

Packet Updates in Santa Clara County

SVECS – Silicon Valley Emergency Communications System

Santa Clara, CA

24 October 2009

Jim Oberhofer KN6PE

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**

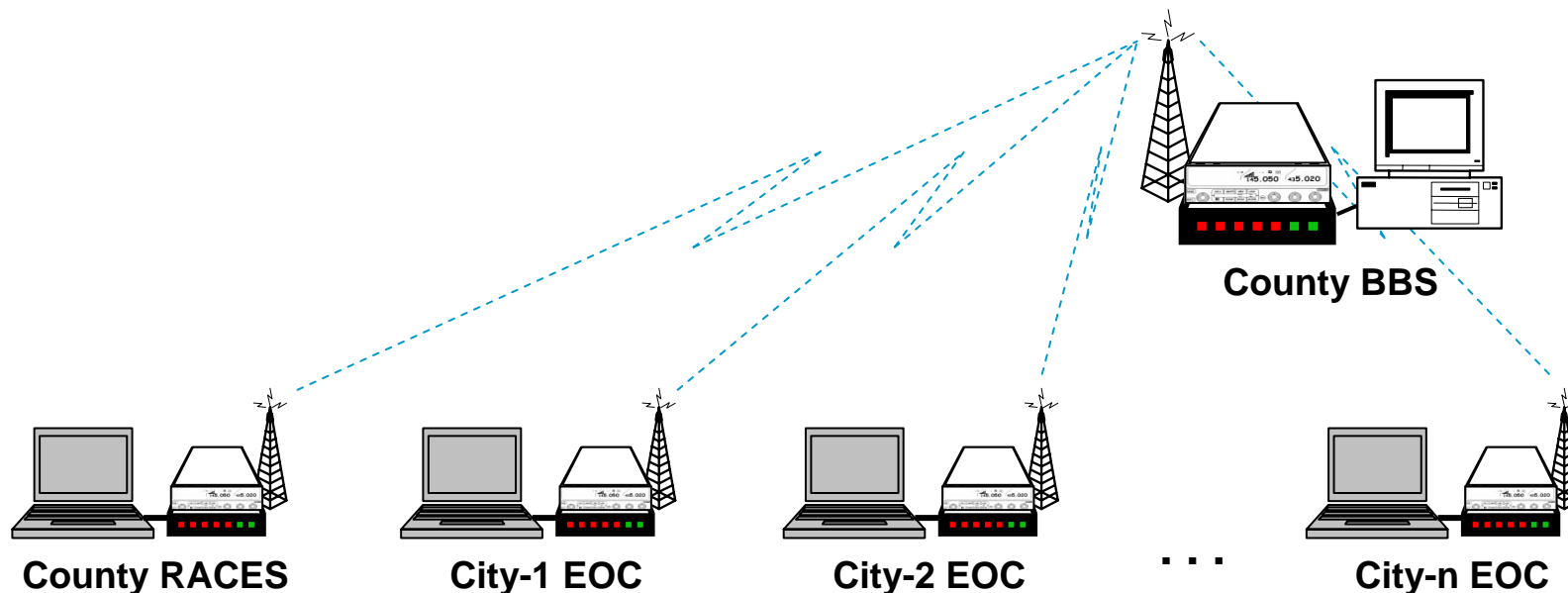
Why use Packet Radio?

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.

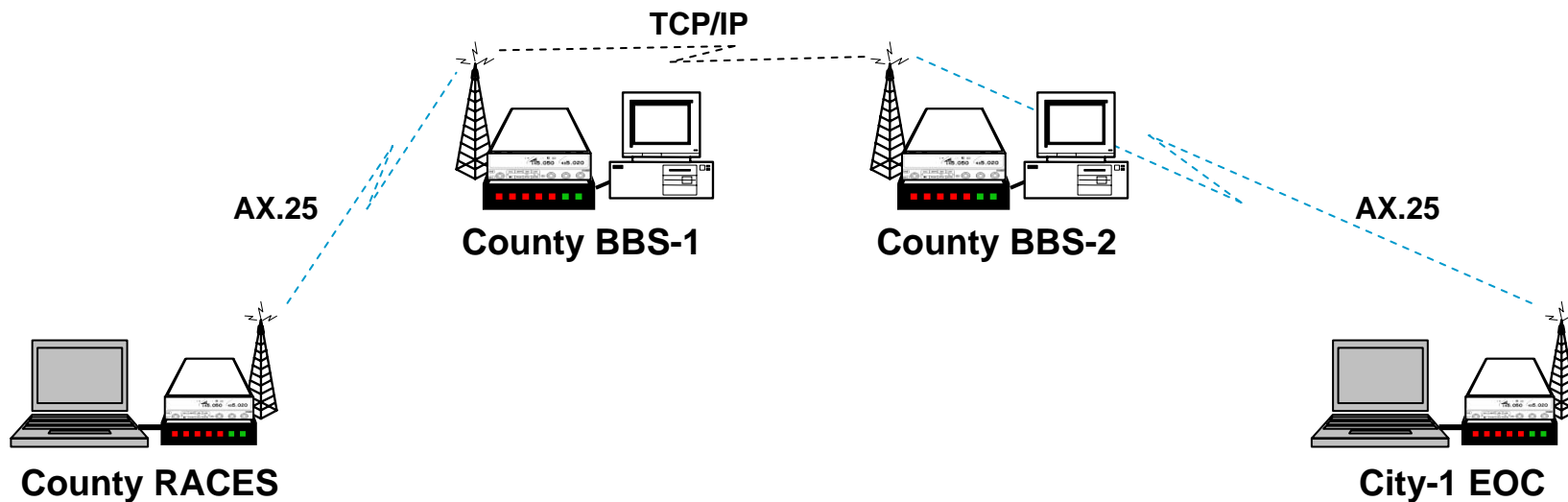


Why use Packet Radio?

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?

