N94-15594

Computer Networking at SLR Stations

Antonín Novotný[1]
Czech Technical University, Prague
Czechoslovakia

Eighth International Workshop on Laser Ranging Instrumentation
Annapolis, MD USA
May 18–22, 1992

Abstract

There are existing several communication methods to deliver data from SLR station to the SLR data centre and back: telephonmodem, telex and computer networks. The SLR scientific community has been exploiting mainly INTERNET, BITNET/EARN and SPAN. 56 countries are connected to INTERNET and the number of nodes is exponentially growing. The computer networks mentioned above and others are connected through E-mail protocol.

The scientific progress of SLR requires to increase the communication speed and amount of the transmitted datda. The TOPEX/POSEIDON test campaign required to deliver Quick Look data (1.7 kB/pass) from a SLR site to SLR data centre within 8 hours and Full Rate data (up to 500 kB/pass) within 24 hours.

We developed networking for remote SLR station in Helwan, Egypt. The reliable scheme for data delivery consists of: compression of MERIT2 format (up to 89%), encoding to ASCII file (files); e-mail sending from SLR station — e-mail receiving, decoding and decompression at the center.

We do propose to use ZIP method for compression/decompression and UUCODE method for ASCII encoding/decoding. This method will be useful for stations connected via telephonemodems or commercial networks.

The electronics delivery could solve the problem of the too late receiving of the FR data by SLR data center.

[1]e-mail: TJEAN@CSEARN.bitnet
TJEAN@earn.cvut.cs

The Name of the Game

The computer network backbone has spread all over the world.

Nowadays we may claim three axioms on network data exchange:

Axiom 1. *All non-local networks are connected to InterNet.*

Axiom 2. *All non-local networks have common protocol — mail protocol.*

Axiom 3. *The longer file is transferred, the longer it takes a byte to get through the network.*

