

**Mode Control with GEDAE :
a real time distributed signal
processor control application**

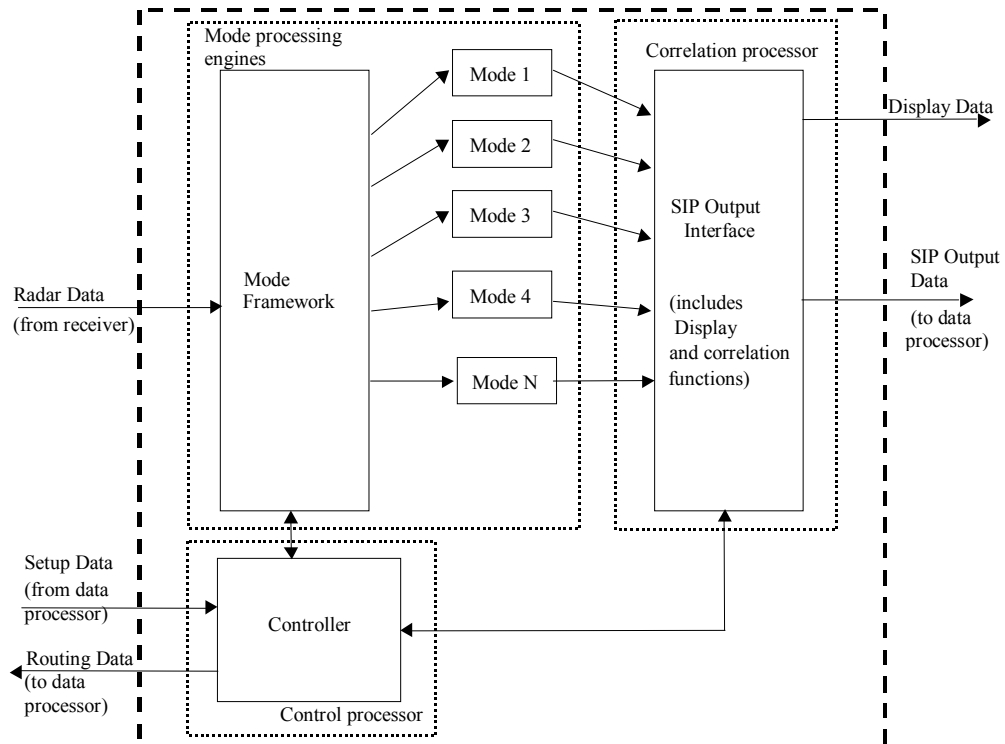
CAPTOR Tranche 2 Radar

- Designed for Eurofighter Typhoon
- Multimode, airborne radar
- Distributed hardware platform
- Round-robin processor scheduling

Introduction

- GEDAE used extensively in data-driven applications
- Large scale
- Control functionality
- Real time performance

Functional Diagram



Basic Model Parameters

- User defines available mode processing resources
- User defines total number of radar modes
- Scalable

Example Configuration

```
const int Tprocs = 6
```

```
const int Mode_Ids[] = {1,2,3,4}
```

```
const int Nmodes = 4
```

```
range p = 0..Tprocs-1
```

```
range m = 0..Nmodes-1
```

