TechTalk120

DigitalATV – Webcams and UDP and DatvExpressServerApp on Windows
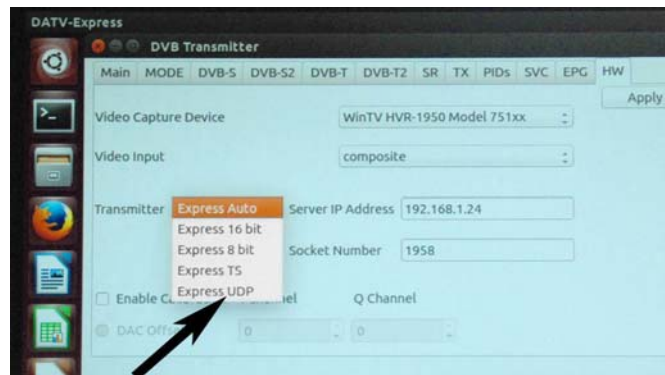
by Ken W6HHC

Fig01 – HW Tab in DATV-Express software GUI has setting planned for UDP stream

Ever since December of 2014, I have been interested in using a web camera with DATV and the DATV-Express exciter board instead of my trusty-but-old NTSC video camera. And for a very long time, the entire DATV-Express project team has wanted to avoid using Hauppauge video-capture units to perform MPEG encoding. Another "wish list" item asked for by hams using DATV-Express board is to be able to send video stream to the board over ethernet or internet. Finally, many hams who want to use DATV do not want to learn how to use Linux…they like the Windows operating system.

This article describes progress that has been made in all four areas mentioned above.

Testing UDP feature without Express_Server
The current DATV-Express software has been implemented with the desire to choose an UDP IP address for the video source that is sending a stream to the CPU running DATV-Express. See **Figure01** for the HW-Tab setting that is planned for this feature. The first set of tests that I tried sent UDP packets with video and audio stream over WiFi from a Windows PC to ODROID configured for UDP video source. I could **NOT** get this set-up to work. Charles G4GUO encouraged me to abandon this configuration for now and start testing the Express_Server code installed on ODROID U3

Testing UDP feature using Express_Server
The Express_Server software was written by Charles G4GUO to better control the receiving of UDP packets by the computer connected to the DATV-Express transmitter board. In this test set-up shown in **Figure02**, A Windows computer has a LogiTech web camera attached and running software called GraphStudioNext to encode the webcam video and use a another piece of software called MajorUDP-Sender to aim the UDP packets to the IP address of the ODROID U3 computer. The ODROID computer is running Lubuntu OS, has the Express_Server software installed and is connected to the DATV-Express transmitter board by USB.

The first testing configuration I tried with the Express_Server software used a LogiTech model C920 webcam, a video-editing software called vMix, encoders configured in a DirectShow Graph called GraphStudioNext installed on a Windows7 notebook computer (see **Figure03**). My initial tests tried to use my home WiFi between the Win7 notebook and the ODROID computer.

