Safe (malware preventative) file transfer modem software app for MSWindows and Linux through Software Defined Radio or audio hardware. Thoroughly proven schematics for TRRS/TRS adapters to RJ45 Cat6A telephone, and similar, included.

By transferring data in a discontinuous (ie. analog) format, none of the computer hardware interfaces will present either keyboard traffic that could transfer and install malware, nor any firmware reprogramming that could cause other devices to do this, nor any malformed network packets to buffer overflow.

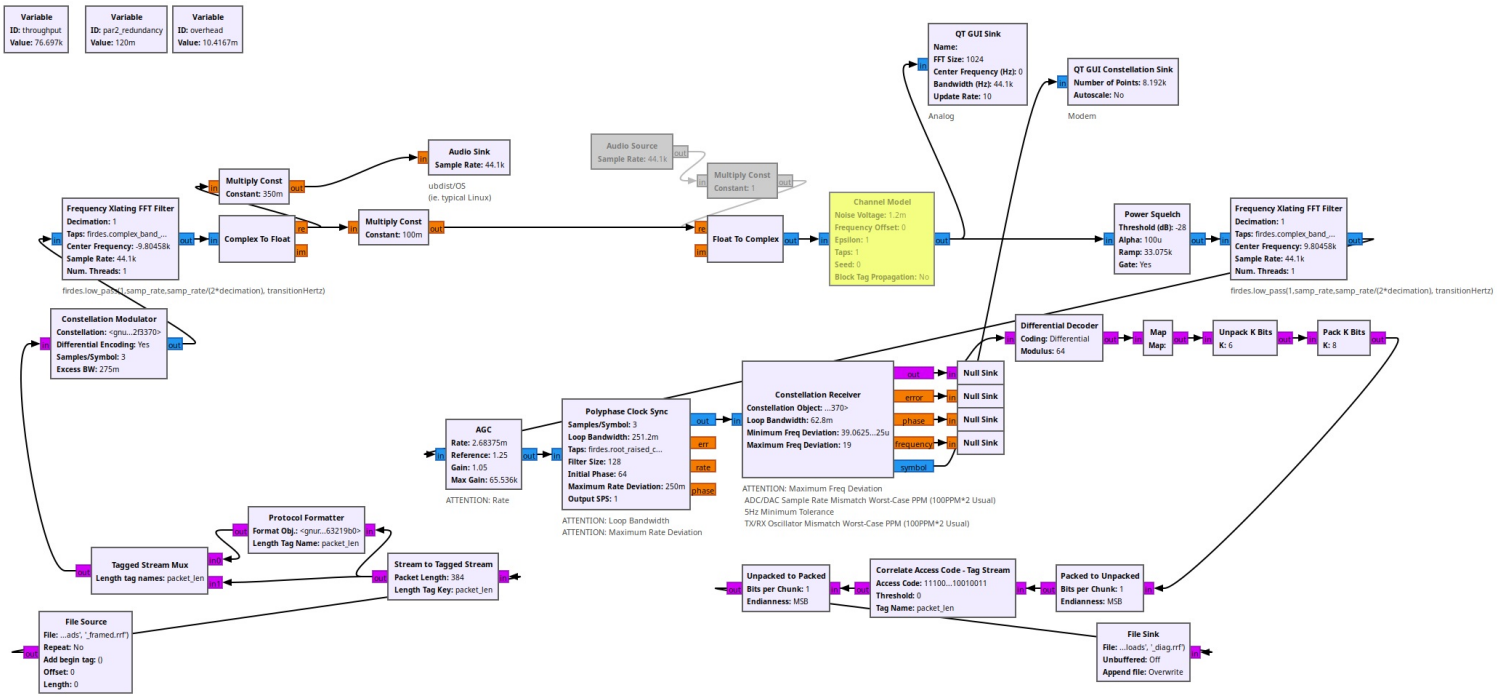
As such, ihis is a necessary Commercial-Off-The-Shelf workaround for the long history of abusing the insane proliferation of computer interfaces with completely inappropriate functionality (eg. reprogrammable SATA firmware wear leveling, BadUSB flash drive reprogramming, SD Card slot SDIO serial/keyboard/etc functionality, parallel port functionality, etc).

This system has been tested with real world audio hardware and does function as designed at decent throughput under challenging conditions.

