Web Access in WinCC OA

Piotr Golonka BE/ICS-STF

CTTB Industrial Controls Forum #14
20 June 2024

https://indico.cern.ch/event/1422813/

WinCC OA on the Web...

- More than 5 different solutions over the past 20 years...
- Introduction: Native UI and its variants
  - Desktop UI, Mobile client
- ULC-UX
- Dashboard
  - The Old One
  - The New One
- Prometheus via NodeJS
- Grafana from archived data
  - Native grafana Oracle data source
  - NextGenArchiver: PostgreSQL and TimescaleDB

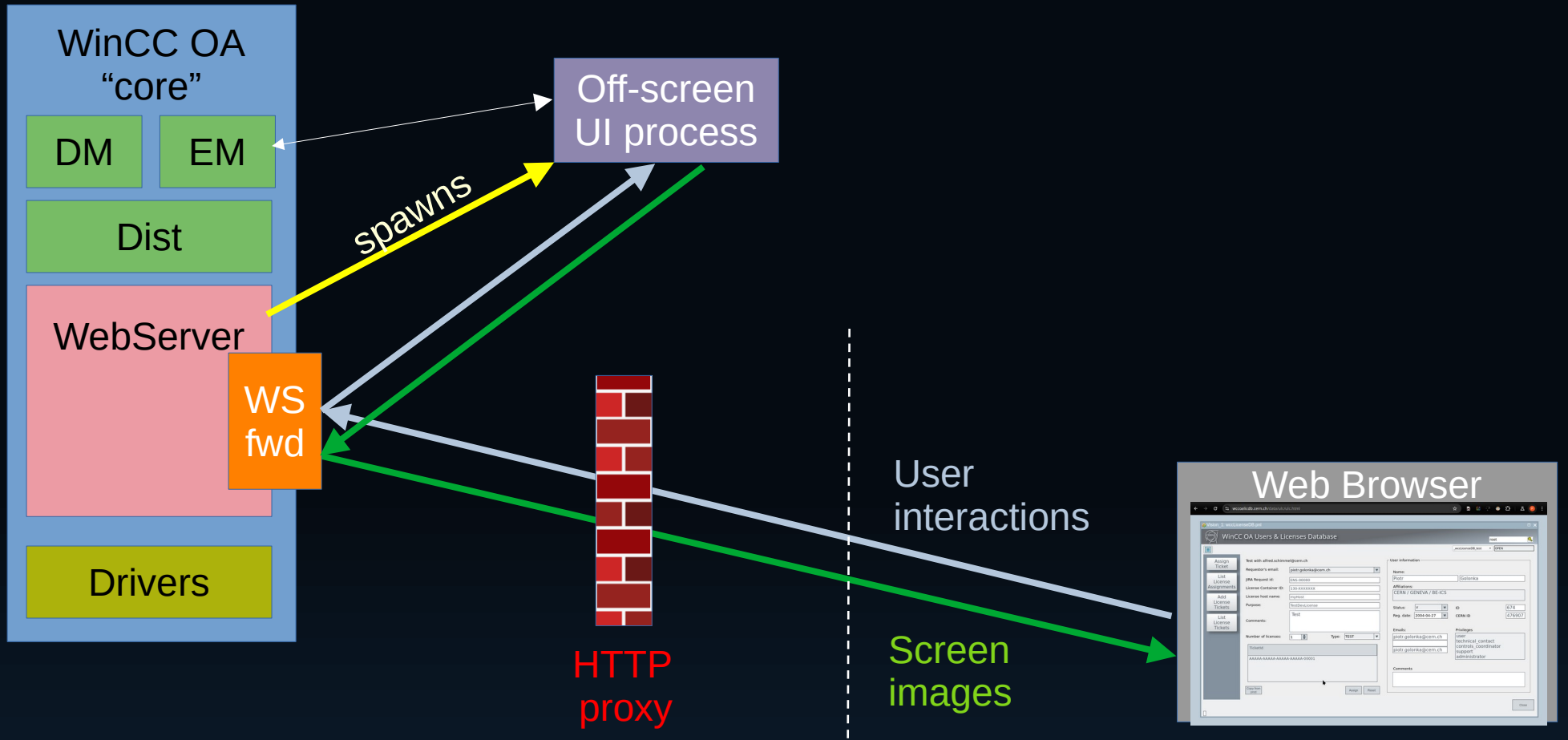
WinCC OA UI

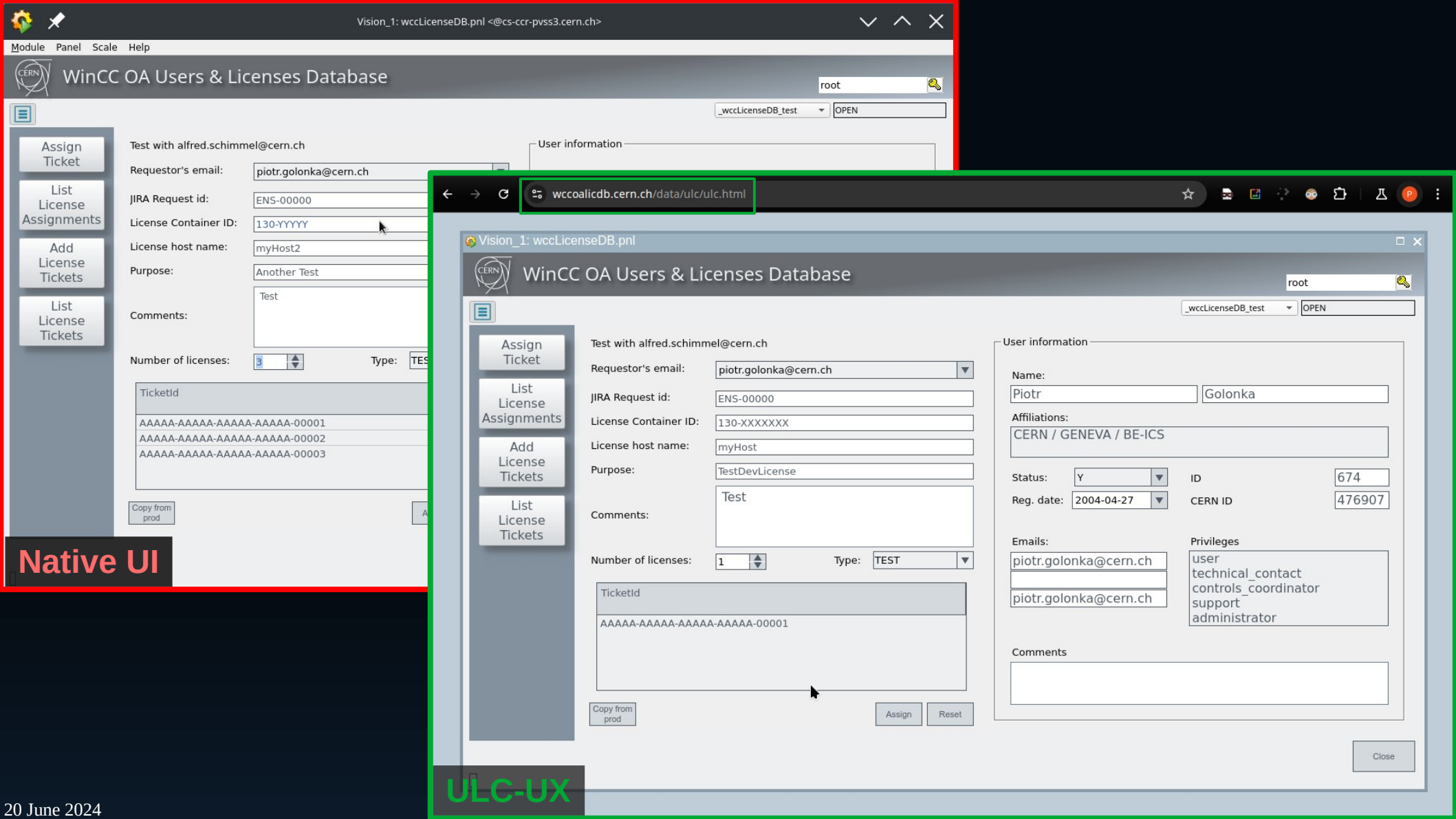
- WinCC OA UI: standalone GUI App, based on Qt, Linux and Windows
  - Connects to the “core” of WinCC OA with TCP/IP
    - Native microservice architecture pattern since 1995...
  - Typically
    - Development: co-located with the rest of WinCC OA
    - Production: Scattered UI on CCC consoles, the rest on CCR servers
  - Modes
    - Runtime (“VISION”) : operation of the panels
    - Engineering (“GEDI”): IDE to edit panels, libraries,
    - Process image browser/configurator (“PARA”)
  - Other interesting options
    - “Desktop UI” – scattered mode with no need for NFS/Samba (http file transfers)
    - Mobile UI for Android – full functionality of the UI(!)
    - Simplified “Operator APP” for iOS
  - **ULC-UX →**

