From Sensors to Visualization Dashboards: **Need for Language Composition**

Sébastien Mosser, Ivan Logre, Nicolas Ferry, Philippe Collet

pictures: sxc.hu

Dashboard – Inspecteur Der

129.241.153.87/InspecteurDeryque/#('h':!(('Map':!('bike-coord')),('v':!(('Gauge':!('bike-speed')),('Video':!('bike-video'))))))

Inspecteur Deryque

Dashboard | Statements | Import | Video demonstration | Flip!

Plan | Satellite

Google

500 m

3000 pieds

Données cartographiques | Conditions d'utilisation

0 3.5 7 10.5 14

bike-speed : numerical

12:01:40.539

This is **not** a

solution paper

«Real-Life»

Paper

1 **Disillusion** (aka «real-life» hurts)

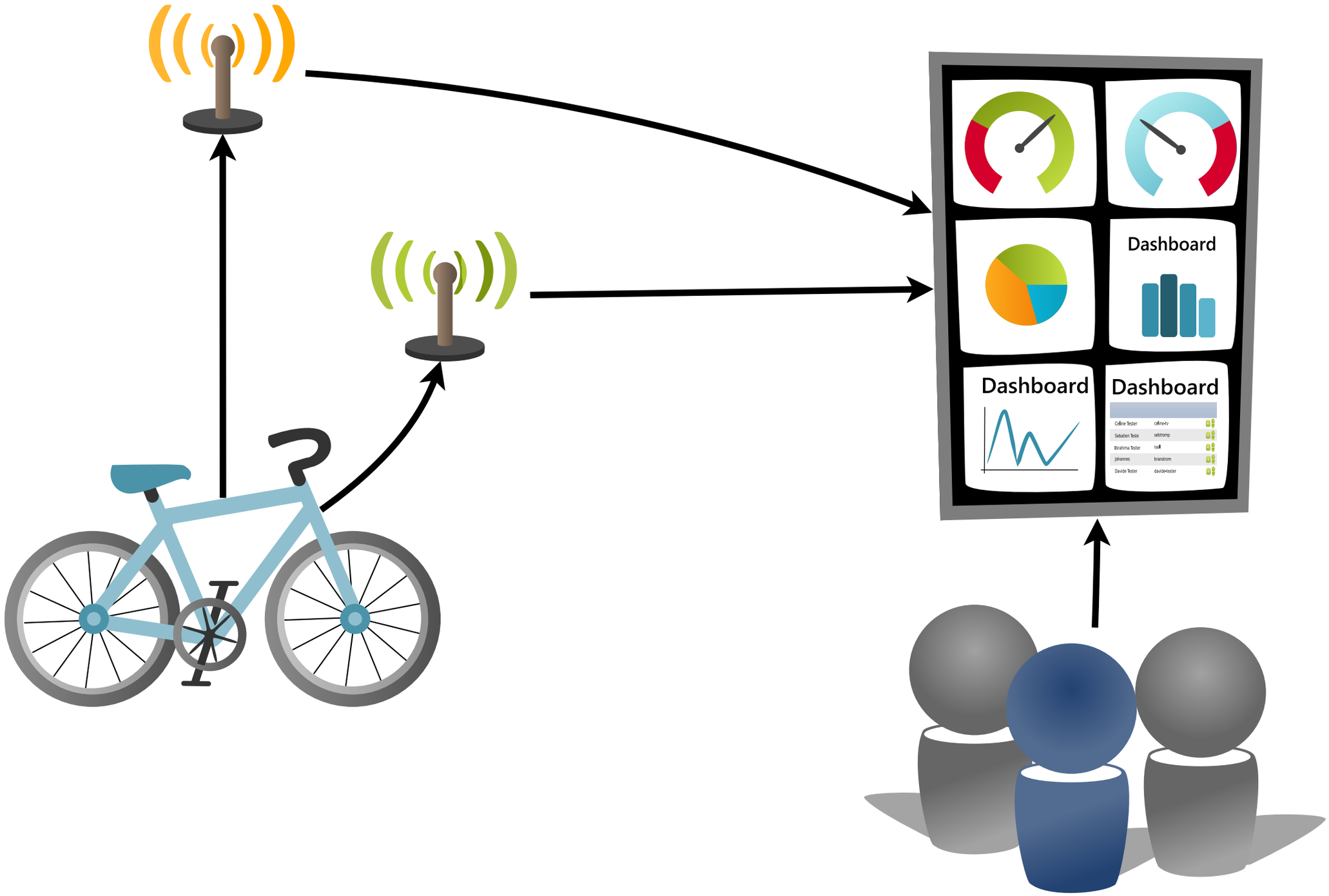
2 **Involved Models**

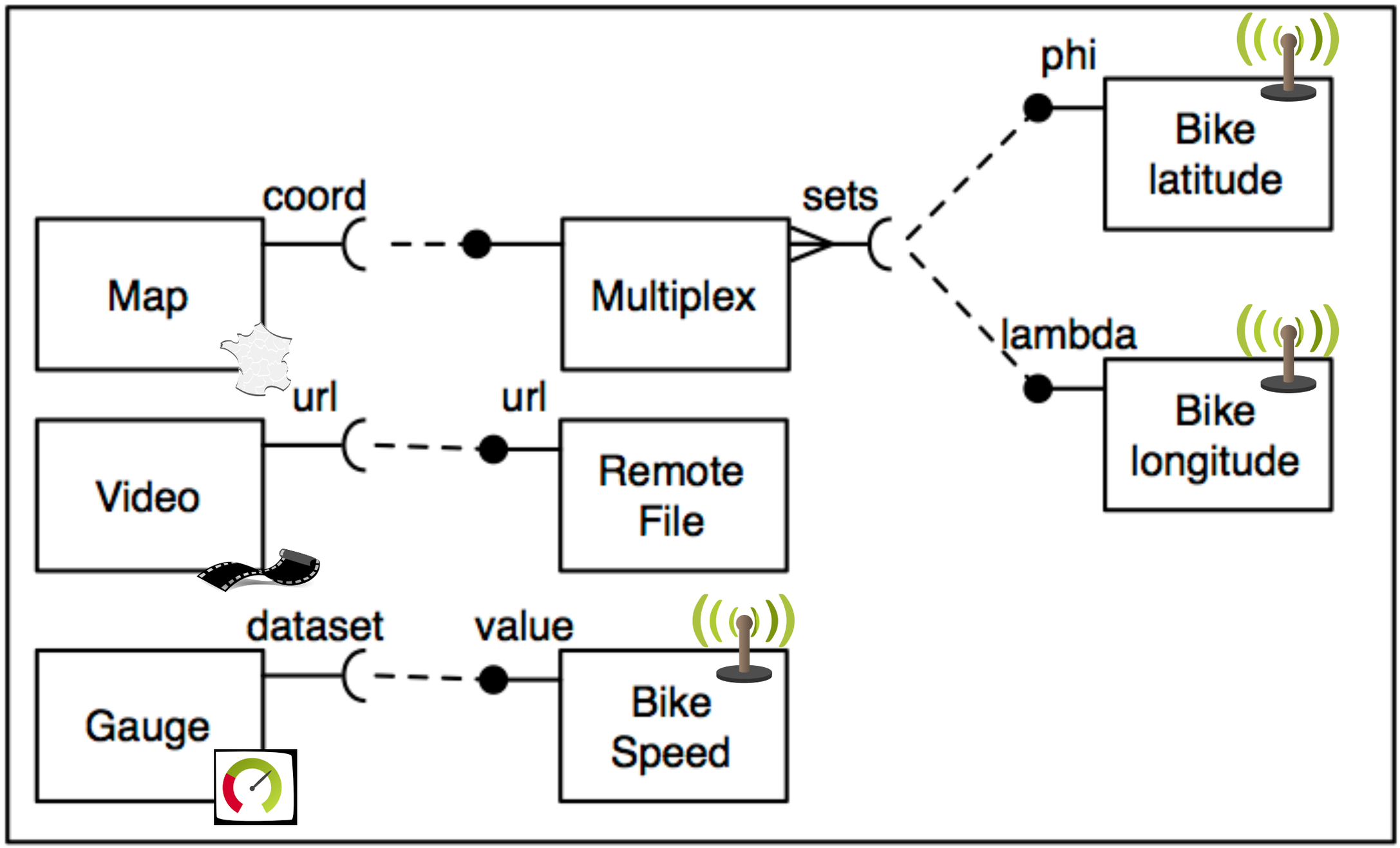
3 **Conclusions**

Disillusion

aka «**real-life**» hurts

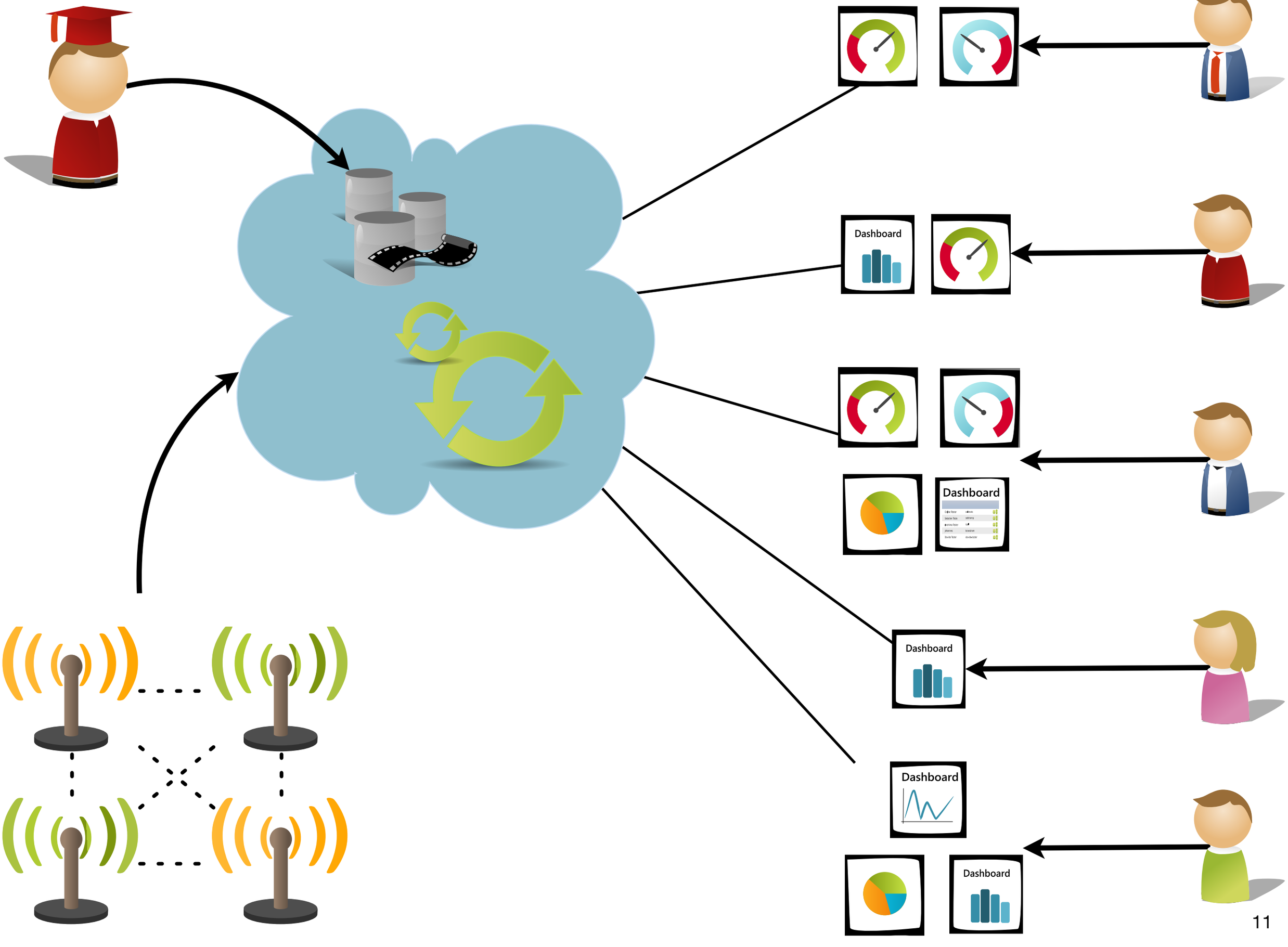
Problem: Sensors → Visualization



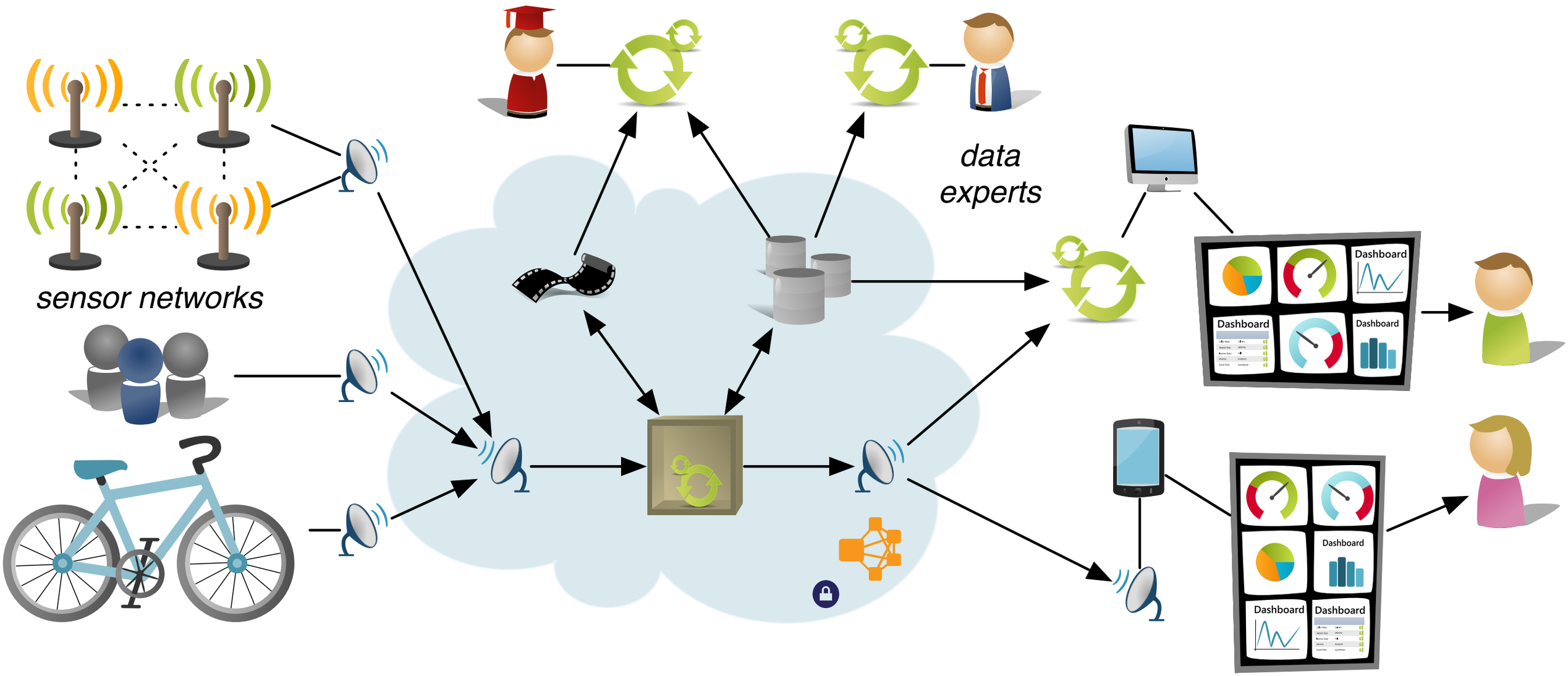


Idea: Components

«Real-Life»


