MONA LISA

MONitoring Agents using a Large Integrated Services Architecture

CHEP03

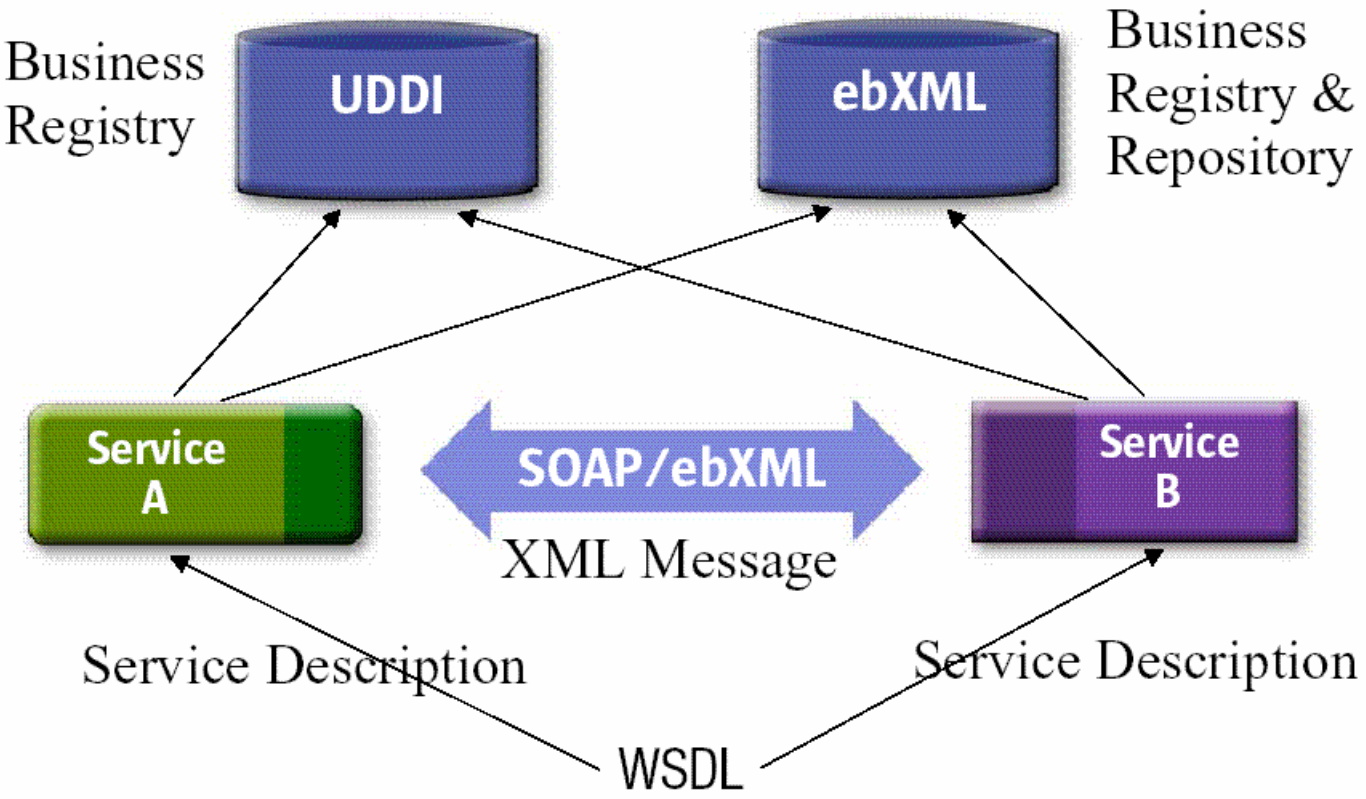
Iosif Legrand

California Institute of Technology

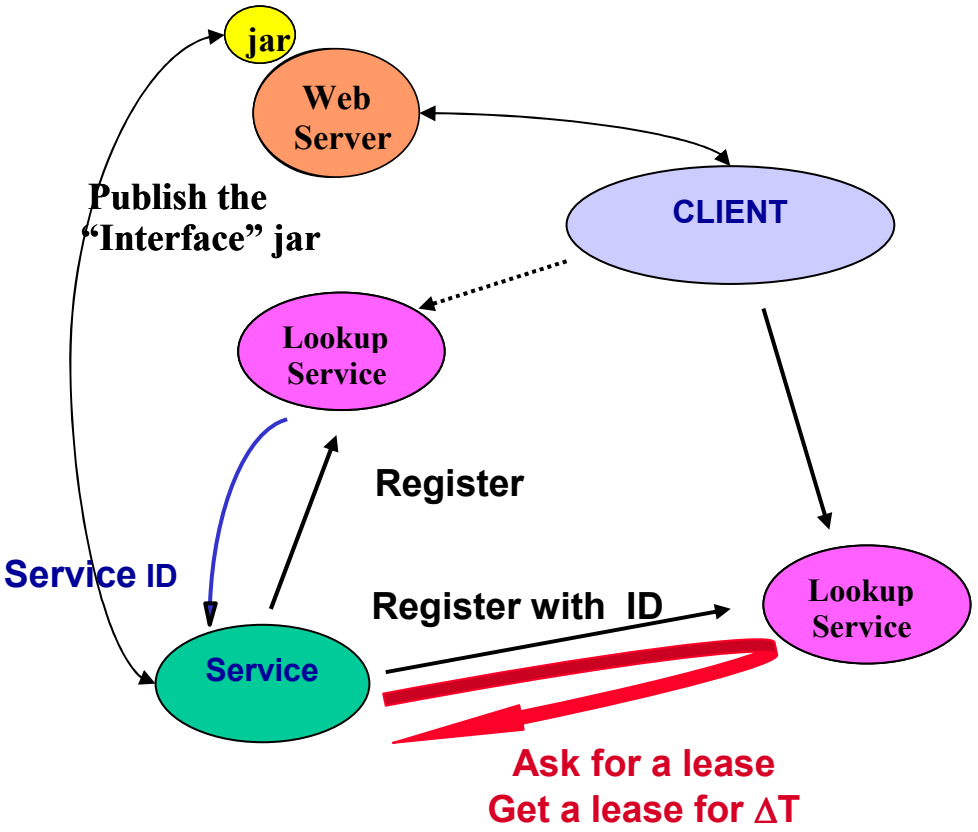
Design Considerations

- Act as a true dynamic service and provide the necessary functionally to be used by any other services that require such information (Jini, UDDI - WSDL / SOAP)
  - mechanism to dynamically discover all the "Farm Units" used by a community
  - remote event notification for changes in the any system
  - lease mechanism for each registered unit
- Allow dynamic configuration and the list of monitor parameters.
- Integrate existing monitoring tools (SNMP, LSF, Ganglia, Hawkeye …)
- It provides:
  - single-farm values and details for each node
  - network aspect
  - real time information
  - historical data and extracted trend information
  - listener subscription / notification
  - (mobile) agent filters and alarm triggers algorithms for prediction and decision-support

WEB Services / WSDL UDDI



JINI – Network Services



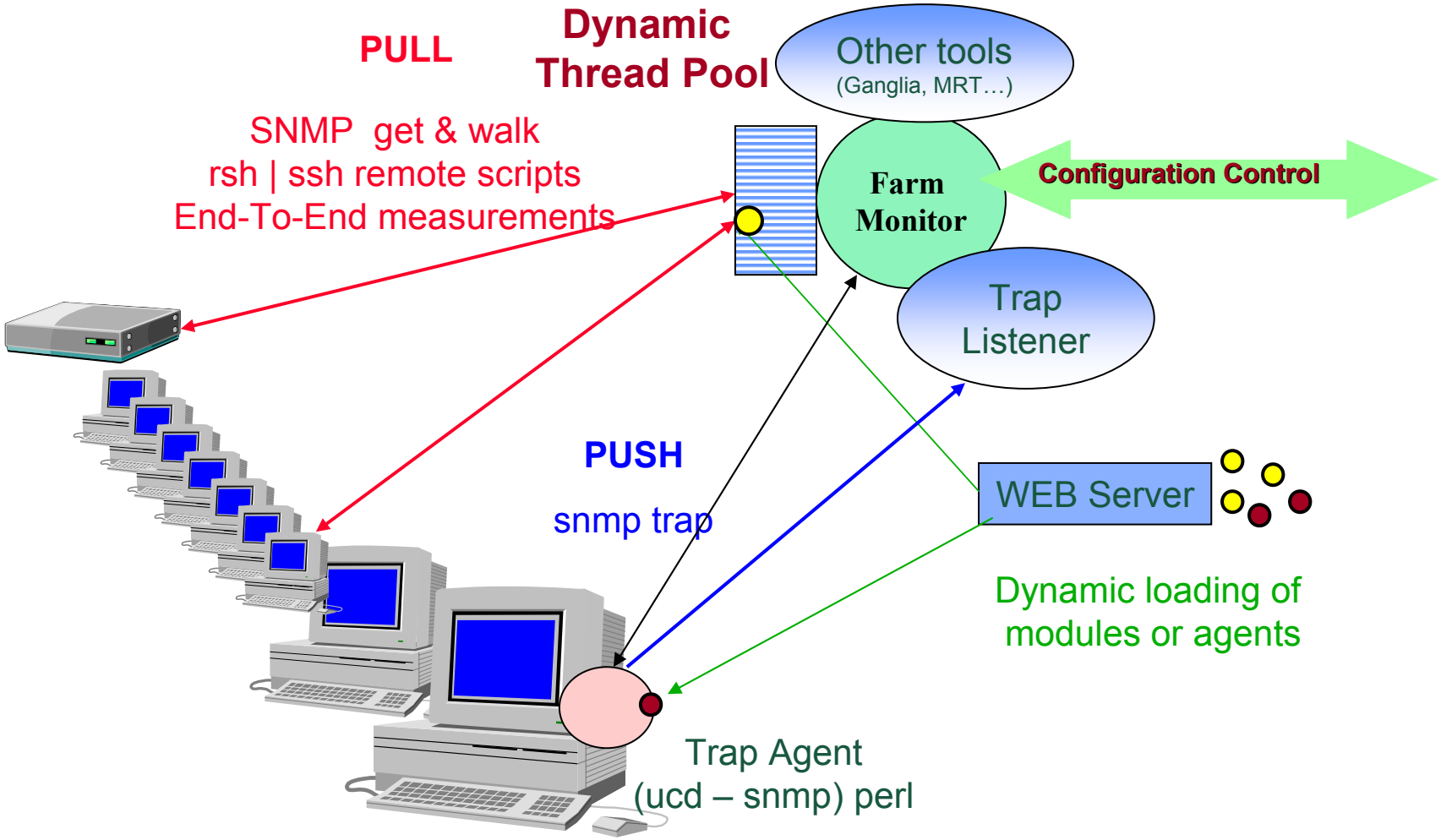
A Service Registers with at least one Lookup Service using the same ID.

It provides information about its functionality and the URL addressed from where interested clients may get the dynamic code to use it.
The Service must ask each Lookup Service for a lease and periodically renew it.

