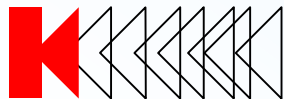


Kinematics' Aspen System for the Malaysian Meteorological Service

presented by

Dr. Mathias Franke, Kinematics Inc.

at the Antelope User Group Meeting in Trieste, Italy
November 29-30, 2004



Contents

- Kinematics: Who we are?
- Aspen System Solution & Antelope Networks
- MMS Aspen System
 - Layout
 - Capabilities
 - VSAT Testing



Kinematics, Inc.

Kinematics has been a leader in the earthquake instrumentation and services business for over 30 years:

- Creating products for monitoring bridges, dams, and structures
- Providing comprehensive seismic information systems (Kinematics' Aspen Systems are the main integration platform for Antelope Software)
- Installing systems for the nuclear power industry



Kinometrics' Aspen System as Solution for Monitoring Networks

- Developed by a Team of Experts
- Open Architecture
- Commercial-Off-the-Shelf (COTS) Equipment
- Antelope Software



Antelope Networks (selection)

Network	Stations	Channels	SPS	Gb/day Compress.
Alaska Regional Seismic Network	266	362	36.2K	4.0
Nevada Regional Seismic Network	140	340	26.8K	3.0
Utah Regional Seismic Network	143	396	22.3K	3.0
UCSD including VSN	1000	2000	~90K	11+
Oman National Network	10	30	3.6K	0.6
Slovenia National Network	20	66	10K	1.6
Korean National Network	54	~300	30.0K	2.7
Austrian National Network	11	28	2.5K	0.2
Saudi National Network	35	105	5.4K	10
Azerbaijan NSIS	14	84	10.1k	1.6

Not included are the channels and processed data volume of the two main data centers in Europe and USA, which run Antelope: ORFEUS and IRIS, respectively.

