

# PHILIPS

sense and simplicity

## Unified Execution Diagrams

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### UED

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Philips Healthcare  
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# Who is Philips Healthcare?

## ExamRoom Workspot (Biplane)



# Who is Philips Healthcare?

## Control Room Workspot



# Who is Philips Healthcare?

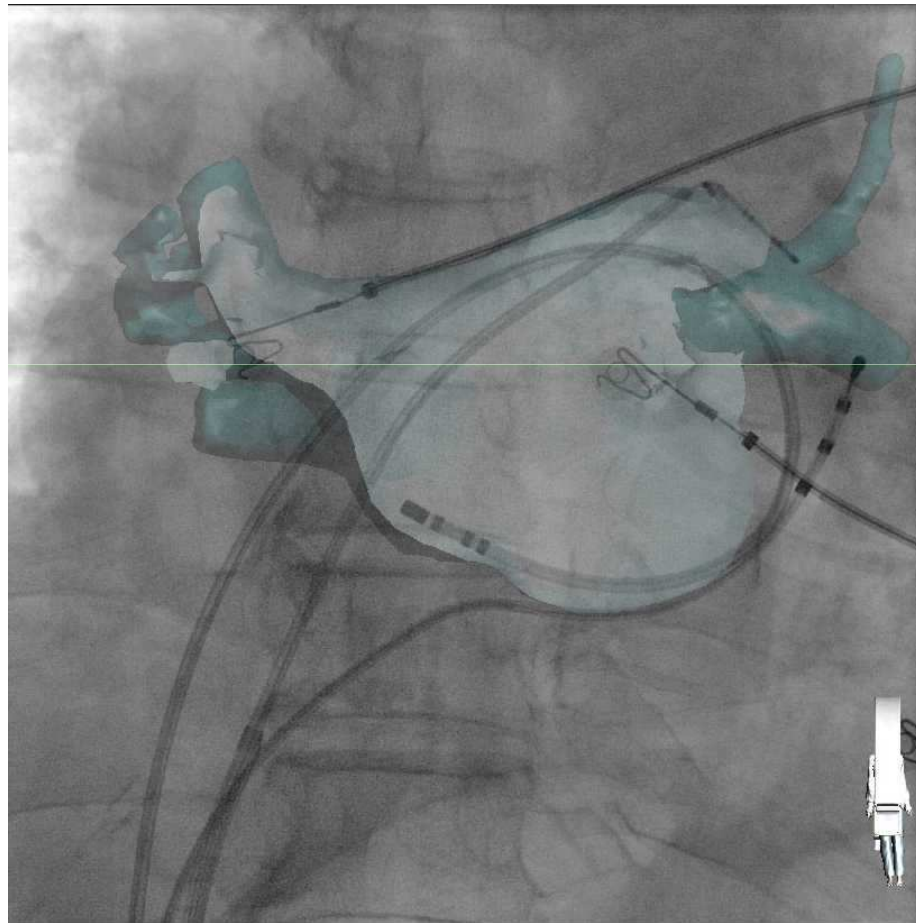
