

What's New in Antelope 5.9

Dr. Kent Lindquist
Boulder Real Time Technologies, Inc.

May 2019
Taormina, Sicily



Thanks to our hosts!!

SeisRaM




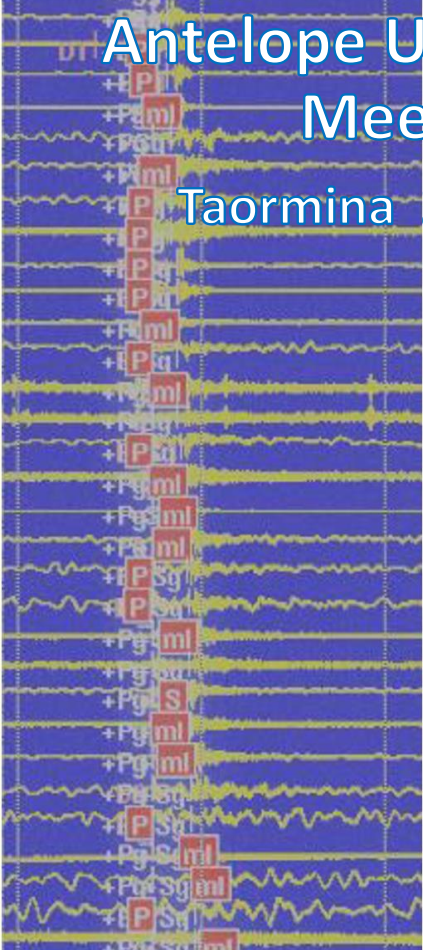
*Thanks on behalf of
BRTT and Kinemetrics*

Antelope Users Group Meeting


Taormina 28-30 May 2019

It is a pleasure to invite you at the AUG (Antelope Users Group) meeting organized by SeisRaM group of the Department of Mathematics and Geosciences, University of Trieste, on 28, 29 and 30 May at Hotel Sole Castello in Taormina, Sicily

www.aug2019.units.it



SeisRaM
International Association of Seismologists and Earthquake Engineers
The Department of Mathematics and Geosciences of the University of Trieste



Contacts:
Giovanni Costa: costa@units.it
Antonella Gallo: antonella.gallo79@gmail.com



Long Line of Successful European AUG Meetings



Slovenia 2018



Vienna 2017



Rome 2016



Baku 2014



Bucharest 2011

- Udine 2015
- Trieste 2012
- Prague 2010
- Vienna 2008
- Trieste 2007
- Ljubljana 2005
- Trieste 2004
- Rome 2000

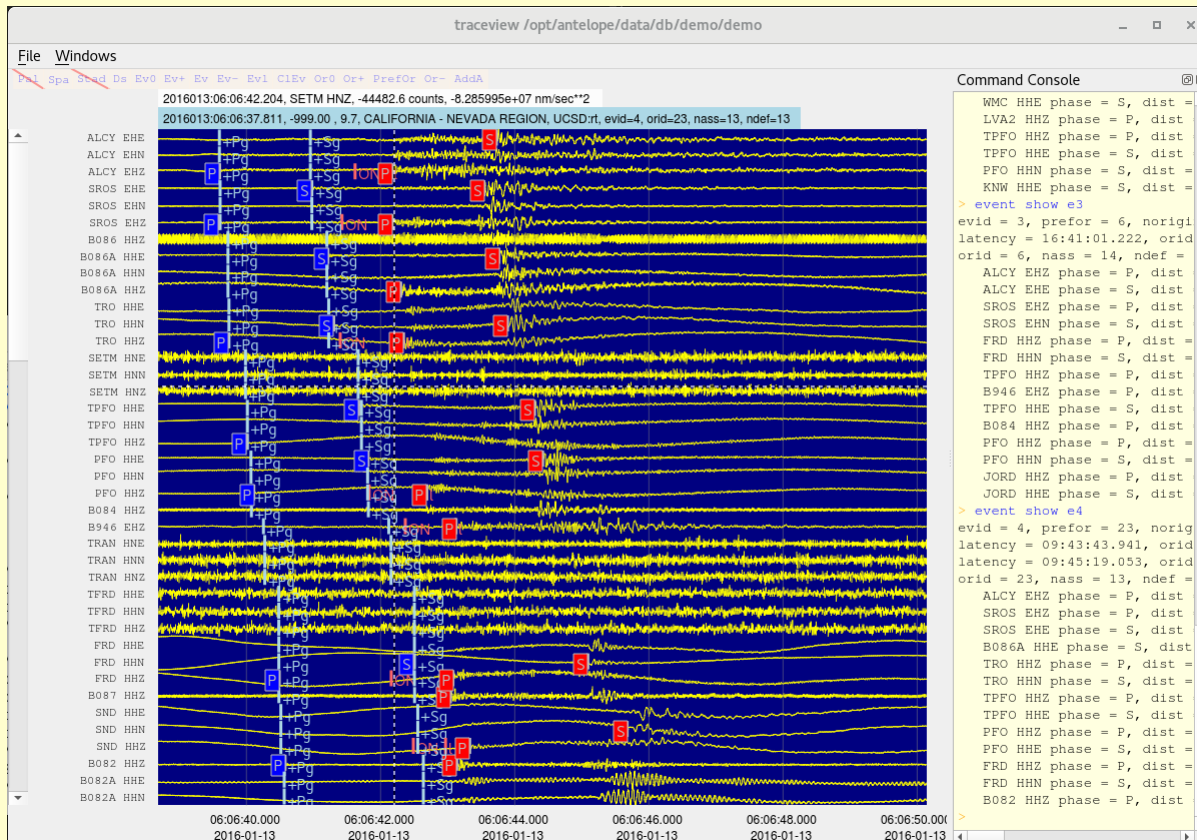


What's New In Antelope 5.9

- Major Advances
 - **traceview(1)**
 - **dbloc(1)** prototype
- Infrastructure
 - Operating System Support
 - Linux Installation
 - X11 on Mac OSX
 - **install_boot_scripts(1)** for **rtexec(1)**, **amd(1)**, **ald_proxy(1)**
 - *Interpreters – with MATLAB support for R2018a, R2018b, R2019a*
 - *Python 3*
 - **install_obspy(1)**
- Variety of noteworthy smaller improvements
 - Qt-based **inspect_snapshot(1)**
 - Qt-based **setup_site(1)**
 - Qt-based **antelope_update(1)**
 - Qt-based **rtdemo(1)**
 - **orb2orb(1)** match/reject expressions on output connections
 - Custom map lines and areas
 - **dbevents(1)** with *traceview* waveform display
- Coming year

traceview(1)

