Try a 3-PC System to Extend your EUMETCast options

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I recently described my Home *EUMETCast* Receiving Station on my web pages and asked David Taylor to give it a critical eye as I discuss his software in some detail. It was he who suggested I write for *GEO Quarterly* and describe my thinking and conclusions while assembling this home system. I will not describe the software side of things in detail as that has been covered extensively in earlier Quarterlies, although I will however address some software issues.

I have been involved in Amateur Astronomy for about seven years and have been an active member of Macclesfield Astronomical Society for the same time. As we used to hold all our meetings at Jodrell Bank, radio astronomy is therefore always prominent in our meetings. We only meet there for our monthly 'workshops' since the Planetarium was demolished.

I missed a talk on 'Radio Meteor Detection' but was fascinated by the principles and had a go myself. One needs a scanner, a dipole aerial and a computer running free software available on the web. The data is fascinating, especially when one can correlate visual sightings with radio detection. However, the system becomes automatic and I wanted to go further.

Two years ago I discovered the RX2 weather satellite receiver and various sites describing home-brew quadrifilar helical antennas. By January 2006 I was operating a reliable APT system with a homemade QFH in the roof space and the RX2. I then discovered the GEO website (and joined) and all the talk of *EUMETCast*. By August 2006 I had my licence, EKU and software and started to receive images.

Figure 1 - The workstation, showing the three PCs.

The PC System

Having read the FAQ's on David Taylor's website and articles by Arne van Belle and others, I determined on a 2-PC system. However, I eventually ended up with a 3-PC system. I had upgraded my original PC in January 2006 but decided to improve it further: this has evolved as data rates have continued to increase. For my second PC I bought an off-the-shelf 'student' model, for reception only, and then brought into use my son's PC (my 3rd), an essentially home-built PC in a new case. This allowed me to reconfigure my system as described below. I honestly think a 3-PC system is highly desirable, *especially if you do a lot of computing other than EUMETCast reception*. At present the total data received by my system is of the order of 31 gigabytes (GB) per day.

Available Data

Data from EUMETSAT is received via a TV broadcasting satellite, *Hot Bird-6* at 13°E. The service is called *EUMETCast* and is provided by a *tq®-TELLICAST* server. *EUMETCast* services provided by EUMETSAT now include Meteosat-9 (MSG-2), FSD, AVHRR and Metop-A data.

- Meteosat-9 (MSG-2) is a second-generation geostationary weather satellite for Europe, providing twelve spectral channels.
- Meteosat-8 (MSG-1) is, as I write this, sending experimental rapid scan data of Europe every 5 minutes.
- FSD - foreign satellite data - includes hourly images from geostationary satellites around the world, such as the GOES-West and GOES-East stationed over the Americas, Meteosat-7 provides the Indian Ocean Data Coverage (IODC), and MTSAT-1R covers Asia and Australia.
- EARS-AVHRR provides high-resolution 5-channel HRPT image data from the AVHRR scanner on NOAA-17 and NOAA-18. Data from several ground stations (Canary Islands, Northern France, and Svalbard, north of the Arctic Circle) is combined to give Europe-wide coverage. The data has a 1km per pixel ground resolution.
- EUMETCast is the main dissemination mode for data from the Metop-A satellite, launched in October 2006. This satellite provides high-resolution continuous round-the-world coverage, with data at 1km per pixel resolution.

My System

My system starts with the 80 cm dish and LNB purchased from GEO shop and is mounted on a fence in the front garden. The fence posts not being absolutely rigid, an additional pole has been driven into the ground. I initially thought that movement in the fence adversely effected my reception: however the problem turned out to be the neighbour's trees overhanging the line of sight, especially worse when raining. I have completely cleared the trees to give much better reception although it is still degraded when I mow the lawn and by the occasional very high-sided vehicle. I am looking at ways of mounting the dish on the end wall of the house. Unfortunately the ideal mounting wall has a telephone pole right in the line of sight.

