

# ***CaSnooper and Other CA Diagnostics***

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## ***Argonne National Laboratory***



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# *Topics Covered*

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- **Network and Channel Access Basics**
- **CaSnooper**
- **CASW**
- **ParseCASW**
- **RunCaSnooper**



# ***Introduction to Networks***

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- **Channel Access uses two Network Protocols, UDP and TCP**
- **UDP (User Datagram Protocol)**
  - One way, unreliable
  - Send out packets, no guarantee they reach their destination
- **TCP (Transmission Control Protocol)**
  - Two way, reliable, persistent
  - Socket at each end
  - Acknowledgements, timeouts, retransmissions, etc. guarantee reliability



# Introduction to Channel Access

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- **Search request**

- Sequence of UDP packets (up to 100 total or about 8 min.)
- Sent by clients when they want to find PVs



- **Exist test**

- Done by *each* server for *each* search request packet

- **Beacon**

- Sequence of UDP packets sent by servers
- Starts fast at startup, evolves to heartbeat



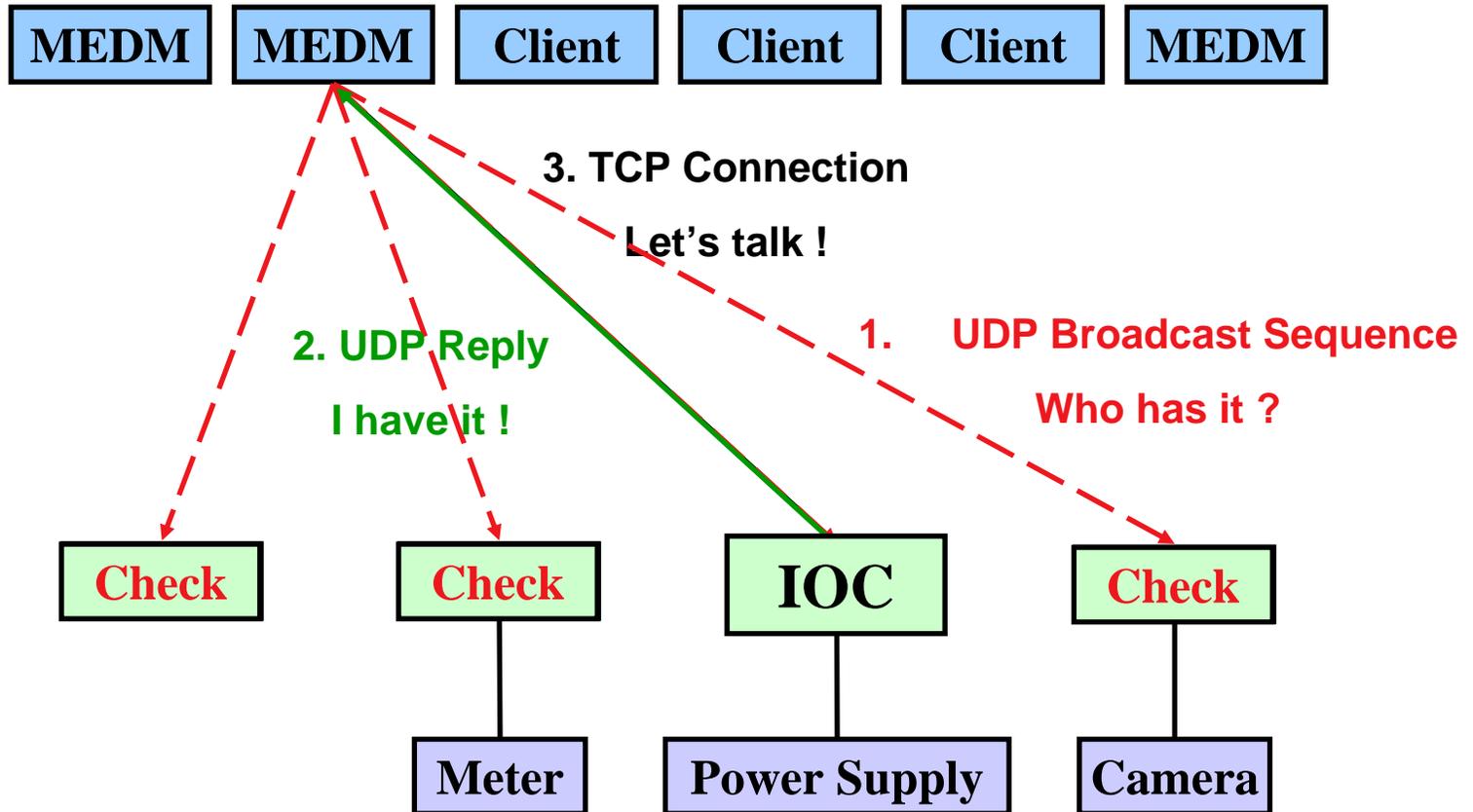
- **Beacon anomaly**

- Any beacon that is not at the heartbeat interval



- Clients use to determine connection status, reissue searches

# Search and Connect Procedure



# ***Nonexistent PVs are a problem***

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- **The search request sequence ends early for found PVs**
  - Typically on the first or second packet
- **Goes the full 100 packets (~ 8 min) for nonexistent PVs**
- **Each server has to do an exist test for each packet**
- **Badness:**
  - Uses up network bandwidth
  - Uses up resources in servers
  - Contributes to network storms

*Slow network -> Beacon anomalies -> Reissued search requests -> Slow network*
- **Note: As of 3.14.5, Channel Access is more conservative about reissuing search requests**

# CaSnooper

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- **CaSnooper is a server whose ExistTest routine keeps track of search requests rather than seeing if it has the PV**