Dashboard
Dashboard
Dashboard
Dashboard
Dashboard

Real Problem: IoT → IoS

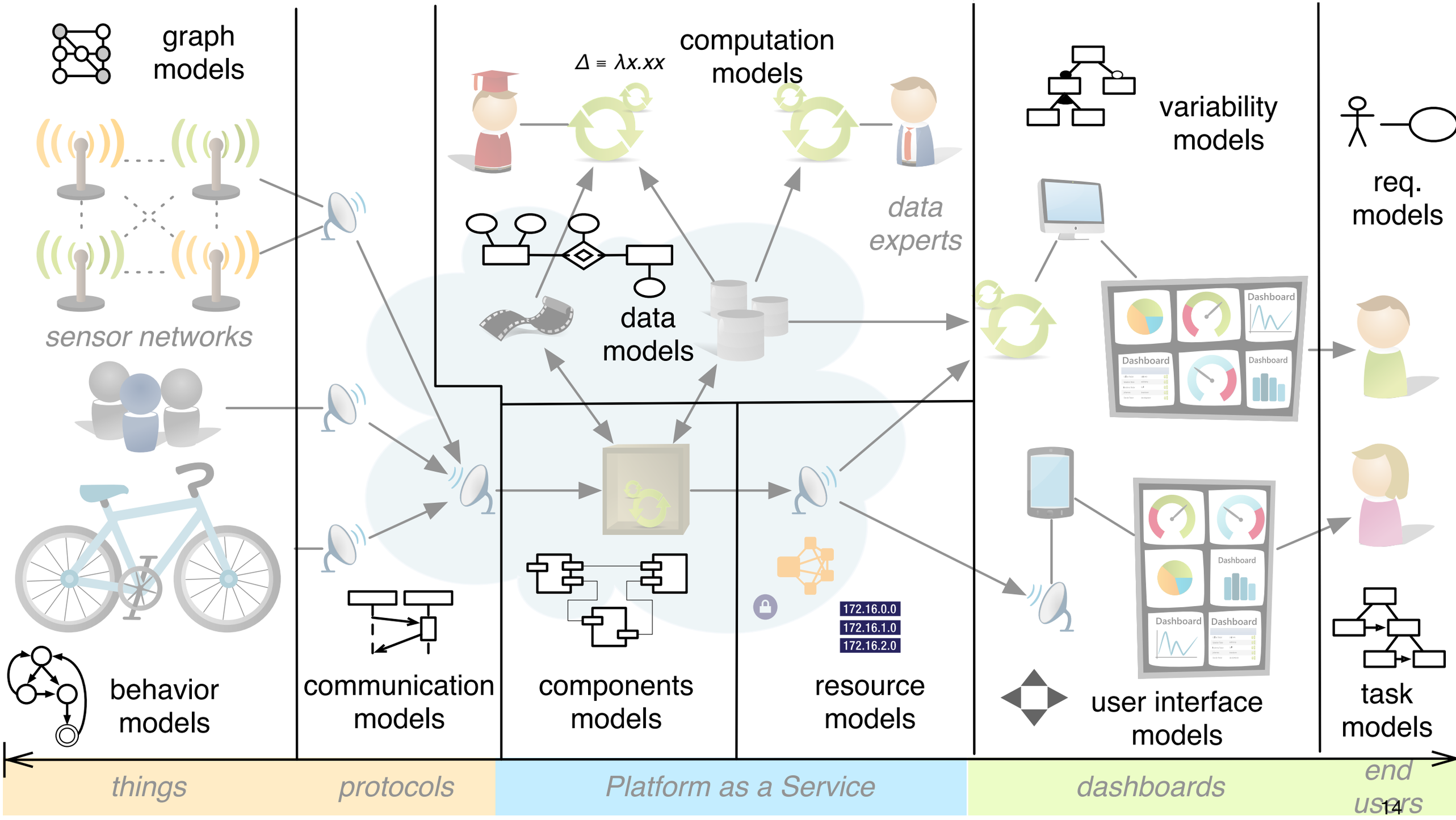


things | *protocols* | *Platform as a Service* | *dashboards* | *end users*

Systematic

Modelling

Eleven kinds of models!



Coherency?

Reusability?

