

The logo is a circular emblem with a red outer ring containing the text "EMERGENCY COMMUNICATIONS" at the top and "RADIO AMATEUR OPERATIONS" at the bottom, separated by two stars. The inner blue circle features a satellite, a laptop, a radio tower, and a satellite dish. The text "A.C.S." is written in large yellow letters at the bottom of the inner circle.

# **Pinellas ACS Training**

## **Introduction to Winlink**

**2/16/2023**

**Mike Drake**

**Pinellas ACS Training Officer**



# Agenda



- Winlink Overview
- Winlink Architecture and Operating Modes
- Digital Communications
- Winlink Training



# Winlink Overview

## Description



- E-mail program
  - Download from the Winlink website ([Winlink.org](http://Winlink.org)) - **No Cost**
  - Requires a valid FCC license
  - Users can exchange messages
    - Registered Winlink users (example: WA1RYQ to W7WMS)
    - Registered Winlink user to/from Internet addresses (Example: W7WMS to [WA1RYQ@ARRL.net](mailto:WA1RYQ@ARRL.net))
  - Messages can be exchanged using any of the following connections
    - Internet
    - VHF/UHF Radio
    - HF Radio
    - Satellite (Iridium)

A radio connection is not required to send or receive messages via Winlink



# Winlink Overview

## Description



- Reliability, Accuracy and Flexibility
  - High reliability (99.99% availability for 15 years)
  - 100% accurate message transmissions.
  - Radio connection bridge to Internet e-mail
  - Radio-only store and forward without Internet
  - Peer-to-peer connections between radio end-users
- Interoperability: Connect different types of systems
  - Bridge different radio capabilities (VHF/UHF/HF)
  - Bridge protocols: Pactor, ARDOP, Packet, VARA FM, VARA HF

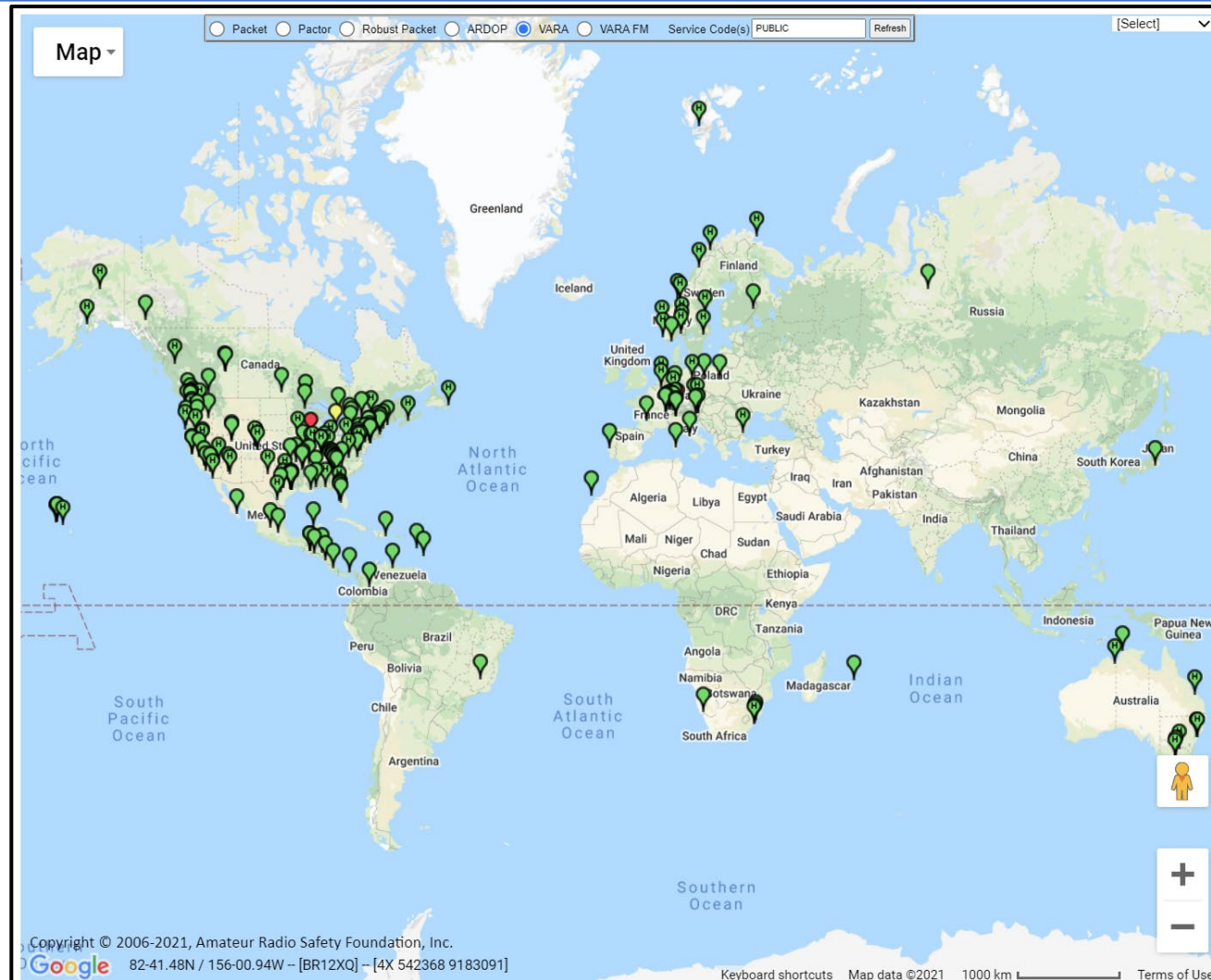
- FEC – Forward Error Correction
- ARQ – Automatic Repeat Request



# Winlink Overview

## HF Stations Located Worldwide

Geographical dispersion and redundancy improves reliability



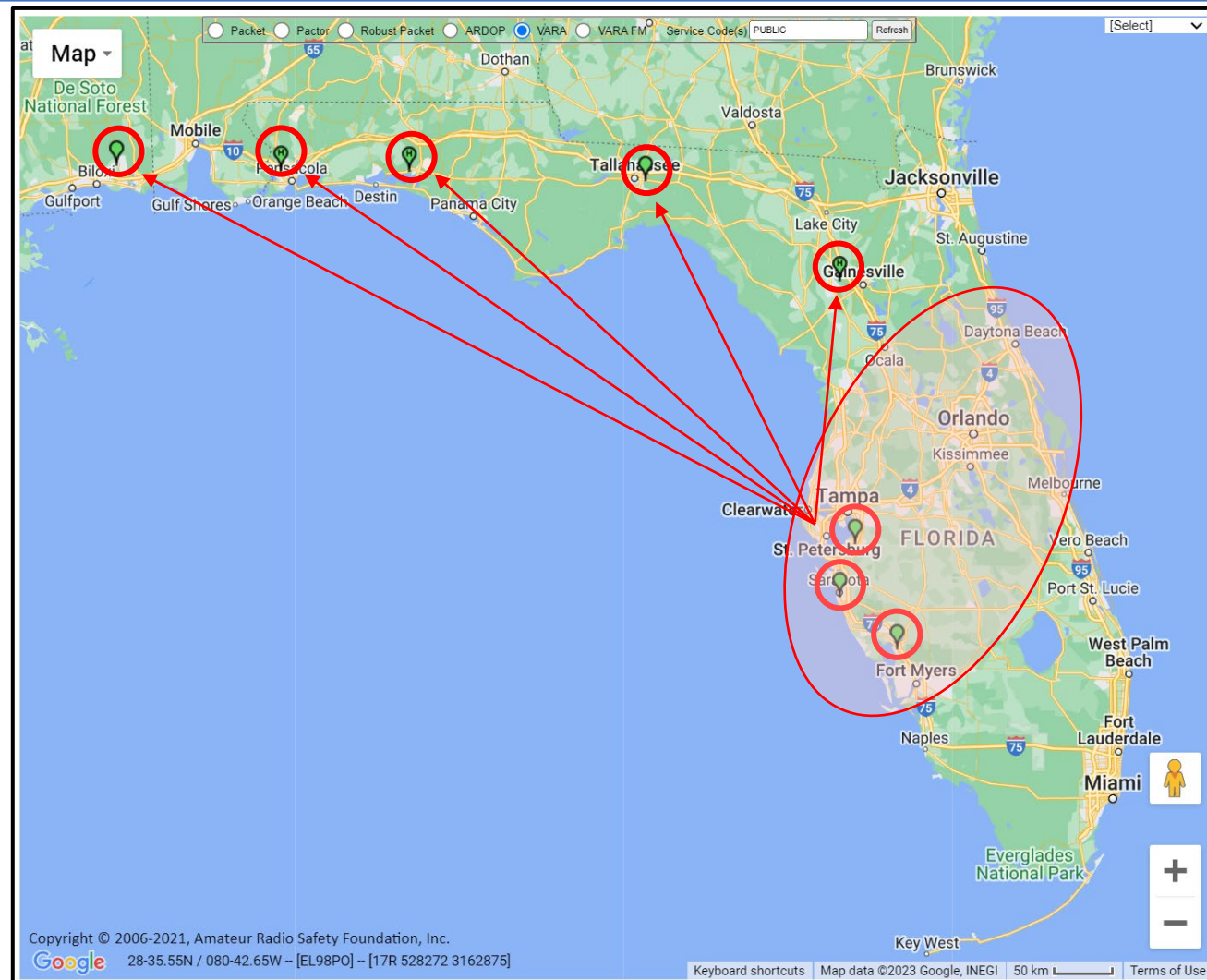




# Winlink Overview

## HF Stations Located in Florida

Geographical dispersion and redundancy improves reliability

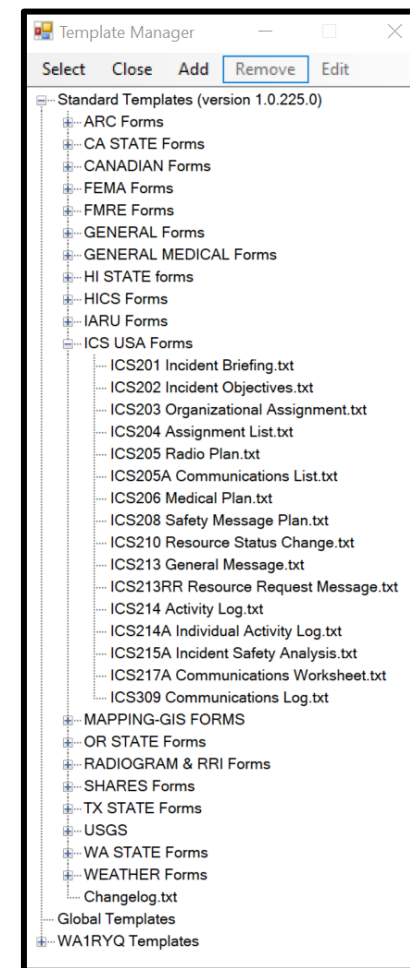




# Winlink Overview

## Description

- Standard e-mail format with many features
  - Standard NIMS ICS Forms embedded within program
  - Binary file attachments (pictures, PDF, spreadsheets)
  - Automatic message compression/decompression
  - Whitelist used to control SPAM
- Automatic message logging and ICS report generation
- Stores messages for pickup at a later time





# Winlink Overview

## Description

- Frequency agility
- Good operation at most power levels
- Not limited by station-to-station propagation

HF Channel Selector									
Exit Select Update Via Internet Update Via Radio Map Forecast SFI All RMS									
Callsign	Frequency (kHz)	Mode	Grid Square	Hours	Group	Distance (mi)	Bearing (Degrees)	Path Reliability Estimate	Path Quality Estimate
N4SER	3595.000	V2300	EL87RH	00-23	PUBLIC	40	158	99	99
K4KPR	7101.200	V2300	EL87TQ	00-23	PUBLIC	27	114	96	96
N4SER	7103.700	V2300	EL87RH	00-23	PUBLIC	40	158	96	96
K4KPR	10147.000	V2300	EL87TQ	00-23	PUBLIC	27	114	94	94
K4KPR	14109.500	V2300	EL87TQ	00-23	PUBLIC	27	114	92	92
AK4SK	10130.000	V500	EM60VL	10-07	PUBLIC	275	312	91	52
AK4SK	10146.850	V2300	EM60VL	10-07	PUBLIC	275	312	91	52
KX4Z	10147.000	V2300	EL89RQ	00-23	PUBLIC	128	007	90	53
KX4Z	7103.500	V2300	EL89RQ	00-23	PUBLIC	128	007	90	51
W4DIG	7082.500	V500	EL86XV	00-23	PUBLIC	80	145	89	52
N4SER	10146.200	V2300	EL87RH	00-23	PUBLIC	40	158	89	52
W4DIG	10146.500	V2300	EL86XV	00-23	PUBLIC	80	145	88	52
W4UC	10146.500	V2300	EM60IL	00-23	PUBLIC	326	305	88	50
K4KPR	21091.200	V2300	EL87TQ	00-23	PUBLIC	27	114	87	87
K4PAR-4	10144.600	V2300	EM83II	00-23	PUBLIC	381	356	86	49
WM4RB	14096.500	V2750	EM75ME	00-23	PUBLIC	523	346	85	49
AK4ZX	14110.500	V2300	EM75KA	00-23	PUBLIC	514	345	85	49

