The Application of Deductive Synthesis to the Rapid Assembly and Re-Assembly of Grid Applications

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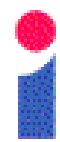


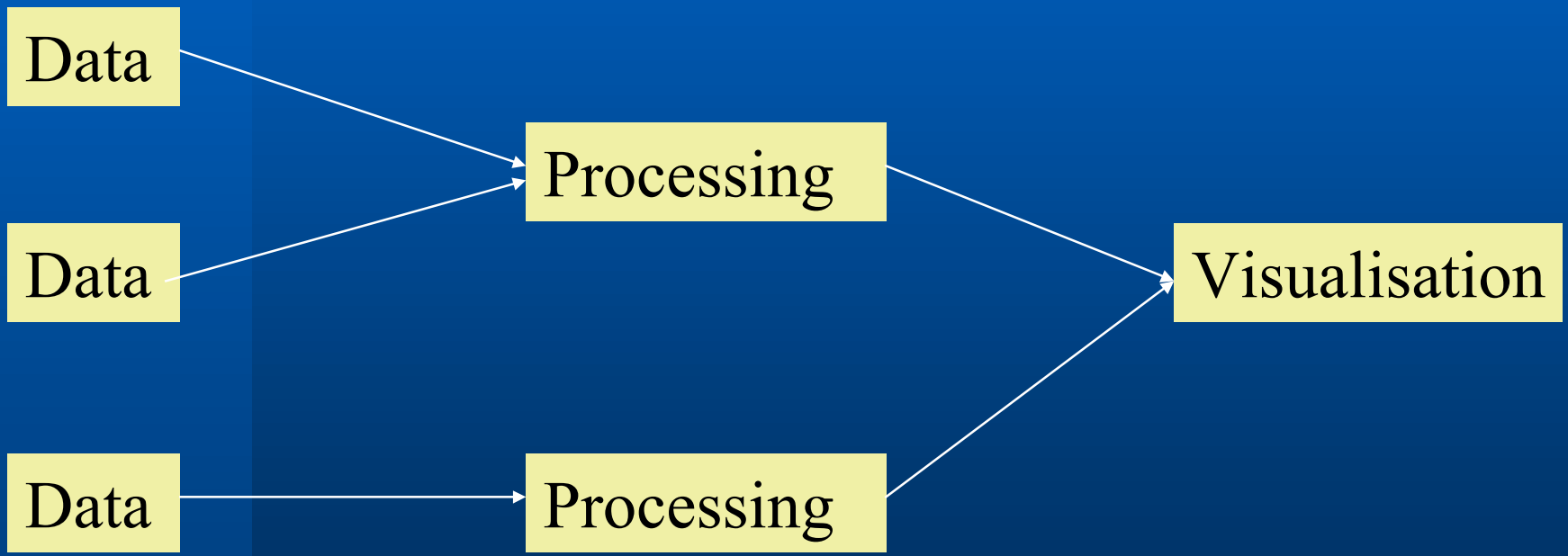
EPSRC Research Project

- Grant Holders: Alan Bundy, Alan Smaill.
- Project Student: Bin Yang.
- Start Date: 1st Jan 2003.
- Duration: 3 Years.
- Part of UK e-Science Programme.

e-Science and the Grid

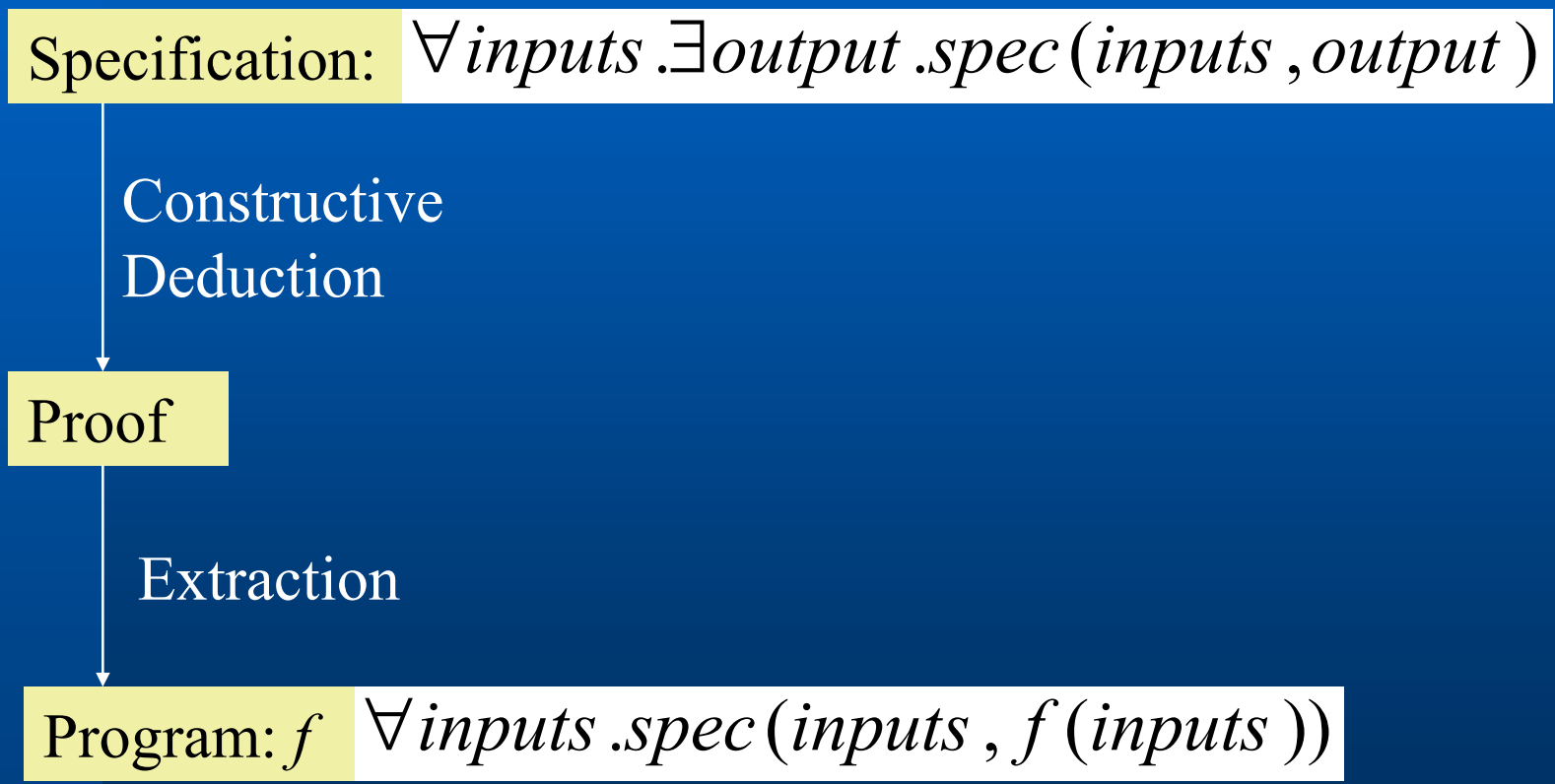
- Data-intensive sciences: particle physics, genomics, Earth satellite monitoring.
- Distributed, high-performance computing; high-bandwidth communications.
- Need for rapid assembly and re-assembly of Grid applications.

