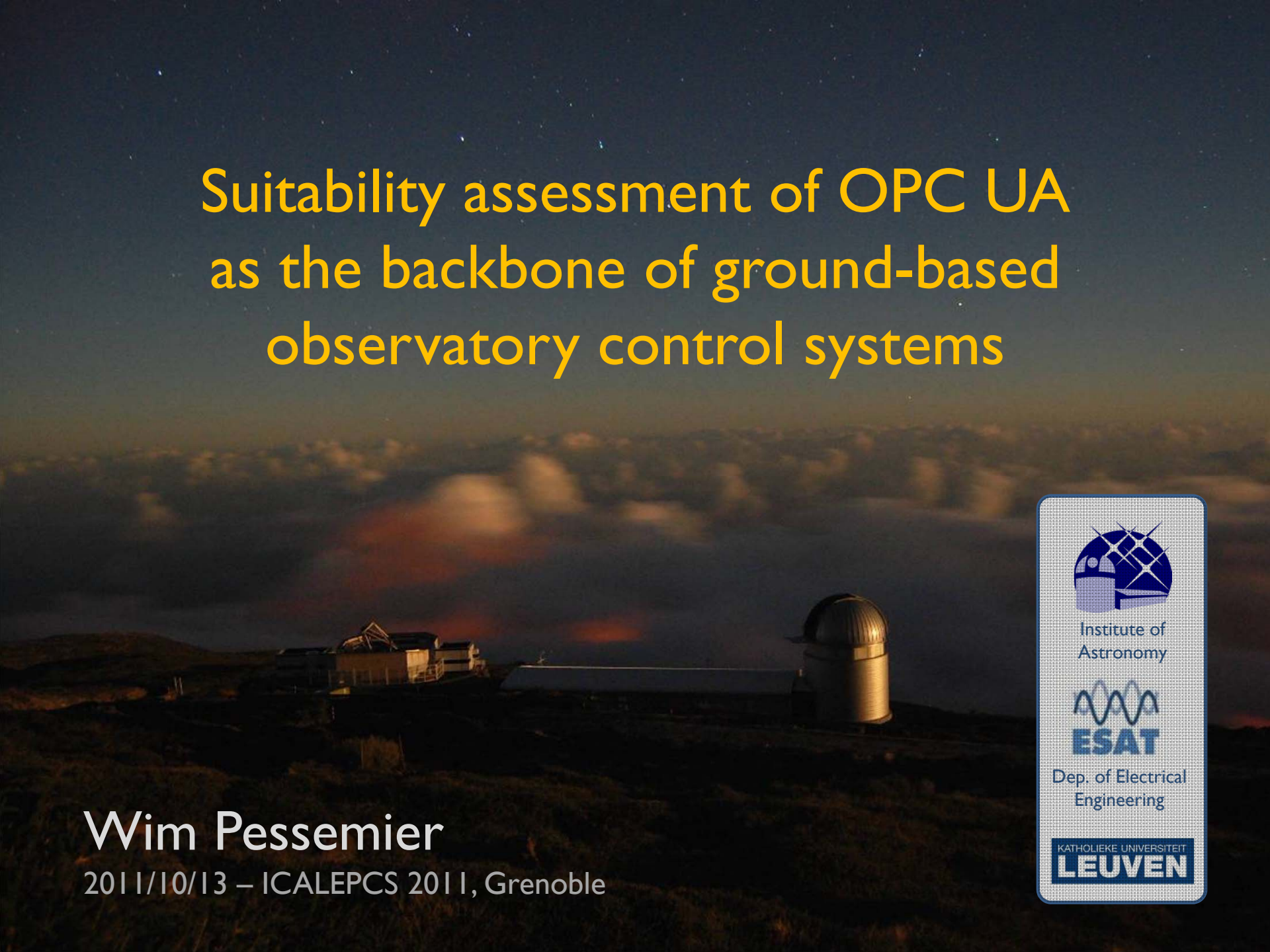
# Suitability assessment of OPC UA as the backbone of ground-based observatory control systems