Multiple clinical applications



**PHILIPS**

# Who is Philips Healthcare?

Life critical equipment

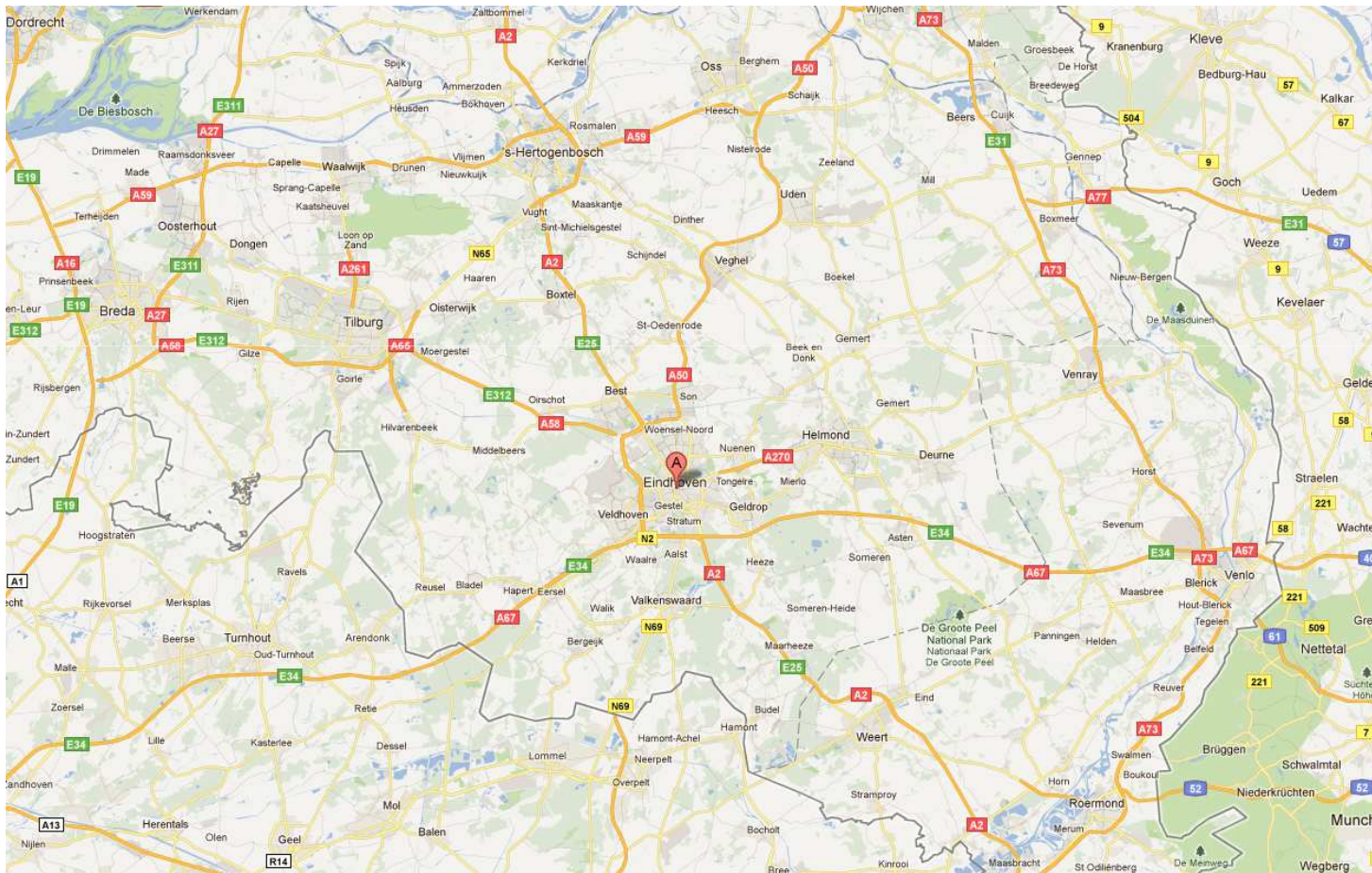


# What was our challenge?

Understand Threading aspects in complex systems

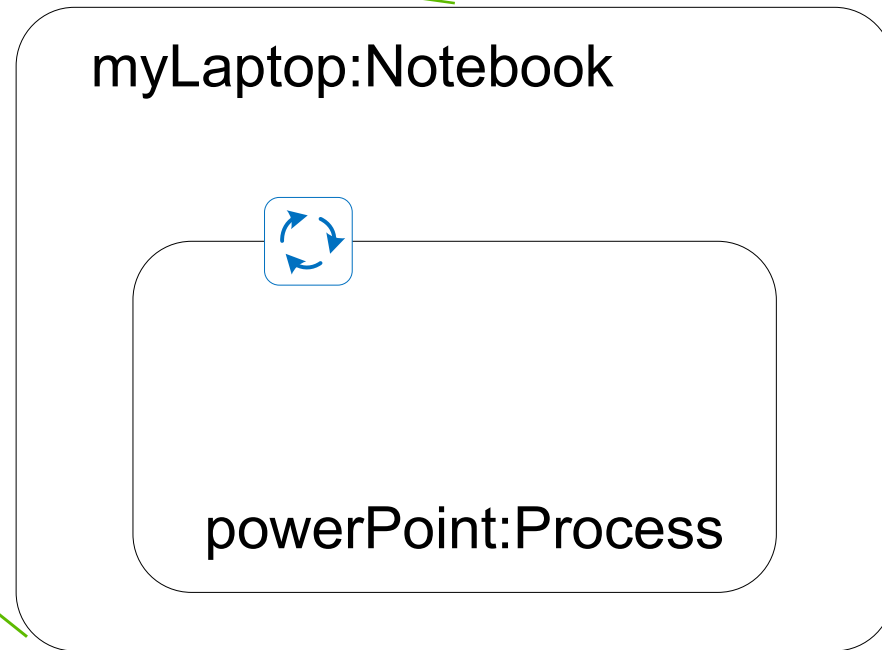
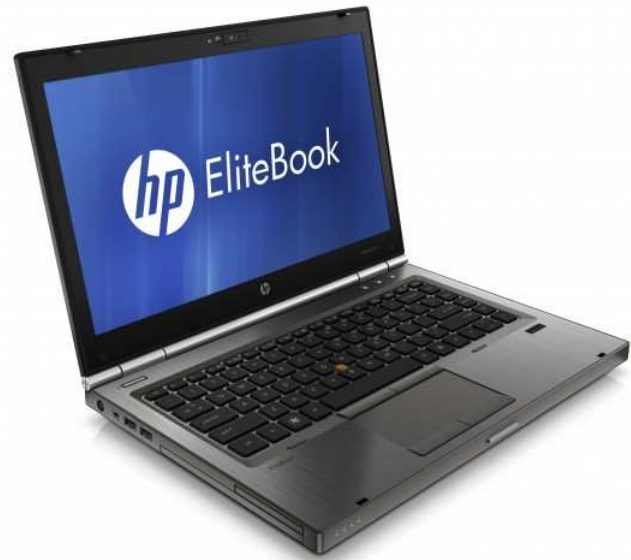


# What is an UED?



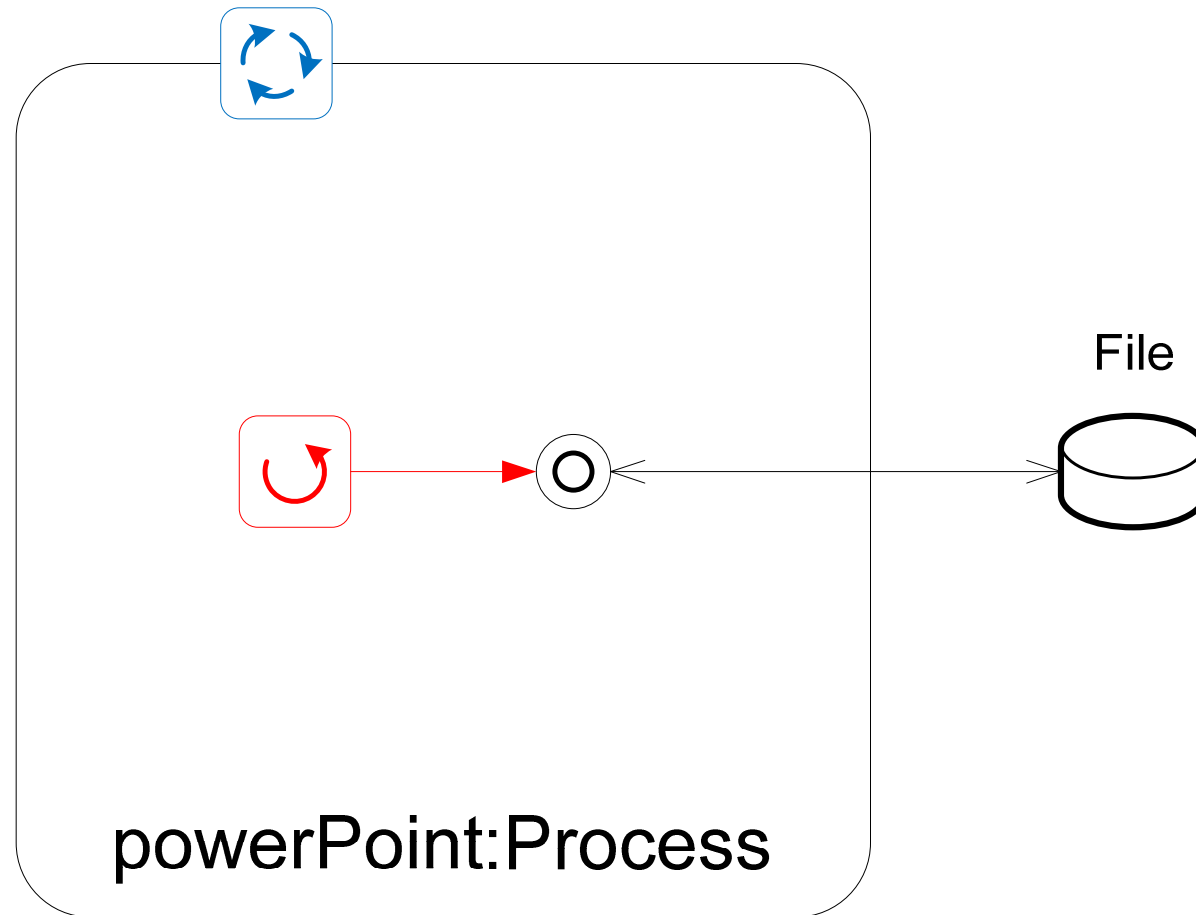
# What is an UED?

Machines(PCs) and Processes



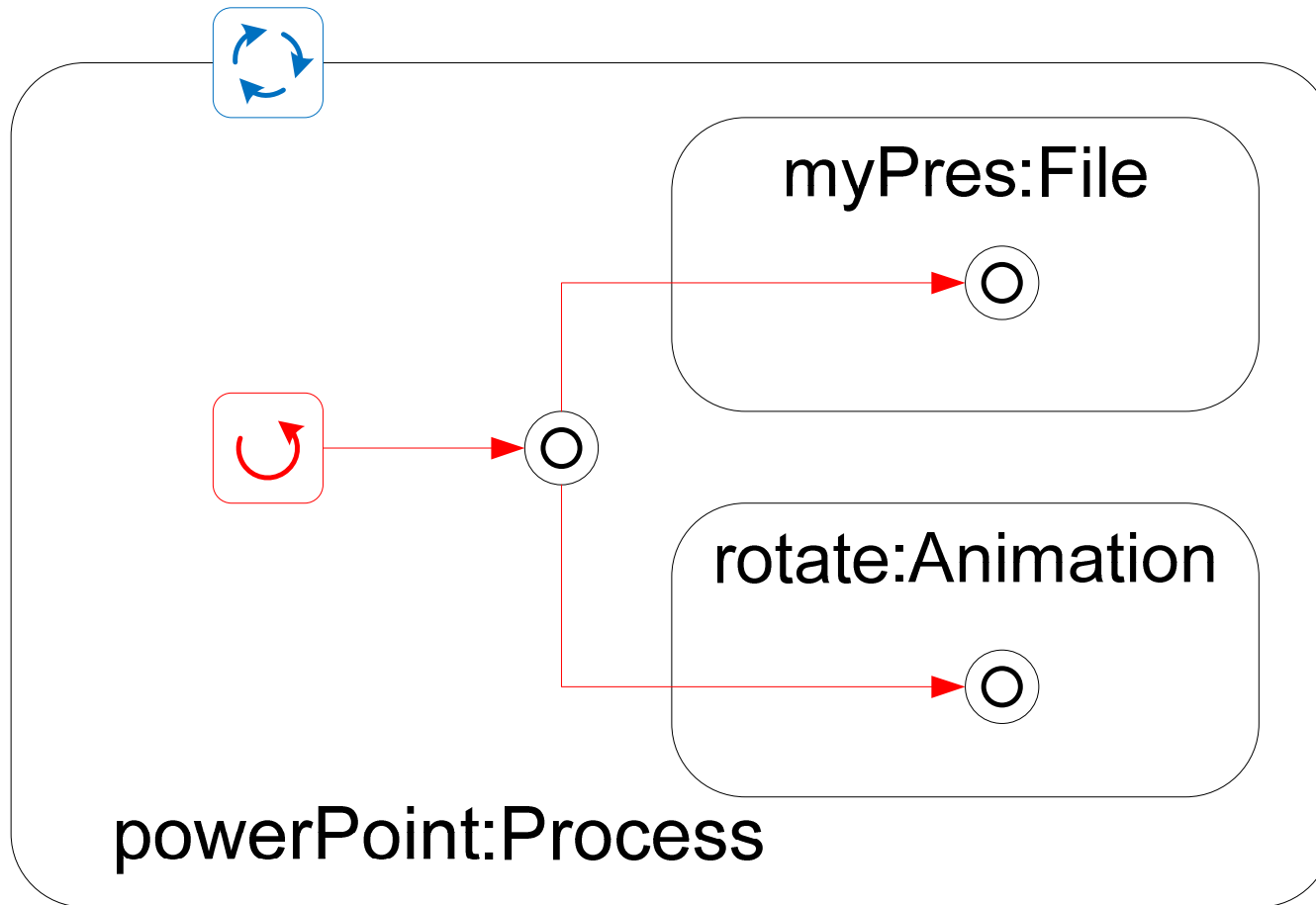
# What is an UED?

Threads and functions



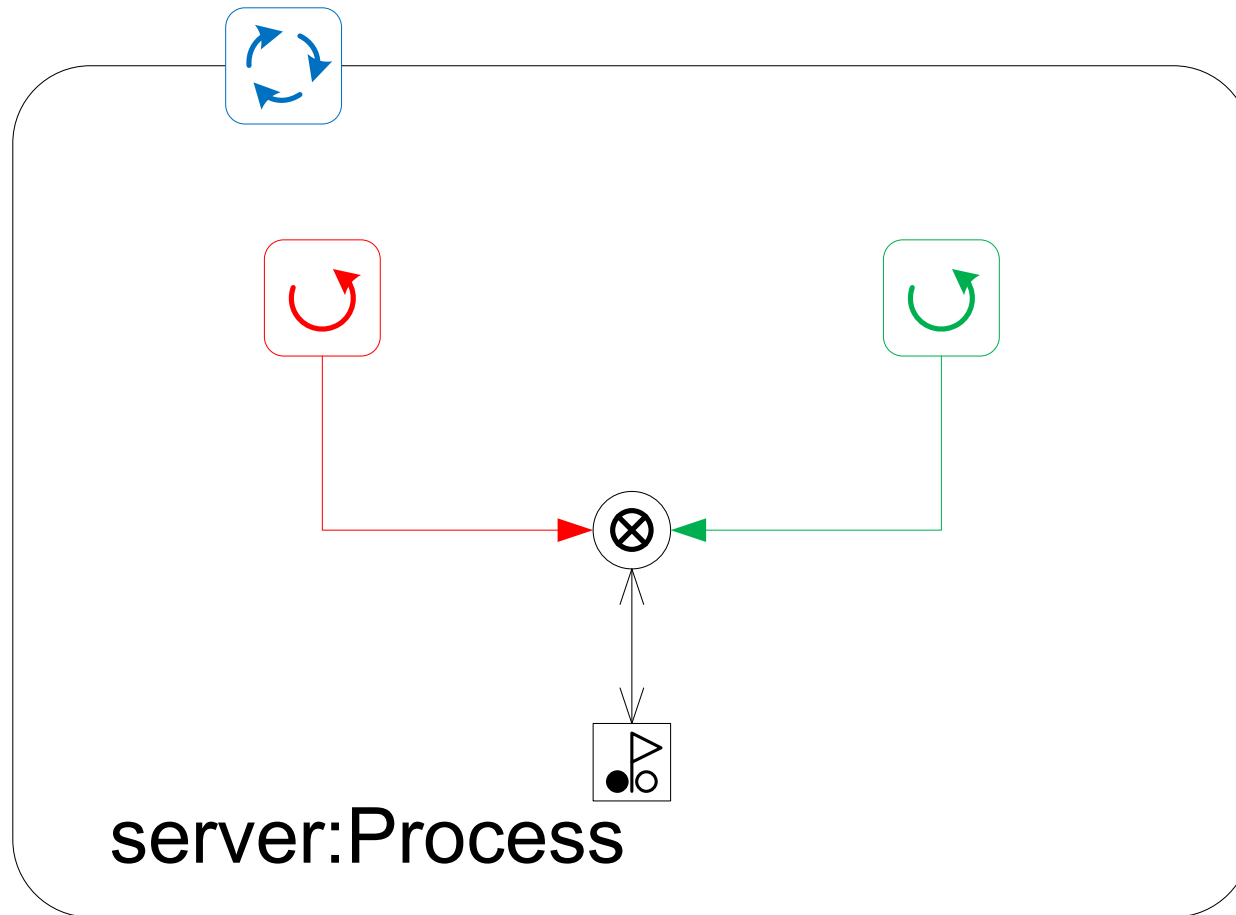
# What is an UED?

Modules



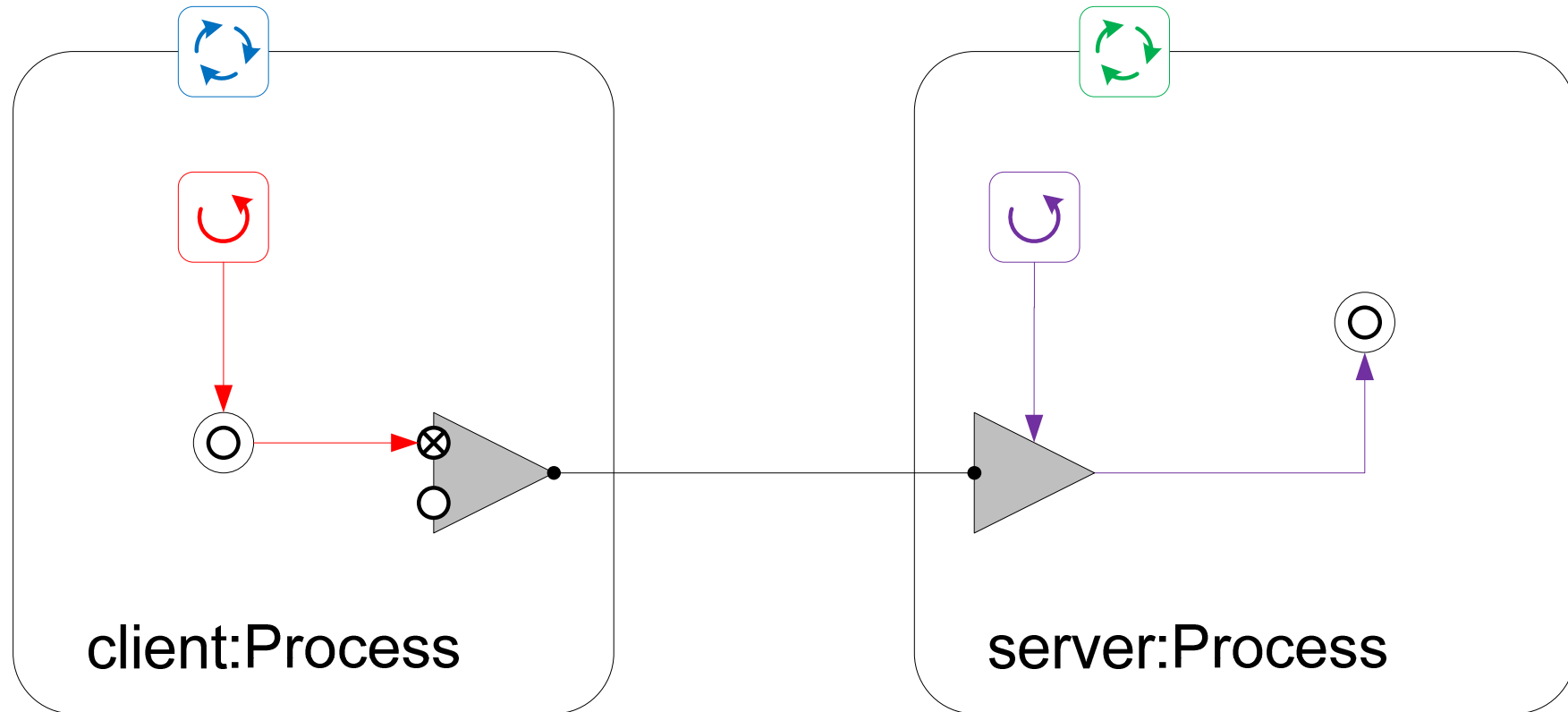
# What is an UED?

Multi-threading and blocking



# What is an UED?

Channels between modules



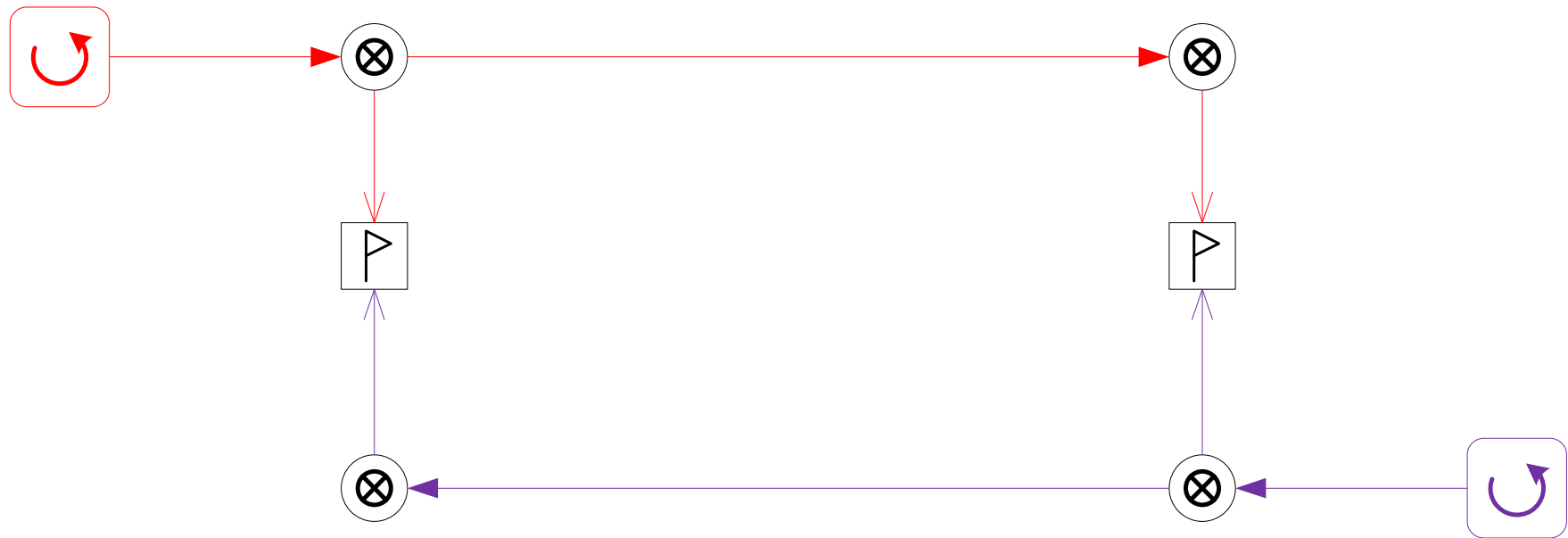
# Purpose of UED

Insight in:

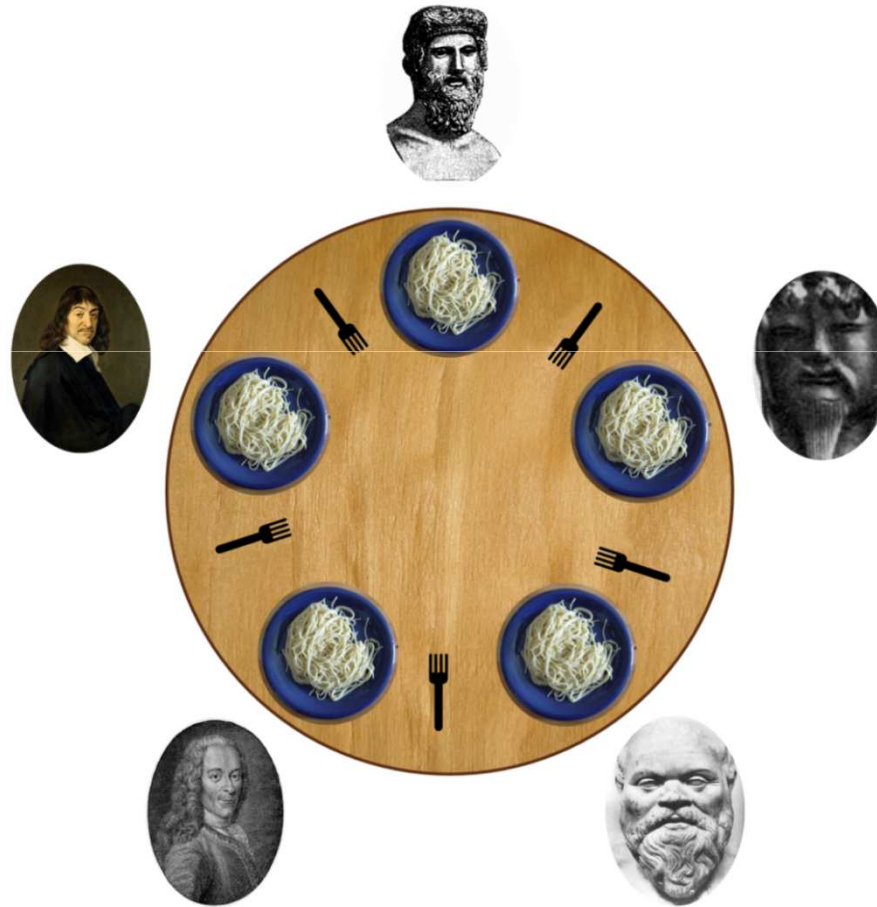
- Data integrity
- Deadlocks
- Lifelocks
- Race conditions
- Buffer overflows/underflows

