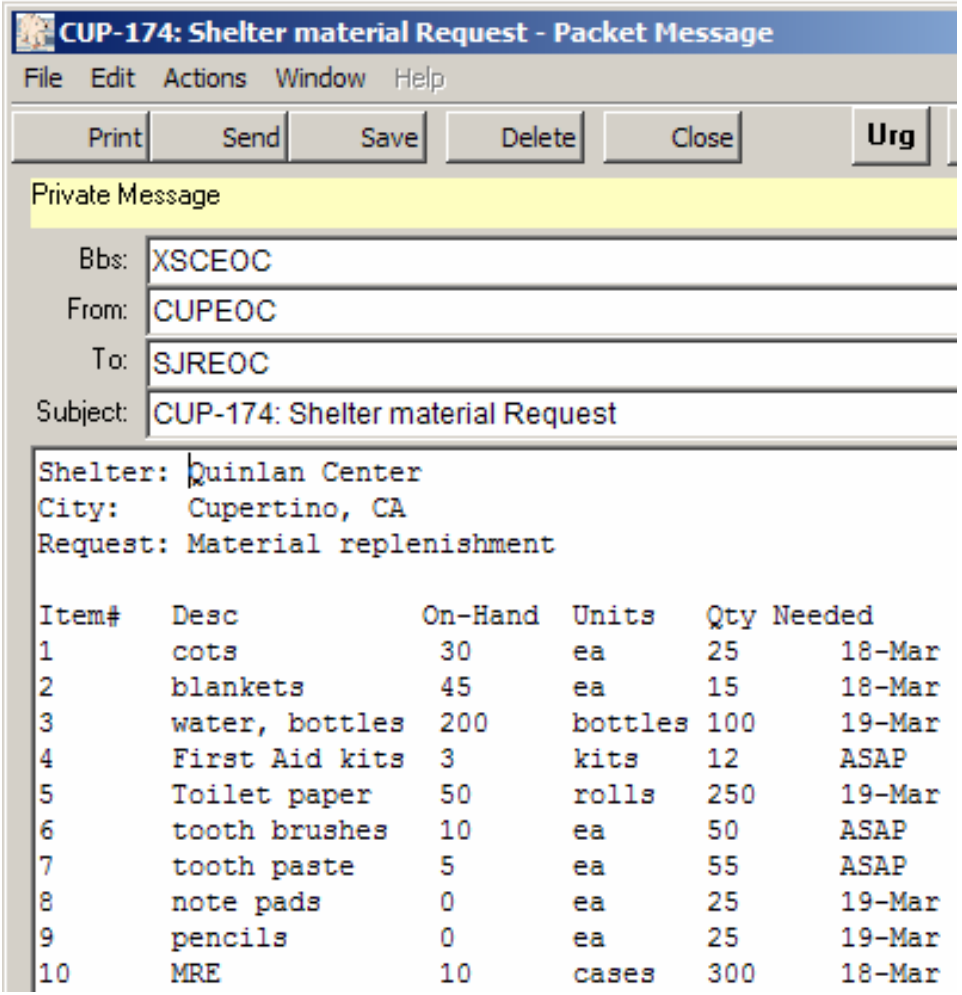


Why use Packet Radio?

The case for packet radio

4. Complex messaging

- Packet is ideal for passing lists of material, addresses, instructions, or complex words (i.e. pharmaceuticals or chemicals)
  - you do not want to mistake ***Hydrogen Sulphide*** (a gas) with ***Hydrogen Sulfate*** (an acid)
- Packet-based messaging ensures...
  1. the originator can verify the content before it is sent (more than likely typed it him/herself),
  2. reduces transcription errors between the sender and receiver, and
  3. keeps the voice channel clear for more critical traffic.



Why use Packet Radio?

The case for packet radio

5. Reduces message handling

- Packet messaging can originate from the source using standard office applications (or other methods) and sent directly to the packet app or by *sneaker-net* to the radio room for loading and sending.
- Because packet is digital and relies on a computer, messages can also be printed directly to a printer (assuming the terminal program supports it, such as Outpost).

Why use Packet Radio?

The case for packet radio

6. Supported by the Amateur Community

- Packet is supported by hams with the interest and intent of supporting a disaster response when commercial communications is overwhelmed or lost.
- During last year's Chino Hills Earthquake…
  - Magnitude 5.4 Earthquake
  - telephone companies reported no physical damage to telecommunications facilities.
  - phones in the San Bernardino County Sheriff's station worked only intermittently
  - Sprint: "… reported an 800% increase over normal call volume in the half hour after the earthquake struck… the volume soared past predictions for emergencies."
  - Verizon: "… about 40% more than the peak we expect during disasters."

Source: Los Angeles Times article, "Post-quake callers overload phone systems", 30-July-08

Why use Packet Radio?

The case for packet radio

7. Packet aligns with how we work today

- Message complexity and timeliness of delivery drives how we use…
  - The telephone and email (during non-emergencies)
  - The radio and packet (during an emergency)
- We would use packet radio for the same reasons we would use internet email: message accuracy, delivery, privacy*, and the ability to handle message complexity.

	Simple Messages	Complex Messages
Mode	**Voice**	**Packet**
Messages	**Short messages**	**Lists, instructions, details**
Delivery	**Immediate**	**Store & forward; mail drop**
Equipment	**Radio**	**Radio + TNC + PC + SW + BBS**
Complexity	**Short learning curve**	**Easier with Outpost vs. native packet commands**

Why use Packet Radio?

The case for packet radio

8. Expectations

- Our connected society has come to rely on our inherent ability to contact anyone, at anytime (thanks to cell phones and WiFi)
  - ***Wireless connectivity has evolved beyond a novelty to an EXPECTATION***

- The Santa Clara County Emergency Management Association (EMA) knows that our local communications infrastructure ***WILL FAIL*** during an earthquake and ***expects*** Ham Radio to enable the response and speed the recovery.

- Packet is well suited to support the response mission. *Are we ready?*

Where are we today?

(… with packet!)

Our current operating environment

Where are we today?

1. New focus and enthusiastic support for packet by the County's Emergency Management Association and local RACES organizations
   - Packet messaging is a part of every county exercise
   - Packet is built into the new County RACES MAC qualification program
   - County is making loaner packet PCs available
   - Cities are promoting packet within their jurisdictions

2. County RACES established a Packet Committee
   - Jim Clark N6JRC
   - Bob Fishman K6FSH
   - Michael Fox N6MEF
   - Jerry Haag KF6GAC
   - Phil Henderson KF6ZSQ
   - Doug Kalish KA3L
   - Jim Oberhofer KN6PE
   - David Ranch KI6ZHD
   - Tom Smith KD6SOJ
   - Al Whaley KV6U

Our current operating environment

Where are we today?

