

# Remote Radio Solutions

Fred Glenn  
K9SO



# Not covered in this presentation

There are many ways to accomplish radio remote control including methods for remote repeater access like [D-STAR](#), [Echolink](#), [IRLP](#), [WIRES](#) and [eQSO](#) . There are other worldwide networks based on digital radios such as DMR-MARC and Brandmeister.

These will not be covered in this presentation.

This presentation will cover remote operating of analog radios with specific applications for operating on the HF bands, even though many of the techniques may be extended to VHF/UHF radios.

**There are a number of Internet based options available such a RemoteHams.com and the RHR “superstation” company. Our goal here is to how to set up remote stations rather than how to use others that may be available. That said, I encourage you to look into those options.**

# Five basic HF Remote Control Techniques

1. CAT Connection and a remote desktop
2. CAT + Serial Servers
3. Web Server at remote site
4. Proprietary Radio Software
5. Control Head linking

All require 2-way audio channels, usually VoIP  
All require additional control channels for safety



# The early days were harder

My first remote stations were complex

- DTMF control over 450MHz links
- A pre-tuned SB200 amplifier for each band
- Almost all controls hand-built

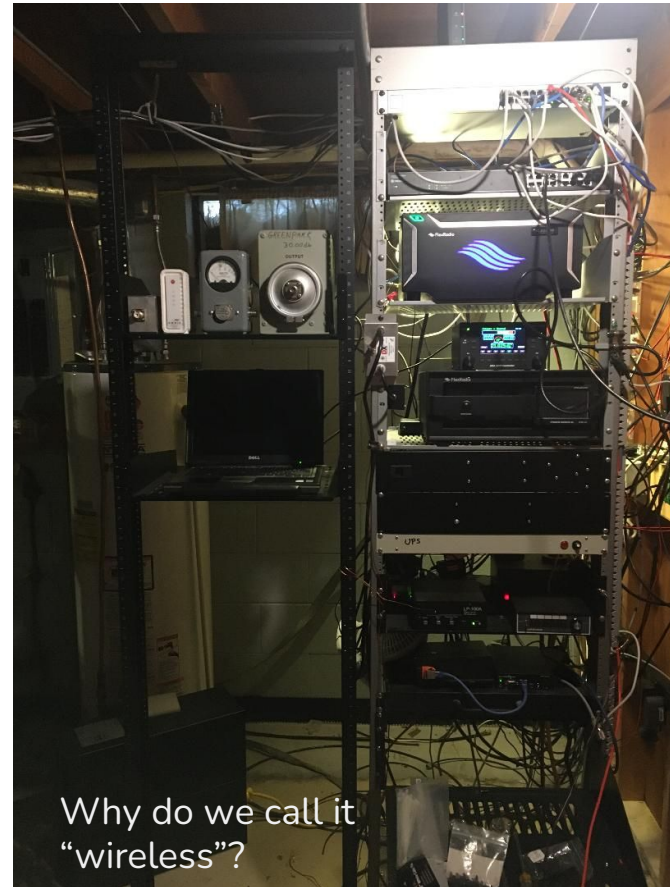


# Simpler today, but still lots of wires and cables

FlexRadio and IC-706MKIIg systems  
in Wisconsin all in one rack.

Similar setup in North Carolina

My “shack” changed so often I could  
never keep the wiring neat

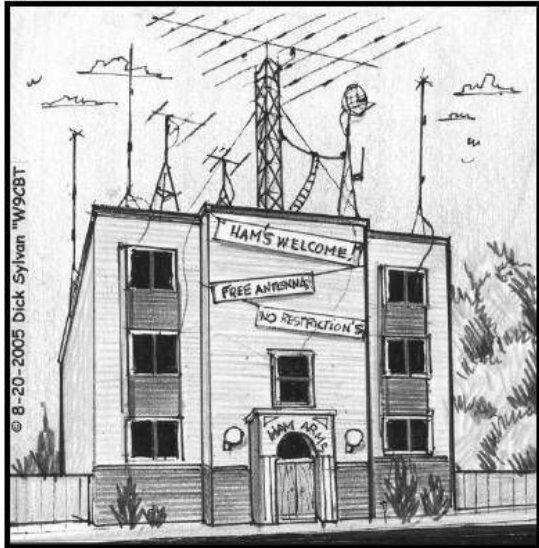


Why do we call it  
“wireless”?

# Why remote?

Apartments For Rent

Restrictions



"Looking For an Apartment Where You Can Put Up an Antenna? — Dream On!"

Convenience



Who wants to work here?



**Don't hide in the basement!**

**CREEPY MAN  
HIDING IN MY  
BASEMENT**





**Join the family or take a vacation**





# Introducing the “RetroRig”

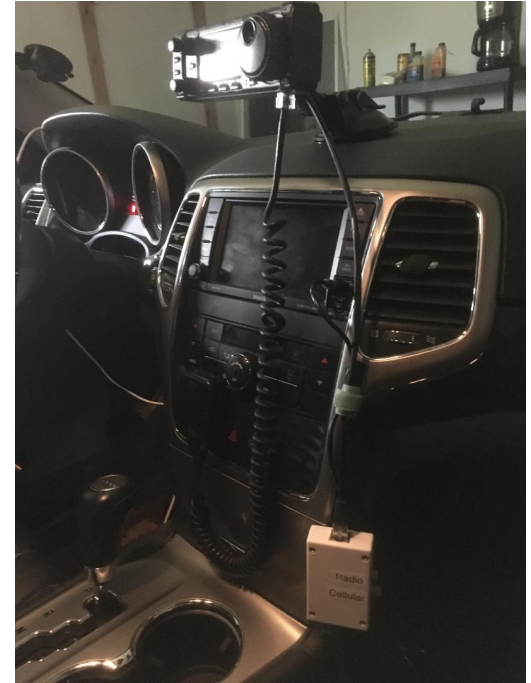
They may have the look of 1960's era CB radios, but they pack a powerful portable punch



Battery operated, WiFi hotspot linked, all band, all mode, remote radio controllers