- **It can print the names of all PVs being searched for and related statistics using several report formats**
- **It can also check if these PVs are connected (C) or not (NC)**
- **It has internal PVs if started with the `-n` option**
  - ExistTest rates that can be monitored
  - Others that allow it to be controlled from an MEDM screen
    - *Specify report parameters, make reports, exit*
- **Ways to run CaSnooper:**
  - Run at the command line to get one report
  - Run with PVs and monitor, say with StripTool
  - Run with PVs and control with MEDM for continuous operation

# Sample CaSnooper Output

Two lines from RunCaSnooper →

Print top 10 (-p10) →

Check top 10 (-c10) →

```

CaSnooper
Starting CcSnooper...
Type Ctrl-C to stop it
Starting CaSnooper 2.1.0.1 (8-27-2003) at Nov 04 13:50:08
EPICS 3.14.3
Individual Name is CaSnoop.test
PV name prefix is CaSnoop

Nov 04 13:50:42:
There were 17508 requests to check for PV existence for 2307 different PVs.
Max(Hz): 11.17
Mean(Hz): 0.22
StDev(Hz): 0.61

PVs with top 10 requests:
1 willow:52275 FEL:$(M8).VAL 11.17
2 willow:52275 FEL:$(M8).RBV 8.94
3 gateway433:33790 FE:09:ID:SR:HPOS:CC.VAL 4.15
4 gateway433:33790 FE:09:ID:SR:VPOS:CC.VAL 4.15
5 willow:52275 FEL:VUV4f2_ab1e.VAL 3.35
6 gateway435:33270 s17id:scan1.NPTS 3.06
7 gateway435:33270 s17id:scan1.MPTS 3.06
8 gateway435:33270 s17id:scan1.PASM 3.06
9 gateway435:33270 s17id:scan1.P1EP 3.06
10 gateway435:33270 s17id:scan1.P1AR 3.06

Nov 04 13:51:01:
There were 23868 requests to check for PV existence for 2329 different PVs.
Max(Hz): 10.45
Mean(Hz): 0.19
StDev(Hz): 0.56

Connection status for top 10 PVs after 10.00 sec:
1 willow:52275 FEL:$(M8).VAL NC 10.45
2 willow:52275 FEL:$(M8).RBV NC 8.36
3 gateway433:33790 FE:09:ID:SR:HPOS:CC.VAL NC 4.01
4 gateway433:33790 FE:09:ID:SR:VPOS:CC.VAL NC 4.01
5 willow:52275 FEL:VUV4f2_ab1e.VAL NC 3.13
6 gateway435:33270 s17id:scan1.NPTS NC 3.04
7 gateway435:33270 s17id:scan1.P1PV NC 3.04
8 gateway435:33270 s17id:scan1.R1PV NC 3.04
9 gateway435:33270 s17id:scan1.CMND NC 3.04
10 gateway435:33270 s17id:scan1.P1EP NC 3.04
    
```

individual name, prefix

statistics

machine:port, (can be used to identify source)

name

search rate in Hz

Not connected, will be C for connected (hardly ever the case)

