COMSERV

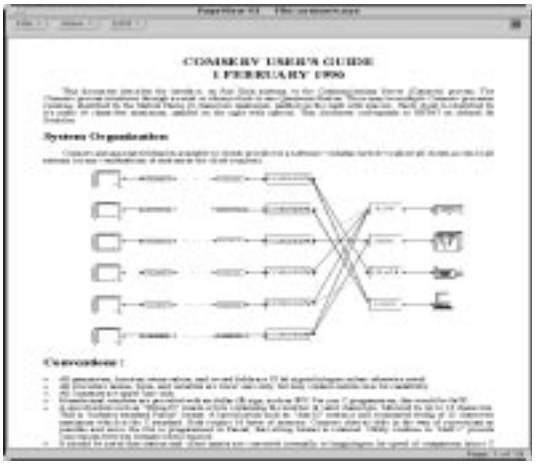
ADVANCED OPEN SOFTWARE FOR SEISMOLOGICAL NETWORKS

General Description

COMSERV is an open-standards suite of software that runs on Unix systems for real-time acquisition of seismological network data. The suite includes separate programs for a variety of central-station functions in a modular client-server design to permit easy extension and modification for particular user requirements. Quanterra has developed the package for public release in close collaboration with leading institutions, including IRIS, UC Berkeley, and Caltech.

Client-Server

COMSERV uses a powerful client-server design, in which a copy of the comserv process controls communication with each field station, and through a well-defined interface, may communicate with an unlimited number of "client" processes that may have need of the data. Using this organization, each "client" can be concerned with only one simple job, such as recording data on disk, or annunciating network alarms. Clients may be attached to all stations, or any subset. The figure below, from the *COMSERV* User's Guide, illustrates the concept:



USHEAR®: Secure Data Transmission

Our sophisticated *USHEAR*® system and application software gives our Q680 and Q4120 field systems capabilities that are impossible in simple 'field' boxes and 'recorders'. Multiple, simultaneous data access modes, flexible reconfiguration, remote status acquisition, diagnostics, and software updates (by dial-up or network), TCP/IP login, and more are built into *USHEAR*.

USHEAR's *Quanterra Smart Link*, or *QSL*, protocol allows selective user-definable priority transmission of specific data types, such as broad-band event or long-period continuous, over a simple serial asynchronous link, or over a standard TCP/IP socket interface. CRC error correction and sliding-window retransmission virtually eliminate the possibility of incorrectly-received data. The protocol also contains system advisory messages and event detections from the remote stations, and allows central-site triggering and reconfiguration without stopping data acquisition. The transmitting system, or DA (Data Acquisition) processor will retain all data that are not acknowledged for later transmission. The link may be temporarily completely cut, and the receiver powered down or reconfigured without loss of data.

Serious Software for Science and Critical Public Services

Critical real-time network operations, such as UC Berkeley, Caltech, the National Center for Disaster Prevention Research in Japan, and others have chosen *COMSERV*-based network acquisition software for a number of compelling reasons:

- Reliable software hosted on reliable SunOS Unix systems that are well integrated in their research environments.
- A well-documented, easily extended source package: not a "black box".
- No exhorbitant licensing fees.
- Vigorous User-Group, involved in actual network operations, contributing new clients and applications.
- Interfaces are now being developed for the IRIS DMS 'Portable Data Collection System', to provide a complete network acquisition and data management facility.

Serial or TCP/IP Telemetry

Because Quanterra's *USHEAR* application software package operates with a full-featured real-time operating system, many functions such as remote login, data transmission to multiple independent clients, and standard functions such as telnet, ftp, and a Berkeley TCP/IP "sockets" programming interface are built-in. *COMSERV* can take full advantage of the TCP/IP capability, allowing real-time collection over a TCP/IP socket interface, or over a standard duplex serial link.

Telemetry via a TCP/IP socket provides many advantages where hardware permits, such as simultaneous access for transmission of data buffered at the field station on request, maintenance and diagnostics, and software update. Quanterra recently installed the entire COMSERV package and upgraded field software on the Japan National Disaster Center Network entirely remotely, using TCP/IP connections across the Internet to Q680 data loggers at each field site.

