Grid Service Orchestration using the Business Process Execution Language

Wolfgang Emmerich

Professor of Distributed Computing
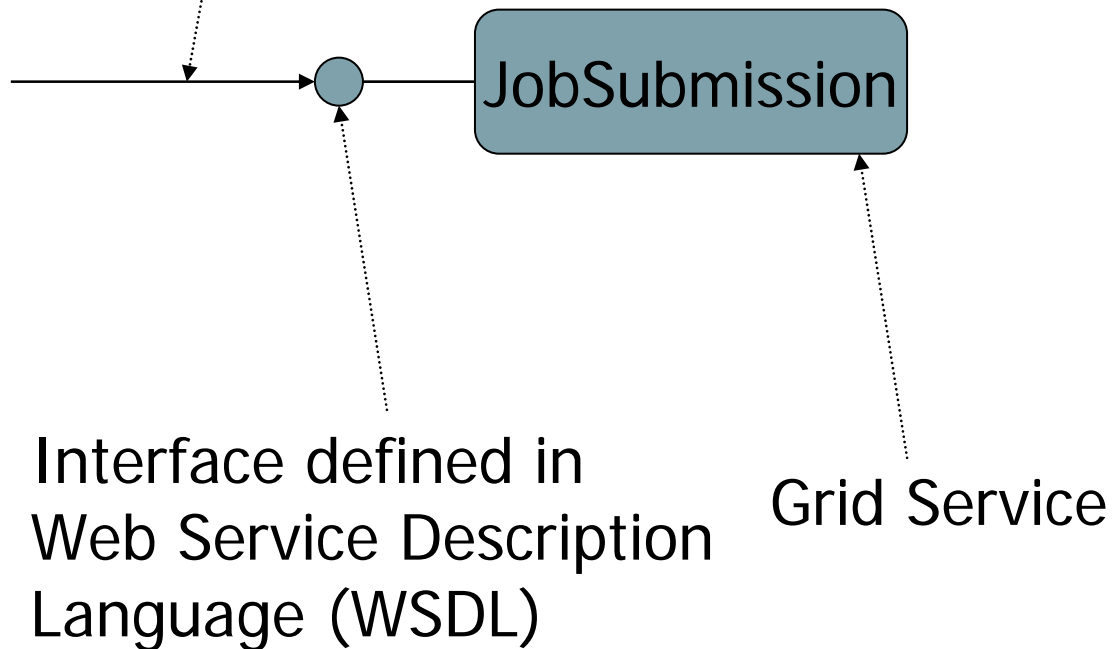
Dept. of Computer Science

University College London

http://sse.cs.ucl.ac.uk

UCL

What is a Grid Service?

Invocation through sending a message
in Simple Object Access Protocol (SOAP) format

JobSubmission

Interface defined in
Web Service Description
Language (WSDL)

Grid Service

Grid service orchestration

- Isolated grid services not very useful
  - Grid services need to be composed into larger workflows
  - This is called *orchestration*

- Grid orchestrations change frequently
  - avoid hard coding them

- Existing scripting languages not suitable
  - Distributed
  - long running
  - concurrent

