An Architectural Support for Self-Adaptive Software for Treating Faults

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- Context
- Fault tolerance
- Computation, coordination and configuration
- Dynamic reconfiguration
- Concluding remarks

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Context

- What does "self healing" mean to you?
  - Fault tolerance – a means to achieve dependability;
- What part of the self-healing problem are you dealing with?
  - Fault treatment at the architectural level;
- What part are you not dealing with?
  - Error processing;
- What applications are you targeting?
- What are the top two/three new technical ideas/approaches:
  - *Structural adaptability* - separation between computation and coordination for the provision of flexible structures;
  - *Behavioural adaptability* - immune inspired fault tolerance;

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Fault Tolerance

The undesired - but in principle expected - circumstances that affect the dependability of systems:

• • • → failure → fault → error → failure → fault → • • •

Fault tolerance - the provision of services in spite presence of faults;

- *Error processing* - detection, damage assessment, and recovery;
- *Fault treatment* - diagnosis, and repair;

Fault assumptions in terms of *nature* and *rate*;

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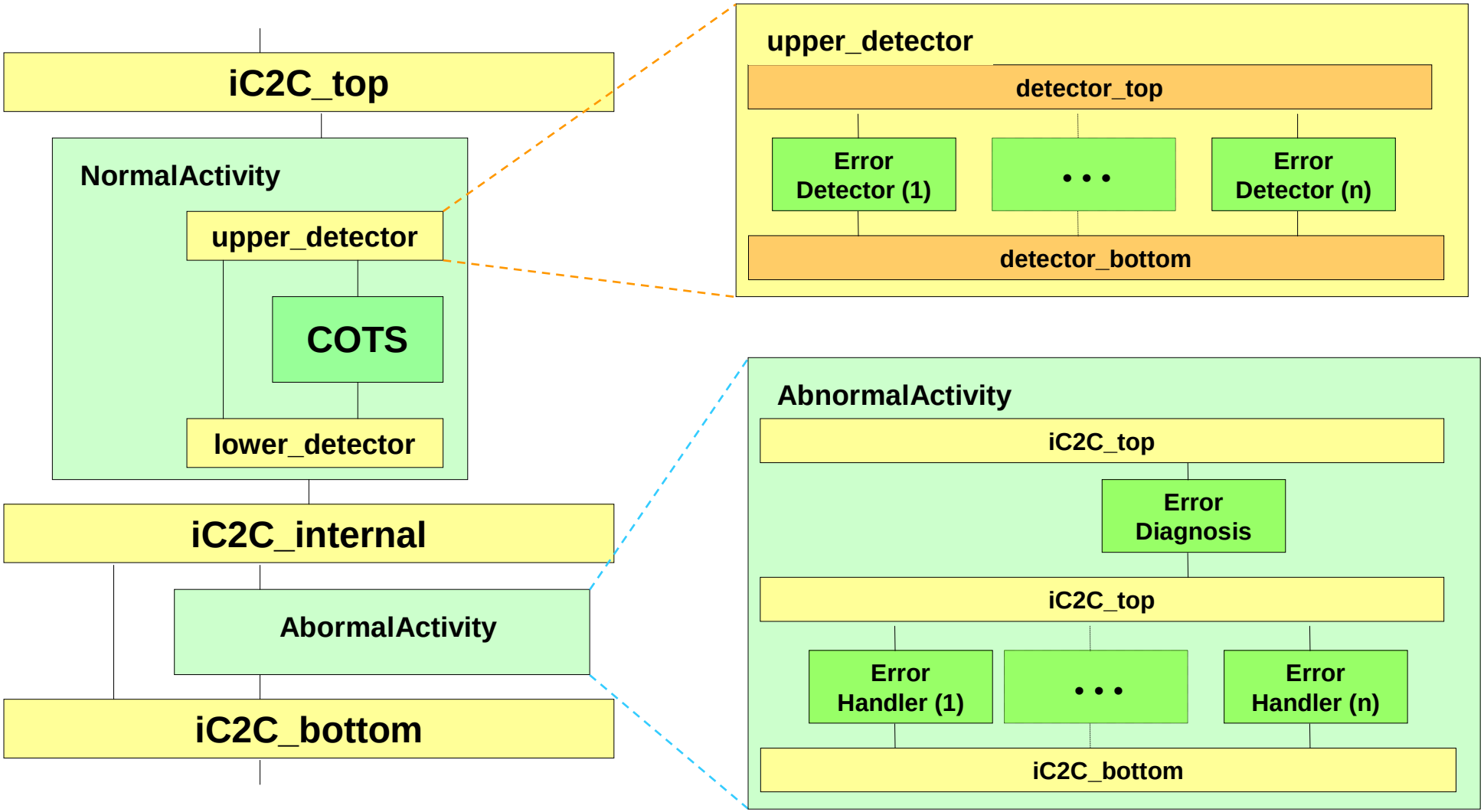
Idealised Fault Tolerant C2 COTS (iCOTS)



