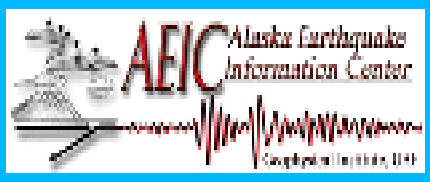


Alaska Earthquake Information Center

University of Alaska Fairbanks

Delivery of Earthquake Notification Systems to Emergency Managers in Alaska

AEIC Internal Report 2008-04

by Glenn Thompson, Roger Hansen, Josh Stachnik and Mitch Robinson

August 2008

Suggested citation:

Thompson, G., Hansen, R., Stachnik, J., Robinson, M., 2008, Delivery of Earthquake Notification Systems to Emergency Managers in Alaska, University of Alaska Fairbanks, AEIC Internal Report 2008-04.

This version was last revised: August 2008

This document, any updates to it, and any additional information are available at:
http://www.aeic.alaska.edu/AEIC/internal/report/2008-04/

The Alaska Earthquake Information Center is a cooperative program between the Geophysical Institute of the University of Alaska and the U. S. Geological Survey with support from the Earthquake Hazards Programme.

Table of Contents

1. Heading1 1
Heading 1.1 1
1. The Development System 4
1.1 Directory structure 4
1.2 ORBSERVER CONFIGURATIONS 5
1.2.1 Orbserver sgms:6510 (summary) 5
1.2.2 Orbserver sgms:6511 (eocserver) 6
1.2.3 Orbserver sgms:6512 (eocmirror) 7
1.3 Other key programs and aliases 8
1 INTRODUCTION 12
Hardware 12
2 SOFTWARE 14
1.1 DBEVENTS (ANTELOPE) 14
3 References 25
4 Computers: 27
5 Data import modules: 27
6 Processes: 27
7 Cronjobs: 27
8 Data export modules: 27

1. Heading1

Heading 1.1

Some text…

Project coordination, main contacts:

Roger Hansen, roger@giseis.alaska.edu

Mark Roberts, mark.roberts@alaska.gov

UAF systems administration:

Mitch Robinson, mitch@giseis.alaska.edu

Paul Delys, paul@gi.alaska.edu

The tcp/ip network information:

Identifier	*ip address*	*Subnet Mask*	*Machine name*	*Data direction*
Fairbanks EOC	216.67.105.44	255.255.255.255	Ash	Pull
Fort Richardson	209.165.165.93 (no firewall?)	255.255.255.224	AEIC-iMac-Fort-Richardson	Pull
Anchorage Muni EOC	209.193.41.116	255.255.255.224	AEIC-ANC_EOC	Pull
Valdez EOC	209.161.163.48, 10.10.10.90/24	10.10.10.1	AEIC_Valdez_EOC	
Kodiak EOC	208.155.82.110 (public, no firewall)	255.255.255.240	AEIC_Kodiak_EOC	
Seward EOC	192.168.1.22 internal, 24.237.136.125	255.255.255.0	AEIC_Seward_EOC	
Soldotna EOC	192.168.210.233 internal, 192.168.210.1 gateway, 209.193.25.111 public	255.255.255.0 (internal), 255.255.255.192 public	AEIC_Soldotna_EOC	
Bill Witte's iMac	137.229.51.99	255.255.255.255		Push

Identifier	***ip address***	***Subnet Mask***	***Machine name***	***Data direction***
giseis network	137.229.32.0	255.255.255.0	N/A	
AEIC wall iMac			lappcip1.giseis.alaska.edu	Pull
GI wireless network	137.229.29.0	255.255.255.0	N/A	
GTMac			GTMac	Pull

To remote login, use the following command:

ssh eoc@ip-address

To transfer files, use the following command:

sftp eoc@ip-address

EOC contact information:

Identifier	***Physical address for deployment***	***Primary contacts***	***Systems administrator***
Fairbanks EOC	Fairbanks North-Star Borough Emergency Operations Center, 3175 Peger Road, Fairbanks, AK 99709-5499	Barry Jennings David Gibbs dgibbs@co.fairbanks.ak.us	Steve Smith <ssmith@co.fairbanks.ak.us>, Don Logan <dlogan@co.fairbanks.ak.us>
Fort Richardson	State of Alaska Division of Homeland Security and Emergency Management State Emergency Coordination Center, National Guard Armory, Fort Richardson, Anchorage.	Bryan Fisher<b.fisher@alaska.gov>	David Lee <david.lee@alaska.gov> Mark Merchant mark.merchant@alaska.gov
Anchorage Muni EOC	Municipality of Anchorage Emergency Operations Center, 1305 E Street, Anchorage, 99501.	Vince McCoy McCoyVG@ci.anchorage.ak.us Kattaryna Stiles, Acting Director, 343 1407	Roberts, John C. <RobertsJC@ci.anchorage.ak.us
Valdez EOC	Valdez City Hall, 212 Chenea Ave. Valdez attention Chris Farmer Fedex 2nd day – doesn't recommend any ground services	Fire Chief George Keeney Ph# 835-4560, gkeeney@ci.valdez.ak.us, Eric Phillips ephillips@ci.valdez.ak.us	cfarmer@ci.valdez.ak.us (IT Head 907 835 4313

Identifier	***Physical address for deployment***	***Primary contacts***	***Systems administrator***
Kodiak EOC	Kodiak Island Borough Police Department, 217 lower Mill Bay road, kodiak. Attention: Bud Cassidy, Paul Van Dyke, Kris Brewster (Need to send by FedEx or UPS)	Bud Cassidy 486-9363, bcassidy@kib.co.kodiak.ak.us	Paul VanDyke <pvandyke@kodiakak.us> Karl Short <kshort@kodiakak.us> Duane Dvorak <ddvorak@kodiakak.us> Kris Brewster kbrewster@city.kodiak.ak.us>, Information Systems Administrator City of Kodiak 907-486-8668
Seward EOC	Seward Fire Department (City Emergency Operations Center / Dispatch), 316 4th Avenue, Fire Station? Ups ground, attn jan melvin	David Squires, 2(2)4-3445, dsquires@cityofseward.net Jan Melvin,	Mike Meeks (IT Head, mmeeks@cityofseward.net) 907 362 1855, Josh Estes Kirsten Vesel <kvesel@cityofseward.net> Phillip Oates <poates@cityofseward.net>
Soldotna EOC	The Kenai Peninsula Borough Emergency Operations Center, 253 wilson lane , soldotna, 99669 (Bob Jones, 8/7 will send ip address) attn scott walden	Scott Walden 262-2097, swalden@borough.kenai.ak.us	Hanson, Ben <BenHanson@borough.kenai.ak.us> Jones, Bob <Bjones@borough.kenai.ak.us>, 714-2110

The CISN_Display usernames & passwords used are:

Identifier	***Installation date***	***Other information***
Fairbanks EOC	12/11/07	
Fort Richardson	04/30/08	

Identifier	*Installation date*	*Other information*
Anchorage Muni EOC	01/05/08	
Valdez EOC		
Kodiak EOC		
Seward EOC	08/04/08	
Soldotna EOC	08/05/08	
Bill Witte's iMac	01/11/08	

Software overview:

Server:

System diagram

Directory structure

Programs developed (dbevents_aeic, delete_event, dbsubset2orb, orbsegment, parseShakeMapArchive, rename_webmaps)

Client:

System diagram

Directory structure

Programs developed (watch_for_deletes, dbevents_aeic)

Project repository (Mac software)

An Antelope-based system for delivering near-real-time seismic data to Emergency Operations Centers in the state of Alaska

1. The Development System

1.1 Directory structure

The development system is located at /home/glenn/dev/ = ($DEV). Under here are several directories including:

bin/	Where executable code is stored

bin/	Where executable code is stored
cache/	Where webmaps and shakemaps are stored are “cached” on disk
db/	Where databases are stored
lib/	Where any code libraries are stored
man/	Where man pages are stored (documentation)
orb/	Where each orbserver is configured
pf/	Where parameter files are stored
src/	Where source code is stored

Three orbservers are configured in the $DEV/orb directory:

Alias	Orbserver	Description
summary	sgms3:6510	Creates a mirror or the live summary database at $DEV/db/dbsum/dbsum
eocserver	sgms3:6511	Furnishes an orbserver with all the data that need sending to a remote EOC
eocmirror	sgms3:6512	Replicates the operation of an EOC client at a remote location

Each orbserver has the following directory structure:

rtexec.pf	The parameter file for rtexec
bin/	Contains aliases to executables needed in $DEV/bin
db@	An alias to $DEV/db
logs/	Logfiles from processes on this orbserver
orb/	Files containing current contents of this orb
pf/	Contains aliases to parameter files needed in $DEV/pf
rtsys/	Contains a database of the startup and shutdown times of processes on this orbserver
state/	Files containing state information needed for some processes

1.2 ORBSERVER CONFIGURATIONS

1.2.1 Orbserver sgms:6510 (summary)

Description:

- The purpose of this orb is to produce a mirror of the live summary event database “/iwrun/sum/db/dbsum/dbsum”, which can then be modified without any damage to the live systems being caused. This developmental summary database is then stored at “$DEV/db/dbsum/dbsum”.

- origin2orbpf.pl is used to place /pf/orb2dbt packets corresponding to origins (which match certain criteria) in the live summary database on $ORB.

- orb2dbt then processes these packets, creating the developmental summary database.

Processes running:

- orbserver -p $ORB pf/summary.pf
- bin/origin2orbpf.pl -s 60 -n 4 -m 0.0 -t 60 $DBSUM $ORB logs/last_lddate
- orb2dbt -select '(/pf/orb2dbt)' -v -overwrite -state state/orb2dbt $ORB $DB

Directories:

bin/
- origin2orbpf.pl -> /home/glenn/dev/bin/origin2orbpf.pl*

pf/
- orb2dbt.pf -> ../../../pf/orb2dbt.pf
- summary.pf -> ../../../pf/orbserver.pf

1.2.2 Orbserver sgms:6511 (eocserver)

Description:

- The purpose of this orb is to act as a clearing house for iMacs at remote EOCs to connect to to download seismic data.

- origin2orbpf.pl is used to place /pf/orb2dbt packets corresponding to origins (which match certain criteria) in the developmental summary database on $ORB.

- orbdbt2orb.pl processes these /pf/orb2dbt packets and segments corresponding waveform data from $ORBWFSEG and places those data on $ORB.

- rename_recenteq_gifs.pl monitors the recenteqs website for new events, copies the corresponding webmaps (gif files) and places these into $DEV/cache/webmaps and send/webmaps.

- Events deleted by the Duty Seismologist using dbevents_aeic will also result in a corresponding (event_time).del message file being posted in send/delete.

- orbxfer2 processes new webmaps found in send/webmaps and delete messages placed in send/delete and places these on $ORB.

Processes running:

- orbserver -p $ORB pf/eocserver.pf
- bin/origin2orbpf.pl -s 60 -n 4 -m 0.0 -t 60 $DBSUM $ORB logs/last_lddate
- bin/orbdbt2orb.pl -v -p pf/orbdbt2orb.pf $ORB $ORBWFSEG $ORB
- orbxfer2 -w send $ORB

Cronjobs running:

- bin/rename_recenteq_gifs.pl /usr/local/mosaic/Seis/recenteqs_sub/quakes /$DEV/cache/webmaps send/webmaps (every 5 minutes)

Directories:

bin/
- orbdbt2orb.pl -> ../../../bin/orbdbt2orb.pl*
- origin2orbpf.pl -> ../../../bin/origin2orbpf.pl*
- rename_recenteq_gifs.pl -> ../../../bin/rename_recenteq_gifs.pl*

pf/
- eocserver.pf -> ../../../pf/orbserver.pf
- orbdbt2orb.pf -> ../../../pf/orbdbt2orb.pf2dbt.pf -> ../../../pf/orb2dbt.pf

send/
        delete/
        webmaps/

1.2.3 Orbserver sgms:6512 (eocmirror)

Description:

- The purpose of this orb is to mirror the system that will be available on iMac computers at various EOCs around the state of Alaska.

- orb2orb copies all data from the eocserver (sgms3:6511) orb, including /pf/orb2dbt packets, waveform data, webmaps and delete messages.