- Qt-based replacement for *dbpick(1)*



- *More details in upcoming talks*

dbloc(1)

- ***dbloc2(1)*** has outgrown its original design
- Part of *Qt* graphics Modernization initiative
- Initial design work courtesy of:
 - Taimi Mulder
 - Trilby Cox
- Will likely take several years to stabilize

dbloc(1) Prototype

The screenshot displays the dbloc(1) Prototype software interface, which is used for seismic data analysis. The main window shows a multi-trace seismic plot with station names (e.g., ERM BHZ_00, YSS LHZ_00) and a time window from 20:28:30.000 to 20:33:00.000 on 2019-04-14. A trial event map on the right shows a globe with colored arrows indicating seismic activity. Below the plot is a table of event data:

rec	Fate	(pref)oxid	evid	lat	lon	depth	time	nasa	ndef	review	magnitude	auth	
000000	Keep	Delete	44	4	42.459	144.793	45.56	2019104:20:28:31.287	23	0	r	5.31(mb)	USGS:rus
000001	Keep	Delete	4	4	42.459	144.793	45.56	2019104:20:28:31.287	0	0	r	5.31(mb)	USGS:rus
000002	Keep	Delete	42	4	42.534	145.116	13.39	2019104:20:28:26.593	35	23	M	5.31(mb)	OLDB.MBMeMwp
000003	Keep	Delete	44	4	42.489	144.734	97.81	2019104:20:28:38.553	23	15	M	5.31(mb)	OLDB.MBMeMwp

The interface also includes a 'Dbloc Command Console' at the bottom with the following commands and output:

```
Dbloc Command Console
Analysis Time Window = 1555224856.587 4/14/19 06:54:16.587 UTC
+ 600.000 seconds
('event' mode)
dbloc> atw 600
Analysis Time Window = 1555224856.587 4/14/19 06:54:16.587 UTC
+ 600.000 seconds
('event' mode)
dbloc> analyze e51
dbloc> tvshow o51
dbloc> analyze e69
dbloc> tvshow o77
dbloc> analyze e4
dbloc> tvshow o42
dbloc>
```

The Traceview Command Console shows the following output:

```
Traceview Command Console
BFO BHZ_00 phase = P, dist = 81.49, residual = 3.170, nondefining
TX31 BHZ phase = P, dist = 84.33, residual = 3.878, nondefining
WT BHZ_00 phase = P, dist = 87.71, residual = 3.207, nondefining
SSPA BHZ_00 phase = P, dist = 88.21, residual = 3.083, nondefining
tv> traces maximum 25
tv> traces fit
tv> traces maximum 16
tv> traces fit
tv> ta
tv>
```

- *More details in upcoming talk*

Operating-system Support

- *Antelope 5.9* is released on
 - *RedHat/CentOS 7.4*
 - *Mac OS X 10.13 (High Sierra)*
- *Antelope 5.9* is compiled with:
 - Linux:
 - *Clang 6.0.0* compiled on *CentOS Linux 7.4*
 - *GCC 7.2.0 gfortran* compiled on *CentOS Linux 7.4*
 - Darwin:
 - *Clang 5.0.0* compiled on *OSX 10.9.5*
 - *GCC 7.1.0 gfortran* compiled on *OSX 10.9.5*

Linux Installation

- We recommend installing most complete *Linux* Environment Group (feature set) available
- In *RHEL*:
 - “*Development and Creative Workstation*”
 - (Not “*Minimal Install*”)
- Missing dynamic libraries (*libXss.so*, *libnettle.so*, etc.) most common symptom of insufficient install
- Enterprise Class Software:
 - *Antelope* chosen to support mission
 - OS chosen to support *Antelope*
 - Hardware chosen to support OS
- (Recommendation would be different if we were tailoring for multi-purpose research environments instead of operational missions)
- The fix, per *notes_linux_setup(5)*:
 - **% *yum groupinstall "Development and Creative Workstation"***

X11 Support on Macs

- Last *Xquartz* update October, 2016
 - “For OSX 10.6.3 or later” [not reassuring]
 - <http://www.xquartz.org>
- *X11*-forwarding of *Qt* apps on *OSX*
 - Constant battle
 - May disappear with *Qt5.12* / *Antelope 5.10*
- Several key apps left to port:
 - *orbrtd*, *dbbuild*, *dlmon*, *rtm*

New *install_boot_scripts(1)*

- Script to install turnkey (startup-on-boot) mechanisms for
 - *rtexec(1)*
 - *amd(1)*
 - (Licensing daemon for serial #'s or dongles on *Linux*)
 - *ald_proxy(1)*
- One script can install all programs
 - *rtexec(1)* may require *amd(1)*
- Based on
 - *launchctl(1)*, *launchd(8)* (*OS X*)
 - *systemctl(1)*, *systemd(1)* (*Linux*)
- Replaces *install_turnkey_boot_script(8)*, *install_amd_daemon_script(8)*, *S99antelope(8)*, *S99amdd(8)*
- The *install_boot_scripts(1)* executable is now in $\$ANTELOPE/bin$ directory
- All raw materials in $\$ANTELOPE/data/system$
- *Must be run as root, e.g. with sudo(8)* command
- Added Stefan Radman's suggestions for multi-system support

Antelope 5.9 Interpreters

- *Qt* -> *Qt5.11.0*
- *MATLAB* support:
 - *R2018a, R2018b, R2019a*
- *Perl*: Still *Perl 5.26.1*
- *TCL/Tk*: Same as previous few years
- *Python*: *Python3!*
 - *Python 3.6.5*



Antelope Port to Python 3

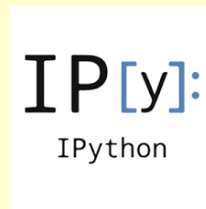
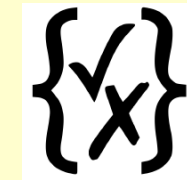
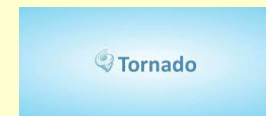
- The Port
 - Antelope use of *Python* is extensive—very complicated job
 - Initiated by Kent Lindquist and Danny Harvey June '17
 - Final big push by Rohan Ambli of Ambli, LLC
- Drivers
 - *Python 2* End-Of-Life 2020
 - Availability of programming talent
 - Community interest in *ObsPy* (<http://www.obspy.org>)
 - Support for new capabilities e.g. FDSN Web Services
- Advances
 - *pip3* install of almost all modules
 - `/opt/antelope/python3.6.5/bin/pip3`
 - Pre-install of all modules needed by *ObsPy* as of April 2019
 - Updated *matplotlib*
 - Added *scipy*

matplotlib

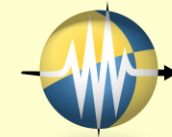


Antelope Python 3

- Pre-built *Python* interpreter
- Comprehensive *Antelope* APIs for data handling, analysis, sophisticated plotting
- More than 80 standard third-party modules pre-built and ready to go

