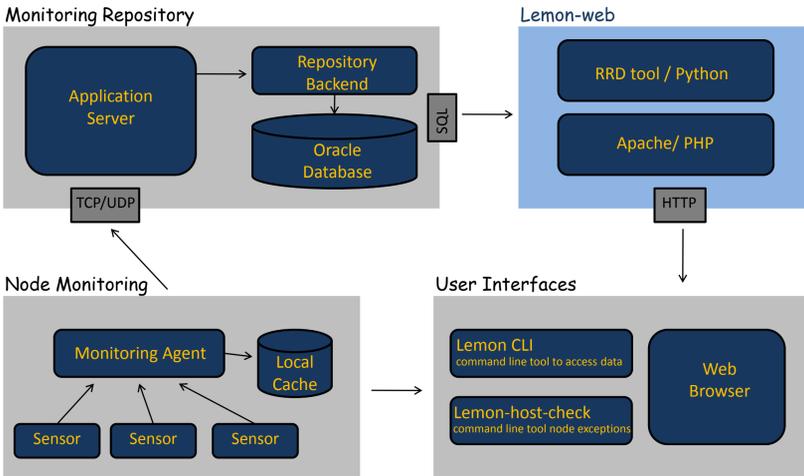




## Lemon – LHC Era Monitoring overview

Lemon is a server/client based monitoring system. On every monitored entity, a monitoring agent with sensors is responsible for retrieving the monitoring information. The monitored samples are stored in a local cache and also forwarded to the application server. The application server stores the received samples in a central monitoring repository which can interface to either a relational database or a flat-file backend. A web based interface, called Lemon-web, is provided for the visualization of the data.

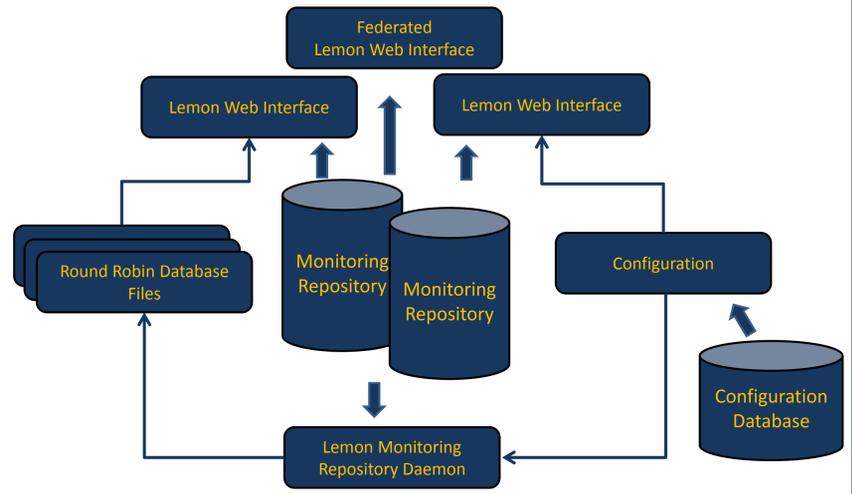


## Lemon front-end concept

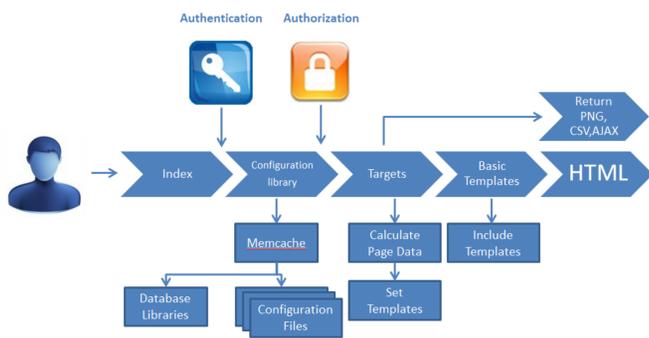
The Lemon-web application is used to retrieve metric information from the monitoring repository, to store it into time serialized data structures and to provide data visualization. Round Robin Database (RRD) files are used for **time series** data storage. Every file holds information from all metrics measured for a given entity like. Data from the RRD files is then passed to the web interface for visualization.

