RECIPE

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RECIPE website:
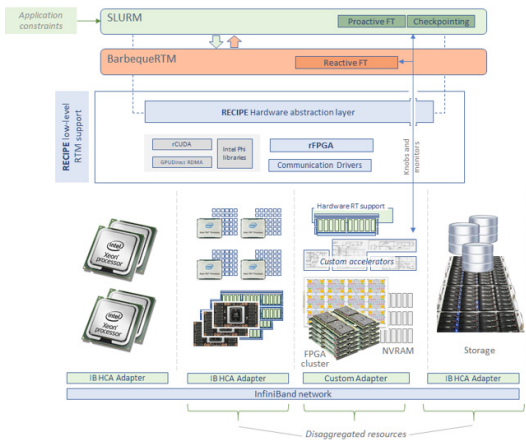http://www.recipe-project.eu/

POLITECNICO
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OBJECTIVES

RECIPE (REliable power and time-ConstraInts-aware Predictive management of heterogeneous Exascale systems) provides the tools needed to make the heterogeneous resources in future High Performance Computing (HPC) systems more robust and reliable.
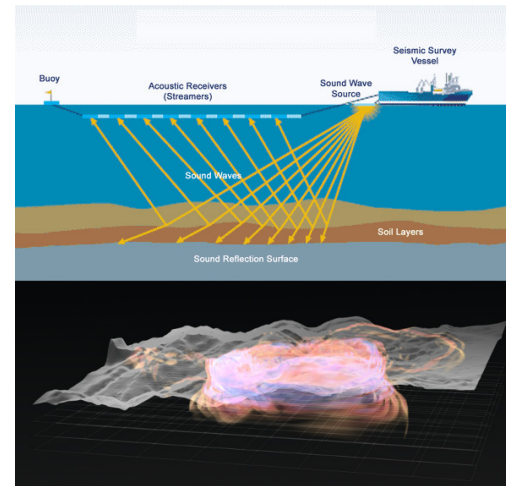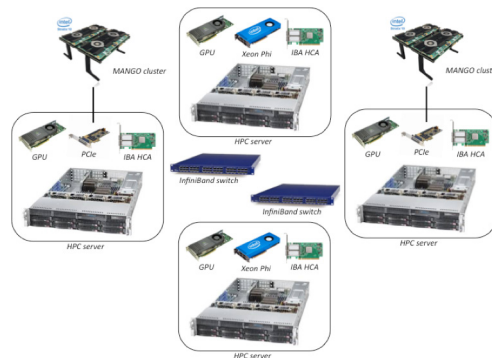
The main goals are:

- 25% increase in energy efficiency
- 15% increase in mean to time failure
- Up to 25% improvement in energy-delay product
- Occurrence of fault executions reduced by 20% with recovery times compatible with real-time performance

GEOPHYSICAL EXPLORATION

The most promising geophysical imaging tool nowadays is Full Waveform Inversion or FWI. Potentially, FWI can retrieve physical parameters for a whole 3D subsurface volume directly from the seismic data. However, the tool has its limitations, as are the necessity of specially acquired data (low-frequency, long-offset), good initial models and huge computational demands. In our tool, the FWI tool has inherited the efficient implementation of the algorithmically similar RTM and boosted its capabilities in order to turn this very costly imaging algorithm into a commodity.

PROBLEM and METHODOLOGY

RECIPE provides a hierarchical run-time resource management infrastructure to optimise energy efficiency and minimise the occurrence of thermal hotspots. This preserves the time constraints imposed by the applications, and ensures reliability for both time-critical and throughput-oriented computation.

More powerful and less energy-hungry supercomputers are needed.

However, the supply needed to keep HPC centres running is about to exceed the capabilities of the power grid. We therefore need to exploit resource heterogeneity. RECIPE provides the tools to manage these heterogeneous resources in future HPC systems.

MORE THAN A RECIPE...

Our FWI tool incorporates novel pre-conditioning, data compression and workflow control ideas that make its approach unique and result in very high-resolution 3D subsurface models.

The resulting models are of very high quality even at deep sections, while the computing costs are not too different from those required for other high-end imaging applications (e.g. RTM). Together with accelerated kernels running on advanced HPC platforms, our tool is mature and ready to reduce uncertainty in seismic exploration surveys today.