Increasing Interoperability, what is the Impact on Reliability? Illustrated with Health care examples

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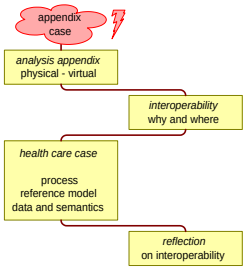
Abstract

In all domains the amount of interoperability between systems is increasing. The individual systems tend to be developed and evolve independently. The consequence is that the end-to-end reliability depends on the quality of interoperation of the involved systems.
We will discuss the relationship between interoperability and reliability. This will be illustrated by examples from the health care domain.



June 5, 2018
status: planned
version: 0

From Comp.Risks

Dominican fined $25,000 for removing wrong person's appendix

<...snip...>

The mistake occurred Nov. 14 when two female patients were scheduled for computed tomography, or CT scans, according to the state report.The first patient underwent an appendectomy that very evening because of the CT results. But the surgery was unnecessary. The next day, a radiologist discovered the patient's CT scan was actually that of a second patient.

Hospital staff told state inspectors that the technologist had trouble starting the required intravenous line for the first patient and took her out of the CT scan room to complete that task.

However, the patient's information had already been entered into the computer system for the CT scan. After the second patient's scan was completed, a radiology technician noted the error, removed the first patient's information and entered information on the second patient.

When the first patient's information was deleted from the computer in the scan room, it was not deleted from the computer system used by the radiologist.

"This was due to an incompatibility of the software between the two systems," the state report said.

