System Maintenance Procedures for Users

Introduction

The Nanometrics Digital Seismograph System is designed to operate for long periods of time without any operator intervention. The minimum level of system maintenance required is monitoring system operation, and deletion of old log files.

This document provides guidelines to help operators set up their own system operation schedules and maintenance procedures, and includes some examples of diagnosing certain problems with the acquisition system. More detailed information on how to perform specific procedures is included in other sections of the system documentation. Please ensure that all procedures be performed by users familiar with the system. This document is not meant to replace the Nanometrics training course in any way.

Generic instructions

System configuration

Please do not hesitate to contact Nanometrics with any minor question prior to changing system configuration.

Note: Only qualified persons should open the computer hardware. The Nanometrics warranty is voided if the computer hardware is opened before the expiry of the warranty period.

- Consult the computer manufacturer's documentation before performing any maintenance of the computer hardware.
- Check and clean any floppy diskette of viruses before inserting it into the floppy disk drive of the computer.
- Consult Nanometrics support prior to installing any software on the acquisition computer, other than the software that is shipped with the system.
- Keep a diary type log book to record all changes made to the system.
- Update the custom configuration diskette(s) after each change made to program input files.

System operation

- Leave the Data Acquisition Computer turned on with the operating system and all configured Nanometrics software (Watchdog, NAQSServer, ExtractServer) in perfect operational status. All other programs should be exited prior to leaving the system for unattended operation.
- Set logging verbosity to WARNING level for normal monitoring of the system. If the system displays any abnormal operation, increase the verbosity level to INFO level for a time period not to exceed 1 hour, and monitor the system. Reset the verbosity level to WARNING and remove the information from the active log files after completing troubleshooting.

Maintenance procedures

The following is a list of general procedures for system maintenance, using Nanometrics acquisition software:

1. Run Waveform and check that all the data are being received for each channel and that the quality of the data is acceptable.
2. Run NAQSView and check the battery voltage, SOH readings, GPS signal readings and all other relevant settings to determine the condition of the remote seismic sites.
3. Check the Naqslog files for each day since the last maintenance sequence was performed. Record the time and description of any warning messages such as unit reboots, software crashes, GPS losses, communication failures,

or other abnormal messages. These messages can be used to track system problems and explain breaks in data.

4. Check the NmxtoCD1 and AutoDRM log files for all relevant days. Record any authentication problems or other abnormal messages.
5. Perform an rbfsum for each channel, and check for gaps, breaks, or high numbers of retransmissions. See *Rbfsum* under *Troubleshooting Hints* for more information. If gaps, breaks, or high numbers of retransmissions occur, perform a summary extract using the "extractp -s" command. See *Summary extract* under *Troubleshooting Hints* for more information. Log all of the operations performed in the Operation Log Book.
6. Once you have performed a summary extract to identify the types of gaps, perform a state-of-health extract using the "sohextrp" command. See *SOHextract* under *Troubleshooting Hints* for more information.
7. Delete all the old log files, keeping only those recorded in the last 30 days.

Troubleshooting Hints

Rbfsum

The **rbfsum** function will allow you to determine whether the entire acquisition system appears to be functioning properly, whether there is the possibility of a problem, or whether something in the system is malfunctioning. An **rbfsum** should be run on all of the ringbuffers as a maintenance procedure. An example of an rbfsum result file is shown below:

```
RbfSum version 1.06   copyright (C) Nanometrics, Inc. 1997-2001

C:\Nmx\User\Ringbuff\RV213.B1Z

Hour starting:        Data (sec)    ReTx(%)    Gaps (sec)      Breaks
2001-09-07_20:00      1811.840      87.2       1788.160        7
2001-09-07_21:00         0.0         0.0       3600.0          -
2001-09-07_22:00         0.0         0.0       3600.0          -
2001-09-07_23:00         0.0         0.0       3600.0          -
2001-09-08_00:00      2632.342       0.8        967.658        -
2001-09-08_01:00      3600.0         0.0          0.0          -
2001-09-08_02:00      3600.0         0.0          0.0          -
2001-09-08_03:00      3600.0         0.0          0.0          -
2001-09-08_04:00      3600.0         0.0          0.0          -
2001-09-08_05:00      3600.0         0.0          0.0          -
2001-09-08_06:00      3600.0         0.0          0.0          -
2001-09-08_07:00      3600.0         0.0          0.0          -
2001-09-08_08:00      3600.0         0.0          0.0          -
2001-09-08_09:00      3600.0         0.0          0.0          -
2001-09-08_10:00      3534.050       0.0         65.950        1
2001-09-08_11:00      3600.0         0.0          0.0          -
2001-09-08_12:00      3600.0         0.0          0.0          -
2001-09-08_13:00      3600.0         0.0          0.0          -
2001-09-08_14:00      1488.548       0.0       2111.452        -
```