Fig02 – Block Diagram for sending LogiTech web cam video by UDP to ODROID running Express_Server
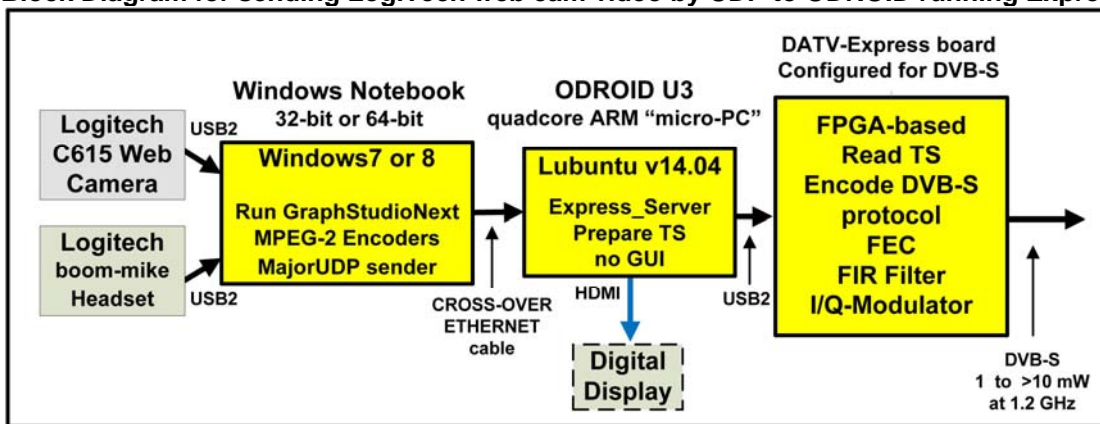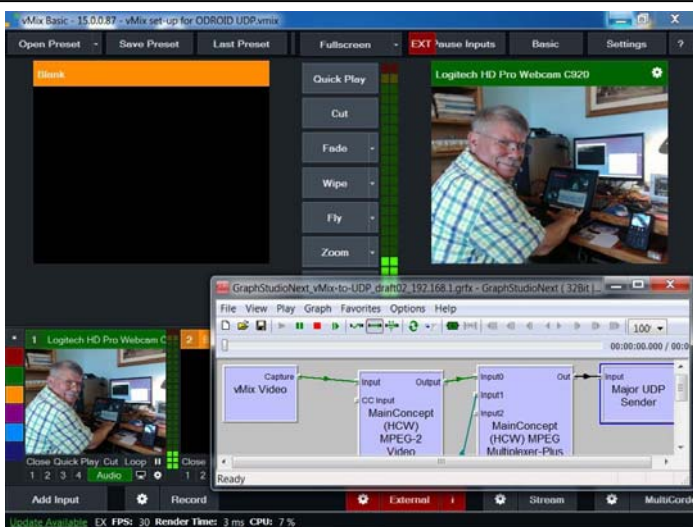
Fig03 - vMix manages the C920 video and GraphStudioNext allows MPEG2 encoding and aims the UDP packets to the Wi-Fi port on ODROID

There were two areas of problems with this first testing configuration that I tried on the Win7 computer:

1. The LogiTech model C920 webcam outputs video that has already encoded using H.264 video compression (aka MPEG-4). Initial tests showed close to 12 seconds of latency delays to receive the video on my receiver. When I reported my C920 results on a DATV internet forum, Jean Pierre F6DZP reminded me that my test set-up was forcing the Win7 computer to first decode the H.264 video stream back to a non-encoded stream and then finally using GraphStudioNext to encode to the MPEG-2 standard. F6DZP recommended that I try using an earlier non-H.264 webcam.

2. The free video editor I was using, vMix BASIC SD (Standard Definition) model, was nice (even allows "green screen" magic) but added a level of complexity that I did not really need. It turns out that Charles had used it in one of his testing set-ups only because it was an easy tool to use to overlay his call letters on top of the video stream…to use during a DATV contest. But vMix added some operational complexity and also prevented me from controlling directly the source-filters settings for the LogiTech equipment.

The next Win7 testing configuration I tried with the Express_Server software was to change the webcam to an older LogiTech model C615 that I owned and to eliminate the vMix video editing software. **Figure04** shows the configuration of "filters"

that I now used in GraphStudioNext (I use the latest free version, V0.7.0.430).
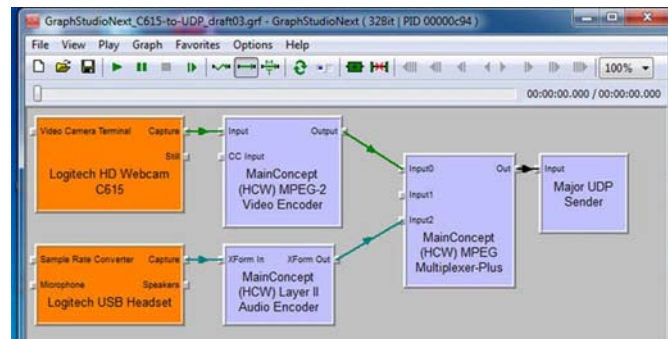
Fig04 - Configuration of DirectShow filters using GraphStudioNext filter for using C615 webcam on Windows. The MajorUDP-Sender software block is aiming packets to ODROID IP address

With the C615 camera, the latency was much improved (perhaps less than using Hauppauge video capture units), but the video would freeze after a minute or two while using a WiFi configuration between the two computers. I suspected perhaps buffer overflow somewhere? G4GUO encouraged me to switch to an ethernet "cable" connection…Charles pointed out he also had poor results with WiFi even though he had "line of sight".