<...snip...>

from Santa Cruz Sentinel http://www.santacruzsentinel.com/ci_9356389

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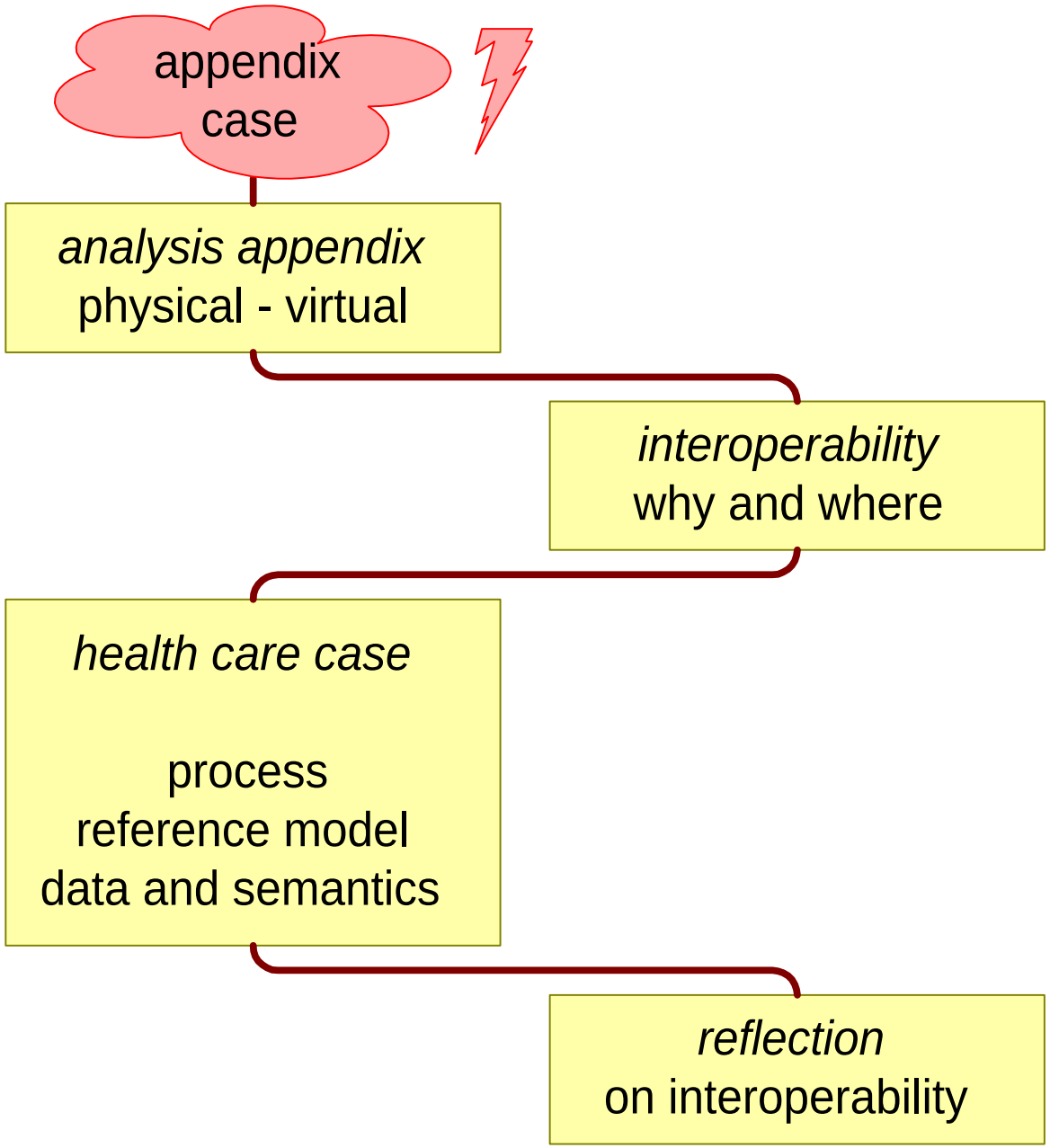
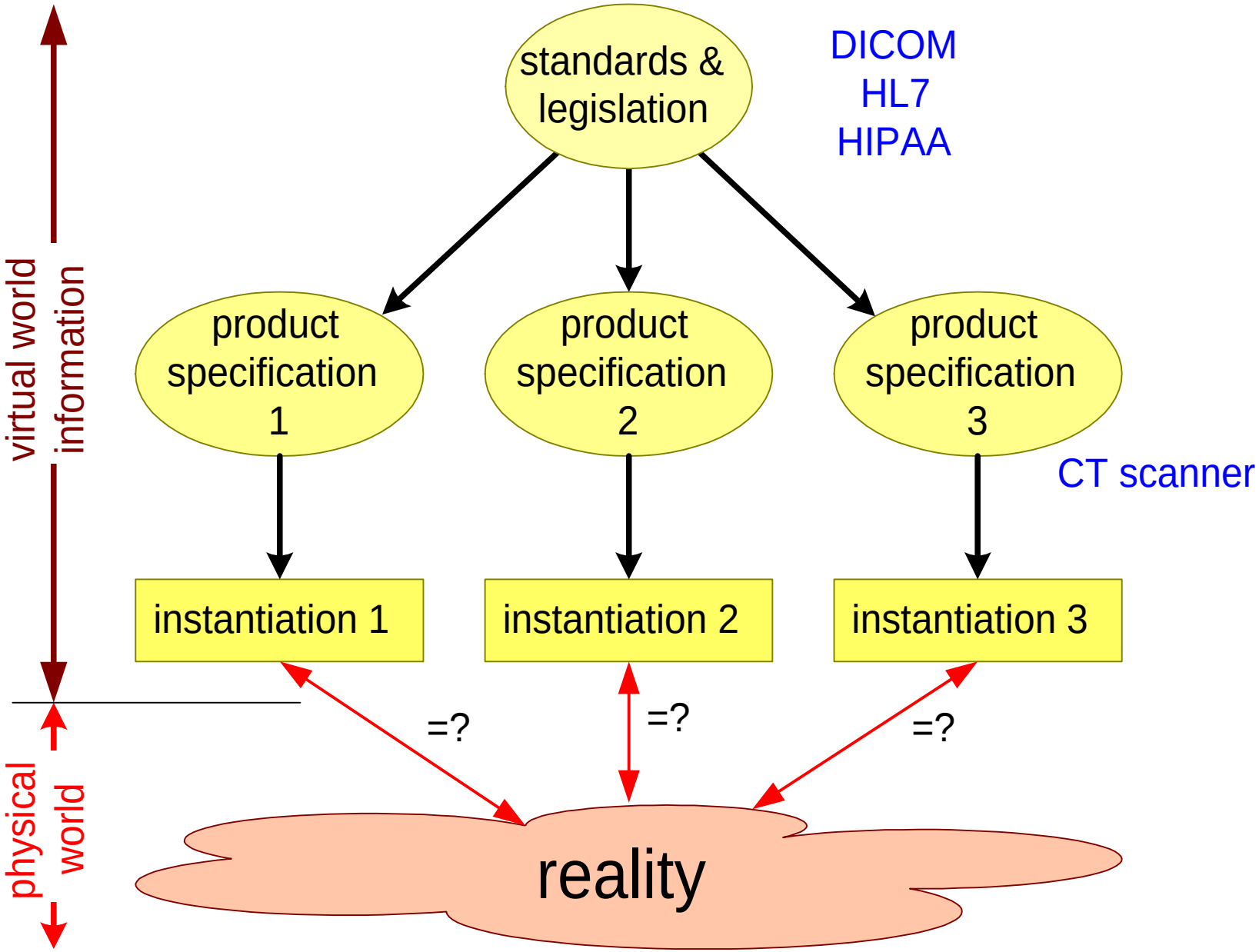
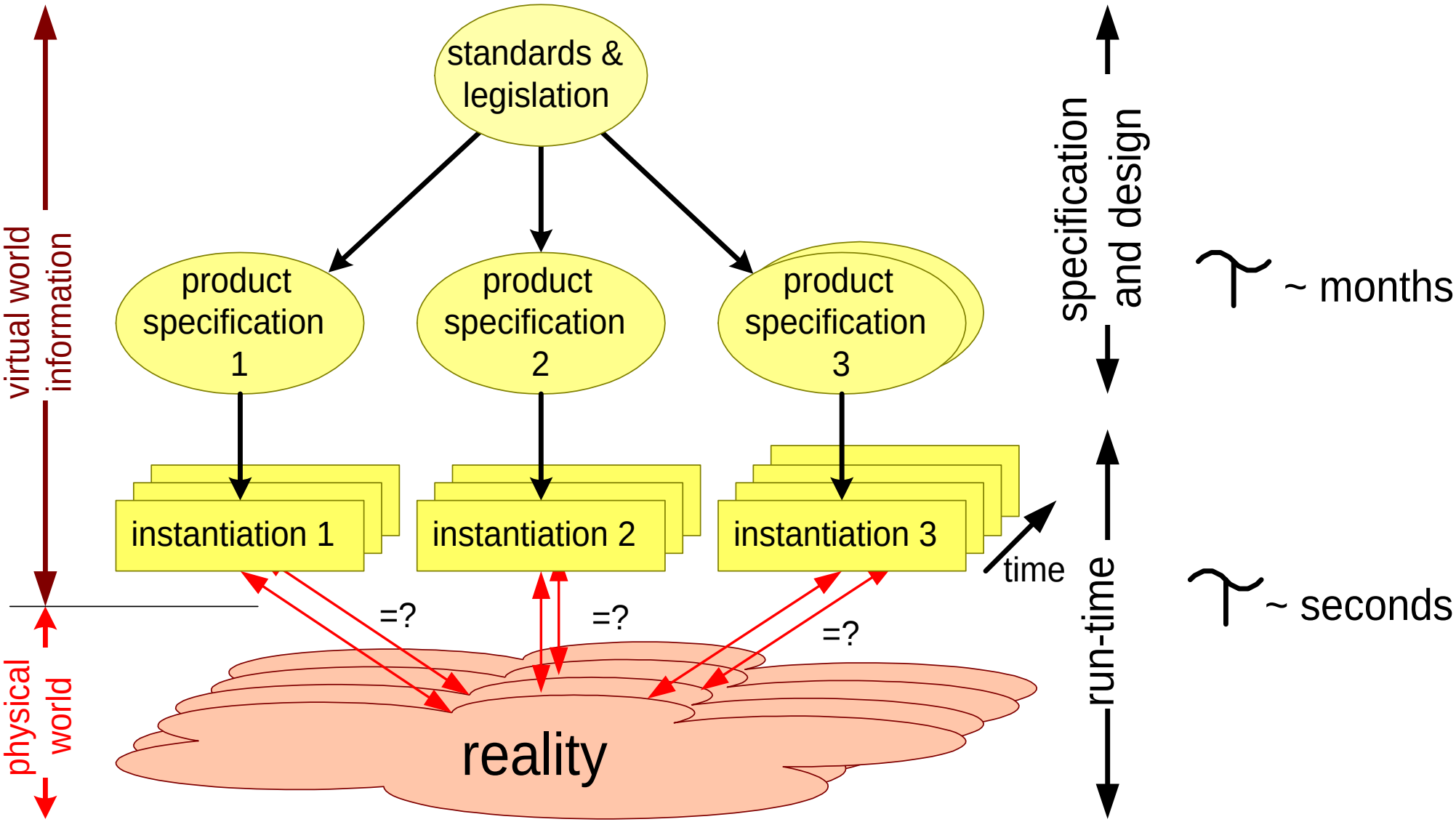


