LNLS Status for Controls and Acquisition GUI Strategies

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Overview of SIRIUS

- 4GSR synchrotron light source
- 10 beam lines in operation, 4 in construction or commissioning
- Now in maintenance shutdown (July 25th to November 11th)

- EPICS framework based control system

Technologies in use

Development

- Equipment control and monitoring:
  - Mostly python, PyQt5, pyqtgraph, PyDM
    - Zero code (pure QtDesigner), low code (QtDesigner + some python logic), pure code (PyQt5 + PyDM components)
  - Some use of web solutions
    - Typescript, React, Next.js, epics2web
    - Mostly only monitoring
  - Minor use of EDM, MEDM, CaQtDM, CSStudio
    - No developments, only community ready to use GUIs

Technologies in use

Development

- Acquisition
  - Mostly Jupyter Notebook and/or python PyEpics + PyQt5
  - Some use of web solutions
    - MxCube
    - Some adhoc solutions in some beamlines
    - Preliminary implementations for integrating with bluesky solutions
      - Turborepo + Next.js (managing the monorepo and building the apps)
      - tRPC + @tanstack/react-query (API routes)
      - shadcn/ui (UI components)
      - Server-Sent Events (SSE) (stream data from sources like Kafka and Bluesky HTTP-server)

Open for collaboration :)

- Visualization during experiments
  - Adhoc solutions with silx, pyqtgraph and/or matplotlib

Technologies in use

Deployment

- Desktop python solutions
  - packaging
  - micromamba environments with dependencies from pypi, conda-forge and local pip repository packages

- Web solutions
  - Containerization with docker and podman
  - Orchestration with docker compose and podman compose

Challenges and strategies

Development

- Provide generic, shareable solutions while enabling tailored developments suited to each beamline's experimental environment.
  - Strategy:
    - Propose standardized solutions for equipment control and monitoring GUIs.
    - Create shareable libraries as a foundation for customized solutions where applicable.
    - Implement ad hoc solutions for acquisition GUIs.

- Provide generic tools for visualizing and interacting with (partially) processed data to support decision-making during experiments.
  - Strategy:
    - Exploring customized solutions using silx or pyqtgraph.

Challenges and strategies

Deployment

- Migration to Python packaging:
  - Currently in progress, focusing on defining standards and migrating existing solutions.
  - Strategy: Define and utilize template tools, such as cookiecutter or copier.

- Definition and implementation of automated deployment tools:
  - Strategy: Use Ansible to track package versions and manage computer configurations.

- Tracking Package Usage:
  - Difficulties to track which packages are in use and which can be discontinued
  - Strategy: ?

High level questions

- What tools do you use for data visualization (e.g., interaction, comparison) with data structured in Nexus format?

- For users of experiment orchestration libraries (e.g., Bluesky):
  - What GUI solutions do you implement for acquisition and experiment control?
  - What feedback have you received from beamline users regarding your solution?

- For those exploring web-based control/acquisition GUI solutions:
  - Is anyone investigating the technologies we discussed?
  - Are you encountering challenges with streaming real-time data from similar sources? If so, how do you address these challenges?

Thank you

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