The data in the five columns of the rbfsum result file—Hour starting, Data (sec), ReTx (%), Gaps (sec), and Breaks—can be interpreted to help determine how the system is operating:

Hour starting column

The first row in the Hour starting column displays the first hour during which NaqsServer was receiving data, i.e., the first hour in which data was being entered into the ringbuffers. To display only the information corresponding to the time from which the rbfsum was last run, specify a start time and duration when entering the rbfsum command. (Most users do not need to see the rbfsum results of the entire ringbuffer, since this may include data from many days or weeks depending on the size of the ringbuffers.) Refer to the Playback software manual for the rbfsum command description.

The date and time displayed under the Hour starting: column should correspond to the start time you specified when entering the rbfsum command. Typically this will be the previous day's date at

the top of the column and the current date and time at the bottom of the column. If the date and times are incorrect, check that the rbfsum command you entered had the proper syntax.

Data (sec) and Gaps (sec) columns

Rbfsum catalogues its results in an hourly format. This means that if data was received for only a portion of an hour, that portion in seconds will be displayed under the Data (sec) column. If the entire system is operating correctly you should see 3600 seconds displayed in all the rows except the first and last under the Data (sec) column as well as all zeros under the Gaps (sec) column.

The sum of the Data (sec) column and the Gaps (sec) is always equal to 3600. If one of the rows displays something other than a complete hour's worth of data, i.e., data (sec) is less then 3600 and gaps (sec) is greater than zero, this is an indication of a communication breakdown somewhere in the system during that time. A gap is essentially a period in time during which no data was received. It takes into account any request for retransmission which occurred. Three types of gaps can occur:

- The symptoms of the first type of gap are incorrect sequence numbering (missing packets) and incorrect time. These gaps are often associated with a communications breakdown.
- The symptoms of the second type of gap, referred to as a time tears, are correct sequence numbering but incorrect time.
- The symptoms of the third type of gap are incorrect time and a sequence re-initialization. These gaps are often associated with a TCP reboot or power-cycle of the digitiser.

A system which is behaving normally should have no gaps in the data. If gaps are indicated, you can assume that there is a problem with the system and proceed to the summary extract section.

ReTx (%) column

The ReTx (%) column indicates the percentage of retransmission requests the seismic site has received, i.e., data that was not received on the first pass. Retransmissions do not represent lost data, but data that had to be transmitted again before being received. Some retransmission will occur in almost any system, however, retransmission should not be consistently high. A large number of retransmissions indicates a break in communication between the acquisition computer and the seismic site. Shutting down the NaqsServer software on the acquisition computer and then starting it up later can be a cause high numbers of retransmissions. Depending on the type of telemetry used, harsh environmental conditions can be a contributor to high retransmission numbers. If you see gaps in the data and zero retransmissions, this may be an indication of an improperly configured Naqs.stn file or digitiser.

Breaks column

The Breaks column indicates how many breaks in data occurred to form a gap in the data.

