Imperial College London

Performance guided scheduling in GENIE through ICENI

http://www.genie.ac.uk/

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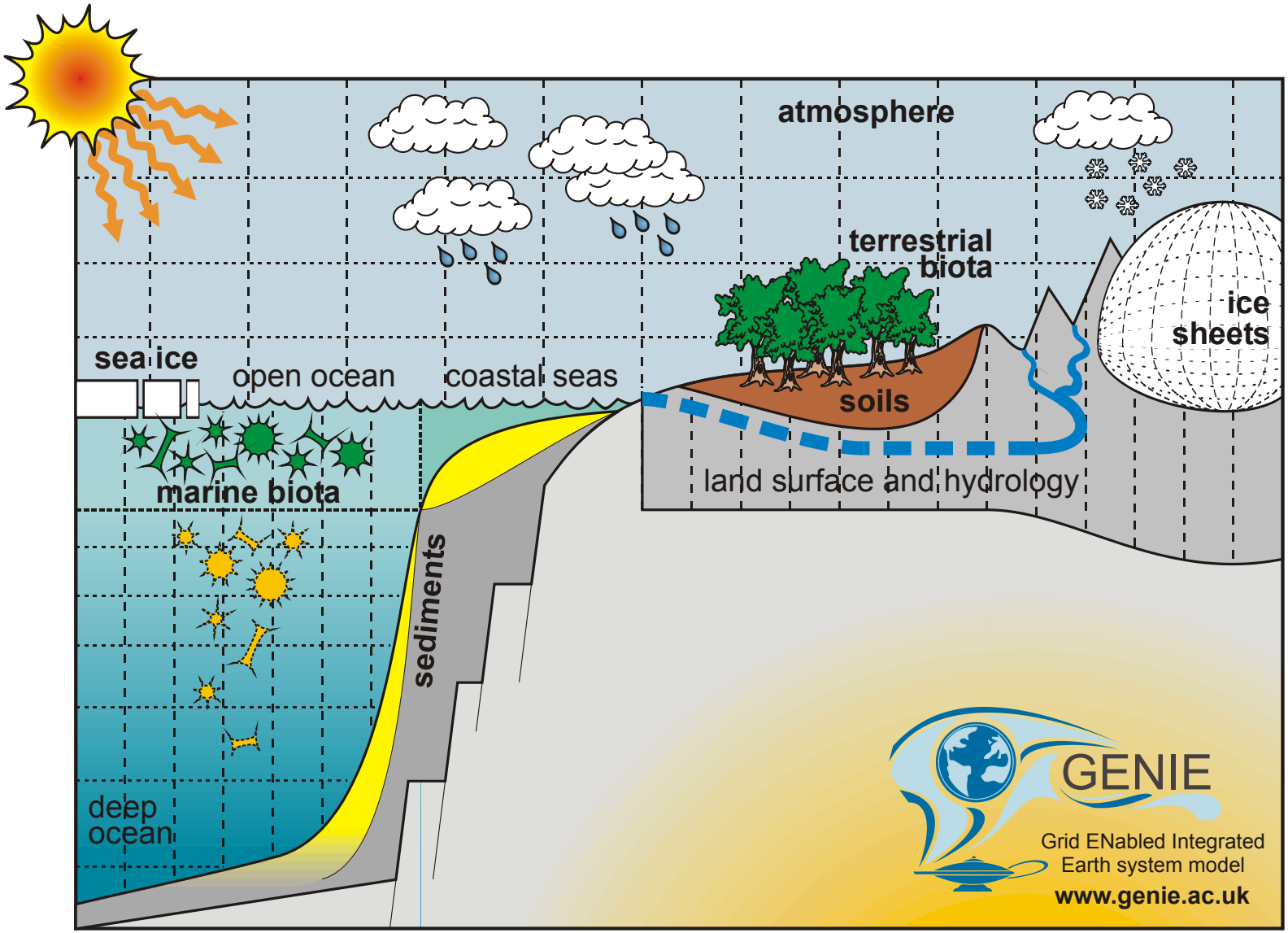
What is GENIE?

