

# XNAT Tuning, Optimization, and Monitoring

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**Audience:** XNAT Administrators

**Overview:** Discuss NRG's experience running a large XNAT installation, including methods for tuning, testing, and monitoring the application and database.

## XNAT Scales

From small studies for a single lab to hundreds of studies, including large, multi-site studies.

### Central Neuroimaging Data Archive (CNDA)<sup>1</sup>

As of June 2010: 500+ Studies, 11k+ Imaging Sessions, 9TB of archives

### CNDA Architecture<sup>2</sup>

- 1x Kemp load balancer (handles HTTPS communication)
- 1x Quad-core Xeon, 16GB RAM: PostgreSQL 8.3
- 2x Dual-core Xeon, 4GB RAM: Tomcat 5.5 & DicomServer<sup>3</sup>
- BlueArc NAS
- 32-core Sun Grid Engine cluster

### Future Architecture

- Reduce single points of failure!
  - Standby Kemp
  - Archival storage SAN
  - PostgreSQL Warm Standby<sup>4</sup>
- Wash U super computer for processing
- Upgrade without downtime

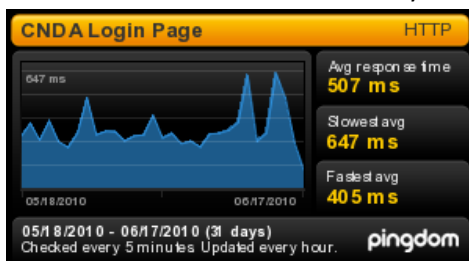
## Monitoring XNAT

### Google Analytics<sup>5</sup>

Measure frontend usage with tracking code in Footer.vm

### Pingdom<sup>6</sup>

World-wide tests of site availability & response time



<sup>1</sup> <https://cnda.wustl.edu>

<sup>2</sup> <http://nrg.wikispaces.com/Example+XNAT+Architecture>

<sup>3</sup> <http://nrg.wikispaces.com/DicomServer>

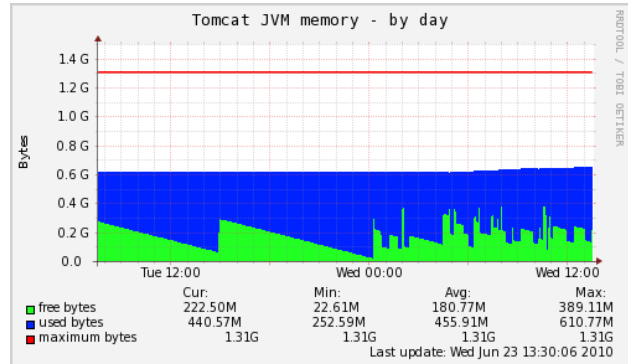
<sup>4</sup> <http://www.postgresql.org/docs/8.4/static/warm-standby.html>

<sup>5</sup> <http://www.google.com/analytics/>

<sup>6</sup> <http://www.pingdom.com/>

## Munin<sup>7</sup>

System metrics for PostgreSQL, Tomcat, CPU, etc.



## Monit<sup>8</sup>

Process monitoring & management that performs actions when conditions are met (e.g. email me and restart Tomcat if JVM memory > 95%)

## Measuring Performance

### JMeter Load Testing

Simulate multiple clients hitting server

### YourKit Profiling

Find memory leaks & code hot spots

## Tuning

### PostgreSQL Tuning<sup>9</sup>

- Upgrade to PostgreSQL 8.3 or later
- Split app server & database server (powerful database server)
- Default settings designed for legacy machines (postgresql.conf)

### Tomcat Tuning<sup>10</sup>

- Increase JVM memory
- Increase connections/threads (should be load balancing)

### XNAT Tuning

- Upgrade to XNAT 1.4
- Increase database pool connections

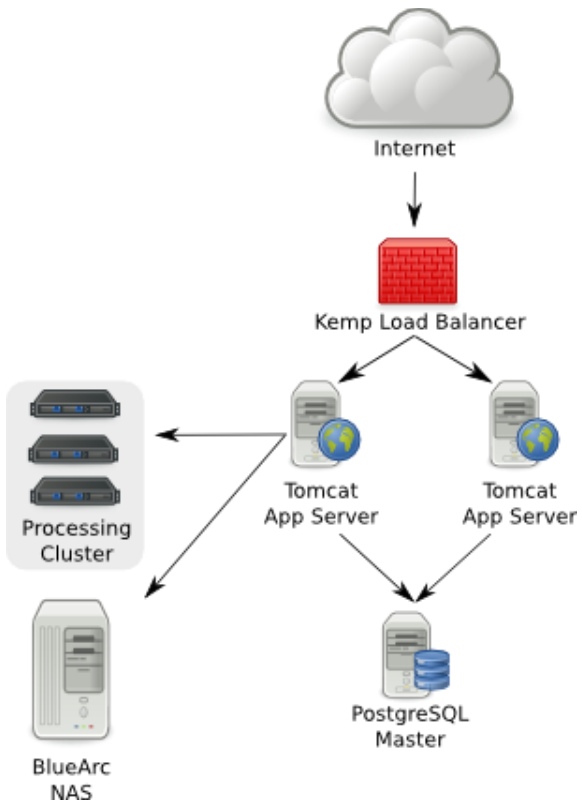
<sup>7</sup> <http://munin-monitoring.org/>

<sup>8</sup> <http://mmonit.com/monit/>

<sup>9</sup> <http://nrg.wikispaces.com/PostgreSQL+Tuning>

<sup>10</sup> <http://nrg.wikispaces.com/Tomcat+Tuning>

### Current CNDA Architecture



### Future CNDA Architecture

