Contributing Project Partners

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Why CEM?

• CEM is important in civil and defence sectors.
• Complex electronic systems are key to platforms such as the More Electric Aircraft and the All Electric Ship.
• Response of systems to lightning strikes and EM pulses.
• CEM simulations of these systems are usually computationally intensive.
Why Use the Grid?

• Industrial and academic partners form an “extended enterprise” in which resources are intrinsically distributed, and only partially shared.

• Partners may be prepared to share data, but not the hardware and proprietary software that produces the data.
GECEM Objectives

• To use and develop Grid technology to enable large scale and globally distributed science and engineering.

• Key areas of interest include:
  – Performance and fault tolerance.
  – Secure remote execution.
  – Collaborative analysis and visualisation.
  – Easy and uniform access to resources via a problem-solving environment.
Typical GECEM Mode of Use

• Geometry created at location A (e.g., IGES, STEP, FLITE format).
• Geometry data transferred to location B where corresponding mesh is generated.
• Mesh is transferred to location C where CEM simulation determines solution on mesh.
• Simulation results are visualised collaboratively at multiple locations.
Issues in Remote Execution

• Performance and resilience. Mainly network issues.
• Security. Would like to migrate code to remote resource, execute it, and return results with minimum risk of unauthorised interference.
Issues in Collaborative Analysis and Visualisation

• Two modes of use:
  – “Follow the leader”
  – Independent exploration.

• Asynchronous analysis and visualisation – need to be able to annotate data with metadata (in addition to provenance data).

• Need to create and maintain archive of annotated output data sets.
Issues in PSEs

• PSE provides user access to GECEM data, software, and hardware resources.
  − Data includes geometries, meshes, and output.
  − Software includes mesh generator, CEM solvers, analysis and visualisation tools.
• Provides visual environment for composing applications.
• Provides tools for discovery and monitoring of GECEM Grid.
GECEM Demo

• Based on Globus Toolkit 2 (GT2).
• Uses UK e-Science Certificate Authority.
• Initiates GECEM session from client (a laptop) via script.
• Generates mesh and PML layer at UWS.
• Sends mesh to WeSC.
• Migrates CEM radar cross-section solver (RDS) to WeSC.
• Executes CEM solver at WeSC
• Send output back to client where it is visualised.
Use of GT2

• The following GT2 commands are used:
  – `grid-proxy-init`
  – `grid-copy-url` for copying files
  – `globus-job-run` for controlling remote execution

• We aim to move to a service-based architecture using GT3 in the near future.
The Output

- Status results are returned to the client throughout execution.
- Results of CEM simulation are returned to client and visualised.
Visualisation
Future Work

- The demo maps out the basic features of the GECEM Grid but there is a lot of work to do in all areas.
- Migration from GT2 to service-based GT3.
- Incorporation of Grid resources at Singapore Institute of HPC into GECEM Grid.
- PSE needs to be developed.
- Collaborative visualisation software need to be evaluated and developed if necessary.
- Secure migration and execution.
Concluding Remarks

• GECEM aims to demonstrate a globally distributed extended enterprise based on Grid technologies.

• A simple script-based demonstration of the main features of the GECEM Grid has been developed.

• Need messaging system through which services can interact.

• GECEM PSE will control all aspects of the users access to GECEM resources.