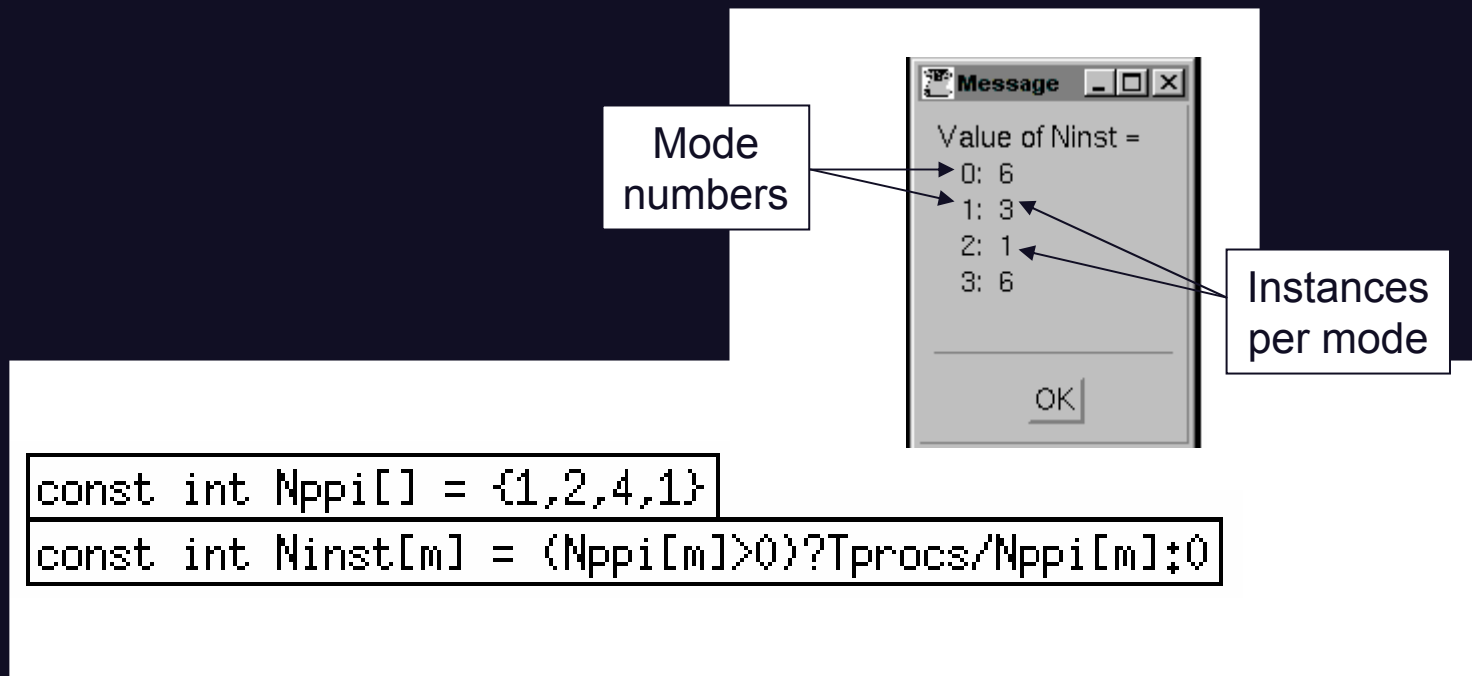
Distribution

- Modes distributed over multiple processors
- Multiple instances of modes
- Processors run multiple modes

Parallelise mode processing and increase throughput

Mode Instance Calculation

- User defines number of processors per instance
- GEDAE calculates total number of mode instances



Instance Routing

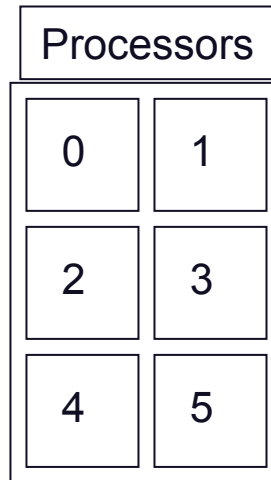
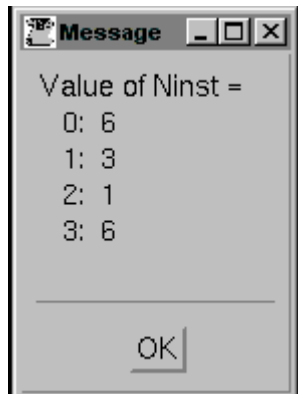
- Relate selected instance to actual hardware
- Route parameter set to correct mode instance
- Receive radar data on correct processor

