

OpenACS and EuroTcl 2022

OpenACS 5.10 and Beyond



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JUNE 30, 2022



- **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

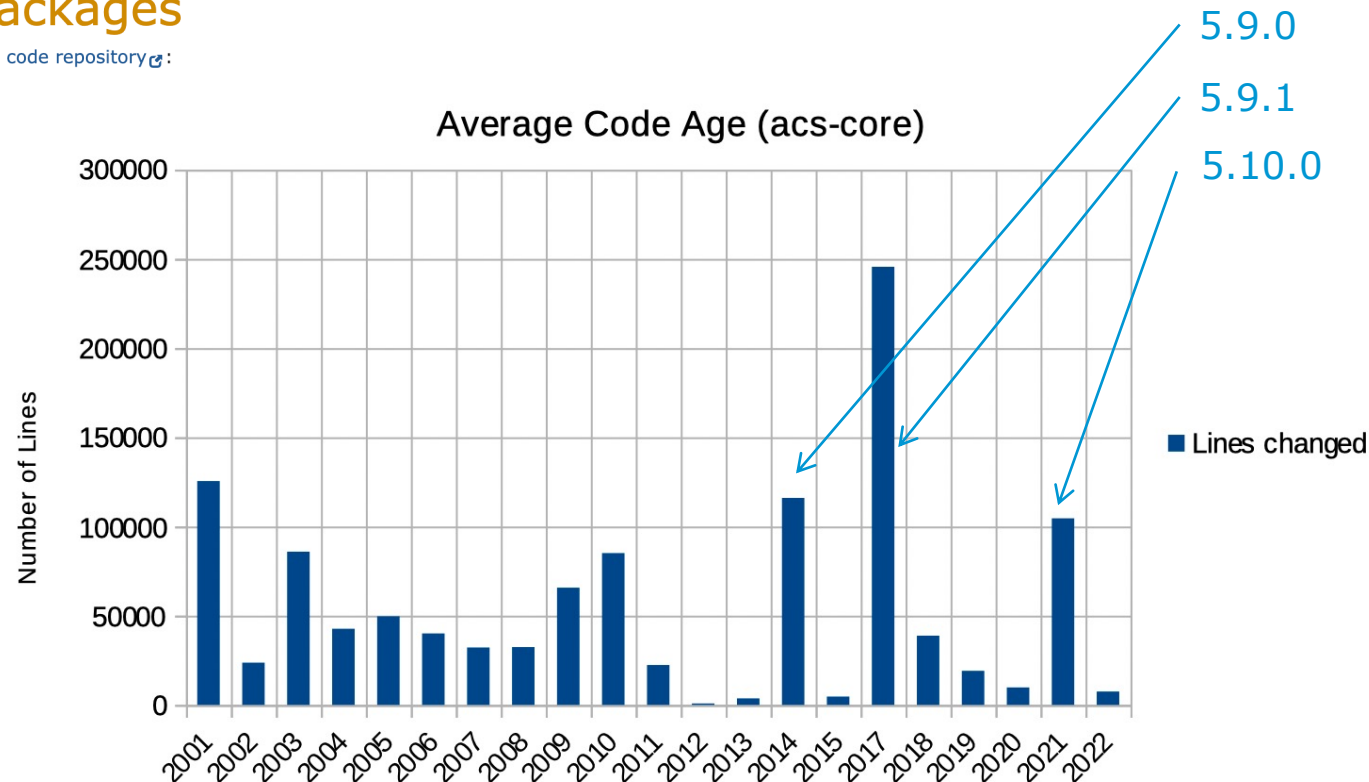


Code Age analysis for acs-core packages (based on git-blame statistics)

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 Service Contract
 - ACS Subsite
 - ACS Tcl
 - ACS Templating
 - ACS Translations
 - Intermedia 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

OpenACS Development

▪ 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)
- xooauth: 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

GN's Main Site Home

Mitglieder Administration



Search

Go!

GN's Main Site : ACS Automated Testing : Administration

Category [all | config | db | api | web | smoke | populator | production_safe]
[] View and run only tests in this category. Tests can have more than one category. (more info)
☐ Include Stress tests
☐ Include tests that may compromise security

Mode [quiet | **verbose**]
[] Quiet mode shows only test failures.