Audio output should be just below the point of distortion (ie. 99% volume). Audio input volume MUST be kept lower, analog signal should appear at one quarter full input amplitude. Attenuation of more than 3dB to TRRS microphone ports is apparently unnecessary. Coupling impedance and DC load at TRRS microphone connection should be ~1.6kOhm. Higher DC impedance at TRRS microphone port will result in substantial amplifier current noise and EMI sensitivity. TRRS headphones connection DC load should be <<40kOhm. Heavy capacitive coupling >>250uF is apparently acceptable to bypass any DC impedance to improve signal strength, though any amplifier output without ~300Ohm resistive coupling will impose a near short circuit to other outputs on the same line. Capacitor polarity should always place the negative side of the capacitor towards the line (ie. towards the load on the line to ground).

Auditing is a nice bonus for the audio interface - a mere continious analog recording may be kept without possibility of tampering by the malware.

Optical Data Diodes may be formed by widely available ADC/SPDIF and DAC/SPDIF fiber optic adapters.



Usage

```
./ubiquitous_bash.sh
```

Standards

input.rrf
framed.rrf
output.rrf

Any automation of the preprocessing/postprocessing step by 'gr-pipe' may use a separate 'flowgraph' pointing to 'framed.rrf' . Similarly, shell/batch files may perform this step.

Design

Conclusions

*) Framing arbitrary size files with stock GNURadio is not possible, due to 'Stream to Tagged Stream', at least with the stock version, blocking output until a multiple of the specified length for tagging.

*) Cygwin installation of GNURadio may be possible. Possibly also gr-pipe .

Safety

Reference

https://lists.gnu.org/archive/html/discuss-gnuradio/2017-07/msg00249.html

https://wiki.gnuradio.org/index.php/Correlation_Estimator#:~:text=Correlation%20Estimator%20The%20Correlation%20Estimator%20block%20correlates%20the,to%20get%20a%20time%20and%20phase%20offset%20estimate.

https://dsp.stackexchange.com/questions/68306/16-qam-gnu-radio

https://wiki.gnuradio.org/index.php?title=QPSK_Mod_and_Demod
'might have an ambiguity of 90 degrees in the constellation. Luckily, we avoided this problem by transmitting differential symbols.'

https://discuss-gnuradio.gnu.narkive.com/KrFwQ9Fz/why-no-phase-ambiguity-in-digital-bert
'scrambler/descrambler pair is insensitive to the phase ambiguity'

https://www.gnuradio.org/grcon/grcon17/presentations/building_a_moderately_complex_mode_with_spare_parts/Dan-CaJacob-Building-a-Moderately-Complex-Modem-with-Spare-Parts.pdf
'Correlation estimator and 2nd Costas Loop clean up the ambiguity'

https://github.com/greatscottgadgets/hackrf/issues/1159
MAJOR - SEVERE - 'Possible solution: at TX startup, have the M4 not run baseband_streaming_enable until the first two 16KB transfers have arrived from the host, meaning that the M0 has a full buffer ready to transmit.'

https://www.reddit.com/r/RTLSDR/comments/o7owrl/hackrf_frequency_drift/
https://imgur.com/a/ggsuPTm

https://stackoverflow.com/questions/54946638/punctured-convolutional-codes-in-gnu-radio
'Gnu Radio Puncture pattern' 'Puncture size' 'Delay values'

https://aaronscher.com/GNU_Radio_Companion_Collection/Audio_modem.html

https://wiki.gnuradio.org/index.php?title=CygwinInstallMain

https://wiki.gnuradio.org/index.php/Packet_Communications
MAJOR - 'Functionally it replaces a 'File Source' block and a 'Stream to Tagged Stream' block. The advantage of this block is that when the input file size is not an exact multiple of the selected packet length, the remainder at the end of the file is not lost in the 'Stream to Tagged Stream' buffer. This precludes the need for a pre-processor such as the text padding program above.'

https://raw.githubusercontent.com/gnuradio/gnuradio/master/gr-digital/examples/ofdm/ofdm_loopback.grc

https://wiki.gnuradio.org/index.php/Packet_Communications
MAJOR - 'Header Format Object' .
MAJOR - 'Using Header Format Default and Correlate Access Code' .

https://wiki.gnuradio.org/images/f/fd/Pkt_7_base_fg.png
'Protocol Formatter' 'Format Obj'
'Header/Payload Demux'

https://wiki.gnuradio.org/images/8/89/Pkt_7_base.grc
Format Obj.: hdr_format

https://github.com/gnuradio/gnuradio/blob/master/gr-digital/examples/ofdm/tx_ofdm.grc
Format Obj.: header_formatter.base()

https://www.gnuradio.org/doc/doxygen/classgr_1_1digital_1_1packet__header__default.html
'packet_header_default'

https://www.youtube.com/watch?v=RnAgqGR-D-8
https://www.youtube.com/watch?v=VR0mej2o-SM
Windows... HackRF...

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