Cupertino Amateur Radio Emergency Service

Topic: Introduction to Packet

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Date: Thursday, 05-March-2009, 19:30

Event: Cupertino ARES Meeting, Orientation Training

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Topics

1. What is Packet Radio

2. The "Why's" for Packet Radio

3. Packet Radio Components

4. Introduction to Outpost

5. Deploying Packet

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What is Packet Radio?

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What is Packet Radio?

… in a nutshell

- Amateur Packet Radio is one of many digital modes that Hams can use to build wireless computer networks

- Amateur Packet is built on the AX.25 protocol, a mature extension of the industry standard X.25. With this protocol, comes transparency, error correction, and automatic control

- Data transfer speeds range from 1200 baud up to 19.6K Baud (higher speeds = wider bandwidth)

- Packet establishes a "private connection" between two stations while sharing a frequency with other stations

- Packet can use Bulletin Board Systems (BBSs) for dropping off and retrieve messages between users

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What is Packet Radio?

What are the components?
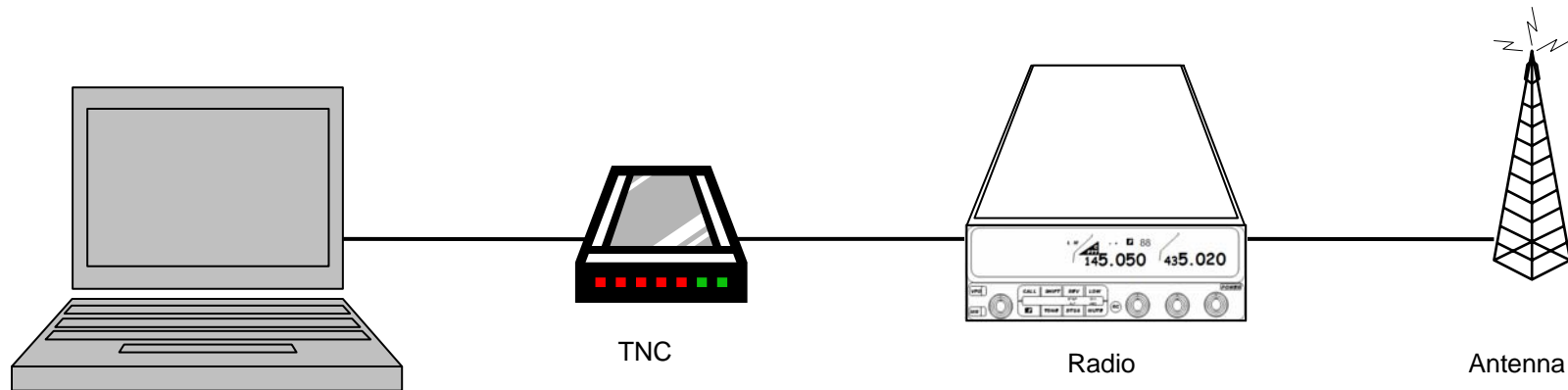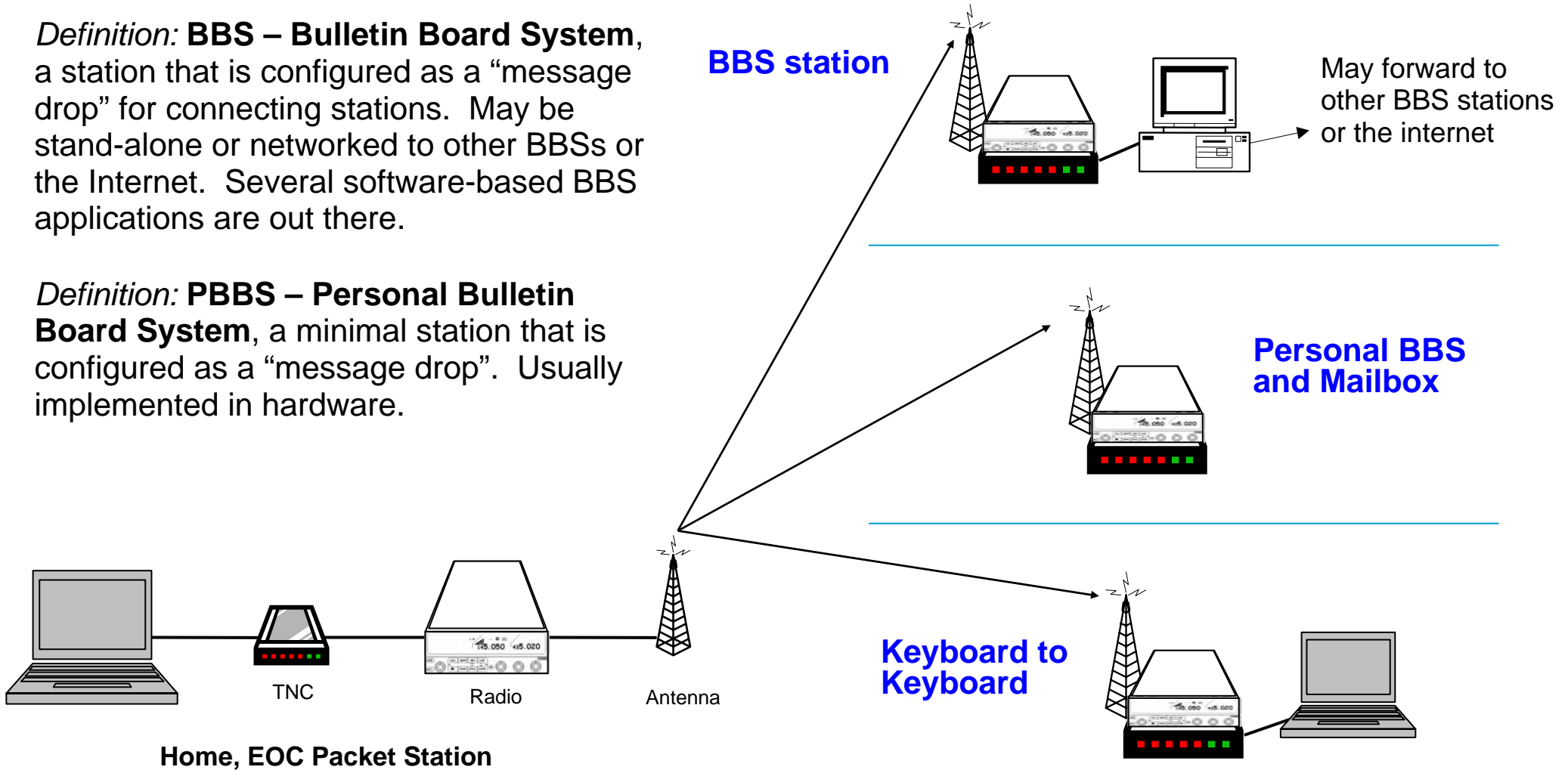

TNC   Radio   Antenna

- **Computer:**   runs a "terminal emulation" program

- **TNC:**   Terminal Node Controller; similar to a telephone modem; the interface between your radio and your computer; may be hardware or software

- **Radio:**   and antenna; transmits the digital data sent to the TNC to another packet station

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What is Packet Radio?

What can we connect to?

Definition: **BBS – Bulletin Board System**, a station that is configured as a "message drop" for connecting stations. May be stand-alone or networked to other BBSs or the Internet. Several software-based BBS applications are out there.

Definition: **PBBS – Personal Bulletin Board System**, a minimal station that is configured as a "message drop". Usually implemented in hardware.