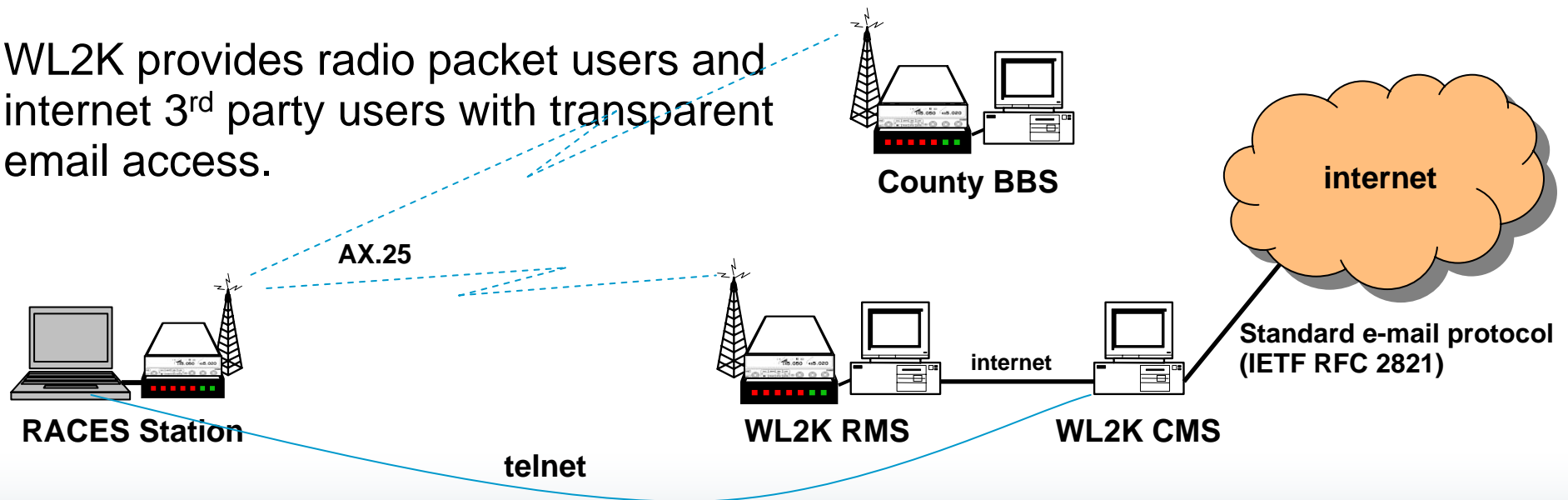
The case for packet radio

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.

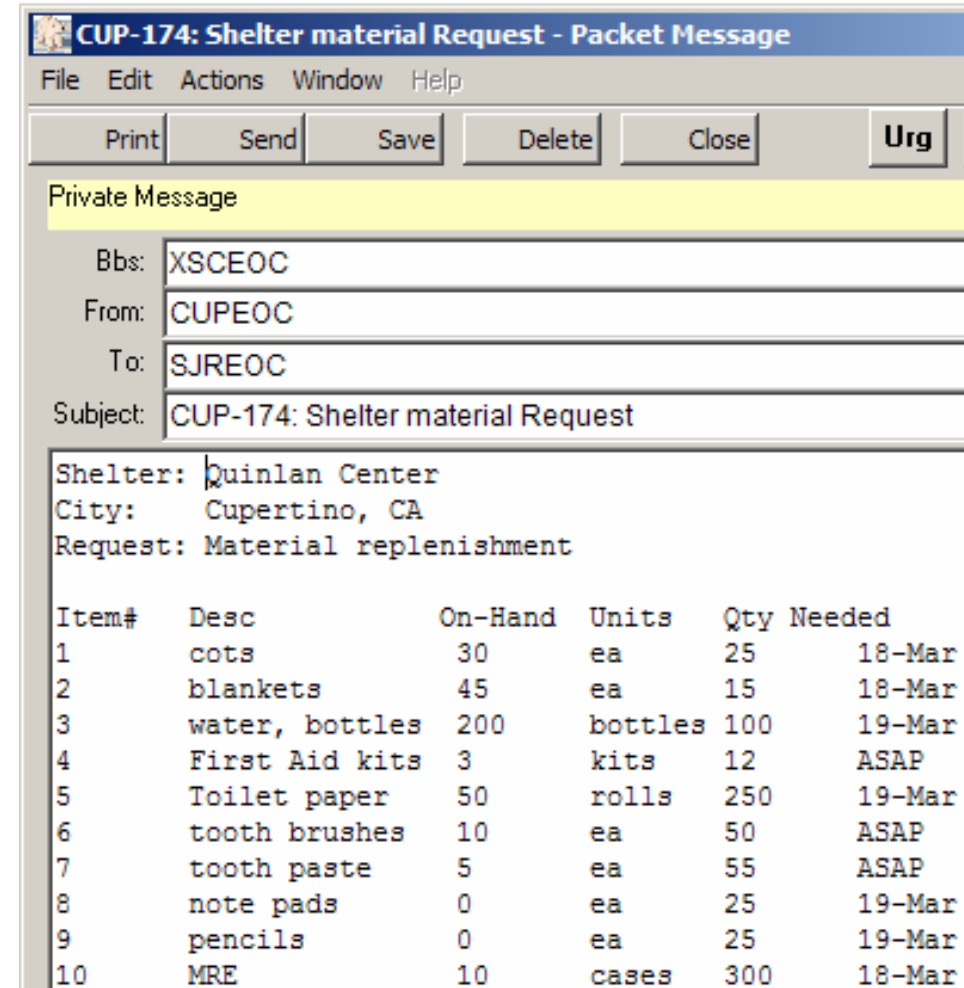


Why use Packet Radio?

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.



CUP-174: Shelter material Request - Packet Message

File Edit Actions Window Help

Print Send Save Delete Close Urg

Private Message

Bbs: XSCEOC

From: CUPEOC

To: SJREOC

Subject: CUP-174: Shelter material Request

Shelter: Quinlan Center
City: Cupertino, CA
Request: Material replenishment

Item#	Desc	On-Hand	Units	Qty Needed	
1	cots	30	ea	25	18-Mar
2	blankets	45	ea	15	18-Mar
3	water, bottles	200	bottles	100	19-Mar
4	First Aid kits	3	kits	12	ASAP
5	Toilet paper	50	rolls	250	19-Mar
6	tooth brushes	10	ea	50	ASAP
7	tooth paste	5	ea	55	ASAP
8	note pads	0	ea	25	19-Mar
9	pencils	0	ea	25	19-Mar
10	MRE	10	cases	300	18-Mar

