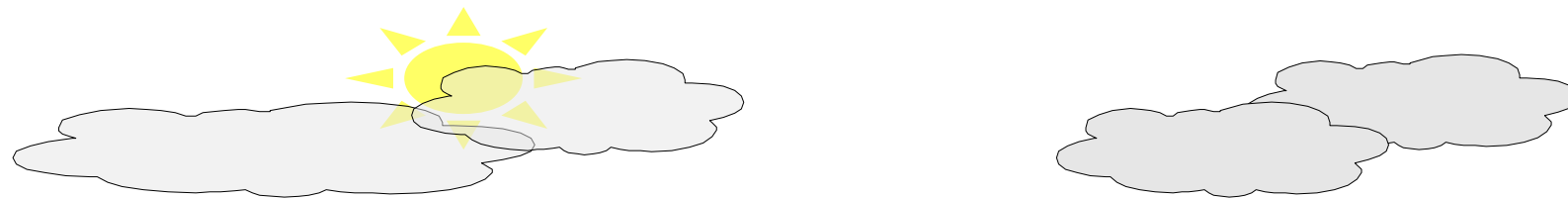


ESP Telemetry and Shore Stations

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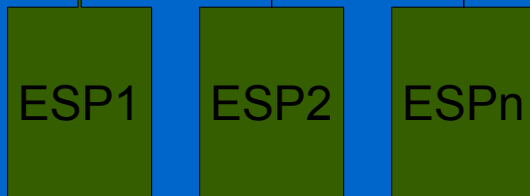
ESP Buoys and Shore Station



Internet via cable, DSL or
Cellular Modem

Shore
Station

Freewave 900Mhz
Multipoint SLIP



Freewave Radios model FGR-115WC



- Unlicensed 900Mhz, up to 1 watt RF output
 - Not legal in much of world outside the Americas
- RS-232 serial interface
 - 115.2 kBits/s – RTS, CTS, and Carrier Detect required
 - Configuration via RS-232 Break or switch in back
 - Configuration menus always at 19.2 kBits/s
 - Lots of arcane settings and modes
 - See CVS: ESP/gen2/software/ppp/freewave.cfg
- ESP originally used Point-to-Point mode with PPP
 - Radios paired by their serial numbers
 - Required changing call books remotely when radio

failed

http://www.freewave.com/files/datasheets/FGR115RC_WC%205.14.09.pdf



Freewave Radios in point-to-multipoint mode



- ESP now uses point-to-multipoint mode
 - One (master) shore station can support up to many (10+) ESP slaves
 - Slave cannot directly communicate with each other
 - All radios must be set to the same FreqKey and Network ID
 - Downloads from shore to ESPs are much slower as point-to-point
 - Uploads are as fast as point-to-point (~7 Kbytes/s)
 - Uses SLIP to encode ethernet packets in RS-232 serial
 - Serial Line Internet Protocol (rfc1055 circa 1988) works
 - Radios form a point-to-multipoint (party-line) serial network

http://www.freewave.com/files/datasheets/FGR115RC_WC%205.14.09.pdf



Shore Stations

- Consist of:
 - Vertically polarized Yagi antenna
 - Usually mounted high on poll, pointed to sea
 - Freewave radio strapped on same pole (to minimize RF cable length)
 - All radio connections must be carefully sealed against weather
 - Pictured enclosure is the “ESP shore server”, containing:
 - Same Linux host TS-7200 CPU found in each ESP and stand alone MFB
 - One channel serial board (for **COM3 port to Freewave**)
 - Real-Time clock
 - Switched Freewave radio power out



Shore Station Services

- Shore Stations' FTP sites are live on Internet
 - But use <ftp://bufflehead> when you can
 - Saves network bandwidth and fees
- SSH access for commanding server & its ESPs
 - Non-standard SSH ports are used
 - To evade marauding password probing 'bots
 - ssh access is easy from bufflehead
 - \$ ssh sunsetbeach #in watsonville
 - \$ ssh socal #in orange county, near Huntington Beach
 - \$ ssh espacruz #brent's house in santa cruz
 - Otherwise, one must know the nonstandard port numbers
 - They are in the file /etc/ssh/ssh_config on bufflehead



