
# Diagnosis for component-based system

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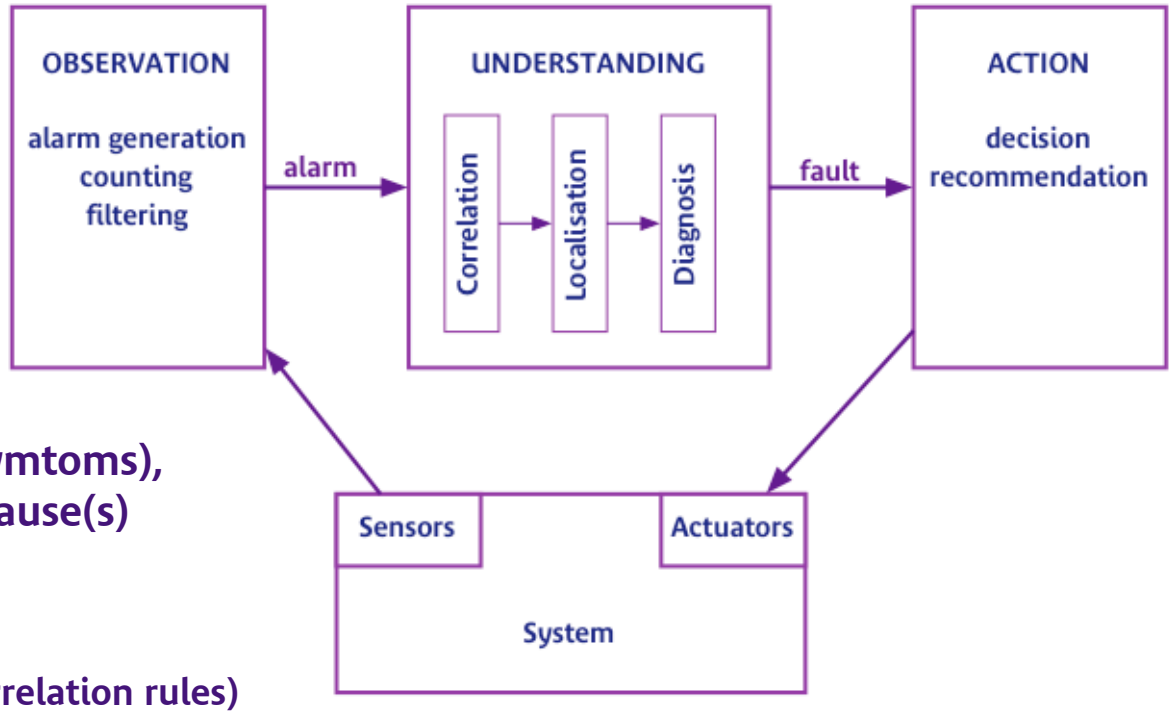
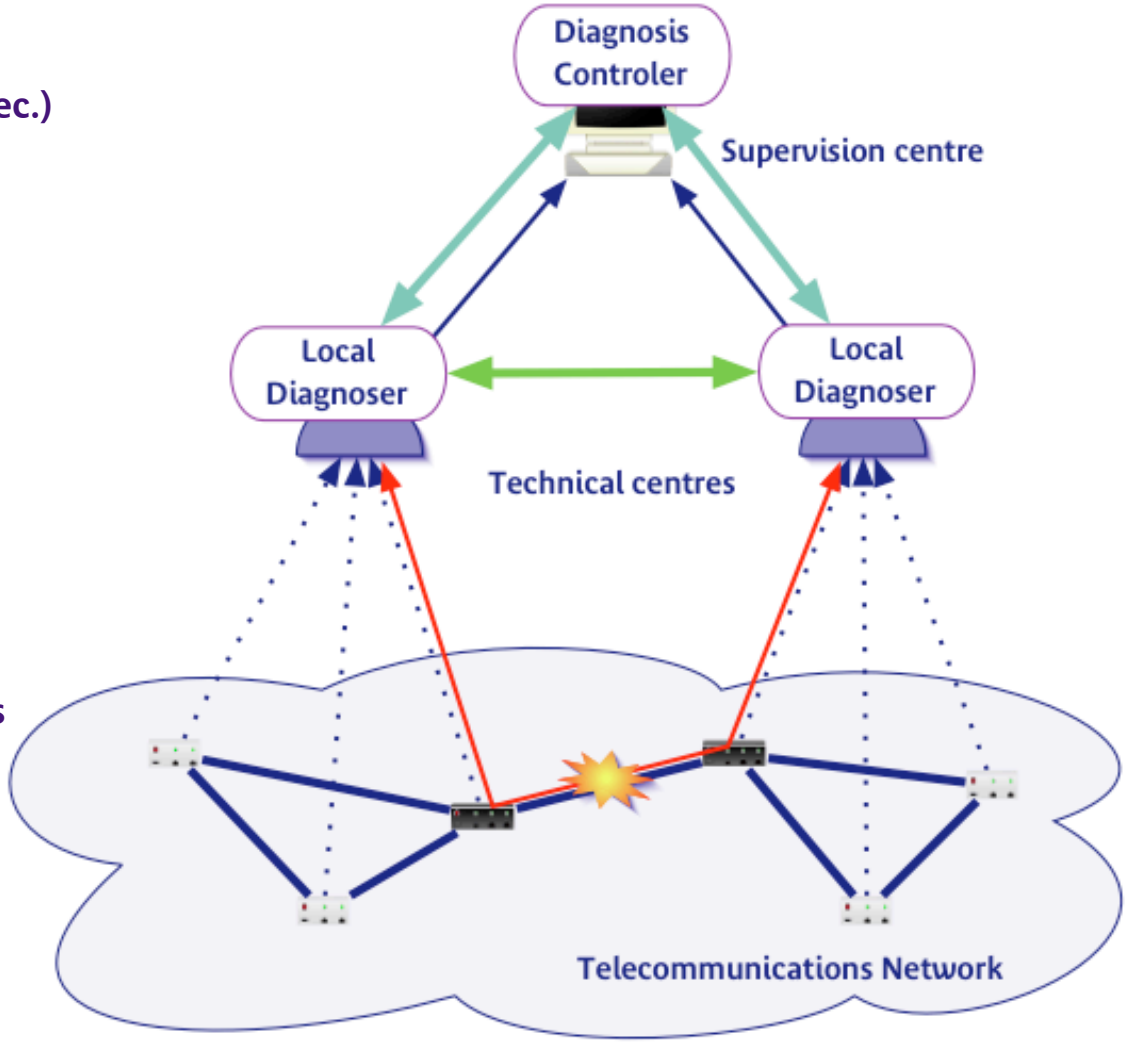
# The diagnosing problem