The logo for matplotlib, featuring the word "matplotlib" in a blue sans-serif font with a circular icon containing a multi-colored plot.The logo for NumPy, showing a 3D grid of blue and yellow cubes next to the word "NumPy" in a blue serif font.The logo for SciPy, featuring a blue circular icon with a white 'S' and the word "SciPy" in a bold black font.The logo for Boulder Real Time Technologies (BRTT), showing a stylized mountain range and the text "BRTT BOULDER REAL TIME TECHNOLOGIES, INC." in blue and green.The logo for pillow, featuring the Python logo icon and the word "pillow" in a light grey sans-serif font.The logo for scikit learn, with the word "scikit" in blue and "learn" in orange, next to a blue circle.The logo for IPython, showing the text "IP[y]:" in blue and "IPython" in black below it.The logo for SQLAlchemy, with "SQL" in black and "Alchemy" in red, in a stylized font.The logo for JEDI, featuring a black and white geometric pattern resembling a stylized 'J' or a flower.The logo for Pygments, showing a green and red arrow pointing right and the word "Pygments" in black.The logo for Werkzeug, a yellow diamond with a black hammer icon and the word "WERKZEUG" in black.The logo for Babel, with the word "Babel" in a stylized font and the tagline "speaking your language" below it.The logo for YX, featuring a black curly brace on the left and a black 'X' on the right.The logo for Tornado, a light blue rectangle with the word "Tornado" in white.The logo for python pip, with the Python logo icon and the text "python pip" in black.The logo for Zope, featuring a blue circular icon with a white 'Z' and the word "Zope" in black.The logo for Flask, showing a black silhouette of a flask and the word "Flask" in black.The logo for Kinometrics, featuring a red square with white geometric patterns and the word "Kinometrics" in white.

install_obspy(1)



ObsPy

A Python Framework for Seismology

- New contributed-code utility *install_obspy(1)*
- All supporting *Python* modules already in *Antelope Python*
- N.B. Needs compilers for the *ObsPy* installer

```
[/opt/antelope][5.9] kent% install_obspy
```

```
Collecting obspy
```

Downloading

```
https://files.pythonhosted.org/packages/b4/fa/87a6b3612d7060c585cb0aec518ede6a75fc5b002897d3991633d857fc19/obspy-1.1.1.zip (23.9MB)
```

```
100% |#####| 23.9MB 1.2MB/s
Requirement already satisfied: future>=0.12.4 in ./python3.6.5/lib/python3.6/site-packages (from obspy) (0.17.1)
Requirement already satisfied: numpy>=1.6.1 in ./python3.6.5/lib/python3.6/site-packages (from obspy) (1.16.2)
Requirement already satisfied: scipy>=0.9.0 in ./python3.6.5/lib/python3.6/site-packages (from obspy) (1.2.1)
Requirement already satisfied: matplotlib>=1.1.0 in ./python3.6.5/lib/python3.6/site-packages/matplotlib-3.0.3-py3.6-macosx-10.13-x86_64.egg (from obspy) (3.0.3)
Requirement already satisfied: lxml in ./python3.6.5/lib/python3.6/site-packages (from obspy) (4.3.2)
Requirement already satisfied: setuptools in ./python3.6.5/lib/python3.6/site-packages/setuptools-39.2.0-py3.6.egg (from obspy) (39.2.0)
Requirement already satisfied: sqlalchemy in ./python3.6.5/lib/python3.6/site-packages (from obspy) (1.3.1)
Requirement already satisfied: decorator in ./python3.6.5/lib/python3.6/site-packages (from obspy) (4.3.0)
Requirement already satisfied: requests in ./python3.6.5/lib/python3.6/site-packages (from obspy) (2.18.4)
Requirement already satisfied: cycler>=0.10 in ./python3.6.5/lib/python3.6/site-packages (from matplotlib>=1.1.0->obspy) (0.10.0)
Requirement already satisfied: kiwisolver>=1.0.1 in ./python3.6.5/lib/python3.6/site-packages (from matplotlib>=1.1.0->obspy) (1.0.1)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in ./python3.6.5/lib/python3.6/site-packages (from matplotlib>=1.1.0->obspy) (2.2.0)
Requirement already satisfied: python-dateutil>=2.1 in ./python3.6.5/lib/python3.6/site-packages (from matplotlib>=1.1.0->obspy) (2.6.1)
Requirement already satisfied: urllib3<1.23,>=1.21.1 in ./python3.6.5/lib/python3.6/site-packages (from requests->obspy) (1.22)
Requirement already satisfied: chardet<3.1.0,>=3.0.2 in ./python3.6.5/lib/python3.6/site-packages (from requests->obspy) (3.0.4)
Requirement already satisfied: certifi>=2017.4.17 in ./python3.6.5/lib/python3.6/site-packages (from requests->obspy) (2018.4.16)
Requirement already satisfied: idna<2.7,>=2.5 in ./python3.6.5/lib/python3.6/site-packages (from requests->obspy) (2.6)
Requirement already satisfied: six in ./python3.6.5/lib/python3.6/site-packages (from cycler>=0.10->matplotlib>=1.1.0->obspy) (1.11.0)
Building wheels for collected packages: obspy
  Building wheel for obspy (setup.py) ... done
  Stored in directory: /Users/kent/Library/Caches/pip/wheels/11/d6/40/c448464ae42229b2f9fb46b71be0213e10e9628346b7f1198f
```