# Example of an UED

## Classical Deadlock

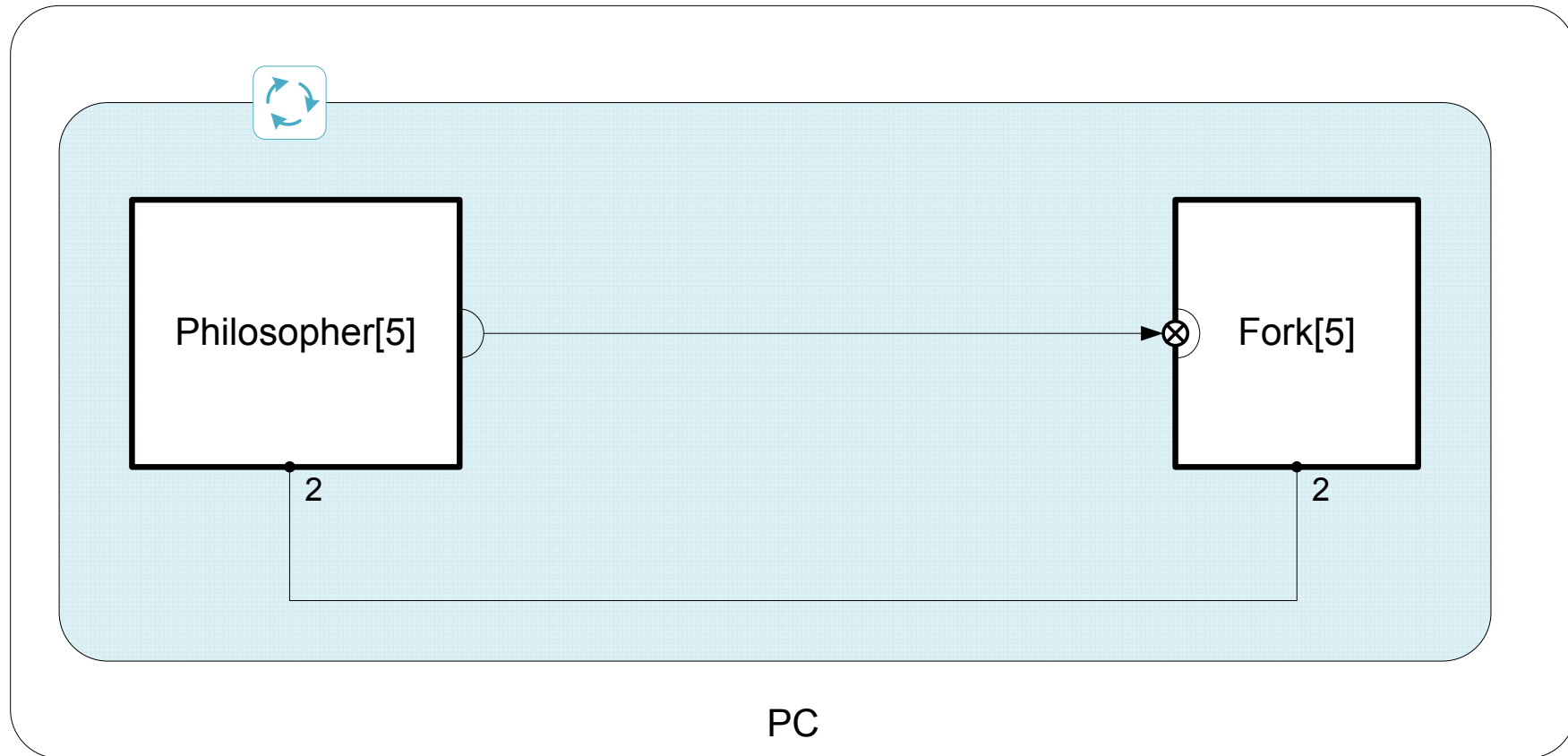


# Dining Philosophers Example



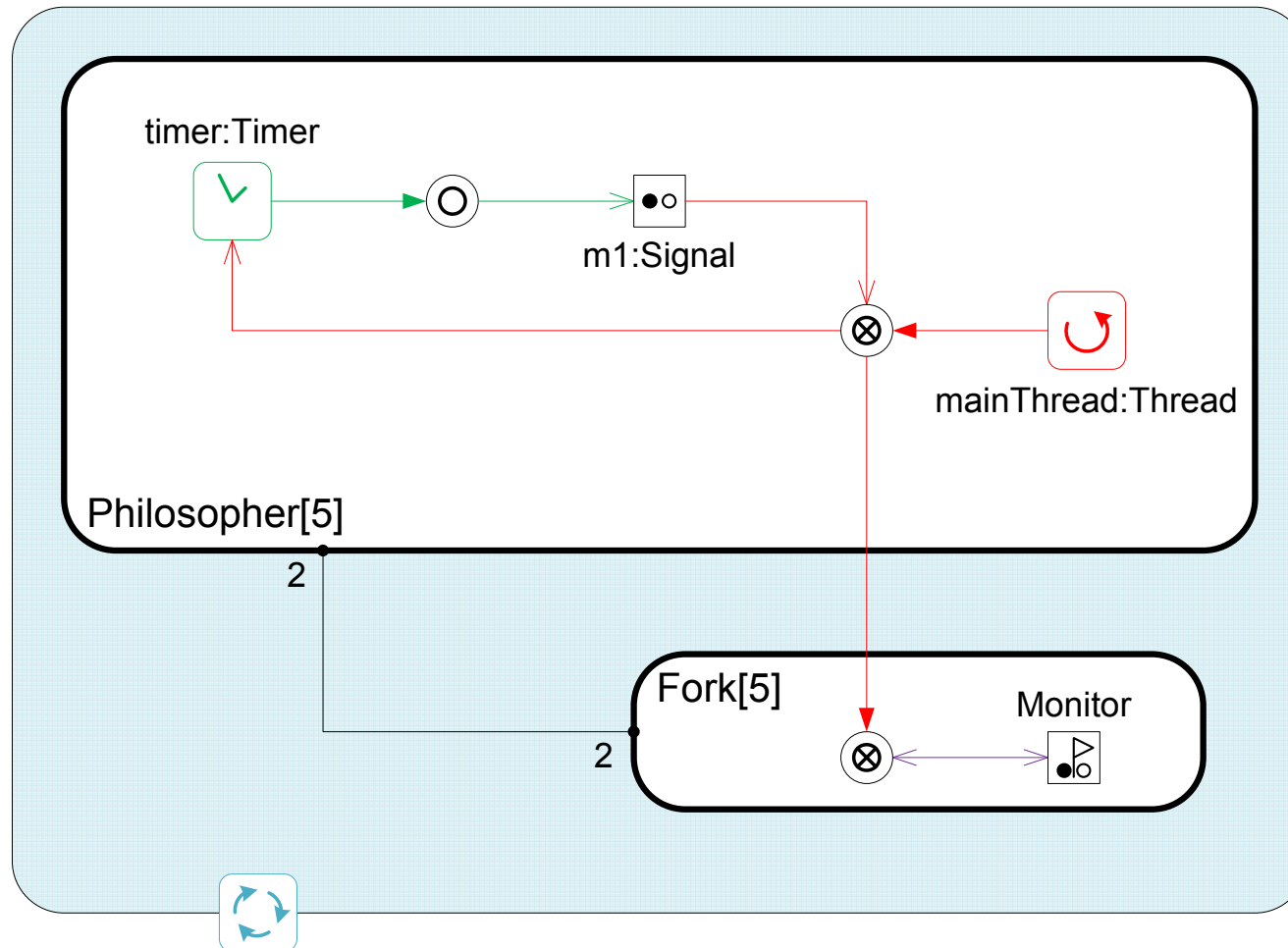
# Dining Philosophers Example

## Deployment UED



