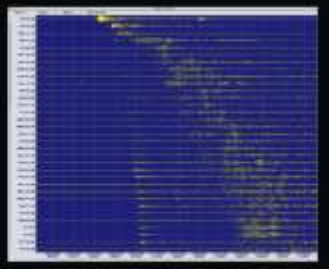
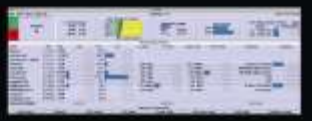
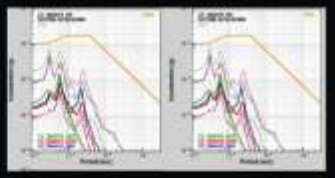
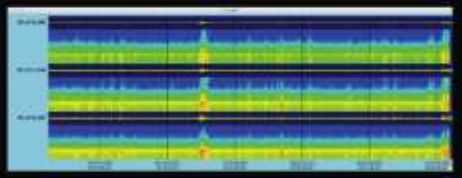
Antelope









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Antelope

Dr. Kent Lindquist
Boulder Real Time Technologies, Inc.

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Antelope Presence

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

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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

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Antelope Key Points

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

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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***

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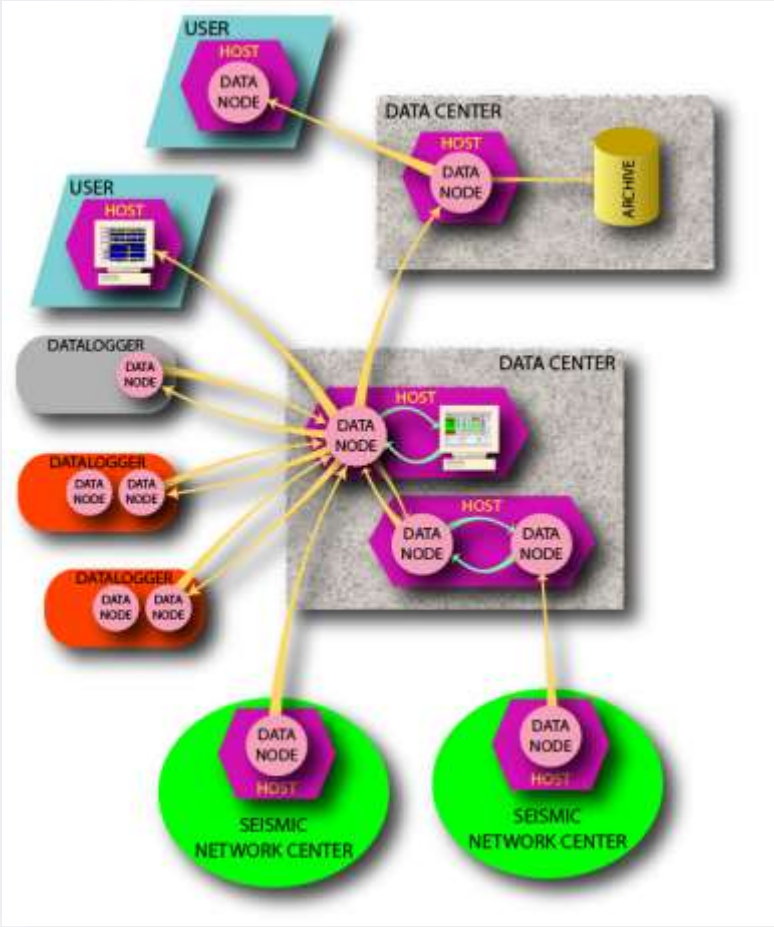
Data Transport Backbone

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



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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

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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 Kinemetrics 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

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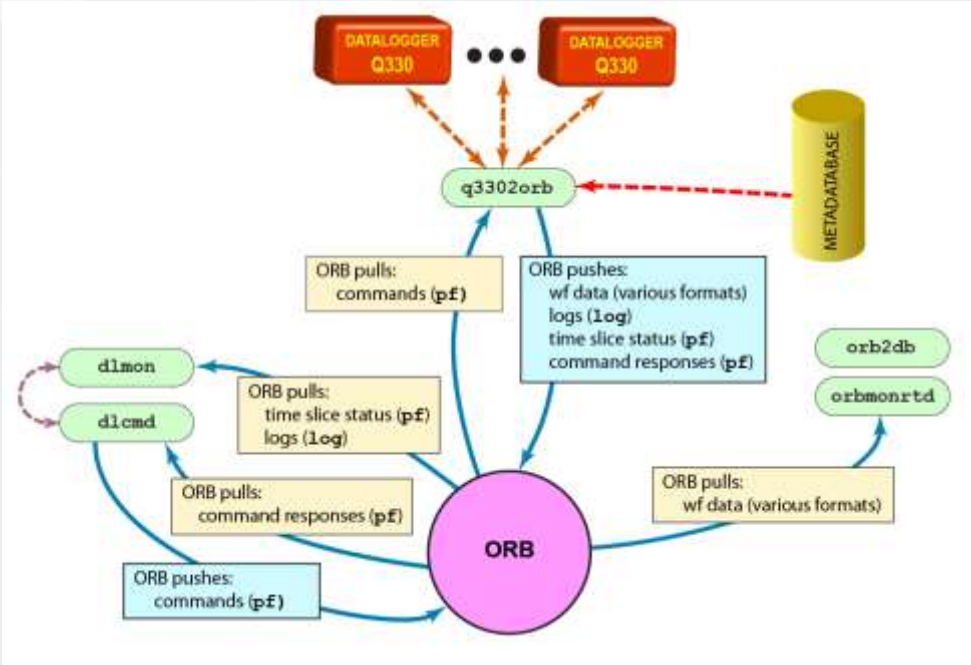
Data Acquisition: q3302orb

