Packet Radio Overview

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Agenda

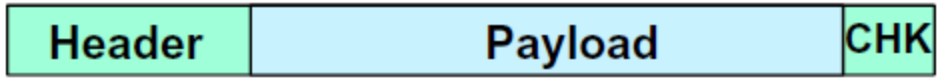
1. What is Packet Radio?
2. Why use it?
3. The Packet Radio Network

What is Packet Radio?

What is Packet Radio?

… in a nutshell

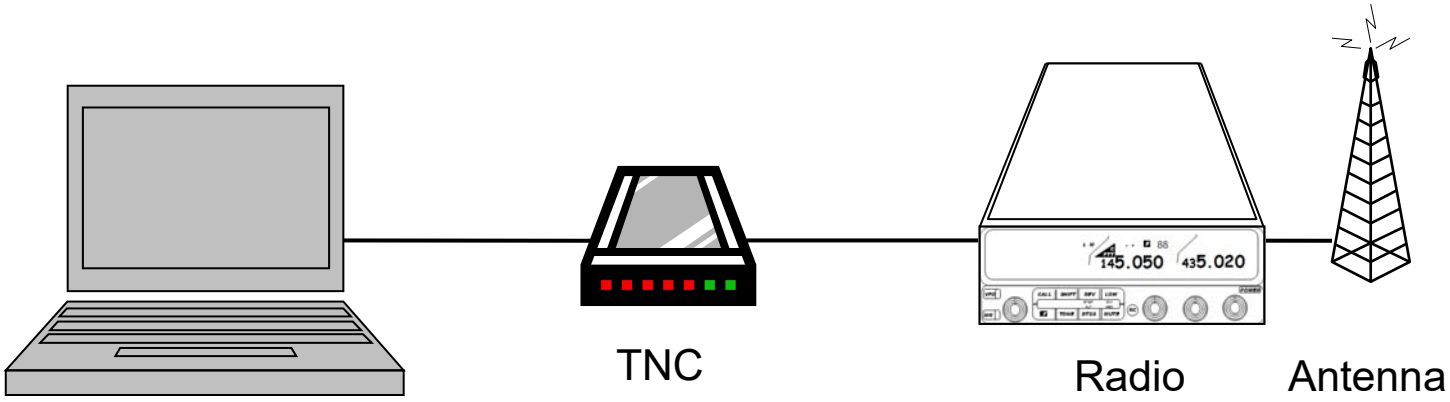
- One of many digital modes available in Amateur Radio
- Transmitted information is received 100% error free!
- Uses the AX.25 protocol, an extension of the ITU X.25, with data transparency, error checking, and automatic control
- Divides data streams into *bite-sized* packets
- Sends a “packet” of data at a time: envelope + payload



  - Envelope contains a header at beginning and checksum at end
    - Header includes the From and To addressing information
    - Payload contains the data to be sent
    - Checksum determines if packet was received error free
- Data transfer speeds from 1200 baud to 19.6K Baud on VHF/UHF

What is Packet Radio?

What are the components?



