

Online Condition Monitoring in CalemEAM

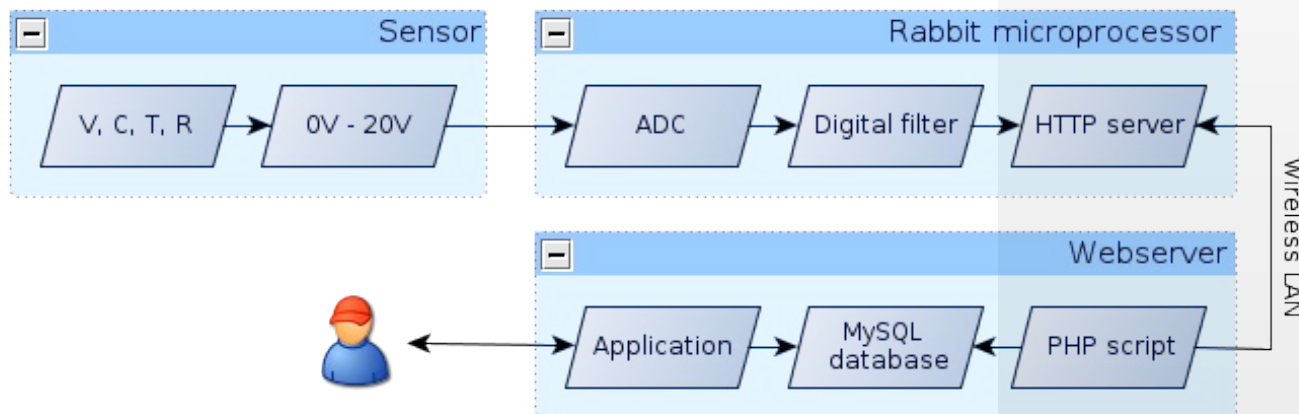
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Overview

- **Introduction**
 - Solar power plant
 - Asset Management Software
 - CalemEAM (1-3)
- Fundamentals
- Realisation
- Conclusion

Solar Power Plant

- Facility of laboratory “Energy Management”
- Study and research of renewable energy
- Monitoring of different values,
e. g. current, voltage, sunradiation, temperature
- Rabbit RCM 3700 for data processing with HTTP server



EAM software

- Enterprise Asset Management (EAM) software
- Platform to connect people, processes, assets, knowledge, capabilities and informations of a facilities (like the solar power plant)

“Organizing, planing and controlling the acquisition, use, care, refurbishment, and/ or disposal of assets to optimize their service delivery potential and minimize the related risks and costs over their entire life.”

CalemEAM (1)

- EAM software solution suite for asset management
- Developed by **CalemEAM Inc.** in Austin, Texas, USA
 - <http://www.calemeam.com/>
- Apache, MySQL, PHP and JavaScript
- Based on open source technologies
 - Kabuki Ajax Toolkit – **AjaxTK**
 - JsUnit, Log4php, Phing, JSMIn, WICK, etc.
- Different Editions
 - Community, Professional, Enterprise

CalemEAM (2)

Welcome, Administrator. Your local time is Thu, 7/8/10 10:34 AM. [My account](#) [Sign out](#) [Help](#)

CalemEAM
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[Asset](#) [Asset](#) [Codes](#) [Report](#)

[Dashboard](#) [Asset list](#) [Asset](#)

Main Part Contract Downtime Customize

Asset part

[New](#) [Open](#) [Delete](#) [Customize](#)

Item	Type	Note
No results found.		

