



Linux - HPSDR

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- Existing software to support HPSDR
 - PowerSDR runs on Windows
 - Combination of C and C#
 - KISS Konsole runs on Windows
 C#





• Goal

• Write Linux software for HPSDR





- HPSDR Hardware
 - Atlas Bus
 - Ozy/Magister USB I/O
 - Mercury receiver
 - Penelope transmitter
 - LPU Power Supply
 - Excalibur 10 MHz clock source
 - PennyWhistle RF Power Amplifier
 - Pandora Enclosure

- Coming soon ...
 - Alex RF Bandpass Filters
 - Ozy II Ethernet I/O
 - Hermes Single board HPSDR transceiver







Mercury



Penelope

• HPSDR Hardware



Atlas

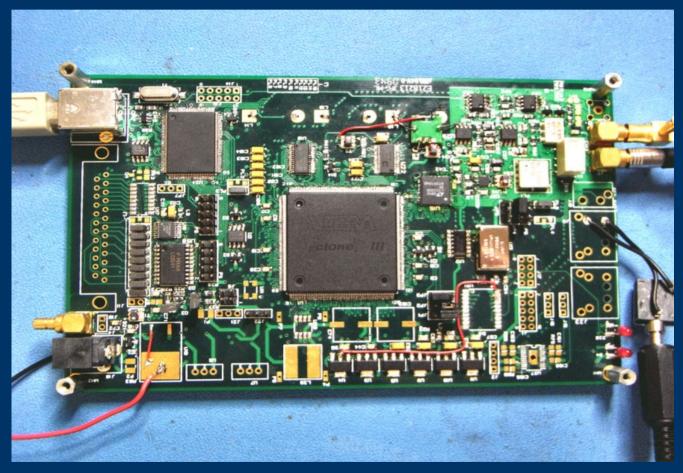


Ozy/Magister





• HPSDR Hardware



Hermes





- HPSDR Hardware
 - FPGA on each card
 - Allows reprogramming of the hardware.
 - Original Mercury FPGA code implemented 1 receiver with either 48KHz, 96KHz or 192KHz bandwidth from anywhere within the 60MHz sampling range of the receiver.
 - New development to implement up to 8 receivers within a single Mercury card.

















- Software
 - USB interface to Ozy (packet rate for 48000 bps samples)
 - 512 byte packets
 - 8 byte header
 - Mox Frequency (Rx or Tx or Both) Full Duplex Rx speed (48000,96000,192000) Clock sources Rx preamp
 - 63 Tx I/Q samples and audio samples

 I and Q samples 16 bits each
 Audio samples are 2 channels of 16 bits





• Software

- USB interface from Ozy (packet rate dependent on sample rate)
 - 512 byte packets
 - 8 byte header PTT Dash/Dot ADC overflow Software version of Ozy, Mercury, Penelope Forward power
 - 63 I/Q and Microphone samples I and Q samples 24 bits each Microphone sample 16 bits





• Software

• USB bandscope interface from Ozy

4096 16 bit samples





• Software

• ghpsdr

- Written in C
- Uses DttSP for DSP functions
- Uses GTK+ for GUI





• Software

- Multi threaded
 - thread to read USB I/Q and Microphone samples
 - thread to read USB bandscope samples
 - thread to process I/Q samples
 - thread to process bandscope smaples
 - thread for spectrum/waterfall display update
 - thread for bandscope display update





• Software

• Modular source code

filter.c agc.c frequency.c audio.c audiostream.c hpsdr_setup.c band.c bandscope.c libushio.c bandscope_control.c main.c bandscope_update.c meter.c command.c meter_update.c display.c mode.c display_setup.c_ozy_buffers.c

ozy.csozy_ringbuffer.cspreamp.ctrproperty.cureceiver.cvsetup.cvsinewave.cxsoundcard.csspectrum_buffers.csspectrum.cv

spectrum_update.c subrx.c transmit.c util.c vfo.c volume.c xvtr_setup.c





• Software

ghpsdr

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				Transmit
AF Pan				Power Mic Gain AF Gain AF Pan



• Software

SDR Forum Dayton 2010



ghpsdr

😣 🛇 🔗 HPSDR: setup					
HPSDR Display XVTR					
				Ozy FX2 version: XX090211	
				Ozy software version: 16	
				Mercury software version: 30	
				Penelope software version: 0	
Speed:	● 48K	○ 96K	○ 192K		
LT2208:	🥑 Dither	🧭 Random			
122.88MHz Clock Source:	O Penelope	Mercury			
10MHz Clock Source:	O Atlas	O Penelope	Mercury		
Mode:	Other	O Class E			
Mic Source:	🔿 Janus	Penelope			
Alex Attenuation:	ODb	0 10Db	O 20Db	O 30Db	
HPSDR Duplex:	Half	O Full			



• Software

SDR Forum Dayton 2010



ghpsdr

😣 🛇 📀 HPSDR: setup	
HPSDR Display XVTR	
Spectrum High	
Spectrum Low	-180
Spectrum Step	
Spectrum Update Rate	15
Waterfall High	-110
Waterfall Low	-140
Bandscope High	
Bandscope Low	
CW Pitch	600
	Spectrum Averaging
SpectrumAverage Smoothing	0.4
	✓ Bandscope Averaging
Bandscope Average Smoothing	





• Software

But what about Mercury supporting multiple receivers?



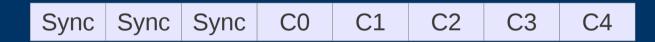


• Software

USB I/Q Data Stream

USB data is transferred in 512 byte packets.

8 bytes of header data.

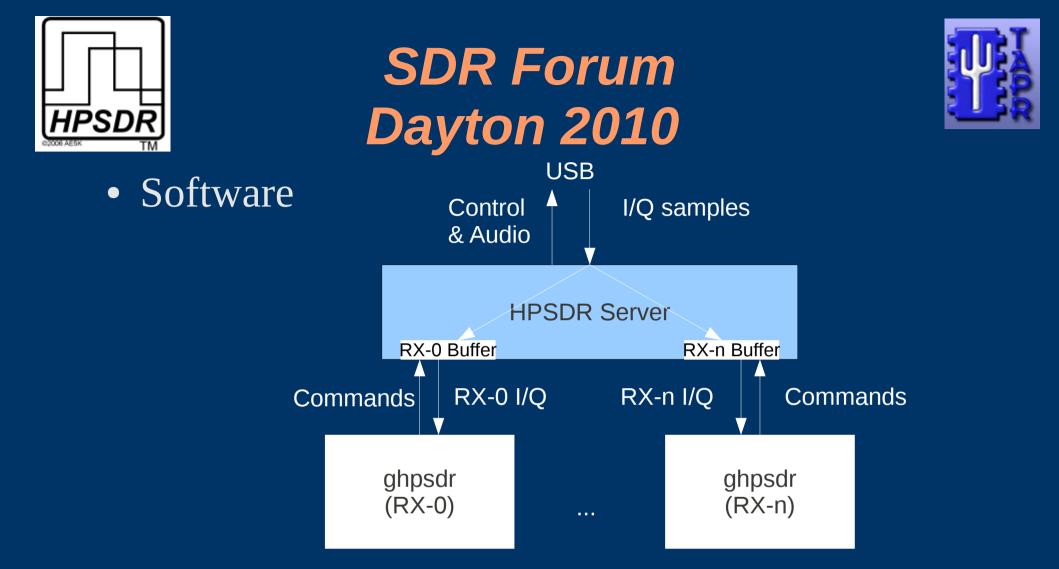


Receiver I/Q data and Mic sample.



I and Q samples are 24 bits (3 bytes). Microphone samples are 16 bits (2 bytes).

Number of samples per packet varies depending on number of receivers.



TCP connection for Commands I/Q data sent over UDP





• Software

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DSB SPEC DRM FM/N 110 5.0k 4.4k 3.8k 3.3k	
Filter 2.9k 2.7k 2.4k 2.1k	
5.0k 4.4k 3.8k 3.3k	
2.9k 2.7k 2.4k 2.1k + High 1.50 -	
1.8k 1.0k Var1 Var2 + Low -2850 -	
+ High -150 - I - DSP	
+ Low -5150 - NR ANF NB NB2	
DSP NONE SPECTRUM PANADAPTER PAN/WATER SCOPE	PHASE PHASE2
NR ANF NB NB2 20,0 25,0 30,0 30,0 30,0 30,0 30,0 30,0 30,0 3	0 35.0 40.0 45.0 50.0 55.0 60.0
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on a second s	SubR) 3.732.901
AF Gain Transmit	
AF Gain Off Zoom x1 Zoom x2 AF Pan Power Mic Gain	AF Gain AF Pan
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• Software