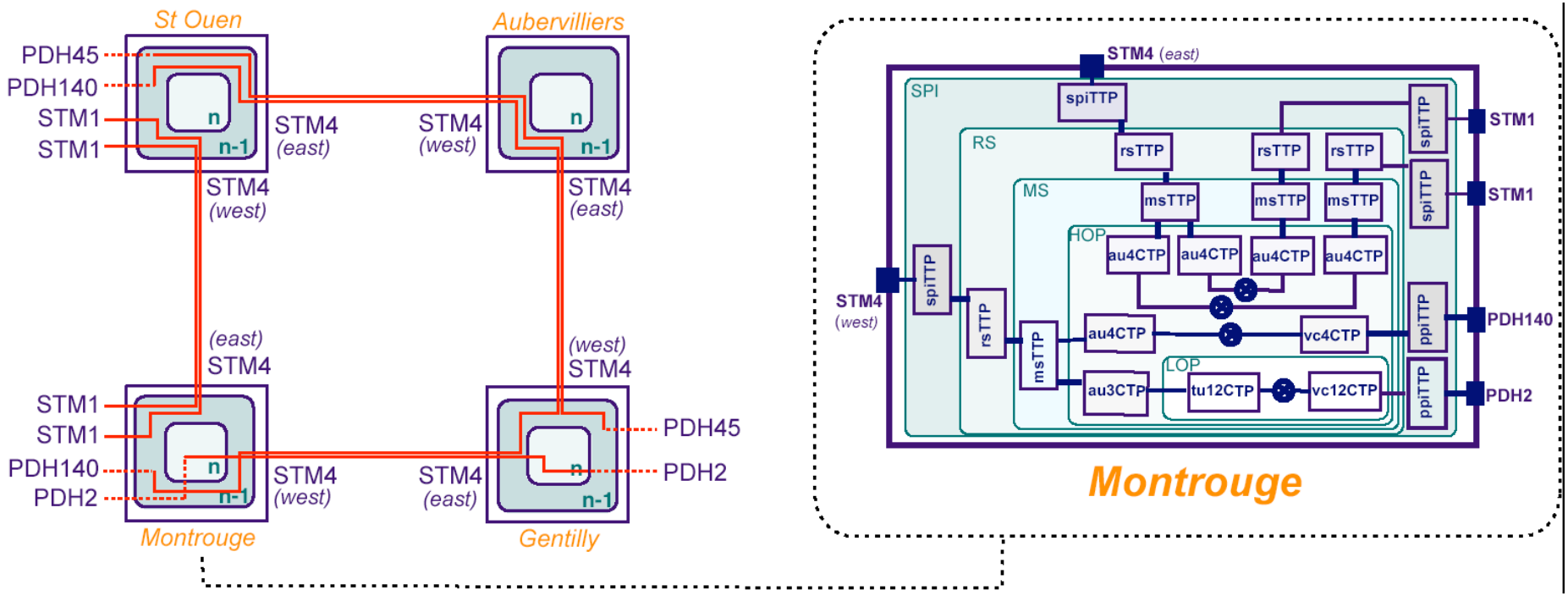

- From the observations (the symtoms), to find the possible primary cause(s)
- Two families of approaches:
  - expert-based (deduction/correlation rules)
  - model-based (nominal or fault models)
- Two distinct objectives
  - maintenance (off-line, accuracy)
  - supervision/monitoring (real-time, QoS)

# Magda: a distributed-diagnosis experiment

- **Knowledge modeling:**
  - elementary component (ITU rec.)
  - component behavior (alarm propagation model)
  - network topology
  - logical connections
- **Symptoms:**
  - alarms
- **Diagnosis:**
  - histories of components states that explain the alarms
  - causalities between them

