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Worry-free Experimental Metadata collection tool for Tango-Controls/TINE and HDF5

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Can software run unattended for years, reliably supporting scientific experiments?

Since 2016, the P05 beamline at Hereon, DESY, Germany, has operated an experimental metadata collection system that requires close to zero maintenance. This software has supported hundreds of experiments, contributing to numerous scientific publications with minimal intervention.

In this paper, we present the design choices, technology stack, and architectural patterns that enabled this exceptional reliability. We discuss our extensive use of Java and its ecosystem, including observability frameworks and reactive programming, which were instrumental in ensuring scalability and robustness. Additionally, we highlight recent enhancements in HDF5 integration and upstream control system interoperability, developed as part of the DAPHNE4NFDI project*.

Our experience demonstrates how well-designed software solutions can operate autonomously for years, providing valuable insights for long-term system sustainability in scientific research facilities.

Footnotes

- Barty, A., Gutt, C., Lohstroh, W., Murphy, B., Schneidewind, A., Grunwaldt, J.-D., Schreiber, F., Busch, S., Unruh, T., Bussmann, M., Fangohr, H., Görzig, H., Houben, A., Kluge, T., Manke, I., Lützenkirchen-Hecht, D., Schneider, T. R., Weber, F., Bruno, G., ⋯Turchinovich, D. (2023). DAPHNE4NFDI - Consortium Proposal. Zenodo. https://doi.org/10.5281/zenodo.8040606

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