ULC-UX

- “Ultra-Light Client UX”
  - **Full UI** experience in a web browser: operation, engineering
  - Server side:
    - Window-less UI manager process, transmitting rendered content and interactions via RDP
    - Runs an embedded WinCC OA HTTP Server
  - Client side running in a browser – quite lightweight, render the images, transmit user interactions back
  - Communication using websockets
- Technology resembles the ROG
  - No extra installation required, single application only…
- Considerations
  - Stable technology, at the core of WinCC OA for more than a decade
  - Every user’s session requires a new UI manager to start on the “server”
    - Would not scale for tens of users accessing the same application at the same time
    - Same applies to ROG, anyway...
  - Security: HTTP reverse proxy should be put atop of it
    - Built-in load-balancing method has some issues when combined with a proxy

ULC UX architecture




Vision_1: wccLicenseDB.pnl <@cs-ccr-pvss3.cern.ch>
Module Panel Scale Help
WinCC OA Users & Licenses Database
root
_wccLicenseDB_test
OPEN
Assign Ticket
List License Assignments
Add License Tickets
List License Tickets
Test with alfred.schimmel@cern.ch
User information
Requestor's email:
piotr.golonka@cern.ch
JIRA Request id:
ENS-00000
License Container ID:
130-YYYYY
License host name:
myHost2
Purpose:
Another Test
Comments:
Test
Number of licenses:
3
Type:
TicketId
AAAAA-AAAAA-AAAAA-AAAAA-00001
AAAAA-AAAAA-AAAAA-AAAAA-00002
AAAAA-AAAAA-AAAAA-AAAAA-00003
Copy from prod
Native UI
wccoalicdb.cern.ch/data/ulc/ulc.html
Vision_1: wccLicenseDB.pnl
WinCC OA Users & Licenses Database
root
_wccLicenseDB_test
OPEN
Assign Ticket
List License Assignments
Add License Tickets
List License Tickets
Test with alfred.schimmel@cern.ch
User information
Requestor's email:
piotr.golonka@cern.ch
JIRA Request id:
ENS-00000
License Container ID:
130-XXXXXXX
License host name:
myHost
Purpose:
TestDevLicense
Comments:
Test
Number of licenses:
1
Type:
TEST
TicketId
AAAAA-AAAAA-AAAAA-AAAAA-00001
Copy from prod
Assign
Reset
Name:
Piotr
Golonka
Affiliations:
CERN / GENEVA / BE-ICS
Status:
Y
ID
674
Reg. date:
2004-04-27
CERN ID
476907
Emails:
piotr.golonka@cern.ch
piotr.golonka@cern.ch
Privileges
user
technical_contact
controls_coordinator
support
administrator
Comments
Close
ULC-UX

20 June 2024

ULC-UX

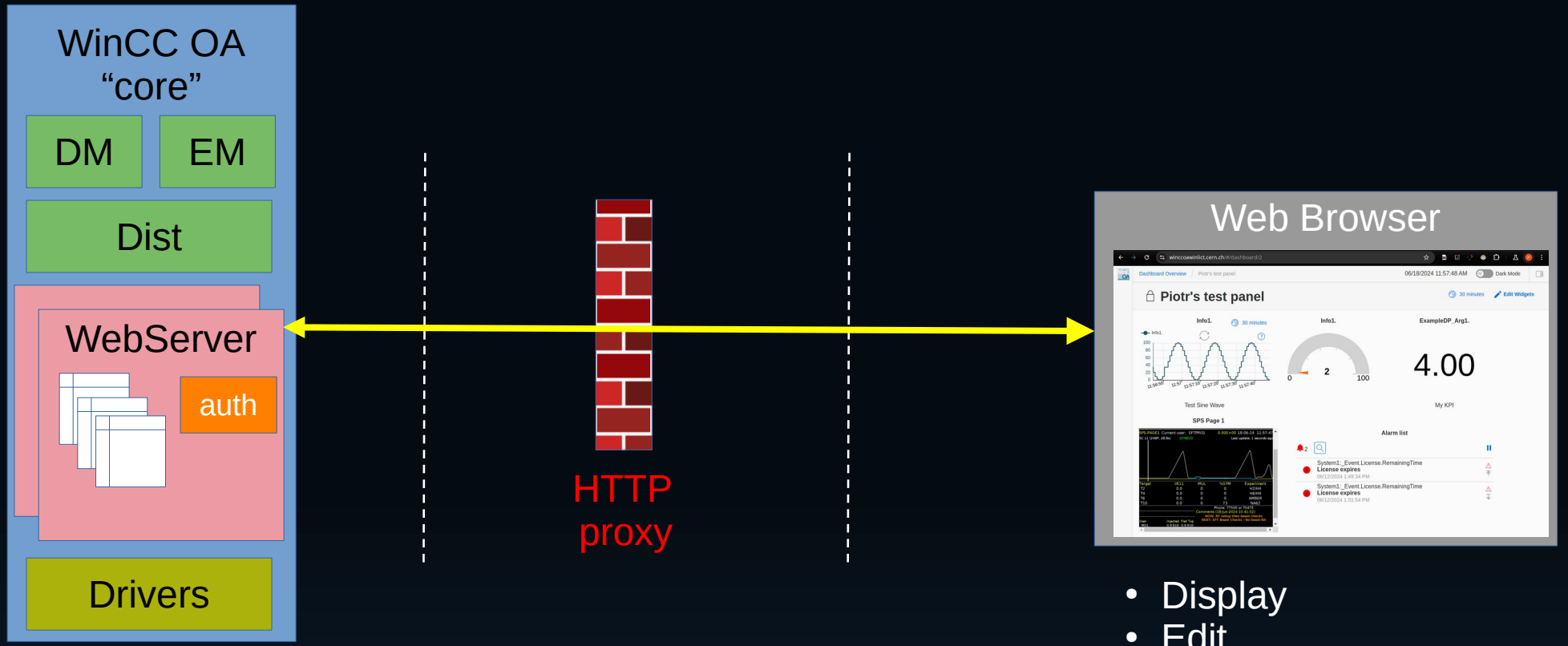
- Possible solution for web access when
  - Small number of users
  - Need for active operation and/or engineering, desktop and mobile
  - Use existing applications and panels “as is” without any development
  - Requires a “server” to run the UI instances
    - VM or the data server itself would do, similar to ROG
  - Requires extra security setup (proxy)
  - IT Security restrictions
    - No clearing to make it accessible on the internet
    - Need to clarify if OK to access TN-hosted systems from GPN

- Others
  - Architectures might potentially be extended by employing dist/redu/mxproxy to provide better isolation and scalability or develop dashboards
  - Possible centralized proxy server for many applications, to ease maintenance

WinCC OA Dashboard: “old”

