Maintaining Traceability Links between Design and Runtime Architectures to support Autonomic Management

Philippe LALANDA

Stéphanie CHOLLET

Etienne GANDRILLE

Catherine HAMON

Context

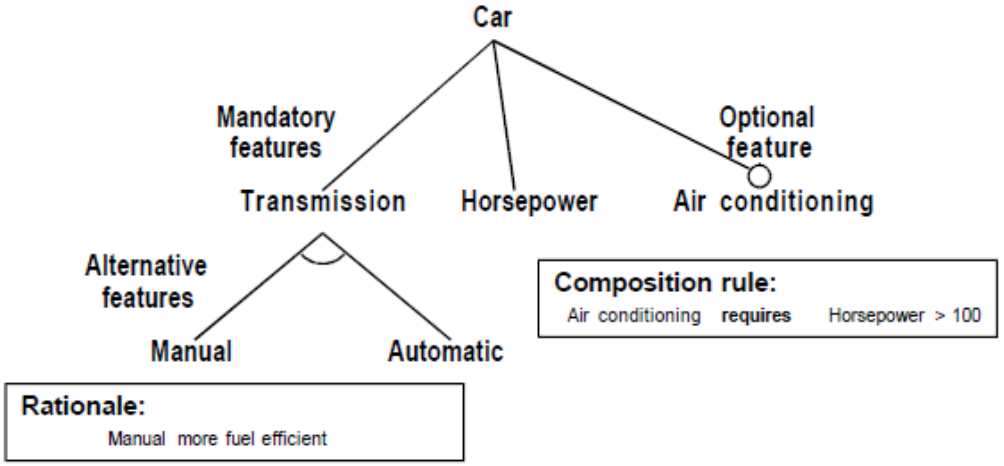
- Applications build on heterogeneous resources
  - Cloud services
  - Devices: sensors, boxes, smartphones…

- BUT, no control over resources life-cycle
  - Resources can appear and disappear
  - Resources may be unknown before application starts