**Before we get there, let's cover the basics of remote operating at a high level**

**You CAN take it with you ... .**



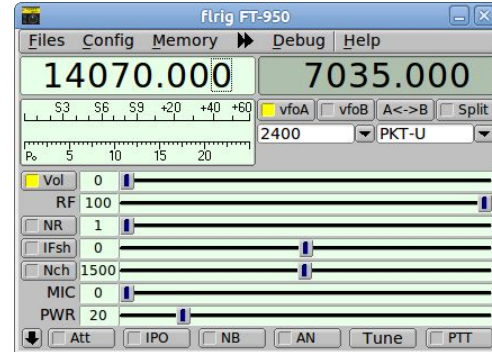
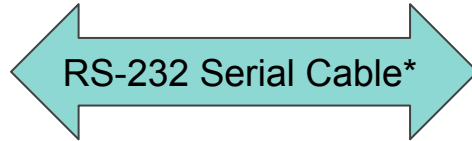
# **Solution 1: Remote desktop**



# Solution 1: Computer Aided Transceivers (CAT)



Example radio with  
RS-232 output (DB9)



PC running FLRig Software  
HRD, and many others

\* More modern radios may use  
USB for this connection

A simple cable link between radio and a host PC

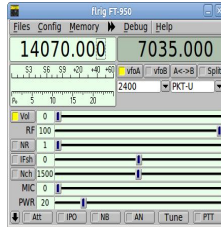
# Many users stop here and simply run Remote PC access software

- Difficult to manage a remote PC from miles away
- High latency connections are common



Remote Radio

Hard wired  
RS-232



PC at remote site



But no paddle CW!

Happy Ham running remote PC software





## Ham Radio Deluxe and other Rig control programs

I should point out that HRD and other rig control programs have a “server-client” feature. I put these into the same category as the remote desktop approaches because they require remote PCs and they violate my

**PRIME DIRECTIVE OF REMOTE STATION CONTROL:**



# NO PCs IN THE MAIN CONTROL LOOP AT THE REMOTE SITE!

IMHO, Windows is still too unstable. Over the years, I have learned to mistrust it.

They're OK for backup systems, diagnostics, cameras, etc., but if you go down that path, you may come to regret it as I did.

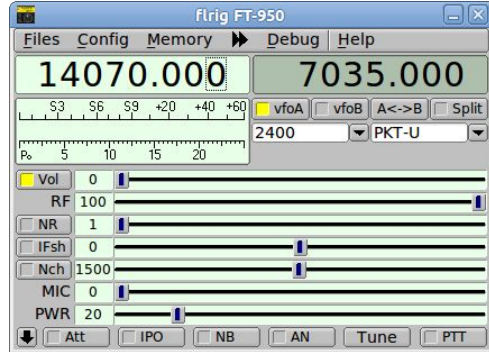
Regular updates will throw off your settings. Open ports make PCs vulnerable to hackers.



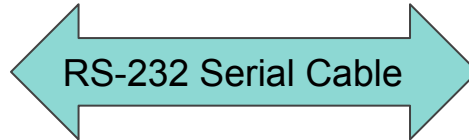
# **Solution 2: CAT + Serial Servers**



# Solution 2: Computer Aided Transceivers (CAT) + Serial Servers



Example radio with  
RS-232 output (DB9)



PC running FLRig Software  
(many other choices available)

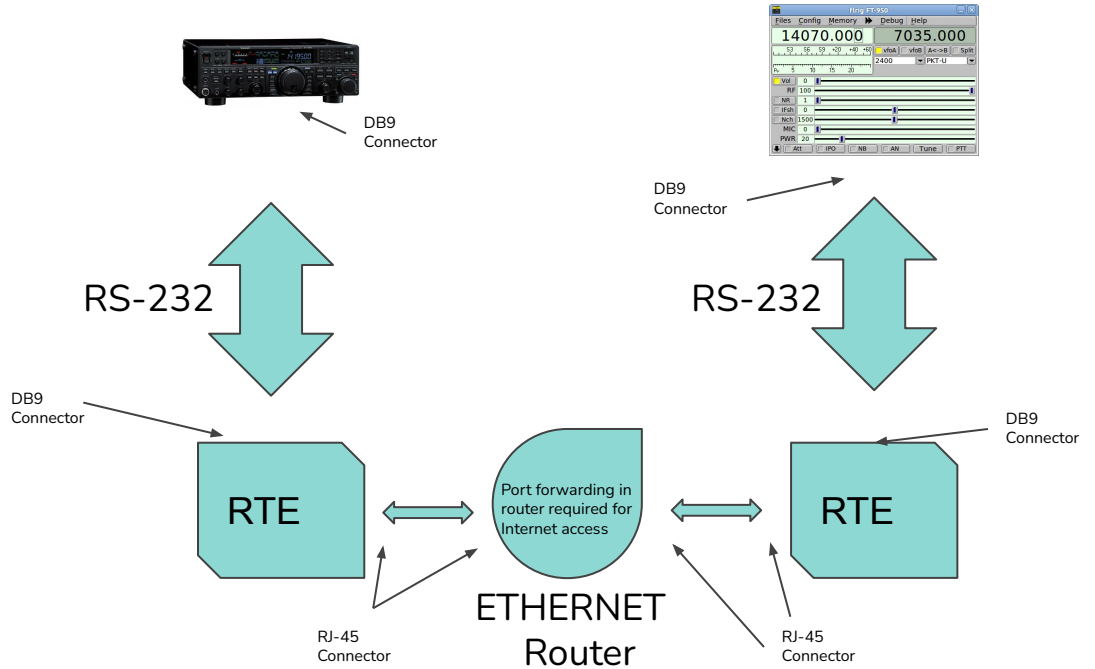
**But a far better way is to run a very long data cable! Let's build one!**

# Introducing the SERIAL SERVER

(aka, Serial to Ethernet adapter or Radio to Ethernet - RTE adapter)



Two Serial Servers simply can act as a long RS-232 cable connected through your router





# Low cost Serial servers

- Set local IP addresses
- Port forwarding in router required for Internet access
- Many tutorials available



Note: if your radio or computer only has USB ports, adapters will work. (FTDI chips recommended)



Many low cost servers available today



RemoteRig boxes have 3, but seem expensive @ ~\$500 per pair

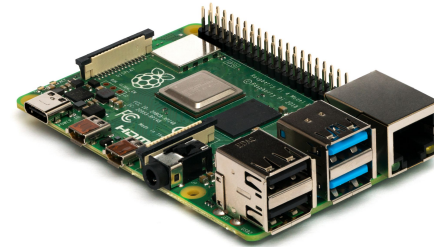
# Hearing your radio requires a VoIP link