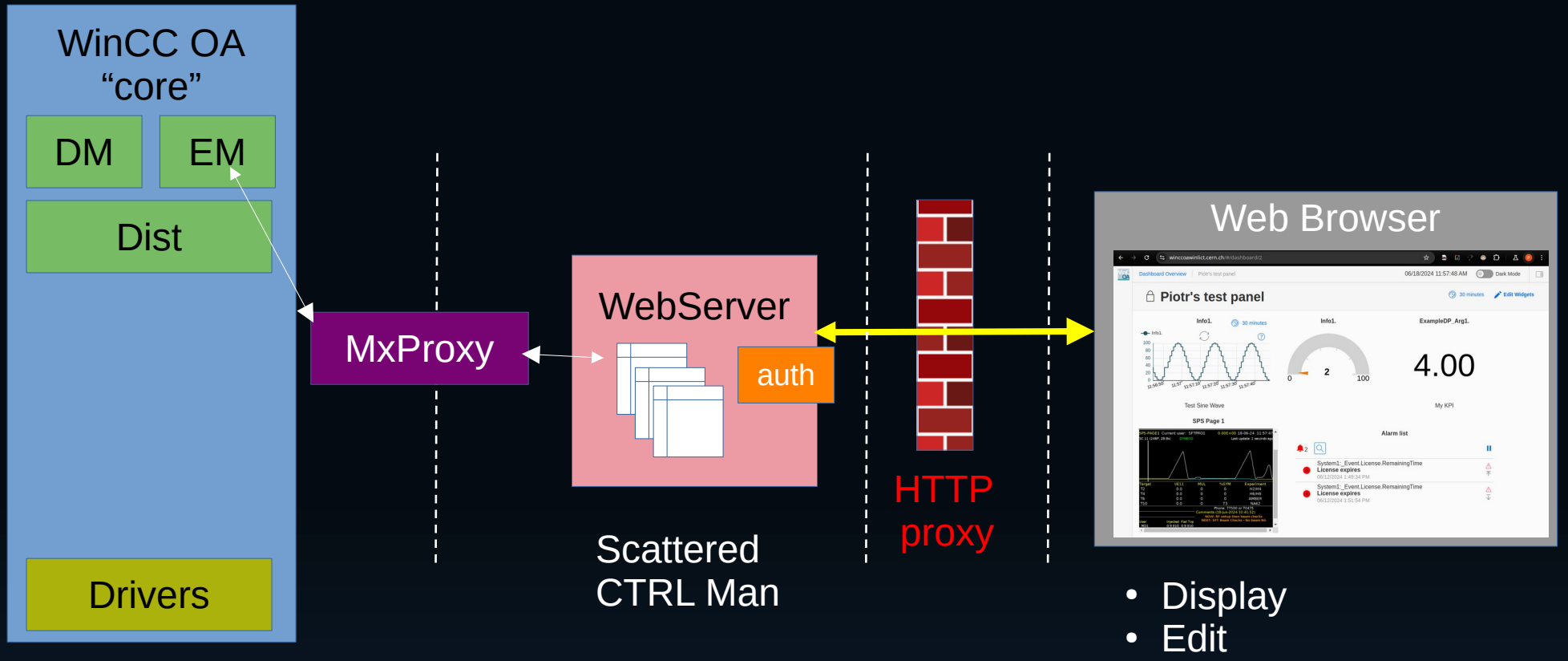
- Native web application
  - Immediate live and historical data from WinCC OA
  - Based on Angular.js framework, custom web-socket protocol
  - Features and performance you would expect from a modern dashboard
    - Design, configure, display, authenticate
    - May be combined with ULC-UX, Iframes, OARxJS-API
    - Extendable: widget API
  - Served by theWinCC OA;s built-in web server (CTRL)
  - JSON Configuration stored in a WinCC OA datapoints
    - Possible to generate/configure dashboards dynamically
- Considerations
  - For Security/Scaling consider a reverse HTTP proxy
  - Built-in load-balancer
  - Available for a few years now, stable, extendable
  - Considered deprecated → new Web Dashboard and new Web UI

Dashboard architecture



- Display
- Edit

Dashboard architecture (2)



- Display
- Edit

winccoawinlict.cern.ch/#/dashboard/2

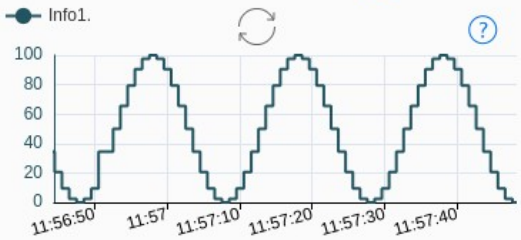
Dashboard Overview / Piotr's test panel

06/18/2024 11:57:48 AM Dark Mode

Piotr's test panel

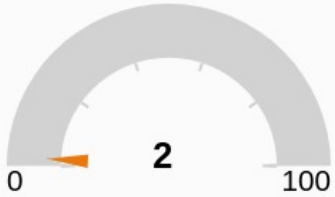
30 minutes Edit Widgets

Info1. 30 minutes



Test Sine Wave

Info1.

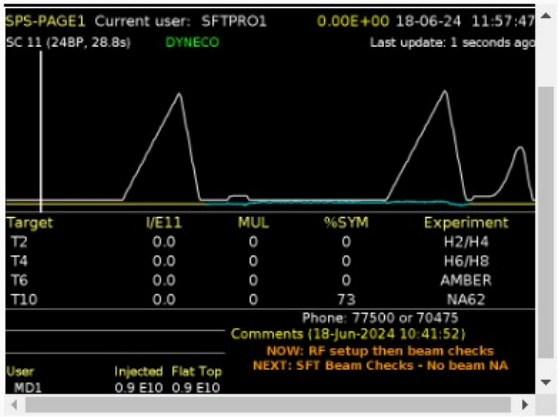


ExampleDP_Arg1.

