Remote Contesting at K3AJ
4 Years & 75,000+ QSO So Far!
Updated 9/2024

More than one way to approach remote contest operation – Remote the Radio

- Access the radio via a remote hardware or software solution and run contest software at the remote site
  - If multiop, network the instances of N1MM via internet
  - Works with radios that can be remoted "out of the box" like the Flex or the K4
  - Works with hardware solutions like Remote Rig, K3-0, K4-K4, Yaesu SCU-LAN10, Icom RS-BA1

Internet
Connection

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┌──────────┐     ┌────────────────┐              ┌────────────────┐     ┌──────────┐
│  Remote  │─────│ Proprietary Radio │   ──────>   │ Proprietary Radio │─────│  Radio   │
│ Computer │     │     HW/SW      │              │     HW/SW      │     │          │
└────┬─────┘     └────────────────┘              └────────────────┘     └──────────┘
     │
┌────┴─────┐
│   N1MM   │
│          │
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Remote Operator
Site

Station (Shack)
Site
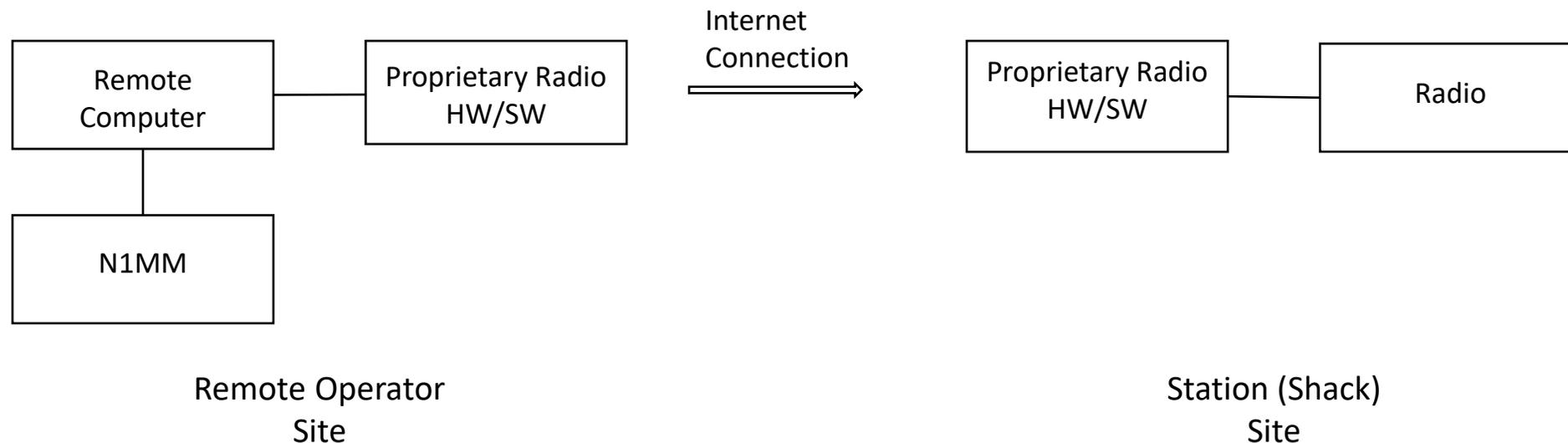
More than one way to approach remote contest operation – Remote the Shack Computer

- Run the radio and the contest software on the shack computer and access the shack computer remotely using a remote desktop app + a VOIP app for audio
  - No special remote hardware required
  - Radio agnostic
  - Simple software set up – Remote Desktop + Mumble for audio at the remote computer
  - Easy to incorporate station controls via shack computer
  - Standardized and promoted by "The Godfather" – Gerry W1VE (see appendix)

Internet
Connection

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| Remote Computer | | Shack Computer | Radio |