Roll your own: You need a bidirectional path. One for speaker, one for microphone. This can be done with a pair of Pi's:



Raspberry Pi running  
Talkkconnect (Mumble)



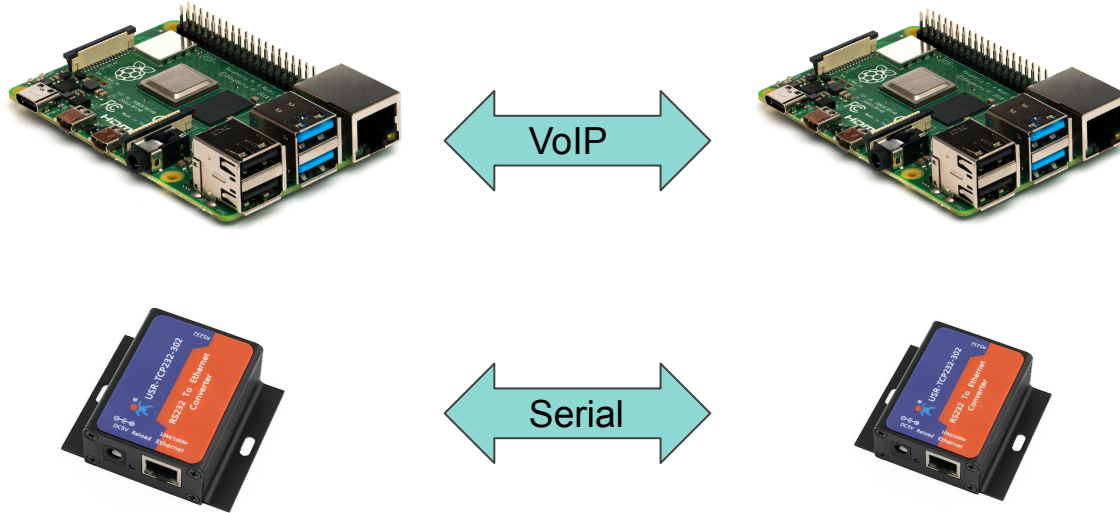
Raspberry Pi running  
Talkkconnect (Mumble)

# So for basic local CAT control you need:

## Two IP links and four devices

PTT can be asserted via RTS/CTS serial port leads

No paddle CW!



I'll call this **LOCAL CAT** control since the control software is local to the operator running on a local PC

# CW Ops need yet another link and additional equipment for paddle CW

Check out MORCONI keyer over Ethernet [MORCONI.COM](http://MORCONI.COM)





## **Sounds complicated ...**

It is if you want to “roll your own”, but there are commercial solutions that roll it all together.



# RemoteRig is a complete “local” CAT control system

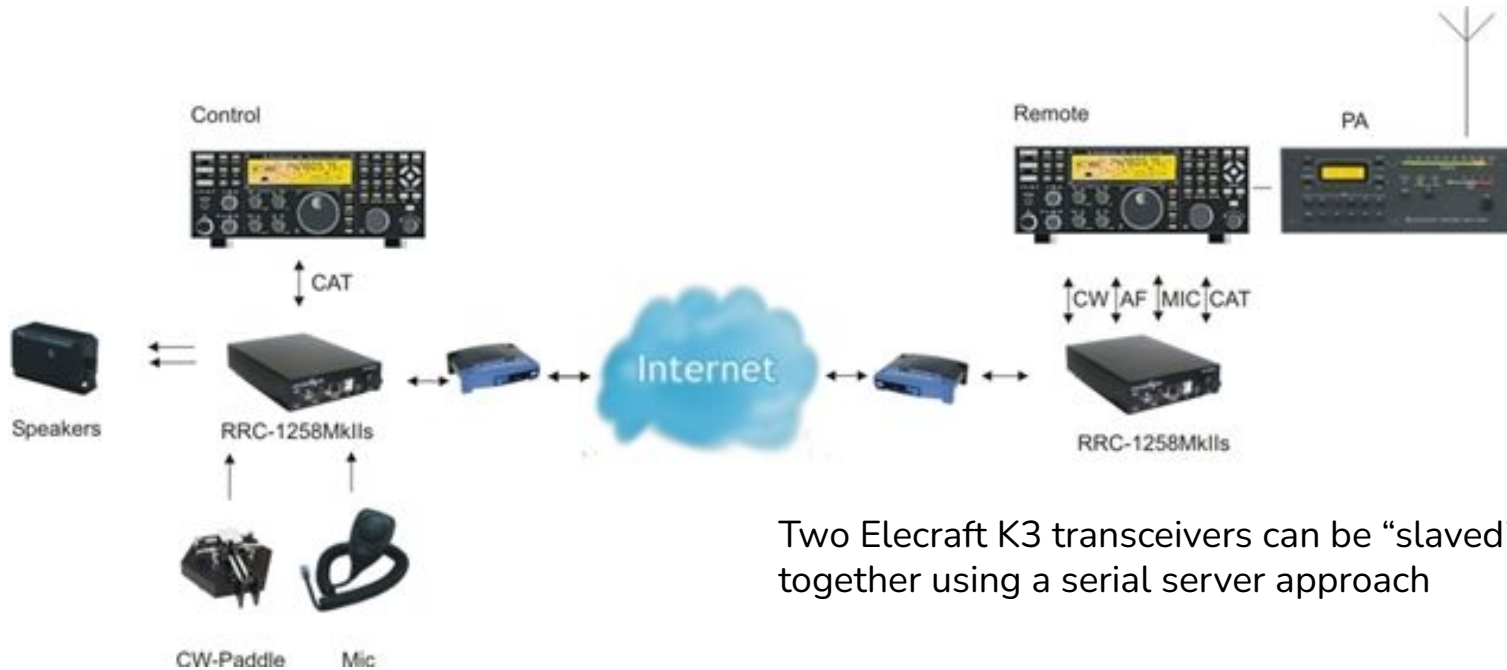
- Includes three serial servers (others useful for rotor control, amp control, etc.)
- Two bidirectional audio links
- Additional remote switching with appropriate interfaces
- Rig control software is local to the operator
- **No remote PC required**
- CW paddle keying and keyer included

New NANO app



With all the performance they provide, they're a good value

# High end solutions using RemoteRig



Two Elecraft K3 transceivers can be “slaved” together using a serial server approach



# Several Yaesu radios and some Kenwoods can be slaved too

- FT-450
- FT-950
- FT-950
- FT-950
- FT-2000
- FT-2000
- FT-5000
- FT-5000
- FT-5000
- FT-9000
- FT-9000



FT-950



FTDX-5000MP



Kenwood TS-590's

# Solution 3: Web Server





## Solution 3: Web server at remote site

Howard Nurse, W6HN, has recently teamed up with MFJ to create a web server based remote control system.