I chose to use a "cross-over ethernet" cable between the two computers. The only tricky part of the "cross-over ethernet" cable installation is that you have to configure both computers for static IP addresses. Setting Windows for a static IP address was straight forward through the Win Control Panel. But setting a static IP address on the ODROID was difficult to sort out …I had to "Google For It" and sort through adding the code below to the INTERFACES system file in the NETWORK folder.

> **auto eth0**
> **iface eth0 inet static**
> **address 192.168.1.10**
> **netmask 255.255.0.0**
> **gateway 192.168.1.20** (this is the
>   static IP address of the Win7)

Confirm IP addresses are working by pinging from Win7 to ODROID at 192.168.1.10. The static IP addresses cable connection worked perfectly and video was stable in testing lasting more than 8 hours.

One significant difference when using the Express_Server software is that there is **NO** Graphic User Interface (GUI). There is only a command line user interface to show you the server is running (see **Figure05**). The configuration settings that you configure for DATV-Express board DVB-S parameter settings are editable in a text file called, **express.txt**.
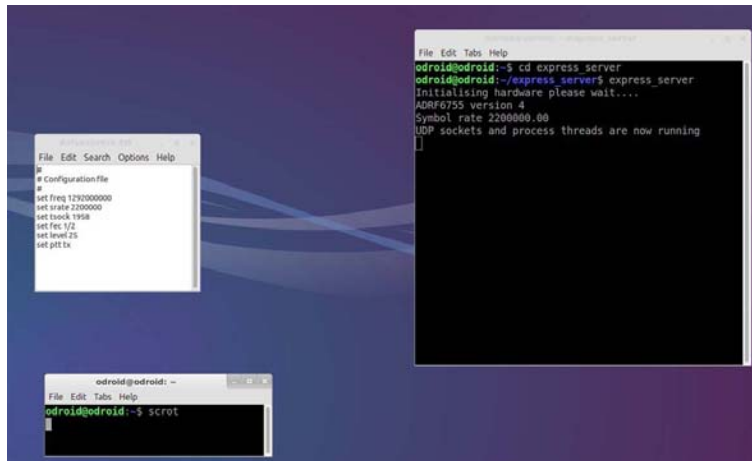
Fig05 – The express_server software is installed and runs (terminal window is on right) on ODROID. It captures incoming internet UDP packets and sends Transport Stream to DATV-Express board. The configuration settings text file is shown on left.

There are two notes about express_server. First, I had to build the express_server software on the ODROID computer from source code that G4GUO makes available on his github (see URL at end of article). G4GUO points out that although I tested the express_server on an ODROID U3 (see **Figure02**), the Express_Server software will run on any linux system.
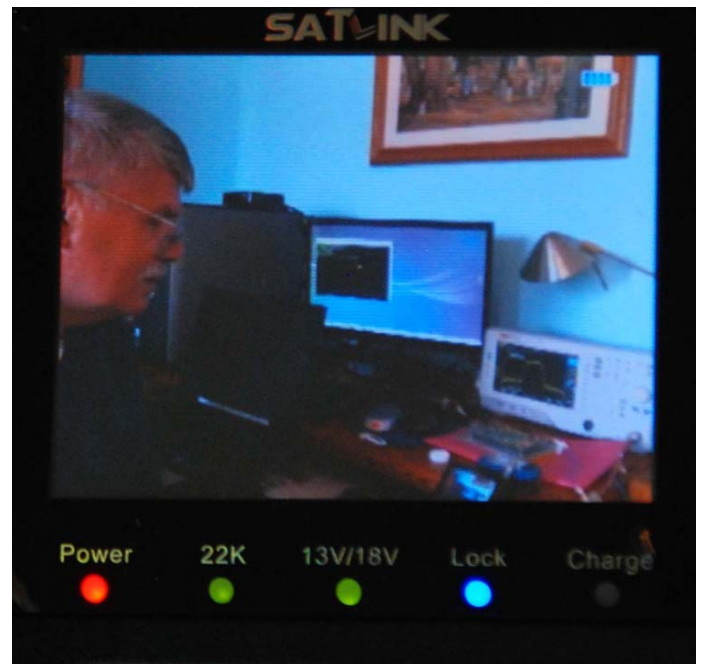

Fig06 - First stable video received using the express_server and cross-over Ethernet cable for UDP packets

**Testing DatvExpressServerApp on Windows (no linux used)**
A constant request by hams wanting to use the DATV-Express transmitter board was "when will Windows be available?". I then tested the software that Charles G4GUO has written, called the DatvExpressServerApp, that allows the DATV-Express board to be connected directly to a Windows computer running Win7 or Win8. **Figure07** shows the block diagram for my testing set-up.