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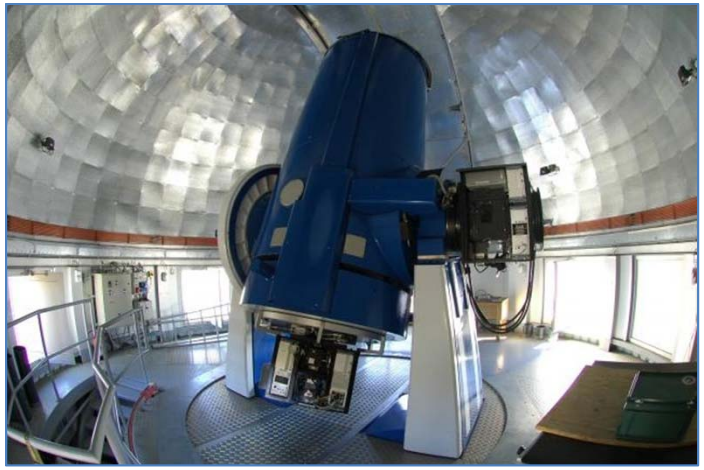
2011/10/13 – ICALEPCS 2011, Grenoble

# Mercator Telescope

- 1.2 m optical telescope with
  - Fiber-fed echelle spectrograph (R~85000)
  - 2K*6K FT CCD camera
  - 3-channel 2K*6K FT CCD camera (‘12)
- La Palma (Canary Islands, Spain)
- Transputer based legacy TCS is gradually being replaced by a **Python-based framework** providing:
  - common services
  - communication drivers



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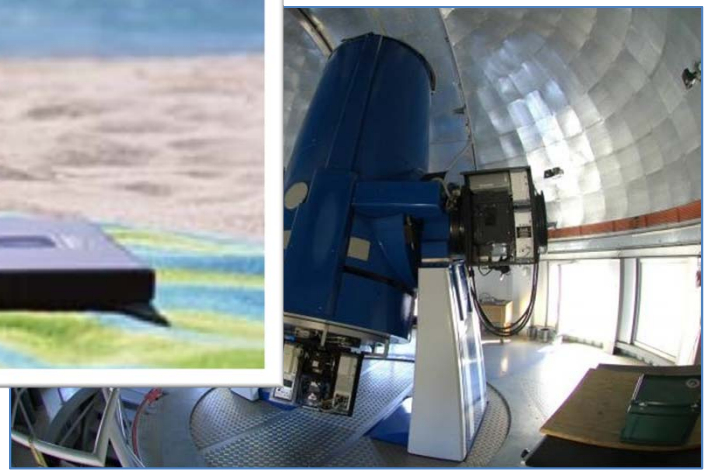

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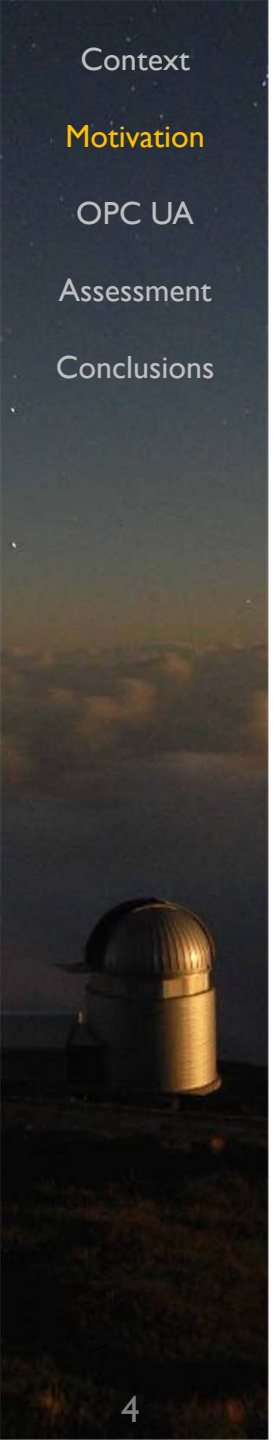