Successfully built obspy

Installing collected packages: obspy

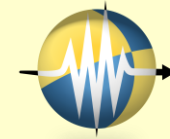
Successfully installed obspy-1.1.1



ObsPy in Antelope

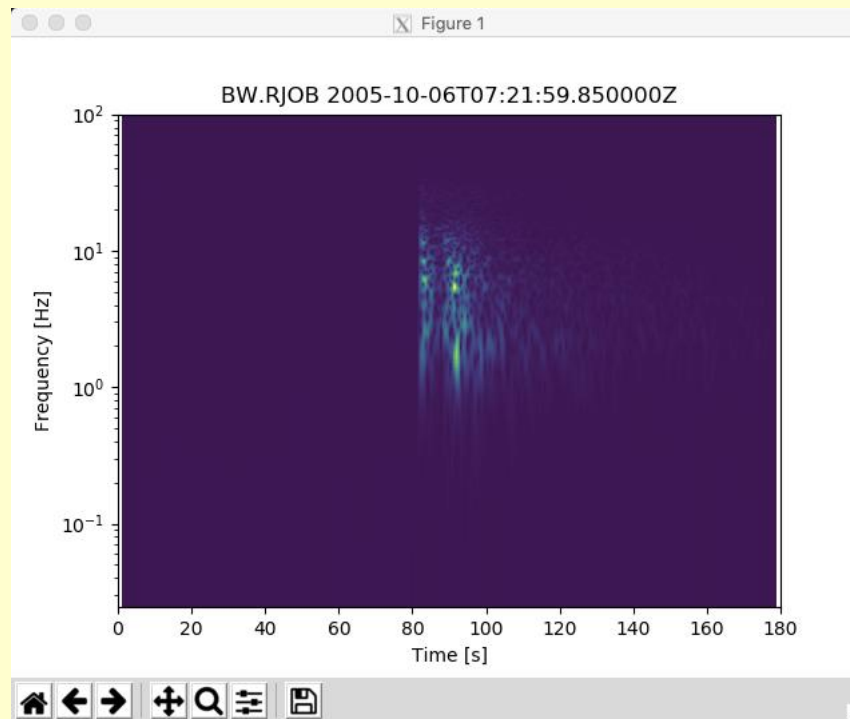
```
[nyas:/opt/antelope][5.9] kent% python  
Python 3.6.5 (default, Mar 22 2019, 21:04:14)  
[GCC 4.2.1 Compatible Clang 5.0.0 (trunk 306208)] on darwin  
Type "help", "copyright", "credits" or "license" for more information.
```

```
>>> import obspy  
>>> st = obspy.read("https://examples.obspy.org/RJOB_061005_072159.ehz.new")  
>>> st.spectrogram(log=True, title='BW.RJOB ' + str(st[0].stats.starttime))
```



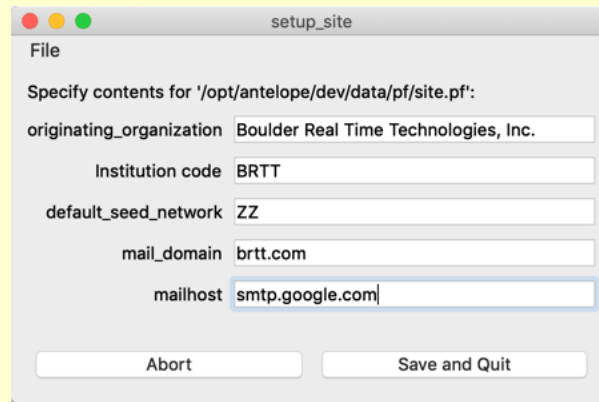
ObsPy

A Python Framework for Seismology



New *setup_site*(1)

- Straight replacement for old *setup_site*(1)
- Part of *Qt* modernization and installer modernization