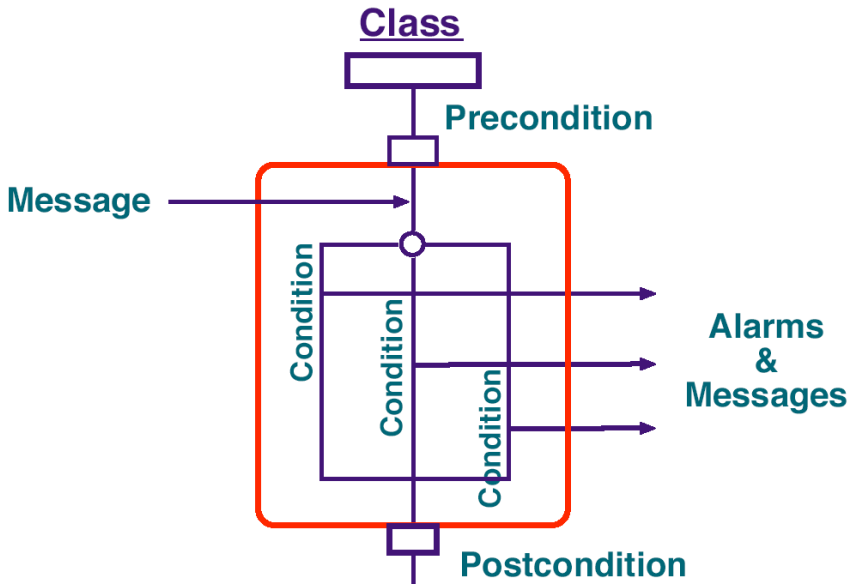


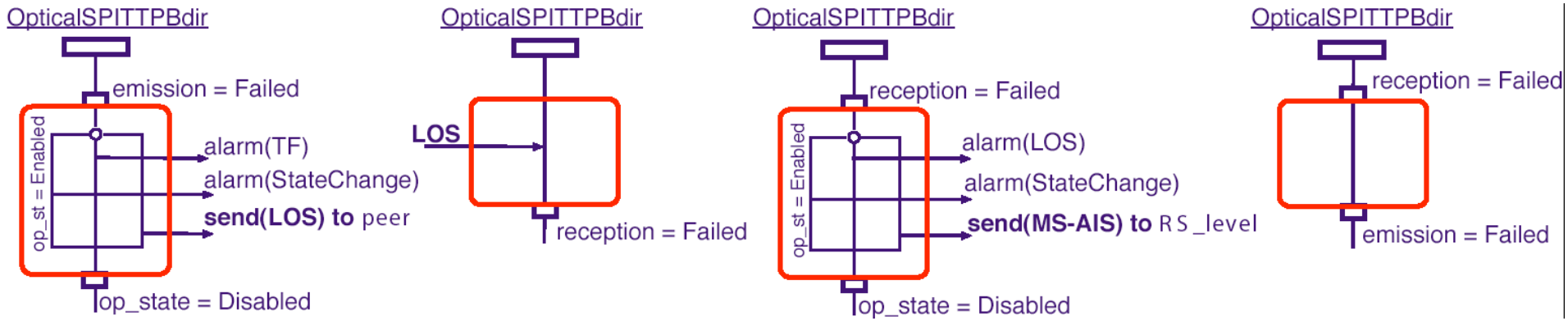
# Magda modeling: component topology/connectivity



# Magda modeling: component behaviour

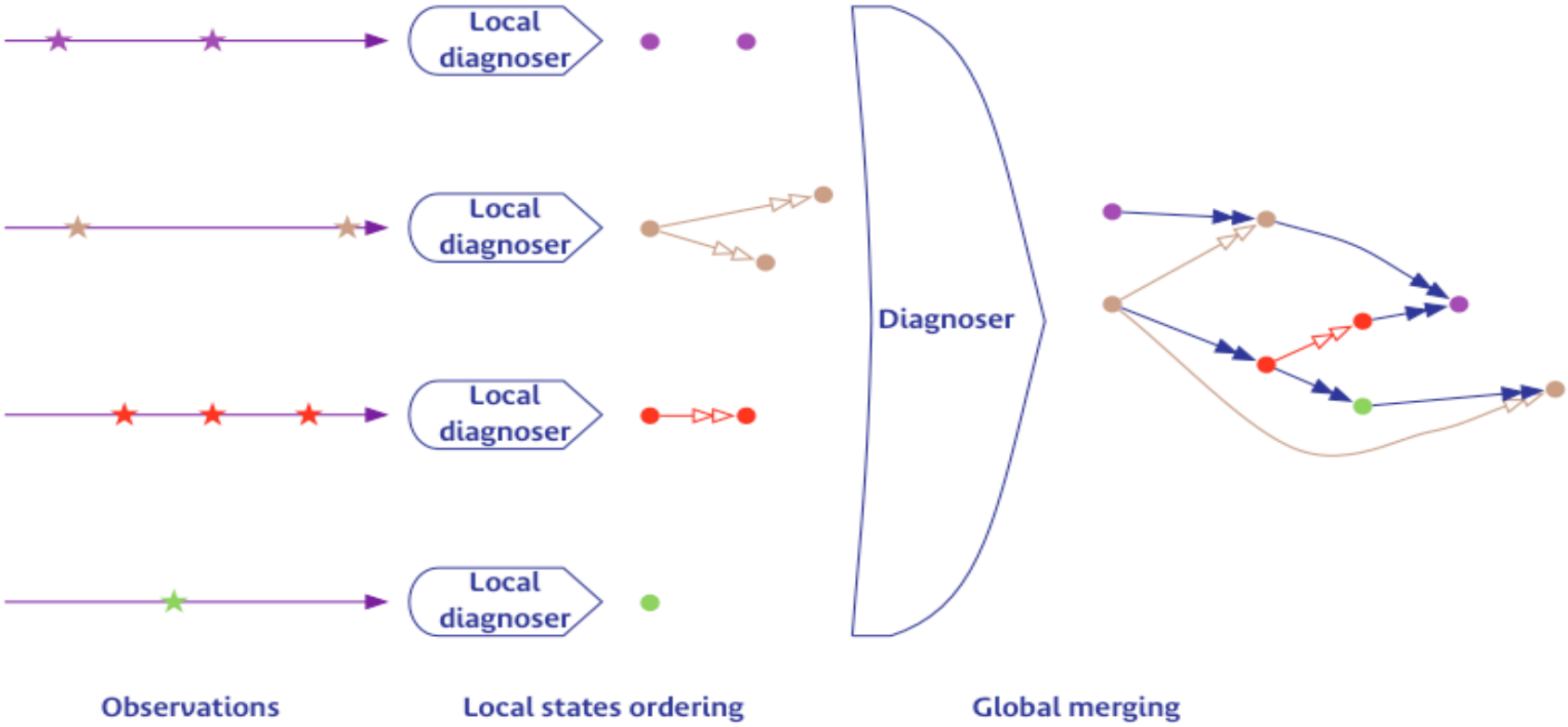
- Tiles: local alarm propagation model
  - one or zero input message
  - pre/post-conditions
  - produces messages to other components
  - produces alarms (symptoms)
- Diagnosis: connecting the tiles
  - with respect of the topology



