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# Meaning and Behaviour in Grid Oriented Components

**Anthony Mayer**, Stephen McGough, Murtaza Gulamali, Laurie Young, Jim Stanton, Steven Newhouse and John Darlington

London e-Science Centre,  
Imperial College, UK



# Workflow Questions



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- “**From where**” does workflow originate?
  - Separation of concerns & meta-data
  - Composition, Collaboration & Orchestration
  - Impacts on the programming model
- “**How**” shall we utilise it?
  - Grid middleware
  - Scheduling opportunities



# A Grid Programming Model: Components & Services



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- Component
  - “A unit of composition in which all context dependencies are explicit” -Szypierski
  - “... A component has a clearly defined interface and conforms to a prescribed behaviour common to all components within the architecture”- CCA
- Service
  - “Component performing a task”
  - (of *Web Services*) “... a software system URI, whose public interfaces are defined and described using XML...” – W3C



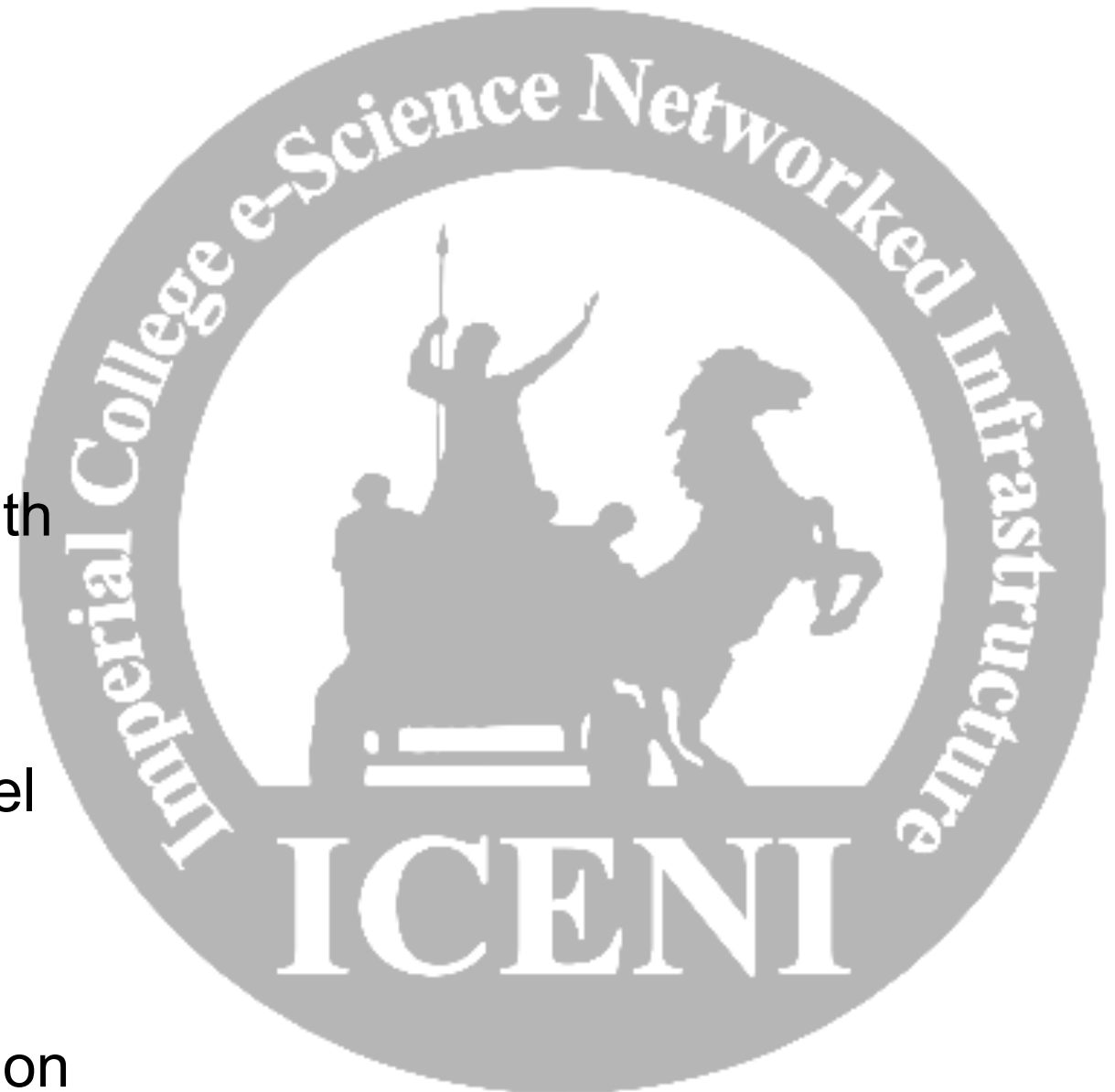
# ICENI

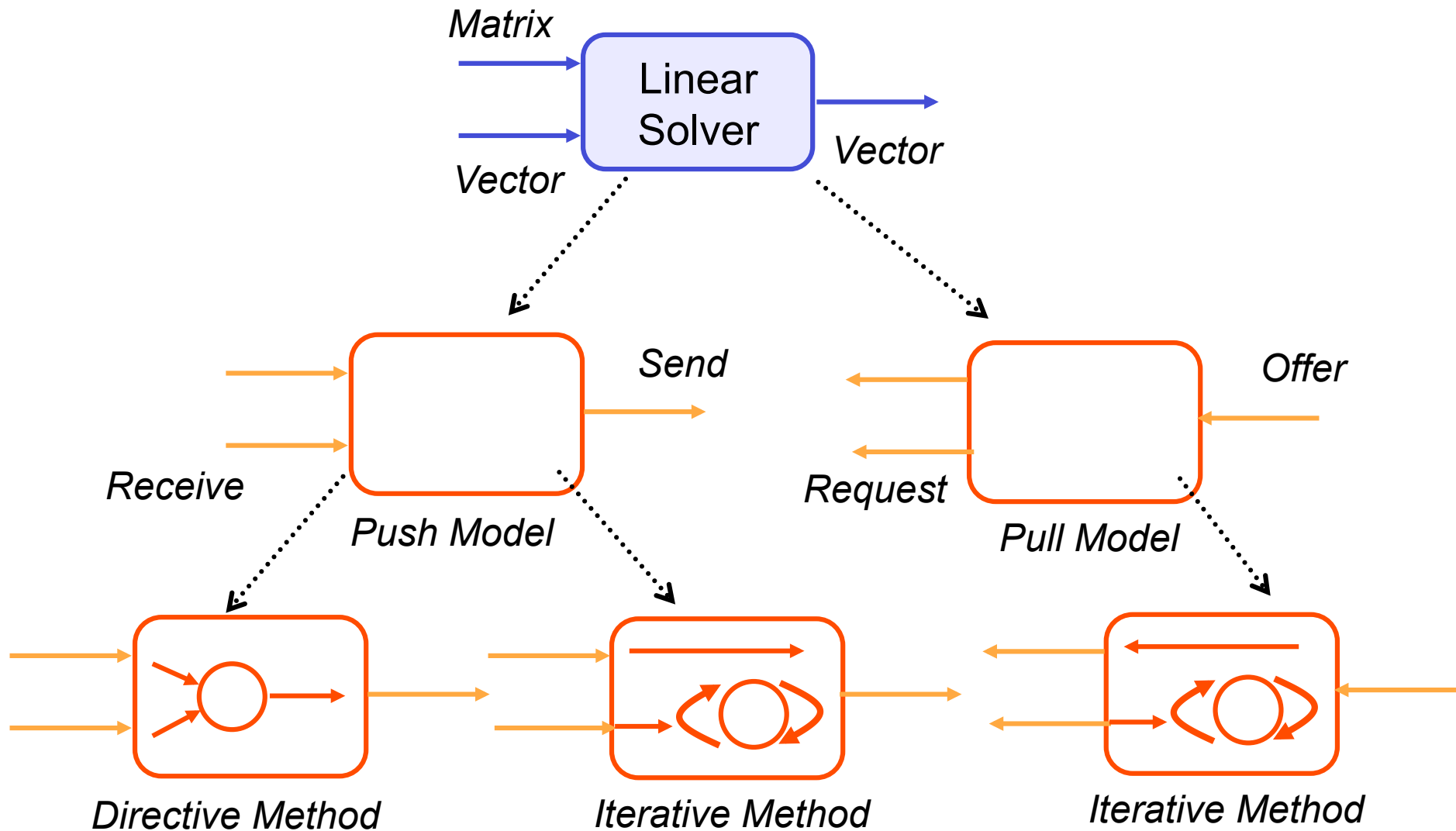


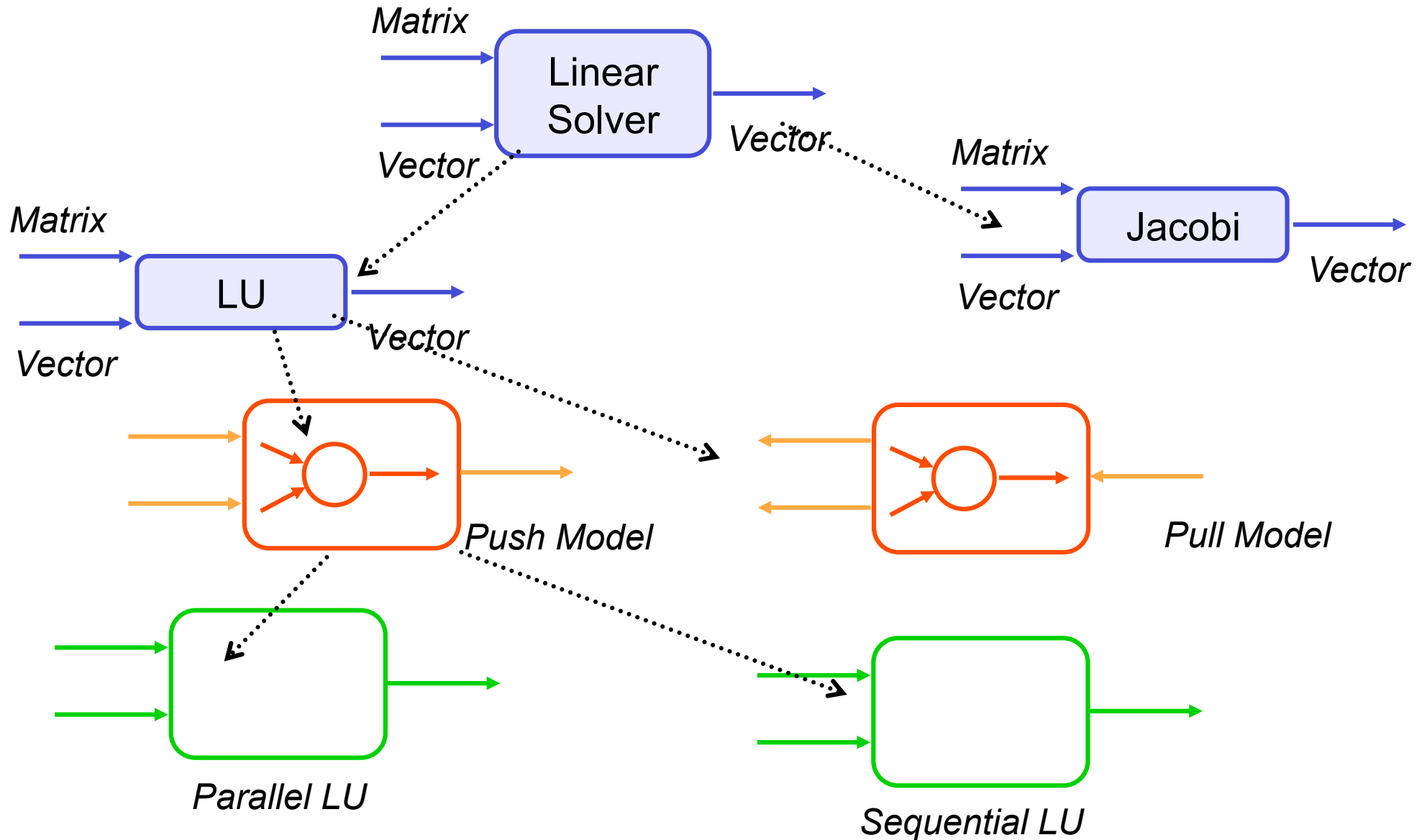
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- **IC E-Science**  
**N**etworked  
**I**nfrastructure
- Interoperable and Integrated Grid Middleware
- Associate meta-data with Grid Services
- Federated Services described by Usage Policy and Service Level Agreement
- Foundation for higher-level Services and Autonomous Composition



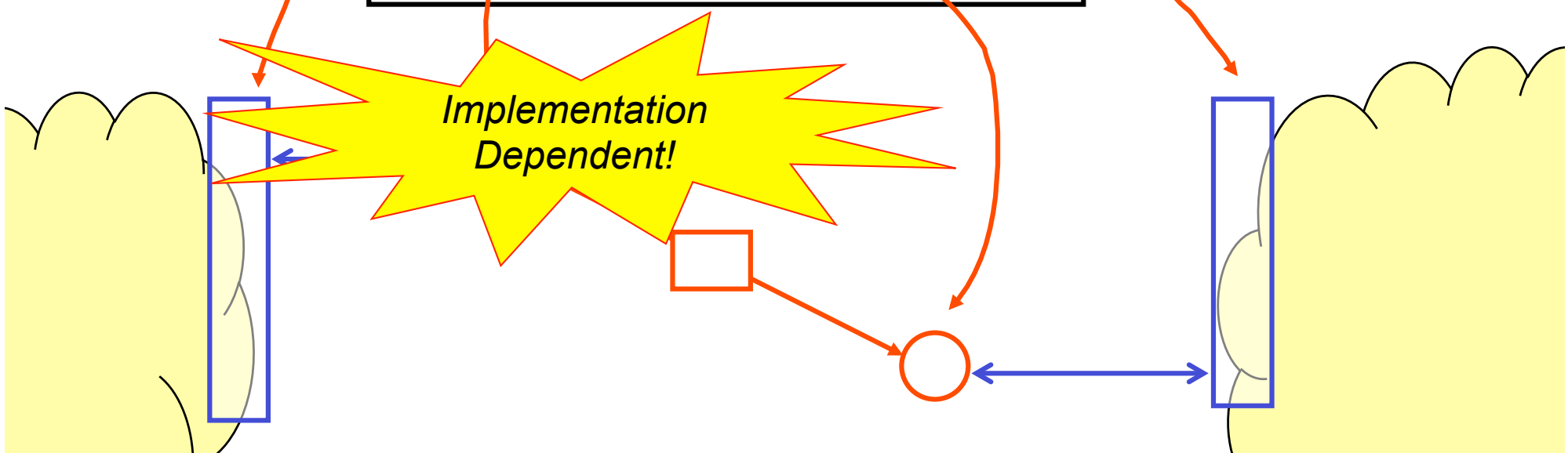




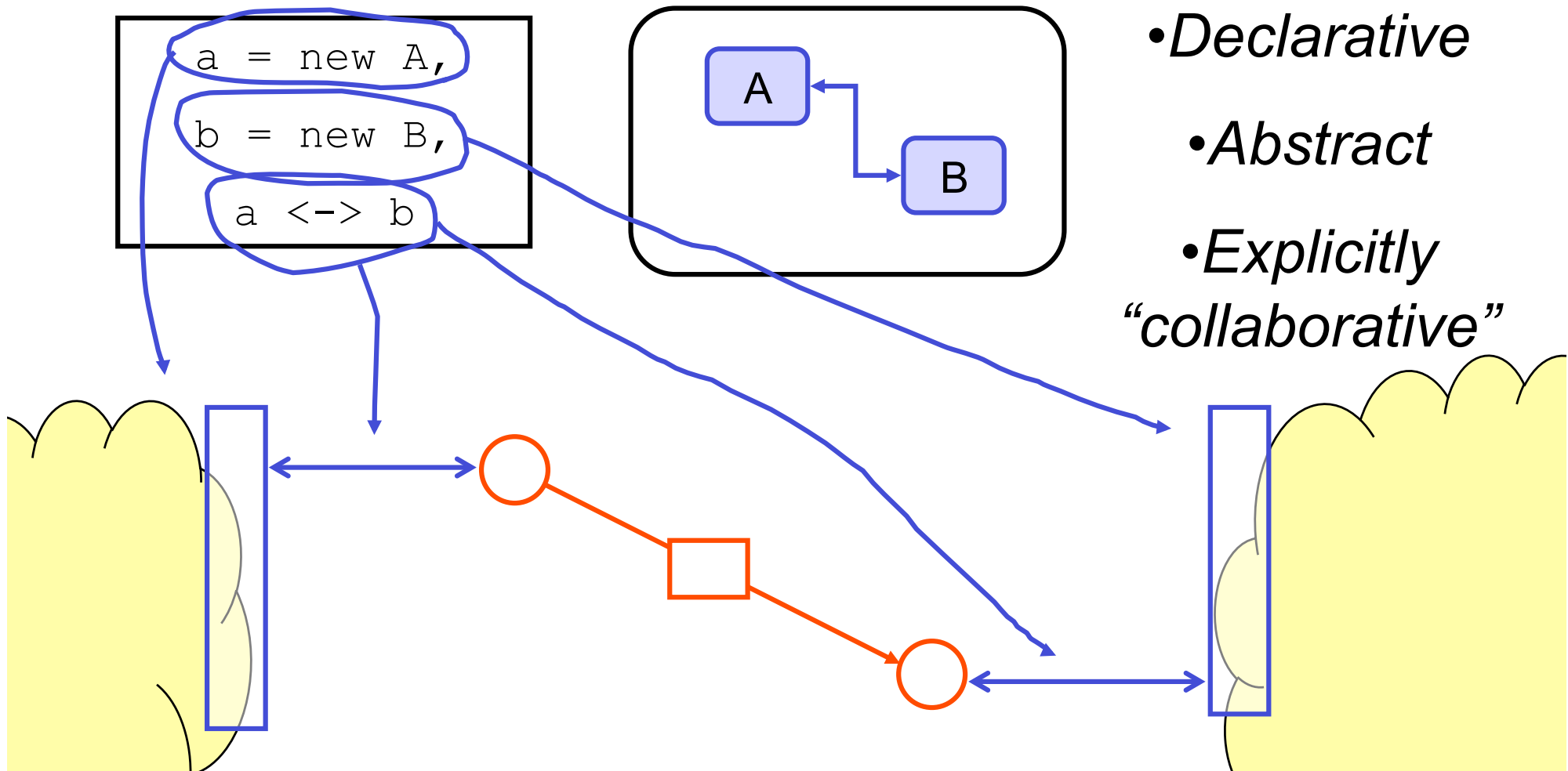
- User defined script – explicit workflow

```
a = new A;  
b = new B;  
a.doWork();  
b.getFrom(a);
```