3. County RACES operates a 3 channel BBS system with Tactical Call and digipeater support…
4. … that hosts 25 organizations, 16 of which are active on packet

Who is ACTIVE* on Packet
- Campbell
- Cupertino
- Gilroy
- Los Altos
- Los Altos Hills
- Los Gatos
- Milpitas
- Morgan Hill
- Mountain View
- NASA – Ames
- Palo Alto
- San Jose
- Santa Clara
- Santa Clara County
- Saratoga
- Sunnyvale

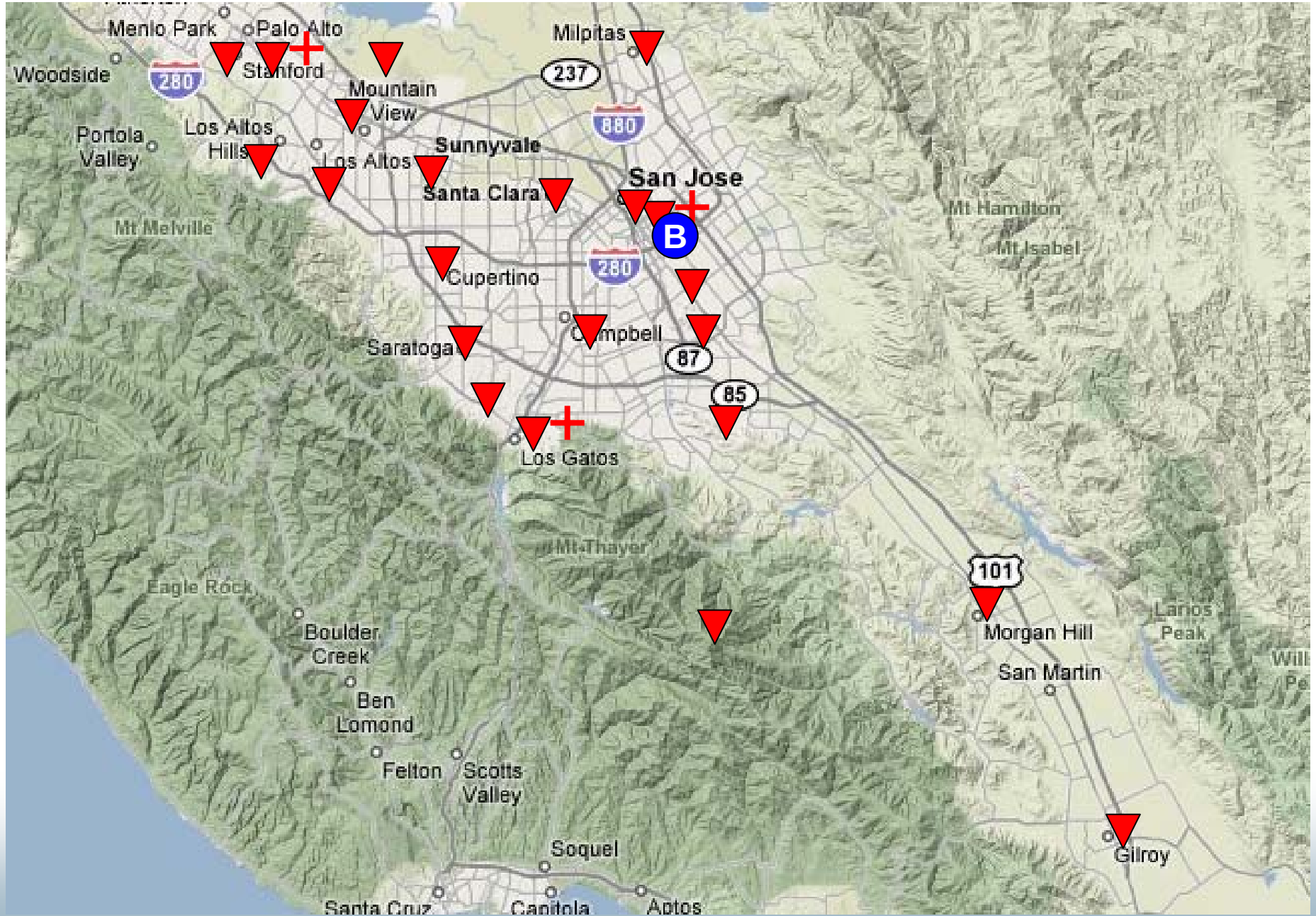
Who else has a Tactical Call
- County Comm
- Loma Prieta
- Los Gatos Red Cross
- Monte Sereno
- Palo Alto Red Cross
- San Jose Red Cross
- San Jose Water Company
- Santa Clara Valley Water District
- Santa Cruz County
- Stanford

Who else wants to use Packet
- Various cities in the county
- 14 County hospitals

*__Active__ means: the city/agency…
(i) is confirmed as an active packet user,
(ii) has participated in County RACES Drills, and
(iii) has equipment and resources to support packet operations

Our current operating environment

Where are we today?

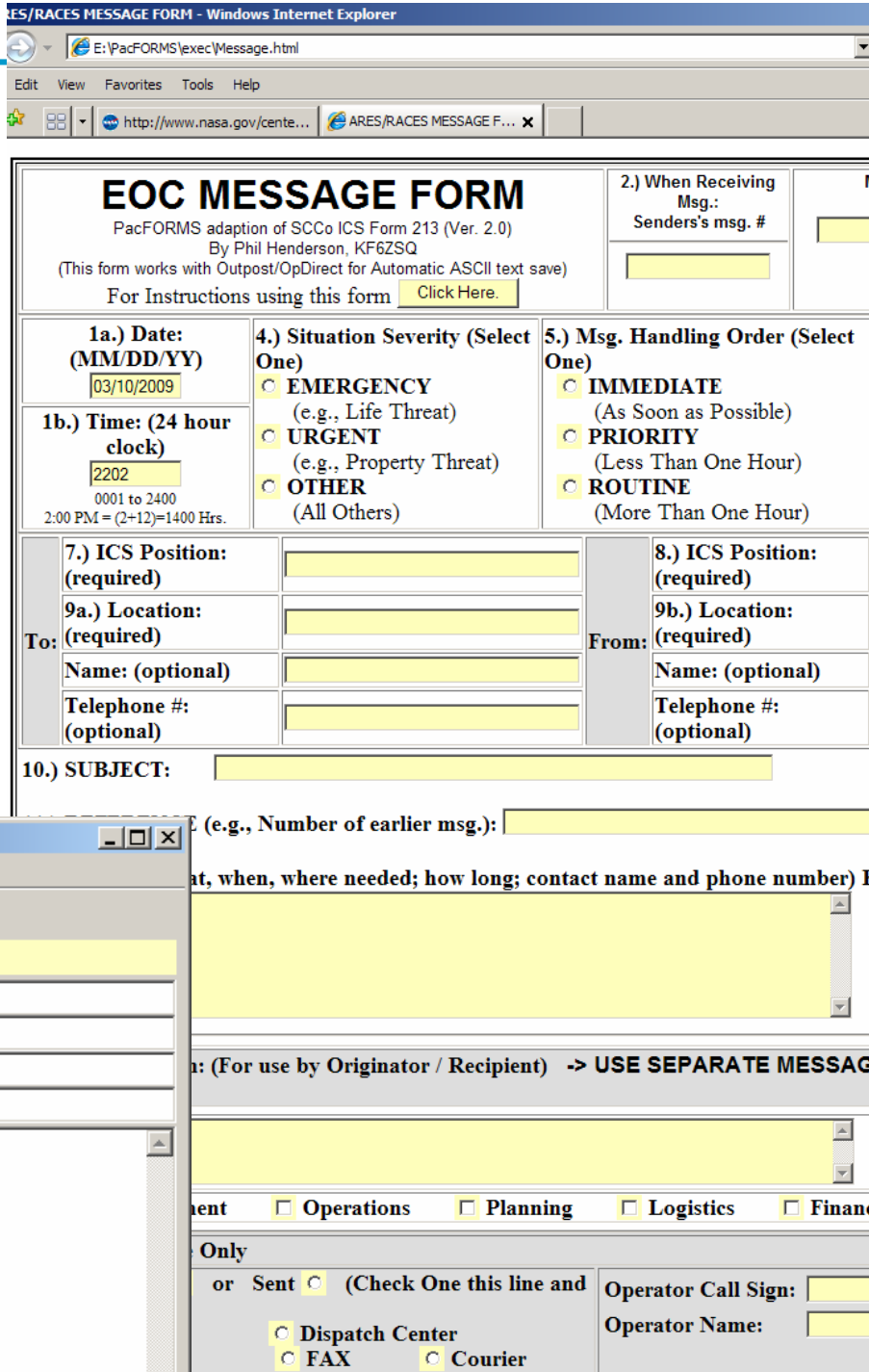


Our current operating environment

Where are we today?