Fig07 – Block Diagram showing the DatvExpressServerApp software runs completely on a Windows machine and connects to DATV-Express board
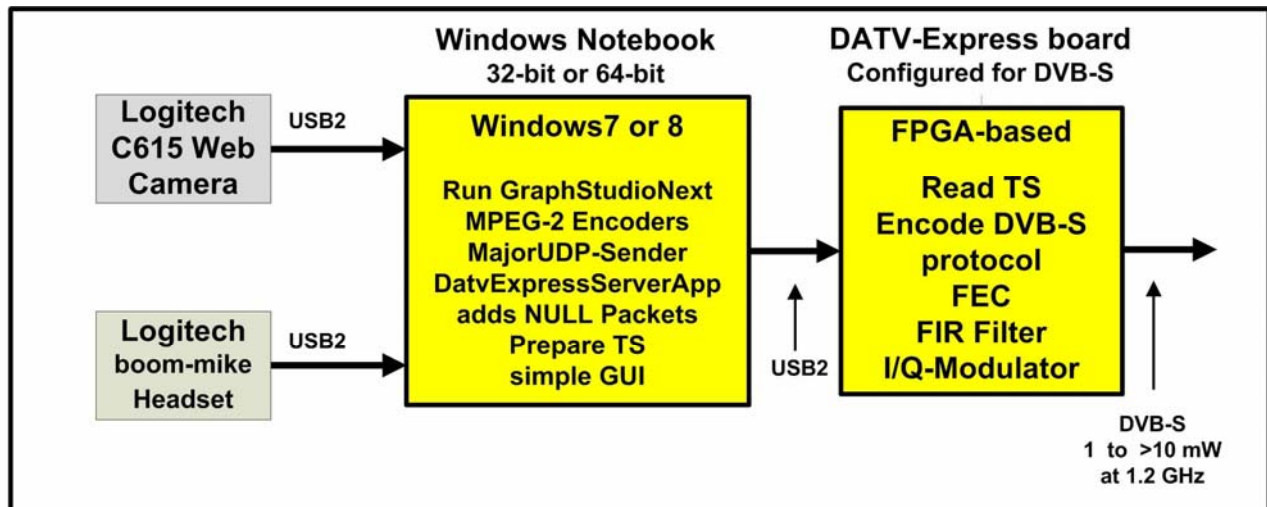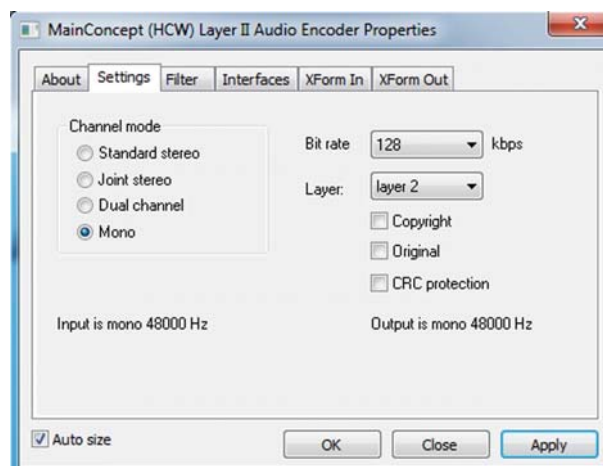
This testing configuration uses the same GraphStudioNext set of filters that had been used in **Figure02** and **Figure04**. The only difference is that the Major-UDP-Sender software now aims UDP packets to the internal loopback IP address on the Windows PC, 127.0.0.1.