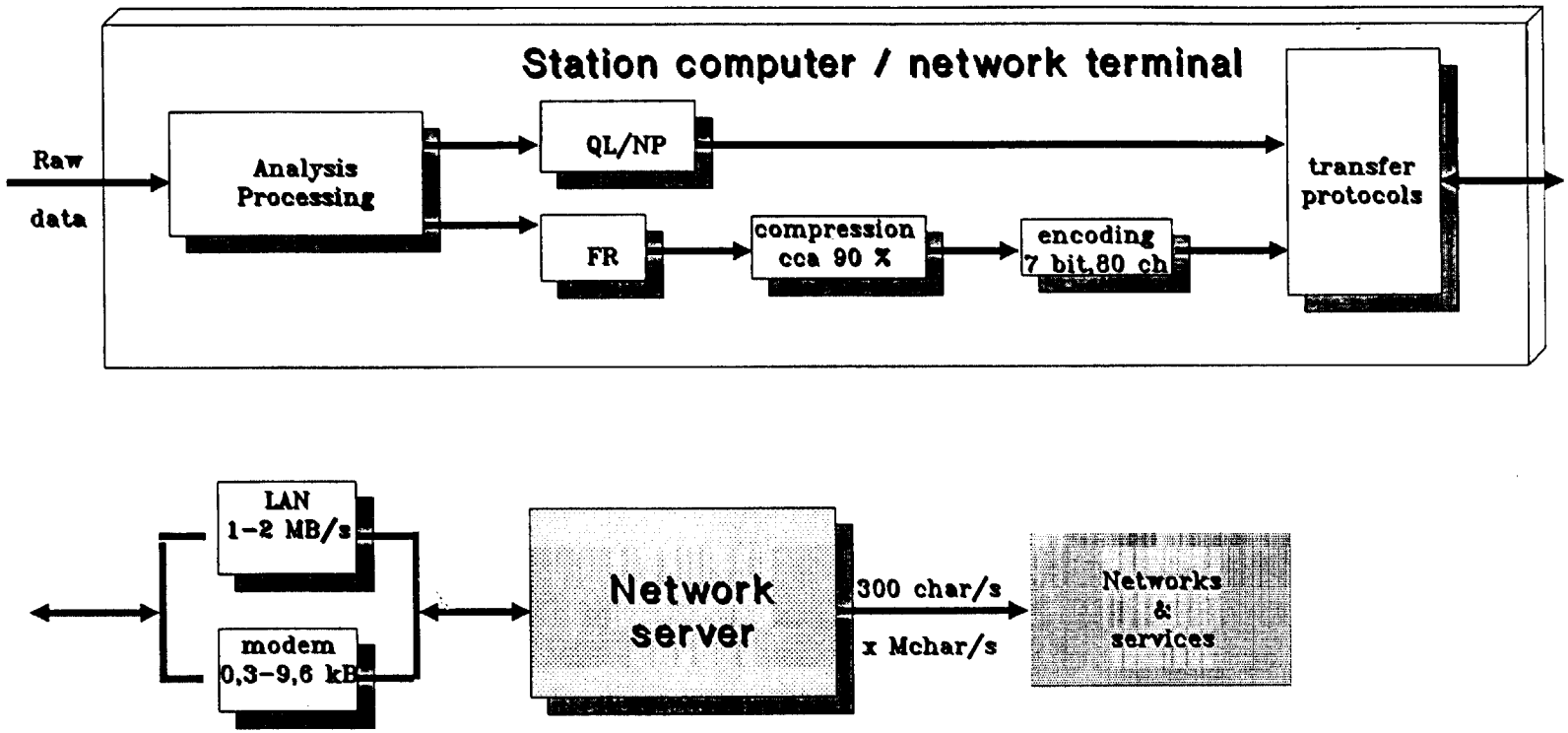
Networking within the SLR Community

The most commonly used non-commercial networks are BITNet, InterNet, SPAN, UUCP. All are used on the satellite laser ranging facilities over the World.

The CSTG SLR Subcommission Meeting in Passadena, CA USA, March 12, 1992 agreed that "InterNet will be implemented to all of the SLR and other DOSE related stations. This includes the stations in Russia and some of the other Commonwealth states that participate in the global network."

We will propose the new computer network standard for data handling between SLR data center and SLR stations. The following two figures schematically show one of the possible configurations.