In this approach, the radio control software is at the radio site and wired directly to the radio (solution 1) instead of using a serial server.

Connection and control is via any web browser on any device just like accessing any web page.

Based on the Raspberry Pi, it has several other interfaces for station control included.

With a built in VOIP link, it's pretty complete.



MFJ-1234B



## Solution 3 (continued): Web server at radio site

At just over \$300, it's a good value solution. Only one is required!

Port forwarding is still required on your router for Internet access

No remote head or radio master/slave capabilities

Limited choices of control software

Built-in CW paddle keyer (based on K1EL approach)

Ability to control multiple support devices, switches, etc.

Open source MUMBLE audio links



# Solution(s) 4: Proprietary





# Solution 4: Radio Proprietary: FlexRadio

Radio manufacturers have introduced their own Internet remote software programs

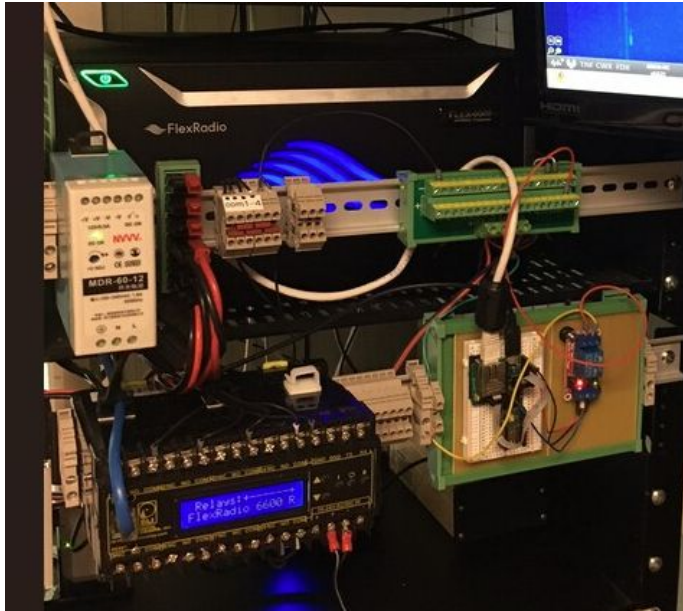


FlexRadio 6600 and Maestro

- By far, the best proprietary remote capability is from FlexRadio. Operation over the Internet from a remote location is indistinguishable from local operating.
- With the addition of a FlexRadio Maestro control head, a “real radio” feel is maintained (tuning knobs, volume controls, etc.)
- The Maestro may be WiFi linked and can be battery operated
- Operation from any Windows PC or Apple desktop
- Operation from iPhone and tablets (option)
- SmartLink internet linking software is compatible with FlexRadios only
- Paddle CW performance is excellent
- Low latency operating... perfect for contesting
- Full capability to support any digital mode and RTTY with multiple digital “sound cards”

