# Programmable and Modifiable Grid Applications

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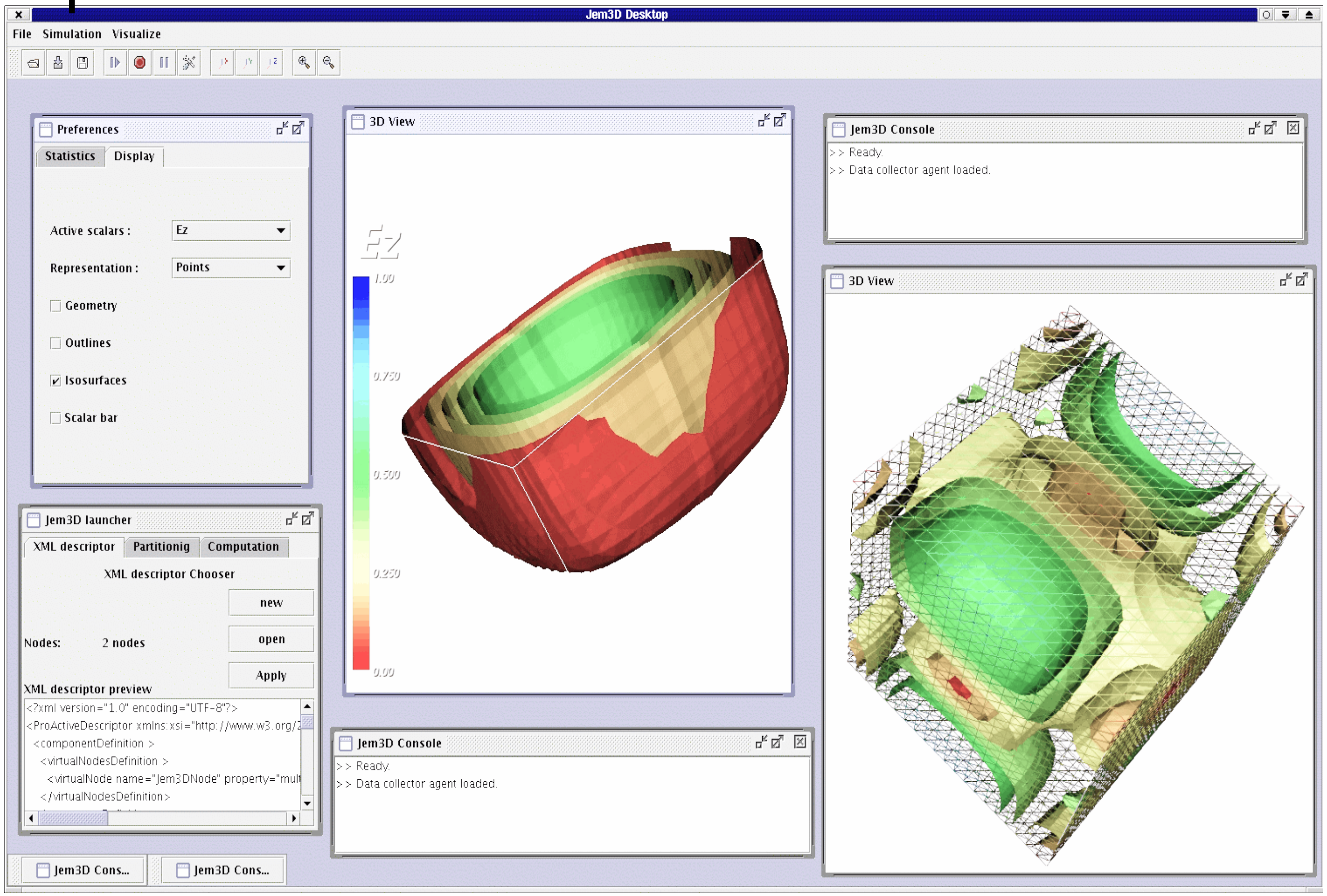
# Context

- Problem
  - How to develop programmable and modifiable grid applications
- Solution approach
  - Component-based software development
- Ingredients
  - Component model: *ProActive/Fractal*
  - Design approach (methods, guidelines, modelling languages, patterns, etc)

# Jem3D

- 3D electromagnetic application
- Finite volume solver for Maxwell 3D equations



Active scalars : Ez

Representation : Points

□ Geometry

□ Outlines

☑ Isosurfaces

□ Scalar bar

Nodes: 2 nodes

XML descriptor preview

```
<?xml version="1.0" encoding="UTF-8"?>
<ProActiveDescriptor xmlns:xsi="http://www.w3.org/2
  <componentDefinition >
    <virtualNodesDefinition >
      <virtualNode name="Jem3DNode" property="mult
    </virtualNodesDefinition>
```

```
>> Ready.
>> Data collector agent loaded.
```

```
>> Ready.
>> Data collector agent loaded.
```

