



East Lake CERT Training

Introduction to Winlink

12/16/2023

Mike Drake

Pinellas County ACS Training Officer

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Agenda



- Introduction
- Winlink Overview and Installation
- Winlink Express Operation
- Digital Communications

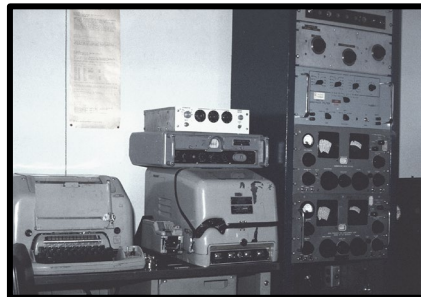


Introduction

Instructor



- Licensed since 1973
- Amateur Extra Class
- Army MARS
 - 1973 - 1975
- Navy MARS
 - 1977 – 1985
 - Adak Alaska, Augsburg West Germany, Pensacola FL
- University of Florida
- Retired – E-Systems/ECI – Raytheon
 - Systems Engineering – Communications, and Data Fusion Systems
- Training Officer – Pinellas ACS

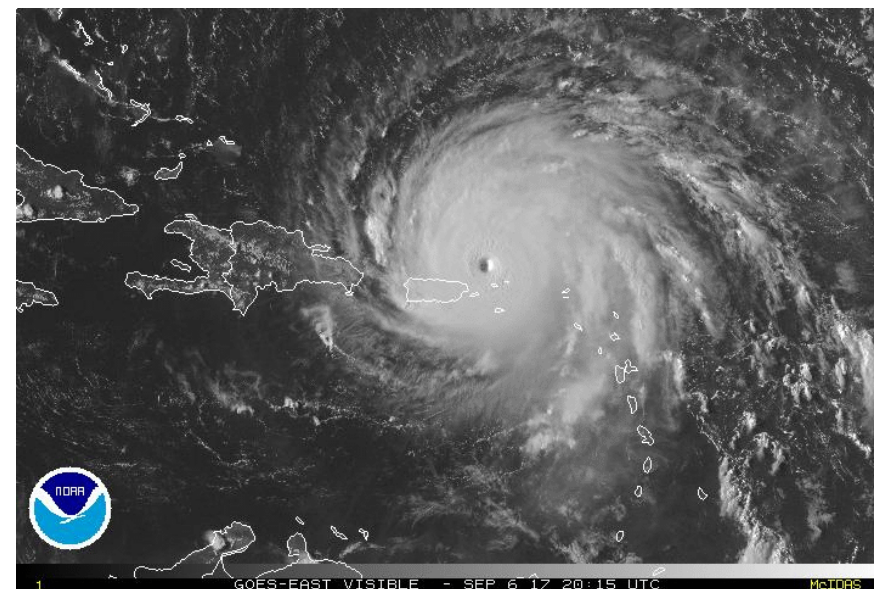




Introduction

PinCo ACS Training Objectives

- Support Pinellas ACS Mission
 - Augment Government communications during times of emergency when normal communication systems have sustained damaged, are being overtaxed, or backup radio operators are required.
 - Tropical Storms and Hurricanes
 - Non-Tropical Weather Events
 - Public Safety Communication Emergencies
 - Localized Emergencies
 - Regional / National Emergency



Hurricane Irma



Introduction

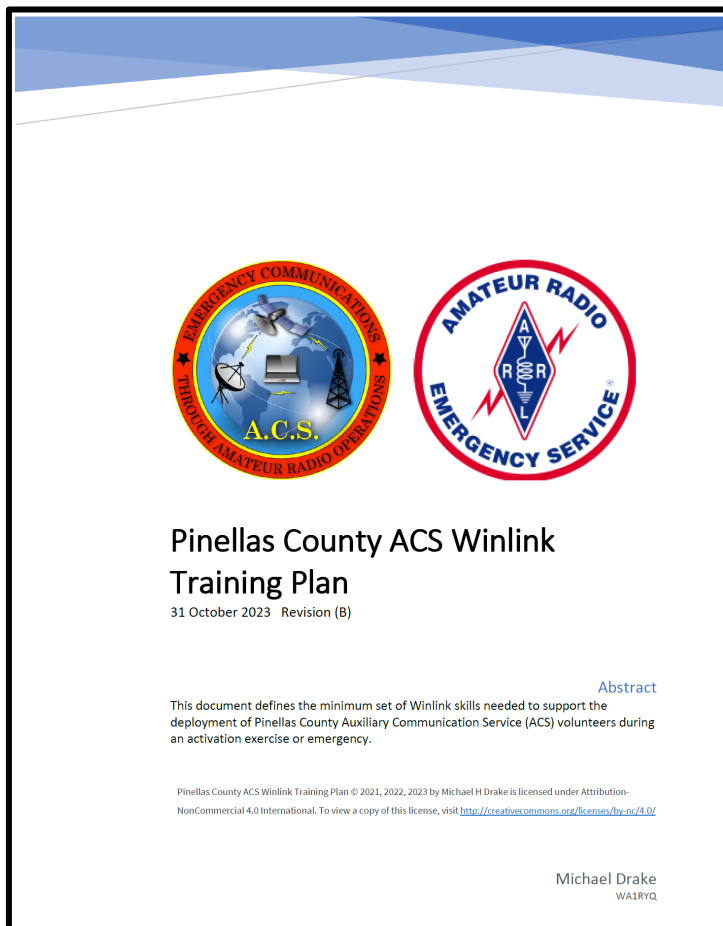
Winlink Training Objectives

- 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.



Introduction

Pinellas County ACS 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/>



Agenda



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- Digital Communications



Winlink Overview

Description



- E-mail program
 - Download from the Winlink website (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)
 - Messages can be exchanged using any of the following connections
 - Internet
 - VHF/UHF/HF Radio
 - AREDN Mesh
 - 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

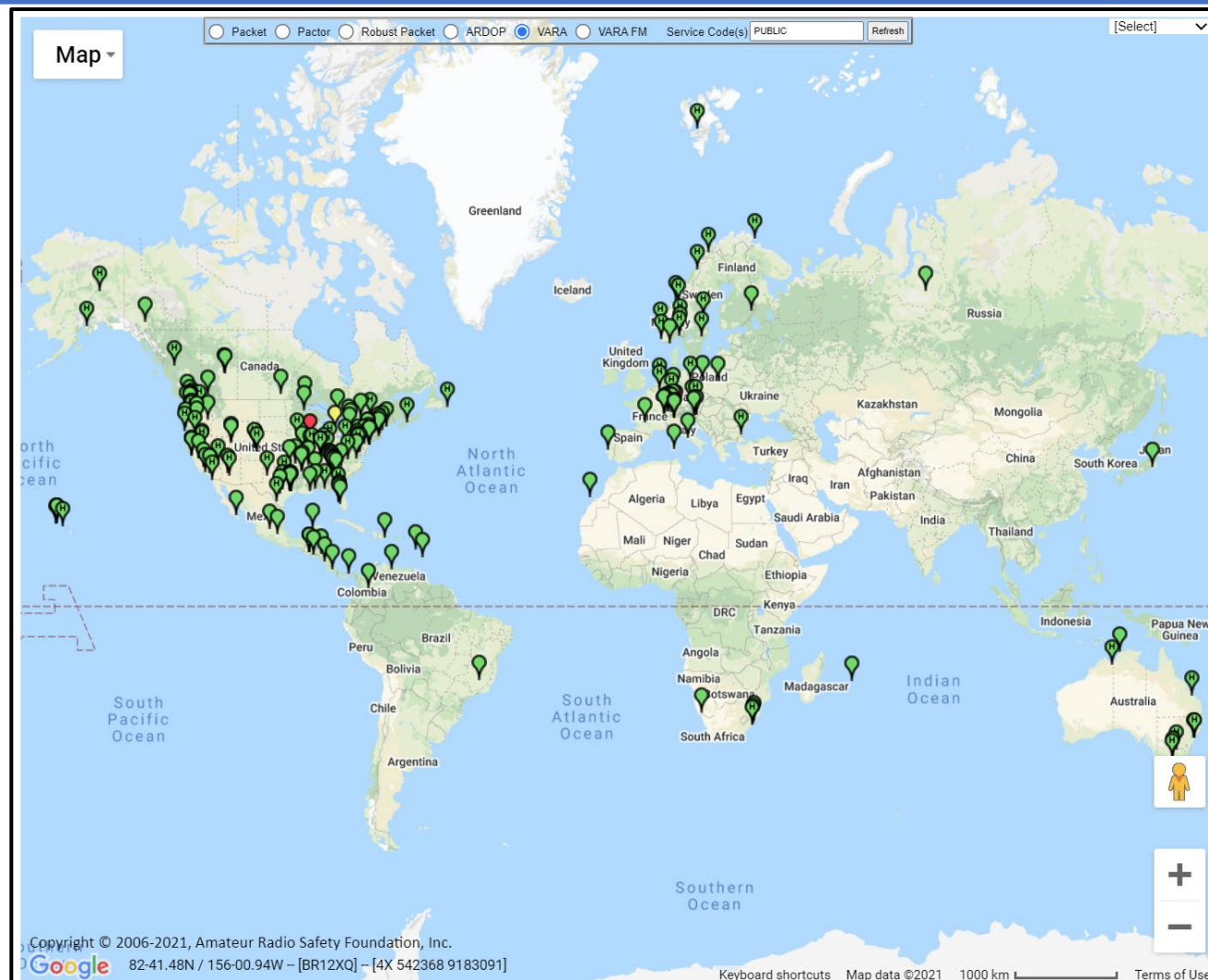
- FEC – Forward Error Correction
- ARQ – Automatic Repeat Request