BBS station

May forward to other BBS stations or the internet

Personal BBS and Mailbox

Keyboard to Keyboard

TNC

Radio

Antenna

Home, EOC Packet Station

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Why use Packet Radio?

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Why use Packet Radio?

The case for Packet

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.


County BBS

County RACES   City-1 EOC   City-2 EOC   . . .   City-n EOC

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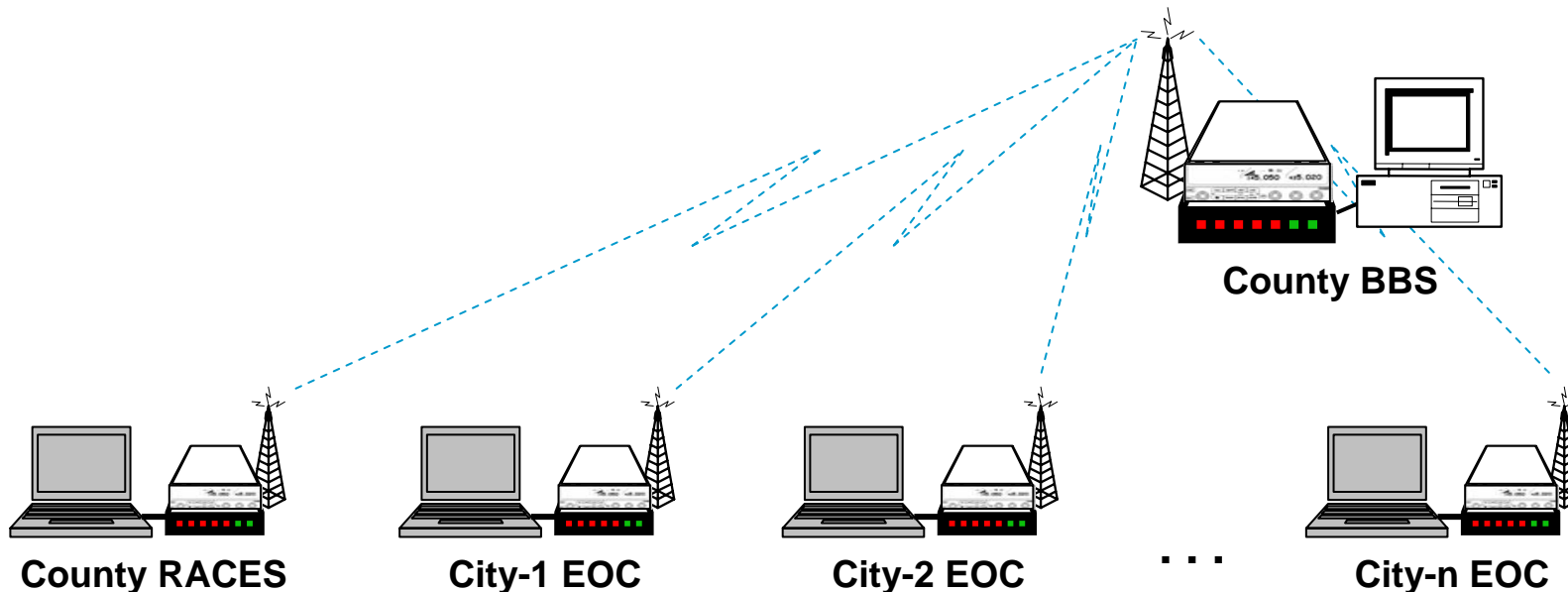
Why use Packet Radio?

The case for Packet

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.

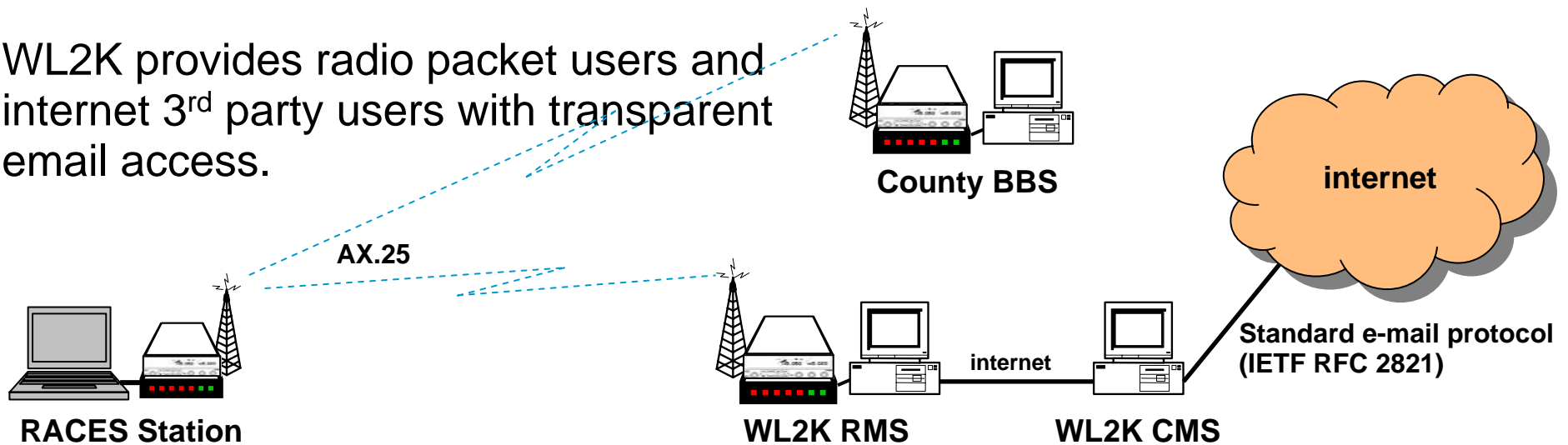- TCP/IP is also used to support interlinking BBSs together

TCP/IP

AX.25

County BBS-1

County BBS-2

AX.25

County RACES

City-1 EOC

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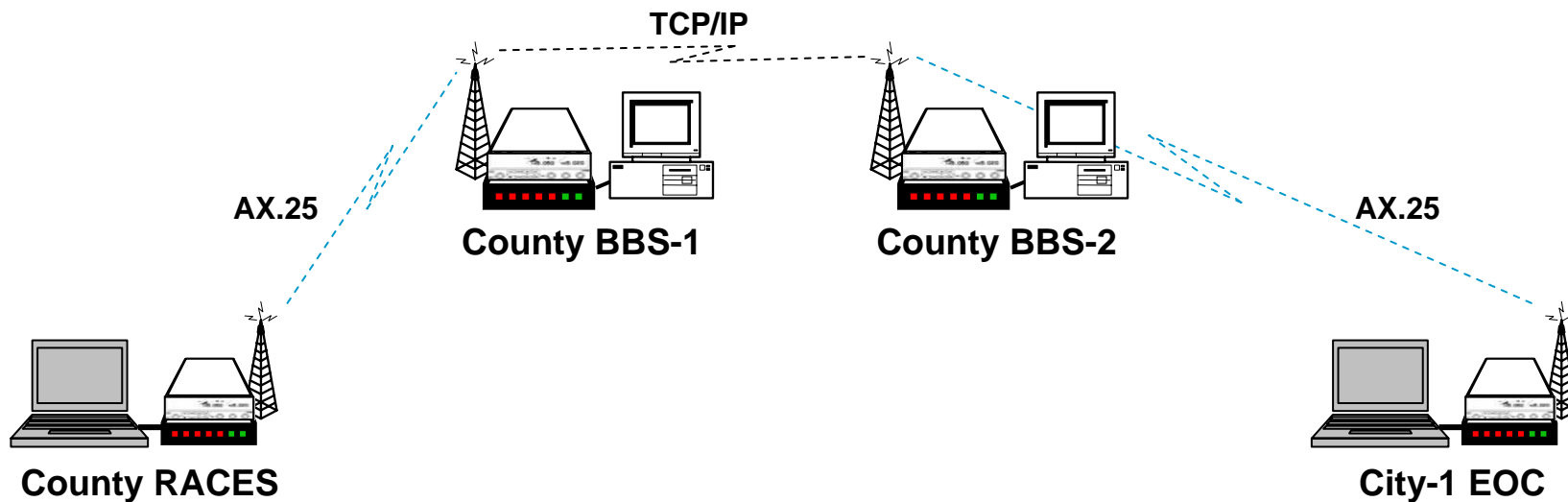
Why use Packet Radio?