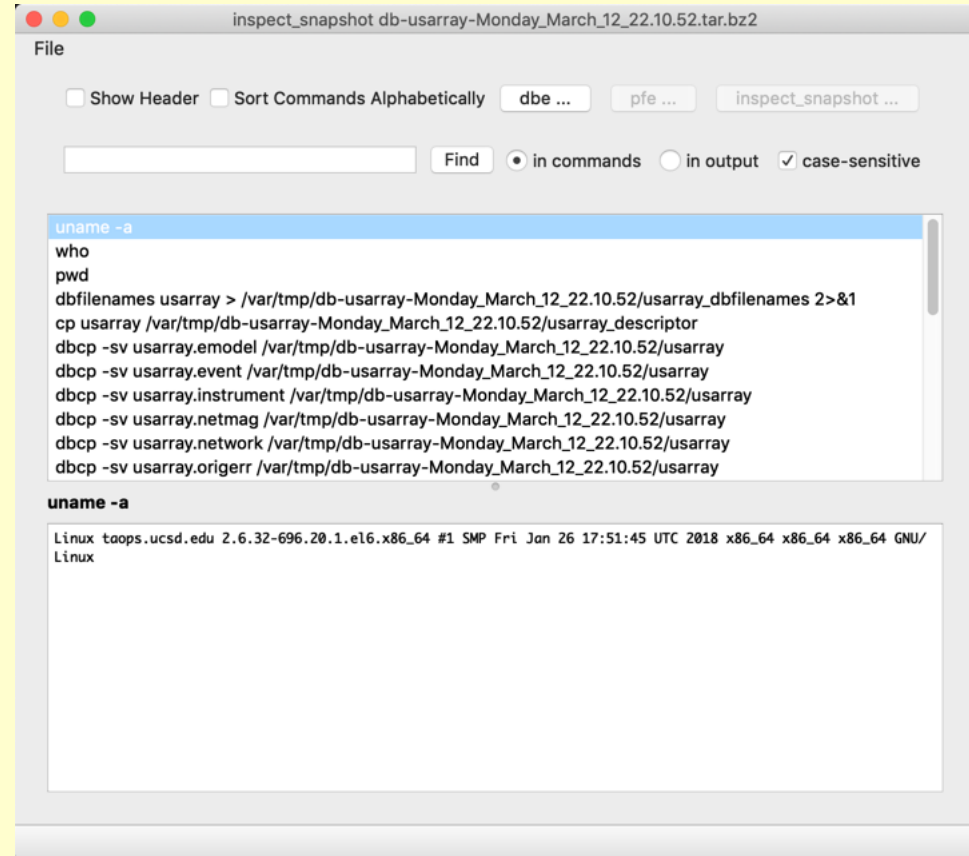


Written by:
Sue Simoncic
Pitch, Roll, & Yaw LLC

New *inspect_snapshot(1)*

% *inspect_snapshot* db-usarray-Monday_March_12_22.10.52.tar.bz2

- Various snapshot generators available:
 - *licsnapshot(1)*
 - *rtssnapshot(1)*
 - *dbsnapshot(1)*
 - *dbloc_snapshot(1)*
- Snapshots are frequently requested by support@brtt.com
- Feel free to look at these snapshots if so inclined -- perhaps you will see the problem quickly



```
inspect_snapshot db-usarray-Monday_March_12_22.10.52.tar.bz2
File
 Show Header  Sort Commands Alphabetically   
   in commands  in output  case-sensitive

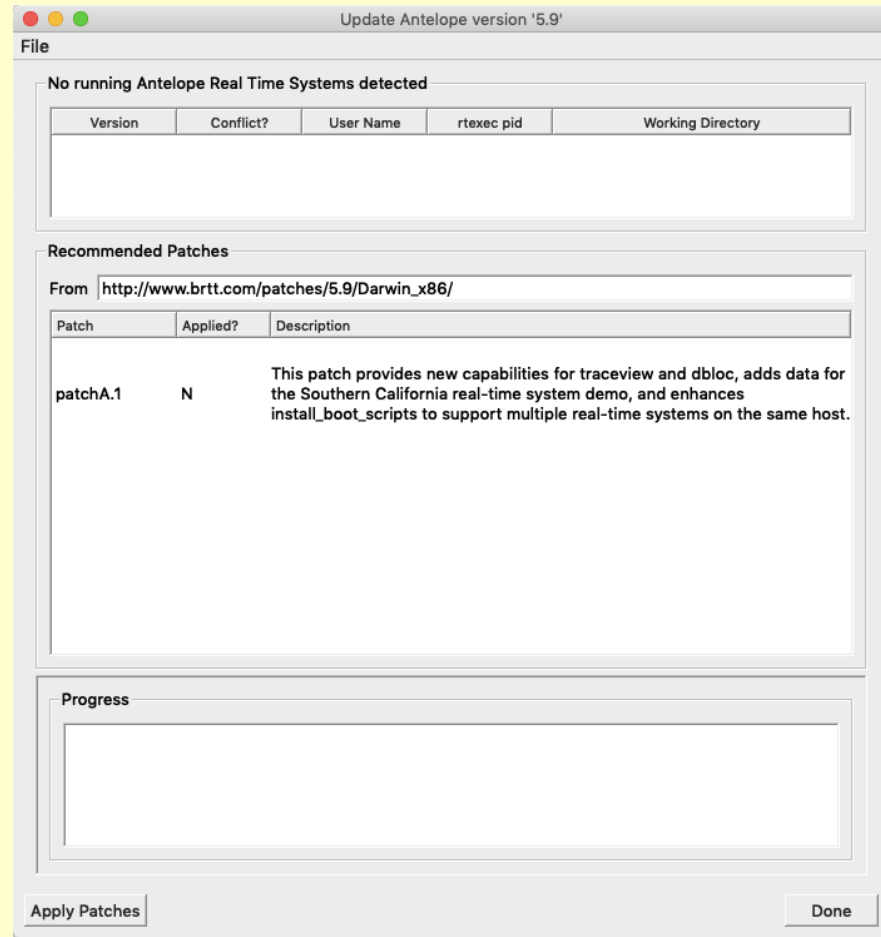
uname -a
who
pwd
dbfilenames usarray > /var/tmp/db-usarray-Monday_March_12_22.10.52/usarray_dbfilenames 2>&1
cp usarray /var/tmp/db-usarray-Monday_March_12_22.10.52/usarray_descriptor
dbcp -sv usarray.emodel /var/tmp/db-usarray-Monday_March_12_22.10.52/usarray
dbcp -sv usarray.event /var/tmp/db-usarray-Monday_March_12_22.10.52/usarray
dbcp -sv usarray.instrument /var/tmp/db-usarray-Monday_March_12_22.10.52/usarray
dbcp -sv usarray.netmag /var/tmp/db-usarray-Monday_March_12_22.10.52/usarray
dbcp -sv usarray.network /var/tmp/db-usarray-Monday_March_12_22.10.52/usarray
dbcp -sv usarray.origerr /var/tmp/db-usarray-Monday_March_12_22.10.52/usarray

uname -a
Linux taops.ucsd.edu 2.6.32-696.20.1.el6.x86_64 #1 SMP Fri Jan 26 17:51:45 UTC 2018 x86_64 x86_64 x86_64 GNU/
Linux
```

Written by:
Sue Simoncic
Pitch, Roll, & Yaw LLC

New *antelope_update*(1)

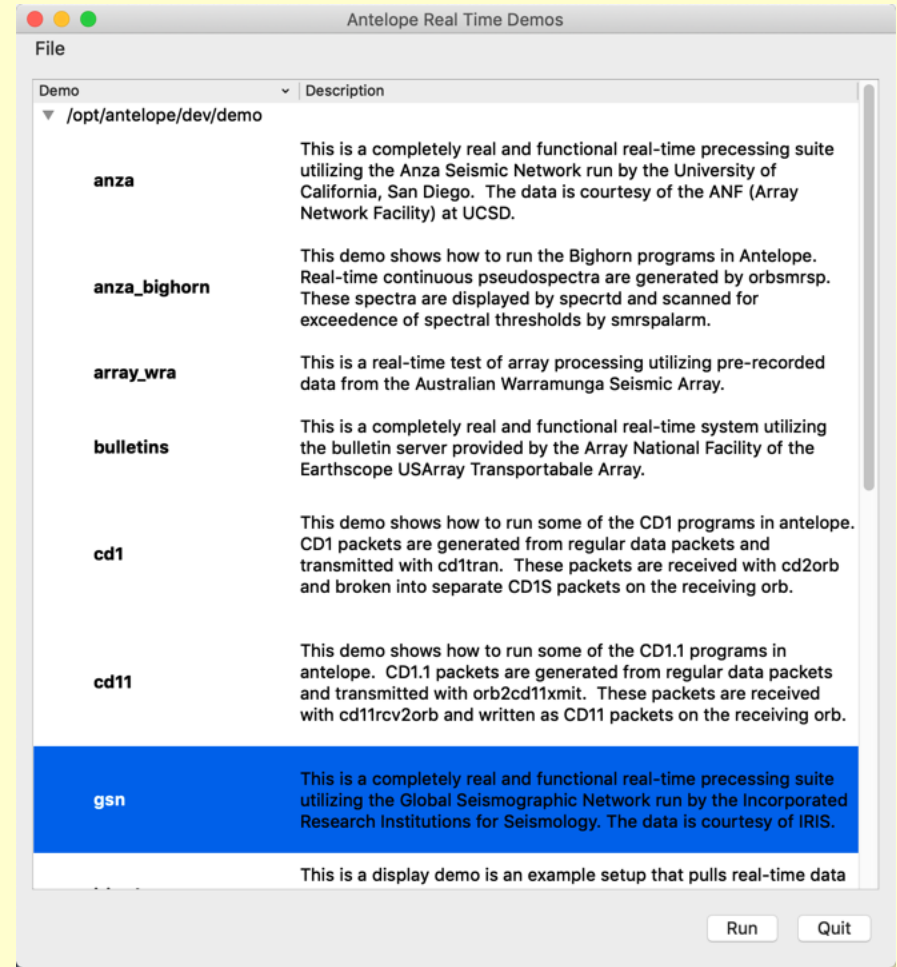
- Modern Qt interface
- Auto-detection of running real-time systems under updating version
- Override capability for updating running systems (not recommended)