N1MM

Remote Operator
Site
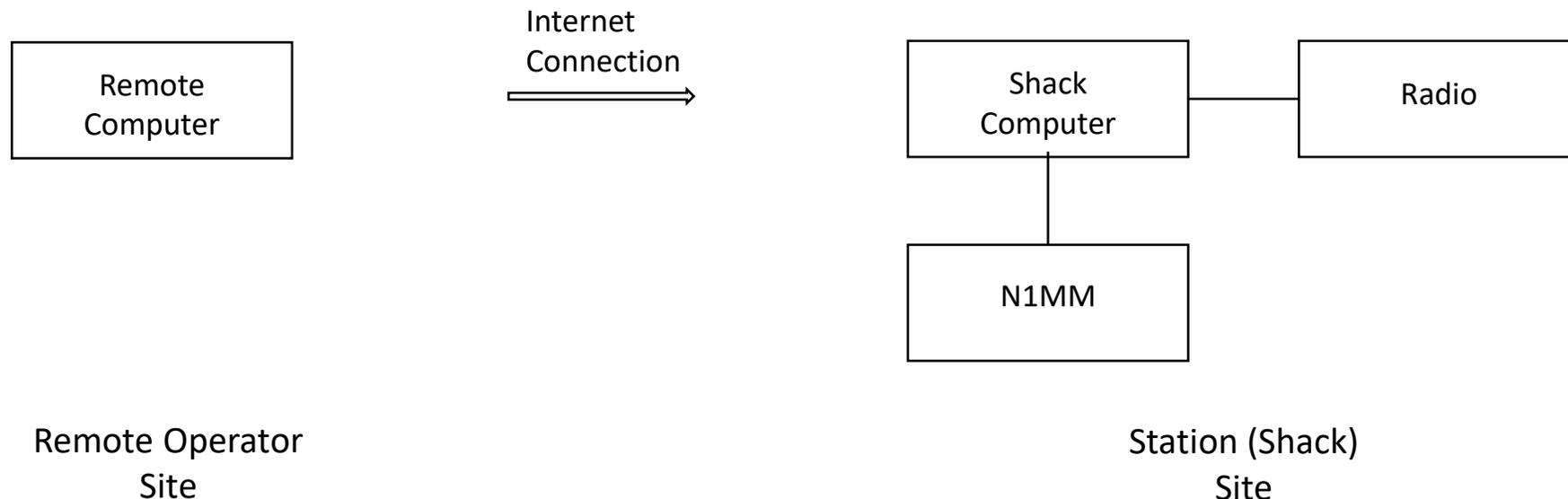
Station (Shack)
Site

K3AJ approach

Overall approach:

- Set the station up to be operated from the shack computer
- Run contest software (N1MM+) on the shack computer
- Remote ops use remote desktop software – VNC Server/Viewer - to take control of shack computer
- Remote ops get audio via Mumble
  - Mumble is the standard, go-to audio app used by the online gaming community

Compromises/limitations:

- Limited radio fiddling – Rely on N1MM+ for frequency control (no big knob, alas)
  - Use mouse wheel, Up/Down arrows, click in band map or in Spectrum Window to tune the radio.
- Define N1MM+ Band Map buttons for radio control functions as needed (RX bandwidth, XIT, whatever you need) using CAT commands
- We also run Win4Yaesu on the shack computer so the remote ops can make any radio adjustment they want
- Use N1MM function key messages and CTL-K for keyboard CW (no paddle for CW at K3AJ)

Software choices

- Remote Desktop
  - TeamViewer, AnyDesk, Rust Desk, Real VNC, many others should all work
    - Rust Desk is open source and free for the self-hosting option
  - K3AJ uses Real VNC (VNC Server Professional, VNC Viewer)
    - Currently $50/year for server, Viewer is free. Similar cost to other paid services

REALVNC

SWITCH TEAMS

Professional   Team K3AJ
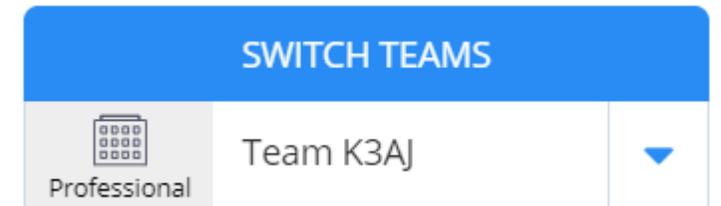
Software choices

- Audio
  - Reliable audio is critical – especially for CW
  - K3AJ currently using Mumble - Provides reliable, high quality, low latency audio
    - Mumble is the "Industry Standard" for on-line gaming
    - Mumble has client/server architecture
      - Client is used at both the station end and the remote end – both communicate with a server in the cloud (it is possible to host a server on the station computer – but not necessary or recommended)
      - There are public servers, or you can pay to have your own via several available services
      - W1VE offers private Mumble servers hosted in a big data center for $10/year – Current approach at K3AJ

Software choices

- N1MM+ is our logging software
  - The N1MM+ Spectrum Window is driven by an SDR Play RSP1A
- PST Rotator is our automation/computer control solution for accessories
  - Drives two Green Heron RT-21 rotator controls
  - Automates SteppIR tuning and provides software front panel for SteppIR
  - Drives two USB relay boards to operate the K9AY RX antenna, power switches, 80M antenna selection
- Antenna selection is automated using a Unified Microsystems band decoder and a modified Ameritron RCS-10 switch
- Win4Yaesu provides full radio control
  - Similar products for ICOM/Elecraft
  - Incorporates reliable radio port sharing for N1MM+/Win4Yaesu
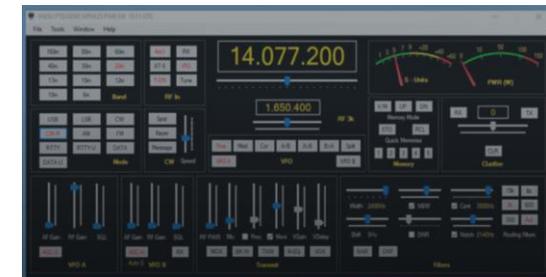
Shack/Remote Computer Screen via VNC Viewer - RTTY