The case for Packet

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.

County BBS

internet

AX.25

RACES Station

WL2K RMS   internet   **WL2K CMS**

Standard e-mail protocol (IETF RFC 2821)

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Why use Packet Radio?

The case for Packet

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
```

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Why use Packet Radio?
The case for Packet

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 via *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).

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Why use Packet Radio?
The case for Packet

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 the recent Chino Hills Earthquake…
  - Magnitude 5.4 Earthquake
  - phones in the San Bernardino County Sheriff's station worked only intermittently
  - telephone companies reported no physical damage to telecommunications facilities.
  - 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

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Why use Packet Radio?

The case for Packet

7. Packet aligns with how we work today

- Message complexity and timeliness of delivery drives how we use…
  - The telephone versus email (during non-emergencies)
  - the radio versus 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	Many commands to learn (native Packet)

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Packet Radio Components

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Packet Radio Components

What are the components?

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Connecting PCs to Radios

TNCs… Terminal Node Controllers

- Interface between the computer and the radio

- Can be implemented in Hardware or Software

  Hardware

  - Kantronics

  - Timewave

  - PacComm

  Software

  - AGWPE

    - Pre-built interfaces

    - Sound Card Packet

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Connecting PCs to Radios – options

PC, TAPR2 TNC, Radio
  Pros: easy integration
  Cons: more HW Cost

TAPR2 TNC   Radio   Antenna
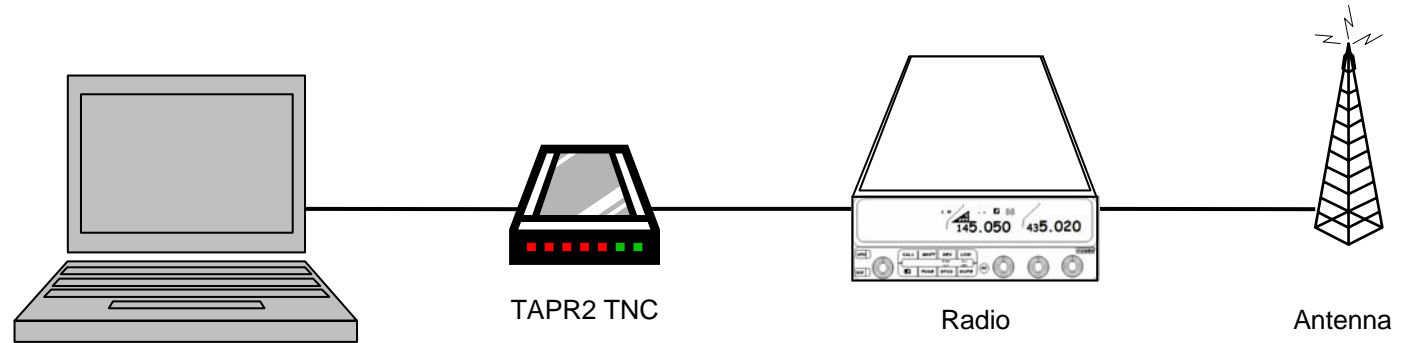
PC, AGWPE Software
KISS TNC, Radio
  Pros: cheaper HW
  Cons: SW config

KISS   KISS TNC   Radio   Antenna
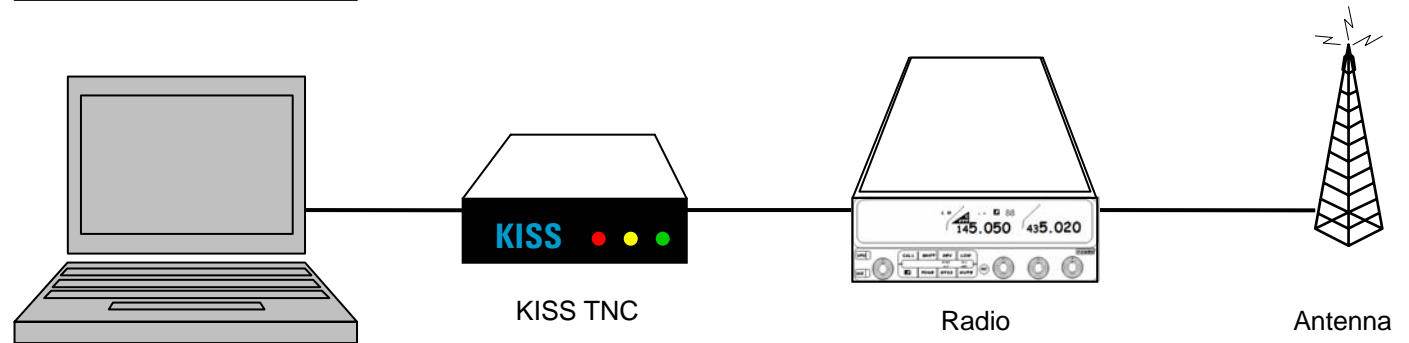
PC, AGWPE Software
Sound Card IF, Radio
  Pros: very cheap Interface
  Cons: SW config, IF
      assembly required

Sound Card IF
Components   Radio   Antenna

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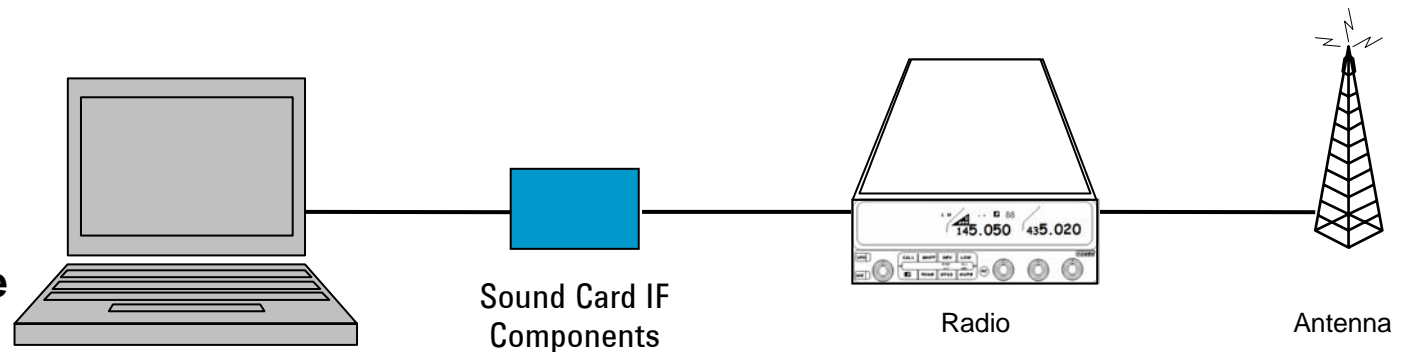
Connecting PCs to Radios

Hardware approach

Some (not all) TAPR2-compatible TNCs

Tucson Amateur Packet Radio (TAPR): the organization that created the protocol standard (AX.25) for today's TNCs.

~$169

~$169

~$220

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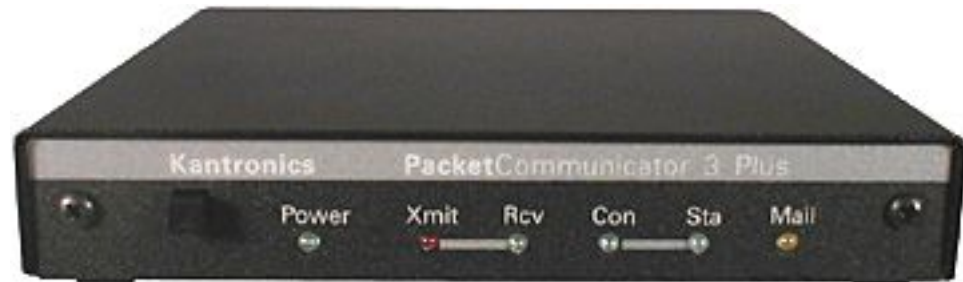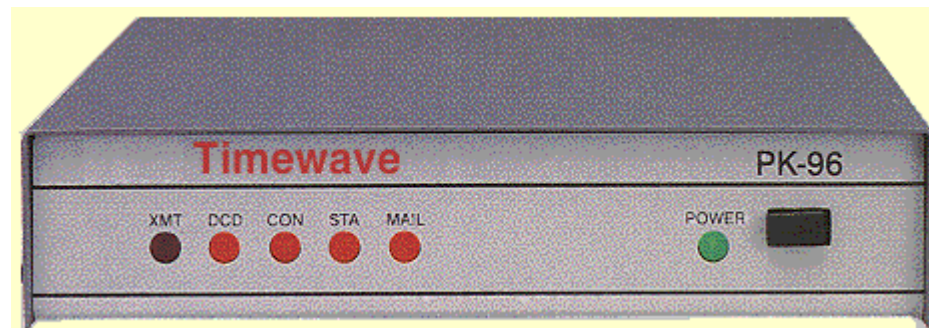
Connecting PCs to Radios

$45-60

Software and Hardware appaorch

- **AGWPE**

  - SV2AGW's Packet Engine

  - TNC management Program

  - Controls TNCs that run in KISS

  - Kits and Pre-assembled Interfaces

    - Tigertronics… SignaLink

    - West Mountain Radio … RigBlaster

    - MFJ… 1275, 1275M

  - Or, use a PC's sound Card for packet

$50

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Connecting PCs to Radios

Interface Cables

PC-to-TNC

- Standard serial modem cable

- USB-to-Serial, Standard serial modem cable

TNC-to-Radio
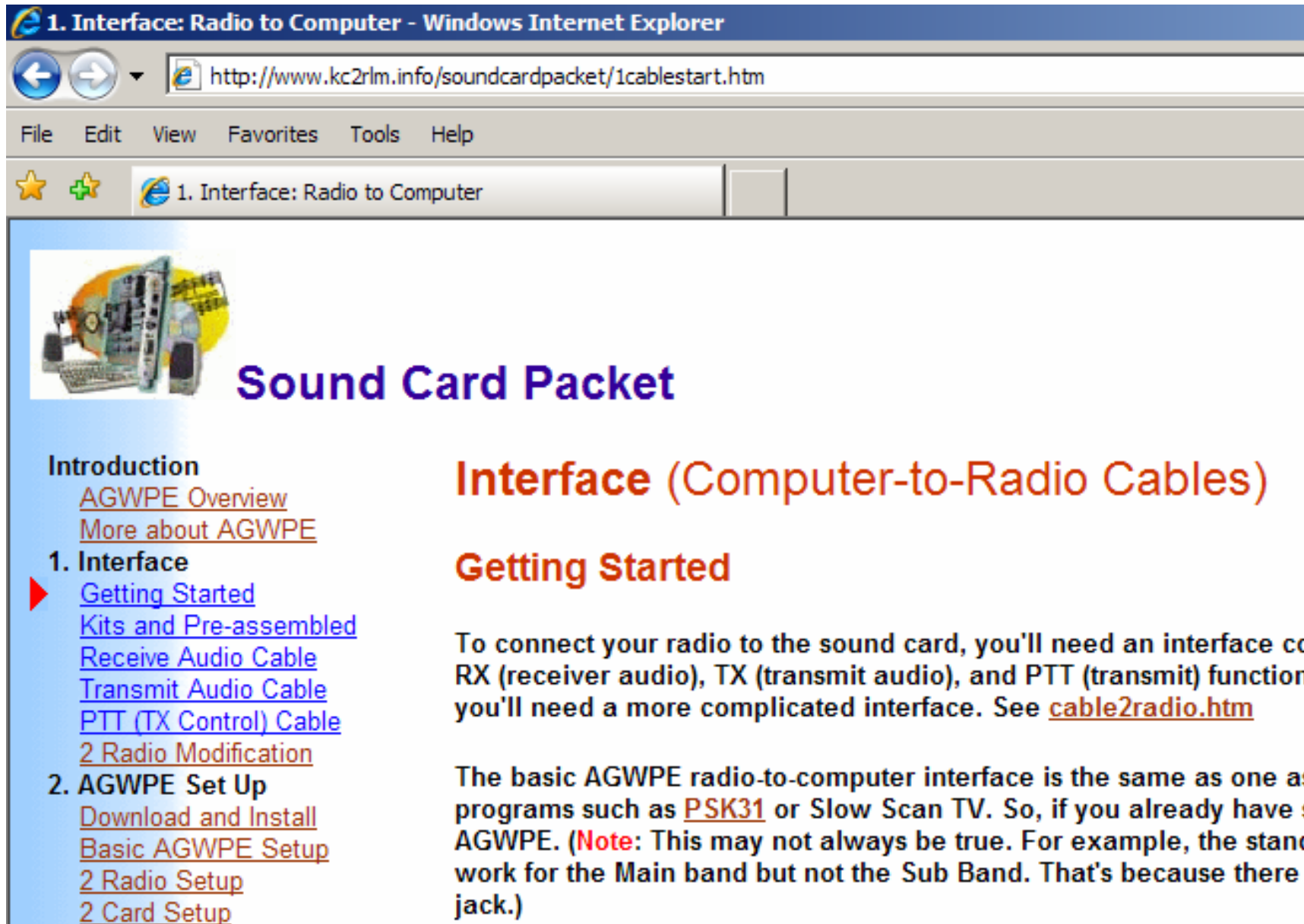
- custom… each Radio has a different pin-out for Audio-in, Audio-out, and PTT