# The FlexRadio remote NW at K9SO

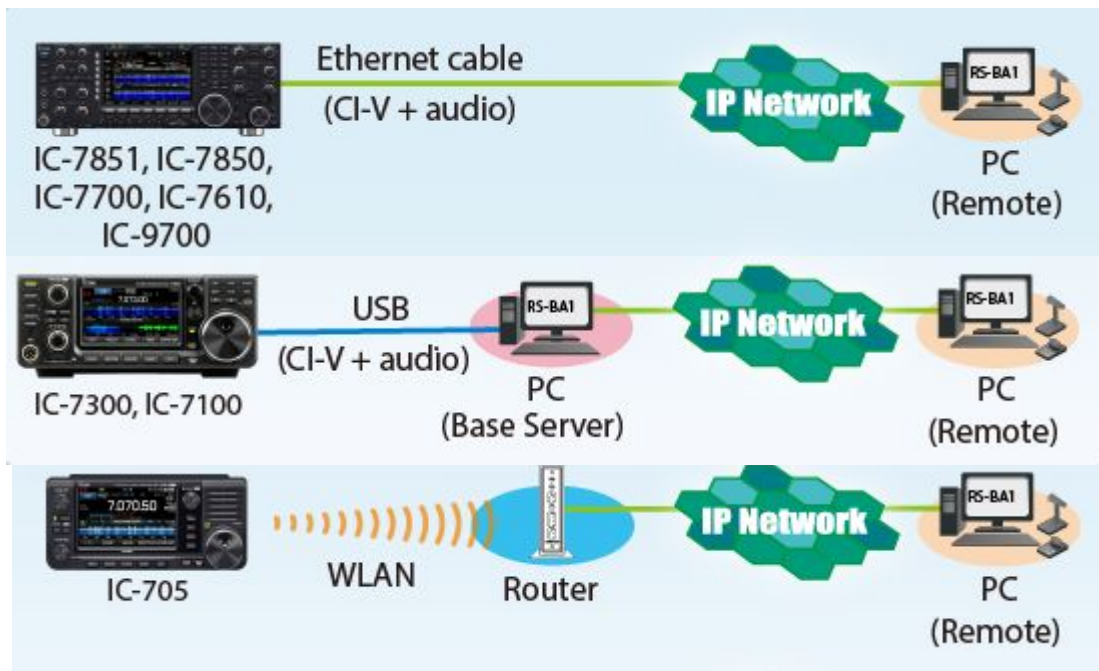
North Carolina



Q-SO Qorners, Wisconsin

# Radio Proprietary: ICOM RS-BA1

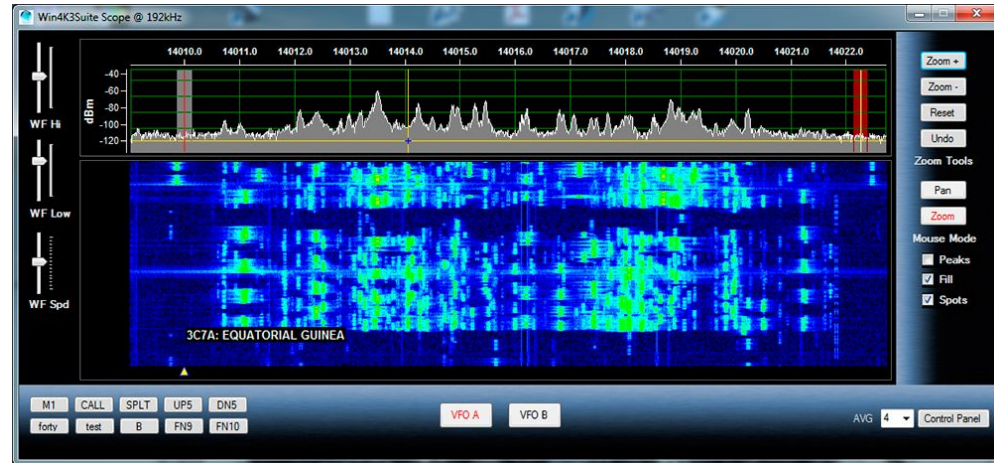
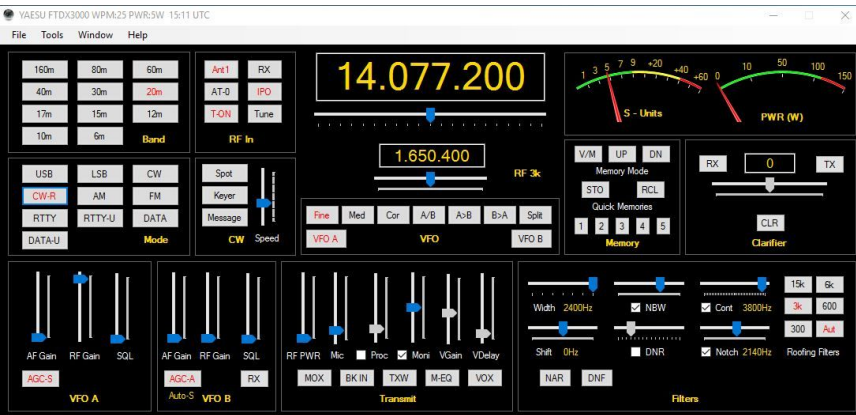
Connect the IC-2700 to a PC over a local Wi-Fi network.





# Radio Proprietary: Win4 Yaesu Suite

Win4Yaesu Suite also comes with a Ham Radio Deluxe compatible server interface allowing HRD LogBook and DM780 to connect and log frequency band and mode information. Supports QSY clicks on HRD spots.



Yaesu FTDX-1200, 3000, 5000, 9000 and FT-991





# Radio Proprietary: Elecraft

K3/O-Mini



Links based on RemoteRig system



# Solution 5: Control Head Linking





# Solution 5: Control Head Linking

TS-480



IC-7100



IC-706



Kenwood  
D710/D700



IC-2725/2730



Many of these panels (but not all) are linked via simple serial data connections and are remoteable



# Control Head Linking, continued

- Note that the serial communications is TTL level serial data ... NOT RS232 ... and NOT the CAT port.
- Since RemoteRig can interface to either RS-232 or TTL serial, it is perfect for this application.
- The concept is very nearly identical to SOLUTION 2: CAT + Serial Server except that the data sent is not the CAT data, but rather the Head-to-radio communications data
- 
- Panel (control head) remote control is the ultimate “real feel” radio experience
- RemoteRig system pioneered this approach
- Some have attempted to decode the data but ...
- ... you only need to repeat it. The radio will understand even if you don't

# The IC-706MKIIg network at K9SO

My IC-706MKIIg network consists of 5 remote head sites all linked to a central radio unit via “very long” head to radio cables. I’m never away from my Ham friends in Wisconsin.



NC Living Room



Control



Retro Rig I

Radio Unit in Wisconsin  
UHF/VHF vertical @ 80'  
SteppIR DB18e @ 65'



Wisconsin Living Room



Grand Cherokee  
Mobile

# K9SO's Kenwood "RetroRig"



A Kenwood control head linked to a TS-B2000 in North Carolina. 40/20/15m dipoles & a simple dual band VHF/UHF vertical keeps me in touch with my friends on the Charlotte repeaters.



# So which solution do I use?

## ALL OF THEM!

They each have their place in a fully remote controlled radio station

- Remote PC for diagnostics (solution 1)
- Serial servers for control of Yaesu radios in backup/guest system (solution 2)
- Web servers for misc. Switching (power) and rotor control (Green Heron) (solution 3)
- Radio proprietary for the FlexRadio network and Icom IC-9700 (solution 4)
- Remote head linking for IC-706MKiig and Kenwood TS-B2000 systems (solution 5)



## The FlexRadio remote NW at K9SO



**You might need more stuff!**







# Additional “MUST-HAVE” equipment

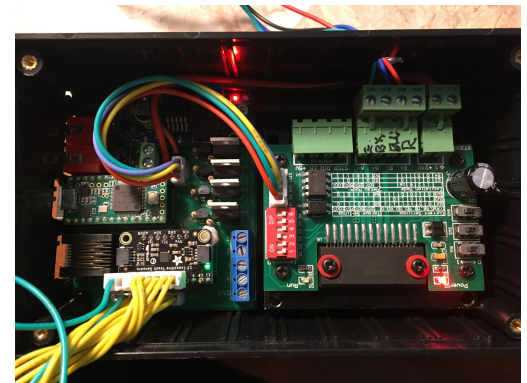
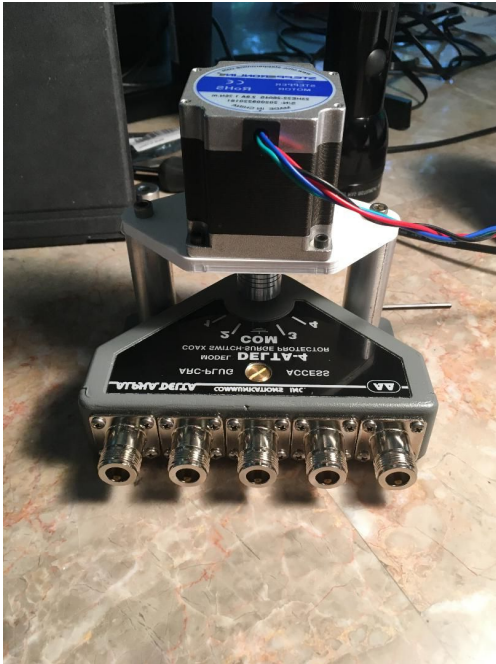
No matter what solution you chose, you will want:

- FCC required time-out 3 minute timer
  - Often built into modern radios
  - Limits Keydown (PTT) time
- Control links for peripheral devices
  - RF amplifiers (band switching is left to local CAT control)
  - Antenna selection (under local automatic CAT control)
  - Rotator control (host rotor controller WEB server)
- Failsafe shutdown in the event Internet connection is lost
  - Remote main power and misc equipment power switching (WEB server based)
  - “Internet Pinging” to verify connection has not been lost
  - Shut down everything automatically if the Internet connection has been broken

# Be prepared to roll your own

Some parts aren't commercially available like a 1.2GHz remote switch that can handle some power. Alpha Delta switches can do the job, but they're manual ... and I don't do manual.

So I mounted a stepper motor on top of it and designed a touch panel controller for it:



# Peripheral Control Links

There are many solutions available today, but currently I am using:



Green Heron RT-1D

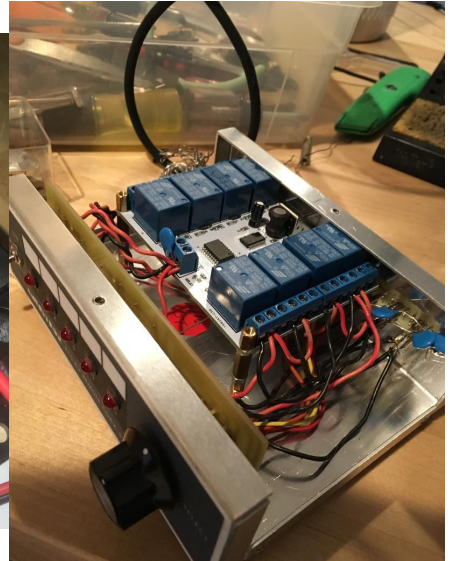
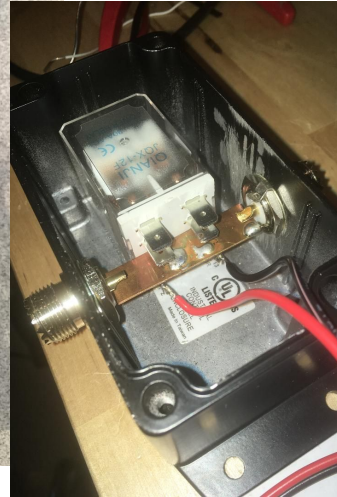
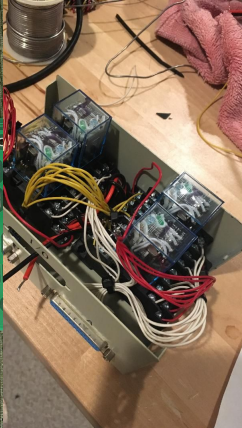
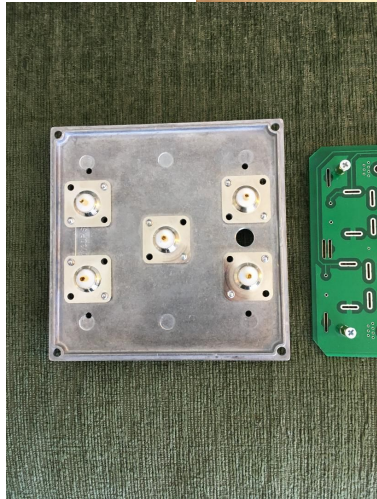
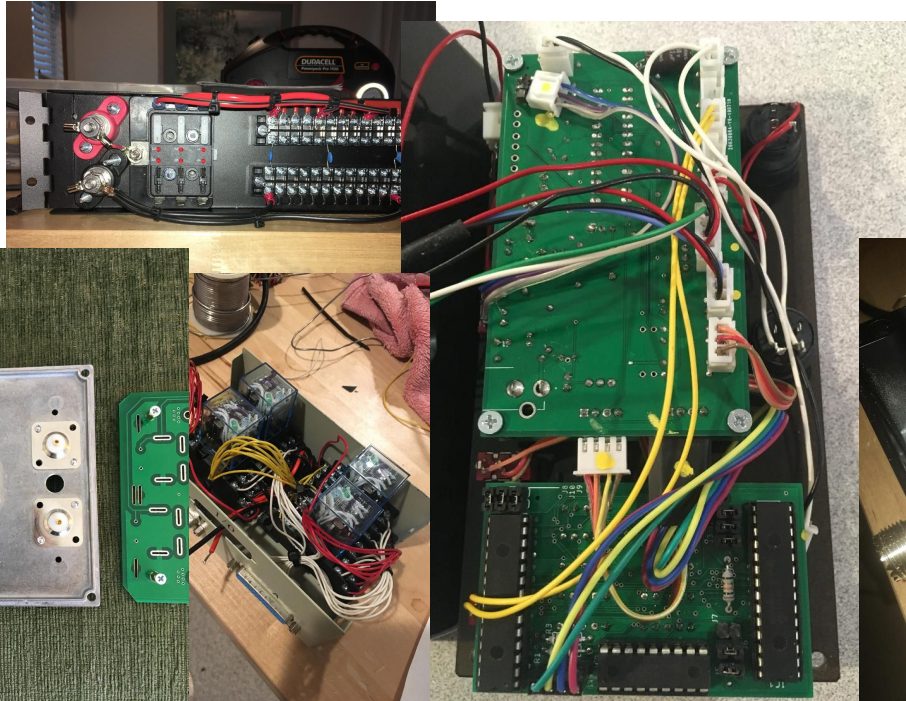