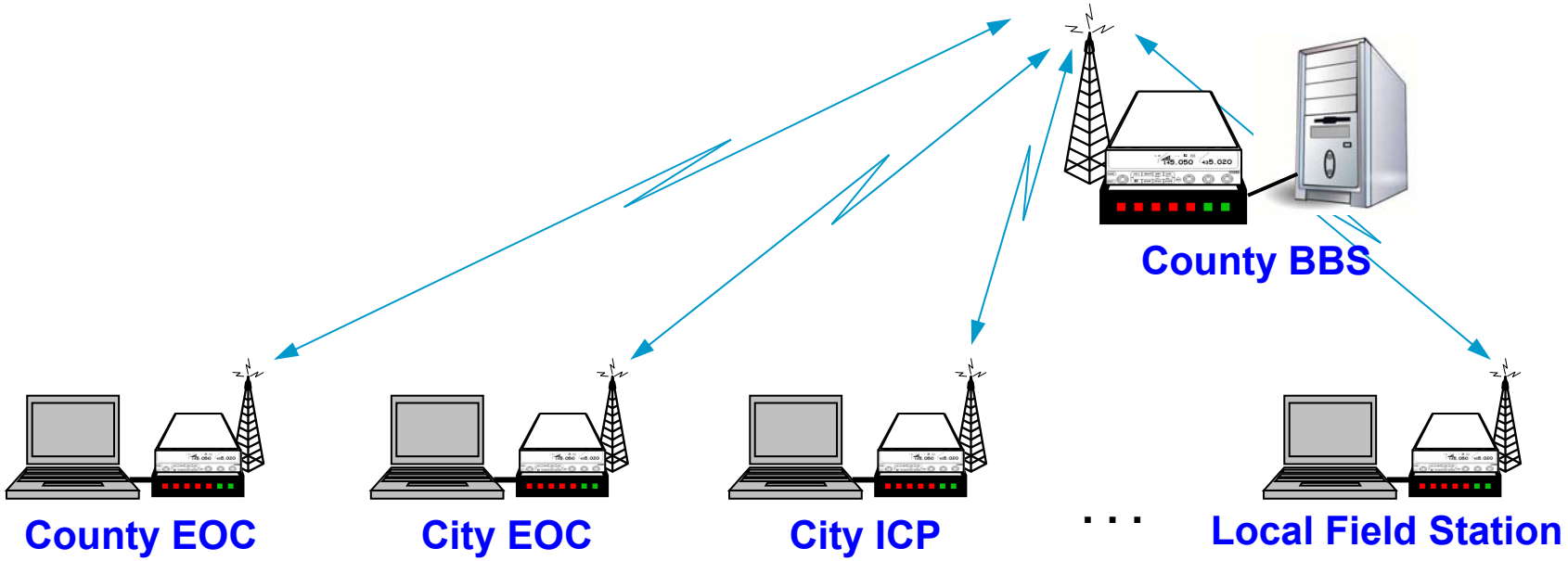
Computer:	runs a “terminal emulation” program
TNC:	Terminal Node Controller; similar to a telephone modem; implements the AX.25 protocol, and is the interface between your radio and your computer. May be implemented in either hardware or software
Radio:	… and antenna; transmits the digital data sent to the TNC to another packet station

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.

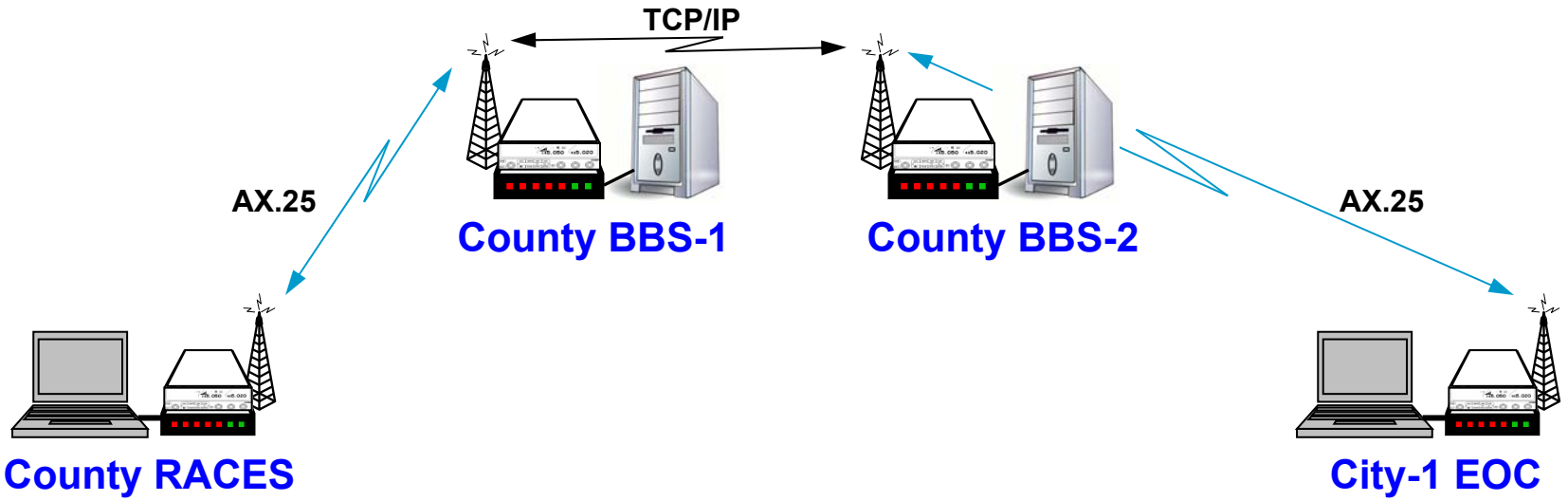


Why use Packet Radio?