COMSERV's ability to use a TCP/IP socket for data input provides a simple means of "filtering" incoming data formats to provide collection from sources of data other than Quanterra systems. Caltech, for example, simultaneously employs Quanterra and Kinemetrics, Inc., field systems using a software "filter" for K2 strong-motion data.

Clients

Clients are in use or in development for the following functions:

"Reliable" data logging (i.e. can sustain receiver power down)

Collection of message and advisory text from field sites

Automatic network monitoring of a set of stations.

Manual control of all field station parameters

Annunciation of event detection at the field station.

Real-time graphic display in an X window.

Central-site triggering of the network.

Analog output via Quanterra *DAC480*.

COMSERV - **QUANTERRA, INC.** *Harvard, MA, 01451. TEL 978-772-4774 FAX: 978-772-4645*

Examples

The following illustrates remotely logging in to UC Berkeley's network control processor.

```
telnet bdsn.geo.berkeley.edu
Trying 128.32.146.39 ...
Connected to bdsn.geo.berkeley.edu.
Escape character is '^]'.
SunOS UNIX (bdsn.geo.berkeley.edu)
login: steim
Password:
Last login: Thu Mar 21 15:54:42 from quanterra.harvar
Use the "dquota -v" command to check on your disk quota limits and disk usage.
```

To quickly check on the acquisition and recording status of the entire network, the "netmon" program can give a brief overview. This informs which COMSERV processes are running, whether communications are actually functioning, and whether any "clients" are registered.

```
bdsn% netmon
station=ARC config_state=A target_state=A present_state=R
   server=comlink pid=24722 status=Good
   client=DLOG pid=24728 status=Good
station=BKS config_state=A target_state=A present_state=R
   server=comlink pid=1214 status=Good
   client=DLOG pid=2701 status=Good
station=BKS2 config_state=A target_state=A present_state=R
   server=comlink pid=14549 status=Good
   client=DLOG pid=14556 status=Good
station=BRI2 config_state=A target_state=A present_state=R
   server=comlink pid=1216 status=Good
   client=DLOG pid=2650 status=Good
station=BRIB config_state=A target_state=A present_state=R
   server=comlink pid=1218 status=Good
   client=DLOG pid=2703 status=Good
station=BRK config_state=A target_state=A present_state=R
   server=comlink pid=1220 status=Good
   client=DLOG pid=2705 status=Good
station=CMB config_state=A target_state=A present_state=R
   server=comlink pid=1222 status=Good
   client=DLOG pid=2655 status=Good
station=CMSB config_state=A target_state=A present_state=R
   server=comlink pid=1224 status=Good
   client=DLOG pid=2658 status=Good
station=HOPS config_state=A target_state=A present_state=R
   server=comlink pid=1226 status=Good
   client=DLOG pid=2660 status=Good
station=JRSC config_state=A target_state=A present_state=R
   server=comlink pid=1228 status=Good
   client=DLOG pid=2662 status=Good
station=KCC config_state=A target_state=A present_state=R
   server=comlink pid=25546 status=Good
   client=DLOG pid=25552 status=Good
station=MHC config_state=A target_state=A present_state=R
   server=comlink pid=1234 status=Good
   client=DLOG pid=2668 status=Good
station=MIN config_state=A target_state=A present_state=R
   server=comlink pid=1236 status=Good
   client=DLOG pid=2670 status=Good
station=ORV config_state=A target_state=A present_state=R
   server=comlink pid=18743 status=Good
   client=DLOG pid=18754 status=Good
station=PKD1 config_state=A target_state=A present_state=R
   server=comlink pid=9683 status=Good
   client=DLOG pid=9729 status=Good
station=PKD2 config_state=A target_state=A present_state=R
   server=comlink pid=9685 status=Good
   client=DLOG pid=9734 status=Good
station=RFSB config_state=A target_state=A present_state=R
   server=comlink pid=11582 status=Good
   client=DLOG pid=2678 status=Good
station=SAO config_state=A target_state=A present_state=R
   server=comlink pid=13403 status=Good
   client=DLOG pid=13407 status=Good
station=SAO2 config_state=A target_state=A present_state=R
   server=comlink pid=25559 status=Good
   client=DLOG pid=25575 status=Good
station=WDC config_state=A target_state=A present_state=R
   server=comlink pid=7689 status=Good
   client=DLOG pid=7703 status=Good
station=YBH config_state=A target_state=A present_state=R
   server=comlink pid=18445 status=Good
   client=DLOG pid=18452 status=Good
```