Asset meter

[New](#) [Open](#) [Delete](#) [Refresh data](#) [Reading history](#) [Add reading](#) [Customize](#)

Meter no.	Reading	Time taken	Note
Sunradiation	1.917	Fri, 5/21/10 11:55 PM	

CalemEAM (3)

- Online Condition Monitoring
 - Not realized yet!
 - BUT: Assets can have measurements/ readings
 - Module “Asset” → “Part” → “Asset meter”
- The idea:
 - Add asset meter to each sensor asset
 - Asset meter of sensor assets getting its measured values/ readings (e. g. pyranometer → radiation)

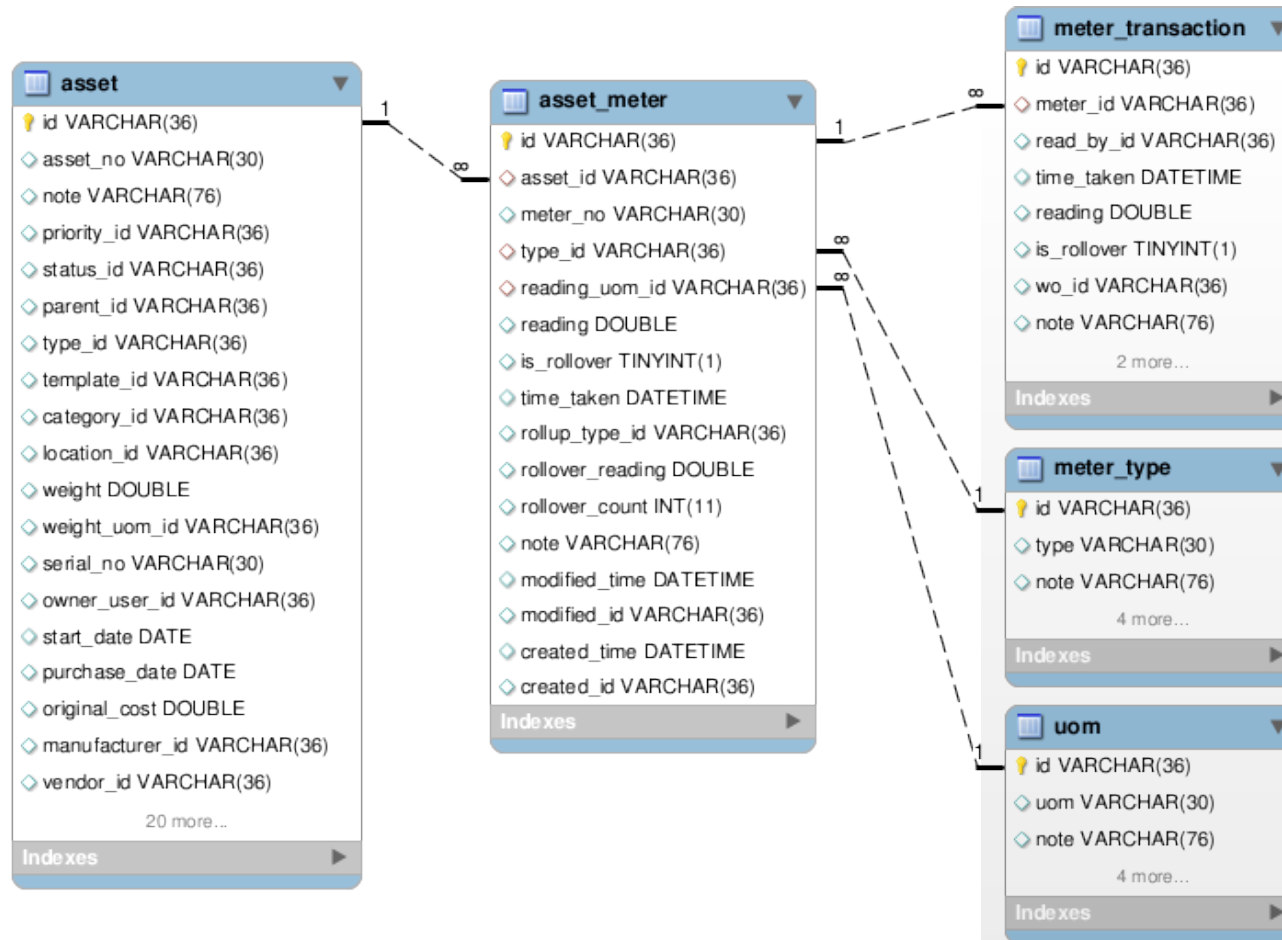
Overview

- Introduction
- **Fundamentals**
 - CalemEAM database (1-2)
 - Client-side CalemEAM (1-4)
 - Server-side CalemEAM
 - Deploy functionality (1-2)
- Realisation
- Conclusion

CalemEAM database (1)

- Whole CalemEAM database is very extensive!
- Assets are related to its measurements
 - an “asset” can have many “asset_meters”
 - an “asset_meter” can have
 - one “meter_type” (e. g. temperature, voltage)
 - one “uom”, unit of measure (e. g. °C, V)
 - many “meter_transaction” (measurements/ readings)
- All data records are unique by using an UUID
 - Universal Unique Identifier following RFC 4122
 - **74fb3514-9667-1c44-4593-7b41670e1814**

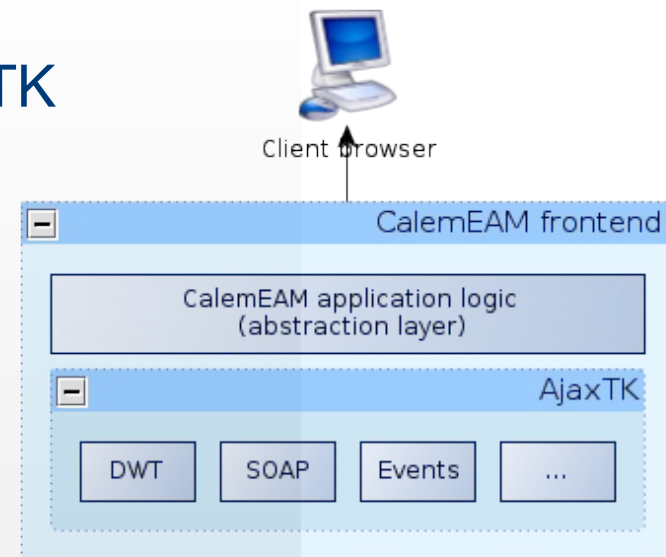
CalemEAM database (2)



Client-side CalemEAM (1)



- AjaxTK framework with CalemEAM specific abstraction layer
 - Actually not many knowledge of AjaxTK framework is necessary to develop a new module
 - **But:** Client object tree is extensive, confusing and undocumented!
- Each client-side module has its own directory located in the path “client/modules/”
- Modules have a pre-specified structure



Client-side CalemEAM (2)



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- Module definition in client object tree of abstraction layer

```
CalemModuleDef["modCalemContact"] = {
  CalemModuleInfo: {
    id: "modCalemContact",
    icon: "CalemContact",
    defaultMenu: 'CalemContactFormList',
    toolBar: {
      CalemToolBarInfo: {
        type: 'CalemToolBar',
        layout: ['modCalemContact', 'sep', 'CalemContactFormList'],
        list: [{CalemLabelInfo: {id: 'modCalemContact', className: 'CalemModuleLabel'}},
              {CalemSeparator: {id: 'sep', className: 'CalemToolBarSeparator'}},
              {CalemMenuItemInfo: {id: 'CalemContactFormList'}} ]}
      }
    }
  }
};
```



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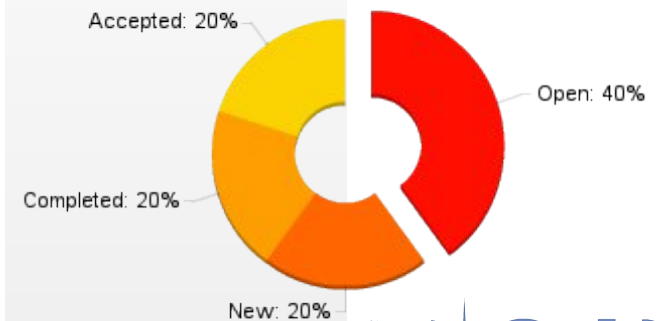
Client-side CalemEAM (3)



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- amCharts – free flash charts
 - Antanas Marcelionis: <http://amcharts.com/>
 - Already included in CalemEAM (module “Dashboard”)
 - Different sets for stock, column & bar, line & area, pie & donut, scatter & bubble charts
 - XML configuration file
 - XML or CSV data file
 - Very good documentation
 - Helpful configuration tool on webpage

WO Count by Status



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Client-side CalemEAM (4)



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- Client-side configuration of CalemEAM
 - CalemConf.js resp. CalemConf.custom.js under “client/conf/”
 - Customize currency
 - Customize calender lookup (first day of week)
 - Add new module (on client-side)
 - Order of module buttons

All customizations take only an effect after using CalemEAMs deploy functionality!