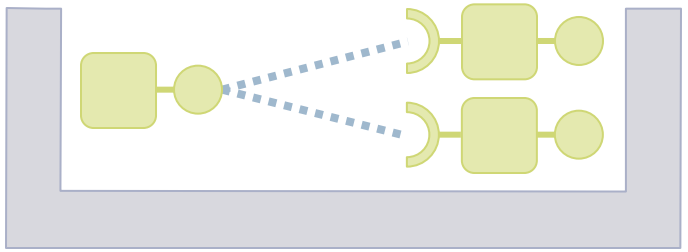
Application Adaption

Application Adaptation

- Design level
  - Software product lines

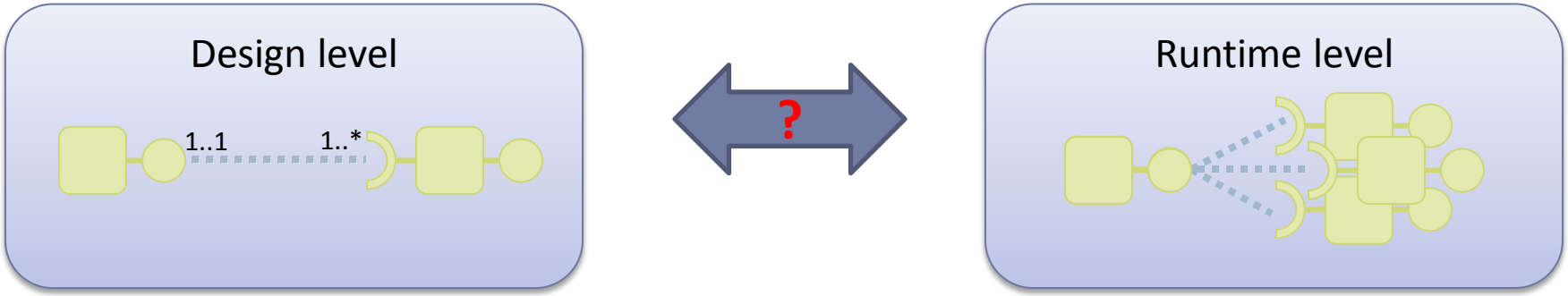


- Code level
  - Service-Oriented Component Models

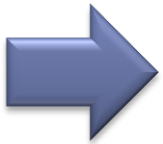


Administration level

- Problem: Gap between design and runtime levels

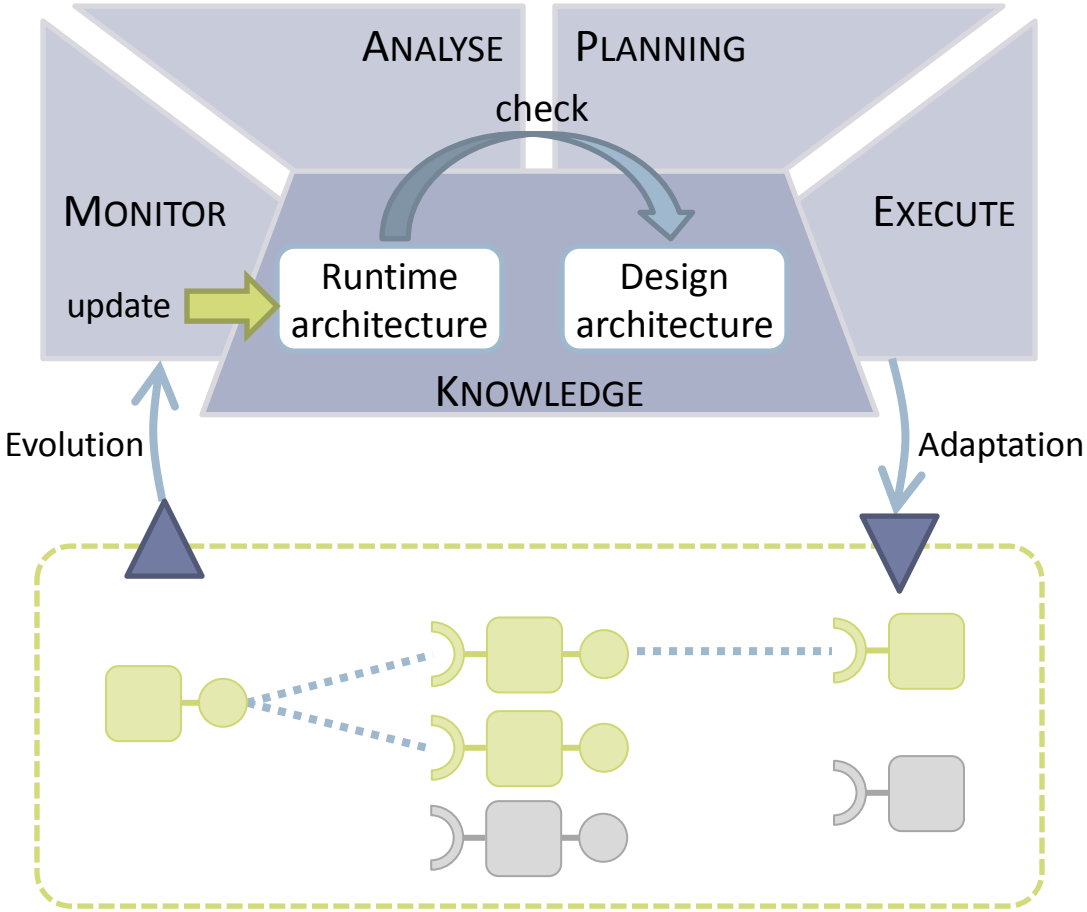


- Consequences:
  - Complexity of administration tasks increases
  - Administration tasks are error-prone