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while stage.status() == STS_MOVING:
 try:
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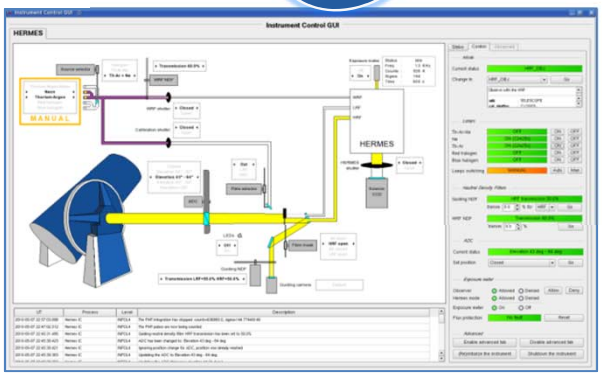


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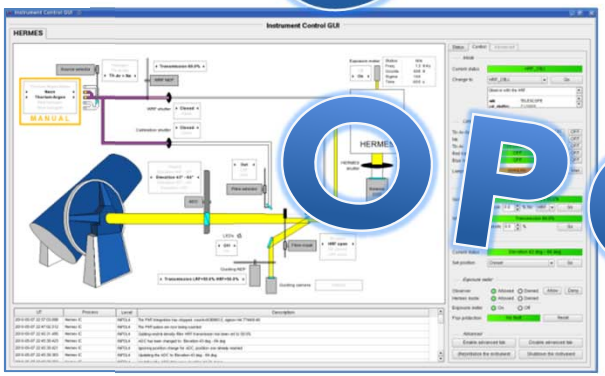


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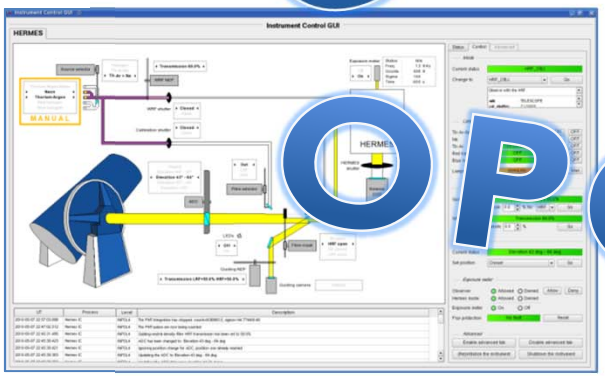


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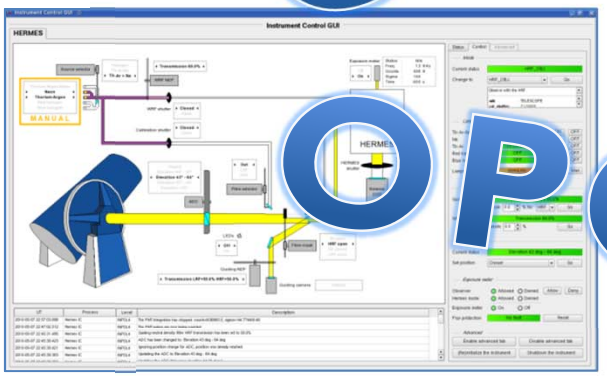


