Feedback Welcome About

- data you'd like to be able to view this way.
- better ways of looking at it than this.
- ways of avoiding visualization entirely.

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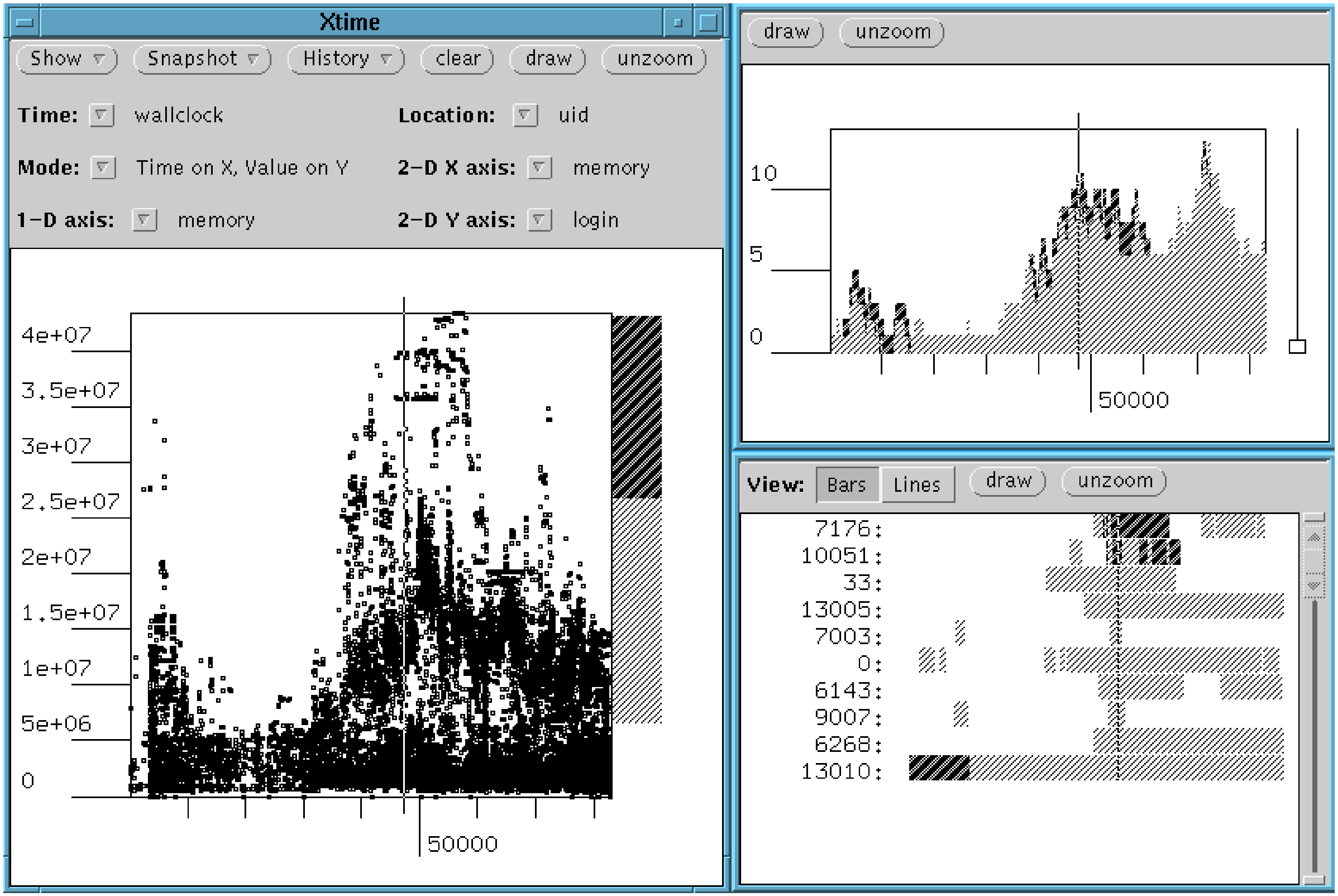
Conclusions

- Xscal is a very powerful tool, but
  - it is tremendously difficult to format data for it
    - from other formats
    - over time (see paper)
  - it suffers from the ‘canonical problems’ that plague all visualization tools:
    - patterns emerge by luck.
    - must choose the correct view to spot.
- We need a simpler, domain-specific tool.
- I’m willing to create it, but would like feedback on what’s useful to see.