Win4Yaesu

PST Rotator
Relay Board
Controls

Mumble
Client

N1MM+
Buttons for
radio control

PST Rotator
K9AY
Direction

PST Rotator
Rotator, SteppIR
Controls

KPA1500
Controls

Shack/Remote Computer Screen via VNC Viewer - CW

K3AJ Hardware/Software Diagram
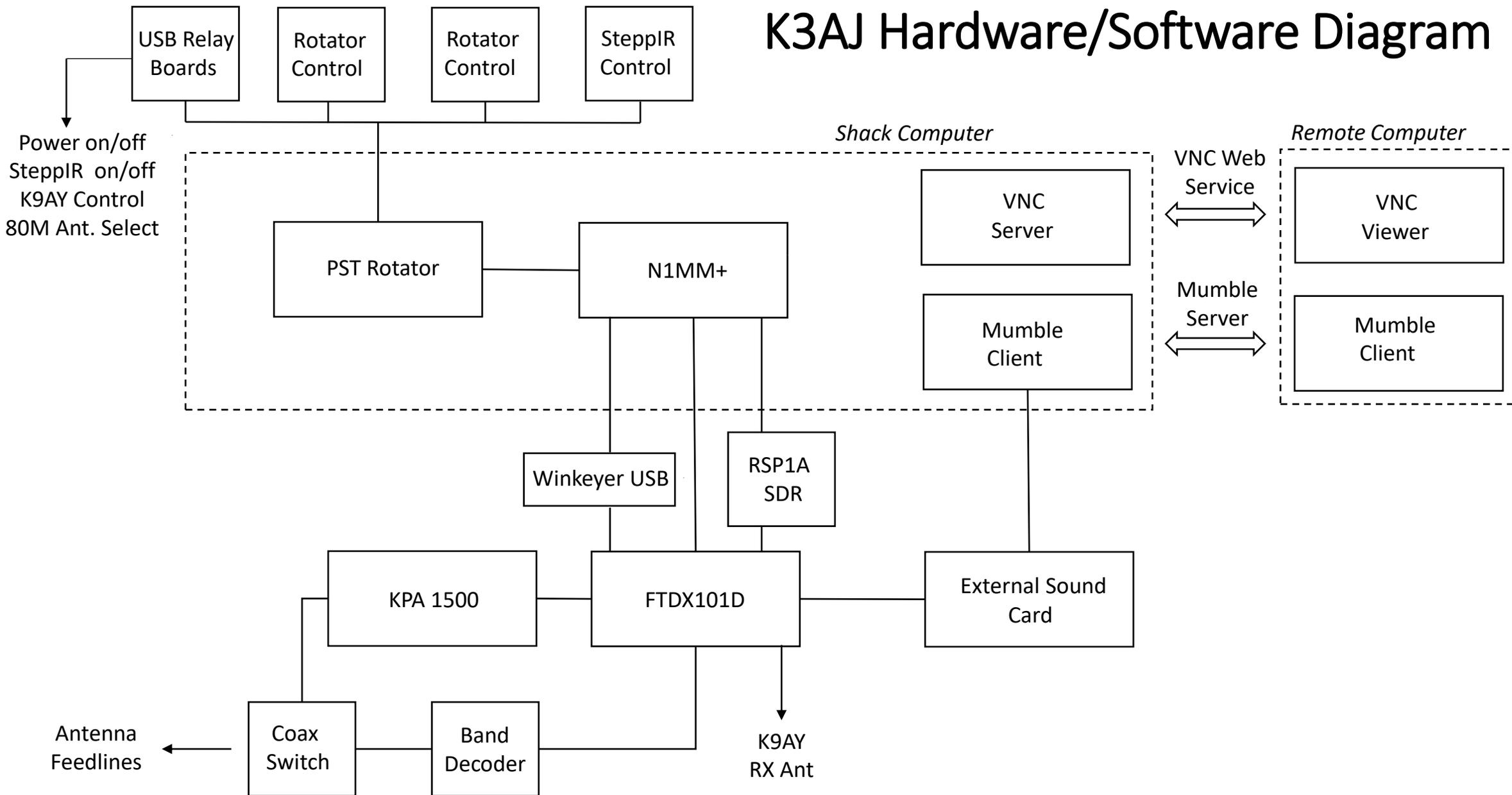
How well does it work?