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

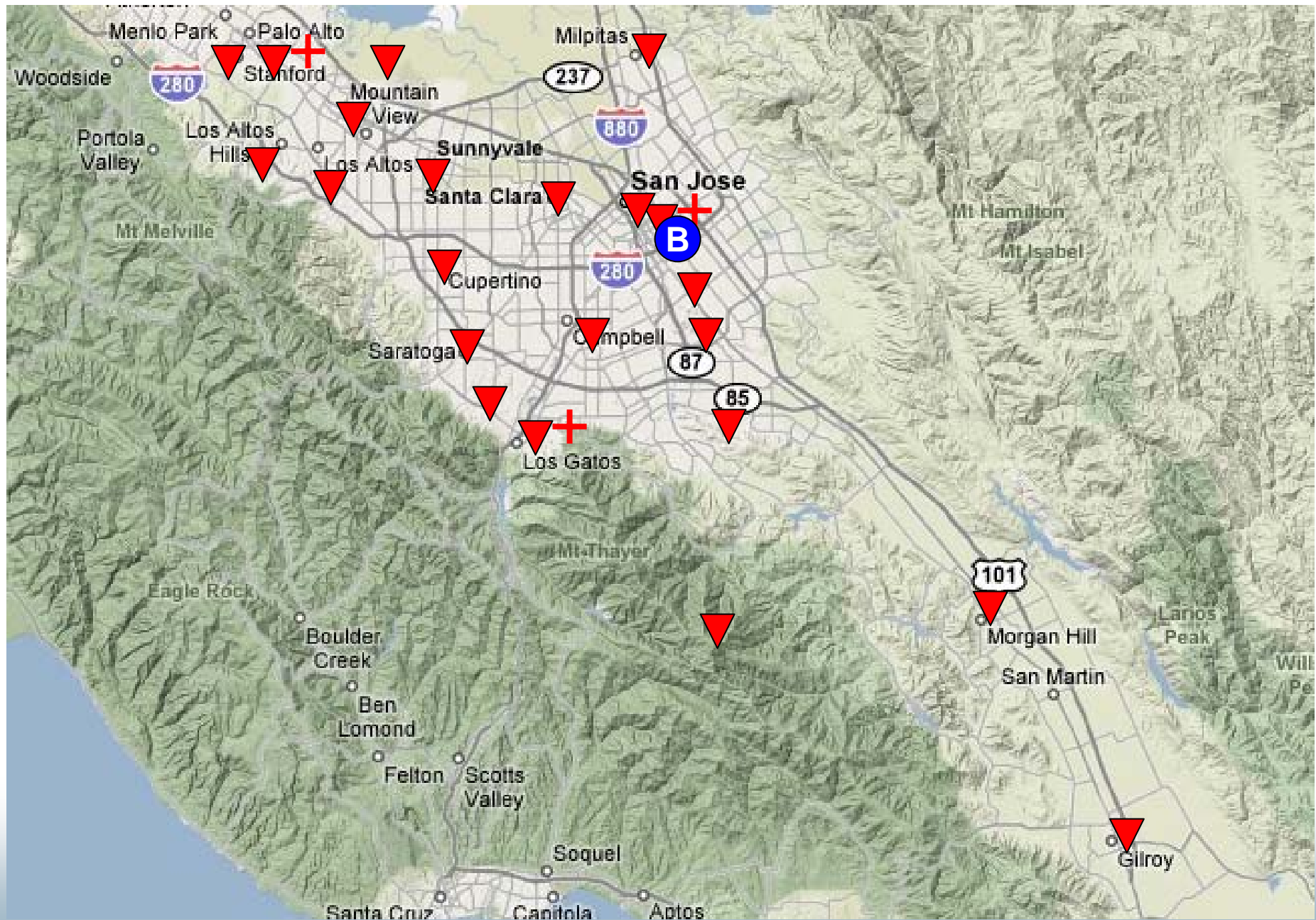
- Various cities in the county
- 14 County hospitals

***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

EOC MESSAGE FORM
PacFORMS adaption of SCCo ICS Form 213 (Ver. 2.0)
By Phil Henderson, KF6ZSQ
(This form works with Outpost/OpDirect for Automatic ASCII text save)
For Instructions using this form [Click Here.](#)

2.) When Receiving Msg.:
Senders's msg. #

1a.) Date: (MM/DD/YY) 03/10/2009

1b.) Time: (24 hour clock) 2202
0001 to 2400
2:00 PM = (2+12)=1400 Hrs.

4.) Situation Severity (Select One)
 EMERGENCY (e.g., Life Threat)
 URGENT (e.g., Property Threat)
 OTHER (All Others)

5.) Msg. Handling Order (Select One)
 IMMEDIATE (As Soon as Possible)
 PRIORITY (Less Than One Hour)
 ROUTINE (More Than One Hour)

7.) ICS Position: (required)

9a.) Location: (required)

Name: (optional)

Telephone #: (optional)

8.) ICS Position: (required)

9b.) Location: (required)

Name: (optional)

Telephone #: (optional)

10.) SUBJECT:

New Packet Message

File Edit Actions Help

Print Send Save Close Urg Pvt Bul NTS

Private Message; Delivery Receipt Requested

Bbs: WBXSC-1

From: CUPEOC

To: XSCEOC

Subject: Status of Cupertino EOC

The following operating positions are staffing at the EOC:

Director Emergency Services	Dave Knapp	777-1234
Planning/Intel Section	Bob Knight	777-2345
Logistics Section	Ken Smith	777-3456
Operations Section	Bill Wright	777-4567
Finance Section	Trudy Collins	777-5678

All phone numbers are in the 408 area code.

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.

continuing where jnos 1.11f left off

JNOS 2.0

by Maiko Langelaar / VE4KLM

*Packet Radio / IP router / node / BBS
HF connectivity / forwarding
Internet Gateway / Telnet node / Email
APRS Services*