My workstation (figure 1) looks a bit crowded but works well. I use a KVM (keyboard, video, mouse) switch to move between two of the PCs and *VNC Viewer* to access the third. This means that I only need one keyboard and one mouse to control everything. All PCs are attached via Ethernet cables to a wireless router/modem. The wireless is only used by my laptop.

All the PCs have names associated with Astronomy. Naming the PCs makes networking much simpler. The default names can be pretty horrendous. If you load Windows yourself, you get the option to name the PC during installation. In Win XP it can be changed in Control Panel, though best done before networking.

'Kepler' is the Receive Only PC

A *TechniSat* DVB *PC-TV-Star* PCI card installed in this PC receives the signal. I initially used a *TechniSat Skystar* USB box but it wasn't able to keep up with the vast amount of data provided after the Metop-A launch. Also installed is the EKU (Electronic Key Unit), supplied by EUMETSAT at €40, and the necessary *Tellique* software package costing a further €60. These are both obtained direct from EUMETSAT and allow access to the data.

Kepler is an *HP Pavilion computer*, intended mainly for students, fitted with an with AMD *Sempron* 1800 MHz processor. 80 GB hard drive, 1 GB RAM and Windows XP Home. I added another 1GB RAM and a second 200 GB SATA hard drive. I was planning to add two additional SATA drives and run them in RAID 0, but unfortunately XP Home doesn't support RAID, so I stuck with one drive.

This hard drive has the *TelliCast* software and received data folders only. It doesn't get anywhere near capacity as the raw data is removed by data management software almost immediately. I switch off the processing PC at night, so only around 7-8 hours of data tends to accumulate.

Finally, I added a *Q Soft* 320 MB Ram Drive and changed the case cooling fans to something quieter. This PC runs continuously 24 hours a day.

'Galileo' is the Processing PC

I built this PC myself using parts purchased in early 2006 and upgraded it to cope with *EUMETCast*. It contains an *AMD Sempron* 1833 MHz processor, 2GB RAM, 40 GB and 120 GB hard drives plus twin 200 GB SATA hard drives in RAID 0. There are lots of cooling fans, mainly by Zalman, a Zalman copper CPU heat sink and fan and Zalman fanless cooling for the graphics card. This PC runs very quietly and critical temperatures are never more than 10°C above ambient. The operating system on this computer is Windows XP Pro.

Figure 2 - 'Galileo'

This PC runs all David Taylor's software for about 16-18 hours per day.

'Newton' is my Do Everything Else PC

Newton is not associated with *EUMETCast* and is used for. Internet browsing, email, word processing, PowerPoint, Photoshop etc. It also runs FTP software, regularly downloading data from *Kepler* and uploading it to my web pages. This was originally my son's PC and contains an *AMD Sempron* 1.7GHz processor, 1.25 GB RAM and a 72 GB hard drive with Windows XP Home. I have re-cased this PC, added better cooling and soundproofed it. *Newton* runs 16-18 hours a day.

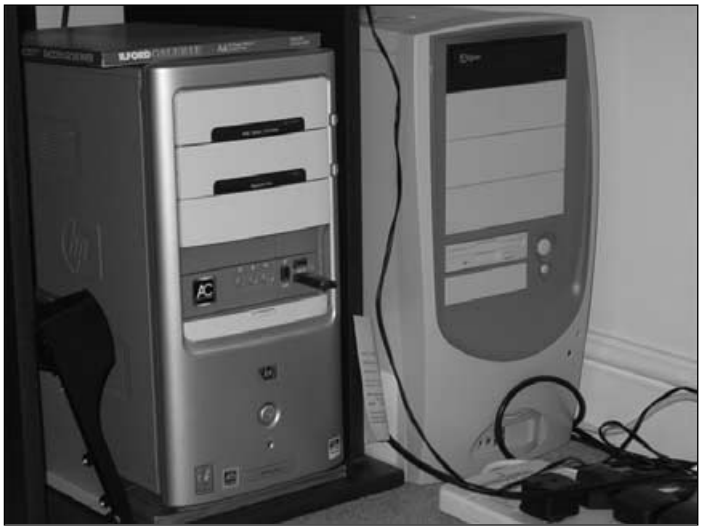

Figure 3 - 'Kepler' and 'Newton'

I operate the System as follows.