PC-to-Radio (sound-card packet)

- Or build your own AGWPE-Sound Card Packet… http://www.kc2rlm.info/soundcardpacket/

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Sound Card Packet

Screenshot of web browser showing:

Interface (Computer-to-Radio Cables)

Getting Started

To connect your radio to the sound card, you'll need an interface co RX (receiver audio), TX (transmit audio), and PTT (transmit) function you'll need a more complicated interface. See cable2radio.htm

The basic AGWPE radio-to-computer interface is the same as one as programs such as PSK31 or Slow Scan TV. So, if you already have AGWPE. (Note: This may not always be true. For example, the stand work for the Main band but not the Sub Band. That's because there jack.)

Navigation menu:
- Introduction
  - AGWPE Overview
  - More about AGWPE
- 1. Interface
  - Getting Started
  - Kits and Pre-assembled
  - Receive Audio Cable
  - Transmit Audio Cable
  - PTT (TX Control) Cable
  - 2 Radio Modification
- 2. AGWPE Set Up
  - Download and Install
  - Basic AGWPE Setup
  - 2 Radio Setup
  - 2 Card Setup

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Sound Card Packet – Receive Audio

http://www.kc2rlm.info/soundcardpacket/

Receive Audio to Sound Card LINE IN Jack

Transformer

Sound Card
LINE IN Plug

Radio RX Audio

Shield

RX to Tip

Radio Ground

Ground to Sleeve
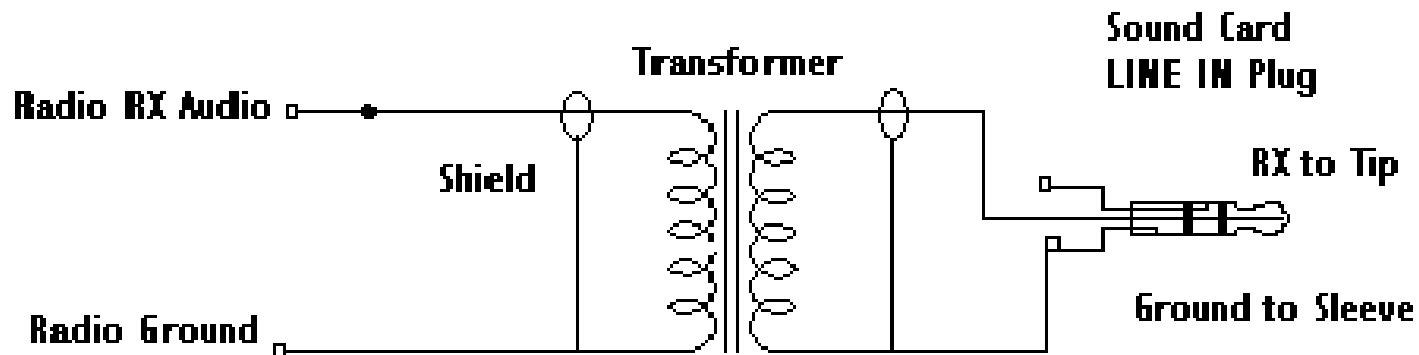
Receive Audio to Sound Card MIC Jack with 10:1 Attenuation

1:1 Transformer

Sound Card MIC Plug

Radio RX
Audio Out

100K

RX to Tip

10K

Ground to Sleeve

Radio Ground

Shield
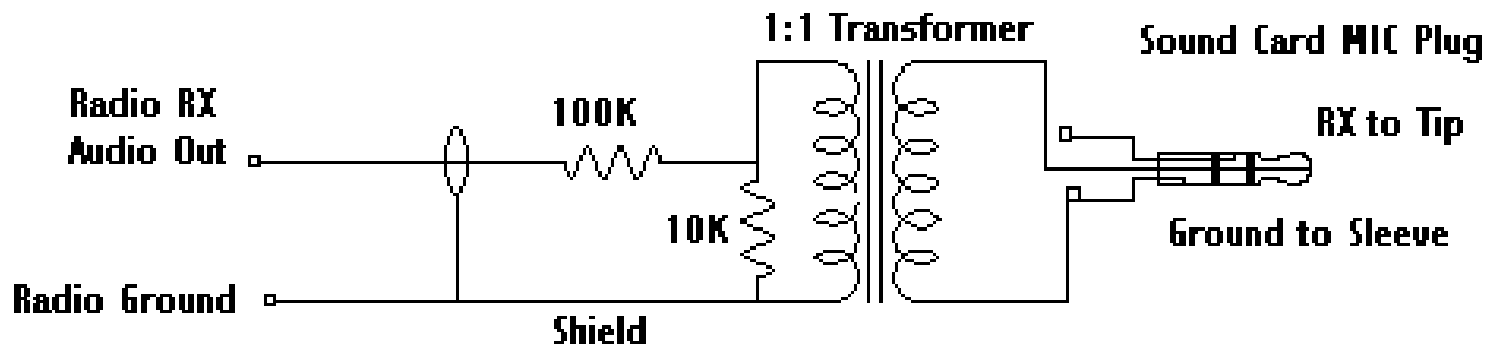
Radio Shack #273-1374 for a 1:1 or #273-1380 for a 1000:8.
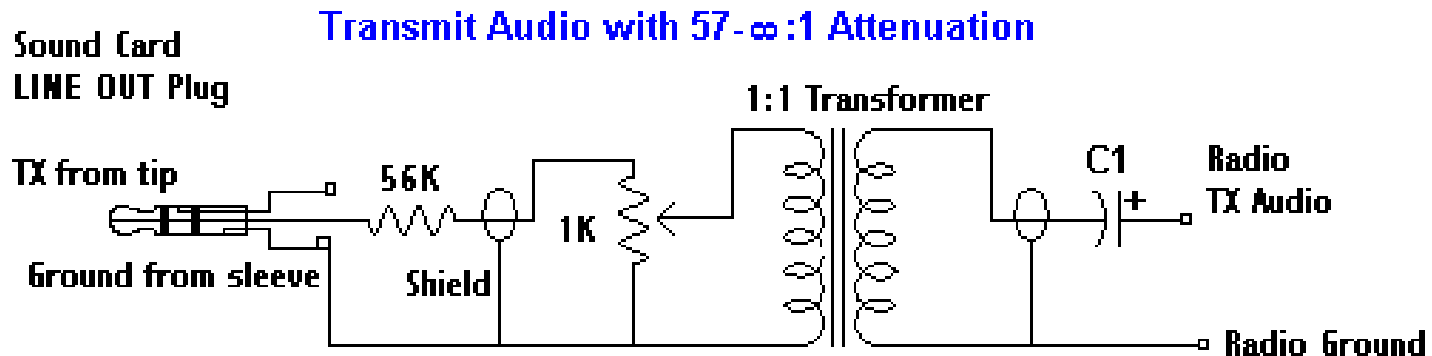