Xtime
Show
Snapshot
History
clear
draw
unzoom
Time: wallclock
Location: uid
Mode: Time on X, Value on Y
2-D X axis: memory
1-D axis: memory
2-D Y axis: login
4e+07
3.5e+07
3e+07
2.5e+07
2e+07
1.5e+07
1e+07
5e+06
0
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draw
unzoom
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5
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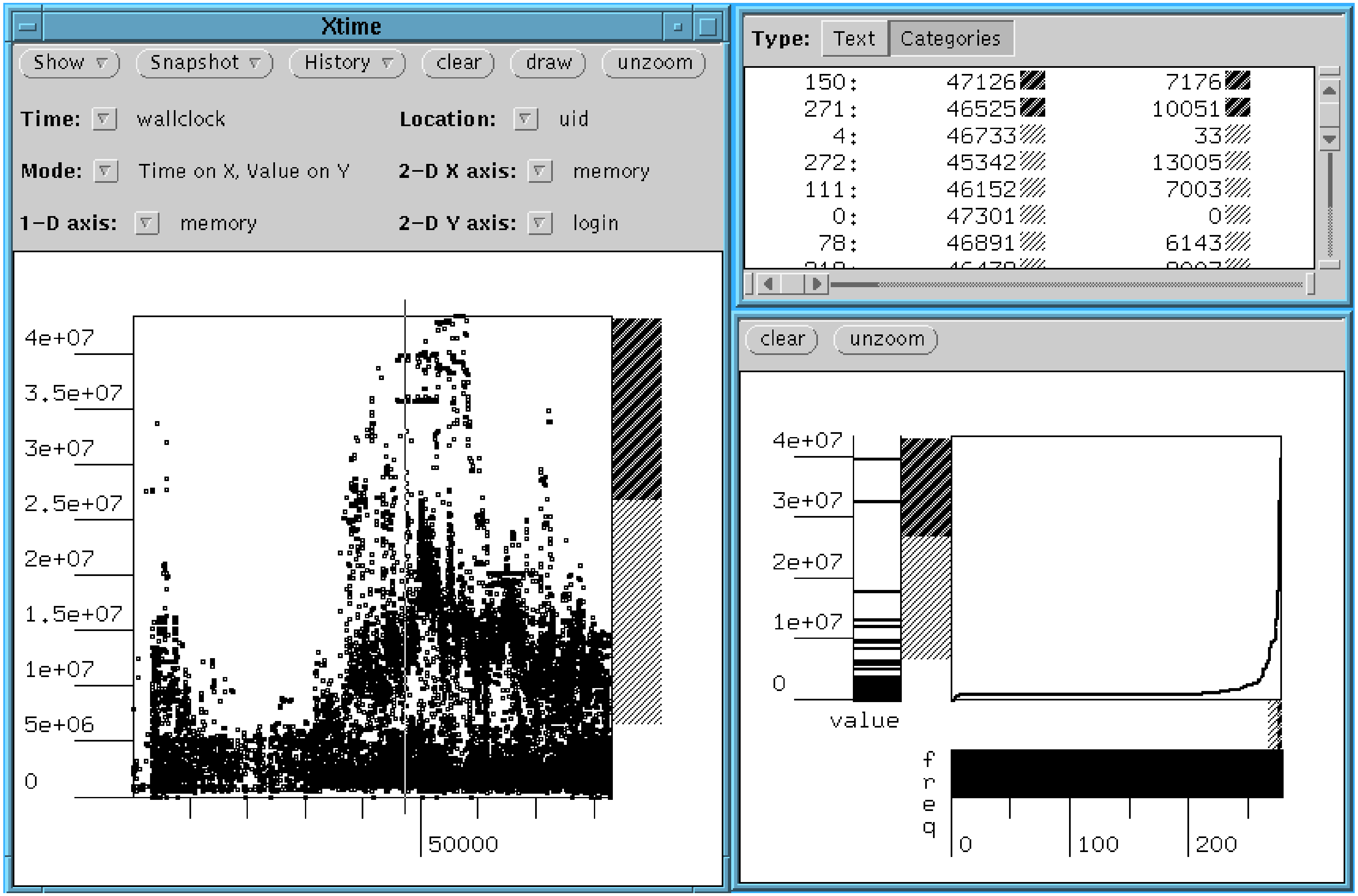
50000