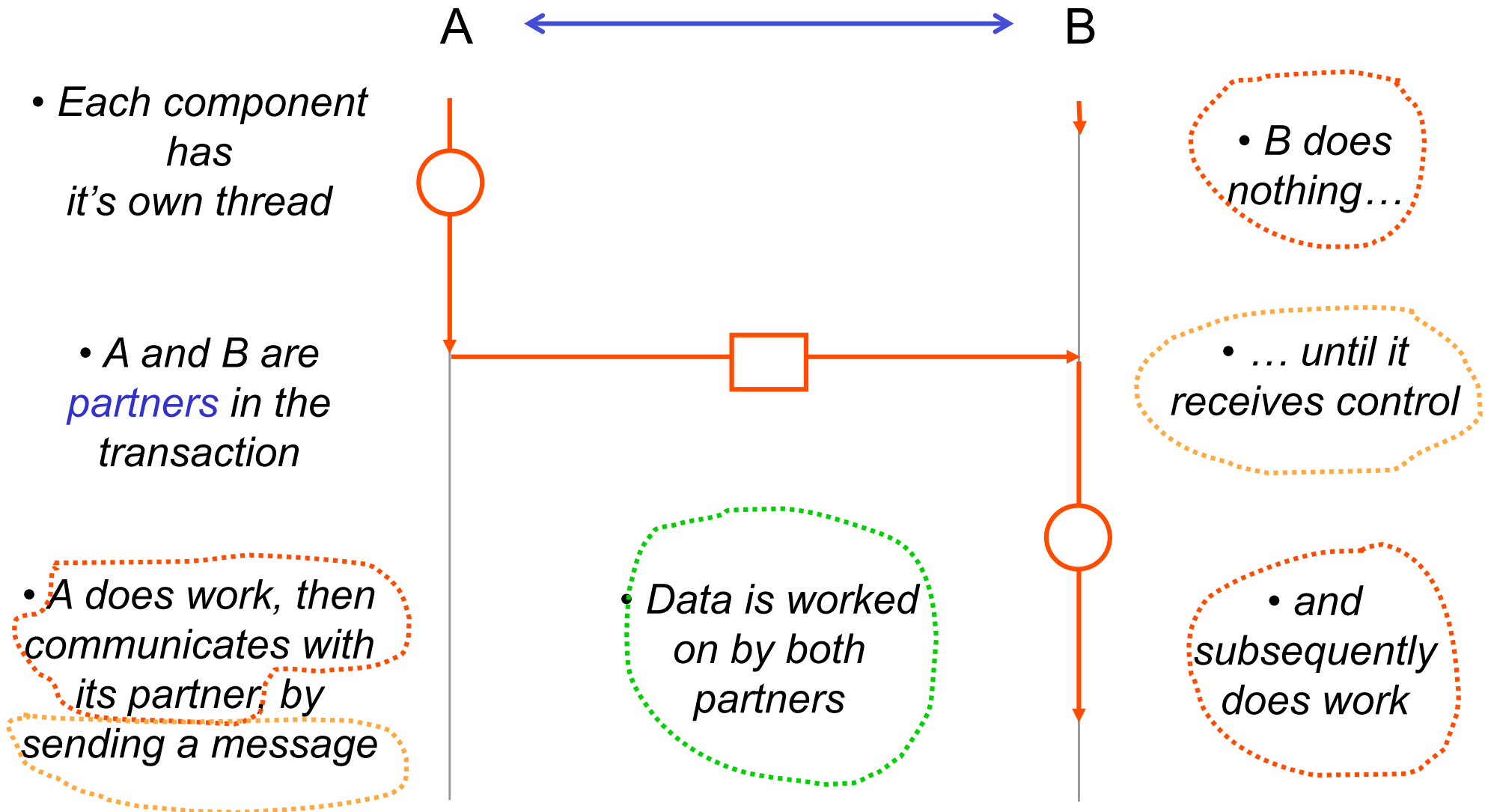
- *Imperative*
- *Procedural*



- User composition – collaborative workflow









# What we need to know



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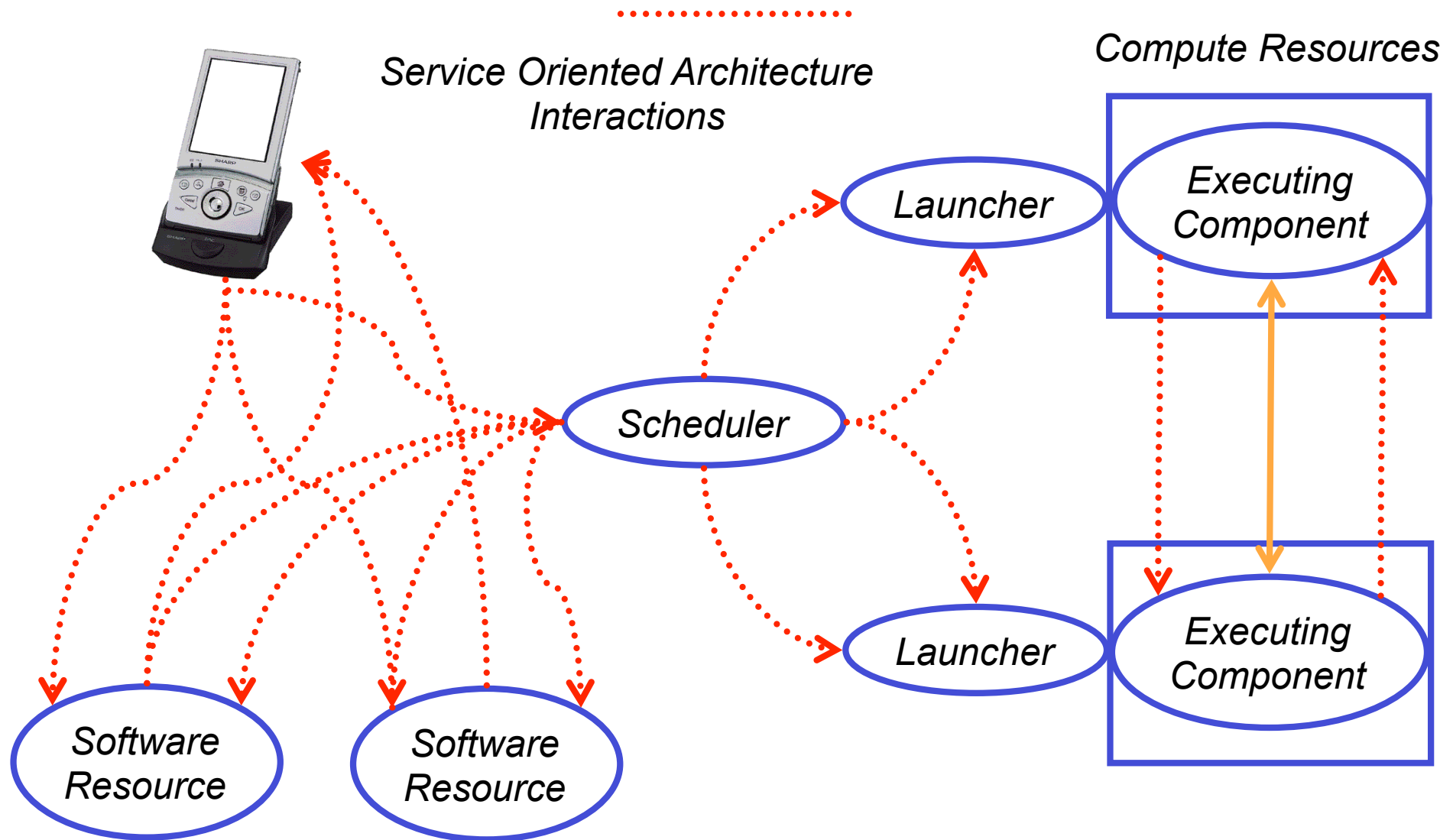
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CDL: Meaning	Potential Collaboration	Ontologies Semantic Grid
BDL: Behaviour	Communication Characterisation	Internal Behaviour
IDL: Implementation	Data Structures	Performance