Winlink Overview

HF Stations Located Worldwide

Geographical dispersion and redundancy improves reliability

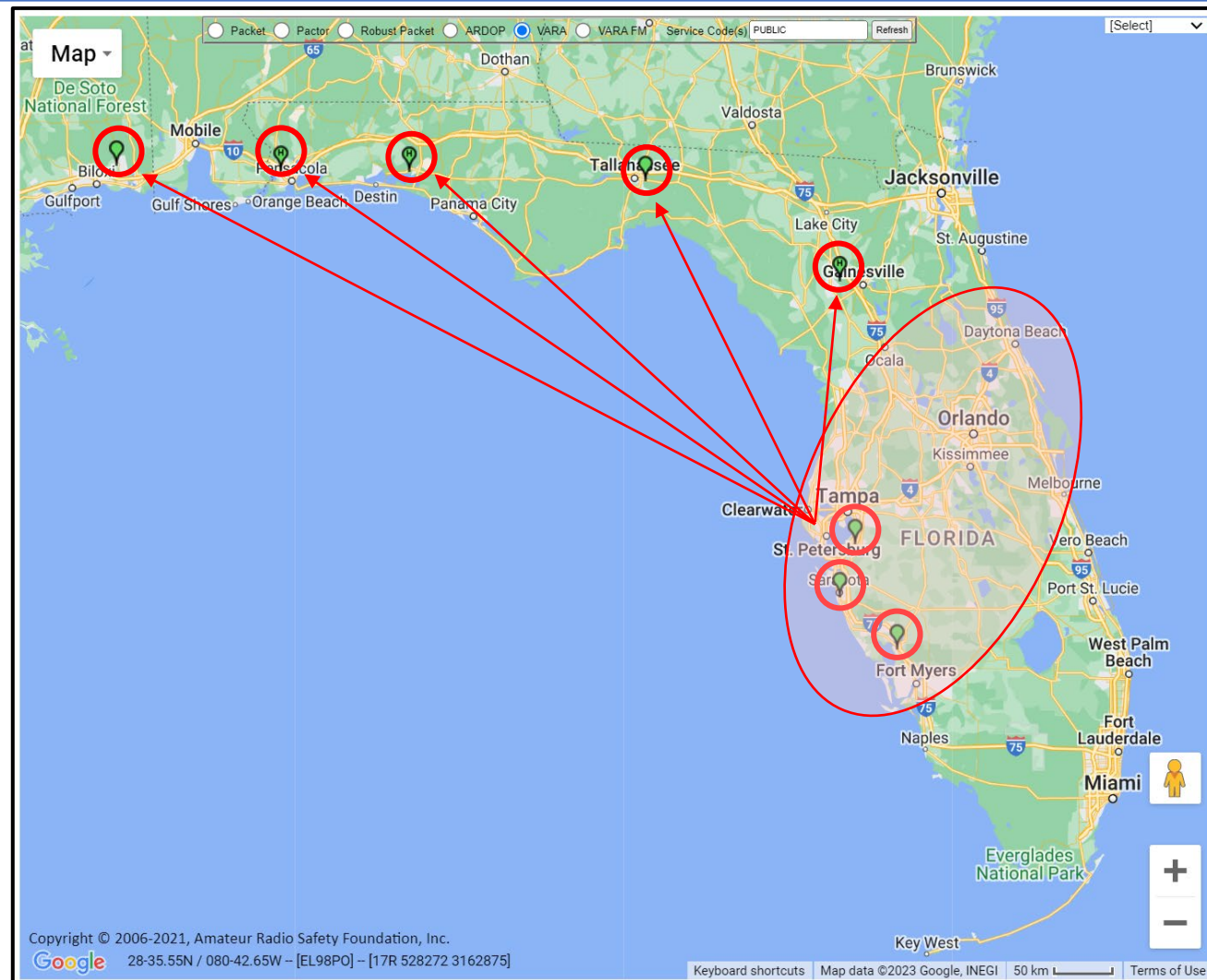




Winlink Overview

HF Stations Located in Florida

Geographical dispersion and redundancy improves reliability

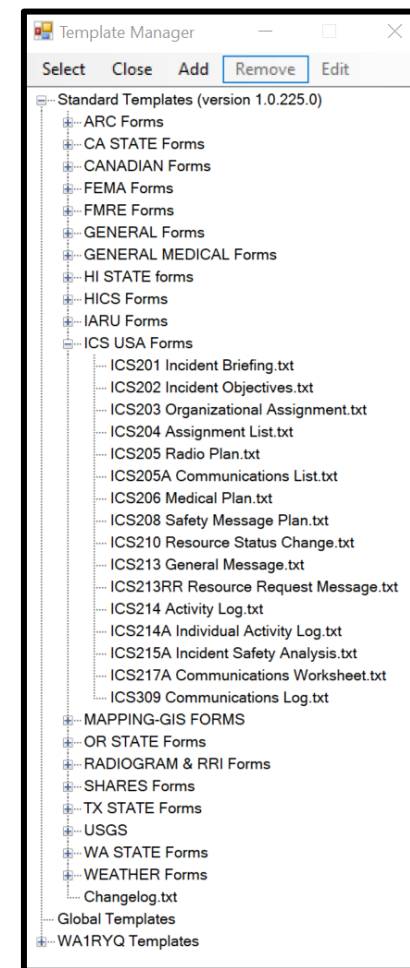




Winlink Overview

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

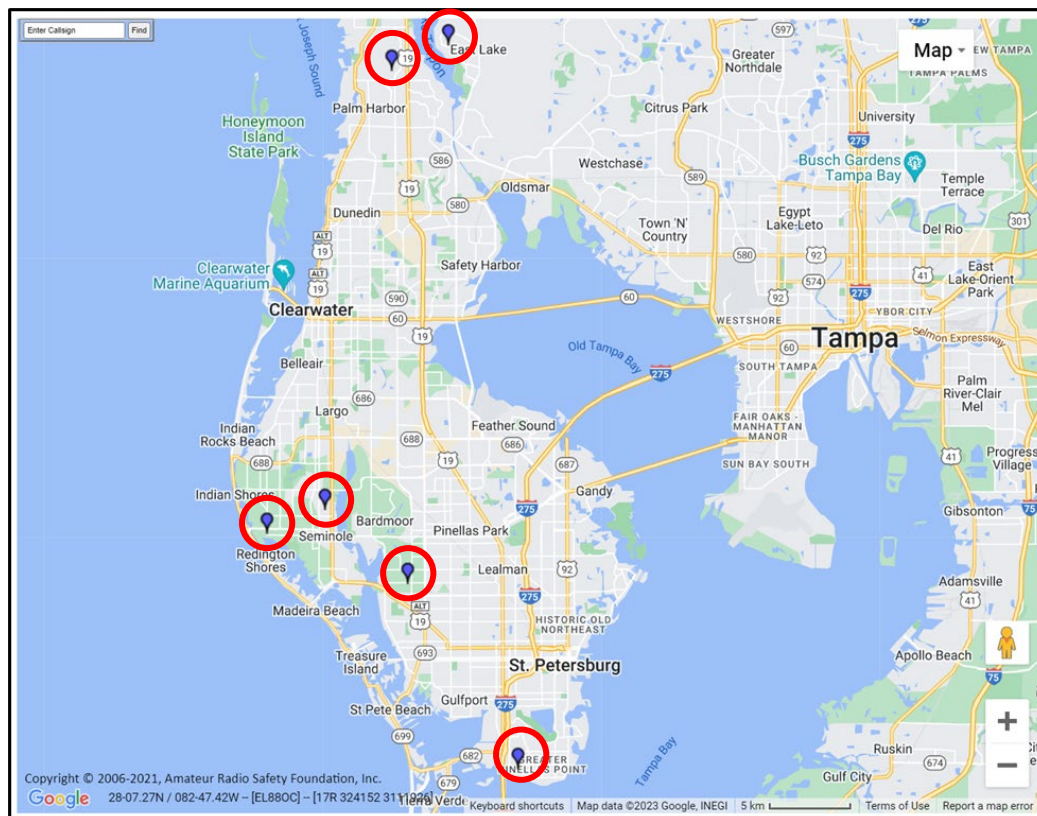


Winlink Overview

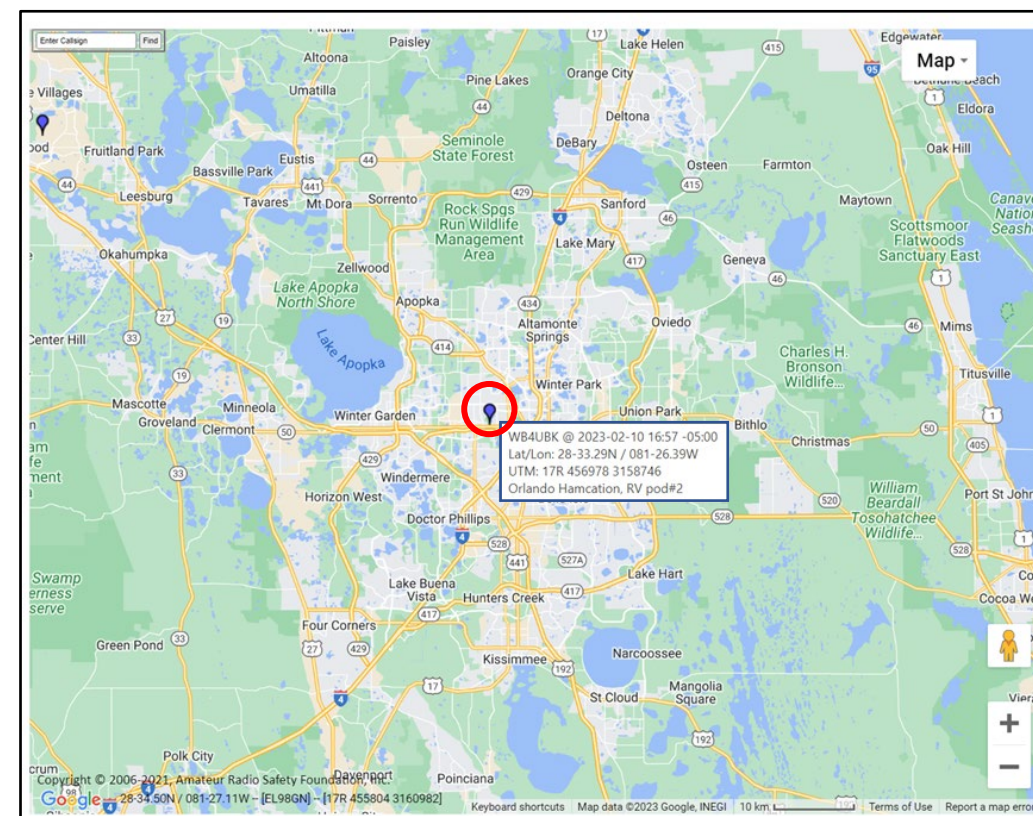
Description – Position Reports



Reports from ACS Winlink Training



Detailed Information



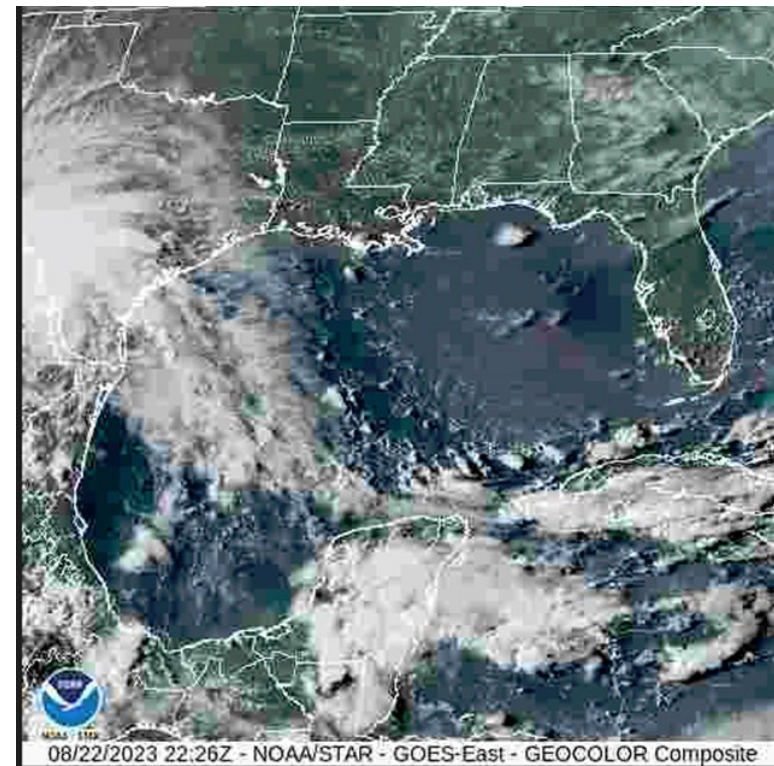


Winlink Overview

Description



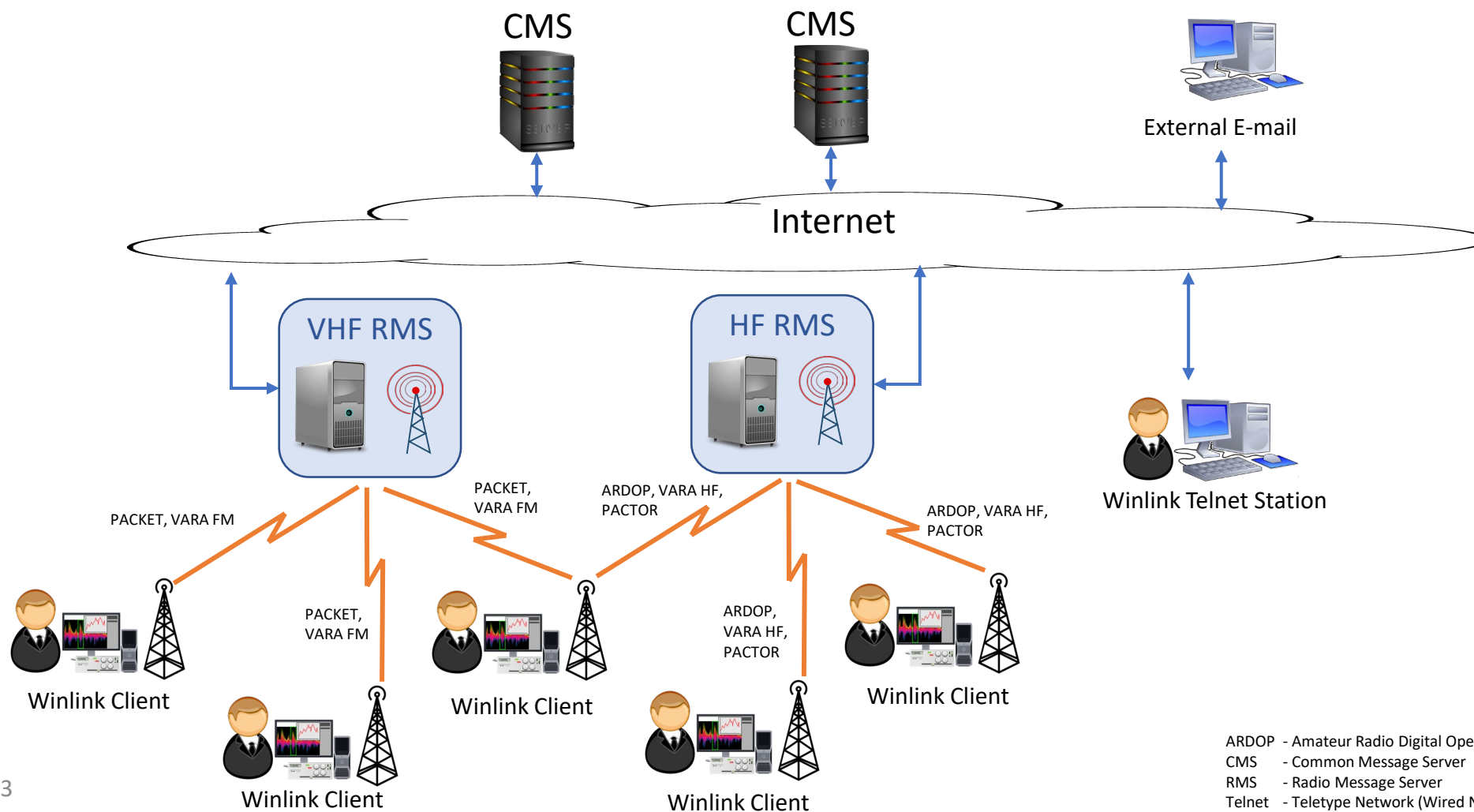
- Weather and Information Bulletins
- Wide adoption by EmComm related agencies
 - Amateur Radio Emergency Services (ARRL ARES)
 - Military Auxiliary Radio System (DOD/MARS)
 - Radio Amateur Civil Emergency Services (RACES)
 - National American Red Cross (ARC)
 - Southern Baptist Disaster Relief
 - Salvation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





Winlink Overview

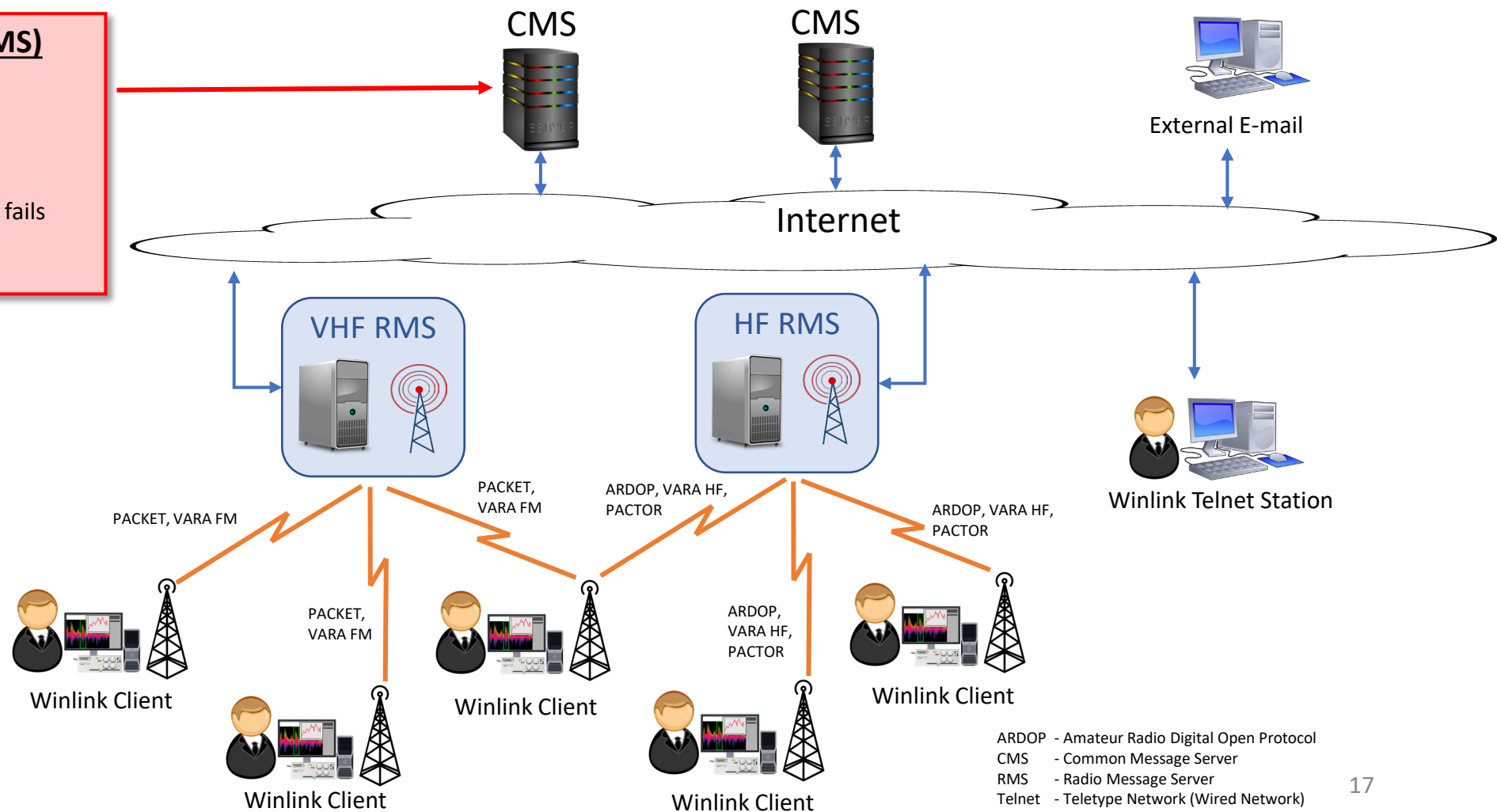
System Architecture





Common Message Server (CMS)

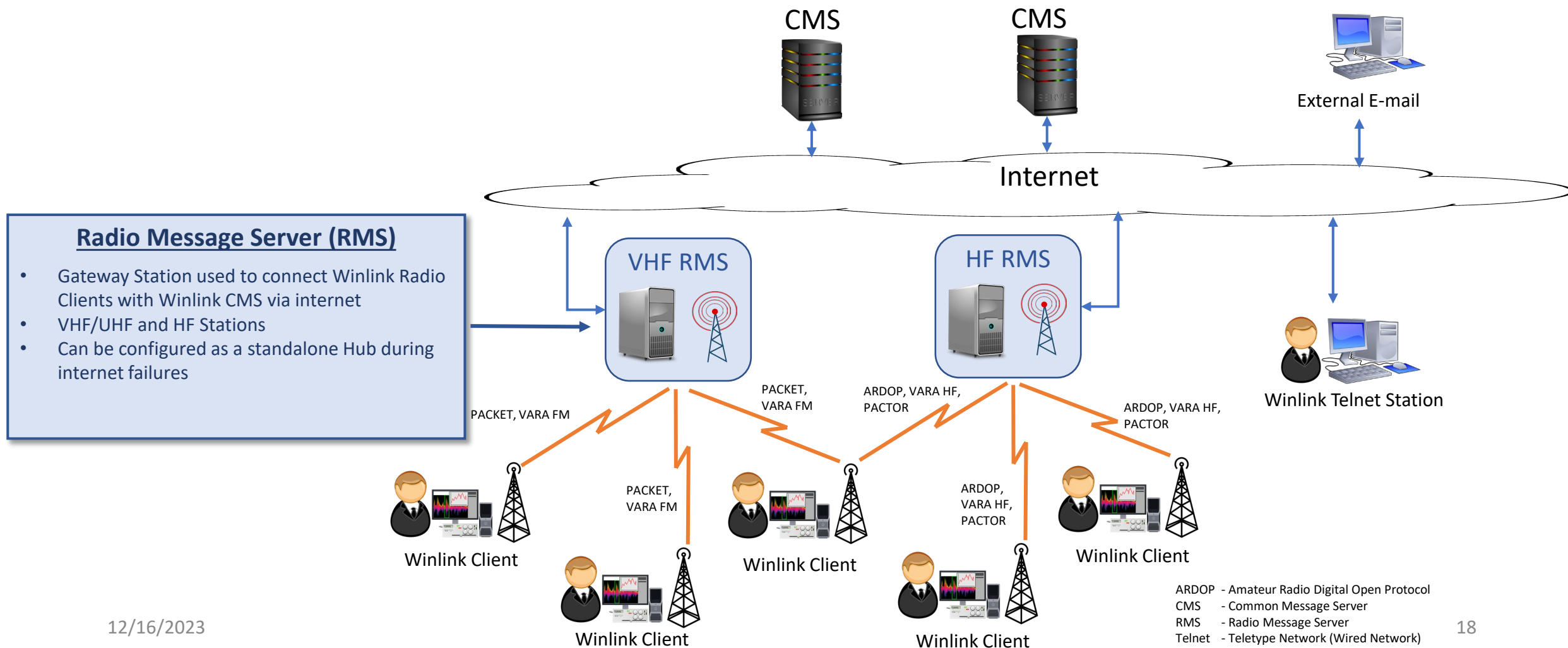
- Winlink Email Server
- Redundant Locations
- Hosted by Amazon Web Services (AWS)
- Realtime Backups between servers
- Automatic switchover if primary Server fails





