DOD Iridium RUDICS

First Deployment Experiences

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Outline

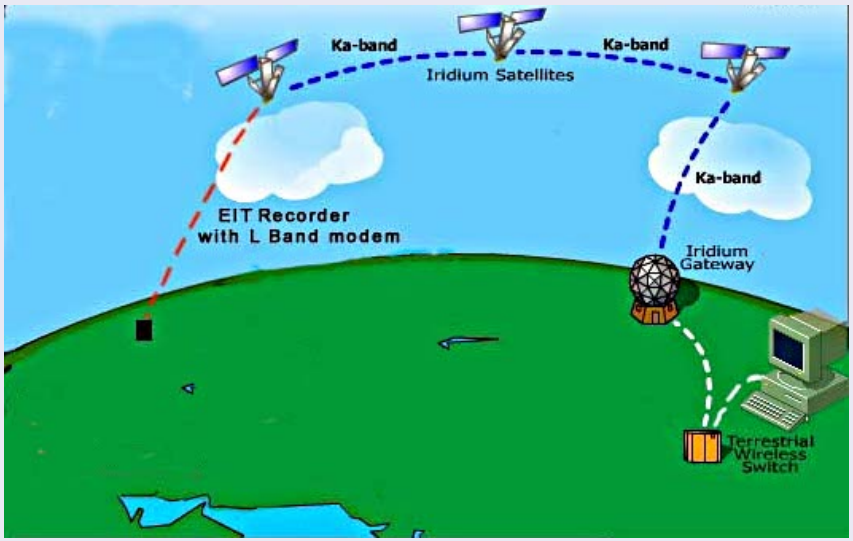
What is RUDICS?

Router-based Unrestricted Digital Internetworking Connectivity Solution

- ISU calls gateway
- Gateway connects to predetermined IP address and port
- IP connection between ISU and host application

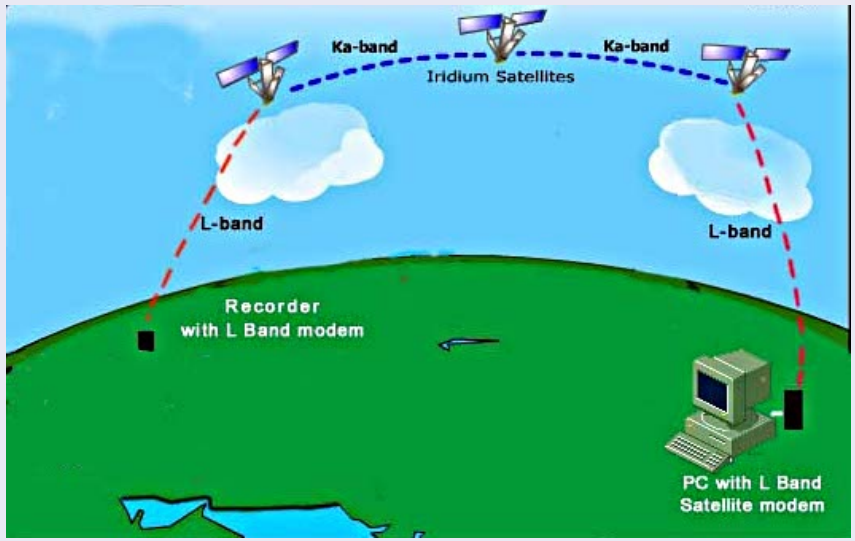
Comparison to PPP Dialup

RUDICS



- Fast connect (6 secs)
- Scales to many clients
- More reliable, long uptimes
- Protocol free

PPP



- Long connect (30 secs)
- Paired modems
- Frequent disconnects
- TCP/IP stack

Simple to Implement

ISU Client

```
AT+CBST=71,0,1
ATDT 0088160000500
```

Host Service

```
import socket

s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.bind(('', 9080))
s.listen(1)
conn, addr = s.accept()

while True:
    data = conn.recv(1024)
    if not data:
        break
    print 'Received:',repr(data)

conn.close()
```

Example Application: O-Buoy

IPY-OASIS (Ocean-Atmosphere-Sea Ice-Snow interactions in Polar Regions)

O-buoys: self-contained, autonomous buoys for long-term observations of atmospheric chemical species in the polar marine boundary layer