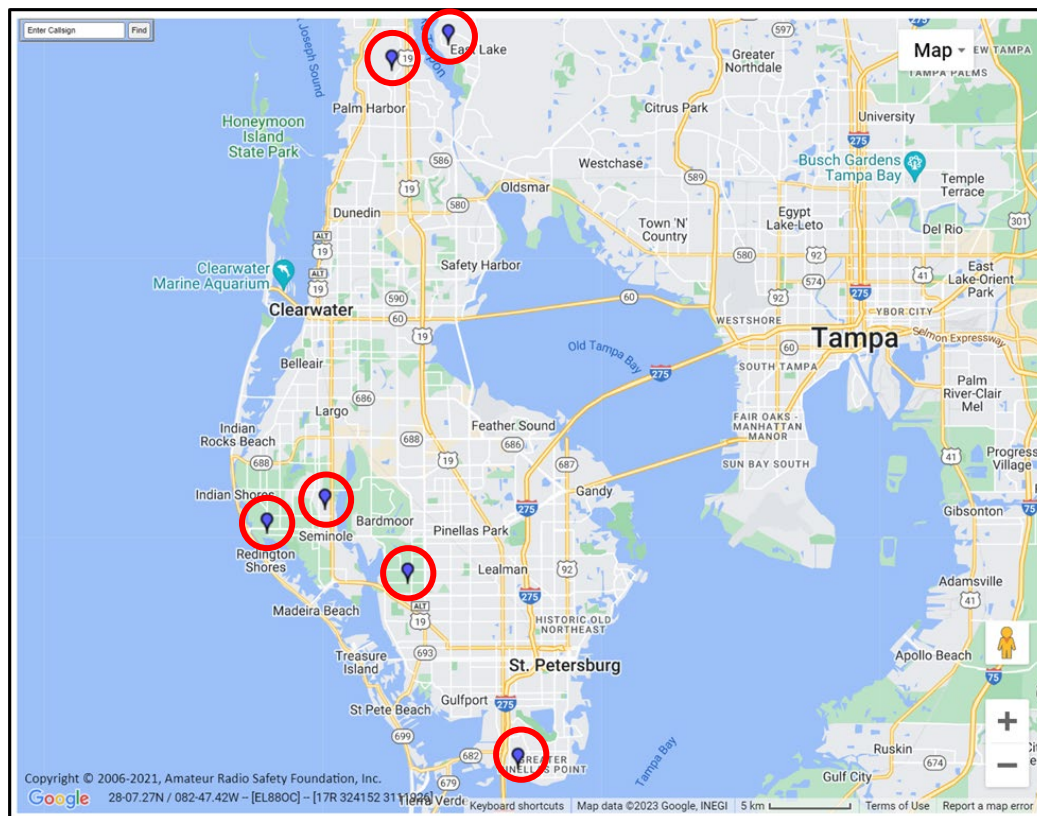




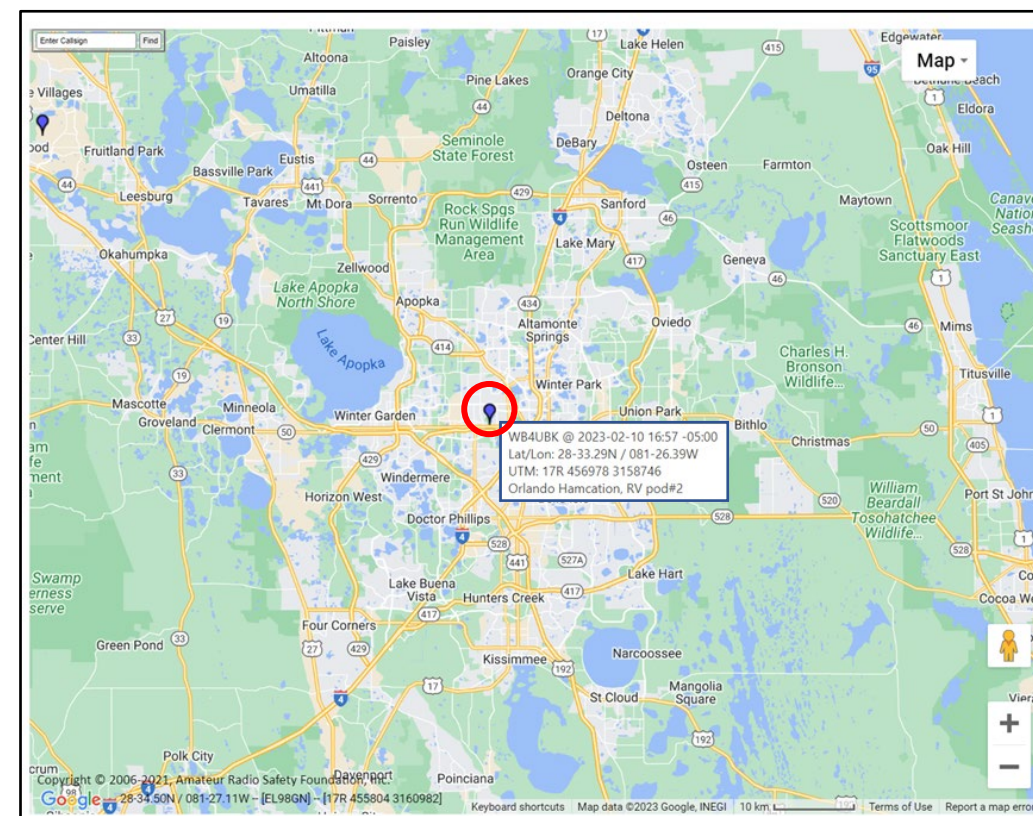
# Winlink Overview

## Description – Position Reports

### Reports from ACS Winlink Training



### Detailed Information



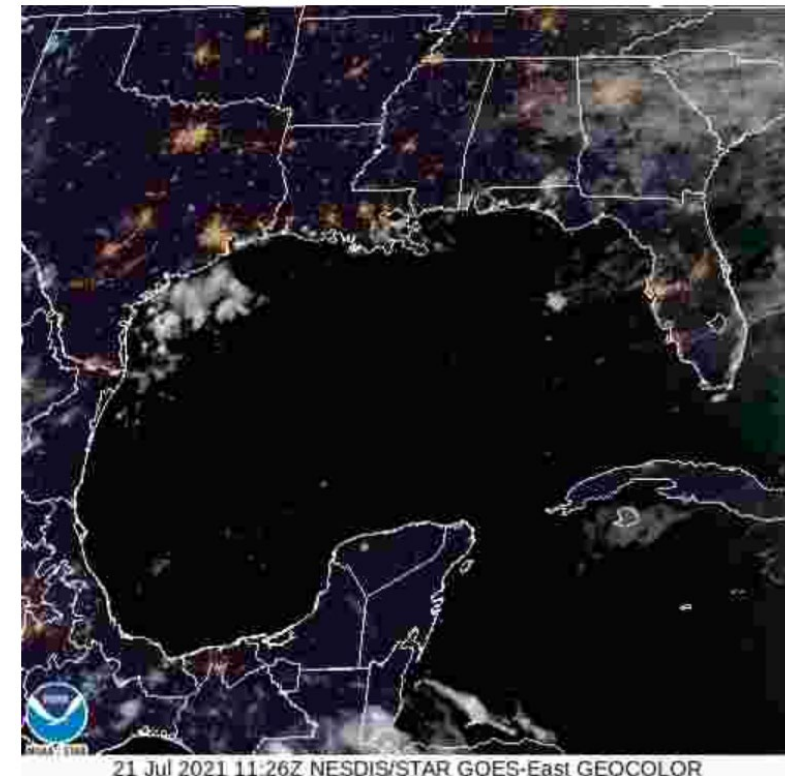


# Winlink Overview

## Description



- Weather and Information Bulletins
- Wide adoption by EmComm related agencies
  - Amateur Radio Emergency Services (ARRL ARES)
  - Military Auxiliary Radio System (DOD/MARS)
  - Radio Amateur Civil Emergency Services (RACES)
  - National American Red Cross (ARC)
  - Southern Baptist Disaster Relief
  - Salvation Army
  - US Coast Guard
  - SHARES
  - Many Federal, state and local government agencies, world-wide





# Agenda



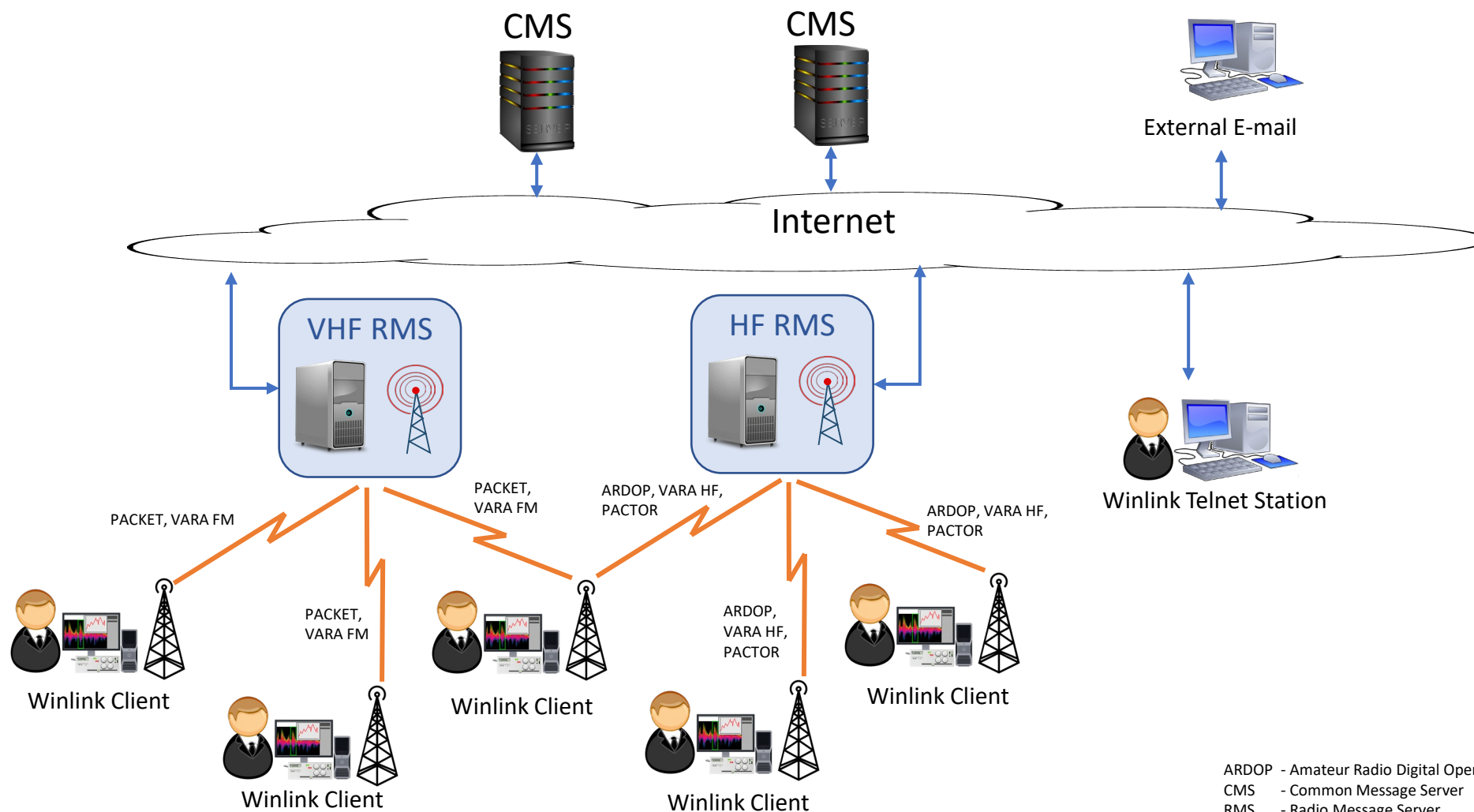
- Winlink Overview
- Winlink Architecture and Operating Modes
- Digital Communications
- Winlink Training