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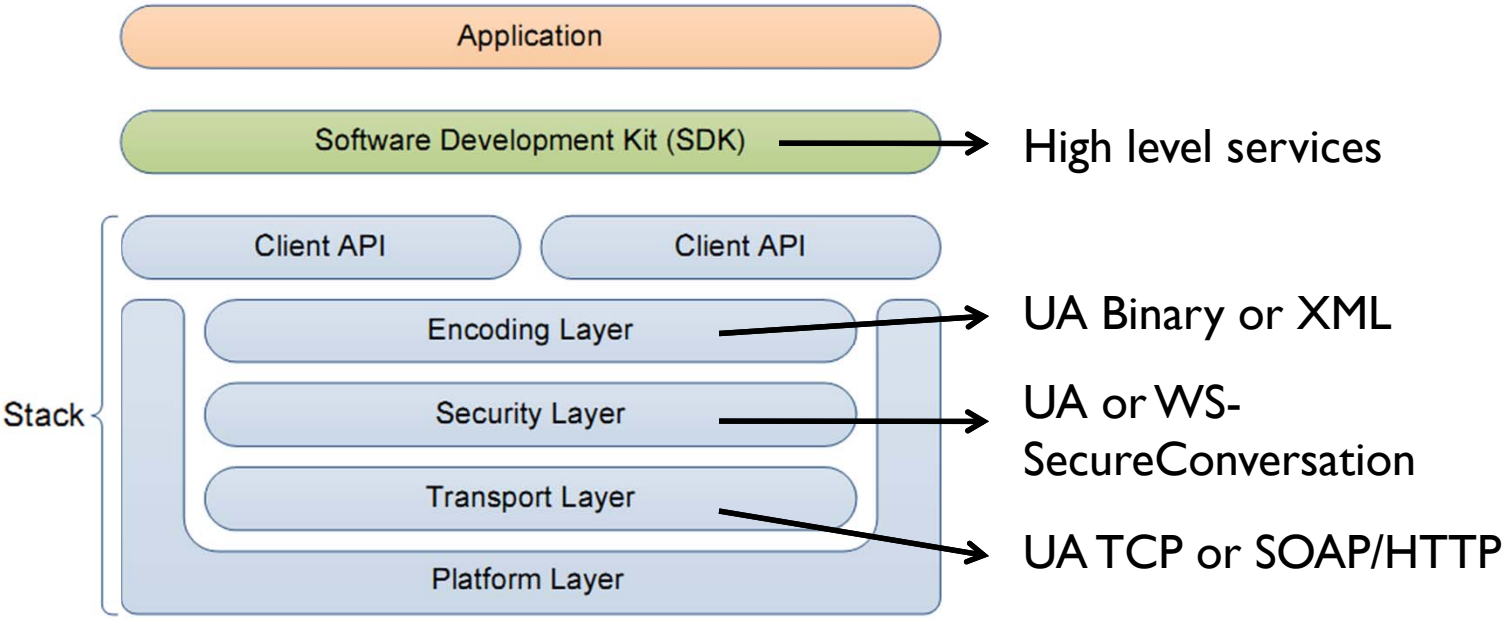
# OPC Unified Architecture

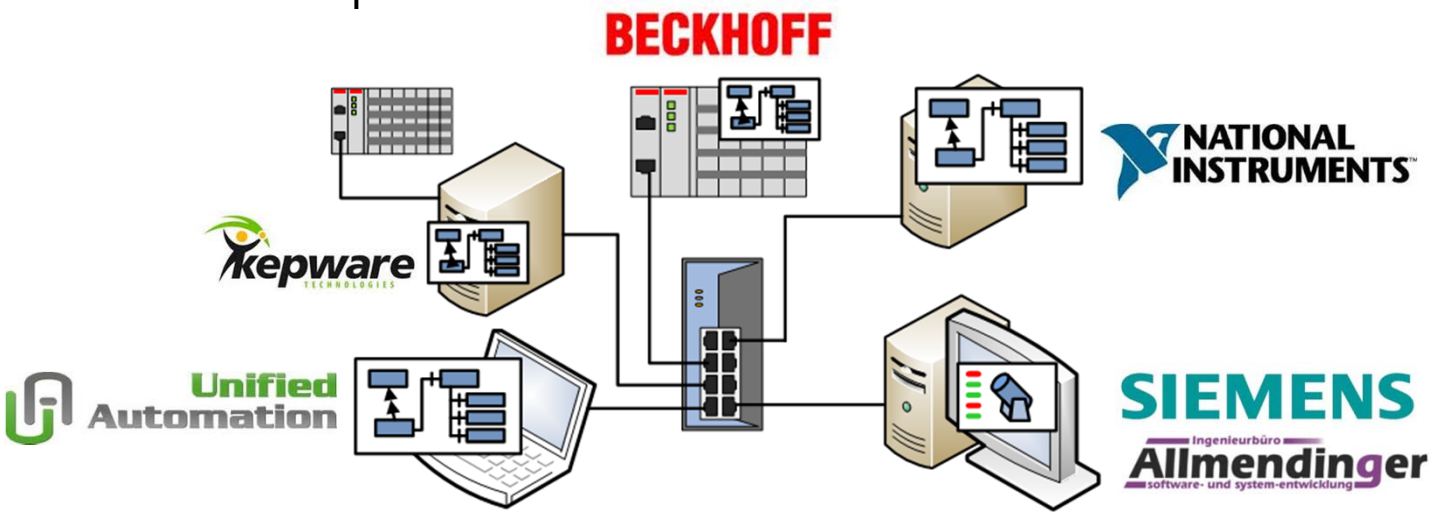
- "Classic" OPC functionality
  New concepts and functionality
  New technology
  } OPC UA
- Service Oriented Architecture
- Specification documents + code deliverables