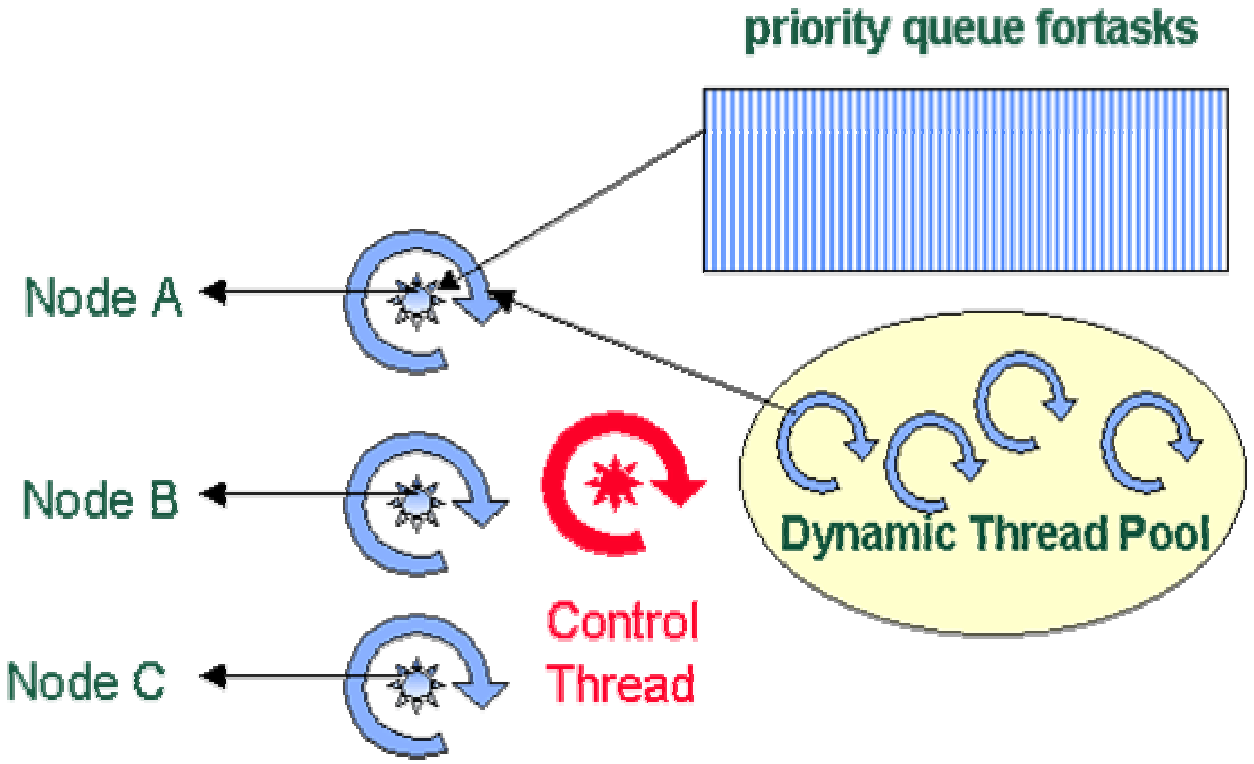
If a Service fails to renew the lease, it is removed form the Lookup Service Directory. When problems are solved, it can re-register.

The lease mechanism allows the Lookup Service to keep an up to date directory of services and correctly handle network problems.

Monitoring: Data Collection

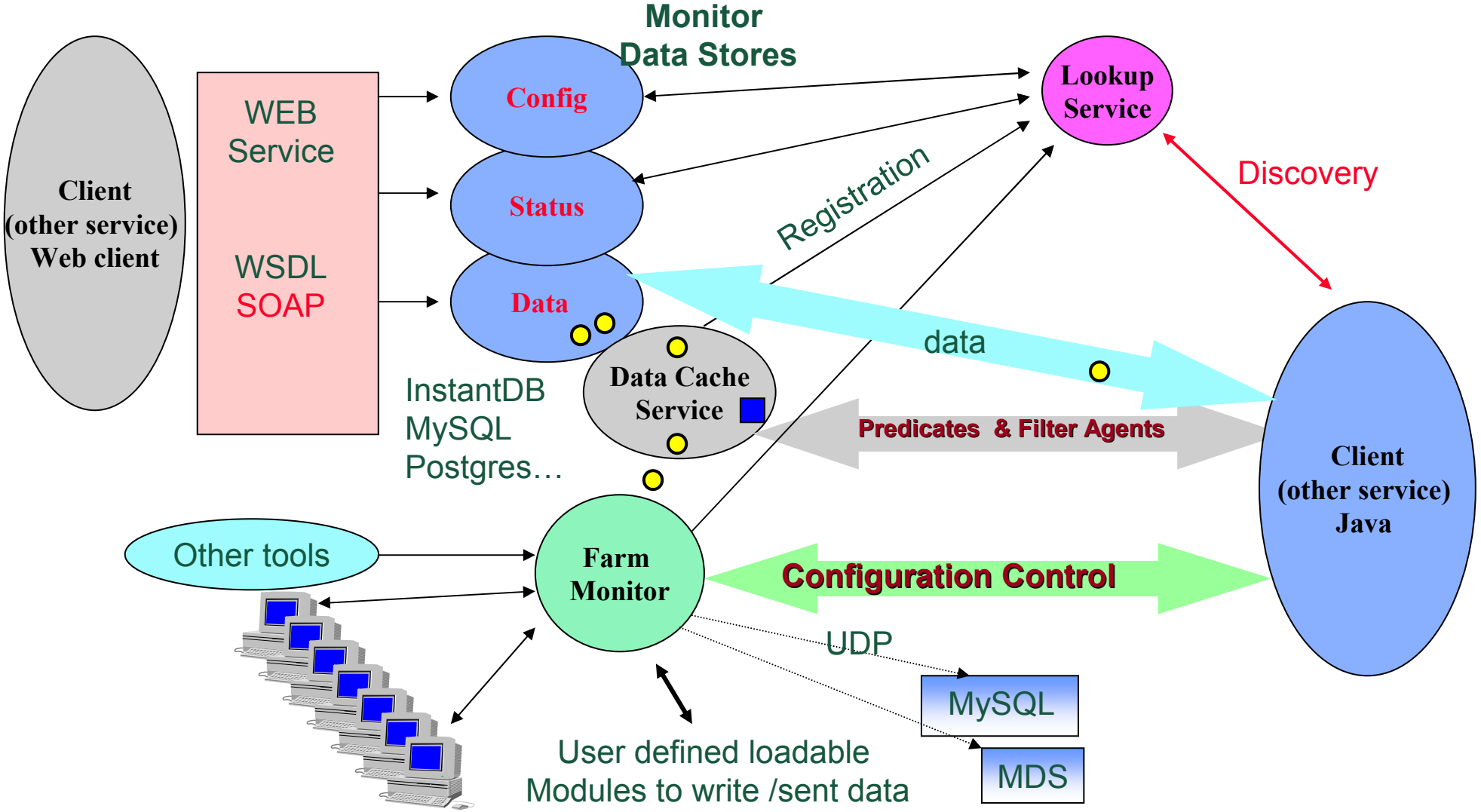


The Muti-Threaded Execution Architecture



- Each request is done in an independent thread
- A slow agent / busy node does not perturb the measurements of an entire system
- Ex: Monitor 300 nodes @ 30 seconds interval → 10-15 Threads are running in parallel

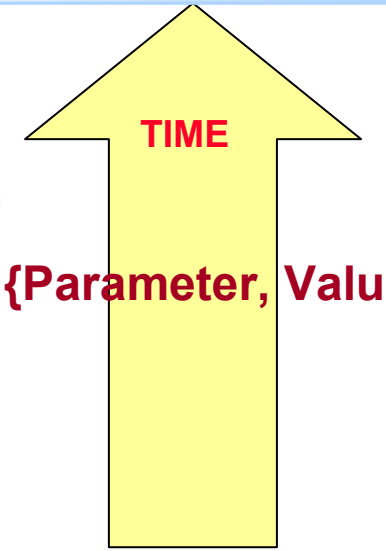
Farm Monitor UNIT & Data Handling



Data Handling

Data Model

- Configuration — Farm , Function (Cluster), Node, Module
- Monitored Values — {Parameter, Value}



- (Automatic) Mapping of the Data Model in :

  XML, SQL, SOAP, …

- Configuration & Results objects are store in a DB

  (dynamically configurable for InstanDB, Postgres, MySQl, Oracle …)

- Subscription to results objects matching a template / predicate
- Clients can load filter objects into the Data Cache service and generate any derived (or aggregate) data structures and register to receive them.
- Monitored parameters have a life time