5. **Adopted or chartered new tools** to make packet messaging easier and more efficient

   - **PacFORMS** – web-based forms that standardize the data collection process between the city EOCs and the County EOC
   - **Outpost** – Packet program for exchanging packet messages with the BBS



So, what's the problem?

Where are we today?

1. **Out of date packet infrastructure**
   - Obsolete BBS software – the AA4RE BBS author has no plans for future development or enhancements.
   - Old hardware – BBS operates on an 80386-based PC, other old hardware.
   - DOS operating system.
   - The last system failure took several weeks to resolve.
   - No formal back-up BBS system in place in the event of a county BBS system failure.
2. **Message throughput with a single BBS instance**
   - With more packet use, we are seeing packet message bottlenecks and access problems.
   - To address message delivery, packet policies and procedures have been defined that inherently reduce the effectiveness and efficiencies of packet messaging.
   - County RACES is concerned with the current system's ability to handle an activation-level message volume.

The Enhanced County Packet System

A proposal…

Enhanced County Packet System

1. … was submitted to (and approved by) County RACES to upgrade the County's Packet Infrastructure that would…
   i. address these problems, and
   ii. handle the anticipated growth in digital message traffic as both County and Cities look to exploit packet.

2. Implement a system of contemporary BBSs that would be networked together and configured to support the County's digital messaging needs.

What do we need?

Enhanced County Packet System

The new packet system needs to address the following:

1. Common hardware platform… intel-based, current X86 architectures
2. Contemporary O/S… Linux or Windows
3. Current BBS app… still supported, widely used
4. Message volume… handle the current and anticipated growth
5. TNCs and radios… support 1200 and 9600 baud speed
6. Leverage of the installed base hardware
7. Number of users… support the current users and ad-hoc (MACs)
8. Tactical Call support
9. Expandable… cover what we have today, add to it as necessary
10. Interoperability… with our PacFORMS and Outpost toolset
11. Short learning curve… looks and behaves like what we have today

What the new system will look like

Enhanced County Packet System

1. Adopt JNOS as the BBS of choice.
   - Based on Phil KA9Q's *Network Operating System* (NOS) for packet radio, originally written in the late 80's.
   - Provides the amateur packet community with a BBS application environment with a strong emphasis on networking.
   - Supports both the AX25 and TCP/IP protocols.
   - Open-source and still under active development.
   - The latest version is available for Linux, Windows, OS/2, and MacOS X.

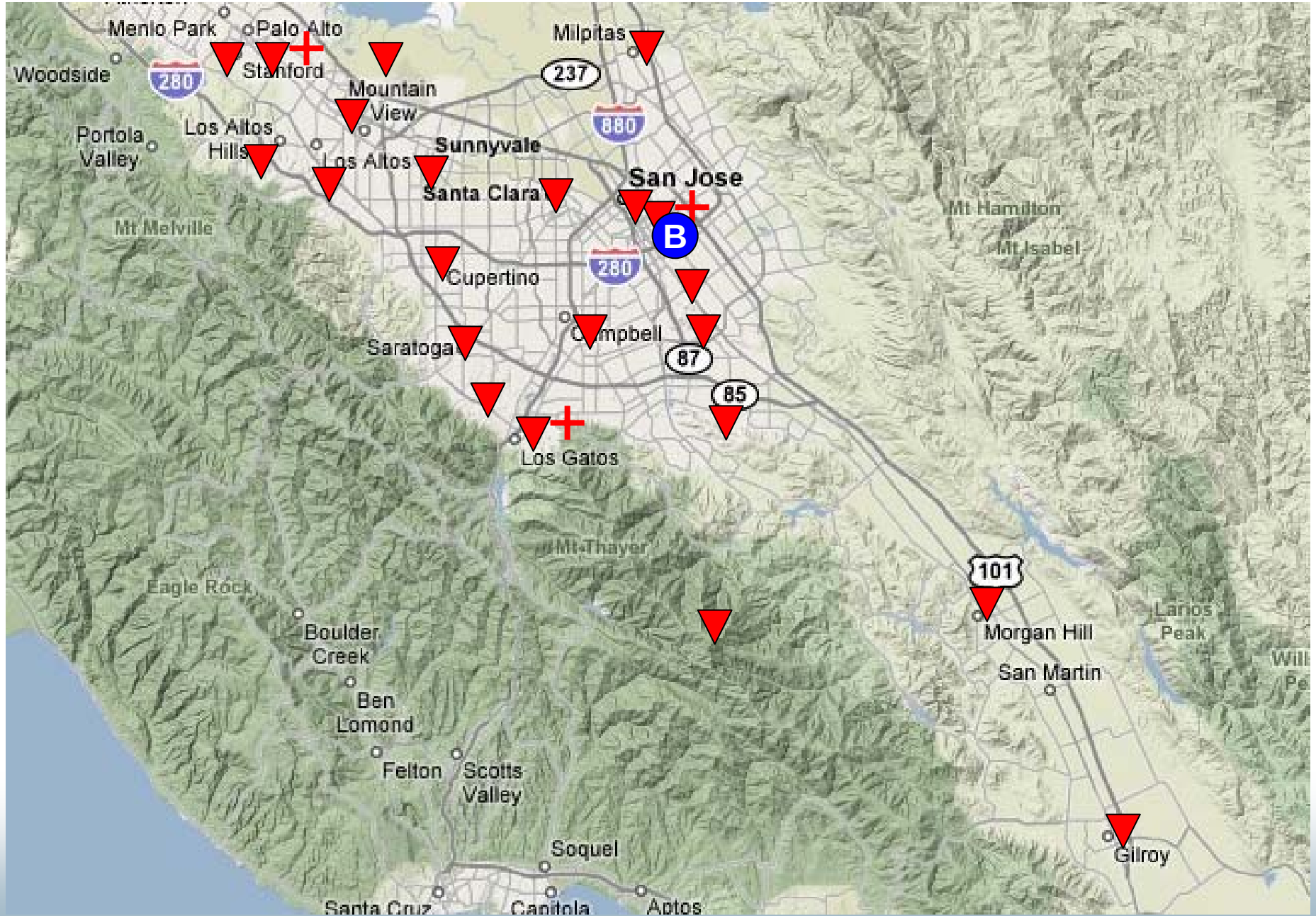
City / agency alignment

Enhanced County Packet System

2. SCC is divided into 4 packet ***areas***, each with a dedicated JNOS BBS (Message Server) serving the cities within that region.