# Winlink Overview

## System Architecture



ARDOP - Amateur Radio Digital Open Protocol  
CMS - Common Message Server  
RMS - Radio Message Server

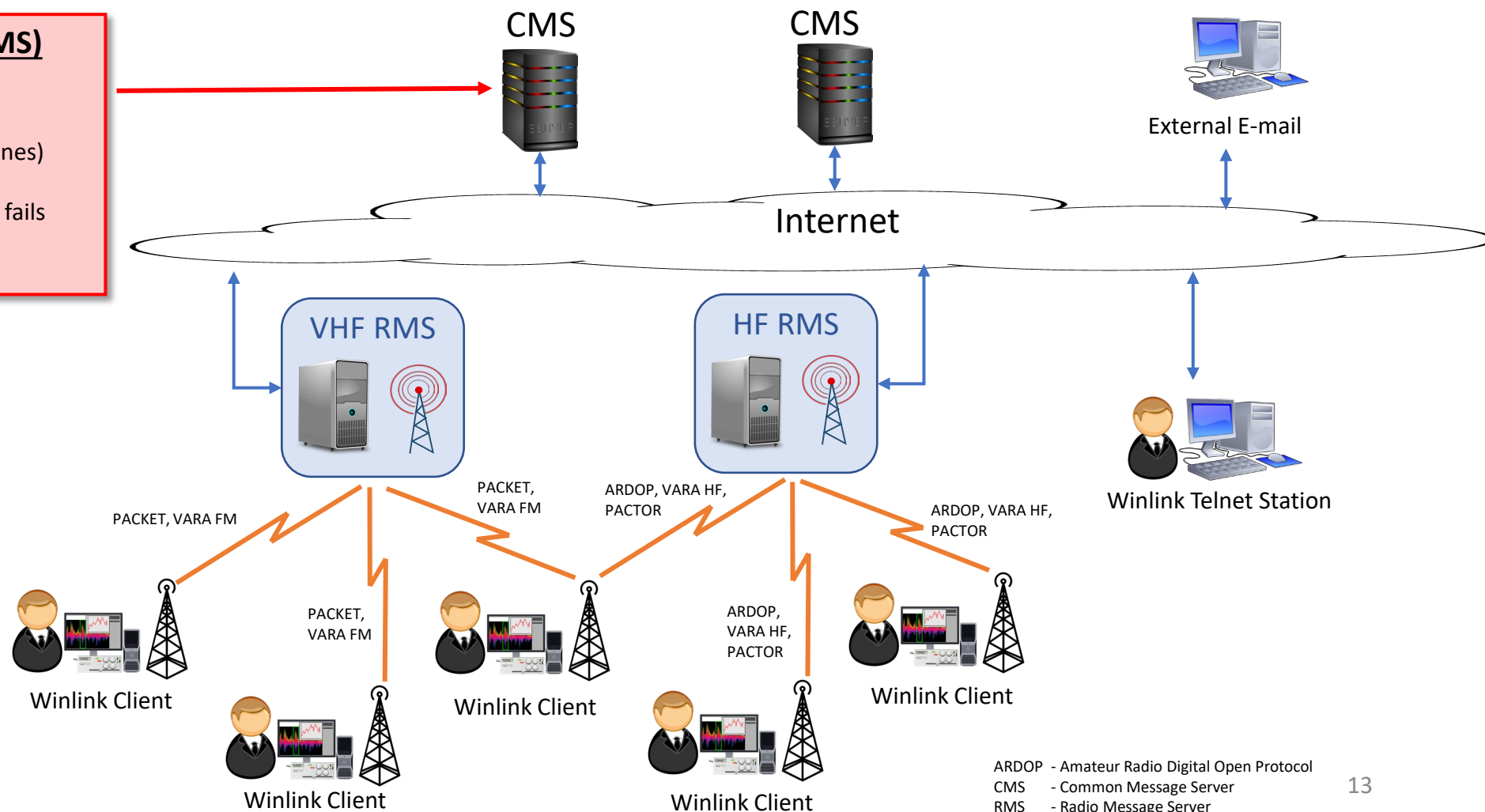


# Winlink Overview

## System Architecture – Conventional Mode

### Common Message Server (CMS)

- Winlink Email Server
- Hosted by Amazon Web Services (AWS)
- Redundant Locations (Different Avail Zones)
- Realtime Backups between servers
- Automatic switchover is primary Server fails

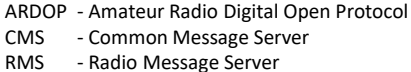






## Radio Message Server (RMS)

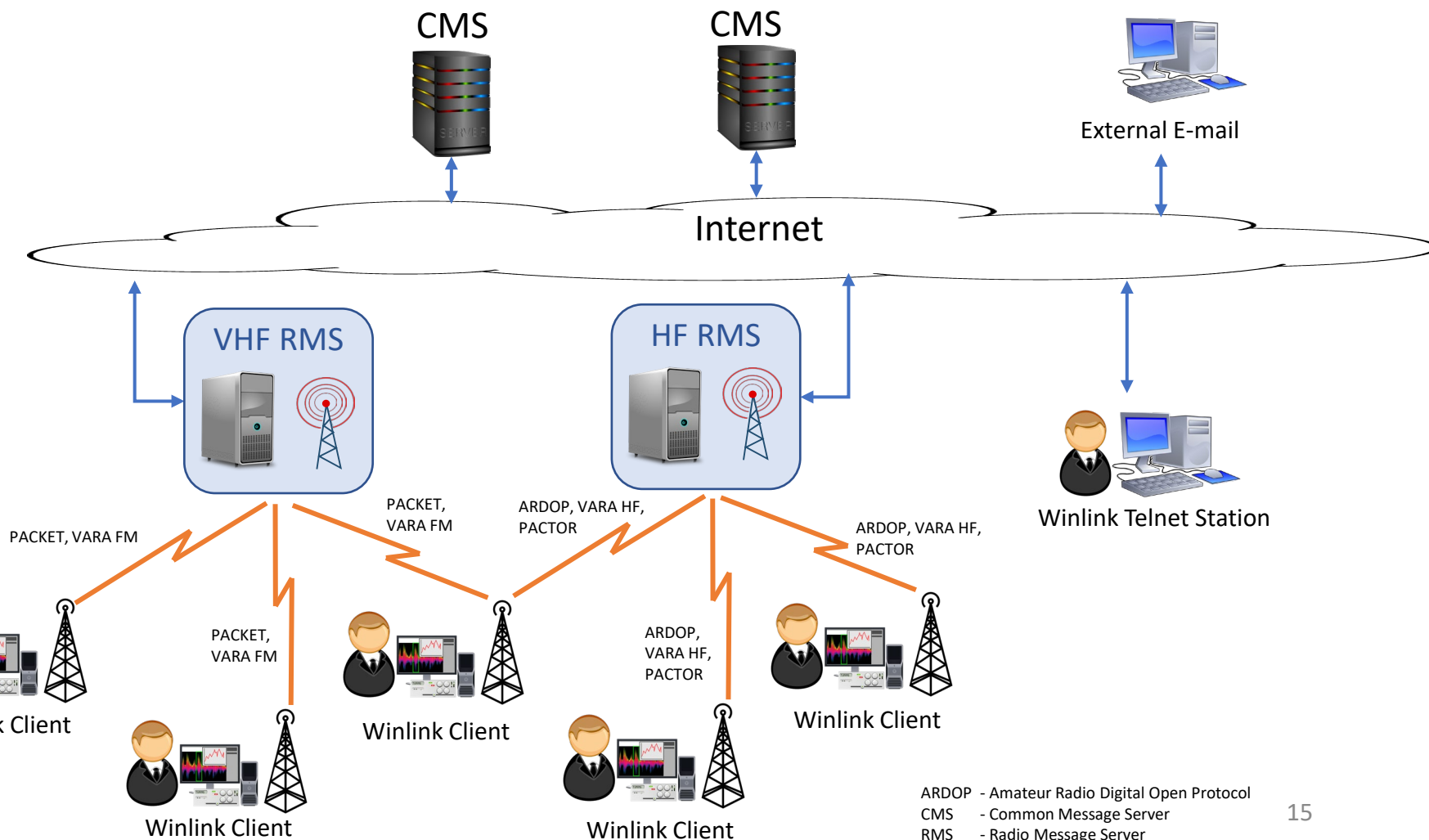
- Gateway Station used to connect Winlink Radio Clients with Winlink CMS via internet
- VHF/UHF and HF Stations
- Can be configured as a standalone Hub during internet failures





# Winlink Overview

## System Architecture – Conventional Mode



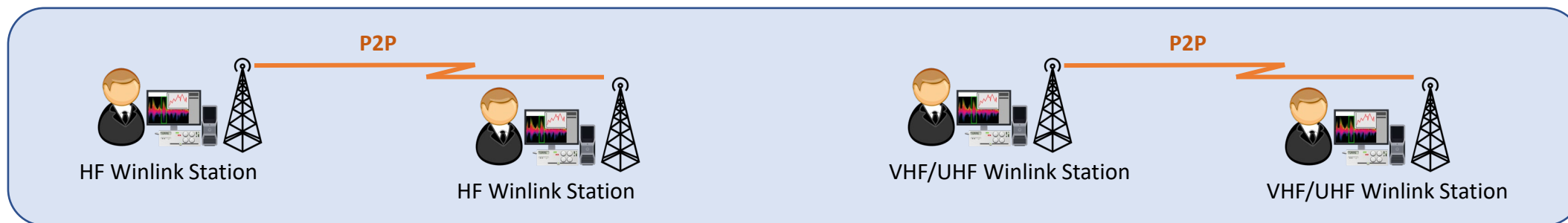
ARDOP - Amateur Radio Digital Open Protocol  
CMS - Common Message Server  
RMS - Radio Message Server



# Winlink Operating Modes

## Peer-to-Peer (P2P)

- Direct radio connection between two HF or VHF/UHF client stations
- The Internet is not used
- Only the two client stations are involved.



### Advantages

- Can operate independent of Internet and RMS
- Mixed mode nets possible on VHF/UHF (voice and digital)

### Disadvantages

- Connections are limited by RF propagation
- Both stations must be on the air at the same time
- Stations must use some other form of communication to coordinate connections or have a pre-established plan for frequency and time.

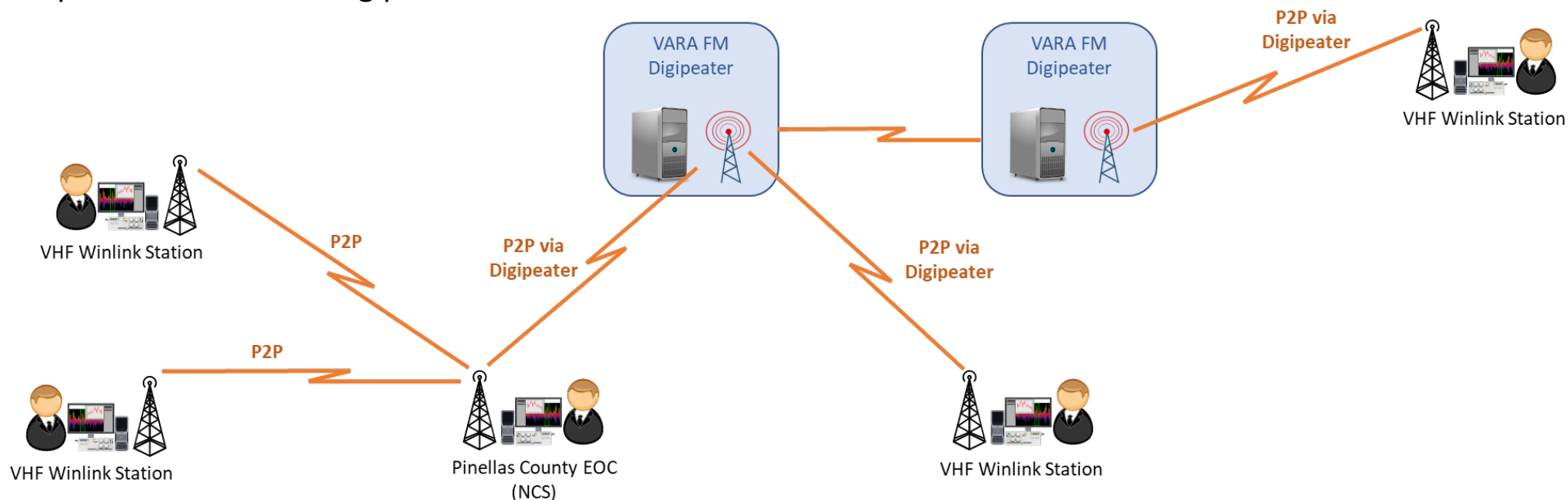


# Winlink Operating Modes

## Peer-to-Peer (P2P)

### Digipeaters

- Extend the range of Conventional or P2P VHF/UHF Exchanges
- Winlink Supports exchanges through one or two digipeaters
- VARA License required to use VARA Digipeater