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Sound Card Packet – Transmit Audio

http://www.kc2rlm.info/soundcardpacket/

Transmit Audio with 57-∞ :1 Attenuation

Sound Card
LINE OUT Plug

TX from tip

Ground from sleeve

56K

1K

Shield

1:1 Transformer

C1

Radio
TX Audio

Radio Ground

C1 = optional capacitor blocks DC voltage; may be required for radios sharing
TX and PTT lines, e.g. hand held radios

Transmit Audio with 100:1 Attenuation

Sound Card
LINE OUT Plug

TX from tip

Ground from sleeve

100K

Shield

1K

1:1 Transformer

C1

Radio
TX Audio

Radio Ground

C1 = optional capacitor blocks DC voltage; may be required for radios sharing
TX and PTT lines, e.g. hand held radios

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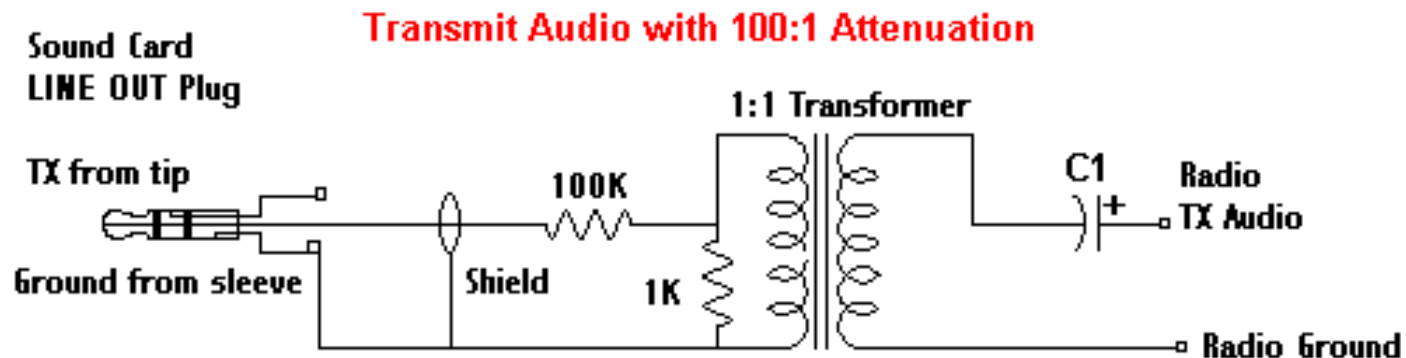
Sound Card Packet – Push-To-Talk

http://www.kc2rlm.info/soundcardpacket/

PTT Circuit Using Optocoupler

Serial RTS or DTR Pin — R1 — 1 — 6 — 5 — Shield — Radio PTT

D1 — IC

Computer Ground — 2 — 3 — 4 — Radio Ground

DB 9 pin assignment
- 1 — Data carrier detect
- 6 — Data set ready
- 2 — Receive data
- 7 — Request to send
- 3 — Transmit data
- 8 — Clear to send
- 4 — Data terminal ready
- 9 — Ring indicator
- 5 — Signal ground
- Protective ground

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Introduction to Outpost

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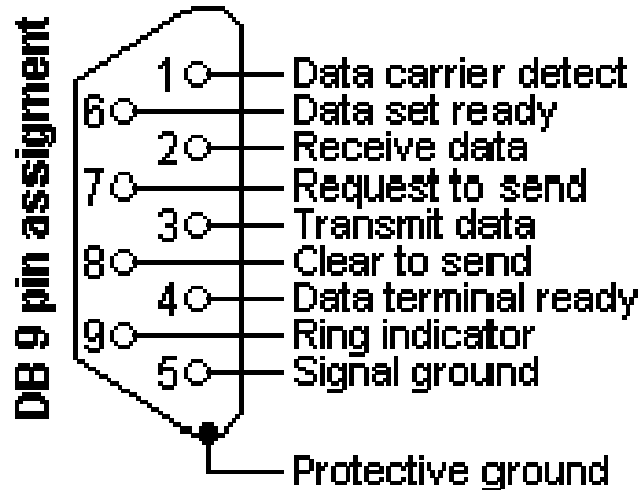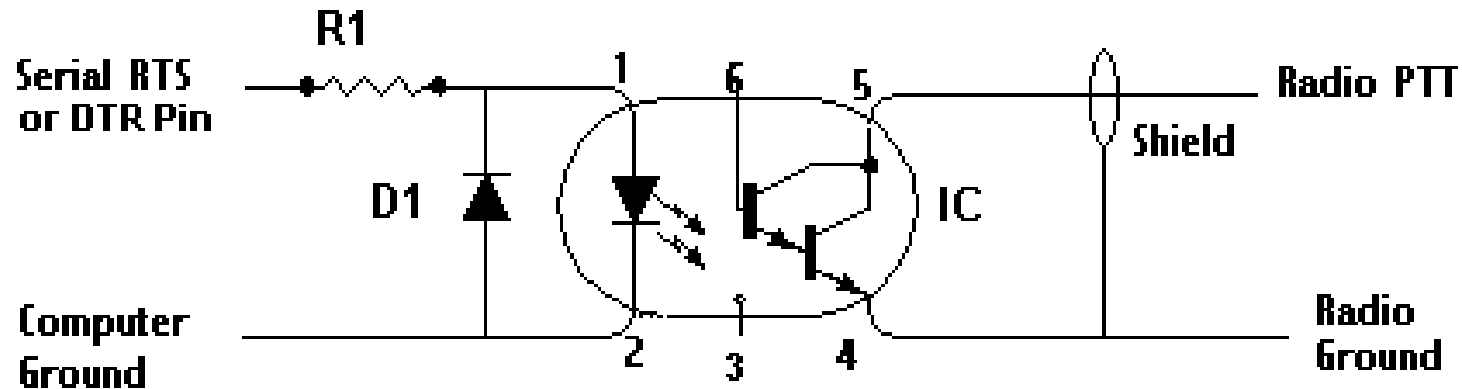
A brief introduction

Outpost Packet Message Manager

What is Outpost?

- A Windows-based packet messaging client that hides the complexity of the packet world

- Helps automate all the features available with the packet message handling environment

- Manages all message-handling between you and the BBS