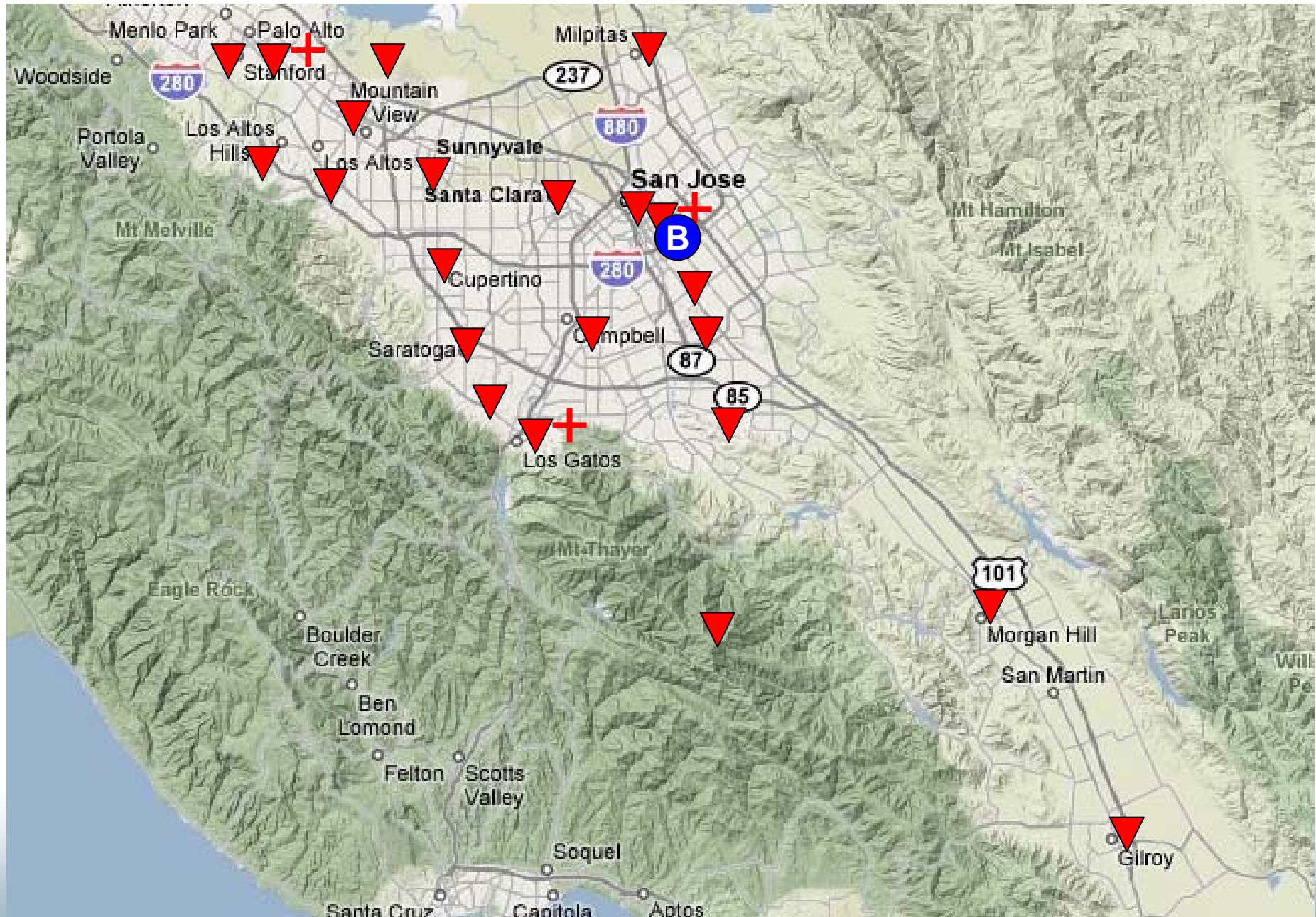
City / agency alignment

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.

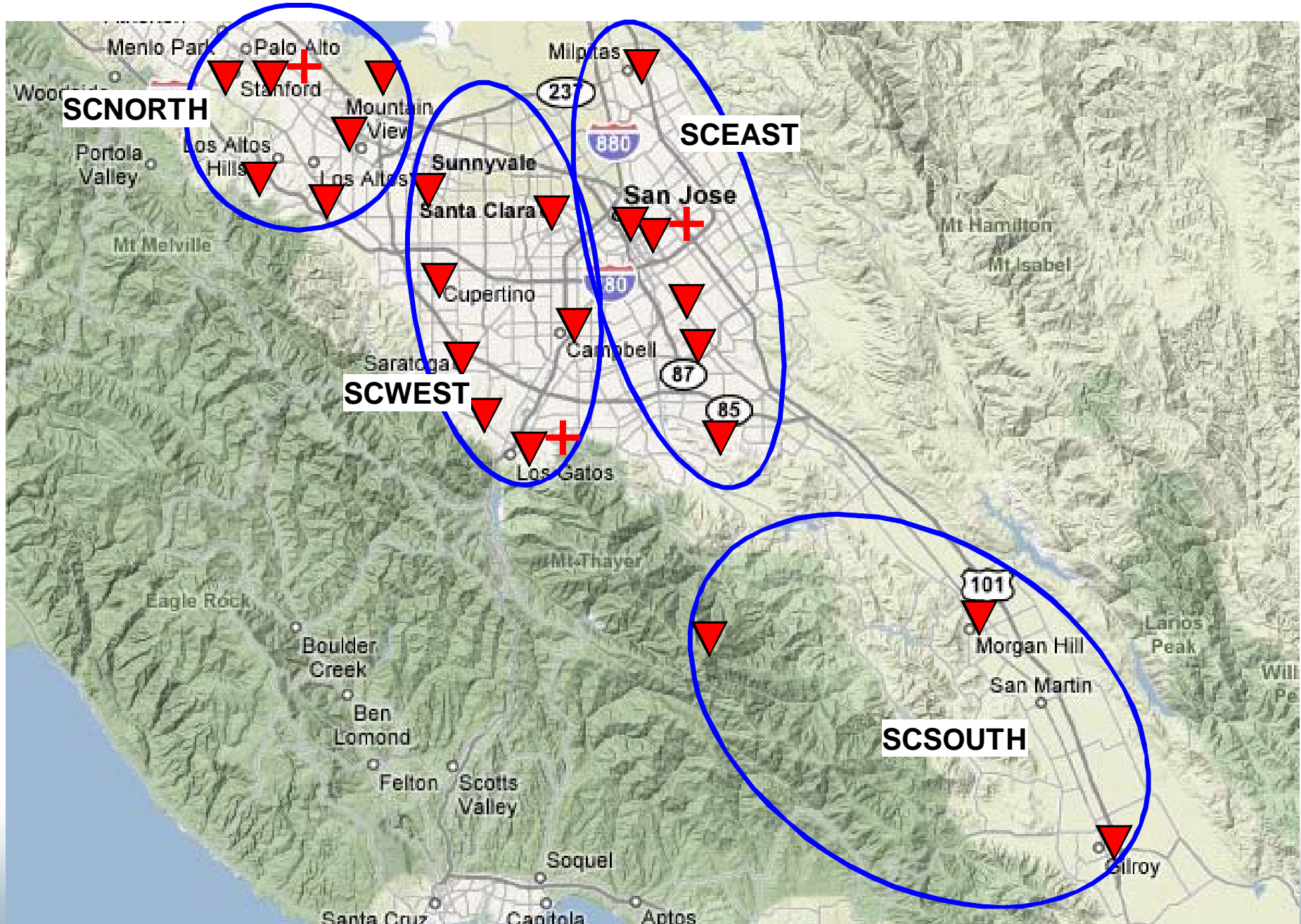
Where is everybody?