MMS Aspen System

Layout

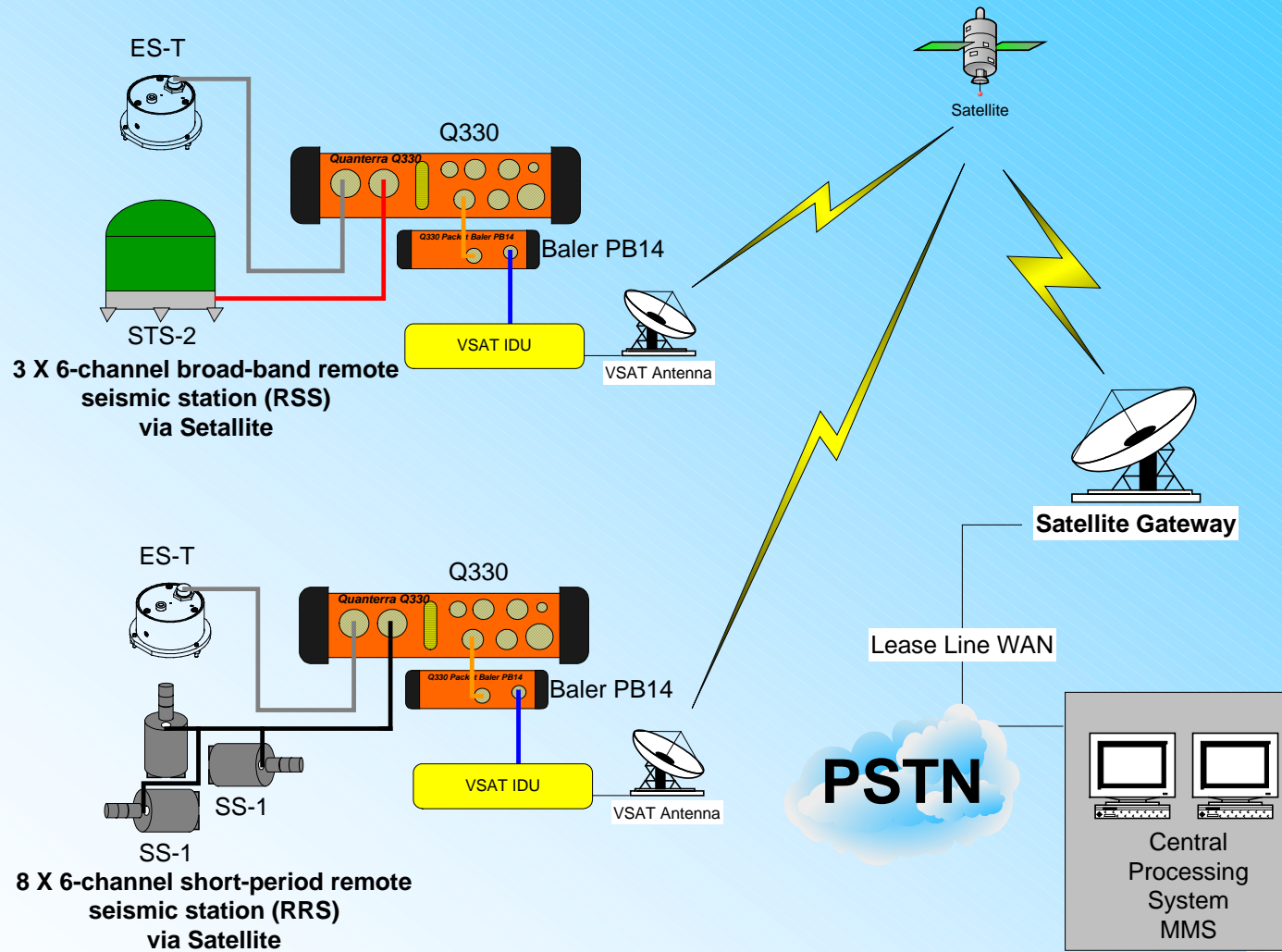


MMS Aspen System

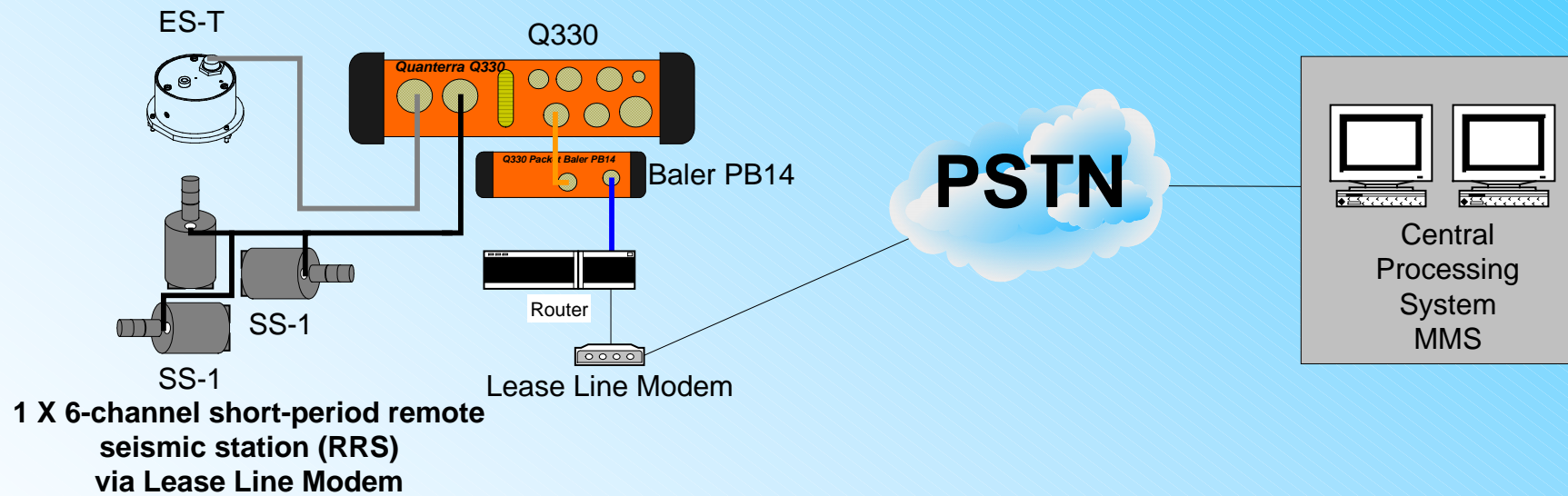
- 12 Remote Sites
 - 3 Broad-Band or Short-Period Channels
 - 3 Strong-Motion Channels
 - High Dynamic Resolution (24-bit digitization)
- VSAT Communication
- Data Center
 - Real-Time Data Acquisition & Processing
 - Seismic Information System (relational data base)