- orb2dbt builds a parametric earthquake database from the /pf/orb2dbt packets which should match the developmental (and live) summary databases, subsetted according to criteria set on the eocserver. The output database is db/eocdb/eocdb.

- orb2db builds the corresponding waveform tables in the same database.

- orbxfer2 saves the webmaps into received/webmaps (for use by dbevents_aeic) and the delete messages to received/delete.

- watch_for_deletes monitors received/delete, and acts on delete messages it sees there by running delete_event to delete the corresponding event from the eoc database. It also removes any corresponding webmap (from received/webmaps/) and shakemap (from shakemaps/).

Processes running:

- orbserver -p $ORB pf/eocmirror.pf
- orb2orb $ORBCH $ORB
- orb2dbt -v -select '(/pf/.*|/db/.*)' -overwrite -state state/orb2dbt $ORB $DB
- orb2db -p pf/orb2db.pf -S state/orb2db_data $ORB $DATADB
- orbxfer2 -p pf/orbxfer2.pf -S state/orbxfer2 $ORB

Cronjobs running:

- bin/watch_for_deletes -p pf/watch_for_deletes_eocmirror.pf $DB received/delete

Directories:

bin/
- delete_event -> ../../../bin/delete_event*
- watch_for_deletes -> ../../../bin/watch_for_deletes*orbdbt2orb.pl -> ../../../bin/orbdbt2orb.pl*

pf/
- eocmirror.pf -> ../../../pf/orbserver.pf
- orb2db.pf -> ../../../pf/orb2db.pf
- orb2dbt.pf -> ../../../pf/orb2dbt.pf
- orbxfer2.pf -> ../../../pf/orbxfer2.pf
- watch_for_events_eocmirror.pf -> ../../../pf/watch_for_deletes_eocmirror.pf

received/
        delete/
        webmaps/
cache/
        webmaps -> ../received/webmaps
        shakemaps/

1.3 Other key programs and aliases

dbevents_aeic (in $DEV/bin/) is used to examine event databases. Most commonly it will be run on the live summary database, the developmental summary database or the EOC database.

The alias **duty_dbevents** is used to run dbevents_aeic on the live summary database, in which case the parameter file $DEV/pf/dbevents_aeic_duty.pf is used. This has yet to be implemented – the current system wide alias points to an old version of aeic_dbevents.

The alias **dev_dbevents** is used to run dbevents_aeic on the developmental summary database $DEV/db/dbsum/dbsum, and again the parameter file $DEV/pf/dbevents_aeic_duty.pf is used. This gives the user the permission to delete events from the database, (old) QDDS system, Shakemap system and EOC system. To handle the deletes, the script ***delete_event*** (in $DEV/bin/) is called. This does 6 things:

1) The event is deleted from the developmental summary database.
2) A delete message is placed into $DEV/orb/eocserver/send/delete, to initiate the process of deleting the event from the EOC system.
3) The 'cancel' program is called to delete a ShakeMap corresponding to the event (if it exists)
4) The QDDS delete script is called to delete the event from QDDS. Note, this uses the old Antelope-QDDS interface. Mitch is developing a new one which will use an ignore database, and the delete_event program will then need to create a record in this ignore database to initiate an event deletion from QDDS.
5) If it exists, the corresponding webmap is deleted from the cache at $DEV/cache/webmaps.
6) If it exists, the corresponding ShakeMap is deleted from the cache at $DEV/cache/shakemaps.

The alias **eoc_dbevents** is used to run dbevents_aeic on the eoc mirror database $DEV/db/eocdb/eocdb. The parameter file $DEV/pf/dbevents_aeic_eocmirror.pf is used.

Note that ***delete_event*** is also run by the program ***watch_for_deletes*** (which runs as a cronjob) on eocmirror. In this case it does 3 things:

1) The event is deleted from the eoc mirror database, $DEV/db/eocdb/eocdb.
2) If it exists, the corresponding webmap is deleted from the local cache at $DEV/orb/eocmirror/cache/webmaps.
3) If it exists, the corresponding ShakeMap is deleted from the local cache at $DEV/orb/eocmirror/cache/shakemaps.

NEAR-REAL TIME DISPLAY OF EARTHQUAKE LOCATIONS AND MAGNITUDES AT EMERGENCY OPERATIONS CENTERS

Two different solutions – which is better?

Questions:

1. ***What type of computer (PC, Mac, Sun) can your organization support?***
2. ***What operating system (Windows, MacOS, Linux, Solaris) can your organization support?***
3. ***Do you care about seeing waveforms?***
4. ***How many minutes "latency" is acceptable?***

Current problems diagnosed from dbevents:

1. There are no waveforms for EHZ in any of the databases.
2. There are no arrivals for EHZ on travel:6510.
3. aeic_dbevents does not run on MacOS.
4. dbevents does not have audible voice, so can't use this (however, a geographic region & map can be configured).
5. when connecting to database on travel remotely, get a "can't find 'elev'" problem. This is not a problem when running from travel. Have to use database on inverse instead!
6. aeic_dbevents somehow needs merging with dbevents.
7. orbdbt2orb segments waveform data multiple times. How can this be eliminated?
8. how do I import shapefiles into quakewatch and get them to work?
9. how to create waveform data images for quakewatch?
10. probably need to setup a quakewatch server if we choose this solution.
11. discrepancies between what shows up on AEIC wall, duty_dbevents, and what is seen on Mac & travel
12. probably bigger discrepancies with what is seen via qdds
13. what about NEIC solutions and associated magnitude discrepancies?
14. how to

"Antelope"	"QuakeWatch"
FEATURES: • Used by AEIC (events as we see them) • Complicated, but powerful • Commercial software • Runs on MacOS, Linux and Solaris but not Windows (currently a key program only runs on Solaris) • Takes hours to install / configure • Less latency DATA: • Earthquake locations • Town names • Waveforms (optional) • Detection stations (optional) • Topography • Voice announcement of earthquakes	FEATURES: • Designed for emergency managers (tailored) • Simple, but limited • Free (subscription required) • Runs on Windows, MacOS, Linux and Solaris • Takes < 15 minutes to install and configure • More latency • Based on an open-source GIS / easy to add new layers DATA: • Earthquake locations • Town names • No waveforms (yet) • All stations (optional) • No topography (yet) • No voice, just audible alarm • Links to other data: Shakemaps, Felt reports, Focal Mechanisms, Aftershock Forecasts, Tsunami Warnings • Can be filtered for a specific geographic region and magnitude threshold

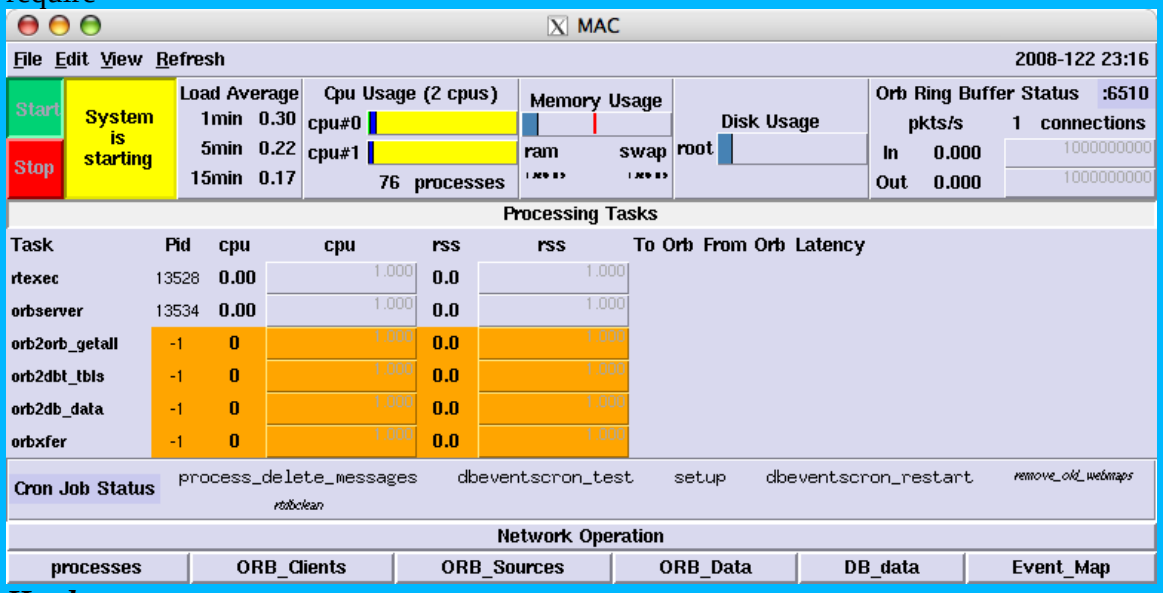
- cisn_display took 30 minutes for 23:46:43
- antelope took 4 minutes!

EARTHQUAKE NOTIFICATION SYSTEM: USER GUIDE

1 INTRODUCTION

The Alaska Earthquake Information Center (AEIC), based at the Geophysical Institute, University of Alaska Fairbanks, has been funded by the Department of Homeland Security to develop a near-real-time notification system for earthquakes in Alaska that can be , to a number of regional emergency operations centers (EOCs) around the state of Alaska. As well as providing information such as the latitude, longitude, depth and magnitude of an earthquake, a goal is to provide a link to information about the intensity of ground shaking.

The solution the AEIC decided upon was to provide two separate notification systems, for reasons of redundancy and robustness. ***Antelope*** is a commercial real-time seismic data acquisition and analysis package which forms the backbone of the AEIC's seismic monitoring programme. ***CISN_Display*** is a free program which allows emergency managers to view recent earthquake activity. Antelope does not run on Microsoft Windows, and a choice had to be made between MacOS, Linux and Solaris. The AEIC felt that of these, MacOS would be the easiest to configure and support at remote sites. The AEIC primarily uses Solaris in its offices, and while this is probably the most stable operating system of all, MacOS comes close, and does not require



Hardware

iMacs were the cheapest Macintosh that capable of supporting two monitors. They are also visually very impressive.

The iMac has the following specifications:

- 20 inch widescreen LCD display

- 2.16 Ghz Intel Duo Processor
- 4MB cache
- 1 GB of RAM
- 250 GB hard drive
- 128 MB graphics card
- built-in iSight web camera
- Ethernet card
- 2 firewire ports, 3 USB 2.0 ports
- wireless network ('AirPort') card
- integrated stereo speakers and microphone (required for audio announcements)

To this has been added a 3-button USB mouse, a miniDVI to DVI adapter, and a 23 inch Cinema HD widescreen monitor.

The AEIC uses a commercial real-time seismic data acquisition and analysis package called ***Antelope***. This is installed on this iMac, and this allows a remote EOC to view real-time earthquake information in the same way as scientists and technicians at the AEIC do. The program for viewing the data is called *dbevents* [Figure 1] and this should be displayed on the left-hand-side monitor. A continuous TCP:IP connection is made to a server at the AEIC to transfer earthquake parameters as soon as they are computed, which is usually 1-5 minutes after an earthquake has occurred (it may be longer if the event is way out in the Aleutians). Waveform data are also copied, as soon as they become available, but these may take a few minutes longer.

Figure 1: The *Antelope* program *dbevents*. This consists of four panels. Left: a map of the selected earthquake event (circle) and the seismic stations the earthquake was detected on (triangles). Top-center: the earthquake event list shows just one event. Bottom-center: the origin

list shows that two origins were computed for this event. Right: the waveforms are shown from each station on which the event was detected.

On the right-hand-side monitor (which is the iMac computer itself), you will see CISN_Display. This is not an AEIC product. It was developed by the California Integrated Seismic Network (CISN). However, most of the earthquake parameters for the state of Alaska are computed by the AEIC, and then sent to one of the CISN servers. CISN_Display connects to one of these servers, and downloads new earthquake data as soon as they are available. The time delay for this system is longer, usually on the order of 10 – 20 minutes.

Figure 2: *CISN_Display*. This consists of 4 panels. The main panel is the map, centred on South-Central Alaska. Below this is information about the currently selected event, which is marked with an arrow on the map view, and highlighted on the event list (top right). Bottom right is a legend and tools for zooming, scrolling and resetting the map view.