NATURAL ENVIRONMENT RESEARCH COUNCIL

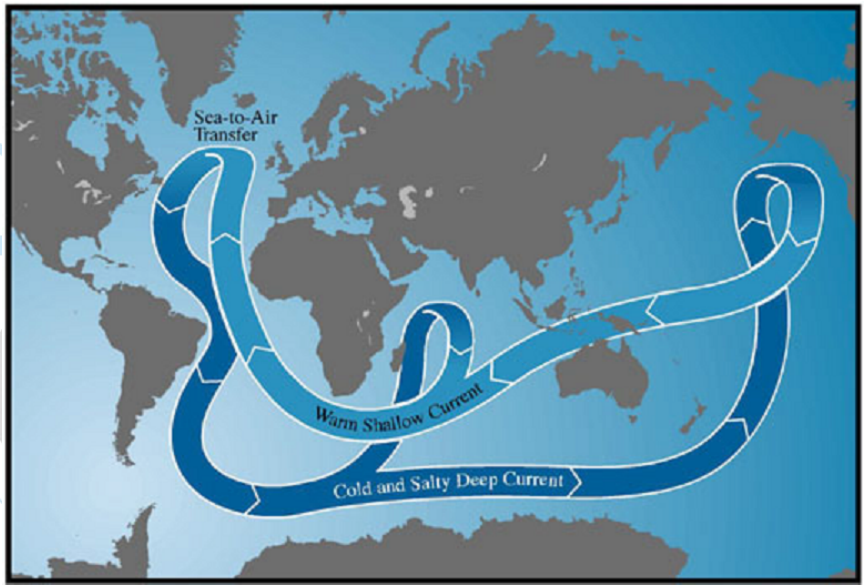
- Grid ENabled Integrated Earth system model.
- Investigate long term changes to the Earth's climate (i.e. global warming) by integrating numerical models of the Earth system.
- e-Science aims:
  - Flexibly couple together state-of-the-art components to form unified Earth System Model (ESM).
  - Execute resultant ESM on a Grid infrastructure.
  - Share resultant data produced by simulation runs.
  - Provide high-level open access to the system, creating and supporting virtual organisation of Earth System modellers.

GENIE model components



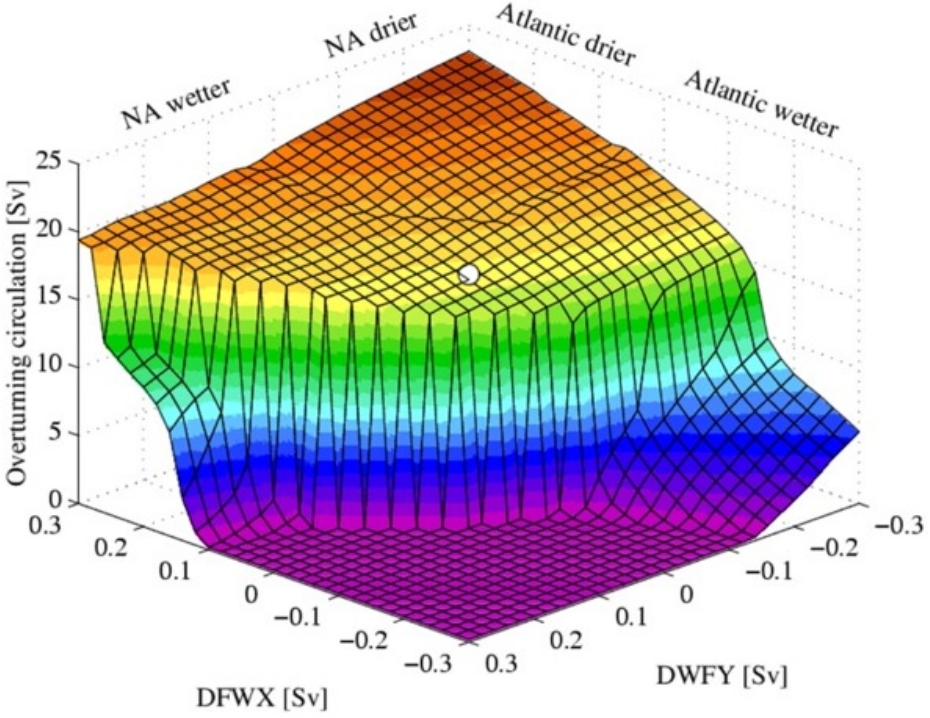
Previously in GENIE…
Investigating the thermohaline circulation

- Investigated influence of freshwater transport upon global ocean circulation
- Performed several parameter sweep experiments, each consisting of ~1000 simulations of a GENIE prototype.

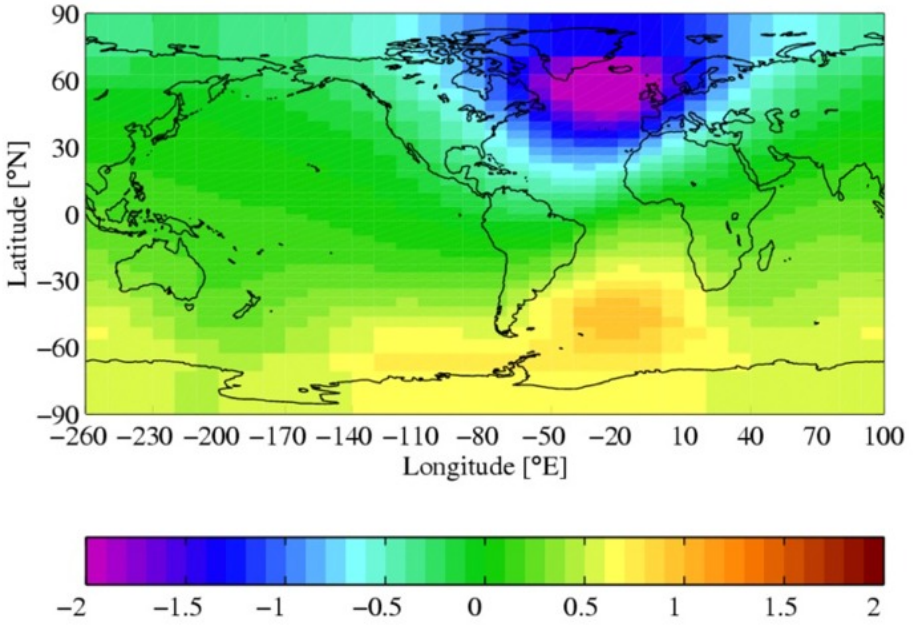


- Used a Grid infrastructure:
  i. Portal – create, submit and manage experiments.
  ii. Condor pool – execute simulations in parallel.
  iii. Database management system – archive and process resultant data.