we **Fail** ed

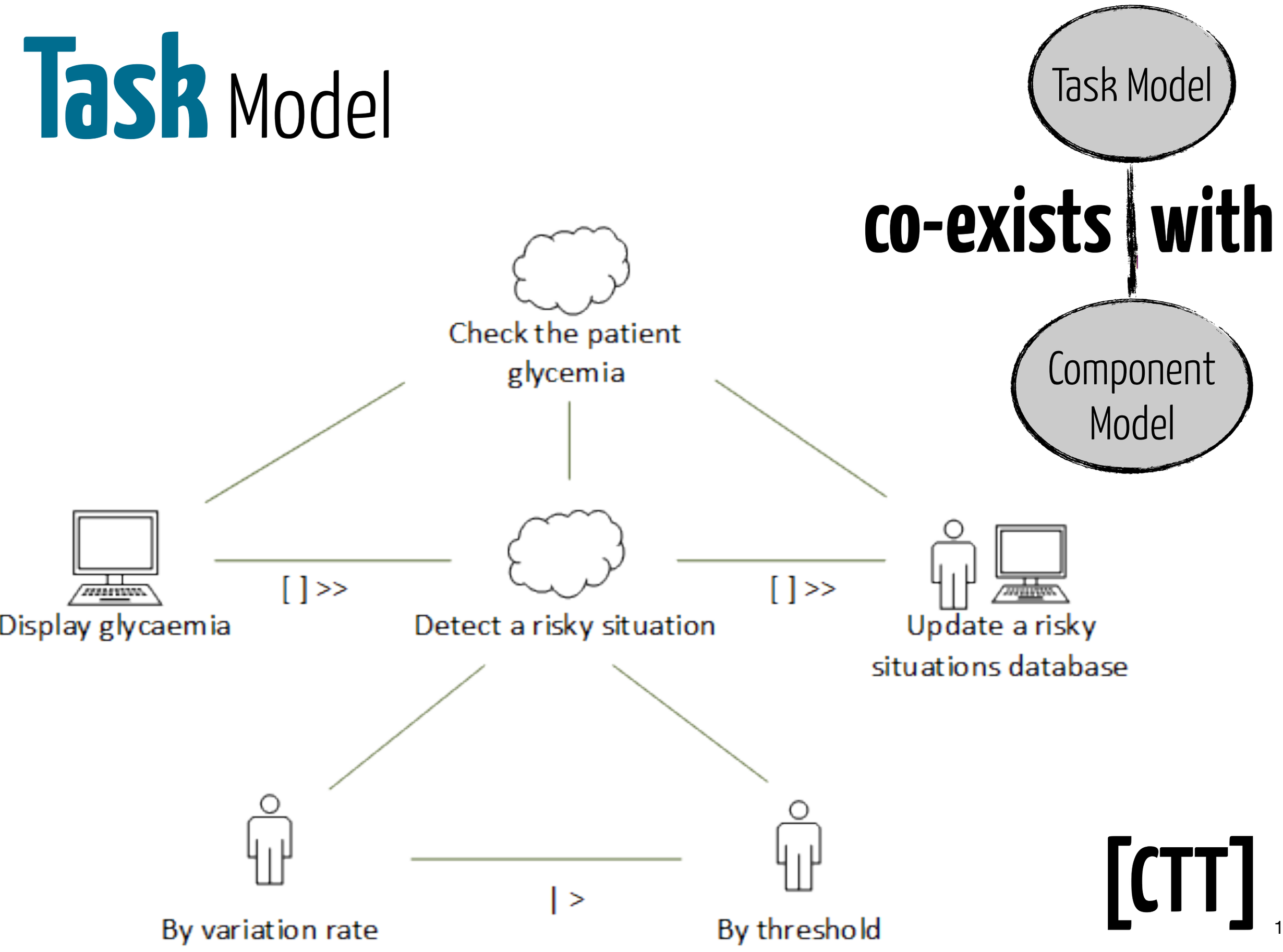
⇒ Interesting

Use Case!

Involved Models

2

Task Model



[CTT]

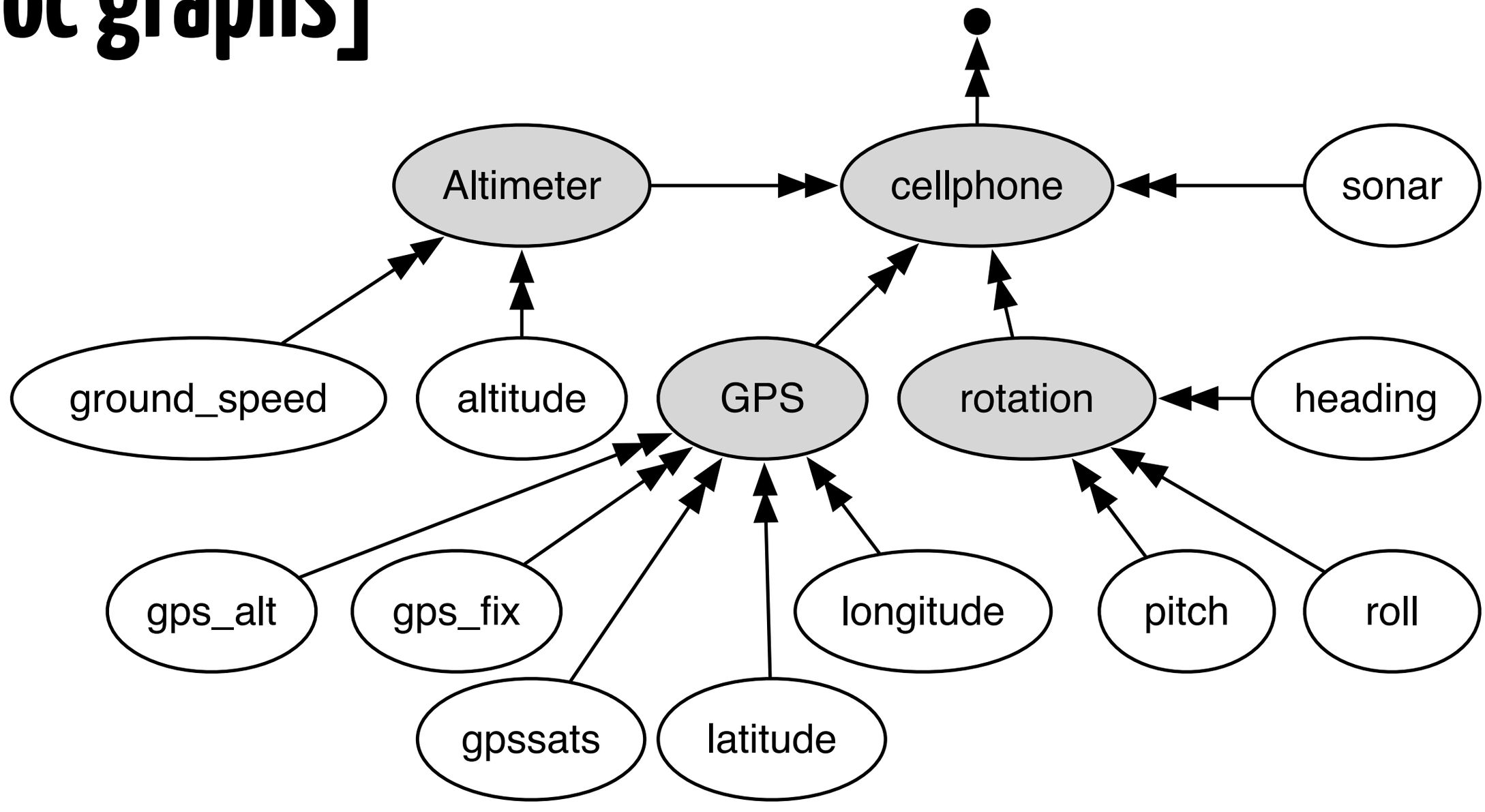
Co-exists with

We **expect** these models to be **coupled** by a **small** and **well-defined interfaces**.

«The component model used to reify the cloud application is loosely coupled with the task models defined for each user role.»

Sensor **Network** Model

[ad'hoc graphs]



