Internet Voice Linking for Amateur Radio

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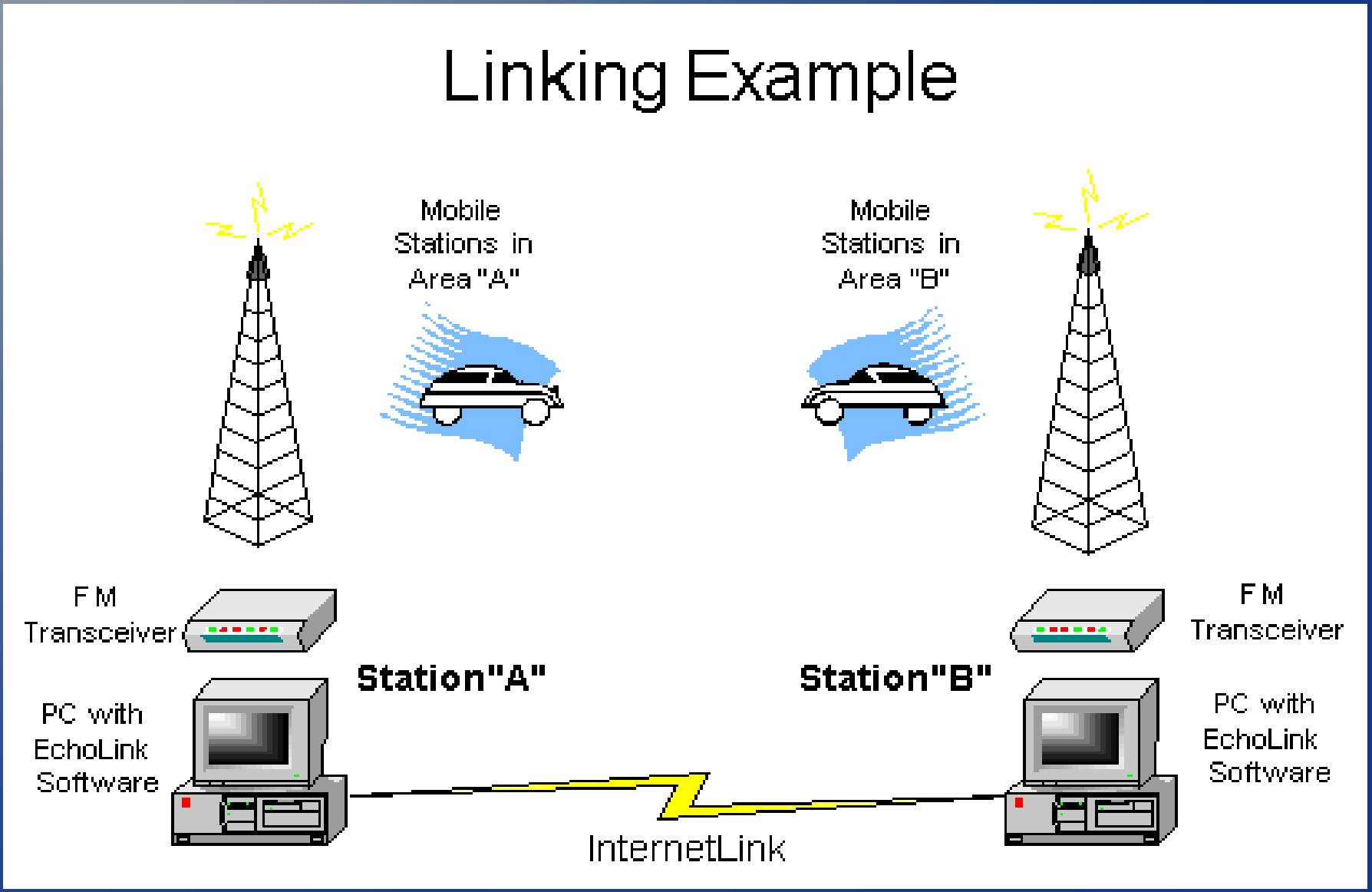
What is Internet Voice linking?

Internet VoIP linking

- Is a method of interconnecting repeaters, endusers, or BOTH to one OR MORE remote repeaters or endusers
- Endusers? With different solutions, you can connect to a remote system from directly from an amateur radio (HT via RF), from a Smartphone, or standard computer (Windows, Mac, Linux..) via the Internet

An Example from Echolink.org



Why would I want to use Linking?

- Supports adhoc wide communications. For example, Echolink was used in linking during the Shuttle Challenger recovery operation
- Though HF is fun, it's NOT a reliable system to communicate to specific HAMs day or night. If the Internet is up, VoIP linking *IS* reliable
- With just an HT and a tech license, you can now talk to the world be it to a different repeater on a different *continent**
- You can connect into *"topic"* reflectors / conferences that talk about specific topics

So you're just talkinkg about Echolink right?

- No.. not at all! There are a LOT more solutions!
  - Echolink (EchoMac, Svxlink/Qtel, etc)
  - IRLP
  - AllStar / XIPAR (Asterisk based w/ Echolink, IRLP, AutoPatch, SIP, etc)
  - D*star (open protocol, proprietary CODEC) ony from Icom & homebrew kits so far)
  - WIRES II (Proprietary DTMF system from Yaesu)
  - EQSO (15 online nodes out of 857 in Jan 2013)
  - Hamsphere ($$)

A bit of VoIP Linking history

- The first consumer VoIP system that gained visibility was Vocaltec's iPhone Windows application in 1997. The first IRLP prototypes used this software

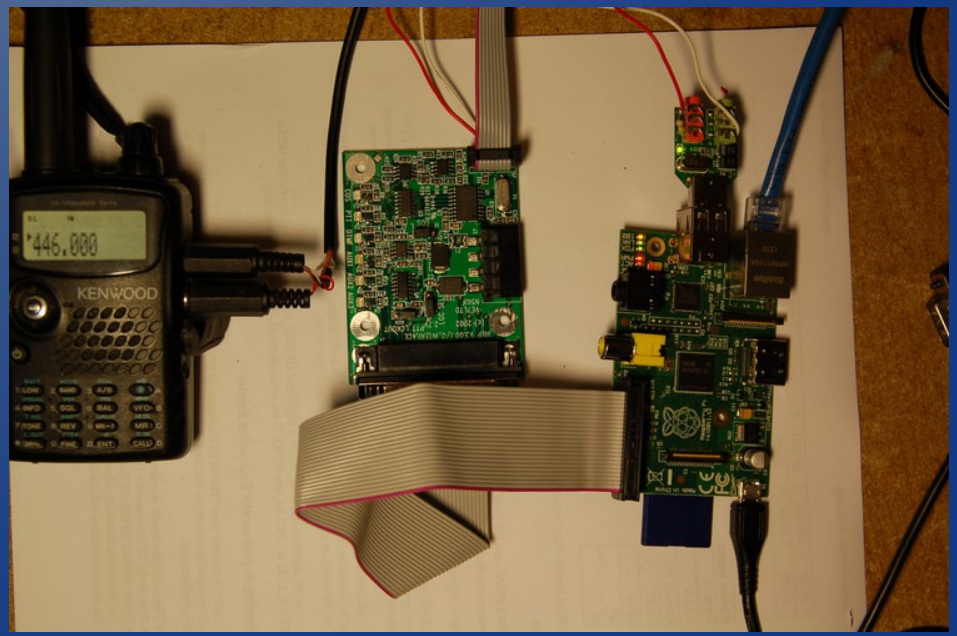
- EQSO (2001), iLink (2001), Echolink (2002),
- Yaesu WIRES II (2003), D*Star (2004),
- Allstar (2006)

What are the differences?

IRLP
Internet Radio Linking Project

- Was the first reliable VoIP linking system developed by VE7LTD in Canada in 1997
- Intended to link a repeater to a remote repeater or to a “reflector” of many repeaters
- Does NOT support enduser connections from Smartphones / PCs like Echolink or D*star
- ***Requires proprietary hardware*** to support COS and DTMF decoding via a parallel port (USB parallel adapters don't work) – An issue!
- Server software runs on the Centos/Linux OS using the Speak Freely VoIP protocol

The IRLP board and Solutions



Examples of very Successful IRLP Systems in California

- WinSystem
  - A very VoIP centric system spanning over 87 different repeaters in the mainland US, Hawaii, with dynamic links from England, Australia, and Japan!
- CARLA
  - A hybrid RF and IRLP interconnected repeater system spanning over 30 repeaters throughout California

Echolink

- Developed by Jonathan Taylor, K1RFD as an improvement over the closed iLink system
- Does ***not*** require any proprietary enduser HW but some 3rd party hardware *improves* it's use
- Supports communications where ***no*** RF is used (smartphone to smartphone) – This point really bothers some HAMs as it might not use RF
- Official software clients on Windows, Apple iPhone/Pad, Android & unofficial apps for Apple (EchoMac), Linux/BSD (Svxlink/Qtel, CQInet)
- Allows for easy setup on either a simplex frequency (node) or repeater (“sysop” mode)

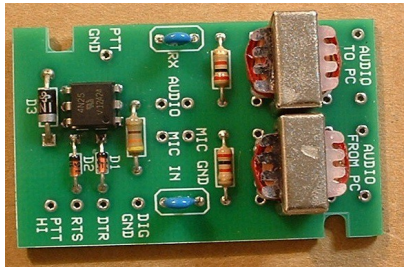
Echolink Node Types

- There are three general types of Echolink nodes. For example:
  - KI6ZHD (no suffix) : Usually means this is a software only connection (PC program, Smartphone, etc)
  - KI6ZHD-L : Indicates a node listening on a half-duplex simplex frequency
  - KI6ZHD-R : Indicates a node listening to a full-duplex repeater – The Echolink system could be hosted with the repeater or be remotely linked via an RF connection

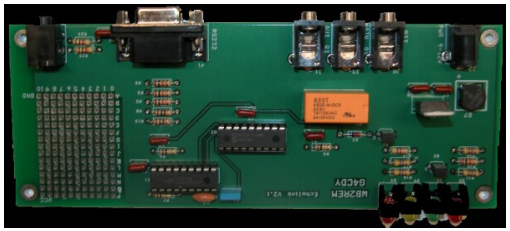
Hybrids: EchoIRLP, Allstar

- Software is available for Linux-based IRLP nodes to support Echolink connections as well called “EchoIRLP” (uses “theBridge” software)
- Allstar nodes can also host both IRLP and Echolink connections

Echolink: Optional Hardware



Computer soundcard loop-Isolation only



Soundcard Isolation & DTMF Decoder

Soundcard Isolation, DTMF Decoder, and COS support

Native Radio Support With COS support ?isolation?