- Lets you read, delete, create, reply to, or forward messages back to the BBS

- Enables ARES / RACES teams to support the response efforts and requirements of our local served agencies by pass digital traffic

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A brief introduction

Outpost Packet Message Manager

Creating messages

- Familiar email-app look & feel

- Supports Private, NTS, and bulletin messages

- Freeform formatting

- Delivery and read receipts

- Different ways for originating messages

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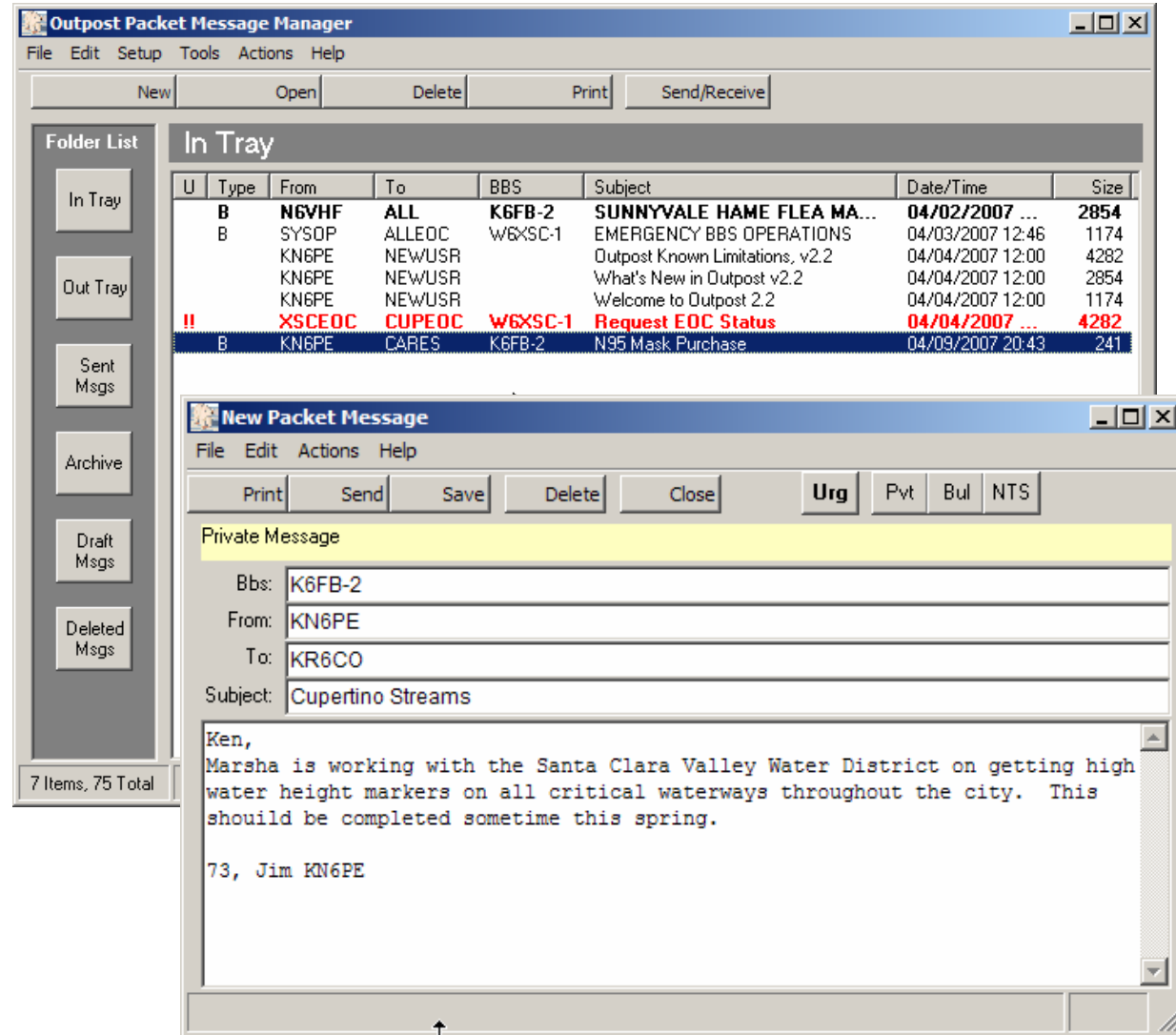
A brief introduction

Outpost Packet Message Manager

Viewing messages

- Supports viewing, printing, deleting or saving a message to a local file

- Reply and Forward message formatting

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A brief introduction

Outpost Packet Message Manager

Helps implement packet operating policies, such as…

1. All stations will identify with a tactical call sign

2. All messages are sent as private messages

3. All messages are uniquely identified

4. All messages are as short as possible

5. All stations will check the BBS periodically for traffic

6. All stations will check for specific message types

7. All message traffic becomes part of the official event documentation package

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Deploying Packet

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Aligning Packet in California

The California environment…

State OES…

Three state regions…

Counties…

Local Level towns and cities

FEMA

CA State OES

Coastal Region   Inland Region   Southern Region

Op Area/SCC   …   Op Area/SF   Op Area/Napa

CBL CUP … LGT MTV SJC