Previously in GENIE… Scientific achievements



Intensity of the thermohaline circulation as a function of freshwater flux between Atlantic and Pacific oceans and mid-Atlantic and North Atlantic.



Surface air temperature difference between extreme states (off - on) of the thermohaline circulation.

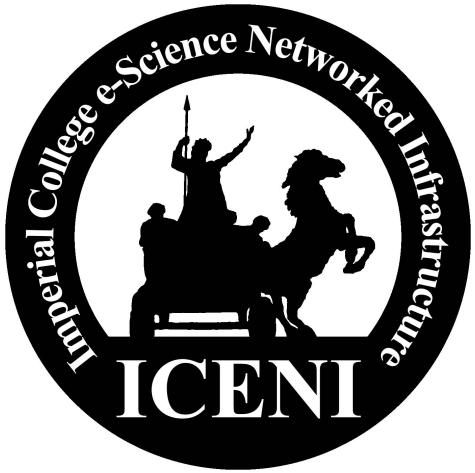
North Atlantic 2°C colder when the circulation is off.

New scientific findings → papers published!

Limitations of Grid infrastructure

- GENIE model hard-coded – cannot use alternative models without recoding.
- Format of input/output data not flexible.
- Parameter space being investigated is fixed.
- True resource brokering not taking place.

Solution:

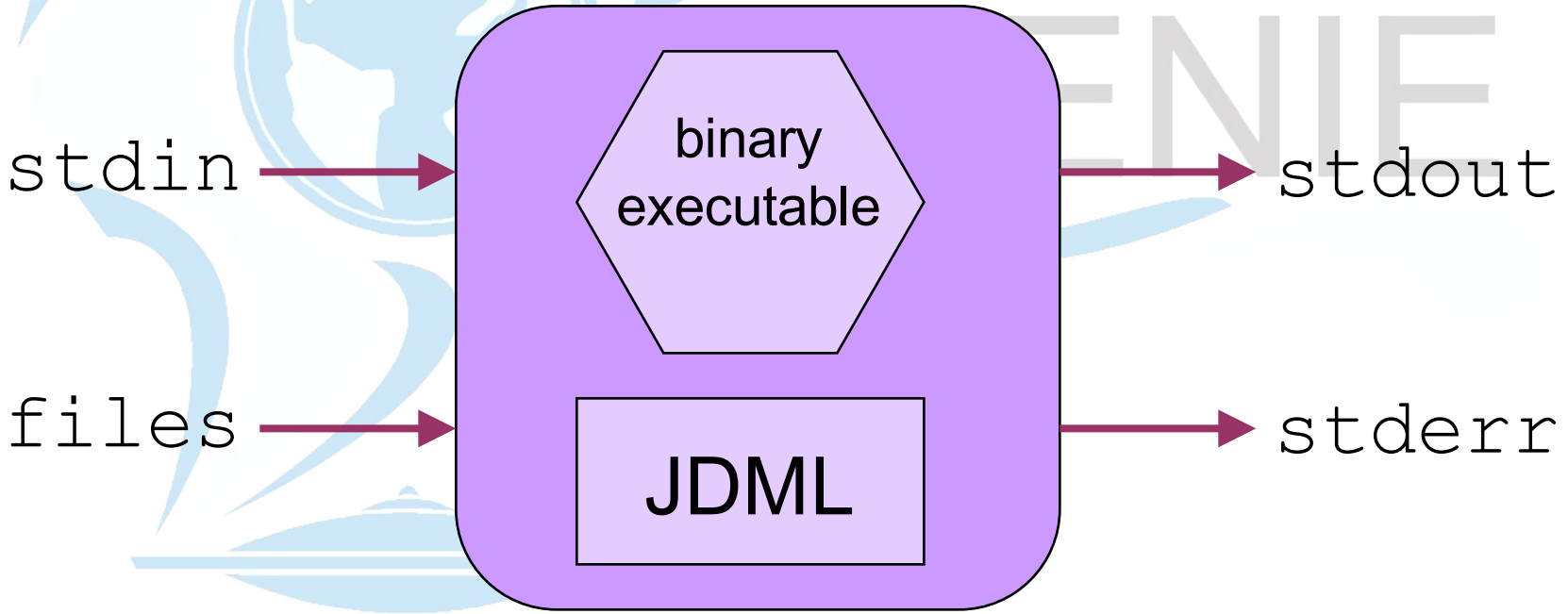


Advantages of ICENI

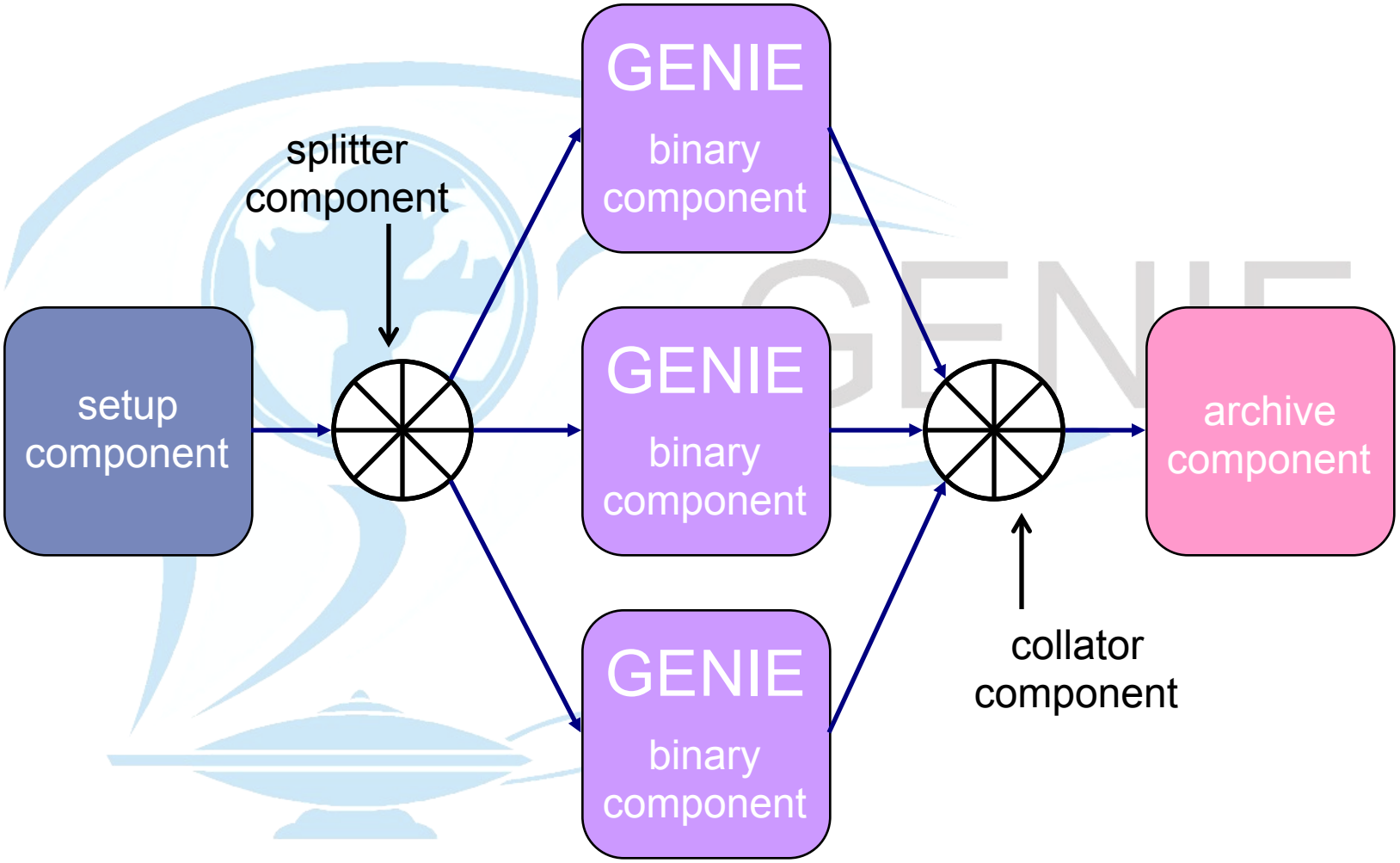
- ICENI Netbeans client allows experiment to be built in a systematic and repeatable way.
- Component based programming model provides flexibility and extensibility.
- Service oriented architecture allows for true resource brokering and Grid enablement of application.

ICENI Binary Component

- Allows you to wrap a binary executable as an ICENI component.

