

The image features a perspective view of a digital tunnel. The walls and floor are composed of glowing blue binary code (0s and 1s) that recede into the distance, creating a strong sense of depth. At the far end of the tunnel, a bright white light emanates from a central point. In the foreground, several computer monitors are arranged in a row, their screens displaying vertical columns of binary code. The overall color palette is dominated by deep blues and bright whites, giving it a high-tech, futuristic appearance.

*Packet Communications using Winlink*

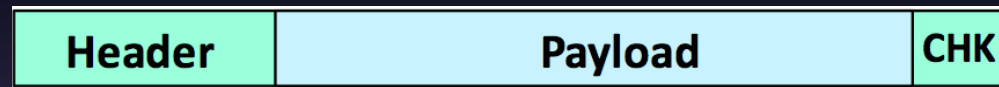
*Ron Schwartz K2RAS*

# What can Packet Radio Do?

- Packet can send emails and data files directly between radios (**without the Internet**)
- Emails and data can be forwarded worldwide (**without the Internet**) using radio connected servers
- Emails can be sent from a radio, to normal Internet email accounts (if the destination account is connected to the Internet)

# How Packet Radio Works (the only technical slide!!)

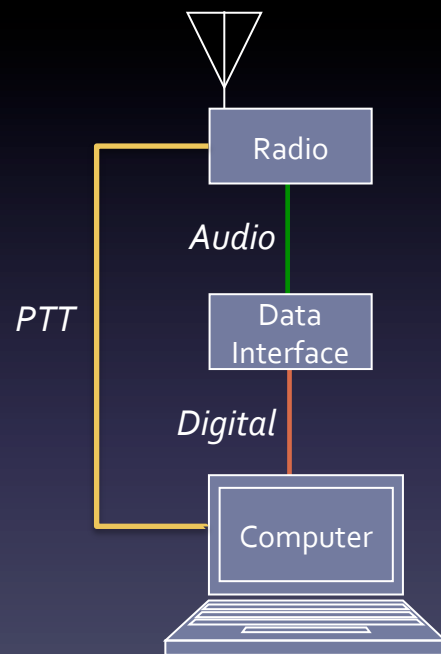
- Packet Radio uses the AX.25 protocol
- Sends **packets** (an 'envelope' containing a data payload)



- Envelope contains the header at the beginning and a checksum at end
- Checksum determines if packet is error-free
- Header contains addressing information (to, from)
- Modulation is usually Frequency Shift Keying (FSK)
- Payload contains the data to be sent

# Required Hardware Setup

## Option 1: Use a Hardware TNC



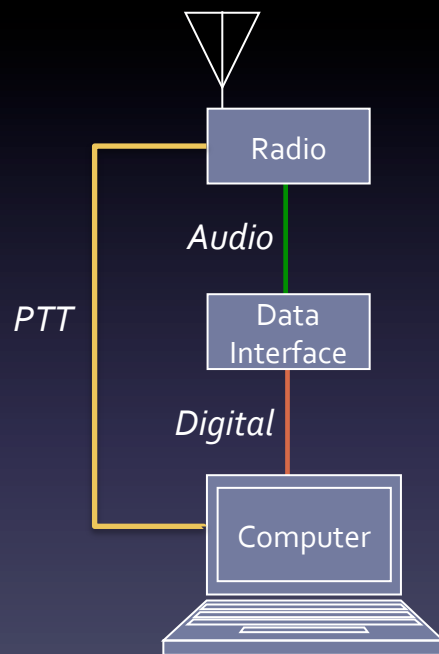
Radio with data and audio-out connections

Terminal Node Controller (hardware TNC) (Kantronics)

Software: RMS Express email client

# Required Hardware Setup

## Option 2: Use a Software TNC



Radio with data and audio-out connections

Direwolf (Software TNC) AND Soundcard with Audio and PTT modem (Signalink)\*\*

Software: RMS Express email client

\*\* Some newer radios have built-in soundcards (IC-7300)

# How to Send Packet Traffic

## OPTION 1: Simple Radio to Radio

Radio Sent Email  
Longmont, CO



Radio Delivered Email  
London, UK



# How to Send Packet Traffic

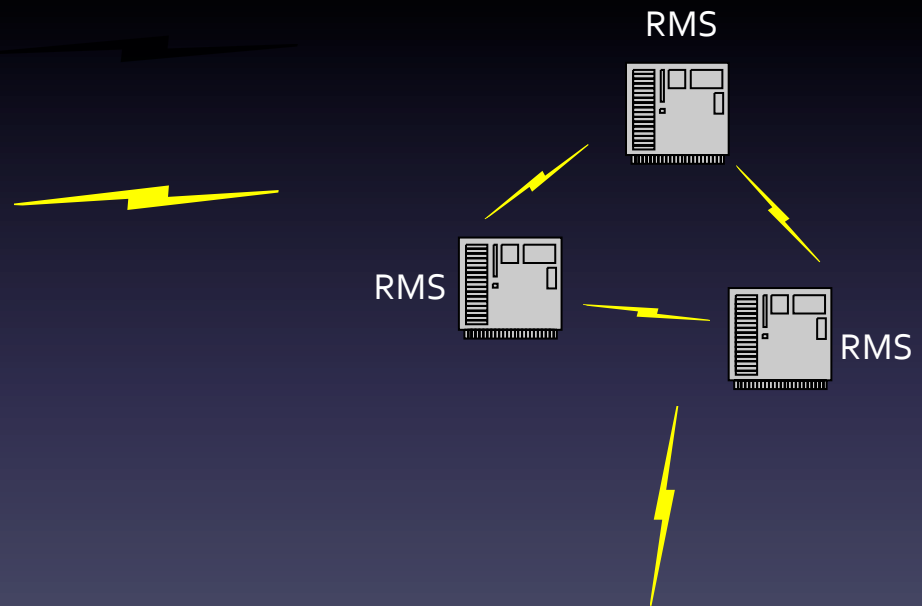
## OPTION 2: Use the Winlink System

- **WinLink** is an worldwide system of servers which provide packet **email and file forwarding** over Ham radio
- Winlink can use VHF (short distance), or HF (worldwide)
- Winlink uses RMS Express software on PC (runs on Macs using a virtual machine)