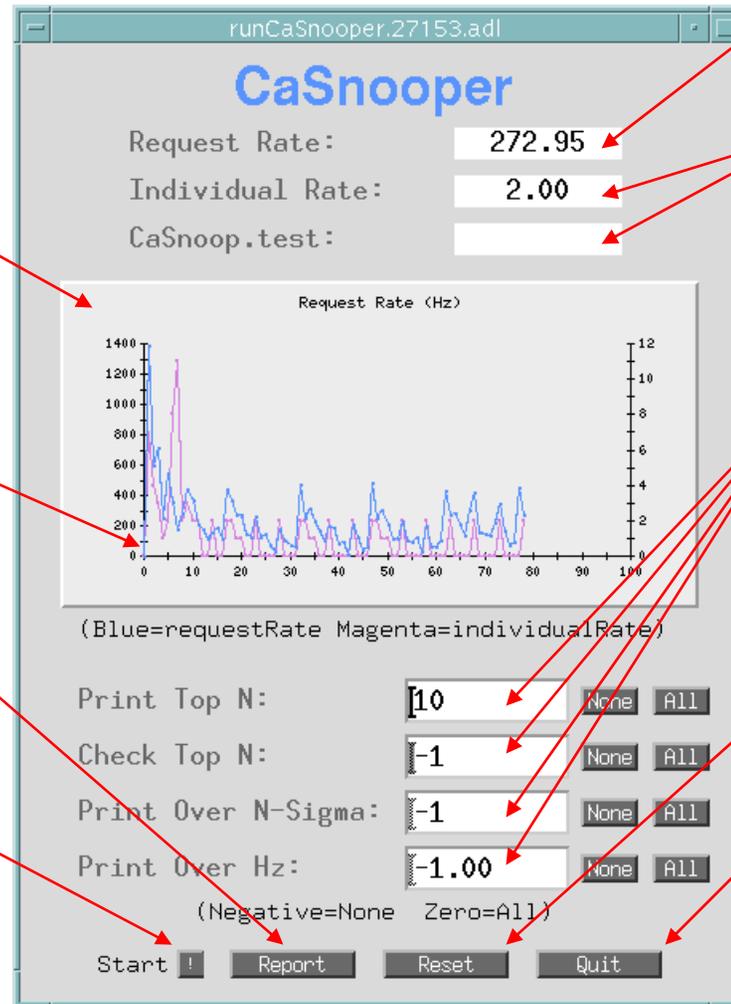
# Control CaSnooper via MEDM

Cartesian plot of requestRate and individualRate

CaSnooper was started here (with EPICS\_CA\_REPEATER\_PORT = 5065)

Execute selected reports in the CaSnooper stdout

Shell command to start CaSnooper, CASW, StripTool, etc.



Request rate

Individual rate for CaSnoop.test, which doesn't exist

Use these to set what will happen when you press Report. Case illustrated will print the top 10.