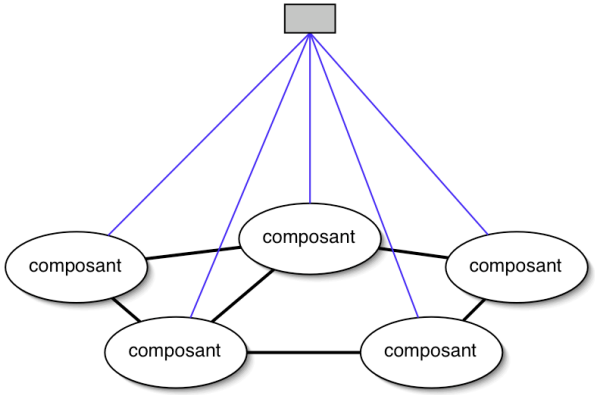
# Distributed Magda Diagnoser

- Observations orders states with causal relationships
  - Local ordering then global merging (ambiguity / observation losses are allowed)
  - Root of the graph = primary causes

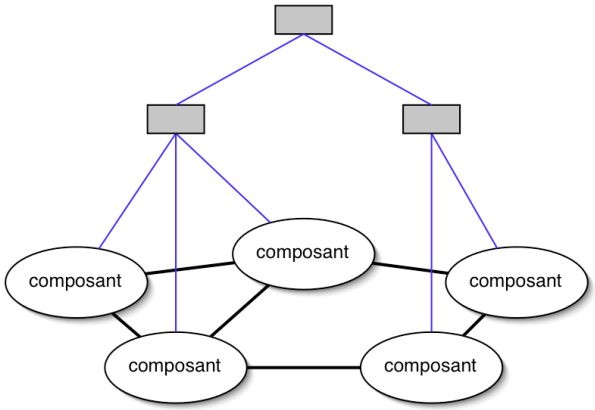


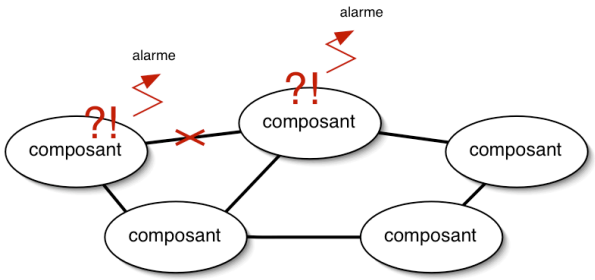
# Distributed Diagnoser Architectures

(a) Diagnostic centralisé

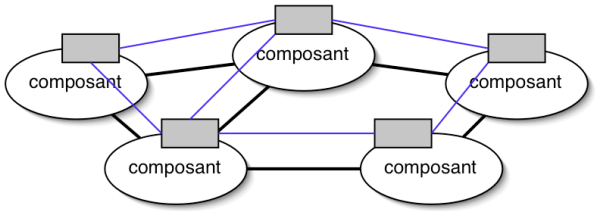



(b) Diagnostic hiérarchique

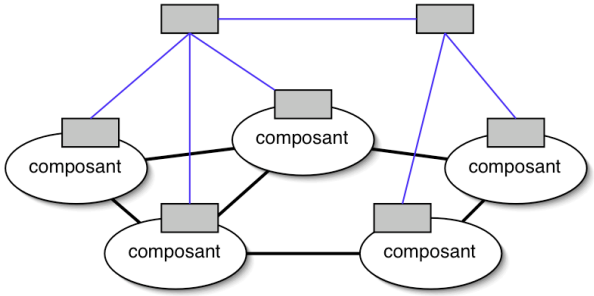



(c) Diagnostic distribué



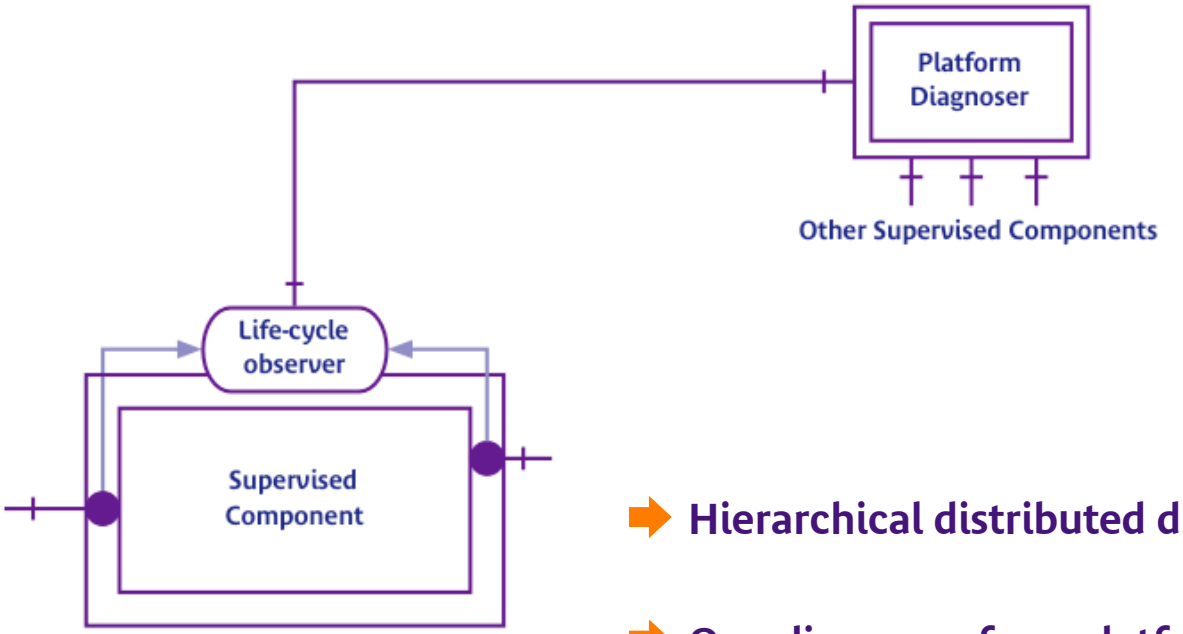

(d) Diagnostic hiérarchique distribué



# Fractal diagnosis problem

- Objective
  - Platform administration (must work also with OTS Fractalized-component)
  - THIS IS NOT component debugging
- Model: nominal behavior
  - life-cycle automata (local behavior)
  - additional knowledge
    - software failure mode and effect analysis
- Faults: discrepancy from nominal behavior
  - Locked Component
  - Bad component use (wrong inputs)
  - Bad response (wrong outputs, exception)
- Observations
  - exchanged messages between components
  - user interaction
  - additionnal system observations ? (cpu, …)