Your gateway to Winlink is called a **Radio Message Server**, or “RMS”

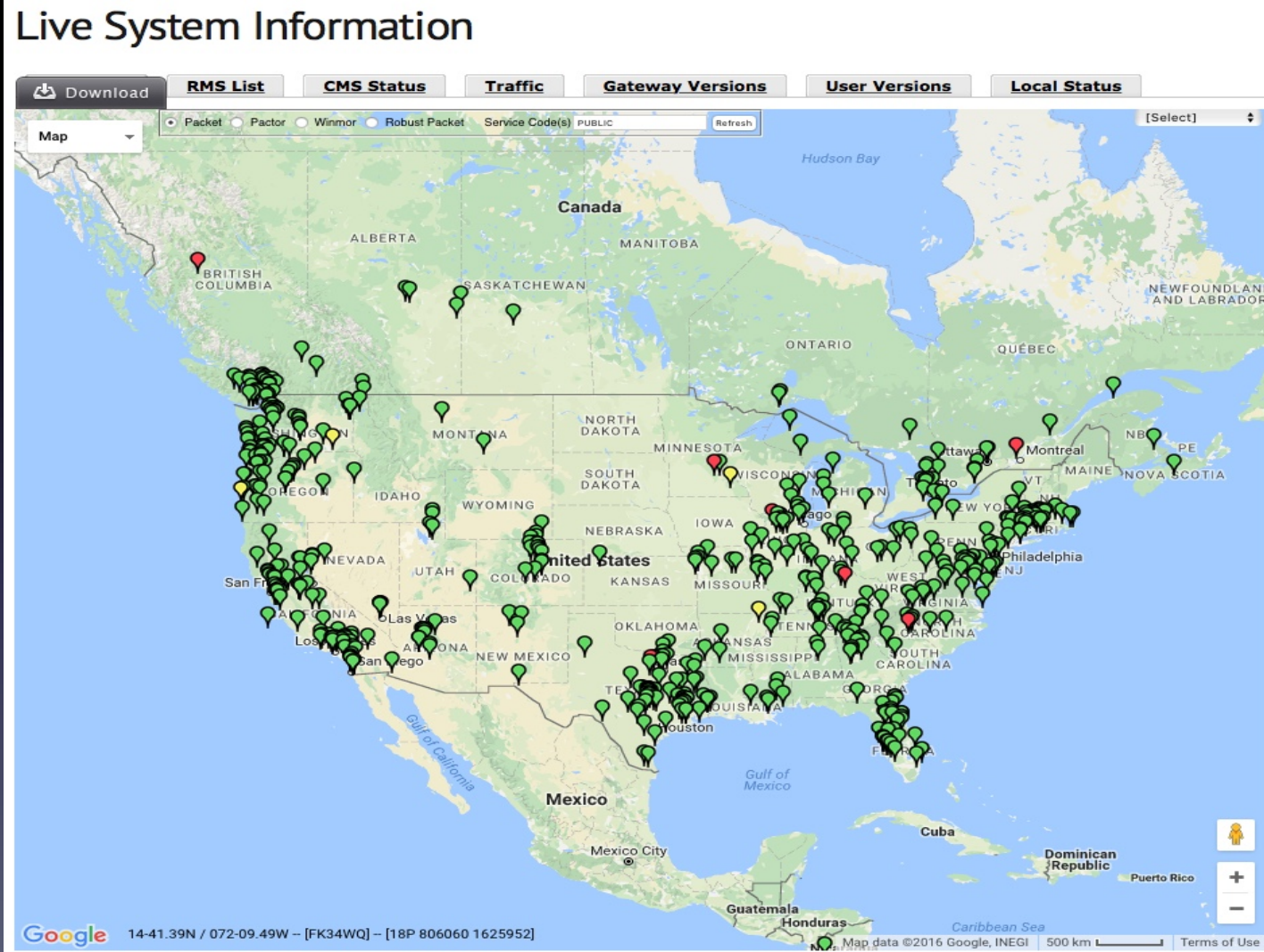


Your radio connects to a **Radio Message Server (RMS)**



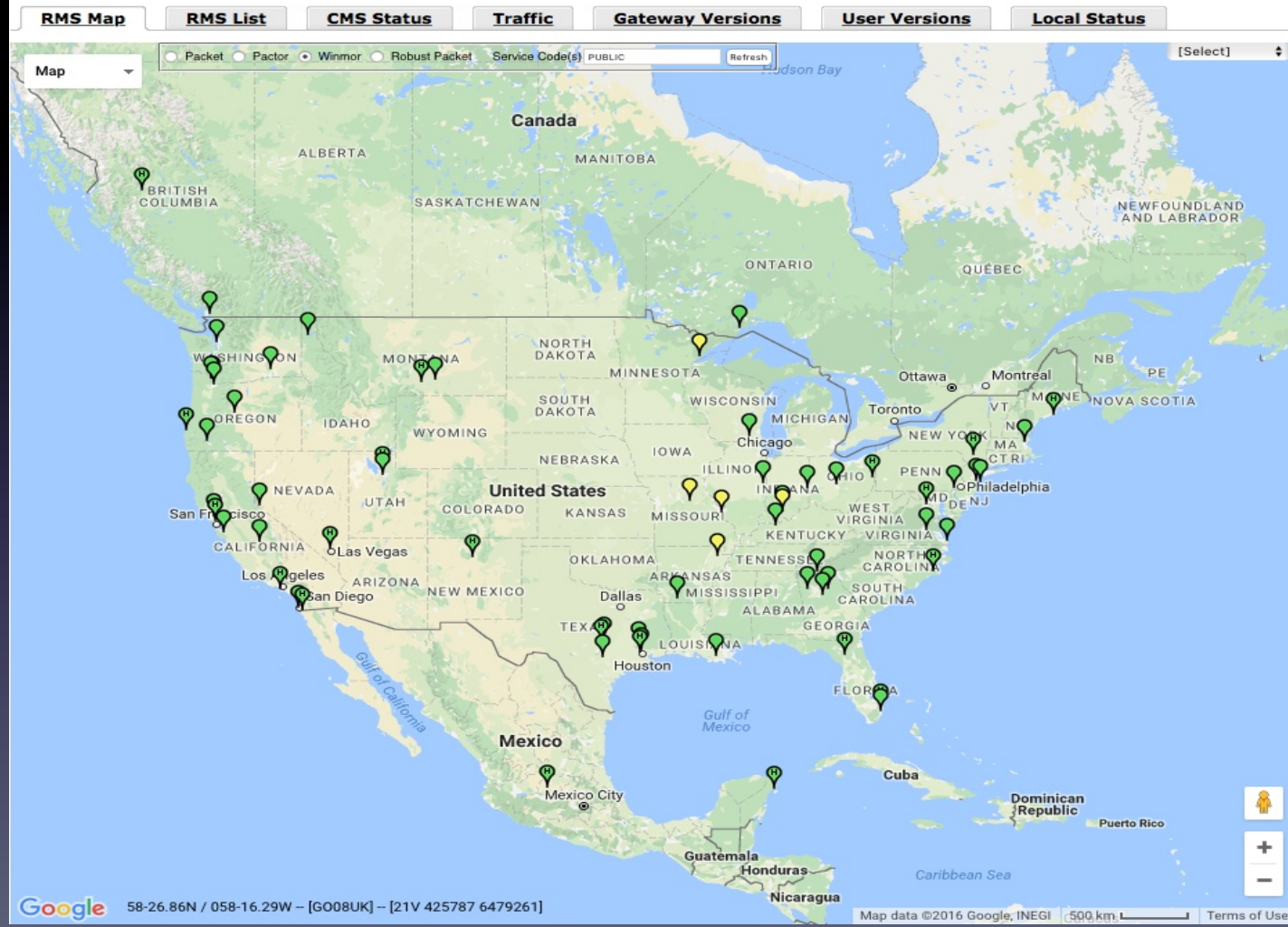


# VHF/UHF Winlink RMS Sites in US

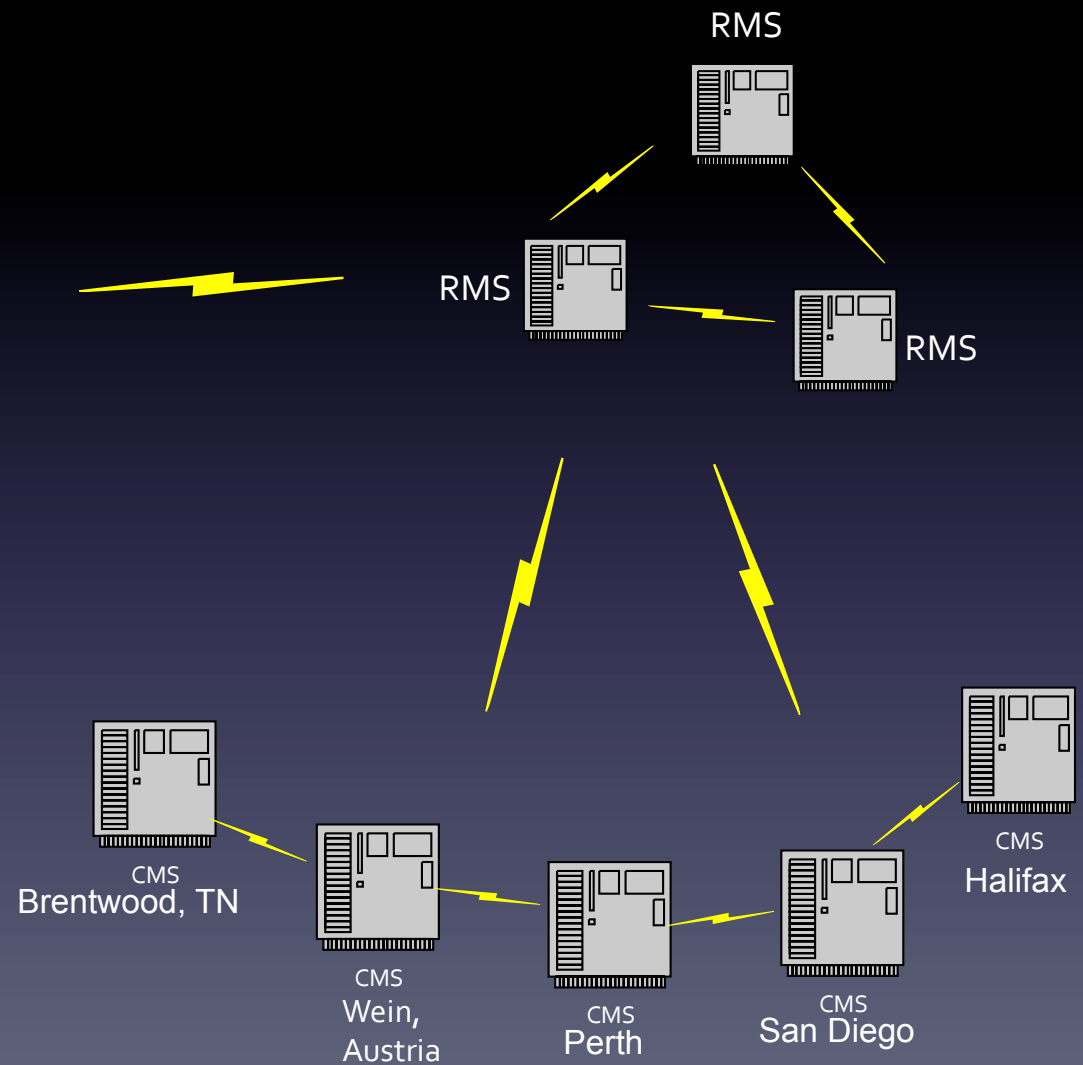