Winlink Overview

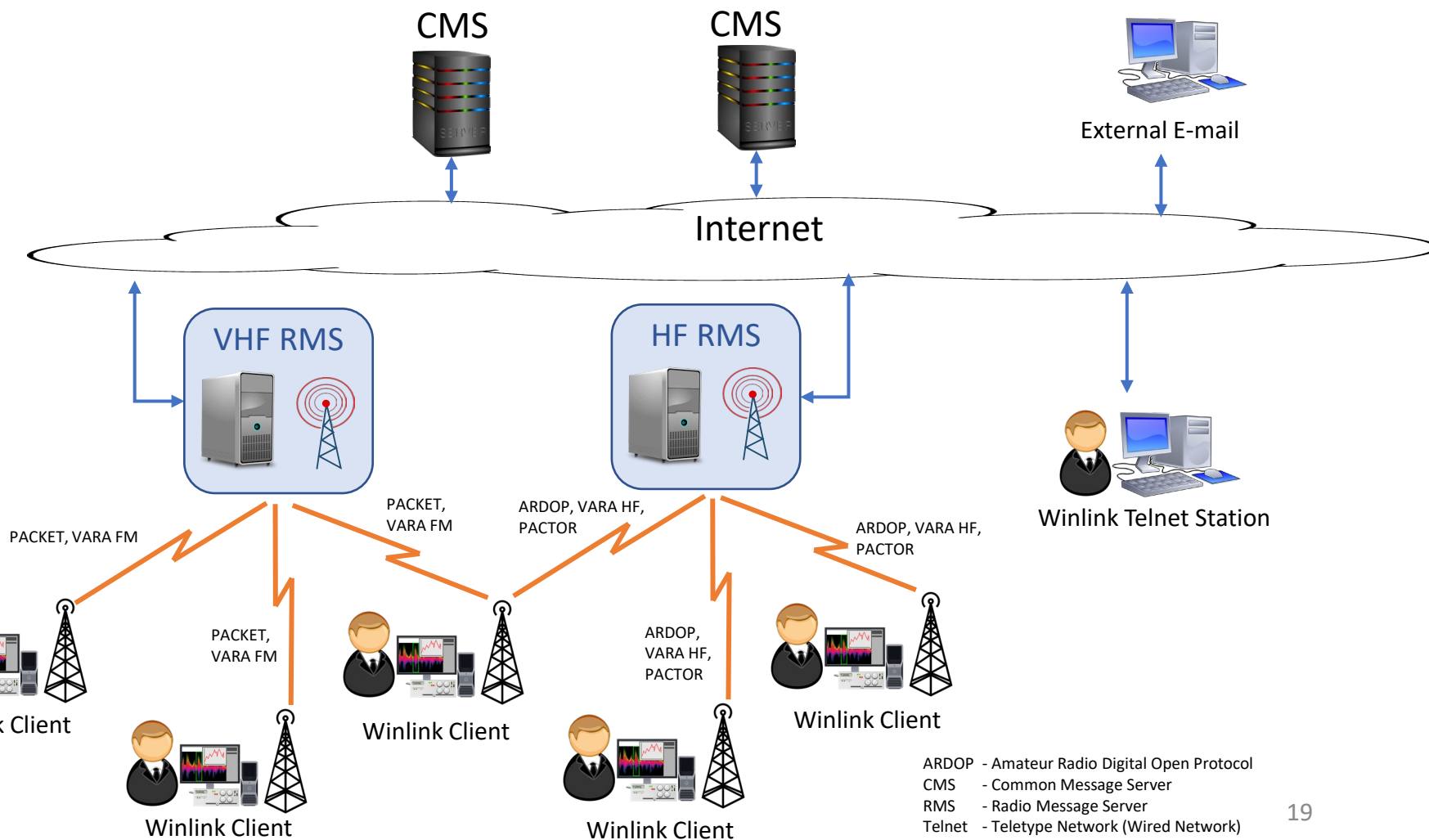
System Architecture – Conventional Mode





Winlink Overview

System Architecture – Conventional Mode

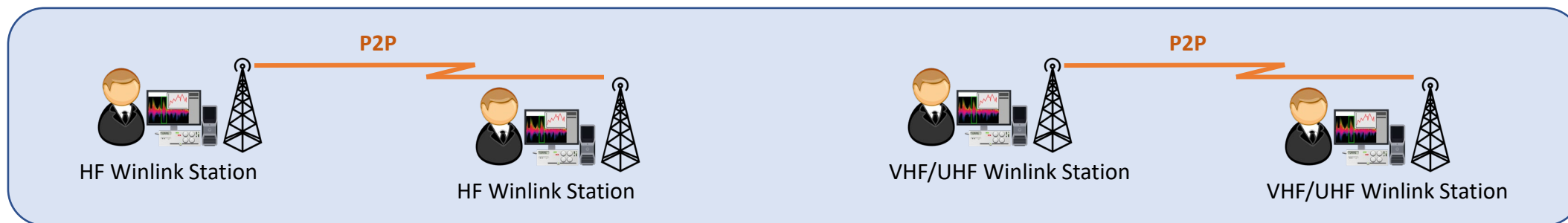




Winlink Operating Modes

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.

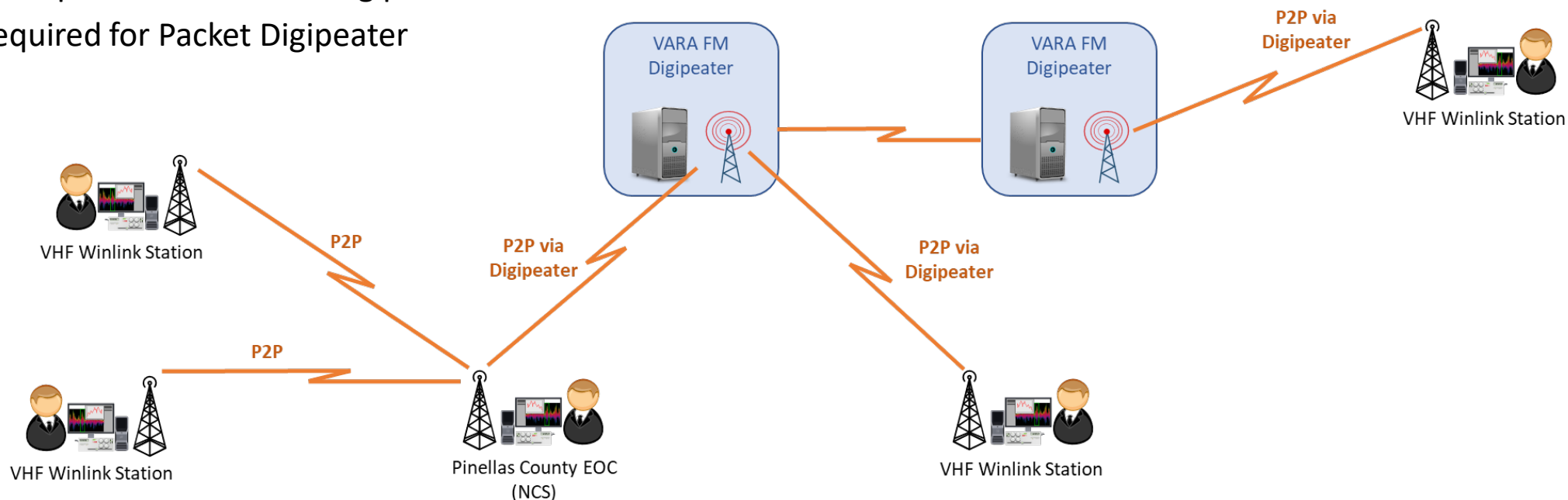


Winlink Operating Modes

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
- No License required for Packet Digipeater