*Interface*

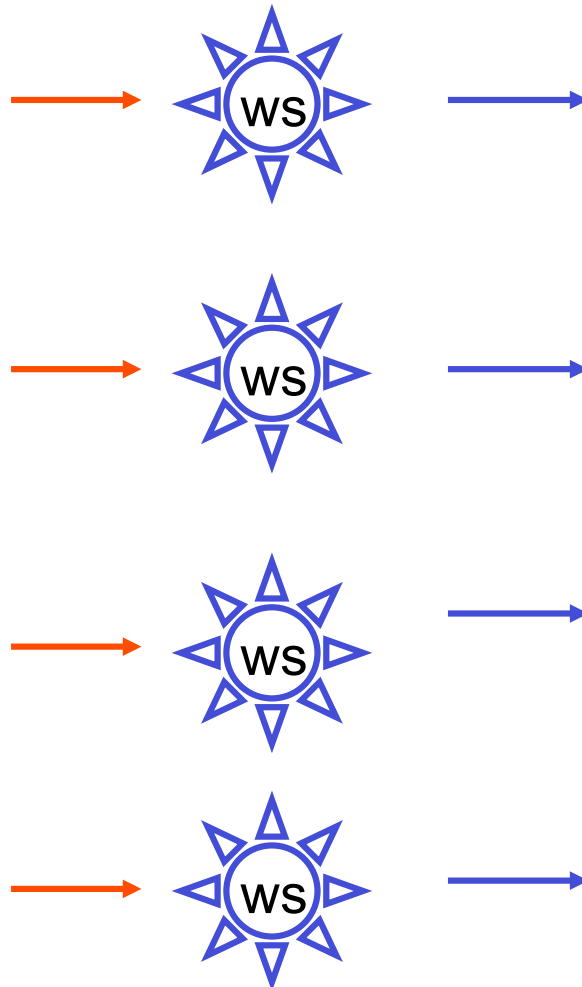
WSDL

*MetaData*



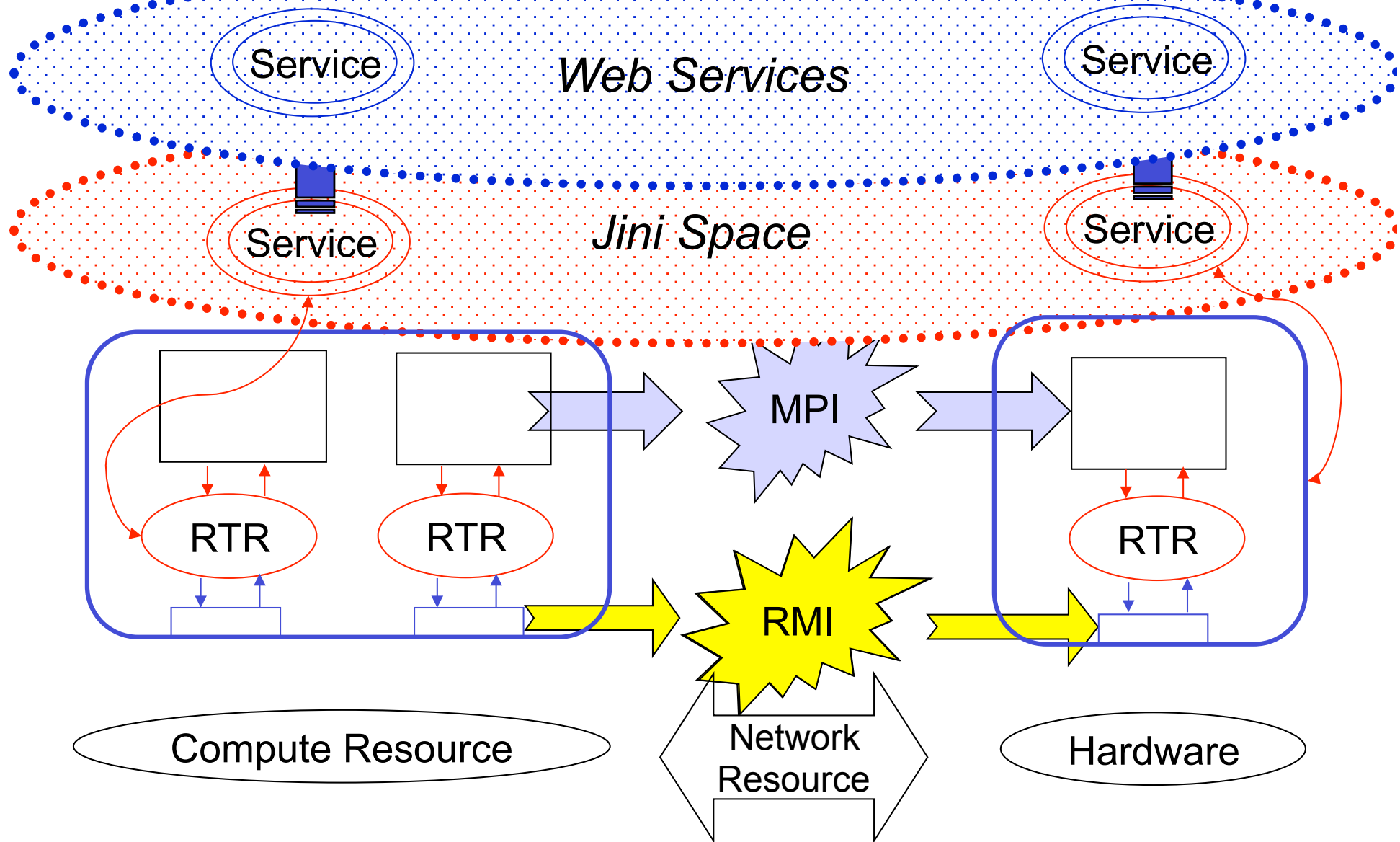
## Lifecycle

1. Potential
  - Stateless
  - “Class”
2. Deployed
  - Stateful
  - “Object”
3. Executing
  - Stateful
  - Transient!
4. Completed



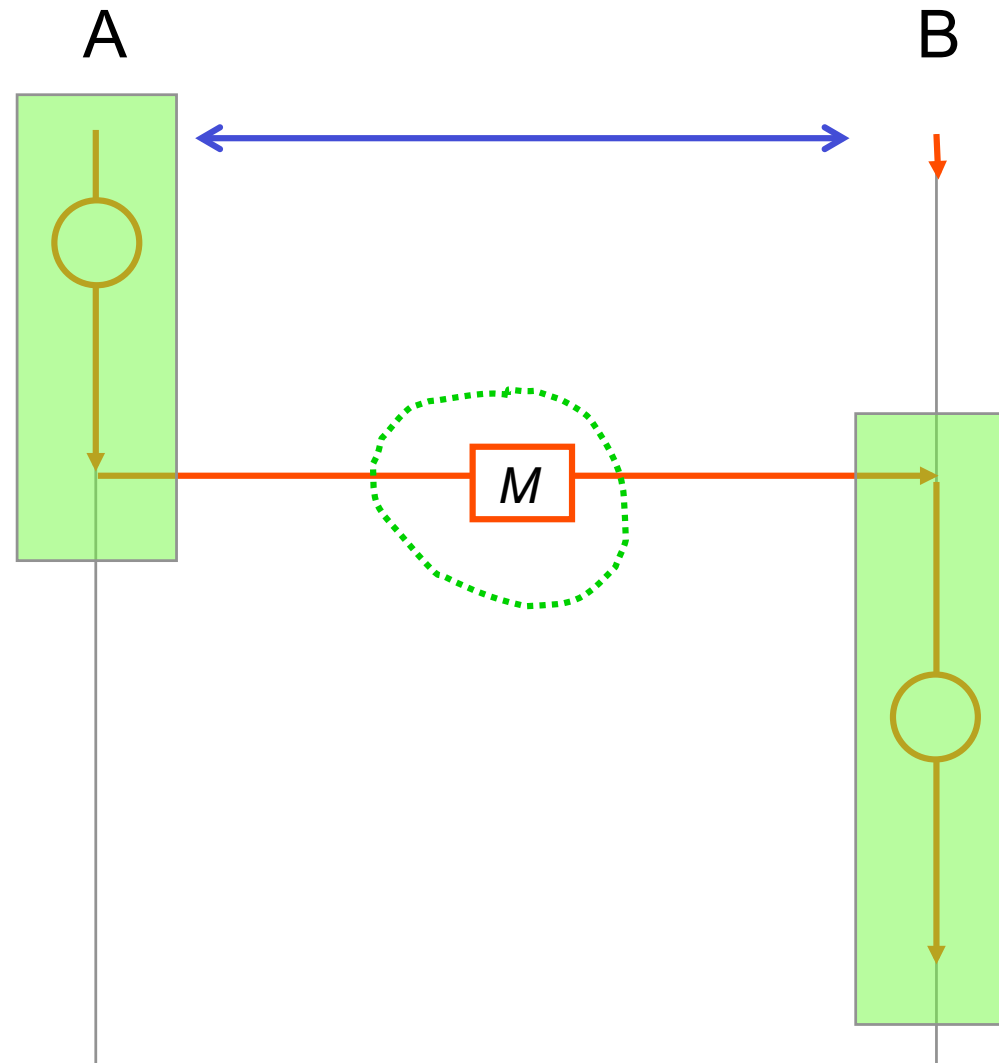
## ICENI Services

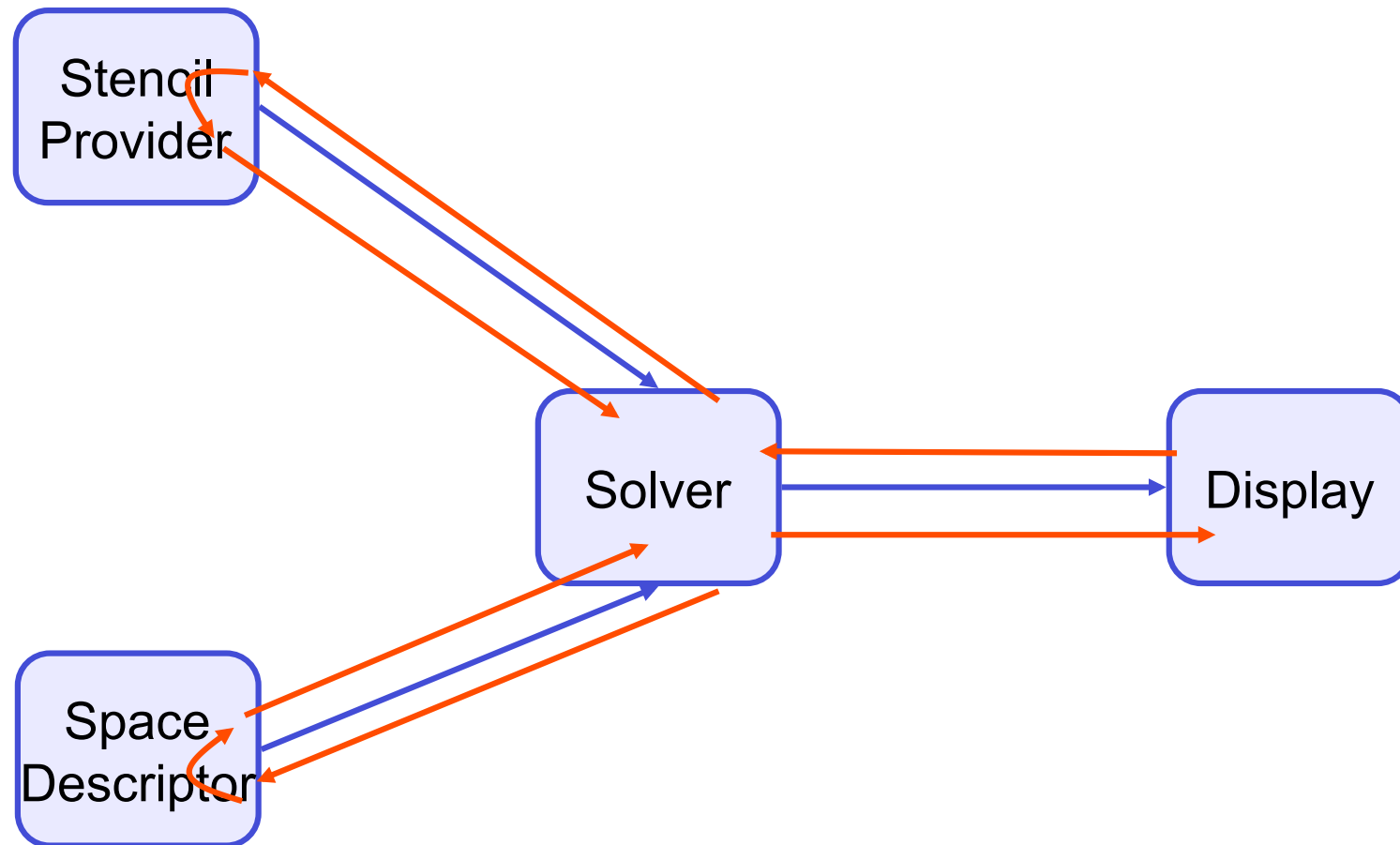
- Composition
- Static info
- Queue info
- Ownership
- Interaction
- Reconnect
- Logging