Reset the counters in CaSnooper

Stop CaSnooper

# CASW

- **CASW (Channel Access Server Watcher) monitors Beacon Anomalies**
- **Is a simple command-line utility**
- **Part of EPICS Base**
- **Prints a line with a timestamp when it sees a beacon anomaly**

CaSnooper Starting

```
Starting CASW...
Type Ctrl-C to stop it
There will no output until a beacon anomaly occurs
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:50:39.322522701
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:50:44.331146567
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:50:44.331729436
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:50:49.337082255
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:50:49.338022943
chiron:5064                    2003-11-04 11:50:52.285177497
chiron:5064                    2003-11-04 11:50:52.299845797
chiron:5064                    2003-11-04 11:50:52.320118219
chiron:5064                    2003-11-04 11:50:52.348091798
chiron:5064                    2003-11-04 11:50:52.408653298
chiron:5064                    2003-11-04 11:50:52.536166793
chiron:5064                    2003-11-04 11:50:52.788118789
chiron:5064                    2003-11-04 11:50:53.298866476
chiron:5064                    2003-11-04 11:50:54.321393444
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:50:54.344781889
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:50:54.345192506
chiron:5064                    2003-11-04 11:50:56.369893513
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:50:59.352993929
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:50:59.353456538
chiron:5064                    2003-11-04 11:51:00.466606322
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:04.357752360
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:04.359234565
chiron:5064                    2003-11-04 11:51:08.660414353
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:09.366160712
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:14.373282812
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:19.380480042
chiron:5064                    2003-11-04 11:51:23.660740900
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:24.387719304
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:29.397511716
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:34.401504995
chiron:5064                    2003-11-04 11:51:38.661120641
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:39.410394708
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:44.416328586
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:49.424073457
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:54.432394468
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:51:59.438268469
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:52:04.445217601
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:52:09.457422947
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:52:14.460862062
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:52:19.467448738
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:52:24.471852165
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:52:29.473472890
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:52:34.478712317
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:52:39.484049642
pcdiag6.aps4.anl.gov:5064      2003-11-04 11:52:44.489705934
```

# ParseCASW

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- **CASW produces a list of beacons that came at the wrong time**
  - Listed in the order they happen
    - *Intervals between anomalies are important*
    - *Not easy to see from the output*
  - Anomalies from different causes are mixed together
  - Cause of an anomaly sequence is not readily apparent
- **ParseCASW parses the CASW output**
  - Uses artificial intelligence to try to determine the event that caused the anomaly (e.g. an IOC coming up)
  - Prints the events instead of the anomalies
- **Can be used in two ways**
  - Parse output saved from CASW (or SDDS data loggers)
  - Pipe CASW into ParseCASW in real time

# ParseCASW Output

```
Emacs 21
File Edit Options Buffers Tools Help

iocid04b:5064      2004-05-18 15:07:02.699825995
iocid04b:5064      2004-05-18 15:07:02.820376078
iocid04b:5064      2004-05-18 15:07:02.949850578
iocid04b:5064      2004-05-18 15:07:03.227257161
iocid04b:5064      2004-05-18 15:07:03.773111244
iocid04b:5064      2004-05-18 15:07:04.860120243
iocid04b:5064      2004-05-18 15:07:06.983292074
iocid04b:5064      2004-05-18 15:07:11.248919487
iocid04b:5064      2004-05-18 15:08:02.752896604
ioclid5:5064       2004-05-18 15:08:06.104330352
iocid01:5064       2004-05-18 15:08:06.106132852
iocid01:5064       2004-05-18 15:08:06.138858851
iocid01:5064       2004-05-18 15:08:06.208655601
iocid01:5064       2004-05-18 15:08:06.338916851
iocid01:5064       2004-05-18 15:08:06.605788351

---:-- casw.051804.txt (Text)--L77-- 8%-----
iocid04b:5064 May 18 14:28:08 Medium long sequence ←
iocid03:5064 May 18 14:40:53 Medium long sequence
iocid03:5064 May 18 14:45:36 Short sequence
ioclid5:5064 May 18 15:00:50 Short sequence ←
ioclid5:5064 May 18 15:04:17 Medium long sequence ←
iocid04b:5064 May 18 15:07:02 Medium long sequence ← Flakey IOC
ioclid5:5064 May 18 15:08:02 Short sequence
iocid01:5064 May 18 15:08:06 Server coming up ← Most common
iocid02:5064 May 18 15:08:57 Probably server coming up
iocid03:5064 May 18 15:09:54 Probably server coming up
iocid04:5064 May 18 15:10:46 Server coming up
iocid05:5064 May 18 15:11:39 Server coming up
ioclid5:5064 May 18 15:12:05 Medium long sequence ← Flakey IOC
ioccs21fb:5064 May 18 15:14:23 Server coming up
iocid04b:5064 May 18 15:14:52 Medium long sequence ←

---:-- parsecasw.txt (Text)--L9-- 5%-----
```