Lemon-web supports entities **data aggregation** (e.g. hosts) into groups (by cluster, by rack, by hardware model, etc.) and provides a summary or average view of each group, even if certain entities may be part of multiple groups.

Lemon-web supports the federation of Lemon instances.



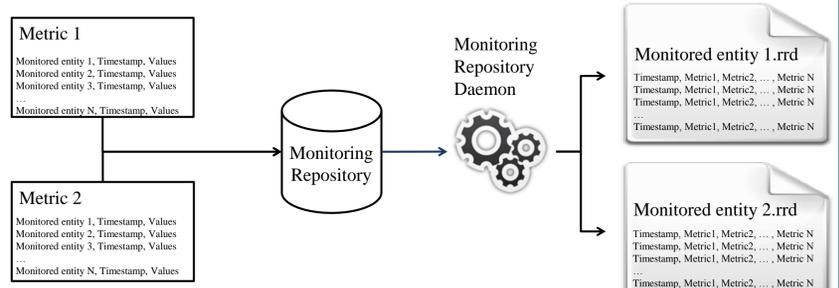
## Lemon-web workflow



The new Lemon web design:

- backend refactored using Model-View-Controller pattern
- integrated with CERN Single-Sign-On authentication with high granularity authorization
- using Memcache for caching graphs and entities configuration
- simple template engine used for the separation of the workflow logic from the user interface
- support for multiple monitoring repositories
- user views: a user customization of the displayed entity page and graphs

## Lemon Monitoring Repository Daemon



Monitoring Repository Daemon:

- collects, aggregates and caches monitoring data from the central Monitoring Repository
- stores collected and aggregated data as RRD (Round Robin Database) files per monitored entity
- provides any multi-level aggregation with detailed monitoring of expected and reporting entities (visualized in reliability graphs)
- supports aggregation operations: sum, subtraction, multiplication, division

## Used technologies



## Lemon Visualization

Example of the visualization for the aggregated cluster of hosts

Information for: **ixplus (view: host, source: clusters)**

Cluster information:

- Number of hosts (down): 81 (1)
- Operating system(s): Scientific Linux CERN SLC release 5.7 (Boron), Scientific Linux CERN SLC release 5.8 (Boron), Scientific Linux CERN SLC release 5.2 (Carbon)
- Average of up times: 55days, 5h:17m
- Hosts down: bdev62
- Select from hosts: None is selected
- Select from subclusters: None is selected
- Parent cluster(s): This cluster has no parent clusters.

Load average distribution:

Graphs: CPU utilization, Network utilization, Graph Reliability.

Scaling (new): Manual scaling, Minimum value for the graphs, Maximum value for the graphs, Show the view of this (NICE) user.

### Detailed graphs (enhanced)

Memory utilization:

- Swap Used (Aggregation) on tapeserver
- Cached (Aggregation) on tapeserver
- Buffered (Aggregation) on tapeserver
- Shared (Aggregation) on tapeserver
- Free (Aggregation) on tapeserver

DB data scan (enhanced): PartitionWriteRate on ixsec1614 for PartitionName

The new functionality provided by the new Lemon web visualization:

- improved time precision to visualize aggregated data stored in RRD files
- advanced graphs visualization based on the HTML 5 (mouse zoom in/out)
- reliability graphs to monitor data aggregation
- export and visualization of the historical data (e.g. one year) from the central Monitoring Repository with high time granularity (up to collection rate, e.g. 5 min) and on fly aggregation (e.g. power efficiency calculation)
- widget to embed any graph (available as "Link to this graph" below any graph)

Advanced graphs (new): CPU utilization on lemonsrv02

Reliability graphs (new): Apparent (Power)

Entity view customization (enhanced): Add new graph to view "host"

### Export from the Monitoring repository

PDU Units

Actual (Power) (sum)

Reliability (reported)

Reliability (total)

Apparent (Volt-Ampere) (sum)

Apparent (reported)

Reliability (total)

Average: 245768.791

Average: 35.000

Average: 36.000

Average: 2659612.370

Average: 35.000

Average: 36.000