View: Bars Lines
draw
unzoom
7176:
10051:
33:
13005:
7003:
0:
6143:
9007:
6268:
13010: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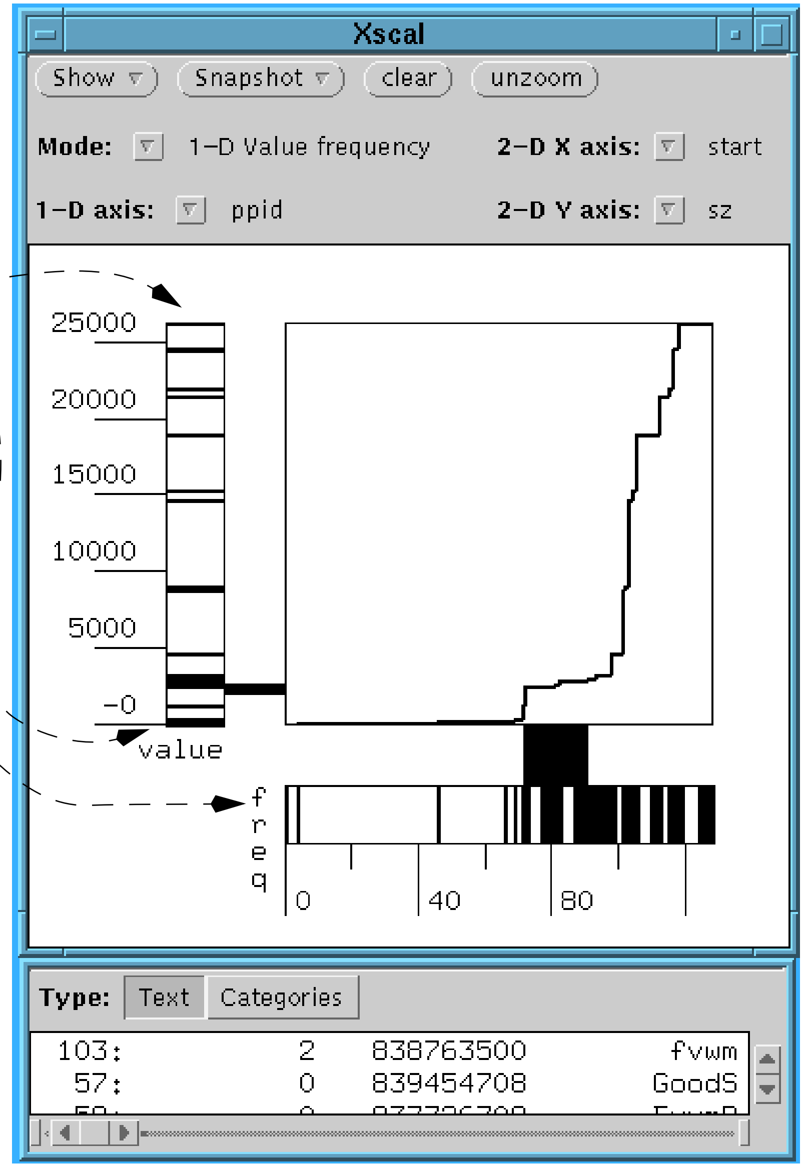
4e+07
3.5e+07
3e+07
2.5e+07
2e+07
1.5e+07
1e+07
5e+06
0
50000
Type: Text Categories
150: 47126 7176
271: 46525 10051
4: 46733 33
272: 45342 13005
111: 46152 7003
0: 47301 0
78: 46891 6143
clear
unzoom
4e+07
3e+07
2e+07
1e+07
0
value
freq
0
100
200