# HF Winlink RMS Sites in US

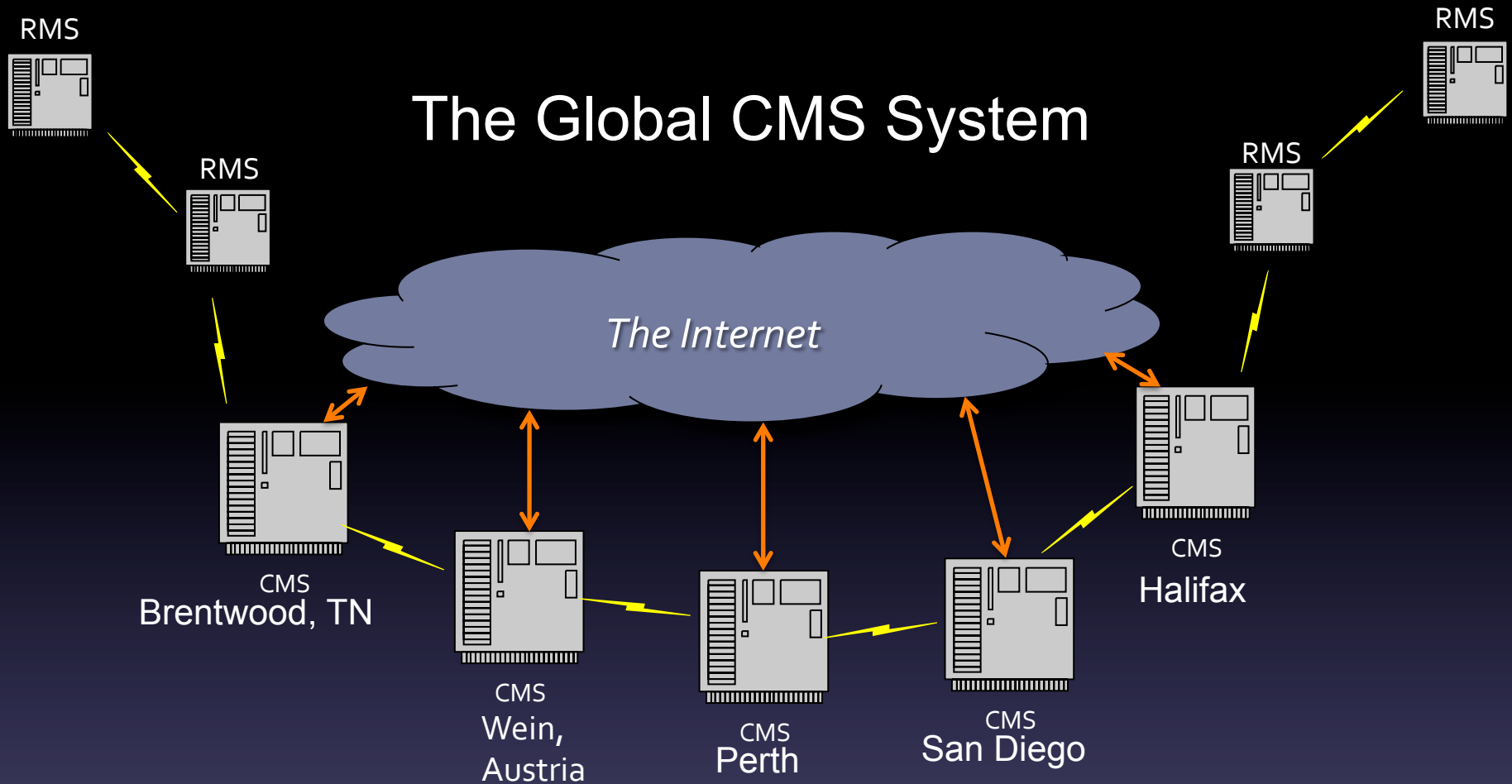
## Live System Information



# RMS stations can link through global Common Message Servers (CMS) Servers

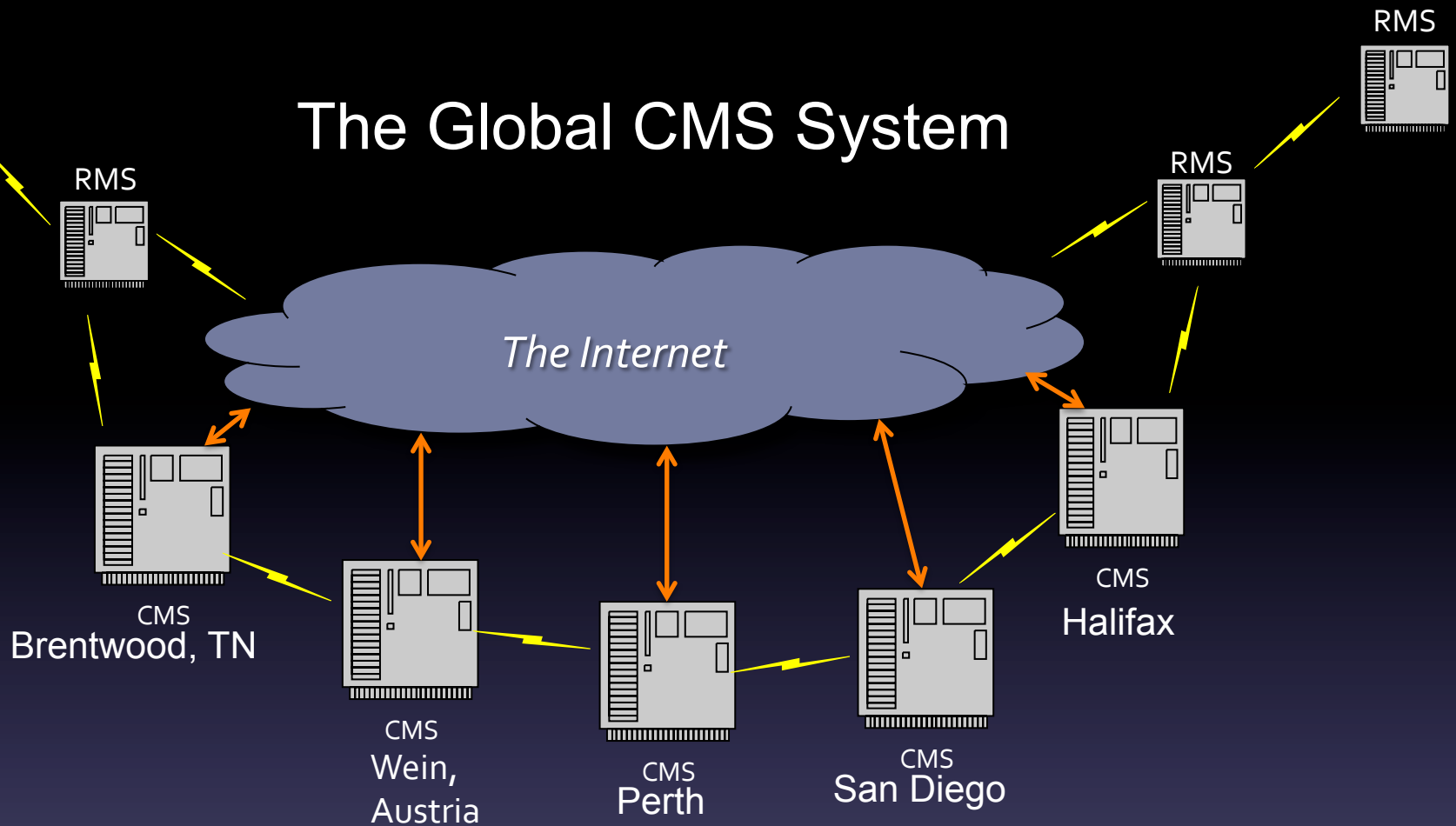


# The Global CMS System



*Five **Common Message Servers (or CMS)** organize, synchronize and manage WinLink e-mail traffic. They are connected to the Internet, but they can also directly send messages by radio if an Internet connection is unavailable.*

# The Global CMS System



The five **CMSs** have the same (e.g. redundant) information and individually can run the entire system.

