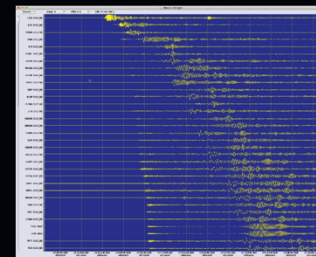
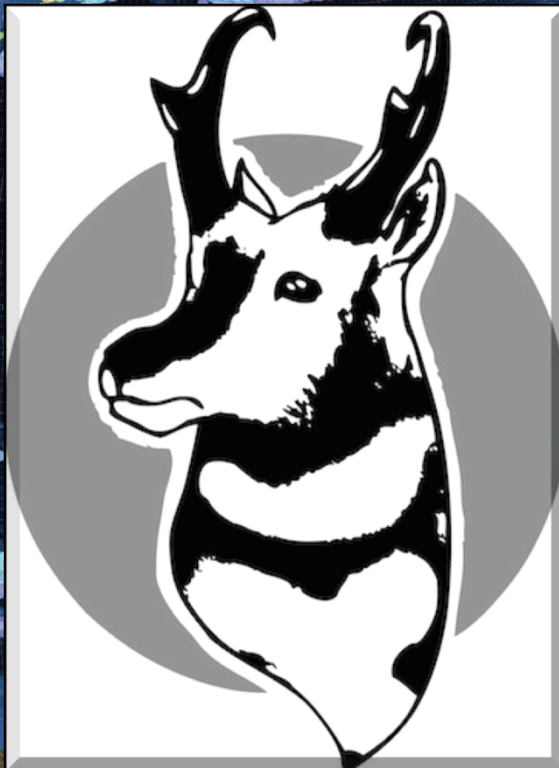
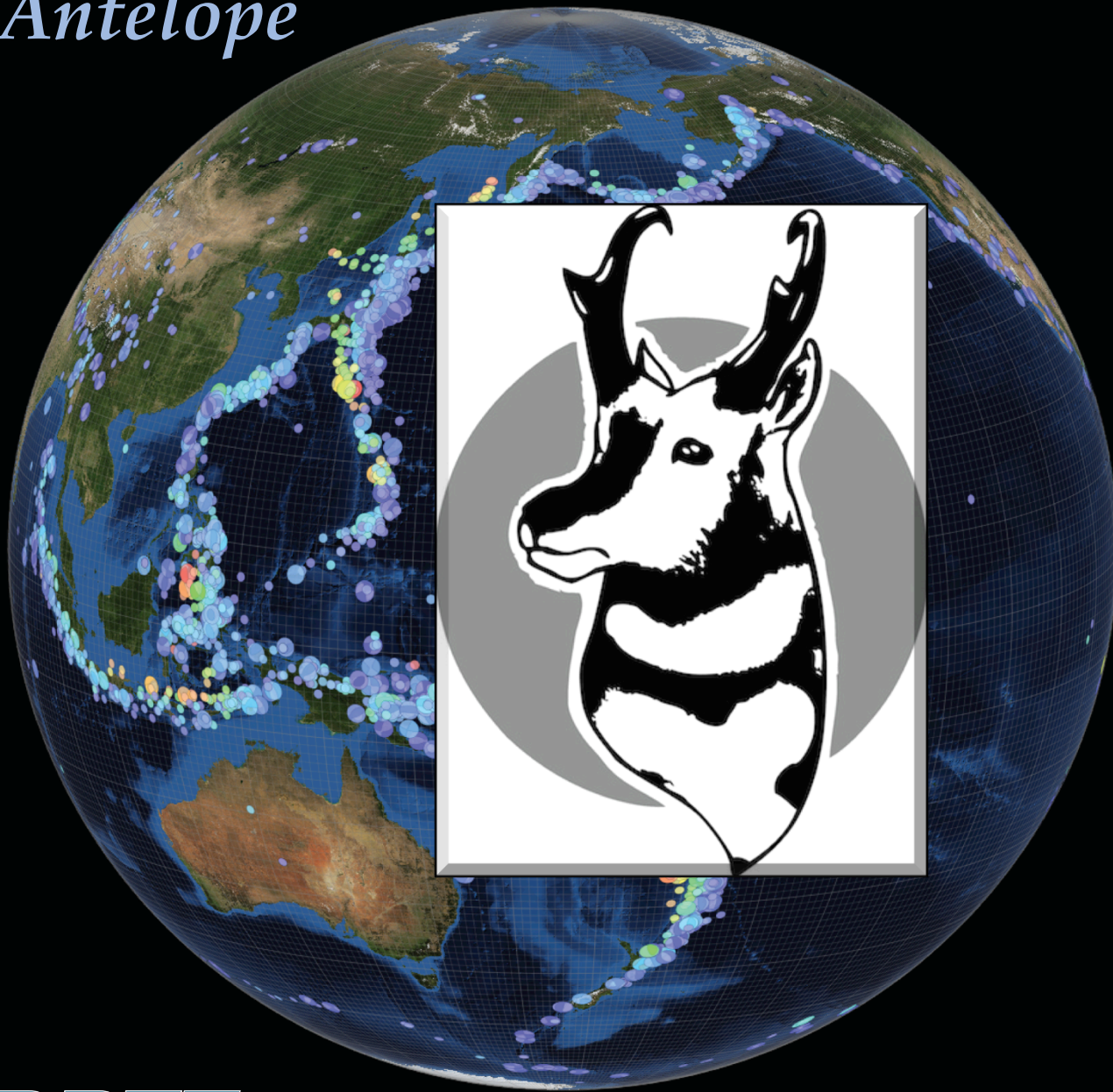
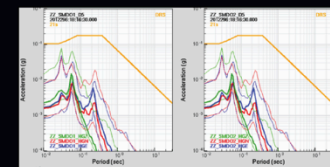
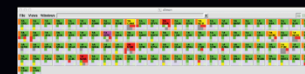
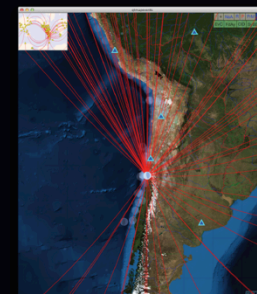


