

# SNMP-based Monitoring of a Computing Cluster

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# Talk Outline

- The Monitoring Challenge
- Some Existing Tools
- ASC: the Asynchronous SNMP Collector
- Conclusions and Future Work



# The Challenge

BaBar's Data Reprocessing suddenly stops.  
What happened?

- Client process(es) crashed
- Server process(es) crashed
- The local disk failed
- The CPU melted
- /tmp overflowed
- None of the above



# Requirements

- **Scalable** up to  $\approx 150$  machines and more.
- **Easy to configure**: If one has to do simple things the effort required to configure the tool should be minimal.
- **Extensible**: New functionalities should be easy to add as they are needed.
- **General**: Needs to monitor the network switch, tape library, UPS, environmental system...
- **GUI-independent**: Should work as a regular UNIX daemon, yet providing a convenient user interface(s).



# Some tools

There are many freely distributable monitoring tools available.

- MRTG <http://people.ee.ethz.ch/~oetiker/webtools/mrtg/>
- NGoP <http://www-isd.fnal.gov/ngop/>
- RemStats <http://silverlock.dgim.crc.ca/remstats/release/index.html>
- Ganglia <http://ganglia.sourceforge.net/>
- Nagios <http://www.nagios.org/>
- Snips <http://www.netplex-tech.com/software/snips/>
- Cricket <http://cricket.sourceforge.net/>
- Many, *many* others...



# What's wrong?

So, why don't simply use one of the many programs available?

Because they fail to meet our requirements. In particular:

- Many of them don't scale well/at all.
- Configuration is highly nontrivial in most cases (lots of different configuration files scattered around...).
- Many of them require special dæmons running on the monitored hosts: can't handle the network switch/tape libary/UPS...



# The Do-It-Yourself approach

So we decided to build a tool (**ASC**, the *Asynchronous SNMP Collector*) from scratch.

- The tool is entirely written in **C**.
- Use asynchronous (non-blocking) **SNMP** requests for data collection.

SNMP (*Simple Network Management Protocol*) is a standard protocol supported by many different pieces of hardware. Even our air conditioning system speaks SNMP...



# The Do-It-Yourself approach (2)

- Data are stored in **Round Robin Databases**  
Provide facilities for storing timestamped data with different granularities; facilities for plotting graphs are also provided
- The configuration file is written in **XML**
- ASC embeds a simple **HTTP** interface  
HTML pages are generated by applying an **XSLT** stylesheet to an automatically-generated XML status file





# XML Configuration File

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE monitor SYSTEM "monitor.dtd">

<monitor numconnections="20" asclogfile="/monitor/asc.log"
        httpdlogfile="/dev/null" rrrdir="/monitor"
        htmldir="/monitor/html" ascverbosity="3" >

<!--
== Hosts configuration
-->

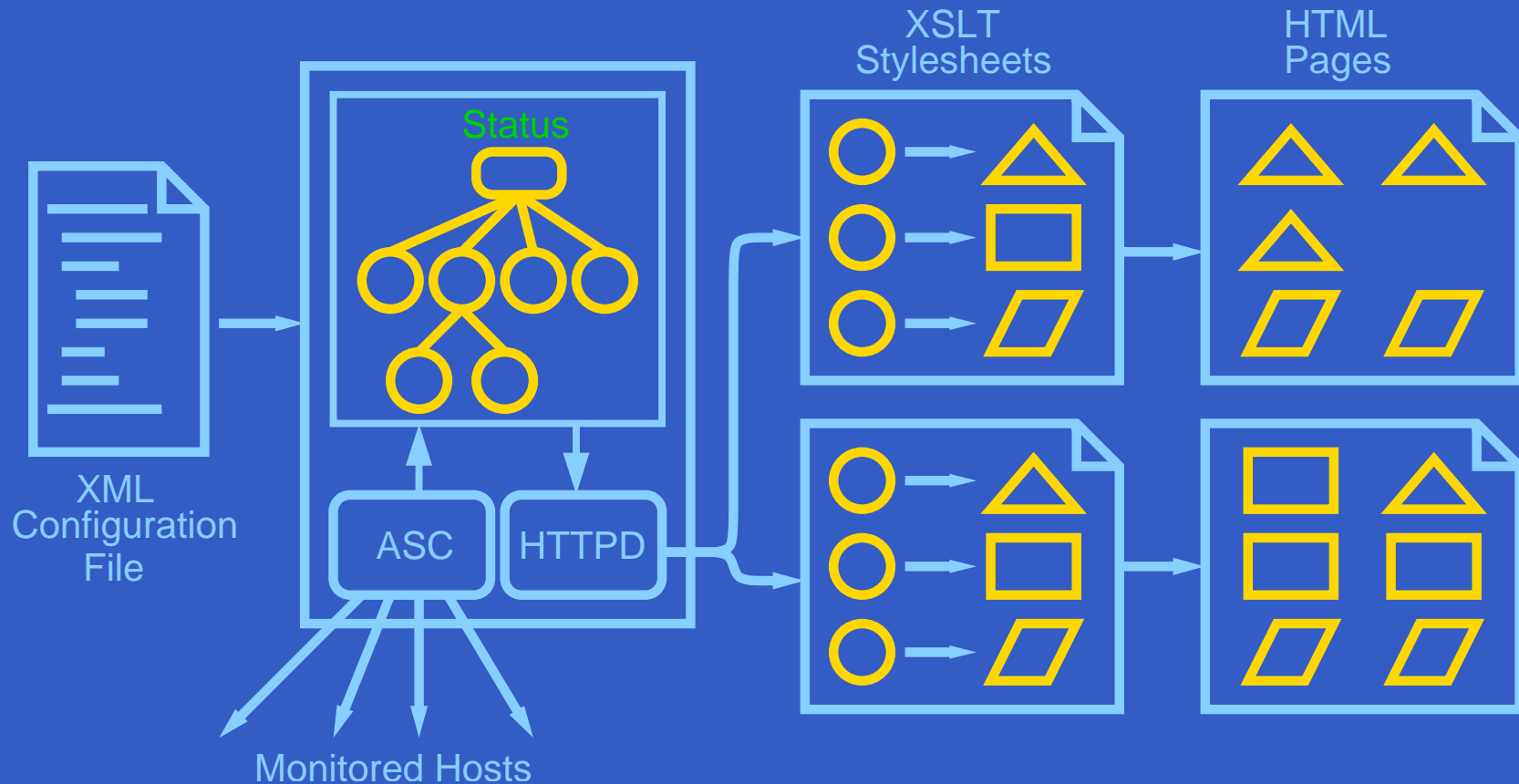
<host name="localhost">
  <description>This machine</description>
  <miblist>
    <mib id="cpuUser" name=".1.3.6.1.4.1.2021.11.50.0" type="COUNTER">
      <archives>
        <rra cf="AVERAGE" granularity="60" expire="604800"/>
      </archives>
    </mib>
  </miblist>