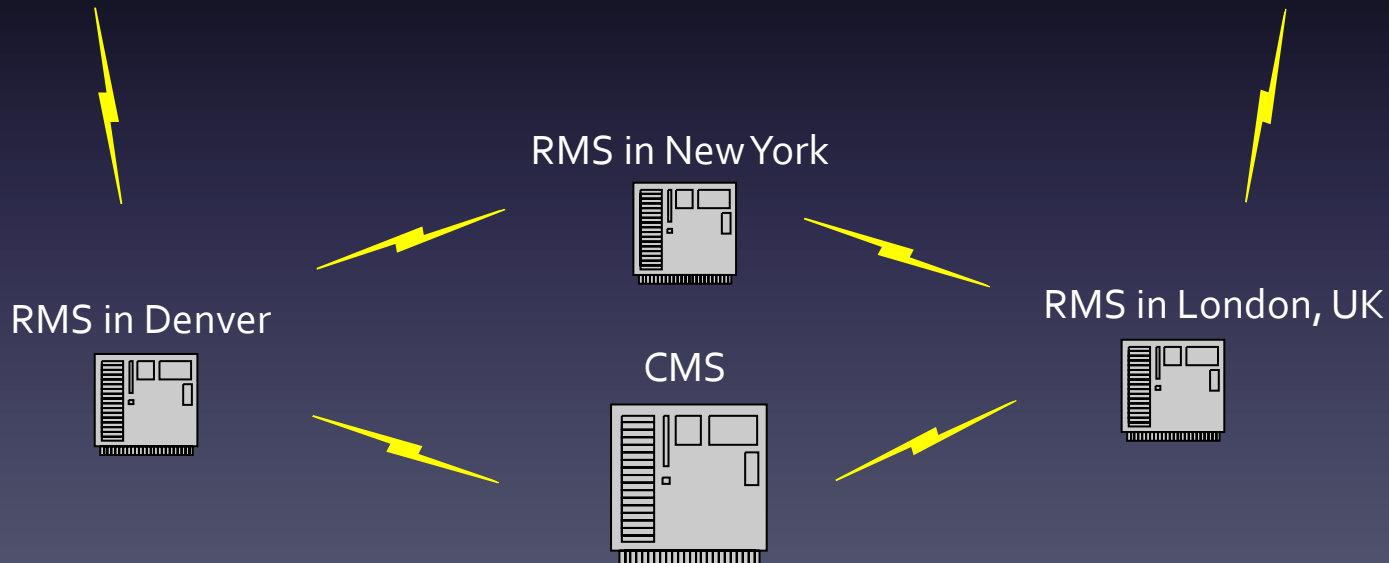
# Scenario 1

## Sending Winlink messages **without** the Internet

Radio Sent Email  
Longmont, CO



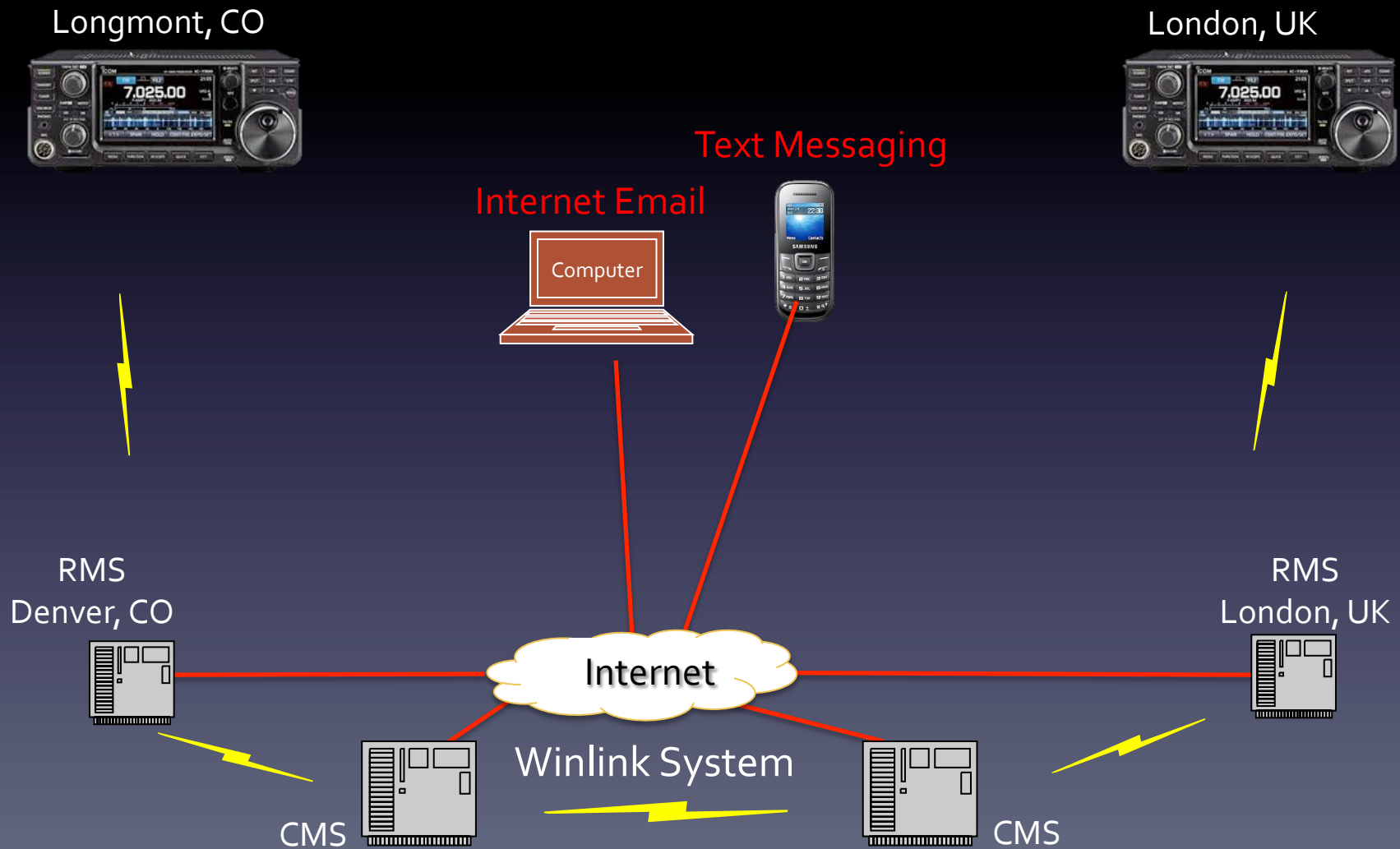
Radio Delivered Email  
London, UK



The Winlink System

# Scenario 2

## Sending Winlink messages **with** the Internet



# Registering for Winlink

The first time you send a message using RMS Express, you will be registered in the Winlink system and will have a `callsign@winlink.org` address.

Your account remains active as long as you use it regularly. Inactive accounts will be purged after about 1 year



## Advanced Topic: Hybrid Winlink Mode

- **Hybrid mode** sends Winlink traffic worldwide, bypassing the Internet\*\*
- Radio Message Servers (RMSs) switch automatically to radio-only network mode when forwarding *radio-only messages*
- Worldwide network uses HF forwarding
- Message routing is dynamic and fully automatic
- Hybrid mode requires Winmor (HF), or Pactor (**NOT VHF PACKET**)
- Pactor is used for backbone links between RMSs

\*\* Normal (non-hybrid) mode utilizes Internet connections when available

## Advanced Topic: Hybrid Winlink Mode

During radio-only (Hybrid) operation, messages sent to you will be stored on the RMS(s) you select as your **Message Pickup Stations (MPS)**.

- Up to 3 MPS's can be selected, but to reduce network traffic, it is recommended that only 2 MPS be used.
- A duplicate copy of the message is delivered to each MPS, and you can **pick up your messages from any MPS**.