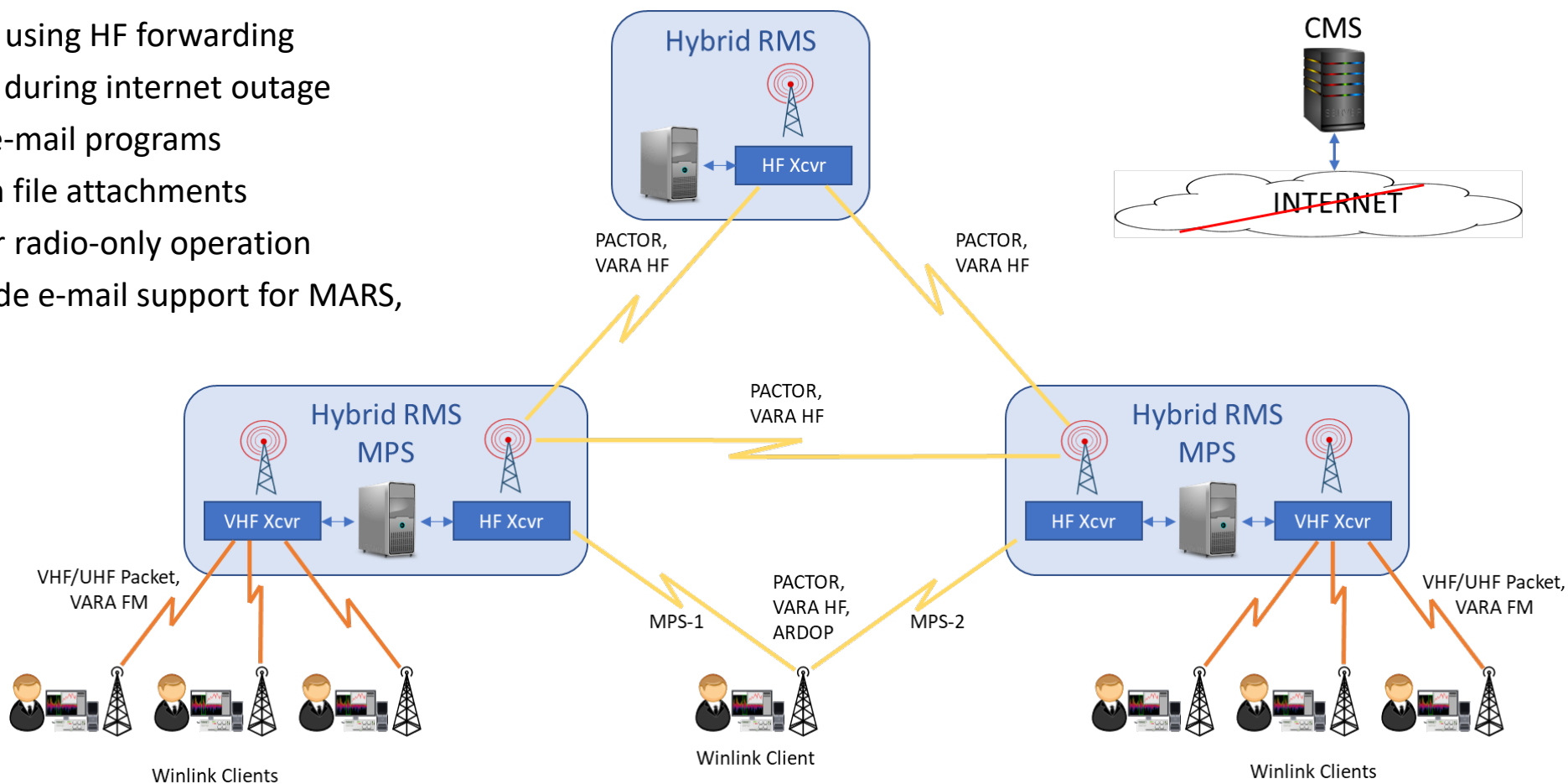




Winlink Operating Modes

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



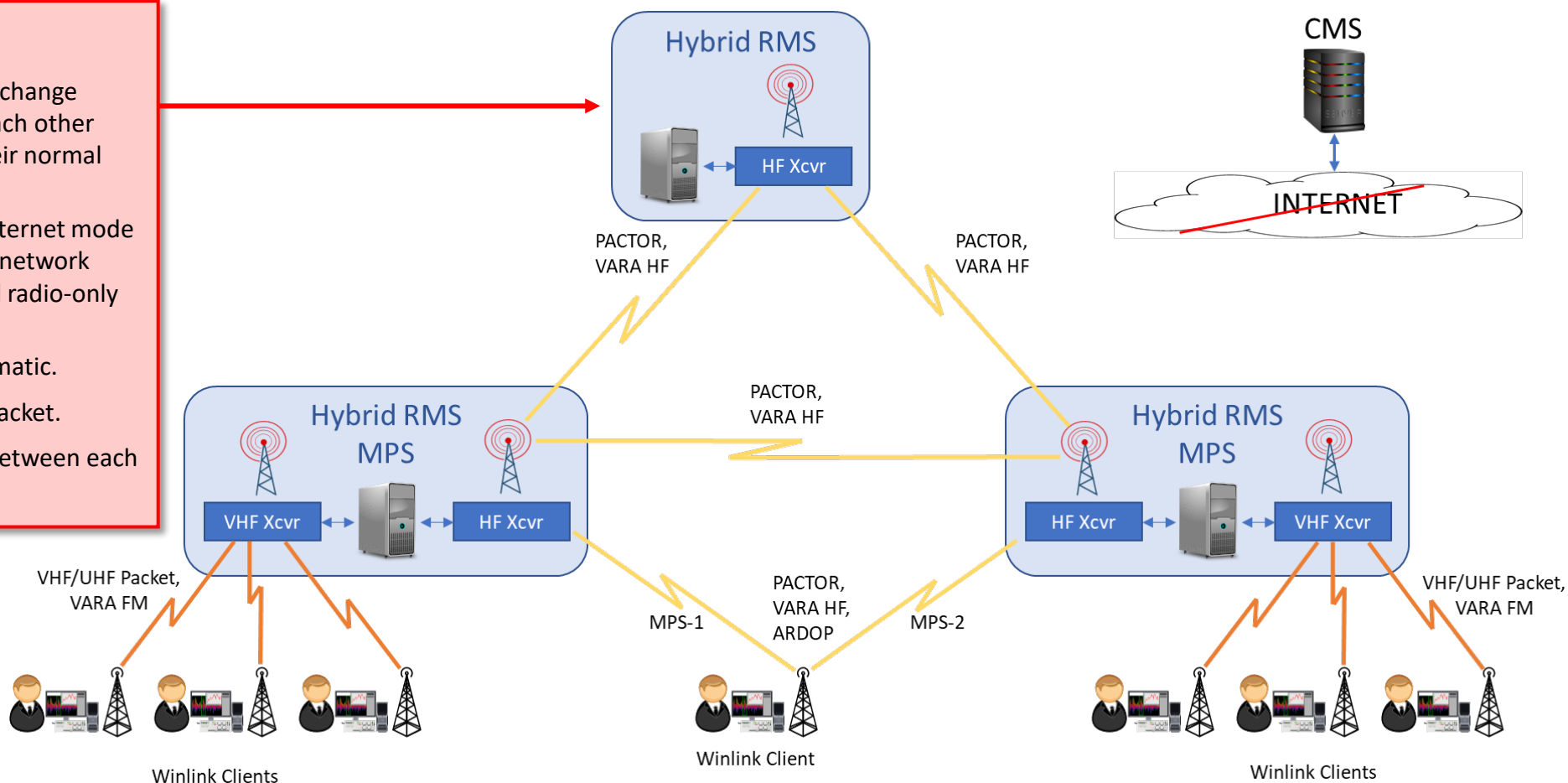


Winlink Operating Modes

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



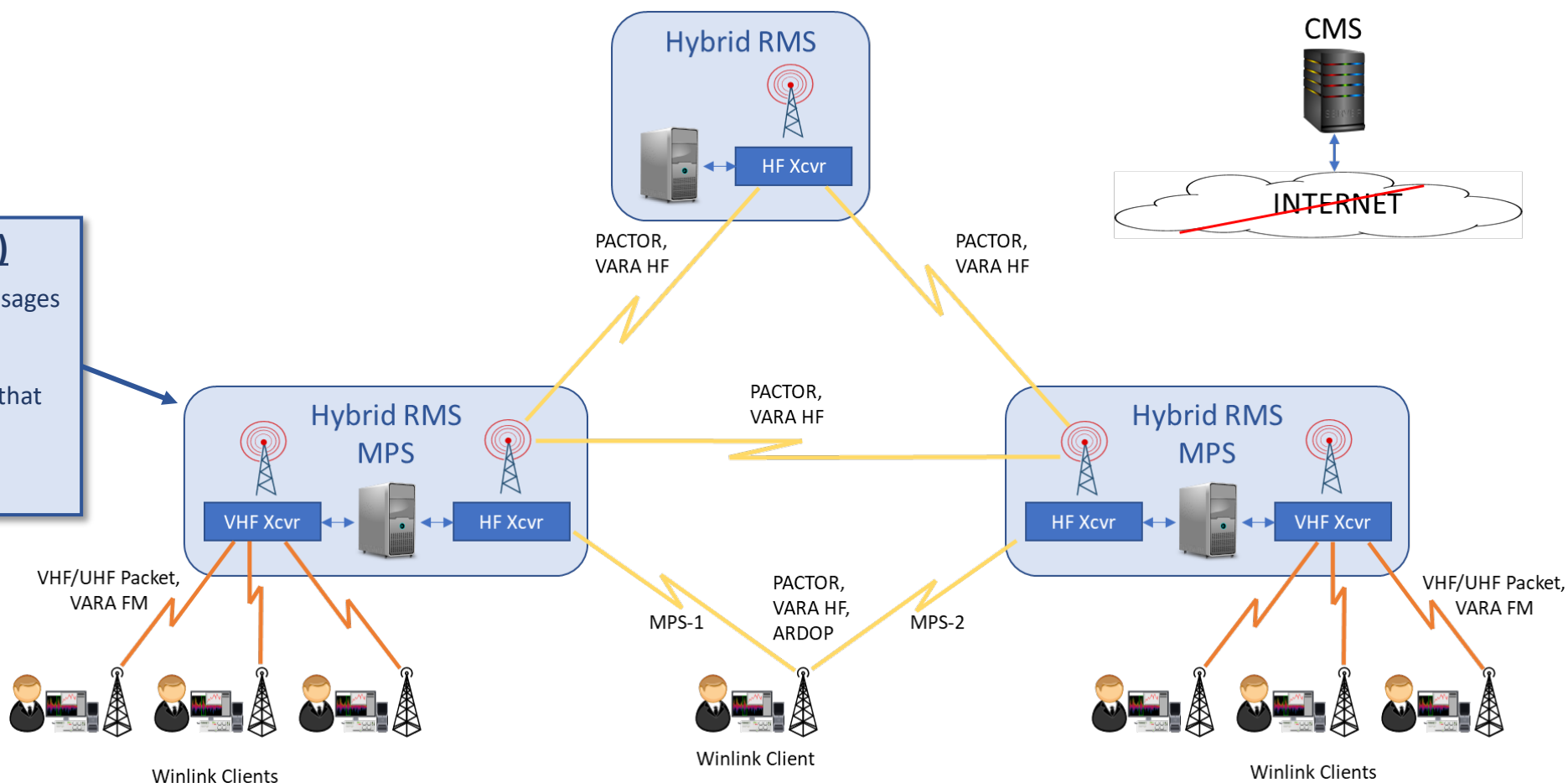


Winlink Operating Modes

Hybrid

Message Pickup Stations (MPS)

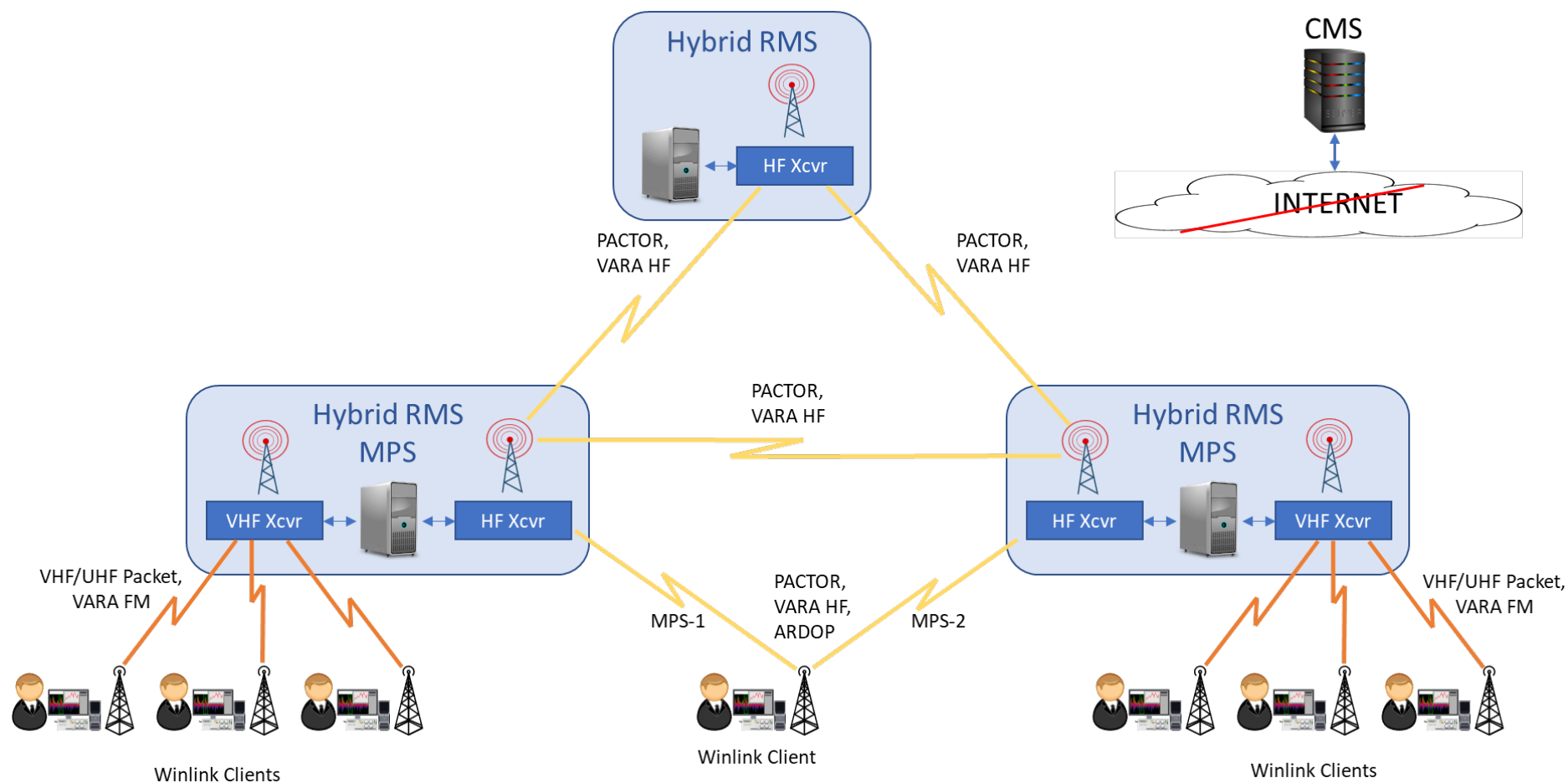
- Hybrid RMS used by client to receive messages during an internet outage
- Each user can select up to 3 MPS to store incoming messages (Winlink Recommends that no more than 2 are selected)





Winlink Operating Modes

Hybrid



Winlink Client

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



Winlink Operating Modes

Hybrid

Winlink Client

- Destination Station

Message Pickup Station

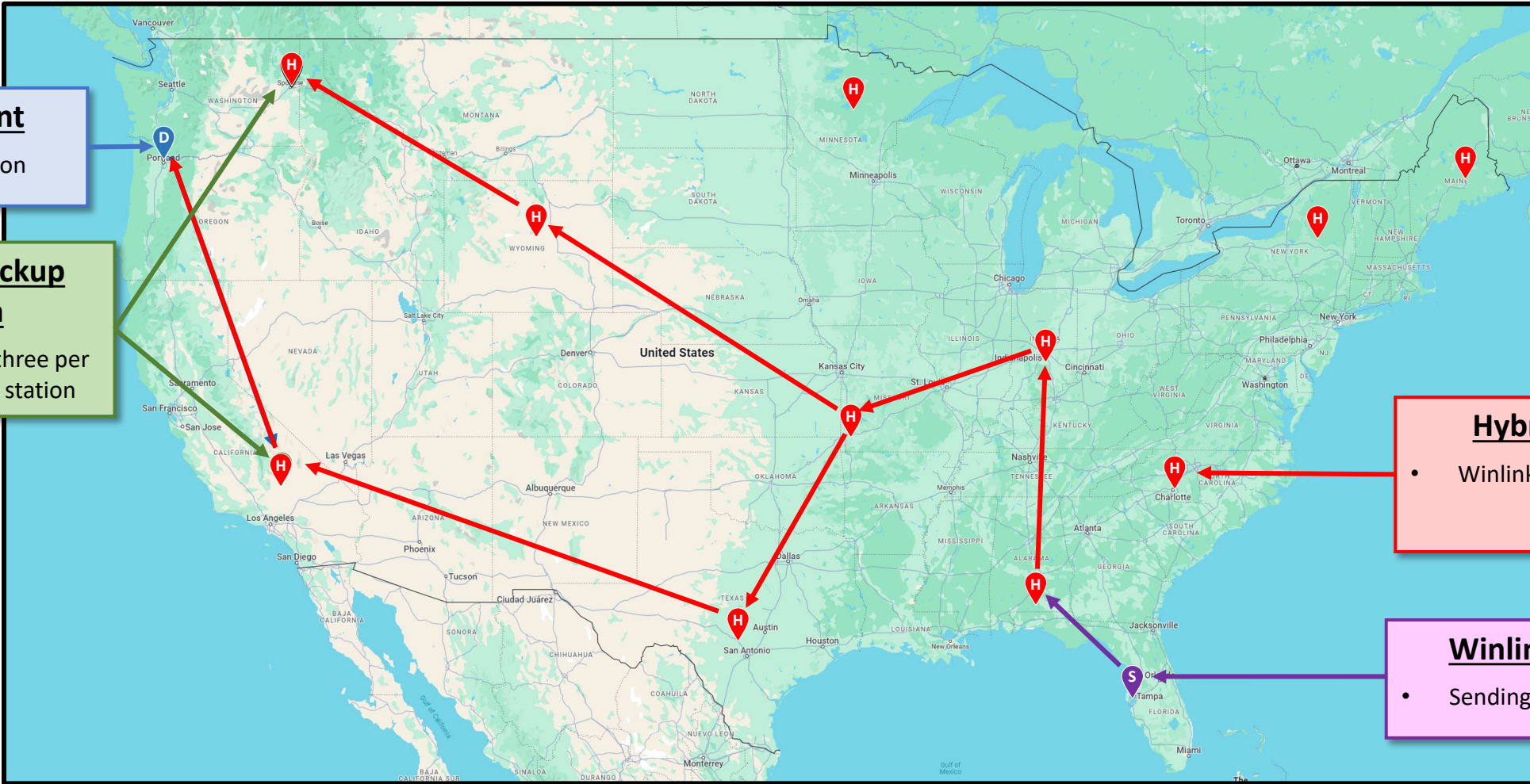
- Maximum of three per Winlink Client station

Hybrid RMS

- Winlink Email Server

Winlink Client

- Sending Station

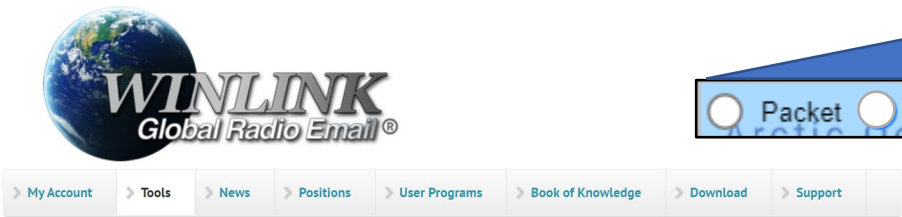




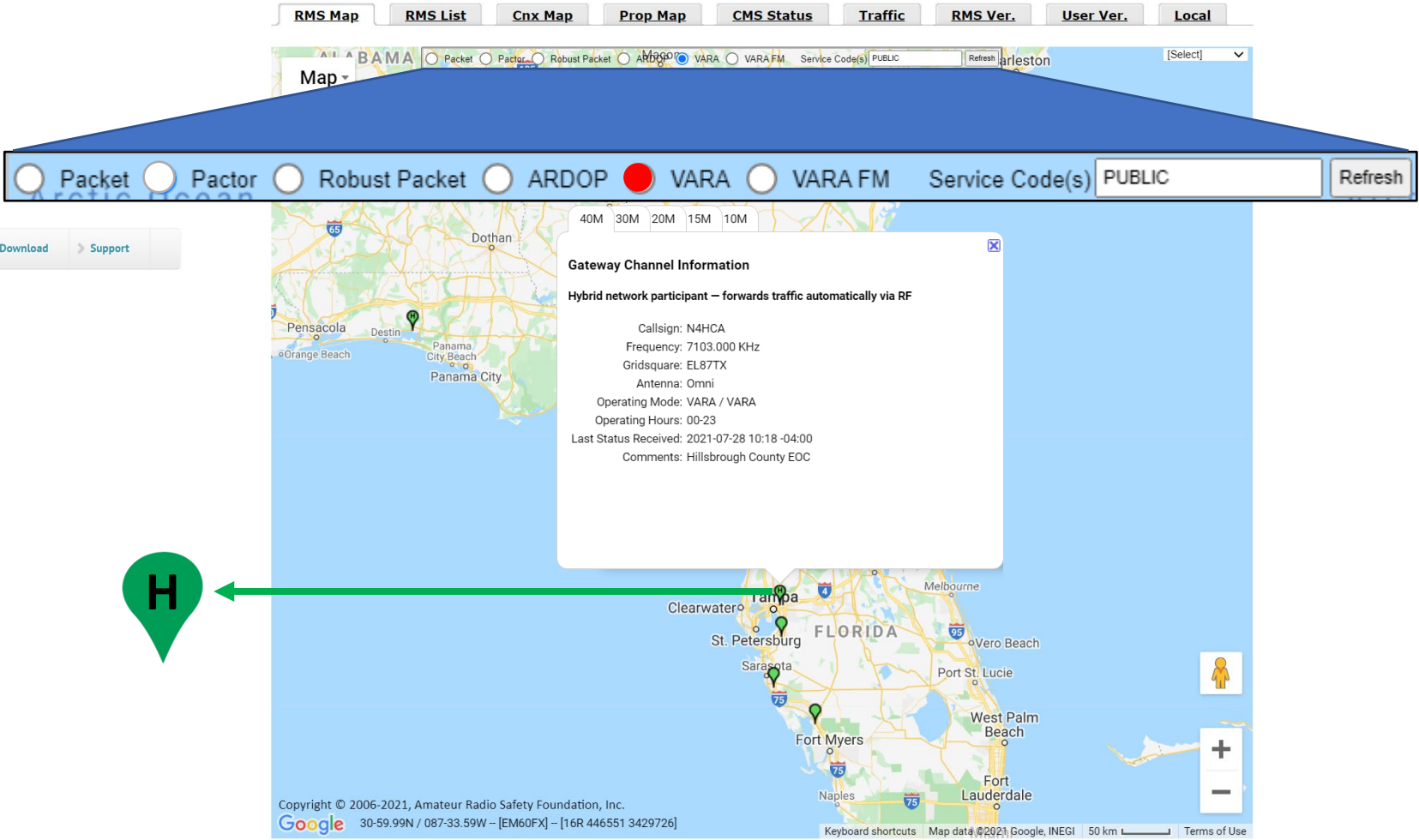
Winlink Operating Modes

Hybrid Station Identification

Go to the Winlink Website



Select Tools

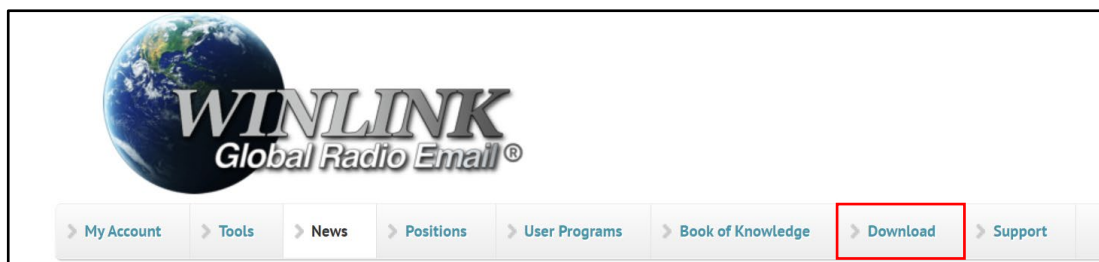




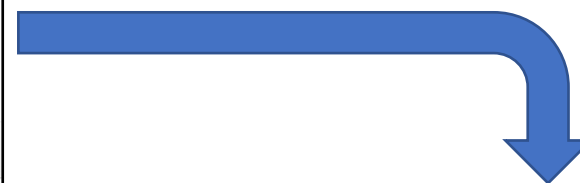
Winlink Express Installation

Program Download

- Go to Winlink Web site and Download software



<https://www.winlink.org/>



downloads.winlink.org - /

8/20/2023	6:35 PM	<dir> Sysop Programs
7/5/2023	1:00 PM	<dir> User Programs



downloads.winlink.org - /User Programs/

[\[To Parent Directory\]](#)