Antelope



| Station | Time | Depth (km) | Magnitude | Location |
|---------|---------------------|------------|-----------|-------------|
| STN001 | 2023-10-26 12:00:00 | 10 | 2.5 | 180°E, 10°N |
| STN002 | 2023-10-26 12:00:05 | 10 | 2.5 | 180°E, 10°N |
| STN003 | 2023-10-26 12:00:10 | 10 | 2.5 | 180°E, 10°N |
| STN004 | 2023-10-26 12:00:15 | 10 | 2.5 | 180°E, 10°N |
| STN005 | 2023-10-26 12:00:20 | 10 | 2.5 | 180°E, 10°N |



A large, semi-transparent globe of the Earth is centered in the background. Overlaid on the globe is a complex satellite data visualization consisting of numerous small, glowing yellow and white dots connected by thin lines, forming a dense, irregular pattern that suggests a global network or data collection path.

Antelope

Dr. Kent Lindquist
Boulder Real Time Technologies, Inc.

BRTT



Antelope Presence

- Antelope running on All 7 Continents
- Countries
- Cities
- Critical Facilities
- Structures



Antelope Applications

- Seismic data center operations
 - Several-station networks
 - Hundreds of station networks – USArray, Italy/DPC , Chile
- Seismic network and inter-network operations
 - weak motion processing
 - strong motion processing
- Data exchange
 - Real-time “virtual” seismic networks
 - Non real-time (e.g. SEED, autoDRM, web-based)
 - Access to other tools, such as SAC and MATLAB
- CTBT/NDC operations
- Infrasound
- Hydroacoustics
- Portable telemetry deployments (USArray)
- Offline processing of “standalone” portable deployments (IRIS/PASSCAL)
- Research in seismology (University Community)
- Induced Seismicity Applications
- Structural health monitoring
- Generic “sensor webs” and multi-hazard monitoring



Antelope Key Points

- Enterprise-grade core infrastructure
- Dual support for data-driven mission and operations-support mission