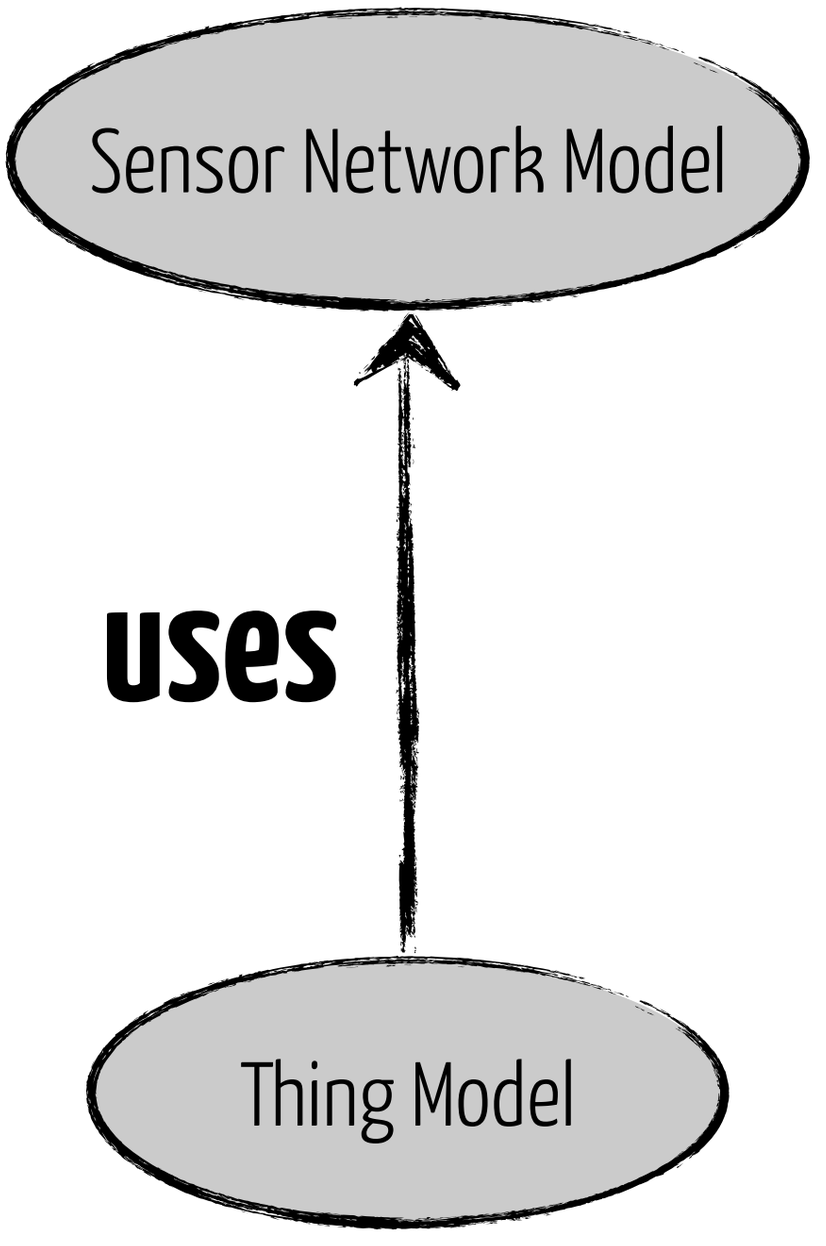
Case study: EBike, equipped with 11 sensors

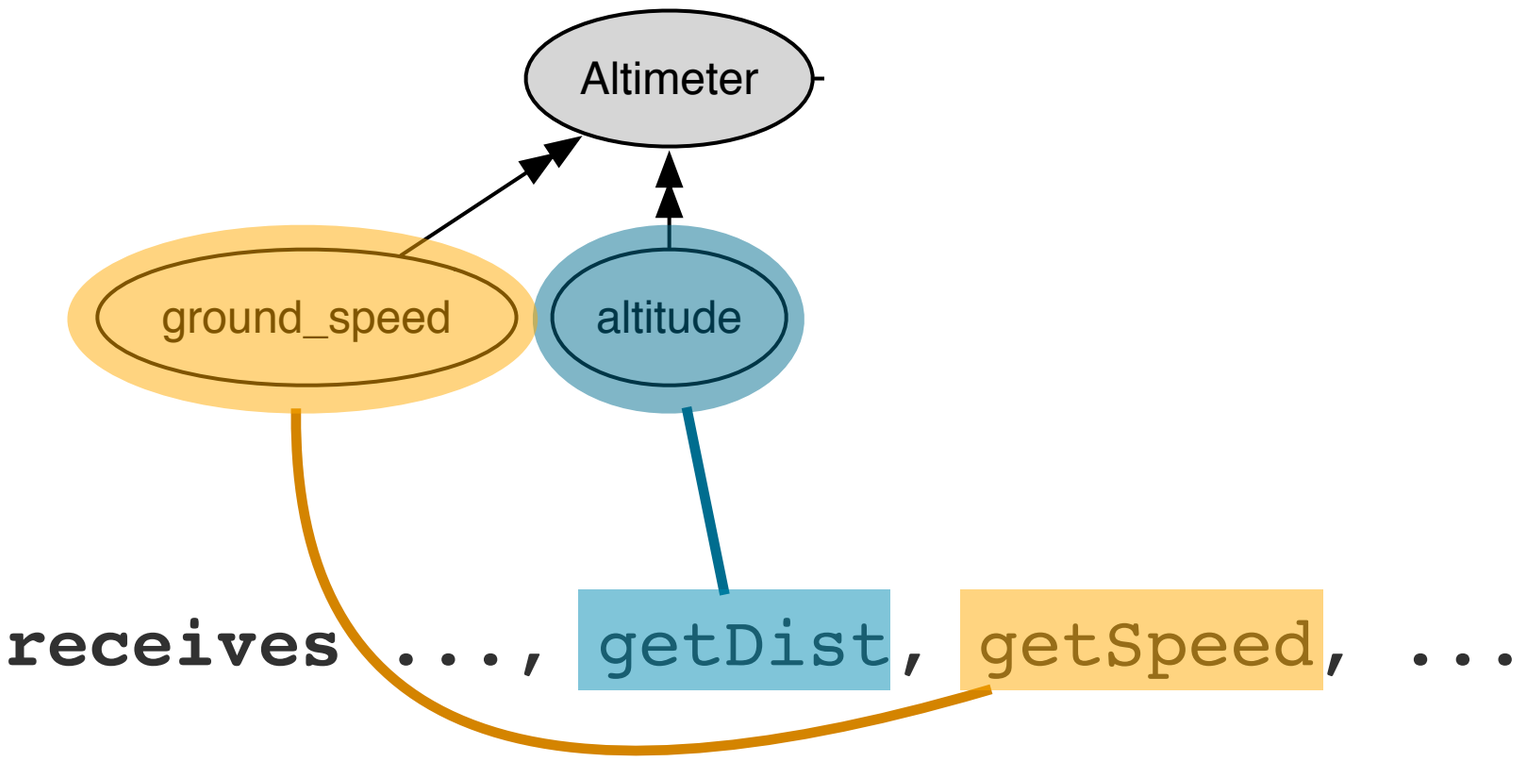
Thing Model

```
thing EBike {

  provided port Sensors {
    receives getAirTemp, getCtrlTemp, getCurrent,
             getDist, getPower, getSpeed, getVoltage

    sends AirTempValue, CtrlTempValue, CurrentValue,
          DistValue, PowerValue, SpeedValue, VoltageValue
  }

}
```

[ThingML]

Needs for Language Composition





```
context Root inv: measurements->forAll(m |
 (m.name.oclIsUndefined() implies ! baseName.oclIsUndefined()) and
 (m.unit.oclIsUndefined() implies ! baseUnit.oclIsUndefined()) and
 (m.time.oclIsUndefined() implies ! baseTime.oclIsUndefined()) )
```

SenML 10

Root

baseName: String [0..1]
baseUnit: String [0..1]
baseTime: Int [0..1]

measurements
*

Measurement

name: String [0..1]
unit: String [0..1]
time: Int [0..1]
updateTime: Int [0..1]