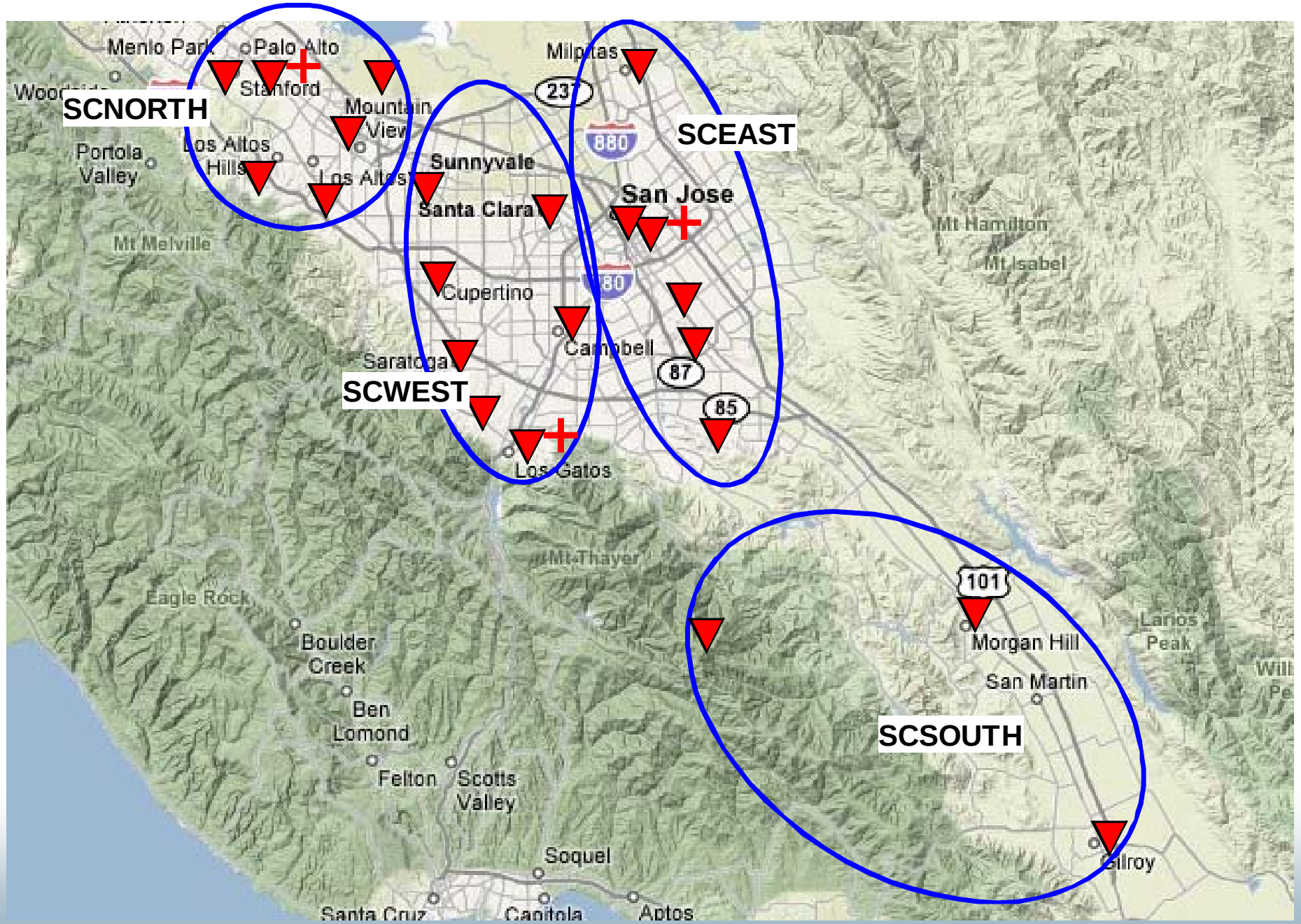
Where is everybody?

Enhanced County Packet System



Grouping city/agencies into packet areas

Enhanced County Packet System



City / agency alignment

Enhanced County Packet System

3. Each JNOS BBS is hosted by a city and supported by either County RACES or the host City's local ARES/RACES organization.

4. Assign participating cities and served agencies a primary JNOS BBS for their main packet access.

Node Name	SCNORTH	SCSOUTH	SCEAST	SCWEST
Host City	Mountain View	Gilroy	San Jose	Cupertino
Assigned Cities	1.Palo Alto 2.Los Altos 3.Los Altos Hills 4.Mountain View 5.NASA AMES.	1.Gilroy 2.Morgan Hill	1.Milpitas 2.San Jose 3.San Jose Red Cross 4.County EOC	1.Sunnyvale 2.Santa Clara 3.Cupertino 4.Campbell 5.Saratoga 6.Los Gatos
Others Pending	1.Palo Alto Red Cross 2.Stanford University	1.Loma Prieta	1.County Comm 2.San Jose Water 3.SCVWD	1.Monte Sereno 2.Los Gatos Red Cross

BBS Names and Routes

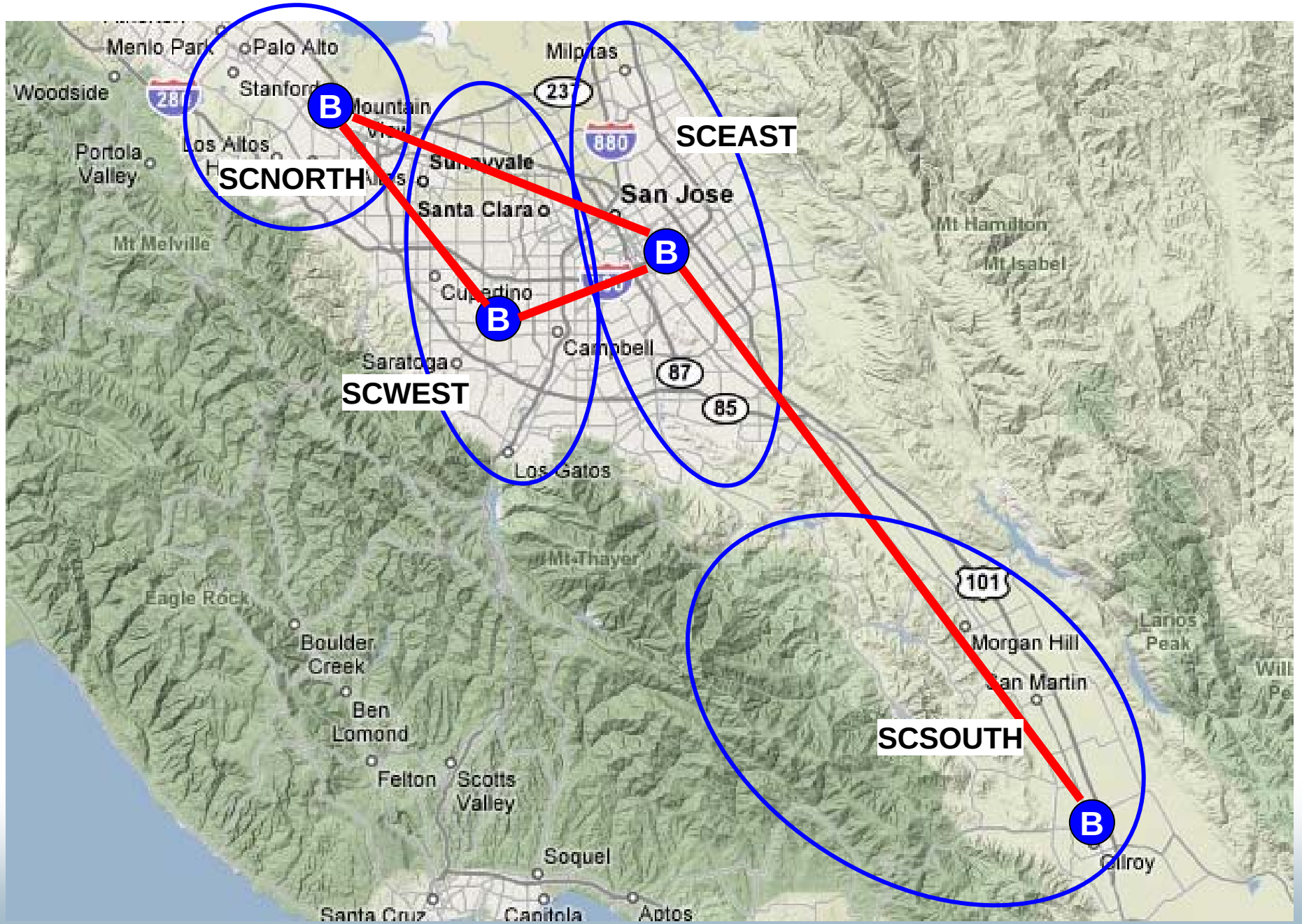
Enhanced County Packet System

5. City and Served Agencies will connect to their assigned BBS

Node Name	SCNORTH	SCSOUTH	SCEAST	SCWEST
Host City	**Mountain View**	**Gilroy**	**San Jose**	**Cupertino**
IP Address (Test Only)	44.4.2.1	44.4.14.128	44.4.12.1	44.4.6.1
BBS Connect Name	**K6MTV**	**--TBD--**	**W6XSC**	**K6KP**
Direct routes to:	SCEAST SCWEST	SCEAST	SCNORTH SCSOUTH SCWEST	SCNORTH SCEAST
Indirect Routes to:	SCSOUTH	SCNORTH SCWEST		SCSOUTH