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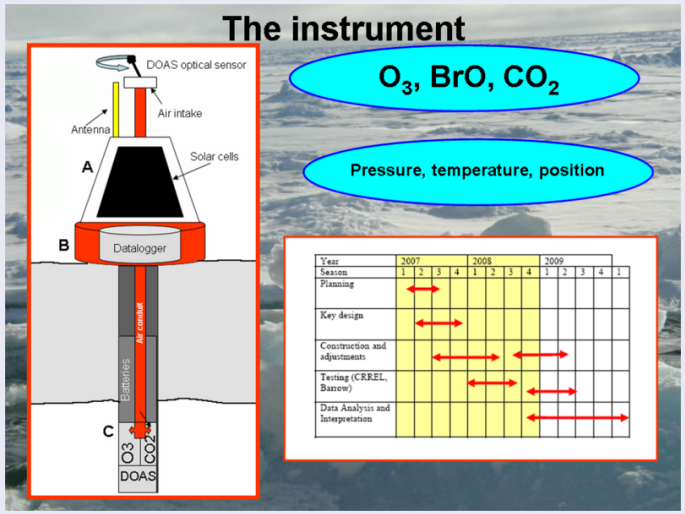
In-situ long-term ocean-based measurements of chemical species in the atmosphere above Polar Ocean surfaces do not exist (except from satellites). Surface based observations are only available from a few land-based observatories and short-term cruises or research aircraft campaigns. Such data are especially important to quantify the sea-



Data Transport Network

Open-Source, NFS Information Technology Research Project

Real-time system for distribution of data from multiple instruments over unreliable networks.

- Publish and subscribe
- Multiple data sources
- Store and forward
- Data distribution
- Linux-based, Python, common Internet standards

Major components

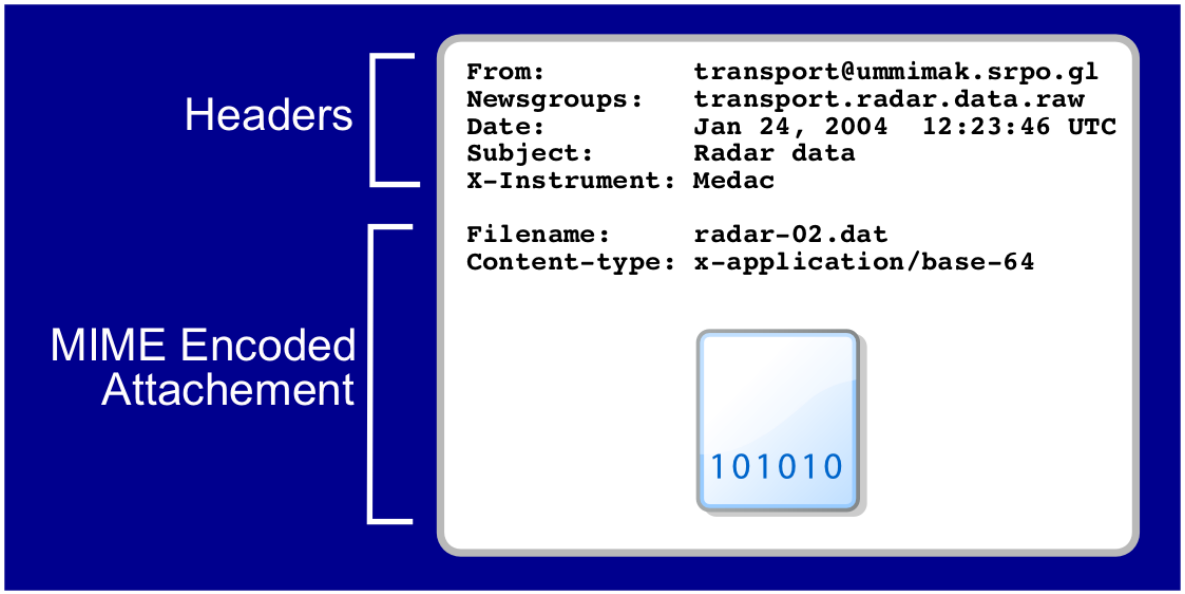
Supervisor

- Collection of programs
- Heirarchial groups
- Common configuration and logging
- Watchdog and introspection
- Network services (XML-RPC)