D*star

- On a voice linking level, D*Star is similar to Echolink or IRLP:
  - You can link a local repeater to another repeater
  - You can link the local repeater to a remote reflector that has many other repeaters linked
  - There are PC only forms of D*star w/o using RF using external hardware such as the DV Dongle
- But.. D*star also can:
  - Link individual radios to each other much like a cellphone, do callsign routing, send TXT msgs

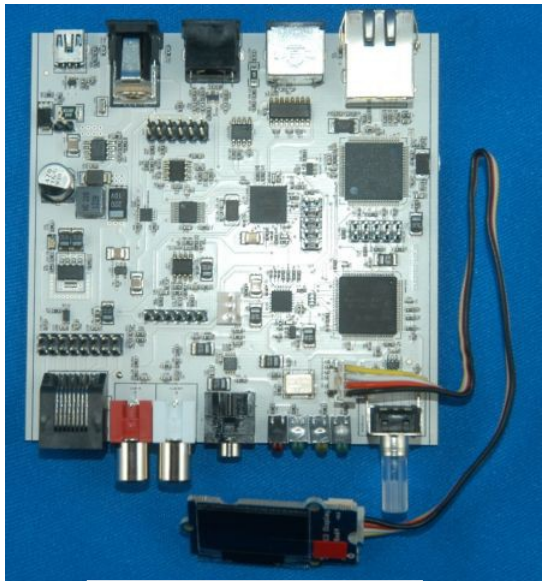
D*star Continued

- Instead of DTMF tones to instruct the repeater to connect / disconnect to remote stations, the D*star HAM configures their radio for a specific remote station and then hits the PTT button. When keyed-up, the various connect / disconnect message are digitally uploaded to the repeater using D*star formatted packets

Example D*star Enduser Hardware

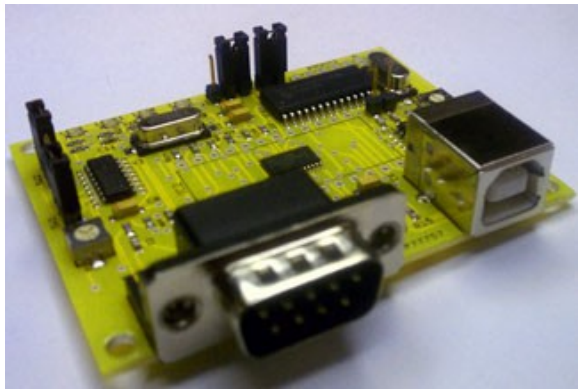
HTs

Mobiles



Home Brew

Computer
Connected



Internet Linking Philosophies & Do's / Don'ts

Different VoIP Communities Operate Differently…

- Echolink connections are usually brought up in an adhoc fashion. Connections usually timeout and the connection is then left down
- IRLP usually links together a few repeaters and connections never timeout (always up). If a HAM disconnects the link and it then times out, the IRLP repeater usually reverts back to the pre-configured IRLP node/reflector
- D*star typically remains linked to reflectors 24/7. If unlinked or timed out, they will almost always revert to a pre-configured reflector

Dos and Don'ts

- DO: When using RF, always listen first and then announce your intentions: “KI6ZHD, controlling Echolink” before trying to make any connections
- DO: Once you make a connection.. LISTEN for ~10-15 seconds and then announce your presence. If you want to chat, say so.. “KI6ZHD is calling a friendly CQ for anyone on frequency”
- DO: Linked systems are slower to hear your voice so make sure you wait 1-2 seconds after asserting PTT and then starting talking

Dos and Don'ts

- DO: Leave longer than normal gaps during your QSO so that other people on this SHARED system can get a word in edgewise if they have priority, etc. traffic

Dos and Don'ts

- DON'T: Ragchew / Talk a long time when connected to a large linked system or a repeater on a big reflector like the WinSystem, CARLA, etc

Linking Codes

- Most Linking systems have unique codes to tell the local system to link, unlink, give status, etc.
- Echolink and IRLP have unique codes to do the basics BUT...
- Hybrid systems like EchoIRLP, Allstar, and repeaters that wish to keep their systems closed *can* configure PREFIX codes to keep unknown people from using their systems

Really.. What are the codes?

- IRLP codes *--usually--* are..
  - The IRLP node number and it will just connect
  - 73 to disconnect
  - status.irlp.net or repeater website for more info
- Echolink codes *--usually--* are..
  - the Echolink node number and it will connect
  - # to disconnect
  - www.echolink.org/Help/dtmf_functions.htm
- Hybrids: For example, Bay-Net uses #00 <node> for IRLP, #00A <node> for Echolink, #00 73 to disconnect either IRLP or Echolink

Getting your feet wet.. via RF

- Bay-Net : EchoIRLP : 145.390 - / PL 100.0Hz
- K6SA : Echo/IRLP : 146.665 – / PL 114.8Hz
- W6CX : 147.060 MHz + / PL 100Hz
- N6NFI : 145.230 - / PL 100.0Hz (net time only)
- WR6ABD : 442.900 + / 162.2Hz (WinSystem)
- KI6ZHD-L : 146.595 pl136.5

- So many others.. go search by Zip code, Country, etc!

Getting your feet wet.. via Software

IRLP

- Bay-Net : 3802
- K6SA : 3671
- W6CX : 3057
- Reflectors:
  - Winsystem : 9100

Echolink

- Bay-Net : 314933
- K6SA : 85531
- W6CX : 133896
- N6NFI - KR6DD-L
- 146.595 pl136.5 : KI6ZHD-L on 767882

- So many others Go search by zipcodes!

Getting Started with Echolink on your computer or Smartphone

- The creation of an Echolink account ***requires*** using a Windows-based computer. Once created, Smartphone, Apple, Android, Linux, etc. clients will work just fine
- The only tricky part is the ***validation*** that you're a HAM. The Echolink people support multiple ways to do this easily from emailing or FAXing a scanned copy of your Amateur Radio license to using a valid ARRL Logbook of the World (LOTW) certificate www.echolink.org/validation_docs.htm

Further Reading

- Echolink: http://www.echolink.org/
- IRLP: http://www.irlp.net
- AllStar (server software): allstarlink.org
- The LinkBox (server software): www.qsl.net/kb9mwr/projects/voip/thelinkbox.html
- The VoIP stigma: sparqi.blogspot.com/2007/08/echolink-follies.html
- More VoIP History: www.qsl.net/kb9mwr/projects/voip/plan.html

Event More Reading

- Echolink tips, more history, etc; arc.tzo.com/ham/echolink.php

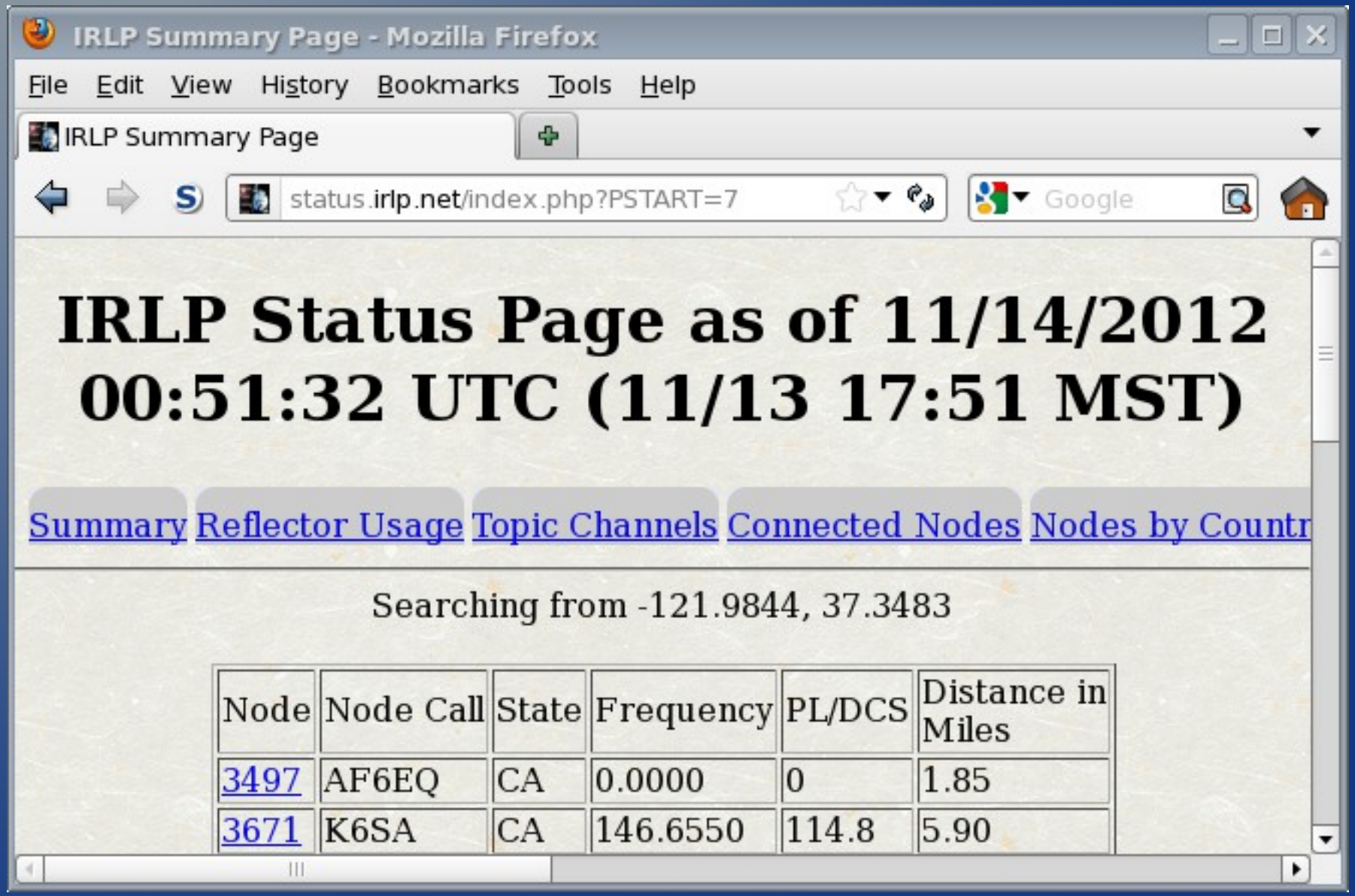
- Step by Step Instructions for Echolink validation and installing Svxlink/Qtel for Linux

  http://www.trinityos.com/HAM/CentosDigitalModes/hampacketizing-centos.html#43.svxlinkqtel