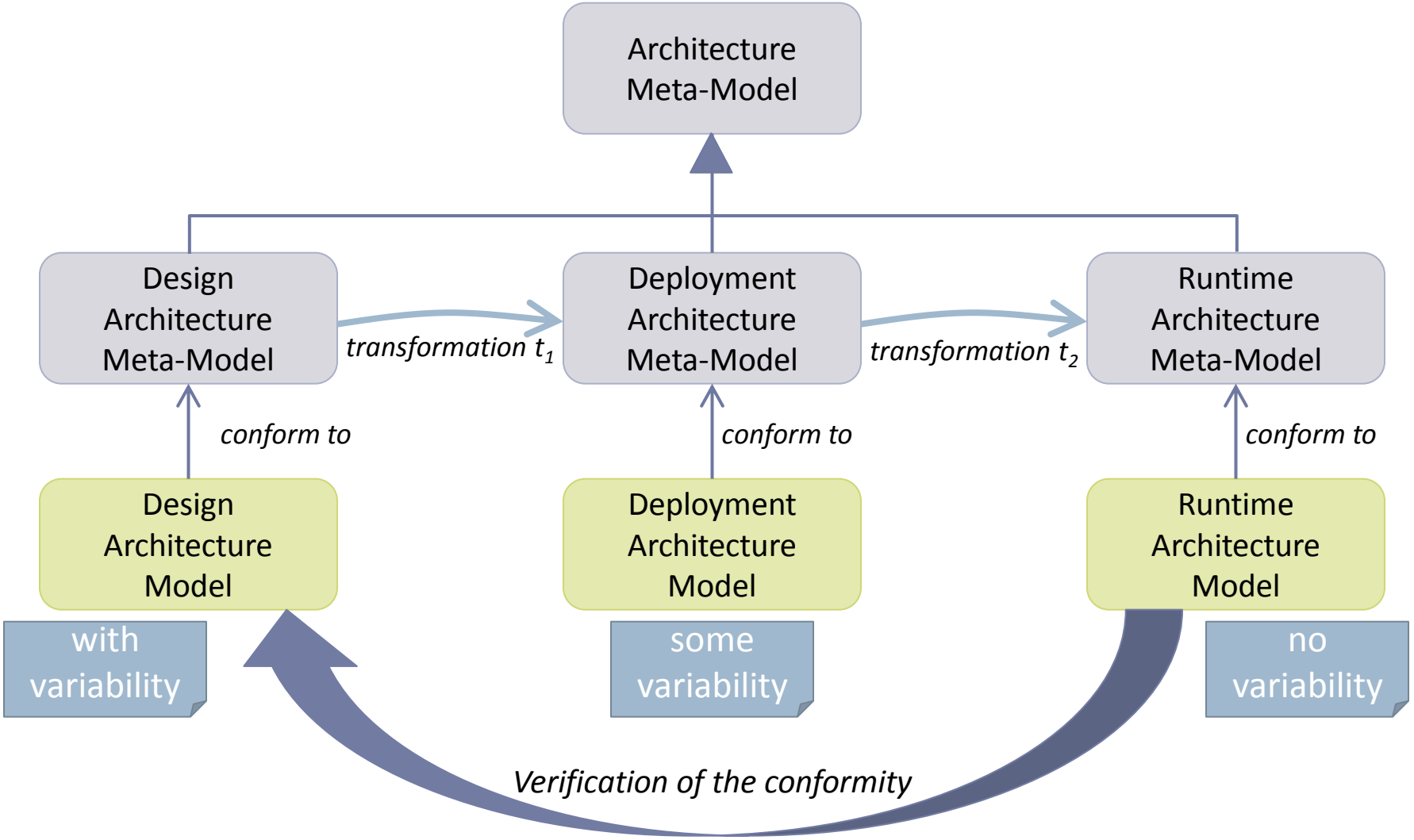


Self-administration

Our approach

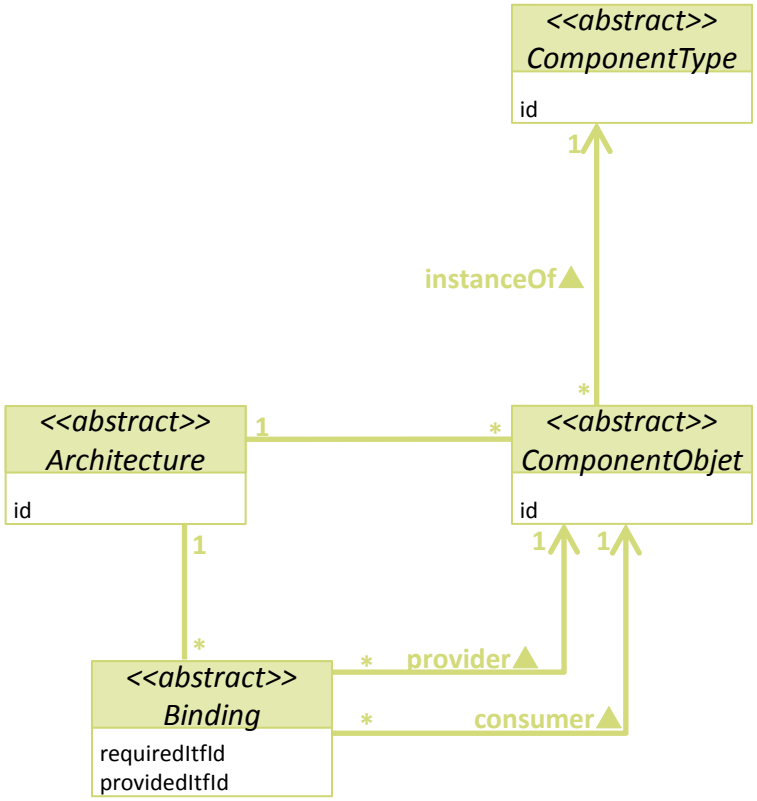


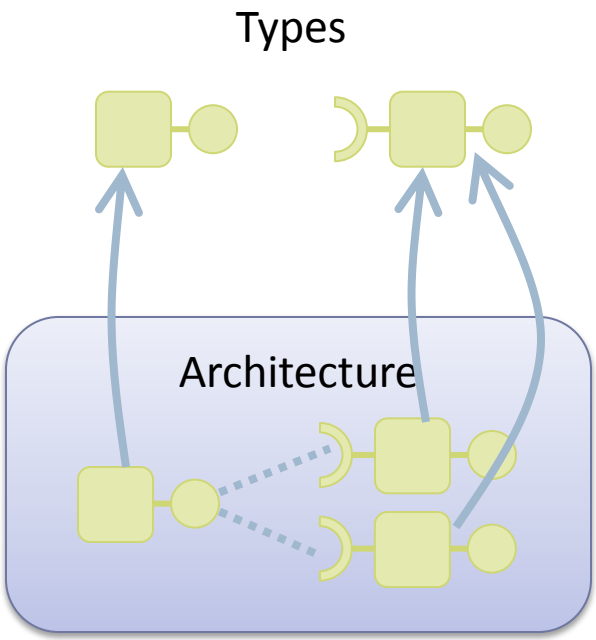