- *Temporal:*  
*A then B*

- *Spatial:*  
*Data M is shared*





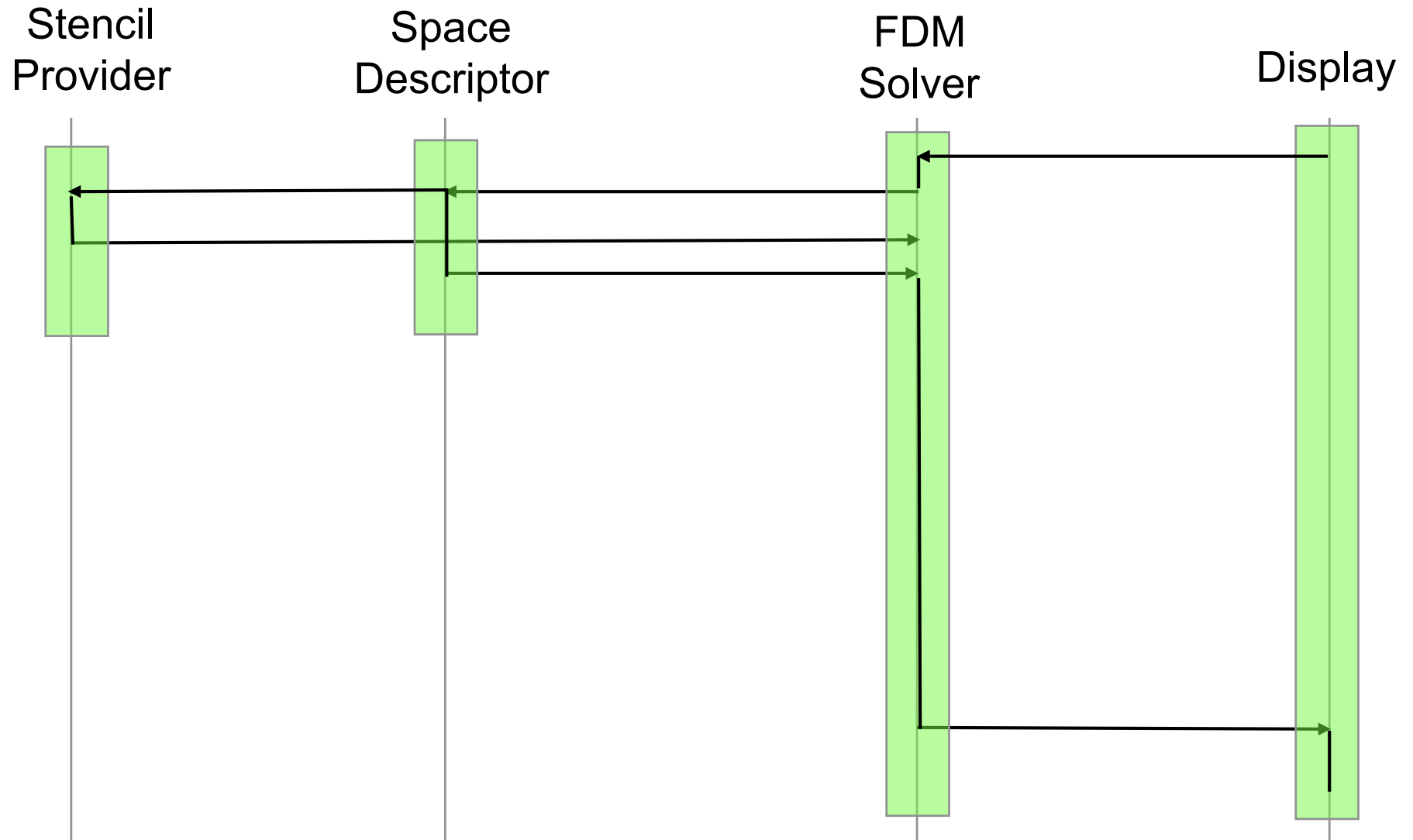


# Workflow: FDM

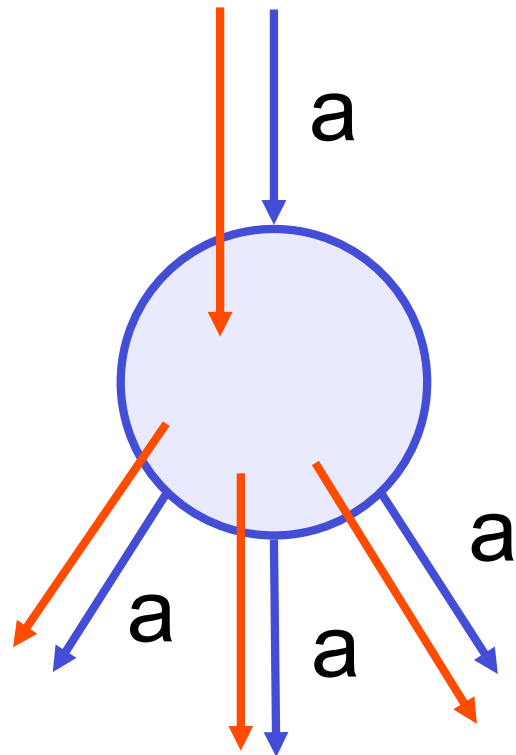


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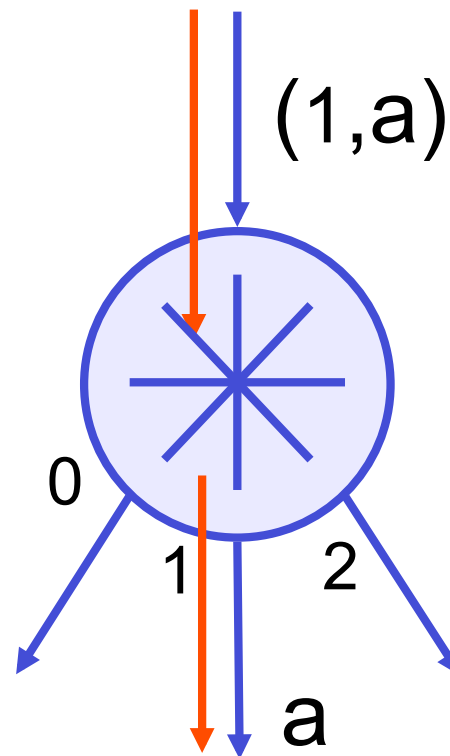
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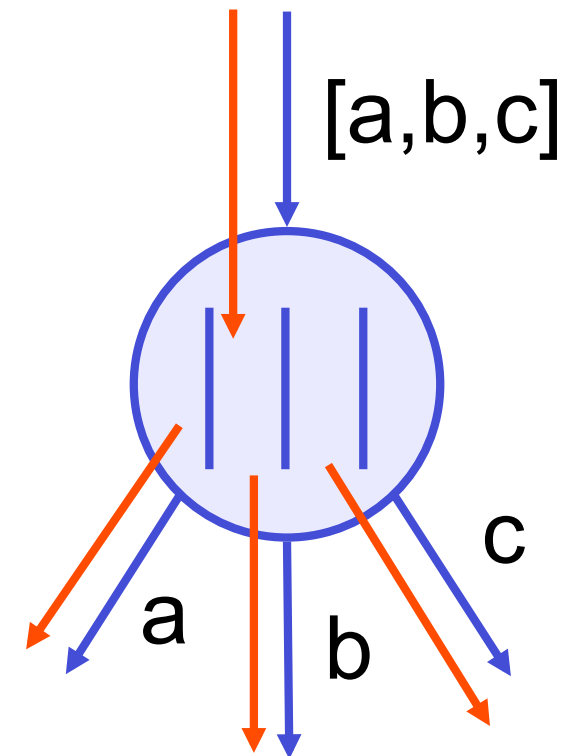