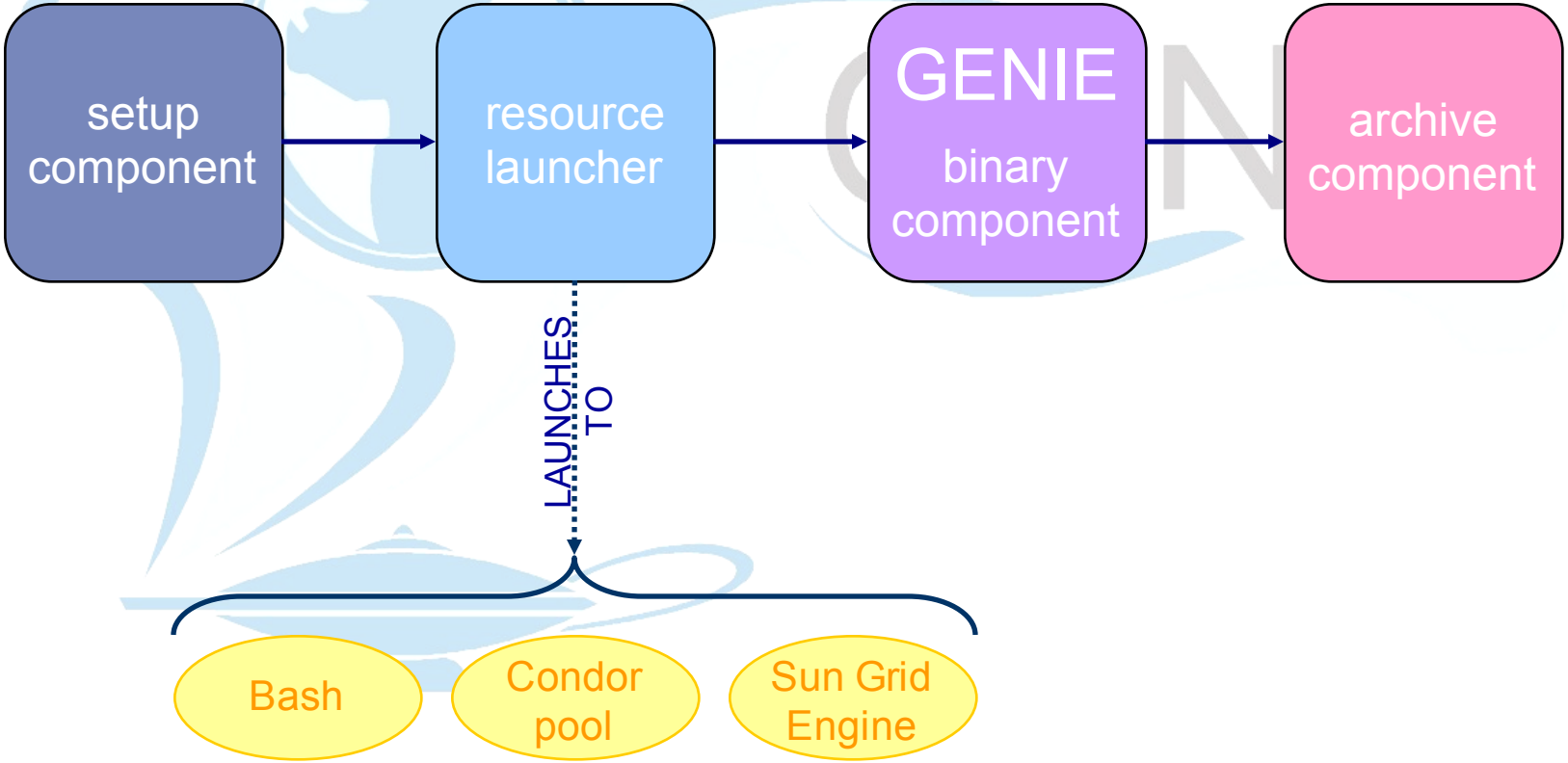


A GENIE experiment as an ICENI application



A GENIE experiment as an ICENI application

- Introduce high-throughput resource launcher…



Performance experiments

- Ran 8 different types of experiments to evaluate performance of ICENI:

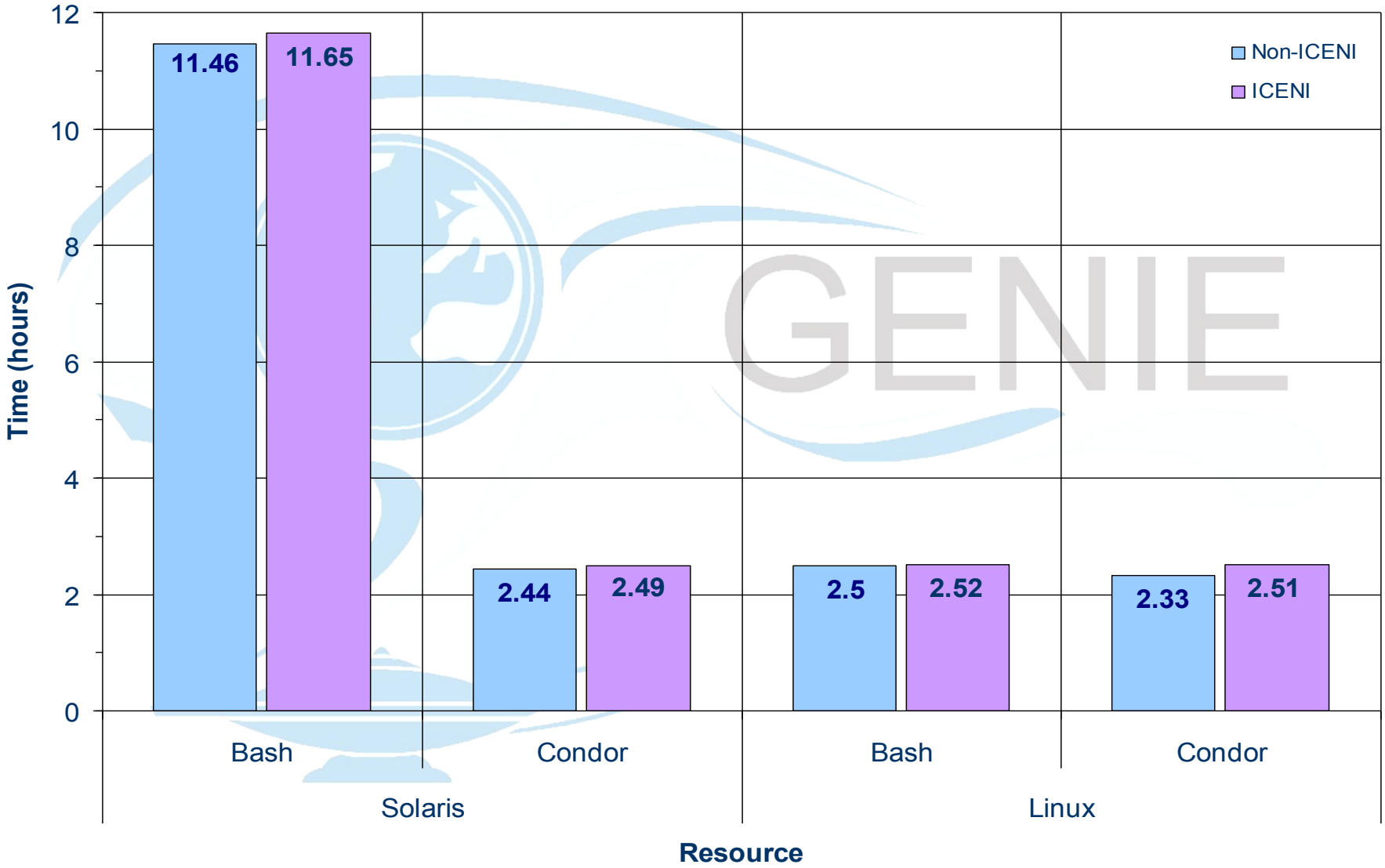
#	Resource	Job Type	Middleware
1	Solaris	Bash	Non-ICENI
2			ICENI
3		Condor	Non-ICENI
4			ICENI
5	Linux	Bash	Non-ICENI
6			ICENI
7		Condor	Non-ICENI
8			ICENI

Solaris
- Shared memory server
- 8 × 900MHz UltraSparc II CPUs
- 16Gb memory

Linux:
- Beowulf cluster
- 16 × 2GHz Intel Dual Xeon CPUs
- 2Gb memory

- Each experiment run several times in order to obtain an average sojourn time.

Performance results



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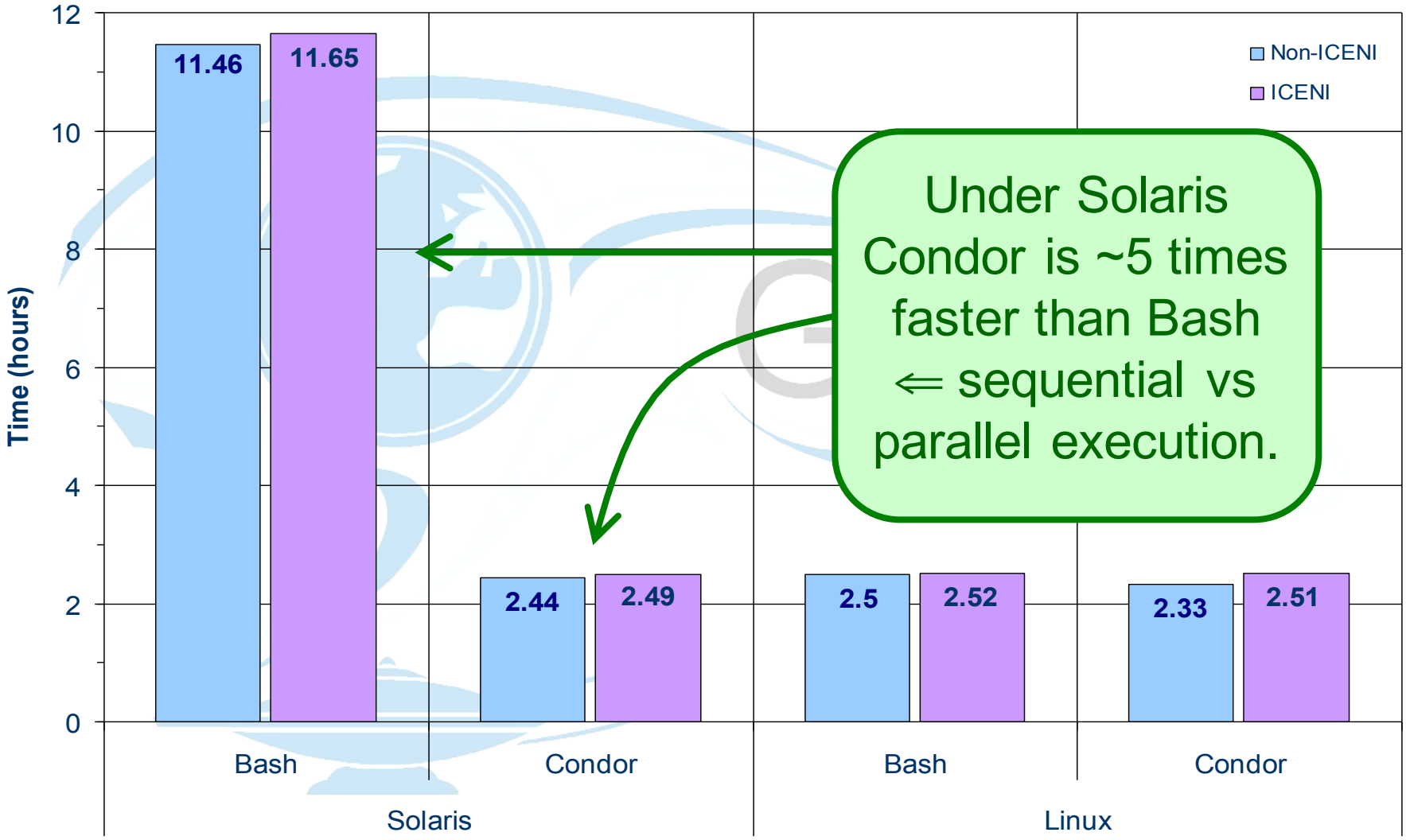