Shore Station Services cont'd

- Shore Stations upload each ESP's FTP data near the top of every hour
 - Only new data is uploaded via FTP
 - This scheme is confused if files are not sequentially written
 - Only data from each ESPs top level directory (no hires images)
- Bufflehead uploads FTP data from each shore station near 20 minutes past the top of each hour
 - Force immediate upload from ESPs off socat to bufflehead:
`esp@bufflehead $ ssh socat bin/upload`
`esp@bufflehead $ uploadStations`
 - Files appear under /ESP/station or ftp://bufflehead/ESP/station
 - Bufflehead's ftp site & /ESP share only accessible inside MBARI



How do a upload a hires image?

- Do this at about 30 minutes past the hour
- From a Linux prompt on the shore station:

```
$ cd /var/log/espName/esp
```

```
$ mkdir hires #if the directory does not already exist
```

```
$ cd hires
```

```
$ wget ftp://espName.radio/esp/hires/file.tif
```

- This will get the file up to the nearest shore station
- Bufflehead will upload it at 20 minutes past the top of the next hour
- Could create a script to run called fetch to run on shore station: ??

```
$ fetch espName.radio/esp/hires/file.tif
```



Accessing deployed ESPs via Shore Stations

- All access to deployed ESPs outside the MBARI network is via ssh to its Shore Station
- Step 1: ssh to the shore station as described in previous slide
- Step 2: Telnet to desired ESP
 - The telnet connection will connect much faster than ssh would
 - Tenet session is in the ssh tunnel to the shore station, so it's secure
- Example of establishing an ESP client session with ESPmack off ESP-SoCal.endofinternet.org:

```
bufflehead $ ssh esp@socal
```

```
#opens secure
```



Email Tunneling Overview

- ESPs send email via Simple Mail Transfer Protocol (SMTP)
- SMTP is an old, ubiquitous, insecure protocol
 - Great for propagating SPAM !!
 - MBARI's mail servers will not accept it from outside sources
 - Tunneling makes ESP mails look like they come from within MBARI
- Bufflehead maintains ssh sessions with each shore station
 - These forward the stations' SMTP port (#25) to that of mail.shore.mbari.org
 - It's tricky to keep the tunnels from collapsing
 - Routers want to break these “idle” connections
 - Occasional “keep-alive” traffic avoids this
 - Also need to kill zombie forwarding processes on stations



Email Tunneling: Starting, Stopping & Testing

- To start Email tunneling, as user esp on bufflehead:
`esp@bufflehead $ tunnelESPmail`
- To stop Email tunneling, as user esp on bufflehead:
`esp@bufflehead $ tunnelESPmail stop`
- To test Email tunneling, as any user on a shore station:
`esp@ESPsunset:~$ telnet mail smtp`
220 snow.shore.mbari.org MBARI Mail Service ...
#Success! Press Control-C to exit from telnet and dance a jig
- If telnet reports “connection refused”, email forwarding not working
 - On bufflehead, check logs with:
`esp@bufflehead $ tail -F /var/log/esp/*tunnel*.out`



Preparing Shore Stations for Deployment

- Each shore station uploads from ESPs serviced by it
 - ESP's serviced are `/var/log/ESP*`
 - `ESP*.radio` is often a symlink to `espname`
 - Top level `ESP*.radio` directories are “seeded” with subdirs and files to upload:
 - Typically the subdirectory “esp” and the file “messages”
 - First, archive any old data you want to keep
 - Just before deployment, for each ESPname:

```
root@...$ > /var/log/messages #truncate kernel log
```
 - As user esp:

```
esp@...$ cd /var/log/ESPname  
esp@...$ rm -rf * #remove all previously uploaded data  
esp@...$ mkdir esp
```



Preparing Bufflehead for Deployments

- Bufflehead uploads from all MBARI's ESP shore stations in use
 - ESP's serviced are /var/log/ESP/station/*
 - Top level station directories are “seeded” with subdirs listing ESPs

from each to upload:

- One subdirectory for each ESP deployed off that station
- First archive any old data you want to keep
- Just before deployment, for each shore station:

```
esp@...$ cd /var/log/ESP/station/stationHostName
```

```
esp@...$ rm -rf *
```

```
esp@...$ mkdir espName1 espName2 espNameN
```

- Where *espNameN* is a name of an esp off this station:

» *espbruce, espmack, etc.*

- The *espNames* must match those in the station's top FTP directory



Preparing ESPs for uploading to shore

- Each ESP's FTP site is based at /var/log
 - /var/log/messages (kernel messages) should be emptied
 - /var/log/esp should be emptied after archiving elsewhere

```
root@ESPname # cd /var/log
```

```
root@ESPname # > messages #do not rm this file!
```

- If you do, reboot or:

```
# service syslog restart
```

- As User esp:

```
esp@ESPname $ rm -rf /var/log/esp/*
```

- ESPs and Shore Stations Real-Time clocks are not sync'd to network time

- They drift a couple minutes a month, set them, as root user,
with:



Starting (& Stopping) Hourly Uploads of ESPs from shore stations

- Each shore station uploads every hour from its ESP moorings
 - This process must be manually started after each reboot
 - Do this from each station's esp user's account (not root)
`esp@station $ start hourly upload`
 - To stop uploads:
`esp@station $ killall -q hourly sleep upload wget`
 - You must stop uploads per above before re-starting them
 - Rebooting the shore station is another way to stop uploads
 - Not a bad idea at the end of a deployment



Starting (& Stopping) Hourly Uploads Shore Stations from Bufflehead

- Bufflehead uploads from each shore station 20 minutes past top of each hour
 - This process must be manually started after each reboot
 - Do this from Bufflehead's esp user's account (not root)
`esp@bufflehead $ uploadHourly`
 - To stop uploads:
`esp@bufflehead $ killall -gw hourly`
 - You must stop uploads per above before re-starting them
`esp@bufflehead $ ps -fUesp` #will display relevant process info
 - Look for an “hourly uploadStations” process in the ps command's output
 - Don't even think about rebooting bufflehead :-)
 - It's been up for 258 days



Shore Station at Sunset Beach

<ftp://SunsetBeach.endofinternet.org>

- At 36 Sunset Beach Drive, Watsonville, CA
 - On roof of house on cliff 100+ ft above the beach (with a great view!)
 - We pay homeowner, Abe Novin, \$599/yr
- His Linksys router is configured to pass FTP and SSH traffic to our shore server
 - We access his router's setup pages via Freewave radio link from MBARI
- We use the free dynamic DNS server at dyndns.com
 - To map his varying IP address assigned by ComCast
 - To the hostname of: [SunsetBeach.endofinternet.org](ftp://SunsetBeach.endofinternet.org)
- This ESP shore server has a fixed local IP address of 192.168.1.20



Shore Station in Santa Cruz

`ftp://brent.homeunix.org:2121`

- At 425 Clinton Street, Santa Cruz, CA
 - Strapped to the chimney of my house 0.3miles from the Seabright Beach
- MBARI shares my DSL internet & existing Linksys wi-fi router running OpenWRT
- The router is configured to pass FTP and SSH traffic to the shore server
 - MBARI assesses this router's setup pages only via me :-)
- I use the free dynamic DNS server at dyndns.com
 - To map my varying IP address assigned by DSLextreme
 - To the hostname of: `brent.homeunix.org`
- The server has a fixed local IP address of 192.168.8.20
 - All the ESP slaves must be configured with IP addresses between



Shore Station in Orange County, CA

<ftp://ESP-SoCal.endofinternet.org>

- At Orange County Sanitation District between Huntington and Newport beaches
 - On roof of 50 ft high building overlooking settling ponds and beaches
 - Server is mounted in a weatherproof plastic box at base of 15 foot antenna tower
- A Verizon EVDO cellular modem provides internet access via a Cradlepoint MBR900 router
 - <http://www.cradlepoint.com/support/mbr900>
 - Service costs \$60/month for up to 5GB, \$40/month for up to 250MB
- Access router's setup pages remotely via secure http site
 - It is OK to Reboot the router in the Tools/System menu
 - Other changes may break remote access – have a