</host>

</monitor>
```



# XML to HTML Output



# HTML Interface

**Farm Overview**

| SNMP Status | Machine                        |
|-------------|--------------------------------|
| NR          | <a href="#">bbr-cndserv01</a>  |
| OK          | <a href="#">bbr-datamove01</a> |
| OK          | <a href="#">bbr-farm001</a>    |
| NR          | <a href="#">bbr-farm002</a>    |
| NR          | <a href="#">bbr-farm003</a>    |
| NR          | <a href="#">bbr-farm004</a>    |
| NR          | <a href="#">bbr-farm005</a>    |
| NR          | <a href="#">bbr-farm006</a>    |
| NR          | <a href="#">bbr-farm007</a>    |
| NR          | <a href="#">bbr-farm008</a>    |
| NR          | <a href="#">bbr-farm009</a>    |
| OK          | <a href="#">bbr-farm010</a>    |
| OK          | <a href="#">bbr-farm011</a>    |
| NR          | <a href="#">bbr-farm013</a>    |
| NR          | <a href="#">bbr-farm014</a>    |
| NR          | <a href="#">bbr-farm015</a>    |
| OK          | <a href="#">bbr-farm016</a>    |
| NR          | <a href="#">bbr-farm020</a>    |
| OK          | <a href="#">bbr-import</a>     |
| OK          | <a href="#">bbr-tape01</a>     |
| NR          | <a href="#">bbr-test01</a>     |
| OK          | <a href="#">bbr-user</a>       |
| OK          | <a href="#">catbb1</a>         |

**MIB Name Type TimeStamp Last Value**

|              |              |            |  |
|--------------|--------------|------------|--|
| importTotal  | NR           | 1020081898 | 5876492  |
| hostUpTime   | TIMETICKS    | 1020079483 | 9 days, 19:47:42.96  |
| hostLocation | OCTET STRING | 1020068656 | Unknown (edit /etc/snmp/snmpd.conf)  |
| hostName     | OCTET STRING | 1020068656 | bbr-import.pd.infn.it  |
| hostID       | OCTET STRING | 1020068656 | Linux<br>bbr-import.pd.infn.it<br>2.4.9-21smp #1 SMP<br>Thu Jan 17 14:01:48<br>EST 2002 i686 |
| icpuIdle     | INTEGER32    | 1020081898 | 84   |
| icpuSystem   | INTEGER32    | 1020081898 | 9  |