Antelope Key Points

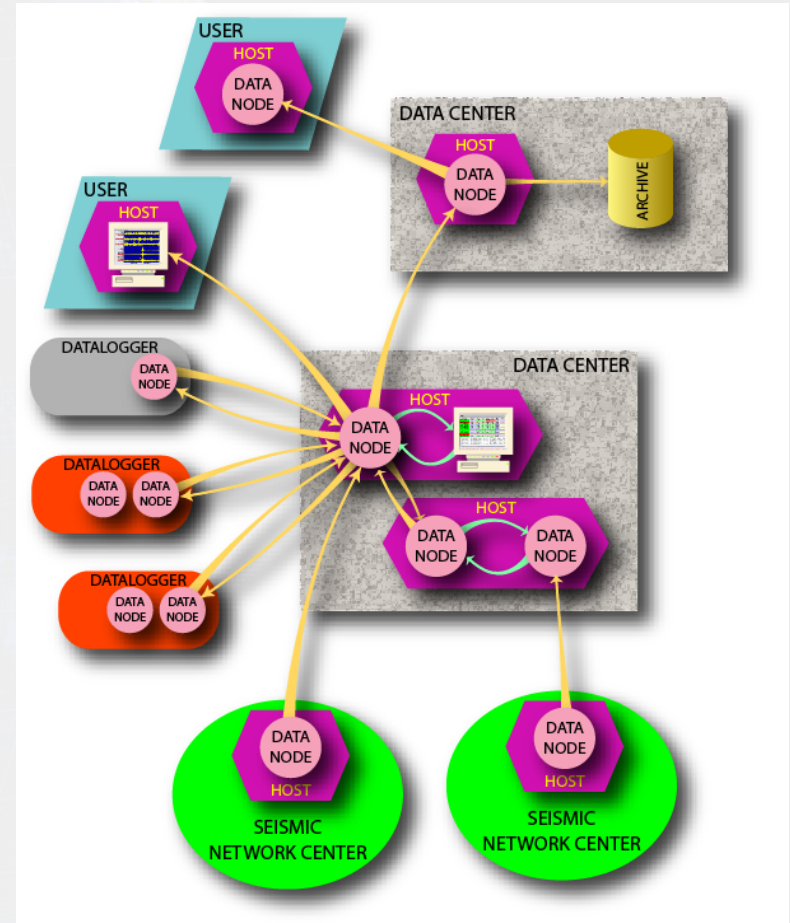
- Complete software package for traditional seismic network operations
- ***Extensible Middleware Framework*** for interconnecting data sources with data processing to create custom earth monitoring systems
- Store-and-forward packet system enables reliable transport, processing, dissemination
- Embedded relational database system
- Core utilities available for both streaming and batch-mode processing
- Has been applied to numerous environmental monitoring domains
 - seismic, tsunami, volcano, strong-motion, sensor-web, structural health
- ***Open architecture***, with both closed and open-source components
- High performance and reliability
- High scalability
- High interoperability
- Minimum processing and communications latencies (early warning)
- Productive development environment for new/extended functionality
- ***Coherent engineering throughout creates highly robust, highly functional, low cost-of-ownership system – only available from commercial code***



Data Transport Backbone

orbserver

- *orbserver* / *orb* protocol
- Network transparent
- Data-neutral
- Data-driven
- Extremely reliable
- Short-haul Inter-process communication
- Long-haul, low latency data transport
- Extension to standard networking stack:
 - IP = packet transport
 - TCP = reliable transport of bytes
 - Orb = reliable transport of monitoring-data packets





Data Acquisition

- Antelope provides the worldwide premier software utilities to acquire data from, monitor the health of, and control Kinemetrics dataloggers
- Three-tiered model for acquisition
 - Data
 - State-Of-Health
 - Command-and-control



Data Acquisition Strategy

- One orb client executable for each datalogger model
- All data, state-of-health, commands exchanged through orb packets
- Programs are generally threaded: many dataloggers served by each program instance
- ***Huge amount of time and effort invested in these programs to foresee and circumvent every reasonable and many unreasonable acquisition problems***



Data Acquisition: altus2orb

altus2orb

- Supports entire Kinometrics Altus product line
- Works with legacy Altus dataloggers
- Works with Rock dataloggers running in Altus emulation mode
- Provides TCP server communication mode for modem threads
- Provides POC reception capability: keep streaming data alive when remote IP address changes
- Large-network field-proven

The screenshot displays a complex data acquisition software interface. It features a grid of data points, likely representing sensor readings over time. The interface includes a menu bar at the top with options like 'File', 'View', and 'Window'. The data is organized into multiple columns, with some cells highlighted in different colors (red, green, blue, yellow) to indicate specific data states or errors. The overall layout is dense and technical, typical of professional data logging software.