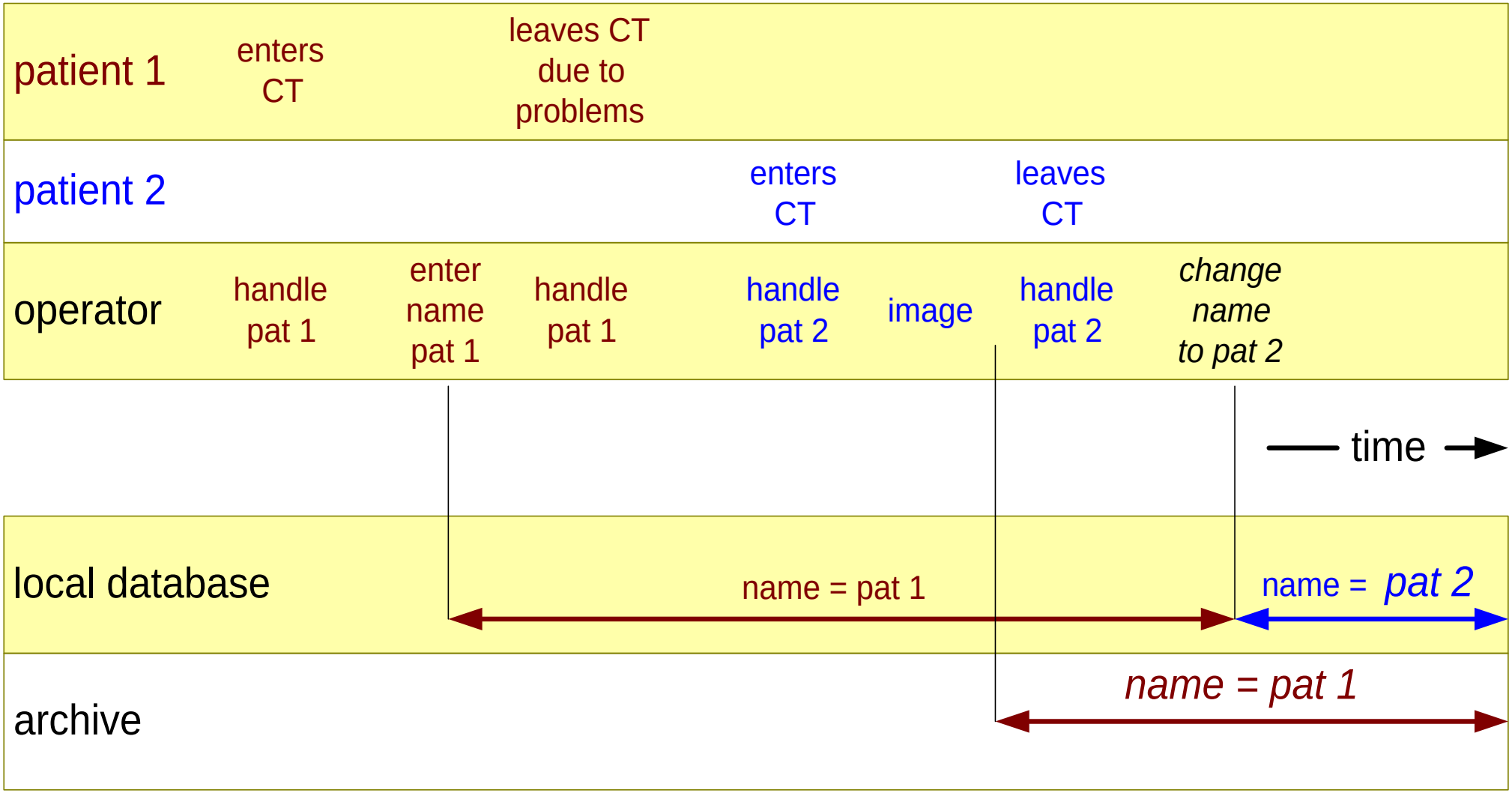
Physical and Virtual World Views



Adding Dynamics; the Time Dimension



Example: the Appendix Case



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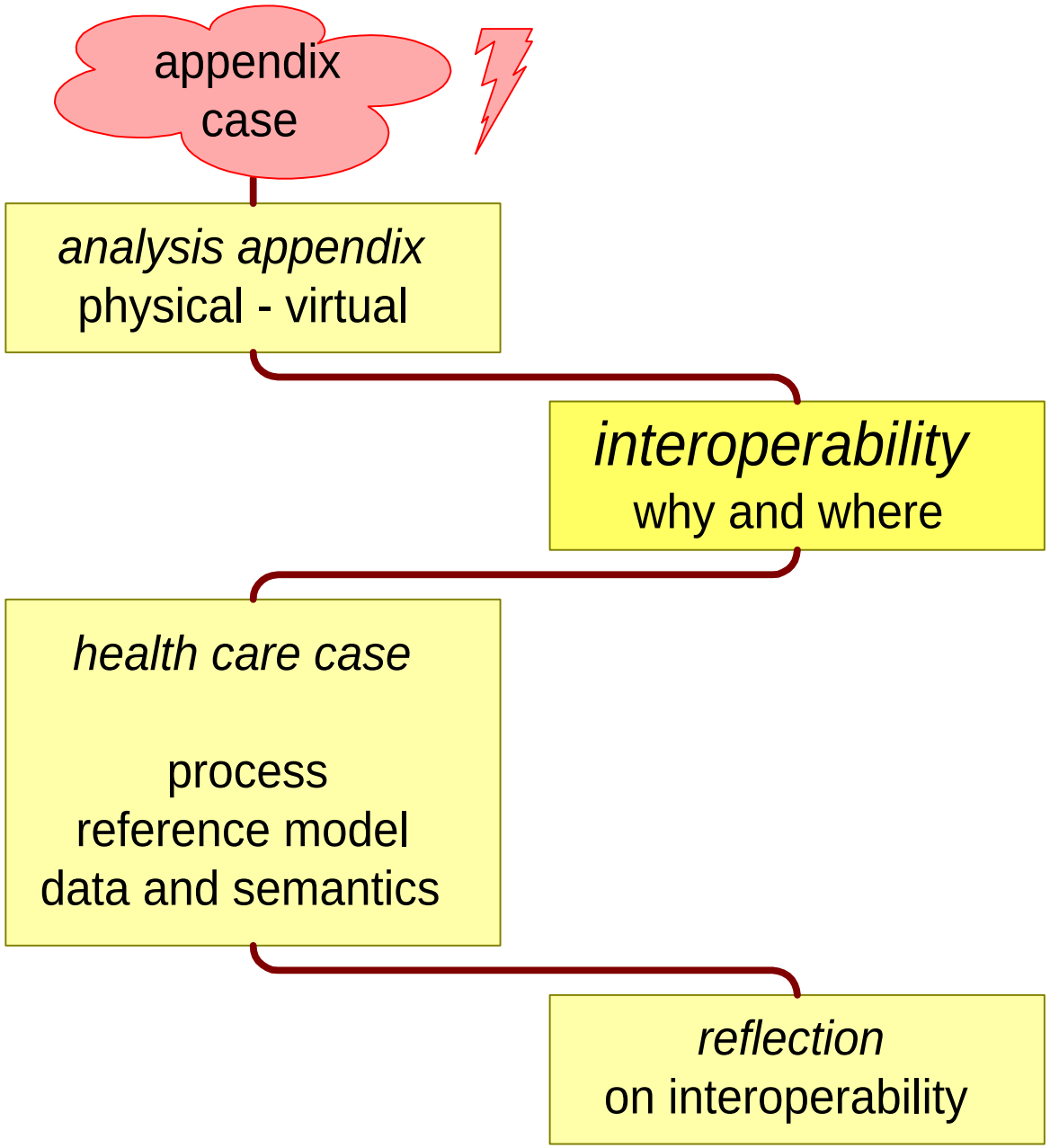


Interoperability is happening everywhere

defense #ships, #tanks, #planes, #weapons, #soldiers, ...

health care #hospitals, #clinical departments, #physicians, #pathologies, #patients, ...

traffic control *et cetera*

entertainment *et cetera*

telecommunication

administration

manufacturing

et cetera

Interoperability Requires Standards

interoperability

"extremely challenging"