For a more verbose report, for example, from a particular station, the "-v" option may be specified. This informs how many packets have been transferred, a brief summary of communications link quality, and additional information on registered clients. The information on link quality is particularly valuable for serial links, which may exhibit high uncorrected error rates.

```
bdsn% netmon -v sao2
station=SAO2 config_state=A target_state=A present_state=R
   server=comlink pid=25559 status=Good
      config_dir=/data/aq01/config/etc/SAO2
      program=/data/aq01/config/bin.1.0/comserv
      seg=8212 nclients=1
      Ultra=1, Link Recv=1, Ultra Recv=1, Suspended=0,
      Data Format=QSL
      Total Packets=1558011, Sync Packets=9,
      Sequence Errors=15
      Checksum Errors=0, IO Errors=0, Last IO Error=0
      Blocked Packets=1, Seed Format=V2.3B,
      Seconds in Operation=2006698
      Last Good Packet Received at=
            14:20:56.540835 Sat Mar 23 1996
      Station Description=
            San Andreas Geophysical Observatory Quanterra [EM]
   client=DLOG pid=25575 status=Good
      pidfile=/data/aq01/config/pid/SAO2.dlog
      program=/data/aq01/config/bin.1.0/datalog
```

If communications were interrupted, designated recipients would receive e-mail:

```
Subject: netmon timeout
Status: RO
************************************************
Report from netmon on host virgo
Timeout: station TYM for 0 hours 4 minutes
Last good packet = 13:21:17.892585 Wed Feb 14 1996
Current time = 13:25:17.963971 Wed Feb 14 1996
************************************************
```

Simple Configuration

Clients do each specific job in the COMSERV environment. The client *datalog*, for example, provides reliable recording on disk of any or selected data telemetered from field sites, in FDSN-approved "mini-SEED" data files that may be exchanged directly with other data users. Additional software exists to combine multiple mini-SEED files into complete SEED V2.3B volumes. The *netmon* and *datalog* clients and companion software were contributed by Doug Neuhauser at the UC Berkeley Seismographic Station.

Comserv and its clients use a series of simple ASCII configuration files to control acquisition: two "global" configuration files that make a "network", and individual files that configure each station.

/etc/network.ini

This file controls the *netmon* process:

```
wvserv{4}% cat /etc/network.ini
[netm]
logdir=/home/comserv/logs
cmddir=/home/comserv/cmds
lockfile=/home/comserv/config/pid/netmon.lock
server_startup_delay=10
client_startup_delay=10
max_check_tries=5
poll_time=2
min_notify=240
re_notify=3600
res_notify=1
max_shutdown_wait=30
notify_prog=/usr/ucb/mail -s "netmon timeout" comserv
wvserv{5}%
```

/etc/stations.ini

This file tells the *netmon* process what stations constitute the network:

```
cat /etc/stations.ini
[KIS]
dir=/home/comserv/config/KIS
desc=Bosai station KIS
source=comlink
[TKA]
dir=/home/comserv/config/TKA
desc=Bosai station TKA
source=comlink
[TKD]
dir=/home/comserv/config/TKD
desc=Bosai station TKD
source=comlink
[SGN]
dir=/home/comserv/config/SGN
desc=Bosai station SGN
source=comlink
[ISI]
dir=/home/comserv/config/ISI
desc=Bosai station ISI
source=comlink
[KZK]
dir=/home/comserv/config/KZK
desc=Bosai station KZK
source=comlink
[JIZ]
dir=/home/comserv/config/JIZ
desc=Bosai station JIZ
source=comlink
[TYM]
dir=/home/comserv/config/TYM
desc=Bosai station TYM
source=comlink
```

datalog, netmon,* and *station.ini

Within the config directory, each station has a private directory:

```
wvserv{6}% cd /home/comserv/config
/home/comserv/config
wvserv{13}% ls
CHS/  HKW/  IWT/  KFU/  KZK/  SGN/  TKD/  TYM/  pid/
FUJ/  ISI/  JIZ/  KIS/  OHS/  TKA/  TNR/  etc/
```