Kepler receives *EUMETCast* continuously. Apart from system processes, the only software running is *Setup4PC*, *TelliCast*, *Filezilla Server*, *VNC Server* and *MRTG* monitoring (covered below). There is no anti-virus or anti-spyware running, though I do complete the monthly Windows update.

An essential part of the setup, to minimise data loss, is a RAM Drive. This is a virtual hard drive that speeds up the writing to disk process that the data rates demand. In the *Tellicast* configuration one sets up a folder in this drive where data can be held temporarily before it is written to the hard drive. A file called *0.fsy* is created.

Virtual Network

I can only access this PC by virtual networking from either of the other two PCs: for this I use *RealVNC*, available at:

http://www.realvnc.com/products/free/4.1/download.html

The download is less than 1 MB and is quick and easy to install. Some conflicts between TelliCast and RealVNC have been reported but I have experienced no such problem. I initially installed *Real VNC* so that I could connect remotely from my laptop when setting up the dish and LNB. I could then monitor signal quality wirelessly. Occasionally, I have to connect *Kepler* to the keyboard and mouse for setting up. However, most tasks can be completed via the virtual network.

MRTG

I need to be able to monitor various factors on this PC. I use *MRTG* 2.15.0 (Multi Router Traffic Grapher), a clever piece of software that allows many processes to be checked every few minutes. David Taylor has been posting his results for some time and, towards the end of 2006, was encouraging others to do the same so that *EUMETCast* reception could be monitored Europe-wide.

Consulting

http://www.david-taylor.myby.co.uk/mrtg/EumetcastEurope.html

allows one to check whether poor reception is local or general.

Setup4PC allows Signal Quality (%), Signal to Noise Ratio (dB) and Bit Error Rate (ppm) of the *SkyStar* card to be recorded. I measure total *SkyStar* traffic activity in Bytes per second.

I measure network activity between the receive and processing PCs. The *TelliCast* software records missed and recovered data packets; this data is monitored.

Finally the temporary file '*0.fsy*' is monitored. If the file overfills, usually because of corrupt data in bad weather, one can take appropriate action (delete it).

All this information is held as html files and .png images in a folder called *C:\myweb\documents*.

Setting up MRTG

To set up *MRTG* on a Windows XP computer, first enable SNMP by going into **Control Panel → Add/Remove Programs → Add/Remove Windows Component**, and make sure *Management and Monitoring tools* is checked.

One also needs, if not already installed, *Active Perl*, which can be downloaded from:

http://www.activestate.com/Products/ActivePerl/

and MRTG_2.15.0 available from:

http://oss.oetiker.ch/mrtg/

Go to Downloads → Stable Release and select *mrtg-2.15.0.zip*. Download this file then unzip and install it. Go back to the website and click on 'Documentation', select '*mrtg-nt-guide*' and follow the instructions for building a configuration file. You will have to add extra lines to your configuration file, plus some perl scripts, to monitor the various parameters you require. These all need to be placed in the '*mrtg-2.15.0/bin*' folder. The program *b2status.exe* needs to be added to the 'bin' folder.

Once *mrtg.cfg* has been correctly configured, you should be able to run it by typing the command

perl mrtg mrtg.cfg

to start MRTG from the Windows Command Shell. If it is working correctly, results files should start building up in the directory you have specified.