2 SOFTWARE

There are two main applications you should see on this iMac, "dbevents" and "CISN Display". Both of these are designed to show recent earthquake events, and mainly consist of a map view and a list view:

1.1 DBEVENTS (ANTELOPE)

On the left hand screen you should see a program called 'dbevents' which is part of a real-time seismic monitoring package called "Antelope", written by Boulder Real-Time Technologies. The Alaska Earthquake Information Center buys a licence for Antelope, and it is the foundation of our data acquisition, event detection, location and magnitude

determination systems. AEIC also develops its own Antelope modules, several of which have been critical to this project. dbevents is just one of many Antelope programs we have extended, and it is a tool for viewing and earthquake database created by other Antelope programs. It consists of 4 main panels:

1) On the left is the large map [Figure 3]. The circle indicates the earthquake epicenter (or 'origin'). The triangles indicate seismic stations on which the event was detected (a blue triangle for any station used for that origin, an orange triangle for any station that wasn't used). By clicking on a triangle, the station code should popup. There may be more than one circle, meaning that more than one origin was computed for this event. As the seismic waves spread out, Antelope finds detections from additional stations, and recomputes the origin. If the event triggers our seismic alarm system, the Duty Seismologist will review the event within about 40 minutes, and compute a new origin, which will then overwrite all automatic origins. Right-clicking on an origin (a circle) on the map brings up a summary of that origin, and options to display a detailed map of that event, or a ShakeMap (if there is one, usually there will not be). Ignore the options to review or delete the event.

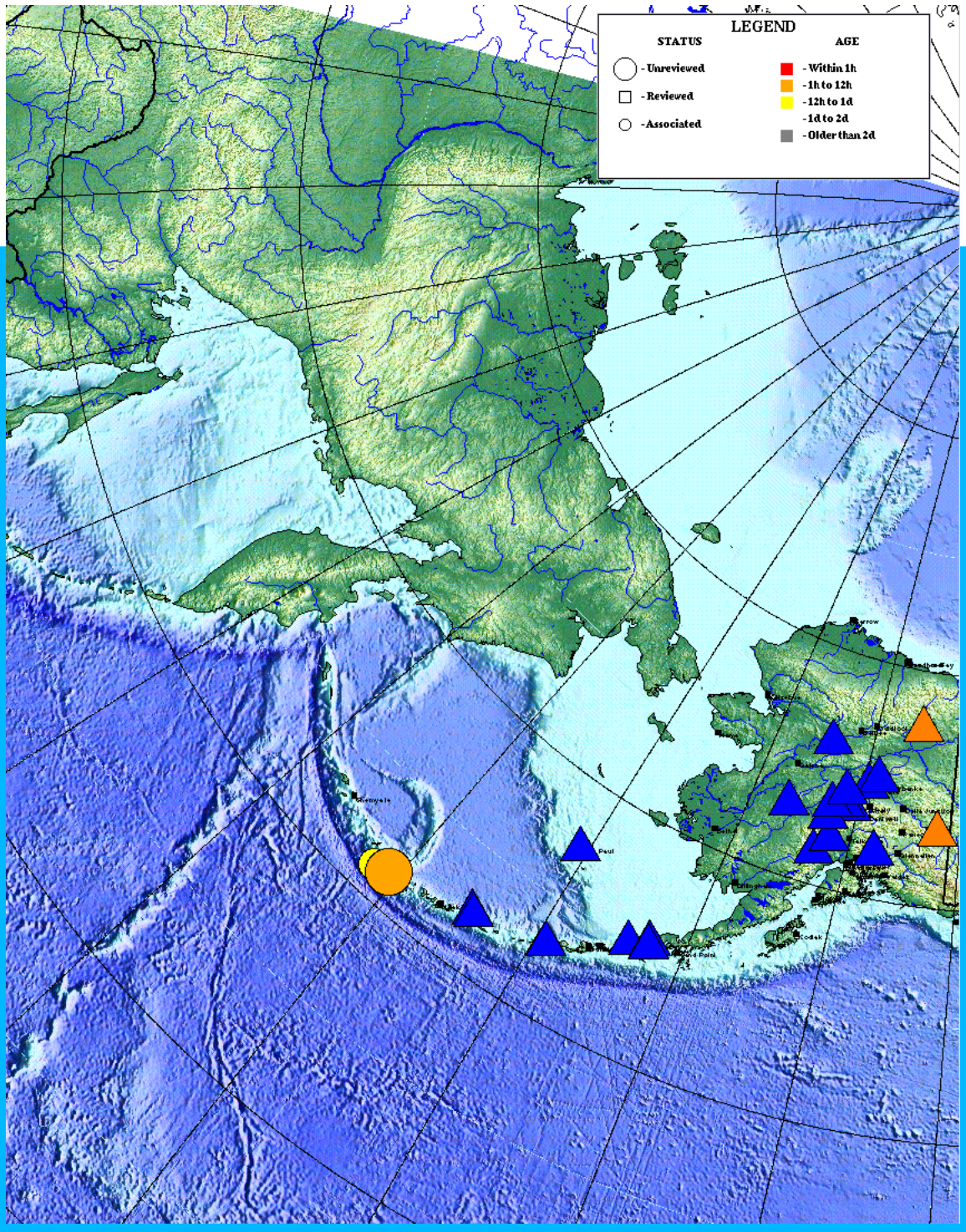


Figure 3: map panel from dbevents.

2) The panel centre-top shows the list of events. The UTC (GMT) time of each event is shown, along with its magnitude, the number of stations it was detected on, and the Flinn-Endahl Region (area of the world) in which it occurred. The event shown in map view is highlighted in green (this will usually be the most

recent event). Use the mouse to select events. The letter 'r' next to an event in this list indicates the event has been reviewed by the Duty Seismologist (either because it was an alarm event, or because it was mislocated by the automatic algorithms).

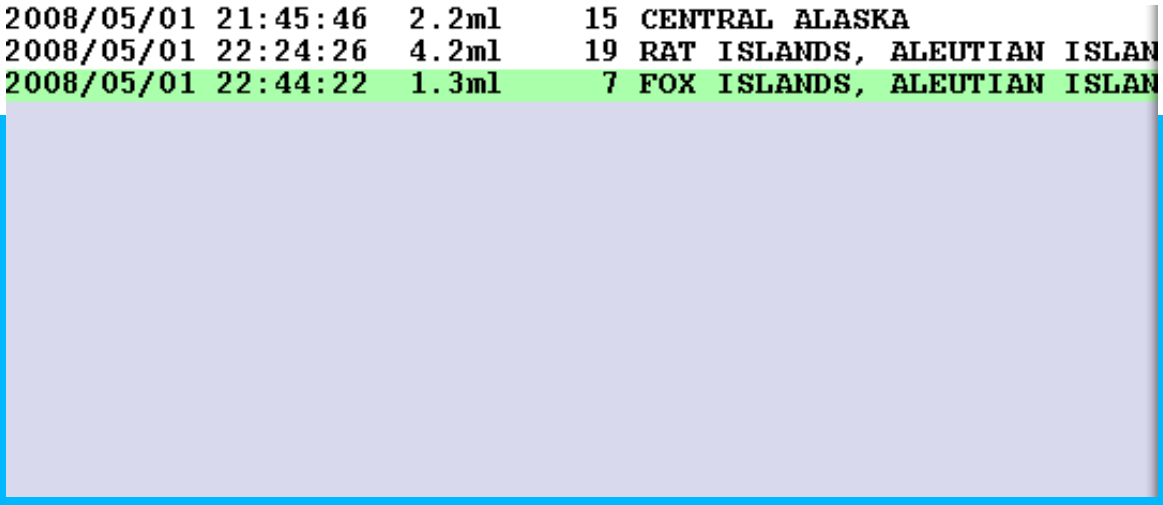
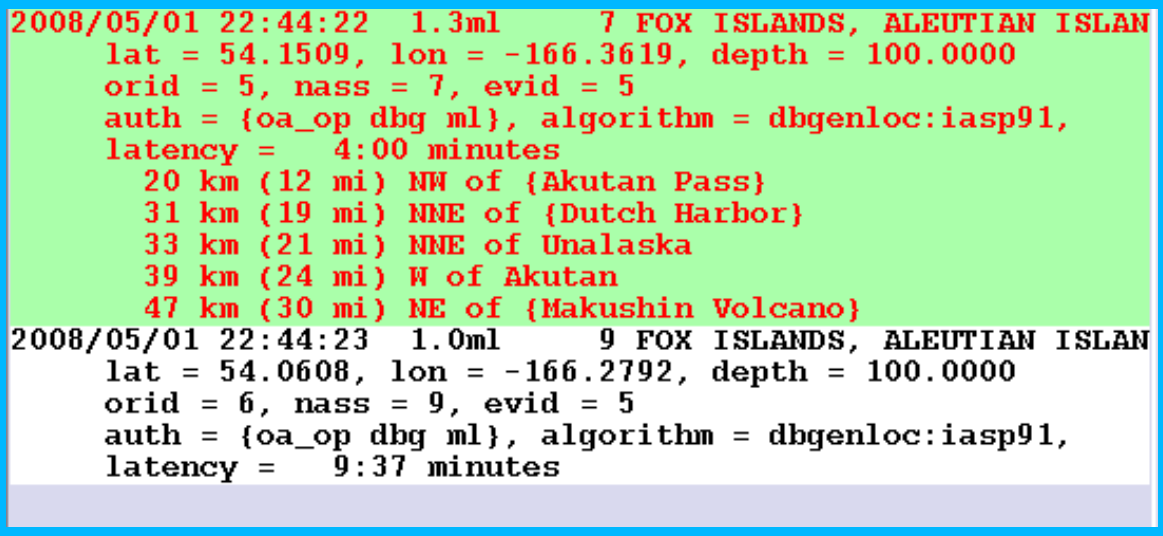


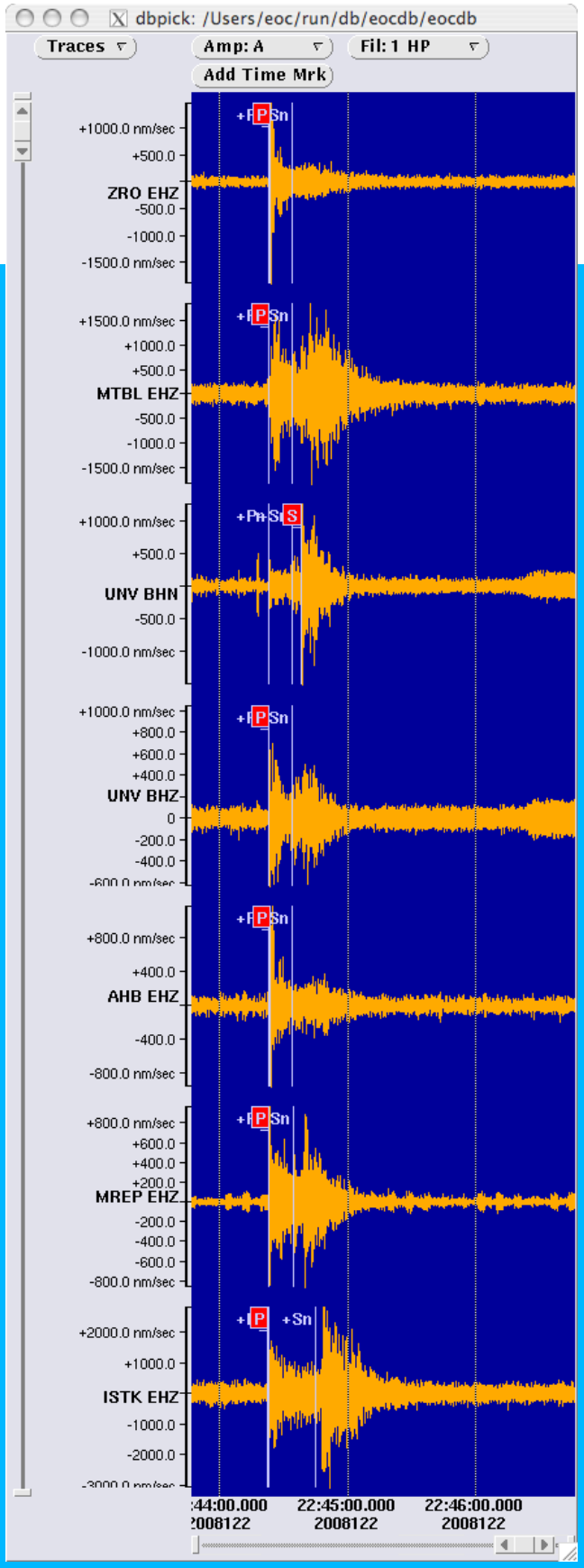
Figure 4: The event list in dbevents.