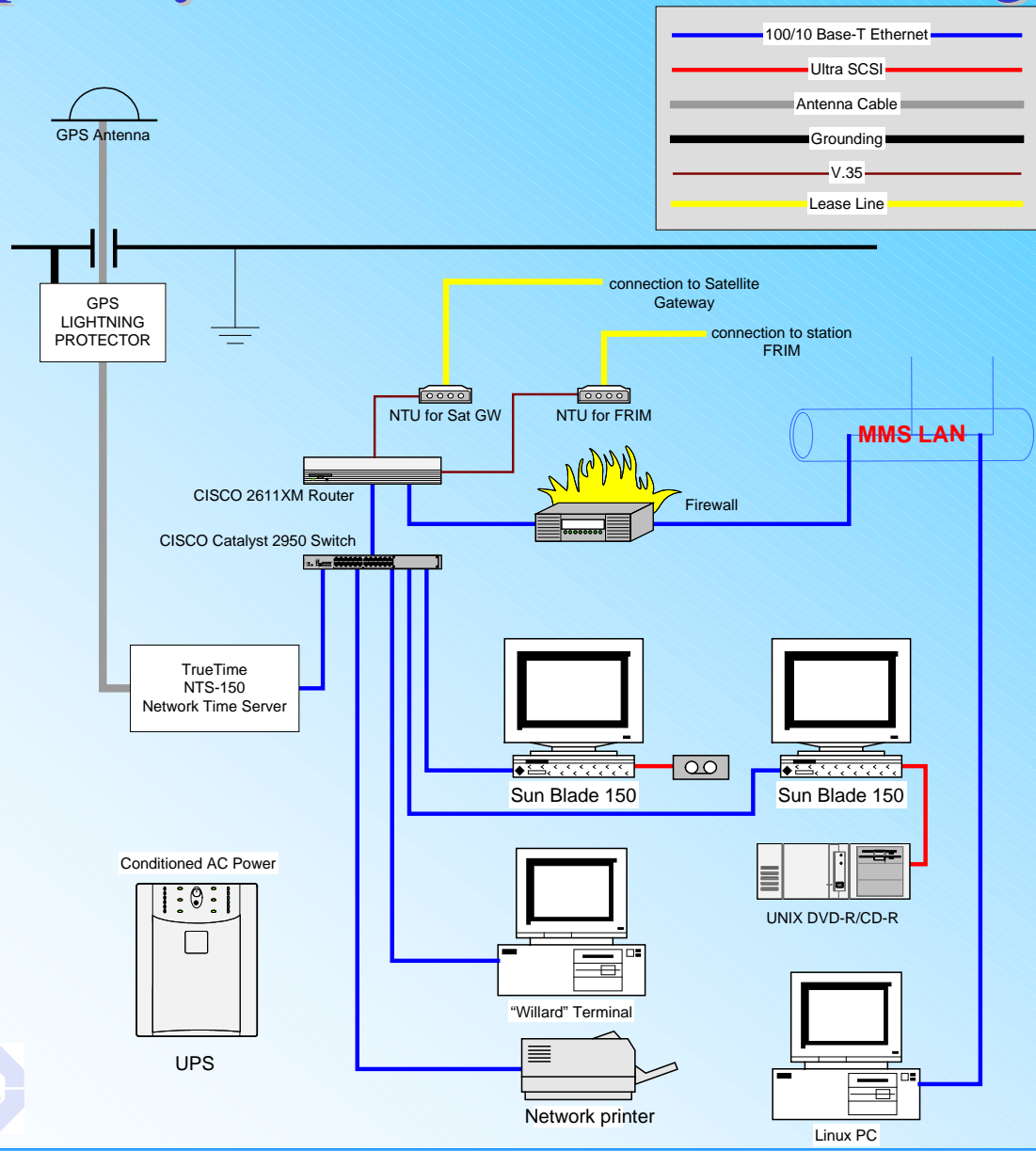
MMS Aspen System : Satellite Communication