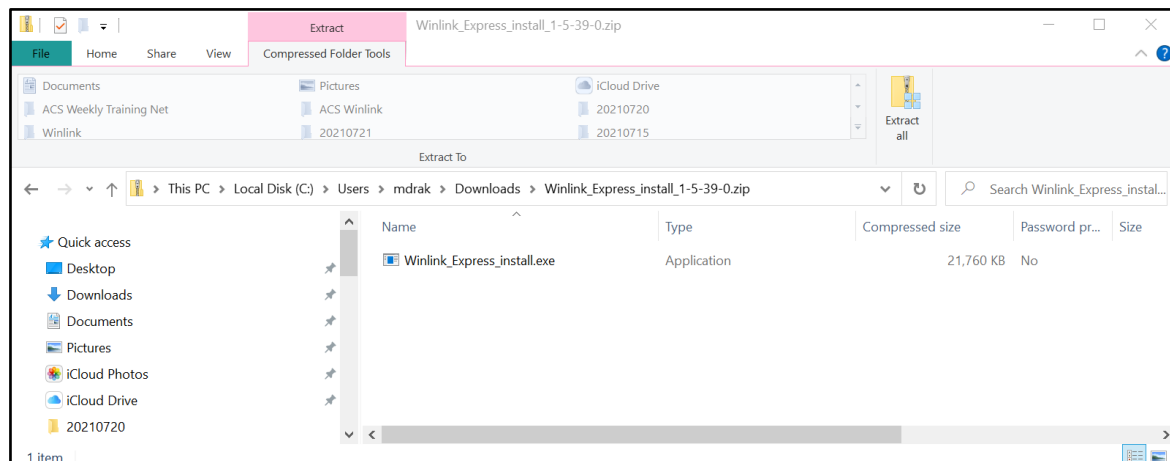
6/3/2023	6:34 PM	626	Latest VARA Modem download site.rtf
6/3/2023	6:34 PM	1846835	Paclink_install_4-3-11-0.zip
6/3/2023	6:34 PM	1101	README_Software_Install_Instructions.txt
6/3/2023	6:33 PM	847697	RMS_Link_Test_install_2-0-24-0.zip
6/3/2023	6:34 PM	12176	SCS_PTC-IIIusb and end of PTC-IIusb Iipro_Ilex.pdf
7/5/2023	12:59 PM	40006834	Winlink Express install 1-7-8-0.zip



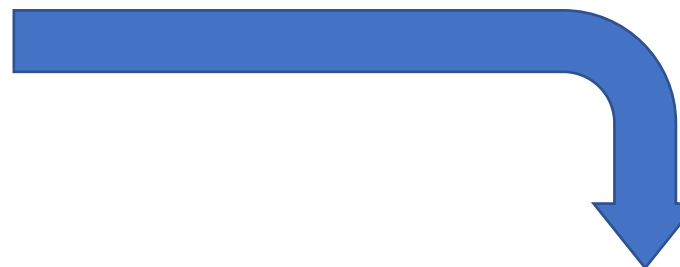


Winlink Express Installation

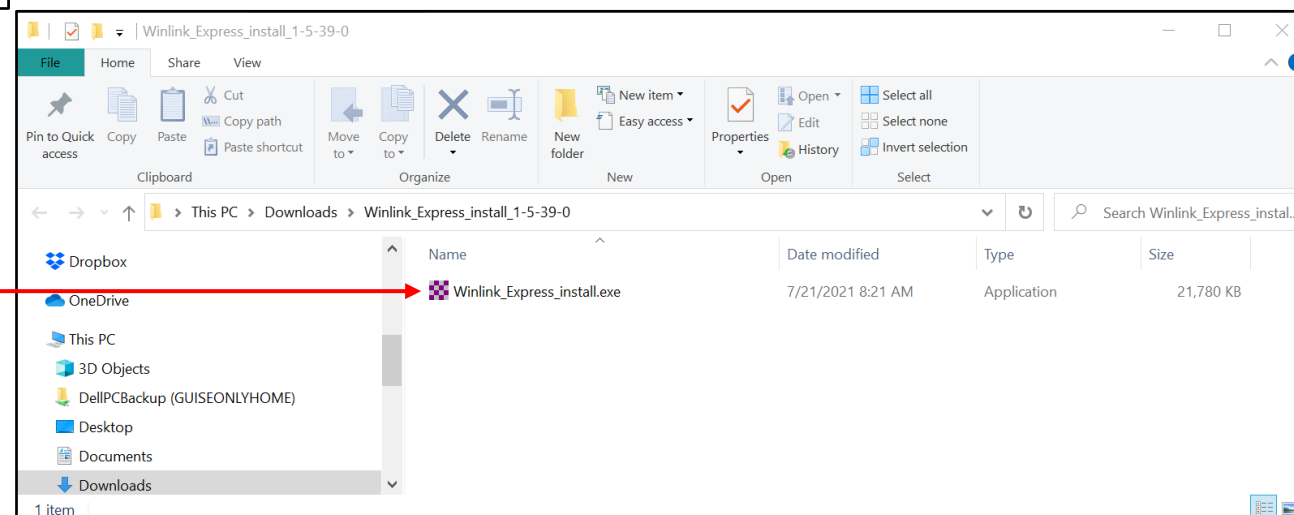
Program Download



Unzip the Downloaded File



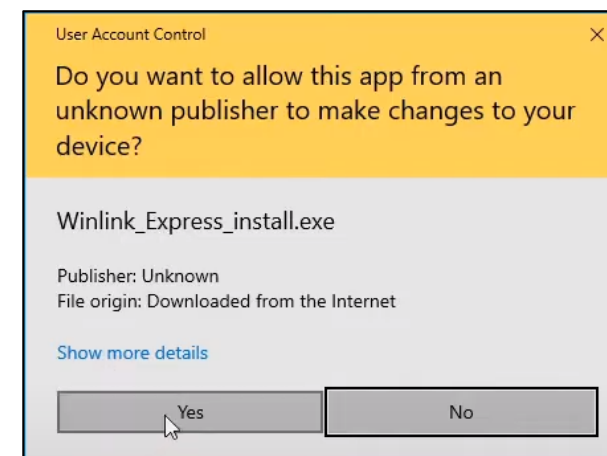
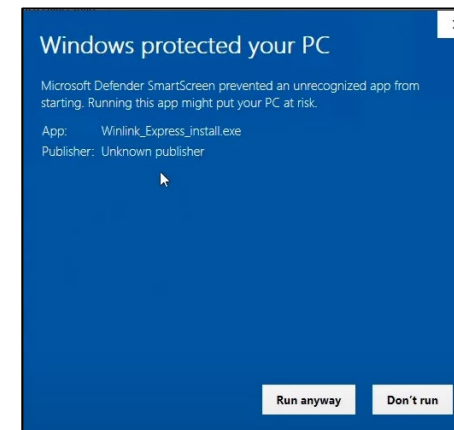
Run the file





Winlink Express Installation

- Warning Pop-up may be displayed
 - Safe if file has been downloaded from Winlink.org
- Follow directions and install in default locations
- Recommend Desktop shortcut
- Run Winlink





Winlink Express Installation

Account Set-up

Required Fields

- My Callsign
- My Password (Case Sensitive)
- Password Recovery e-mail
- My Grid Square
- Service Codes

Optional Fields

- Contact Information
- Program Options
- Registration Key

Winlink Express Properties

Call Signs
My Callsign: **WA1RYQ** My Password: **.....** (Case sensitive)
Callsign suffix (optional): (Used for country code)
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: **EL87OU**
Winlink Express registration key:

Service Codes
PUBLIC EMCOMM
(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
☒ Automatically install updates without prompting

Click the Update Button

Winlink Account must be created within the Winlink Program



Winlink Express Installation Registration



- Registration to your callsign is voluntary
- Supports Winlink system and all ARSFI projects
- Program will periodically display a registration reminder screen.
 - You can click a button to be reminded later and continue use the program without registering.
- If you register your callsign (Approximately \$24)
 - You will receive a hexadecimal key linked to your call sign
 - Enter key on the setup screen
 - Once your registration key has been entered, the registration reminder will not display.

Winlink Express Registration

Winlink Express is made possible through the Amateur Radio Safety Foundation Inc. Your registration of Winlink Express and support for the ARSF makes the Winlink system possible. Registering Winlink Express also registers your callsign to use the Winmor TNC.

Registration Site URL (click):
<http://www.arsfi.org/express.aspx>

Enter Registration Key

Call Sign: WA1RYQ

Registration Key:



Agenda



- Winlink Overview and Installation
- Winlink Express Operation
- Digital Communications



Winlink Express Operation

Create and Send a Message via Telnet

Winlink Express 1.5.39.0 - WA1RYQ

WA1RYQ Settings Message Attachments Move To: Saved Items Delete Open Session: Telnet Winlink Logs Help

New Message (indicated by a red arrow pointing to the envelope icon in the toolbar)

Reply to Message (indicated by a red arrow pointing to the reply icon in the toolbar)

No active session...

System Folders

- Inbox (20 unread)
- Read Items (72)
- Outbox (0)
- Sent Items (56)
- Saved Items (0)
- Deleted Items (36)
- Drafts (1)
- Inbox

Personal Folders

- 2021-ARC-EXERCISE (9)

Global Folders

Contacts

- ARC_SOUTHEAST & CARIBBEAN
- BOB_HUGHES
- BRIAN_D_WRIGHT
- BRUCE_C_KREUTZER
- CLAYTON_PARROTT
- DAVE_BYRUM
- DOUG_WILLIAMS
- ED_MORGAN
- GARRY
- GERRY_POLLACK
- JIM_WEDLAKE
- JULIE_CHALHOUB
- KEVIN_A_WALKER
- LARRY_RUEGGER

Date/Time	Message ID	Size	Source	Sender	Recipient	Subject
2021/07/21 11:42	G7P1GIU0CS03	16074	SYSTEM	SERVICE	WA1RYQ	INQUIRY - https://cdn.star.nesdis.noaa.gov/GOES16/ABI/SECTOR/cgl/GEOCOLOR/600x60
2021/07/21 11:39	2LSKX311UN93	13523	SYSTEM	SERVICE	WA1RYQ	INQUIRY - https://cdn.star.nesdis.noaa.gov/GOES16/ABI/SECTOR/gm/GEOCOLOR/500x500
2021/07/21 11:39	GAIXNBNU7YSI	2080	SYSTEM	SERVICE	WA1RYQ	INQUIRY - http://www.celestrak.com/NORAD/elements/noaa.txt
2021/07/21 11:37	800J5JDAXN6S	1419	SYSTEM	SERVICE	WA1RYQ	INQUIRY - https://tgftp.nws.noaa.gov/data/raw/fp/fpus62.kmfl.sft.mfl.txt

Message ID: G7P1GIU0CS03
Date: 2021/07/21 11:42
From: SERVICE
To: WA1RYQ
Source: SYSTEM
Downloaded-from: Telnet:cms.Winlink.org
Subject: INQUIRY - <https://cdn.star.nesdis.noaa.gov/GOES16/ABI/SECTOR/cgl/GEOCOLOR/600x60>
Resource URL: <https://cdn.star.nesdis.noaa.gov/GOES16/ABI/SECTOR/cgl/GEOCOLOR/600x60.jpg>
Inquiry ID: GLCURIR.GIF
Attachment: 600x600.jpg
Note: The image file was very large as requested and has been altered to allow processing.

Thanks for using Winlink, an Amateur Radio Safety Foundation sponsored project. For information about Winlink or to manage your Winlink account please visit: <https://www.winlink.org>

For information on how you can help support Winlink and other Amateur Radio Safety Foundation projects please visit: <https://www.arsfi.org>



Winlink Express Operation

Create and Send a Message via Telnet

Once the message is complete,
Click the Post to Outbox Button

Enter a new message

Post to Outbox Select Template ICS 213 Winlink Check-in Field SitRep Attachments Spell Check Save in Drafts Close

From: WA1RYQ Send as: Winlink Message ☒ Request message receipt Set Defaults

To: KJ4RUS

Cc: WA1RYQ@ARRL.NET

Subject: Testing my new Winlink Account

Attach:

Good Afternoon Clayton! Just testing my new Winlink Account. Please let me know if you receive this message.

Thanks!

Enter a callsign or
internet Email Address

Enter a message Subject

Enter your message

CAUTION

- Message content must conform to FCC Part 97 Rules!
 - Message Content – No Privacy
 - Third Party Traffic
 - Business Content
 - Obscene Content
 - Encryption



Winlink Express Operation

Create and Send a Message via Telnet

Winlink Express 1.6.0.4 - WA1RYQ

WA1RYQ Settings Message Attachments Move To: Saved Items Delete Open Session

No active session...

System Folders

- Inbox (9 unread)
- Read Items (91)
- Outbox (1)
- Sent Items (201)
- Saved Items (0)
- Deleted Items (205)
- Drafts (3)

Personal Folders

- 2021-ARC-EXERCISE (9)
- 20211202 PACS Winlink (36)
- 20211215 PACS Winlink (39)
- 20220105 PACS Winlink (26)
- 20220119 PACS Training (1)
- FL Winlink Net (11)

Global Folders

Contacts

- ARC SOUTHEAST & CARIBBEAN
- BOB_HUGHES
- BRIAN_D_WRIGHT
- BRUCE_C_KREUTZER
- CHRISTINE_E_DUEZ
- CLAYTON_PARROTT
- DAVE_BYRUM
- ED_MORGAN
- GARRY_L_POTTS
- GERRY_POLLACK
- JIM_WEDLAKE
- JULIE_CHALHOUB
- KEVIN_A_WALKER
- LARRY RUEGGER

Date/Time Message ID Size

2022/01/28 15:32	ABRJPRXW9Z9E	1
2022/01/28 15:30	L0S6LCKCSD4Q	1
2022/01/25 16:18	G2X2QGGH07GK	1
2022/01/23 06:50	328797R504BU	1

Message ID: ABRJPRXW9Z9E
Date: 2022/01/28 15:32
From: SERVICE
To: WA1RYQ
Source: SYSTEM
Downloaded-from: RMS:KJ4RUS-10
Subject: INQUIRY: WL2K_NEARBY

List of users nearby WA1RYQ
Position: 27-50.44N 082-49.70W posted at:
(NOTE: All dates in UTC, distance in nautical miles)

Winlink 2000 Nearby Mobile Users
(Only the latest report for each call within the past 10 days is listed.)