# Assessment

- Scope:
  - Requirements analysis
  - Feasibility analysis
- Approach:
  - Analyze OPC UA specification
  - Analyze COTS implementations: completeness, maturity

➔ Test set-up:



# Requirements

- Platform independence
- Scalability
- Reusability
- Communication paradigms
- Complex data
- Alarms
- Logging
- Location transparency
- Historical archive
- Dependability
- Lifecycle management
- Performance

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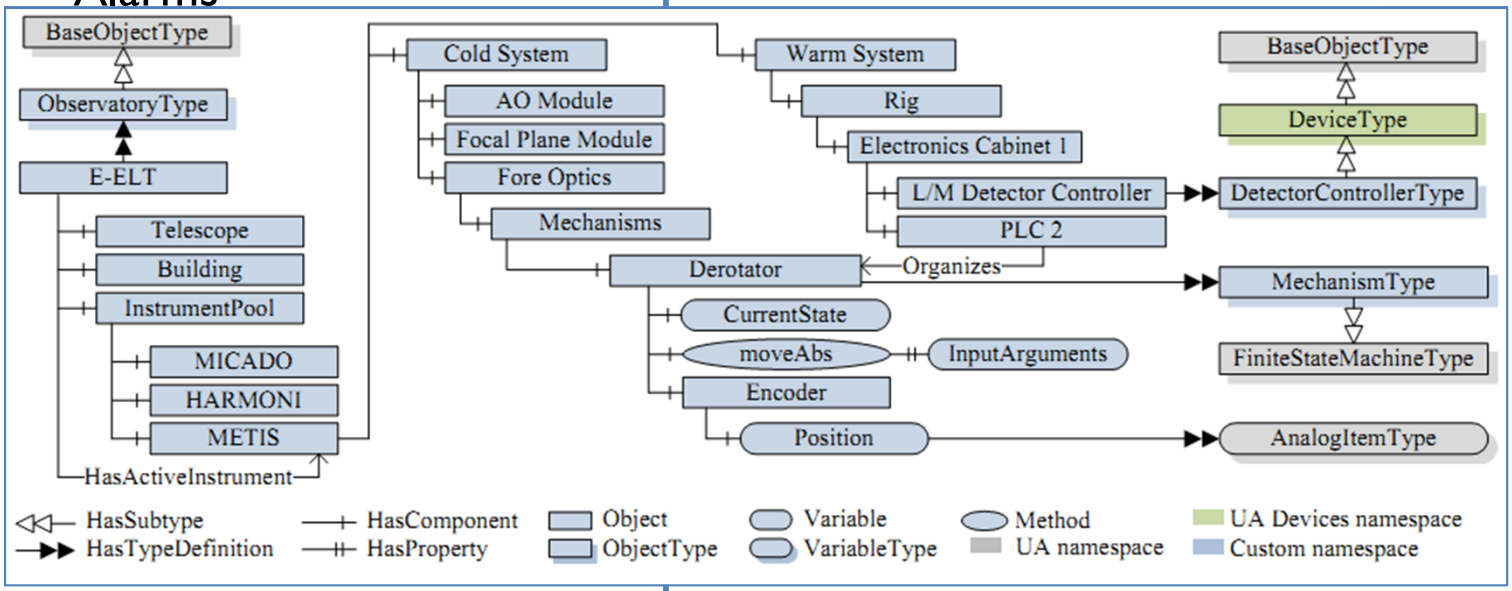
- Vertical reusability of industrial products becomes easier
  - SCADA
  - BAS
  - Safety controllers
  - ...
- Horizontal reusability via standardized type definitions → companion standards