MMS Aspen System : Lease-Line Communication



MMS Aspen System : Central Processing System



MMS Aspen System

Capabilities

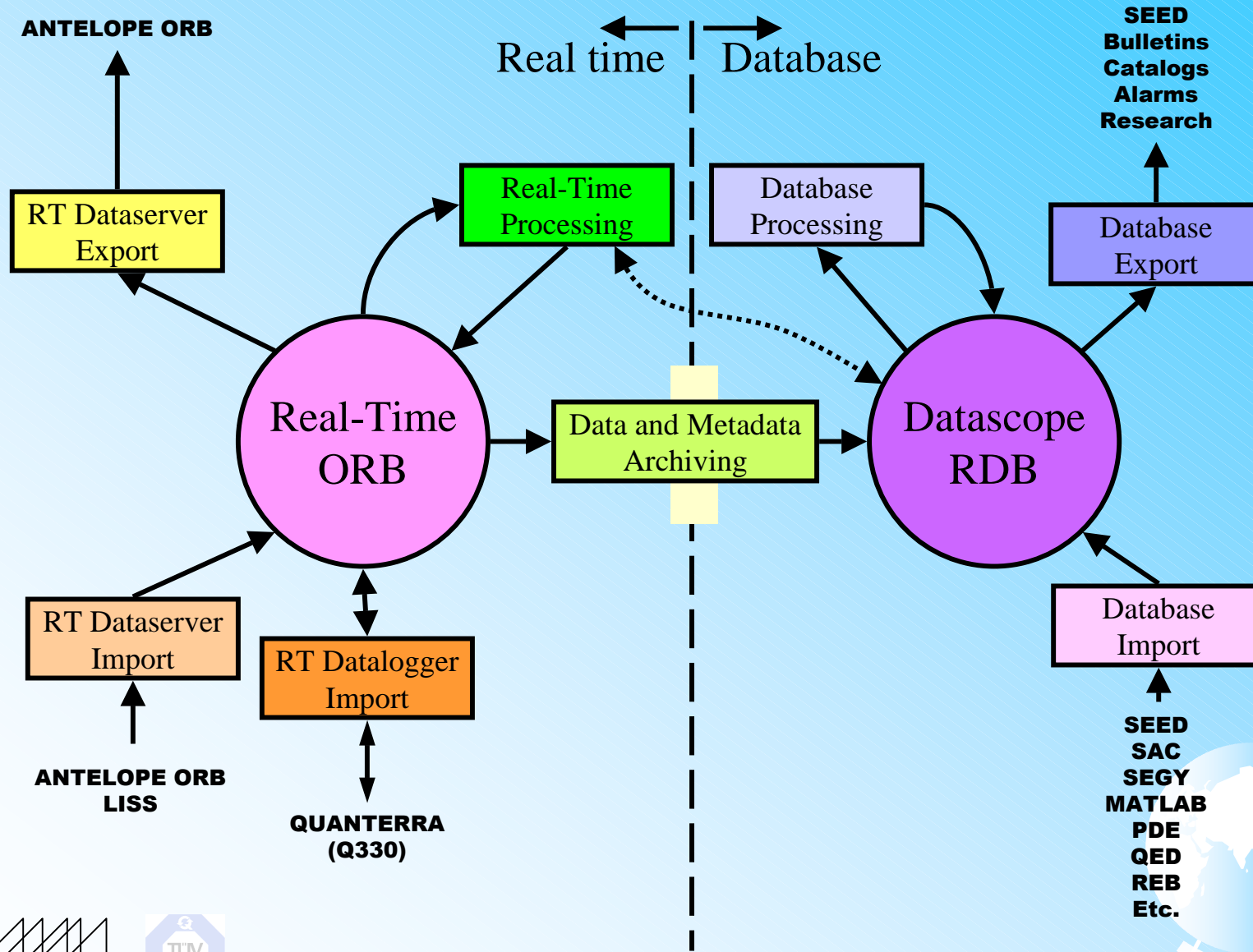


Aspen Network & Seismic Information System

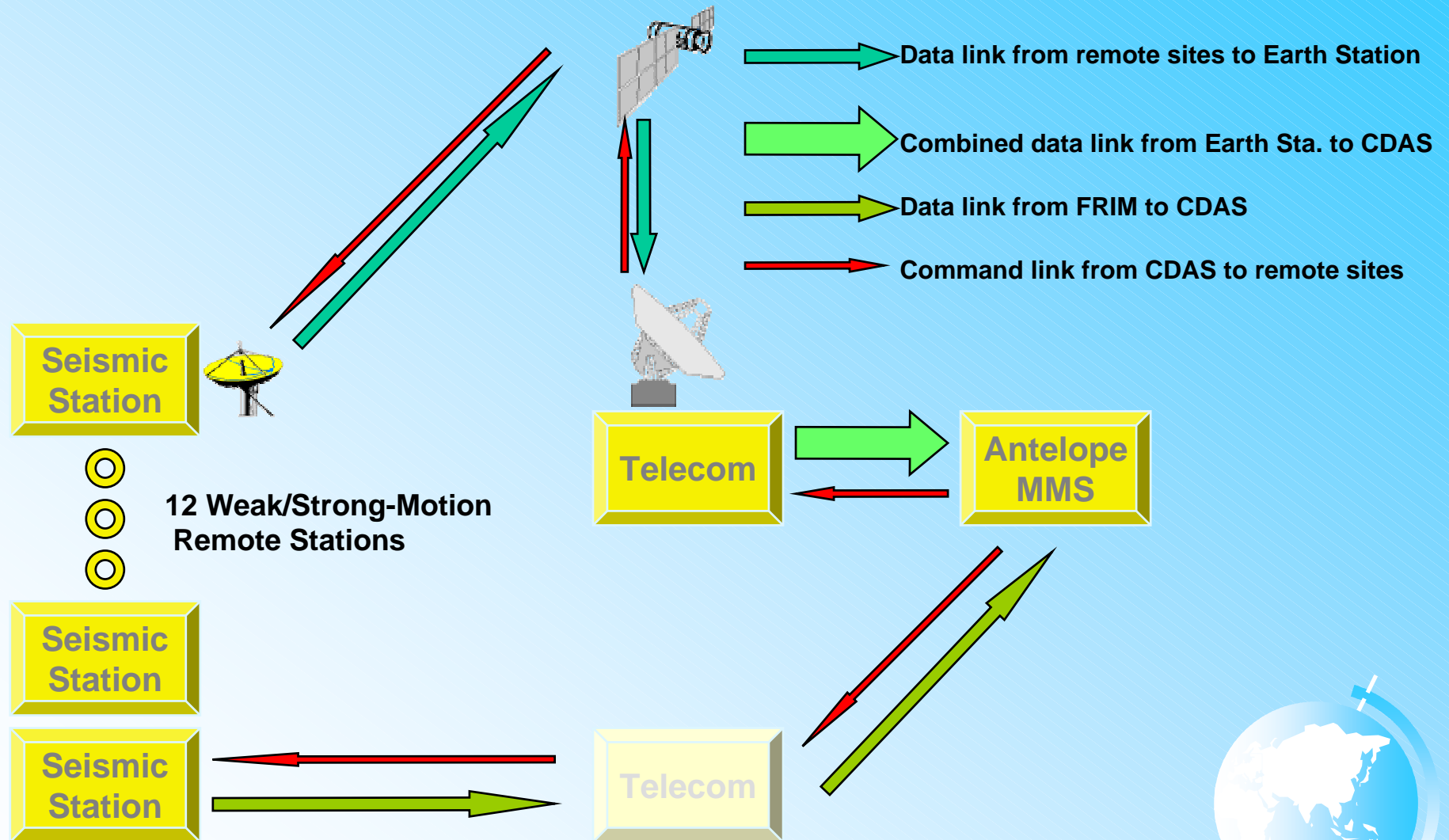
- Instrumentation
 - 24-bit high resolution data
 - IP aware Q330 digitizer
 - Broad-band data & strong-motion data
- Antelope Software
 - Antelope Real-Time System (ARTS)
 - Relational database system (DataScope)
 - Antelope toolbox