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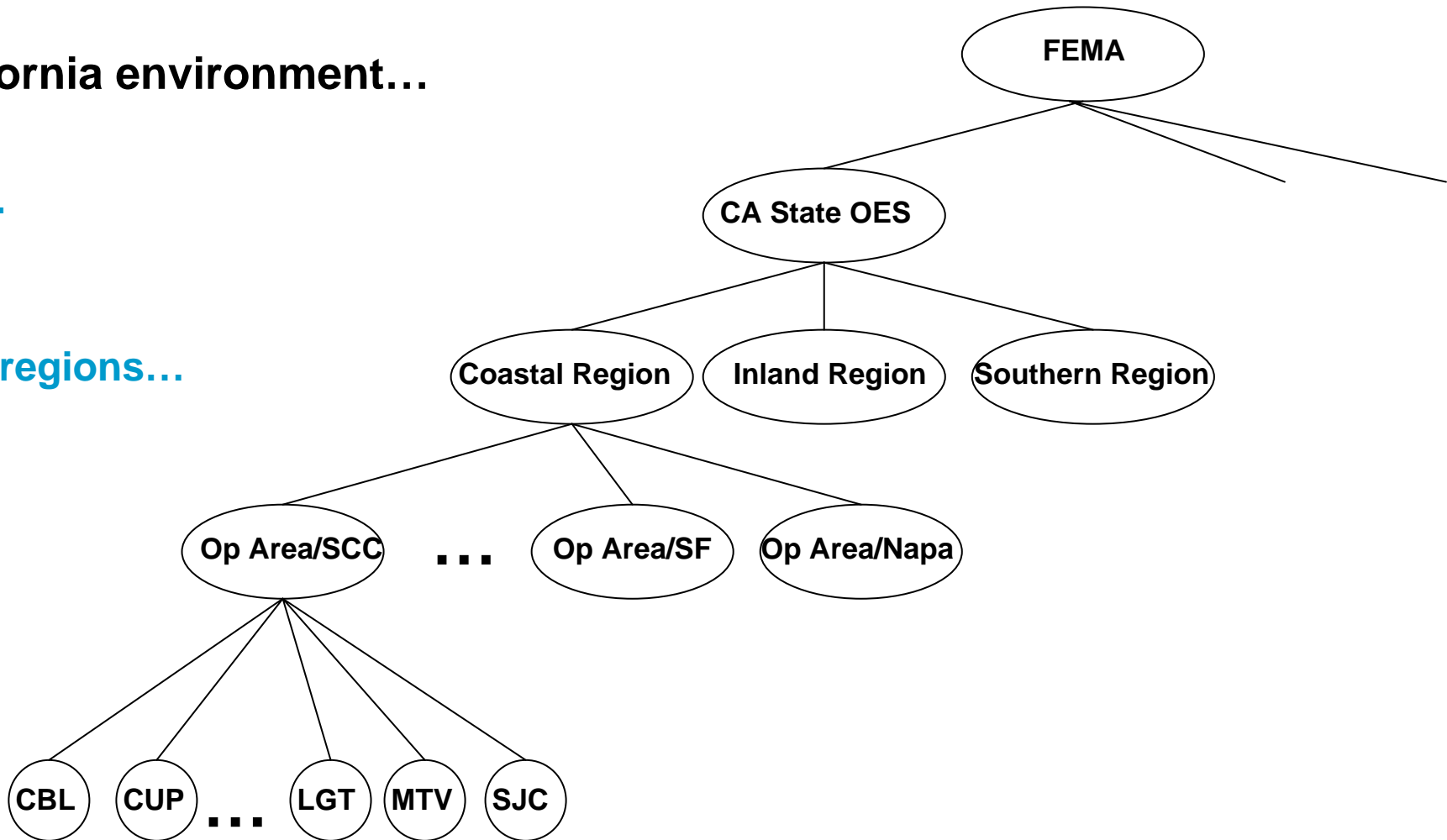
SCC's Packet Infrastructure – today
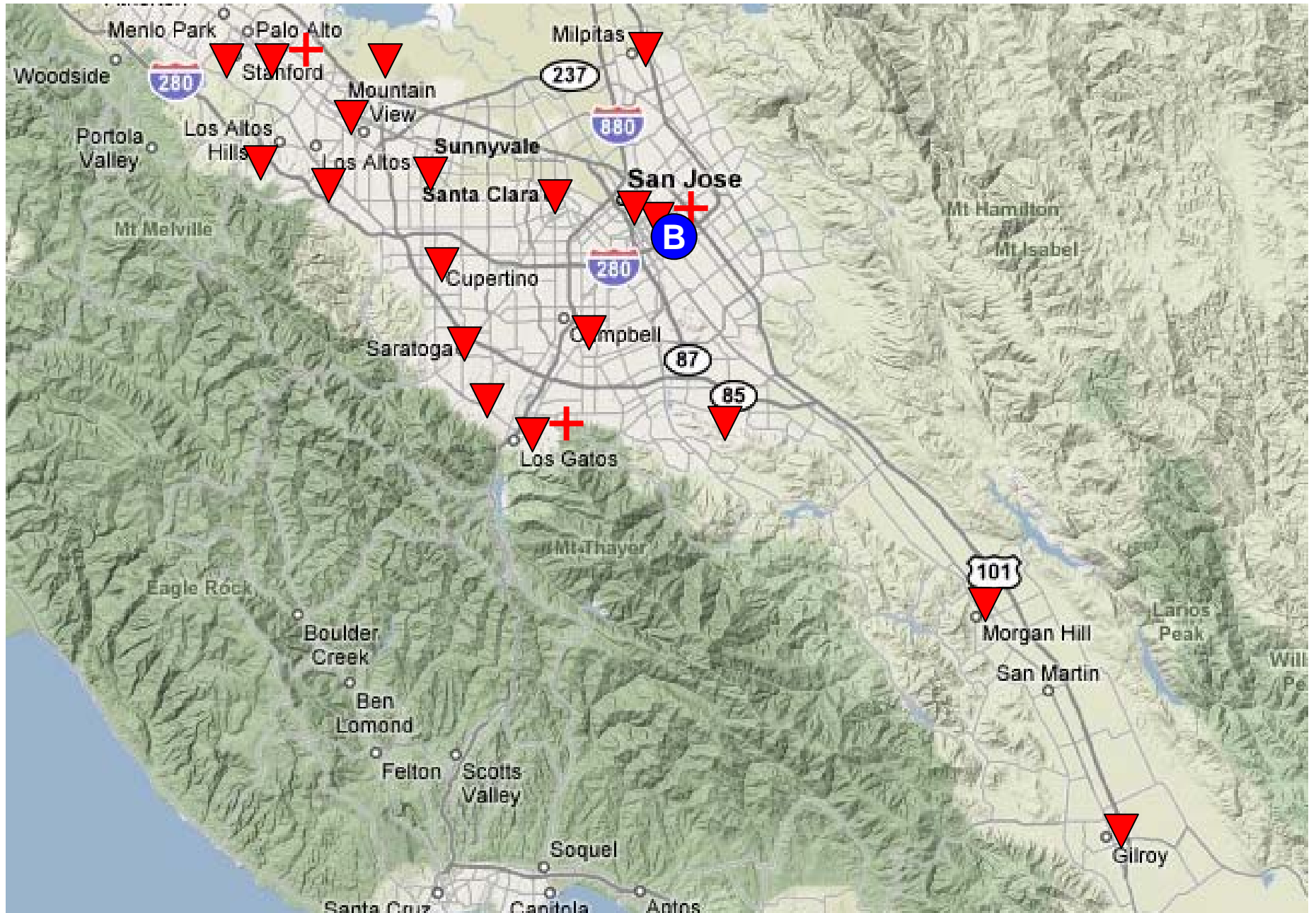
SCC's Packet Infrastructure – proposed

144.990
223.580

144.910
223.660

145.070
223.560

144.970

Link: 433.430 @ 9600 baud

34
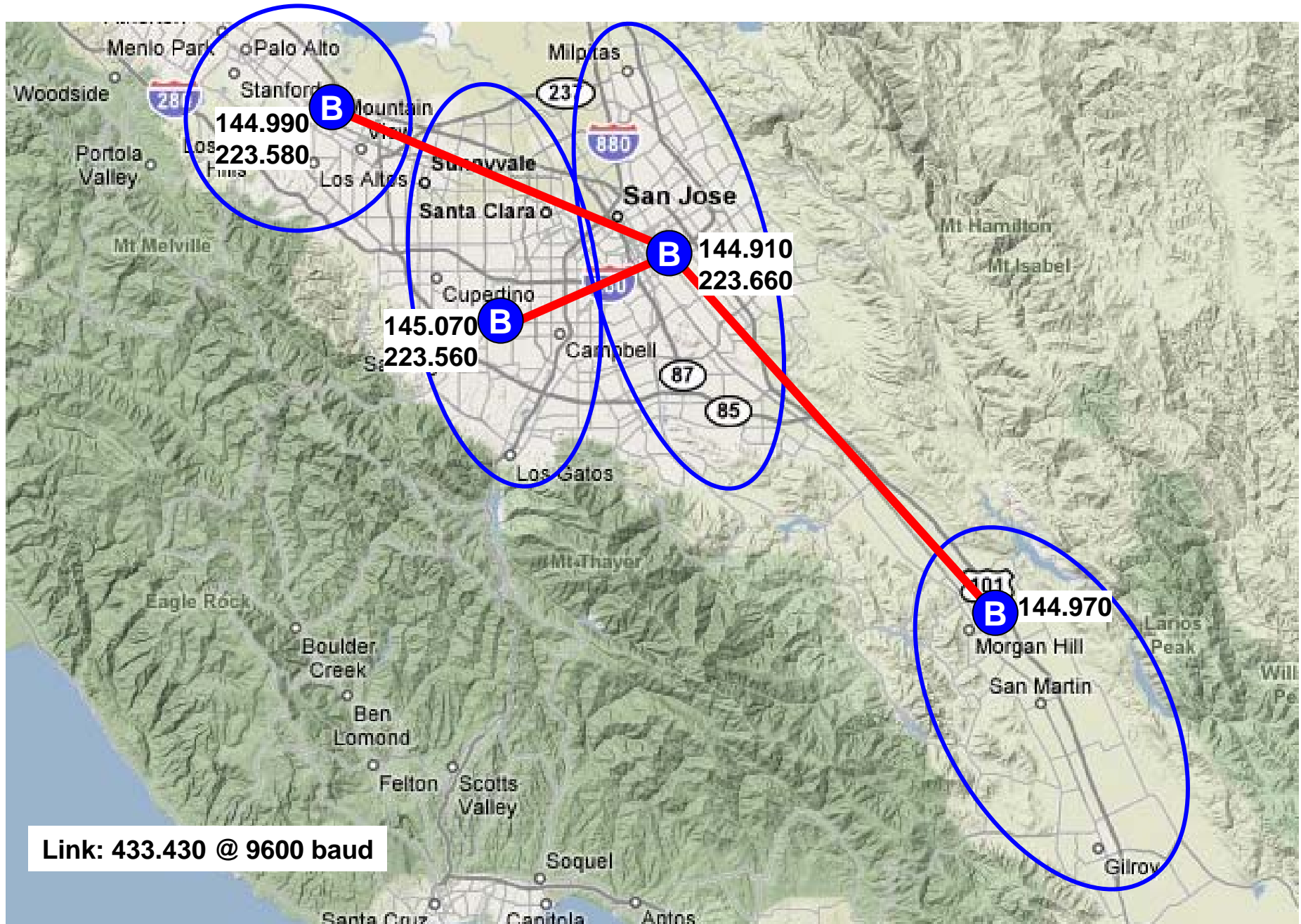
Deploying Outpost

Santa Clara County and PacForms

- Santa Clara County OES required a backup means to pass RIMS messages

- Packet Radio was the logical choice; Outpost was recommended

- County RACES also needed more standard means for soliciting and collecting information from the cities

- PacForms are web-based forms that can be deployed to the EOC staff for quick data entry

- PacForms can run stand-alone or directly pass a formatted message to Outpost

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Deploying Outpost
Santa Clara County and PacForms

Available PacForms

- EOC Message Form

- "City Scan" – Flash Report

- Logistics Request Form

- Hospital Status Report Form, DOC-9

- Hospital-Bed Availability Status Report Form, DOC-9

- SEMS Situation Report

- SEMS Mission/Request Tasking Form

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Why talk about Packet in Cupertino?

1. **Need to support County's requirements for packet communications**

2. **Is there an application for Packet within Cupertino to support the City?**

   - **Field deployment for…**
     - Ark support
     - Medical Center
     - Participation as a County MAC
     - others?

3. **As we think about our response, what information that needs to be passed aligns with the use of Packet?**

4. **Next Steps?**

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Any Questions?

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