4.00

My KPI

SPS Page 1

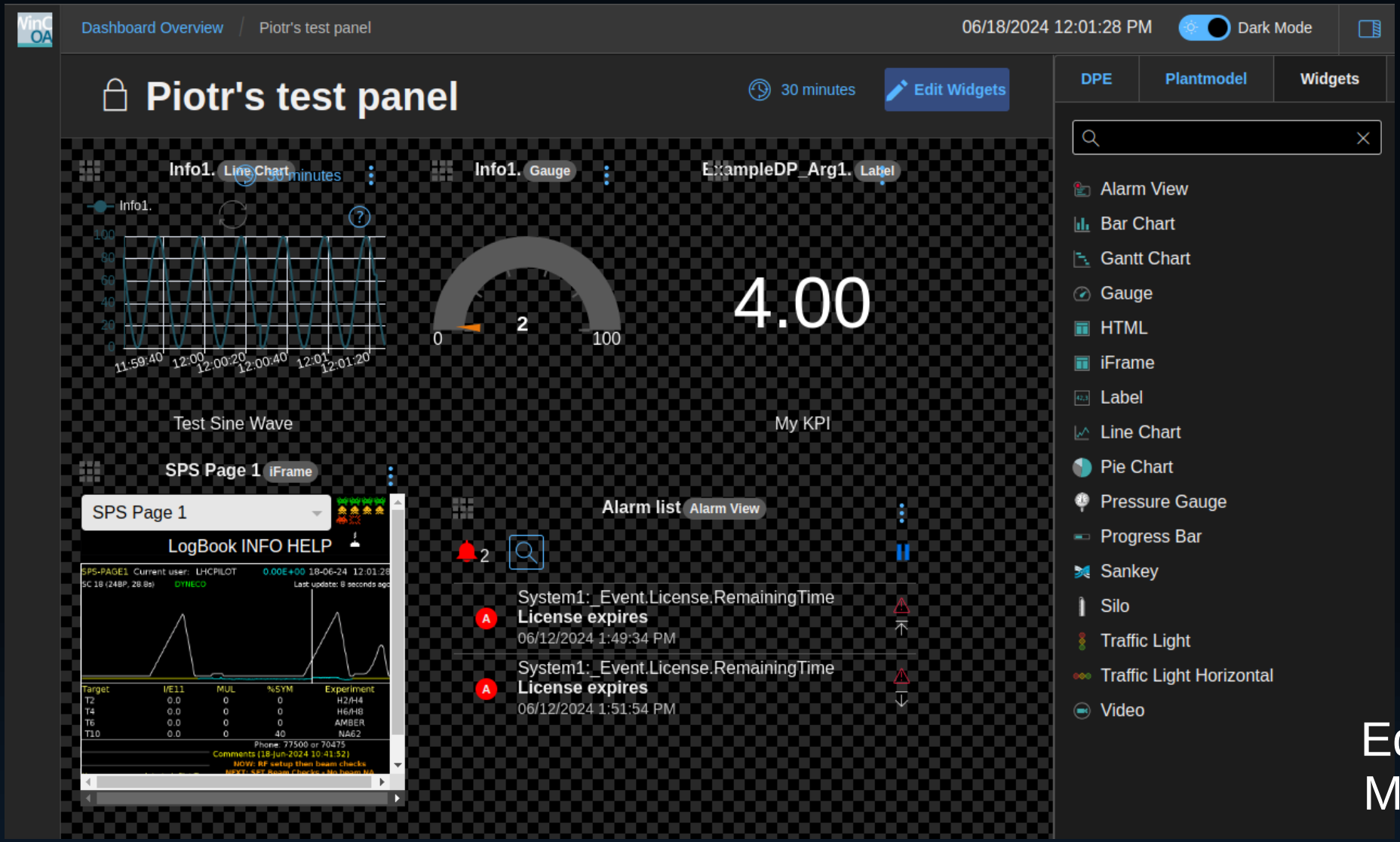


Alarm list

2

System1:_Event.License.RemainingTime
License expires
06/12/2024 1:49:34 PM

System1:_Event.License.RemainingTime
License expires
06/12/2024 1:51:54 PM

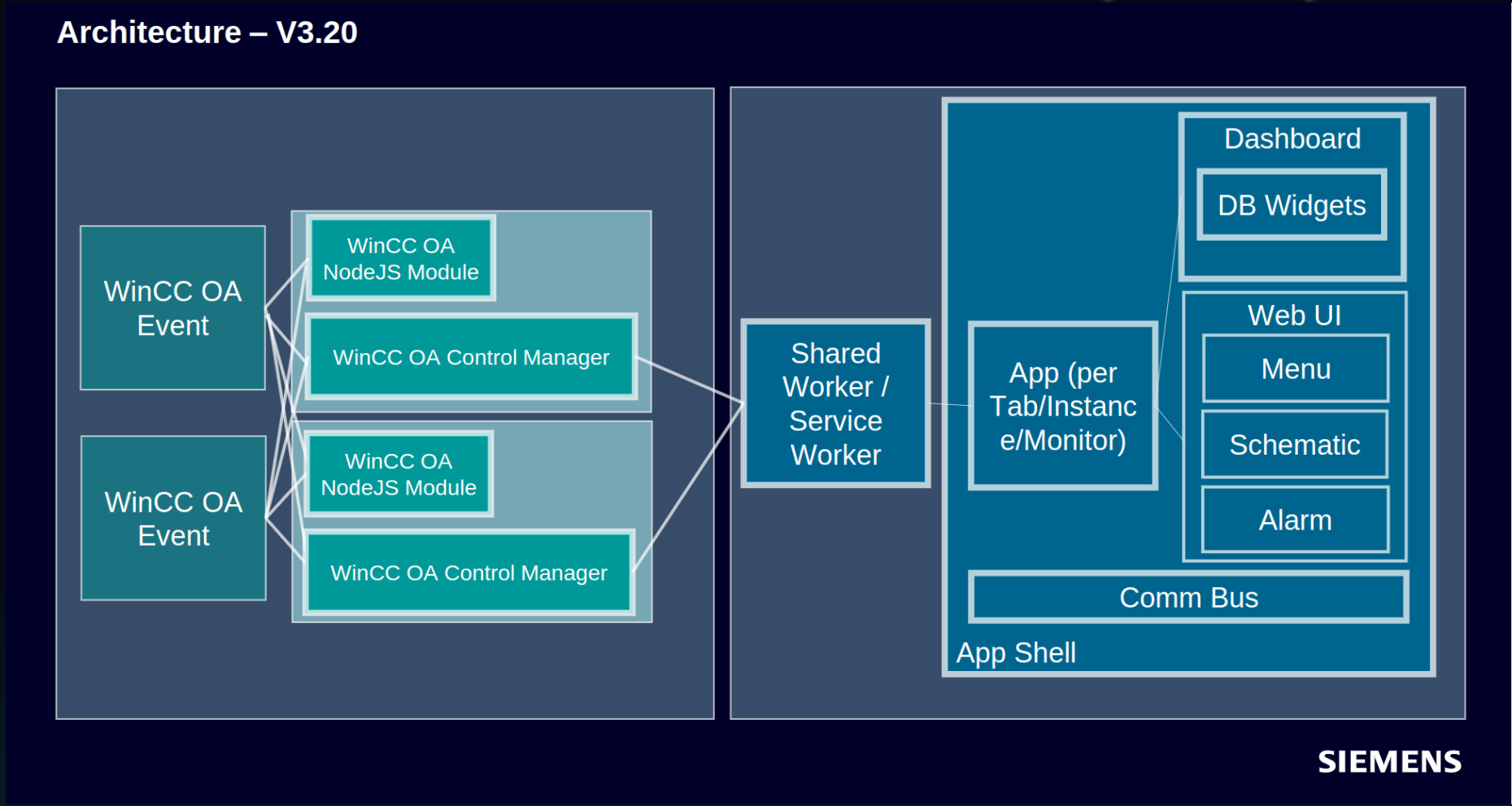

Dashboard Overview
Piotr's test panel
06/18/2024 12:01:28 PM
Dark Mode
Piotr's test panel
30 minutes
Edit Widgets
Info1. Line Chart
Info1.
Info1. Gauge
2
0
100
ExampleDP_Arg1. Label
4.00
Test Sine Wave
My KPI
SPS Page 1 iFrame
SPS Page 1
LogBook INFO HELP
Alarm list Alarm View
2
System1:_Event.License.RemainingTime
License expires
06/12/2024 1:49:34 PM
System1:_Event.License.RemainingTime
License expires
06/12/2024 1:51:54 PM
DPE
Plantmodel
Widgets
Alarm View
Bar Chart
Gantt Chart
Gauge
HTML
iFrame
Label
Line Chart
Pie Chart
Pressure Gauge
Progress Bar
Sankey
Silo
Traffic Light
Traffic Light Horizontal
Video