View by [package | testcase]

» Rerun selected test cases
» Clear test result data

| <input checked="" type="checkbox"/> | Package key | Executed Testcases | Passes | Fails | Warnings | Result | Test coverage |
|-------------------------------------|-------------------------|--------------------|--------|-------|----------|---------|---------------|
| <input checked="" type="checkbox"/> | acs-admin | 5 | 130 | 0 | 0 | OK | 100.00% |
| <input checked="" type="checkbox"/> | acs-api-browser | 15 | 6736 | 0 | 0 | OK | 100.00% |
| <input checked="" type="checkbox"/> | acs-authentication | 36 | 376 | 2 | 0 | FAILED | 100.00% |
| <input checked="" type="checkbox"/> | acs-automated-testing | 6 | 19876 | 0 | 0 | OK | 71.67% |
| <input checked="" type="checkbox"/> | acs-bootstrap-installer | 2 | 23 | 0 | 0 | OK | 53.33% |
| <input checked="" type="checkbox"/> | acs-content-repository | 9 | 100 | 0 | 0 | OK | 33.53% |
| <input checked="" type="checkbox"/> | acs-core-docs | 1 | 41 | 0 | 0 | OK | 100.00% |
| <input checked="" type="checkbox"/> | acs-datetime | 12 | 103 | 0 | 0 | OK | 63.33% |
| <input checked="" type="checkbox"/> | acs-developer-support | 4 | 31 | 0 | 0 | OK | 100.00% |
| <input checked="" type="checkbox"/> | acs-events | No data | - | - | - | - | 100.00% |
| <input checked="" type="checkbox"/> | acs-kernel | 1 | 4 | 0 | 0 | OK | 100.00% |
| <input checked="" type="checkbox"/> | acs-lang | 23 | 9441 | 0 | 10 | WARNING | 56.00% |
| <input checked="" type="checkbox"/> | acs-mail-lite | 1 | 407 | 0 | 0 | OK | 75.00% |

Package summary

Single package coverage

GN's Main Site Home

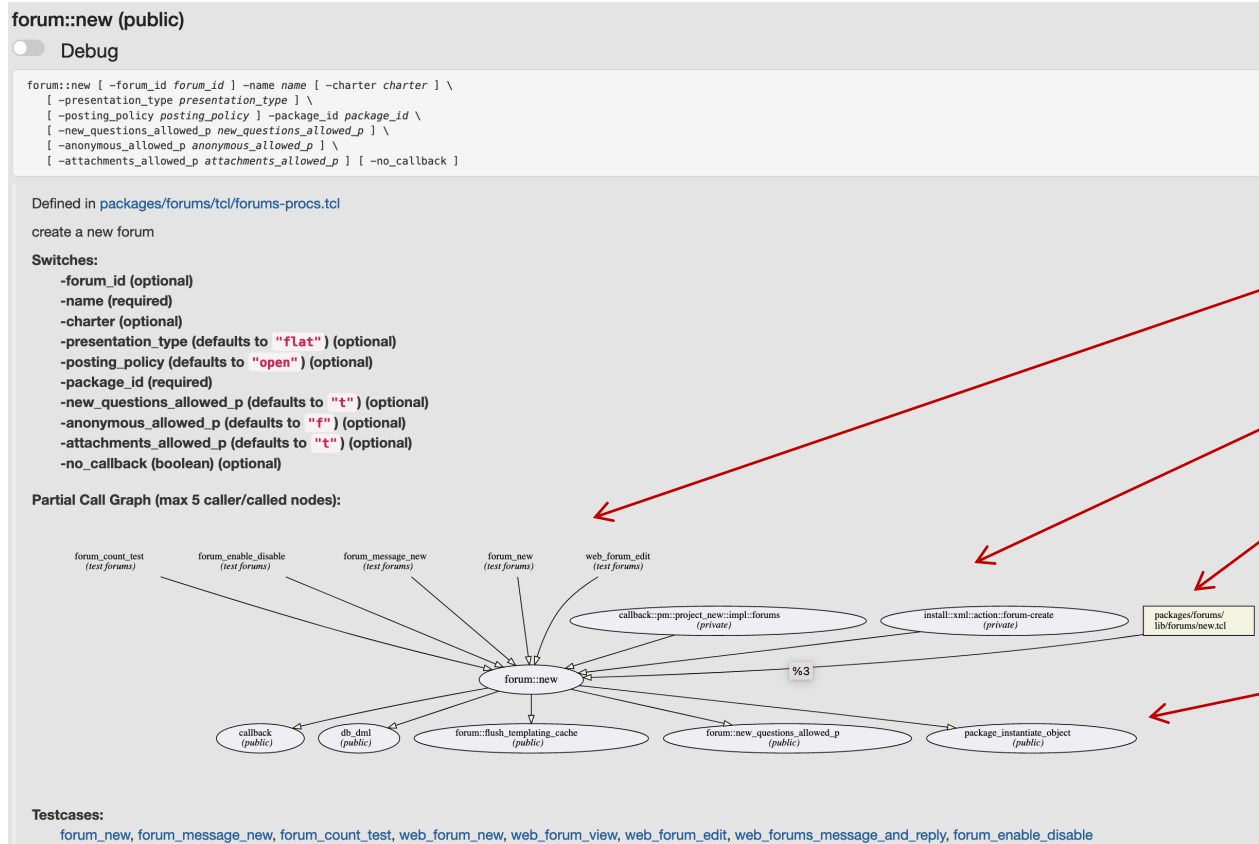
GN's Main Site : ACS Automated Testing : Administration : Package acs-content-repository :

33.53%

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

| 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 |

Clickable Call Graph with Tests integrated in API browser



Test cases

Callers of forum::new

Web Pages

Callees

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)

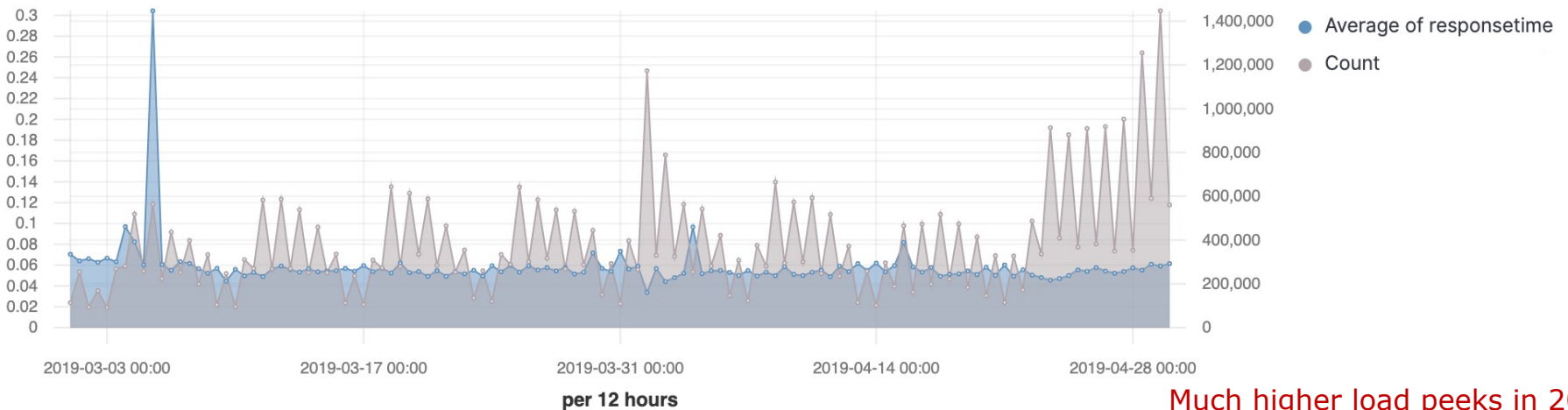
| | SS 2019 | SS 2020 | Factor |
|------------------------|------------|-------------|--------|
| LEARN views | 91.885.514 | 212.689.084 | 2,31 |
| Learning Activities | | | |
| - Editing of Resources | 10.786 | 47.471 | 4,40 |
| - Number of Authors | 411 | 789 | 1,92 |
| Online-Proctoring | -- | 18.692.783 | |
| Lecturecasts | 7.520.999 | 54.208.457 | 7,21 |
| Forums | 449.268 | 2.259.461 | 5,03 |
| Chats | 57.803 | 584.496 | 10,11 |
| Bandwidth April | 11.709 | 186.831 | 15,96 |
| Bandwidth May | 12.671 | 226.985 | 17,91 |
| Bandwidth June | 16.845 | 271.506 | 16,12 |

270TB

- 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, ...)

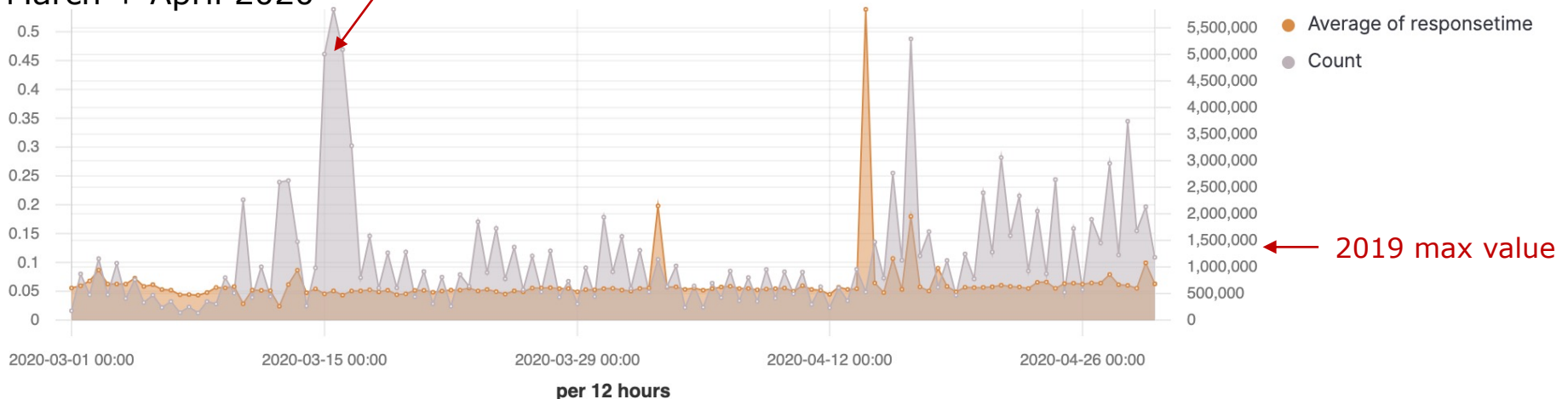
Performance and Usage

March + April 2019



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

March + April 2020



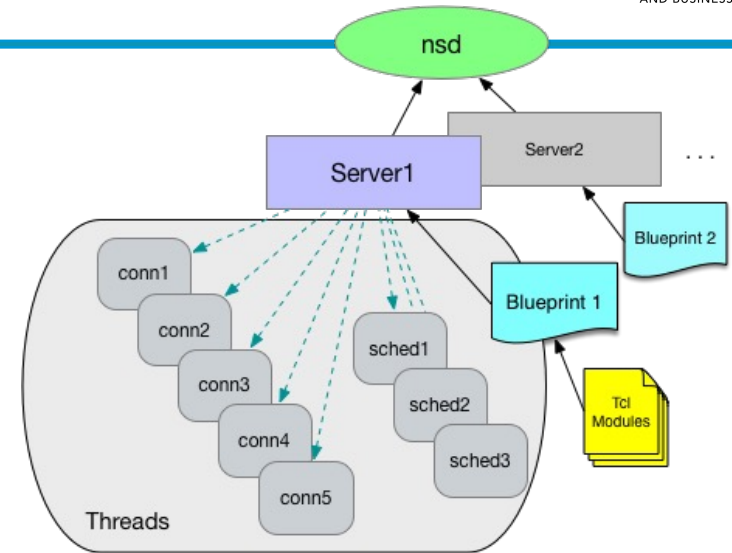
Further OpenACS 5.10.0 improvements

■ General improvements

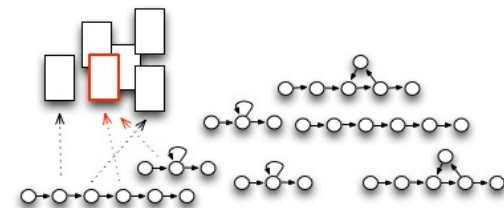
- URN-based registry for .js and .css libraries
- Dynamic Blueprint reloading (effects all threads)
- Improved support for streaming HTML
- Various performance and security improvements
- ...

■ 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



Pages, Questions, ...



Workflow instances

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

Exam on Communication Protocols

Exam Protocol

neumann@wu-wien.ac.at · Gustaf Neumann · 2020-07-26

Exam Published: 15:34:00
Revisions: 1, 2, 3
State: submitted
Duration: 15:34:40 - 15:35:10 (0m 30s - since published: 1m 10s)
Achieved Points: 4.00 (rounded4) of possible 4.00 points, 100.00%, grade: 1
IP: 127.0.0.1

Displayed revisor
Submission revisor

Question 1: Wireless Data Communication (SC, max 3) - (2 minutes)

Which of the following communication protocols is based on wireless transmissions?

- ☐ 10 MBit Ethernet
- ☒ 802.11g
- ☐ 10 GBit Ethernet

That is correct! 1 1 1 points: 2.00 of 2.00

Question 2: Network protocols (MC) - (2 minutes)

Which of the following statements are correct?

- ☒ IP is on the same OSI layer like ICMP.
- ☒ The network layer is responsible for routing tasks.
- ☒ TCP is a connection oriented protocol with error handling and provides a reliable transmission of data over different types of unknown networks.
- ☐ IP is a connection oriented protocol
- ☐ The layers 1 to 4 of the ISO/OSI model contain application protocols.

That is correct! 1 1 1 1 1 points: 2.00 of 2.00

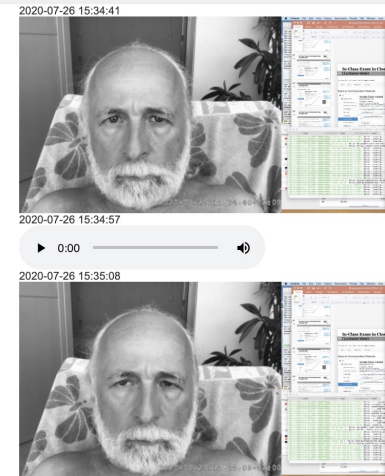
Grade #

1 1

100.00%

neumann@wu-wien.ac.at 4.00 4 100.00% 1

Back



All Open-Source, no proprietary software involved

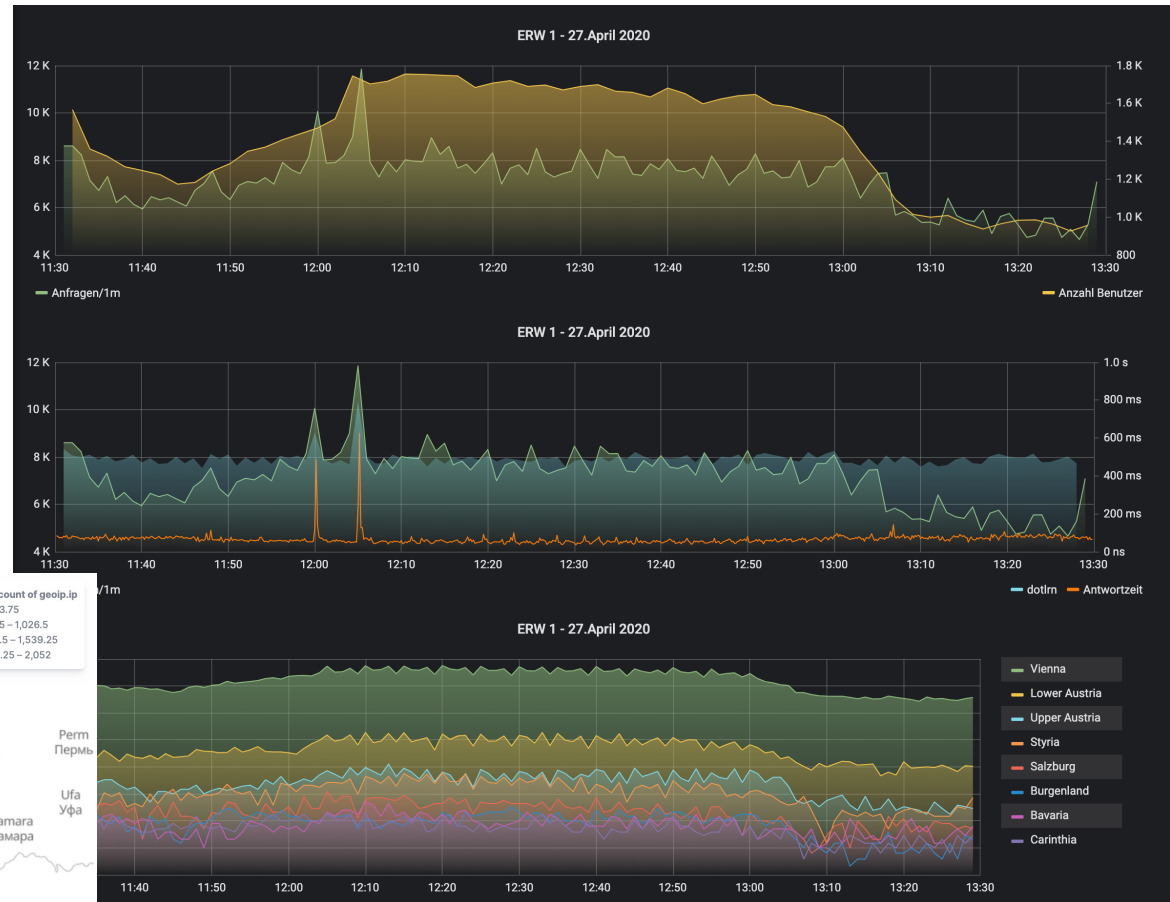
Typical Remote Exams

>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

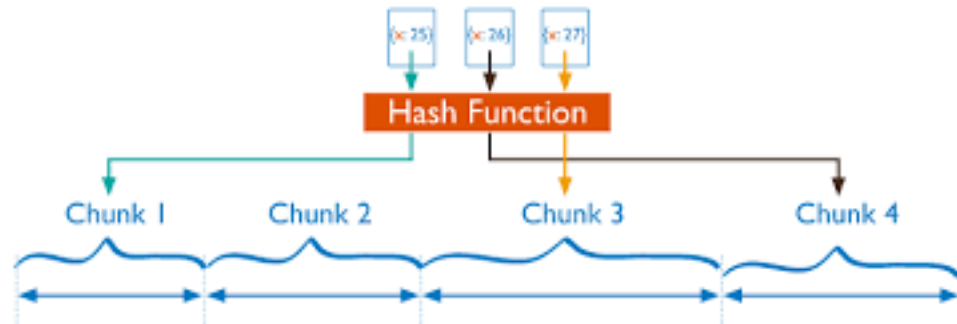
Improved scalability of caching

- 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)

| | | | | | | | |
|-------------------------------------------|-------|-------|--------|------|----|---|-------|
| xotcl object type cache-1 | 30000 | 18125 | 60.42% | 1738 | 10 | 0 | 18248 |
| xotcl object type cache-0 | 30000 | 11529 | 38.43% | 980 | 11 | 0 | 3849 |

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

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



ORACLE



Server-side Tags to ease Theming (NaviServer feature)

Same markup for different renderings based on themes.

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

```
<master>
<p>Version 5.10 <adp:icon name="download">
</p>
```

yourdomain Network Welcome, Gustaf Neumann | [1 Member Online](#) | [Your Account](#) | [Logout](#)
GN's Main Site

Members Administration

Plain-theme
no icon-set

```
<p>Version 5.10 <img src='/shared/images/download16.png' height='16'
width='16' style='border:0; ' </p>
```

Version 5.10 

GN's Main Site Home

Members Administration



Search

Go!

Bootstrap3
glyphicons

GN's Main Site

Version 5.10 

```
<p>Version 5.10 <span class='glyphicon glyphicon-download-alt' aria-hidden='true' ></span>
</p>
```

GN's Main Site Home

Members Administration



Search

Go!

Bootstrap5
bootstrap icons

GN's Main Site

Version 5.10 

```
<p>Version 5.10 <i class='bi bi-download' aria-hidden='true' ></i>
</p>
```

- 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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