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

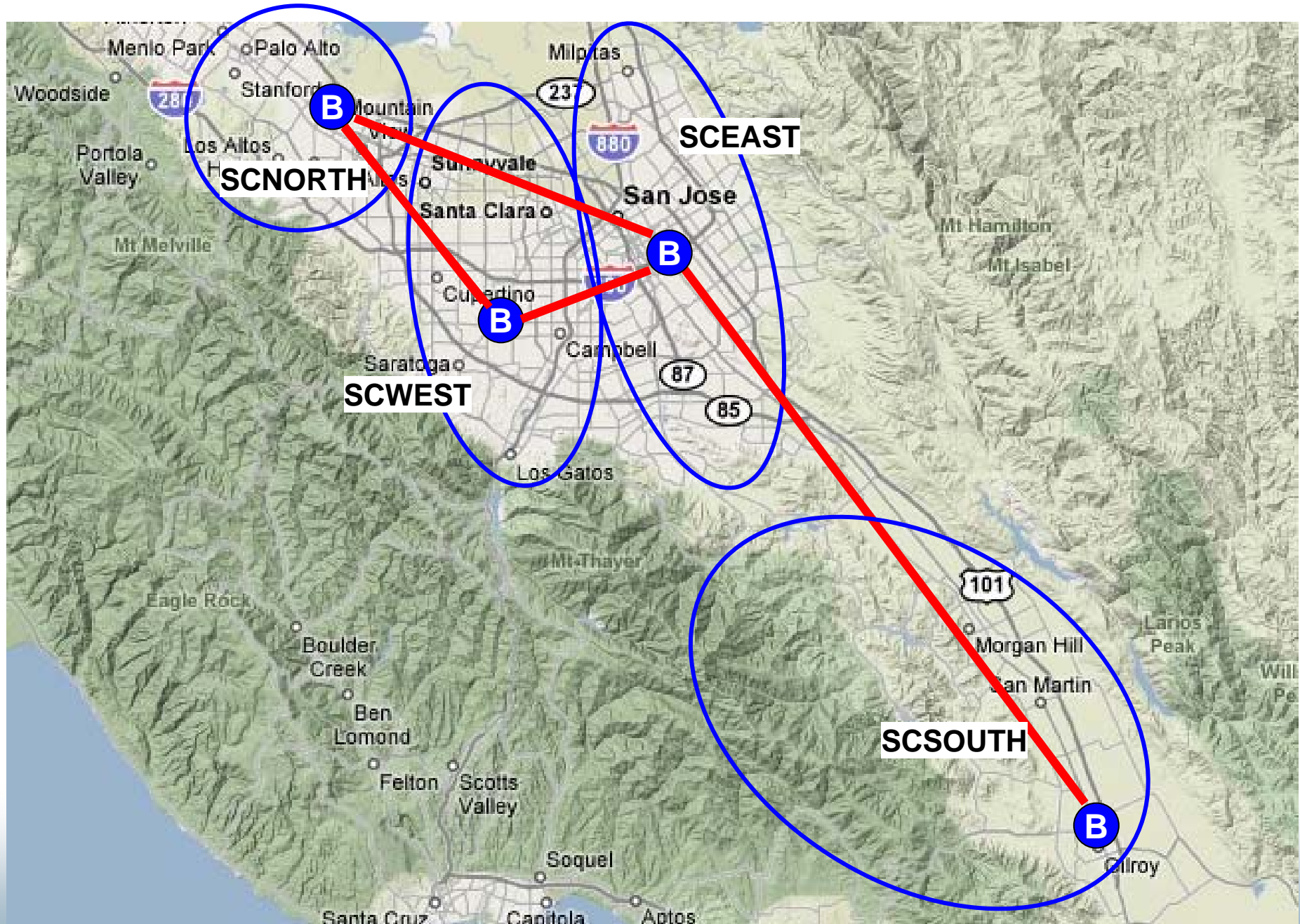
Enhanced County Packet System

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

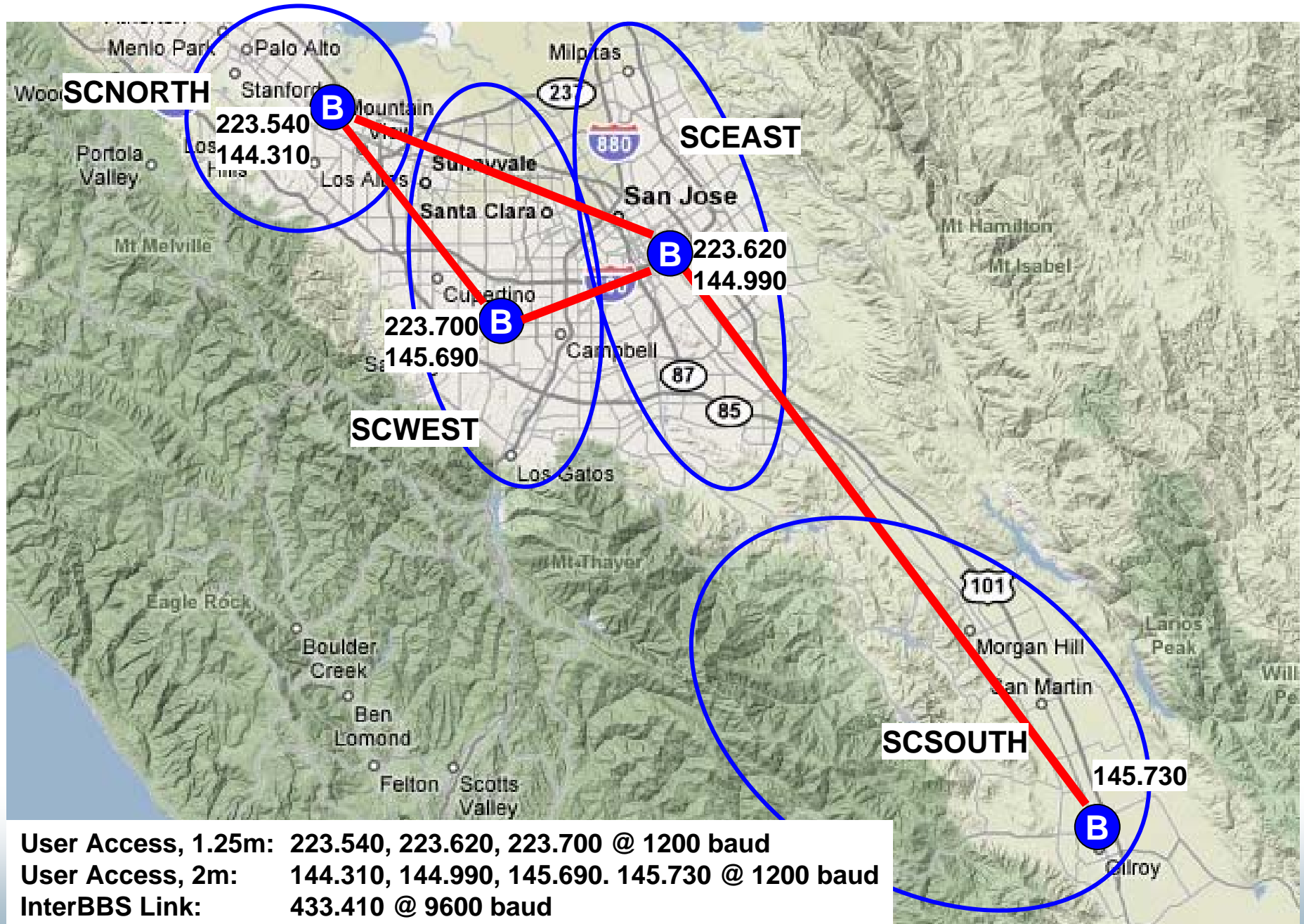
Enhanced County Packet System

- Users access the BBS on different 2 meter and 220 MHz frequencies using standard AX.25 packet with existing equipment at 1200 baud.
- 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