The *station.ini* file contains specific information on for the receiving *comserv*. No detailed information regarding the remote station's configuration is needed, since this is learned automatically comserv over the *USHEAR QSL* communications link. Note the simple configuration of serial or tcp/ip telemetry:

```
wvserv{12}% cat KIS/station.ini
[comlink]
* following are for serial links only
* port=/dev/drm.mcc
* baud=38400
* following are for tcp/ip links only
ipport=33082
netto=120
netdly=30
* following are generic
grpsize=1
grptime=5
notify=y
parity=no
verbosity=1
override=no
station=KIS
segid=8082
pollusec=50000
databufs=200
detbufs=200
timbufs=200
calbufs=20
msgbufs=200
reconfig=50
client1=dlog,3600
uid200=32767
uid122=32767
uid0=32767
* log_seed=xx-lo2
* timing_seed=ac2
[netm]
server=/home/comserv/bin/comserv
* datalog may have -vN option for verbose mode.
client1=dlog,/home/comserv/bin/datalog
* State: A=auto-restart S=start-once R=runable N=non-runable I=ignore
state=A
notify_prog=/usr/ucb/mail -s "netmon notify" comserv
[dlog]
* Pathnames for data directory, program, and pid file.
dir=/home/comserv/data/KIS
pidfile=/home/comserv/pid/KIS.dlog
* Selector specifies general selectors for data, detections, and calibrations.
* Specific type selector lines set the data mask (y|n) for that type,
* and optionally set specific selectors for that data type.
selector=???
data_selector=y
detection_selector=y,???
calibration_selector=y
timing_selector=y
log_selector=y
*
save=???
data_save=y
detection_save=y
calibration_save=y
timing_save=y
log_save=y
*
limit=1d
data_limit=4H,CL?,DP?
data_limit=12H,HH?,HL?
data_limit=2d,V??,U??
data_limit=2d,A??,
detection_limit=1d
calibration_limit=1d
timing_limit=1d
log_limit=1d
*
data_ext=D
detection_ext=E
calibration_ext=C
timing_ext=T
log_ext=L
* Format specifier for filenames:
* %S=STATION %s=station %N=NET %n=net %C=CHAN %c=chan %X=EXTENSION
%x=extention
* %Y=year %y=yr %j=doy %m=month %d=day %H=hr %M=min
filename_format=%S.%C.%X.%Y.%m.%d.%H%M
```

Datalog stores mini-SEED files in non-multiplexed compressed files, one channel per file. A typical listing of a data directory for a particular station contains directories for all the SEED channels that are produced by the field station. The files and directory creation and management of the contents are handled automatically by *datalog*. Channels are classified as Data (directory ending in .D), Event pick information (.E), Timing advisories (.T) and text logs (.L):

```
wvserv{17}% ls -l /home/comserv/data/KIS
total 84
drwxr-x---   2 comserv  freesia     1024 Mar 22 09:40 ACD.D/
drwxr-x---   2 comserv  freesia     1024 Mar 22 09:36 ACE.T/
drwxr-x---   2 comserv  freesia     1024 Mar 22 09:30 BHE.D/
drwxr-x---   2 comserv  freesia     1024 Mar 22 09:30 BHN.D/
drwxr-x---   2 comserv  freesia     1024 Mar 22 09:30 BHZ.D/
drwxr-x---   2 comserv  freesia      512 Mar 22 10:38 BHZ.E/
drwxr-x---   2 comserv  freesia     1024 Mar 22 09:39 HHE.D/
drwxr-x---   2 comserv  freesia     1024 Mar 22 09:39 HHN.D/
drwxr-x---   2 comserv  freesia     1024 Mar 22 09:39 HHZ.D/
drwxr-x---   2 comserv  freesia     1024 Mar 22 10:30 HHZ.E/
drwxr-x---   2 comserv  freesia     1024 Mar 22 09:37 HLE.D/
drwxr-x---   2 comserv  freesia     1024 Mar 22 09:37 HLN.D/
drwxr-x---   2 comserv  freesia     1024 Mar 22 09:37 HLZ.D/
drwxr-x---   2 comserv  freesia     1024 Mar 22 10:38 HLZ.E/
```