Model-Driven Architecture



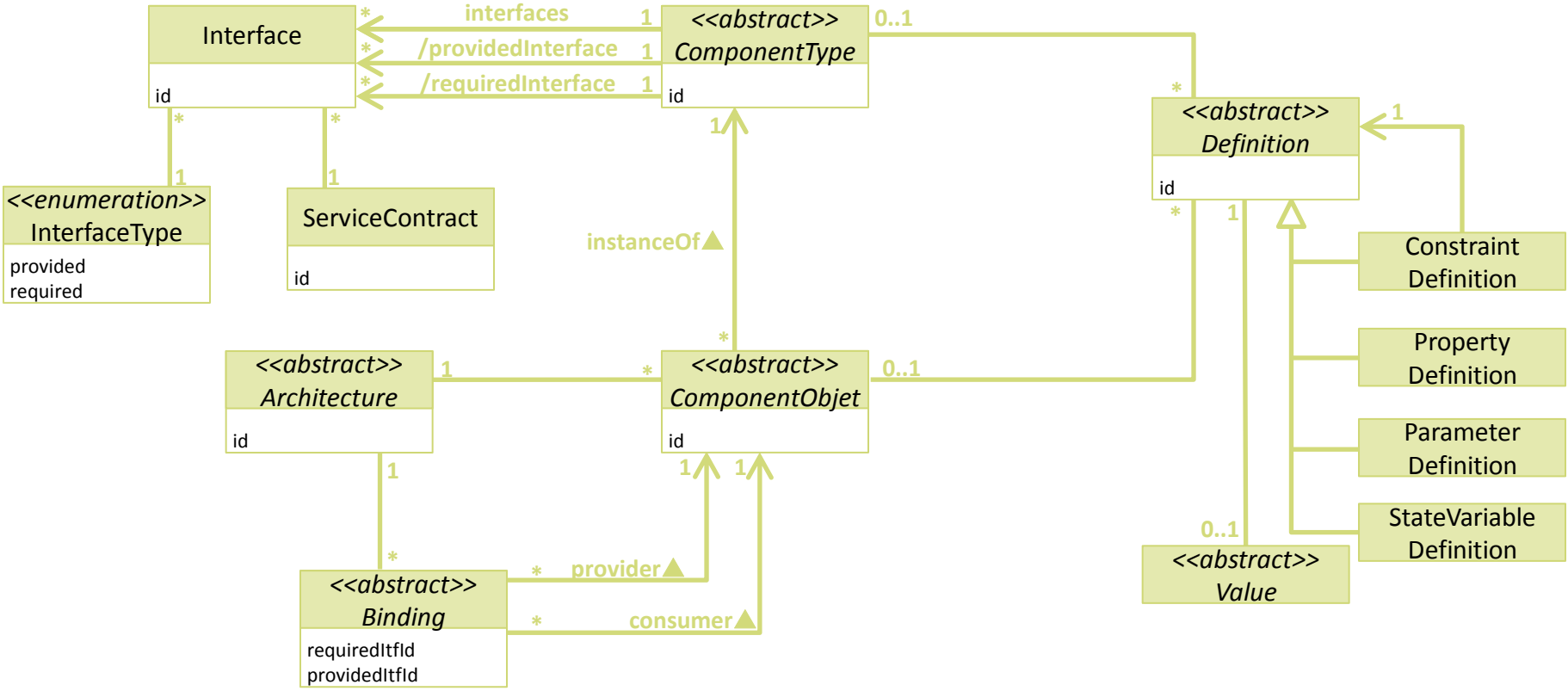
Philippe LALANDA, Stéphanie CHOLLET, Etienne GANDRILLE, Catherine HAMON