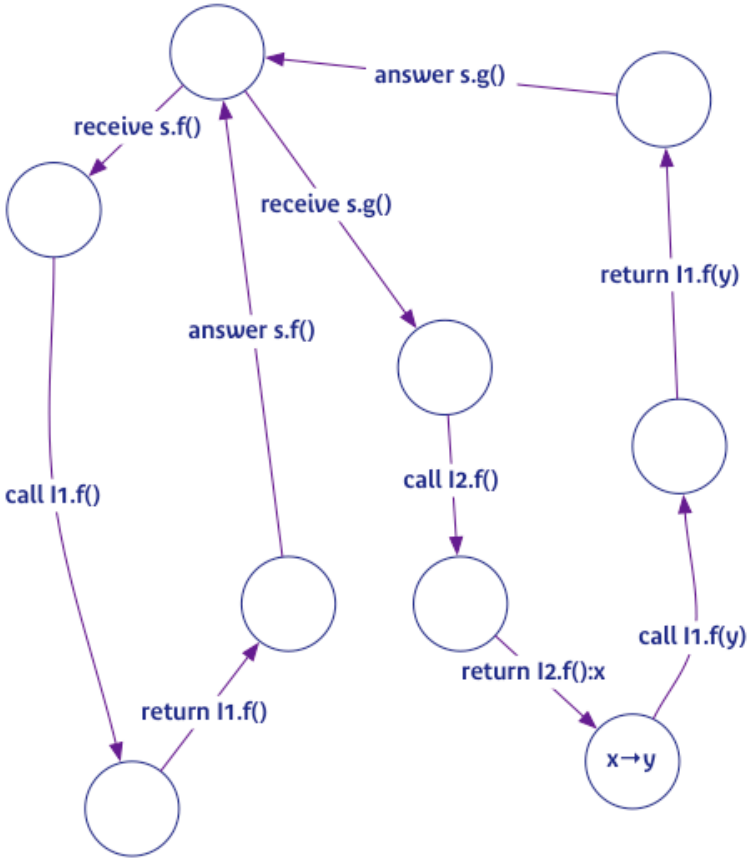
# Component diagnosis architecture




- Hierarchical distributed diagnosis
- One diagnoser for a platform
  - the diagnoser is a component
- One observer (the life-cycle controler) for each component
  - observations could be made through the interceptors