- Once a message has been downloaded from one MPS, the message will not be downloaded from another MPS.
- You can register your MPS using an Internet connection or a radio message.

# Advanced Topic: Hybrid Winlink Mode

Hybrid Network Parameters

Parameters specified on this screen control the flow of messages when they are being sent via radio-only forwarding.

Message Pickup Stations (MPS)

MPS 1: K5AEA

MPS 2: K7DAV

MPS 3: KC8YJJ

Update list of RMS available as MPS

Display list of RMS available as MPS

Register MPS via Internet

Queue radio message to register my MPS

Last update: 2019-04-14-10:30

When operating in radio-only mode, incoming messages for you will be held on the designated Message Pickup Station RMS until you pick them up.

Add /auto/ to subject lines

Save Cancel

# Advanced Topic: Hybrid Winlink Mode

- Hybrid mode uses **adaptive MESH network routing**.
- If a direct link is not available to the **destination MPS**, an intermediate RMS will relay the message.
- The **optimum path** is computed by each RMS based on HF propagation estimates, time of day, Pactor speed, message size and other factors.
- Adaptive Routing.
  - Each intermediate RMS recomputes the optimum path.
  - If a RMS is unavailable, the system will route around it.
  - Busy RMS are tried a few times and then routed around.
  - Radio messages can be relayed through RMS that are or are not connected to the Internet.

