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HPC, HTC and Cloud: converging toward a seamless computing federation with interLink

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In the era of digital twins a federated system capable of integrating High-Performance Computing (HPC), High-Throughput Computing (HTC), and Cloud computing can provide a robust and versatile platform for creating, managing, and optimizing Digital Twin applications. One of the most critical problems involve the logistics of wide-area with multi stage workflows that move back and forth across multiple resource providers. We envision a model where such a challenge can be addressed enabling a "transparent offloading" of containerized payloads using the Kubernetes API primitives enabling a transparent access to any number of external hardware machines and type of backends. Thus we created the interLink project, an open source extension to the concept of Virtual-Kubelet with a design that aims for a common abstraction over heterogeneous and distributed backends. The primary goal is to have HPC centers exploitable with native Kubernetes APIs with an effort close to zero from all the stakeholders' standpoint.

interLink is developed by INFN in the context of interTwin, an EU funded project that aims to build a digital-twin platform (Digital Twin Engine) for sciences, and the ICSC National Research Centre for High Performance Computing, Big Data and Quantum Computing in Italy. In this talk we will walk through the key features and the early use cases of a Kubernetes-based computing platform capable of extending its computational capabilities over heterogeneous providers: among others, the integration of a world-class supercomputer such as EuroHPC Vega will be showcased.

Significance

The presented solution enhances the Virtual-Kubelet technology with a design that aims for a common abstraction over heterogeneous and distributed Kubelet backends. The primary goal is to have HPC centers exploitable with native Kubernetes APIs with an effort close to zero for all the stakeholder.

The characterising feature of the interLink project is the definition of a common API spec between the Virtual-Kubelet and the remote host runtime implementation, so that any provider can be completely free deciding how a container execution request can be satisfied.

References

Experiment context, if any

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