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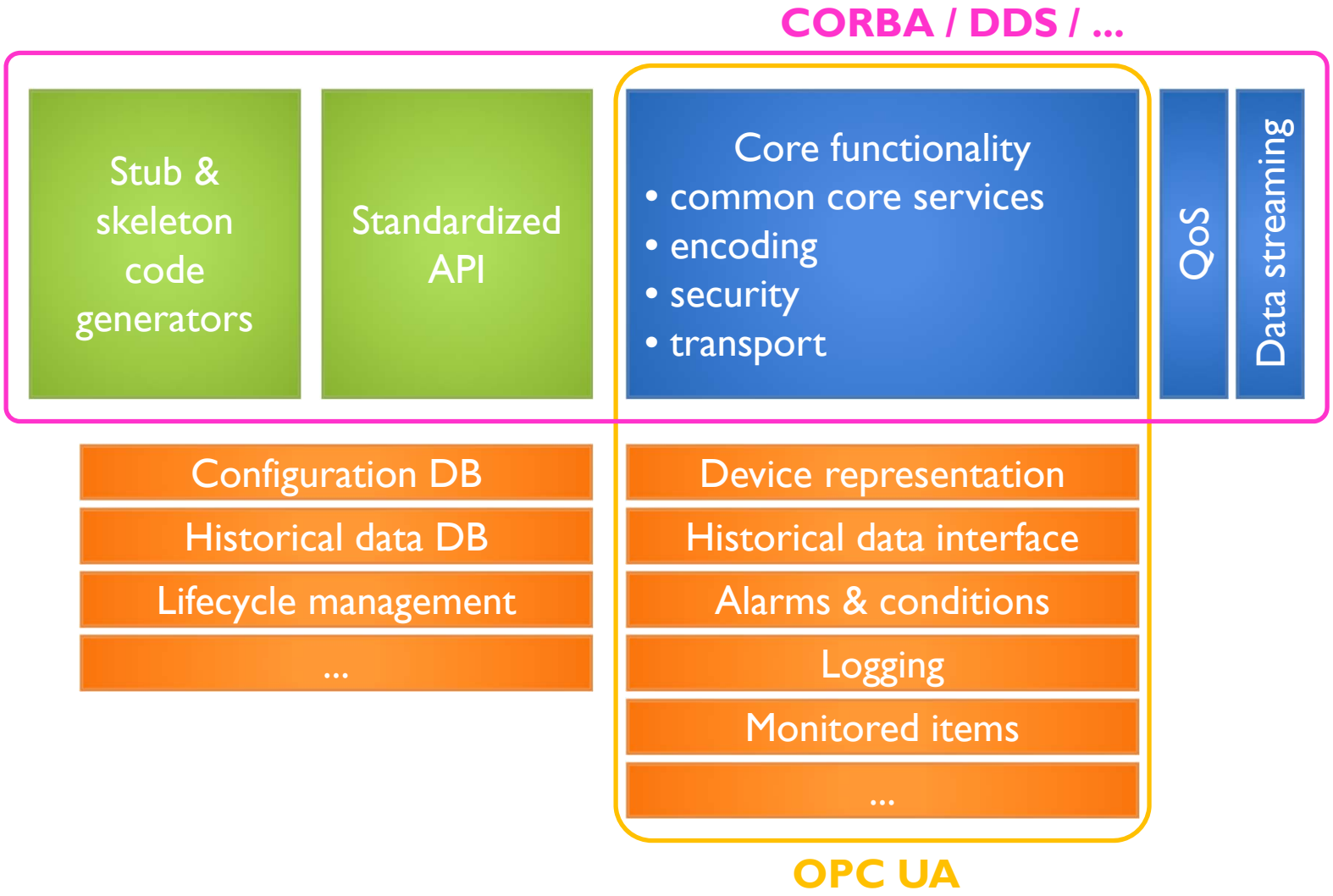
- Reliability and availability
  - Heartbeat in both directions
  - Lost connection ~~=>~~ lost data
  - Redundancy for clients and servers
  - ...
- Security
  - Signing
  - Encryption
  - Certificates
- Maintainability
  - Extensible (encodings, transport)
  - No standardized API
    - ➔ dependent on particular SDK