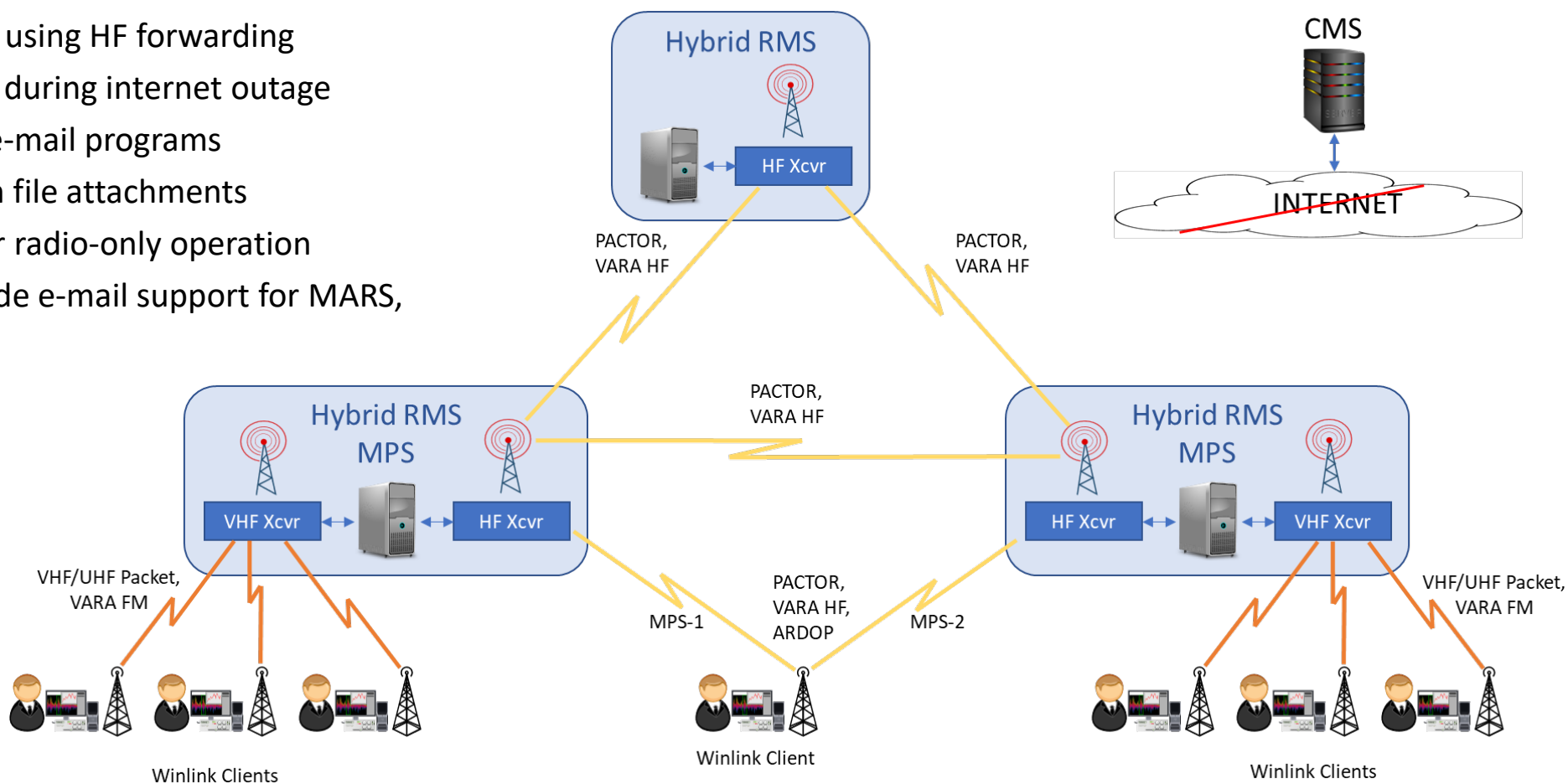




# Winlink Operating Modes

## Hybrid

- Wide-area, RF MESH network using HF forwarding
- Radio-only Winlink Operation during internet outage
- Uses standard Winlink client e-mail programs
- Supports standard e-mail with file attachments
- Satisfies DoDI requirement for radio-only operation
- Currently providing nation-wide e-mail support for MARS, SHARES and civil agencies





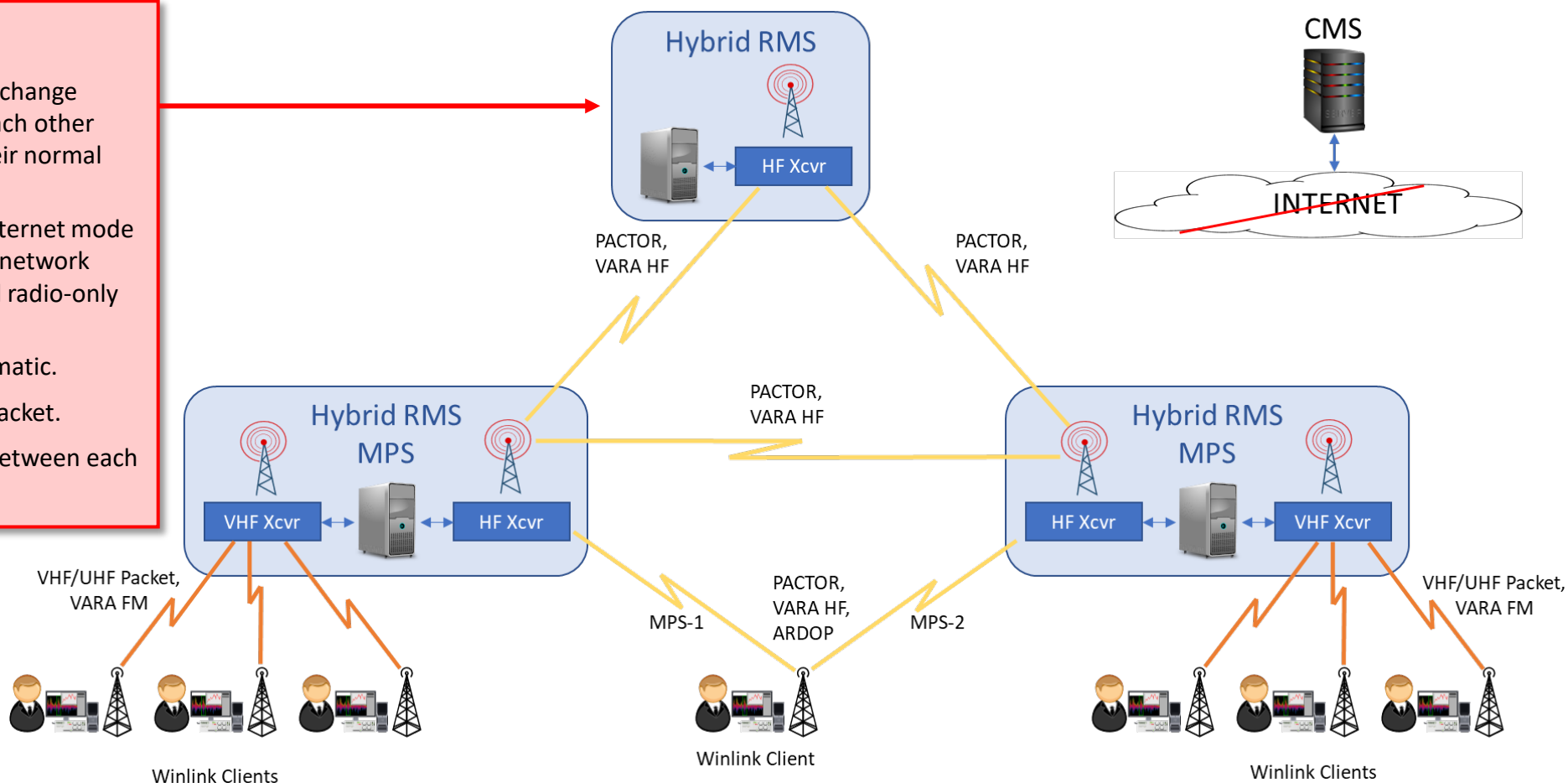


# Winlink Operating Modes

## Hybrid

### Hybrid RMS

- RMS HF and RMS VHF/UHF stations that exchange messages (on behalf of others) between each other using "radio", in addition to performing their normal Winlink functions.
- Each Hybrid RMS runs in normal Winlink Internet mode and will switch automatically to radio-only network mode during an internet outage to forward radio-only messages.
- Message routing is dynamic and fully automatic.
- Users can connect using Pactor, VARA, or Packet.
- Pactor and VARA used for backbone links between each Hybrid RMS