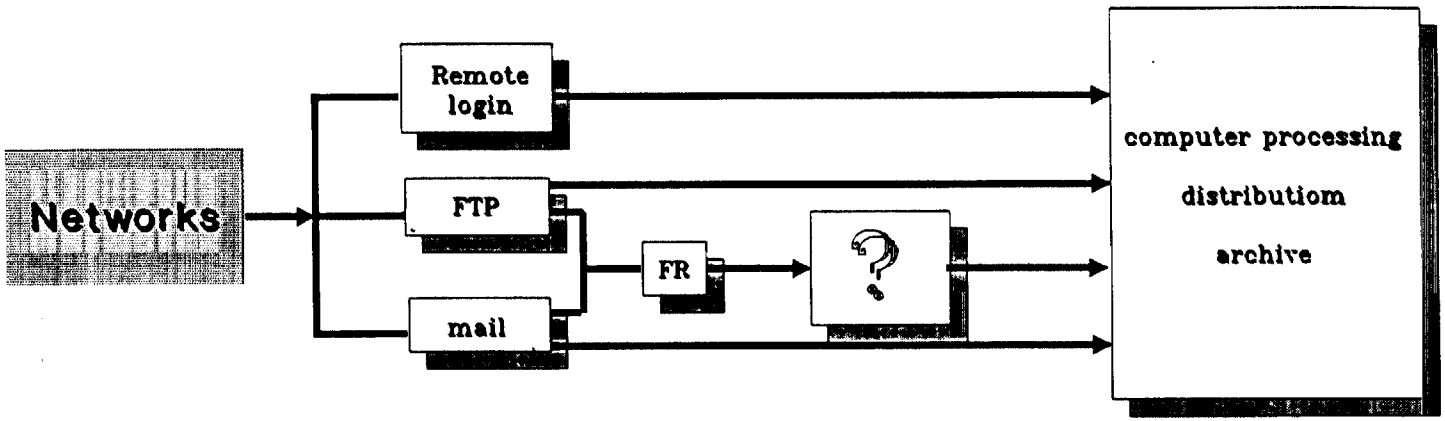
Results handling at SLR stations

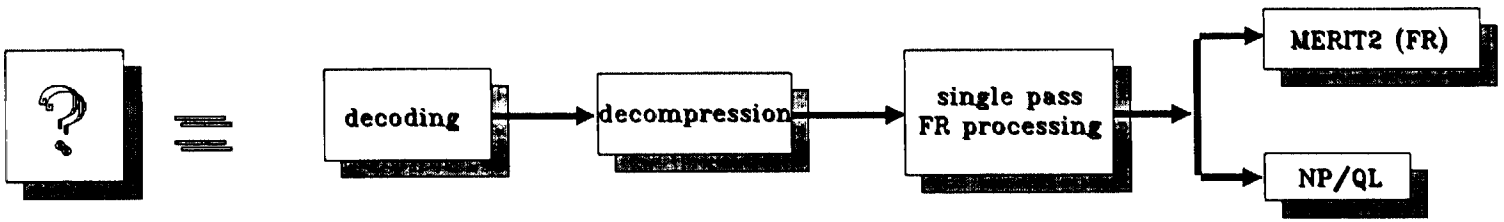


Remark: NP/QL data are redundant.

Results handling at data center

NASA/BENDIX, Eurolas/DGFI





Networks Data Exchange

Mail at other networks

From the other networks, the files are sent to InterNet (and back) as a mail without any difficulties. The possibility of FTP (*File Transfer Protocol*)is strongly reduced to the use of mail servers.

Selection of Large networks [2]

applelink	Apple Computer, Inc.'s in-house network
bitnet/earn	international academic network
bix	Byte Information eXchange: Byte magazine's commercial BBS
bmug	Berkeley Macintosh Users Group
compuserve	commercial time-sharing service
connect	Connect Professional Information Network
envoy	Envoy-100 (Canadian commercial mail service)
fax	Facsimile document transmission
fidonet	PC-based BBS network
geonet	GeoNet Mailbox Systems (commercial)
ieee-compmail	A DIALCOM system supporting IEEE users
internet	the Internet
mci	MCI's commercial electronic mail service
mfenet	Magnetic Fusion Energy Network
nasamail	NASA internal electronic mail
peacenet	non-profit mail service
sinet	Schlumberger Information NETwork
span	Space Physics Analysis Network
sprintmail	Sprint's commercial mail service
thenet	Texas Higher Education Network
usdamail	A DIALCOM system for USDA researchers

The more detailed information on mail network-to-network access see[2].

InterNet data transfer protocols

FTP: (*File Transfer Protocol*) Allows a user to connect to host computer and with reduced set of commands get and/or put files. FTP is essentially inaccessible from other nets. Getting files from FTP sites may be provided by mail servers (they retrieve the file and send it as a mail). Putting files by mail servers isn't supported. FTP is unfortunately slow (approx. 500 bytes/second, for longer files 200 bytes/second), the transfer rate depends on traffic in the network. The terminal must stay on-line while putting/receiving.

Mail: A convenient way for sending a file. A user has no possibility to receieve files via mail (in sense that somebody must send the file, it can't send itself).

[2] © 1990 John J. Chew, available as EMAILGUI.ZIP at SIMTEL and TRICKLE archives

The transfer rate is a bit slower, but it does not keep local terminal busy as FTP does. Files longer than 50000 bytes are regarded as "huge" and sent only when the network is free.
Mail is essentially 7-bit protocol, 80 characters per line. Formatted or binary data can be converted to fit.

TelNet: Allows a remote login. Usefull for remote user access to any computer on the InterNet. Unusable for sending/retrieving files. User has to know remote computer's operating system.