The case for packet radio

2. Communications Protocol – Error Free messaging

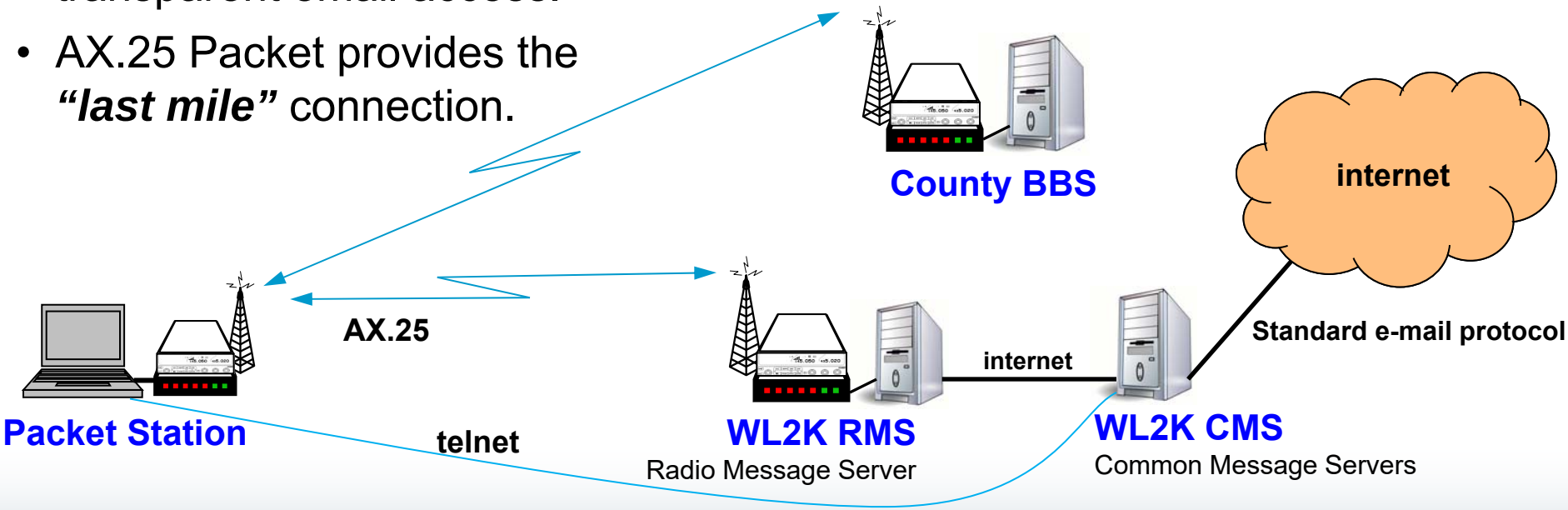
- Packet uses a protocol called AX.25. This is based on the ITU X.25 protocol for networked packet communications.
- AX.25 supports error correction and control that guarantees that all packets (and subsequently messages) are delivered correctly.



Why use Packet Radio?

The case for packet radio

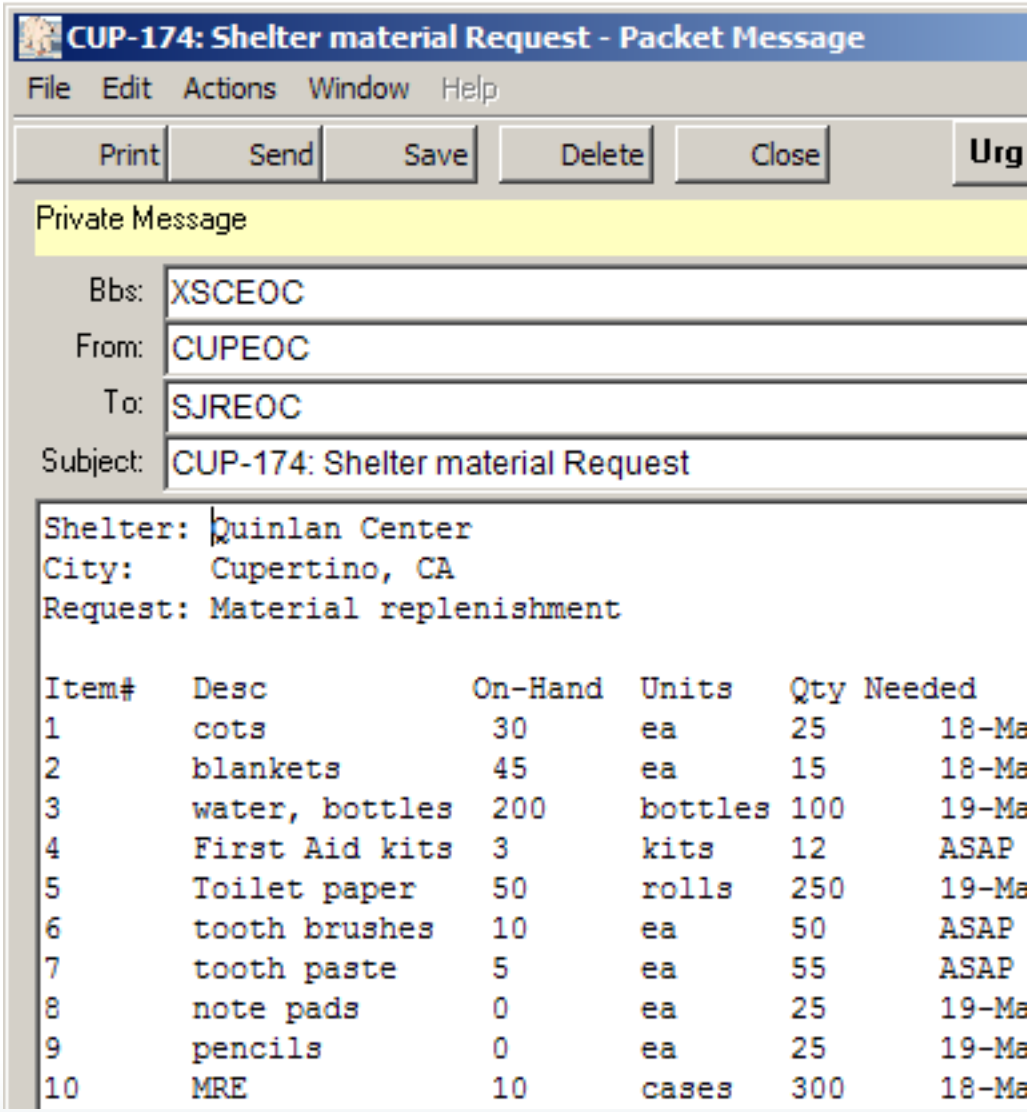
3. **Interoperability**
   - DHS suggested to the ARRL that the Amateur community should design, build, and maintain a national emergency communication digital network.
   - Winlink 2000 (WL2K) was adopted as that solution.
   - WL2K provides radio packet users and internet 3rd party users with transparent email access.
   - AX.25 Packet provides the ***"last mile"*** connection.



Why use Packet Radio?

The case for packet radio

4. **Complex messaging**
   - Ideal for passing lists, addresses, instructions, forms, or complex words (i.e. pharmaceuticals or chemicals)
     - you do not want to confuse ***Hydrogen Sulphide*** (a gas) with ***Hydrogen Sulfate*** (an acid)
   - Messaging by packet ensures...
     1. the originator can verify the content before it is sent,
     2. reduces transcription errors between the sender and receiver, and
     3. keeps the voice channel clear for other critical traffic.



Why use Packet Radio?

The case for packet radio

5. **Wide range of message content**
   - Structured Text
     - Lists
     - Addresses
     - Tables
   - Forms
     - ICS 213 messages
     - 9-1-1 requests
     - Status
     - Logistics
     - Others…
   - Unstructured Text (informal message)
     - Health and Welfare
     - Simple text messages

Why use Packet Radio?

The case for packet radio

6. **Reduces message handling**
   - Messages can originate from standard PC applications and sent directly to the packet application, or memory stick by *sneaker-net* to the radio room for loading and sending.
     - Spreadsheets using .csv (comma-delimited) files
     - Cut-and-paste docs
     - Direct import of text files

   - Because packet is digital and relies on a computer, messages also can go directly to a printer.

Why use Packet Radio?

The case for packet radio

7. And finally…

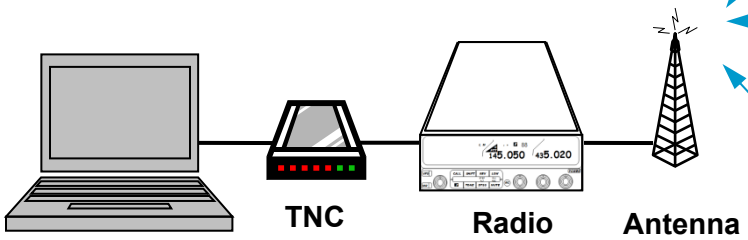
- **It's fast**
  - When there is no Internet, it's fast
  - 7 to 15 times faster than voice
- **It's easy**
  - Hardware: pre-built cables; straight-forward connections
  - Software: if you can use e-mail, then you can use Outpost
- **It's deployable**
  - Virtually anywhere in the city, county, and most of surrounding counties; no specialized radios or antennas are required
- **It fits our served agencies' needs**
  - Preferable for long, complex, and/or high volume messages; explicit acknowledgements

Packet Radio Network

Packet Radio

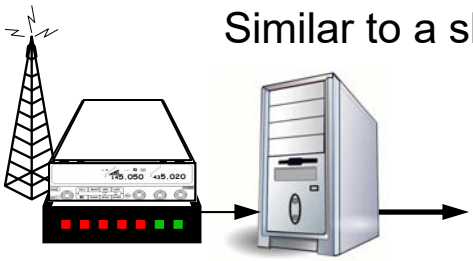
What can we connect to?

A packet station can connect to a variety of other different kinds of stations.



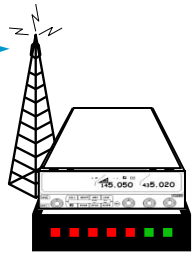
Packet Station

Bulletin Board System (BBS)
Similar to a shared email server

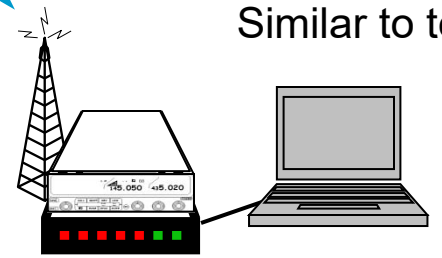


May forward to other BBS stations or the internet

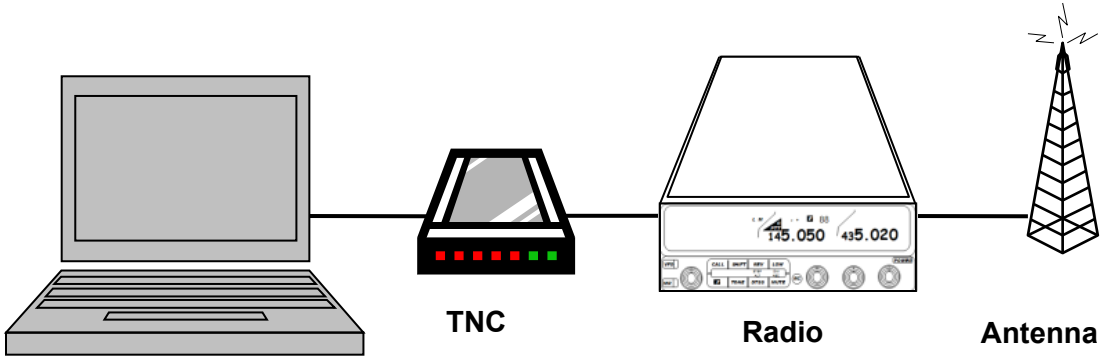
Personal BBS and Mailbox
Similar to a private email server