Editor Mode

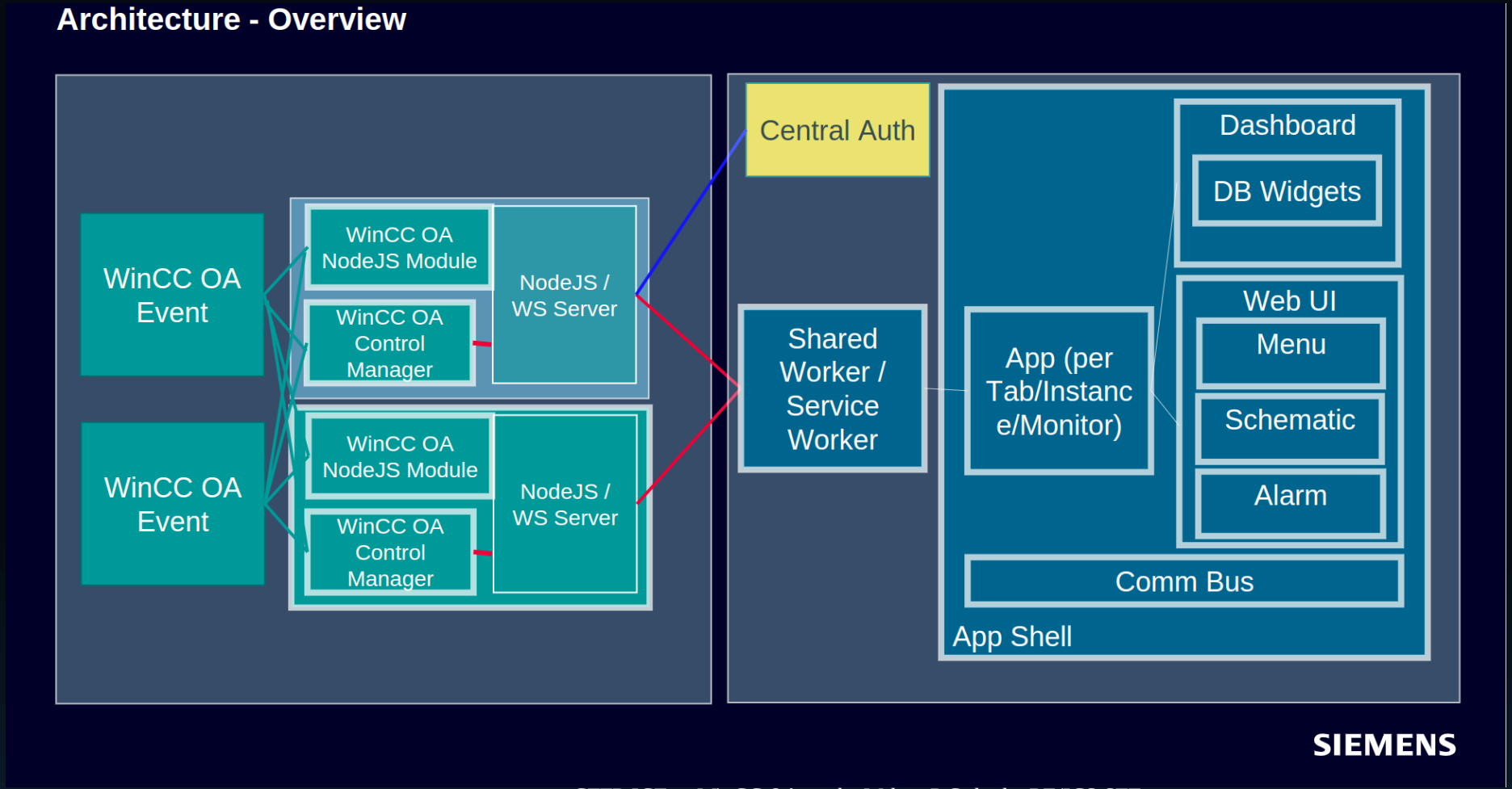
New dashboard

- WIP presented at the WinCC OA Brand Labeling Days last week
  - First release to come in WinCC OA 3.20 patch P0x
- Based on users' feedback and reevaluation of the technology (limitations of the Angular Dashboard)
  - High Performance, smaller memory footprint, lazy load
  - Native browser support: no dependencies on any particular framework
    - Compatibility, Updates, Risk of vendor lock-in and technology abandonment, high migration costs
  - Reusability / Extendability
- State-of-the-art modern web technologies
  - WebComponents, Lit
  - NodeJS
  - Siemens IX components set
  - Will also power the future WebUI
- Maintain compatibility of existing dashboards
  - Except for the new API for components: this time stable

New Web Dashboard (3.20)



New Web Dashboard/UI (3.20+)



Web components

simple-greeting.ts | index.html

```ts
import {html, css, LitElement} from 'lit';
import {customElement, property} from 'lit/decorators.js';

@customElement('simple-greeting')
export class SimpleGreeting extends LitElement {
  static styles = css`p { color: blue }`;

  @property()
  name = 'Somebody';

  render() {
    return html`<p>Hello, ${this.name}!</p>`;
  }
}
```

simple-greeting.ts | index.html

```html
<!DOCTYPE html>
<head>
  <script type="module" src="./simple-greeting.js"></script>
</head>
<body>
  <simple-greeting name="World"></simple-greeting>
</body>
```

Result

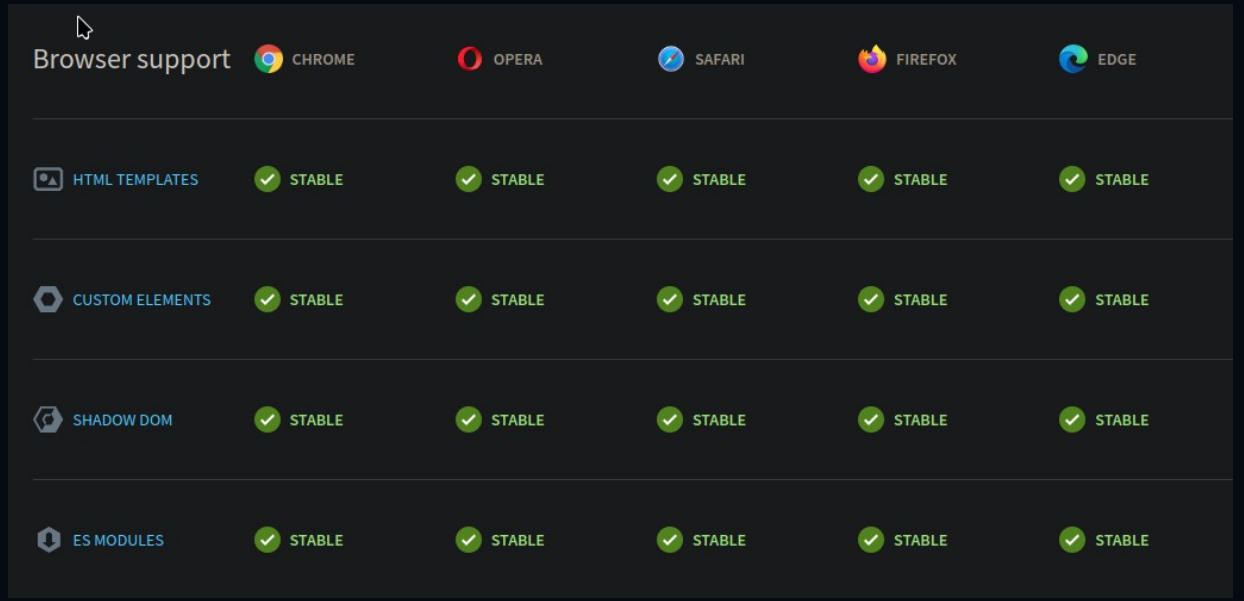
Hello, World!

Custom HTML Elements
Shadow DOM: encapsulation
HTML Templates

- Try it: https://lit.dev/playground/

Web components

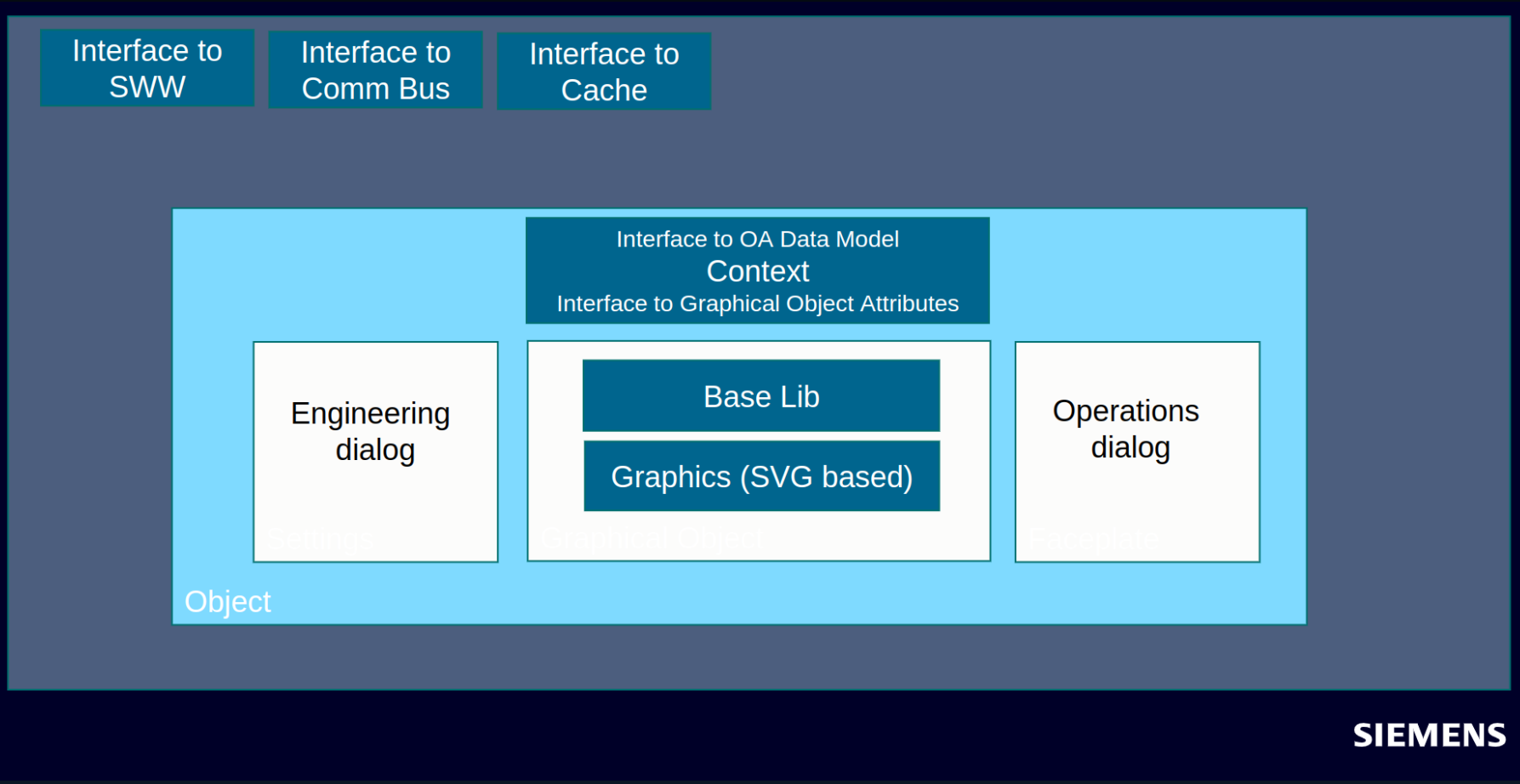
- WEB STANDARD → Compatibility (also with all frameworks)
- Reusability
- Encapsulation
- Flexibility/Customization
- Framework-agnostic
- Performance
- Design systems with consistent UX across apps
- Perfectly suitable for reusable component libraries and WebUIs
- Opensource libraries
  WebComponents.org
  → Adobe Spectrum
  → Siemens IX
  → Google Lit Element
  → StencilJS