Unfortunately, lots of SLR stations are not connected to InterNet and won't be connected soon. What's more, most stations have to use modems to connect to networks (which naturally slows down the transmission). That's why we should figure out how to send shorter files and how to send them from other networks.

What Kind of Data Is Exchanged?

1. From SLR center to SLR stations

   - Prediction (IRV or SAO) $\approx$ 5 kB
   - Whole year IRV - Lageos $\approx$ 100 kB
   - Comments on operation $\approx$ 2 kB
   - Bendix QL analysis $\approx$ 1 kB
   - Reports $<$ 25 kB

   Suggestion: I would suggest the center to deliver these files to SLR stations as a regular mail to an automatic list of addressees. FTP makes the server at SLR center very busy while everybody is trying to receive the files. Due to the network software, when the network breaks down, it takes the biggest care of mail — it is almost always delivered. The FTP data might be easily lost or corrupted during breakdown. The non-InterNeters have to use mail-servers (for example `BITFTP@PUCC`) that may become very busy.

2. From SLR stations to SLR center

   - Comments on operation $\approx$ 2 kB
   - QL or NP data $\approx$ 2 kB/pass
   - FR data MERIT2 format
     130 chars/line, 1 line/point $\Rightarrow$ huge file
     up to 500 kB/pass
     This file is almost undeliverable via mail — it has more than 80 chars/line and

it has more than 50 kB. The Rules of a Network User say that user should never overload the network. In fact this file should never appear in mail! (And it might take several days/weeks to get through the networks.)

- **or** FR data compressed MERIT2 format and UUENCODEd — (compression 89%)
  This way of transmitting FR data solves almost all of the problems mentioned above.

General Overview of Compression Techniques

- The good compression program must be easy to use, commonly used on different OS, must provide fast algorithm and high compression ratio
- Possible techniques:

  ZOO: Not very common, not very high ratio; source code available

  LHA: Not very common; very high ratio

  TAR.Z: Causes problems on non-UNIX OS, not very easy to use (on MSDOS), not very high ratio; very common on UNIX (supported by VAX/VMS)

  ARC: Out-of-date, slower than PKZIP; very common on many OS

  ARJ: New, not free for institutional use; very fast, the highest compression ratio, useful switches, starting to be used on lots of BBS's

  PKZIP: *Recommended*; very fast, good compression ratio, commonly used on most OS, sources available

Encoding & Decoding

General rules for e-mail transmission:

- Convert 8-bit file and/or formatted file into 7-bit 80 chars/line file
- Split huge files (< 50 kB)
- Standard ENCODE/DECODE (UU & XX) programs are available for all network mainframes

Very comfortable shareware UUXFER program (with C sources) is available from D.M.Read (`readdm @ dopey.cc.utexas.edu`)

Features of UUXFER:

- Encoding UU, XX, using external table
- Decoding UU, XX (automatically detected)
- Optional splitting of huge files to user-defined size
- Merge file options
- Interactive/command-line commands
- User friendly
- Supports most of mainframes

Conclusion

According to the Monthly Report on ERS-1 FR Laser Tracking Data Preprocessing, DGFI/D-PAF October 1991 (issued April 1992), it took up to three and half a month to deliver FR data from Simosato, Japan to the SLR Center (on the magnetic tape), and it took five (!!) months to deliver data from Maidanak, CIC on floppy disks!!! This MUST BE CHANGED.

The electronic delivery via computer networks is the effective method to avoid the late delivery results from SLR sites..