Minimise data transfers and bus traffic

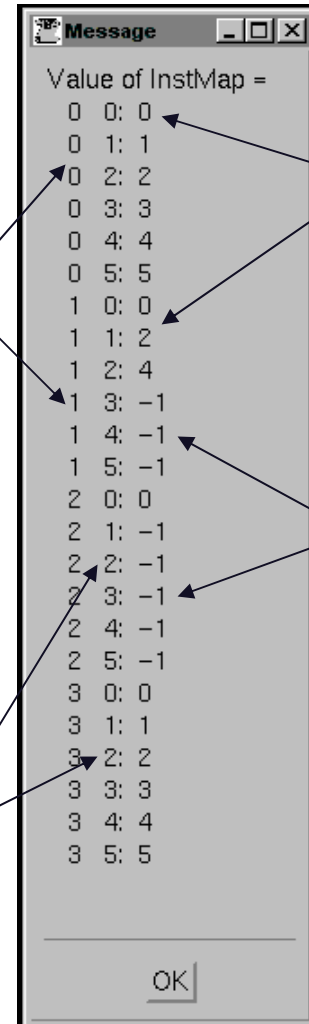
Optimise performance

Instance Mapping

- Automatically calculated
- Maintainable
- Scalable



Potential instances



Instance processors

Invalid instances

Instance Mapping

- Automatically calculated
- Maintainable
- Scalable

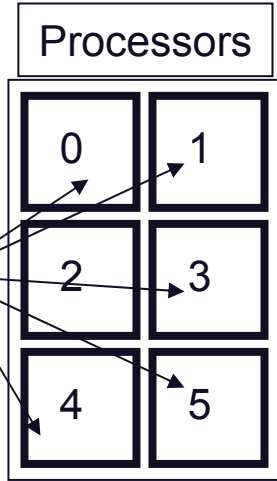
Mode 0

Processors for mode 0 instances

```
Value of InstMap =
0 0: 0
0 1: 1
0 2: 2
0 3: 3
0 4: 4
0 5: 5
1 0: 0
1 1: 2
1 2: 4
1 3: -1
1 4: -1
1 5: -1
2 0: 0
2 1: -1
2 2: -1
2 3: -1
2 4: -1
2 5: -1
3 0: 0
3 1: 1
3 2: 2
3 3: 3
3 4: 4
3 5: 5
```

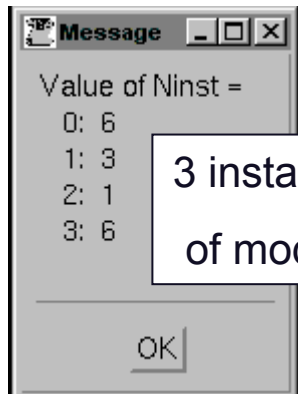
```
Value of Ninst =
0: 6
1: 3
2: 1
3: 6
```

6 instances of mode 0

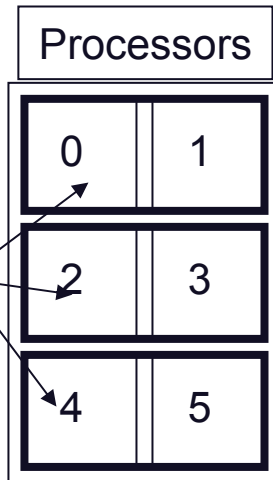


Instance Mapping

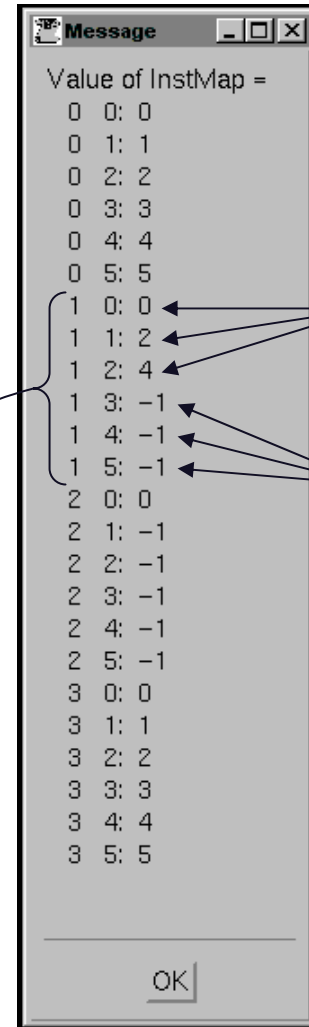
- Automatically calculated
- Maintainable
- Scalable