Demo if time permits

- Demo
  - IRLP
  - Echolink
  - Echolink on a Smartphone
  - D*star

An example of IRLP Nodes



IRLP RF Demo – Node 3802

- QSY to Bay-Net KJ6VU 443.225 +100pl
- Listen and if not in use, announce you are controlling the system
- Connect to the Echo Test server by entering in “#00 9999”
- Go ahead and talk away and you'll hear your voice back
- When done, enter in “#00 73” to hang up
- Try a different machine such as “9100” which is the WinSystem Reflector

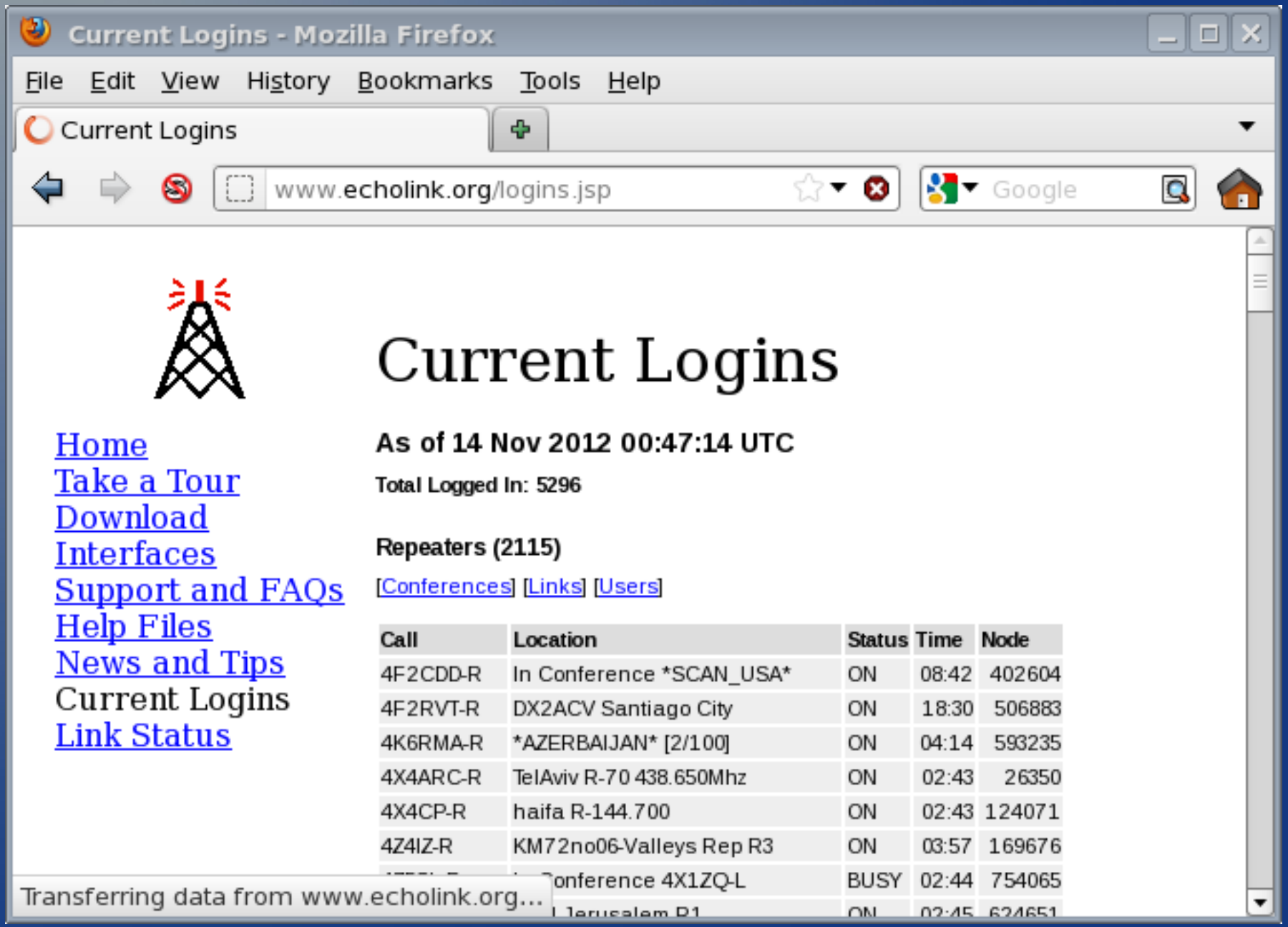
IRLP RF Demo – Node 7588 & 7662

- QSY to K7DAA 147.330+103.5pl : 442.975+100.0pl
- Listen and if not in use, announce you are controlling the system
- Connect to the Echo Test server by entering in “9999”
- Go ahead and talk away and you'll hear your voice back
- When done, enter in “73” to hang up
- Try a different machine such as “9100” which is the WinSystem Reflector

IRLP RF Demo – Node 3671

- QSY the radio to K6SA : 443.150+100pl
- Listen and if not in use, announce you are controlling the system
- Connect to the Echo Test server by entering in “??? 9999”
- Go ahead and talk away and you'll hear your voice back
- When done, enter in “73” to hang up
- Try a different machine such as “9100” which is the WinSystem Reflector

An example of Echolink Logins



Echolink RF Demo – Node 914933

- QSY to Bay-Net KJ6VU 443.225 +100pl
- Listen and if not in use, announce you are controlling the system
- Connect to the Echo Test server by entering in “#00 A9999” (notice the A character)
- Go ahead and talk away and you'll hear your voice back
- When done, enter in “#00 73” to hang up (no A)
- Try a different machine such as “767882” which is KI6ZHD-L home node on 146.595 simplex

Echolink RF Demo – Node 9537

- QSY to K7DAA 147.330+103.5pl : 442.975+100.0pl
- Listen and if not in use, announce you are controlling the system
- Connect to the Echo Test server by entering in “9999”
- Go ahead and talk away and you'll hear your voice back
- When done, enter in “73” to hang up
- Try a different machine such as “767882” which is KI6ZHD-L home node on 146.595 simplex

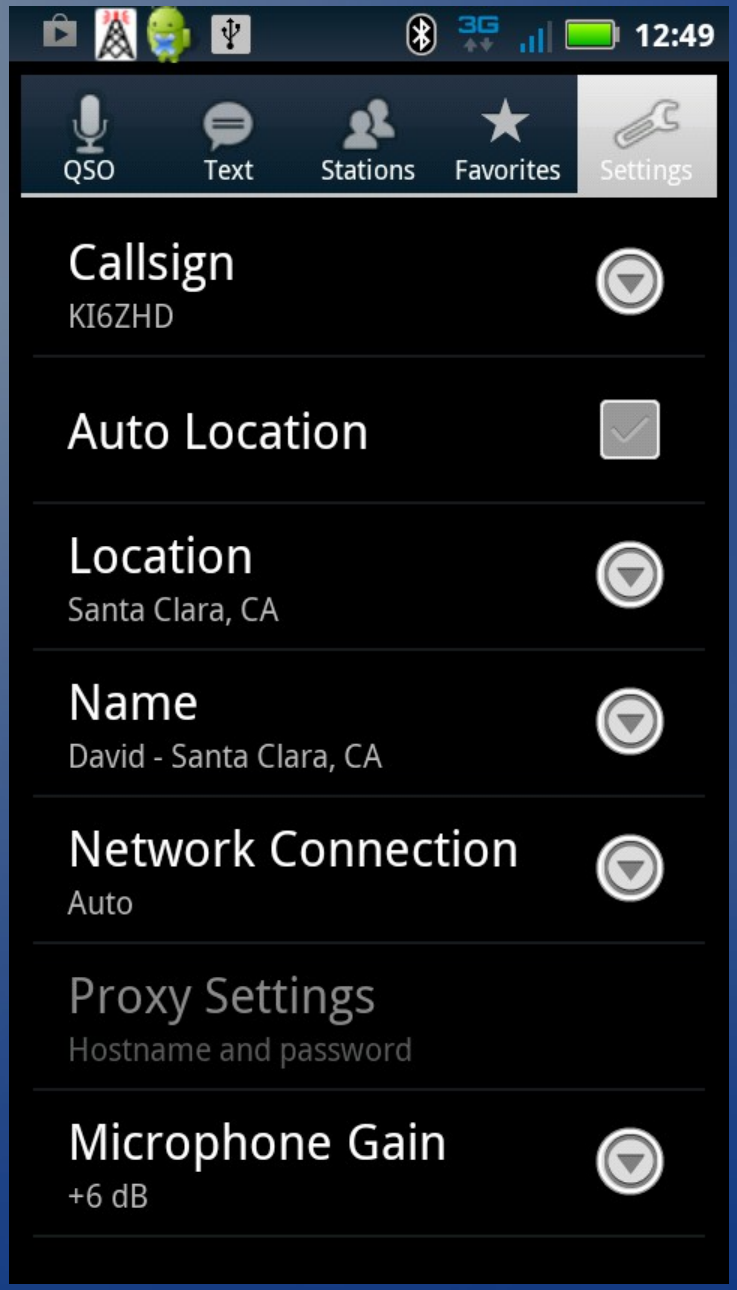
Echolink RF Demo – Node 85531

- QSY the radio to K6SA : 443.150+100pl
- Listen and if not in use, announce you are controlling the system
- Connect to the Echo Test server by entering in “??? 9999”
- Go ahead and talk away and you'll hear your voice back
- When done, enter in “73” to hang up
- Try a different machine such as “767882” which is KI6ZHD-L home node on 146.595 simplex

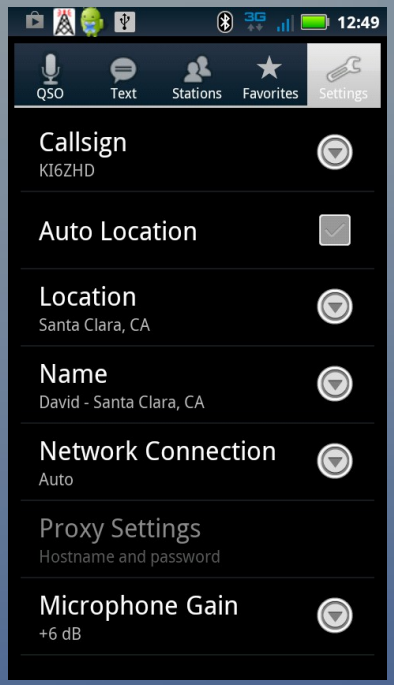
Echolink on SmartPhone Demo

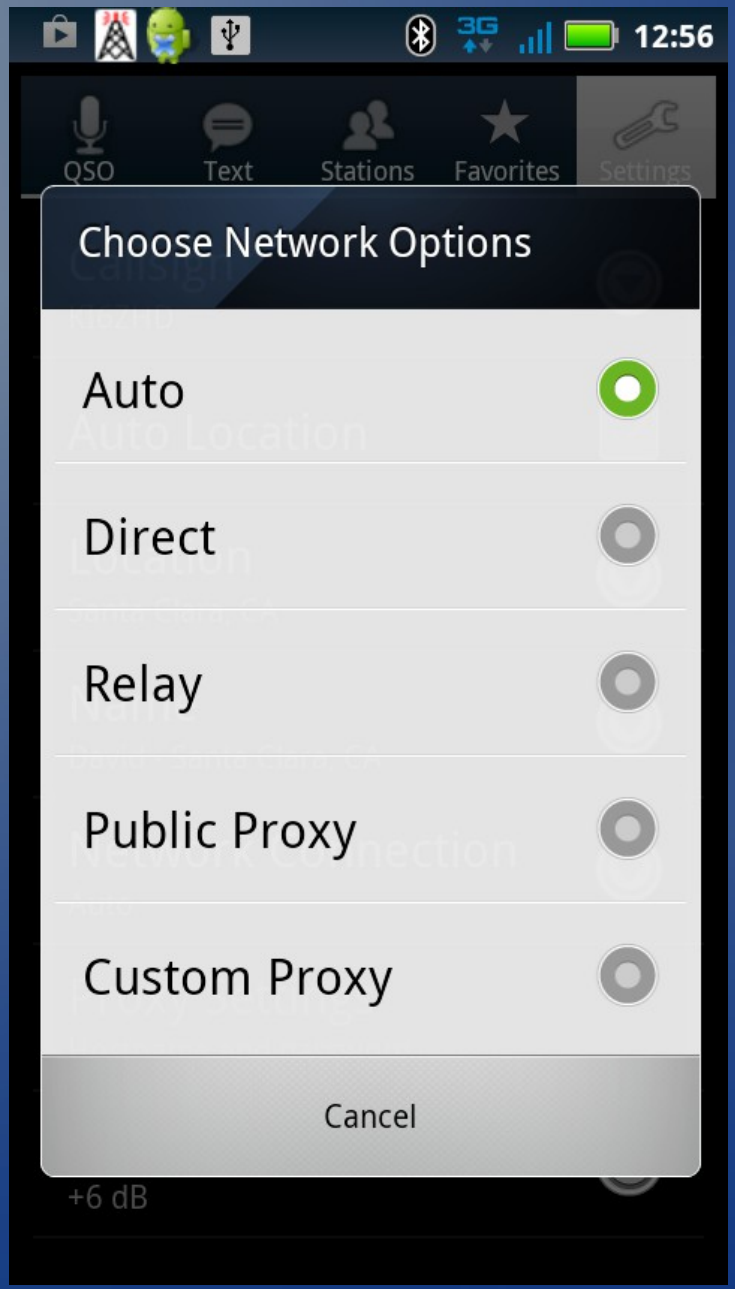
- Requires a pre-validated Echolink callsign as completed via the Echolink for Windows client
- Download the Echolink App for iPhone/Android , enter in your callsign and password, and that's IT!

Echolink on Smartphone Demo



Echolink on Smartphone Demo

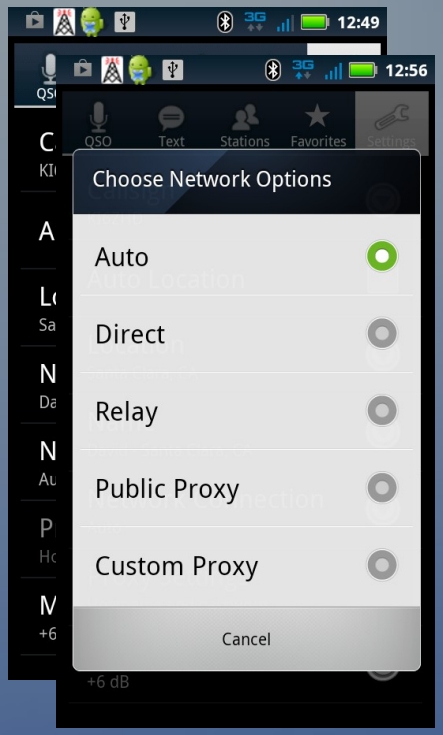


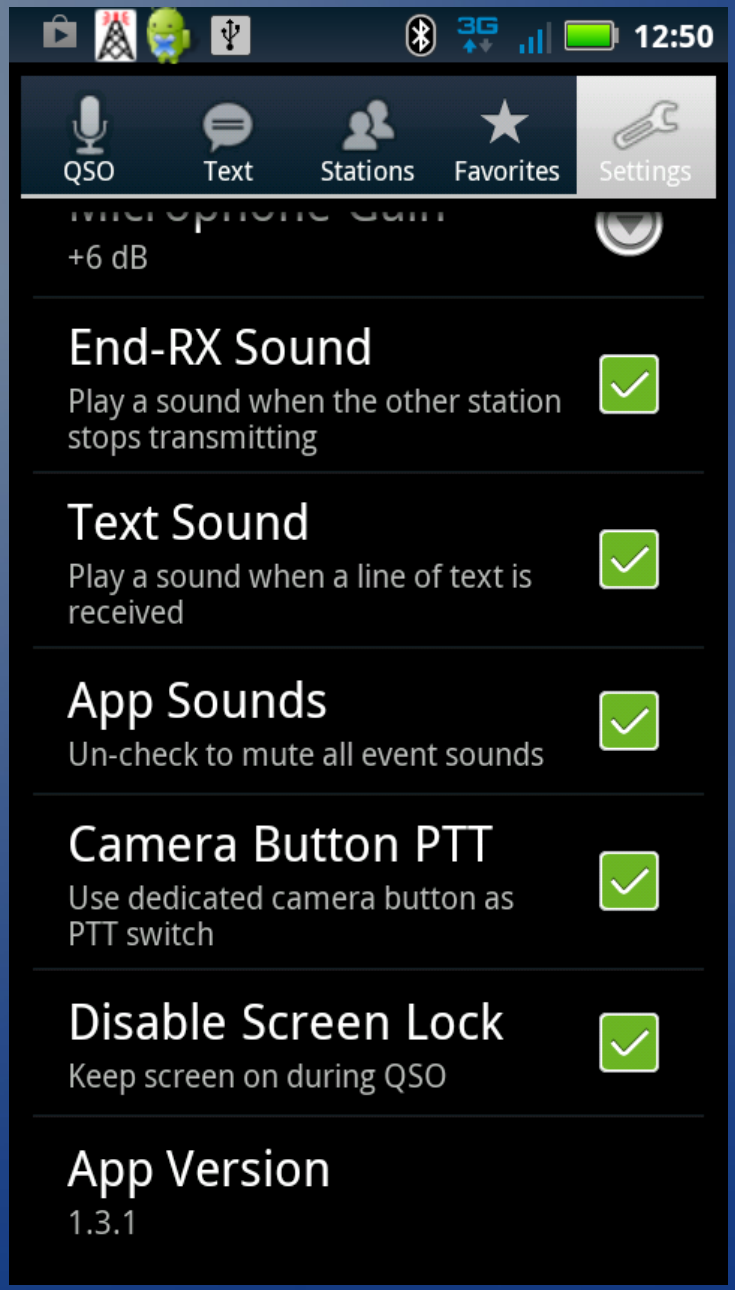


Known issues with Echolink on Smartphones

- With using the Carrier's data connection, the Echolink “Auto” or “Redir” Network Setting will *not* allow for RECEIVING incoming connection requests
  - This is due to most carriers using NAT in their networks w/o supporting customer configured Port Forwarding
- Using “Public Proxy” works around this problem
  - NOTE: I've had some issues where the selected proxies were non-responsive and after the second proxy server attempt, the Android app would become unresponsive.
- Using a home Wifi connection with the required port forwards enabled works with Auto or Direct

Echolink on Smartphone Demo





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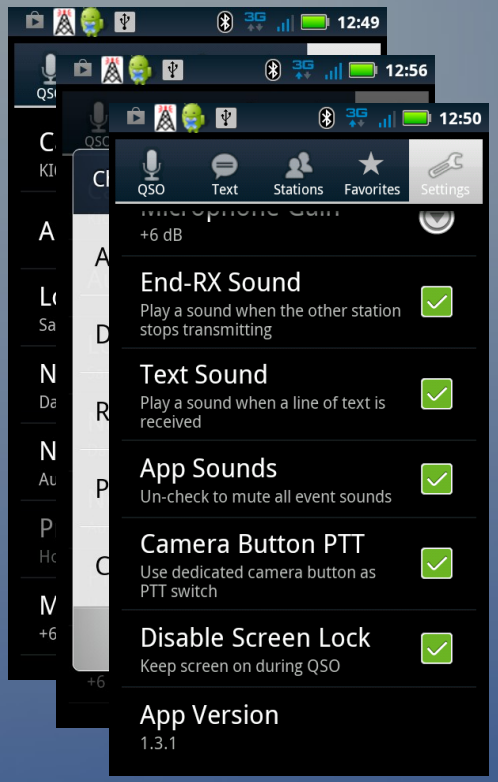