A. Requirements

- All SLR stations can access computer network
- Accepted standard for compression and/or coding
- Files have standard names for automatic processing at data center
- Sufficient operating hours of the involved networks including holidays
- Defined deadline time schedule for FR data delivery (in case QL, NP data would be sent by spare channel)

B. Goals of computer networking at SLR world network

- NP/QL/FR data available for processing at SLR centers within less than 24 hours (hopefully)
- FR data would be transmitted instead of redundant NP and/or QL data
- Increased effectiveness when using data (delivered reliably and in time)
- Much cheaper data exchange

Appendix

Network data exchange of huge data files was successfully tested from Helwan and from Prague during spring 1992

- Helwan — BITNET/EARN
- Prague — BITNET/EARN
  InterNet (the same mainframe)
- München — InterNet

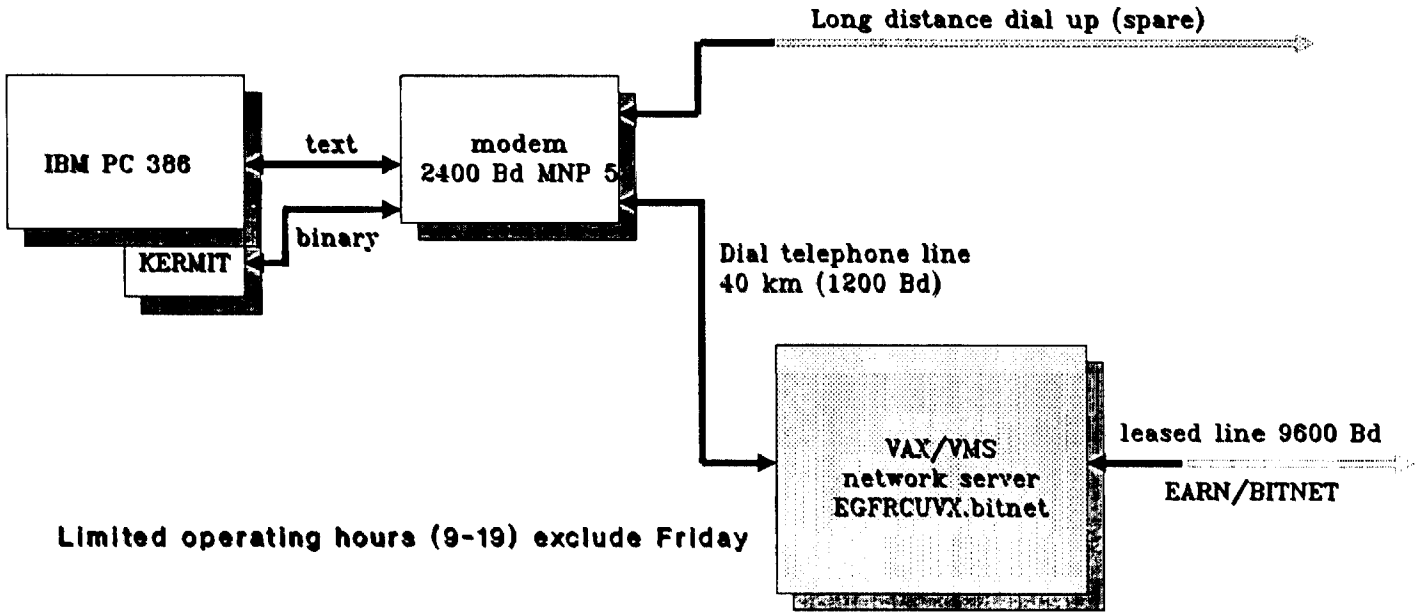
The Prague IBM mainframe was used as data center emulator

1. Helwan — compression, encoding
2. Helwan–Cairo VAX — by KERMIT ($\approx$ 30 B/s)
3. Cairo–Prague — BITNET (file transfer)
   BITNET–InterNet (mail)
4. Prague — decoding, decompression
5. Prague–München — FTP huge file transfer ($\approx$ 100–700 B/s)

All FR data from Helwan were delivered to `Eurolas/DGFI` by e-mail/FTP.

The communication facilities at SLR Helwan are described on the Figure.
Remark: After the workshop, the problem was discussed with Dr. W. Seemüller. The Eurolas Data Center is ready to accept FR data as e-mail (compressed using PKZIP, encoded using UUENCODE/XXENCODE). I expect that all FR data from Helwan SLR will be delivered to EDC compressed and by e-mail from BITNet network.

Communication facilities
SLR Helwan



Spare: