OpenACS 5.10 and Beyond

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Overview

- OpenACS 5.10
  - What’s new (facts and figures)
  - New Packages

- Examples
  - Software quality management (automated testing, API browser)
  - Scalability (COVID experience)
  - COVID induced functionality

- Outlook OpenACS 5.10.1
  - New functionality
  - New packages
OpenACS 5.10 in Figures

- Changes in OpenACS 5.10
  - 3445 files changed, 215464 insertions(+), 193642 deletions(-)
  - 6 additional OpenACS packages
  - Direct Contributions from 13 developers

- Code summary of OpenACS 5.10 release
  - 349 packages, 93 package actively maintained
  - 131 contributors
  - Figures on my development site
    - 21386 unique files
    - 3.2 mio lines of code (+444K lines comment + empty lines), including documentation, 300K lines of Tcl, 200K lines of SQL
    - >55K tests in regression test

- LEARN (roughly *2)
  - 39891 unique files
  - 9.5 mio lines of code (+1.3M lines comment + empty lines), including documentation, 520K lines of Tcl, 240K lines of SQL
Code Age analysis for acs-core packages
(based on git-blame statistics)

Available OpenACS Packages

Wiki pages for the packages available in the OpenACS code repository:

- Packages
  - Available OpenACS Packages
  - Core Packages
    - ACS Admin
    - ACS API Browser
    - ACS Authentication
    - ACS Automated Testing
    - ACS Bootstrap Installer
    - ACS Content Repository
    - ACS Core Docs
    - ACS Default Theme
    - ACS Developer Support
    - ACS Kernel
    - ACS Lang
    - ACS Mail Lite
    - ACS Messaging
    - ACS Reference Data
    - ACS Reference Data Contract
    - ACS Subsite
    - ACS Tcl
    - ACS Templating
    - ACS Translations
    - Intermediate Driver
    - Notifications
    - Reference Data - Country
    - Reference Data - Language
    - Reference Data - Timezone
    - Search
    - Tsearch2 Driver
  - Non-Core Packages
    - ACS Date Time
    - ACS Events
    - ACS Interface
    - ACS Object Management
    - Address Book
    - Ad Server
    - Ajax Filestore UI
    - Ajax Helper
    - Ajax Photoalbum UI
    - Anonymous Evaluation
    - Assessment
    - Attachments
    - Attendance
    - Attribute Management System
    - Auth CAS

History: 20 years in repository
Average age per line: 10 years
Oldest lines: Copyright lines from MIT
Newly developed packages in 5.10.0
- cookie-consent: alerting users about the use of cookies on a website
- boomerang: performance of your website from your end user’s point of view (RUM)
- xoauth: OAuth implementation, including LTI (Learning Tools Interoperability)
  LTI packages: Zoom, BigBlueButton, Jupyter Notebook
- dotlrn-bootstrap3-theme: Bootstrap 3 theme for DotLRN
- xowf-monaco-plugin: Integration of Monaco editor with for coding exercises
- proctoring-support: watching students (camera, screen, sound) during exams

Software Quality management
- Test Coverage analysis
- CI/CD pipeline based on GitLab
- Extended Regression tests (>35K tests)

Easier deployment
- Docker images
Automated testing, coverage analysis

Package summary

Single package coverage

GN's Main Site Home

GN's Main Site: ACS Automated Testing: Administration

Category | Mode | View by
-----------|------|--------
| all | config | db | api | web | smoke | populator | production_safe |

View and run only tests in this category. Tests can have more than one category.

Include Stress tests

Include tests that may compromise security

Run selected test cases

Clear test result data

<table>
<thead>
<tr>
<th>Package key</th>
<th>Executed Testcases</th>
<th>Passes</th>
<th>Fails</th>
<th>Warnings</th>
<th>Result</th>
<th>Test coverage</th>
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<td>acs-admin</td>
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<td>-</td>
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<td>0</td>
<td>OK</td>
<td>75.00%</td>
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</table>

GN's Main Site Home

GN's Main Site: ACS Automated Testing: Administration: Package acs-content-repository:

Package: acs-content-repository
Procs: 170
Procs covered: 57
Coverage: low

33.53%

Proc name | Covered
----------|--------
content::extlink::copy     | Yes    
content::extlink::delete  | Yes    
content::extlink::edit     | Yes    
content::extlink::is_extlink | Yes    
content::extlink::name     | Yes    
content::extlink::new      | Yes    

PAGE 6
Clickable Call Graph with Tests integrated in API browser

```
forum::new (public)
```

**Callers of forum::new**

- forum::new
- forum::new::new
- forum::new::new::new
- forum::new::new::new::new
- forum::new::new::new::new::new

**Callees**

- forum::new::new::new::new::new::new::new::new::new
- forum::new::new::new::new::new::new::new::new::new::new
- forum::new::new::new::new::new::new::new::new::new::new::new
- forum::new::new::new::new::new::new::new::new::new::new::new::new
- forum::new::new::new::new::new::new::new::new::new::new::new::new::new