CALL	Dist(nm @ DegT)	POSITION	REPORTED	COMMENT
WA1RYQ	0.0 @ 000	27-50.44N 082-49.70W	2022/01/28 15:28	Test of GPS Position Report capability.
NF3E	10.0 @ 107	27-47.44N 082-38.93W	2022/01/24 03:53	
W3ATR	31.0 @ 144	27-25.20N 082-29.40W	2022/01/19 18:27	
WP4OH	71.0 @ 079	28-03.18N 081-30.61W	2022/01/27 03:30	PRDOGS kp4dog@gmail.com
N4BUT	89.5 @ 057	28-38.29N 081-23.89W	2022/01/19 20:27	
KA9ZRZ	98.0 @ 065	28-31.45N 081-08.71W	2022/01/27 19:12	
AG0K	110.1 @ 165	26-04.25N 082-17.04W	2022/01/27 00:42	QTH LOCATION WX 54f CLOUDY
K04RHC	192.5 @ 132	25-40.93N 080-10.16W	2022/01/24 13:38	
KK4ZFT	285.6 @ 351	32-32.54N 083-41.11W	2022/01/22 21:44	
WK4PCH	289.1 @ 349	32-34.44N 083-52.23W	2022/01/20 15:55	Posting position report for Peach County EOC. GPS not working in this building.
WY4X	289.4 @ 349	32-34.45N 083-54.00W	2022/01/23 15:46	
WV5Q	349.5 @ 299	30-30.27N 088-45.79W	2022/01/19 23:16	WV5Q DON VANCELEAVE JACKSON MS HF PACTOR 3
KC4WSK	361.3 @ 015	33-37.98N 080-54.64W	2022/01/22 13:02	I am here.
AE5MI	368.3 @ 297	30-30.31N 089-09.75W	2022/01/27 01:38	
K4LLE	375.0 @ 011	33-57.70N 081-21.08W	2022/01/25 13:15	Vara FM P2P Digipeater Station on air most of the time. Gilbert SC 145.530 high
antenna 97'				
K4OFV	381.5 @ 348	34-03.17N 084-24.63W	2022/01/26 16:33	
W1GTT	387.3 @ 012	34-09.31N 081-15.59W	2022/01/27 02:12	"A diversity of modes is essential to an effective EMCOMM system!"

Telnet Winlink

- Telnet Winlink
- Packet Winlink
- Pactor Winlink
- Robust Packet Winlink
- Ardop Winlink
- Vara HF Winlink
- Vara FM Winlink
- Iridium GO Winlink
- Packet P2P
- Pactor P2P
- Robust Packet P2P
- Ardop P2P
- Vara HF P2P
- Vara FM P2P
- Telnet P2P
- Pactor Radio-only
- Vara HF Radio-only

Recipient Subject

WA1RYQ	INQUIRY: WL2K_NEARBY
WA1RYQ	Duplicate Position Report
WA1RYQ	MICHAEL, FL WL Net Report for 1/25/22 + No Name Change
AA1AO...	Call For Check-Ins - YCARES Winlink Net - Jan 23, 2022 - Session 191

One Message in the Outbox

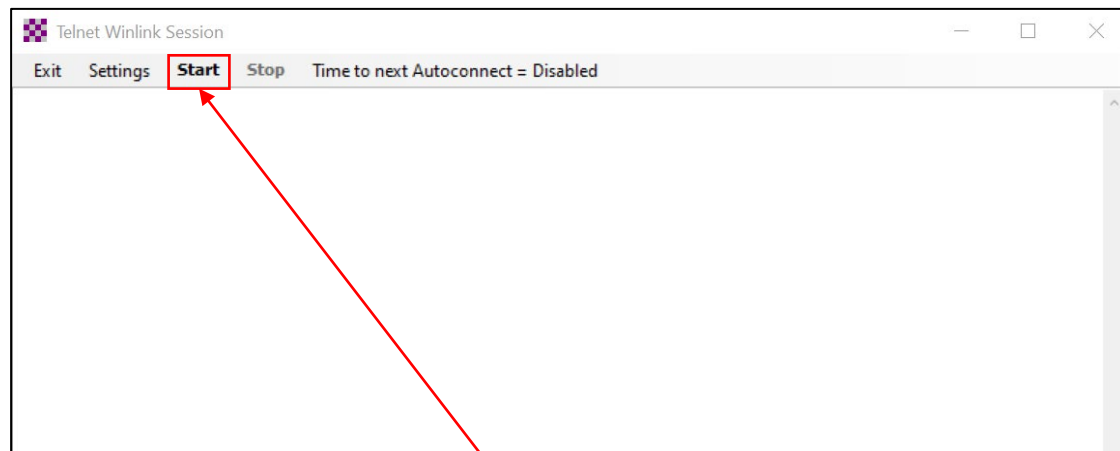
Step 1: Winlink Session Type
Select "Telnet Winlink"

Step 2: Open Winlink Session

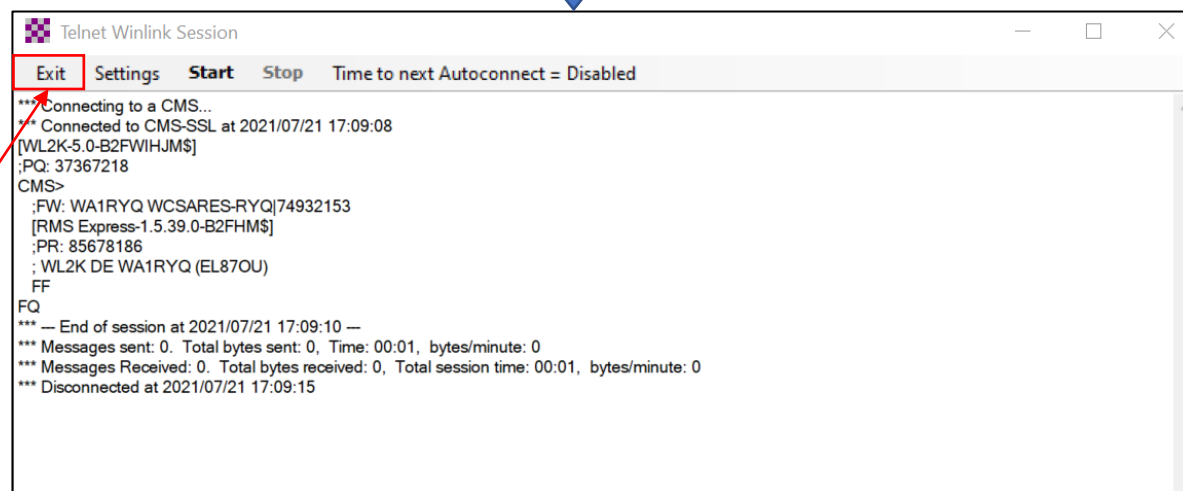
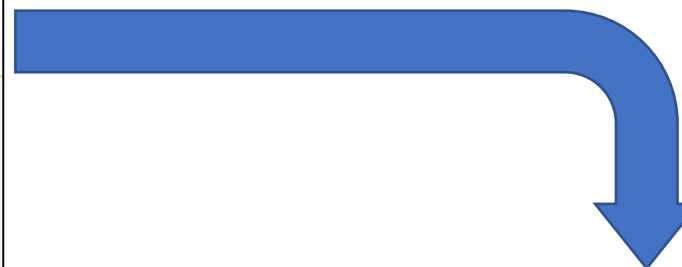


Winlink Express Operation

Create and Send a Message via Telnet



Step 3: Depress the **Start** Button



Step 4: Depress the **Exit** Button

Message has been Sent!



Agenda

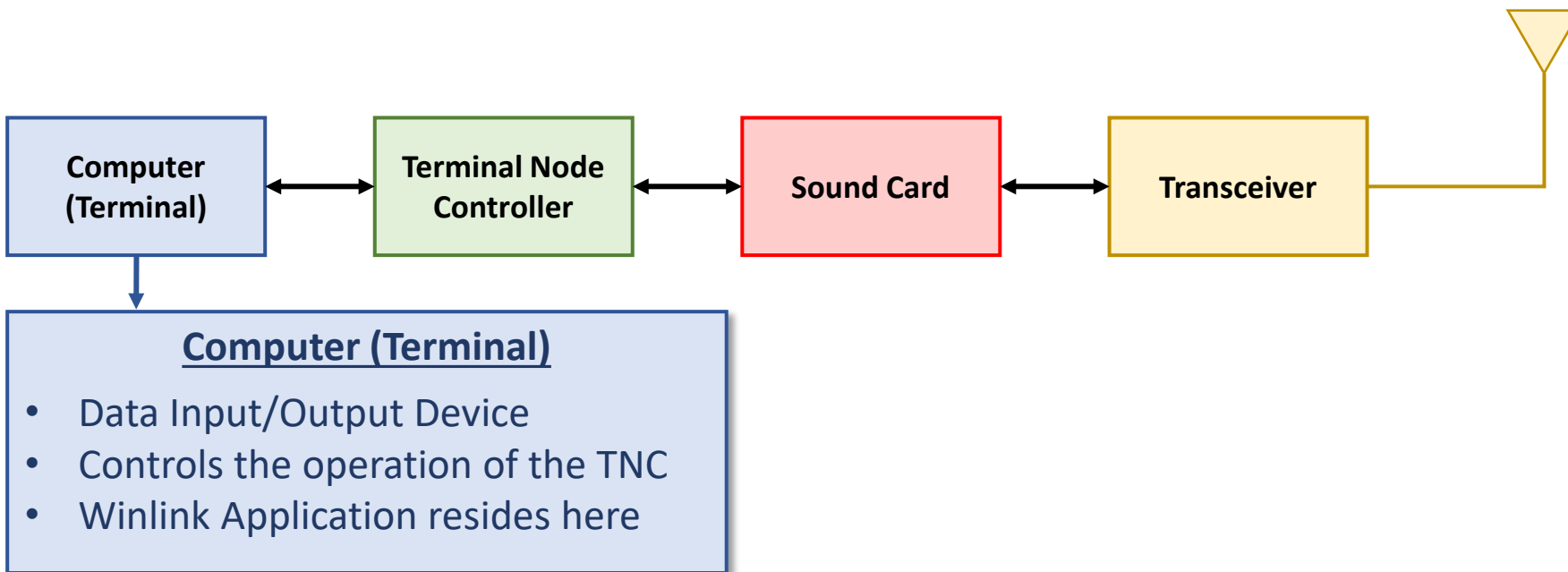


- Winlink Overview and Installation
- Winlink Express Operation
- Digital Communications