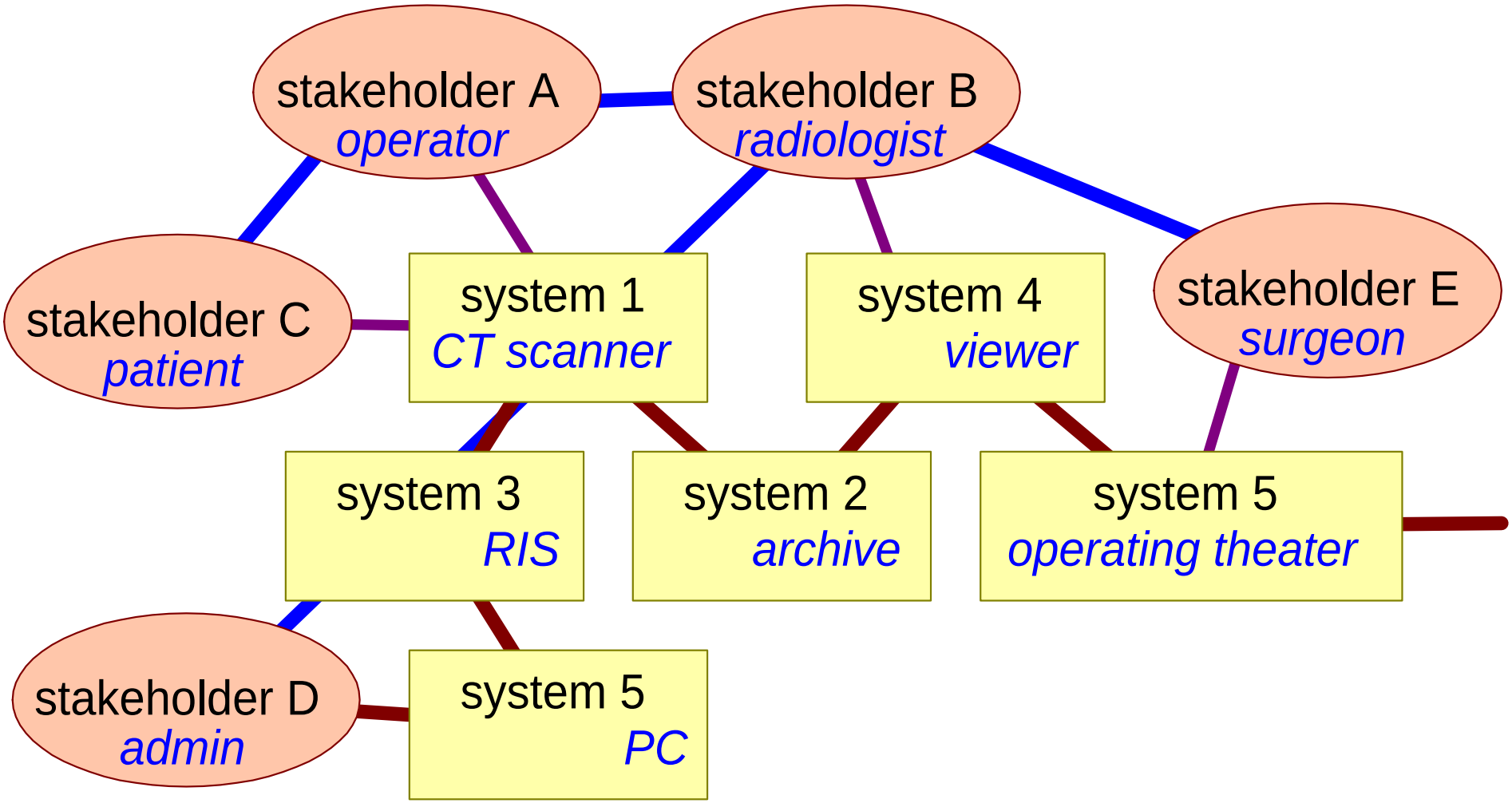
- human factors
- data semantics
- application protocols

connectivity

"only engineering"

- data syntax — formats, tags
- protocols — e.g. TCP/IP
- physical — media, interfaces cables, connectors, ...

Challenge....



End-to-end performance "emerges" from performance of interoperating systems and humans