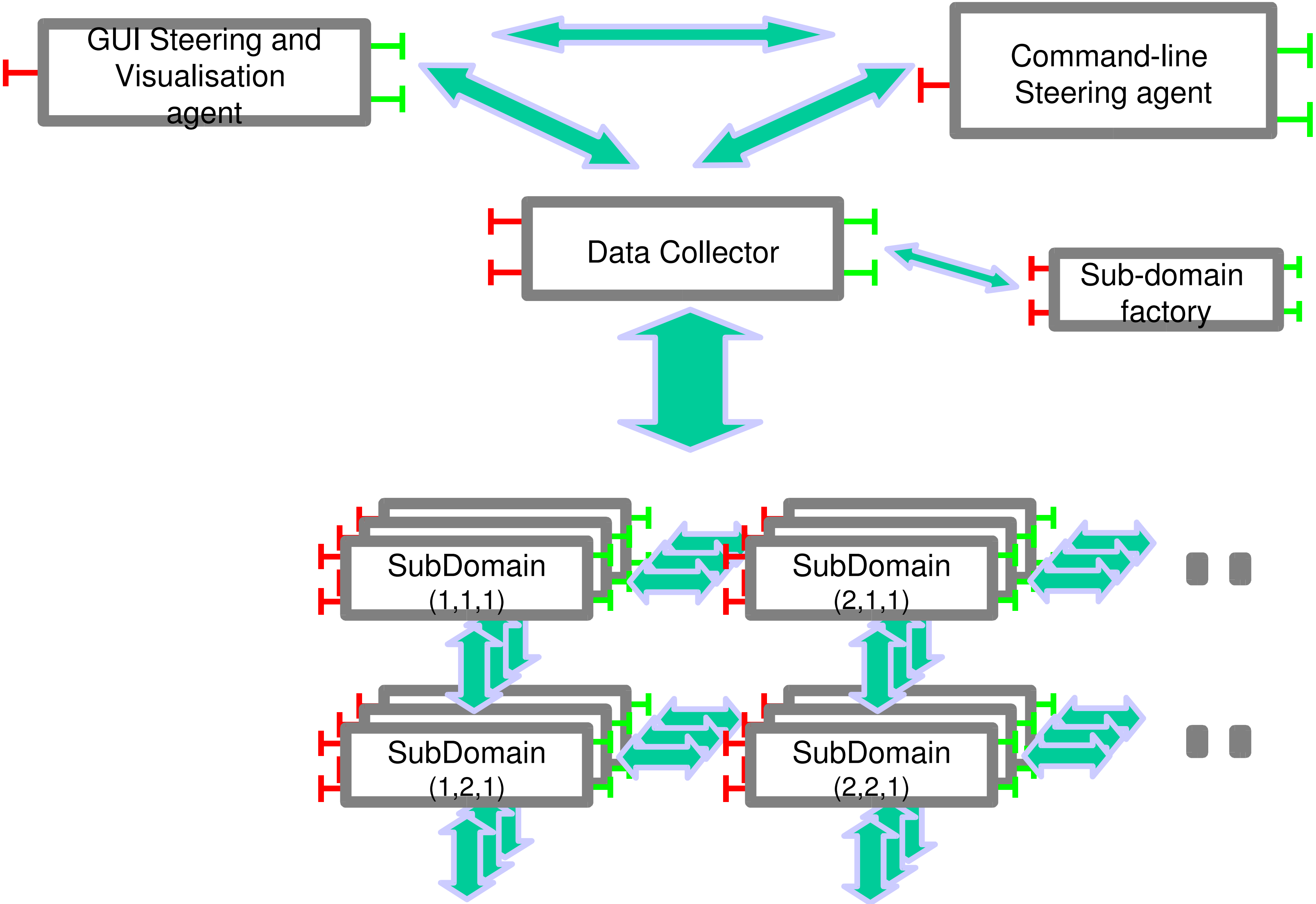
# Jem3D

- Evolved from initial version in Fortran MPI (CAIMAN team @INRIA)

- Based on a Java, object-oriented framework and *ProActive* library

- Parallelisation following a “geometrical decomposition” pattern

# Initial Component Architecture



# Initial Experience

- Componentisation process
  - Architecture recovery dominated effort
  - Little additional code