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Server-side CalemEAM

- Modules are split in **client-side and server-side part!**
 - Server-side module part, each in separate folder:
“server/modules/”
 - Communication between server-side and client-side modules is realized using JSON over SOAP
 - JSON: JavaScript Object Notation, text-based open standard for human readable data interchange
 - SOAP: Simple Object Access Protocol, protocol for exchanging structured information in computer networks
 - AjaxTK logger and server-side logger

Deploy functionality (1)



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- Operating CalemEAM
 - located in “client/launchpad/resource/”
 - “Calem.js.gz” and “Ajax.js.gz”
 - language files beginning with “CalemMsg”
- publish changes: **deploy functionality**
 - Important PHP script: “CalemZipJsCmd.php” in “build/”
 - Shell scripts in “bin/”
 - Example scripts for different operation system



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Deploy functionality (2)



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- Steps of deploy functionality:
 - Copy source code of available CalemEAM common and module parts into “Calem.js” (and other) under “client/launchpad/resource/”
 - Minimize the resulting file with JSMIn JavaScript minimizer
 - Compress file with gzip → “Calem.js.gz”
- Filesize: 4.3 MiB → 2.2 MiB → 239 KiB (“Calem.js.gz”)



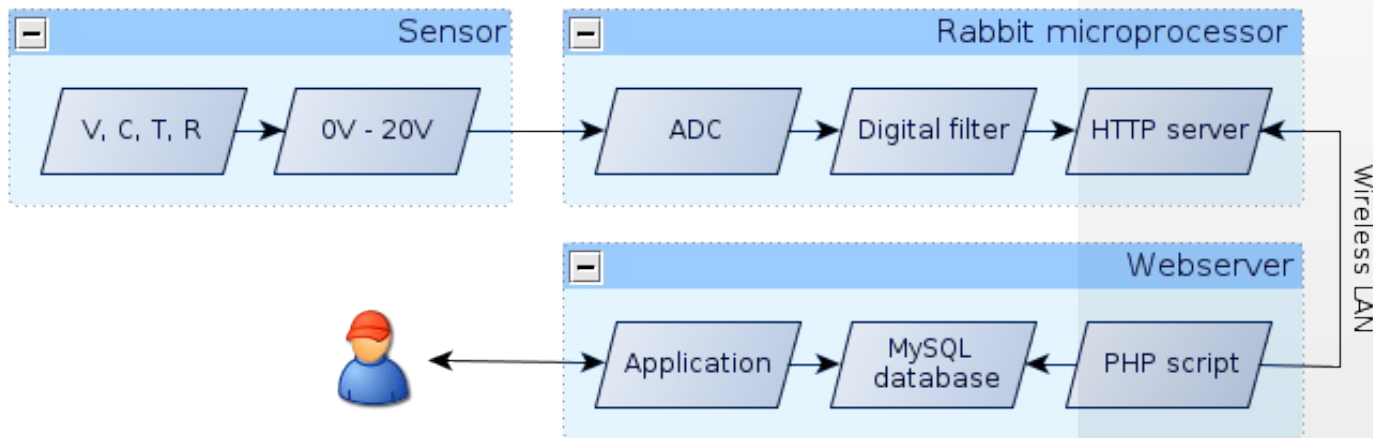
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Overview

- Introduction
- Fundamentals
- **Realisation**
 - Automatic measurements
 - OCM module database
 - Client-side OCM module
 - Server-side OCM module
- Conclusion