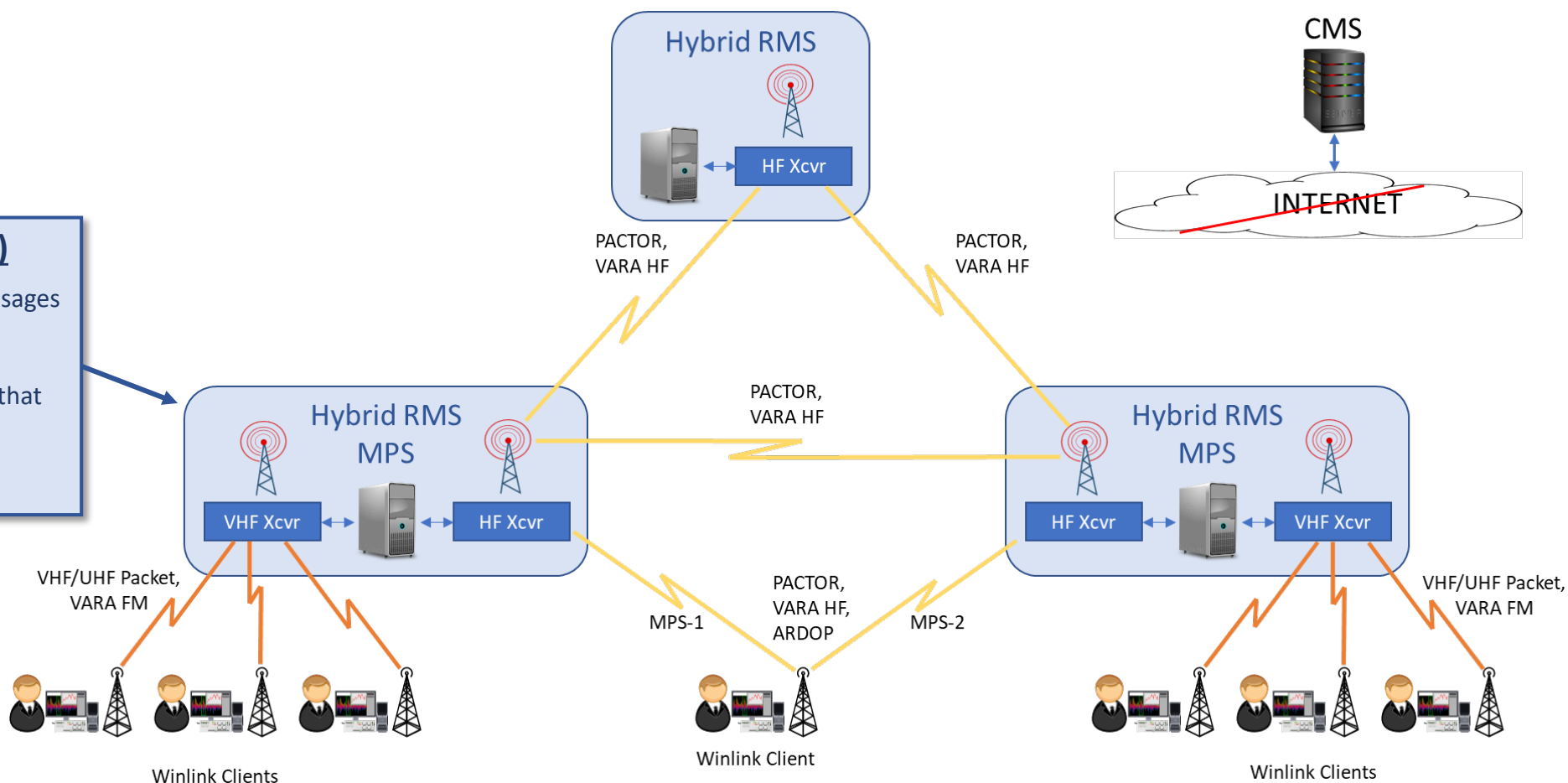


# Winlink Operating Modes

## Hybrid

### Message Pickup Stations (MPS)

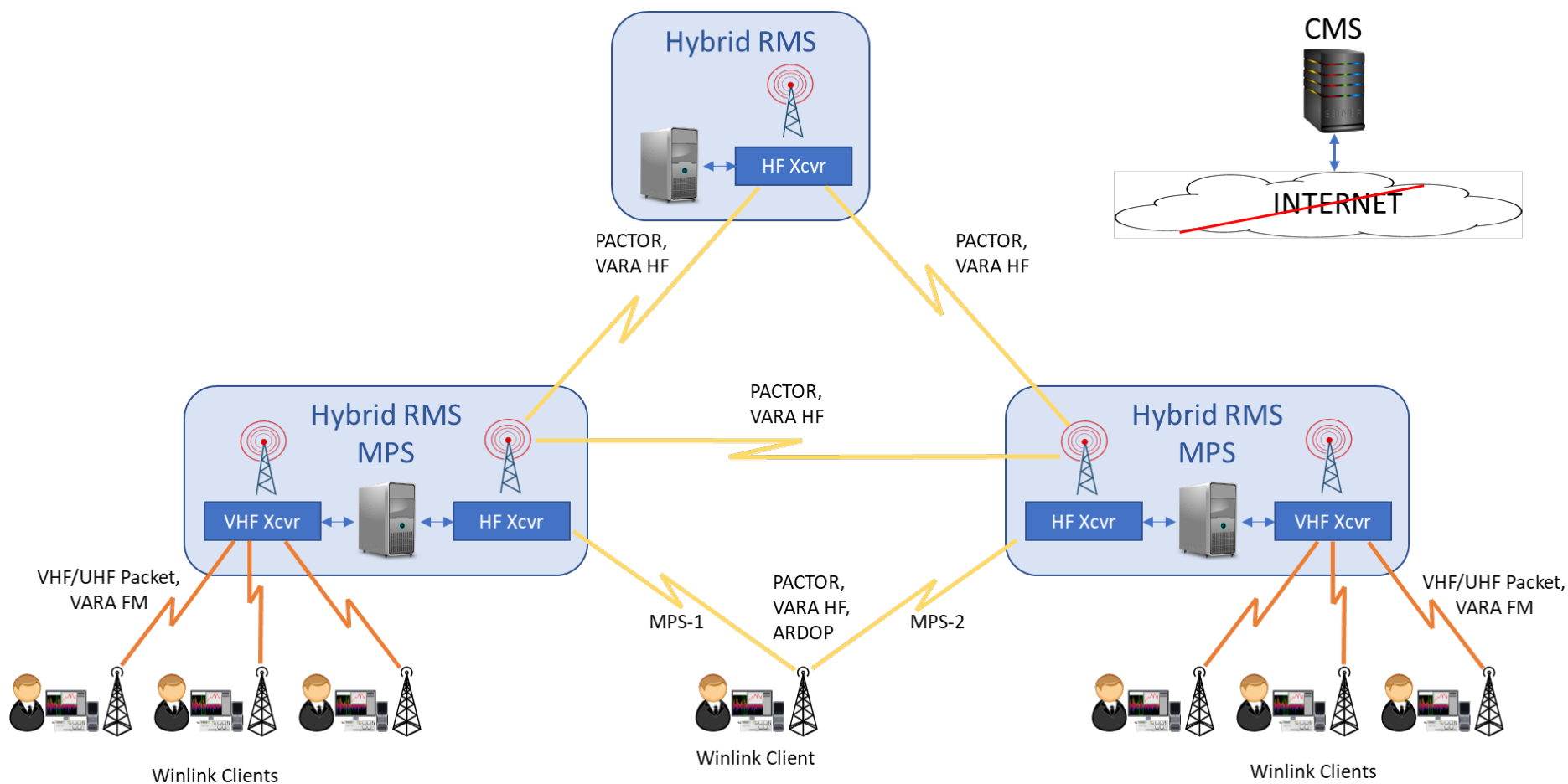
- Hybrid RMS used by client to receive messages during an internet outage
- Each user can select up to 3 MPS to store incoming messages (Winlink Recommends that no more than 2 are selected)





# Winlink Operating Modes

## Hybrid



### Winlink Client

- Individual Winlink User
- Winlink Express Computer Program
- VHF/UHF – Packet, VARA FM
- HF – ARDOP, VARA HF, Pactor



# Agenda

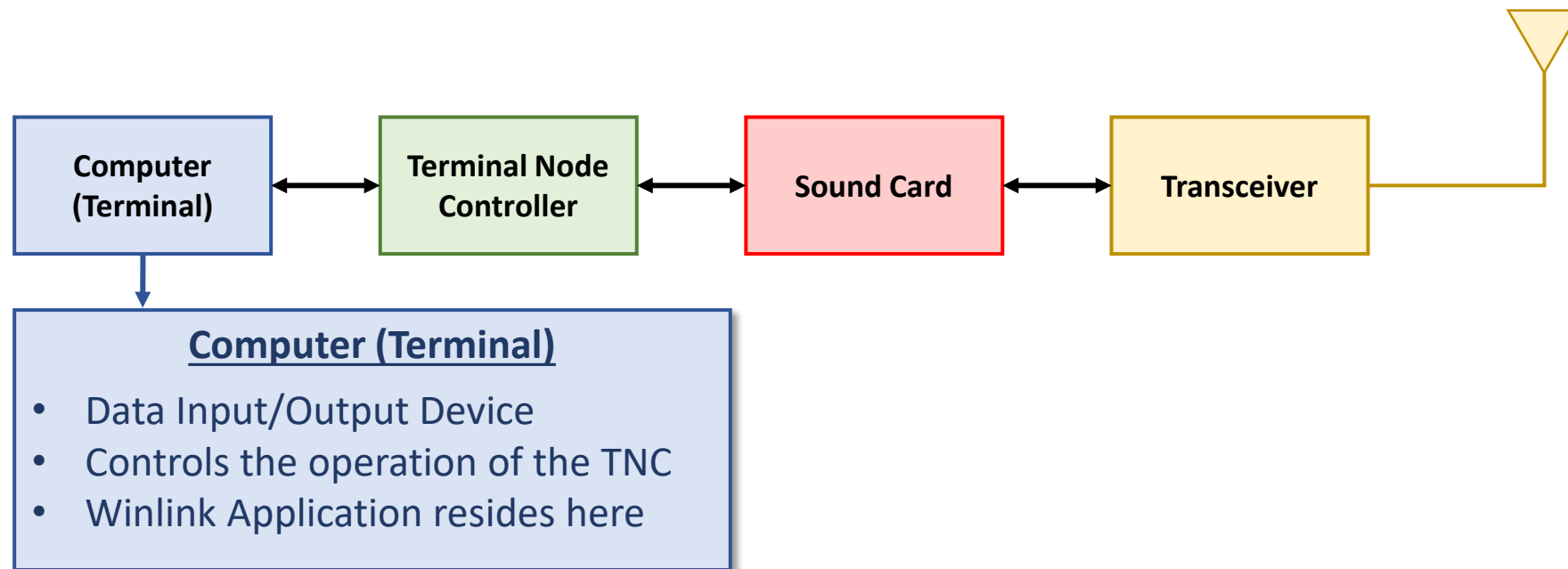


- Winlink Overview
- Winlink Architecture and Operating Modes
- Digital Communications
- Winlink Training