Reliability Suffers from Poor Interoperability

Any mismatch in

connectivity or *interoperability*

shows up first as

functionality or *performance* problem

and then as

intermittent *reliability*

(or safety, security, availability) problem

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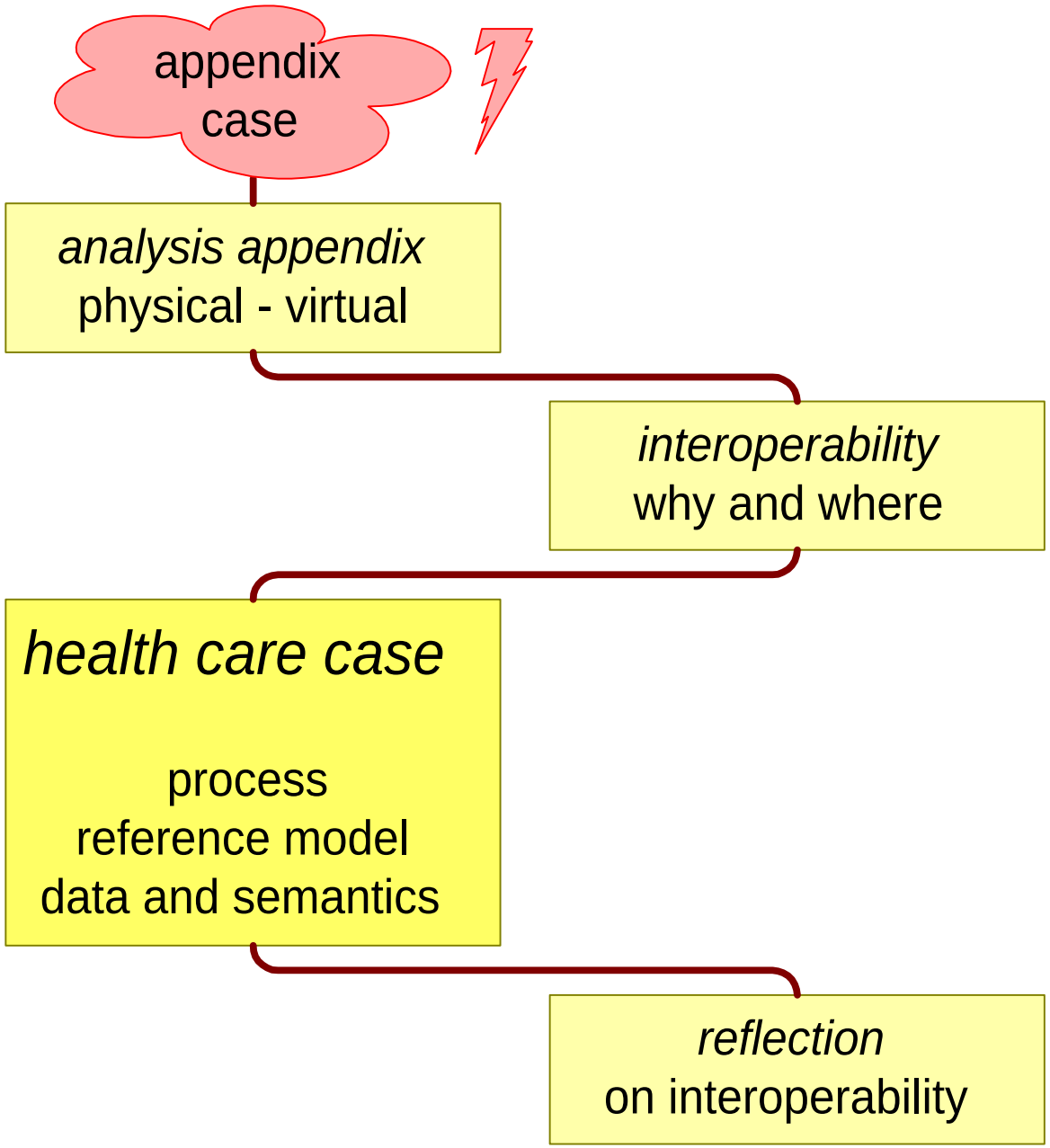
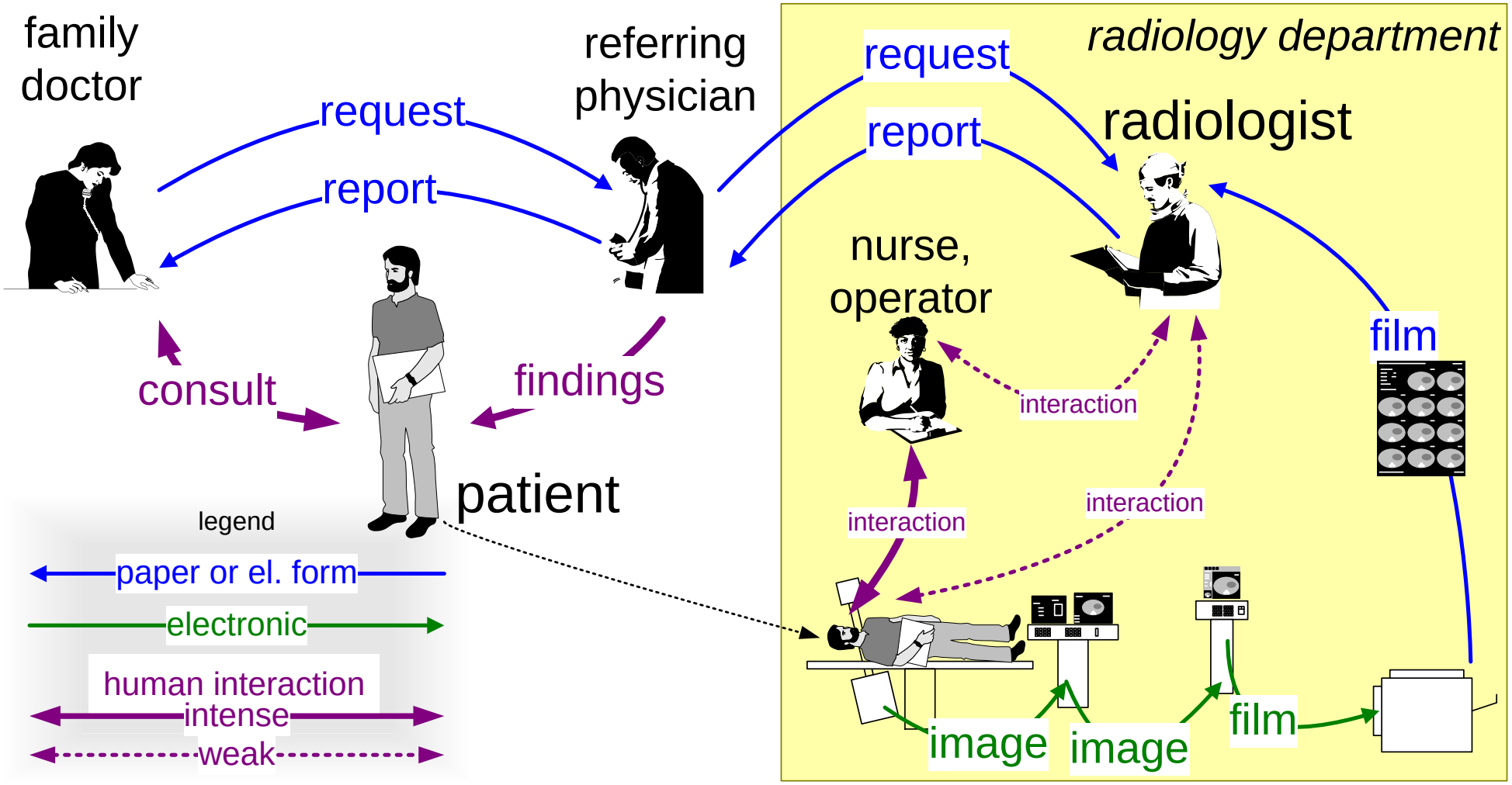
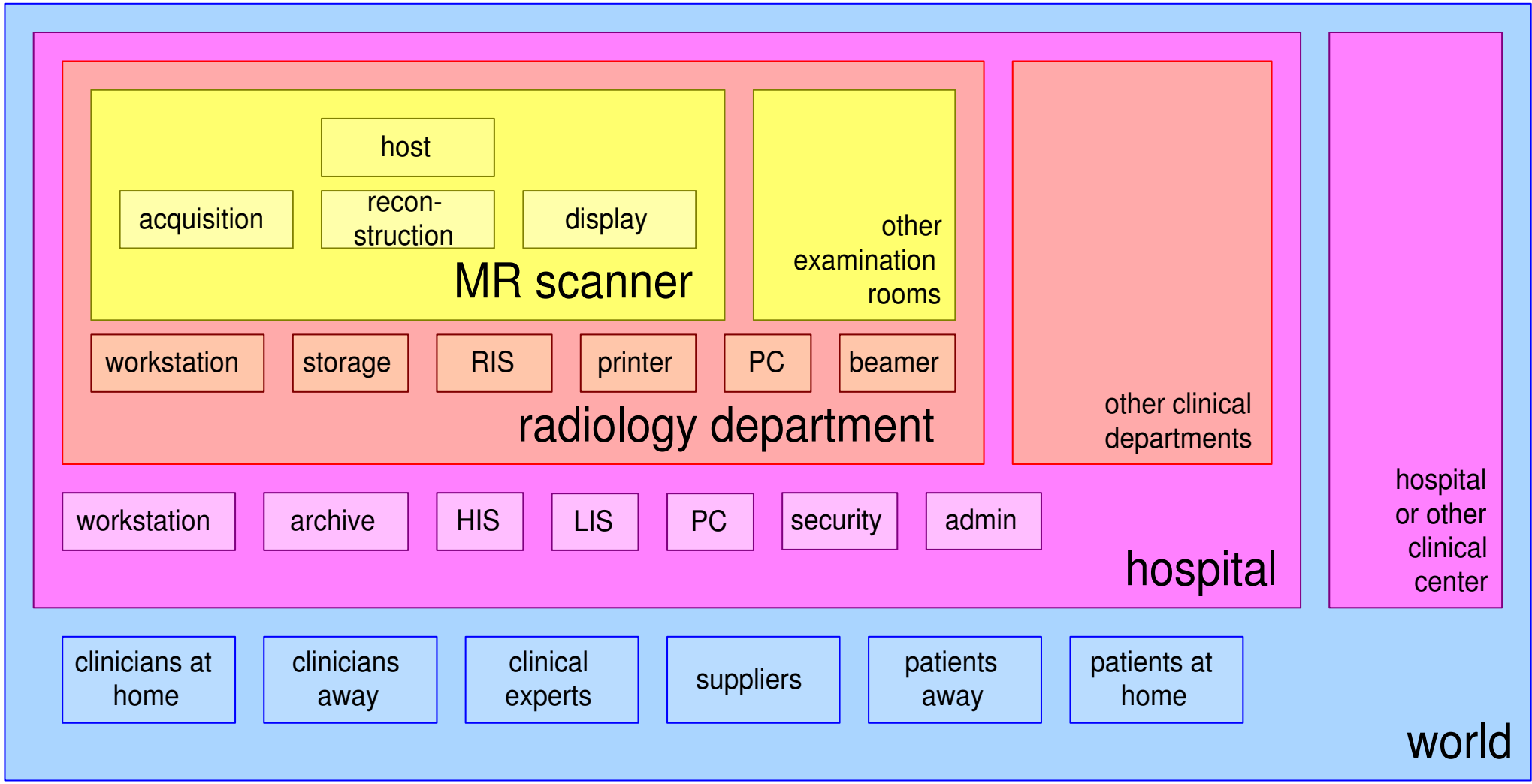