News Server

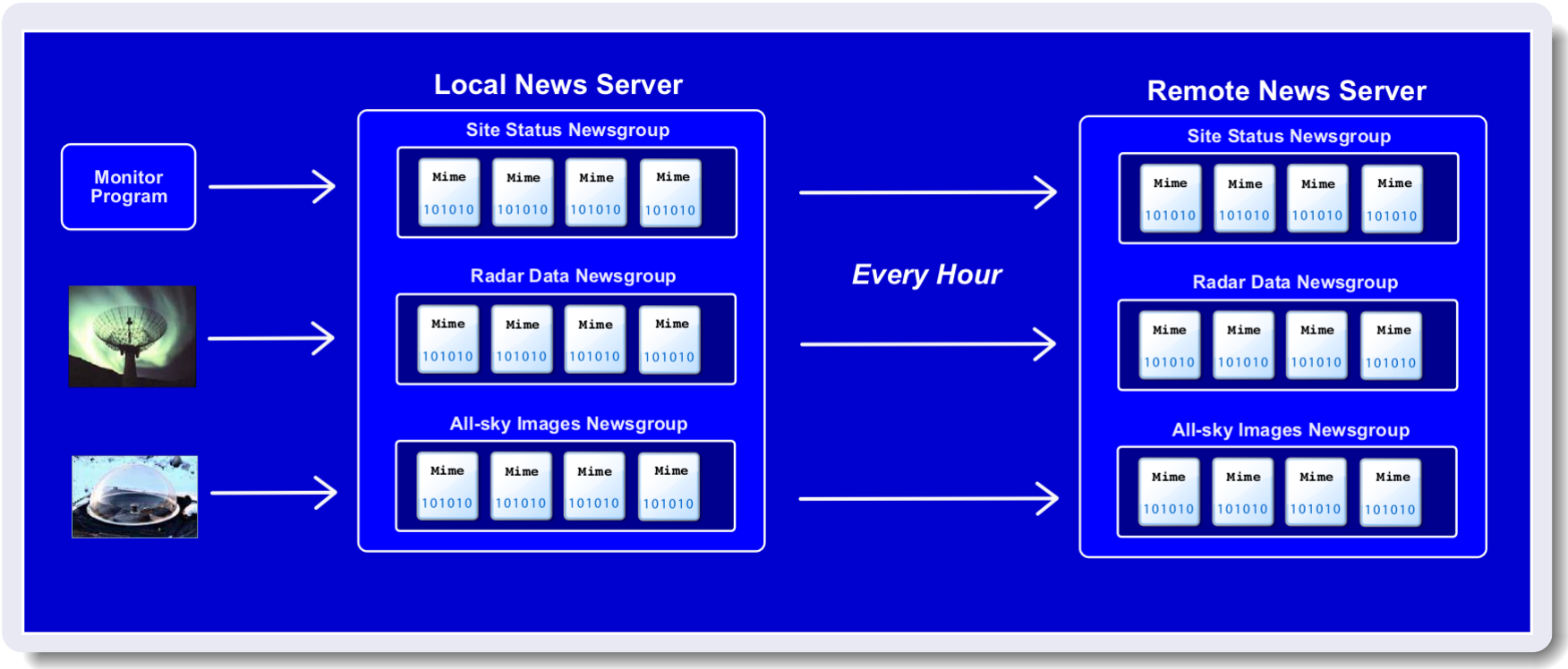
- Message bus
- Store and forward
- Protocols: NNTP, MIME
- Data format neutral

Usenet Message Attachments



- Data files are sent as attachments
- Headers provide metadata
- Any type of data can be sent (text, images, binaries)

News Server Message Exchange



- Periodic transfers (typically every hour)
- Access controls
- Bidirectional
- Data replication

RUDICS Data Transport Protocol

Using TCP Services Over RUDICS

- Desire to use common protocols (HTTP, SMTP, NNTP, etc)
- Language and application support
- Multiplex multiple clients over link
- Connect to multiple services
- Reuse existing client applications
- Disadvantages
  - More processing on client
  - More sophisticated hardware
  - Not as compact

Approach

- RDTP server runs both on client and host
- Service proxies (i.e., NNTP)
- Similar to SSH tunnels
- RDTP packets
  - header
  - payload
  - checksum
- Packet types: SYN, ACK, data
- Sliding window - multiple packets in flight
- Tunable packet size (15KB)
- Retransmits, error checking

Performance
Upload Five 20KB Files

PPP FTP - 7:35

- Dialup: 0:46
- FTP Login: 0:13
- Data: 20480 bytes in 78 secs (262 Bps)

PPP NNTP - 7:04

- Dialup: 0:45
- NNTP connect: 0:07
- Data: 28069 (20480) bytes in 74 secs (378 Bps)

RDTP NNTP - 6:55

- Dialup: 0:15
- Data: 28069 (20480) bytes in 79 secs (352 Bps)

Rough Spots

- Dropped characters at gateway
  - Blocks of data would not be received
  - Worked with DOD gateway to find problem
  - Resolved
- MTP feature on NAL transceivers
  - 2 minute timer - 30KB
  - Break connection if no incoming data
- "Line noise" at start and drop
- Correct dialing strings
- Serial lockups
  - Not a RUDICS problem
  - Embedded ARM systems
  - Reproducible

Conclusions

- RUDICS very nice to develop with
- Improved reliability
- Initial hurdles are past
- Looking to convert existing PPP systems

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