Measurements

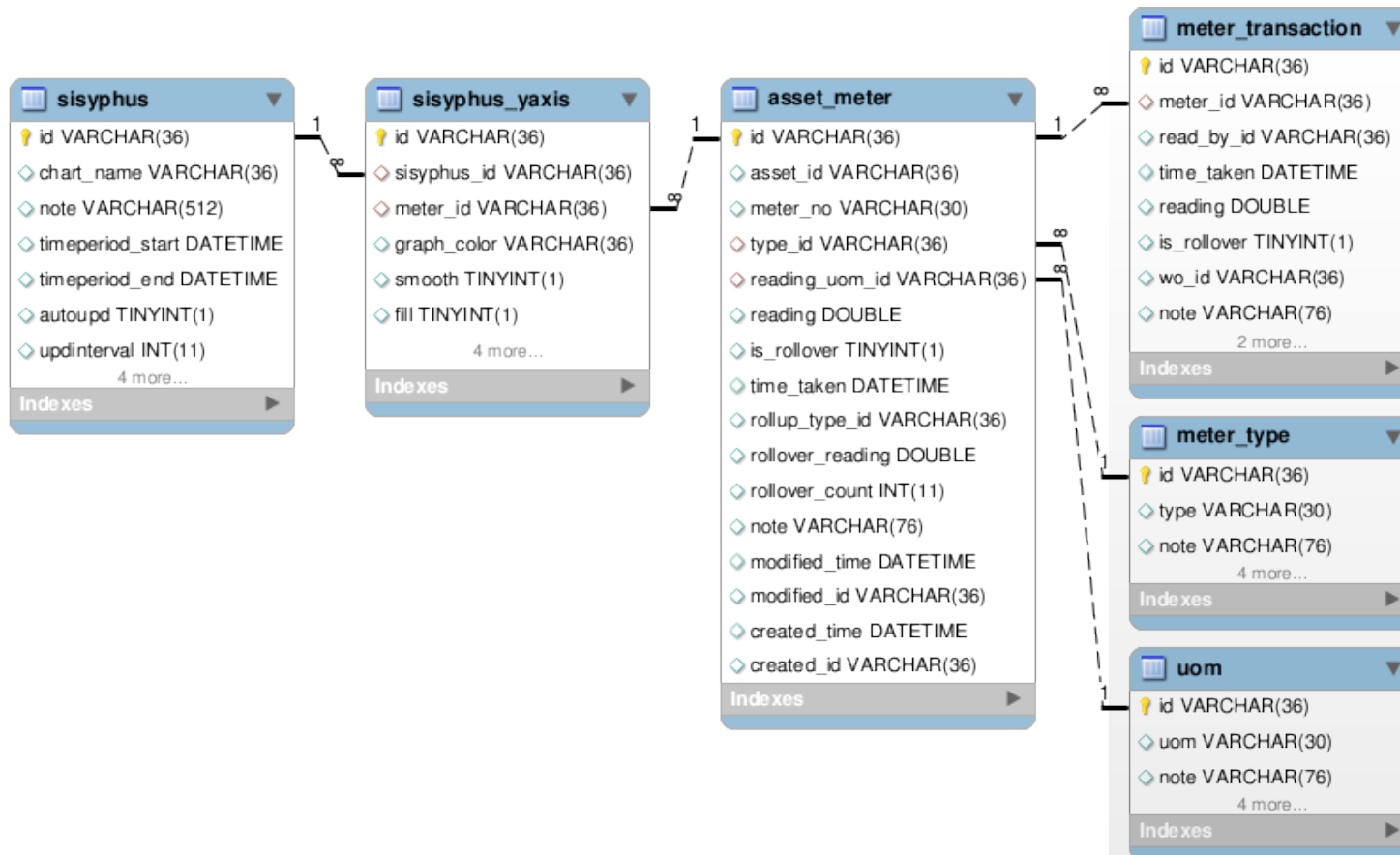
- Automatic measurements in defined period
- Rabbit HTTP server ← **PHP script** → MySQL database
- Periodical run on Linux server on PHP command line interface
 - Command “watch” with option “-n <seconds>”