Typical Grid Application



Data Transformation

Deductive Synthesis

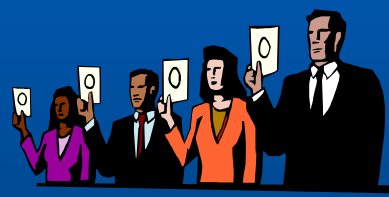


Application to Grid Assembly

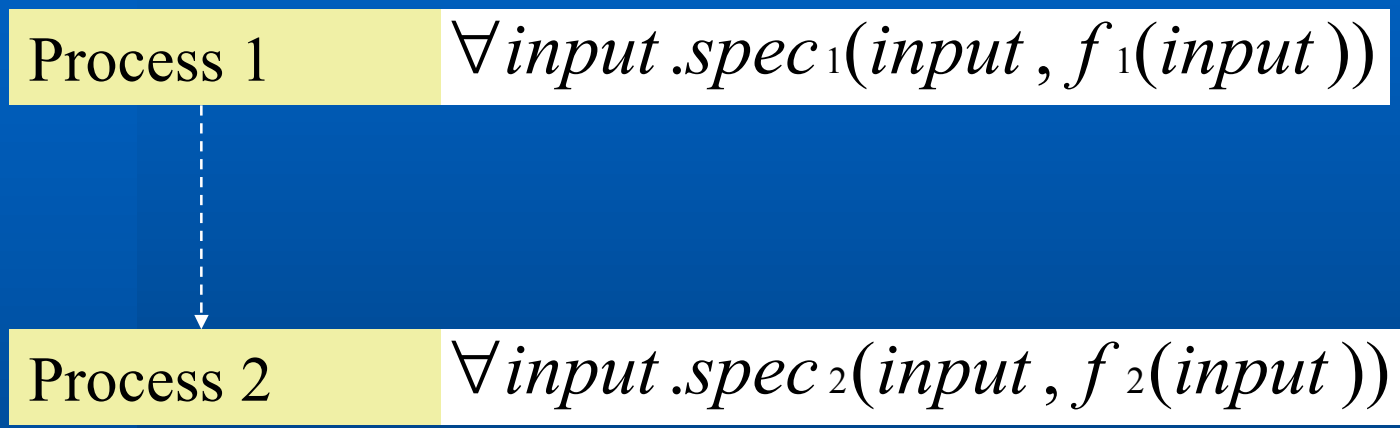
- Specify each Grid service.
- Specify Grid application required.
- Prove specification in constructive logic.
- Extract required Grid application from constructive proof.
- Possibility of user interaction.

Application to Grid Re-Assembly

- Grid application breaks in service...
- …because key Grid service fails.
- Reprove (possibly modified) specification in real time from available services.
- Possibility to use analogy from original proof for total automation.
- Extract revised application.



Simple Example



User specification:

$$\forall input.\exists x.\exists output.spec_1(input, x) \wedge spec_2(x, output)$$

Extracted program: $\lambda x.f_2(f_1(x))$

Conclusion

- Deductive synthesis uses constructive proof to assemble complex objects.
- e-Science requires rapid assembly and re-assembly of Grid applications from Grid services.
- Deductive synthesis can be applied to these tasks.
- Need to explore appropriate formalisms for specification.
- Need to explore automation of proofs.