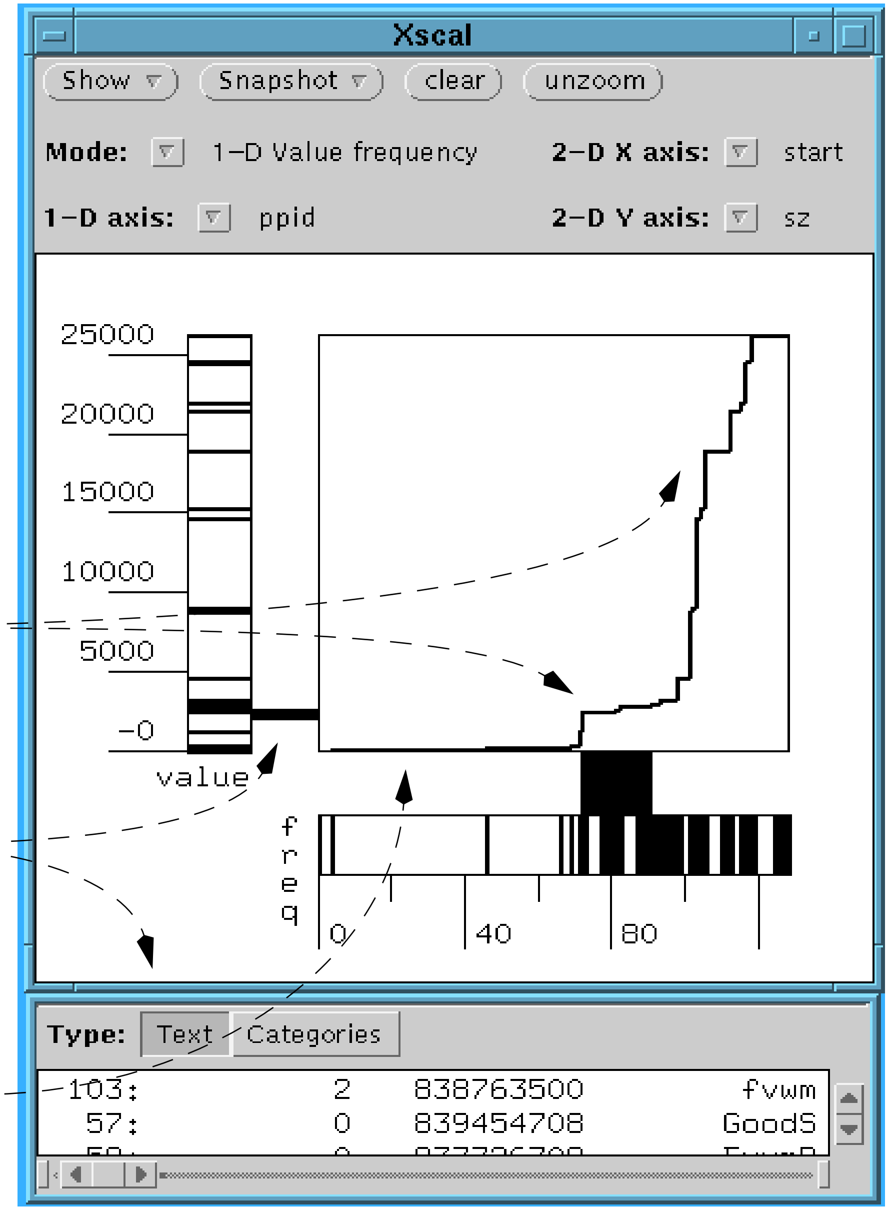
Dealing with Time

- Value scatterplot has a hashmark for each value present
- Frequency scatterplot has a hashmark between each two distinct values
- Plot these against time and present this view for each individual time.