Long File

Short File

Flakey IOC

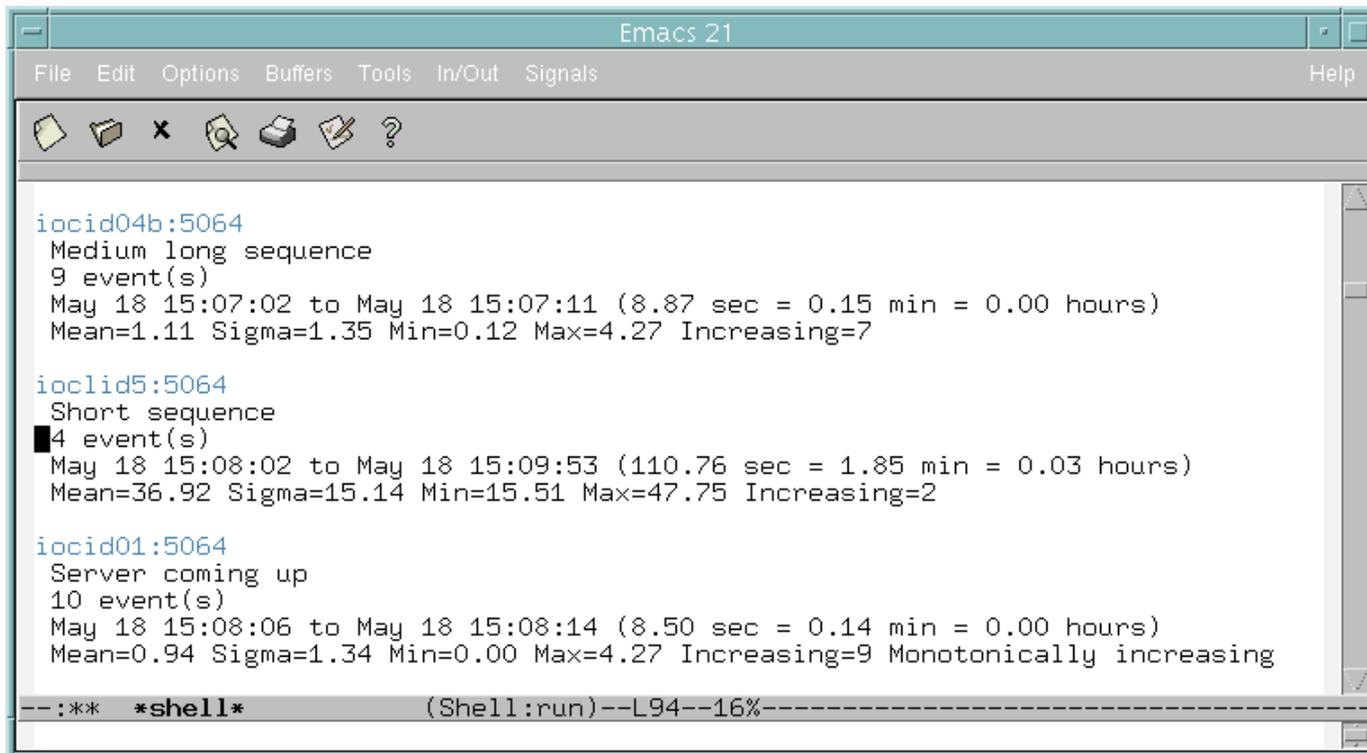
Most common

Flakey IOC



# ParseCASW Verbose Output

- With the `-v` option you get more details
  - You can decide for yourself what kind of event it is



```
Emacs 21
File Edit Options Buffers Tools In/Out Signals Help

iocid04b:5064
Medium long sequence
9 event(s)
May 18 15:07:02 to May 18 15:07:11 (8.87 sec = 0.15 min = 0.00 hours)
Mean=1.11 Sigma=1.35 Min=0.12 Max=4.27 Increasing=7

ioclid5:5064
Short sequence
4 event(s)
May 18 15:08:02 to May 18 15:09:53 (110.76 sec = 1.85 min = 0.03 hours)
Mean=36.92 Sigma=15.14 Min=15.51 Max=47.75 Increasing=2

iocid01:5064
Server coming up
10 event(s)
May 18 15:08:06 to May 18 15:08:14 (8.50 sec = 0.14 min = 0.00 hours)
Mean=0.94 Sigma=1.34 Min=0.00 Max=4.27 Increasing=9 Monotonically increasing

--:** *shell* (Shell:run)--L94--16%
```

# *RunCaSnooper*

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- **RunCaSnooper is a shell script that provides an interface to CaSnooper and CASW with an associated MEDM and StripTool**
- **Is APS specific, but the script can be modified for your needs**
- **By default it brings up an MEDM and a StripTool and does not start CaSnooper**
  - If CaSnooper is running, the MEDM screen will not be white
  - If it is white, you can start CaSnooper from the MEDM screen
- **Uses EPICS\_CA\_REPEATER\_PORT=9876 by default, not 5065**
- **You can also start CASW and StripTool from the MEDM screen**
- **Everything is generated on the fly and stored in /tmp**
  - Logs of the CaSnooper reports and CASW output
  - MEDM ADL file and StripTool configuration files
- **On startup it prints directions and allows you to continue**
  - Intended for occasional use by semi-experienced people

# RunCaSnooper

The screenshot displays the RunCaSnooper application interface. It consists of several overlapping windows:

- CaSnooper (Terminal):** Shows startup logs: "Starting CcSnooper... Type Ctrl-C to stop it. Starting CaSnooper 2.1.0.1 (8-27-2003) at Nov 04 16:36:03. EPICS 3.14.3. Individual Name is CaSnoop.test. PV name prefix is CaSnoop." It also lists top 10 PVs: gateway433, gateway439, willow:522, willow:522, gateway432, gateway432, gateway432.
- CASW (Terminal):** Shows "Starting CASW... Type Ctrl-C to stop it. There will no output until a beacon anomaly occurs." It lists chiron:5064 PVs with timestamps.
- runCaSnooper.rate.12188.stp Graph:** A line graph showing frequency (Hz) over time (Minutes). The x-axis ranges from -20 to 16:47:39 on Nov 04, 2003. The y-axis ranges from 0 to 1000 Hz. Multiple colored lines represent different test rates.
- runCaSnooper.12188.adl (Control Panel):** Displays "CaSnooper" and "Request Rate: 54.01". It includes a "Request Rate (Hz)" sub-graph and a list of test rates with their values:
  - r432.existTestRate: VAL=276.683
  - r431.existTestRate: VAL=279.408
  - r433.existTestRate: VAL=36.5609
  - r434.existTestRate: VAL=162.197
  - r435.existTestRate: VAL=36.3652
  - r436.existTestRate: VAL=40.3589
  - r438.existTestRate: VAL=36.3641
  - CaSnoop.individualRate: VAL=0
  - CaSnoop.requestRate: VAL=34.0146

At the bottom, there is a taskbar with buttons for Sun ONE, Emacs, Phoebus, Hydra, Gateway, locappsTools, StripTool, Nike, and an EXIT button.

# ***More information***

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- Jeffery O. Hill, ***EPICS R3.14 Channel Access Reference Manual***, (EPICS Documentation, 2005 or latest).

<http://www.aps.anl.gov/epics/modules/base/R3-14/index.php>

- W. Richard Stevens, ***UNIX Network Programming***, (Prentice-Hall, Upper Saddle River, NJ, 1998) Vol. 1.
- K. Evans, Jr., ***CaSnooper Reference Manual***, (EPICS Documentation, 2005 or latest).

<http://www.aps.anl.gov/epics/extensions/caSnooper/index.php>

- Has links to more extensive Channel Access presentations

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# *Thank You*

*This has been an  
APS Controls Presentation*

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# *Thank You*

*This has been an  
APS Controls Presentation*