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Computing for Gravitational-wave Research towards O4

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The LIGO, VIRGO and KAGRA Gravitational-wave interferometers are getting ready for their fourth observational period, scheduled to begin in March 2023, with improved sensitivities and higher event rates.

Data from the interferometers are exchanged between the three collaborations and processed by running search pipelines for a range of expected signals, from coalescing compact binaries to continuous waves and burst events, along with sky localisation and parameter estimation pipelines. One of the most important peculiarities of GW computing (and, more generally, of time-domain astrophysics) is that data processing happens both offline and on special low-latency infrastructures, in order to provide timely “event candidate alerts” to other observatories and make multi-messenger astronomy possible.

Significant efforts have been made in recent years to design and build a common computing infrastructure, both in terms of a common architecture and shared resources, to prepare for growing computing demand and increasingly exploit distributed computing resources. Many custom tools, difficult to maintain, have been replaced by more mainstream tools, more widely adopted in the physics community, in order to streamline workflows and reduce the burden of maintenance and operations.

We report on these activities, the status of the infrastructure and the plans for the upcoming observation period.

Significance

Computing infrastructure for GW is coming of age, and will need to be upgraded also in view of future upgrades and of the proposed third generation observatories

References

See, for example, <https://indico.egi.eu/event/5464/contributions/15714/>

Experiment context, if any

Virgo, LIGO, KAGRA

Primary author: BAGNASCO, Stefano (Istituto Nazionale di Fisica Nucleare, Torino)

Presenter: BAGNASCO, Stefano (Istituto Nazionale di Fisica Nucleare, Torino)

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