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Fault Treatment

Isolation of the faults is obtained by *dynamic reconfiguration*:

- availability of redundancies;
- ability to modify system structure;
- definition of acceptable but less desirable levels of service;
  - diversity of services for certain class of failures;

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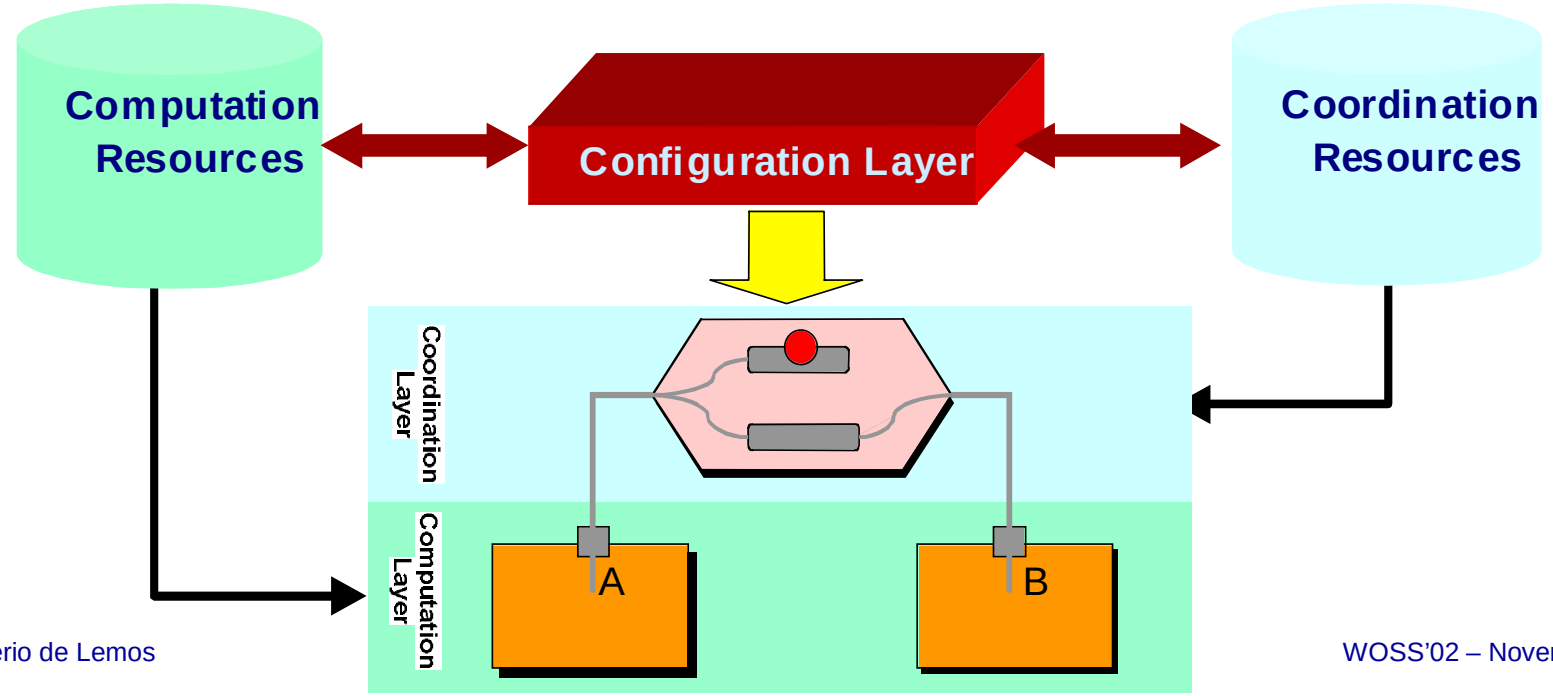
Proposed Architecture

Computation: manages computations performed by components;

Coordination: enforces the interactions between components;

Configuration: determines when and how the components and connectors should be linked;



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Co-operative Architectural Style

connector name
- attributes
- roles
- behaviour
  - initial
  - pre-condition
  - normal
    - invariant
    - operation
    - post-condition
  - exceptional
    - signal
    - handler
    - post-condition
  - failure
    - omission
    - commission

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Fault Treatment

Dynamic reconfiguration is obtained by:

- selecting different components and collaborations;
- sequence of atomic transactions achieving stability;

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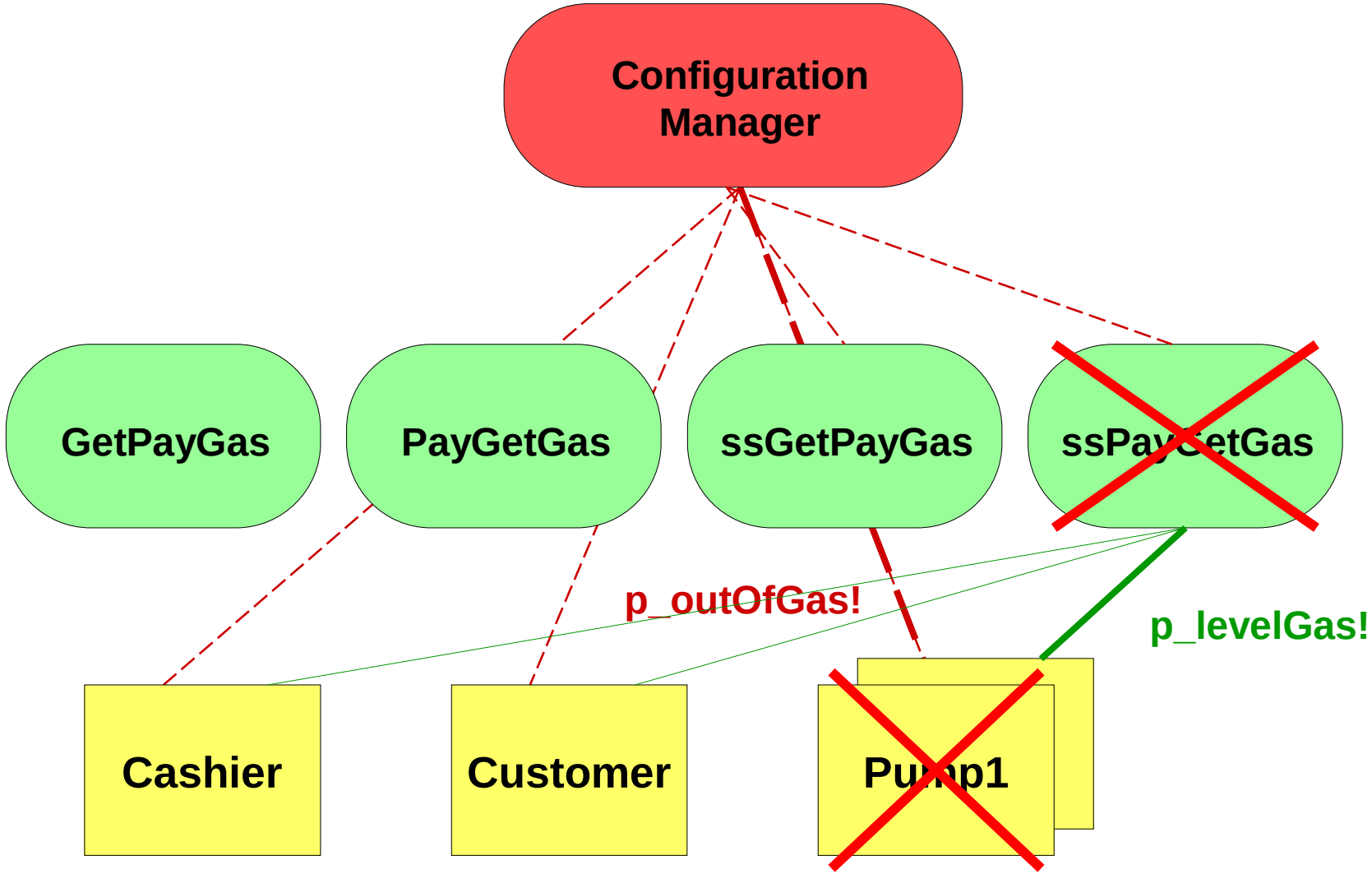
Dynamic Reconfiguration



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Concluding Remarks

Architectural support for dependability:

- definition/identification of structuring concepts, mechanisms and techniques that provide flexibility for supporting run-time adaptability;

Some challenges:

- identification of service redundancies;
- instantiation of reconfiguration policies into strategies;
- realization of the strategies without service disruption;
- techniques for evaluating configuration strategies;

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Concluding Remarks

Immune inspired fault tolerance:

- looking for learning capabilities support that may be able to deal with *unexpected* circumstances:
- it removes the *predictability* aspect;
  - can these learning capabilities be trusted?
  - how to protect the system from undesirable decisions?