From React to HTML-First: Microsoft Edge Debuts ‘WebUI 2.0’

Evaluating the Role of Web Components in 2024 (ICT Institute)

Architecture: widget details



SIEMENS

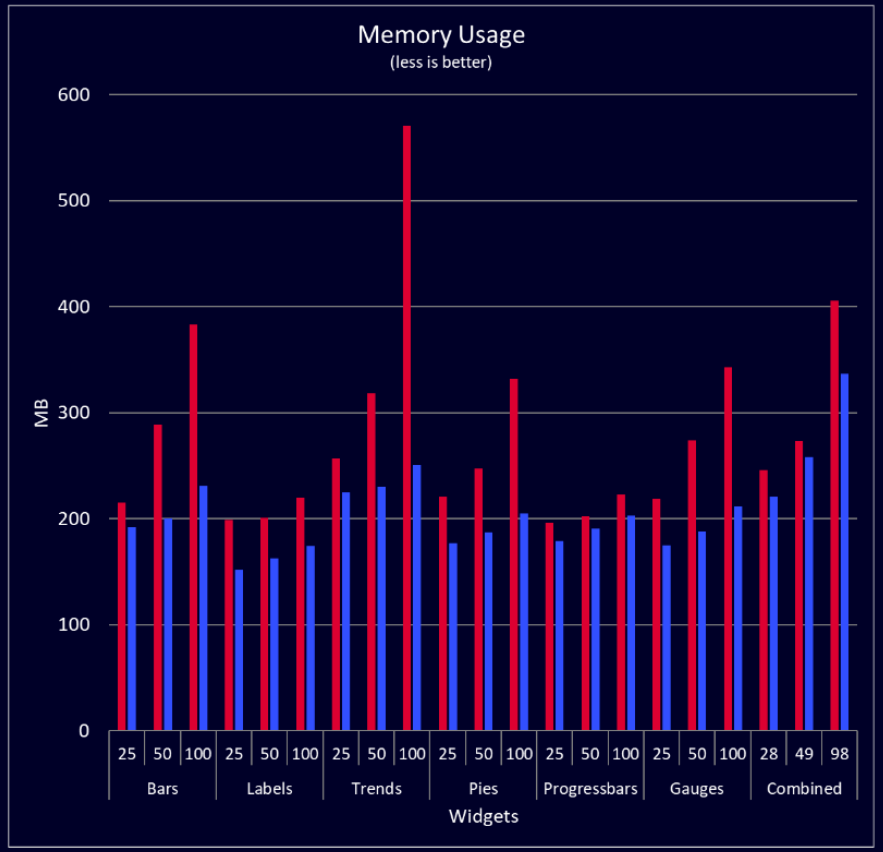
Performance

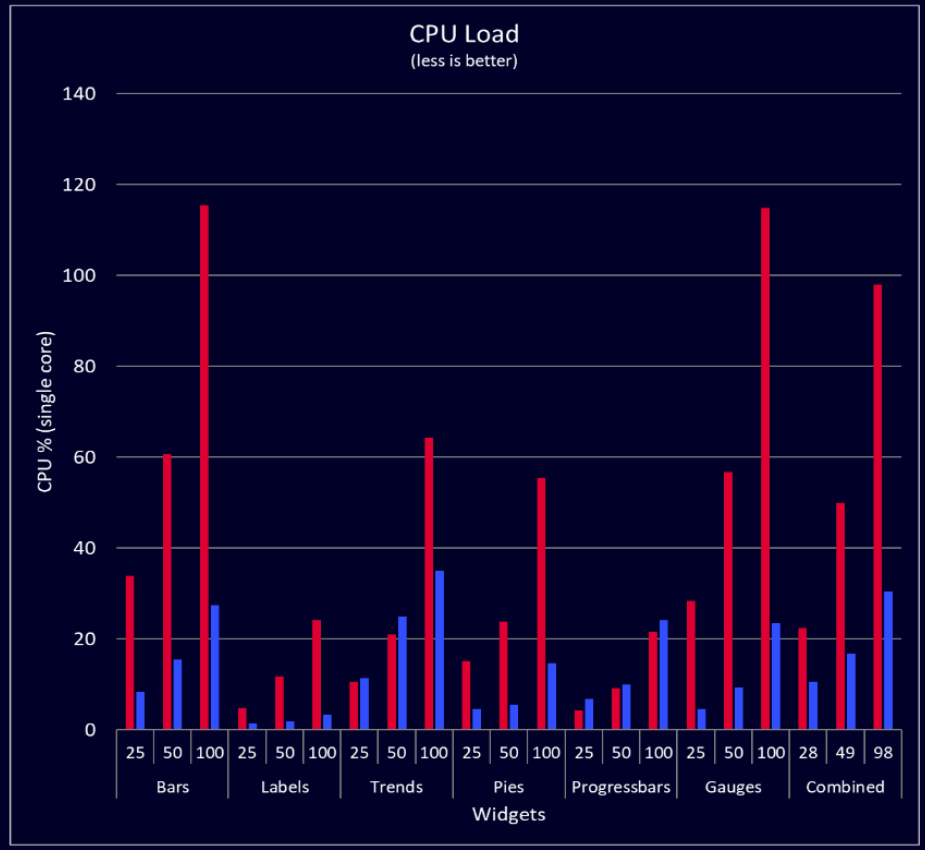
HP Z2 G9 - i7-12700 CPU @ 2.1 GHZ(12 Cores), 64 GB RAM, 512 GB SSD

Unrestricted | © Siemens 2024 | DI FA HMI ISW ETM | March 2024

SIEMENS

Performance (2)