Architecture Meta-Model

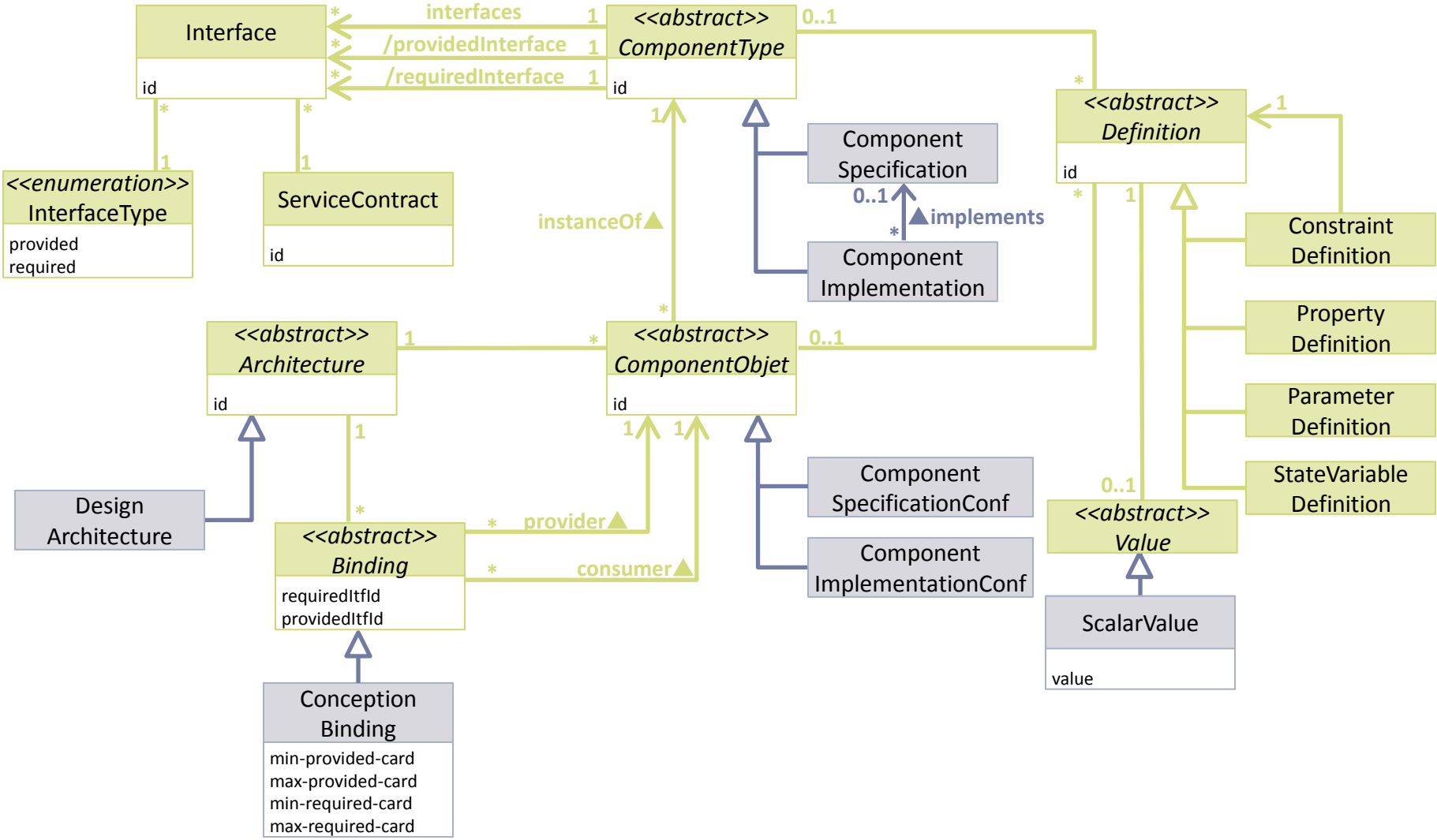




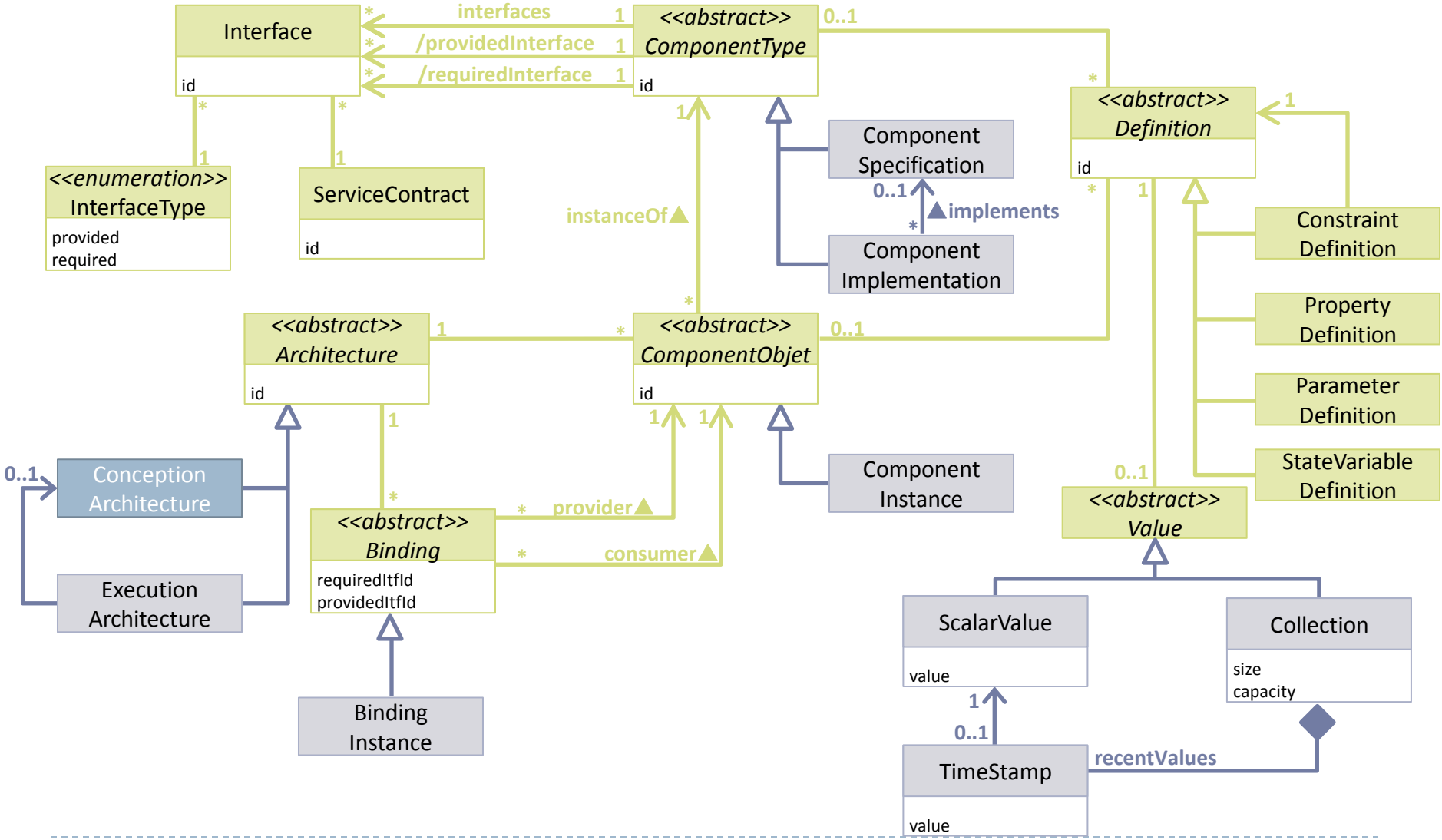
Architecture Meta-Model



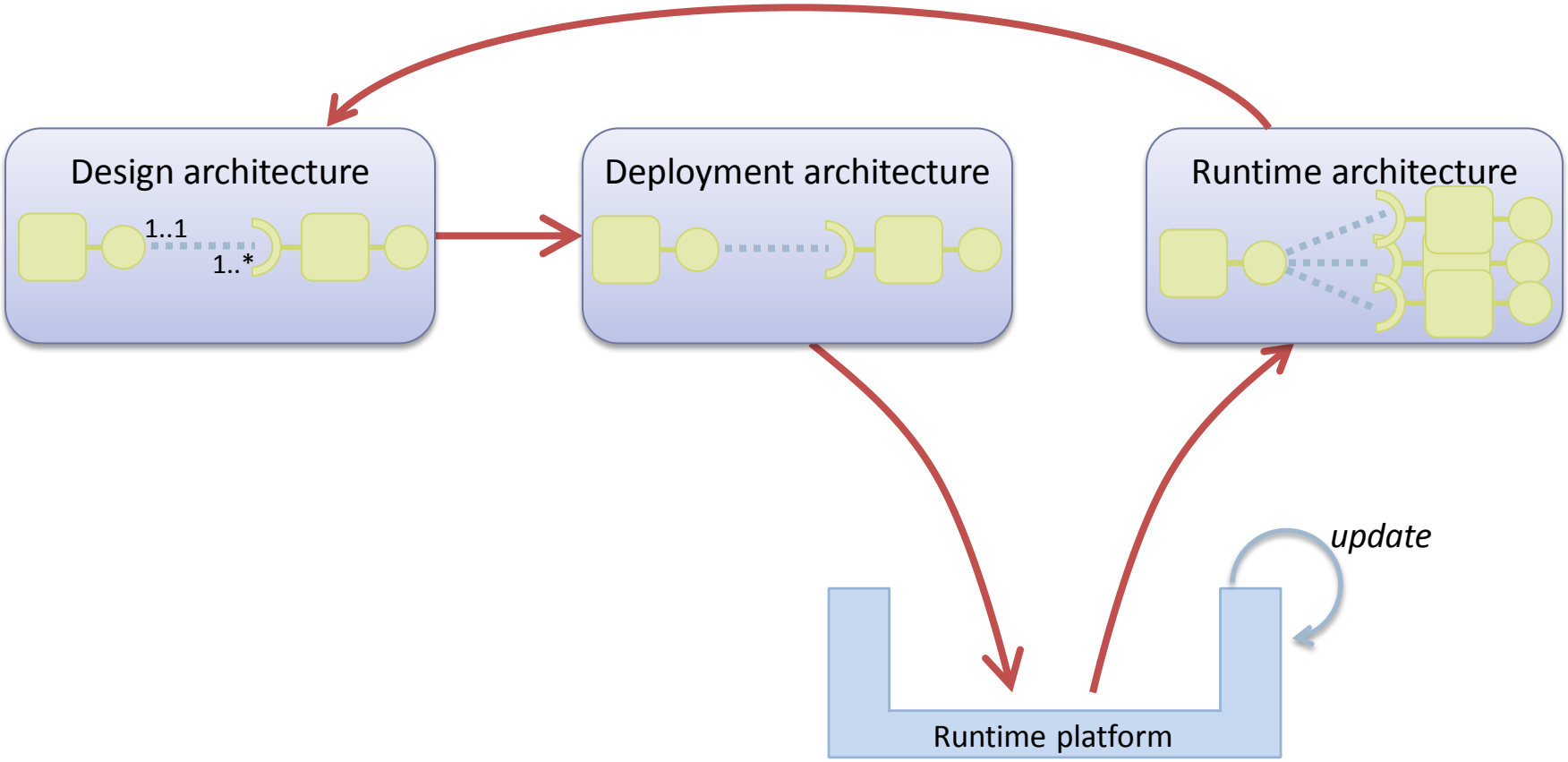
Design Architecture Meta-Model