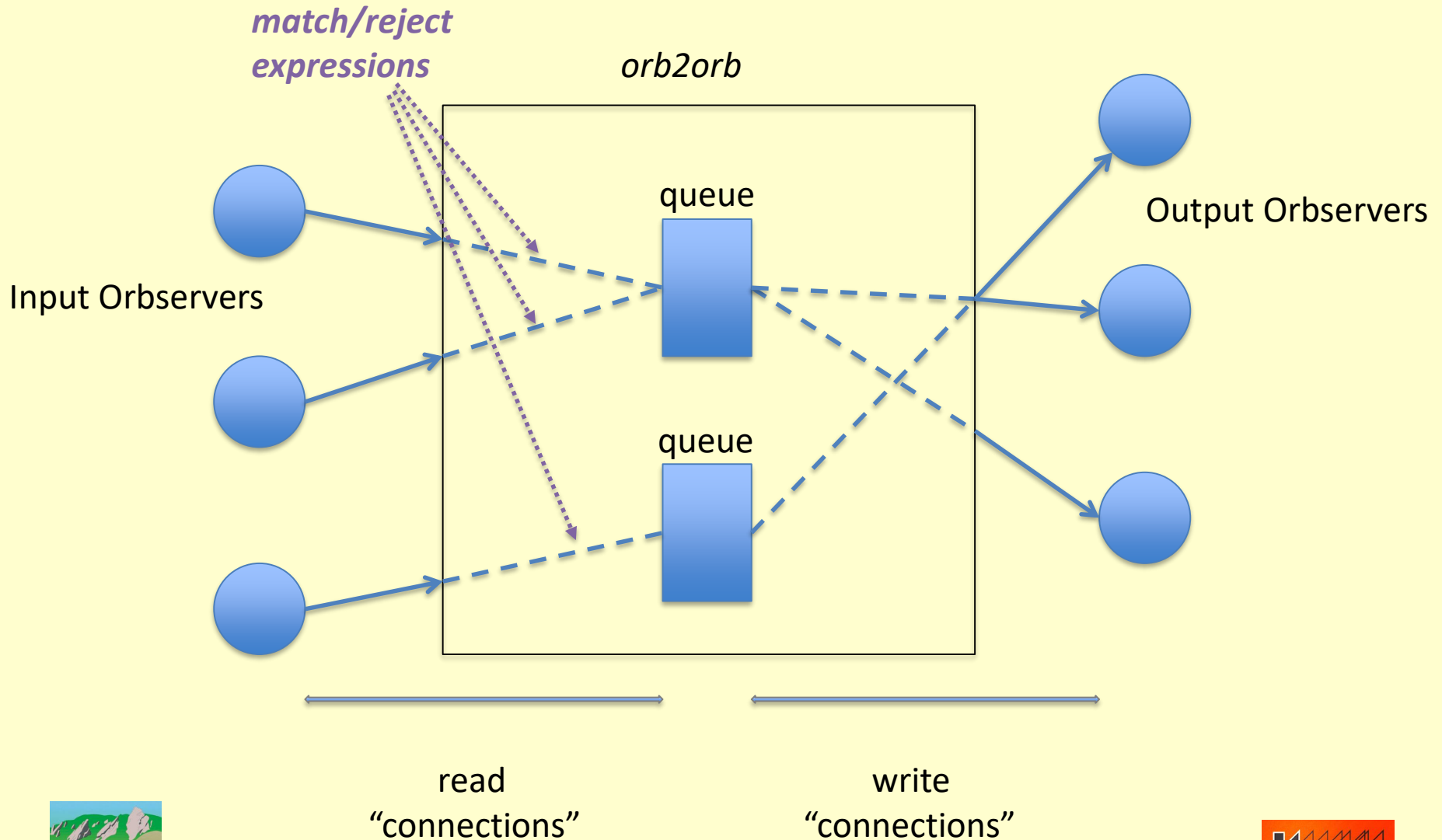
New *rtdemo*(1)

- Command-line version works same as before:
`% rtdemo gsn`
- New Qt-based graphical version:
`% rtdemo`

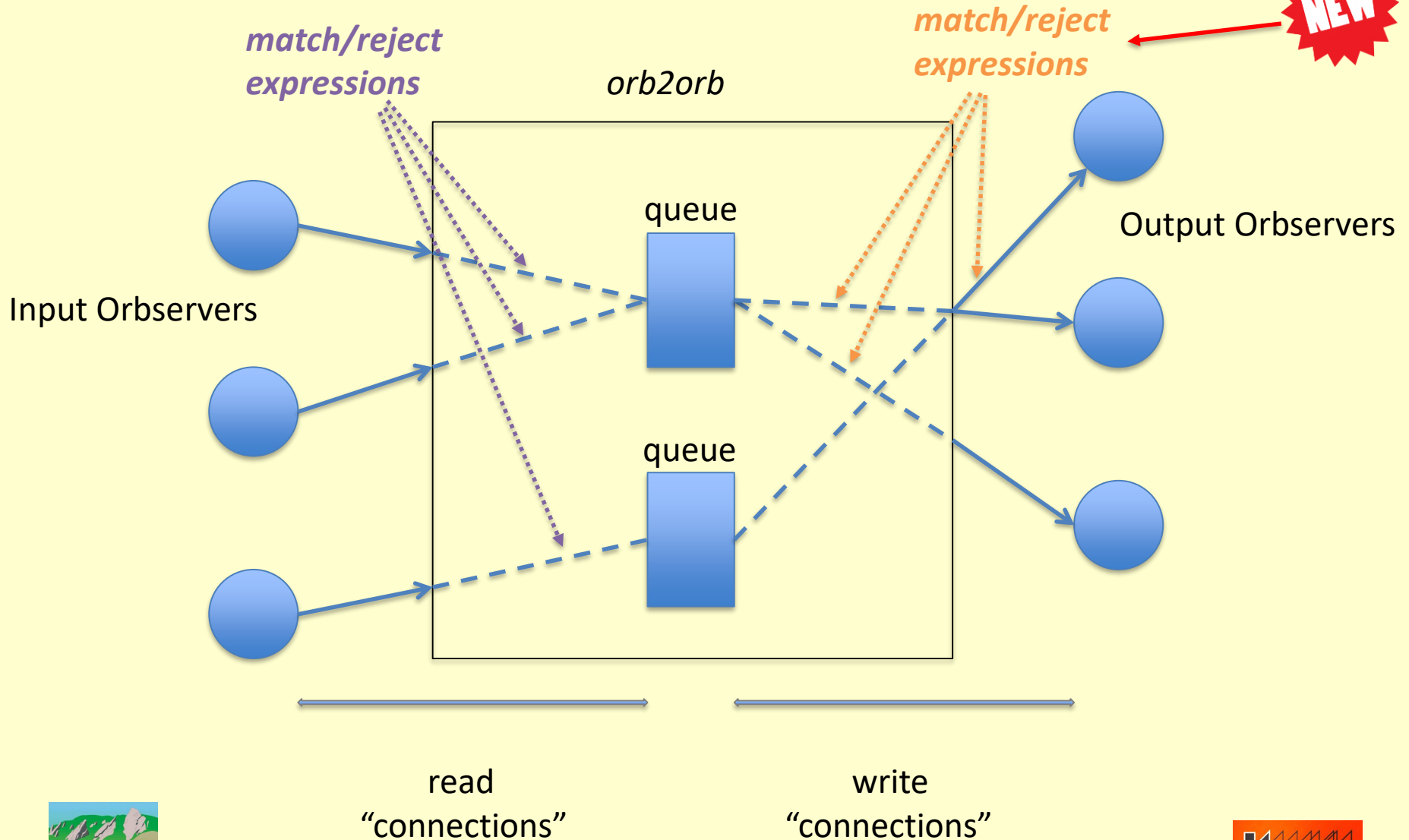
Written by:
Sue Simoncic
Pitch, Roll, & Yaw LLC