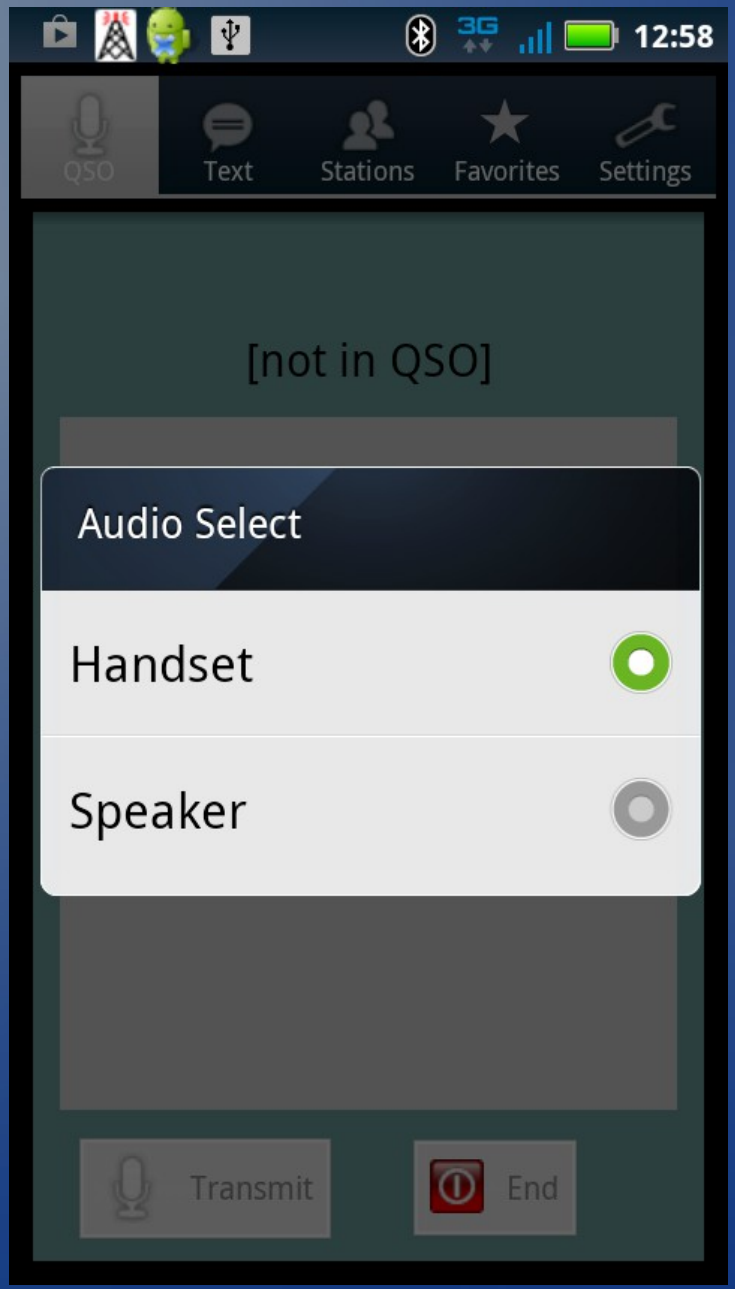

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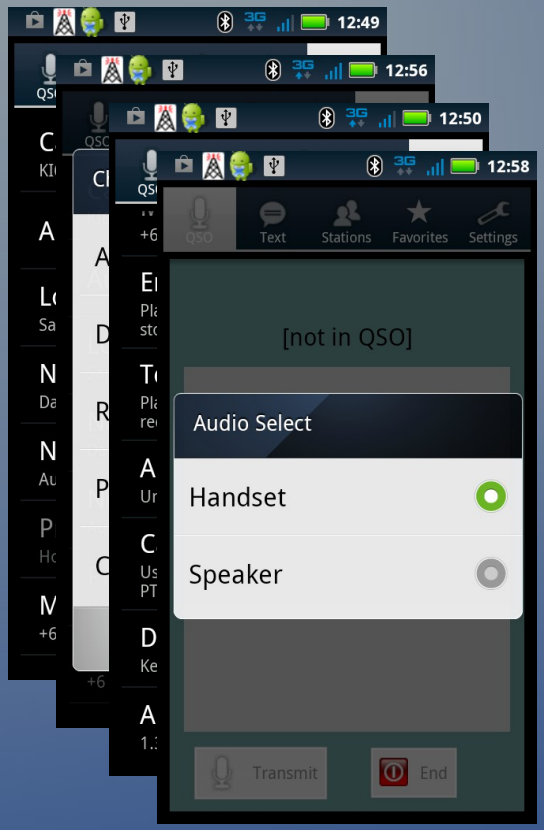

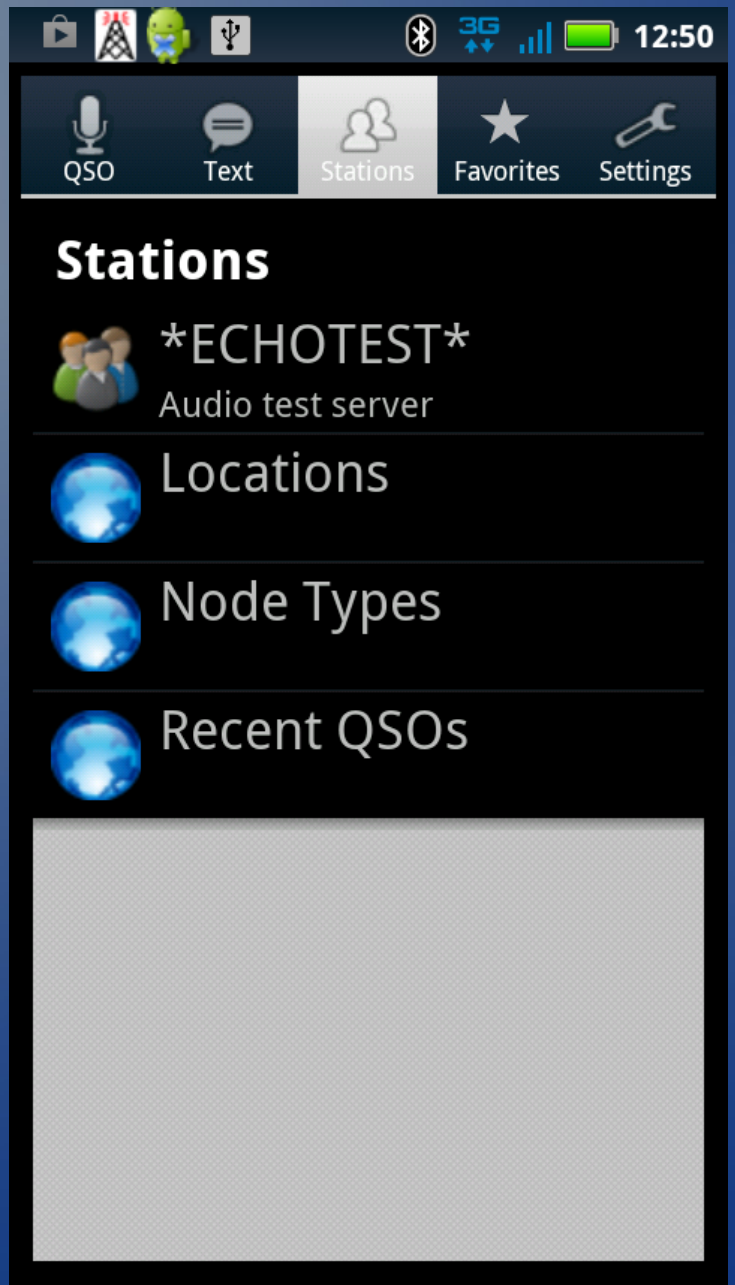

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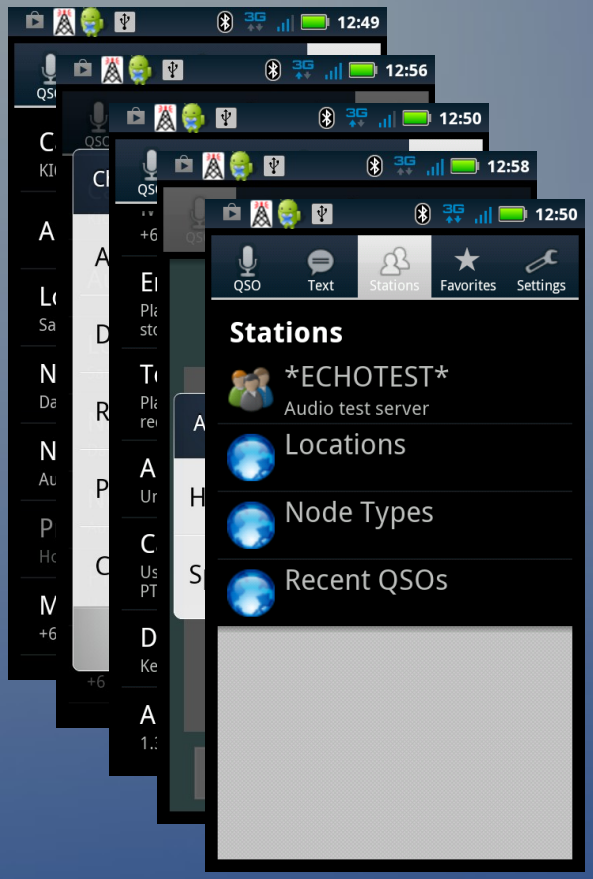