Antelope Roadmap



Aspen Control & Command



Aspen Features

- Open System
- IP based remote sites with 24-bit resolution
- Scalable
- Real-Time processing with integrated database
- Command & Control
- Interoperability
- Alert capability
- Extensive documentation
- Kinometrics ISO9001:2001 quality control system



MMS Aspen System

VSAT Testing



VSAT Testing

Q330 Parameters Window Size

- **Window Size:** Number of “in the air” packets in a sliding window. The Q330 will send up to this number of packets and then wait for acknowledgement.
- **Maximum Timeout / Minimum Timeout:** The timeout out is how long the Q330 will wait for acknowledge before resending a packet. The resend timeout is dynamically adjusted but limited to the range between the maximum and minimum value, in seconds.



VSAT Testing

Q330 Parameters Grouping

- **Group Size/Group Timeout.** Data packets are held from transmission until the number of packets reaches the group size or the Group timeout has been reached.

Note: This mechanism operates within the constraint of the window size.

Grouping is helpful for time domain multiplexing common in VSAT communication links.



VSAT Testing

Q330 Parameters Acknowledgment

- **ACK timeout:** How long the receiver should wait before sending the Q330 an acknowledgment. Sending an acknowledge for every packet generates large amount of back traffic to the Q330.
- **ACK grouping:** How many packets the receiver should accumulate before sending an acknowledgment to the Q330.

Note: The receiver should dispatch an acknowledge when it has received the “ACK grouping” number of valid packets or after “Ack timeout”.

Rule of Thumb:

ACK timeout ~ (ACK grouping / typical packet rate) + 1s



VSAT Testing

Q330 Parameters Software Throttle

- ***Ethernet Max. Bps***: Maximum data throughput in Bytes(!) per seconds for the particular data port. The software throttle will restrict data from this data port to a maximum number of bytes per second over the QNet interface.

Note: Used in two ways: 1) to throttle transfer to as many bytes as the data buffers downstream could receive; 2) to ensure that one data port does not monopolize the interface at the expense of other data ports or configuration functions.



VSAT Testing

- Link Test with “**Link Flooding**” enabled at Q330 installed at one free field site with (1) STS-2 and (1) EpiSensor
- Using Willard for parameter modifications and data throughput monitoring
- Using Antelope for data acquisition and data throughput monitoring in terms of maximum throughput and communication efficiencies



VSAT Testing

Q330 Parameters for VSAT Communication

- Window Size: 64

Note: one of the most significant parameters; throughput increased considerably after changing it from the default value 127 to 64

- Min Time Window: 3.0
- Max Time Window: 20.0
- Group Timeout: 16.0
- Group Size: 30

Note: important parameter in order to define satellite transaction frequency: ~7-10 sec

- ACK Timeout: 10.0
- ACK Grouping: 30
- Ethernet Max Bps: 3750

Note: other very significant parameter to achieve maximum throughput: sat-link bandwidth was set to 30 kbps



VSAT Testing Observations

- The observed data rates were:
6 - 11 kbps
- Max observed data throughput:
~29 kbps
- Communication efficiencies:
~100% (with occasional dropouts)