Digital Loggers (DLI) Ethernet  
AC Power Switch



DLI Ethernet switch w/PING

# You may need to build 240v remote switches, antenna switching controllers, etc





... or even the ultimate in crazy ideas



**Station Control:**  
**All this can get complicated**



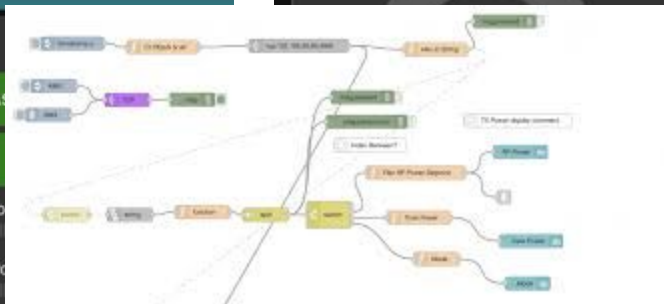


# Node Red can combine it all

Flex 6600

<b>HF Amp</b>	<b>Radio Info</b>
<b>BYPASS</b>	MAS
HF AMP: ON	FLEX - ON
HF TUNER: ON	FWD Po
Flex TX <span style="color:red">●</span> PTT Inhibit <span style="color:green">●</span>	REV Po
Power Setpoint 20 w	SWR 1.2
<b>Flex 12 VDC</b>	Radio Model Flex Radio 6600
Flex Amps 12.0 A	Client Names Man Pro, Maestro
Bus Volts 13.5 v	Client 192.168.50.130,192.168.50.115
TX Volts 13.5 v	Radio Name WA9WUD

Check out the multiple Node Red Forums



RPi Control

Actions

- REBOOT
- SHUTDOWN

Processor

Top Temp

Time	Temp
17:37	26.8
17:47	27.4
17:57	26.6
18:07	27.4
18:17	26.8
18:27	27.4
18:38	27.2

Mid Temp

Time	Temp
17:37	22.6
17:47	22.8
17:57	22.4
18:07	22.8
18:17	22.2
18:27	22.8
18:38	22.4

CPU Temp

Time	Temp
18:00:00	45
00:00:00	44.5
06:00:00	44.5
12:00:00	44.5
19:00:00	45

Disk

43.0 C

25 Usage



# A Deeper Dive into a Remotely operated club station



# Proposal based on FlexRadio Proprietary



FlexRadio can be remotely operated using their proprietary SmartLink system.

This coordinates seamlessly with the standard operating program called SmartSDR. It works so well, that one cannot easily detect that the operation is remote.

It is password protected, but currently only one password is allowed per radio.

# FlexRadio via SmartLink:

# Project North Star

SmartLink provides total connectivity over the Internet

- By itself, only a PC (or MAC) and SmartSDR is required at client
- Full radio control: exactly the same interface as local users
- Negligible latency (typ 40mS). Contest level connectivity
- Phone, iPad, laptop, and tablet access from anywhere
- All SSB, CW, RTTY, and all digital modes included
- 160m - 6m with internal antenna tuners available for use
- 100w output
- Completely transparent operation

Expandable up for all bands up to 1.2GHz with additional equipment.

# SmartLink

Just like being there in real time

Tuning knob accessory

Maestro accessory if you want

iPad if you want

iPhone if you want



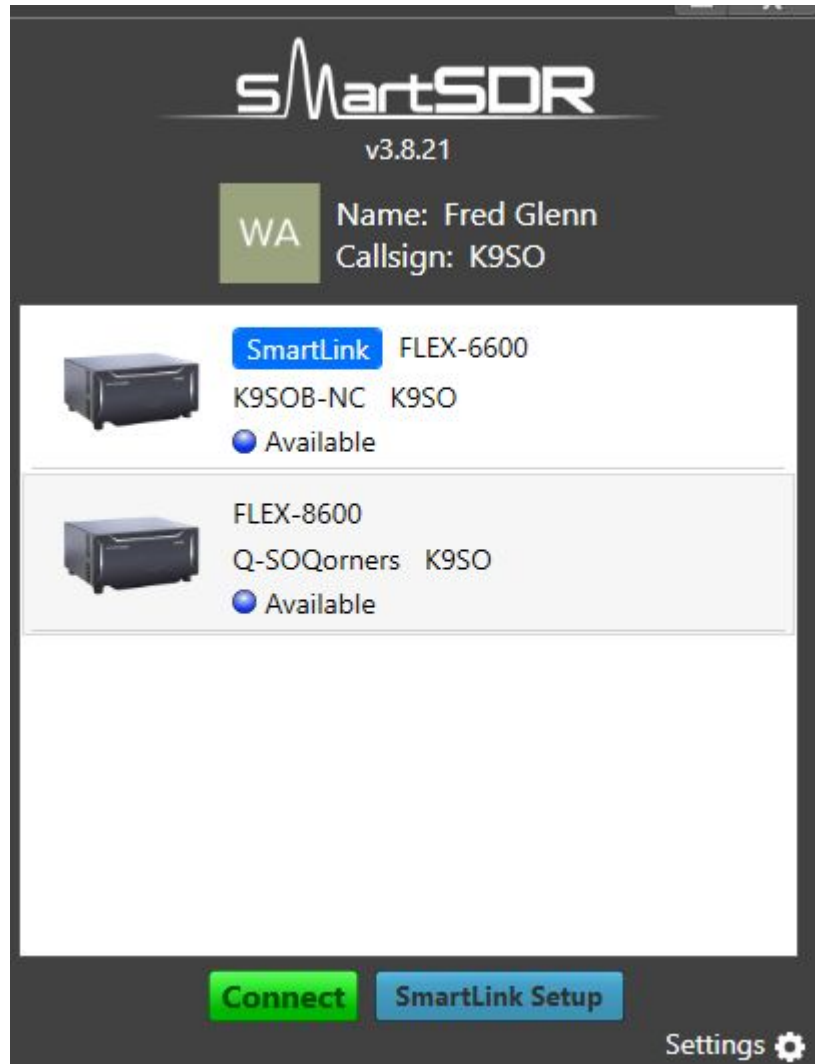
# Project North Star



# Multiple users must have multiple passwords

I fully expect FlexRadio to address this in SmartLink in the future, but until then:

The idea is to use another device to enable the remote radio. Once enabled, the radio will appear on the SmartLink radio selection window:



After enabling, simply select the radio and operate as normal:



Contest quality latency even over long distances

# Station enabling

Remote IP switch to turn on station power supply:



Internet Ping

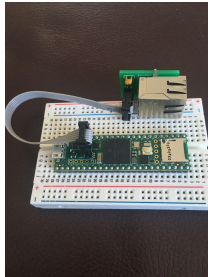
Multiple passwords

User tiers

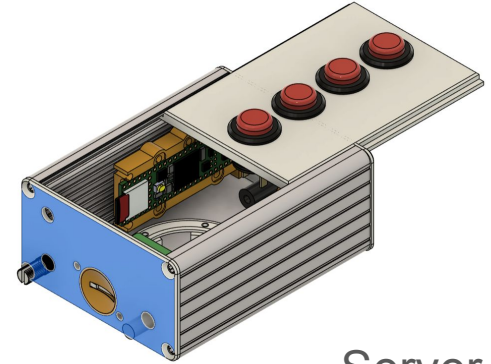


# MORCONI CLUB Interface

Client box:  
simple to deluxe



Radio Status Indicator  
Paddle CW Keyer (MORCONI)  
PTT connection (footswitch, etc.)  
“Dongle” authentication  
Multiple IP selection (radios)  
\$50 cost. 3D printed boxes available



Server box

Authorized user whitelist maintained  
by station owner

Jitter corrected CW paddle and radio  
PTT

Idle user timeout

“Hog user” timeout management  
Radio enabler

Multiple control outputs (IP switch)

# MORCONI CLUB CLIENT (user end)

- Deluxe box can address multiple sites
- Simple client is only a Teensy 4.1
- PTT transmitter interface (mic button, footswitch)
- No open user ports
- Ethernet connection (WiFi capable)
- “Plug-in and Play” with minimal setup required.
- Direct and automatic connection to selected radio sites
- MORCONI ethernet enabled keyer for jitter-correction with CW paddles
- Secure, two step authorization codes
- ~approximate \$39 DIY cost. Assembled units can be sold as a club fundraiser



# MORCONI CLUB SERVER

- Estimated \$75 DIY cost (dual processors)
- No radio site PC required
- Full CW and PTT generic radio interface
- Direct interface to FlexRadios
- Enable station turn-on when client authentication is received. Two step authorization. Up to 256 users
- Limits on PTT control. Others may listen in while radio is in full access mode, but only one will be able to transmit.
- PTT based Time-out timer for those who forget to release.
- “HOGGING” timer capable to limit session times.
- Access authorization list controlled by station owners
- Secure radio site sharing by FlexRadio owners around the globe as participation grows



Radio owner controlled  
whitelist of users

Optional IP switched  
relays

# LRA Club Station KR9RK

## Phase 1: June 2025

- Installation of three 40' towers
- Single FlexRadio 8400
- Gap Titan antenna existing
- Multiband dipole @ 50'
- Simple IP switch log-in (8 users)

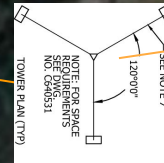
## Phase 2: Oct 2025

- MORCONI NW participation(256 users)
- K9SO North Carolina radio
- TA-33 triband beam @45 feet
- Rotor control for beam
- Multiple antenna selection

## Phase 3:

- More FlexRadio sites around the world.
- Tower extensions to 70 feet
- Web server network control

Tower bases



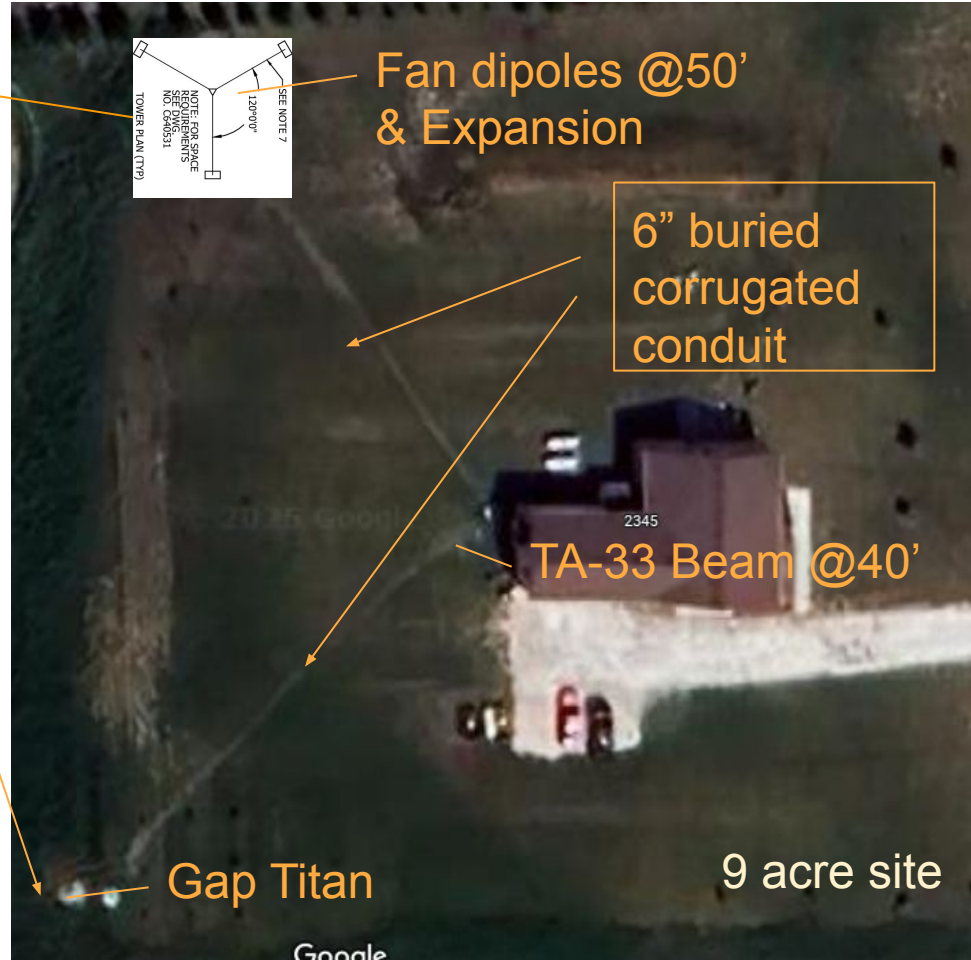
Fan dipoles @50' & Expansion

6" buried corrugated conduit

TA-33 Beam @40'

Gap Titan

9 acre site



# **Solution 6:** **It's all up to your imagination**



**Thank You!**

**... and Happy Remoting**