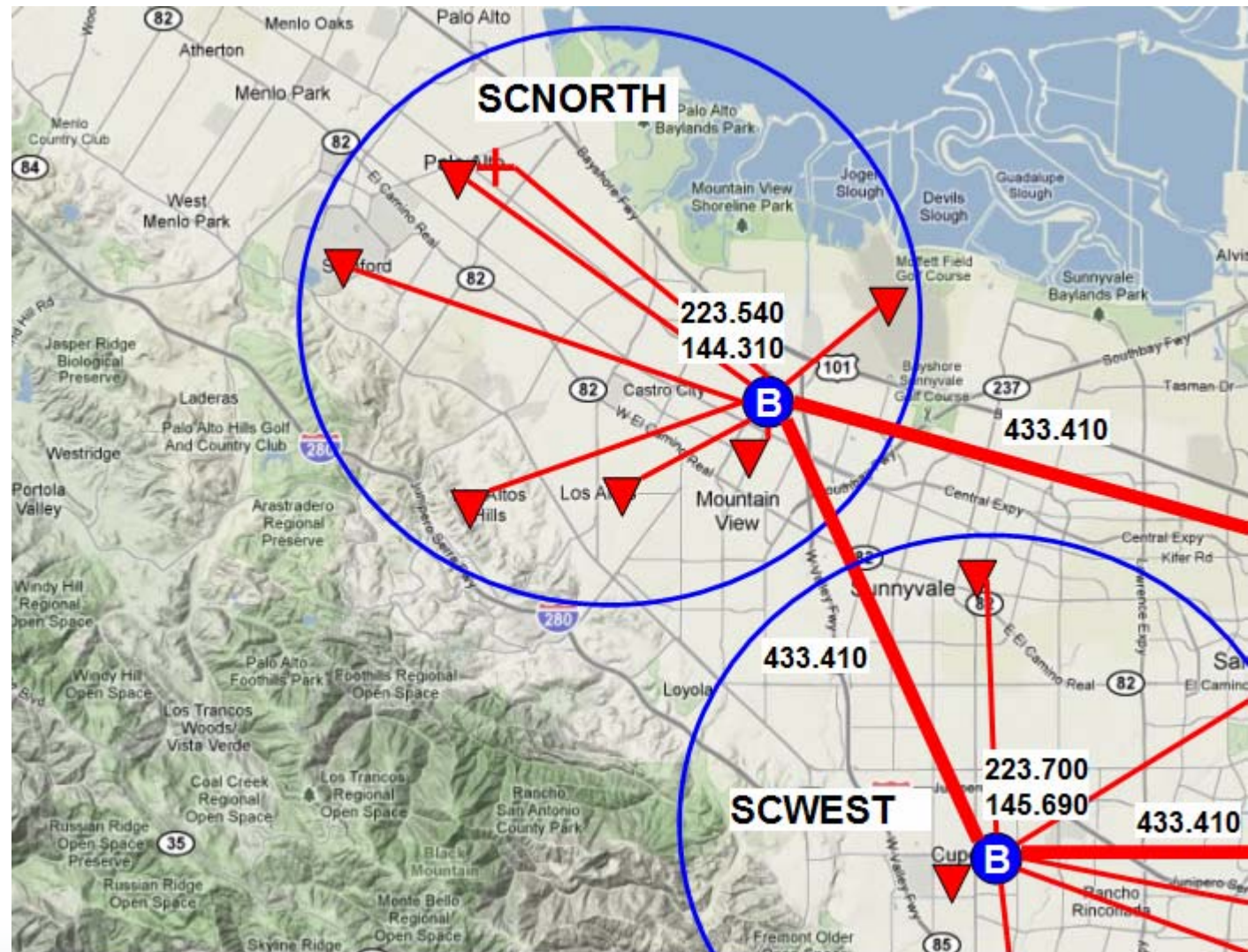
Enhanced County Packet System



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

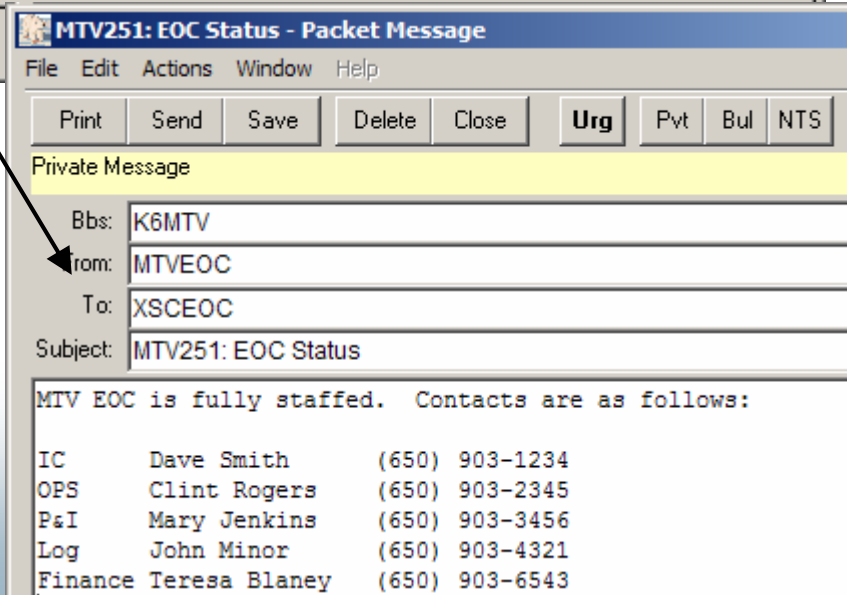
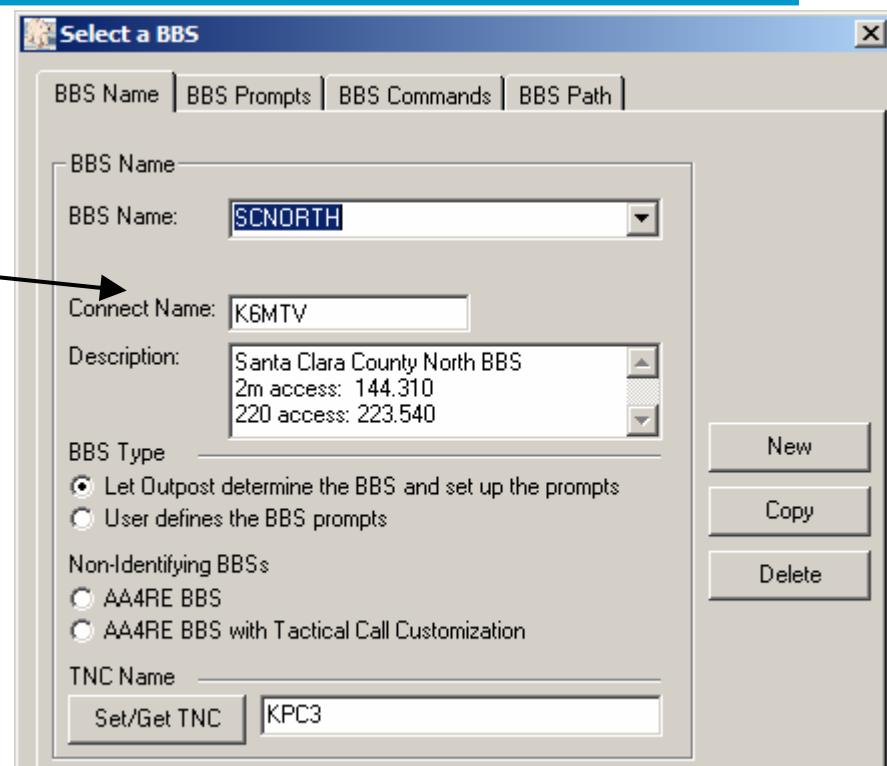
In the MTV Radio Room

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

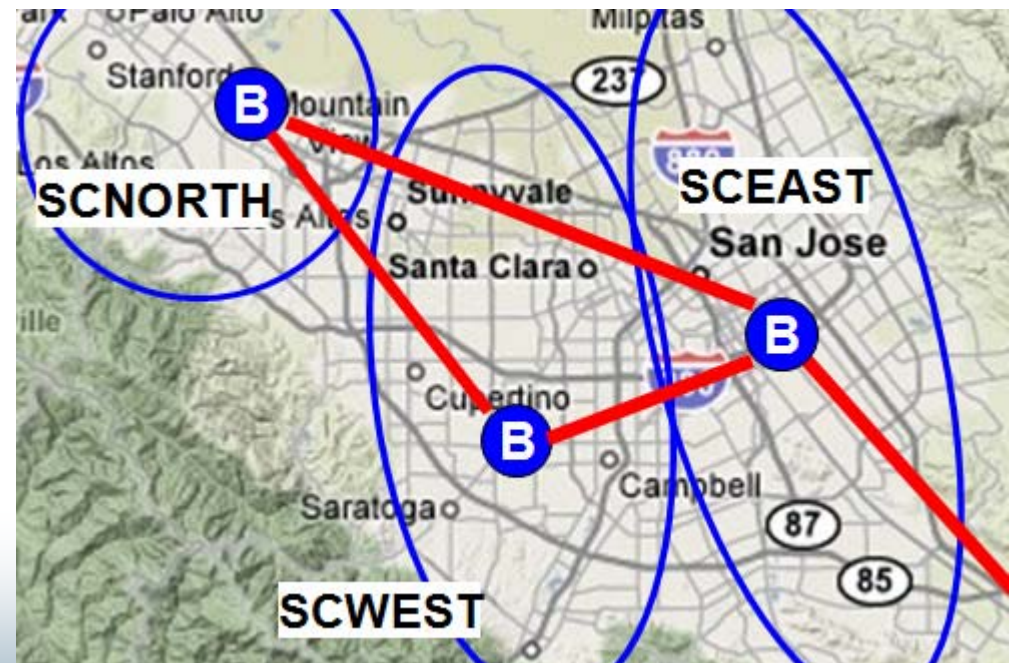
1. JNOS detects that a new message was just received.
2. JNOS checks the destination address against the *alias* file, determines that XSCEOC is not a local user, and changes the address from XSCEOC to XSCEOC@SCEAST.
3. JNOS kicks off its SMTP Process...
 - Looks up the **route** to SCEAST... Direct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