# Dining Philosophers Example

## Implementation UED



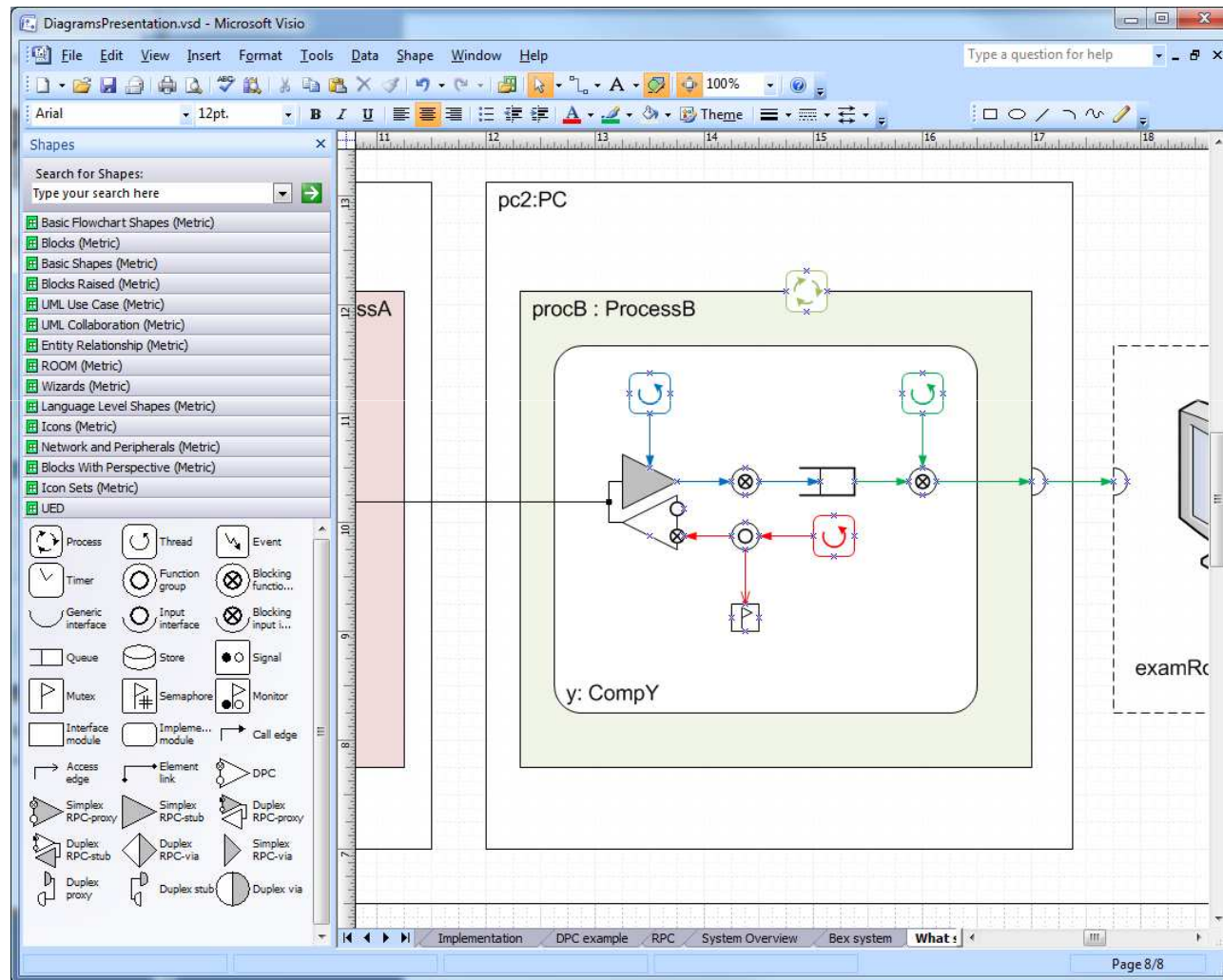
# Dining Philosophers Example

Deadlock check

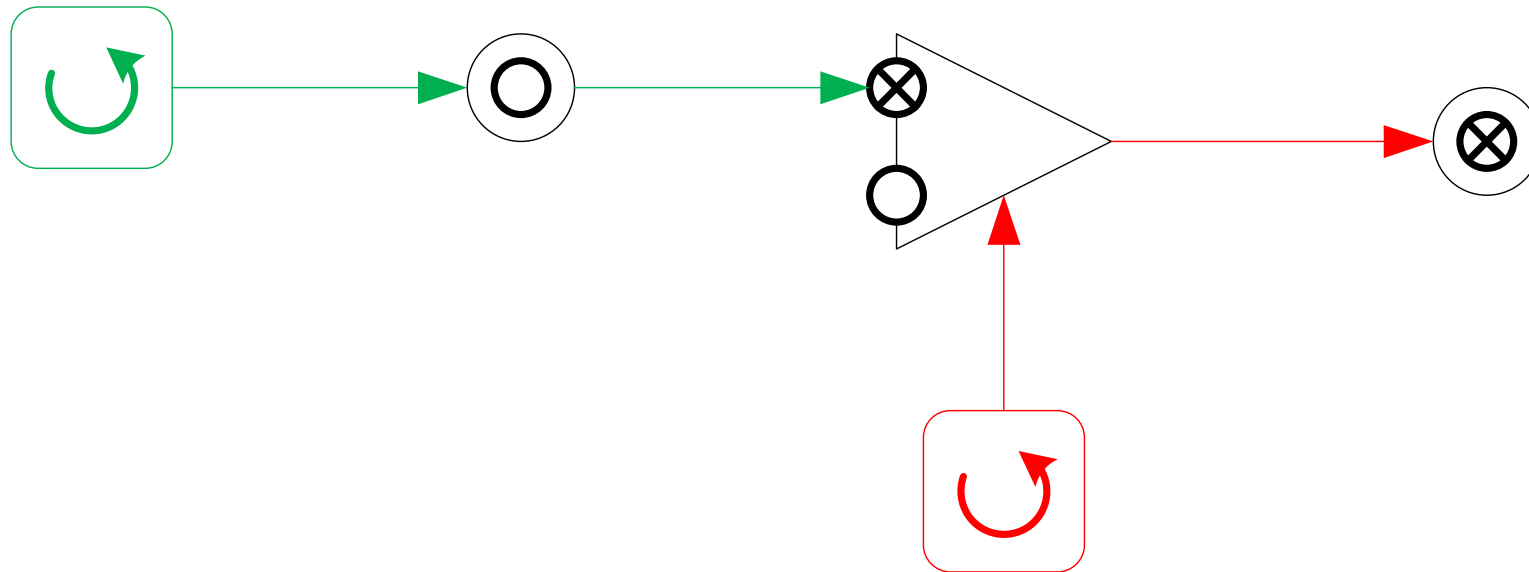