Runtime Architecture Meta-Model



Transformations between architectures

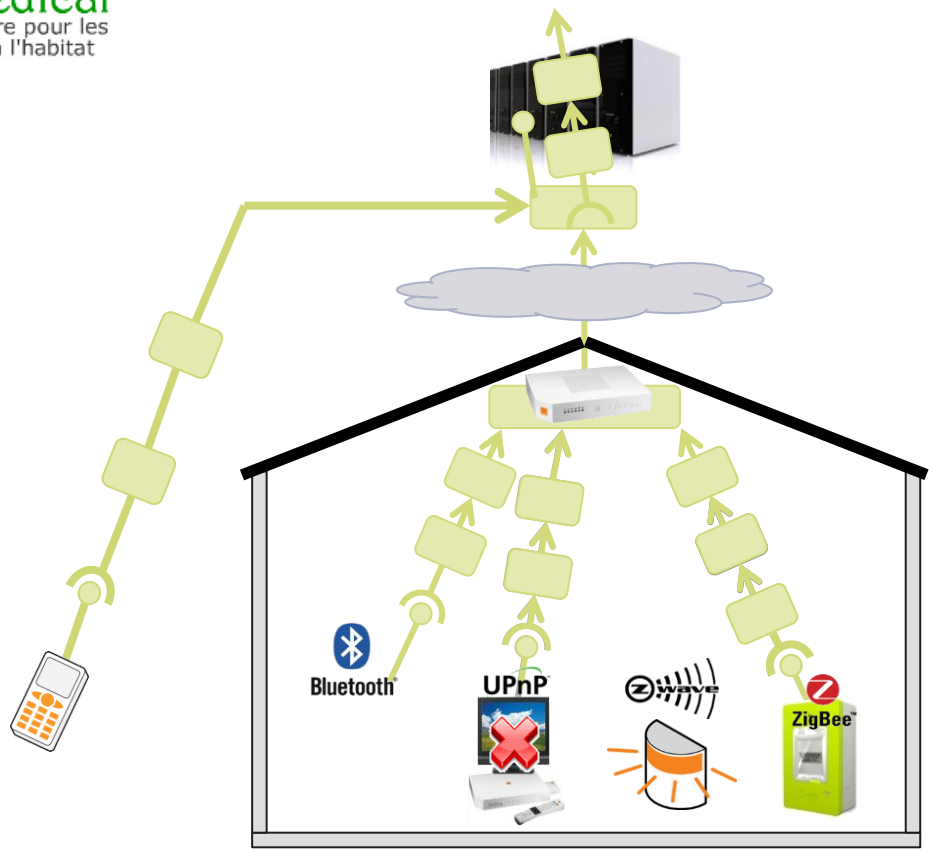


Use case: Actimetrics

- MEDICAL project
