

Multi-view Architecting; Illustrated by an MRI scanner

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Abstract

Many people expect from the system architect that he decomposes the system in smaller components and defines and guards the interfaces. The conventional waterfall model for software development and this architecture view form a dangerous combination: an extremely limited integral understanding with a very late feedback.

A multi-view architecting approach tackles the problem of integral understanding. In combination with spiral or incremental development models a powerful method becomes available for creating complex systems.

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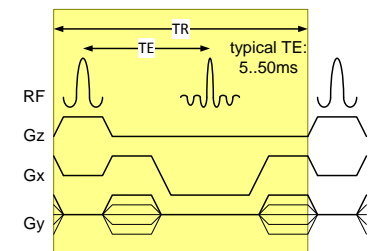
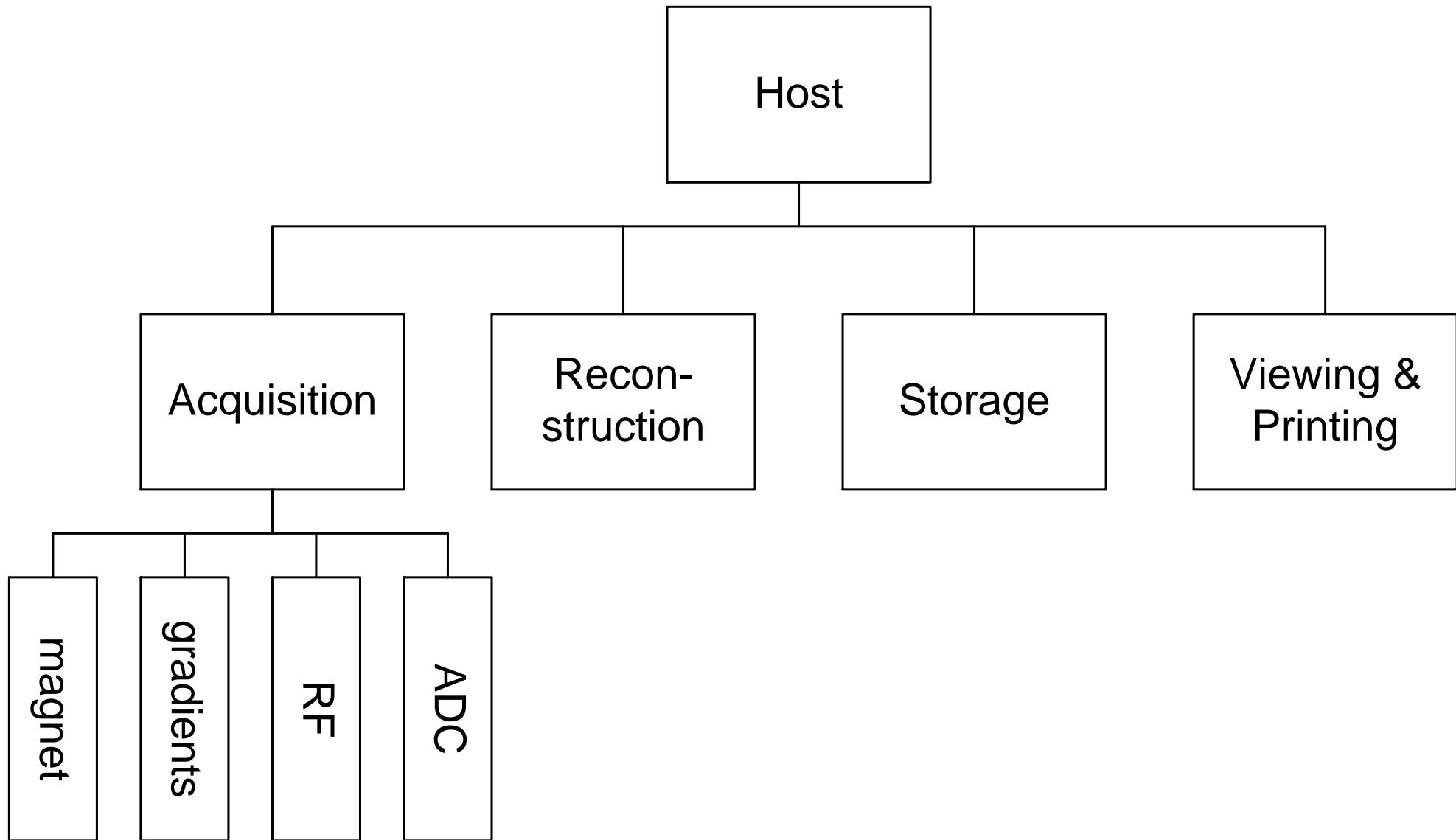