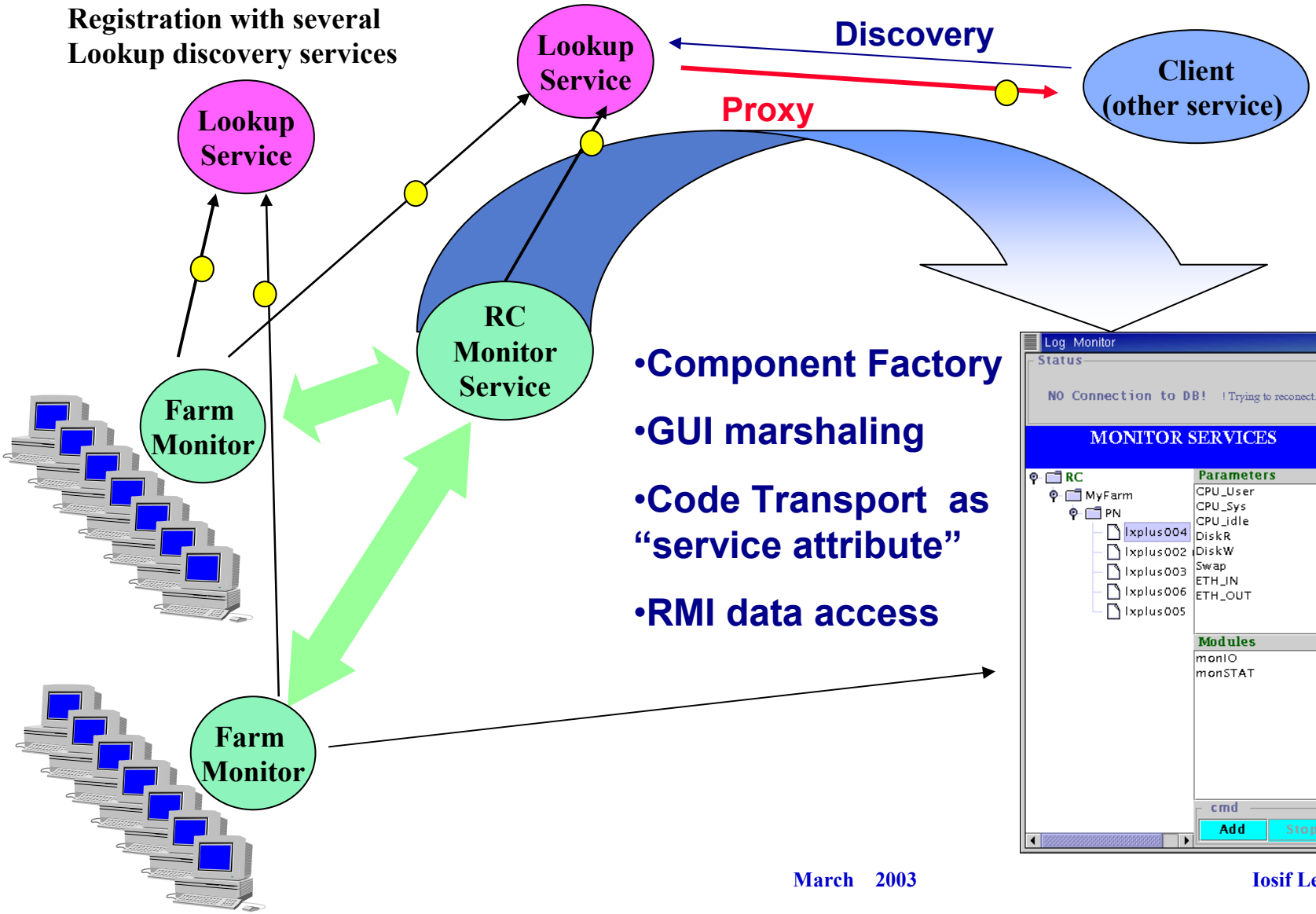
Data Collection Modules

MonaLisa is a monitoring Framework:

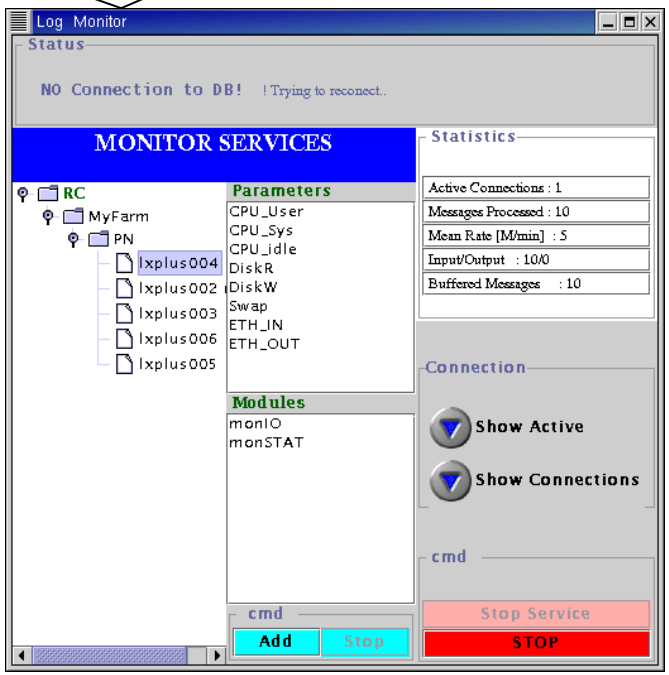
- SNMP (walk and get)
- Scripts , dedicated application (programs) which may be invoked on remote systems
- Interface to Gangia
- Interface to LSF
- Interface to Hawkeye (Wisconsin)
- Interface to LDAP (MDS) (Florida)
- Specialized modules for VRVS

RC Monitoring Service

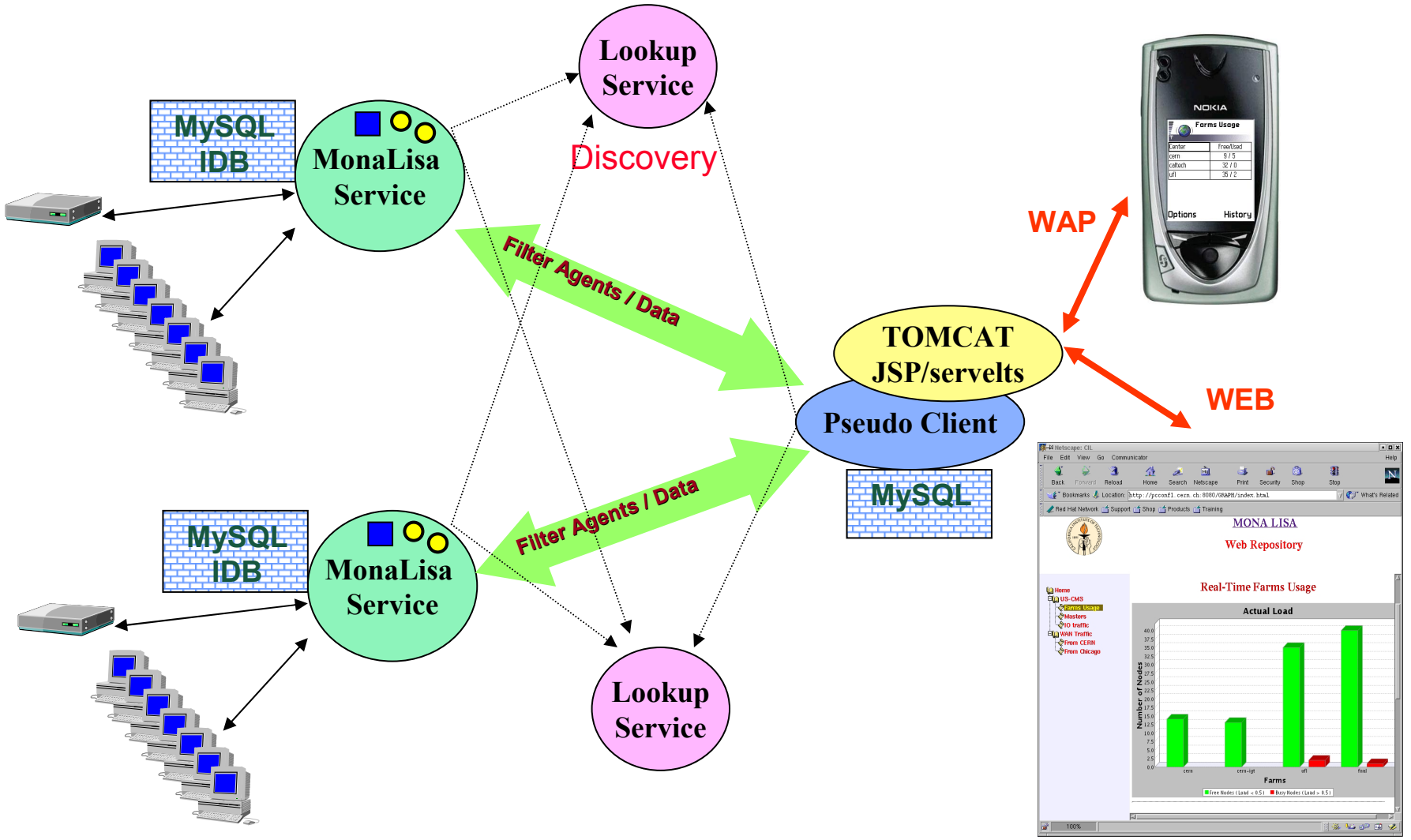
Registration with several
Lookup discovery services



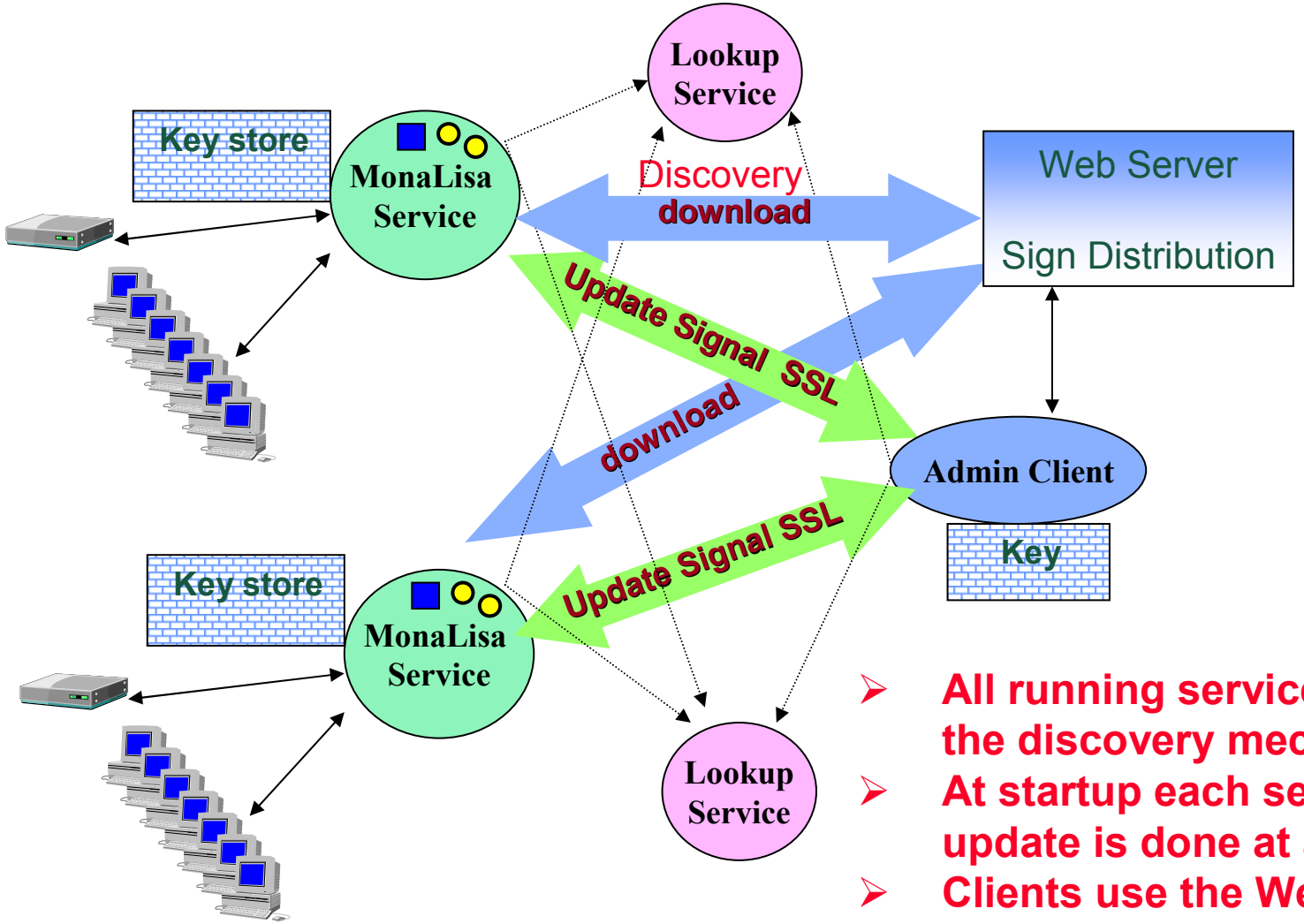
- Component Factory
- GUI marshaling
- Code Transport as "service attribute"
- RMI data access