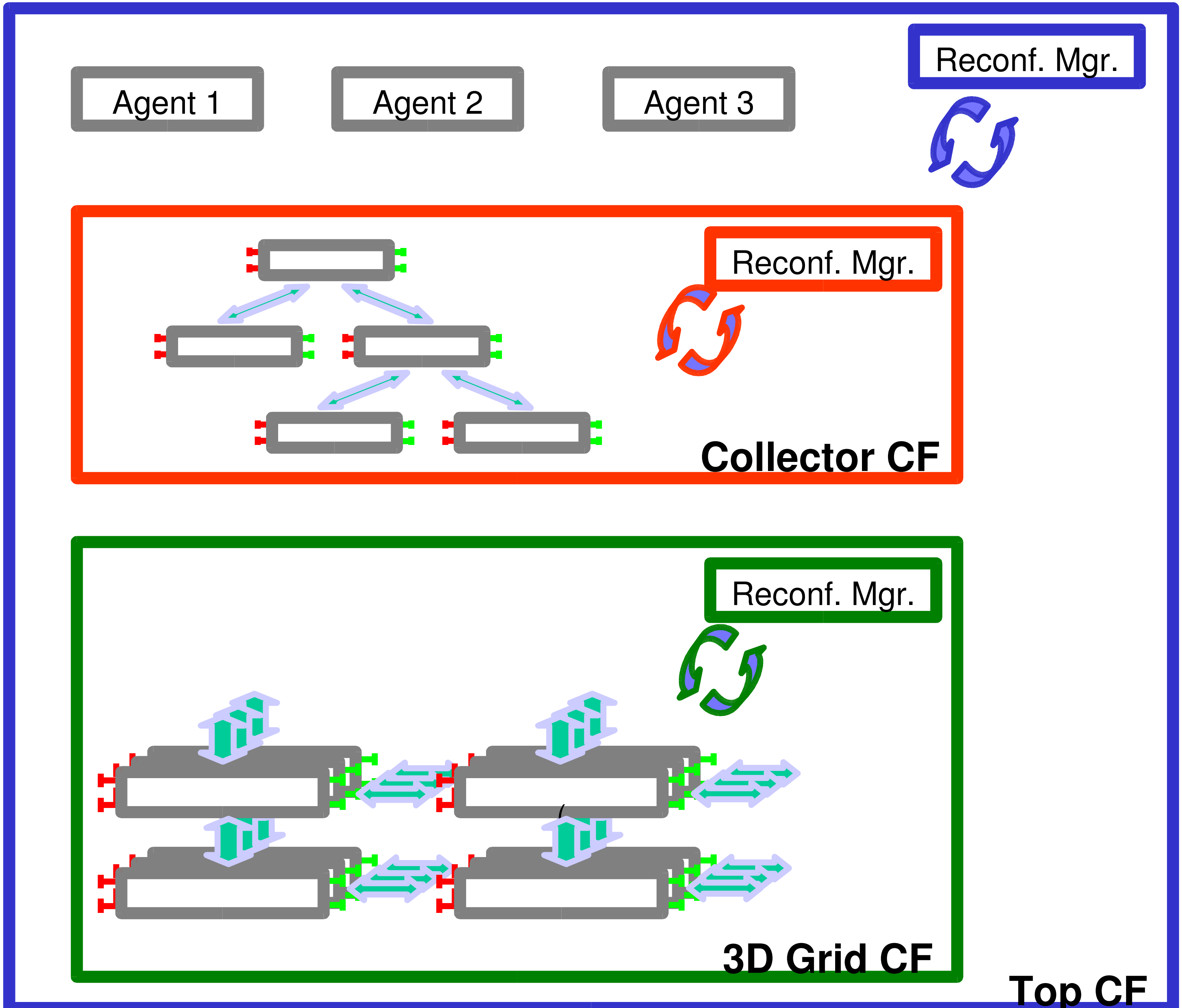
- Immediate benefits
  - Main functional units and communication paths are explicit:
    - understandability, opportunities for design improvement
  - Implementation dependencies removed
    - replaceability, reusability

# On-going Work

- Current architecture has *no* support for:
  - dynamic reconfiguration
  - exploiting 3D geometrical decomposition pattern

- Apply Component Framework-based design approach
  - Multiple, domain-specific CFs
  - CF-based reconfiguration
    - Allows designers to exploit CF-specific knowledge
    - CFs are represented as composite components with CF-specific reconfiguration managers

# CF-based Jem3D



# Summary

- Programmability/modifiability in Grid applications
- Approach
  - ProActive/Fractal component model
  - Design approach based on CFs
- Initial experiments with Jem3D
- On-going/future work
  - Restructure towards a CF-based architecture
  - Study performance impact