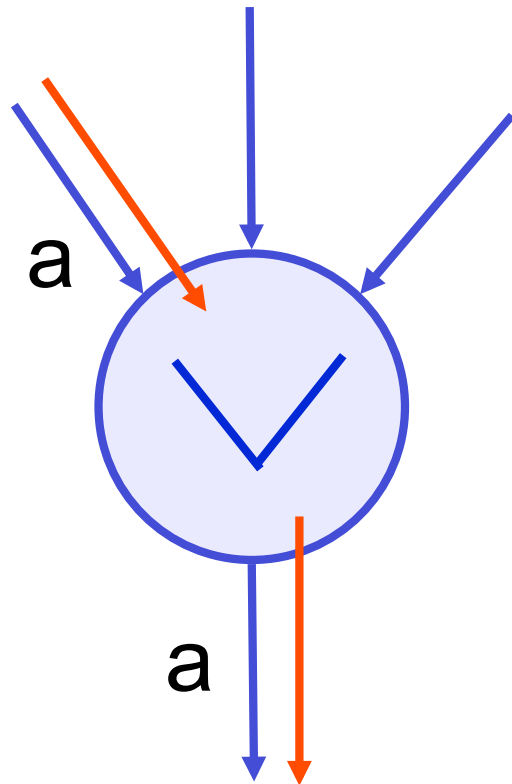
Broadcast



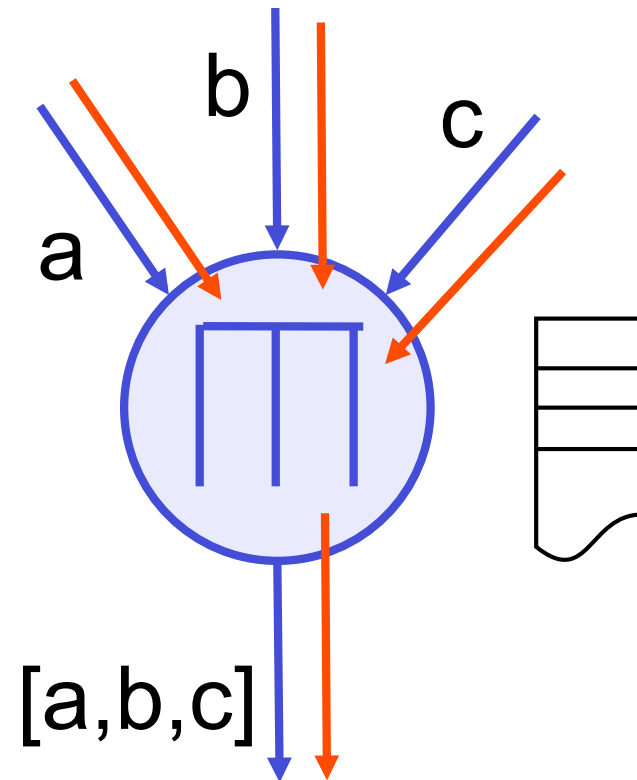
Switch



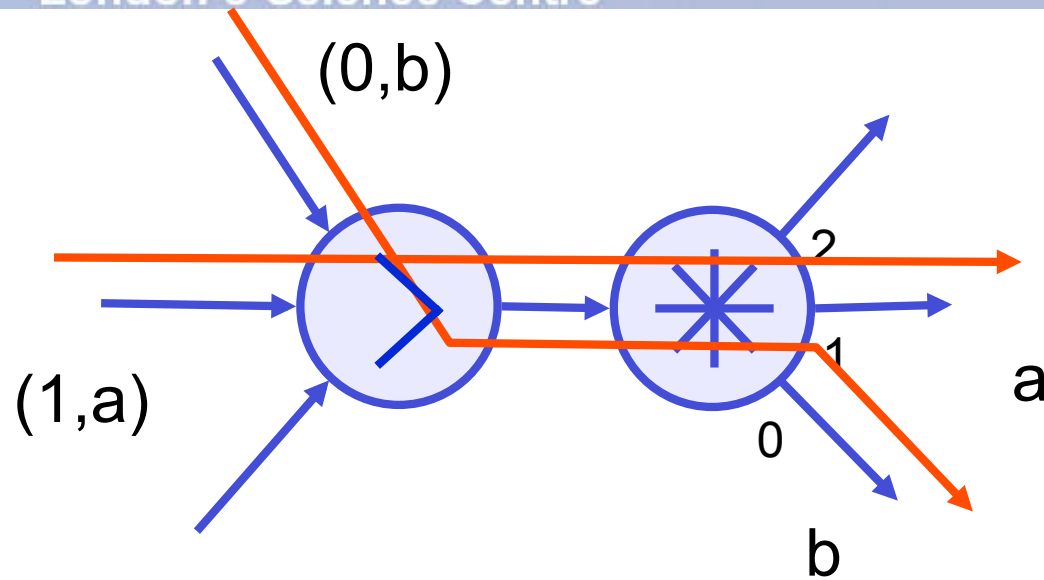
Splitter



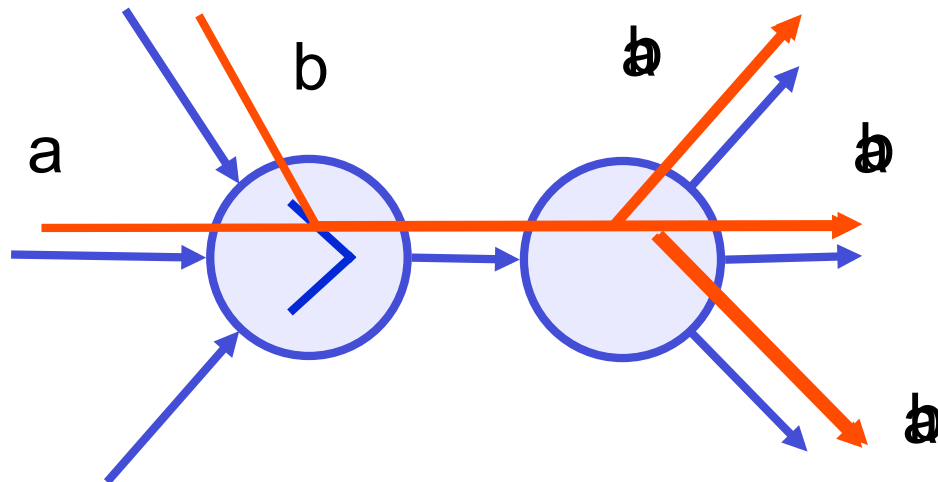
Funnel



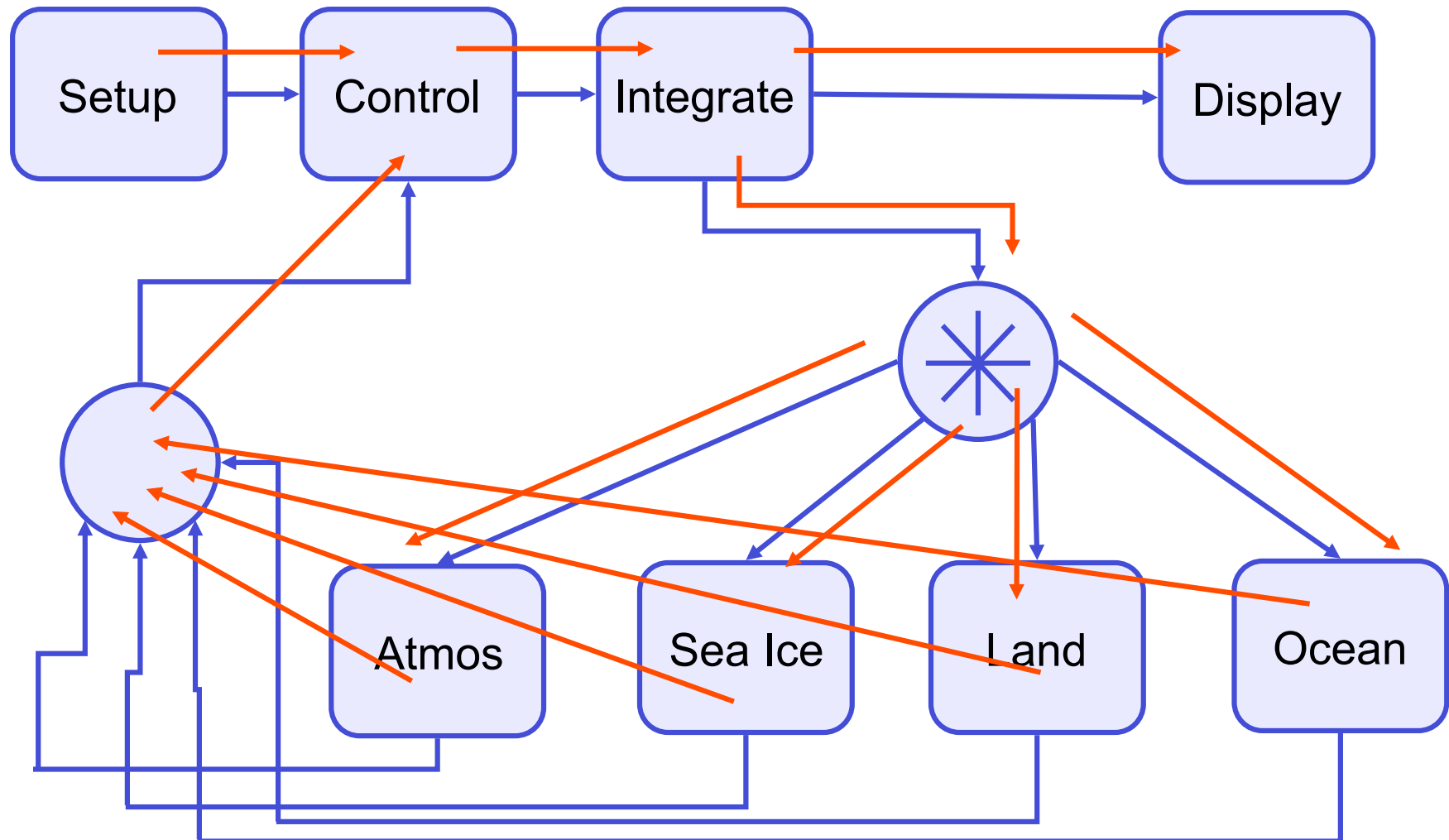
Combiner



Multiple Input Switch (push)



Synchronised  
Many to Many





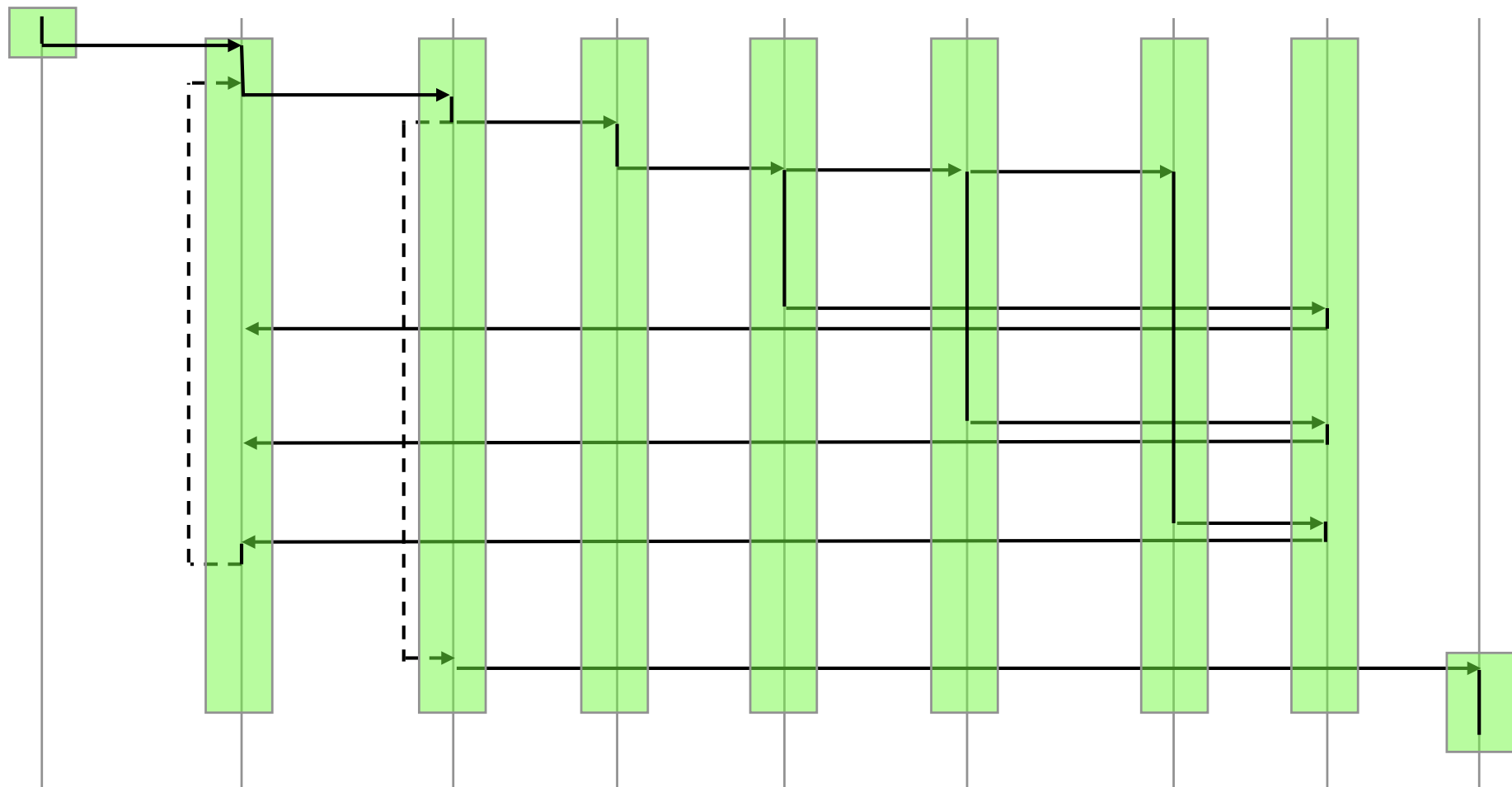
# Workflow: GENIE



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Setup    Control    Integrate    <S> Sea Ice    Atmos    Ocean    <F>    Display