Digital Communications

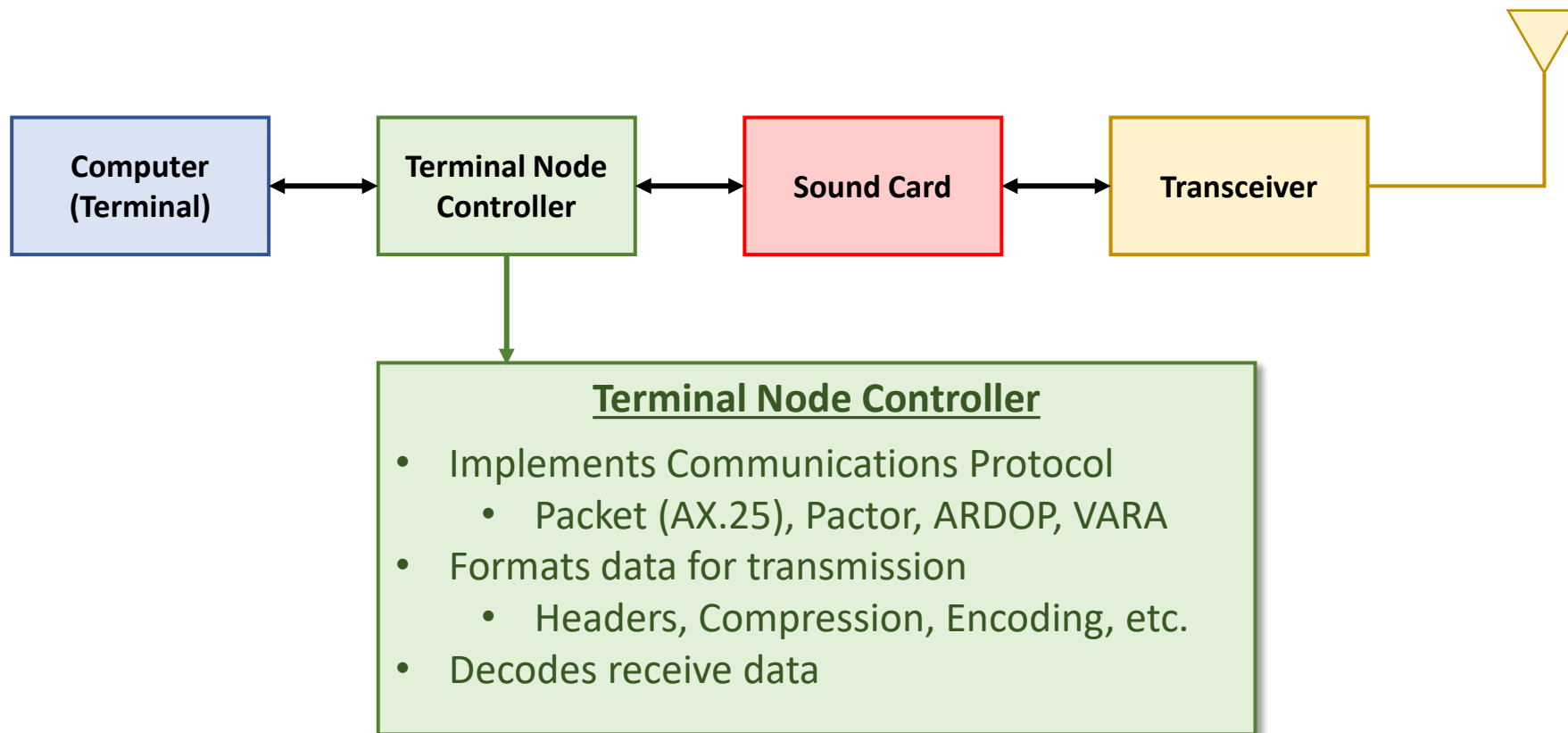
Functional Description





Digital Communications

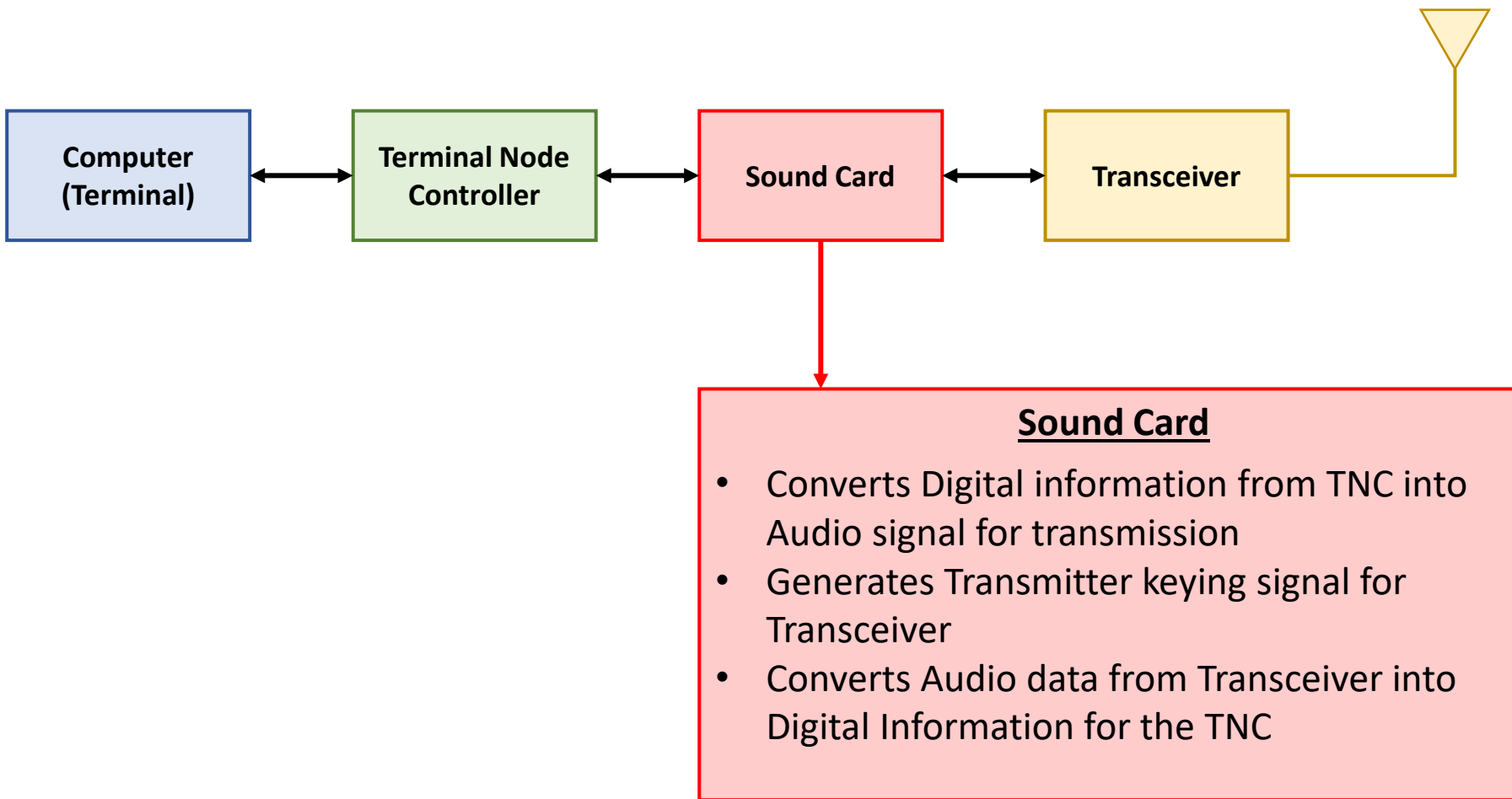
Functional Description





Digital Communications

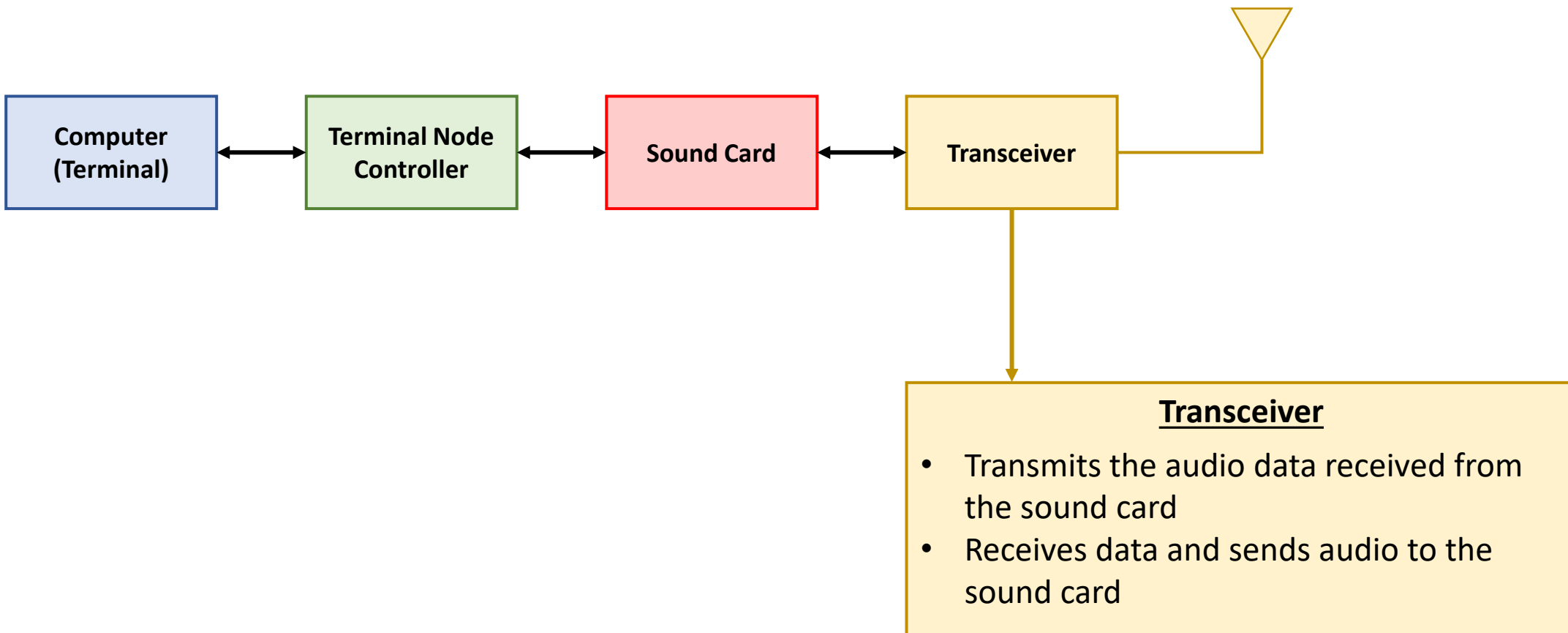
Functional Description





Digital Communications

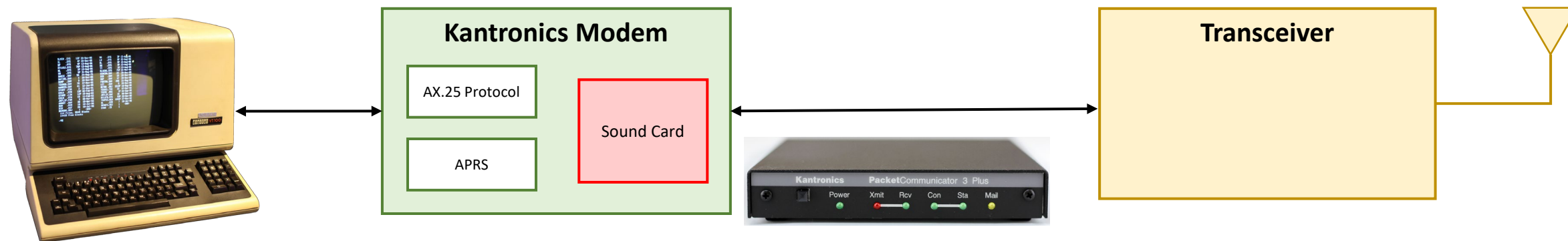
Functional Description





Digital Communications

Functional Description – Development History

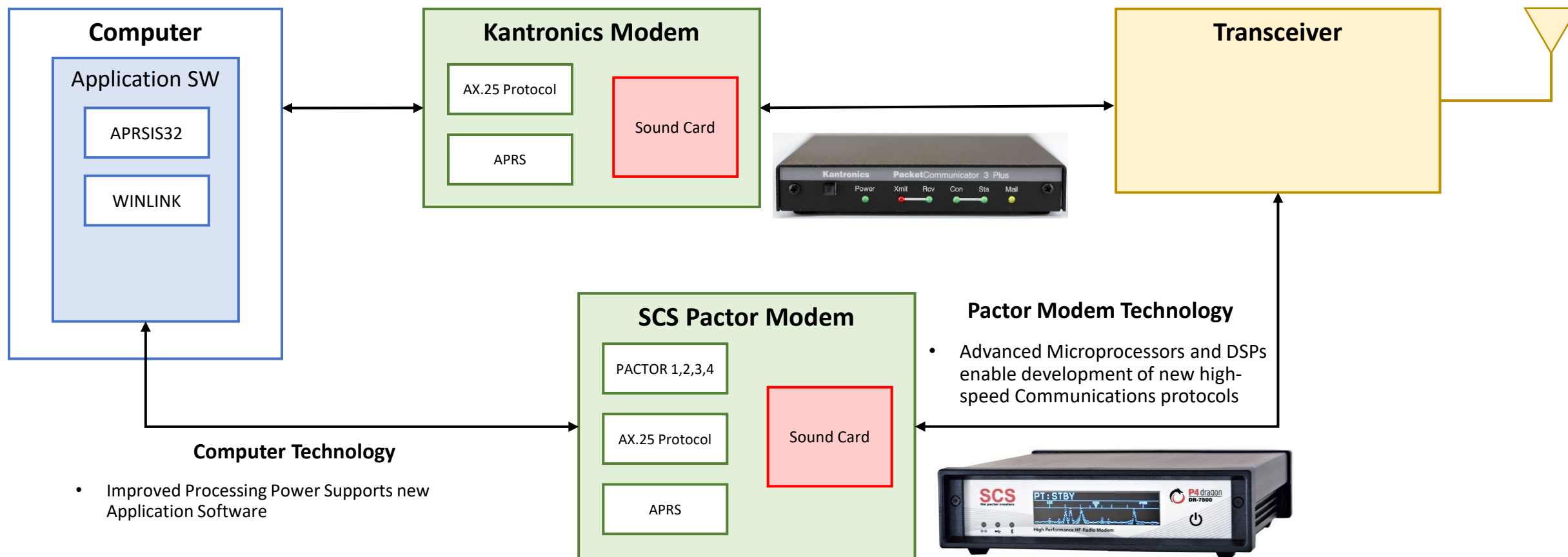


- Dumb Terminal / Microcomputer
 - Input and display unit
 - No application-based computing capability
 - Command line control of TNC
- Terminal Node Controller
 - Dedicated Hardware
 - Manages all aspects of Packet data exchange
 - Packet Assembler/Disassembler



Digital Communications

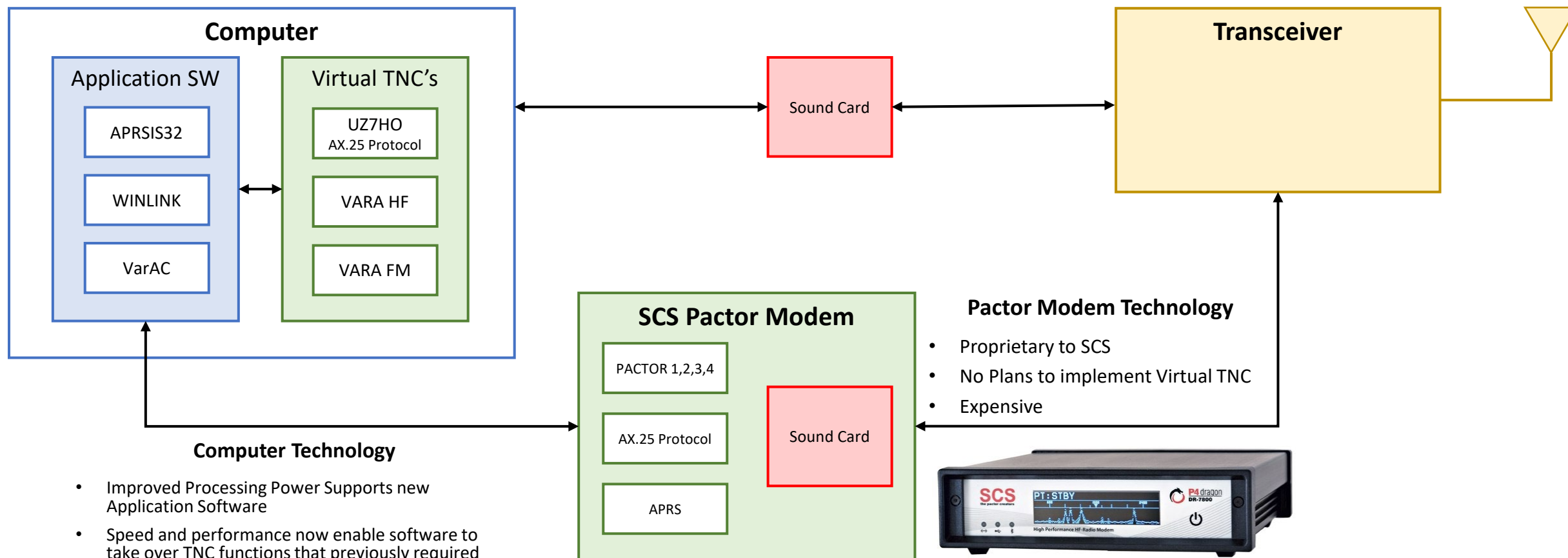
Functional Description – Development History