Module database

- Two new database tables
 - “sisyphus”: chart data
 - Chart name: “chart_name” as `varchar(36)`
 - Start & end of time period as `datetime`
 - Auto update chart as `tinyint(1)`
 - Update interval as `integer`
 - Note as `varchar(512)`
 - “sisyphus_yaxis”: graph data
 - Graph color as `varchar(36)`
 - Smooth & fill graph as `tinyint(1)`

Module database



Client-side module (1)



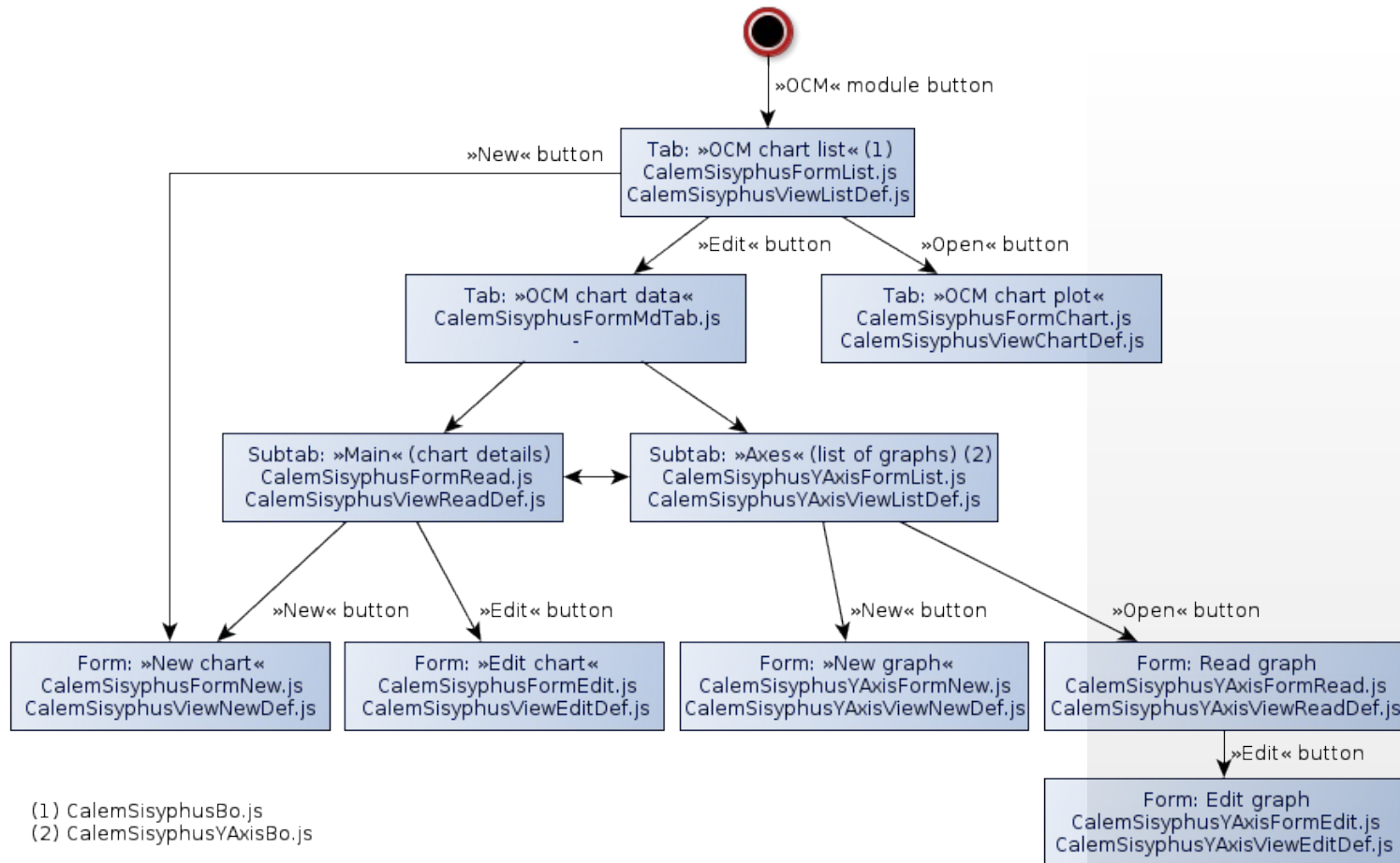
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- Consist of different files
 - Different files for custom view, view, controller and business logic
 - Filenames following a syntax
 - Directories
 - custom/group/CALEM_OOB/
 - client/modules/sisyphus/form/
 - .../controller/
 - .../view/
 - client/modules/sisyphus/bo/