3 instances of mode 1



Mode 1

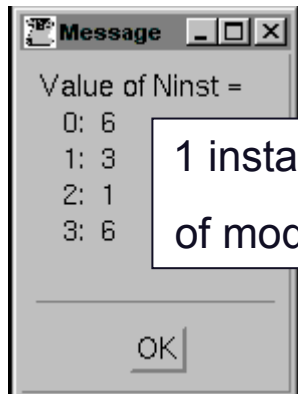


Processors for mode 1 instances

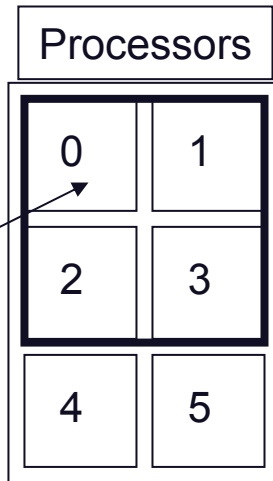
Invalid instances

Instance Mapping

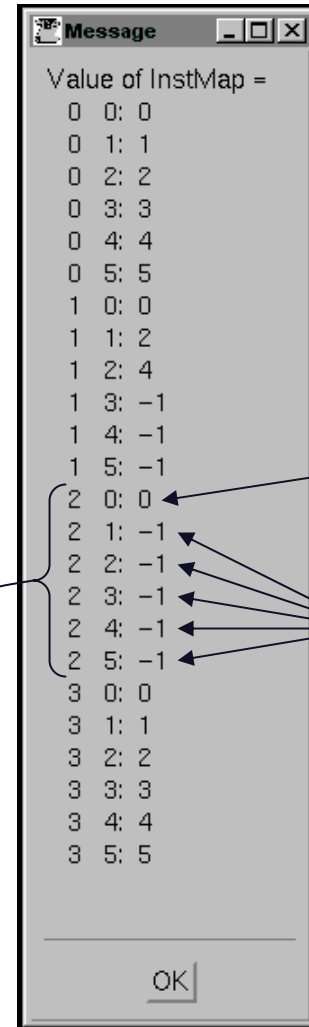
- Automatically calculated
- Maintainable
- Scalable



1 instance of mode 2



Mode 2



Processor for mode 2 instance

Invalid instances

Mode Grouping

- Radar data routed to correct mode graph on processor
- Consistent interfaces to mode groups
- Data routing automatically calculated

Ease progressive integration of radar modes

Mode Types

Message

Value of InstMap =

0	0:	0
0	1:	1
0	2:	2
0	3:	3
0	4:	4
0	5:	5
1	0:	0
1	1:	2
1	2:	4
1	3:	-1
1	4:	-1
1	5:	-1
2	0:	0
2	1:	-1
2	2:	-1
2	3:	-1
2	4:	-1
2	5:	-1
3	0:	0
3	1:	1
3	2:	2
3	3:	3
3	4:	4
3	5:	5