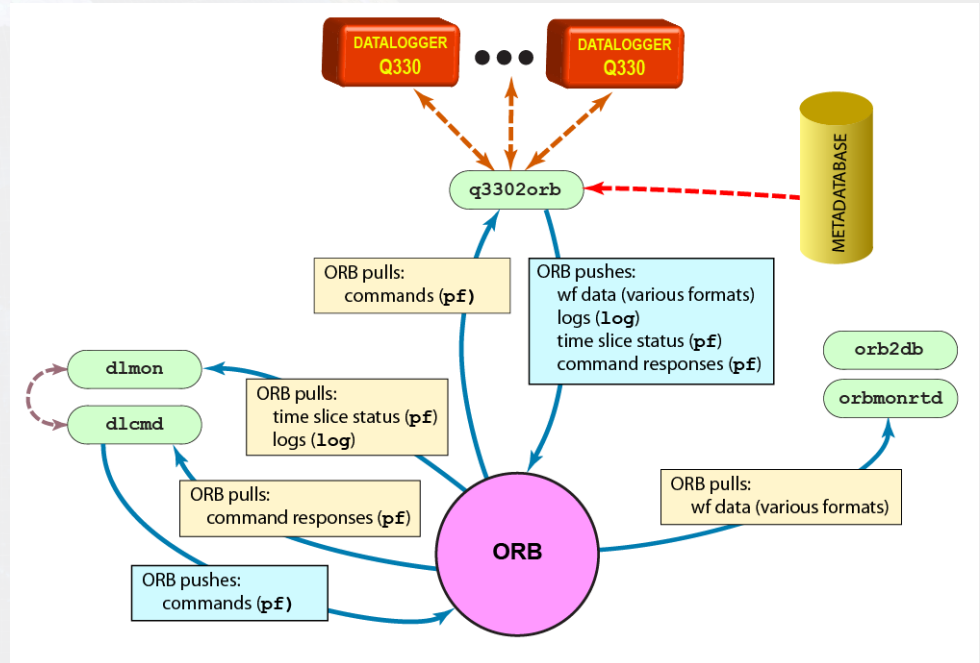
Data Acquisition: q3302orb

q3302orb

Over 2 years at USArray:



- 1166 dataloggers
- 10,292 physical data channels at multiple sample rates
- ~40,000 channels of SOH waveform data
- 8760 instance-days of software running
- 16 Terasamples of end user data collected (not including SOH)



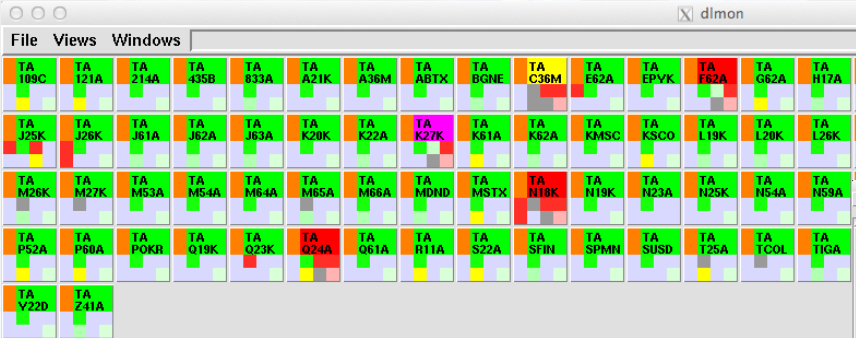
- *0 downtime, 0 lost data* due to acquisition software failures
- 1 FTE to manage data center O&M
- *99.5% data completeness*