**Test cases**

- forum_new
- forum_message_new
- forum_count_test
- web_forum_new
- web_forum_view
- web_forum_edit
- web_forum_message_and_reply
- forum_enable_disable

OpenACS API browser
LEARN @COVID

- LEARN = Inhouse System of WU, based on OpenACS and DotLRN
- OpenACS scaled very well (20K users active per day, 400 views/s)

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<th></th>
<th>SS 2019</th>
<th>SS 2020</th>
<th>Factor</th>
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<td>47.471</td>
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<td>Bandwidth May</td>
<td>12.671</td>
<td>226.985</td>
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<tr>
<td>Bandwidth June</td>
<td>16.845</td>
<td>271.506</td>
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</tr>
</tbody>
</table>

- Avg response time < 0.1 sec:
  - OpenACS, NaviServer, PostgreSQL on a single server
  - Xeon Gold 6154 CPU @ 3.00GHz, 36 cores
  - Lecture Casting (per course 2 Streams via Paella-Player, live or recorded streams, adaptive bitrates, up to 1500 participants per Stream, ...)

270TB
Performance and Usage

March + April 2019

March + April 2020

First COVID shutdown

Much higher load peeks in 2020
Same avg response time <0.1s

2019 max value
Further OpenACS 5.10.0 improvements

- General improvements
  - URN-based registry for .js and .css libraries
  - Dynamic Blueprint reloading (effects all threads)
  - Improved support for streaming HTML
  - Various performance and security improvements
  - …

- New E-Learning functionality in OpenACS
  - Included in packages xowf, proctoring-support

- Learning workflows for
  - Editing learning resources
  - Composing and publishing of complex resources
  - Multiple kind of answering workflows

- Lecturer-paced quizzes, …

- Exams with support for
  - Strong randomization
  - Manual grading and auto-grading
  - Various timing modes
  - Publishing workflow (develop, publish, closing exam, grading, making results available to student, …)
  - IP-filtering
  - proctoring
Remote Assessment

- Newly developed proctoring component
  - From the "idea" to "large-scale real live" in just 5 weeks
  - Due to lock-down: development and large scale testing was a challenge
  - Hardware was not bought for this purpose
  - Recording of Screen + WebCam + Audio
  - Bandwidth requirement max 300kbit/s (suitable for 3G)

- Figures
  - Per exam up to 1500 participants per exam
  - More than 30k remote-exams in May and June

- Very positive feedback from students via social media

All Open-Source, no proprietary software involved
Typical Remote Exams

>1300 participants per exam

Synchronous exams

Short peaks at exam starts

Single server for exam and regular courses

Side effect: Students were taking regular exams from various locations
Improved scalability of caching

- Split caches and cache partitioning
  - Advantages:
    - Different caches use different locks, a lock on a specialized cache does not block operations on the `util_memoize` cache
    - Finer lock granularity
    - Less irrelevant data is processed, when wild-card operations are applied to caches
  - Use different caches for different purposes e.g. separate `permission_cache` in OpenACS 5.10*
  - Cache partitioning: use different caches based on key values (OpenACS 5.10 supports different partitioning strategies as config options)
Cache Partitioning (1/2)

- Similar to “table partitioning” in PostgreSQL or “sharding” in NoSQL databases

- Supported by OpenACS:
  - Evenly distribute cache entries keys between a configurable number of caches

- Requirements:
  - Provide for every cache access a “cache key” for shard calculation
  - Currently cache key must be numeric (typically `object_id`)
Cache Partitioning (2/2)

Example

::acs::KeyPartitionedCache create ::xo::xotcl_object_type_cache \
   -package_key xotcl-core \
   -parameter XOTclObjectTypeCache \
   -default_size 60000 \ 
   -partitions 2

# . . .
# Usage: CACHENAME eval . . .
#
set item_id [xo::xotcl_object_type_cache eval \ 
   -partition_key $parent_id \ 
   $parent_id-$name { . . . }

# Flush operation
xo::xotcl_object_type_cache flush \ 
   -partition_key $parent_id \ 
   $parent_id-$name
OpenACS 5.11 Preview

- **New packages**
  - Bootstrap 5 theme
  - Icon sets:
    - bootstrap-icons
    - fa-icons
  - Captcha
  - Caldav

- **Added Functionality**
  - Support of Oracle 19c (for acs-core packages)
  - Stronger password hashes
    "scram-sha-256" for password hashing in addition to classic "salted-sha"
    (maybe also argon2*)
  - Cookie namespaces
    (for avoiding conflicts when multiple server instances run on the same host)
  - Usage of adp-tags

  ```html
  <adp:icon name="NAME" title="..." style="..." class="...">
  ```
Server-side Tags to ease Theming (NaviServer feature)

Same markup for different renderings based on themes.

<adp:icon name="NAME" title="..." style="..." class="...">
Summary

- OpenACS 5.10.0
  - OpenACS releases with most changes
  - New functionality
  - Security and scalability improvements
  - Makes use of new NaviServer functionality, when available (based on “Can I use” pattern)
  - High backward compatibility

- Large Scale Usage in real world systems
- Covid19-proof
- Many new features ante portas 5.10.1

- Questions?
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