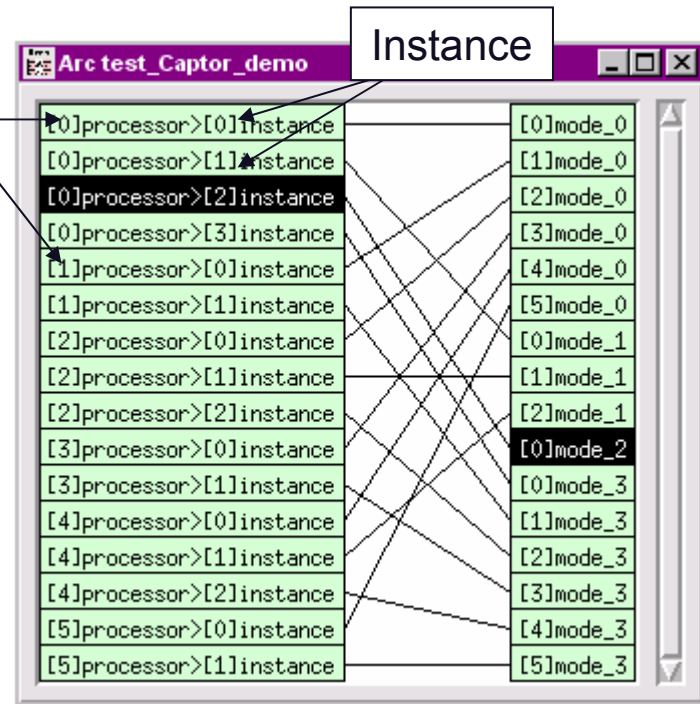
OK

Message

Value of Ninst =

0:	6
1:	3
2:	1
3:	6

OK



Mode Types

Message

Value of InstMap =

0	0:	0
0	1:	1
0	2:	2
0	3:	3
0	4:	4
0	5:	5
1	0:	0
1	1:	2
1	2:	4
1	3:	-1
1	4:	-1
1	5:	-1
2	0:	0
2	1:	-1
2	2:	-1
2	3:	-1
2	4:	-1
2	5:	-1
3	0:	0
3	1:	1
3	2:	2
3	3:	3
3	4:	4
3	5:	5

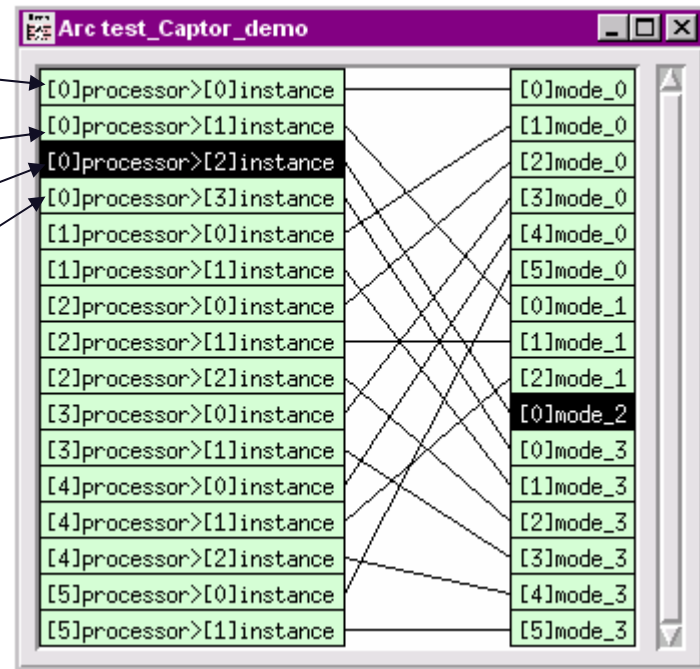
OK

Message

Value of Ninst =

0:	6
1:	3
2:	1
3:	6

OK



Mode Types

Message

Value of InstMap =

0	0:	0
0	1:	1
0	2:	2
0	3:	3
0	4:	4
0	5:	5
1	0:	0
1	1:	2
1	2:	4
1	3:	-1
1	4:	-1
1	5:	-1
2	0:	0
2	1:	-1
2	2:	-1
2	3:	-1
2	4:	-1
2	5:	-1
3	0:	0
3	1:	1
3	2:	2
3	3:	3
3	4:	4
3	5:	5