3) The panel centre-bottom shows the list of all origins for the selected event. As explained above, there can be multiple origins for an event. The selected origin is highlighted in green. The information displayed includes (first line) origin time (UTC), magnitude, number of stations it was detected on, area of the world, (second line) latitude and longitude (in decimal degrees) and depth (in km), (fifth line) latency - i.e. the number of minutes between the event happening and the origin being computed, (additional lines) distances to various communities or landmarks around Alaska.



4) The right-panel is called 'dbpick'. It shows the waveforms for the currently selected origin. When a new event comes in, it usually takes a few minutes for

this to update as the waveform data has to be segmented and downloaded behind the scenes. During this time this panel may appear blank.


dbpick: /Users/eoc/run/db/eocdb/eocdb
Traces
Amp: A
Fil: 1 HP
Add Time Mrk
+1000.0 nm/sec
+500.0
ZRO EHZ
-500.0
-1000.0
-1500.0 nm/sec
+1500.0 nm/sec
+1000.0
+500.0
MTBL EHZ
-500.0
-1000.0
-1500.0 nm/sec
+1000.0 nm/sec
+500.0
UNV BHN
-500.0
-1000.0 nm/sec
+1000.0 nm/sec
+800.0
+600.0
+400.0
UNV BHZ
0
-200.0
-400.0
+800.0 nm/sec
+400.0
AHB EHZ
-400.0
-800.0 nm/sec
+800.0 nm/sec
+600.0
+400.0
+200.0
MREP EHZ
-200.0
-400.0
-600.0
-800.0 nm/sec
+2000.0 nm/sec
+1000.0
ISTK EHZ
-1000.0
-2000.0
+P
+Sn
+S
22:45:00.000
2008122
22:46:00.000
2008122

There is also a menu along the top. As new events are received, they are announced if they are above magnitude 2.0 (this should be configurable through the 'Announce' menu, but as soon as dbevents is restarted, any changes are lost as the parameter file is re-read).

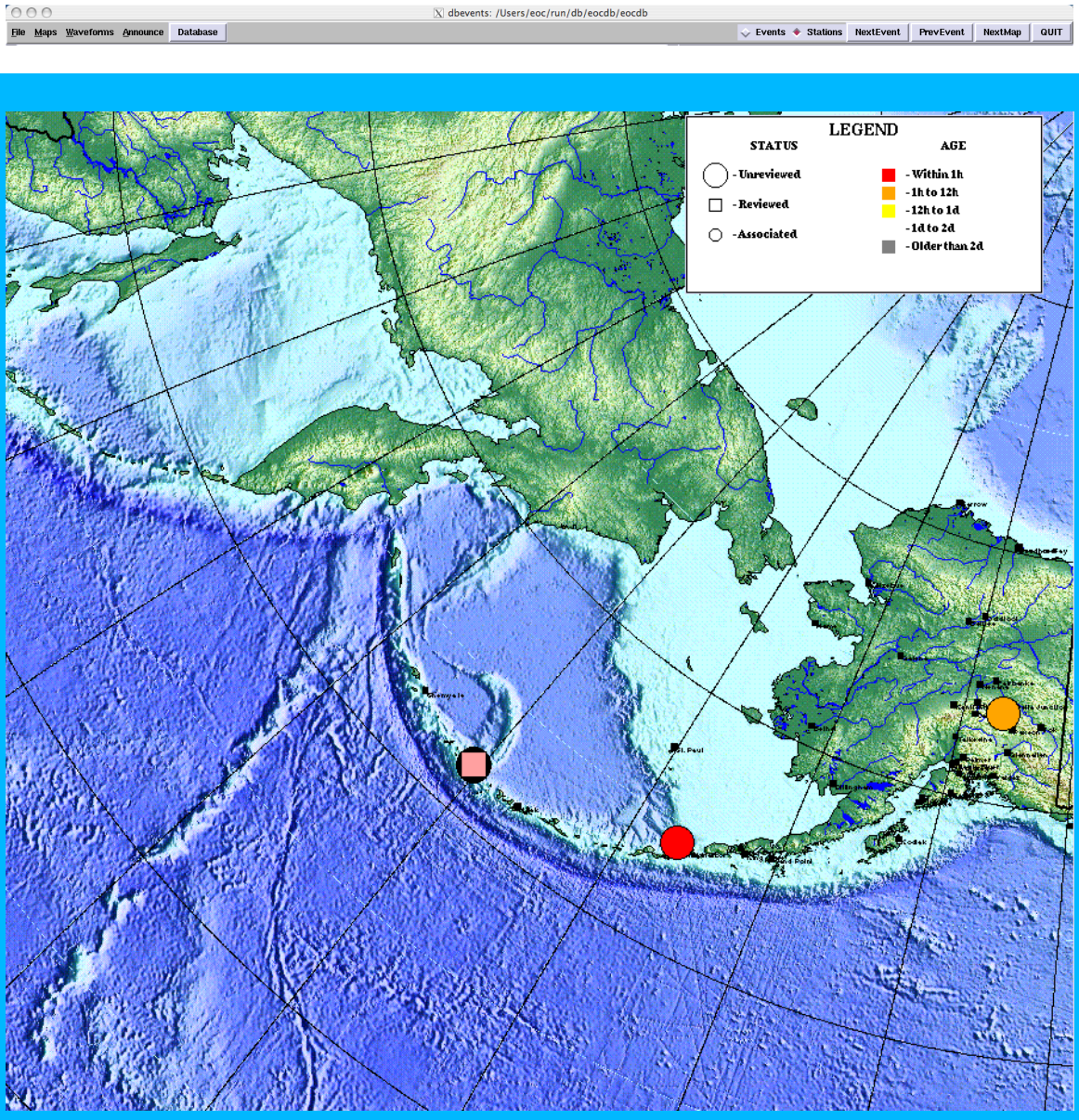


Figure 1: The *Antelope* program *dbevents*. This shows a map of the selected earthquake event (circle) and the seismic stations the earthquake was detected on (triangles: blue indicates station used to compute the earthquake location, orange indicates stations not used). Top-center the earthquake event list shows just one event. Bottom-center the origin list shows that two origins were computed for this event. Right: the waveforms are shown from each station on which the event was detected. The stations are listed in order of their distance from the epicenter. Each waveform here clearly shows an initial onset (P wave) and a later arrival (S wave). The delay between P and S increases with distance.

1.2 CISN DISPLAY

The application you should see on the right-hand side screen is CISN Display. It was created by the California Integrated Seismic Network. All regional earthquake monitoring organisations in the US (and some from elsewhere in the world) send their earthquake information in a format called QDDS to the USGS, and from this a near-real-time database is compiled which sits on a server in California. The CISN_Display software is an program that downloads and plots events from that database. It also consists of 4 panels:

1) The main panel is the map. An arrowhead indicates the currently selected event (usually the most recent event). The size of the symbols indicates the magnitude of the event (see legend, bottom right). To reset the map view, click the 'Reset View' and 'Reset Zoom' buttons (bottom right).

2) The event list shows event time (UTC) and magnitude. The selected event (usually the most recent event) is highlighted in dark blue. Sometimes there will be an 'S' next to an event in this list, indicating that there is a ShakeMap available for this event. ShakeMaps should also be displayed automatically in a web browser (Safari). A 'T' next to an event indicates a tsunami bulletin has been issued.

3) The bottom panel gives more information about each event including Date, Time, Latitude, Longitude, Depth and Magnitude as well as the Data Source (usually the Alaska Earthquake Information Center). Clicking on the 'Info' button should show links to a ShakeMap or Tsunami Bulletin if one was associated with this event.

4) The fourth panel is a legend.

2 BASIC OVERVIEW

AEIC's Antelope real-time monitoring system is very complex. The essential points of interest are that there is a data server in Fairbanks called 'inverse'. Its full domain name is inverse.giseis.alaska.edu. It has an Object Ring Buffer (ORB). An ORB is a circular buffer on disk. New earthquake origins and corresponding waveform data are written to this ORB. The iMac also has an ORB. Data is copied from the ORB on inverse to the ORB on the iMac using an Antelope program called orb2orb. This pulls data from port 6510 on inverse.giseis.alaska.edu to port 6510 on this iMac. To establish an ORB, the Antelope program 'orbserver' is used.

dbevents looks at a database written from data on the orb. The Antelope programs orb2db and orb2dbt write this database.

To stop the database growing without limit, and the accumulation of other files on the system, various scheduled tasks or 'cron jobs' are run.

All these processes are managed by an Antelope program called 'rtexec'. It monitors

programs and restarts them if they crash. Most programs have log files and parameter files.

There is a graphical user interface called 'rtm' which provides a handy way to see what programs are running under rtexec. This is mainly used for configuration and troubleshooting.

CISN_Display is very simple by comparison (though it lacks many of the feautures of dbevents). Ultimately though similar things have to happen in California to create the database it feeds off. And the AEIC data it uses come from Antelope.

3 TROUBLESHOOTING

This shouldn't be too scary, as the iMac installed at the Fairbanks EOC in December 2007 has been working well. However...

If there seems to be a problem with the system, I'd like to know about it (see contact information: section 5). If I am informed, I will try to login to the system remotely using ssh (port 22), if I can. If ssh is not available, I might talk you through some steps on the iMac. Three types of problems that might be encountered are:

i) Computer has frozen: Try to restart using the procedure in section 4. The system is configured to autologin and restart critical software. Its best to use the procedure outlined in section 4, rather than do a hard-reboot, to prevent corrupting the ORB or the database.

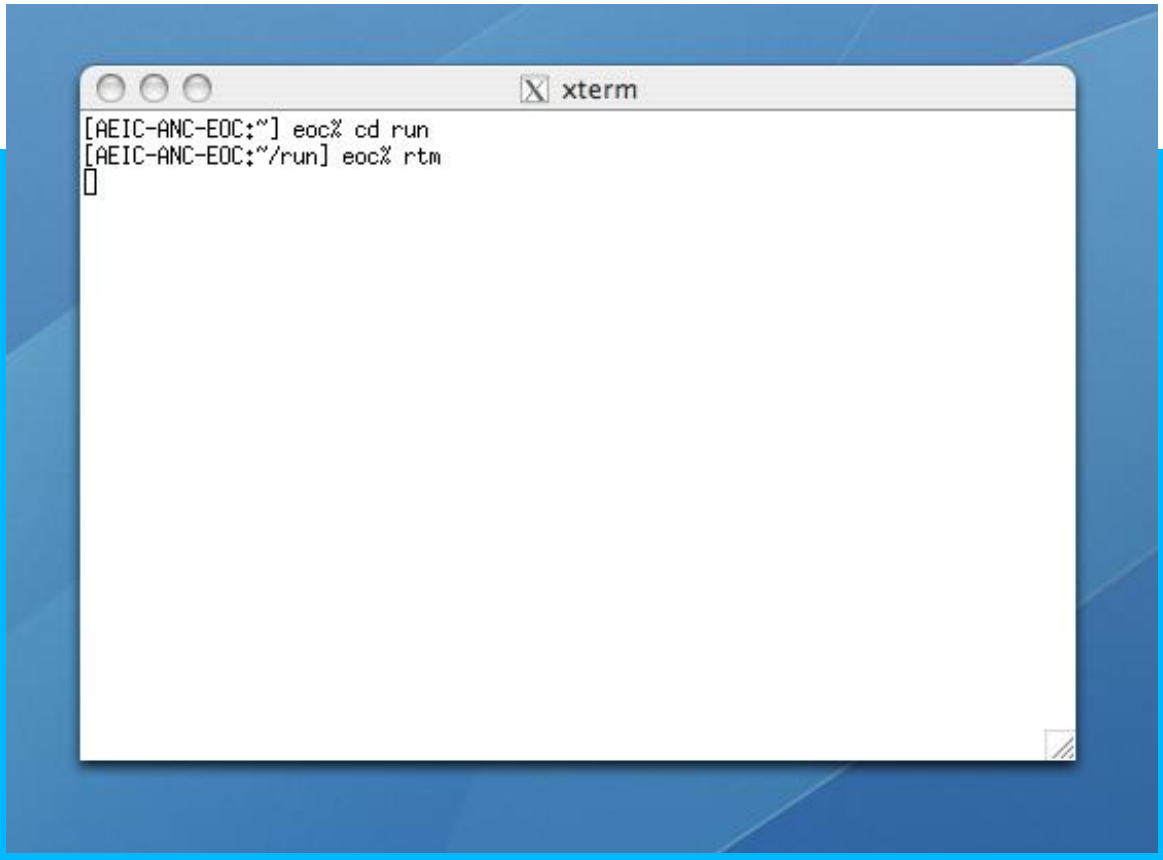
ii) Database or orb has become corrupt: Follow the procedure outlined in section 4, except after 'stop_antelope' (step 3), and before restarting the computer), type:

clean_orb.csh

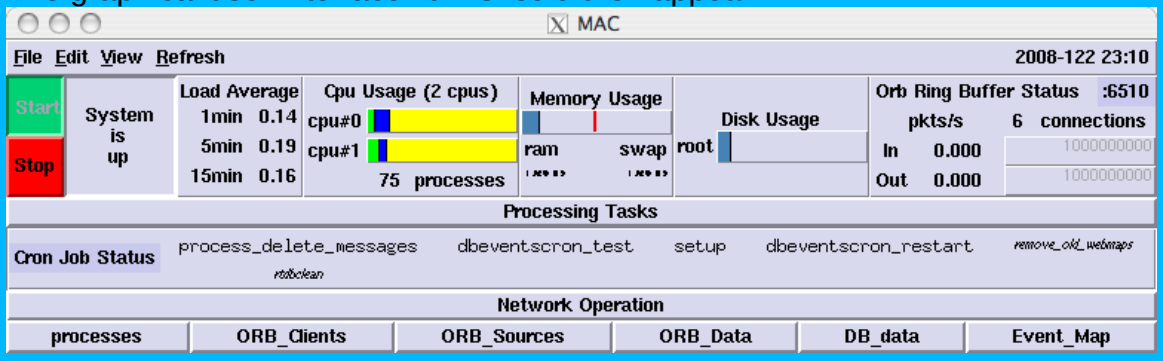
This will clean up the orb and remove the database (you will lose all the events).

iii) ORB communication has been lost: In this case I will ask you to run 'rtm'. First get an X11 terminal window up (see section 4, step 1). Then type:

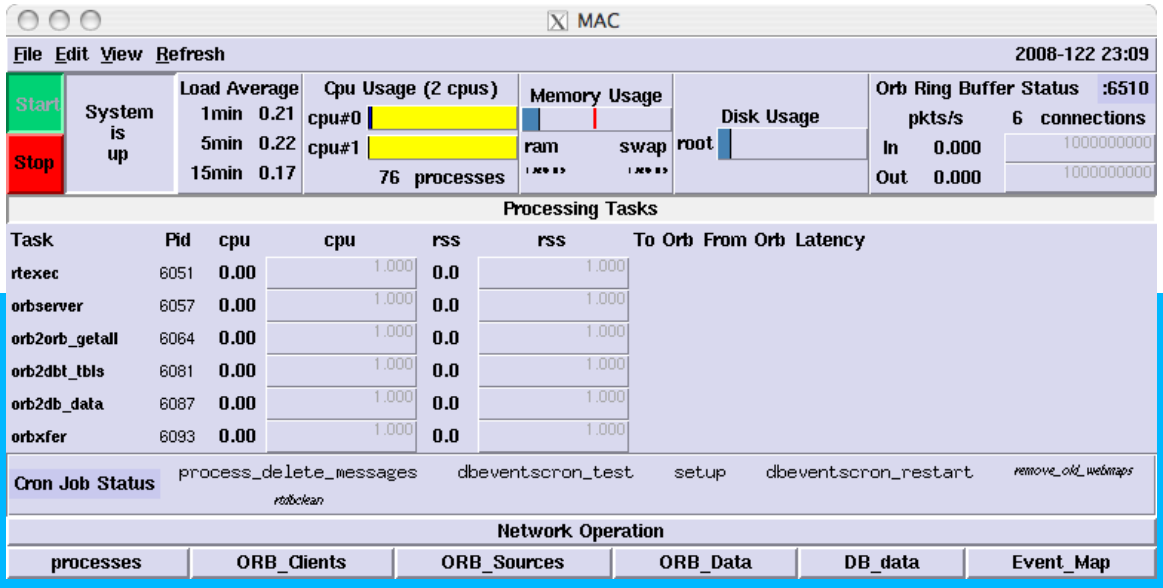
cd run
rtm &



The graphical user interface 'rtm' should then appear.



Click on the 'Processing Tasks' button.



There are 6 processes listed:
- rtexec
- orbserver
- orb2orb_getall
- orb2dbt_tbls
- orb2db_data
- orbxfer

The background around each of these should be gray. If it is yellow or orange, is the Pid field next to it -1? This indicates the process is dead.

To the right of the area marked 'Cron Job Status' there are 5 jobs listed:
- process_delete_messages
- dbeventscron_test
- dbeventscron_restart
- remove_old_webmaps
- rtdbclean

Its not important to know what these are. But again the background should be gray. If its orange or yellow, let me know.

4 RESTARTING THE iMAC

Its preferable to stop Antelope prior to shutting down the computer, otherwise the ORB or the database could become corrupt, and no new events will be received. The most robust method is outlined below:

1.Start X11: There should be an icon on the panel on the bottom of the screen which looks like a big 'X'. Click on this. You should then see the menu bar at the top of the

window change to X11. It should have the menus 'Applications', 'Edit', 'Window' and 'Help'.
2. Click 'Applications' and then, in the drop-down menu that appears, 'Terminal'. This should bring up an xterminal (the Unix prompt).
3. In the terminal ("at the command line") type:
stop_antelope
(and hit <return>)

4. Hit return. Wait for at least 10 seconds. Then click on the apple icon on the top menu bar, and select 'Restart'.
5. The computer will now shutdown, reboot, autologin (as user 'eoc') and restart CISN_Display and rtexec (the Antelope program that controls all other Antelope programs).
6. Start X11 again (see step 1) and bring up a terminal window (see step 2).
7. At the terminal type:
start_antelope
(and hit <return>)

This gives rtexec permission to start other Antelope processes. Within 2-3 minutes, the dbevents window should appear.

5 CONTACT INFORMATION

Glenn Thompson
Seismologist
Alaska Earthquake Information Center
907-474-7424
glenn@giseis.alaska.edu

or:

Roger Hansen
State Seismologist
907-474-5533
roger@giseis.alaska.edu

http://www.aeic.alaska.edu

3 References

Boore, D. M., W. B. Joyner, and T. E. Fumal (1997). Equations for estimating horizontal response spectral and peak acceleration from western North American earthquakes: A summary of recent work, Seism. Res. Lett., 68, 128-153.

Youngs, R. R., S.-J. Chiou, W. J. Silva, and J. R. Humphrey (1997). Strong ground- motion relationships for subduction zones, Seism. Res. Letters, 68, 58-73.

Wesson, R., Frankel, A., Mueller, C., and Harmsen, S. (1999) Probabilistic seismic Hazard Maps of Alaska, USGS Open-File Report 99-36.

Wald, D. J., Worden, B. C., Quitoriano, V., Pankow, K. L, ShakeMap Manual: Technical Manual, User's Guide, and Software Guide, http://pubs.usgs.gov/tm/2005/12A01/.

4 Computers:

5 Data import modules:

6 Processes:

7 Cronjobs:

8 Data export modules:

orb2orb	copies data to another orb
orb2db -r (stationlist)	creates waveform database for all stations not listed (r=reject). These data go to directories like /iwrun/op/run/db/archive.
orb2db_diag -m (stationlist)	creates waveform database for diagnostic stations. These go to directories like /iwrun/op/run/dbdiag/diagnostic.
orb2dbt	creates triggered waveform database and writes to directories like /iwrun/op/run/dbseg/quakes.
orb2db_avo -m (stationlist)	no manpage, but matches (m) the station list and writes them to directories like /iwrun/op/archive_wf/avobaddata/avobaddata.
orbptrigger	triggers tdmt_launch to be run whenever specified packets appear on the orb.
orb2ew	Export to an Earthworm server (for AVO stations)
orb2dbt_web	Seems to create database /iwrun/bak/run/webquakes/quakes. This seems to be linked to the dbrecenteqs cronjob.
orb2vdl	to nsn8.cr.usgs.gov (no manpage).

checkhomerdata	?
make_archive_dblinks	links wfdisc table to a day-volume in the archive
split_archive_database	splits out old days from an rt1.0 archive waveform database being written by orb2db

archive_status_plot	makes plots summarising the archived continuous database
rtreport	useful statistics on network performance / data flow
rtdbclean	remove old waveforms and associated wfdisc rows from real time system
dbsplitcron	?
remove_old_archive_waveforms	removes daily archived waveform directories older than 80 days. Run in conjunction with split_archive_database, which archives current data to daily directories after 2 days.
dbrecenteqs	watches a real-time db of hypocenters and generates maps and related XHTML content.
update_finger	?
rtdbclean	removes old waveforms and corresponding wfdisc runs from dbdisplay/dbdisplay real time database.
Touch_wfdisc	?

orbdetect	a multi-frequency STA:LTA detector
orbtrigger	real-time network trigger
orbassoc	spatial real-time associator/locator. Produces arrival, assoc, event and origin records (which are written to database by orb2dbt)
orbmag	real time Richter/local magnitude computation. Takes packets written by orbassoc and modifies origin packets. Optionally produces netmag and stamag packets too.
orbampmag (mb)	similar to orbmag
orbampmag (ms)	similar to orbmag
orbgenloc	generates a generalized gauss-newton location in real time.
orbwfmeas	this looks for '/db/detection' packets, performs the measurement specified, and then writes new '/db/wfmeas' packets back to the orb.
dbgme	seems to generate a grid of intensity or ground motion for hazard maps. Seems like data goes to /home/shake/run/db/quakes.

orb2orb	copies data packets from one orb to another
grf2orb	?
ida2orb	imports data from an ida hub
q3302orb	from Quanterra 330 dataloggers
k22orb	from Kinemetrics Altus digitizers
guralp2orb	from Guralp digitizers acquired via Scream!
liss2orb	acquire Live Internet Seismic Server data (miniSEED?)
adsend2orb	important analog data from Earthworm
dbt2pf	seems to bring in initial releases from /Seis/catalogs/releases, but no manpage.
orb2dbt_web	seems to be a database linker to data from 6511
orb2dbt2orb	importing data from ice, but no manpage

orbwatch	

fk	data concentrator	137.229.32.207
earlybird	operational system (/iwrun/op)	137.229.32.250
energy	migrational system (/iwrun/mig, which is actually the modern development system)	137.229.32.60
ice	backup system (/iwrun/bak)	137.229.32.103
nordic	development system (/iwrun/dev)	137.229.32.109
inverse	exports eqs to Menlo Park & EOCs	137.229.32.208
tele	alarm response processes	137.229.32.?
moment	Nagios server/display server for wall (Nagios is a popular open source computer system for network monitoring).	137.229.32.40
cdvaeic	for ShakeMaps	137.229.32.142
aeicpipe	for pipeline alarm system	137.229.32.106

There are 6 projects:

1. Pipeline monitoring project
   - Roger and John are working, and Kent may get involved

2. EOC (FEMA funded) project
   -
3. USGS/ANSS (Menlo Park) project

4. Denali National Park Visitors Center project

5. Master events database (Artak)

6. USGS ShakeMap project (Artak)

Its projects 2, 3 and 4 I need to concern myself with at this stage.