Pseudo – Clients & Dedicated Repositories



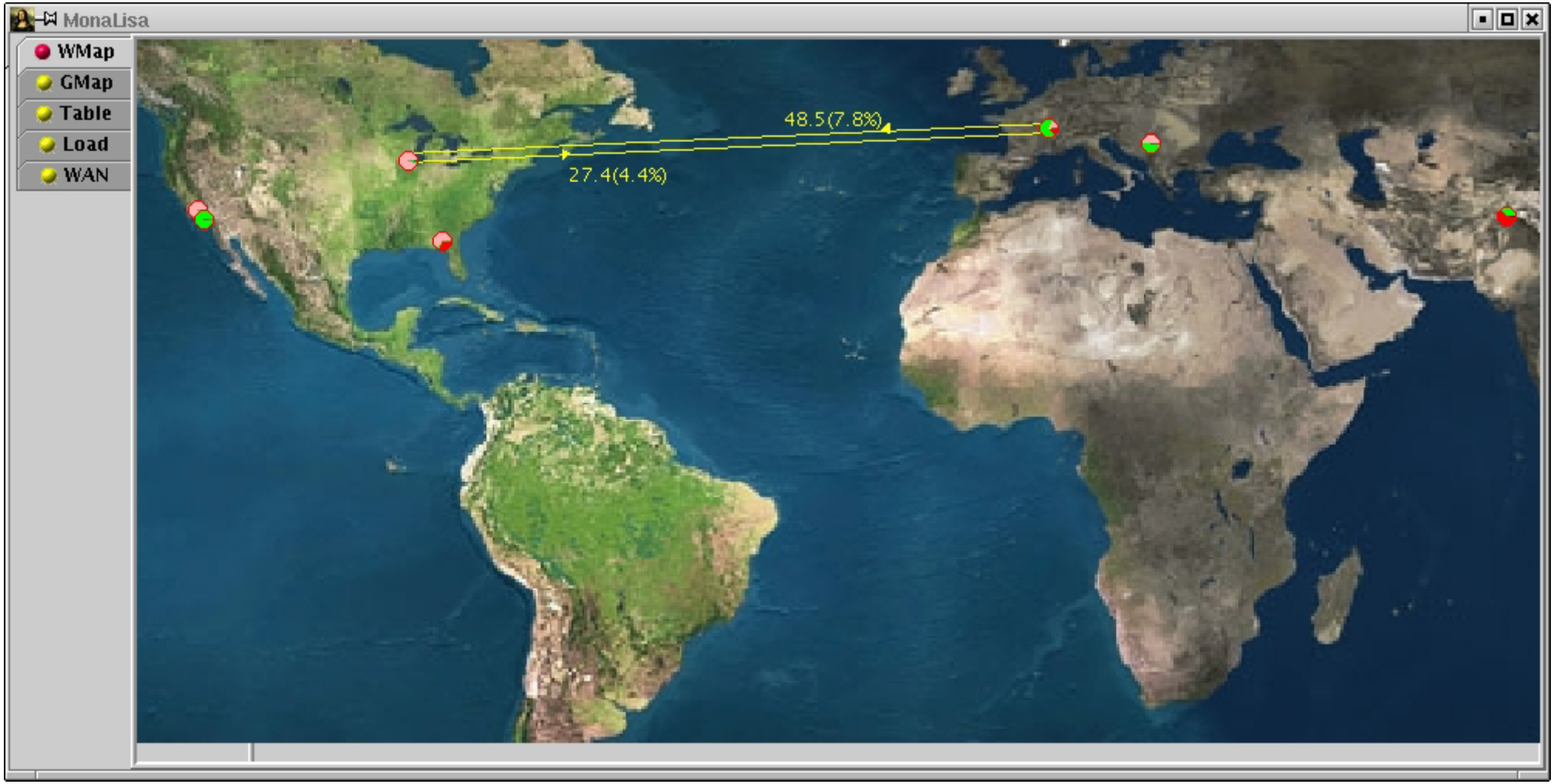
Secure – Automatic Update Mechanism for Services and Clients



- All running services are update using the discovery mechanism
- At startup each service check if it an update is done at a set of Web Servers
- Clients use the Web Start mechanism

DEMO

Global Client / Dynamic Discovery

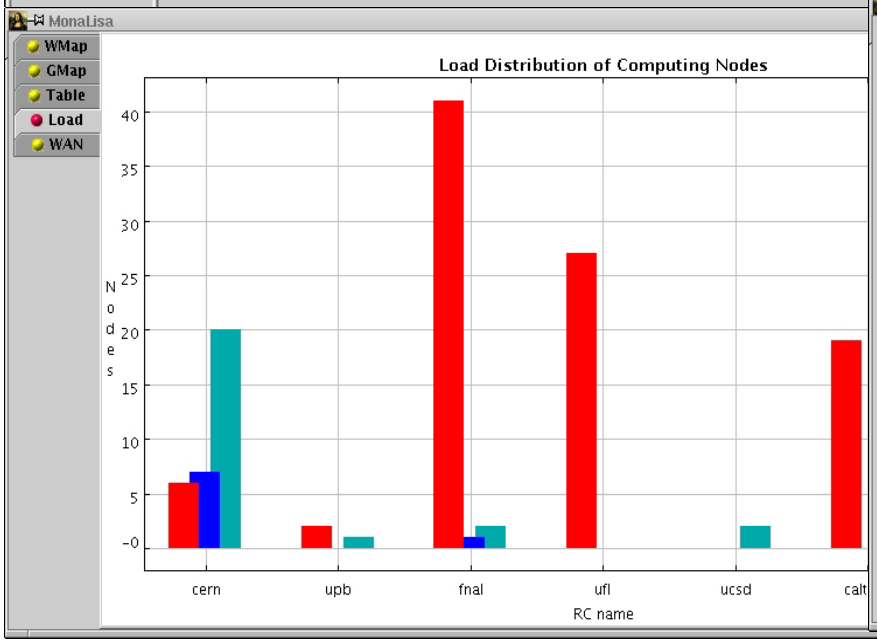


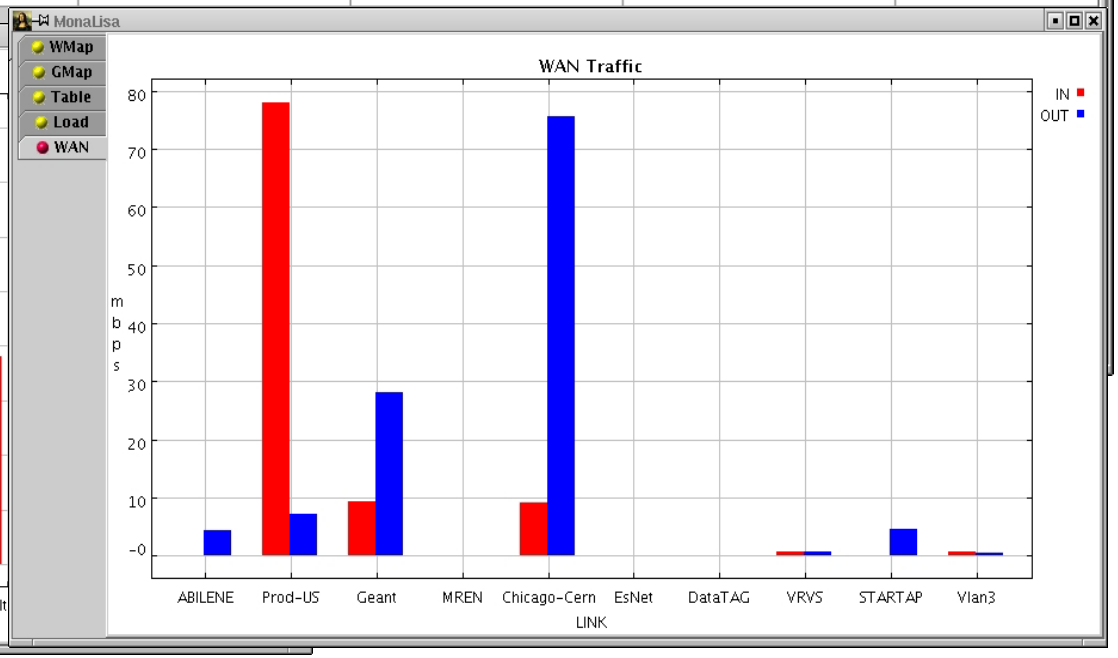
Global Views : CPU, IO, Disk, Internet Traffic …

MonaLisa

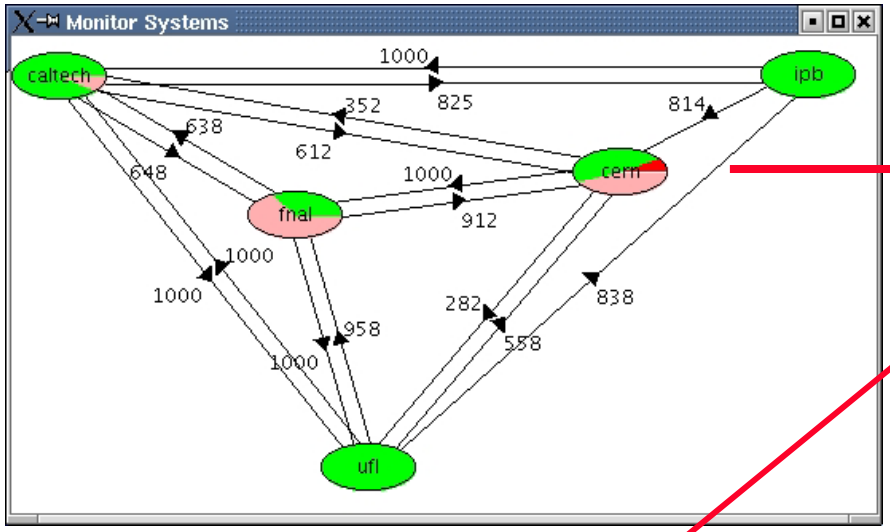
WMap
GMap
Table
Load
WAN

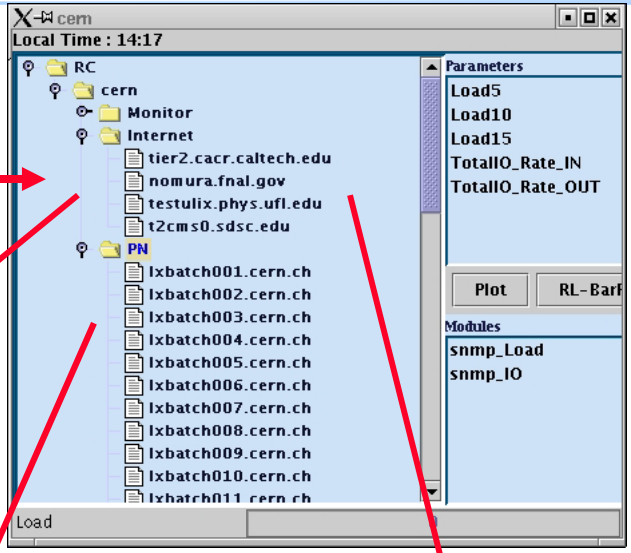
Regional Center *(select to access)*	Free Nodes Load [0 -> 0.25]	RateOUT [KB/s] mean/total	RateIN [KB/s] mean/total	CPU_usr mean	Free Disk [GB] Total/Max	Load mean
cern	16 (42%)	117.9 / 3,772.72	430.55 / 13,777.58	15.39	560.11 / 30.99	0.56
upb	2 (66%)	0.11 / 0.32	0.17 / 0.5	39.99	10.55 / 4.04	0.47
fnal	2 (4%)	0.64 / 28.0	1.27 / 56.0	92.62	Unknown	1.96
ufl	0 (0%)	2.39 / 64.62	1.71 / 46.13	89.09	Unknown	2.39
ucsd	2 (100%)	0.13 / 0.25	0.12 / 0.24	0.02	6.36 / 3.18	0.0
caltech	0 (0%)	7.12 / 135.23	1.07 / 20.3	99.7	Unknown	2.02
nust	3 (37%)	0.13 / 1.03	0.14 / 1.14	0.17	Unknown	0.0