BHZ.D is a typical Data directory, containing compressed mini-SEED files, with each file containing one channel of data (BHZ is 20 s/s high-resolution) for one day. The data being currently acquired are written into the *active* file.

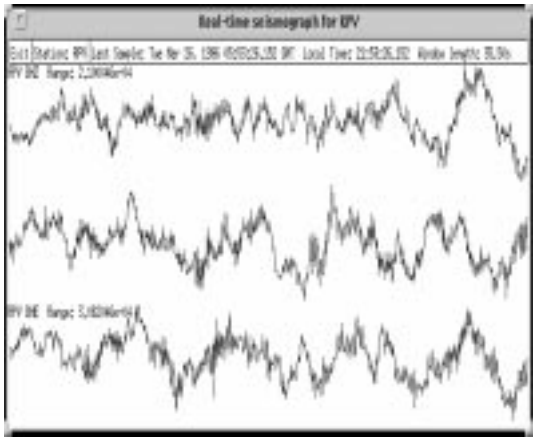
```
wvserv{18}% ls -l BHZ.D
total 60192

-rw-r-----   1 comserv  freesia  2085888 Mar 22 09:30 KIS.BHZ.D.1996.03.21.0000
-rw-r-----   1 comserv  freesia  1815040 Mar 23 05:04 active
```

Clients, clients, and more clients...

Each client does a specific job. For example, the client *xrt*, written by Eric Larson at Harvard, provides a real-time graphic display of waveform data in an X- window. Getting a real-time display via the Internet on your X-windows workstation is illustrated:

```
quanterra% xhost +terra10.gps.caltech.edu
terra10.gps.caltech.edu being added to access control list
quanterra% telnet terra10.gps.caltech.edu
Trying 131.215.65.24 ...
Connected to terra10.gps.caltech.edu.
Escape character is '^]'.
UNIX(r) System V Release 4.0 (terra10)
This computer system is owned by the California Institute of Technology.
        Unauthorized access is strictly forbidden.
login: brian
Password:
Last login: Sat Mar 23 13:54:47 from quanterra.harvar
This computer system is owned by the California Institute of Technology.
        Unauthorized access is strictly forbidden.
     #####
     #   #  ##   #    ##### ######  ####  #   #
     #     # #  #     #   #    #  # #  #
     #     #  # #     #  #####  #    ######
     #     ###### #      #  #    #    #  #
     #   # #  # #      #  #    #  # #  #
     ##### #  # ######   #  ######  ####  #   #
<terra10> brian 1% cd /home/rtem/xrt
<terra10> brian 3% xrt RPV -display quanterra.harvard.edu:0
```