Overlaying our 4 BBSs

Enhanced County Packet System



Frequency Assignments

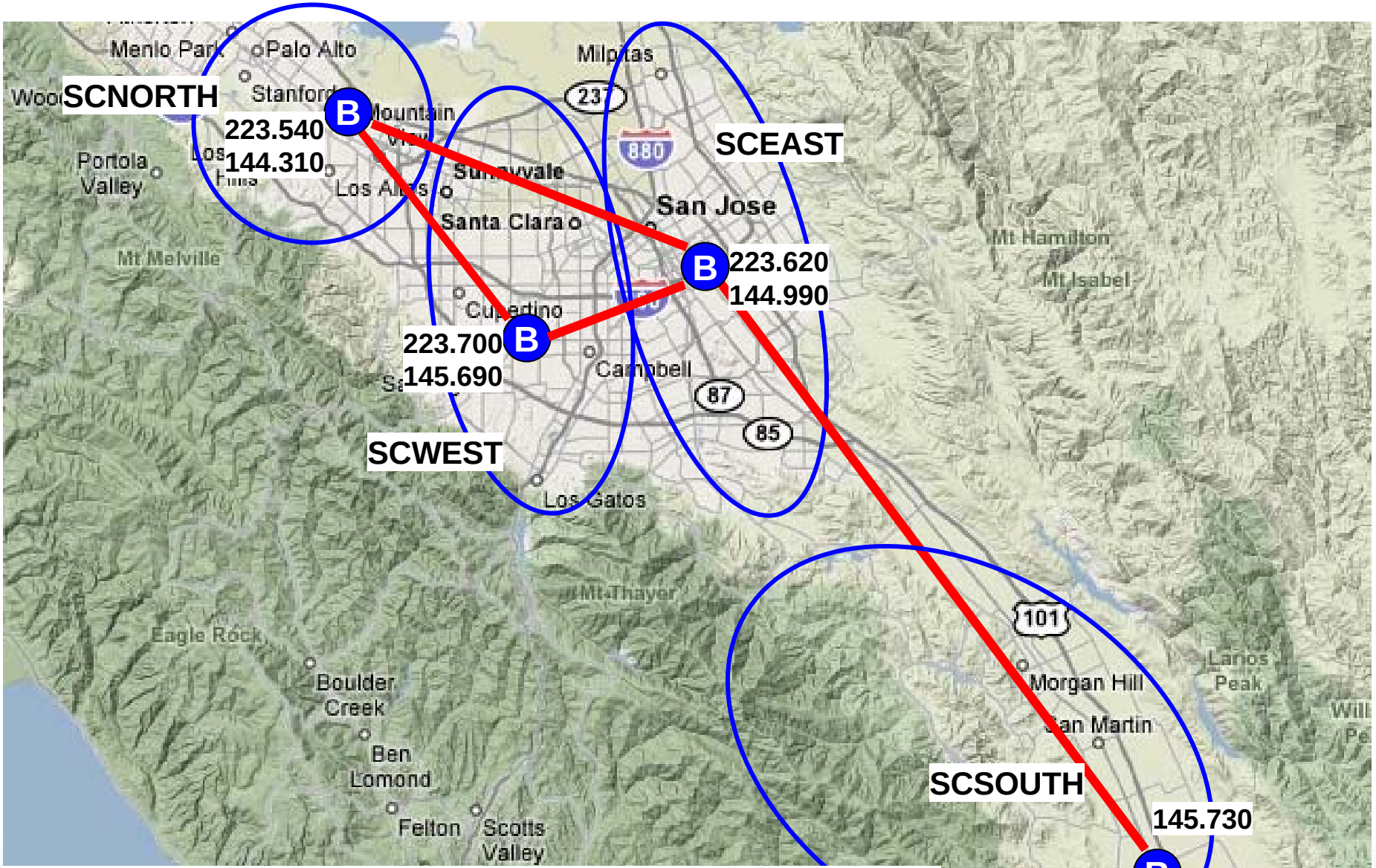
Enhanced County Packet System

6. Users access the BBS on different 2 meter and 220 MHz frequencies using standard AX.25 packet with existing equipment at 1200 baud.
7. Messages are transferred between JNOS BBSs using a common TCP/IP 9600 baud 440 link.

Node Name	SCNORTH	SCSOUTH	SCEAST	SCWEST
Host City	**Mountain View**	**Gilroy**	**San Jose**	**Cupertino**
2 meter user frequencies	144.310 MHz	145.730 MHz	144.990 MHz	145.690 MHz
220 user frequencies	223.540 MHz		223.620 MHz	223.700 MHz
440 Link frequency	433.410 MHz	433.410 MHz	433.410 MHz	433.410 MHz