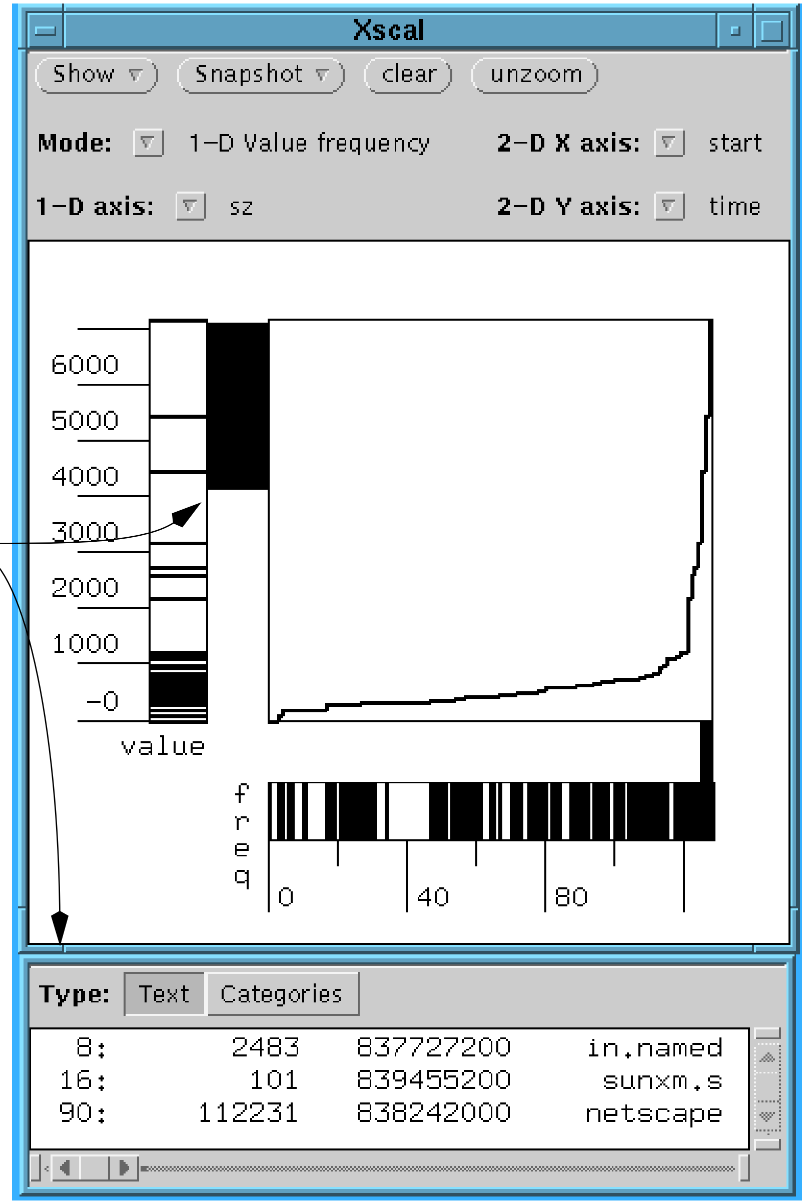
Surprising Information from a mundane source

- Parent Process ID's
- Plateaux show one user session's contribution to total processes
- Zooming in shows that long plateaux are X11 sessions.
- Flat section at bottom represents system processes (from init)



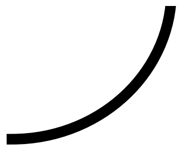
Problem Pursuit

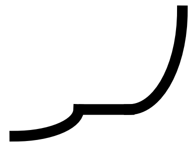
- The value-frequency view hides the identity of participating entities.
- Highlighting problem areas displays identities of problem processes.
- Multiple colors for different kinds of processes.

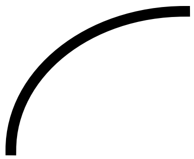


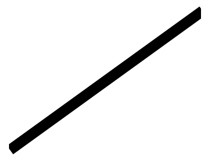
What's Normal?

- Process memory size:

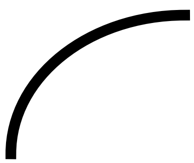
 normal

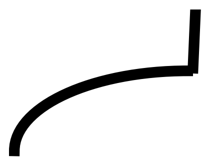
 possible runaway fork(!)

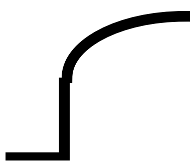
 pigs

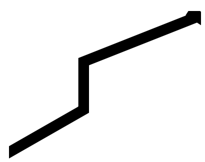
 system too small(!)

- Session time:

 normal

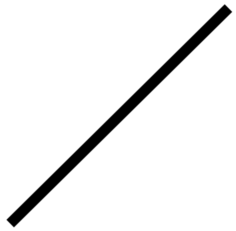
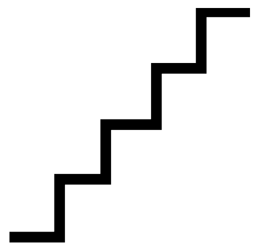
 forgot to log out

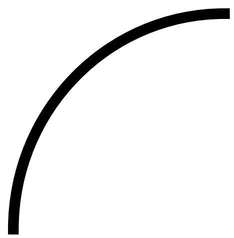
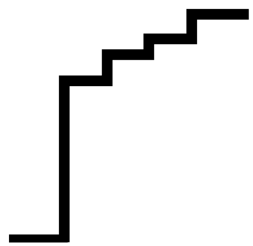
 attack?