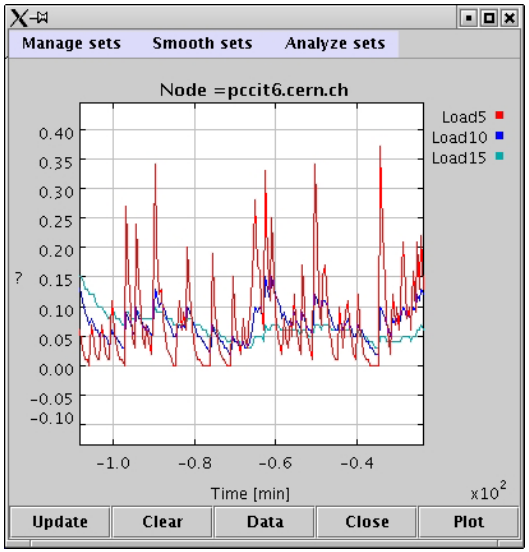


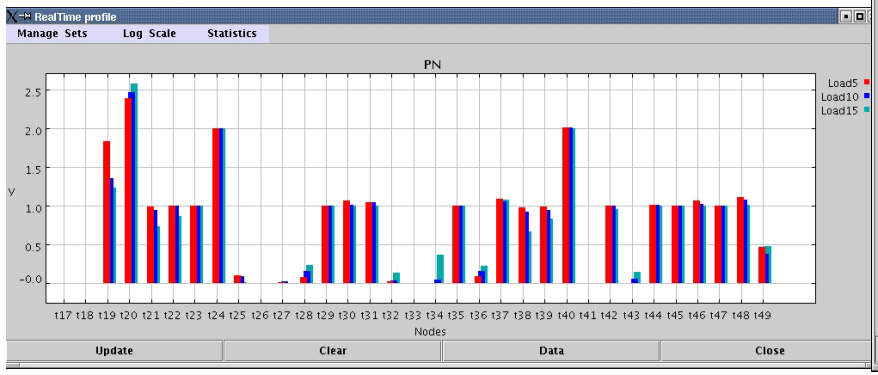


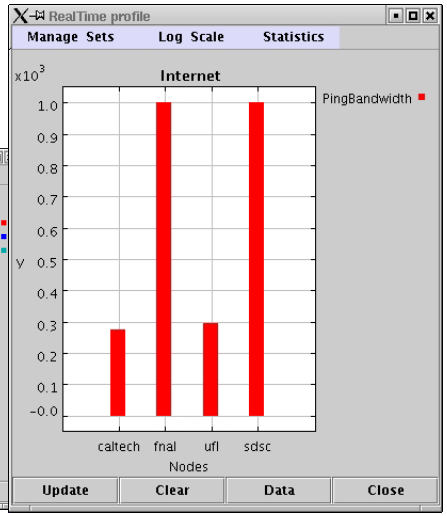
Regional Centers Discovery & Data access



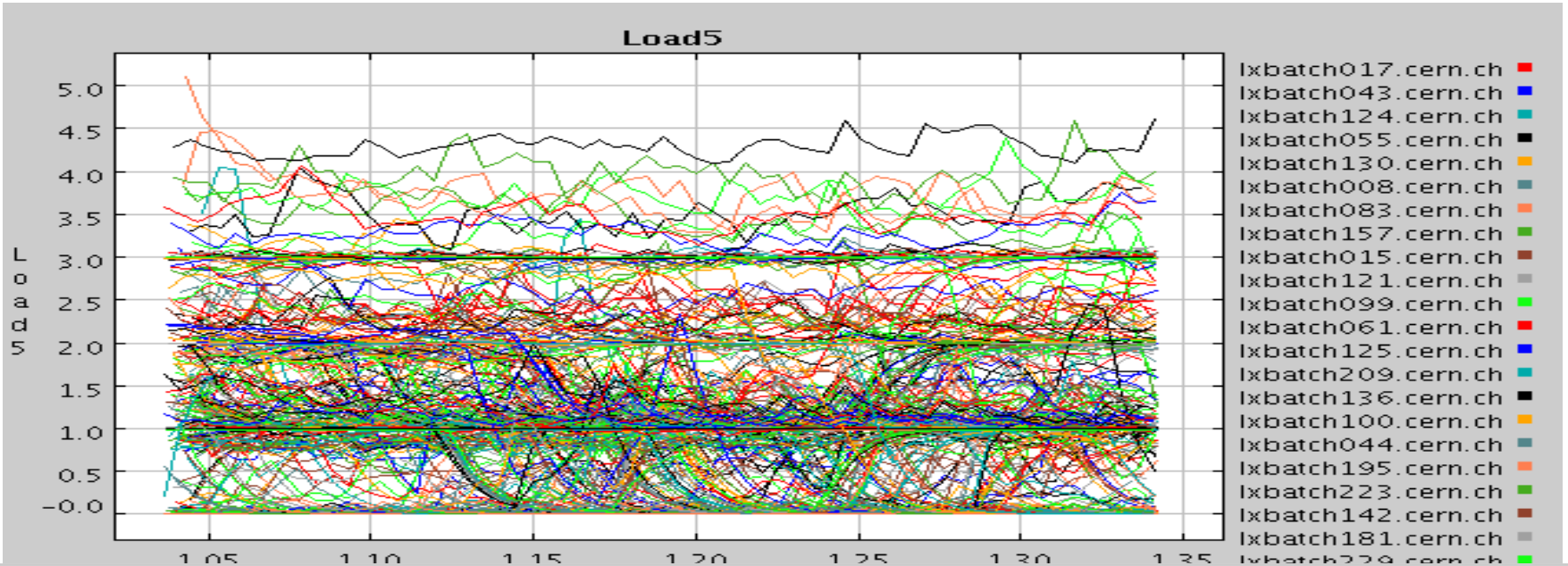


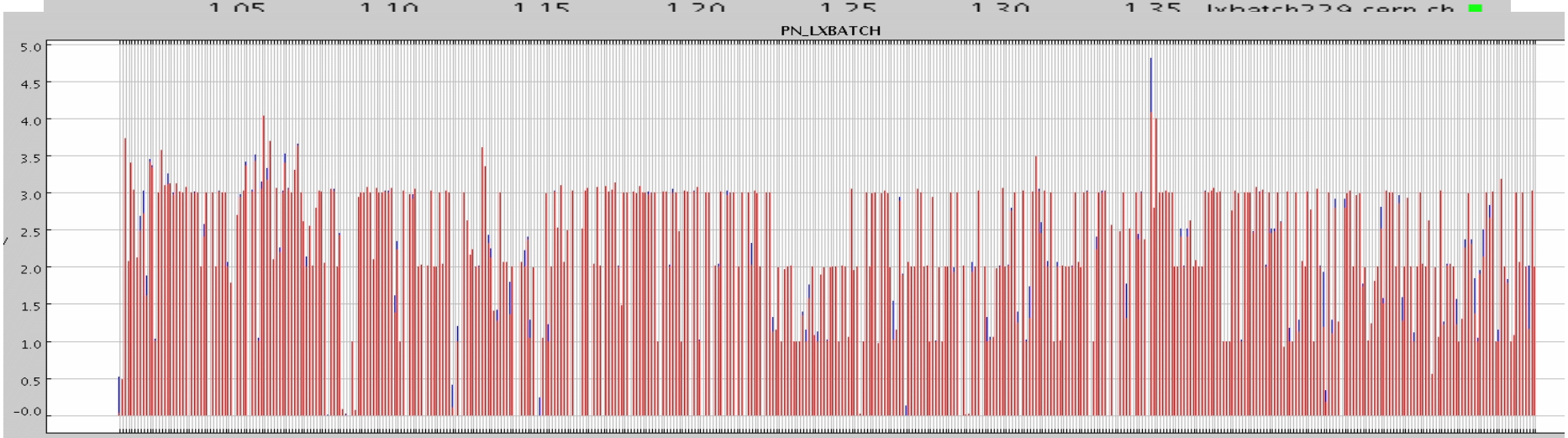






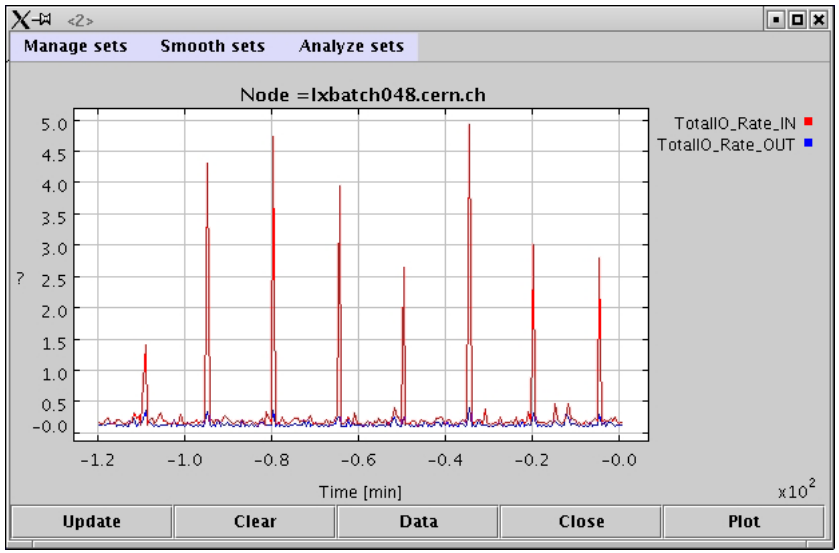
Real-time Data for Large Systems
"lxshare" cluster at cern ~ 600 ndoes