For extra information and examples of files needed see:

- my website:

http://www.alanbanks.org.uk/EumetsatReceivingStation.html

- David Taylor's website:

www.satsignal.eu

From there select EUMETCast under Network Statistics

- Fred van den Bosch has a full set of files on his download page at

http://www.fredvandenbosch.nl/downloads.html

- and I have put a zip file to download them at

http://www.alanbanks.org.uk/MRTGSetup.html

Galileo, the processing PC, is switched on first thing in the morning and all the relevant software runs automatically. It takes an hour or so to catch up with the overnight downloads, the MSG data taking the longest.

At the moment I am running the following software from David Taylor.

- To manage and decode Meteosat-9 (MSG-2) data, I use *MSG Data Manager*.
- To manage and decode Meteosat-8 (MSG-1) rapid scan data, I use a second copy of *MSGDM*. I start this manually after the first copy has processed MSG-2.
- To manage and decode Metop-A data I use *Metop Manager* and to do likewise for the NOAA 17/18 data I use *AVHRR Manager*.
- To make real-time animations from Meteosat-9 or Foreign Satellite Data, I use *MSG Animator*. I am currently running two copies; the second for the rapid scan MSG-1 data.

I use the following as needed

- To make false-colour images, remap to standard map projections, or animate the images from MSG data I use *GeoSatSignal*.
- To make false colour corrected images from Metop-A and NOAA AVHRR data I use *HRPT Reader*.
- Kepler Manager (satellite orbital information)
- For satellite tracking - *WxTrack*
- To geometrically map images - *GroundMap*

Defragmenting

I run anti-virus and anti-spyware software and also use *mst Defrag*, which continuously monitors and defragments all the drives on the PC. The huge volume of write/rewrite operations that occur with all the data would need daily (or at the most, weekly) manual defrags . I found *Windows Defrag* used a lot of resources and took quite a long time. *Mst Defrag* runs in the background and uses little in the way of resources.

The Tellicast System

Data is transmitted from the various spacecraft to Earth stations in Germany (Meteosat 8 and 9), Svalbard (Metop-A) and the Canary Islands, Northern France, and Svalbard (NOAA 17/18 AVHRR). Meteosat 9 data is refined, compressed and encoded as HRIT and LRIT files which are added to the EUMETCast data stream and sent up to the *Hot bird-6* satellite as small 'packets' of data tagged with a packet identifier called the PID. Other packets of data for AVHRR, Metop-A and Foreign Satellite Data (FSD) are also sent up to *Hot bird-6*, but with different packet identifiers (PIDs).

At the receiver one uses the setup for the DVB card to choose which PIDs the card should handle. The data is sent from the DVB card to the *TelliCast* receiving program as an *IP multicast stream* and is now further divided into different channels. A single PID may contain a number of different streams, but each stream will have a different multicast address.

The multicast address of the 'Announcement channel' stream is fixed, and that channel 'talks' to the *TelliCast* program stating what data is available. The *TelliCast* program is configured to accept particular data channels (by editing the recv-channels.ini file in the TelliCast software). When a data stream becomes available the DVB software and the TelliCast software interact with one another, the former verifying that *Tellicast* can handle the data; only if it can (and this may involve an authorisation check through your eToken), will the DVB software actually process the stream and make it available. The data is then written to the configured target drive using, as a temporary folder, the file '*0.fsy*' on the RAM Drive.

Finally, I make use of MSG Data Manager software to convert these files into a usable format for producing images.

Newton - the Utility PC

This is the third PC, which I use for all my other computer needs, including email, browsing, writing this etc.

Those tasks relevant to the EUMETSAT images are as follows:

1 Image enhancement

using *Adobe Photoshop*. Most of the images received warrant further manipulation. I know our editor prefers the raw image when publishing, providing him with no lost data. Generally the images I use are either for presenting at Astronomy workshops or publishing on my web site.