Value

num: Float [0..1]
str: String [0..1]
bool: Boolean [0..1]
sum: Float [0..1]

value
1

Data Model

```
context Value inv: num.oclIsUndefined() xor
       str.oclIsUndefined()  xor
       bool.oclIsUndefined() xor
       sum.oclIsUndefined()
```

http://tools.ietf.org/html/draft-jennings-senml-10#section-6

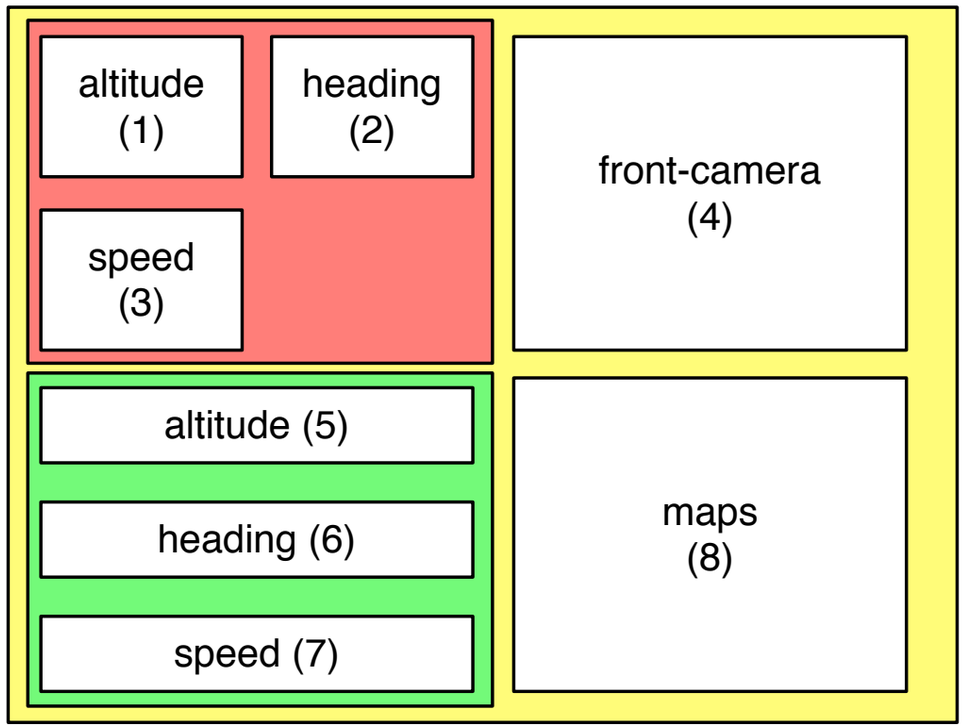
[SenML]

Uses

Strong coupling.

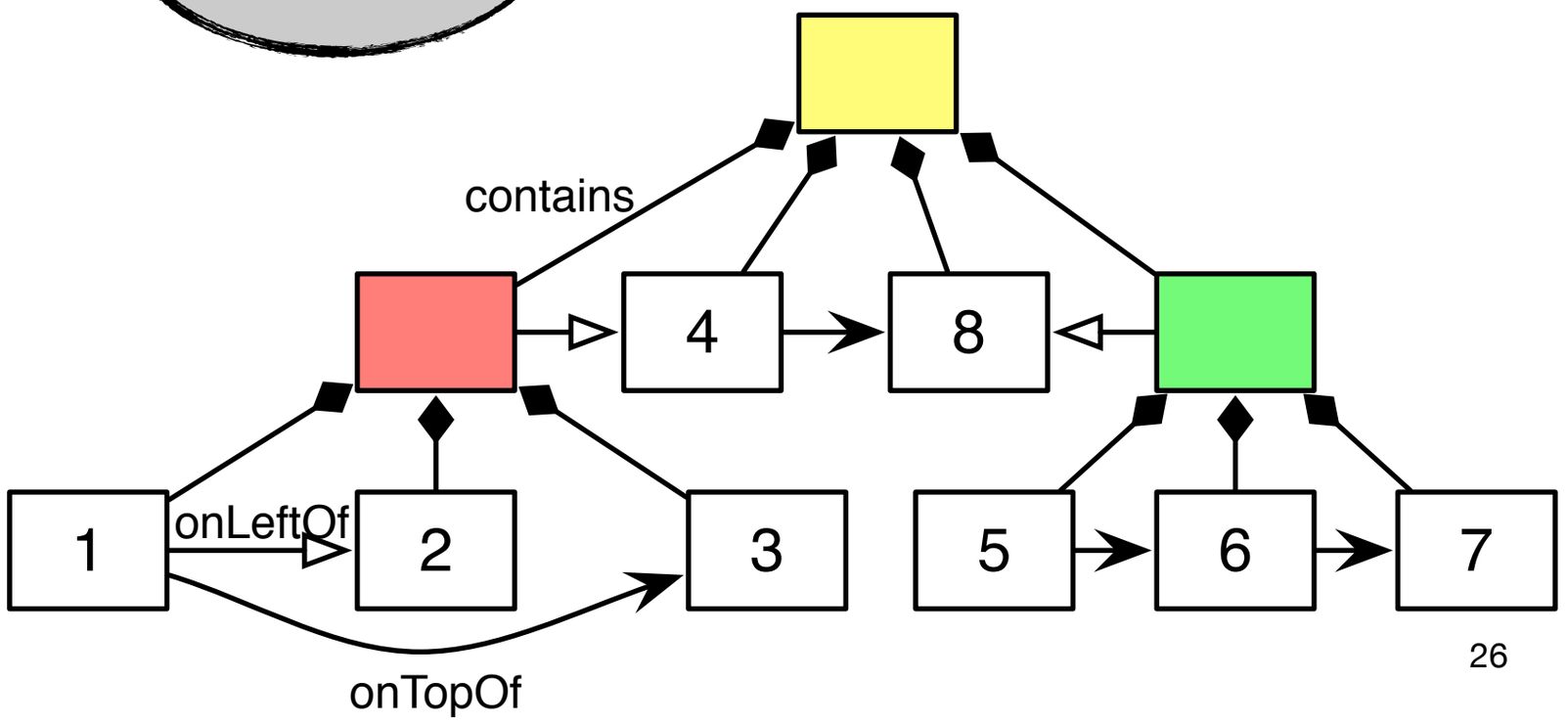
An **evolution** of the «used» model **invasively impacts** the «using» one

«Modifying the data model impacts the component model that works on this data representation.»



Layout Model

[Brel'13]



Constrains

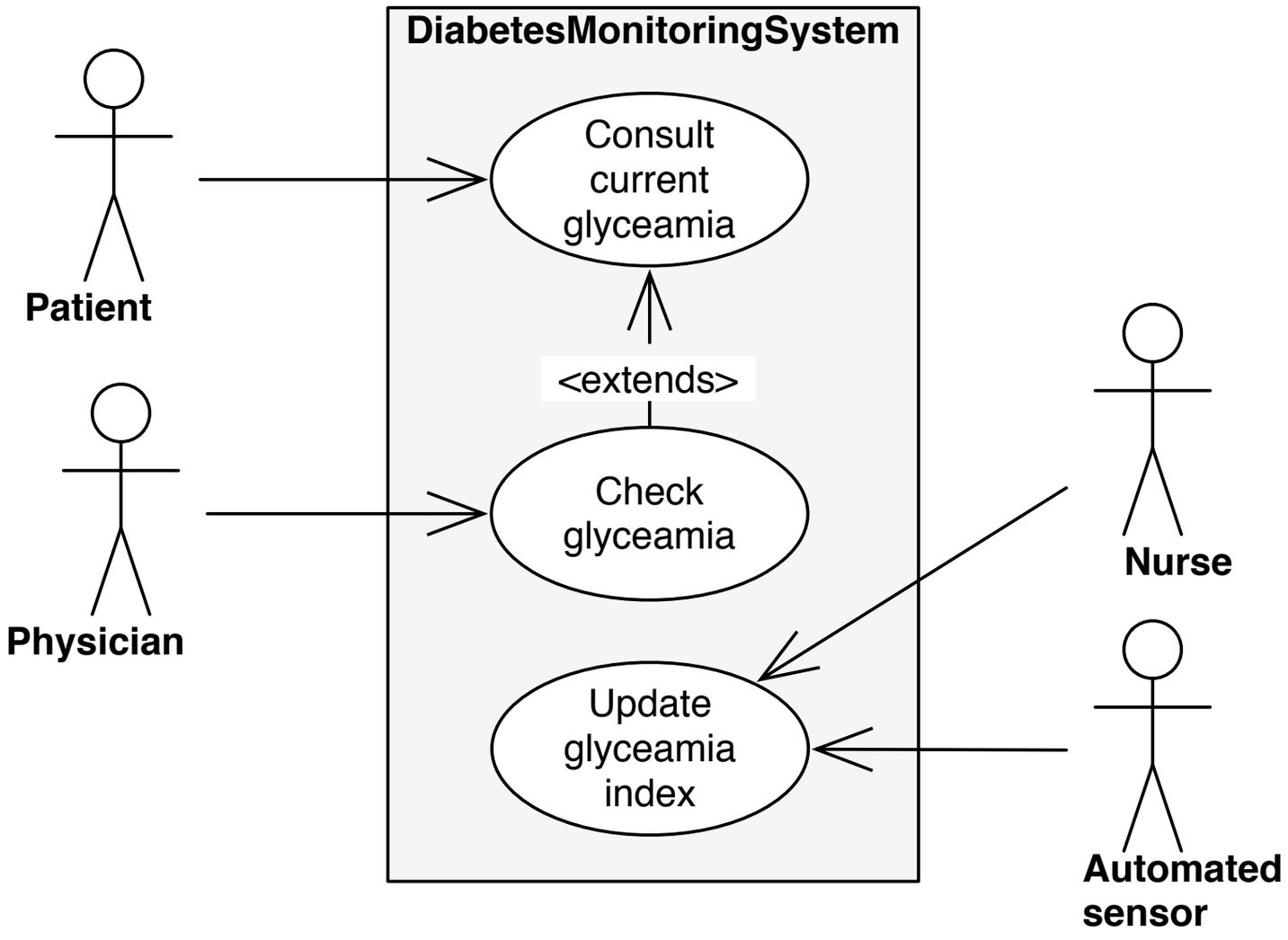
Choices in model M **restricts expressiveness** in model M'.