# Tooling

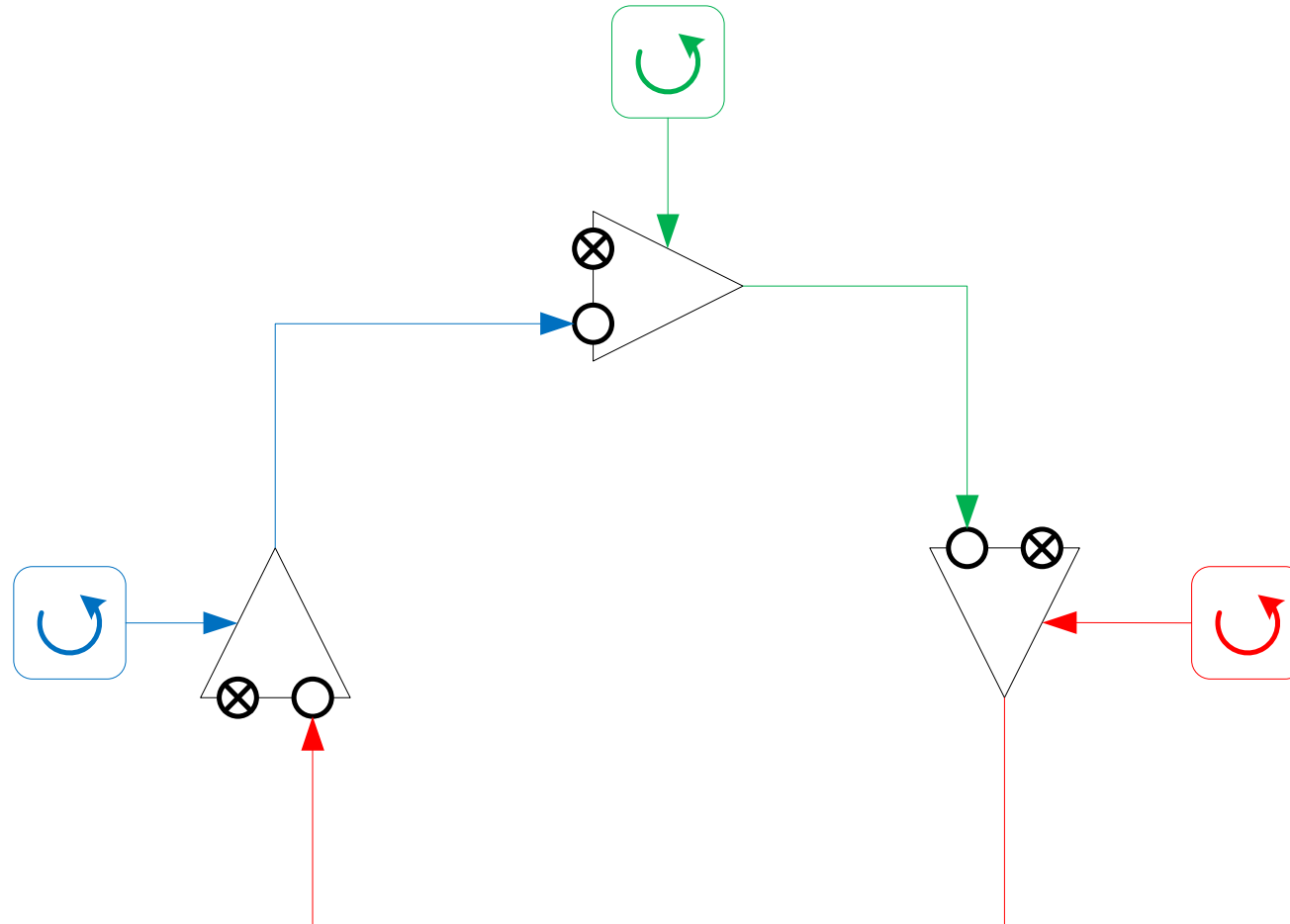
## Visio stencil



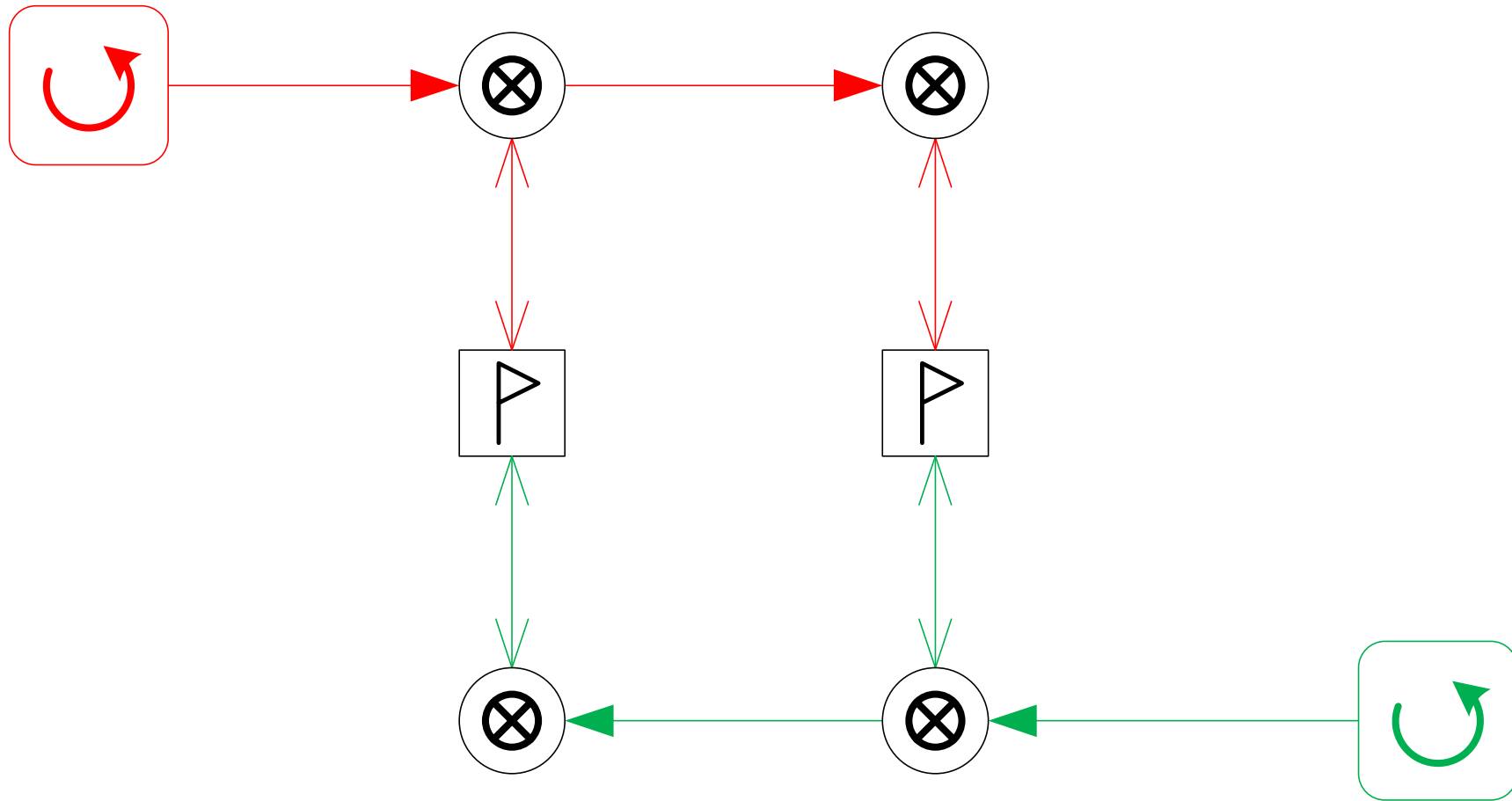
# UED versus UML (DPC + blocking behavior)



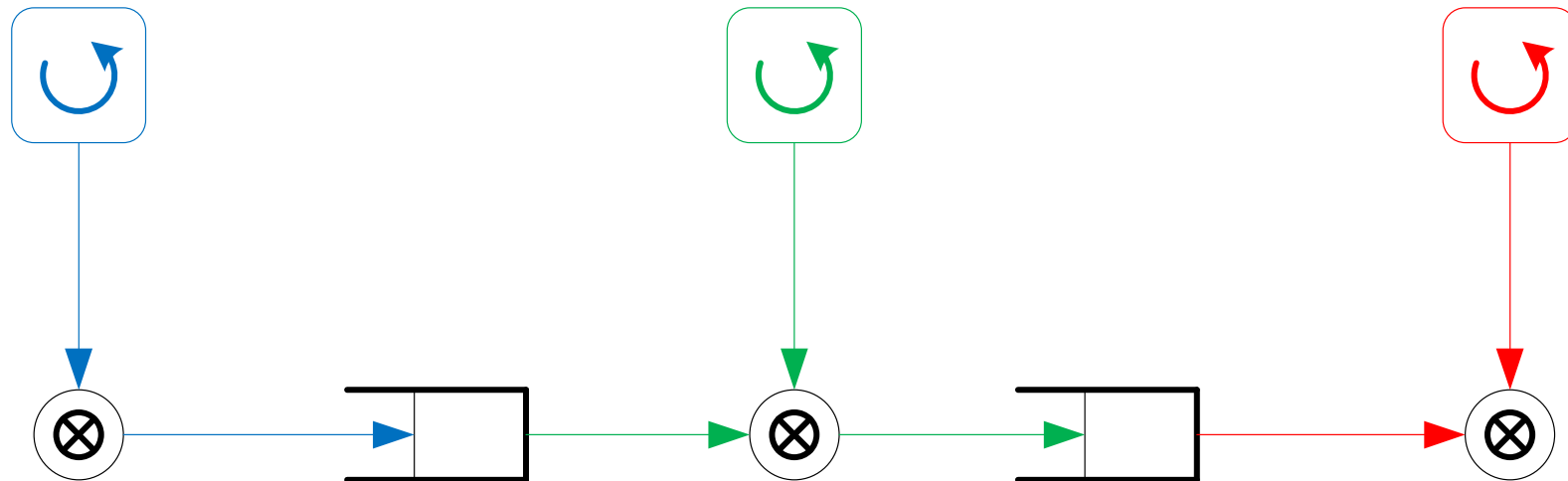
# UED versus UML (race condition)