Keyboard to Keyboard
Similar to texting

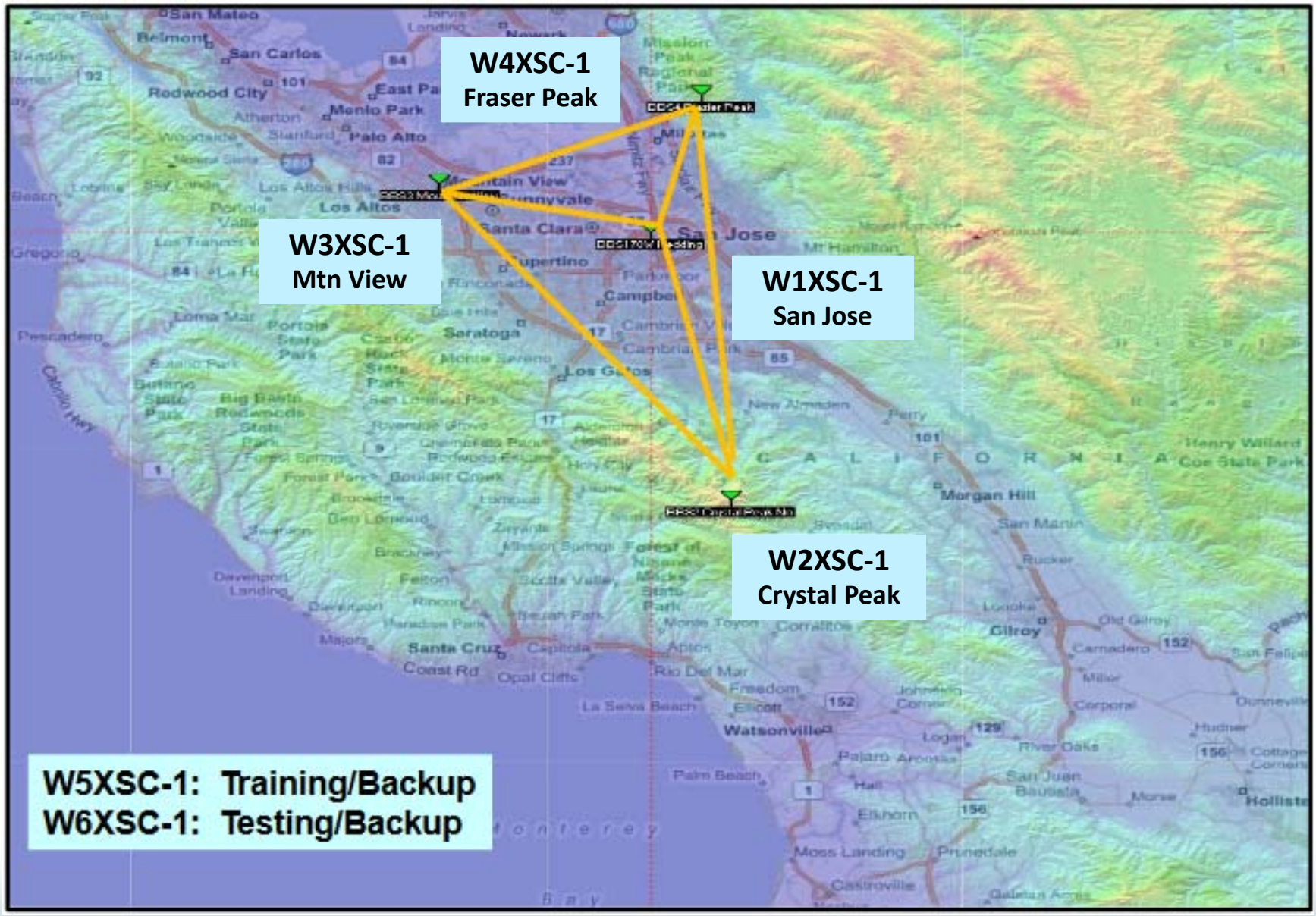


Packet Station



- **PC**
  - Laptop or larger network with at least Windows XP
  - Battery runtime of at least 1 hour
- **TNC**
  - Hardware TNCs preferred (such as a KPC-3+)
  - Software TNCs will work, but they are tricky to set-up and operate
- **Radio**
  - Mobile radio with 25 or more Watts of output
  - HTs will work, but you may become a *hidden node*
- **Antenna**
  - Get the antenna up as high as possible