# Digital Communications

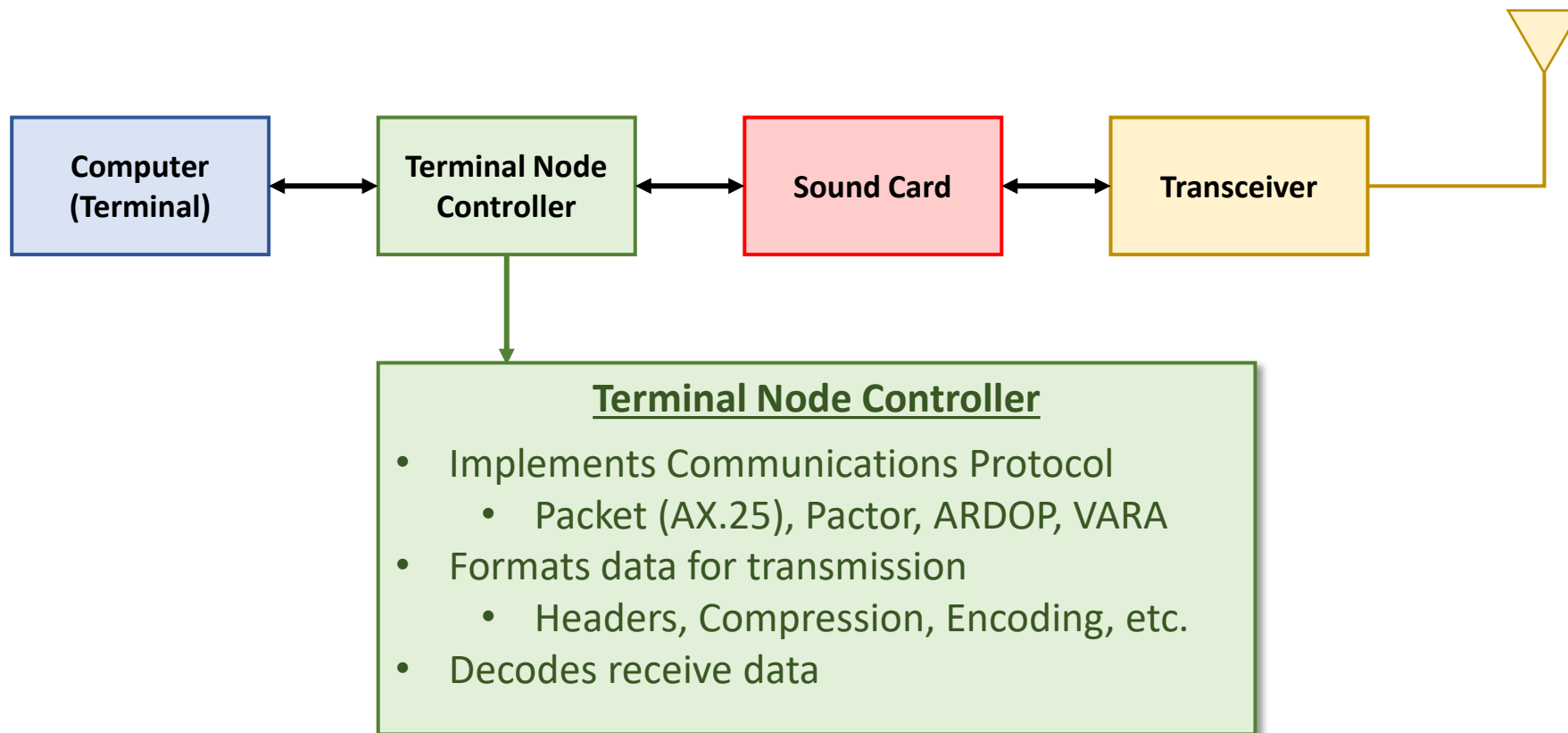
## Functional Description







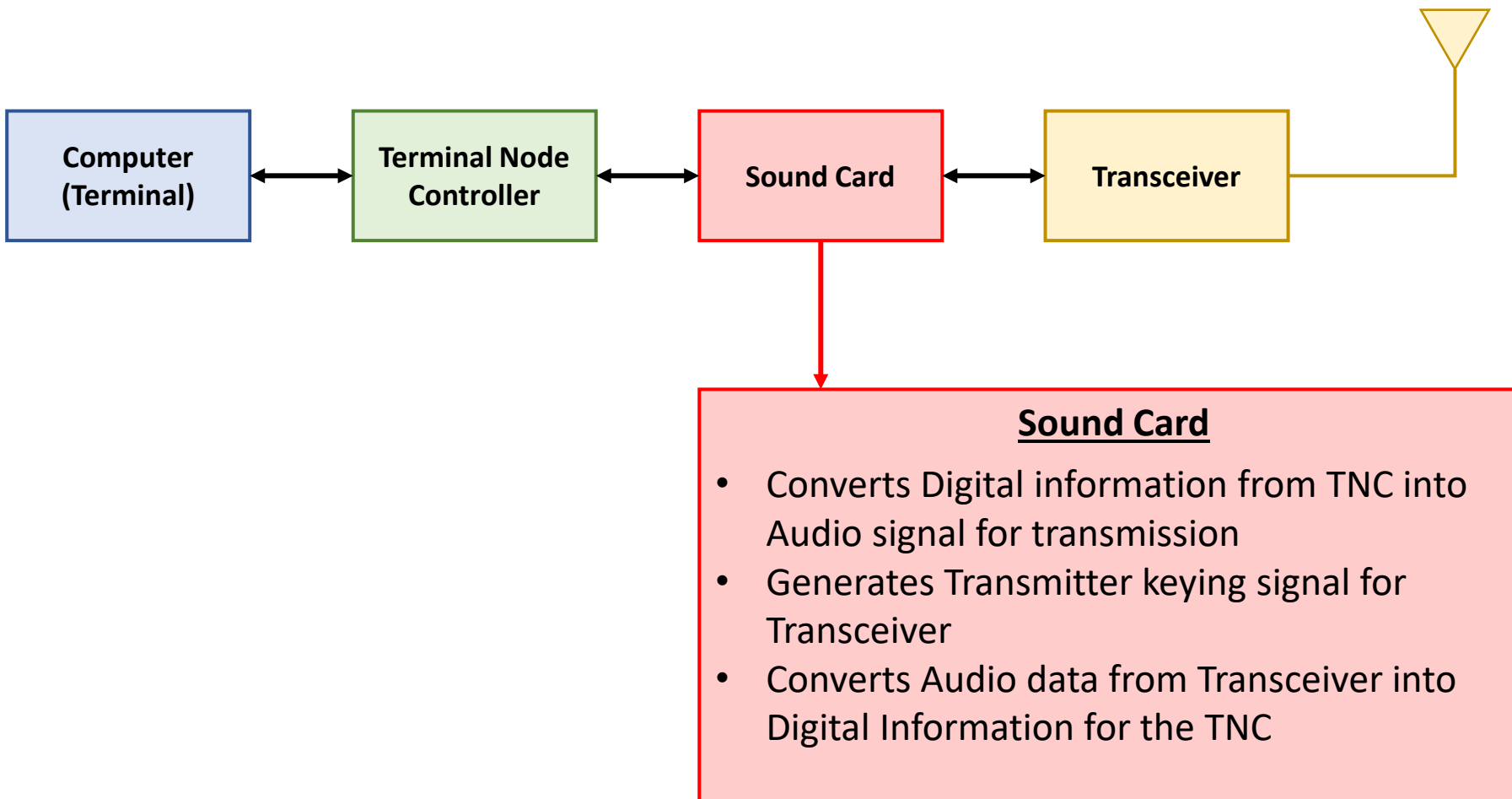
# Digital Communications Functional Description





# Digital Communications

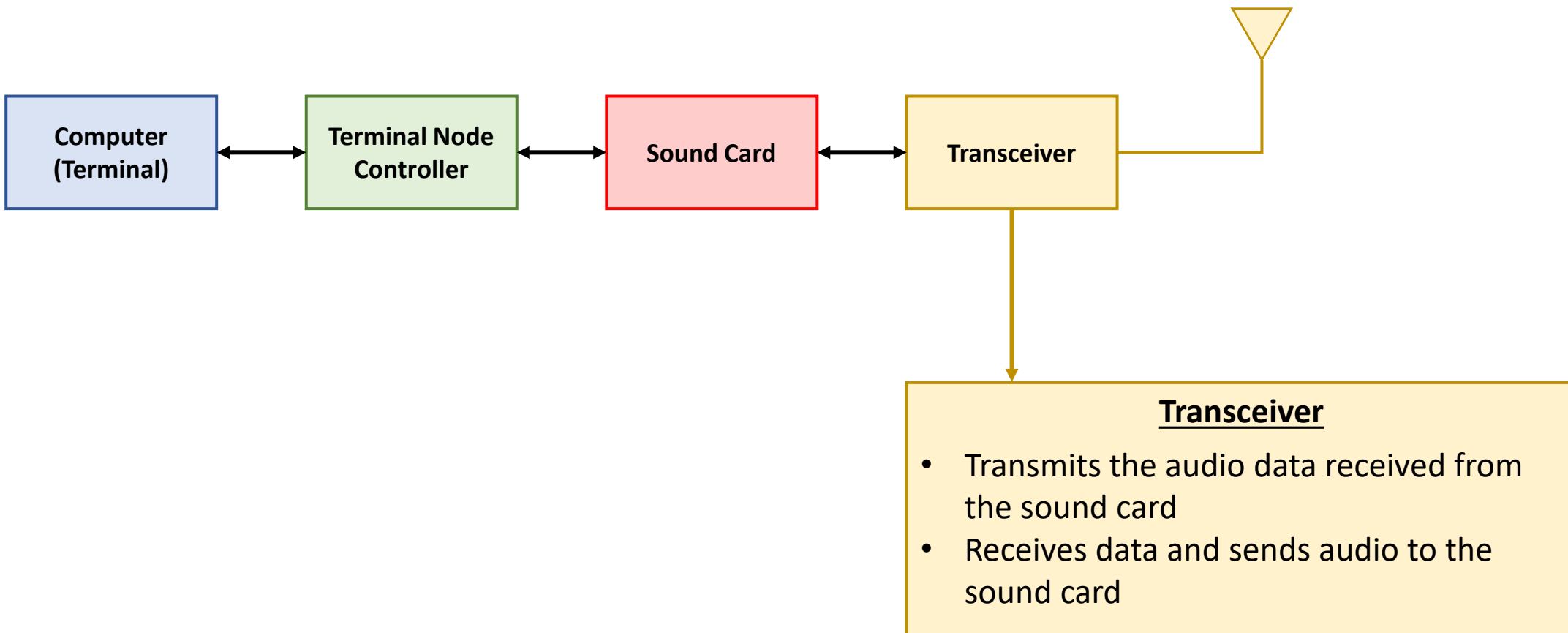
## Functional Description





# Digital Communications

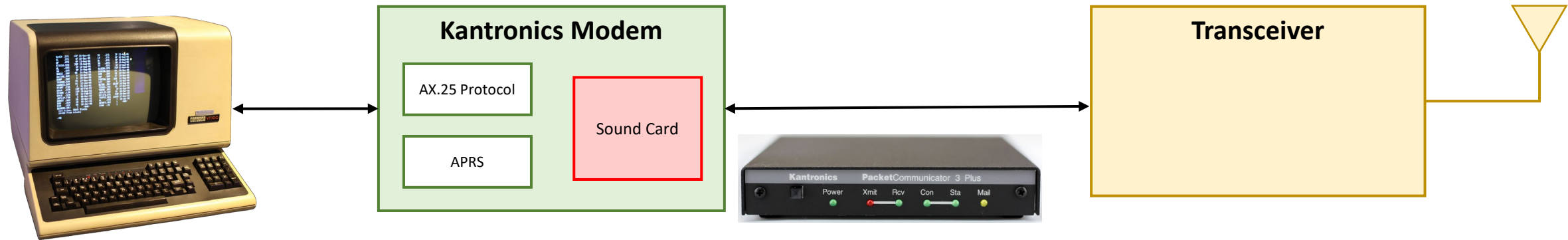
## Functional Description





# Digital Communications

## Functional Description – Development History

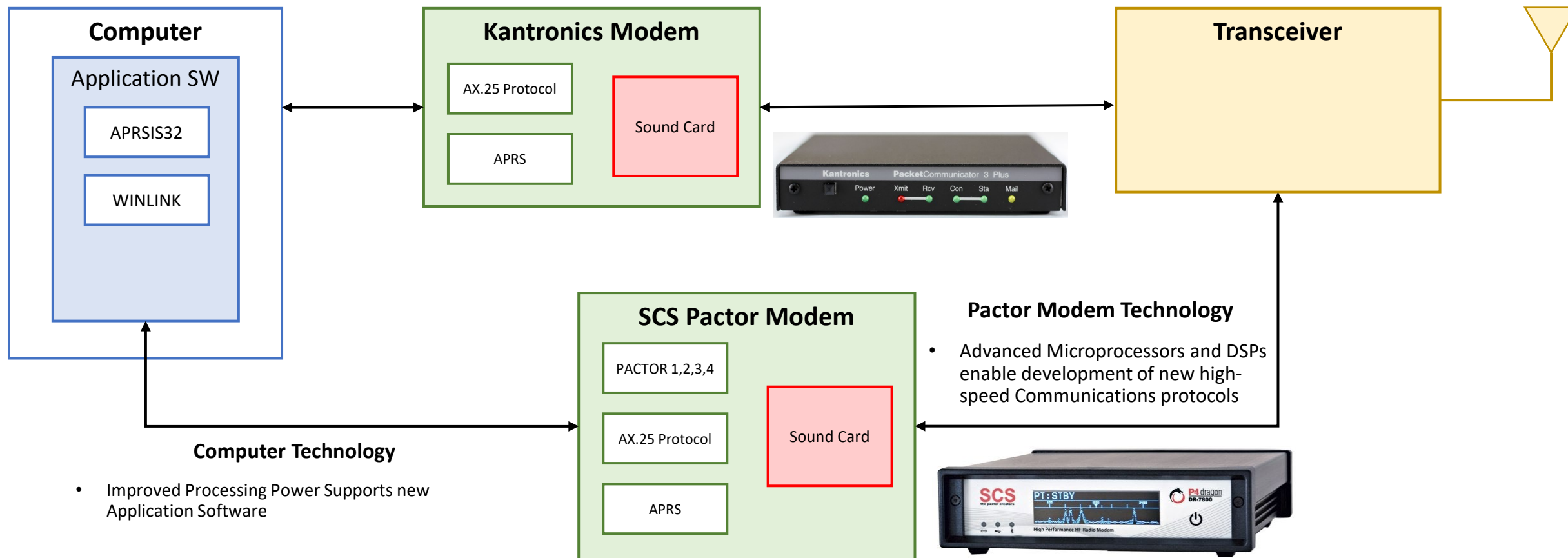


- Dumb Terminal / Microcomputer
  - Input and display unit
  - No application-based computing capability
  - Command line control of TNC
- Terminal Node Controller
  - Dedicated Hardware
  - Manages all aspects of Packet data exchange
  - Packet Assembler/Disassembler