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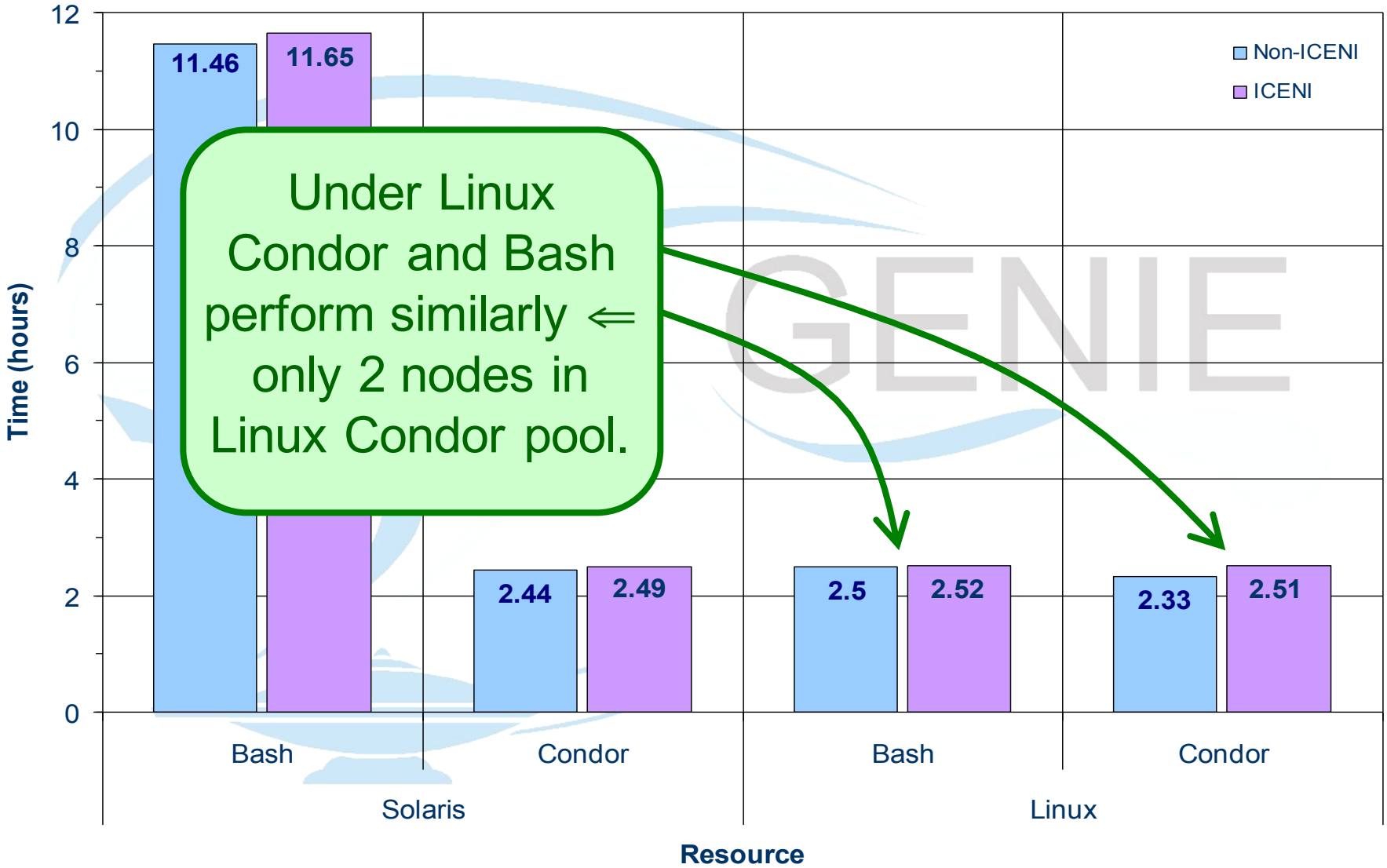