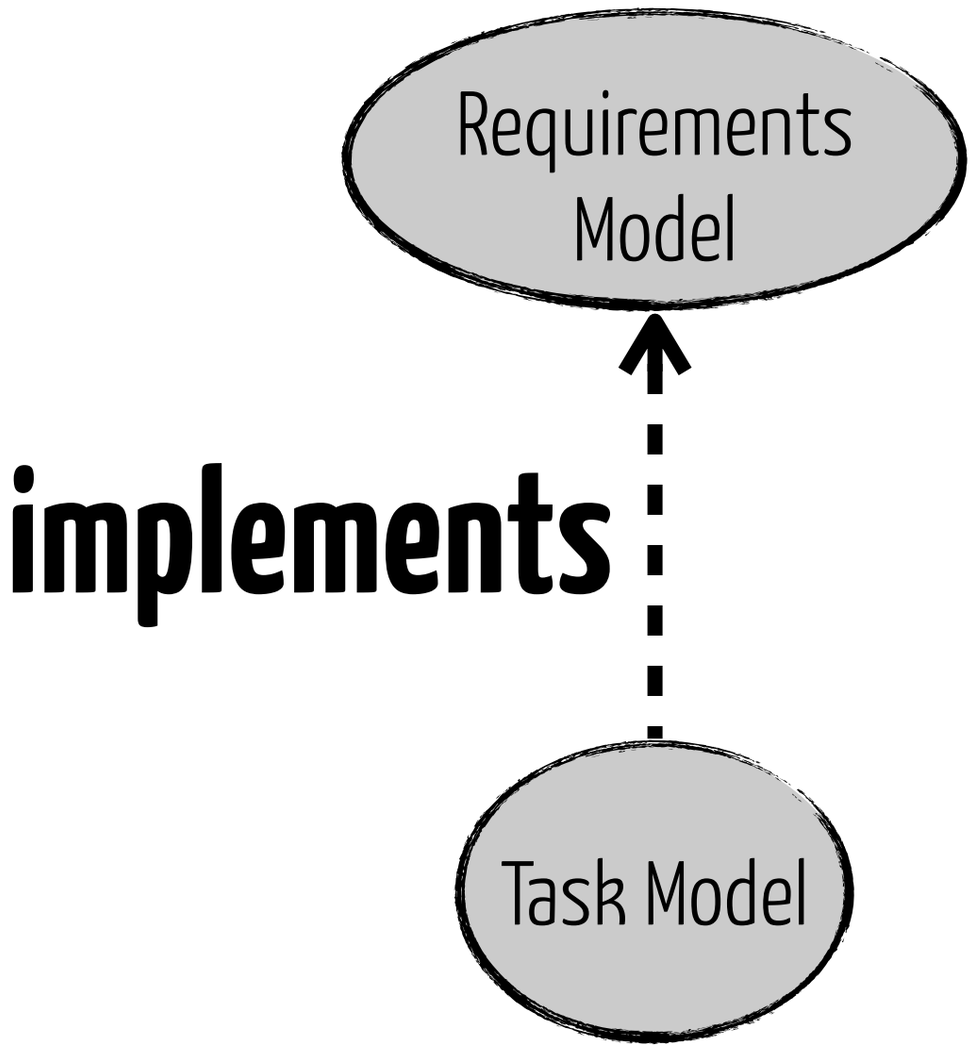
In our case study we observe a

bi-directional nature in each

occurrence of this relationship.

Requirements Model





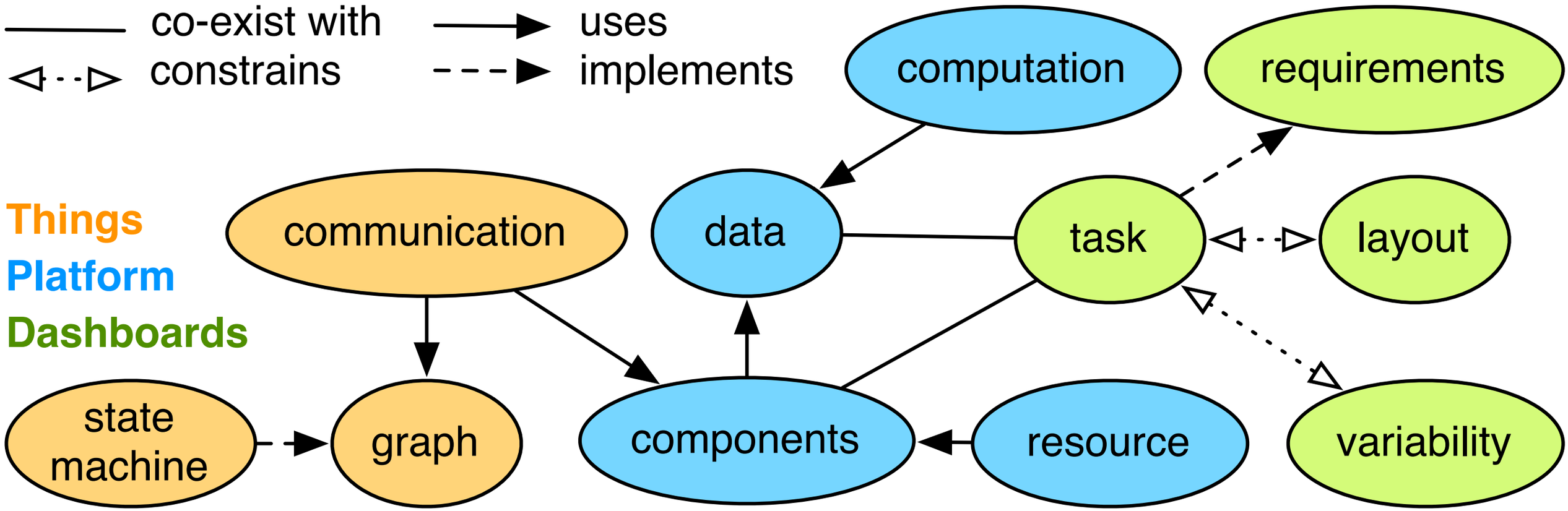
[UML Use Case]

Implements

Several alternative task models can be used to **implement the same** use case.