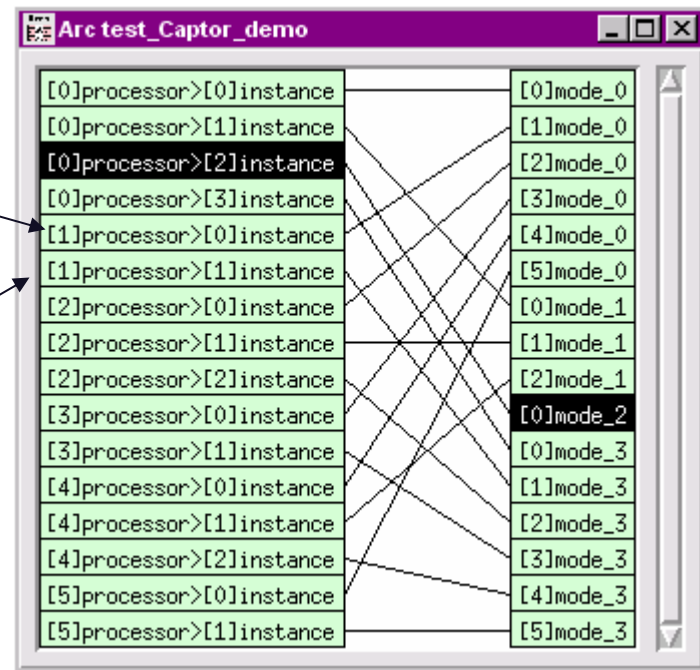
OK

Message

Value of Ninst =

0:	6
1:	3
2:	1
3:	6

OK



Persistent State

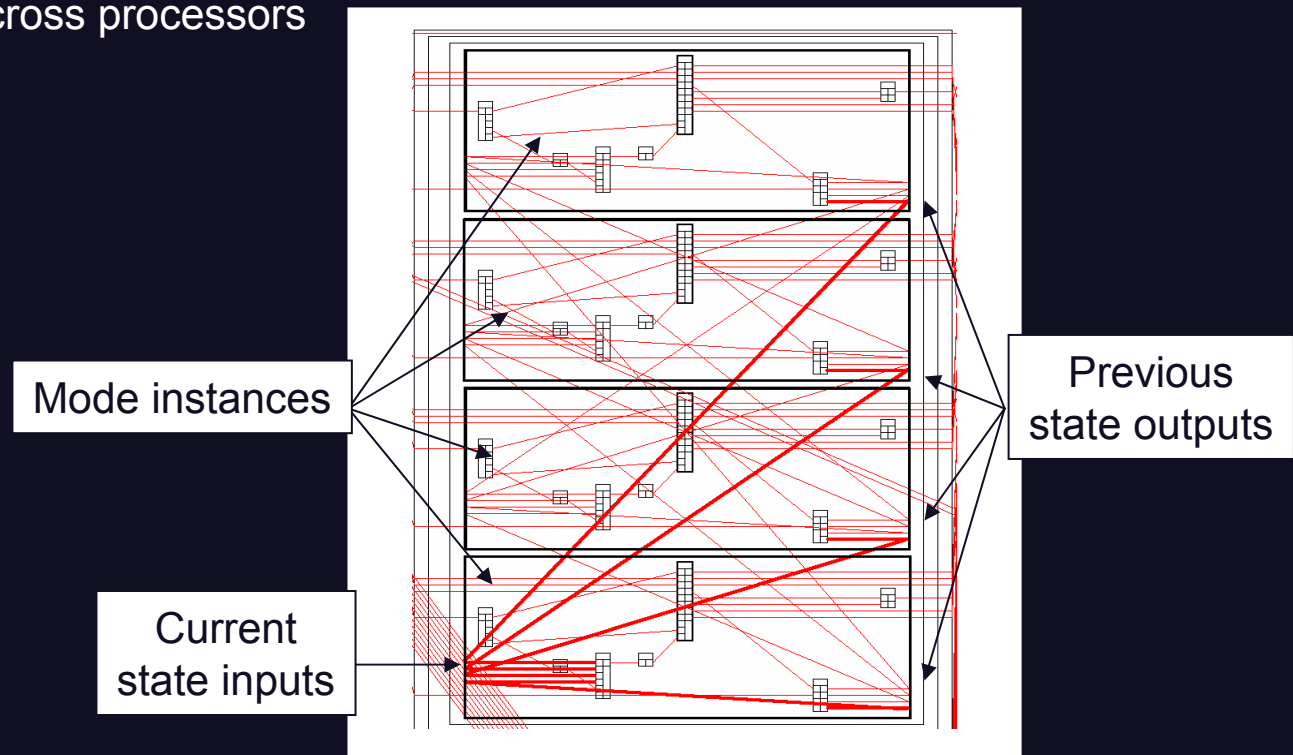
- Successive instances distributed across processors
- State directed from previous instance
- State recalculated on current instance
- State sent to next instance