  - Orange Labs, LIG, Telecom ParisTech, ScalAgent

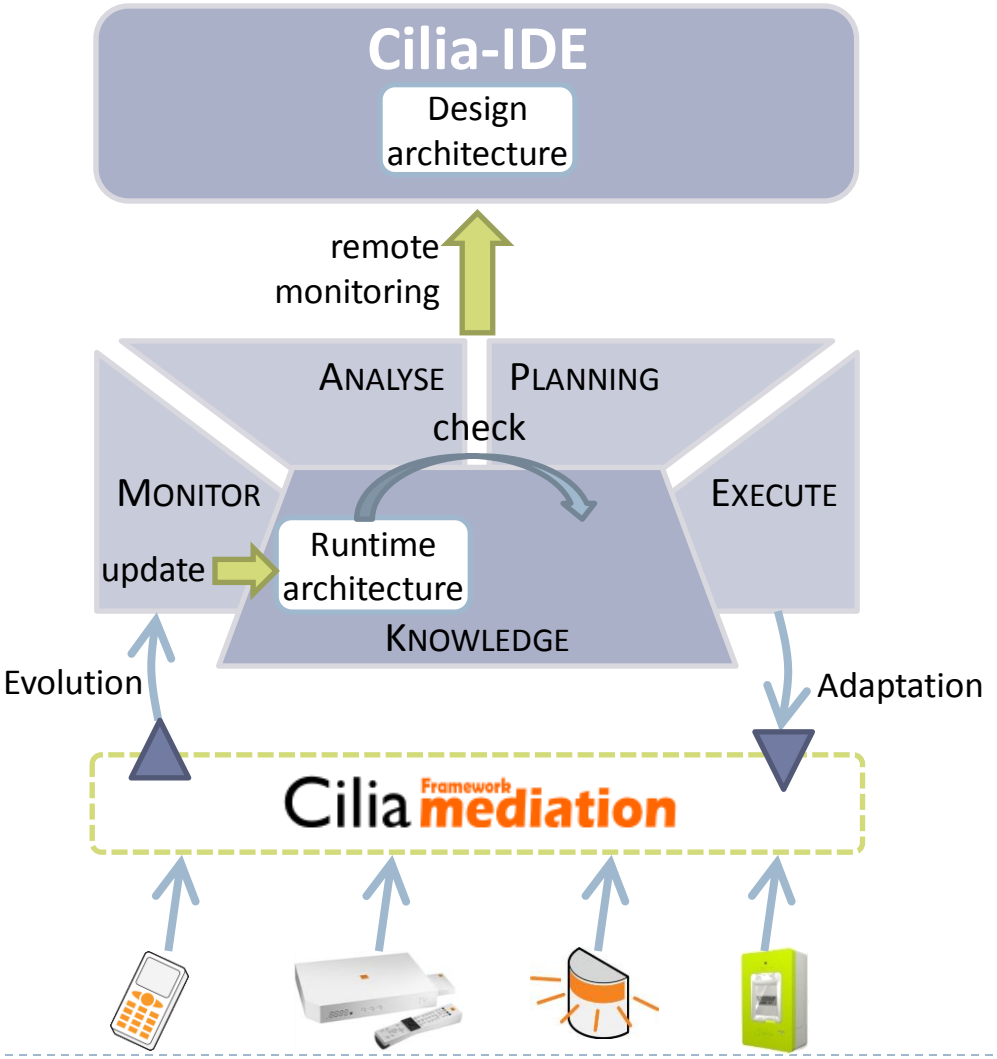
Middleware pour les services à l'habitat

- Environment platform
  - Distributed
  - Heterogeneous
  - Dynamic
  - Flexible