Summary Extract

Performing a summary extract of the data should be your next step in diagnosing a problem with the system, after gaps in the data have been discovered. You can perform a summary extract by using the *extractp -s* command. Remember to add the start time and duration of the data you are interested in. Refer to your Playback software manual for more information. An example summary extract file is shown below:

```
C:\Nmx\User\RINGBUFF\RV213.B1Z

Oldest packet index  = 0
Newest packet index  = 17364
Maximum # of packets = 58133
Packet Size in Bytes = 340
Bundles Per Packet   = 19
Data 2001-09-07_20:08:13.8177  0d  0h 21m 19.8400s @ 100 sps.     3: 457-877
Gap  2001-09-07_20:29:33.6577 3.0400s
Data 2001-09-07_20:29:36.6977  0d  0h  2m 13.7600s @ 100 sps.   425: 879-922
Gap  2001-09-07_20:31:50.4577 3.0400s
Data 2001-09-07_20:31:53.4977  0d  0h  0m 15.2000s @ 100 sps.   470: 924-928
Gap  2001-09-07_20:32:08.6977 3.0400s
Data 2001-09-07_20:32:11.7377  0d  0h  1m  6.8800s @ 100 sps.   476: 930-951
Gap  2001-09-07_20:33:18.6177 3.0400s
Data 2001-09-07_20:33:21.6577  0d  0h  1m 25.1200s @ 100 sps.   499: 953-980
Gap  2001-09-07_20:34:46.7777 42.5600s
Data 2001-09-07_20:35:29.3377  0d  0h  1m 22.0800s @ 100 sps.   541: 995-1021
Gap  2001-09-07_20:36:51.4177 3.0400s
Data 2001-09-07_20:36:54.4577  0d  0h  2m 28.9600s @ 100 sps.   569: 1023-1071
Gap  2001-09-07_20:39:23.4177 -999895142.7501s
Data 1970-01-01_00:00:20.6676  0d  0h  0m 13.7501s @ 100 sps.   618: 0-5
Gap  1970-01-01_00:00:34.4177 999908133.2499s
Data 2001-09-08_00:16:07.6676  0d 10h 32m 58.0501s @ 100 sps.   624: 6-12498
Gap  2001-09-08_10:49:05.7177 -999946125.0501s
Data 1970-01-01_00:00:20.6676  0d  0h  0m 33.8001s @ 100 sps. 13117: 0-11
Gap  1970-01-01_00:00:54.4677 999946157.1999s
Data 2001-09-08_10:50:11.6676  0d  3h 34m 36.8901s @ 100 sps. 13129: 12-4247
Total packets:  17365 (22 empty)
Data sections:   11 (  0d 14h 38m 34.3304s)
Number of gaps:  10 (  0d  3h 38m  0.4096s)
```

If your system is operating properly there should be very few entries in the summary extract file. If you examine the last two lines of the file—Data sections and Number of gaps—you can determine how well the system is functioning.

Using the summary extract example above, note that the Data sections: entry indicates the duration of data received. On the next line, Number of gaps is 10 for a duration of 3 hours and 38 minutes worth of missing data. There can be a number of causes for these gaps and important information can be determined from the summary extract. In the first data and gap entries in the example, note that there was a 3.04 sec gap. Small gaps like these are often associated with communication problems.

The received packet sequence is indicated at the end of each data entry. When a gap occurs the acquisition computer misses a number of packets. If a minor gap like the 3.04 second ones listed in the top of the example file occur, only a few packets are missed and the sequence continues. The first entries of the example file can be listed as: 457-877, gap, 879-922, gap, 924-928, gap etc... These smaller gaps can be attributed to breaks in communication. Larger gaps can be somewhat more difficult to diagnose. If you look at the 8th Data entry you will notice that the data sequence suddenly changes back to zero. You should also notice that the date has changed to 1970-01-01. The cause for the sudden sequence re-initialization and date change is possibly the result of the digitizer being power cycled or a TCP reboot. The duration of the gap is enormous because it is now calculated from the year 1970. Further investigation is required to determine what caused the gaps.

One other type of gap not shown in the example above is called a time tear. The symptoms of a time tear are correct packet sequencing but incorrect time.

SOHextract

Note: Before you perform a state-of-health extract, ensure that the "orion.msg" file is in the directory where the ringbuffers are stored. The orion.msg file is required to translate the Nanometrics error codes into messages.

Once you have performed the summary extract and have an idea of what gaps have occurred, how numerous they were, and when they occurred, you can perform a state-of-health extract

(SOHextract) to determine what may have caused the gaps. To extract the SOH use the sohextrp command as described in your Playback manual.

The “sohextp” command will create a series of different SOH files. Each of these files are text files and will have the name of the ringbuffer that the SOH was extracted from. The extension of each file refers to the type of SOH information contained within it. Not all of the files will be relevant to the problem you are trying to diagnose, therefore, consult the SOH file table in the Nanometrics Playback manual. If you have studied the problem and believe it to be caused by equipment malfunction or you are unable to determine the cause of the problem, contact the Nanometrics support staff for assistance. You may be asked to provide the rbfsum, summary extract and SOHextract files to the support staff.

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