CSSI Frameworks: Re-engineering Galaxy for Performance, Scalability and Energy Efficiency

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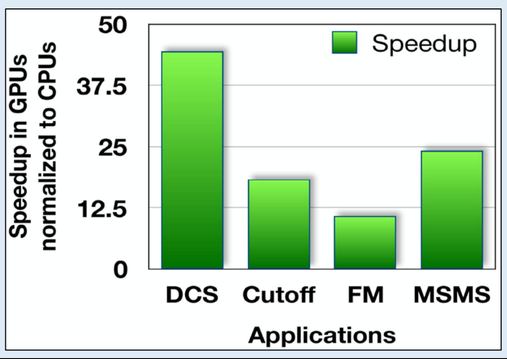
I. What is the Problem?

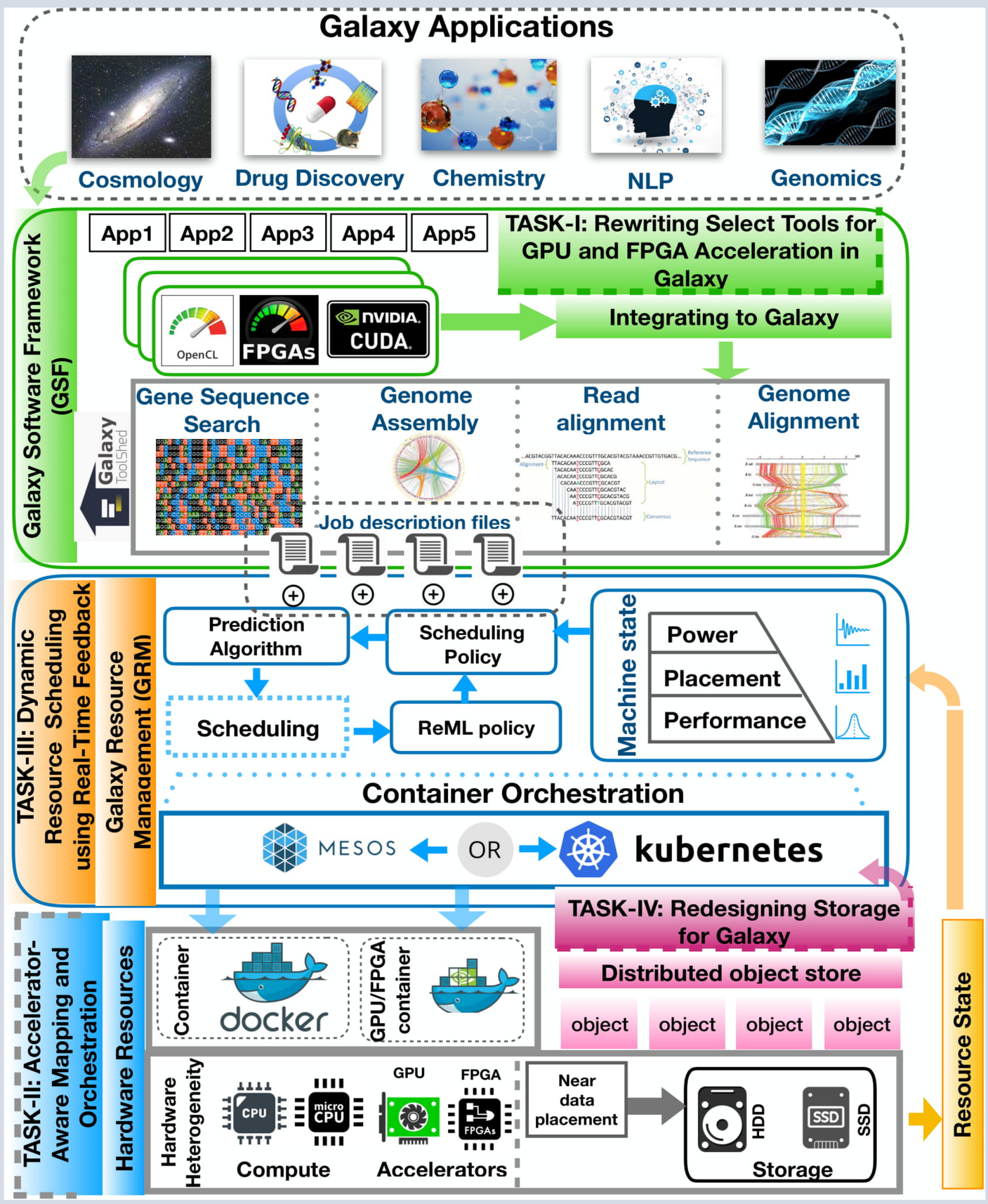
- Galaxy is an open source, web-based framework that is extensively used by more than 20,000 researchers world-wide in many areas.
- Current galaxy implementation does not support GPU and accelerators like FPGAs.
- There is no support for dynamic resource scheduling and management in Galaxy.



II. Our Objective

- **Re-engineer** the Galaxy framework to enable GPUs and accelerators like FPGAs as "first-class" compute engines.
- **Enlarge** the Galaxy community by bringing GPU and FPGA supported tools.
- Enable Galaxy tools to take better advantage of **emerging cluster scheduling** capabilities.
- Achieve significant improvements in performance **scalability** and **energy efficiency**.

III. Our Vision for Galaxy



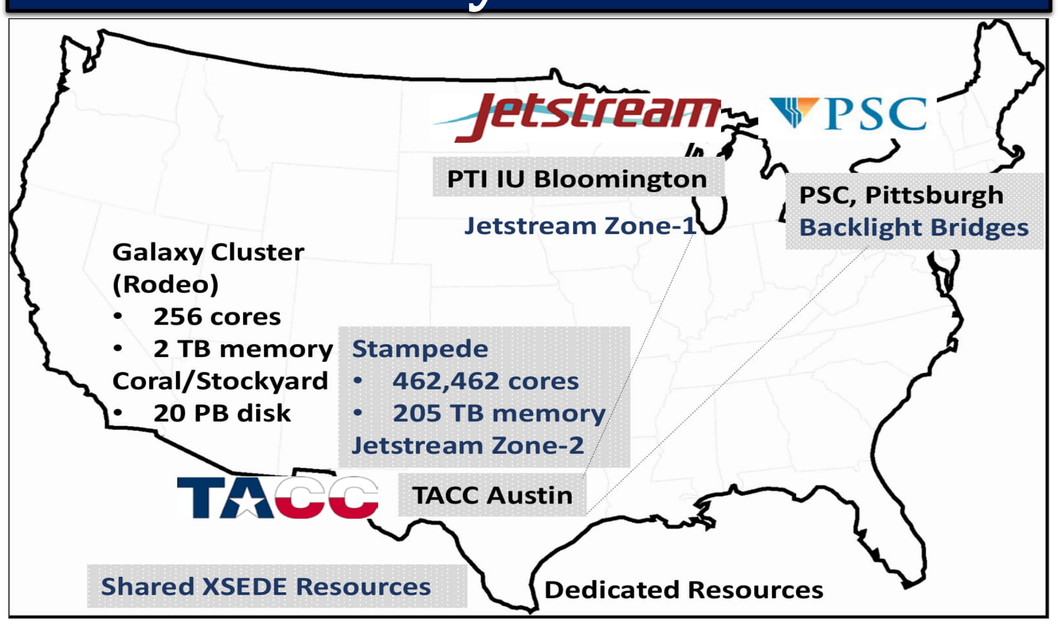
IV. Current Developments

- **Identified** existing GPU based tools such as Racon.
- **Integrated** a GPU based implementation of RACON, a genomic consensus tool to Galaxy Toolshed .
- **Integrated** a GPU-version of Smith-Waterman sequencing tool to Galaxy.
- **Deployed** Galaxy on a Kubernetes managed cluster.

V. Next Steps

- Develop GPU based implementation for existing ML tools for RNN sequencing, using Keras framework.
- Use GPU plugin in Kubernetes to enable GPU access for Galaxy pods.
- Expose GPU metrics to develop resource utilization-aware scheduling policies.
- Develop a Reinforcement-based Machine Learning scheduling framework.
- Develop a distributed data-store using Rook, to enable near data placement based scheduling policies.

Galaxy Centers



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