# RMS Express Setup

Winlink Express Properties

Call Signs

My Callsign:  My Password:

Callsign suffix (optional):  (Used for country code)  Show password

Password recovery e-mail:   
(Non-Winlink e-mail address where lost password will be sent when requested)

Auxiliary Callsigns and Tactical Addresses

My Grid Square:

Winlink Express registration key:

Service Codes

(Use PUBLIC for ham call signs. Separate multiple service codes by spaces.)  
If you change service codes, you must update the list of channels.

Contact Information (Optional)

Name:   
Street address 1:   
Street address 2:   
City:   
State/Province:   
Country:   
Postal code:   
Web Site URL (optional):   
Phone number:   
Non-Winlink e-mail:

Additional information (optional):

Recalculate HF path quality if SFI changes more than:   
Keep logs for  weeks. Keep deleted messages for  days.  
 Display list of pending incoming messages prior to download  
 Warn about connections to stations holding messages  
 Allow diagnostic information to be sent to the Winlink Development Team  
 Automatically install field-test (beta) versions of Winlink Express

Packet Winlink/P2P Setup

TNC Connection

Packet TNC Type: **Kantronics**

Packet TNC Model: **KPC-3+**

Serial Port: **COM3**

Serial Port Baud: **9600**

AutoConnect Time: Disabled

If Auto Connect is enabled, open session when Winlink Express is started

TNC Parameters

1200 Baud  9600 Baud

TX Delay (Milliseconds):	400	300
Maximum Packet Length:	128	255
Maximum Frames:	4	7
Frack:	2	10
Persistence:	160	224
Slot time:	30	20
Maximum Retries:	6	5
Transmit Level:	100	100

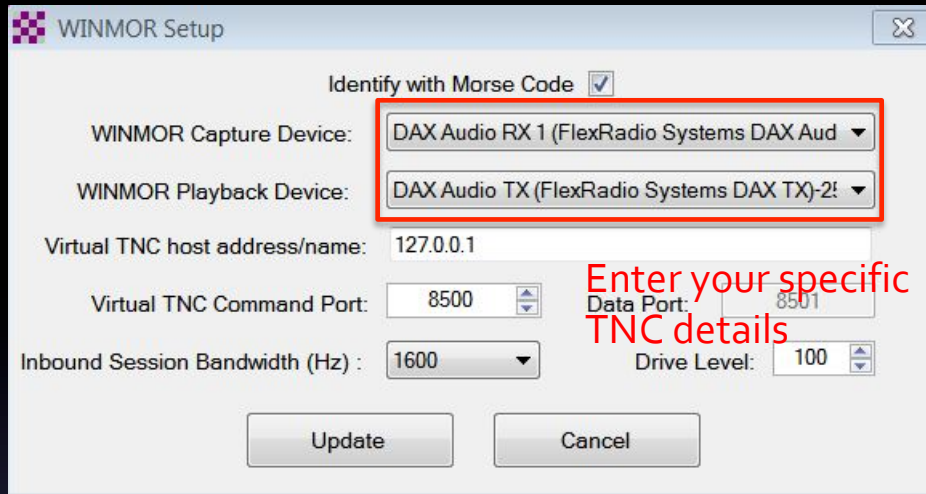
Disable Xmt Level Adjust

Update Cancel

Enter your specific  
TNC details

Setup Packet Winlink  
(VHF operation)

# Setup Winmor Winlink (HF operation)



WINMOR Setup

Identify with Morse Code

WINMOR Capture Device: DAX Audio RX 1 (FlexRadio Systems DAX Aud)

WINMOR Playback Device: DAX Audio TX (FlexRadio Systems DAX TX)-2!

Virtual TNC host address/name: 127.0.0.1

Virtual TNC Command Port: 8500

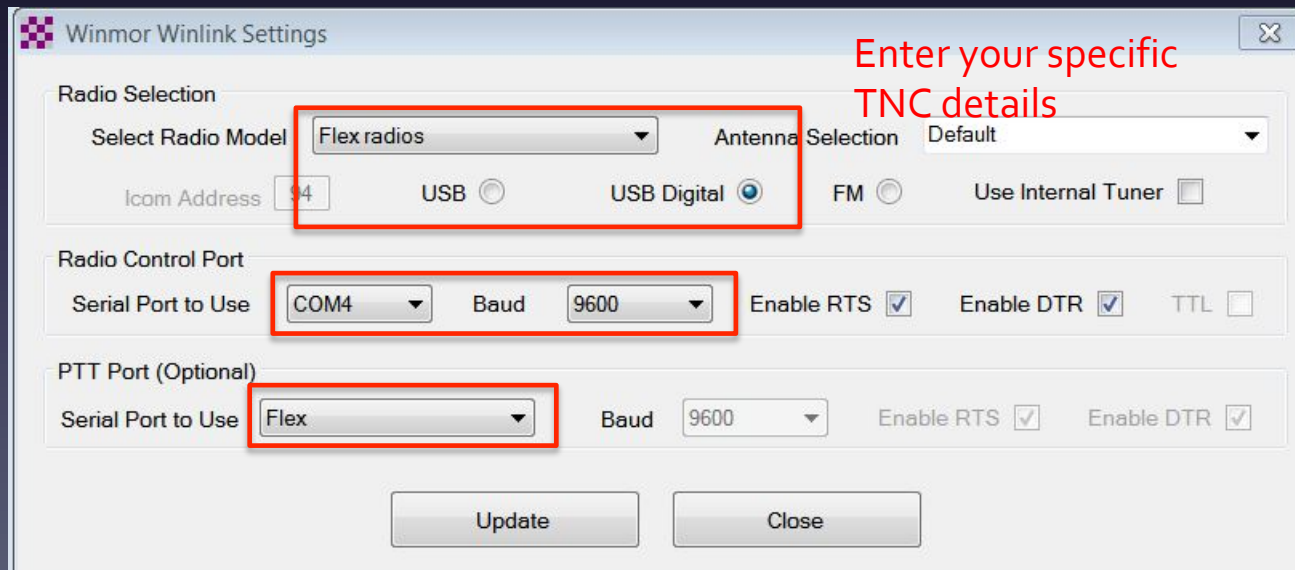
Data Port: 8501

Inbound Session Bandwidth (Hz): 1600

Drive Level: 100

Update Cancel

Enter your specific TNC details



Winmor Winlink Settings

Radio Selection

Select Radio Model: Flex radios

Antenna Selection: Default

Icom Address: 94

USB  USB Digital  FM  Use Internal Tuner

Radio Control Port

Serial Port to Use: COM4

Baud: 9600

Enable RTS  Enable DTR  TTL

PTT Port (Optional)