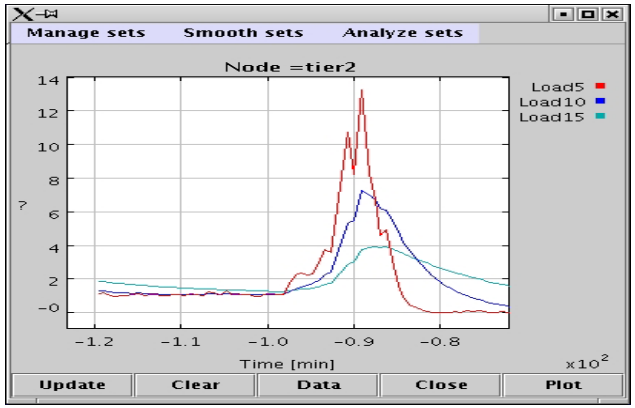


March 2003 Iosif Legrand

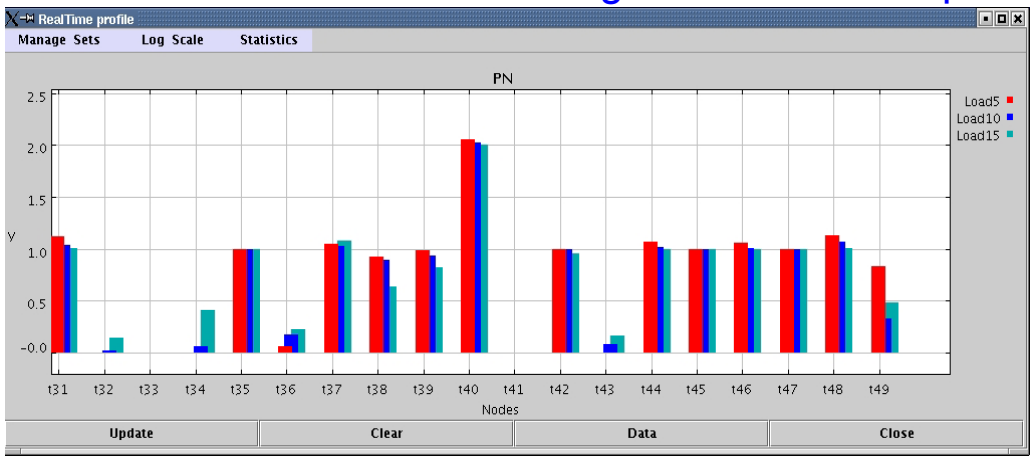
Access to historical and real-time values

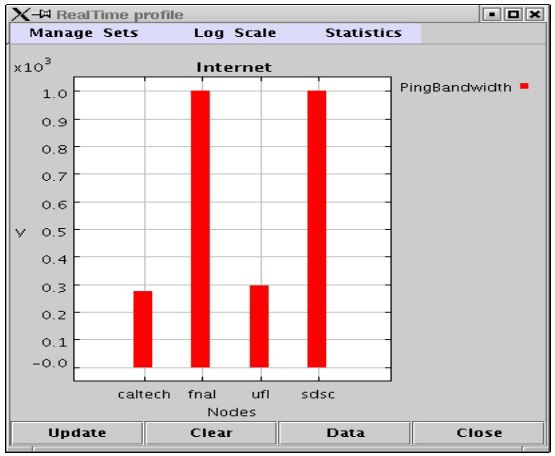


Past values are presented and the GUI remains a registered listener and the new vales are added

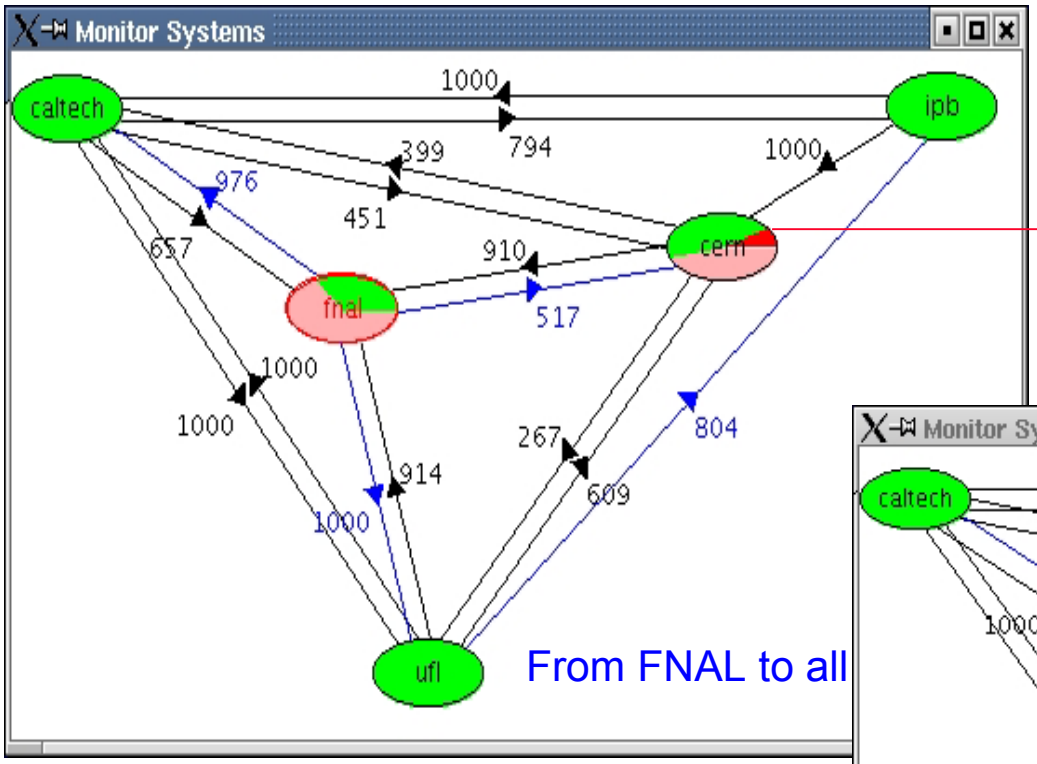


Real Time Histograms for various parameters



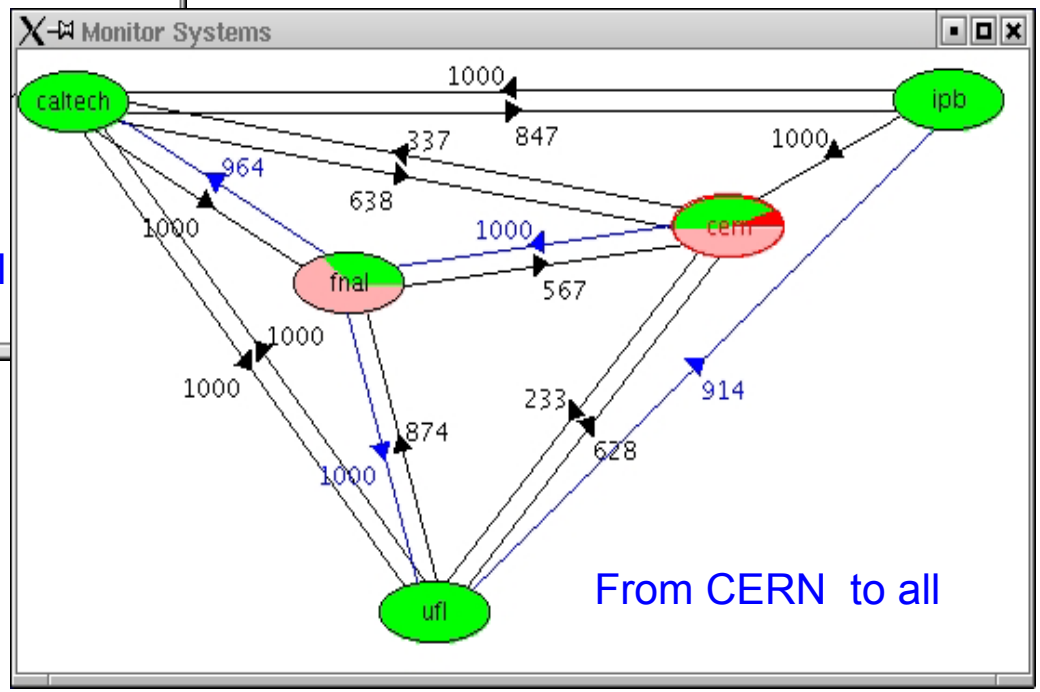


Filter Mobile Agents



Simple “Global Load” filter agent

From FNAL to all

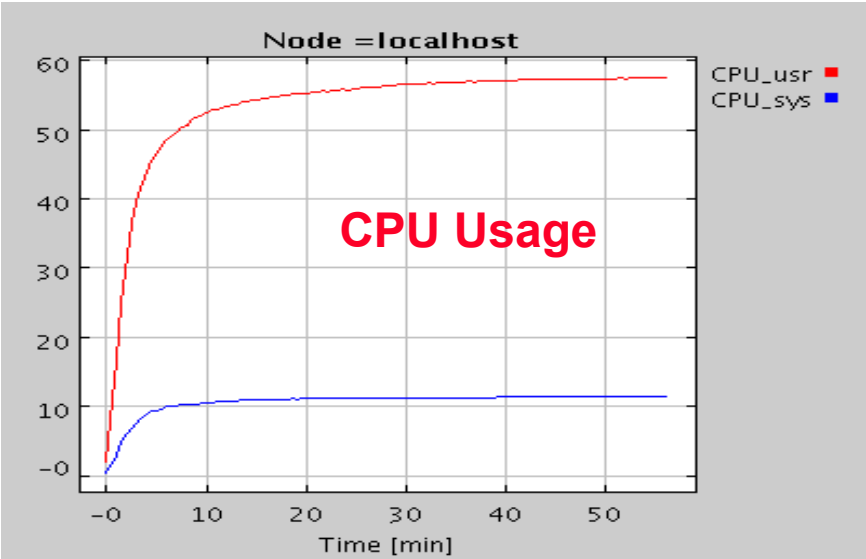


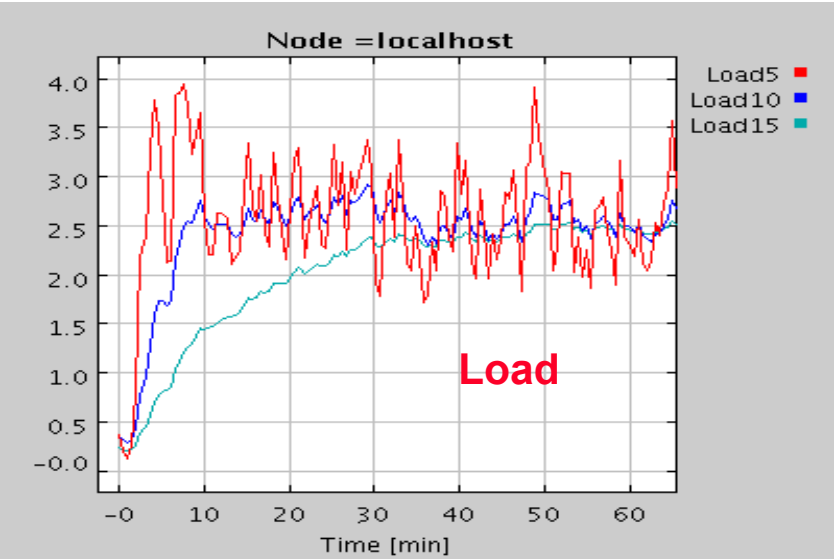
From CERN to all

Maximum Flow Data Replication Path Agent Deployed to each RC and evaluates the best path for real-time data replication