# Component observer

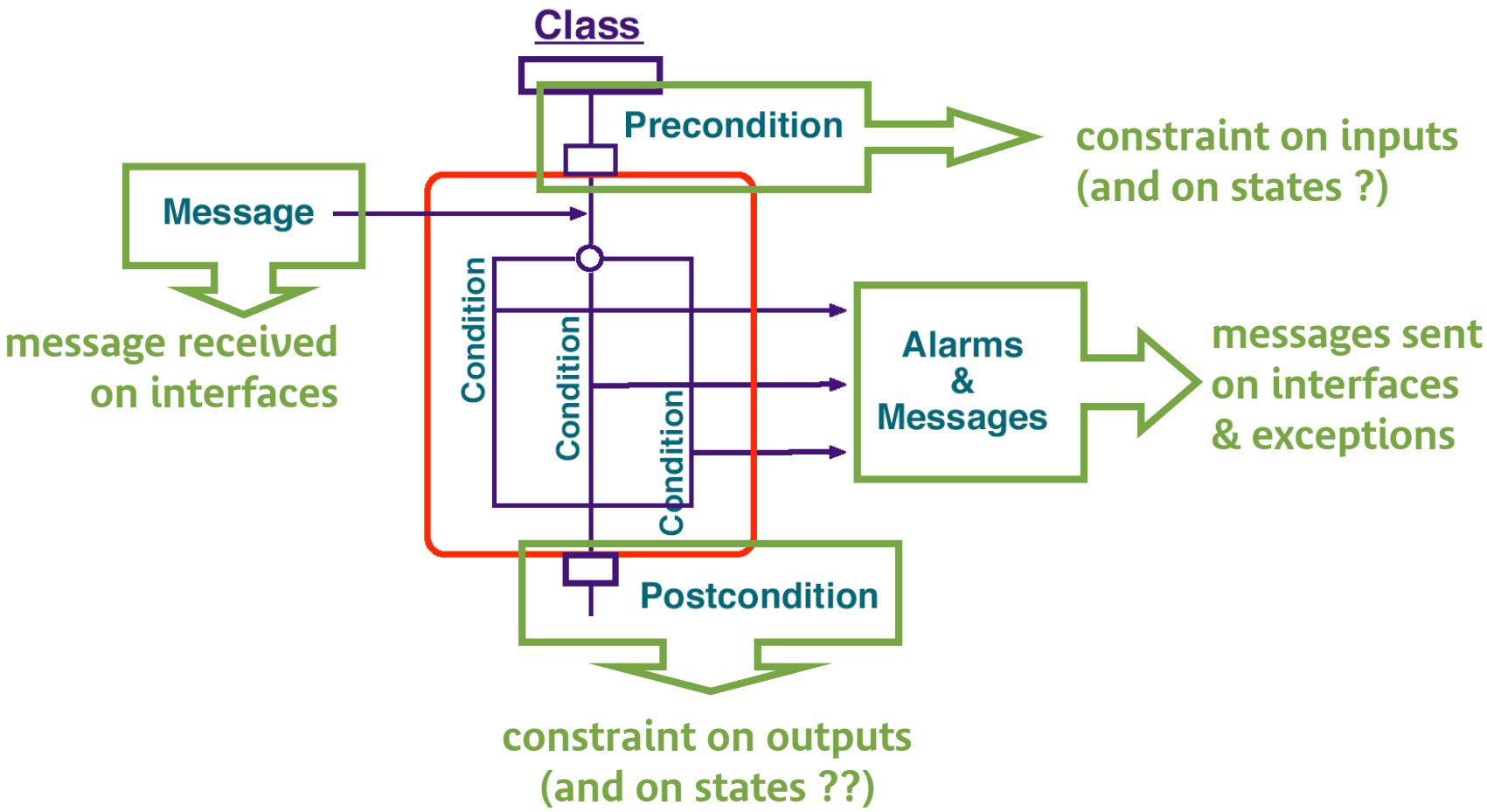
- Life-cycle observer
  - implemented by the way of interceptors
- Local diagnoser
  - Build local histories
- Life-cycle based-model
  - transition:
    - method calls and returns
    - exceptions
  - state:
    - component state
    - faulty state? (will ask a global diagnosis ?)
  - additionnal knowledge on parameter flows



# Additional knowledge for the diagnosis

- Must be easy to collect
  - based on knowledge already integrated in the dvpt process
- Can not be complete
  - Use of ambiguity/obserations losses process capabilities of the diagnoser
- Proposed formalism: rules between the inputs and the outputs
  - e.g. c1.concat(string s1, int n): string
    - if s1 is empty or n=0, returned string is empty
    - if s1 is unbounded or n < 0, throw a exception
    - …
  - e.g. c2. concat(string s1, int n): string
    - if s1 is unbounded or n < 0, returned string is empty
    - …

# Comparison with Magda tiles



# Just do it…

- Find a (real) component-based application
- Exhibit some faulty states (?)
- Define some in/out properties
- Adapt the diagnosis algorithm

# Prospectives

- Diagnosability of the system
  - Notion of n-diagnosability
  - Identification of critical states
- Minimum observers capabilities
  - Ensure no ambiguity between critical states
- Minimize the overhead of the diagnoser
  - Optimisation of interceptors usage