«A task diagram actually implements a given use case.»

Composition Graph



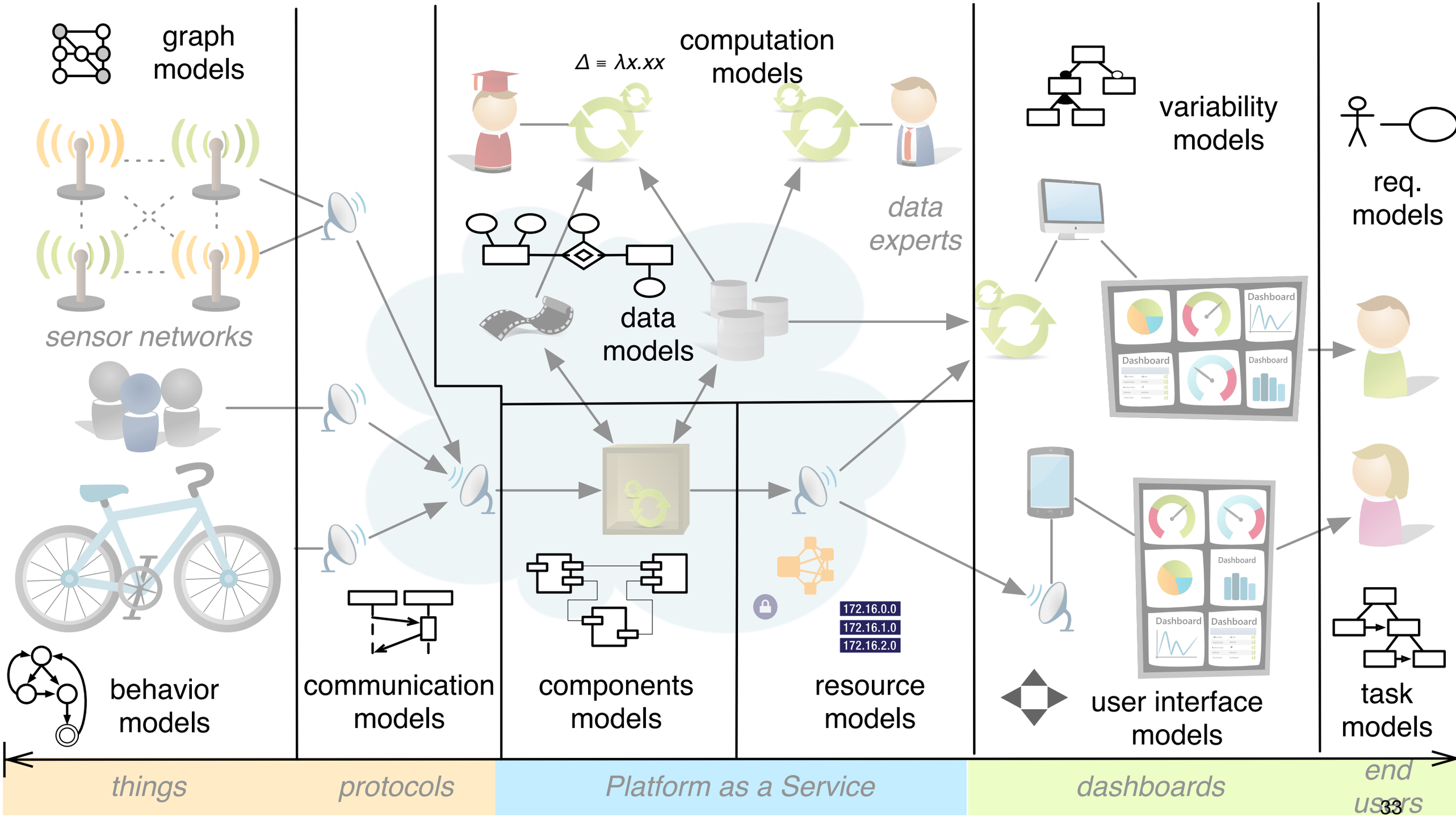
Conclusions

3

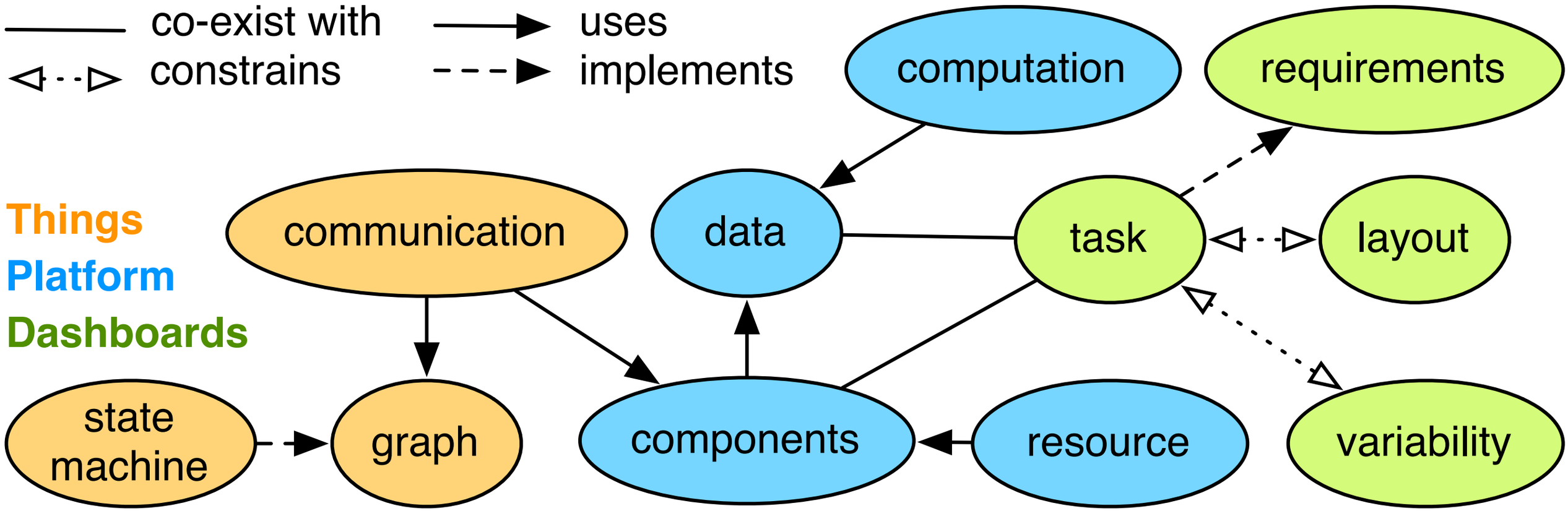
«Real-Life»

Paper

Eleven kinds of models!



Composition Graph



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Sébastien **Mosser** (UNS)

Ivan **Logre** (UNS)

Nicolas **Ferry** (SINTEF IKT)

Philippe **Collet** (UNS)

mosser@i3s.unice.fr

cnrs

Université Nice Sophia Antipolis