- Must have good internet connection at both ends
  - High speed cable/fiber-based internet
  - Use ethernet connection to routers at both ends – WiFi is much less reliable (but I have operated successfully using hotel WiFi at times)
- Depends on mode:
  - FT8/FT4 is a no-brainer. Only need remote desktop app. No audio stream required
  - RTTY is easy. Audio stream for situational awareness and timing, but quality is less critical
  - CW is usually reliable. The operation is only as good as the audio stream quality which in turn depends on internet connection quality
  - SSB is more difficult
    - Requires the audio to be set up correctly in two directions
    - Use of audio recordings and voicing is a viable option – cuts the total latency in half

How does it work?
What about the latency?

- Remote desktop latency = trip to web service + processing time at web service + trip back to the remote desktop.
  - KU7T measured this using Anydesk and reported 50-60 ms
- Audio latency = trip from shack to Mumble server + trip from Mumble server to remote computer
  - W1VE measured total audio latency between a control point in New England and ZF5T at 127 mSec – about 1 CW character at 40 WPM
- The remote op hears everything as a continuous audio stream (the other guy and the TX monitor), just delayed a little more than 100 mSec CW or RTTY. The delay that the other guy might hear in us answering is the same. Not noticeable.
- SSB requires audio to travel both ways, so the latency is doubled – maybe 200 mSec. Use of recordings cuts that in half since they are sent from the shack.

How does it work?
What about the latency? – Connection Stats from Mumble

Good
Connectivity

House of Pain

How does it work?

- W4RN has been doing this a long time, starting at W4BVV with ops as far away as Korea and has scored some very high finishes and category wins in M/2 and M/S with a competitive station and operator team

- W1VE has set this up on some big stations (K1LZ, ZF5T) and achieved winning results

- Successful remote contesting requires some patience and a flexible mindset on the part of the remote operator

- At K3AJ:
  - We mostly do M/S entries
  - The station is loud enough for us to have fun
  - Most of our regular ops have very limited home stations
  - We do mostly CW and RTTY but have done a little Digi and some SSB
  - We recently did our first ever M/2 in NAQP CW. Used an FT-991A as second radio with a laptop for the second radio computer. Our Mumble server has two channels.

Appendix – Useful Links (AKA W1VE's Greatest Hits):

Contest University 2023 – "Understanding Remote Contesting" Gerry Hull, W1VE https://www.contestuniversity.com/wp-content/uploads/2023/05/Understanding-Remote-Contesting-2023.pdf

Contest University 2024 – "Success Strategies for Remote & Hybrid Multiop Contesting" Gerry Hull, W1VE
https://www.contestuniversity.com/wp-content/uploads/2024/05/Pg-34.-W1VE-CTU-Presentation-2024.pdf

Groups.io, "Contesting with Mumble"

RadioSport-Network-Support-Group@groups.io

The Mumble Radiosport Network for Amateur Radio Contesting (details on setting up Mumble)

https://blog.radiosport.network/

Low Latency Remote Audio Worldwide

http://remote.radio

Appendix – K3AJ Station

Radio: Yaesu FTDX101D

Amplifier: Elecraft KPA 1500

Antennas:
- 160M - Inverted L
- 80M – Inverted V at 45 ft./68 ft. Vertical
- 40M – 2-el Yagi at 70 ft.
- 20M – 4-el Yagi at 70 ft.
- 15M/10M – 3-el SteppIR at 50 ft.
- RX – K9AY

Appendix – Ancient History/Evolution of K3AJ Remote

Remote Desktop

- We started out using TeamViewer as our Remote Desktop, but very quickly discovered it would not support the usage we needed with the free version.

- Looked briefly at Chrome Remote Desktop, but it only supports one user account.

- We then moved to the (then available) Home version (free) of VNC Sever/Viewer. It would only support a few users, and then VNC discontinued its free version

- Currently using VNC Server in the shack (paid, Professional subscription approx. $50/year per computer) with VNC Viewer at remote computers (free). Allows many users.

VOIP Applications for Audio

- First attempt was with Skype. Not good enough.

- Next attempt was with RemAud, a free VOIP app specifically developed for amateur radio. It never worked reliably for us and there is no support.

- For several years we used the Remote Hams RCForb app. It is free and there is an active user group. It requires a port forwarding set up at the server (shack) end. It worked well and provided audio reliable enough for effective contesting. It is a very complicated application, as it also incorporates a full radio control panel and can also support auxiliary equipment.

- Finally, we moved to Mumble. In its architecture, you run the Mumble client at both ends (shack and remote computers). The clients connect to a server in the cloud. We have a private server provided by Gerry, W1VE housed in a big data center for $10/year which provides two channels of audio. It is very simple to set up and use. It has proven to be reliable and provides high quality, low latency audio. Mumble is free.

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