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***

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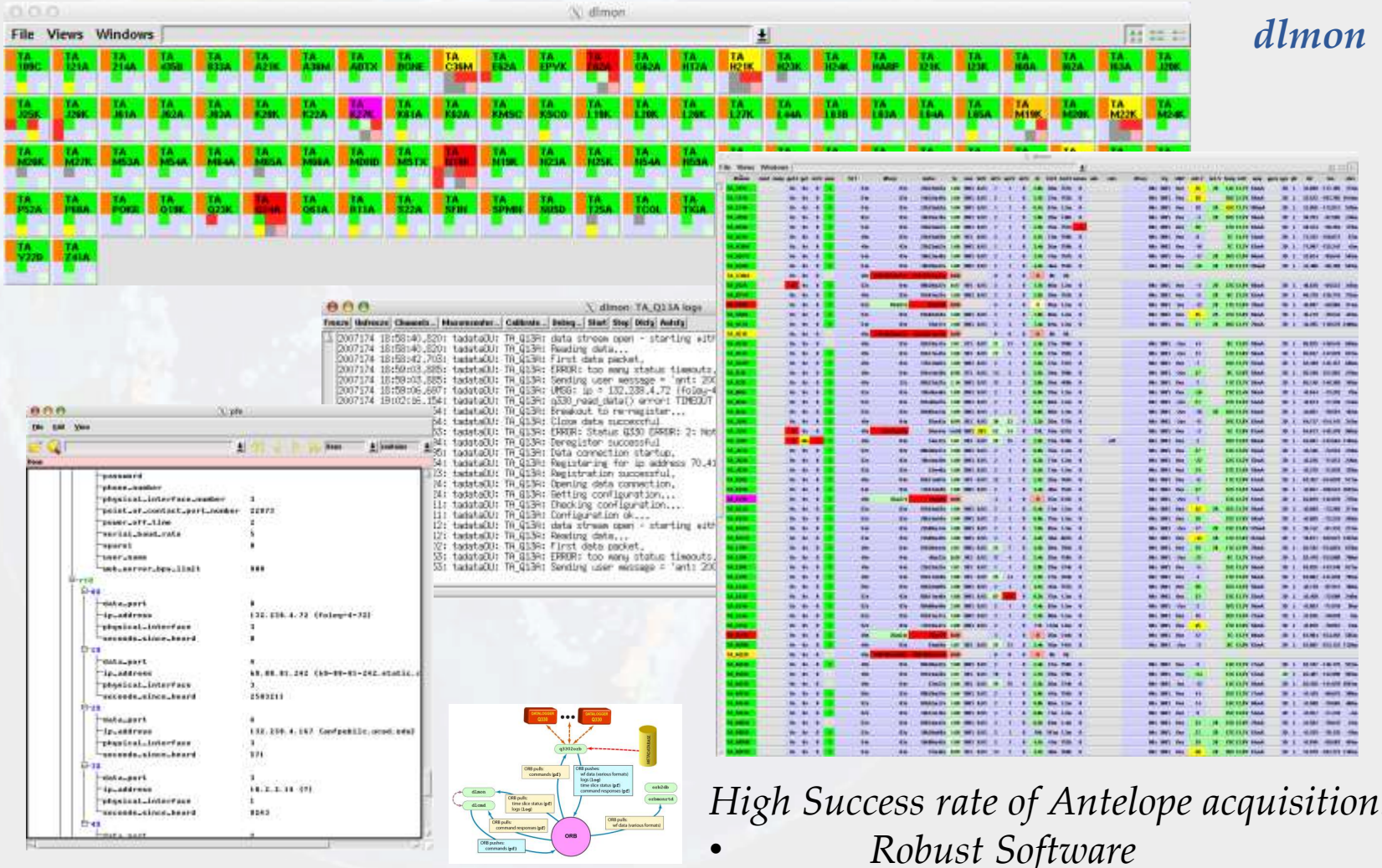
Dataflow SOH Monitoring



dlmon

High Success rate of Antelope acquisition:

- *Robust Software*
- *Sophisticated SOH Monitoring*

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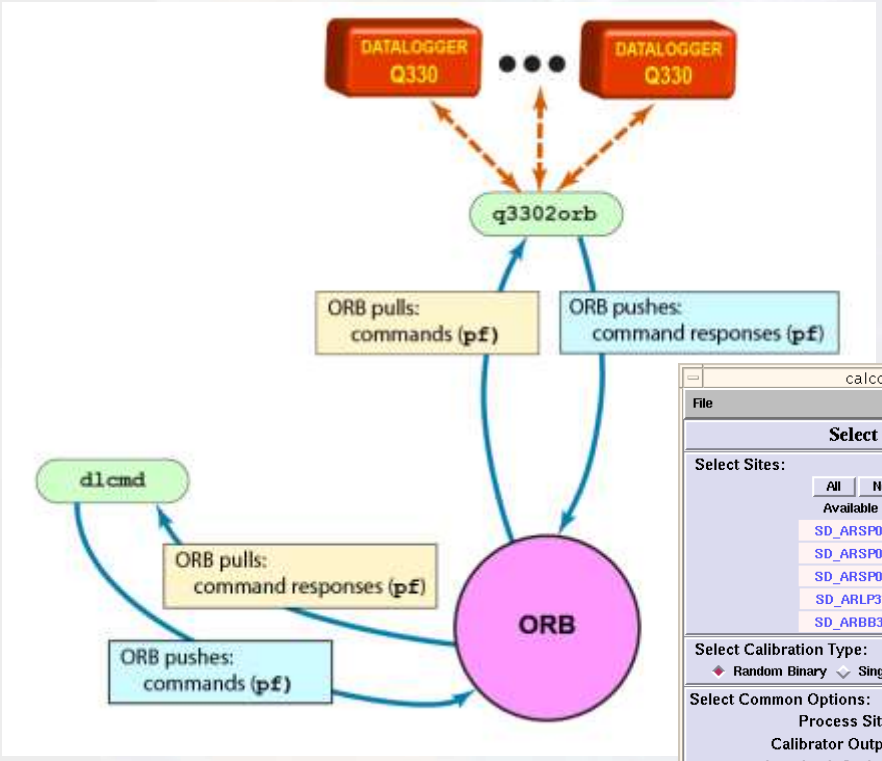
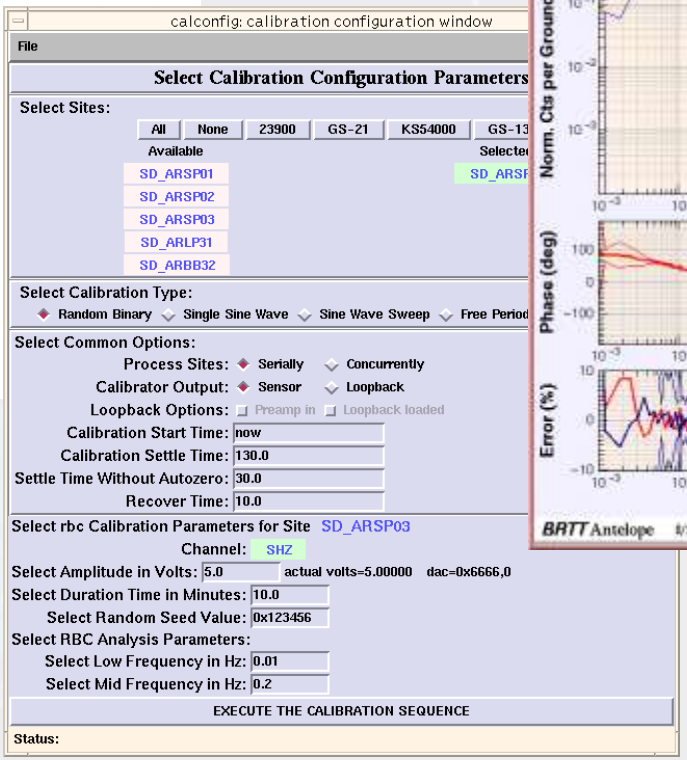
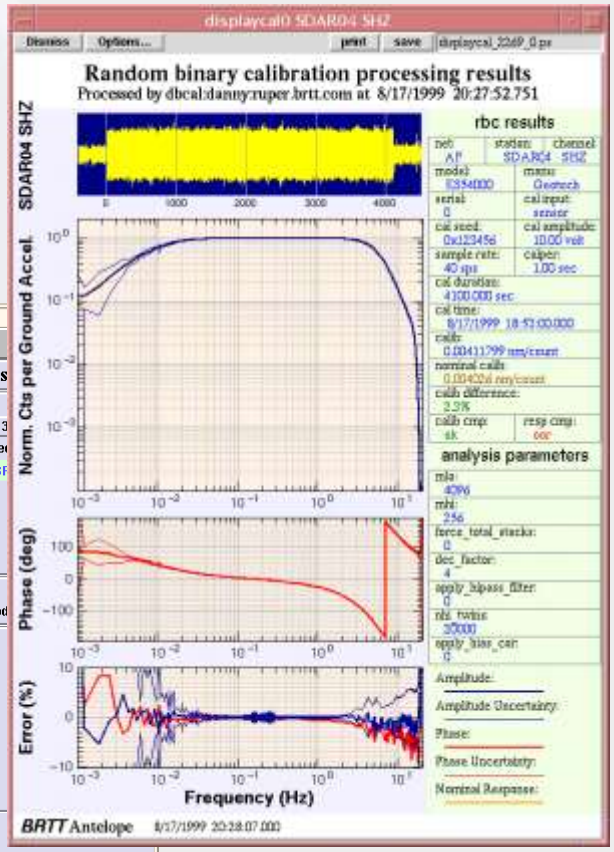
Datalogger Command and Control