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Client-side module (2)



Client-side module (3)

- amCharts stock charts
 - Offering some benefits comparing line charts



- Different graph types: Line, column, candlestick, etc.
- Irregular intervals
- Grouping by time period
- Multiple charts with same vertical axis
- Up to 20,000 data point supported
- Only CSV data files supported!

Client-side module (4)



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- Client-side module is adding an amChart stock chart with specific URL for data and configuration file
 - Data file URL: “tid” query string has value “data”

```
index.php?aid=CalemSisyphus&did=sisyphus_chart&  
tid=data&forceload=1&dsid=74fb3514-9667-1c44-4593-7b41670e1814
```

- Settings file URL: “tid” value is “settings”

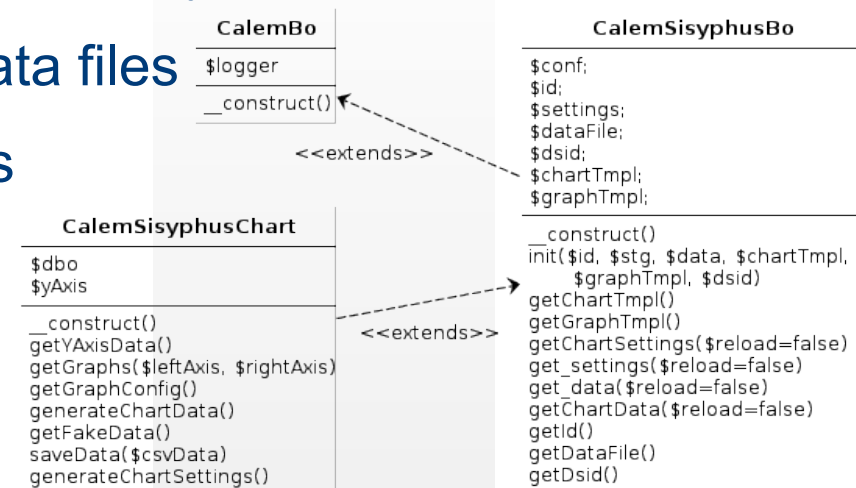
```
index.php?aid=CalemSisyphus&did=sisyphus_chart&  
tid=settings&forceload=1&dsid=74fb3514-9667-1c44-4593-7b41670e1814
```



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Server-side module

- Server-side module replies all queries of URLs with query string containing chart specific UUID
- All files are located in “server/modules/sisyphus/”
 - Subdirectory “data” for data files
 - “settings” for settings files
 - “templates” for templates
- Templates are used to generate settings file
- Settings and data file of each chart are located in directories “data” and “settings”



Overview

- Introduction
- Fundamentals
- Realisation
- **Conclusion (1-2)**

Conclusion (1)

- Open source CalemEAM comes **without** any **documentation!**
- **No support** for free CalemEAM “Community Edition”
 - Source code is extensive, confusing, not transparent and **undocumented!**
- Ajax framework “AjaxTK”
 - **Not** using explicit web standards
 - **No** further development:
Will next browser generation run AjaxTK applications?
 - Only for IE and Firefox – and the others?
- Are AJAX applications the right choice for this task?

Conclusion (2)

- Finally a new module for Online Condition Monitoring could be realized and is now added to CalemEAM!
 - Very basic functionality
 - A lot of thing should be improved (e. g. regression)
 - **It was too much work for too less result!**
- Personal opinion
 - Keep troubles away from you, it is not worthy to invest more time in this software!

Thank you!

I am pleased for your brave attention!

- Thanks to all members of laboratory “Energy Management” for enabling me such a wonderful time here at ITB in Indonesia!
- Are there any questions or comments?