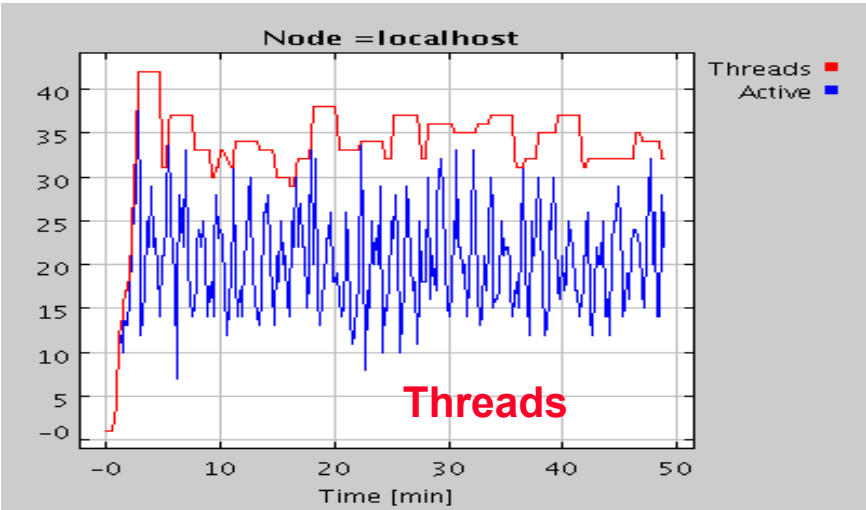
Performance Test: a large snmp query (~200 metrics values) on a 500 nodes farm every 60 s.

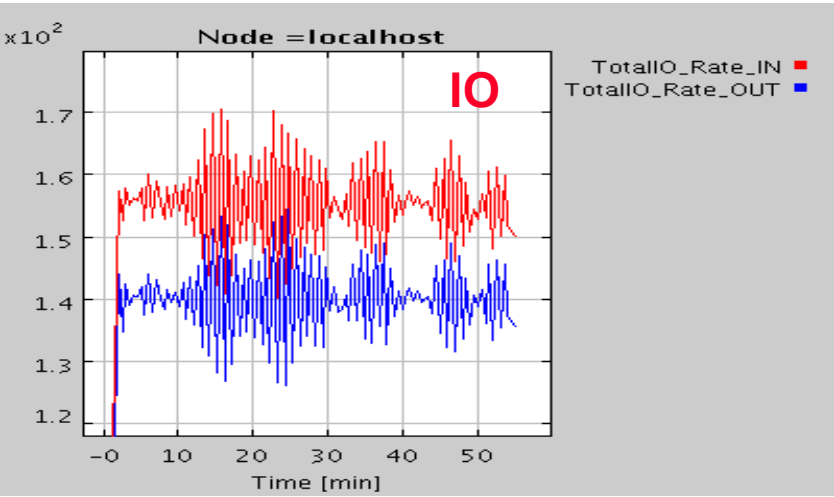
~ 1600 metrics values collected per second.



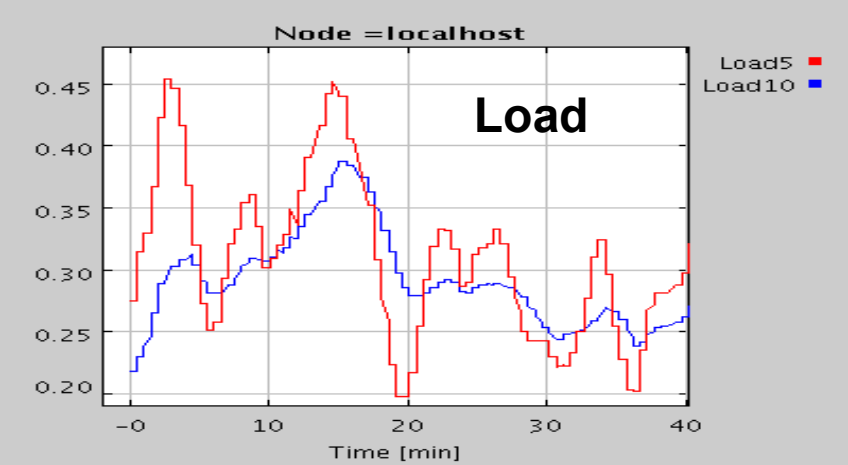


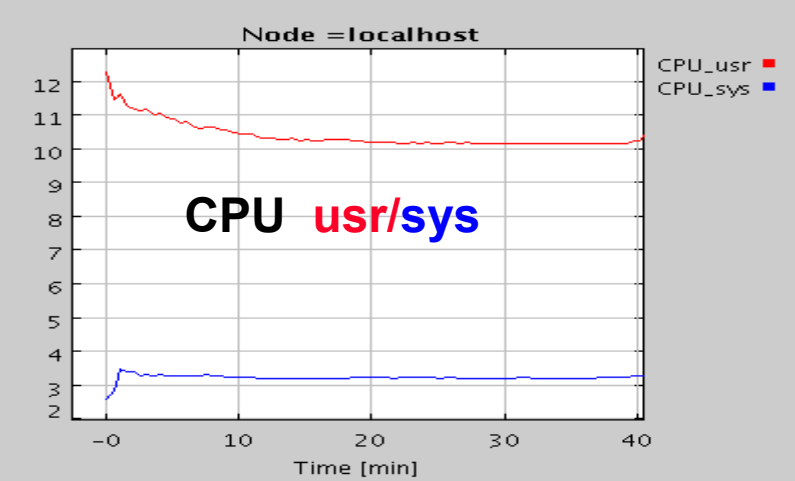
Dell I8100
~ 1GHz





Performance Test: High rate snmp queries (every 15 s) on a large farm (500 nodes)