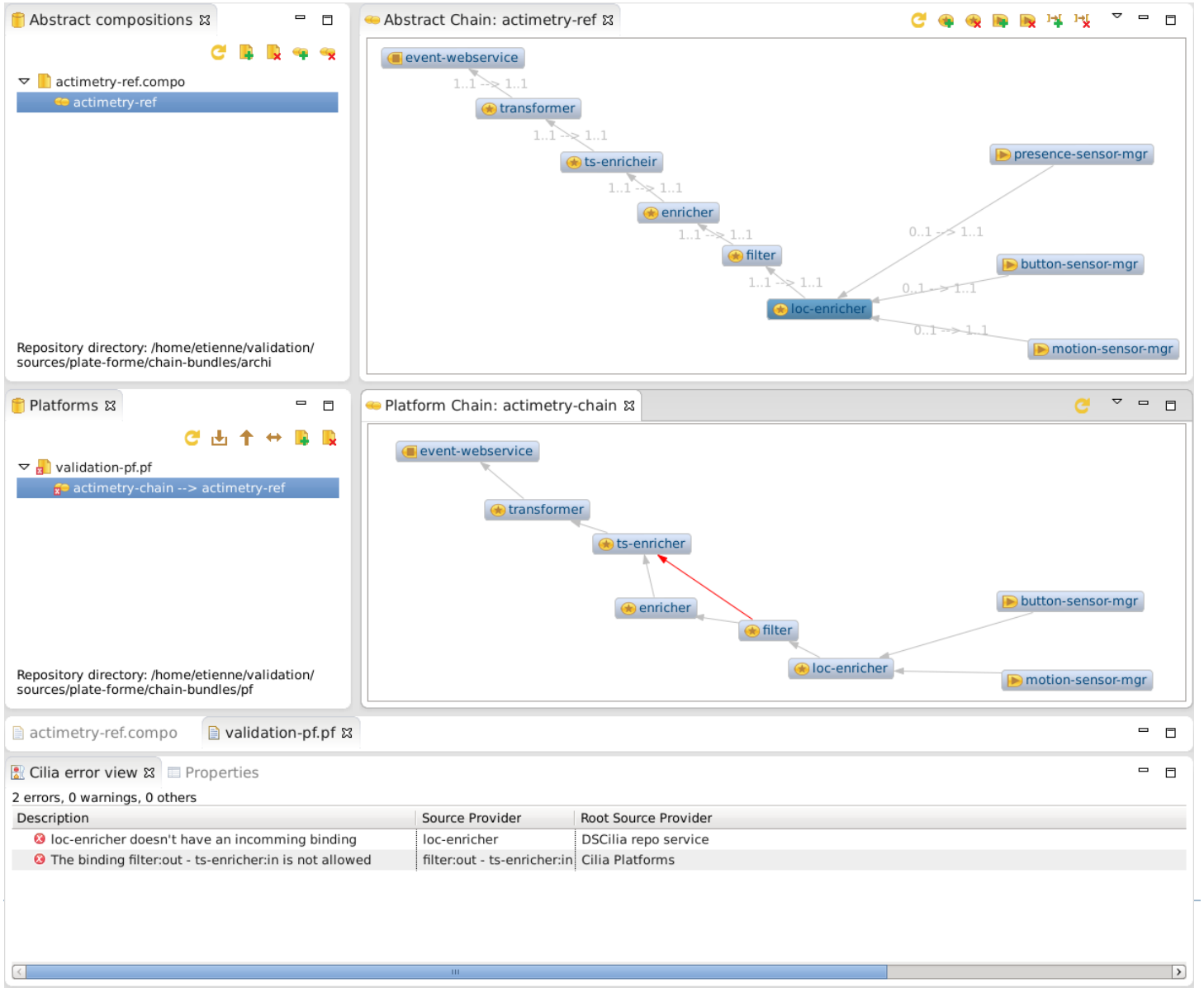


http://www.medical.imag.fr

Implementation



Cilia-IDE


Abstract compositions
actimetry-ref.compo
actimetry-ref
Repository directory: /home/etienne/validation/sources/plate-forme/chain-bundles/archi
Abstract Chain: actimetry-ref
event-webservice
1..1 --> 1..1
transformer
1..1 --> 1..1
ts-enricheir
1..1 --> 1..1
enricher
1..1 --> 1..1
filter
1..1 --> 1..1
loc-enricher
presence-sensor-mgr
0..1 --> 1..1
button-sensor-mgr
0..1 --> 1..1
motion-sensor-mgr
0..1 --> 1..1
Platforms
validation-pf.pf
actimetry-chain --> actimetry-ref
Repository directory: /home/etienne/validation/sources/plate-forme/chain-bundles/pf
Platform Chain: actimetry-chain
event-webservice
transformer
ts-enricher
enricher
filter
loc-enricher
button-sensor-mgr
motion-sensor-mgr
actimetry-ref.compo
validation-pf.pf
Cilia error view
Properties
2 errors, 0 warnings, 0 others
Description
Source Provider
Root Source Provider
loc-enricher doesn't have an incomming binding
loc-enricher
DSCilia repo service
The binding filter:out - ts-enricher:in is not allowed
filter:out - ts-enricher:in
Cilia Platforms

Implementation facts

- 19535 loc
  - Knowledge database : 10939 loc
  - Cilia-IDE : 8379 loc
  - Autonomic manager : 217 loc

- MEDICAL project
  - just ended (2011-2014)
  - reports and videos available : http://medical.imag.fr

Conclusion

- In autonomic management:
  - Knowledge is a keypoint
- Knowledge representation:
  - Architecture abstraction level
  - Runtime platform
  - Execution context

Thank you!

Philippe Lalanda philippe.lalanda@imag.fr
Stéphanie Chollet stephanie.chollet@grenoble-inp.fr
Etienne Gandrille etienne.gandrille@orange.com
Catherine Hamon catherine.hamon@orange.com