Frequency Assignments

Enhanced County Packet System

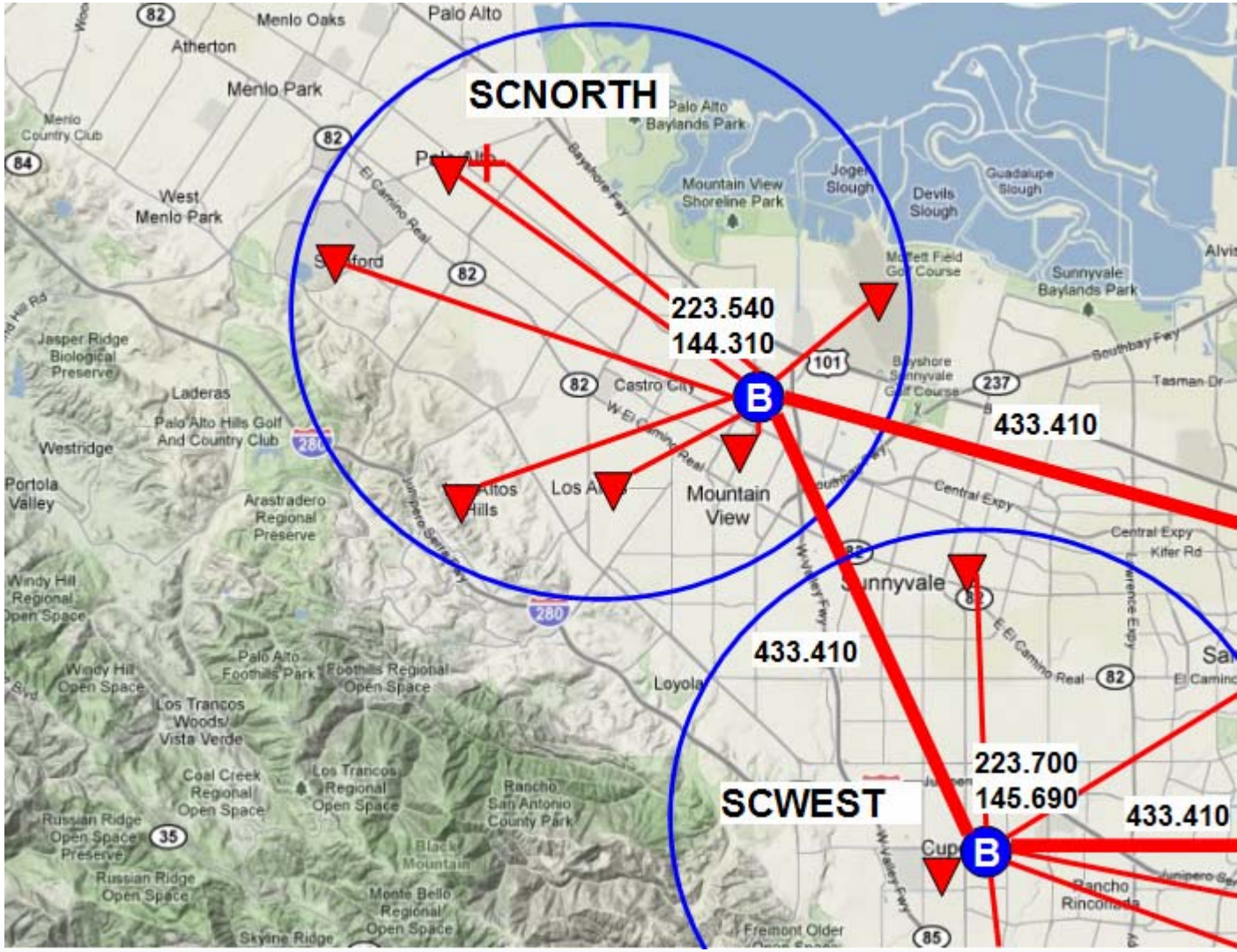


User Access, 1.25m:	**223.540, 223.620, 223.700 @ 1200 baud**
User Access, 2m:	**144.310, 144.990, 145.690. 145.730 @ 1200 baud**
InterBBS Link:	**433.410 @ 9600 baud**

How it works

In general…

1. Users connect to their local BBS
2. Messages addressed to users hosted on this BBS stay local
3. Messages addressed to users hosted on other BBSs are forwarded
4. The BBS handles all the address mapping and transfers to ensure the message gets to the right BBS



How it works

Example: Mountain View EOC wants to send a message to County EOC; what happens…

1. In the MTV Radio Room?
2. At the SCNORTH BBS?
3. At the SCEAST BBS?
4. In the County Radio Room?

How it works

Example: MTV wants to send a message to County EOC

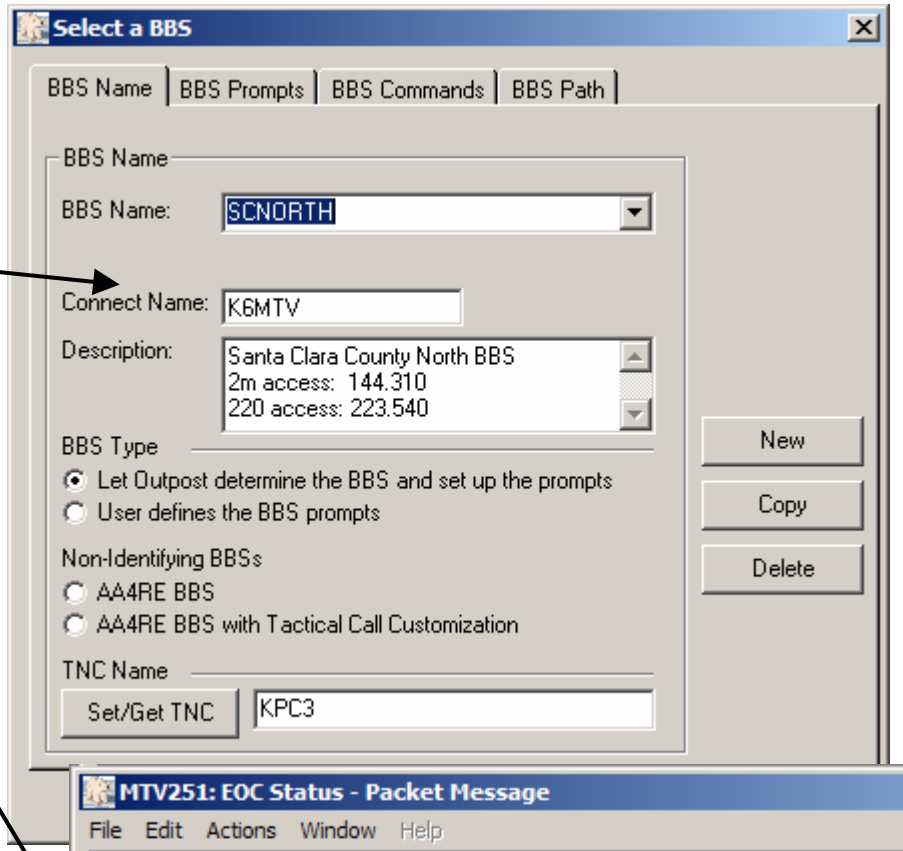
In the MTV Radio Room

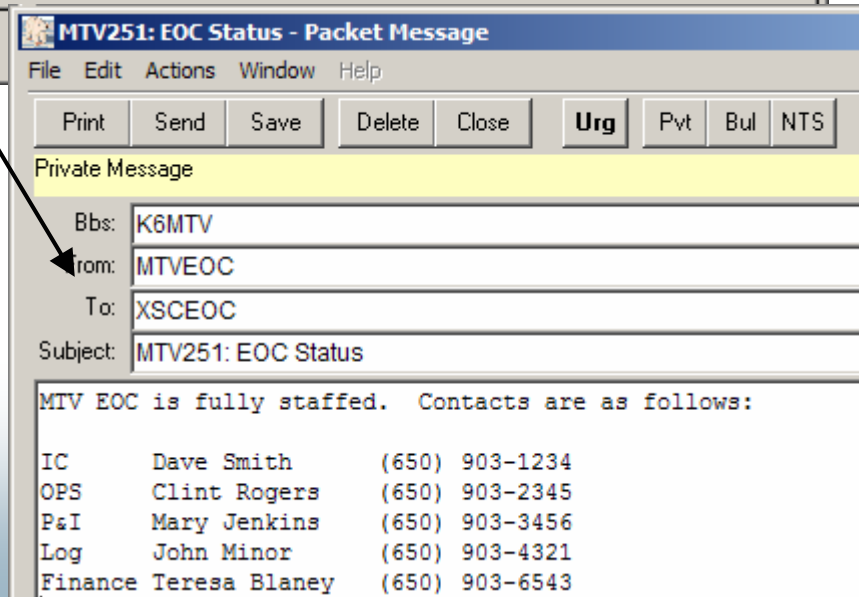
1. In Outpost, check that the BBS is set to K6MTV (SCNORTH).
2. Check that the radio is set to 144.310 (K6MTV's 2m access frequency).
3. Create the message, addresses it to XSCEOC as usual.
4. Press ***send/receive!*** Outpost connects to K6MTV and delivers the message to the BBS.