# More than middleware



# Commercial support

- SDKs: all required functionality is supported, but binary only (↔ official C# stack)
- The rest: still very limited
  - Data access is well supported (read, write, monitored items)
  - Alarms and Conditions are poorly supported (Beckhoff PLCs, UaExpert)
  - Historical Data Access is poorly supported (Beckhoff PLCs, UaExpert)
  - Methods are very poorly supported (UaExpert)

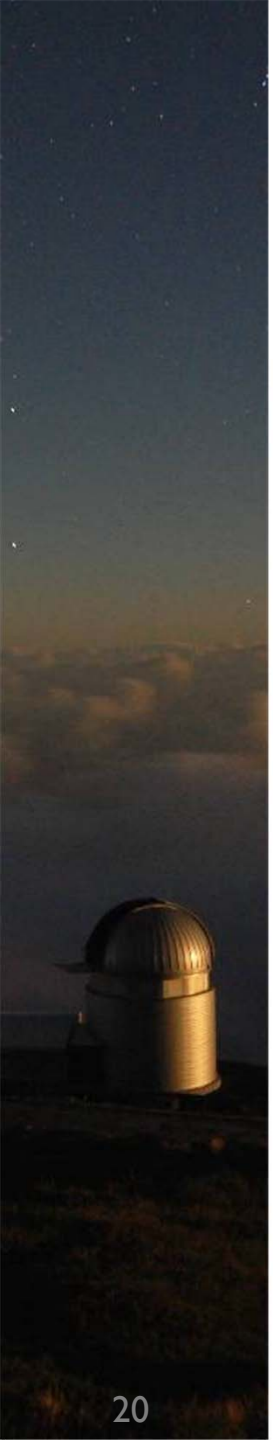
  BUT:
  - it's already more functionality out-of-the-box than what can be achieved with simple communication drivers
  - support will grow in the future
    → new products in the pipeline
    → new technologies in the pipeline
    e.g. 3rd edition of IEC61131-3 → OOP (*CLASS*, *METHOD*, *INTERFACE*, …)

# Conclusions and outlook

- OPC UA specification: interesting technology (to say the least)
  - Very detailed, tailored for **dependable heterogeneous control systems**
- OPC UA stacks and SDKs:
  - Useable right now!
  - It will take some effort to create a framework layer on top of an SDK to allow rapid and comfortable application development
    - Server: skeleton code generation (C++, SWIG), address space management, …
    - Client: stub code generation (C++, SWIG), session/subscription/monitored item handling, …
    - Infrastructure: managers (~container/component), configuration DB, historical DB, A&E GUI, …

    ➔ We already developed a lot of "experimental" code

    ➔ Hope to have basic but functional framework by mid-2012
- OPC UA COTS servers and clients (PLC/SCADA/LabVIEW/…):
  - Only most basic functionality supported now (read, write, monitored items, historical data access, alarms and events, methods)
    ➔ Additional efforts needed (~ aggregating)
  - Backed by a huge organization ➔ support will grow, big potential



# Thanks for your attention!

(and please let's talk to share ideas, experiences, code, ...)

wim.pessemier@ster.kuleuven.be