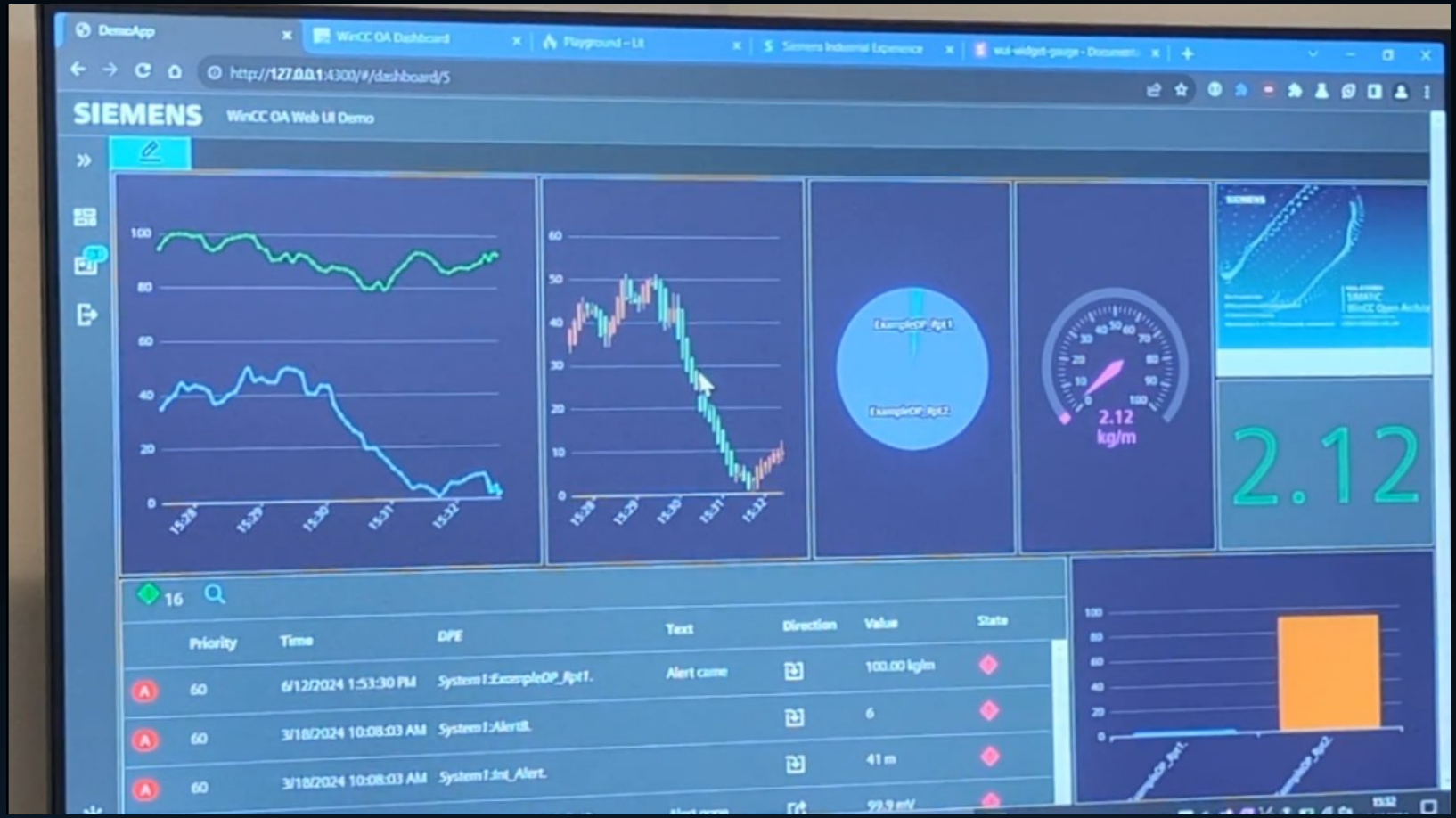




Unrestricted | © Siemens 2024 | DI FA HMI ISW ETM | March 2024

SIEMENS

New web dashboard: WIP (June'2024)



Towards a “Web UI”...

- Evolution of the new Web Dashboard based on the same technologies
- Allow for operation
  - bi-directional communication
  - Applications, schematics, alarms
  - Widgets, faceplates for operation and engineering (UNICOS 2.0?)
- Powered by the NodeJS manager
- Strong authentication, JSON WebTokens, workers
- No “GEDI”-like engineering initially
  - → VisualStudio Code plugins
- We may see some parts of it in 3.21 already
- Common point of interest: scalability, integration with enterprise infrastructure
  - collaboration possible provided we have adequate resources

Prometheus/Grafana

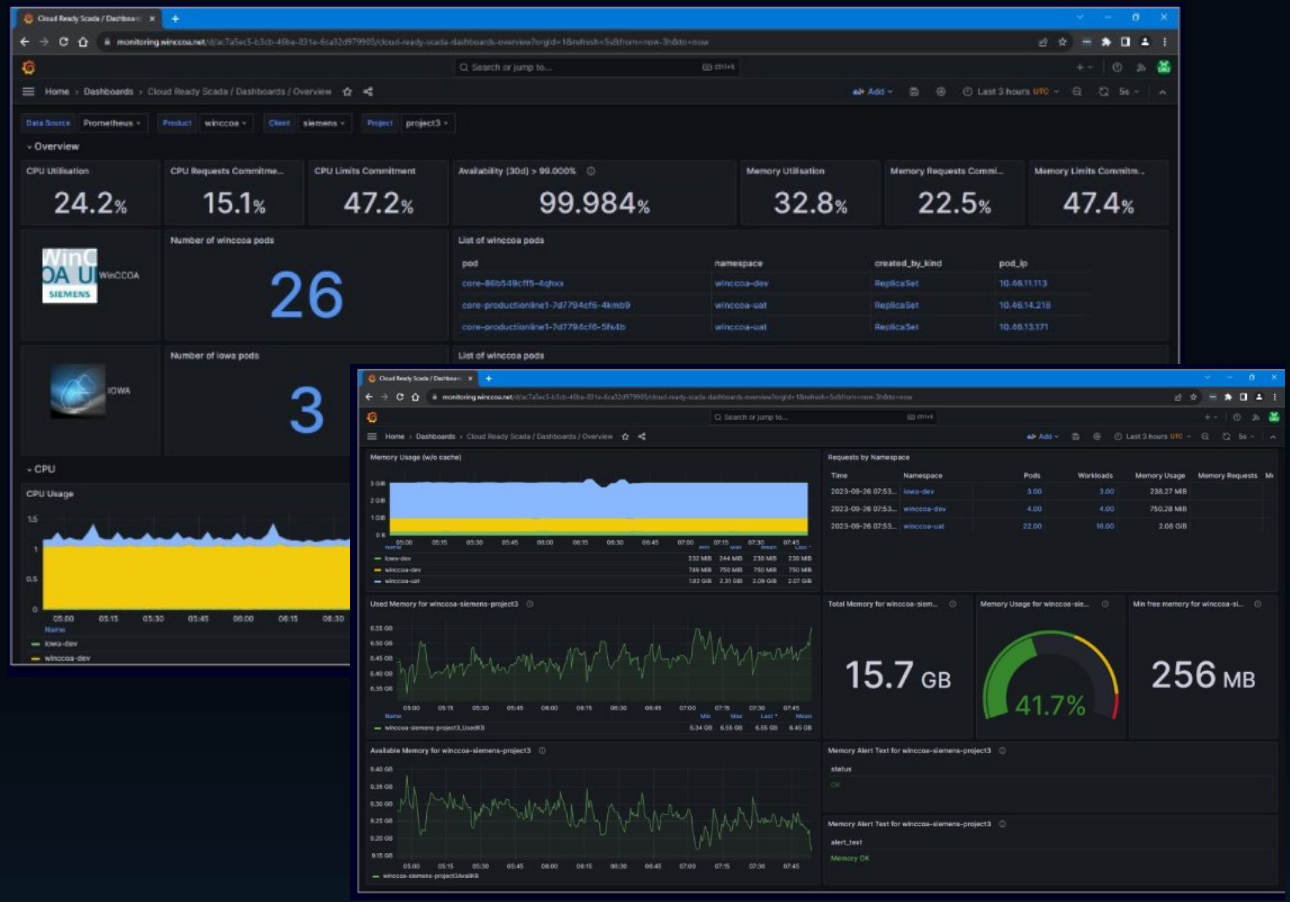
Integration via the new NodeJS/TypeScript manager in WinCC OA 3.20