At the SCNORTH BBS

At the SCEAST BBS

In the County Radio Room





How it works

Example: MTV wants to send a message to County EOC

In the MTV Radio Room

At the SCNORTH BBS

1. JNOS detects that a new message was just received.
2. JNOS checks the destination address against the ***alias*** file, determines that XSCEOC is not a local user, and changes the address from **XSCEOC** to **XSCEOC@SCEAST**.
3. JNOS kicks off its SMTP Process…
   - Looks up the ***route*** to SCEAST... Direct
   - Connects to SCEAST on 433.410 @ 9600 baud
   - Forwards the message to SCEAST
   - Deletes the message off of SCNORTH

At the SCEAST BBS

In the County Radio Room

SCNORTH's Alias File

```
# DO NOT expand SCNORTH
# pafeoc      pafeoc@scnorth
# pafarc      pafarc@scnorth
# stueoc      stueoc@scnorth
# laheoc      laheoc@scnorth
# loseoc      loseoc@scnorth
# mtveoc      mtveoc@scnorth
# nameoc      nameoc@scnorth

# Expand SCSOUTH
gileoc        gileoc@scsouth
mrgeoc        mrgeoc@scsouth

# Expand SCEAST
sjceoc        sjceoc@sceast
sjcarc        sjcarc@sceast
xsceoc        xsceoc@sceast
cbleoc        cbleoc@sceast
mlpeoc        mlpeoc@sceast

# Expand ECWEST
cupeoc        cupeoc@scwest
sareoc        sareoc@scwest
lgteoc        lgteoc@scwest
lgredc        lgredc@scwest
msoeoc        msoeoc@scwest
snyeoc        snyeoc@scwest
snceoc        snceoc@scwest
```

How it works

Example: MTV wants to send a message to County EOC

In the MTV Radio Room

At the SCNORTH BBS

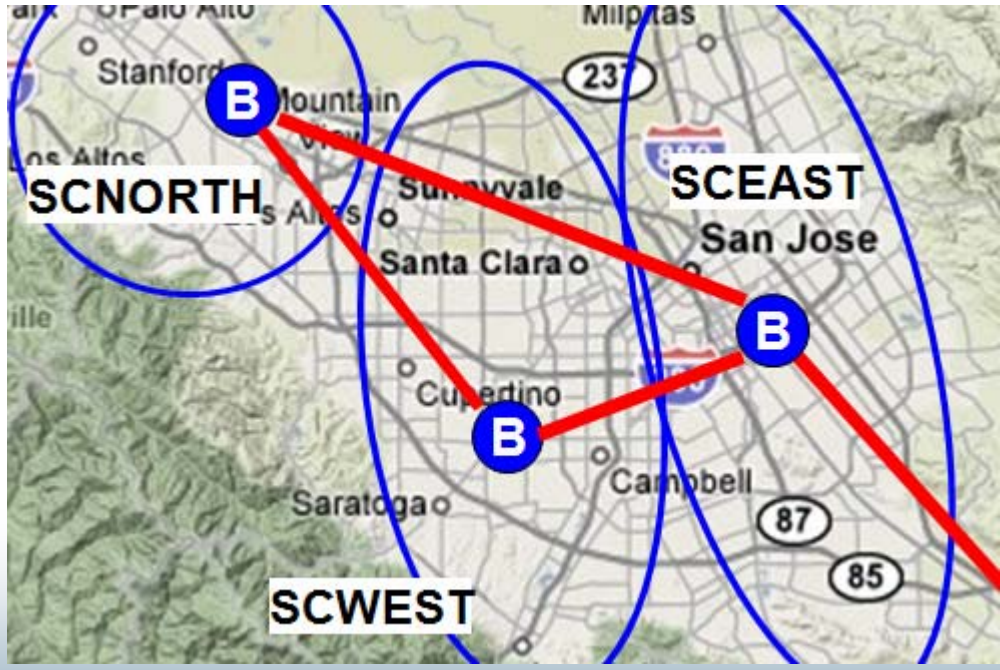
1. JNOS detects that a new message was just received.
2. JNOS checks the destination address against the *alias* file, determines that XSCEOC is not a local user, and changes the address from **XSCEOC** to **XSCEOC@SCEAST**.
3. JNOS kicks off its SMTP Process…
   - Looks up the ***route*** to SCEAST... Direct
   - Connects to SCEAST on 433.410 @ 9600 baud
   - Forwards the message to SCEAST
   - Deletes the message off of SCNORTH

At the SCEAST BBS

In the County Radio Room

SCNORTH's Routing Table

Route SCSOUTH	uhf	SCEAST
Route SCEAST	uhf	direct
Route SCWEST	uhf	direct
Route default	uhf	direct



How it works

Example: MTV wants to send a message to County EOC

In the MTV Radio Room

At the SCNORTH BBS

At the SCEAST BBS

1. JNOS detects that a message was just received.
2. JNOS checks the destination address against the ***rewrite*** file, finds a match with **@sceast**, and changes the address from **XSCEOC@SCEAST** to **XSCEOC**.
3. JNOS kicks off its SMTP Process…
   - moves the message to XSCEOC's local mail box.

In the County Radio Room

SCNORTH's Rewrite File

```
# everything addressed to us from the outside stays here
*%*@scnorth* $1@$2 r
*%*@scsouth* $1@$2 r
*%*@sceast* $1@$2 r
*%*@scwest* $1@$2 r

# everything addressed to a local user stays here.  If they are not really local, 'ALIAS' will fix that.
# *@scnorth* $1
# *@scsouth* $1
*@sceast* $1
# *@scwest* $1

# for remote sites that may be off-line, put them back into the mail queue and keep trying.
*@scnorth* $1@scnorth
*@scsouth* $1@south
# *@sceast* $1@sceast
*@scwest* $1@scwest
```