orb2orb(1) enhancement



orb2orb(1) enhancement



Custom map lines and areas

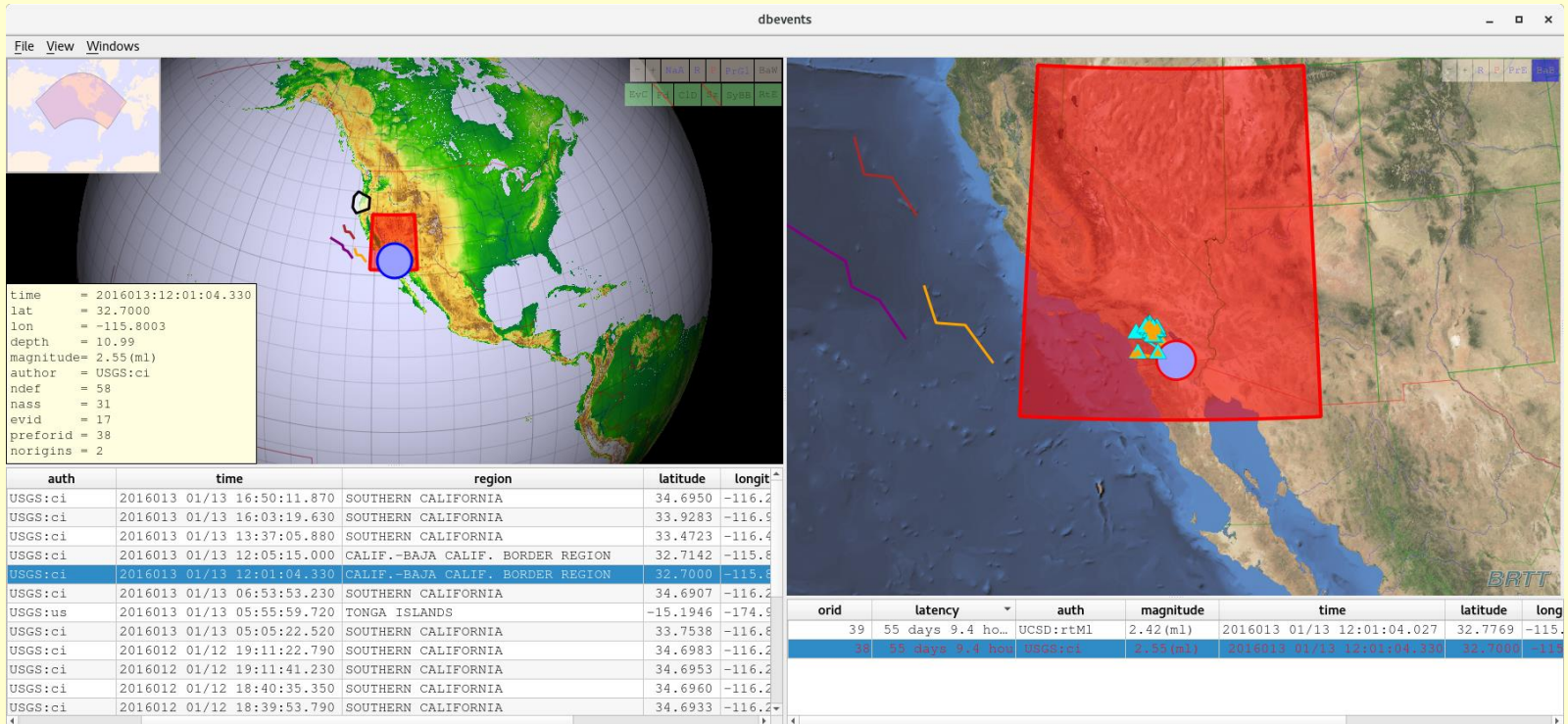
- New parameter-file *map_features.pf*
- Add your own lines
- Add your own areas
- Currently supported in ***dbevents(1)*** and ***dbloc(1)***
- Straightforward text format – could create from *KML* etc.