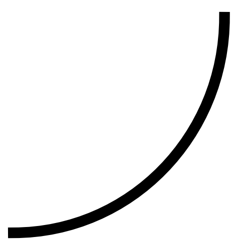
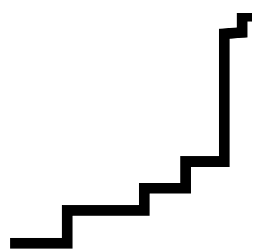
 two kinds of users

Characteristic Curves

large and small number of distinct values:

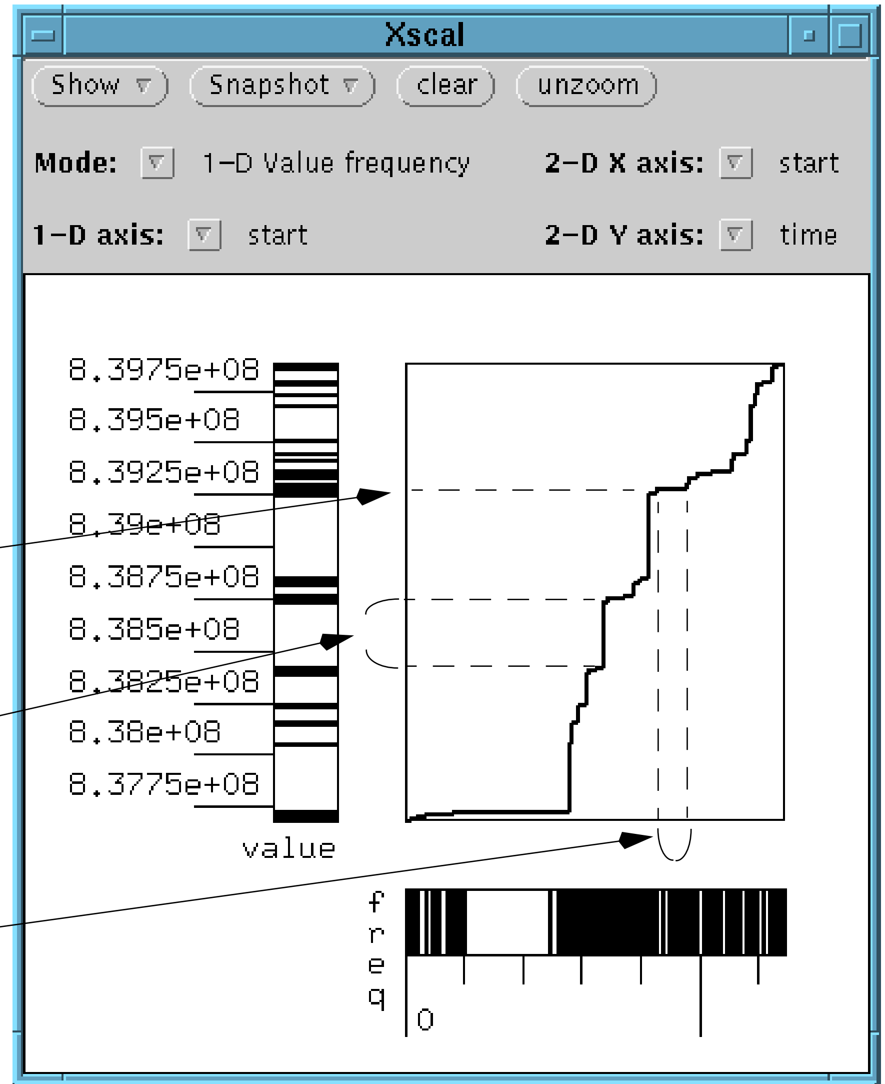
 and  uniformly distributed

 and  mostly large values

 and  mostly small values

Xscal's Value-Frequency View

- value on Y axis
- frequency of values on X axis.
- height of each horizontal line indicates value
- verticals show value gaps
- width of each horizontal line shows frequency



XSCAL

- Comparison views for thousands of variables
- Scale-invariant representation of data, equally usable when there are
  - two or millions of measurements.
  - two or millions of distinct values measured.
- Utilizes value-frequency duality
  - frequency is required to make sense of a few distinct values
  - If there are many distinct values, frequency is relatively unimportant.
- Solution: combine value and frequency in one view.

Overview

- The administrator of a large system or network is constantly exposed to vast amounts of performance data
  - snapshots: details for one instant of time.
  - traces: details over a time period.
- To use this data to detect abnormal conditions, it is first necessary to **define normality**, and then to **detect abnormal conditions** based upon this definition.
- Visualization tools can help, if there is a view in which these behaviors look different.

VISUALIZING HUGE TRACEFILES WITH XSCAL

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