JobMon
An Interactive Job Monitor

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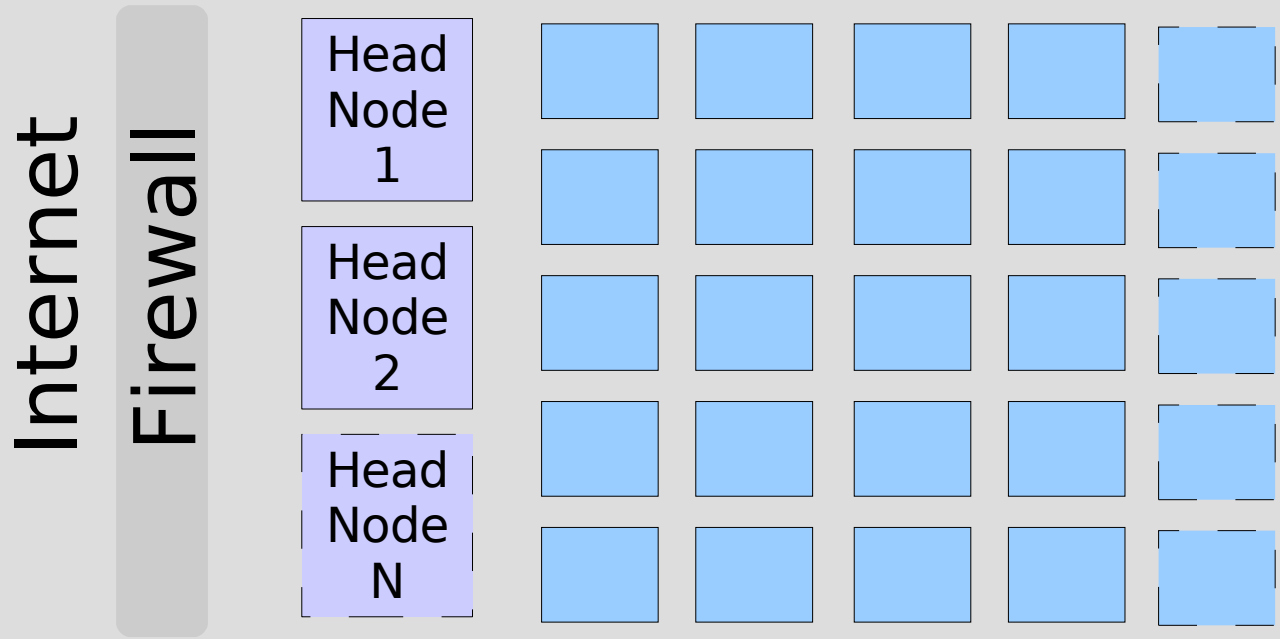
Background

- Thousands of jobs submitted to various clusters in a distributed computing environment
- Presents management and debugging problems for both users submitting jobs and site administrators
- Jobs disappear into a *black box* once they reach worker nodes
- Some tools exist to send monitoring information from individual jobs
- Strong need for interactivity with jobs on worker nodes