EOC Project

BACKGROUND

Sometime in 2004-5, Josh had set up a system that AEIC used to send database tables and waveforms corresponding to events to an EOC at Fort Richardson near Anchorage. Ft. Richardson. At that EOC an orbserver and aeic_dbevents were run. At some point the software stopped working and was no longer maintained. We now need to get it running again, and extend it to other EOC's around Alaska.

Josh has provided the following comments regarding the system that was operational in the past:

" [there] was an operational system at Fort Richardson for quite some time. I think it ran well for the most part. Most of the issues were from poor network connections and nobody was really certain what the system down there was supposed to accomplish. They weren't really sure of what they wanted so I wasn't sure how to cater the software to their needs. I think this is a big part of the EOC push. Hopefully each EOC won't have different system goals. I believe there are some people coming up to Fairbanks to work this out. I went down to Ft. Rich several times to work with them. Very nice people, but nobody was really sure what it's real purpose was. i think the ball is rolling now with some real funding. "

GOALS

Essentially the EOCs need a map showing the locations and magnitudes of events, and their distance from towns and cities. They might also want event waveform data, and maybe continuous data too (good way to see if data are being acquired).

We will probably have 6 EOCs to send data to. And we want to mirror the system we install at each here. So whenever we walk by the screen we can do a visual "its working". Josh was great a writing software. What we also need is to document the software and monitor it day by day.

The strategy suggested by Roger was:

1) Get it the old system running again, which should only take a day or so.
2) Set up a virtual EOC in the lab, on the AEIC wall.
3) Test on a Macintosh computer with 2 monitors, as this would be easier to maintain than Sun/Solaris at an EOC.
4) Have this system ready to show at an EOC meeting at Fairbanks in February 2007.
5) Install at an EOC in Fairbanks first, and maintain this till stable.
6) Extend to other EOC's.
7) If the Antelope-based solution looks difficult, CISN or some kind of webserver based delivery of data could be the answer. CISN pushes data. It might be more practical than running Antelope at lots of EOCs. Natasha and Mitch seem to favour a non-Antelope approach, but there might be a need to develop a lot of new software to deliver such a solution.

ANALYSIS OF THE OLD SYSTEM

This was made difficult by the lack of information concerning the old system:

- no report concerning the history, the design or the maintenance of the system
- no information about which programs constituted the system, or where the source or binary code was located
- no man pages

The learning curve was made somewhat steeper still since it was not clear how the system interfaced with the Antelope software, existing AEIC databases, or AEIC's complex real-time system. So steps had to be taken to learn about all of these simultaneously.

The key to understanding the real-time system is to examine the rtexec.pf file on a particular computer. This file is like a more complex form of a crontab file, but contains information about background processes to initiate and monitor, as well as environment variables and cronjobs. It is run by the the Antelope program 'rtexec', which is an executive for running real-time processes.

By looking at rtexec.pf in the $FEMA_RUN directory (where FEMA_RUN = /net/inverse/export/inverse/fema/run) it could be seen that the program orbdbt2orb was being run, but was pointing to a non-existent parameter file, so it could not have been doing anything. Since Josh was probably the last person to change this, its likely orbdbt2orb had not therefore run successfully for at least 1 year.

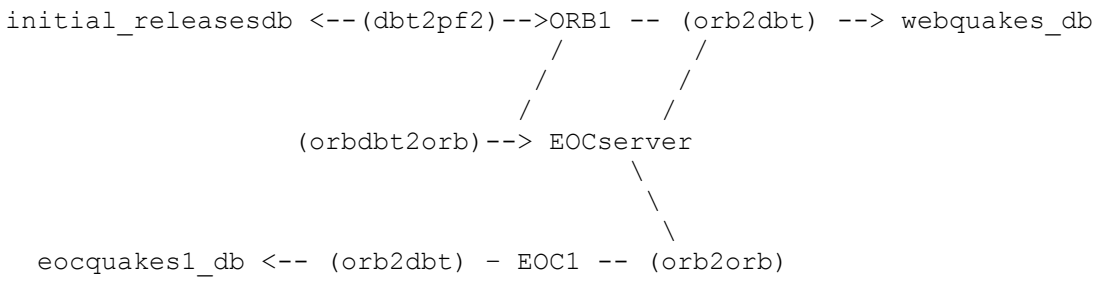
orbdbt2orb watches an orb and sends segmented waveforms to another orb. orbdbt2orb was set up to detect orbdbt2orb.pf packets from ice:6513, and then pull data from ice:6513 and write it out to inverse:6510 by invoking orb2orb. Other processes (orb2dbt and orb2db) were running, with the intention of extracting the packets placed on the inverse:6510 by orbdbt2orb, and writing them to a database along with the corresponding waveform data. Its not clear if orbdbt2orb copies the waveform data, or whether a separate orb2orb process is required to copy continuous data onto inverse:6510, so that orb2db can access it.

orbdbt2orb is looking for any /pf/orb2dbt packets. These exist on many other orbs,
depending on which solutions are desired to be processed. Now, there's a small caveat to orbdbt2orb. It simply looks for /pf/orb2dbt packets. The new and improved associator (orbassoc) spits out lots of these. As more arrivals are picked for a single event, new associations are made and /pf/orb2dbt packets created. orbassoc can be tuned to make an event association after 5,10,15...however many you want, picks are made. SO, in its current
state, orbdbt2orb will blindly process all of these /pf/orb2dbt packets. This isn't a real big deal except that a lot of extra network traffic is created. The receiving orb will be running orb2db and shouldn't duplicate waveforms in the wfdisc. This is just something to be aware of and I don't have a fix for it...yet.

Josh has provided an example packet, orb2dbtexample.pf. He also mentions that dbt2pf2.pl (see “Master Events database') reads the same packets.

DESIGN

This diagram gives an indication of how the new system should look:



Wherever orb2dbt is shown in this diagram, orb2db is also implied.

So dbt2pf2 reads new entries on the initial releases database, and places them on ORB1 (currently ice:6513). orb2dbt then merges these data packets with an output database (currently webquakes_db) AND also copies these packets onto EOCserver (currently inverse:6510). This is the 'clearing house' for EOC data. orbdbt2orb also copies /pf/orb2dbt packets from ORB1 and places them on EOCserver.

EOCserver would be a dedicated orb at AEIC (currently inverse:6510) containing all data necessary for the EOCs. This dedicated orb would have:
-segmented waveforms from orbdbt2orb
-database packets for all events(/db/origin, /db/assoc, ...)

orb2orb processes are then run on a computer at each EOC to copy data from EOCserver. orb2db and orb2dbt are run at each EOC to build event databases out of these packets, which can then be viewed with aeic_dbevents. The remote EOC rtexec would run:

- orb2orb EOCserver LOCALORB
- orb2db (to archive the segmented wfs)
- orb2dbt (to archive the database tables)

Then a database exists at the EOC for aeic_dbevents (or any other display software) to run off of.

The local (EOC) orb should be running orb2db, which will archive the waveforms in an output database wfdisc. The segmented waveforms from orbdbt2orb end up in a database which can be displayed through aeic_dbevents. The segmented waveforms are a way to avoid streaming tons of continuous data for no good reason. aeic_dbevents solely reads from database tables. orb2dbt writes out the database tables that deal with origins (event, origin, arrival, assoc, detection, etc..). These tables are what aeic_dbevents monitors for incoming events. The waveforms that are shown with aeic_dbevents should be in the wfdisc of the same database as origin, arrival...etc.

Some additional notes on the current setup:

- webquakes_db is the nearest AEIC presently has to a master event database, as far as I can tell. Its not clear if ice:6511 receives only released events (via dbt2pf2) or if it also receives automatically detected events (probably via orb2orb from ice:6510). The latter seems likely.

- This would mean that orb2dbt places all events (that would constitute a master event database) on inverse:6510 at present. And orbdbt2orb would grab all /pf/orb2dbt packets on the real-time system, and copy those onto ice:6510.

- Something else that is unclear is the role of orb2db – from where does it get the segmented

waveform data? Does orbdbt2orb copy this off inverse:6513? Or does orb2db need an orb2orb to be running to access the data? Probably the former.

- There is an orb2orb -m (stationlist) process running on inverse:6510, pulling data from ice:6510. This exists to send continuous datastreams for a good sample of stations from around the state. The EOCs wanted to see continuous datastreams for stations close to important features in Alaska.

- There is a second orb2orb pulling data from ice:6513. This just passes along database tables from ice:6513, produced by orb2dbt. This is how db/quakedb and db/quakedb_data are getting updated, even with orbdbt2orb not running.

Changes to the current setup:

- it seems smart to modify rtexec.pf so that orbdbt2orb reads data from ice:6511 rather than ice:6513, as it would be desirable to reduce dependencies (data are copied from ice:6511 to ice:6512, and from there to ice:6513, creating 2 extra point of potential failure). Josh believes that each orb can handle a lot more traffic, and that /pf/orb2dbt packets exist on many other orbs.

- All code should end up in the CVS repository. Code for the old system is rather disorganised. The main directory is /net/inverse/export/inverse/fema/run/bin at present.

- Code should be properly commented, and summarised with man pages. Presently there is little or otherwise inadequate commenting, and no man pages.

- Josh has noted that orbdbt2orb could be rebuilt based on orbstaseg. However, he feels that this would require multiple instances of orbstaseg – one per station. And it monitors detections rather than arrivals.

- Josh feels that for robustness reasons, the EOC project should be moved to Anchorage, to avoid complications with the state microwave system, fiber-optic cables etc.

- As much as possible, use Antelope components, as these will be maintained by BRTT. Antelope evolves, and we don't want our systems to break as a result. Also search for contributed software.

- Where there isn't an Antelope module to do the job, try to wrap or augment an existing program, or at least use a similar program as a base. And share any useful programs with the Antelope Users Group.

- Need to identify a suitable Macintosh computer to run Antelope on. This needs to be able to drive two monitors.

- Josh feels orbdbt2orb should be revamped and renamed. orbstaseg would be a good basis for both. This is for a single station only. Perhaps something like orbnetseg or orbarrseg?

CODING

orbdbt2orb.pl has been modified:

- the code was more logically organised so that related commands were grouped together
- the directives 'use strict' and 'use warnings' were added to make sure that all variables were used in a consistent manner. Several variables clashed, and these problems were eliminated. Other variables were found to be unused, and were removed. Variables were then given global or local scope as necessary with the 'our' and 'my' commands.
- variables were declared and described at the start of the script. Previously there was no description.
- Unsupported switches were removed.
- Each command was commented and simplified where possible.
- Code was indented in a consistent manner.
- An extensive header was added, to explain the purpose of the program and which will be used to document further changes to the program.
- Repeated code was cleaned up by delegation to a new subroutine.
- Usage information was updated.
- Extensive logging was added, to aid maintenance / troubleshooting.

The new version of orbdbt2orb.pl is named orbdbt2orb_new.pl.

TESTING

Currently orbdbt2orb.pl and orbdbt2orb_new.pl are running in parallel to compare performance. Both are running in manual mode on travel, and looking at packets on ice:6511. The former is outputting to travel:6510, and the latter to travel:6511. Orb2db and orb2dbt are then setup (an instance of each for each orb) to write data to a database (db1 and db2 respectively). The path for the rtexec directory on travel is /export/travel1/run.

While it appears both programs are processing the same data packets in the same way, it is not possible to prove this, as currently no database tables are being produced. This suggests an error with the way orb2db (and orb2dbt?) is setup for each orb. It might also help to switch to automated mode for orbdbt2orb.pl & orbdbt2orb_new.pl.

USGS/ANSS Project

On inverse:6511 it seems orbwatch runs and sends data out AEIC ALERT emails to Woody, Jim Luetgert and Josh, based on magnitude and nearness.

Orb2ew operating on orb2ewmenlo.pf also sends strong motion data from AK8028 (Anchorage) and the Fairbanks array (FA04, FA05,...) to an Earthworm wavetank at Menlo Park.

It should send event data (what ANSS wanted), but orb2ew isn't stable at doing this, so it sends continuous data instead.

Orbwatch should be replaced with orbquakealarm, which can send email, page and SMS based on location, magnitude, nass and author etc.

Denali National Park Visitors Center Project:

Its not clear what software exists at present, but it would seem ideal to develop a common approach to all 3 projects.

Master events database

dbt2pf2.pl (which Josh now thinks should be called origin2orbpf.pl) was written to take event information from a database and write out as a pf packed to an orb, that orb2dbt will reap. In doing this, orb2dbt will write out the event information to another database assigning proper ids (orid , evid, arids) for the rows in the appropriate table.

dbt2pf2.pl was written to monitor the 'releases' database and incorporate analyst reviewed earthquakes into the rest of the system. dbt2pf is key to maintenance of an AEIC 'master' event database that can then be used as the clearinghouse for sending information to EOCs, and all other applications that require the “best” event data available. Josh has provided a manpage origin2orbpf.man, which I added to the man1 directory.

It would appear that at some point db2pf.pl was running on inverse. Now its successor, db2pf2.pl runs on inverse.

Artak has used this script as a basis for creating a master events database that he can eventually use as a source for the ShakeMap project. The real-time system could probably be simplified by rewriting existing applications, and developing new applications, with this master events database as its source.

Josh feels this master event database (and the dbt2pf2 process) should reside on the operational system, and be closely monitored.

ShakeMap

Only thing to note is that Artak found it easier to establish new orbs on his machine as a basis for

this work, rather than getting involved with simplifying the existing complex AEIC real-time system. Moreover, this insulates Artak to a large extent from changes in the real-time system by others.

ShakeMap will eventually rely on the master events database that Artak is creating (above).

Other important software components:

Orbmondb: there is no manpage!

Orbdbt2orb

runs on inverse
but references a parameter file in a directory that doesn't exist!
So it can't possible be working!

i.e. /export/inverse/fema/pf
when it should be
/export/inverse/fema/run/pf

parameter file doesn't say much:
mode =0
pretime, posttime = 360
channels BH[ZNE],SH[ZNE],H[ZNE]

It attempts to pull data from ice:6513 and put it on inverse:6510

Do those input packets on ice:6513 exist on other orbs too? Could they come from elsewhere?

And what happens after output packets are placed on inverse:6510? Does aeic_dbevents just pick them up from the orb? Is there a module that writes a database that aeic_dbevents uses?

I am assuming inverse:6510 is just being used for testing purposes. In rtexec.pf there is a reference to a FEMA ip address, but this isn't used. I'm guessing this is a computer at Fort Richardson.

I've hardened/documented orbdbt2orb and called it orbdbt2orb_new

Question is how do we want to set this up?
Presently its designed only to send data to one output orb
But if we're planning to send same data to multiple orbs, which is better:

- modify this program so it uses multiple output orbs?
- Run many instances of this program, each writing to a single orb?

Does orbdbt2orb create orbdbt2orb packets, or does it reap them?

Seems dbt2pf also reaps these packets, so presume something else is creating them. But what?

But that makes little sense, since dbt2pf clearly reads a database, not an orb.

Dbt2pf

This program is not running.
Rtexec is trying to run dbt2pf.pl, but the only program is dbt2pf2.pl
This is the program Josh now thinks should be called origin2orbpf.pl

Appendix 1

DHS Emergency Management Project: Progress to July 2007

Purpose:

The aim of this project is to deliver near-real-time earthquake alert capability to emergency operations centres around the State of Alaska. What this means is that within about 1 to 5 minutes of an earthquake being recorded, an audible alarm will occur at the emergency operations centre(s), and information such as the location and magnitude of the earthquake will be displayed on a computer monitor. This will automatically provide emergency operations centres with crucial earthquake information.

As noted in the previous report (May 2007) the Alaska Earthquake Information Center (AEIC) has identified two software solutions (*Antelope* and *CISN_Display*) for delivering near-real-time earthquake alerts to an emergency operations center (EOC). Each EOC will be equipped with an iMac computer running both applications. Further background information can be found in that report.

Update:

All of the iMacs and extra (23") monitors were received. Three-button mice on are order - these are required for the Antelope software. The iMacs were configured so that following a power outage, there is an automatic login and restart of Antelope and CISN_Display (dbevents needs starting manually though - full instructions will be provided).

During recent weeks, AEIC installed a new version of the Antelope software on its real time systems. This version has also been installed on all the iMacs for best compatibility. Extensive testing and reconfiguration was required. Moreover a new version of the Antelope program *dbevents* was developed, with all of the extensions required by AEIC for this project. These extensions include the ability to see zoomed-in maps of an earthquake epicenter, to add a voice announcing each event as it is detected, and to display a list of towns and other landmarks and their distance from the epicenter.

AEIC has also documented its interface between Antelope and the USGS QDDS

system which feeds CISN_Display. It has become apparent that there is often a significant delay (tens of minutes) between AEIC submitting events to QDDS and them showing up in CISN_Display, which is unacceptable for emergency management purposes.

Further work:

There is still an issue with segmenting waveform data within Antelope which means that waveform data for all seismic stations that registered an event may not be displayed.

There are a couple of issues remaining from upgrade of dbevents which need to be resolved.

There is part of the real-time system feeding data to the iMacs which is not currently on a UPS or configured to automatic restart following a power outage.

Glenn Thompson
AEIC Seismologist
17 July 2007

Appendix 2

DHS Emergency Management Project: Progress to 30 September 2007

Purpose:

The aim of this project is to deliver near-real-time earthquake alert capability to emergency operations centres around the State of Alaska. What this means is that within about 1 to 5 minutes of an earthquake being recorded, an audible alarm will occur at the emergency operations centre(s), and information such as the location and magnitude of the earthquake will be displayed on a computer monitor. This will automatically provide emergency operations centres with crucial earthquake information.

As noted in the May 2007 report the Alaska Earthquake Information Center (AEIC) has identified two software solutions (*Antelope* and *CISN_Display*) for delivering near-real-time earthquake alerts to an emergency operations center (EOC). Each EOC will be equipped with an iMac computer running both applications. Further background information can be found in that report.

Update:

During this reporting period substantial changes to AEIC infrastructure were made to migrate all data processing systems to a single summary event database. These changes will allow much of the data processing software and data management to be streamlined, making it easier to maintain, troubleshoot, and develop. These changes impact all downstream systems, include the system that has been under development for this Emergency Management Project.

Software is also being developed to allow the AEIC Duty Seismologist to delete bogus events from AEIC's summary event database, and for these deletes to be reflected at remote Emergency Management Centers, in Antelope and CISN_.

Some further modifications were made to dbevents, and other programs developed, to enable AEIC-generated ShakeMaps (coloured contour maps of maximum ground acceleration) to be displayed at remote EOCs. This work is nearing completion.

In the previous report it was noted that there was a significant delay between events being detected at AEIC, and these events appearing in CISN_Display. AEIC has undertaken a major redesign of its QDDS interface, though largely driven by other infrastructural changes at AEIC, which may have eliminated this problem or will

otherwise enable AEIC to better monitor and resolve this problem.

Some components of the software systems mentioned above have now been documented in man pages for AEIC staff. This effort will continue, as such documentation greatly assists AEIC in being able to keep the software needed for the EOC project operational.

Further work:

In addition to ongoing work mentioned above:

- There is still an issue with segmenting waveform data within Antelope which means that waveform data for all seismic stations that registered an event may not be displayed.

- There is part of the real-time system feeding data to the iMacs which is not currently on a UPS or configured to automatic restart following a power outage.

- Documentation needs to be provided for Emergency Managers to understand the software installed on the iMac, and the data analysis available through that software.

Glenn Thompson
AEIC Seismologist
15 October 2007

Appendix 3

DHS Emergency Management Project: Progress to 31 December 2007

Purpose:

The aim of this project is to deliver near-real-time earthquake alert capability to emergency operations centres around the State of Alaska. What this means is that within about 1 to 5 minutes of an earthquake being recorded, an audible alarm will occur at the emergency operations centre(s), and information such as the location and magnitude of the earthquake will be displayed on a computer monitor. This will automatically provide emergency operations centres with crucial earthquake information.

As noted in the May 2007 report the Alaska Earthquake Information Center (AEIC) has identified two software solutions (*Antelope* and *CISN_Display*) for delivering near-real-time earthquake alerts to an emergency operations center (EOC). Each EOC will be equipped with an iMac computer running both applications. Further background information can be found in that report.

Update:

The waveform segmentation problem, mentioned in the previous 2 reports, was finally resolved in November. Since November 20th we have been confident that it is performing correctly.

The first iMac was deployed at Barry Jennings at the Fairbanks North-Star Borough Emergency Management office at the Department of Transport on Peger Road, Fairbanks on December 11th. Firewall access had been preconfigured by Steve Smith (Statewide) and Paul Delys (UAF/GI).

This system exhibited no problems with the high data volume rate in the hours following the magnitude 7.2 earthquake at 0930 on December 19th in the Andreanof Islands when more than 40 aftershocks were recorded.

The iMac apparently was found 'off' a few days later, following a power outage. I have recommended that a UPS be purchased for each iMac that is deployed, which will allow the system to ride though outages of a few minutes. Beyond this, unless a generator automatically kicks-in, the iMac will shut down, and somebody on-site will have to press the start button to boot the Mac up following the restoration of power. All software restarts automatically.

Manpages for all programs were completed.

Further work:

- There is part of the real-time system feeding data to the iMacs which is not currently on a UPS or configured to automatic restart following a power outage. At some stage it would be prudent to switch from inverse to kobuk.

- We have offered to provide Barry Jennings any documentation or other training he feels may be necessary for staff at his office to operate this system effectively. Thus far, no requests have been received. We will make same offer to emergency managers at other sites where iMacs are deployed.

- We anticipate deploying 2 more iMacs in the first quarter of 2008.

Glenn Thompson
AEIC Seismologist
31 December 2007

Appendix 4

DHS Emergency Management Project: Progress to 31 March 2008

Purpose:

The aim of this project is to deliver near-real-time earthquake alert capability to emergency operations centres around the State of Alaska. What this means is that within about 1 to 5 minutes of an earthquake being recorded, an audible alarm will occur at the emergency operations centre(s), and information such as the location and magnitude of the earthquake will be displayed on a computer monitor. This will automatically provide emergency operations centres with crucial earthquake information.

As noted in the May 2007 report the Alaska Earthquake Information Center (AEIC) has identified two software solutions (*Antelope* and *CISN_Display*) for delivering near-real-time earthquake alerts to an emergency operations center (EOC). Each EOC will be equipped with an iMac computer running both applications. Further background information can be found in that report.

Update:

The iMac at the Fairbanks EOC performed well, requiring just one intervention when ip addresses had been modified at the EOC without the AEIC being informed. The new ip address for the iMac simply had to be set on the Geophysical Institute firewall and on the data server (inverse) to rectify the problem.

Attempts were made to get ip addresses the AEIC needed for transmitting data from the Anchorage strong motion network.

The Natural Sciences Department at the University of Alaska purchased a similar iMac, and asked the AEIC to configure this for real-time earthquake notification. This has been running since January 11th.

Further work:

- There is part of the real-time system feeding data to the iMacs which is not currently on a UPS or configured to automatic restart following a power outage. At some stage it would be prudent to switch from inverse to kobuk.

- We have offered to provide Barry Jennings any documentation or other training he feels may be necessary for staff at his office to operate this system effectively. Thus far, no requests have been received. We will make same offer to emergency managers at other sites when iMacs are deployed.

- We will deploy two iMacs in Anchorage as soon as we have the necessary ip addresses.

Glenn Thompson
AEIC Seismologist
31 March 2008

Appendix 5

DHS Emergency Management Project: Progress to 30 June 2008

Purpose:

The aim of this project is to deliver near-real-time earthquake alert capability to emergency operations centres around the State of Alaska. What this means is that within about 1 to 5 minutes of an earthquake being recorded, an audible alarm will occur at the emergency operations centre(s), and information such as the location and magnitude of the earthquake will be displayed on a computer monitor. This will automatically provide emergency operations centres with crucial earthquake information.

As noted in the May 2007 report the Alaska Earthquake Information Center (AEIC) has identified two software solutions (*Antelope* and *CISN_Display*) for delivering near-real-time earthquake alerts to an emergency operations center (EOC). Each EOC will be equipped with an iMac computer running both applications. Further background information can be found in that report.