I did have to sort through installing libusb and driver for the DATV-Express board onto the Windows computer. Libusb(0).dll and the signed Windows driver are publicly available and comes from another Amateur Radio project (HPSDR). Make sure that you use the readme file for DatvExprssServerApp called HELP.txt. **Figure08** shows the simple GUI that DatvExpressServerApp provides on Windows.
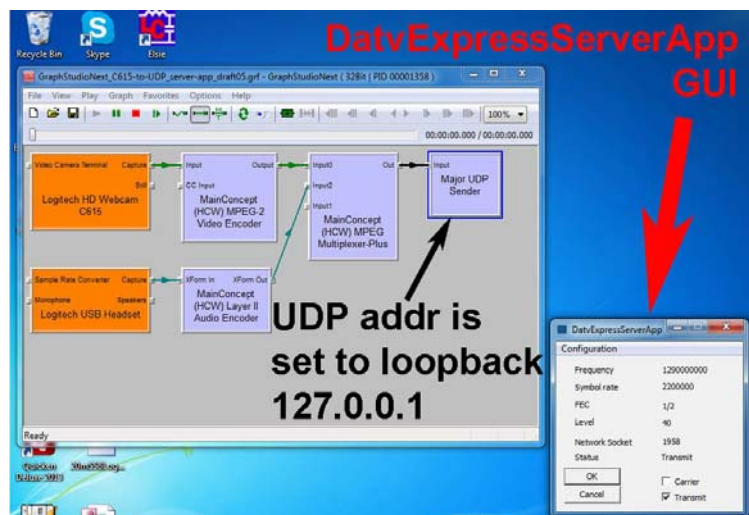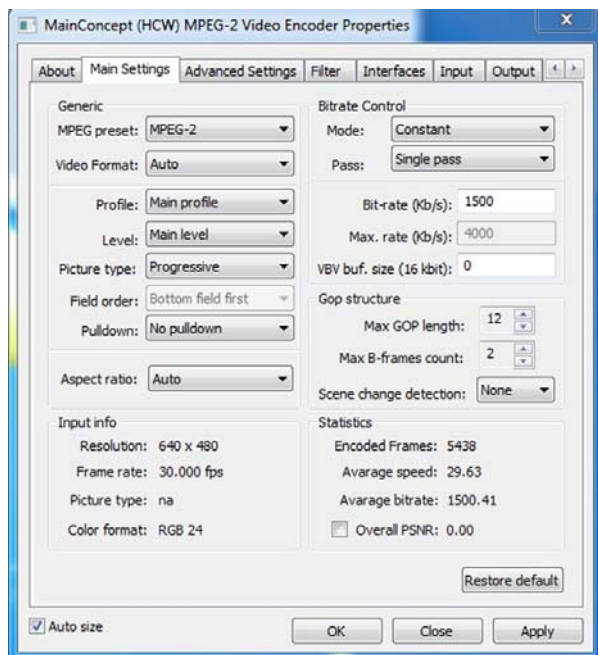

Fig08 - Windows running GraphStudioNext graphs and simple GUI for DatvExpressServerApp

Fig09 – Properties of MainConcept video encoder filter used in my current testing using ConstantBitRate (CBR)

Again notice in **Figure07** that the Hauppauge video-capture board/unit is not used by DatvExpressServerApp. The MPEG-2 audio and video encoder filters in Figure08 are from MainConcept (HCW). I obtained my copy of the three MainConcept filters from the Hauppauge installation CD-ROM that came with my Hauppauge usb-based video-capture unit. The properties display of the MainConcept filter in **Figure09** shows that I have currently set the CBR rate of the desired video bit-rate to 1500 Kbps to not overrun the SymbolRate of 2.20 MSymb/sec that I want to use.
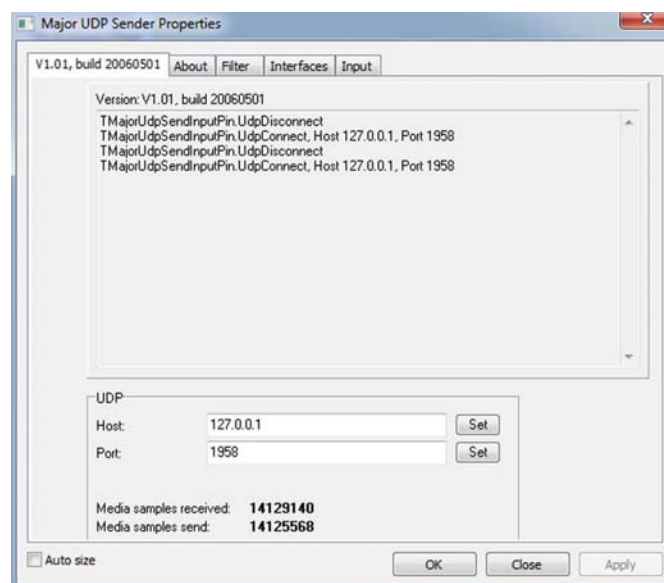