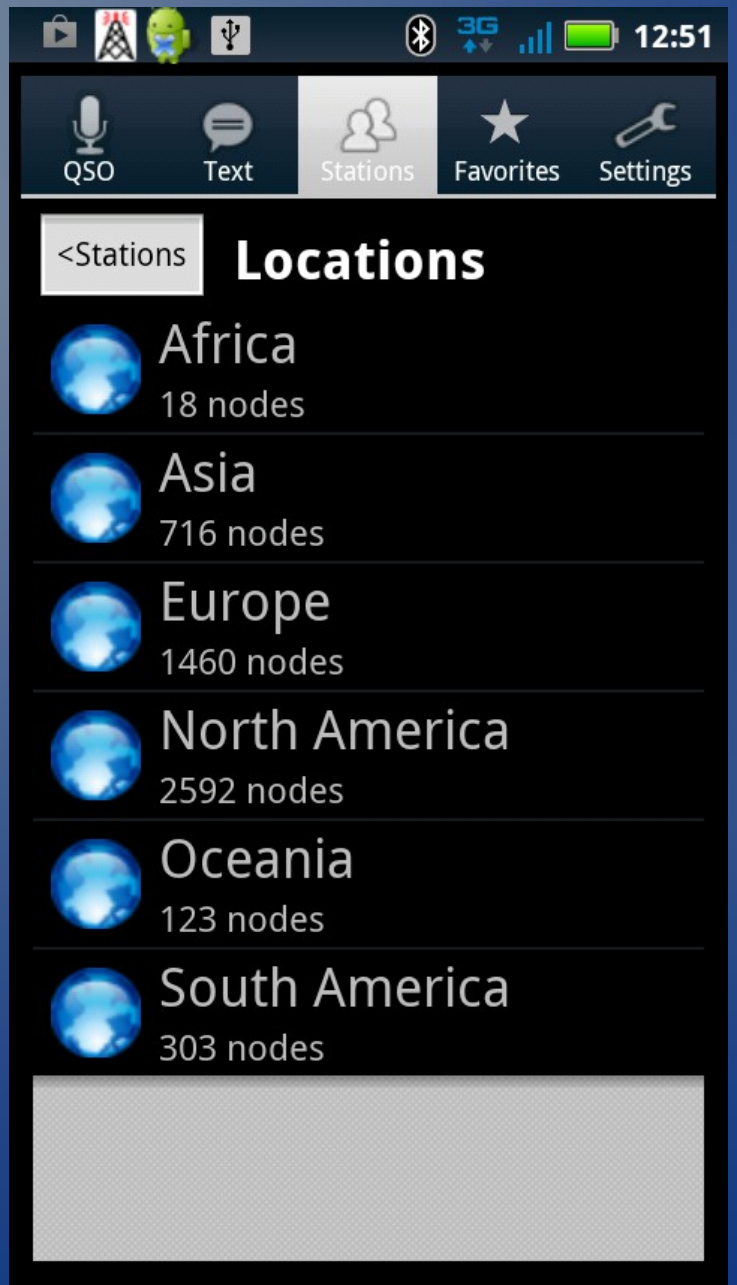

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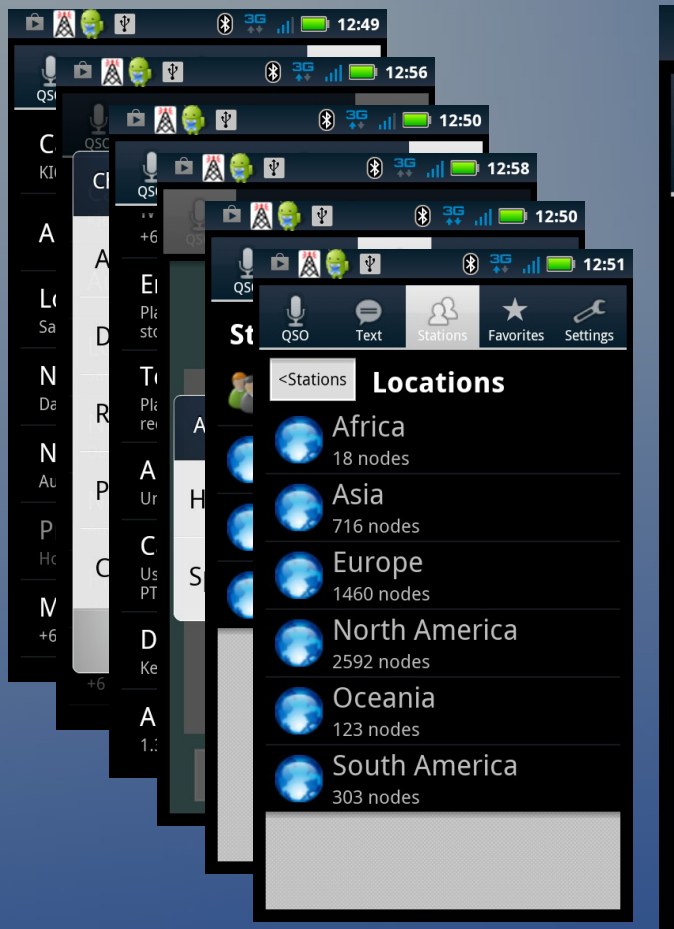

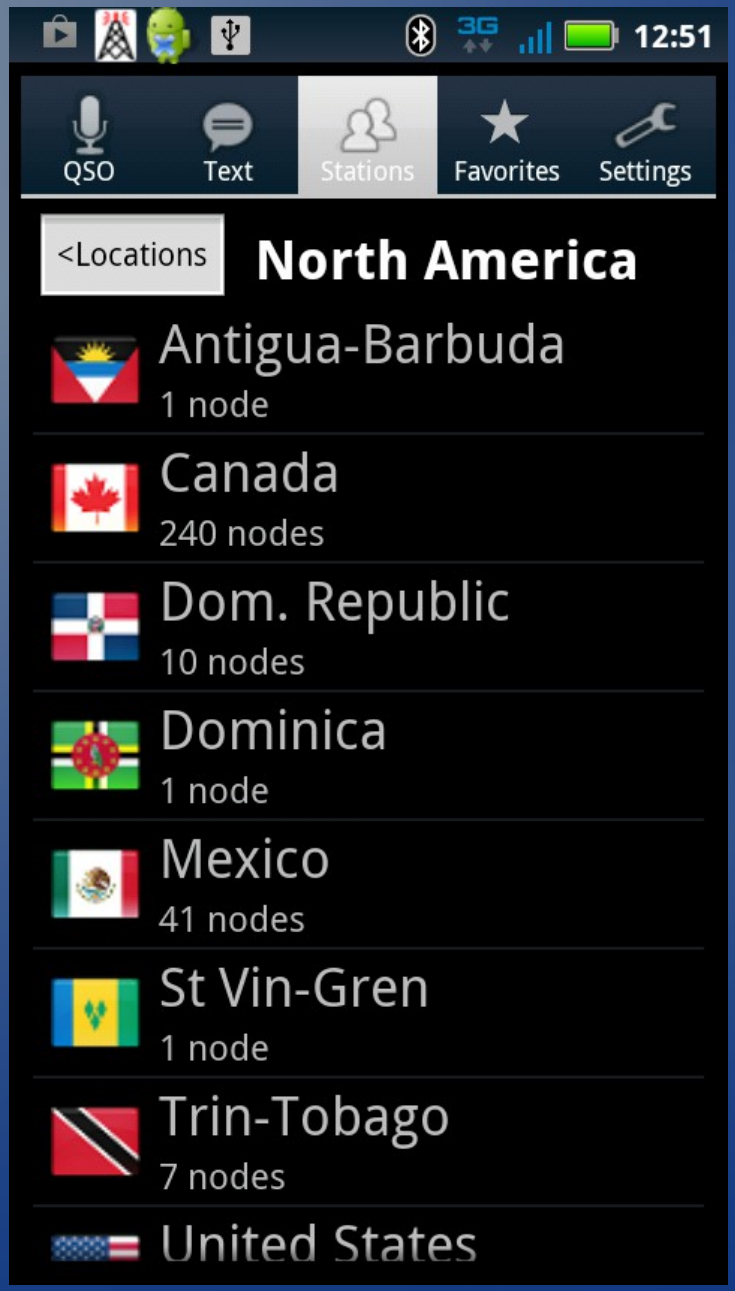

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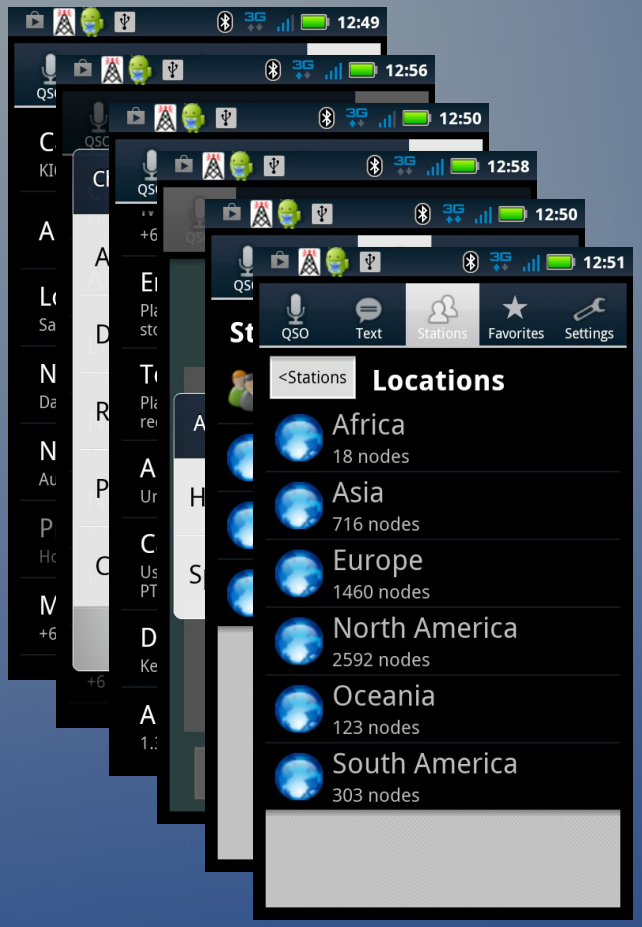