Custom map lines and areas

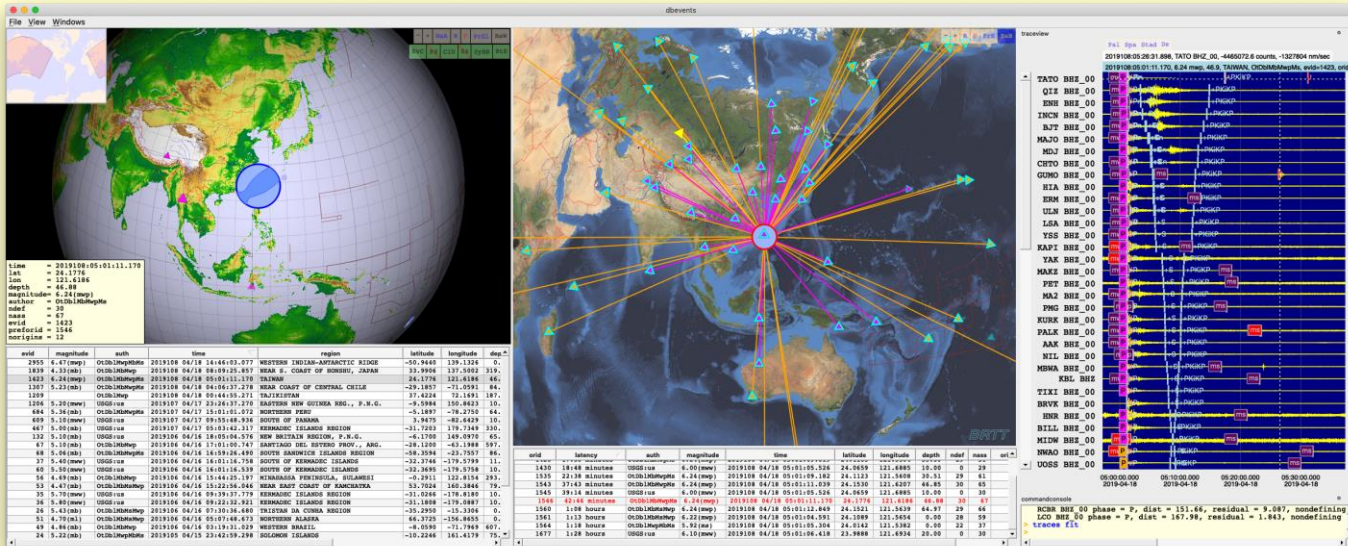
```
map_linear_features &Arr{
  testlinefeature &Arr{
    maps &Tbl{
      dbevents_events
      dbevents_event
      dbevents_origins
      dbloc_maindb_events
      dbloc_trialdb_event
    }
    color_outline purple
    linewidth 3
    lonlat_points_sequence &Tbl{
      -125 33
      -126 34
      -127 34.3
      -127.3 35
      -130 36
    }
  }
}
```

```
map_area_features &Arr{
  testarfeature &Arr{
    maps &Tbl{
      dbevents_events
      dbevents_event
      dbevents_origins
      dbloc_maindb_events
      dbloc_trialdb_event
    }
    color_outline red
    color_fill \#88ff0000
    linewidth 4
    lonlat_points_sequence &Tbl{
      -121 31
      -121 41
      -111 41
      -111 31
      -121 31
    }
  }
}
```


Custom map lines and areas



dbevents(1) with traceview



- `traceview` display in `dbevents(1)`
- Replaces separate launch of `dbpick(1)`
- `BQTraceview(3)` plus `Python` widget wrapper underneath
- Right-click launch of external commands (from `dbevents.pf`) re-instated

Plans for Coming Development Year

- FDSN Web Services support
 - in progress
 - More detail in upcoming talk
- *Qt 5.12 (Long-term release)*
- Operationalizing ***dbloc***
- ***orbrrtd*** in Qt
- Further:
 - *Comments ?*
 - *Suggestions ?*
 - *Requests ?*



Thank You!

Questions?

Introduction - KMI

Kinemetrics, Inc.

- Founded in 1969
- OYO Corp owned in 1991
- ISO9001 since 1999
- \$35M FY2012 revenue (mostly international)

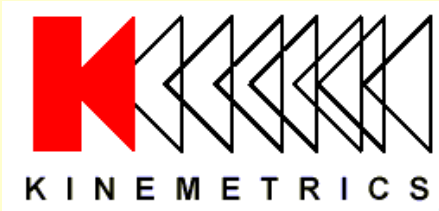


HQ's in Pasadena CA with Sales and Project offices in Switzerland & Abu Dhabi

A screenshot of the Kinemetrics website homepage. The browser address bar shows 'www.kinemetrics.com/p-163-Home.aspx'. The main header features a large image of a worker in a blue uniform and cap working inside a large circular hole in the ground, surrounded by cables and equipment. The Kinemetrics logo is overlaid on this image. Below the header is a navigation menu with links for 'About Us', 'Products', 'Solutions', 'Projects', 'News', 'Downloads', and 'Contact'. The main content area is divided into two columns. The left column contains three news items: 'NEW KINEMETRICS WEBSITES: Kinemetrics has launched 3 new websites', 'MSNBC: EARTHSCOPE: Humankind's largest and most ambitious scientific project', and 'Quanterra Q330S+ Seismic System' with a small image of the device. The right column features a large heading 'The Innovative World Leader In Earthquake Monitoring' and a sub-heading 'Developer of Technologies, Products and Solutions to Advance How People Live and Work'. Below this, it states 'For forty years, Kinemetrics has been creating products for:' followed by a bulleted list: 'Seismic networks', 'Comprehensive environmental monitoring systems', and 'Strong motion and weak motion instrumentation'. At the bottom, it lists 'Project solutions for' with sub-points: 'Structural health monitoring (bridges, dams, buildings)' and 'Seismic arrays'.



Introduction – KMI Team



Designs and manufactures sensors and digitizers – Provides complete systems design, installation and operations



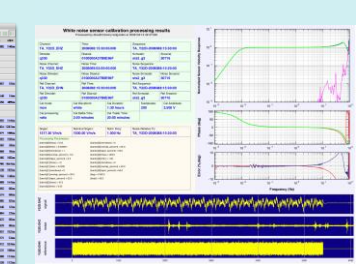
Designs High-End Digitizers



Designs High-End Sensors



A screenshot of a data table showing columns for 'Time', 'Station', 'Channel', 'Value', and 'Quality'. The table contains multiple rows of data, with some cells highlighted in red and green.



Kinematics / BRTT

Comprehensive Hardware, Software, and Services

Kinematics Systems Solutions

- Turnkey complete systems including enterprise-class computing centers and full communications

Kinematics Hardware Manufacturer

- World class Kinematics and Quanterra dataloggers
- World class Kinematics, Metrozet and Streckeisen sensors

BRTT Software Developer

- World class acquisition software for all Kinematics hardware products
- Proven track record for large networks with difficult remote deployments (USArray)
- World class, comprehensive automated and interactive seismic processing software
- Data neutral architecture for support of non-seismic environmental monitoring networks
- Extraordinary Command & Control capabilities with SOH displaying

Kinematics Services

- Complete systems procurement, installation and training including all aspects of both hardware and software
- Network operations