Environment

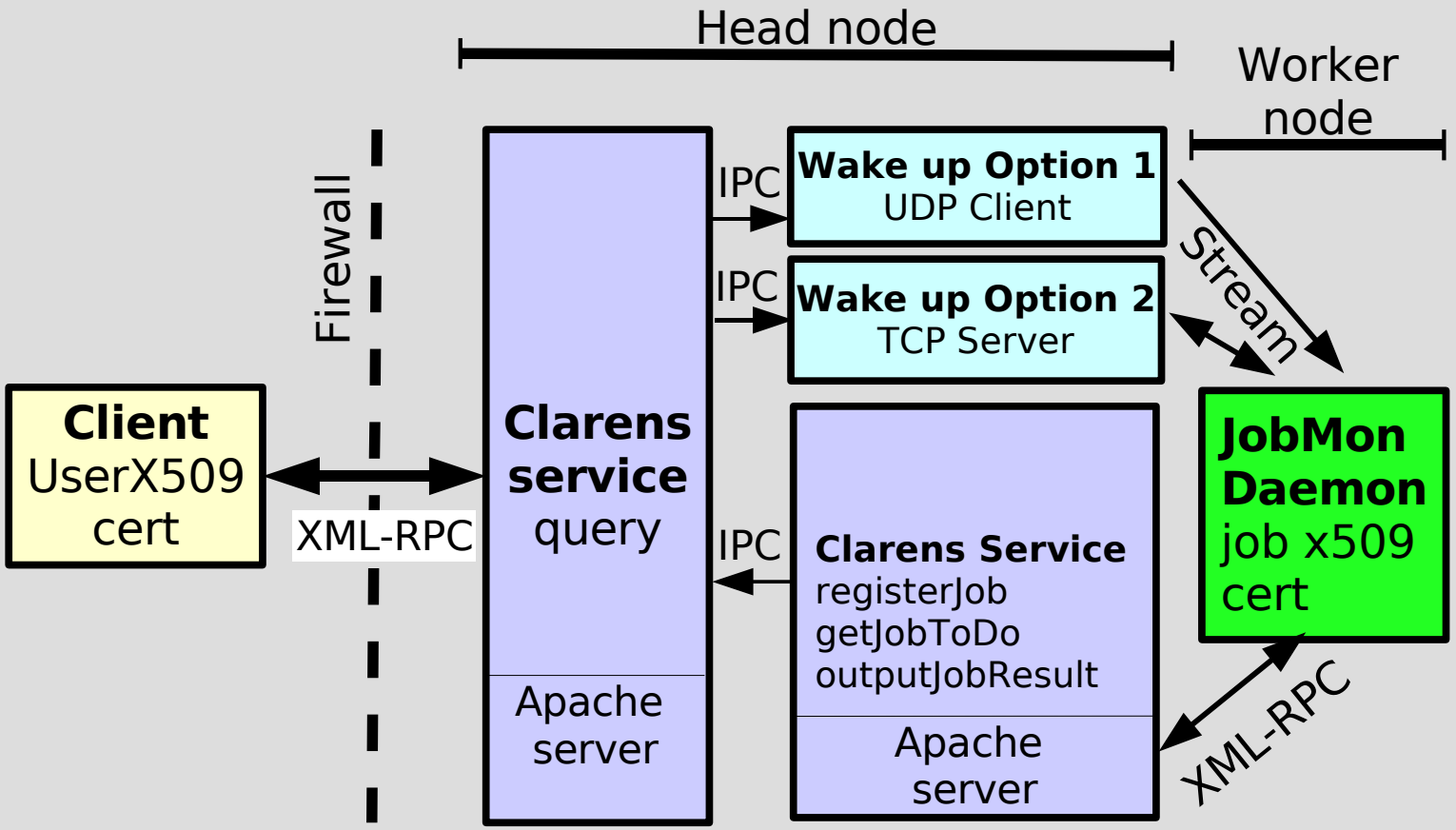
- Multiple clusters
- One or more head node per cluster
- Up to several thousand worker nodes, probably on private network



Networking & Security

- For interactivity we need to contact jobs running on worker nodes
- Worker nodes not allowed to run servers or not publicly addressable
- All network connections at FNAL must be strongly authenticated via Kerberos tickets or or X509

Architecture



Job Initialization

- Job reaches the worker node via batch scheduler
- Includes *JobMonDaemon* wrapper script
- Also unique X509 cert/private key unless credentials can be obtained e.g. Via Kerberos
- *JobMonDaemon* starts up, contacts specified JobMon server, and registers itself
- Retrieves JobMon server configuration
- Either
  - Connects to JobMonTCPServer
  - Starts UDP listener for callbacks

User Request Handling

- Client calls `query` Clarens method, authenticated
- Message sent to job via *JobMonTCPServer* or UDP
- Job wakes up, calls `getJobToDo` Clarens method
- Job performs requested action, calls `outputJobResult` Clarens method
- Result gets returned to the client
- Job periodically re-registers itself using the `registerJob` Clarens method

UCSD

User Commands

- `ps, head, tail, cat, top, kill, ls` (dir)
- `jobs`: Job Status and Information
- `log`: Check progress of a job
- `node`: Show node that job is running on

Performance I

- Web services technology with callbacks chosen to avoid persistent TCP connections, for security
- UDP listener configuration more scalable than *JobMonTCPServer*
- Primary performance bottleneck is the periodic re-registration of jobs
- Re-registration involves setting up new HTTPS connection, authenticating and calling `registerJob` method – slow process

Performance II

- Tests show that for a 3000 node cluster the server can handle re-registrations at 4 Hz with 1s latency
- This translates to a re-registration interval of ~12minutes for each job
- Deployment at CDF Central Analysis facility since March shows ~100 concurrently registered jobs

Authentication and Authorization

- Each job is assigned an ID, from which an X509 cert/private key pair is generated
- The subject of the X509 cert belonging to the job owner is of the form

  `/DC=gov/DC=fnal/O=Fermilab/OU=People/CN=<name>`
- The server will allow this user to connect to all jobs with certificate subjects of the form

  `.../O=Fermilab/OU=People/CN=<name>/CN=<jobid>`
- X509 cert/private key sent with job. No more a problem than sending non-encrypted code!

Summary

- JobMon provides a secure, scalable way for interactive job monitoring
  - Re-registration latency main performance bottleneck
- *JobMonDaemon* requires only Python interpreter on worker node
- Successfully deployed and used by CDF CAF
- Part of VDT since version 1.3.8, deployed on numerous US Grid sites
- http://jobmon.sf.net
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