# Digital Communications

## Functional Description – Development History

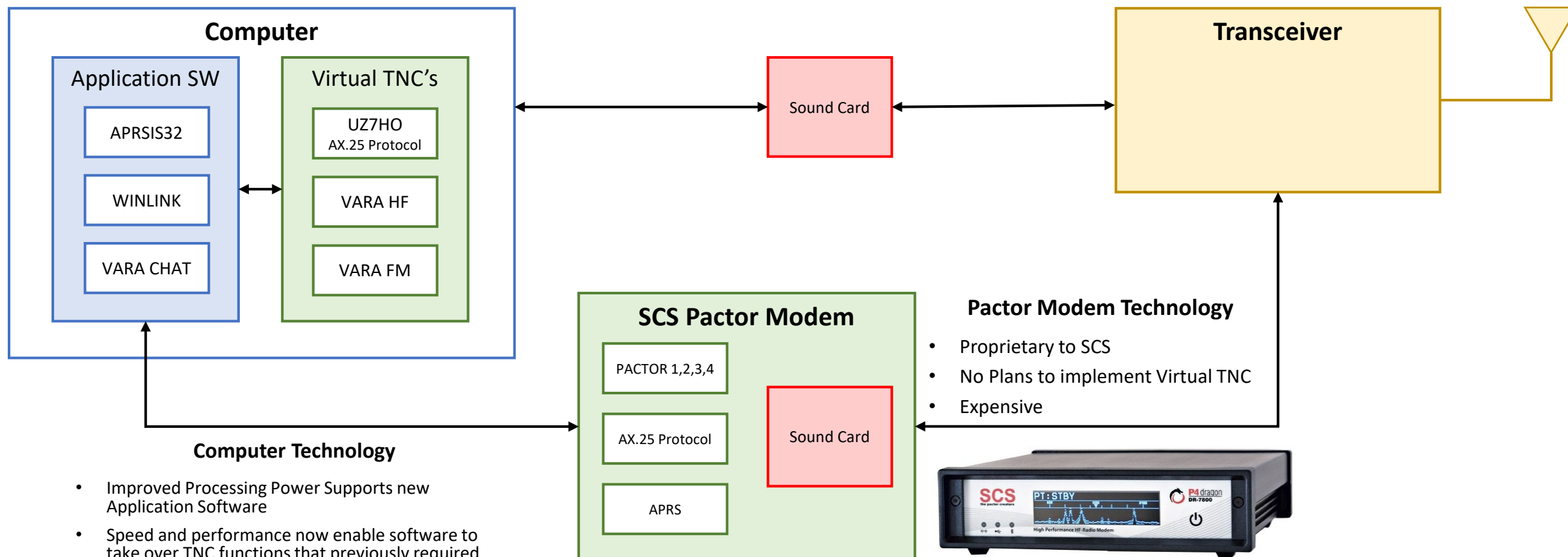






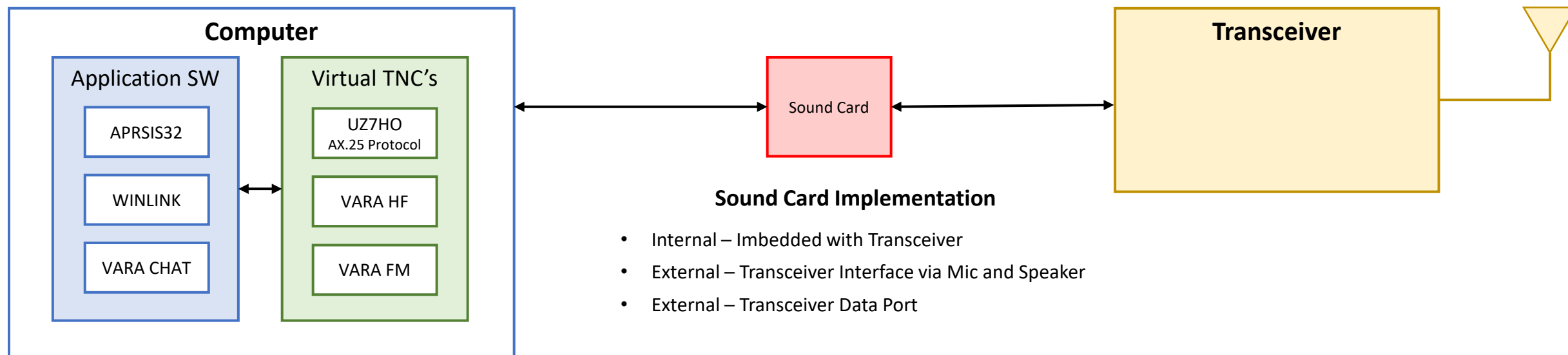
# Digital Communications

## Functional Description – Development History





# Digital Communications Implementation

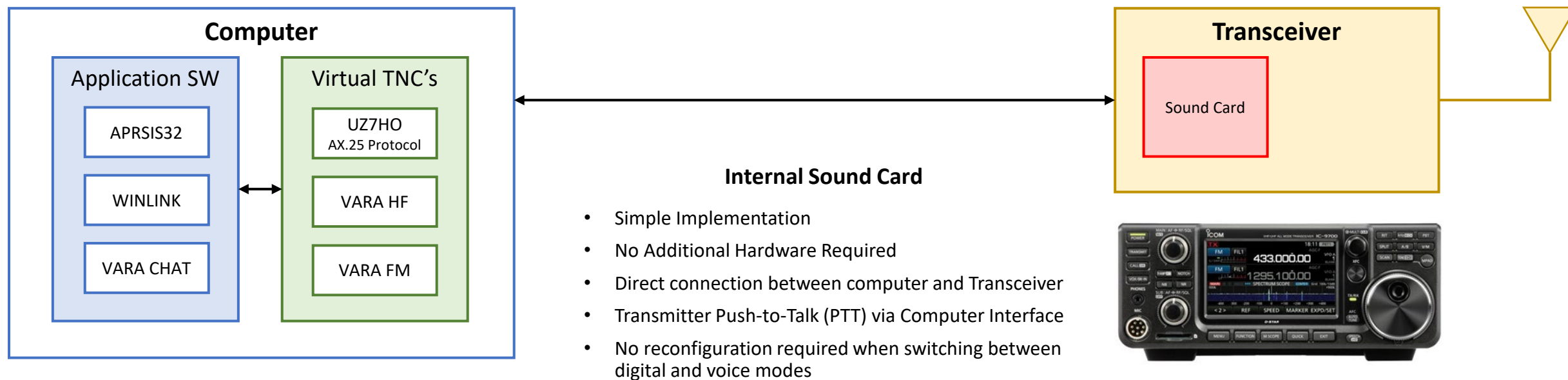


## Computer Technology

- Improved Processing Power Supports new Application Software
- Speed and performance now enable software to take over TNC functions that previously required dedicated hardware
- Virtual TNCs – Low or no cost to user

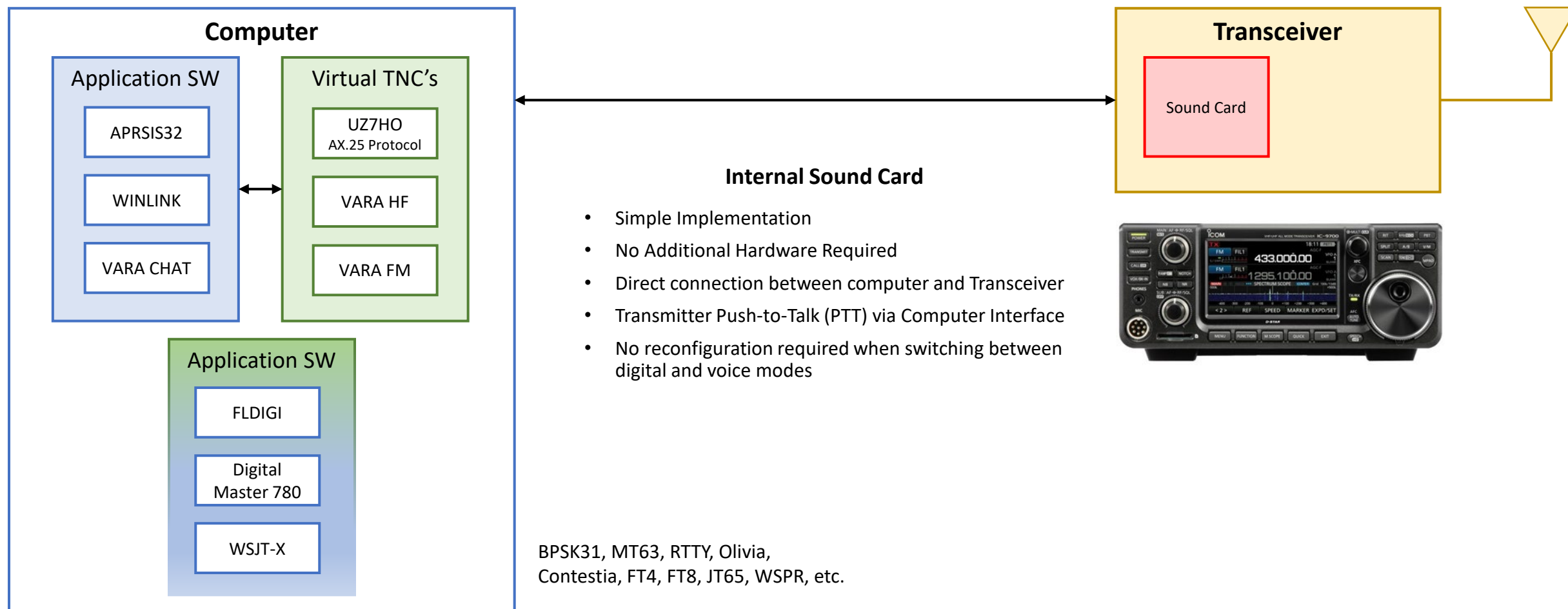


# Digital Communications Implementation – Internal Sound Card





# Digital Communications Implementation – Internal Sound Card





# Digital Communications

## Implementation – External Sound Cards

Many Options Available



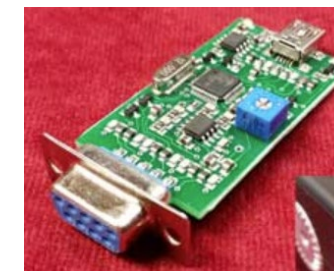
### Tigertronics Signalink™ USB

- Transformer Isolation
- Easy to Configure
- Hardware and Radio Cable Less than \$150
- Connects to Radio Data Port or Mic/Speaker
- Newer Design Support VARA Wide



### Masters Communications

- DRA Series (DRA-50 Shown)
- Purchased as a kit or prebuilt and tested
- Kit and Case \$70; Assembled, Tested, with Case \$100
- Wide Audio Range support VARA Wide
- HeartBeat monitor to prevent stuck PTT
- Best suited for connection to radio data port



### Repeater Builder RIM-Lite V2

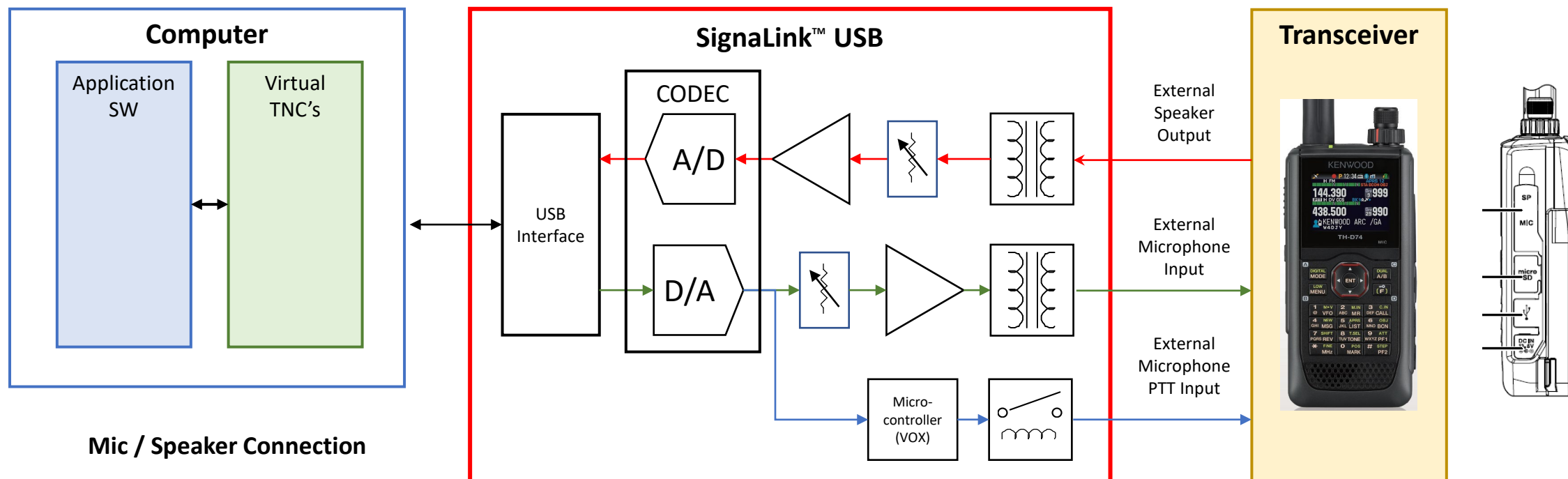
- Hardware approximately \$60
- Connects to Radio Data Port or Mic/Speaker
- Newer Design Support VARA Wide