Fig10 – Properties of MainConcept audio encoder filter used in my current testing

One small issue exists with the VideoPID and Audio-PID. The MainConcept MPEG MUX filter defaults to values of 1001 and 1002 (as compared to values of VidPID = 256 and AudPID = 257 used for most DVB-S installations). You can change the PIDs to another set of values, but I have not determined how to SAVE those new values as default values.

Fig11 – Properties of MajorUDP-Sender software with IP destination address aimed at loopback 127.0.0.1 and socket chosen for an arbitrary 1958

Conclusions

This report is the result of a lot fun trying to break out of the "handcuffs" created by the NTSC/PAL cameras, Hauppauge encoder-boards, and Linux that have somewhat limited the appeal and limited possible applications of the DATV-Express project hardware board.

Using a USB-webcam from Logitech shows that endless cameras can be chosen with many possibilities for other camera interfaces rather than me being restricted to my hand-me-down old (becoming obsolete) home NTSC video camera. I can move to modern cameras now for DATV-Express.

This report also provides a roadmap for using DirectShow filters as software encoders, like the Main-Concept ones used in this report. The iron-clad hand-cuffs to Hauppauge video-encoders for many hams has been broken. It does not take too much imagination to see that other encoder filters for MPEG-4/H.264 can be found and substituted for the MPEG-2 encoders in this report to reduce the video-bit-stream-rate and allow smaller RF Bandwidths for DVB-S transmitters in SD (Standard Definition) mode. Or transmit HD video if your application really needs true HD with the corresponding increase in RF Bandwidth over SD.

The ability to send video UDP packet streams over ethernet and even internet to the DATV-Express transmitter board (instead of being tied to the plugged-in-camera) opens up a thousand new possible applications that were not possible before.

Not being able to use Windows operating system and being forced to deal with Linux has been a learning challenge and a "barrier" for many hams. The new DatvExpressServerApp software from Charles G4GUO will eventually allow Windows to be your choice if that is what you want. G4GUO is quick to point out that the DatvExpressServerApp software is still in a highly "experimental stage". But it is a great start. Other hams may be willing to volunteer to make improvements to the source code and add new features to DatvExpressServerApp in an open source spirit.

Finally, if any readers know how to change and save the default PID/PIS values for video and audio in the MainConcept MPEG MUX filter…please send me an e-mail.

Contact Info – the author may be contacted at **W6HHC@ARRL.net**

Useful URLs

- British ATV Club - Digital Forum – see **www.BATC.org.UK/forum/**
- CQ-DATV online (free monthly) e-magazine – see **www.CQ-DATV.mobi**
- DATV-Express Project for Digital-ATV (User Guide and downloads) – see **www.DATV-Express.com**
- G4GUO github for DATV-Express source code
  – see **https://github.com/G4GUO/datvexpress_gui.git**
- G4GUO github for express_server source code
  – see **https://github.com/G4GUO/express_server.git**
- HardKernel web site for ODROID U3 – see **www.hardkernel.com/**
- HardKernel USA Sales for faster shipping – see **www.ameridroid.com**
- HardKernel web site for free ODROID Magazine – see   **http://Magazine.Odroid.com**
- Chris MWØLLK discussions on vMix and FFMPEG software on Windows to create transport stream – see **http://www.tannet.org.uk/using-ffmpeg-to-generate-a-transport-stream-more-details-and-how-to-add-text-overlays/**
- Orange County ARC entire series of newsletter DATV articles and DATV presentations
  – see **www.W6ZE.org/DATV/**
- Yahoo Group for Digital ATV - see **groups.yahoo.com/group/DigitalATV/**