Phil Maechling at Caltech, has built the real-time telemetered portion of TERRAScope around a COMSERV suite of programs. A display of active processes on the terra10 network control processor gives some idea of the versatility in configuring the COMSERV-based package.

```
S rtem Mar 19 ? 3:40 netmon -D -B -l -b
S rtem Mar 19 ? 0:06 comserv GSC
S rtem Mar 19 ? 0:07 comserv ISA
S rtem Mar 19 ? 0:07 comserv NEE
S rtem Mar 19 ? 2:32 comserv PAS
S rtem Mar 19 ? 0:32 comserv RPV
S rtem Mar 19 ? 0:05 comserv SMTC
S rtem Mar 19 ? 6:48 comserv SNCC
S rtem Mar 19 ? 0:06 comserv SVD
S rtem Mar 19 ? 0:10 comserv USC
S rtem Mar 19 ? 0:12 comserv VTV
S rtem Mar 19 ? 0:13 cpick_card_server -c BHZ
S rtem Mar 19 ? 0:00 /home/rtem/real1/real1 ISA LG
S rtem Mar 19 ? 0:01 datasock GSC HLZ,HLN,HLE
S rtem Mar 19 ? 0:14 /home/rtem/real1/real1 PAS LG
S rtem Mar 19 ? 0:01 datasock ISA HLZ,HLN,HLE
S rtem Mar 19 ? 7:26 /home/rtem/real1/real1 RPV LG
S rtem Mar 19 ? 0:01 datasock NEE HLZ,HLN,HLE
S rtem Mar 19 ? 0:21 /home/rtem/real1/real1 SNCC LG
S rtem Mar 19 ? 1:17 /home/rtem/real1/real1 NEE LG
S rtem Mar 19 ? 0:02 datasock PAS HLZ,HLN,HLE
S rtem Mar 19 ? 0:01 datasock SVD HLZ,HLN,HLE
S rtem Mar 19 ? 0:06 datasock RPV HLZ,HLN,HLE
S rtem Mar 20 ? 0:03 datasock SNCC BHZ,BHN,BHE
S rtem Mar 19 ? 1:05 /home/rtem/qqt5/qqt5_socket PAS
S rtem Mar 19 ? 0:06 /home/rtem/real1/real1 SVD LG
S rtem Mar 19 ? 0:04 datasock SNCC HLZ,HLN,HLE
S rtem Mar 19 ? 0:01 datasock USC HLZ,HLN,HLE
S rtem Mar 19 ? 0:02 datasock VTV HLZ,HLN,HLE
S rtem Mar 19 ? 1:13 /home/rtem/real1/real1 USC LG
S rtem Mar 19 ? 0:10 /home/rtem/real1/real1 VTV LG
S rtem Mar 19 ? 1:00 /home/rtem/qqt5/qqt5_socket SNCC
S root Mar 22 ? 0:42 rpc.rstatd
S rtem Mar 19 ? 19:12 /home/rtem/tvmag/tvmag cajon
S rtem Mar 19 ? 0:03 datasock SNCC BHZ,BHN,BHE
S rtem Mar 20 ? 0:51 nsn2shear -C -c /home/rtem/comserv/
S rtem Mar 20 ? 0:01 tdatasock ISA BHZ,BHN,BHE,HLZ,HLN,HLE
S root Mar 19 ? 0:00 rpc.ttdbserverd
S rtem Mar 20 ? 0:01 datasock GSC BHZ,BHN,BHE
S rtem Mar 19 ? 0:05 tdatasock RPV BHZ,BHN,BHE,HLZ,HLN,HLE
S rtem Mar 19 ? 0:03 tdatasock VTV BHZ,BHN,BHE,HLZ,HLN,HLE
S rtem Mar 20 ? 0:05 tdatasock RPV BHZ,BHN,BHE,HLZ,HLN,HLE
S rtem Mar 20 ? 0:02 datasock USC BHZ,BHN,BHE
S root 13:54:41 ? 0:00 in.telnetd
S rtem Mar 20 ? 0:02 datasock VTV BHZ,BHN,BHE
S rtem Mar 20 ? 0:02 tdatasock USC BHZ,BHN,BHE,HLZ,HLN,HLE
S rtem Mar 20 ? 0:03 datasock RPV BHZ,BHN,BHE
S root Mar 19 ? 0:00 rpc.cmsd
S rtem Mar 20 ? 0:02 datasock USC BHZ,BHN,BHE
S rtem Mar 19 ? 0:04 tdatasock PAS HLZ,HLN,HLE,BHZ,BHN,BHE
S rtem Mar 20 ? 0:02 datasock NEE BHZ,BHN,BHE
S phil Mar 22 ? 0:04 mailtool
S rtem Mar 20 ? 0:02 tdatasock VTV BHZ,BHN,BHE,HLZ,HLN,HLE
S rtem Mar 20 ? 0:04 datasock PAS BHZ,BHN,BHE
S rtem Mar 19 ? 0:03 tdatasock USC BHZ,BHN,BHE,HLZ,HLN,HLE
S rtem Mar 20 ? 0:04 tdatasock PAS HLZ,HLN,HLE,BHZ,BHN,BHE
S rtem Mar 19 ? 25:42 csfill GSC
S rtem Mar 19 ? 0:08 datalog GSC
S rtem Mar 19 ? 0:54 nsn2shear -C -c /home/rtem/comserv/
S rtem Mar 19 ? 0:25 csfill ISA
S rtem Mar 19 ? 0:04 datalog ISA
S rtem Mar 19 ? 56:06 csfill NEE
S rtem Mar 19 ? 0:21 datalog NEE
S rtem Mar 21 ? 0:01 datasock SMTC HLZ,HLN,HLE
S rtem Mar 19 ? 33:56 csfill PAS
S rtem Mar 19 ? 0:38 datalog PAS
S rtem Mar 19 ? 147:38 csfill RPV
S rtem Mar 19 ? 0:51 datalog RPV
S rtem Mar 19 ? 0:06 datalog SMTC
S rtem Mar 20 ? 0:59 csfill SMTC
S rtem Mar 19 ? 0:25 datalog SNCC
S rtem Mar 19 ? 102:36 csfill SNCC
S rtem Mar 19 ? 27:18 csfill SVD
S rtem Mar 19 ? 0:13 datalog SVD
S rtem Mar 19 ? 30:26 csfill USC
S rtem Mar 19 ? 0:14 datalog USC
S rtem Mar 19 ? 53:19 csfill VTV
S rtem Mar 19 ? 0:23 datalog VTV
S rtem Mar 20 ? 0:02 datasock NEE BHZ,BHN,BHE
S rtem Mar 20 ? 0:03 datasock RPV BHZ,BHN,BHE
S rtem Mar 20 ? 0:04 datasock PAS BHZ,BHN,BHE
S rtem Mar 21 ? 0:01 /home/rtem/real1/real1 SMTC LG
S rtem Mar 20 ? 0:15 cpick_card_server -o c -c HLZ,BHZ,HHZ
S rtem Mar 20 ? 0:01 datasock K2X HLZ,HLN,HLE
S rtem Mar 20 ? 0:01 datasock K2X HLZ,HLN,HLE
S rtem Mar 20 ? 0:01 datasock K2X HLZ,HLN,HLE
S rtem Mar 20 ? 0:01 datasock K2X HLZ,HLN,HLE
```