Update:

An earthquake notification computer was successful installed at two EOCs in Anchorage this quarter. The first was installed at the National Guard Armory at Fort Richardson on April 30th. The second was installed at the Municipality of Anchorage EOC on May 1st. Each installation took was very comfortably completed within 1 work day. However, since the computers had to be driven down from Fairbanks, this was a 4 day trip.

In addition to these iMacs, there is are identical machines running on the 'AEIC wall' and in my office, on the giseis and GI wireless networks respectively. Moreover, there is Bill Witte's iMac in the Natural Sciences building. In total, 6 earthquake notification computers are running, and without difficulty.

On May 30th, Mark Roberts provided preliminary contact information for deployment of the four remaining earthquake notification computers. So far there has been no decision made by the individual EOCs regarding when and where to deploy these computers, nor have any ip addresses been provided.

As the previous quarterly report suggested, the software has been very stable, and consequently there has been a much reduced need for software development this quarter. With the software development phase behind, the main cause of delay in this

project has been administratio n and management. Here are the necessary steps as a list:

1) Get the preliminary contact information.
2) Contact the Emergency Manager, explain the project, and ask for the address where the computer should be installed, and the contact information for the person in charge of computer networking. Convince them the computer is beneficial for them, as is not a burden in any way.
3) Contact the Head of Computer Networking. Explain the project, and the need for a static ip address and ssh access.
4) Agree a date for installation. Also determine how to get there, and make an appointment with someone who can provide access to the office in which the computer will be located.
5) Install Antelope, xtools, CISN_Display, Perl modules and project software on the computer. Ensure it works while connected to the GI Wireless network (½ day).
6) Ask Paul Delys to allow a hole for the given ip address through the GI Firewall on ports 22 and 6510 (0 day).
7) Get a travel authorisation signed (¼ day)
8) Deploy and test (1 day).
9) Complete a travel claim (¼ day).

Experience has shown that the first 4 steps can take weeks or months.

The data server *inverse* has now been upgraded to a more powerful computer and is also now in the server room, so power should now automatically failover to UPS and a backup generator, providing greater reliability.

Further work:

- Determine why the program orbsegment sends more than 1 copy of the waveform data.
- Write Technical Report.
- Write User Guide, and distribute.
- Deploy the four remaining computers.

Glenn Thompson
AEIC Seismologist
1 July 2008

Appendix 6

Configuration of an earthquake notification computer

Glenn Thompson

Original: May 3rd, 2007
Latest revision: February 18th, 2008.

This is an overview of how to setup an iMac intended for an EOC.

---

1 Purchasing

1.1 Buy the iMac at UAF Technology Centre. This involves filling out a purchase order in FrameMaker, getting Roger to sign it, then walking it through the Business Office and getting Roger Smith/Jan Dalrymple to sign it off.

1.2 It is also necessary to buy 3-button mice, miniDVI to DVI adapters, and 24 inch monitors.

---

2 Systems administration

2.1 MacOS should already be installed, and the airport (wireless network adapter) should find the GI wireless network. For initial configuration its necessary to enter some locality info and create an admin account (e.g. glenn or mitch).

2.2 Create the eoc account as an adminstrator too under System Preferences -> Users.

2.3 Login as eoc.

2.4 Install X11. Put in MacOS CD 1 and scroll down to “Optional Installs”. Select X11 under the Applications list after getting through the agreement stuff.

2.5 Install XCode Tools from MacOS CD1. This is needed to make and compile code for Antelope and other applications. There is a folder 'Xcode Tools' and beneath this just double-click the XcodeTools.mpkg icon.

2.6 Applications -> Utilities -> NetInfoManager. Change shell for all accounts (e.g. eoc) to tcsh.

2.7 System Preferences -> Display -> Arrangement
Swap the positions of the monitors so that the 23 inch monitor is on the left. Then dbevents will start in the right place. The tops of the two screens should be level – this means dbevents will be displayed correctly, but the downside is the center line displaces windows.

2.8 System Preferences -> Software Update

Deselect 'Check for updates'

2.9 System Preferences -> Energy Saver
Options -> Automatically restart after power failure
Sleep ->
Computer to sleep after: Never
HD to sleep after: Never
HD to sleep when poss: Hard drive never sleep

2.10 Put Applications/Utilities/X11 in the dock at bottom of screen

2.11 Remove unnecessary applications from the dock (drag to trash)

---

3 Installing Antelope

3.1 Borrow Antelope 4.9 CD from Mitch.

3.2 Create a shortcut to the Apache server:
sudo chmod 777 /Library/Webserver/Documents
ln -s /Library/Webserver/Documents /Users/eoc/webserver

3.3 Go under System Preferences -> Sharing, Enable Personal Web Sharing (Apache webserver).

3.4 sudo vi /etc/ssh_config, uncomment the line for ForwardX11 and set to yes.

3.5 sudo vi /etc/sshd_config, uncomment the line for X11Forwarding and set to yes.

3.6 cd /Volumes/Antelope_4.9

3.7 ./Install_antelope

3.8 Enter licence information.
Name: Glenn Thompson
email: glenn@giseis.alaska.edu
institution: University of Alaska Fairbanks
department: seismology
address line 1: 903 Koyukuk Drive
city: Fairbanks
state: AK
country: USA
zip: 99775

3.9 Start the install.

3.10 mv BRTT-license-request webserver/brtt.html

3.11 On the Sun, go to http://(ip address)/brtt.html – email that file to support@brtt.com

3.12 Customize – runs setup_site to configure Antelope for your network (pfecho site.pf)
Seed Network: AK
Institution: AEIC
Originating Institution: Geophysical Institute, UAF
Mail domain: giseis.alaska.edu
Mailhost: kiska

3.13 Apply patches (starts antelope_update).

3.14 Install licence (when it comes from BRTT)

---

4 Installing AEIC extensions for EOC Project

4.1 cd to /Users/eoc.

4.2 On the Sun build a current version of setup.tar:
(i) cd /home/glenn/dev/src
(ii) make
(iii) cd /home/glenn/EOC_PROJECT/FTP
(iv) make

4.3 Download setup.tar to /Users/eoc:
(i) To do this with Safari, simply go to ftp://giseis.alaska.edu/pub and cd to USERS/glenn/EOC_PROJECT. Download the file, which might end up on Desktop/.
(ii) To do this with FileZilla (if installed): Connect to sgms3.giseis.alaska.edu, user=glenn, pass=?, port=22, and go to directory "/home/glenn/EOC_PROJECT/FTP". Make sure the recipient directory is /Users/eoc. Download.

4.4 Uncompress setup.tar with tar xvf setup.tar. This will create a directory tree home/glenn/EOC_PROJECT/FTP/ in the local directory "/Users/eoc".

4.5 mv home/glenn/FTP/EOC_PROJECT/Users/eoc/* .
mv home/glenn/FTP/EOC_PROJECT/Users/eoc/.* .

4.6 rm -r hom*

4.7 Next we want to test the audio capabilities. To do this simply type the following at the xterm prompt:
test_audio

The announcement should be 'Earthquake In". (Note: on Bill Witte's computer I had to create a symbolic link /bin/awish to /usr/local/bin/wish to get tcl programs to work. I also downloaded and instaklled ActiveTcl but I think this is obsolete).

4.8 Check that ORBCH in rtexec.pf has the ip address for inverse (137.229.32.208:6510)rather than inverse.giseis.alaska.edu:6510.

4.9 Start the cronjob for run_rtexec:
crontab cronfile

Congratulations! You have successfully completed the installation of Antelope for an EOC.

5 Installing CISN_Display

5.1 To install CISN_Display, first you need to register the new user at:
http://www.cisn.org/software/cisndisplay.html
To access this, my details are:
username: glenn@giseis.alaska.edu
passwd: pibsih
reg code: 6SYN7 (old code was XYBZ4Q)

5.2 You will be asked to enter the name and url of the organisation, and a contact name and email. Address details are optional. This should result in your contact being sent an email. Ask them to forward you this so you can complete their registration for them.

5.3 CISN_Display should be downloaded from the website, and installed under the eoc account.

5.4 Change the configuration/settings for CISN_Display:
Filters:
minimum magnitude 2.0 (this is to show up in event list, 3.0 is needed to trigger an alarm)
maximum event age displayed (days) 1.0
minimum latitude 50.0
maximum latitude 72.0
minimum longitude -179.0
maximum longitude -130.0

Configuration:
maximum loaded events age 3.0
center latitude 61.5
center longitude -149.5
zoom scale 24000000
banner graphic AEIC

6 Autorebooting

6.1 Enable the cronjob that makes sure rtexec is running whenever eoc is logged in:

cd /Users/eoc
crontab cronfile

6.2 System Preferences -> Accounts
Login Options -> automatically login as eoc
Login Items (eoc) ->
/Applications/CISN_Display/QWClient
/Applications/Utilities/X11

---

8 Installing ImageMagick

This is needed for parseShakemapArchive.pl to be able to download and convert JPEGs to GIFs for display by dbevents_aeic (tcl/tk program):

8.1 To download:
Web browser, go to: http://www.imagemagick.org/script/binary-releases.php
Download the file: ImageMagick-universal-apple-darwin8.10.1.tar.gz (15.5 MB).
To get it from Sun:
Web browser, go to: ftp://giseis.alaska.edu/pub/USERS/glenn/EOC_PROJECT/
8.3 This will probably download to eoc's desktop, and be gunzipped automatically
8.4 chmod 777 /Users/eoc/Desktop/*.tar & mv to /Users/eoc
8.5 su glenn
8.6 mkdir /downloads
8.7 cp /Users/eoc/*.tar /downloads
8.8 cd /downloads
8.9 tar -xf Image*.tar
8.10 exit (from su glenn)
8.11 if .tcshrc has environment variables MAGICK_HOME & DYLD_LIBRARY_PATH & path including MAGICK_HOME/bin set it should work

These are the parameters that should appear in .tcshrc:

setenv MAGICK_HOME /downloads/ImageMagick-6.3.6
setenv DYLD_LIBRARY_PATH $MAGICK_HOME/lib
set path = ($MAGICK_HOME/bin $path)

---

9 How to install LWP::UserAgent

This is needed for parseShakemapArchive.pl to work:

9.1 Download libwww_perl_5.805.tar.gz from CPAN. Alternatively, just get the tar file from downloads/ at ftp://giseis.alaska.edu/pub/USERS/glenn/EOC_PROJECT/ (or CD) and skip 7.2-7.7
9.2 It should automatically be unzipped
9.3 mv to /Users/eoc
9.4 chmod 777 libwww*.tar

9.5 su glenn
9.6 cd /downloads
9.7 cp /Users/eoc/libwww*.tar .
9.8 tar -xf libwww*.tar
9.9 rm *.tar
9.10 cd libwww*
9.11 sudo perl Makefile.PL
9.12 sudo make (this step will fail if Xcode Tools not installed at 1.6)
9.13 sudo make test
9.14 sudo make install
9.15 exit
9.16 rm /Users/eoc/*.tar
9.17 /Users/eoc/.tcshrc file should have PERL5LIB setenv to "/opt/antelope/perl5.8.8/lib/site_perl/5.8.8"

---

10 Creating a backup CD

10.1 Insert a blank CD.

10.2 Open in Finder and burn CD of /downloads, /docs and setup.tar.

---

10 Enabling Remote Access

10.1 Go under System Preferences -> Sharing
10.2 Enable Remote Login (ssh).
10.3 Disable Personal Web Sharing (Apache webserver) and FTP Access.
10.4 Setup a sensible machine name under Sharing. Something like "AEIC_Soldotna_EOC", that will be helpful when remote logging in to the machine as a prompt.

---

11 GoogleMaps programs: (Optional)

11.1 Copy events.html (from where?) to /Users/eoc/webserver

11.2 Apply for a new GoogleMaps PIN. Use the Google Account g*n@hotmail.co.uk, p*k.

11.3 At the top of every hour, /Users/eoc/webserver/events.xml should be (re)created. But in order to see this, the Apache webserver must be running (it will also tell you which domain address to use in applying for the GoogleMaps PIN above). Make sure it is under System Preferences.