Dataflow SOH Monitoring

dlmon



dlmon interface showing a large table of traffic analysis data with columns for TA ID, status, and other metrics.

```
dlmon: TA_Q13A logs
2007174 18:58:40.820: tadatadu: TR_Q13A: data stream open - starting with
2007174 18:58:40.820: tadatadu: TR_Q13A: Reading data...
2007174 18:58:42.703: tadatadu: TR_Q13A: First data packet,
2007174 18:59:03.885: tadatadu: TR_Q13A: ERROR: too many status timeouts.
2007174 18:59:03.885: tadatadu: TR_Q13A: Sending user message = 'ant: 200
2007174 18:59:06.697: tadatadu: TR_Q13A: SMSB: ip = 132.239.4.72 (foley-4)
2007174 19:02:16.154: tadatadu: TR_Q13A: g330_read_data() error: TIMEOUT
34: tadatadu: TR_Q13A: Breakout to re-register...
34: tadatadu: TR_Q13A: Close data successful.
35: tadatadu: TR_Q13A: ERROR: Status 0330 ERROR: 2: Not
36: tadatadu: TR_Q13A: deregister successful
36: tadatadu: TR_Q13A: data connection startup.
34: tadatadu: TR_Q13A: Registering for ip address 70.41
35: tadatadu: TR_Q13A: Registration successful.
34: tadatadu: TR_Q13A: Opening data connection.
34: tadatadu: TR_Q13A: Getting configuration...
11: tadatadu: TR_Q13A: Configuration ok...
12: tadatadu: TR_Q13A: data stream open - starting with
12: tadatadu: TR_Q13A: Reading data...
12: tadatadu: TR_Q13A: First data packet.
33: tadatadu: TR_Q13A: ERROR: too many status timeouts.
33: tadatadu: TR_Q13A: Sending user message = 'ant: 200
```

```
File Edit View
password
phone_number
physical_interface_number 3
point_of_contact_port_number 22873
power_off_time 2
serial_baud_rate 5
spare1 0
user_name
web_server_bps_limit 980

-+--+
| data_port 0
| ip_address 132.239.4.72 (foley-4-72)
| physical_interface 3
| seconds_since_heard 0
|
| -+--+
| data_port 4
| ip_address 69.88.01.242 (69-88-01-242.static.c
| physical_interface 3
| seconds_since_heard 2593211
|
| -+--+
| data_port 4
| ip_address 132.239.4.167 (anpublic.ucsd.edu)
| physical_interface 3
| seconds_since_heard 571
|
| -+--+
| data_port 3
| ip_address 10.2.2.14 (?)
| physical_interface 1
| seconds_since_heard 8243
|
|-----|
| data_port 4
```

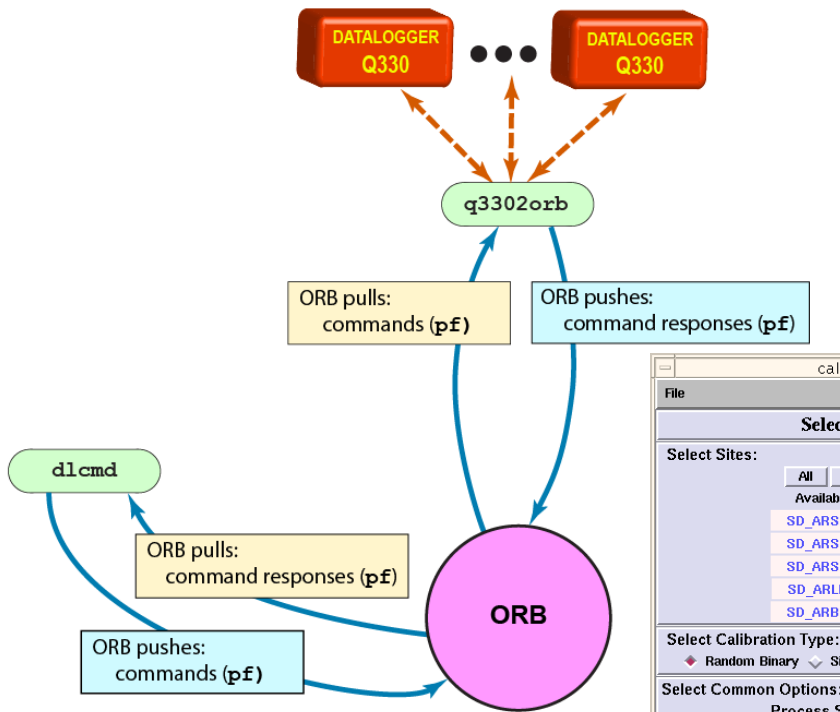


High Success rate of Antelope acquisition:
• Robust Software
• Sophisticated SOH Monitoring