- Dedicated languages required

Qu
TIFF (Uncom
are neede

Grid service orchestration: A motivating example

FileTransfer

JobSubmission

JobMonitoring

Visualization

FileTransfer
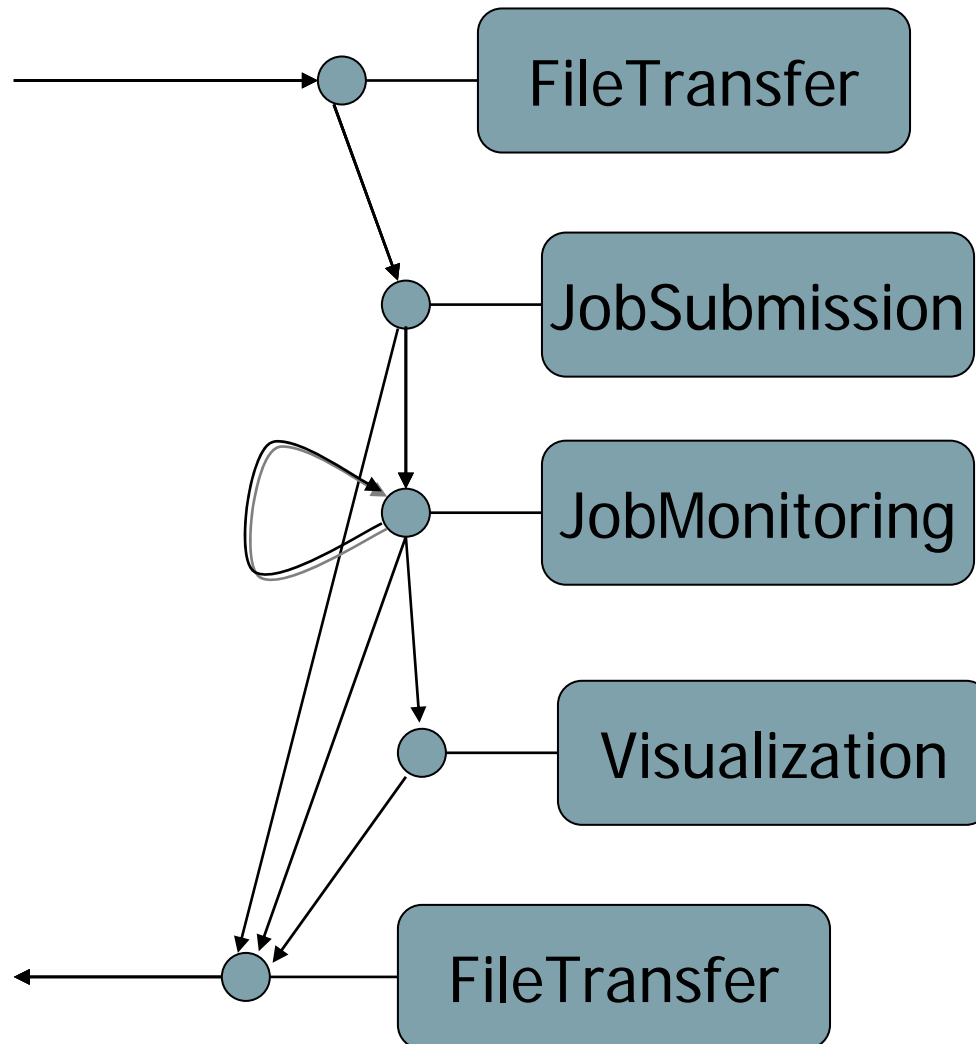
Business Process Execution Language for Web Services

- BPEL4WS arose from the merger of WS Flow Language (IBM) and XLANG (Microsoft)
- Standardised by OASIS
- Over the last year BPEL has become the de-facto standard for web service orchestration
- Products by
  - IBM
  - Microsoft
  - Oracle
  - ActiveEndpoints
  - others

Why use BPEL for grid service orchestration?

- More than a dozen workflow languages for grid computing have been developed over the last decade

- Most of them
  - home grown
  - not standardised
  - built for special application areas

- Commercial and general BPEL environments are likely to be more stable and scalable than any research prototype