# UED versus UML (deadlock)



# UED versus UML (image pipeline)



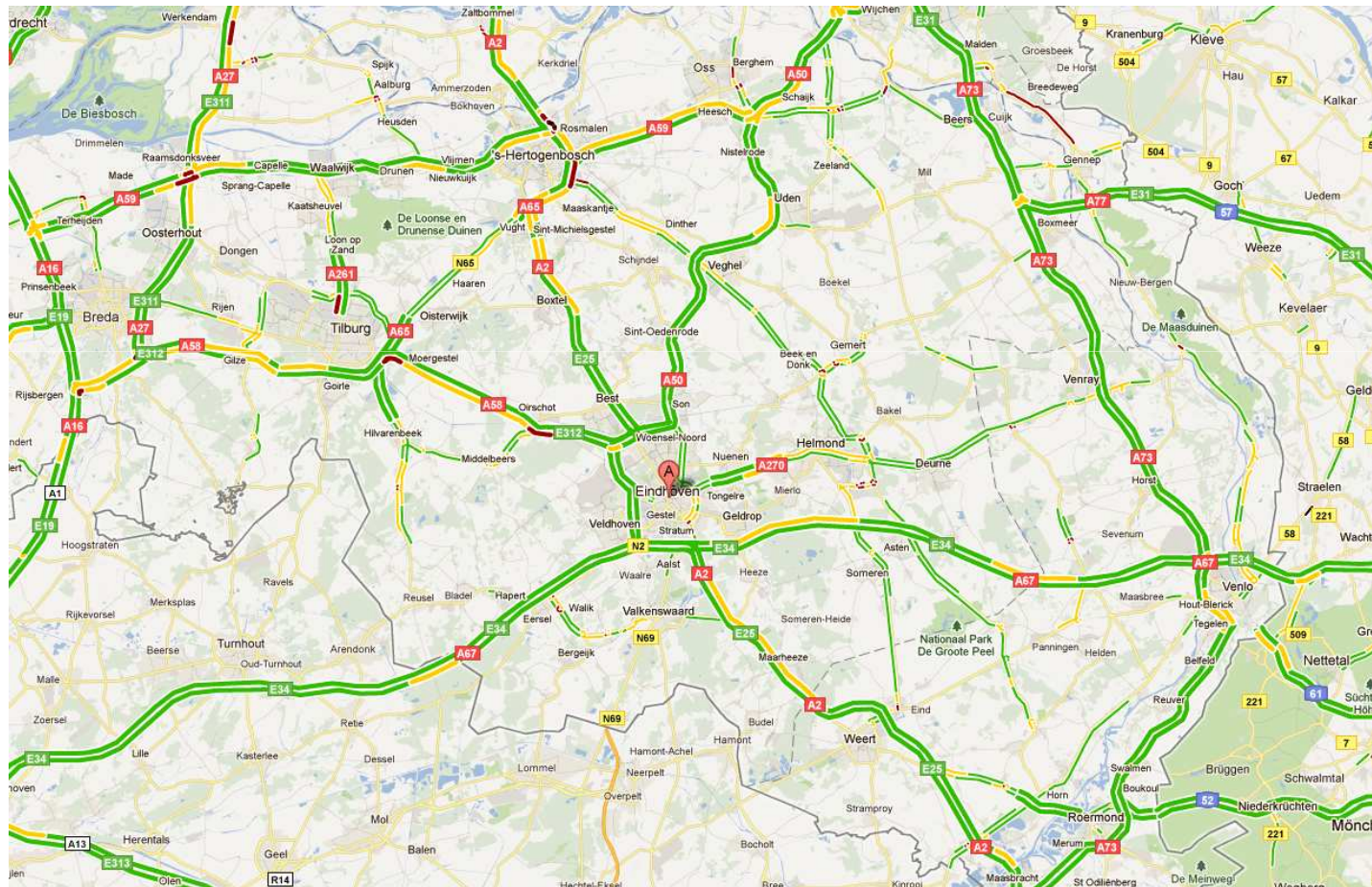
# Experiences with Healthcare

- Construction diagram of the software
- Documentation and specification standard
- Better understanding
- PR solving
- Performance analysis
  - predict context switches

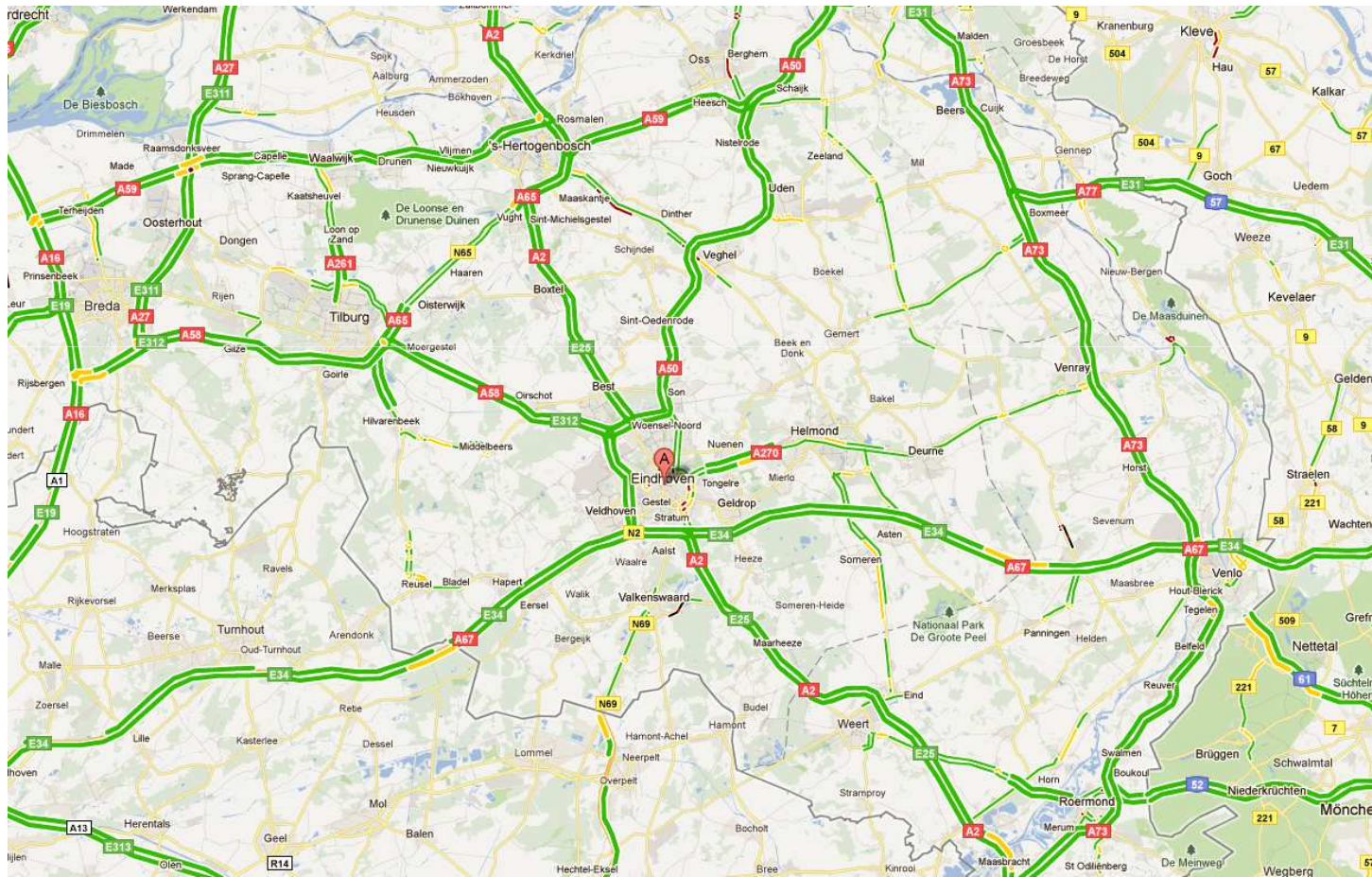
## Ultimate goal

- Automated UED analysis
  - Deadlock
  - life locks
  - data integrity
  - race condition

# Ultimate Goal Solve bottlenecks



# Ultimate Goal Find bottlenecks



## Contact

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