dlcmd





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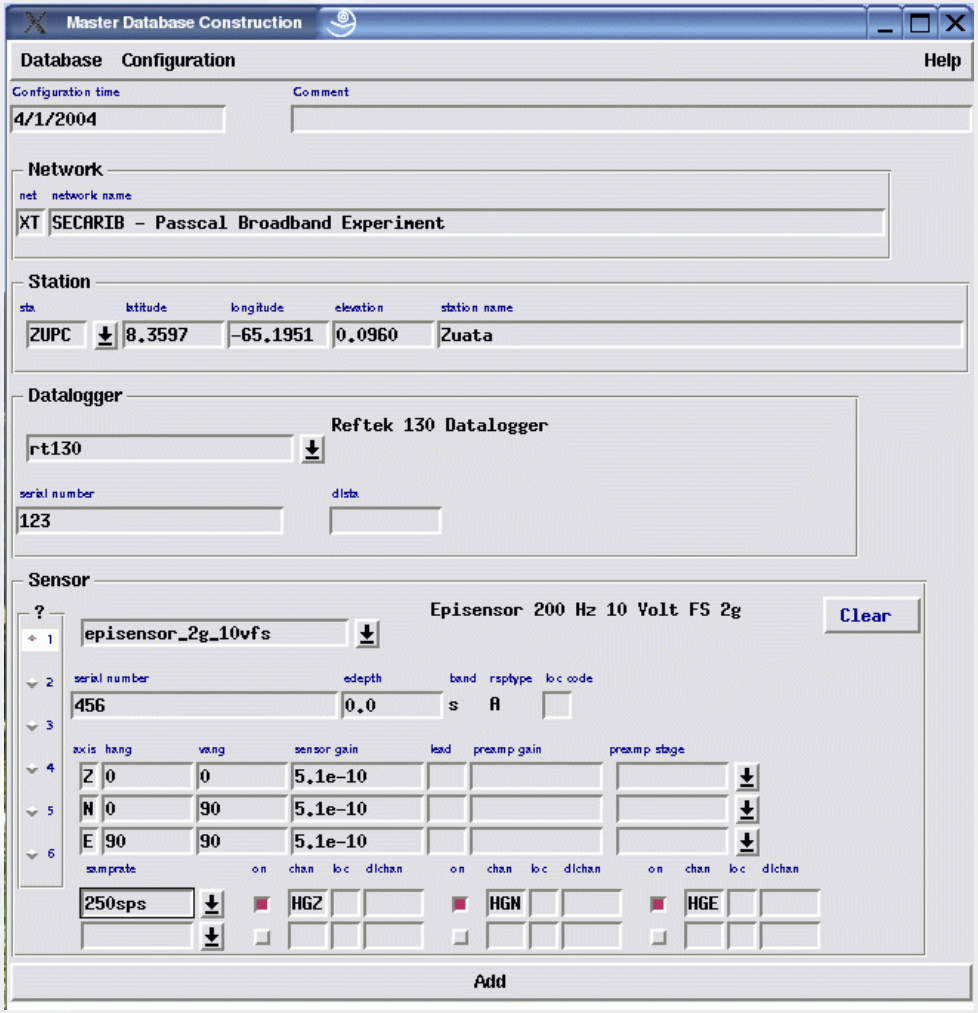
Station Metadata Management

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



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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

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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

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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

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Remainder of Meeting

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

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

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