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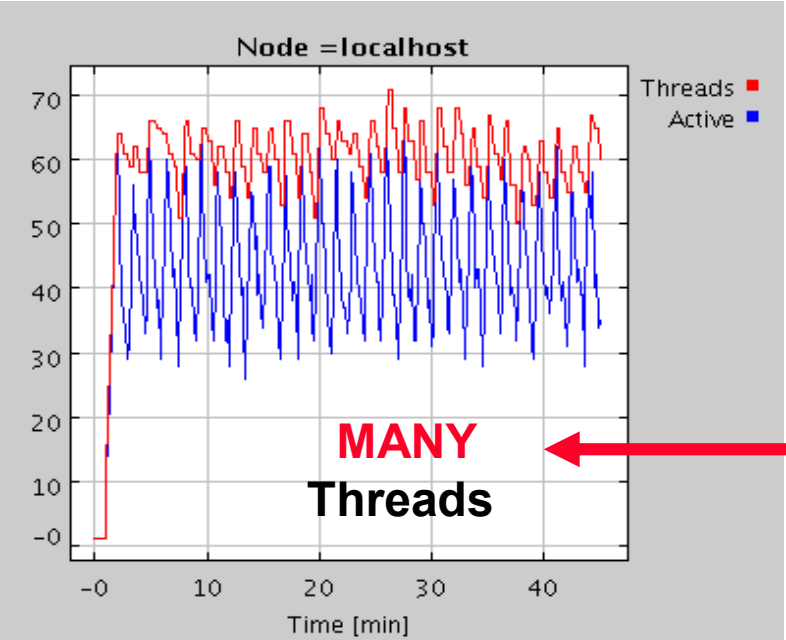
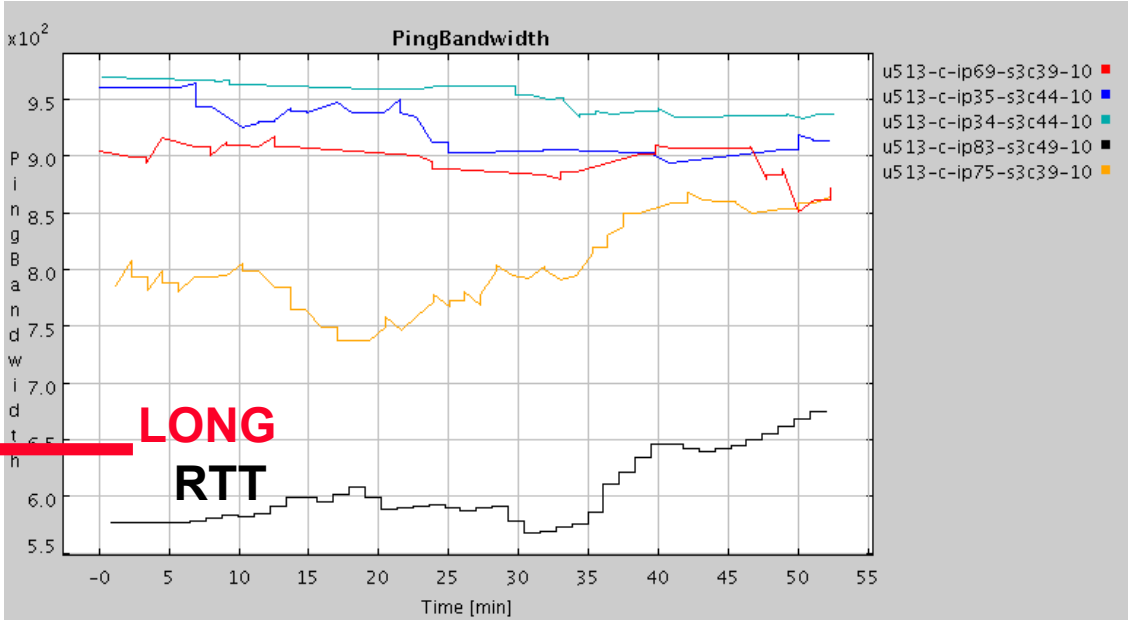
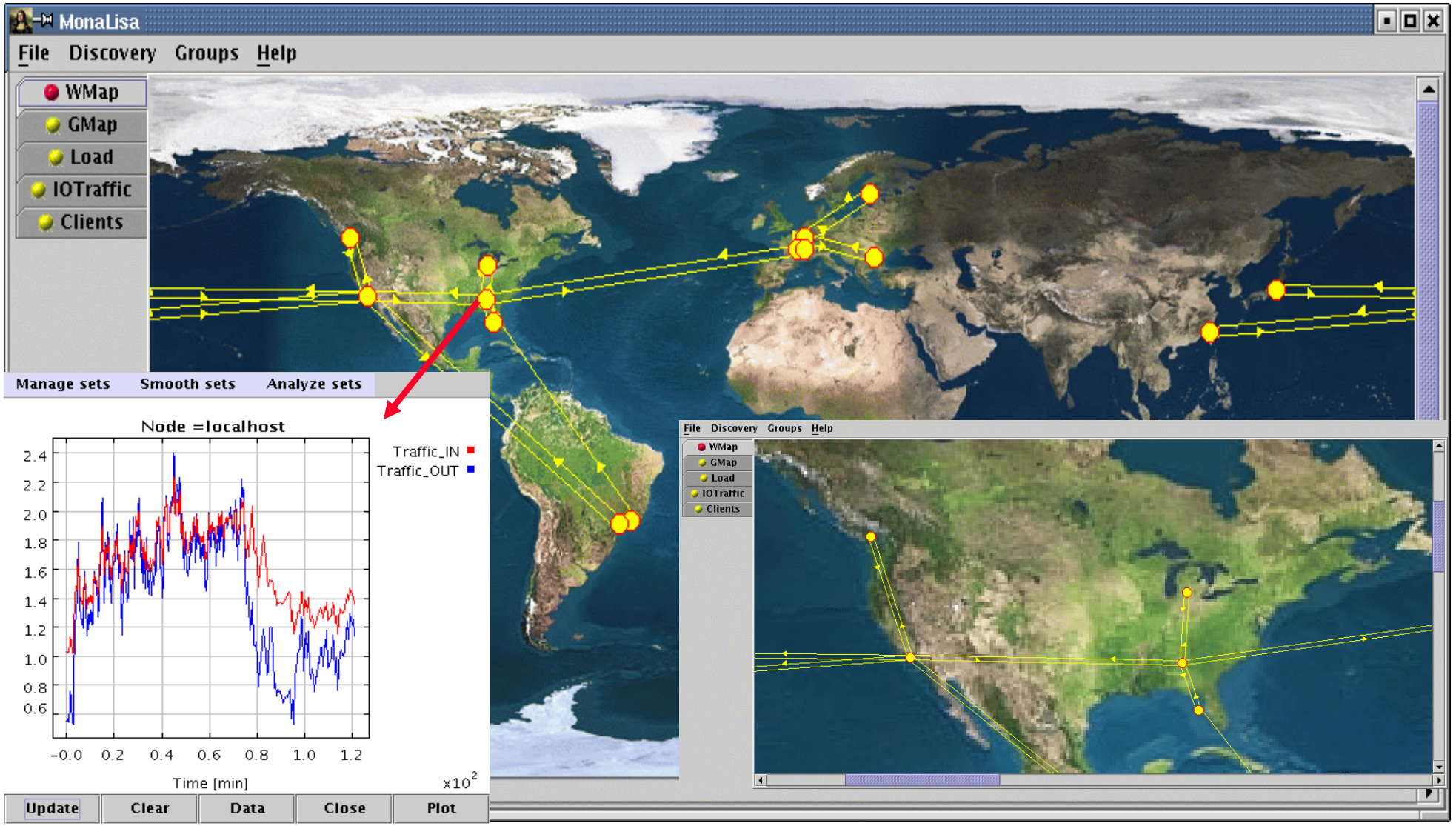
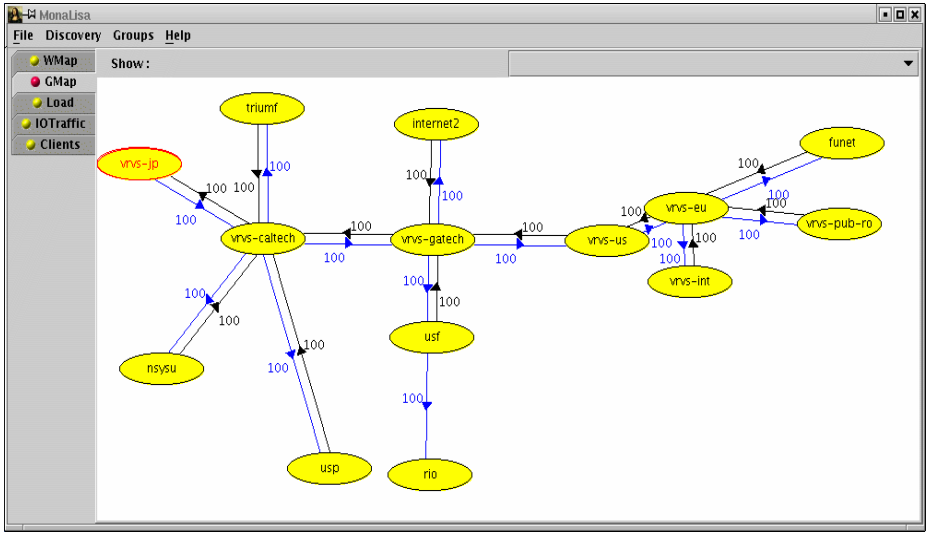


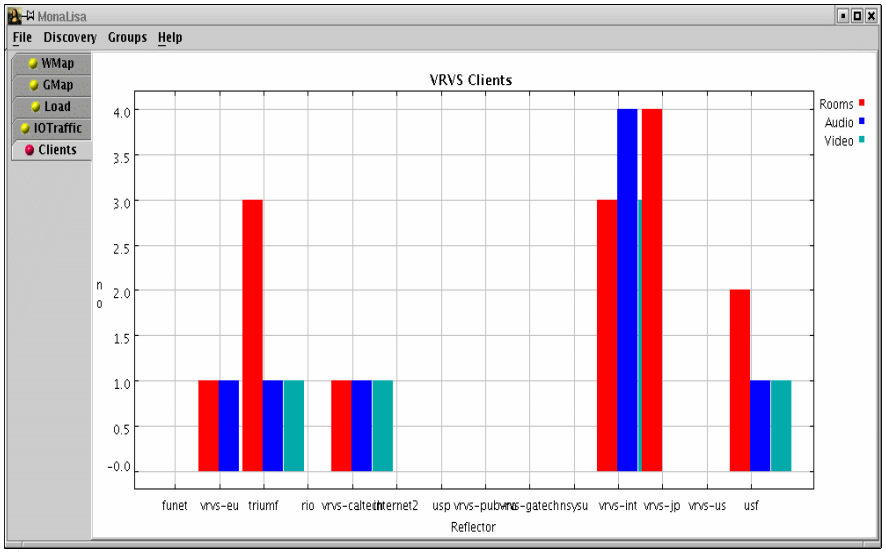


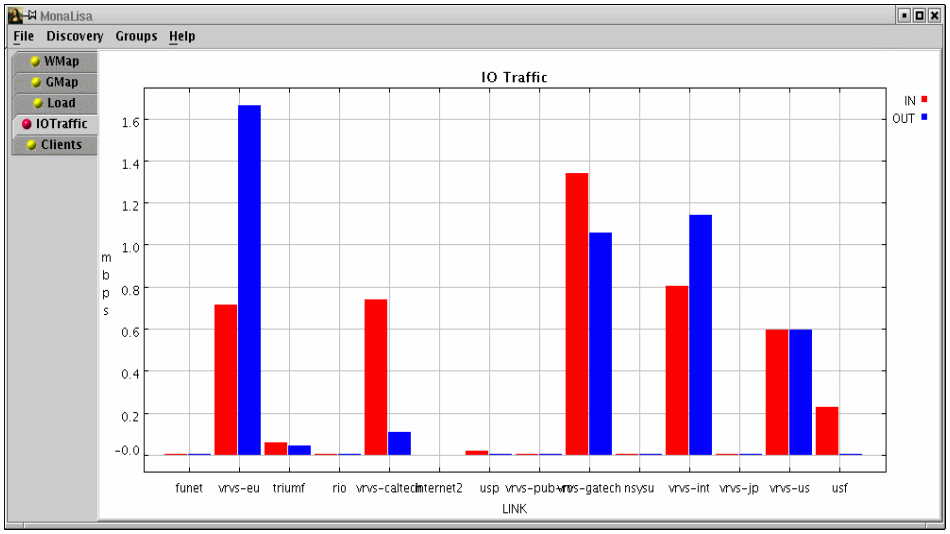
Monitoring VRVS Reflectors

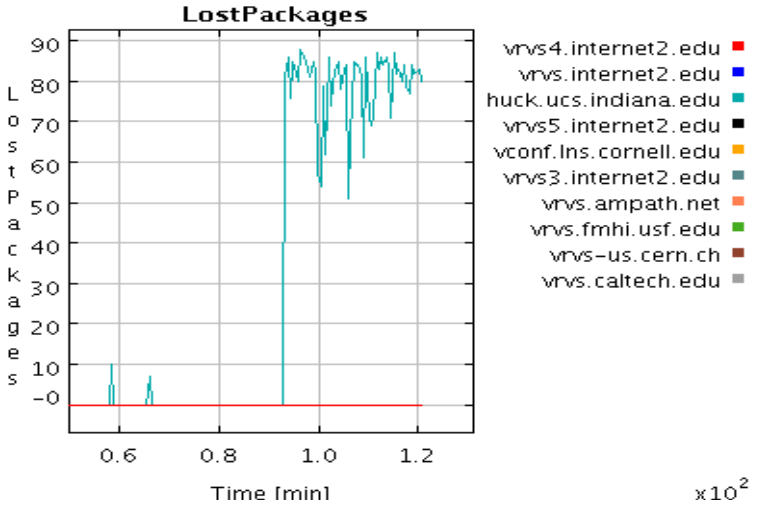


Monitoring VRVS Reflectors (2)









SUMMARY

- MonaLisa is able to dynamically discover all the "Farm Units" used by a community and through the remote event notification mechanism keeps an update state for the entire system
- Automatic & secure code update (services and clients) .
- Dynamic configuration for farms / network elements. Secure Admin interface.
- Access to aggregate farm values and all the details for each node
- Selected real time / historical data for any subscribed listeners
- Active filter agents to process the data and provided dedicated / customized information to other services or clients.
- Dynamic proxies and WSDL pages for services.
- Embedded SQL Data Base and can work with any relational DB. Accepts multiple customized Data Writers (e.g. to LDAP) as dynamically loadable modules.
- Embedded SNMP support and interfaces with other tools (LSF, Ganglia, Hawkeye…) . Easy to develop user defined modules to collect data.
- Dedicate pseu-clients for repository or decision making units
- It proved to be a stable and reliable service

CONCLUSIONS

- MonaLisa is NOT a monitoring or graphic tool. The aim is to provide a flexible and reliable MONITORING SERVICE for higher level services in distributed systems.
- Code mobility paradigm provides the mechanism for a consistent, correct invocation of components in large, distributed systems. Filters and trigger agents can be dynamically deployed to any service unit to provide the required monitoring information to clients or other services.
- MonaLisa is a prototype service under development. Suggestions to improve it, to better describe network elements and computing systems are welcome.

http://monalisa.cern.ch/MONALISA