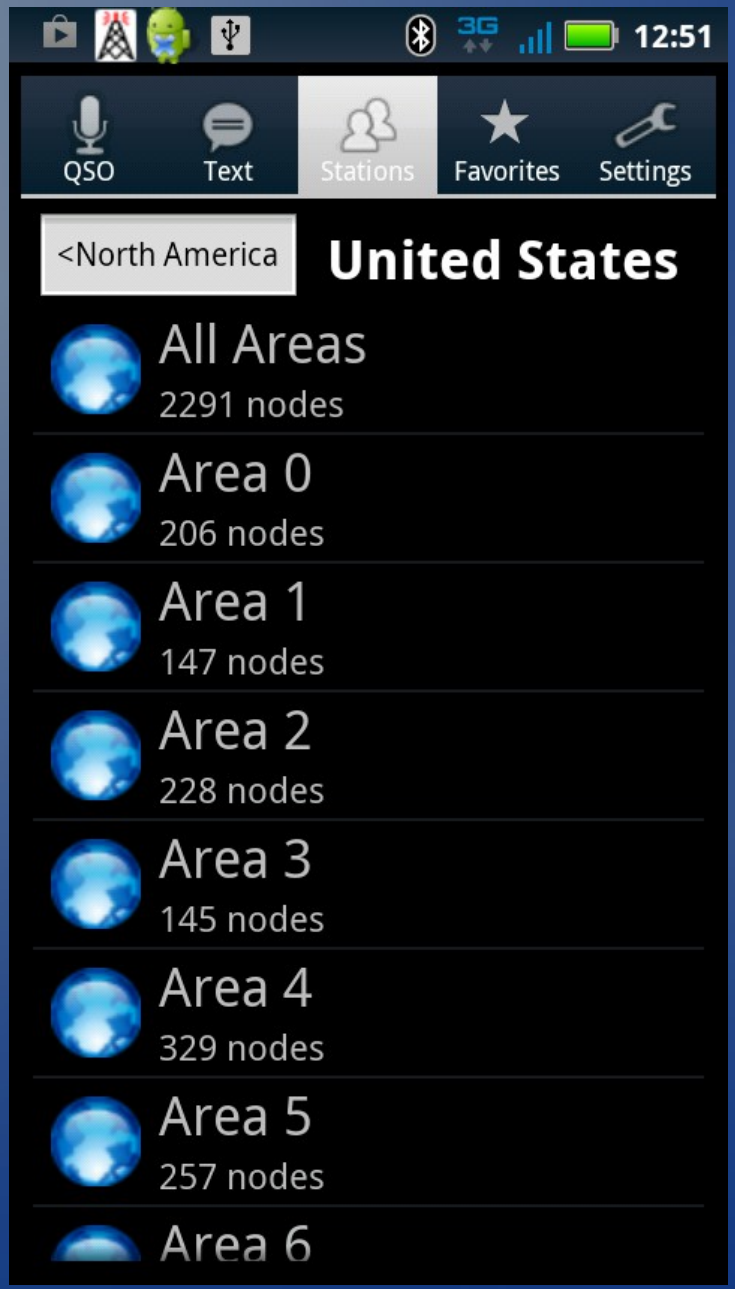

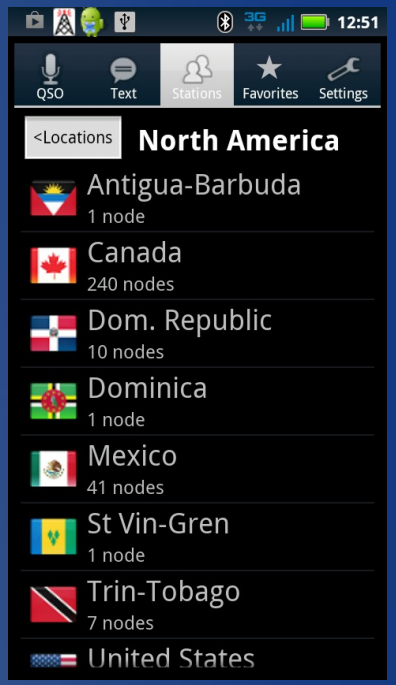

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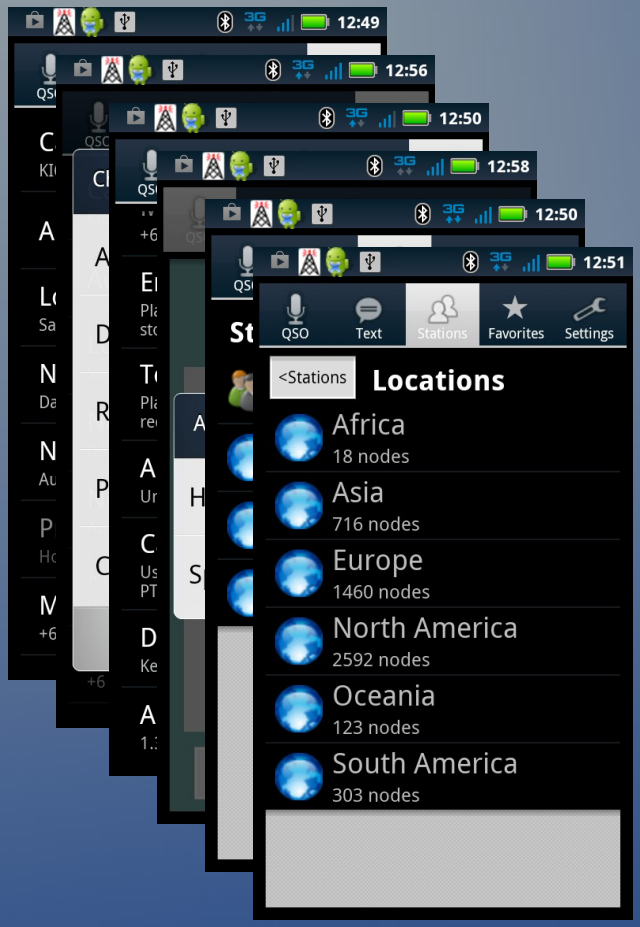

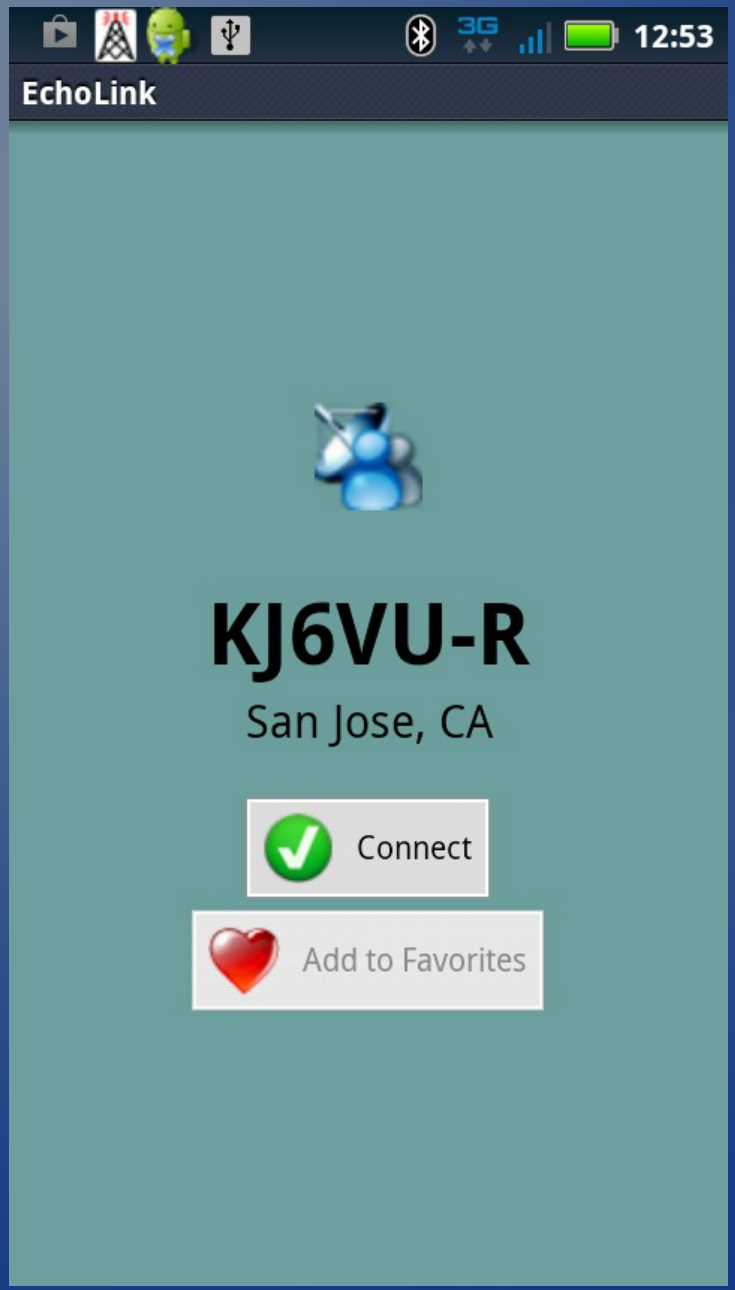

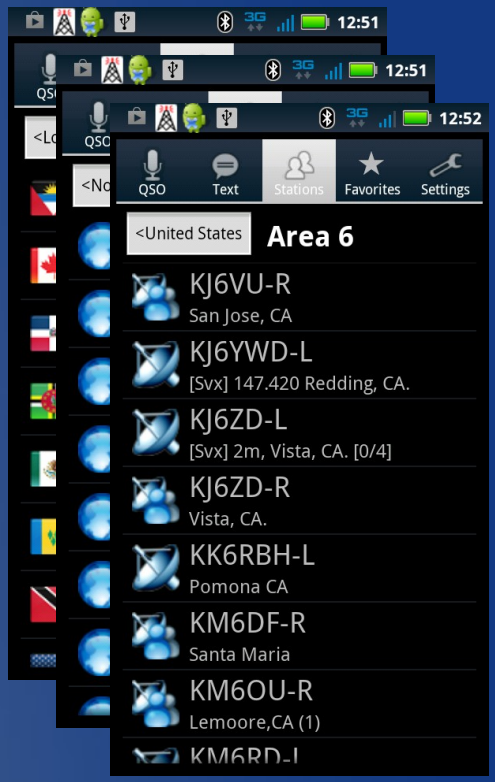

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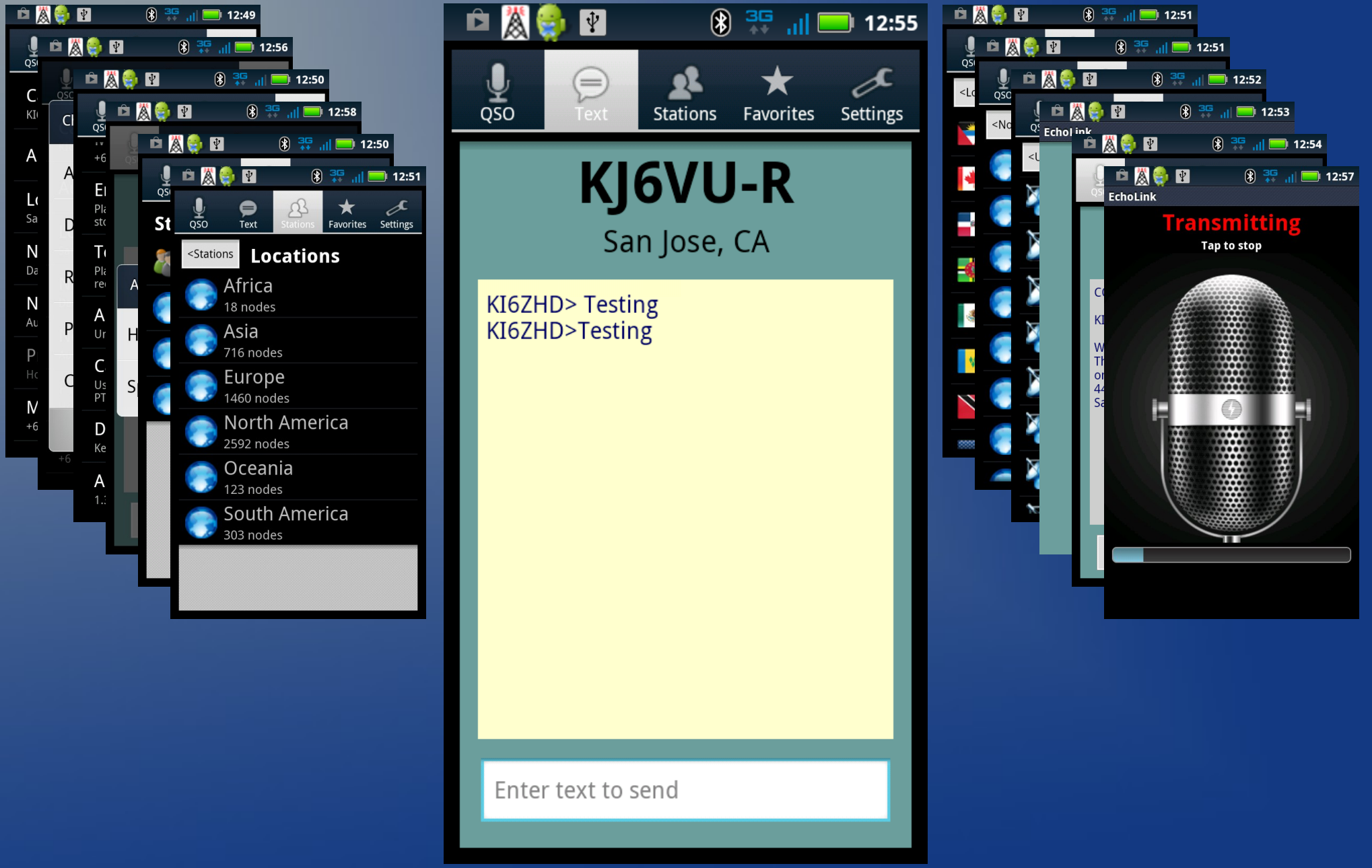