Bandwidth Requirements

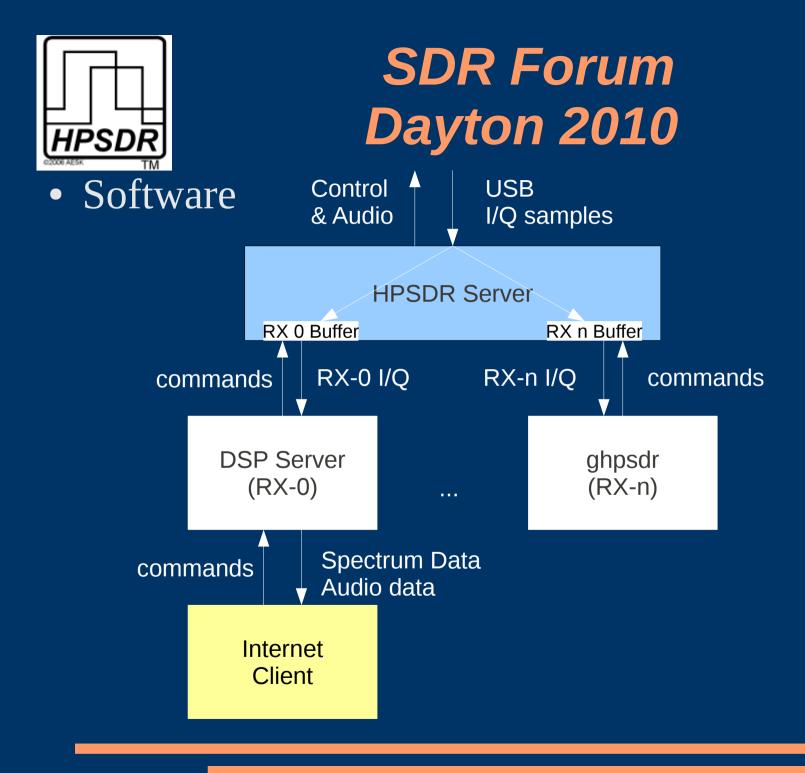
24 bit I samples24 bit Q samples

48000 samples per second = 2304000 bits per second 96000 samples per second = 4608000 bits per second 192000 samples per second = 9216000 bits per second

For just 1 receiver!

8 receivers at 192000 = **73728000** bits per second

My broadband uplink speed is 360 Kbps









- Software
 - Bandwidth requirements per internet receiver
 - Spectrum data sent as 8 bit values
 - Client requests number of samples currently 480 at 10 requests per second.
 - Audio data sent as 8-bit aLaw at 8000 samples per second.
 - Spectrum data = 480*10*8 = 34800 bits per second
 - Audio data =8000*8 = 64000 bits per second
 - 98800 bits per second per receiver





• Software

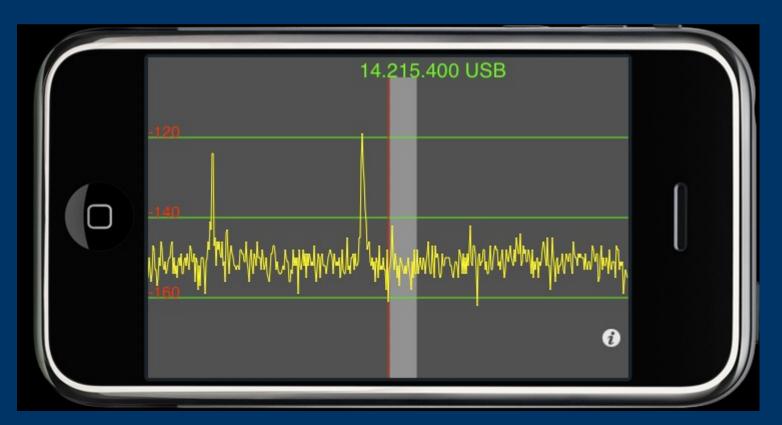
Java Applet Client Runs in any browser window. Can be run as a standalone application.

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- Software
 - iPhone client







- Software
 - Android Client

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• Software

Ongoing development to support other hardware

SDR1000 server Softrock server (both fixed Xtal and Si570) UHFSDR server





Thanks

- HPSDR Group
- TAPR Group
- Phil Harman VK6APH
- Bob McGwier N4HY
- Frank Brickle AB2KT
- Ken Hopper N9VV
- Kirk Weedman KD7IRS
- Bruce Walker W1BW





- References
 - Source code in HPSDR svn repository:

svn://64.245.179.219/svn/repos_sdr_hpsdr/trunk/N6LYT