BPEL in the OMII Environment
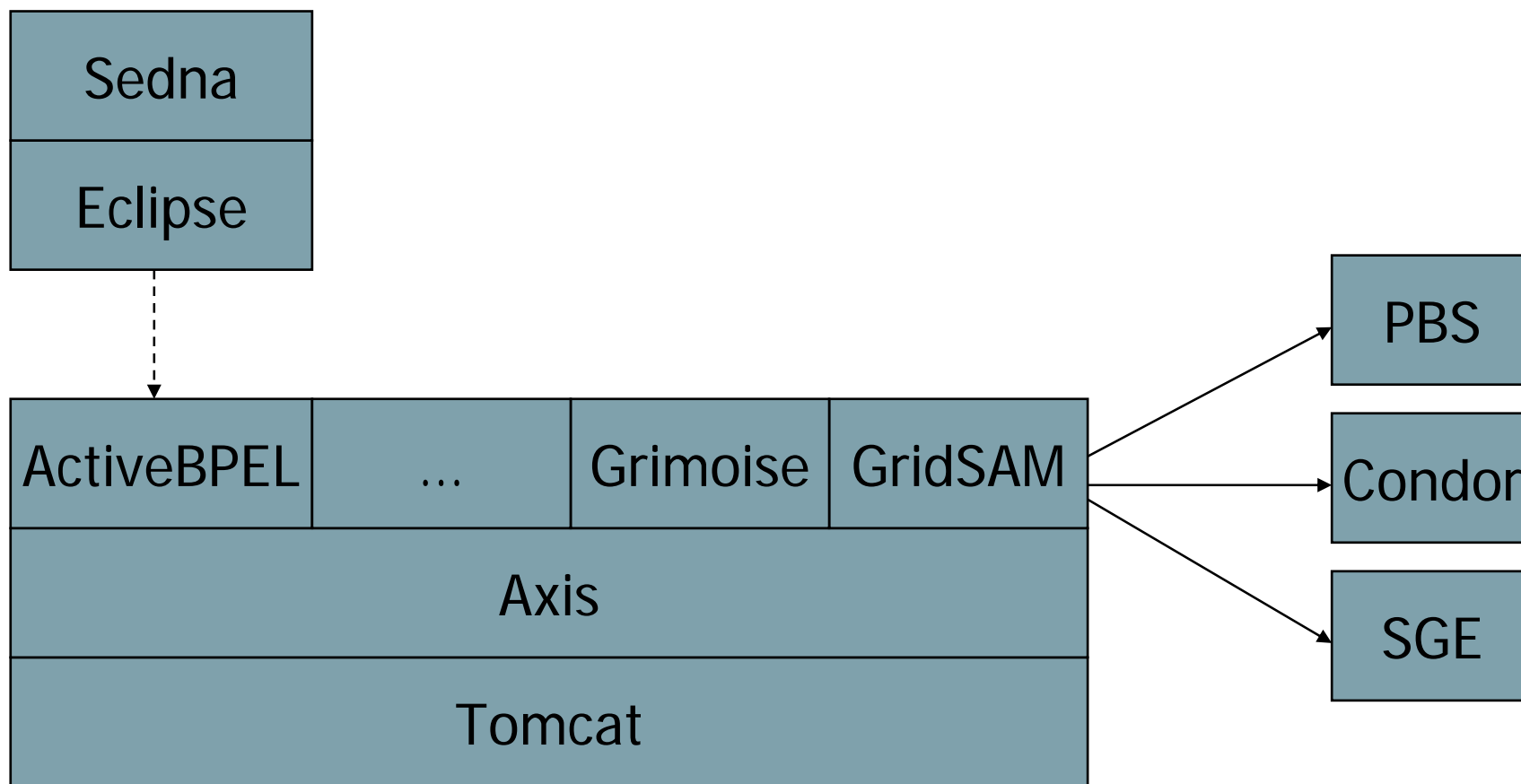
A case study: search for polymorphs

- Crystals may have different polymorphs (shapes): e.g. Carbon:

- For manufacturing design and IP protection it is necessary to know all possible polymorphs.
- Brute-force computational approach:
  - Generate all possible molecule packings
  - Calculate energy of inter-molecular bonding for each
- Defined this computational process in BPEL
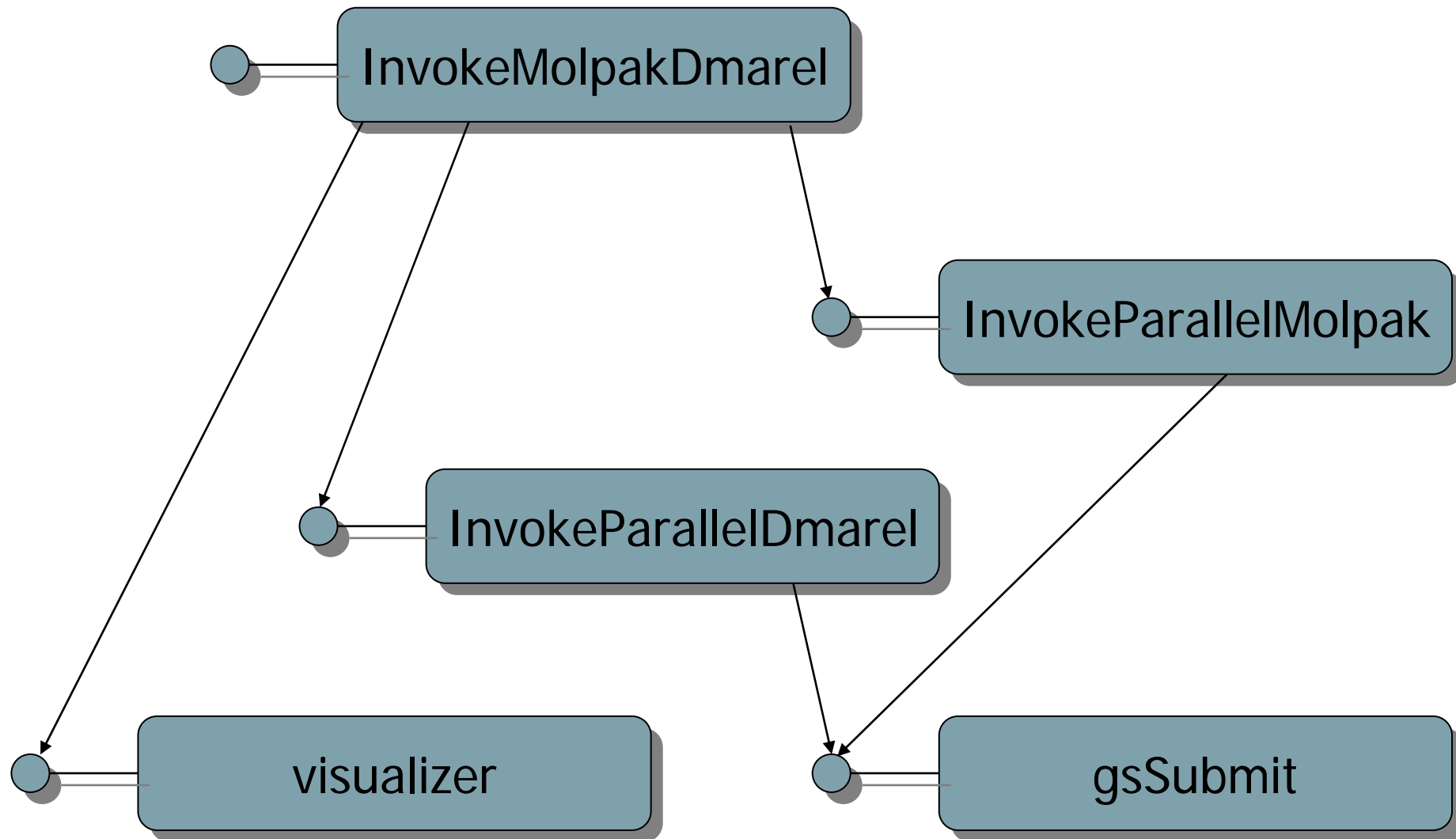
gsSubmit: BPEL Job Submission & Monitoring
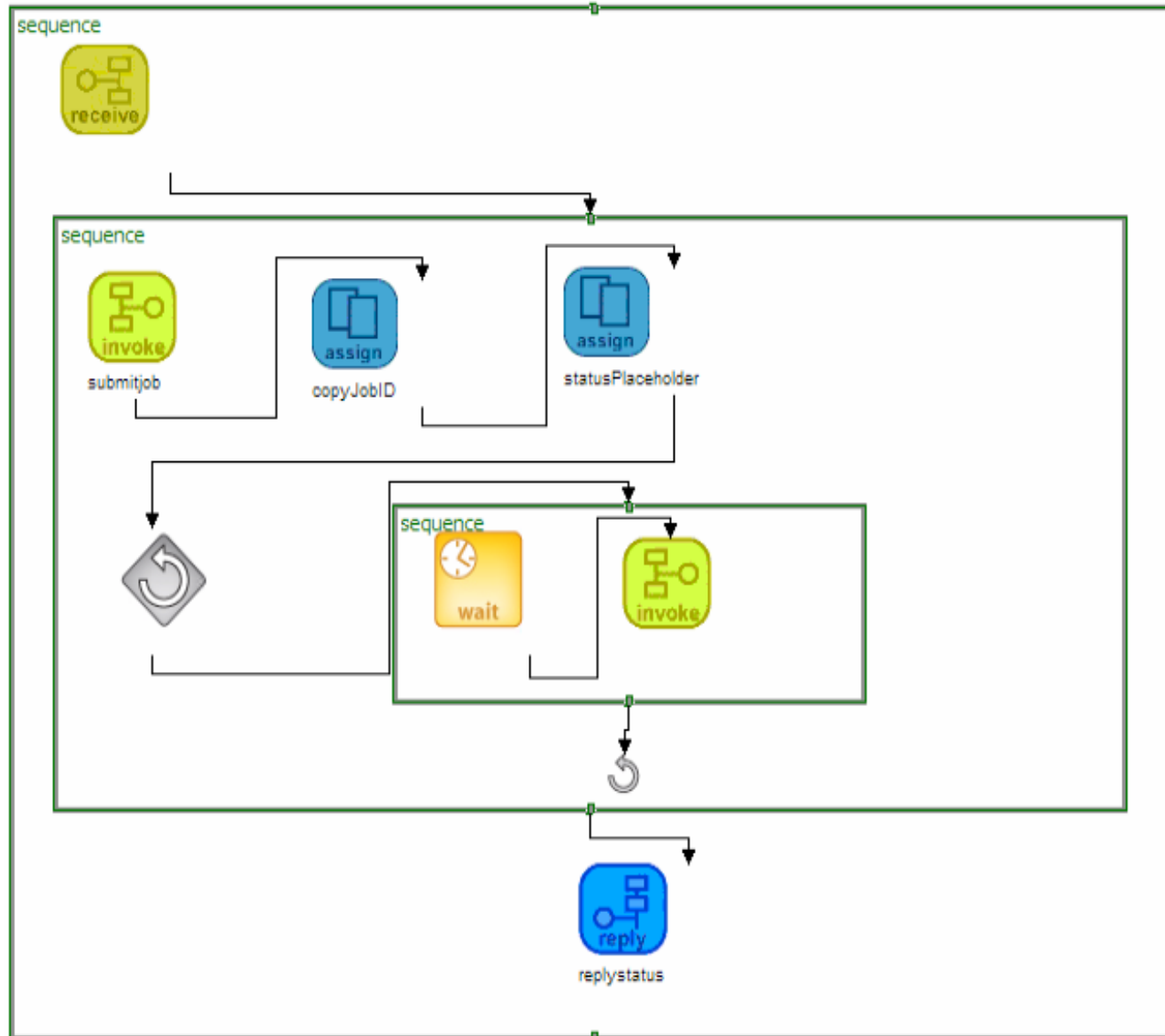
Hierarchical composition in BPEL

Results

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Challenges ahead

- ## Scientific problems

  - Lightweight incentives to resource sharing in grids

  - QoS definition and monitoring

  - Semantic service discovery

- ## Engineering challenges

  - Lightweight security

  - Reliability improvements

  - Usability improvements

  - Availability on commercial BPEL engines

Further information

- W. Emmerich et al. *Grid Service Orchestration using the Business Process Execution Language*. Journal of Grid Computing 3(3-4):283-304. Springer

- Computer cracks crystal structure challenge. http://www.nature.com/news/2005/050919

- OMII: http://www.omii.ac.uk

- OMII-BPEL: http://www.omii.ac.uk/mp/mp_bpel.jsp