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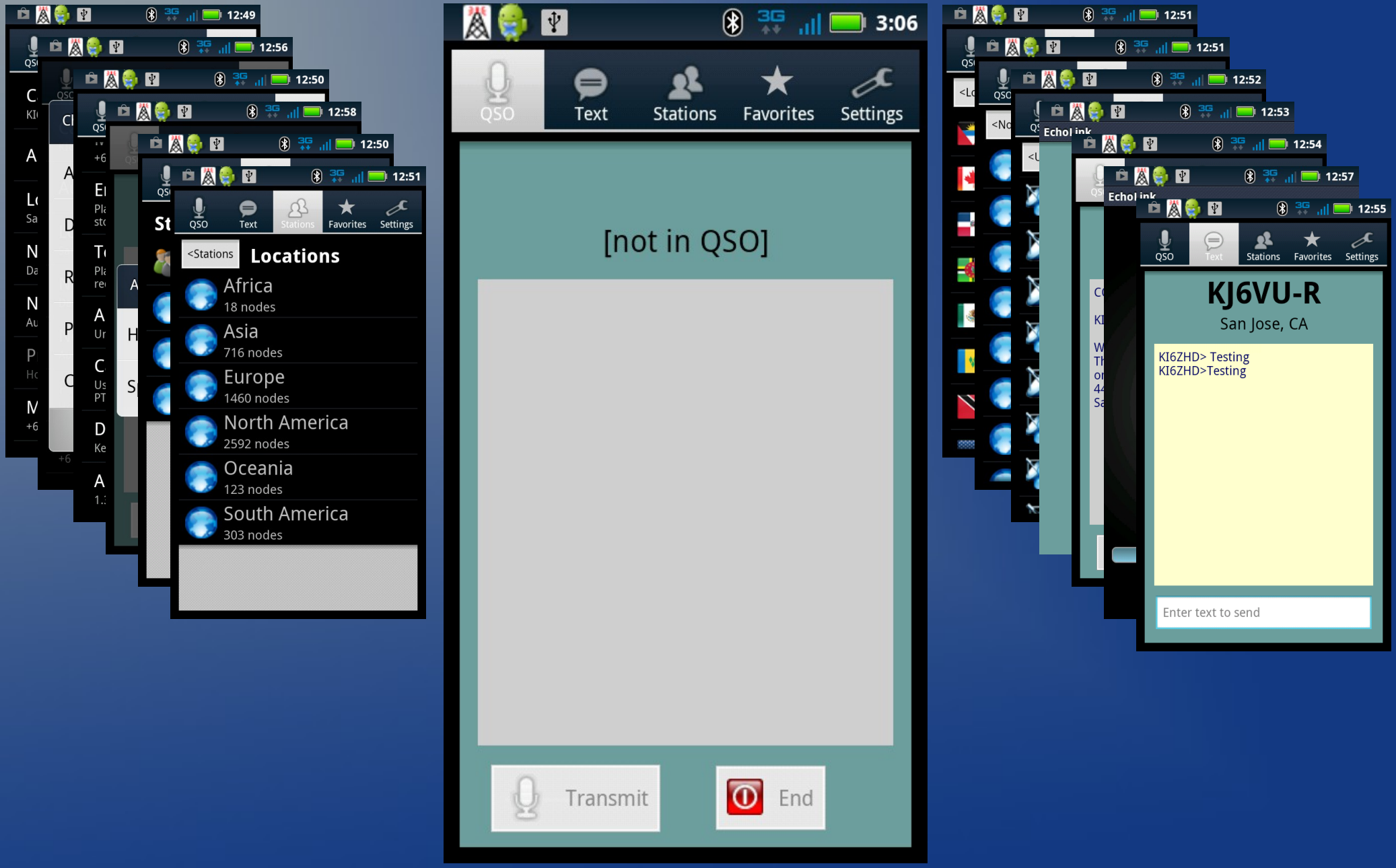
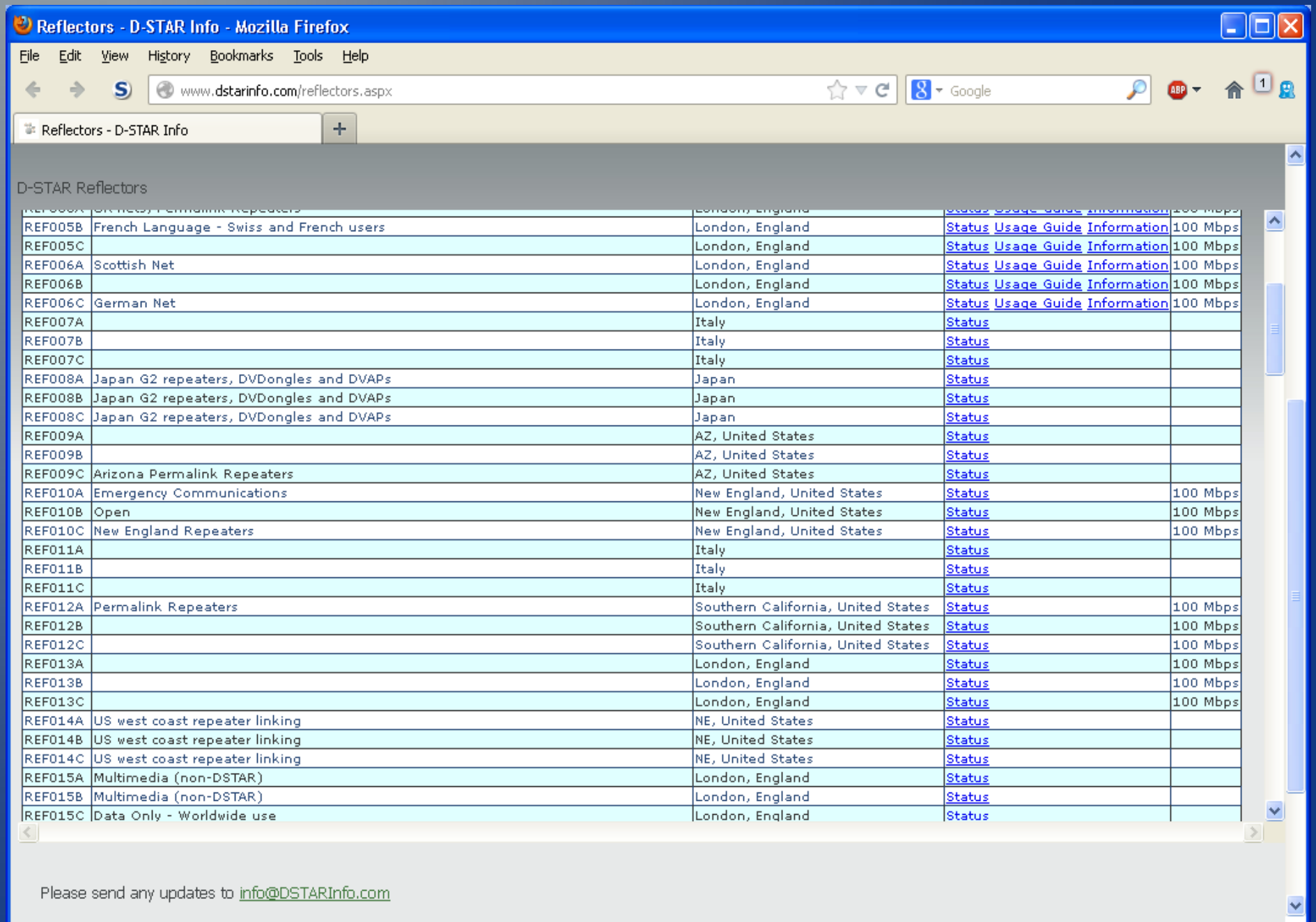


Echolink on Smartphone Demo

D*Star RF Demo

- Dstar is different and a bit more complicate but FAR more powerful
- Much like Echolink, you need to register your callsign if you wish to use the common-in-the-US “US Trust Server”
  - https://k6mdd.dstargateway.org/Dstar.do
-

Example of D*Star Reflectors



Bay-Net D*Star RF Demo

- There are a few fields you have to configure on a D*star enabled radio, dongle, etc:
  - MY : Your callsign
  - RPT1: The local repeater's callsign
  - RPT2: The gateway repeater (usually the local repeater
  - UR : Remote HAMs you want to talk to, usually set to CQCQCQ to talk to anyone or the remote HAM's specific callsign
- With D*Star, the spacing in the various fields *MATTERs!* See the next slides for more

Bay-Net D*Star RF Demo

- A note on the above -B, -G syntax:
  - <callsign>-A usually means 23cm/1.2Ghz
  - <callsign>-B usually means 70cm/440Mhz
  - <callsign>-C usually means 2m/144Mhz
  - <callsign>-G means Internet Gateway enabled
- For this demo, I'm using 444.075Mhz + (no PL)
  - MY : KI6ZHD
  - RPT1: WW6BAY-B
  - RPT2: WW6BAY-G
  - UR : CQCQCQ

Bay-Net D*Star RF Demo

- Get Status of the Repeater:
  - UR: “WW6BAY I” <PTT> (notice the 2 spaces)
  - Text message will give more details (REF014)
- Echo Test Server:
  - UR: “WW6BAY E” <PTT> (notice the 2 spaces)
- To Connect to a different Reflector:
  - UR: “UNLINK U” <PTT> (notice the 2 spaces)
  - UR: “REF004C L” <PTT> (notice the 1 space)

Thank You!

- Questions?

Backup Slide: Terminology

- COS – Carrier Operated Squelch
  - Gives the ability to differentiate PL tones above and beyond open squelch for proper audio on the VoIP side
- Hardware DTMF decoders
  - Offers improved DTMF decoding under difficult RF situations like multi-path, fades, etc

Errata

- Version 8 (01/30/13)
  - Added known issues for Echolink on Smartphones
  - Added option Echolink hardware for improved operations
- Version 7
  - Added subtitles for D*star equipment