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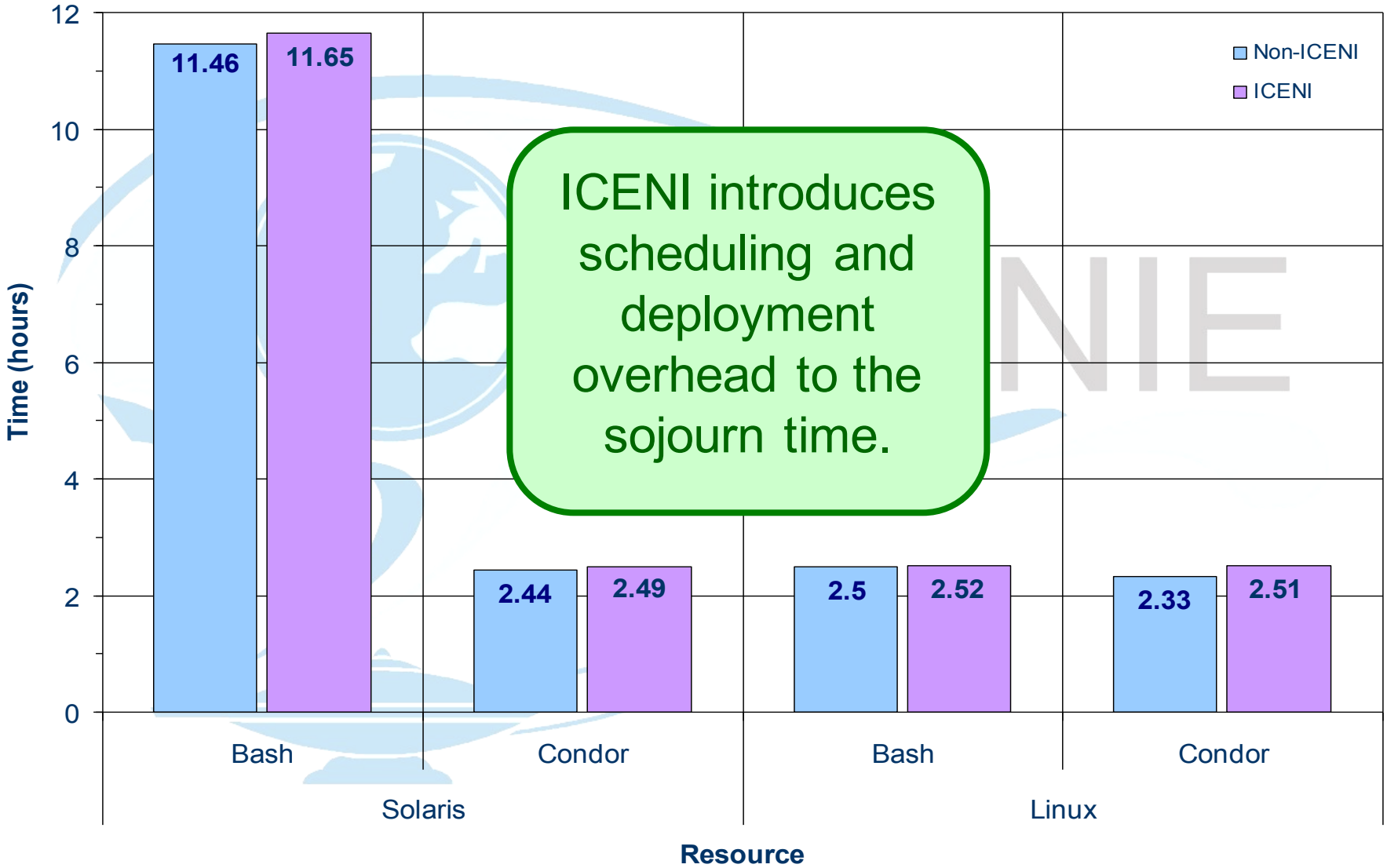

ICENI introduces scheduling and deployment overhead to the sojourn time.

Summary

- Shown how ICENI middleware can be used to launch GENIE experiments.
- Performance overhead is insignificant when compared to advantages of using ICENI to deploy jobs.
- Can create and schedule ensemble experiments across multiple computational resources using true resource brokering.

Future work

- Need to repeat experiments with Sun Grid Engine launcher.
- Need to incorporate component based GENIE model in experiments.
- ICENI is evolving…
  - Adopt new web services.
  - Decouple into separate functionalities.
  - Use GridSAM to launch experiments.

  (please visit the LeSC booth for a demo)

Acknowledgments

- GENIE investigators:

  Prof. Paul Valdes (Bristol), Prof. John Shepherd (SOC, Southampton), Prof. Andrew Watson (UEA), Prof. Melvyn Cannell (CEH Edinburgh), Dr. Anthony Payne (Bristol), Prof. Richard Harding (CEH Wallingford), Prof. Simon Cox (SReSC), Dr. Steven Newhouse (OMII) and Prof. John Darlington (LeSC).

- Recognised researchers:

  Dr. Stephen McGough (LeSC), Andrew Yool (SOC), Dr. Robert Marsh (SOC), Dr. Timothy Lenton (UEA) and Dr. Neil Edwards (Bern).