Datalogger Command and Control



d1cmd

calconfig: calibration configuration window

File

Select Calibration Configuration Parameters

Select Sites:

| | | | | | |
|-----------|------|-------|-------|---------|-----------|
| All | None | 23900 | GS-21 | KS54000 | GS-13 |
| Available | | | | | Select |
| SD_ARSP01 | | | | | SD_ARSP01 |
| SD_ARSP02 | | | | | |
| SD_ARSP03 | | | | | |
| SD_ARLP31 | | | | | |
| SD_ARBB32 | | | | | |

Select Calibration Type:

Random Binary | Single Sine Wave | Sine Wave Sweep | Free Period

Select Common Options:

Process Sites: Serially | Concurrently
Calibrator Output: Sensor | Loopback
Loopback Options: Preamp in | Loopback loaded
Calibration Start Time: now
Calibration Settle Time: 130.0
Settle Time Without Autozero: 30.0
Recover Time: 10.0

Select rbc Calibration Parameters for Site SD_ARSP03

Channel: SHZ

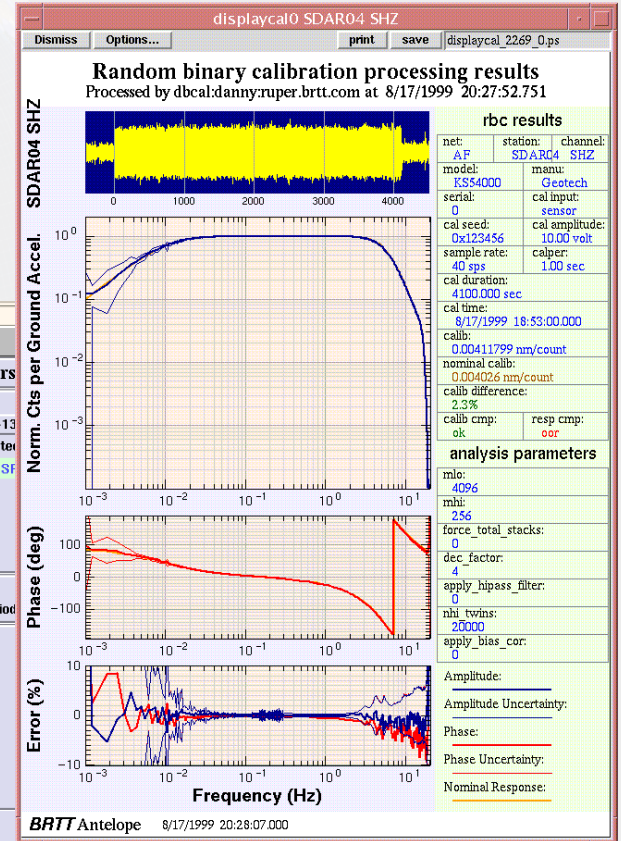
Select Amplitude in Volts: 5.0 actual volts=5.00000 dac=0x6666,0
Select Duration Time in Minutes: 10.0
Select Random Seed Value: 0x123456

Select RBC Analysis Parameters:

Select Low Frequency in Hz: 0.01
Select Mid Frequency in Hz: 0.2

EXECUTE THE CALIBRATION SEQUENCE

Status:





Station Metadata Management

dbbuild

- Program for building the “metadata” part of a Datascope database (*site*, *sitechan*, *sensor*, *instrument*, *calibration*, *stage* tables plus external instrument response files)
- Can operate in either interactive or batch mode.
- Can run from a master configuration file
- Based on well-documented ASCII files
- User-configurable single-stage response files
- set of parameter files that describe standard dataloggers, pre-amps and sensors

Master Database Construction

Database Configuration Help

Configuration time: 4/1/2004 Comment:

Network

net network name
XT SECARIB - Passcal Broadband Experiment

Station

| sta | latitude | longitude | elevation | station name |
|------|----------|-----------|-----------|--------------|
| ZUPC | 8.3597 | -65.1951 | 0.0960 | Zuata |

Datalogger

Reftek 130 Datalogger

rt130

serial number: 123 dlist:

Sensor

Episensor 200 Hz 10 Volt FS 2g Clear

1 episensor_2g_10vfs

| serial number | edepth | band | rsptype | loc code |
|---------------|--------|------|---------|--------------------------|
| 456 | 0.0 | s | R | <input type="checkbox"/> |

| axis | hang | wang | sensor gain | lead | preamp gain | preamp stage |
|------|------|------|-------------|--------------------------|--------------------------|--------------------------|
| Z | 0 | 0 | 5.1e-10 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| N | 0 | 90 | 5.1e-10 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| E | 90 | 90 | 5.1e-10 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| samp rate | on | chan | loc | dchan | on | chan | loc | dchan | on | chan | loc | dchan |
|-----------|-------------------------------------|------|--------------------------|--------------------------|-------------------------------------|------|--------------------------|--------------------------|-------------------------------------|------|--------------------------|--------------------------|
| 250sps | <input checked="" type="checkbox"/> | HGZ | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | HGN | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | HGE | <input type="checkbox"/> | <input type="checkbox"/> |

Add



Embedded Relational Database

Datascope

- Schema-independent relational database system
- Flat-file, no “black box” into which your data disappear
- Written directly from core ideas of relational databases
 - Create *sets* of things
 - Establish *relationships* amongst them
 - Intuitive database operations
- Optimized for real-time monitoring
- Coherently engineered with Real-time Tools
- Many specialized tools and features for seismic tasks



Real-time System

- Unix building-block design
 - Hundreds of small, well-designed programs, each with a clear job
 - Shared-object libraries of generic and specialized tools
- Framework to customize solutions
- Scalable
- Network-transparent
 - Allows local deployments
 - Allows distributed processing
- Demonstration system based on GSN
 - Learning and Testing
 - Augment small networks with global processing for context
 - Basis for rapid configuration of larger operations





Conclusion

Antelope is:

- The Premier, State-of-the-art seismic monitoring software platform in the world
- The industry leader in robustness, flexibility, and design quality
- Open-architecture
- 20 years field-proven
- Commercially maintained, commercially supported

Software is a critical, first-class element of systems that meet customer business mission



Remainder of Meeting

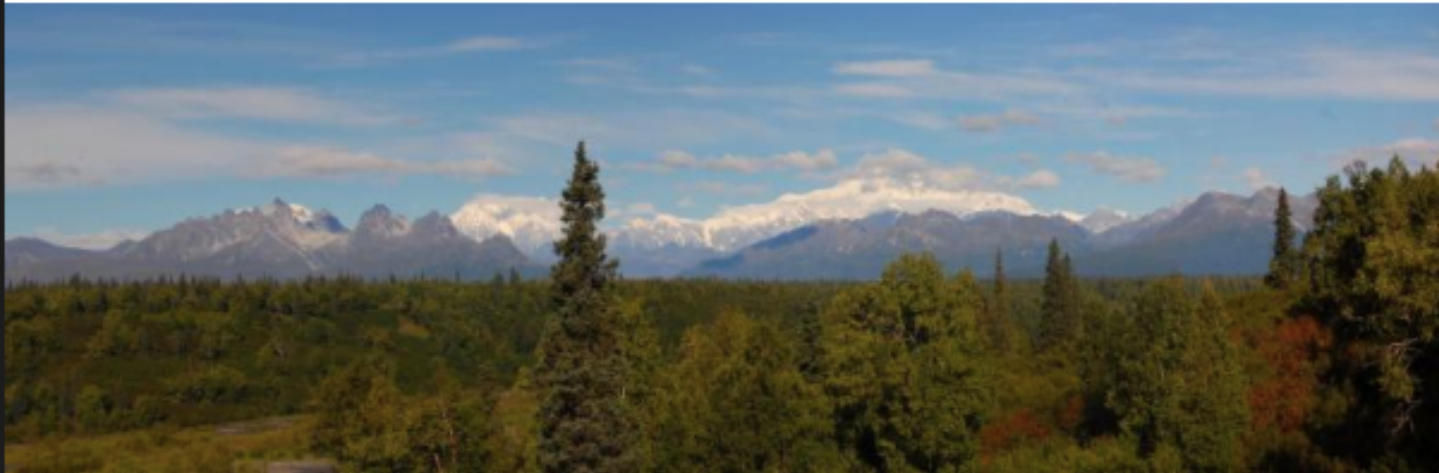
- Anza, CEUSN Network usage
- Dbmoment
- Extending Antelope
- Multi-hazard monitoring
- Afternoon: **Discussion**



Reminder

Antelope User Group

Meeting



August 17-19 Fairbanks, Alaska



<http://www.brtt.com/events/alaska2016/index.html>

BRTT