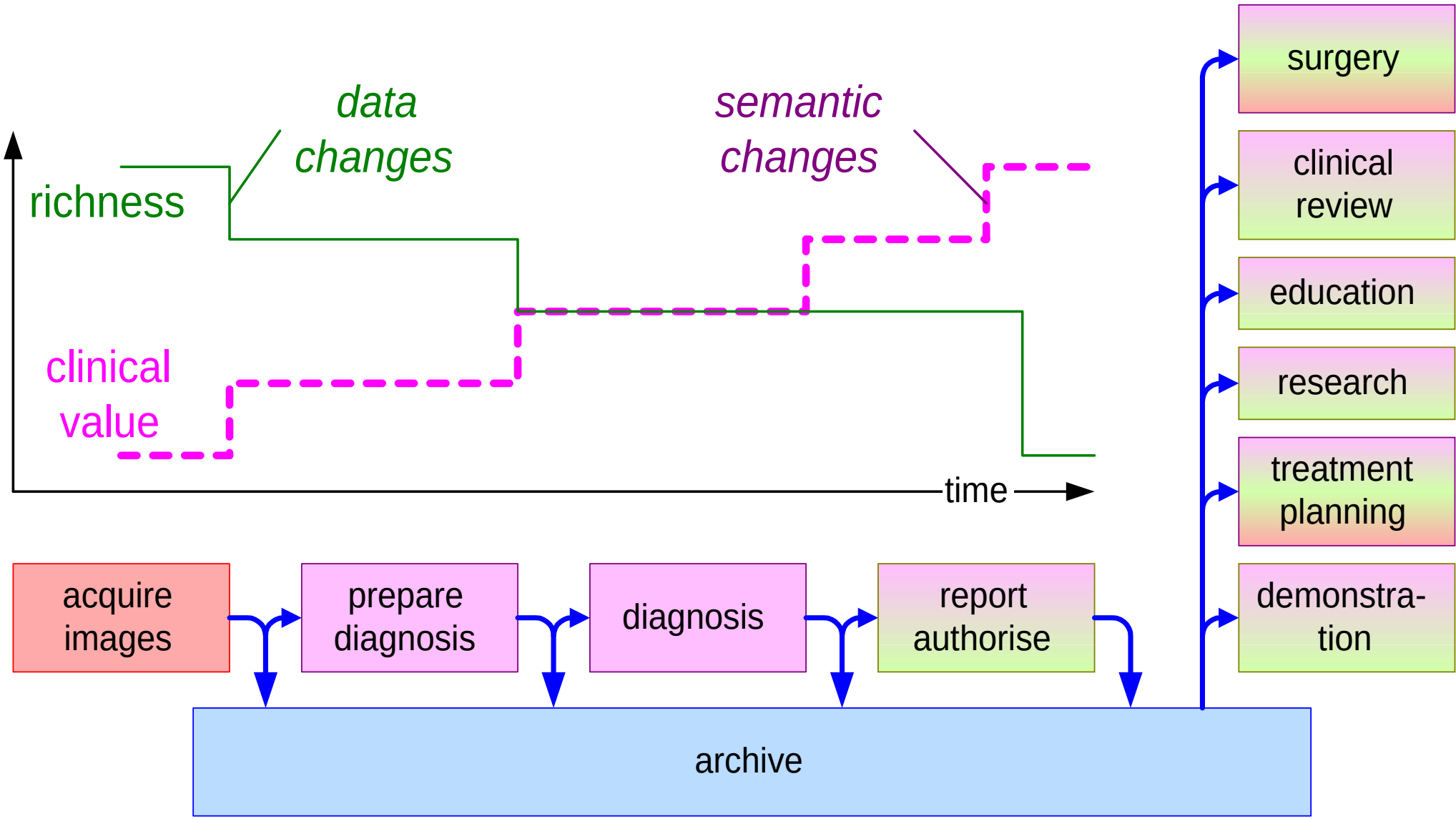
Health Care Work Flow



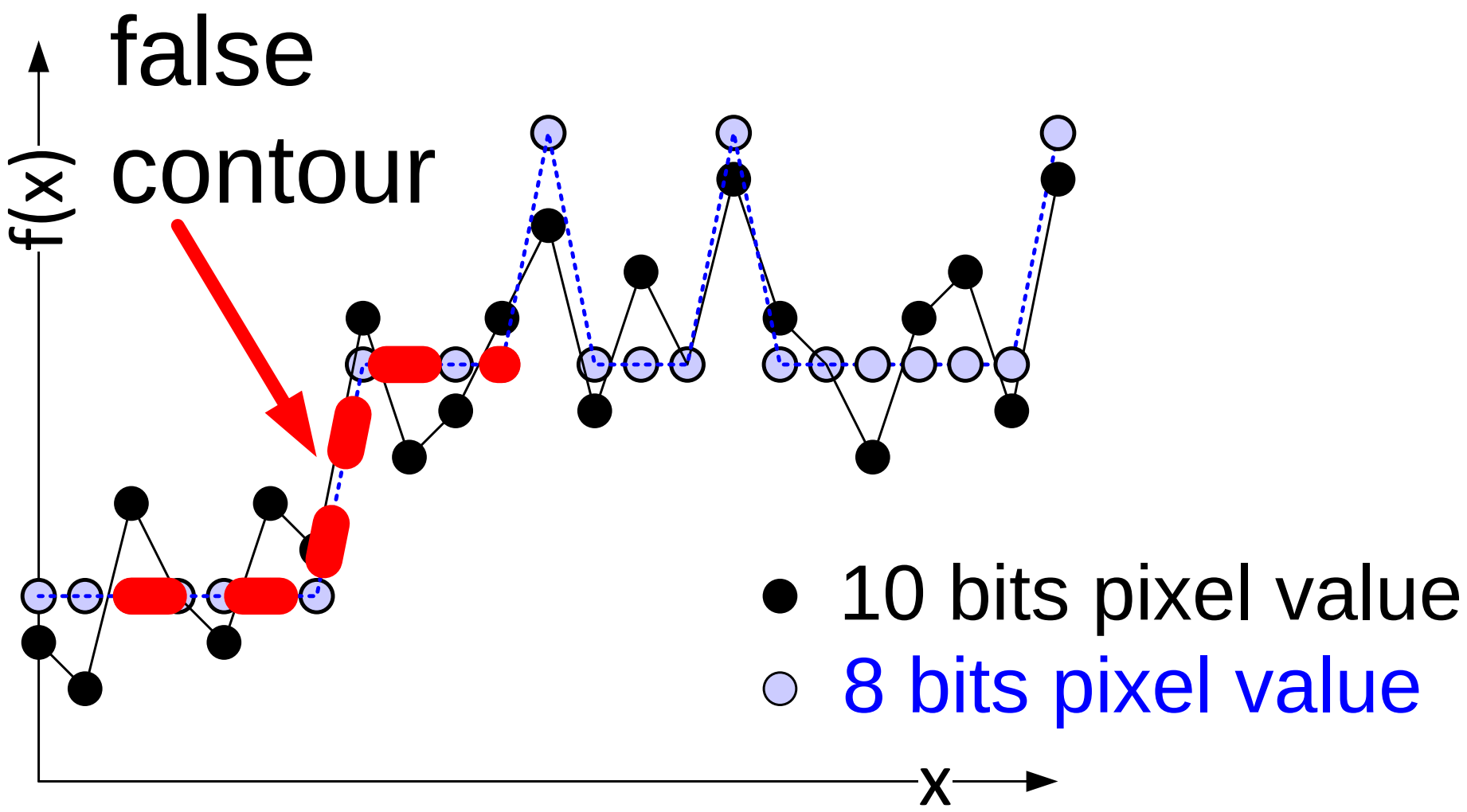
Scopes of Interoperability



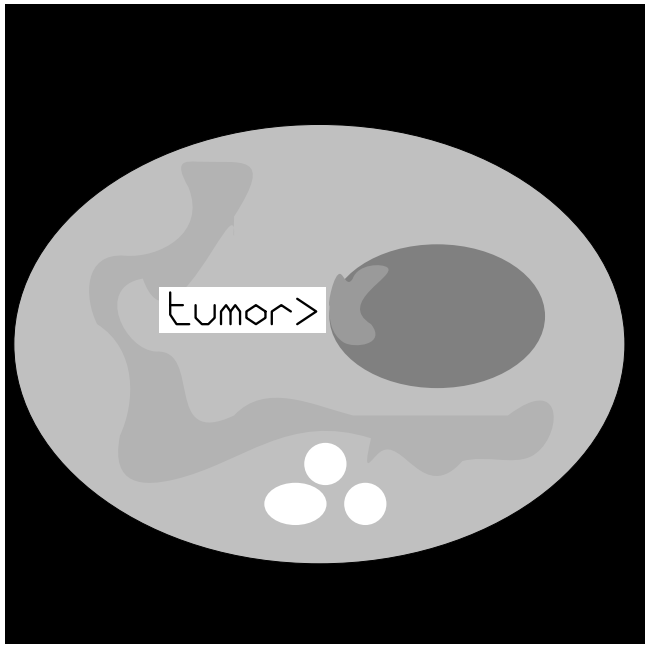
Clinical Process Triggers Data and Semantic Changes