SCC RACES BBS Locations



SCC RACES BBS Network

Operational Concepts

- From anywhere/to anywhere in the county
  - Schools, shelters, hospitals, neighborhoods, parks, tents, ...
  - Even if: Internet, cellular and commercial power are all down!
- All cities/agencies can reach at least 2 BBSs
  - Provides backup in case of failure
  - All users in a city/agency can use the same primary & alternate BBSs
  - All BBSs have equivalent functionality; simplifies training
- The network is run like a commercial network
  - It is intended to work in an emergency
  - UPS, backup generators, physical and network security
  - Testing, automated monitoring, user communications
  - Avoid single points of failure
- Result: Zero service outage in 5+ years!

SCC RACES BBS Network

Which BBS?

- Each city/agency has a primary and secondary BBS.
- All individuals within a City use the same BBS as their city.
- Use the primary BBS whenever possible.
- If primary fails, cities on that BBS are distributed across the other three BBSs.

#	Agency	Prefix	Primary BBS	Secondary BBS
Santa Clara County Cities and Agencies				
1	American Red Cross	ARC	W1XSC	W4XSC
2	CAL FIRE VIPs - Santa Clara Unit	SCU	W2XSC	W1XSC
3	Campbell, City of	CBL	W1XSC	W4XSC
4	Cupertino, City of	CUP	W1XSC	W4XSC
5	Gilroy, City of	GIL	W2XSC	W1XSC
6	Hospitals (all SCCo) & DEOC	HOS	W2XSC	W1XSC

SCC RACES BBS Network

BBS Frequencies

- Access is simplex with no tone
- 2m – User access; typically individuals, some EOCs
- 220 – User access; typically EOCs, some individuals
- 440 – Future

	Call Sign	AX.25	User Access	BBS-BBS	Location
CUPERTINO PRIMARY BBS	W1XSC	W1XSC-1	145.750, 223.620		Santa Clara Co Office Bldg (San Jose)
	W2XSC	W2XSC-1	145.730, 223.560		Crystal Peak (South County)
	W3XSC	W3XSC-1	144.310, 223.540		Mountain View
CUPERTINO SECONDARY BBS	W4XSC	W4XSC-1	145.690, 223.600*	223.600	Frazier Peak (above Milpitas)
	W5XSC	W5XSC-1	varies	varies	Training, events, backup
	W6XSC	W6XSC-1	varies	varies	Testing, backup

Northern California Packet Band Plan

http://ncpa.n0ary.org/ncpabandplan.html

2 Meter Band Plan

- 144.31 EP
- 144.33 Telemetry & Experimental
- 144.35 Keyboard to Keyboard, mailbox
- 144.37 BBS forwarding
- 144.39 APRS (USA and Canada)
- 144.41 APRS (secondary channel)
- 144.43 TCP/IP (OK to run duplex with 145.65)
- 144.91 EP
- 144.93 NA
- 144.95 NA
- 144.97 Misc. Digital
- 144.99 TCP/IP
- 145.01 WL2K
- 145.03 Keyboard to Keyboard, mailbox
- 145.05 Keyboard to Keyboard, mailbox
- 145.07 NA
- 145.09 BBS
- 145.61 Duplex, cross-band
- 145.63 WL2K
- 145.65 TCP/IP 9600 baud (OK to run duplex with 144.43)
- 145.67 DX Spotting
- 145.69 EP
- 145.71 DX Spotting
- 145.73 EP
- 145.75 EP
- 145.77 DX Spotting

NOTES

- APRS – Automatic Packet Reporting System.
- BBS – Full-service Bulletin Board System,
- DX Spotting – Northern California DX Packet Spotting Network
- EP – Emergency Packet
- NA – Not Allocated
- WL2K - Winlink2000 message server or anything involving the Winlink network.

Thank you

Any Questions?