How it works

Example: MTV wants to send a message to County EOC

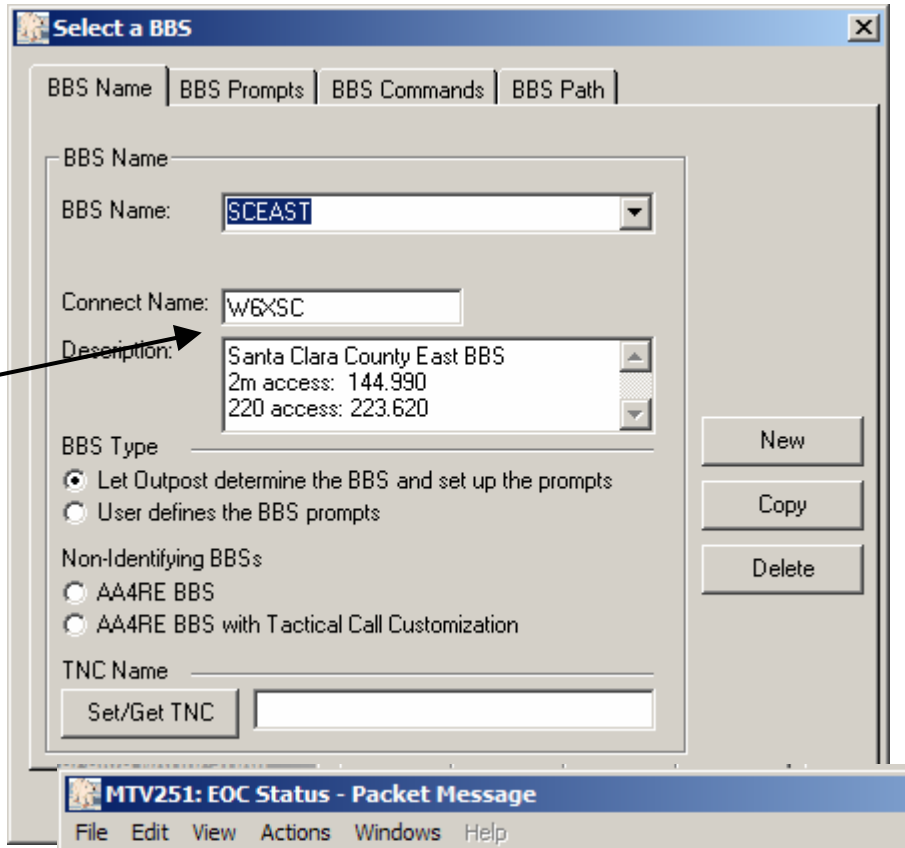
In the MTV Radio Room

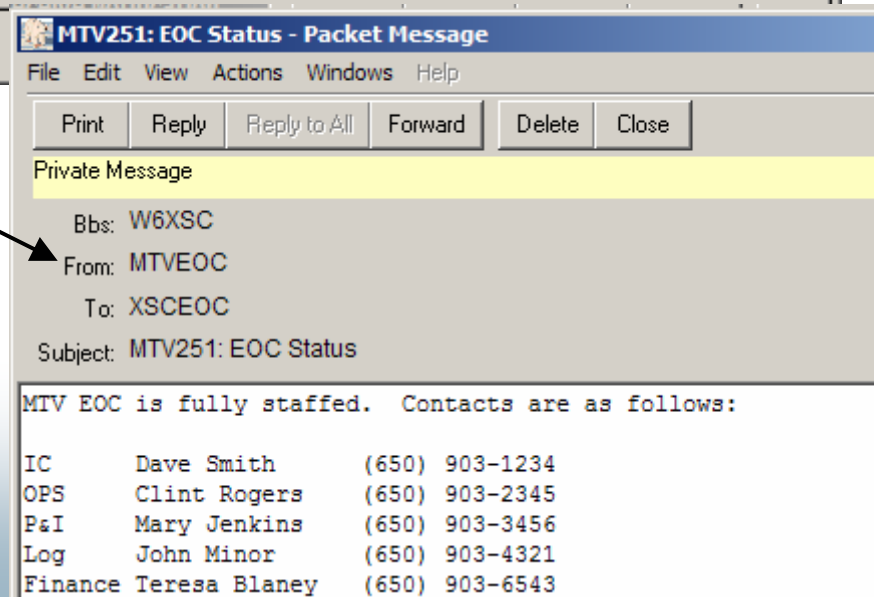
At the SCNORTH BBS

At the SCEAST BBS

In the County Radio Room

1. In Outpost, check that the BBS is set to W6XSC (SCEAST).
2. Check that the radio is set to 223.620 (W6XSC's 220 access frequency).
3. Press ***send/receive!*** to retrieve the message from MTVEOC.





How it works

The network topography and routing

The path to SCSOUTH

1. SCEAST can reach all BBSs directly

SCEAST's Routing Table

Route SCSOUTH	uhf direct
Route SCEAST	uhf direct
Route SCWEST	uhf direct

2. SCNORTH and SCWEST gets to SCSOUTH through SCEAST

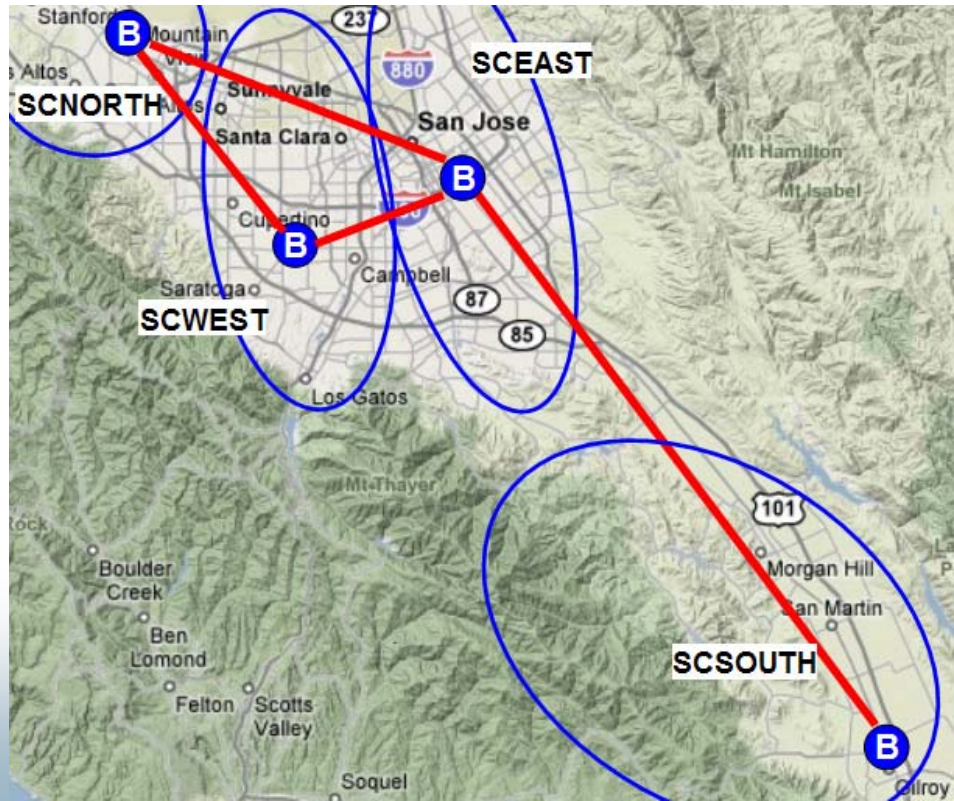
SCNORTH and SEWEST's Routing Table

Route SCSOUTH	uhf	SCEAST
Route SCEAST	uhf	direct
Route SCWEST	uhf	direct
Route default	uhf	direct

3. SCSOUTH gets to SCWEST and SCNORTH through SCEAST

SCSOUTH's Routing Table

route add SCEAST	uhf direct
route add SCNORTH	uhf SCEAST
route add SCWEST	uhf SCEAST



Summary

Implementation Status

1. Proposal approved
2. Frequencies allocated by NCPA
3. IP number block allocated for this system plus some immediate expansions for subsidiary JNOS nodes
4. Implementation in progress
   - SCNORTH... ***Operational!***
   - SCWEST… have all the parts, waiting to put into service
   - SCEAST … will transition after test of two-node system
   - SCSOUTH … temporarily up at developer's house for testing purposes
   - LAH … up as a test system … not scheduled to remain

Summary

Next Steps

1. Get SCWEST on the air
2. Broader test between SCWEST (cup) and SCNORTH (mtv)
3. If all goes well, bring up SCEAST (county) on old 144.910 frequencies. W6XSC-2, -6 digi's work as before.
4. Get SCSOUTH (gilroy) on the air
5. When all nodes are up, move SCEAST from 144.910 to its final frequency

Other ideas: look at converting the digi on Crystal Peak to a traffic-forwarding node (Howard is looking at this proposal) to ensure coverage.

Summary

Considerations

1. Configuration maintenance
2. O/S (Linux) expertise
3. Sysops
4. Designing for the single point of failures
5. Hospital Nets
6. Gateway to the Internet, or Winlink?
7. Intra-county linking with Santa Cruz, San Mateo, Alameda Counties
8. Digipeating with W6XSC-2 and W6XSC-6

Other Packet Changes

1. Outpost v2.4 – in Test, Nov-09 release planned, includes…
    - Address book; supports alias and distribution lists
    - Support for 4 more BBS/PBBSs
    - Various user productivity enhancements, including
        - BBS/TNC recently used
        - BBS friendly name
        - BBS and TNC config cloning
    - Script enhancements
    - Prep for handling “Attachments” and B2F with Winlink
    - Updated Docs and HOW-TO’s

Thank you

Any Questions?