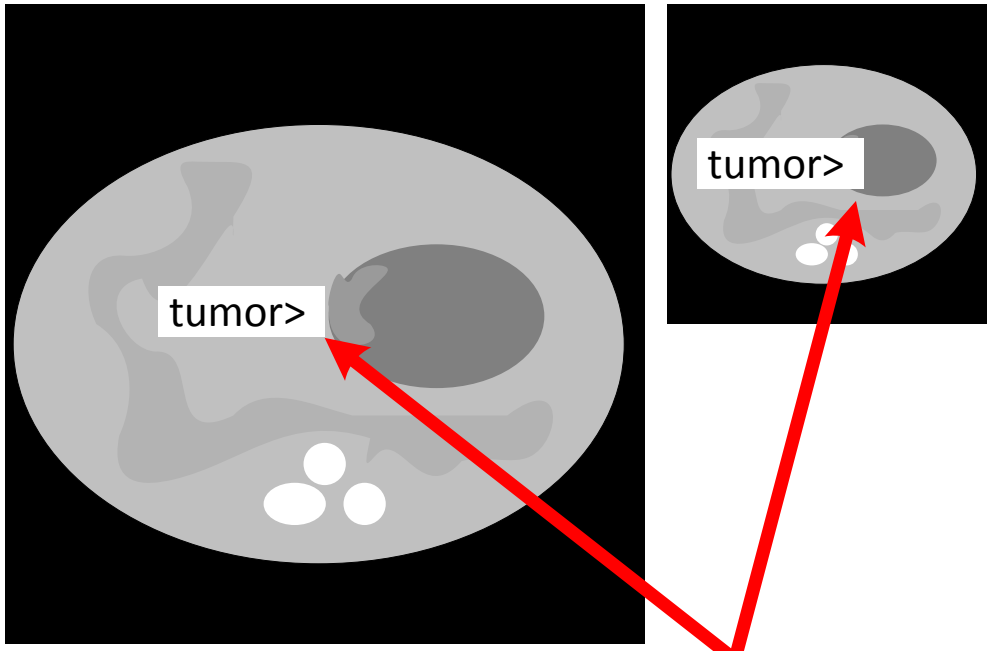
Example of Semantic Safety Problem



Example of Data Processing Safety Problem



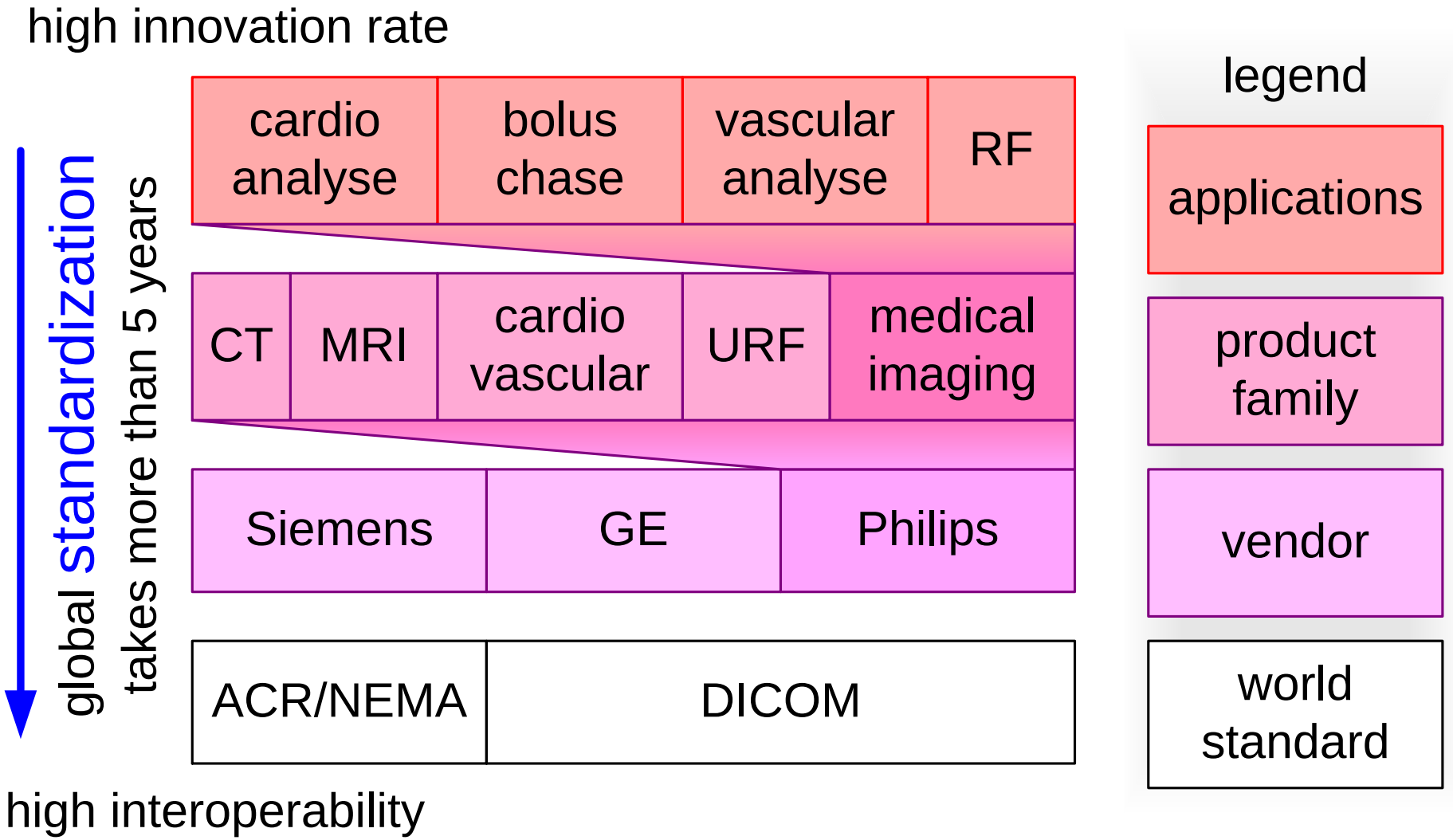
URF monitor output:
fixed size letters at fixed grid



for user readability the font-size was determined "intelligently"; causing a dangerous mismatch between text and image

EV output: scaleable fonts in graphics overlay

Innovation and Interoperability



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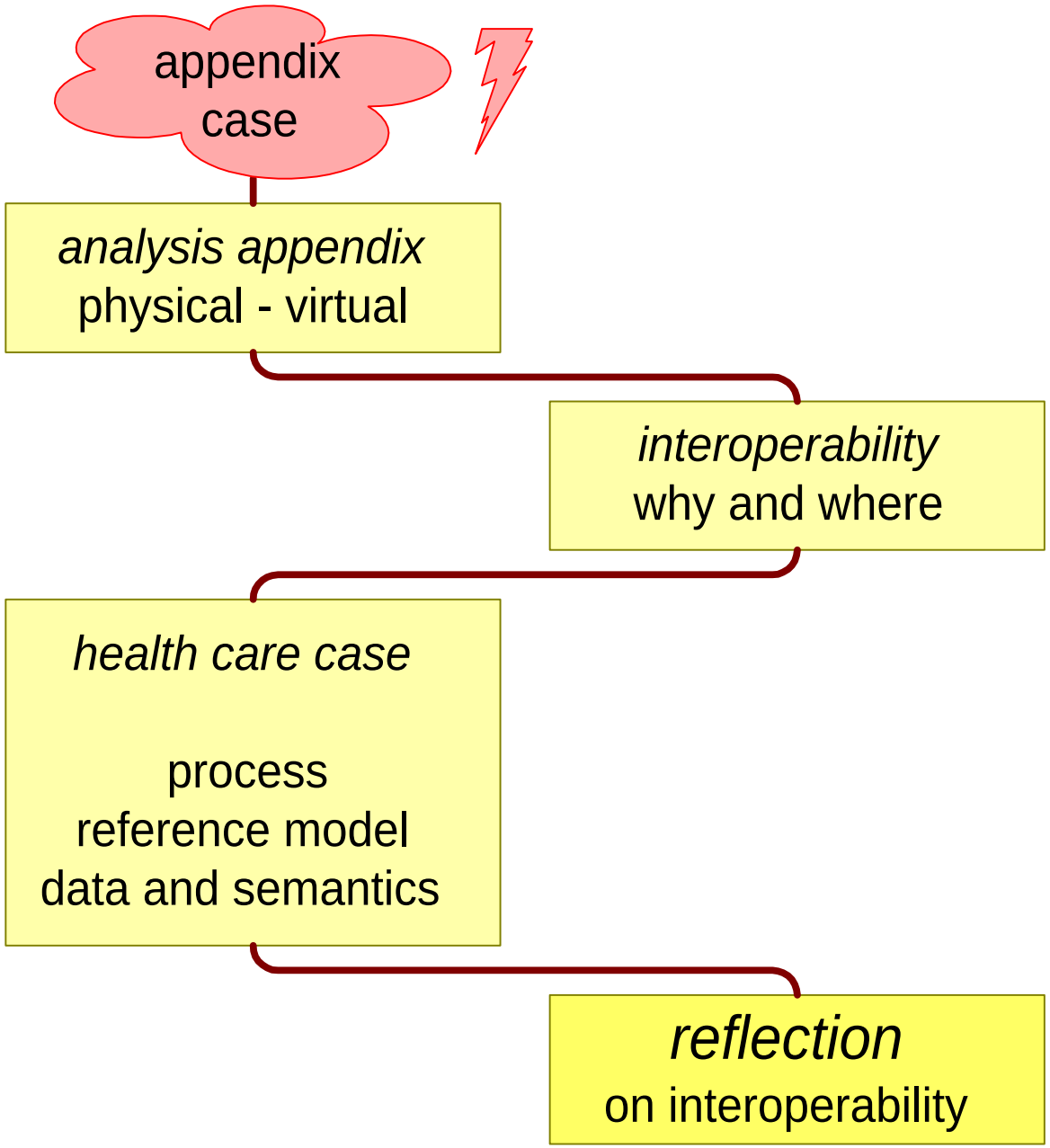

Many Dimensions of Interoperability

integrating **multiple**

applications

cilinical analysis
clinical support
administrative
financial
workflow

in **multiple**

languages
cultures

USA, UK,
China, India,
Japan, Korea
France, Germany
Italy, Mexico

delivered by **multiple**

vendors

Philips
GE
Siemens

based on **multiple**

media, networks

DVD+RW
memory stick
memory cards
bluetooth
11a/b/g
UTMS

and **multiple**

standards

Dicom
HL7
XML

and **multiple**

releases

R5
R6.2
R7.1

Conclusion

many small *interoperability* faults

may create

huge *reliability* problems

mission accomplished.....

....but did we execute the right mission?

to create reliable end-to-end performance

we need to understand the

dynamic interoperation

of many systems and humans