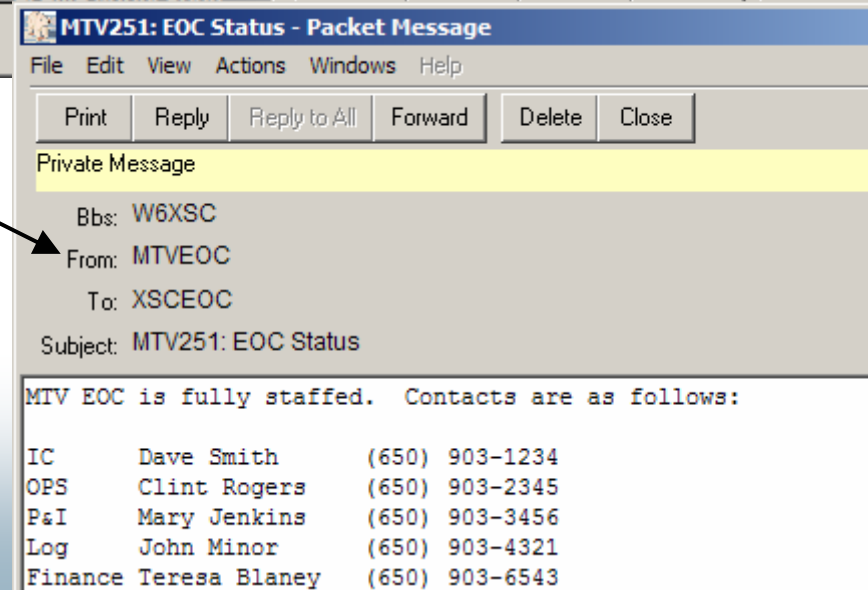
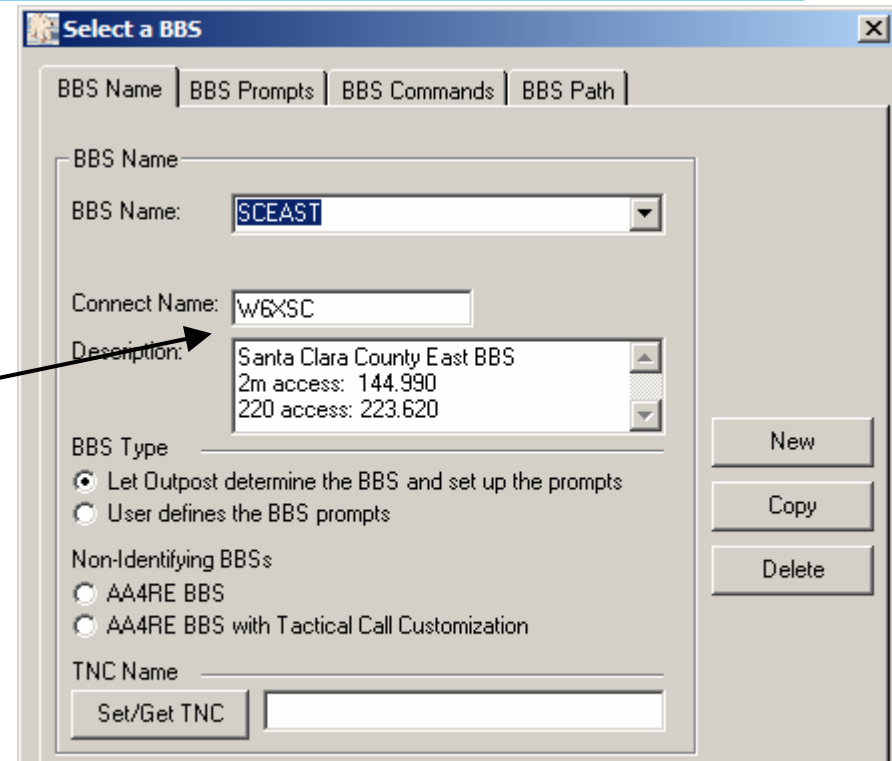
In the MTV Radio Room

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

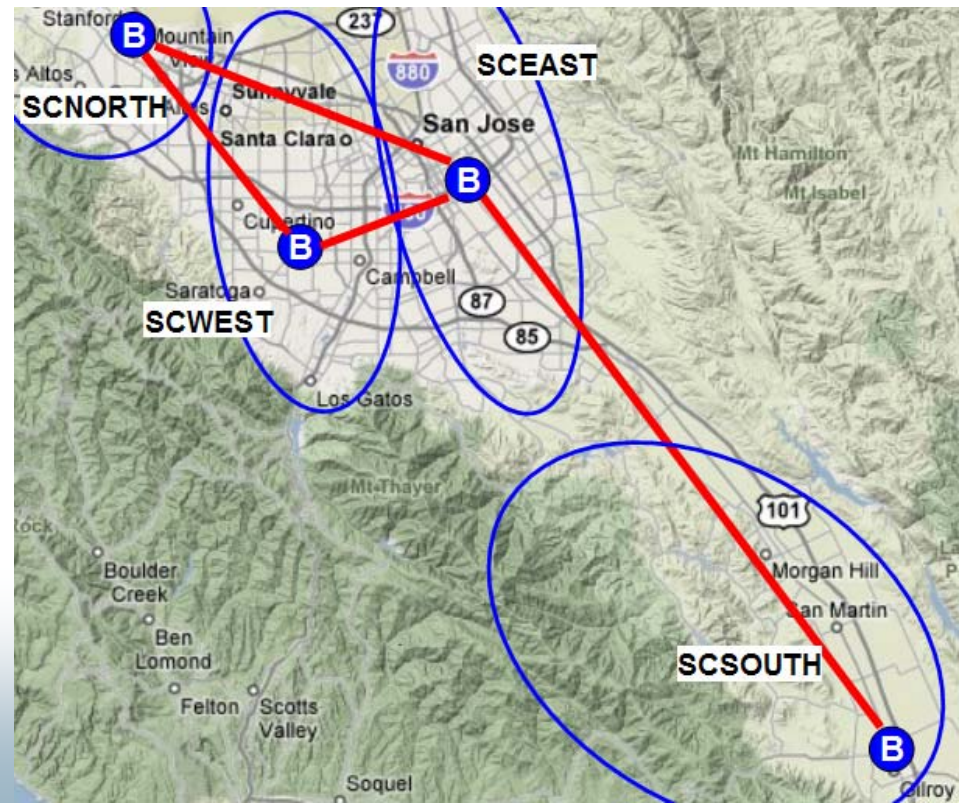
SCNORTH and SEWEST's Routing Table

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?