| icpuUser     | INTEGER32    | 1020081898 | 6  |
| laLoad15     | OCTET STRING | 1020081296 | 2.26   |
| laLoad5      | OCTET STRING | 1020081898 | 2.10   |
| laLoad1      | OCTET STRING | 1020081898 | 1.98   |
| disk4Out     | NR           | 0          | 0  |
| disk4In      | NR           | 0          | 0  |
| disk3Out     | NR           | 0          | 0  |
| disk3In      | NR           | 0          | 0  |
| disk2Out     | NR           | 0          | 0  |
| disk2In      | NR           | 0          | 0  |
| disk1Out     | NR           | 0          | 0  |
| disk1In      | NR           | 0          | 0  |
| net3Out      | COUNTER      | 1020081898 | 796114242  |
| net2Out      | COUNTER      | 1020081898 | 0  |
| net1Out      | COUNTER      | 1020081898 | 3316220784   |
| net3In       | COUNTER      | 1020081898 | 1742320274   |
| net2In       | COUNTER      | 1020081898 | 0  |
| net1In       | COUNTER      | 1020081898 | 1383140934   |
| usrAvail     | INTEGER32    | 0          | 0  |
| usrUsed      | INTEGER32    | 0          | 0  |
| varAvail     | INTEGER32    | 0          | 0  |
| varUsed      | INTEGER32    | 0          | 0  |
| tmpAvail     | INTEGER32    | 0          | 0  |

**bbr-import - Last 3 hours Data**

**bbr-import - Hourly CPU Utilization**

**bbr-import - Hourly Network Utilization**



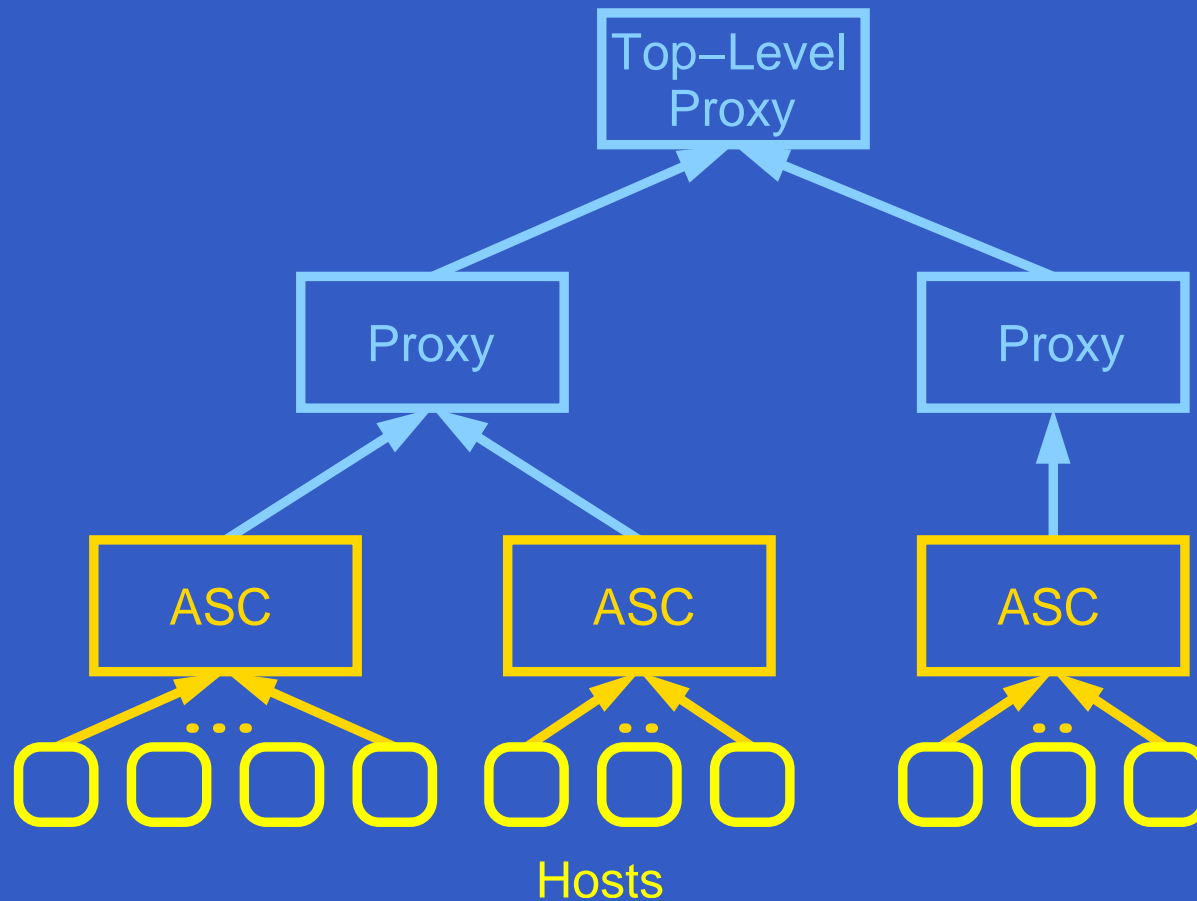
# Conclusions

ASC is still under development. Are we approaching the goals?

- **Scalability** On the test farm ( $\approx 20$  machines) it is working very well. Will it scale tenfold? (Note that applying stylesheets is not cheap...)
- **Easy Configuration** We have a single configuration file, which can optionally be split in different parts and use macros. These are standard features of **XML**.



# Facing a scalability limit



# Work(s) in Progress

- Implement Alarms
- Understand SNMP Traps
- Active control of ASC with its WEB interface
- Implement more XSLT stylesheets
- Write the documentation