# Digital Communications

## Implementation – External – Mic and Speaker Connection



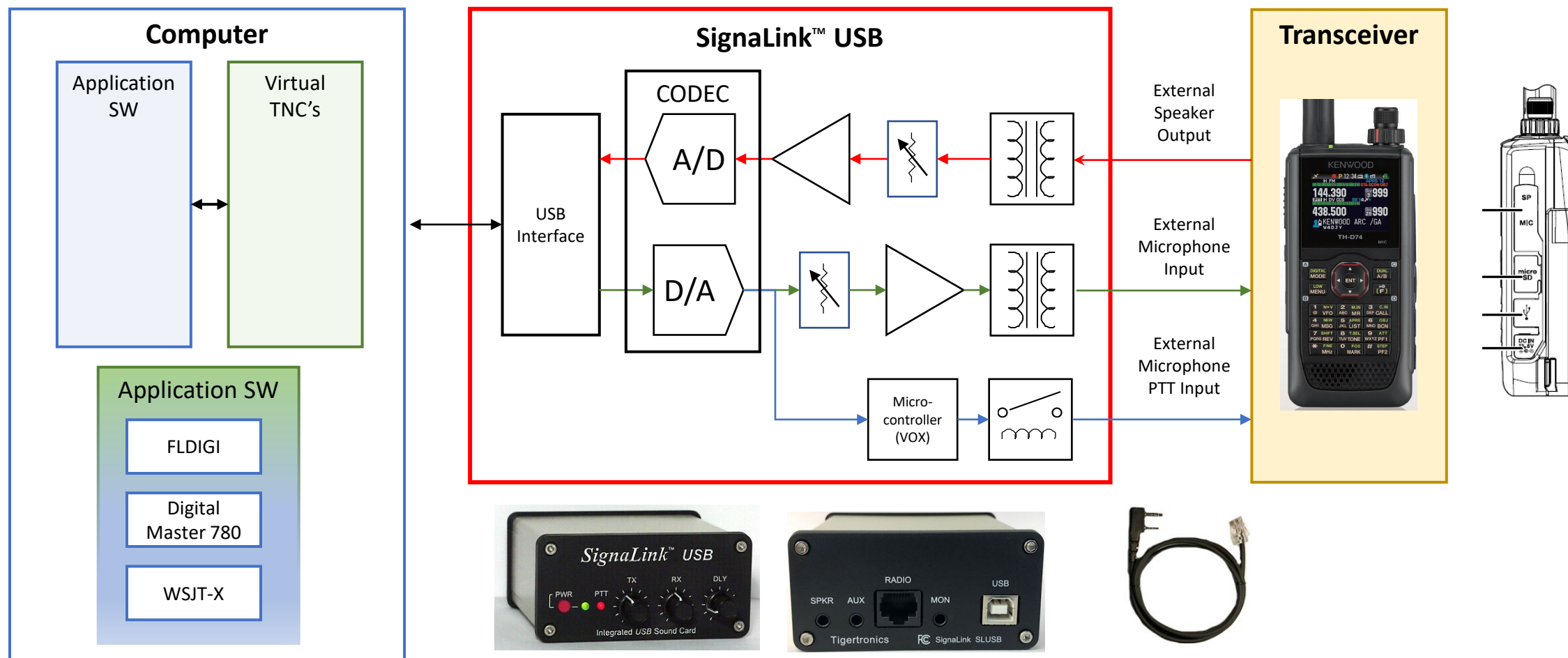
- Straight Forward Implementation
- Disadvantage
  - Cable reconfiguration required when transitioning between voice and digital modes.
  - Support for VARA Narrow only





# Digital Communications

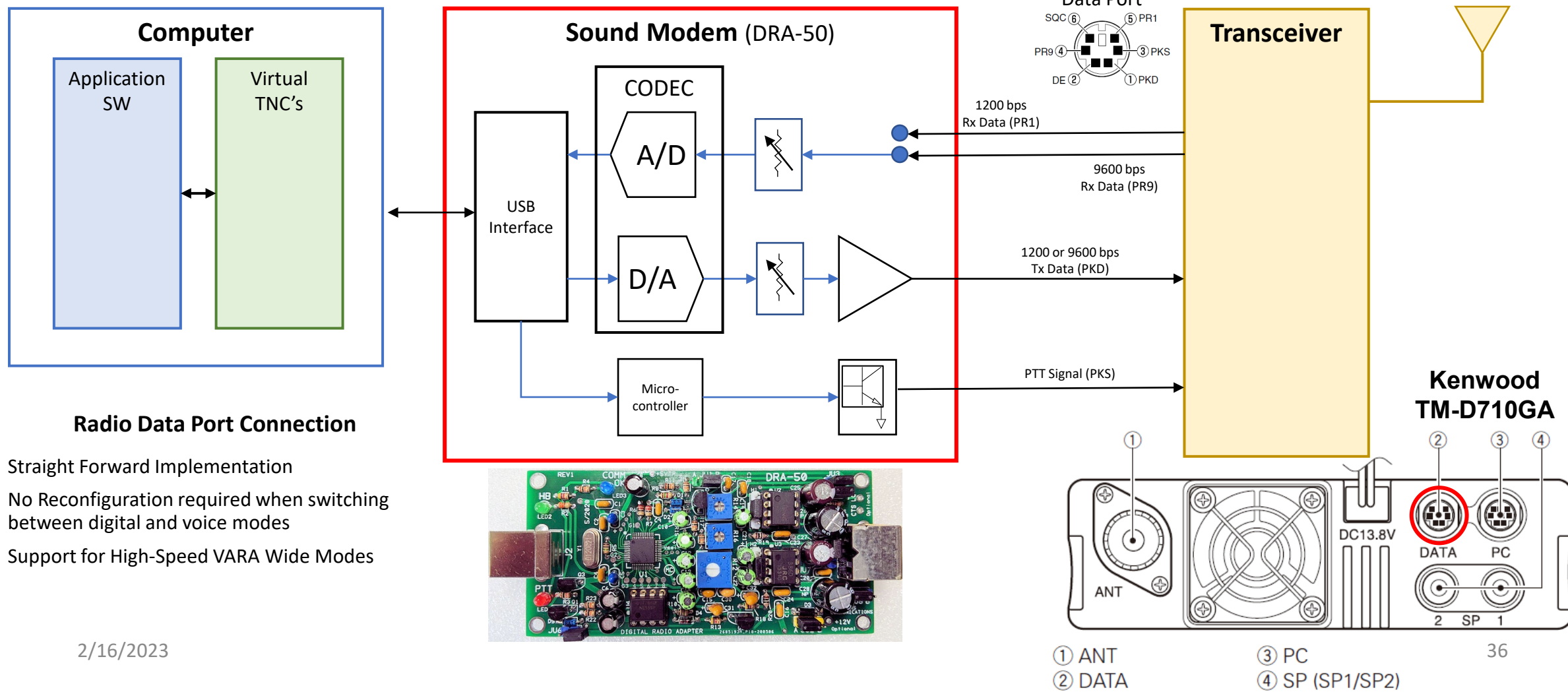
## Implementation – External – Mic and Speaker Connection





# Digital Communications

## Implementation – External – Radio Data Port





# Agenda



- Winlink Overview
- Winlink Architecture and Operating Modes
- Digital Communications
- Winlink Training



# Winlink Training Objectives



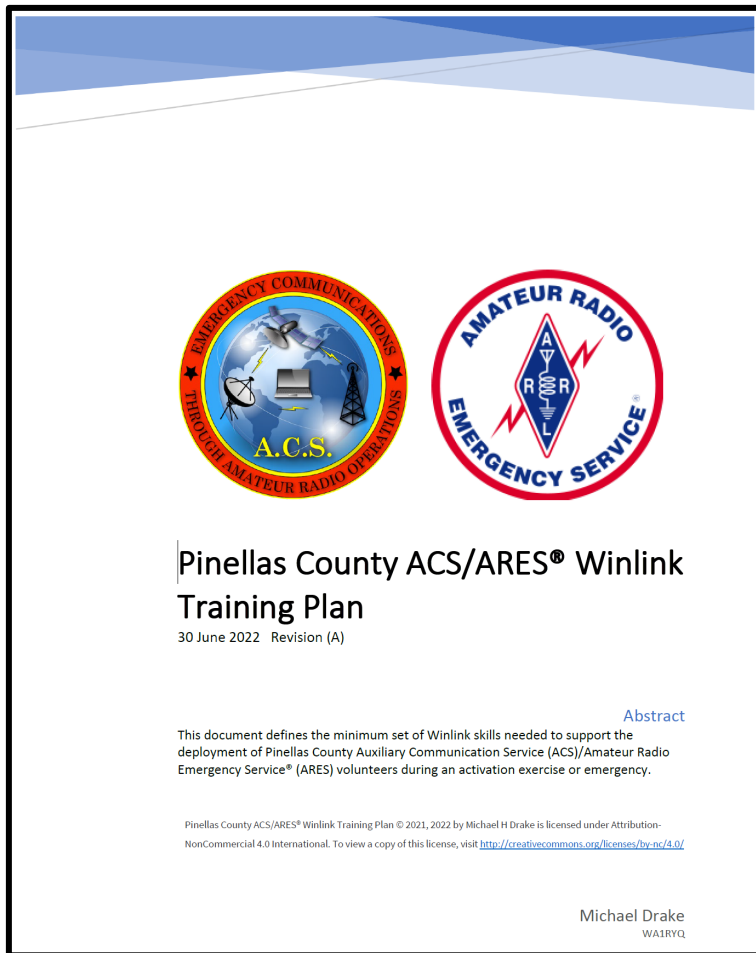
- Develop minimum skills needed for digital deployments using Winlink
  - Set-up and configure a Winlink station
  - Create, send, and receive messages using Winlink Standard Template Forms
    - Internet
    - VHF/UHF radios
- Assumptions
  - No previous Winlink experience is required.
  - Computer with internet access
  - Technician, General, Advanced, or Amateur Extra class Federal Communication Commission (FCC) License.





# Winlink Training

## Pinellas County ACS/ARES® Winlink Training Plan



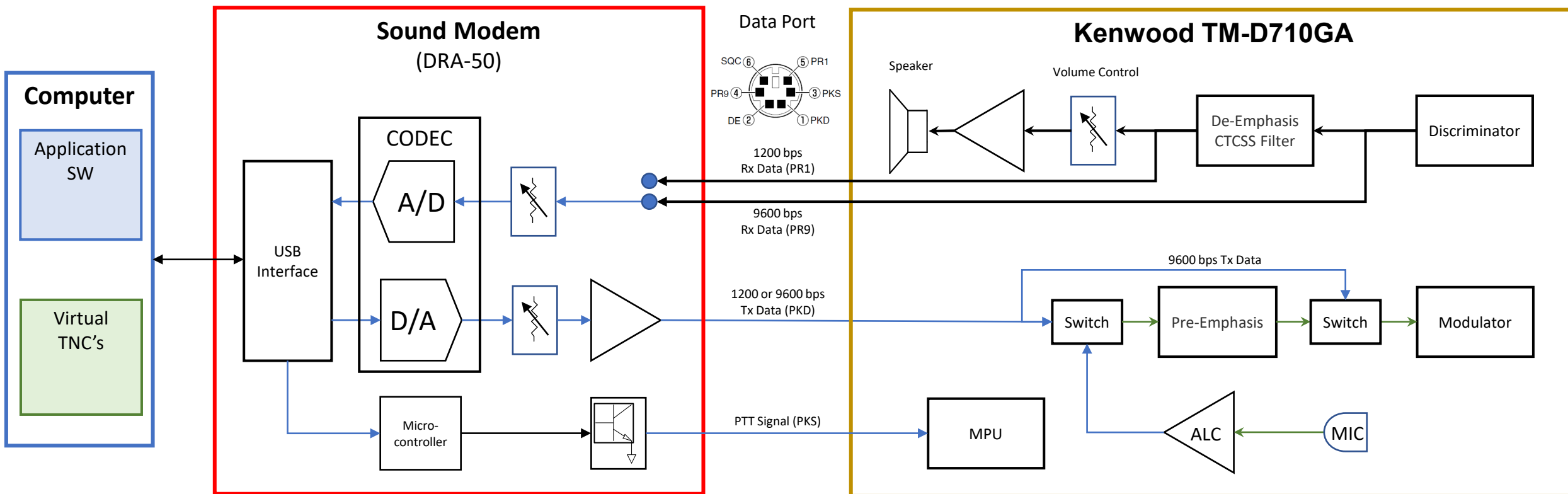
- Skills, Rationale, and Training Approach
  - Five Winlink Skills Sets Defined
    - Basic Winlink VHF/UHF Communication Skills
    - Basic Winlink HF Communication Skills
    - Deployment Ready VHF/UHF Communication Skills
    - Deployment Ready HF Communication Skills
    - Advanced HF/VHF/UHF Communication Skills
  - Web Site References
- Located on PACS Website:
  - <https://www.pcacs.org/training/training-documents/winlink-training/>





# Digital Communications

## Functional Description – External Sound Card



A/D - Analog to Digital Converter  
ALC - Automatic Level Control  
BPS - Bits per second  
CODEC - Coder-Decode  
CTCSS - Continuous Tone Coded Squelch Sys

D/A - Digital to Analog Converter  
MPU - Microprocessor Unit  
PTT - Push to Talk  
TNC - Terminal Control Unit  
USB - Universal Serial Bus