2 File Transfer using AutoFTP Pro

My setup here is as a result of wanting to have my own home web server using the third PC. I have a full copy of my website on this PC, which allows me to check the functionality of the site. *AutoFTP* downloads the *MRTG* data from 'Kepler' (C:\myweb\documents) every 5 minutes. Also in that folder are the saved results (downloaded with the MRTG data) of scheduled jobs from *GeoSatSignal* working on the processing PC. *AutoFTP* then uploads *MRTG* data every 10 minutes to my website and each of the results of the *GeoSatSignal* jobs once per day. Other uploads, such as page updates and new images are sent manually.

3 Web Publishing

This is not so difficult as it may seem. I first tried to set up a web server at home but my ISP wouldn't allow this. It is probably much more secure not to have a web server at home anyway. I bought some web space from *Streamline.net*, which cost me about £29 for two years with a '.org.uk' domain name.

All the software you need is free and I eventually found stuff easy to load and use although I did have a few false starts.

Although I haven't built a web server at home you need some means of checking what you're doing and building a complete copy web site at home before uploading to the web is in my view essential.

Setting up your Web Server

Open Windows **Control Panel → Add/Remove Programs → Add/Remove Windows Components**. If you have a line that says '*Internet Information Services (IIS)*', uncheck it.

You now need to install an application called *AppServ*, which is available at ***http://sourceforge.net/project/***.

To obtain the latest win-32 version, type *AppServ* in the 'Find' field then click 'Downloads'. On the following page, download the file marked 'Appserv Open Project'. Install AppServ. On the opening screen, select 'Apache HTTP Server'. When it asks for 'Server Name' insert your server's Internet URL; when it asks for 'Administrator's email address', insert your email address. You will find that the folder 'c:\Appserv' has now been created, containing a subfolder called 'www'. This is where all the web documents you create must go.

Next, you require the web authoring package *NVU*, which can be downloaded from ***http://www.nvu.com***. Once you have installed *NVU* you can start using it to build web pages, which you must save, along with any images you have included, into your *c:\appserv\www* folder. I learned the bare bones of *NVU* by borrowing *Build Your Own Website* by Kyle MacRae from the library [1].

Once you've got all that sorted you will need web space and some means of uploading the files to it. For file uploading, you will need something like *AutoFTP*, which can be downloaded from ***http://www.primasoft.com/ftp.htm***.

Finally, you require *Active Perl*. This can be downloaded from ***http://www.activestate.com/Products/ActivePerl/***. Just install it and forget about it. There is lots on the web about building your own website. Give it a go.

So there you have it, three PC's under one desk in almost constant use. I've stuck with Windows for all three. I have tried Linux on Newton, but networking is not so easy and I wasn't using the full capacity of the PC.

I post my MRTG monitoring on the web every 10 minutes. I post Met-9 images of 0600, 1200 and 1800 UTC. I regularly add interesting images to the site front page. The whole exercise has been a steep learning curve. The MRTG in particular drove me to distraction over Christmas 2006. As was said recently on a yahoo group "Nothing is obvious until it is obvious to you".

Final Thoughts

A three-PC system may seem extravagant. However, I believe it is a cost effective solution to an upgrade path. One PC I already owned, and I upgraded it by local and *Ebay* purchases. The second was a cheap all inclusive deal—there always seem to be good deals on last year's model. The third was effectively free. I'm sure many GEO members have family gamers who are always upgrading to the latest model, so grab their cast-off' gear when you can. Apart from *EUMETCast*, David Taylor's software and *Photoshop*, all other software I have used is free. The KVM switch was less than £20. There are KVM switches for 4 or more PC's; the cheap ones don't work and reliable ones are expensive.

If your single-PC *EUMETCast* system is struggling, adding a basic specification second or even third PC is effective. The only downside I have is that the 'office' can get a bit warm in summer!

1 *Build Your Own Website* - The complete step-by-step guide to creating a website, by Kyle MacRae is published by the Haynes Group (ISBN: 9781844251162).