Record any WinCC OA metrics or datapoint

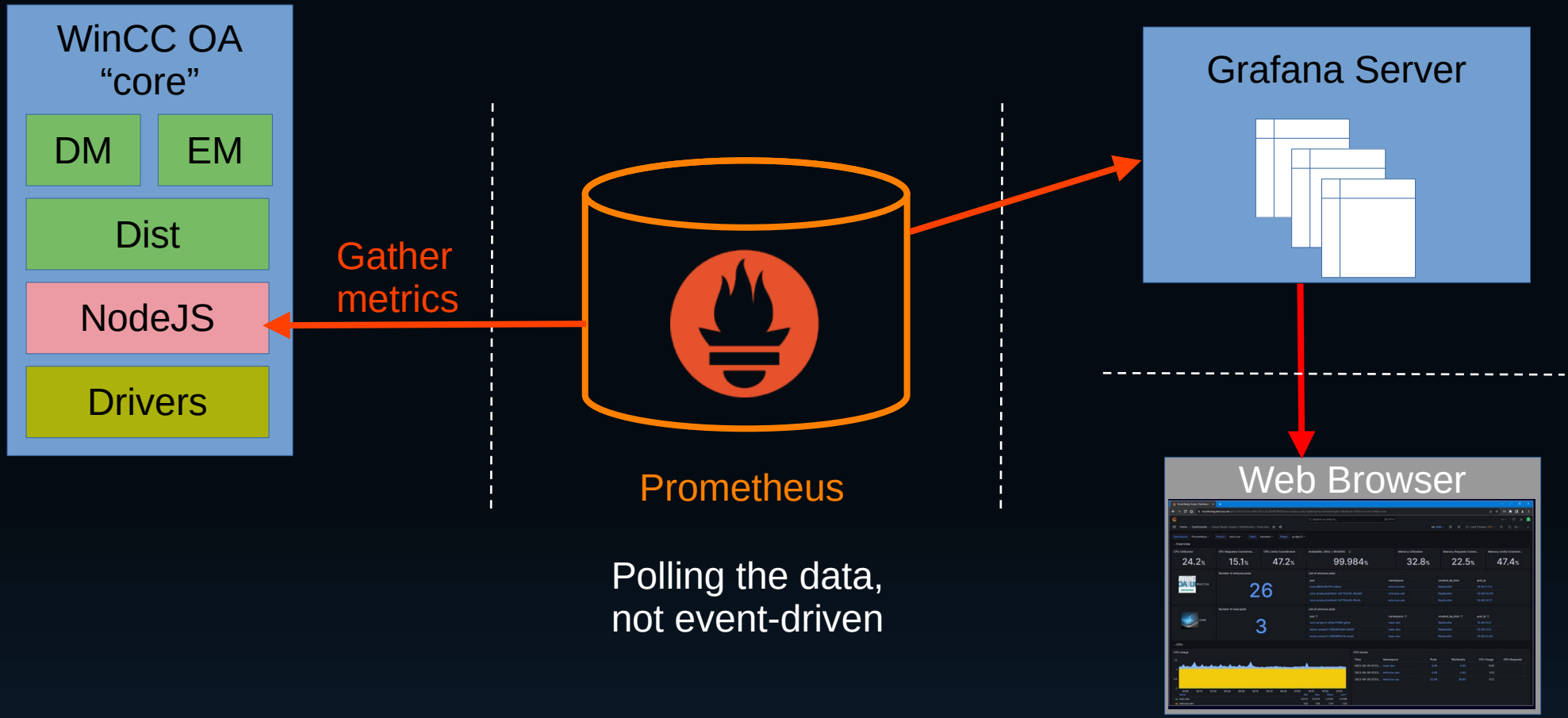
“Native” tools for Kubernetes
(Cloud Native Computing Foundation)

Prometheus:
monitoring/alerting and metrics-gathering system

Grafana



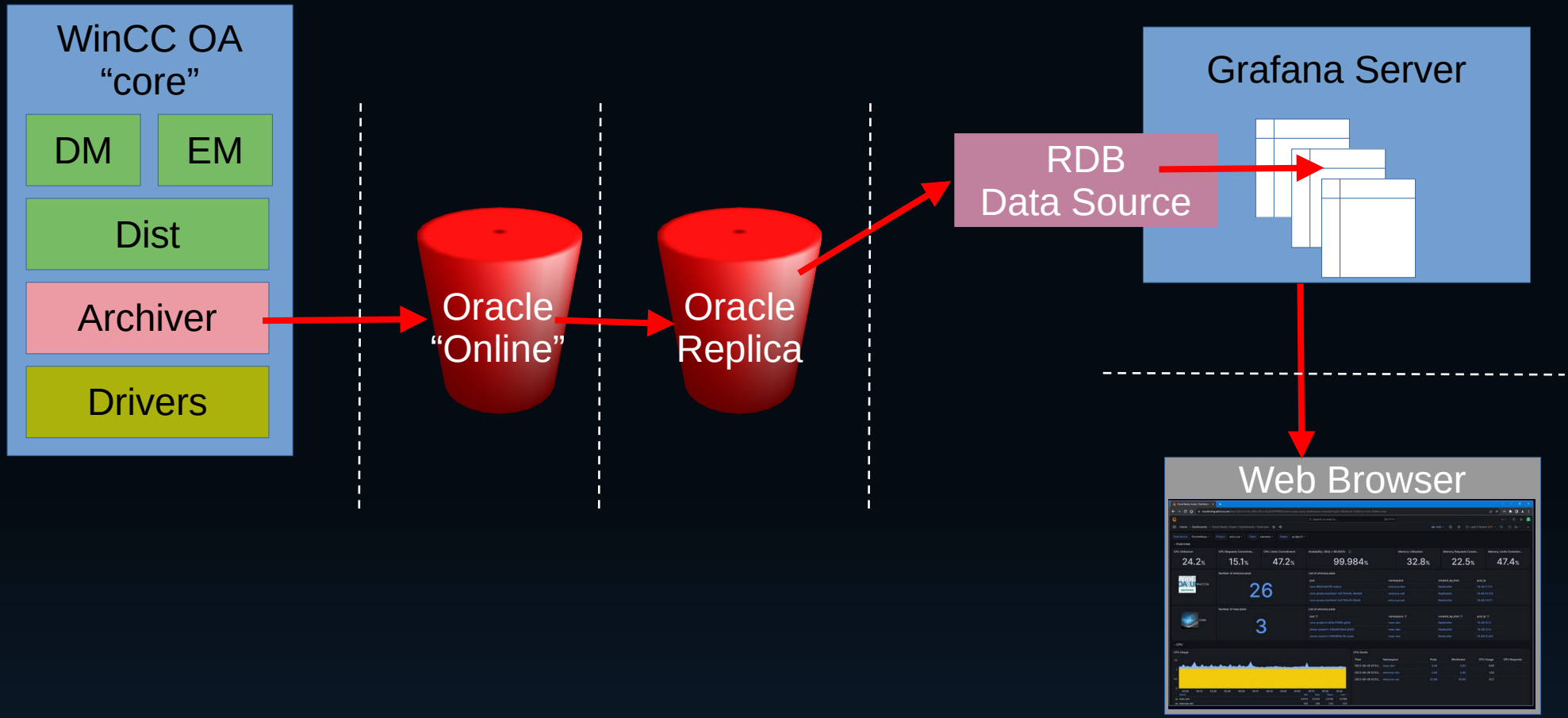
Grafana with Prometheus



Grafana backend for Oracle Archiver

- In-house development at BE-ICS
  - Proof-of-concept: Rafal's pet project in 2022(?)
  - Slightly enhanced, in production in ALICE
- Concept
  - Data source for Grafana to provide data stored by the Oracle RDB Archiver
  - Works on archived data only, no automatic refresh
  - Ideally, data taken from the database replica, not the primary one
  - Very compact and relatively simple code, dedicated to RDB Archiver
- Future
  - NextGen Archiver storing data to PostgreSQL/TimescaleDB
  - Readily available "data sources" for Grafana for these
  - Request from ATLAS to enhance RDB Archiver Grafana source

Grafana with RDB data source



Summary

- A couple of solutions exist already for smaller-scaler deployments
  - ULC-UX
  - Dashboard
  - Grafana source for RDB Archiver
- Very interesting perspectives as of 3.20(+)
  - Prometheus + Grafana for metrics
  - New Dashboard
  - Evolution towards the WebUI
  - May become usable on time for the LS3 updates
  - Non-negligible validation effort required, very limited resources

Questions/Discussion