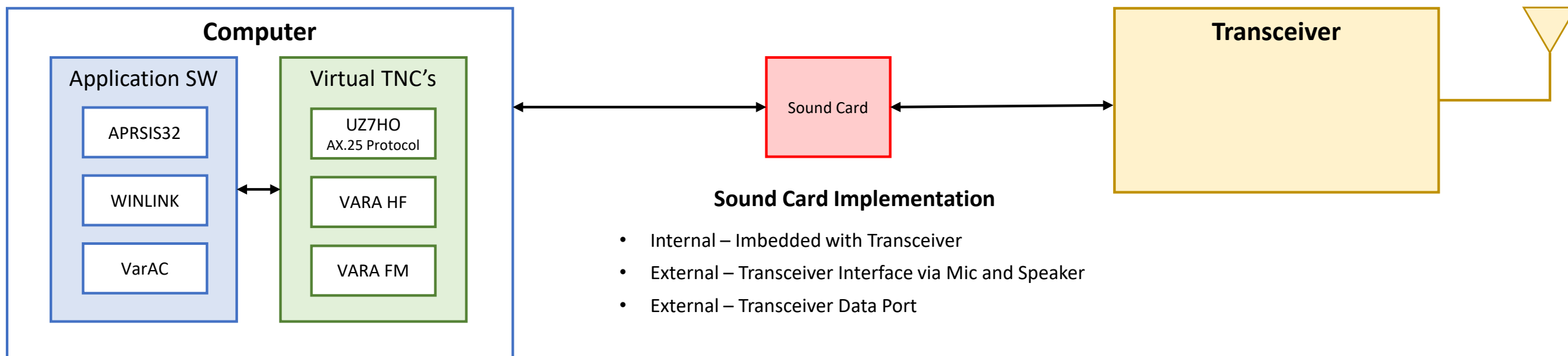
Digital Communications

Functional Description – Development History





Digital Communications Implementation

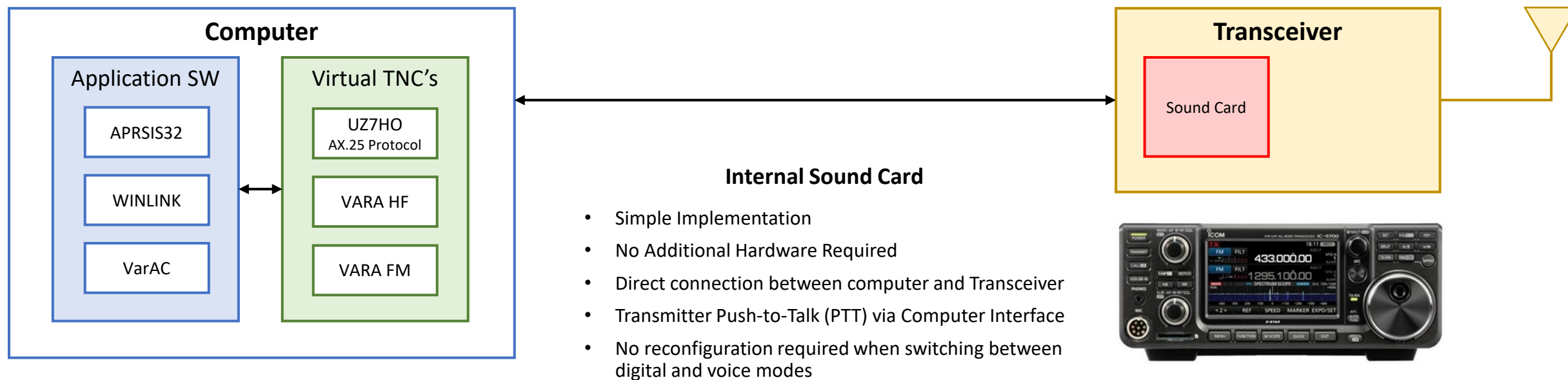


Computer Technology

- 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

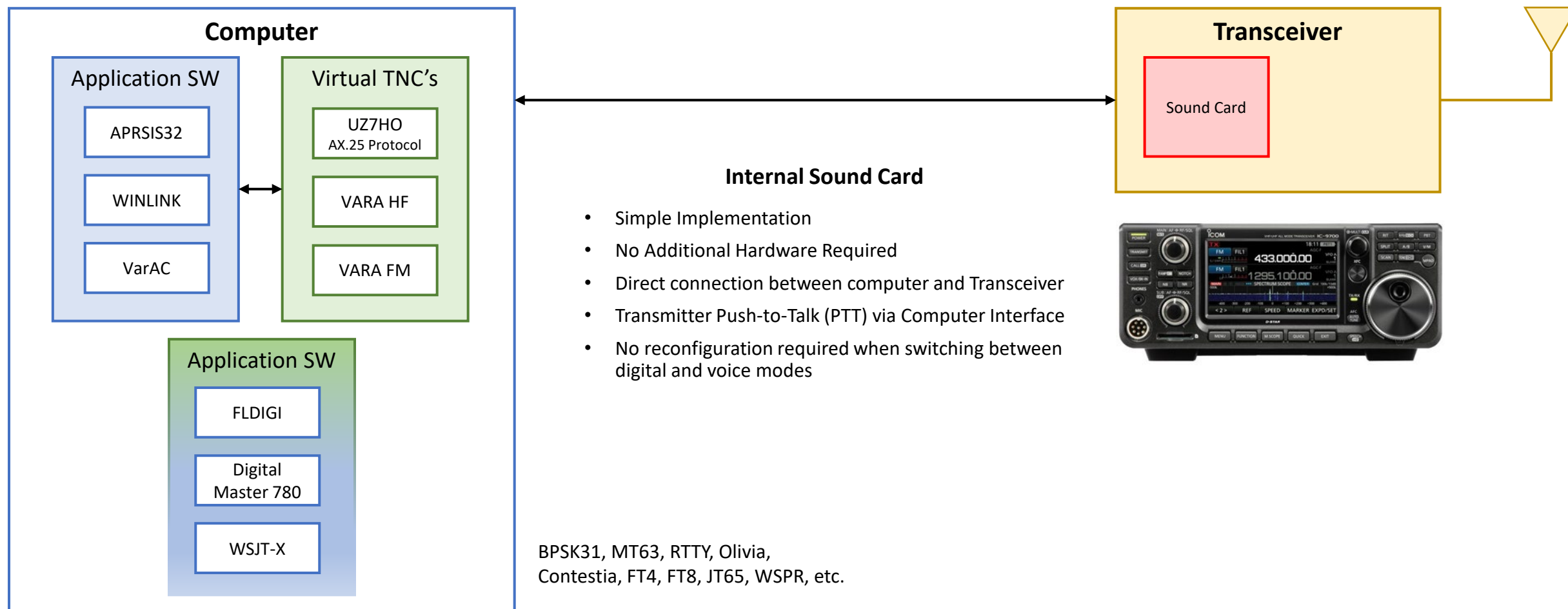


Digital Communications Implementation – Internal Sound Card





Digital Communications Implementation – Internal Sound Card





Digital Communications

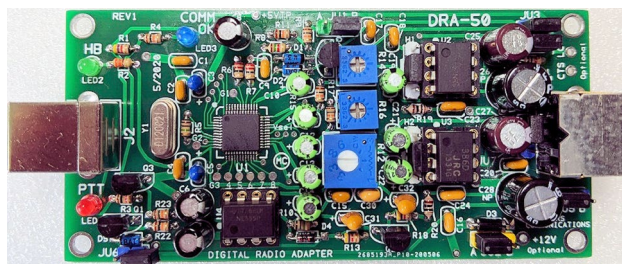
Implementation – External Sound Cards

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



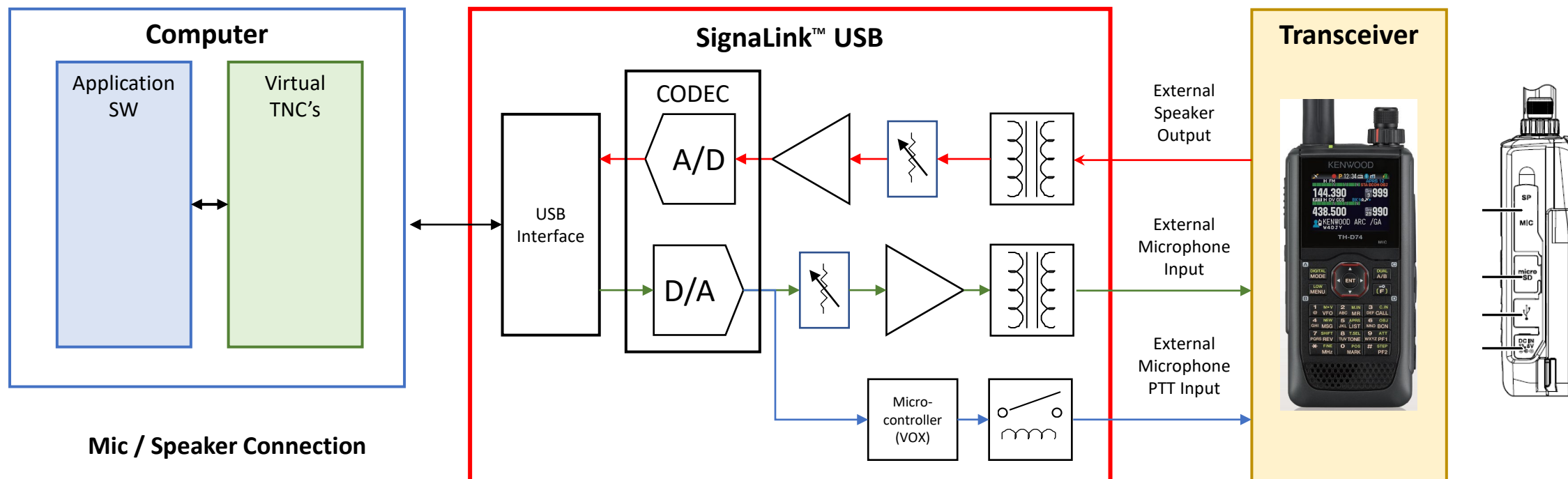
Digirig Mobile

- Hardware and Radio Cables – Approx \$100
- Connects to Radio Data Port or Mic/Speaker
- Supports VARA Wide



Digital Communications

Implementation – External – Mic and Speaker Connection



Mic / Speaker Connection

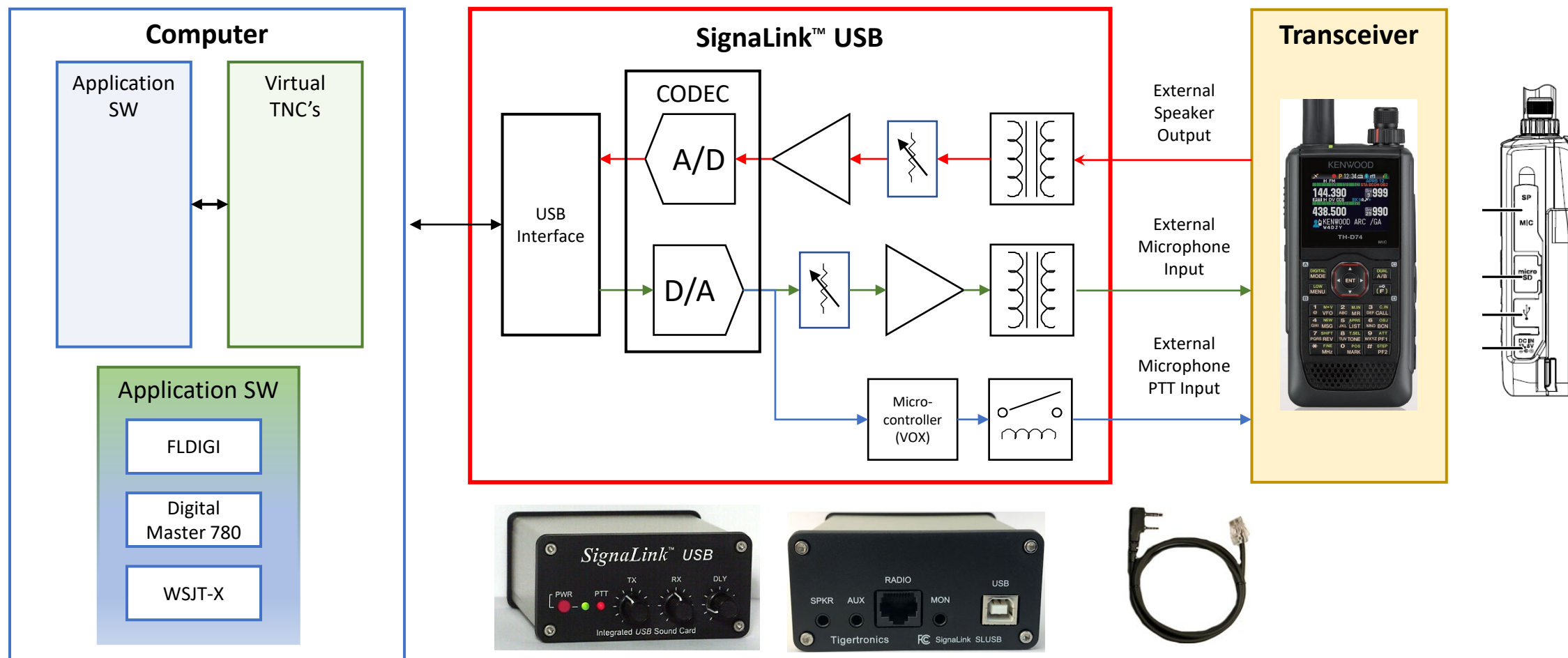
- Straight Forward Implementation
- Disadvantage
 - Cable reconfiguration required when transitioning between voice and digital modes.
 - Support for VARA Narrow only





Digital Communications

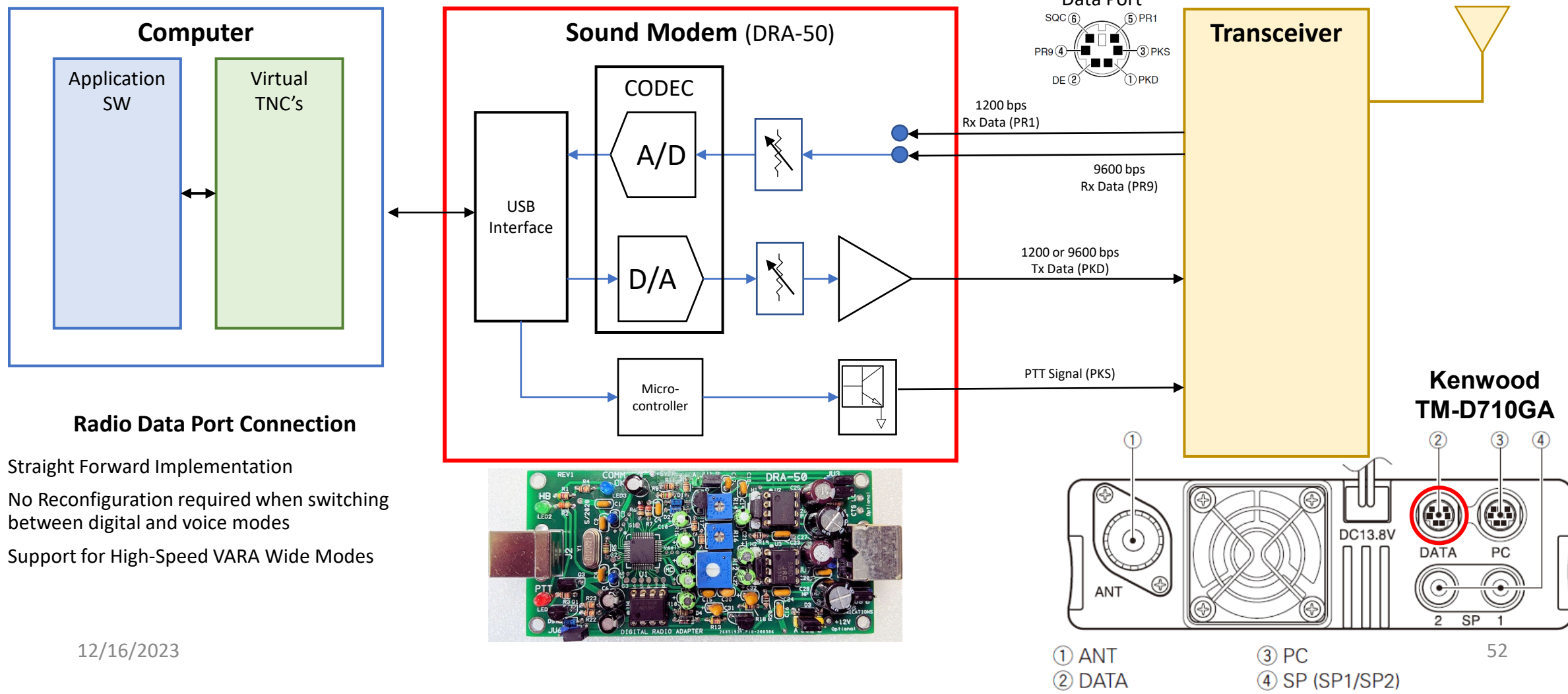
Implementation – External – Mic and Speaker Connection





Digital Communications

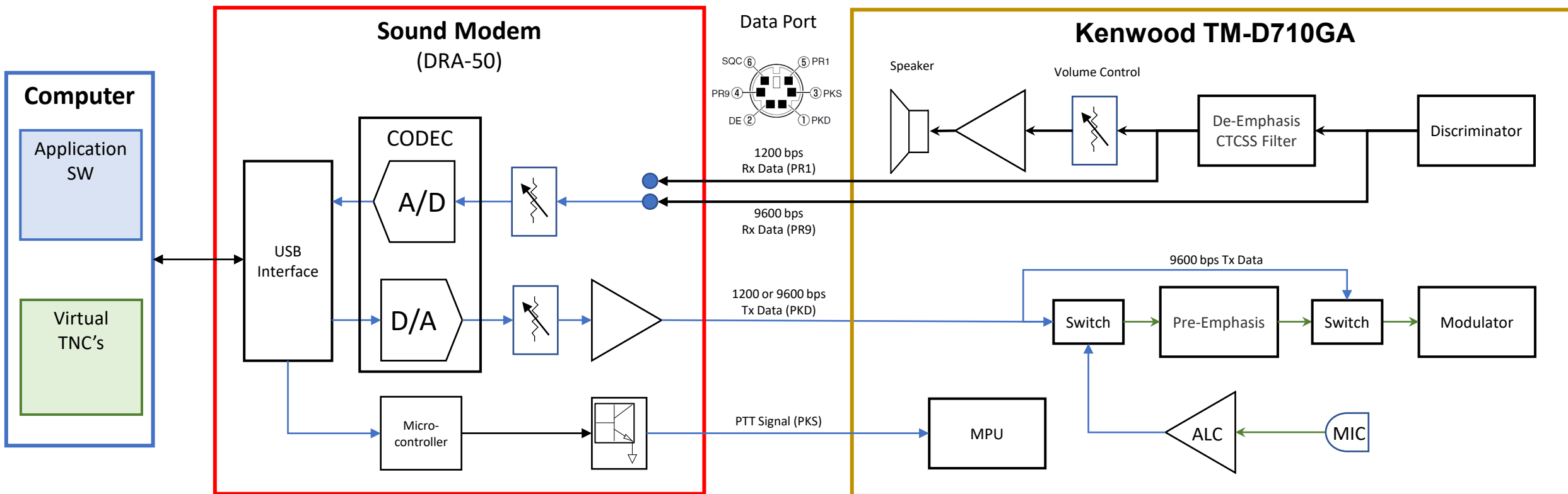
Implementation – External – Radio Data Port





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



Conclusion



- Questions





Winlink Operating Frequencies

§ 97.221 Automatically controlled digital station

- A station may be automatically controlled while transmitting a RTTY or data emission on the 6 m or shorter wavelength bands, and on the following segments.

28.120–28.189 MHz	18.105–18.110 MHz,	10.140–10.150 MHz
24.925–24.930 MHz	14.0950–14.0995 MHz	7.100–7.105 MHz
21.090–21.100 MHz,	14.1005–14.112 MHz	3.585–3.600 MHz

- Except for channels specified in § 97.303(h), a station may be automatically controlled while transmitting a RTTY or data emission on any other frequency authorized for such emission types provided that:
 - The station is responding to interrogation by a station under local or remote control; and
 - No transmission from the automatically controlled station occupies a bandwidth of more than **500** Hz.