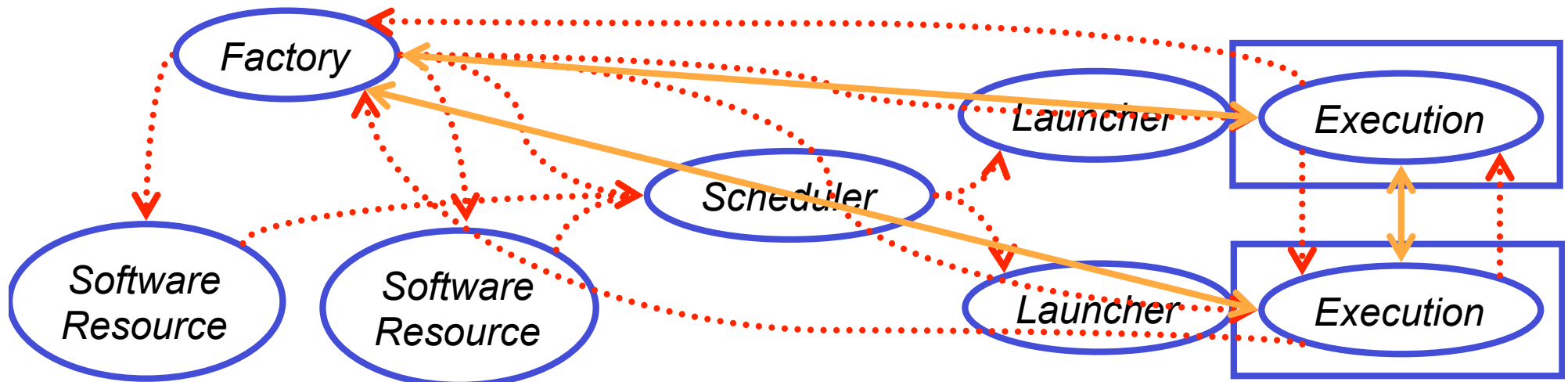
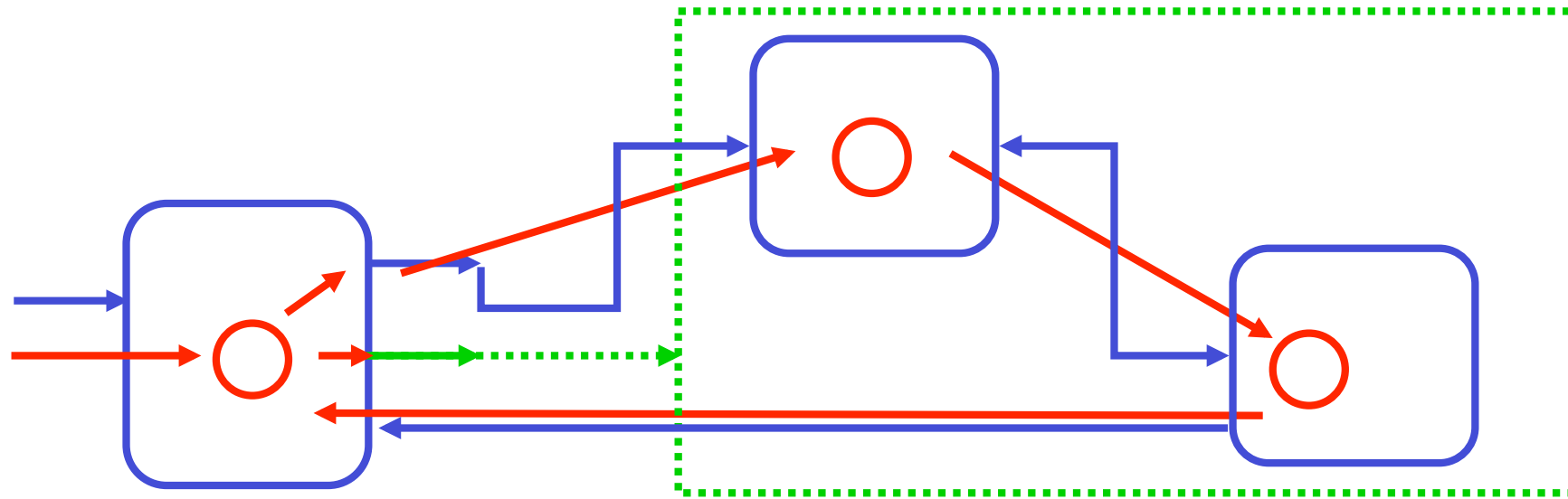