Serial Port to Use: Flex

Baud: 9600

Enable RTS  Enable DTR

Update Close

Enter your specific TNC details



# Running the Winlink Program

The screenshot shows the Winlink Express 1.5.19.0 - K2RAS interface. The window title is "Winlink Express 1.5.19.0 - K2RAS". The menu bar includes "K2RAS", "Settings", "Message", "Attachments", "Move To: Saved Items", "Delete", "Open Session: Winmor Winlink", "Logs", and "Help". The toolbar contains various icons for file operations. The main area displays a message list table with columns: Date/Time, Message ID, Size, Source, Sender, Recipient, and Subject. The left sidebar shows "System Folders" (Inbox, Read Items, Outbox, Sent Items, Saved Items, Deleted Items), "Personal Folders", "Global Folders", and "Contacts". The bottom pane shows the details of the selected message.

Date/Time	Message ID	Size	Source	Sender	Recipient	Subject
2019/02/17 ...	HMU7VP59...	159	K2RAS	K2RAS	rs500cat@ic...	//WL2K test
2019/01/19 ...	IUTX6J9C8...	143	K2RAS	K2RAS	W0ENO-1	//WL2K ee

Message ID: HMU7VP59ZHIX  
Date: 2019/02/17 05:52  
From: K2RAS  
To: rs500cat@icloud.com  
Source: K2RAS  
Subject: //WL2K test

test

Annotations:

- Click Messages to create a new message (points to the "Message" menu item)
- Folders of messages just like other email programs (points to the "System Folders" list)
- Listing of prior contacts (points to the "Contacts" list)

# Creating a Winlink Message

Enter a new message

Close Select Template ARRL RadioGram ICS 213 General Report Attachments **Post to Outbox** Spell Check Save in Drafts

From: K2RAS Send as: Winlink Message  Request read receipt Set Defaults

To: K2RAS;k2RAS@comcast.net

Cc:

Subject: Sample Message

Attach:

Test Message

Messages can be addressed to registered Winlink callsigns or normal email addresses

Choose to send message as Peer-to-Peer, use the Winlink network, or Radio-Only (Hybrid)

Don't forget to post the message to the Outbox folder when you are done

# Opening a Winlink Session Type To Send / Receive Messages

- **Packet Winlink** (VHF packet)
  - Requires a hardware or software (Direwolf) TNC
  - Pactor Radio-only (sends using Hybrid mesh, with no Internet)
- **Winmore Winlink** or **Winmor Radio-only** (HF packet)
  - Does not require a TNC (Winmore includes a software modem)
- **Telnet Winlink** (direct connection to the Internet)
  - Sends email without using a radio
  - Does not require a TNC (uses your Internet connection)

# Open a session type (Packet Winlink or Winmor Winlink)

The screenshot shows the Winlink Express 1.5.19.0 - K2RAS interface. The 'Open Session:' dropdown menu is set to 'Winmor Winlink'. A red arrow points to this dropdown menu. Below the menu, a table lists messages, and a message detail pane is visible at the bottom.

**No active session.**

	Date/Time	Message ID	Size	Source	Sender	Recipient	Subject
	2019/02/17 ...	HMU7VP59...	159	K2RAS	K2RAS	rs500cat@ic...	//WL2K test
	2019/01/19 ...	IUTX6J9C8...	143	K2RAS	K2RAS	W0ENO-1	//WL2K ee

Choose the session type to start sending and receiving messages

Message ID: HMU7VP59ZHIX  
Date: 2019/02/17 05:52  
From: K2RAS  
To: rs500cat@icloud.com  
Source: K2RAS  
Subject: //WL2K test  
test

# Regional Winlink Nodes

## Winlink VHF RMS Internet-connected local nodes

WØIA-10	145.090	Boulder
WØNED-10	145.070	Nederland
KØNTS-10	145.050	Denver (Squaw)
NVØN-10	145.030	Longmont (north)
KAØBSA-10	144.930	Broomfield

## Regional Winlink HF RMS Internet-connected nodes

KD6OAT	14.110	Sandy, UT
N5TW	14.110	Austin, TX (Hybrid)
XE1CRG	14.085	Irapuato, Mexico (Hybrid)
K5AEA	14.097.5	Austin, TX (Hybrid)
K5AEA	7.100	Austin, TX (Hybrid)
N5TW	7.091.5	Austin, TX (Hybrid)
K7DAV	3.597	Ogden, UT (Hybrid)
W5PDO	3.592	Santa Fe, NM (Hybrid)
KE7XO	3.587	Las Vegas, NV (Hybrid)
K6JGL	3.595	Los Angeles, CA (Hybrid)
N5TW	3.596	Austin, TX (Hybrid)
KB5HCD	3.595	Houston, TX (Hybrid)
KC8YJJ	3.589.5	Pittsburgh, PA (Hybrid)

*Red locations use Hybrid Mesh forwarding*

# On to the demonstration...

## References

<http://www.winlink.org>

[http://www.winlink.org/content/e\\_mail\\_or\\_without\\_internet](http://www.winlink.org/content/e_mail_or_without_internet)

<http://www.kantronics.com/products/kpc3.html>

<http://www.tigertronics.com/slusbmain.htm> (signalink modem)