Minimise state transfers and latency

Maximise throughput

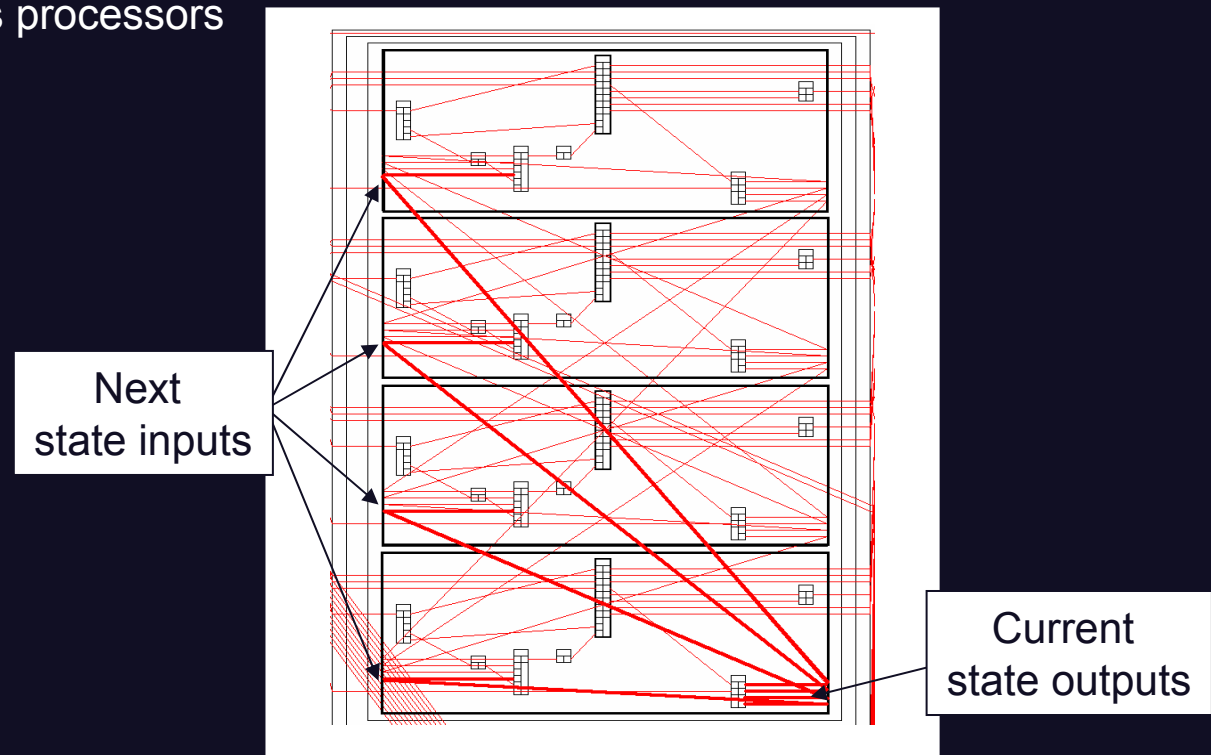
Distributing Persistent State

- Multiple distributed instances of modes
- State shared across processors



Distributing Persistent State

- Multiple distributed instances of modes
- State shared across processors



Future Development

- Segmentation
- Exclusion
- Shared state

Conclusion

- Complex control application
- Single integrated development environment
- GSIM
- Simulation of external entities
- Platform independence
- Scalable

Questions