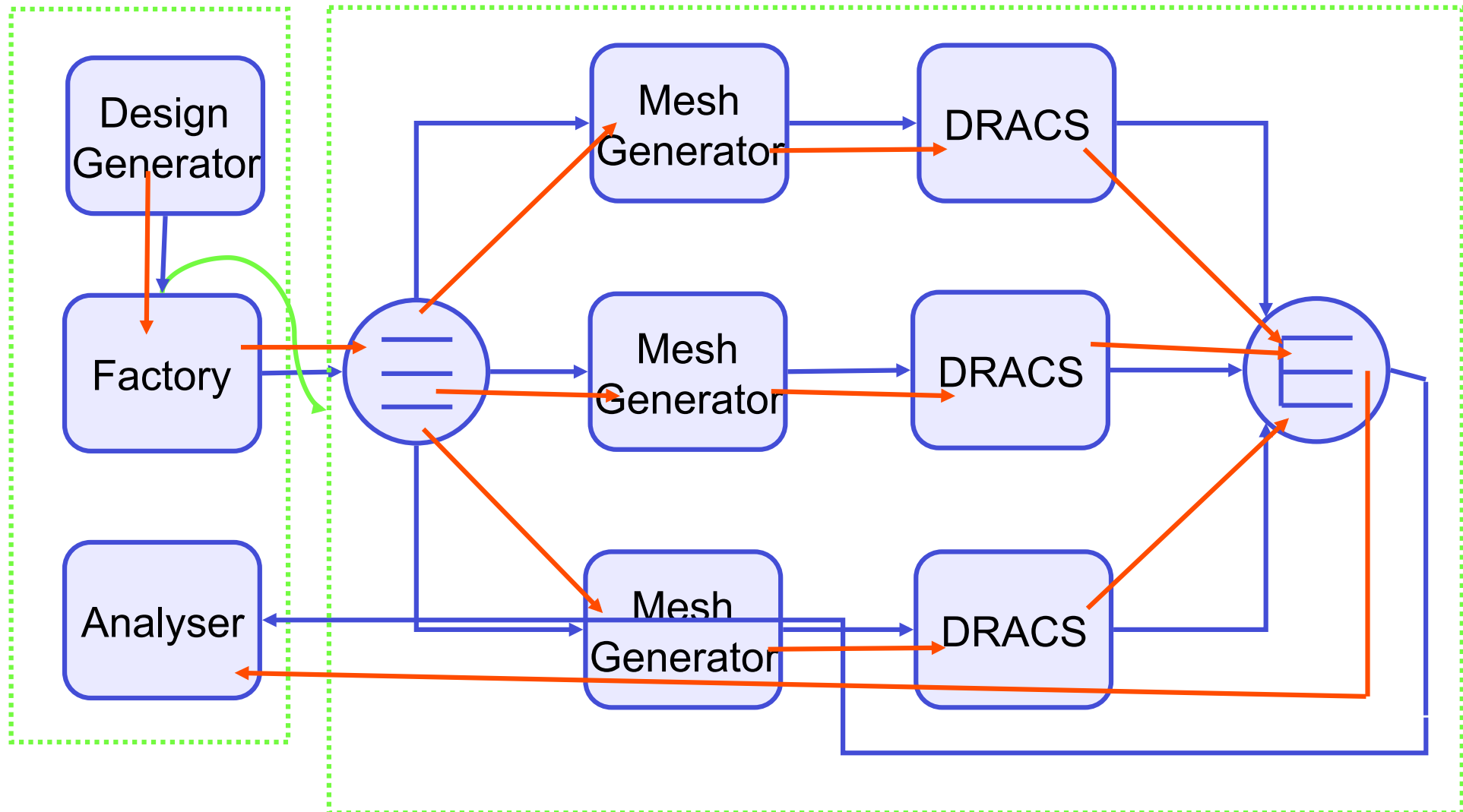
# Factory Component



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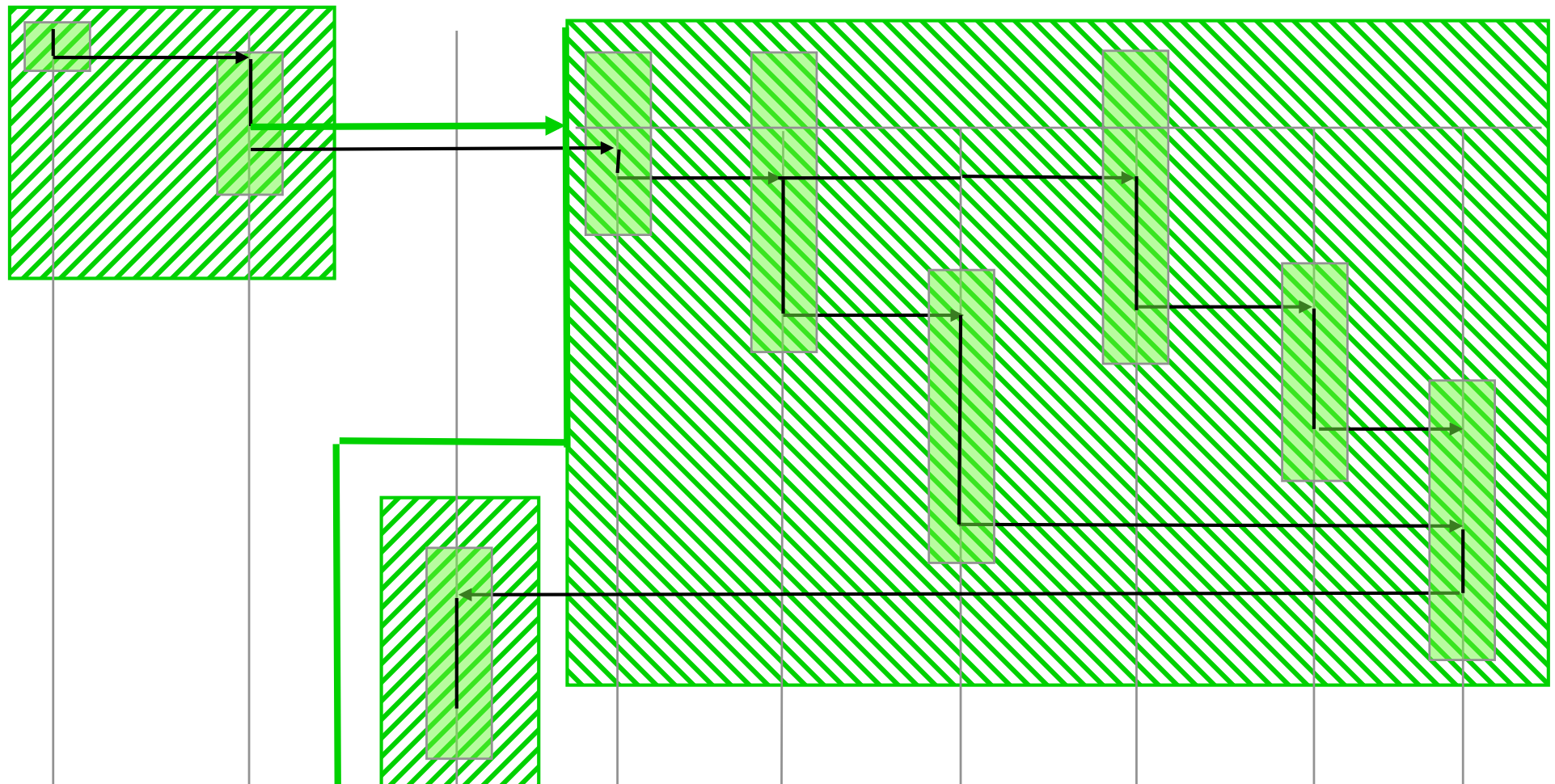
# Workflow: High Throughput Temporal information



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Design    Factory    Analyser    <S>    Mesh1    Dracs1    Mesh2    Dracs2    <G>





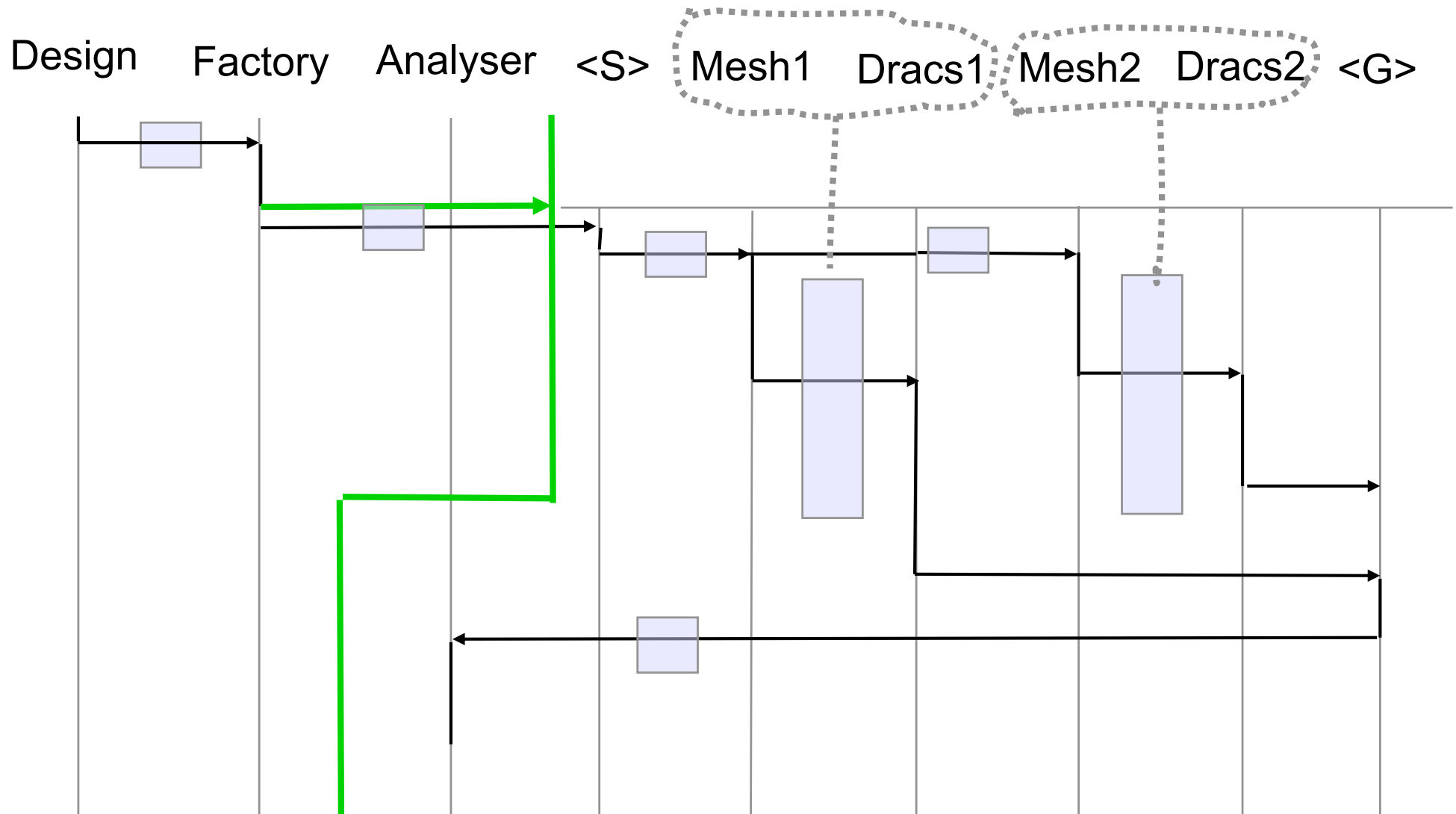


# Workflow: High Throughput Spatial information



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# Expressing Workflow in ICENI



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- *For now,*
  - xml , BDL as counterpart to CDL, IDL
- *For the future,*
  - GSFL?
  - BPEL4WS?
- **Critically:**
  - A community standard workflow description

Standardisations  $\Rightarrow$  Scheduling optimisation  
for third party compositions



# From where does Workflow Originate?



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CDL:  
Meaning

*Composition*

*Collaboration  
Workflow*

+

BDL:  
Behaviour

*Look  
Up*

*Component Behaviour*

=

*Orchestration  
Workflow*

IDL:  
Implementation



# How do we utilise workflow?



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CDL:  
Meaning

BDL:  
Behaviour

IDL:  
Implementation

*Orchestration  
Workflow*

+

*Look Up* → *Performance Characteristics*

=

*Scheduling Opportunities*



# ICENI in action



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NetBeans IDE 3.4 - Project Default - "ICENI Applications" [GENIE]

File Edit View Project Build Tools Window Help

Editing IN ParamSteer(ParamSteer)

Explorer [Runtime]

- Runtime
  - OGSA Grid Services
    - Registration View
      - http://localhost:8080/ogsa/services/t
        - Container Registry Service
        - container Handle Resolver
        - ICENI Application Mapper
        - ICENI Service bashScriptLauncher o
        - ICENI Service roundRobinScheduler
        - ICENI Service icpc.component.rend
        - ICENI Service icpc.component.steer
        - ICENI Service icpc.component.appli
      - Port Types View
      - Components View
      - Processes

Execute

```
sequenceDiagram
    participant mainApp
    participant IcenicrServer
    mainApp->>IcenicrServer: IN ParamWatch(ParamWatch)
    IcenicrServer-->>mainApp: OUT ParamWatch(ParamWatch)
    mainApp->>IcenicrServer: IN DataSet1(DataSet)
    IcenicrServer-->>mainApp: OUT DataSet1(DataSet)
    mainApp->>IcenicrServer: IN ObjectTree(ObjectTree)
    IcenicrServer-->>mainApp: OUT ObjectTree(ObjectTree)
    mainApp->>IcenicrServer: IN ReportParam(ReportParam)
    IcenicrServer-->>mainApp: OUT ReportParam(ReportParam)
    IcenicrServer->>mainApp: IN DataRequest2(DataRequest)
```

Linear Solver x GENIE x

Output Window [Output]

Output x



# Research Funding



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- Natural & Environmental Research Council
  - GENIE



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  - Oliver Jevons (Operations Manager)
  - Susan Brookes (Administrative Assistant)



# Contact Information



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- Centre Activities: <http://www.lesc.ic.ac.uk>
- Directly via e-mail: [lesc@ic.ac.uk](mailto:lesc@ic.ac.uk)
- Regular demonstrations of ICENI on the UK e-Science stand
- Presentation: “OGSA-Jini Integration” by William Lee, Weds 20th 1:30pm, rm 314/5
- LeSC staff available for queries at the [UK e-Science stand](#)...