For each station, comserv runs, in addition to datalog, and a process called “datasock” that provides real-time output to any user via a “well-known” tcp/ip port number:

```
<terra10> joe 34% cat /home/rtem/ports/socket_list
CMB   terra10.gps.caltech.edu  20016
GSC   terra10.gps.caltech.edu  20017
ISA   terra10.gps.caltech.edu  20000
NEE   terra10.gps.caltech.edu  20001
PAS   terra10.gps.caltech.edu  20002
RPV   terra10.gps.caltech.edu  20003
SMTC  terra10.gps.caltech.edu  20004
SNCC  terra10.gps.caltech.edu  20005
SVD   terra10.gps.caltech.edu  20028
VTV   terra10.gps.caltech.edu  20007
USC   terra10.gps.caltech.edu  20006
GPO   terra10.gps.caltech.edu  20033
CMBLG  terra10.gps.caltech.edu  20019
GSCLG  terra10.gps.caltech.edu  20029
ISALG  terra10.gps.caltech.edu  20008
NEELG  terra10.gps.caltech.edu  20009
PASLG  terra10.gps.caltech.edu  20010
RPVLG  terra10.gps.caltech.edu  20011
SMTCLG terra10.gps.caltech.edu  20012
SNCCLG terra10.gps.caltech.edu  20013
SVDLG  terra10.gps.caltech.edu  20030
VTVLG  terra10.gps.caltech.edu  20014
USCLG  terra10.gps.caltech.edu  20015
GPOLG  terra10.gps.caltech.edu  20034
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