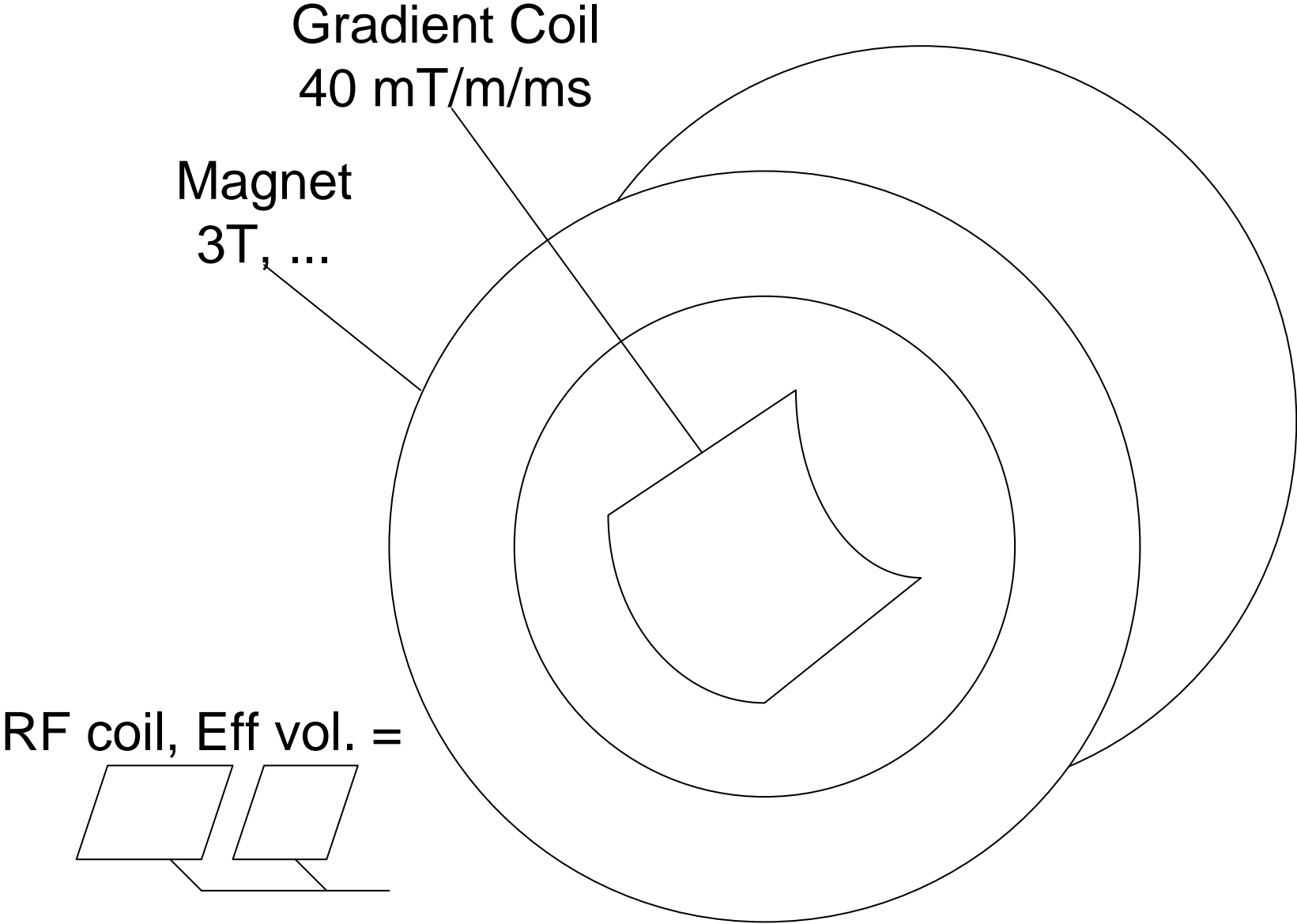
Illustration case: MRI scanner



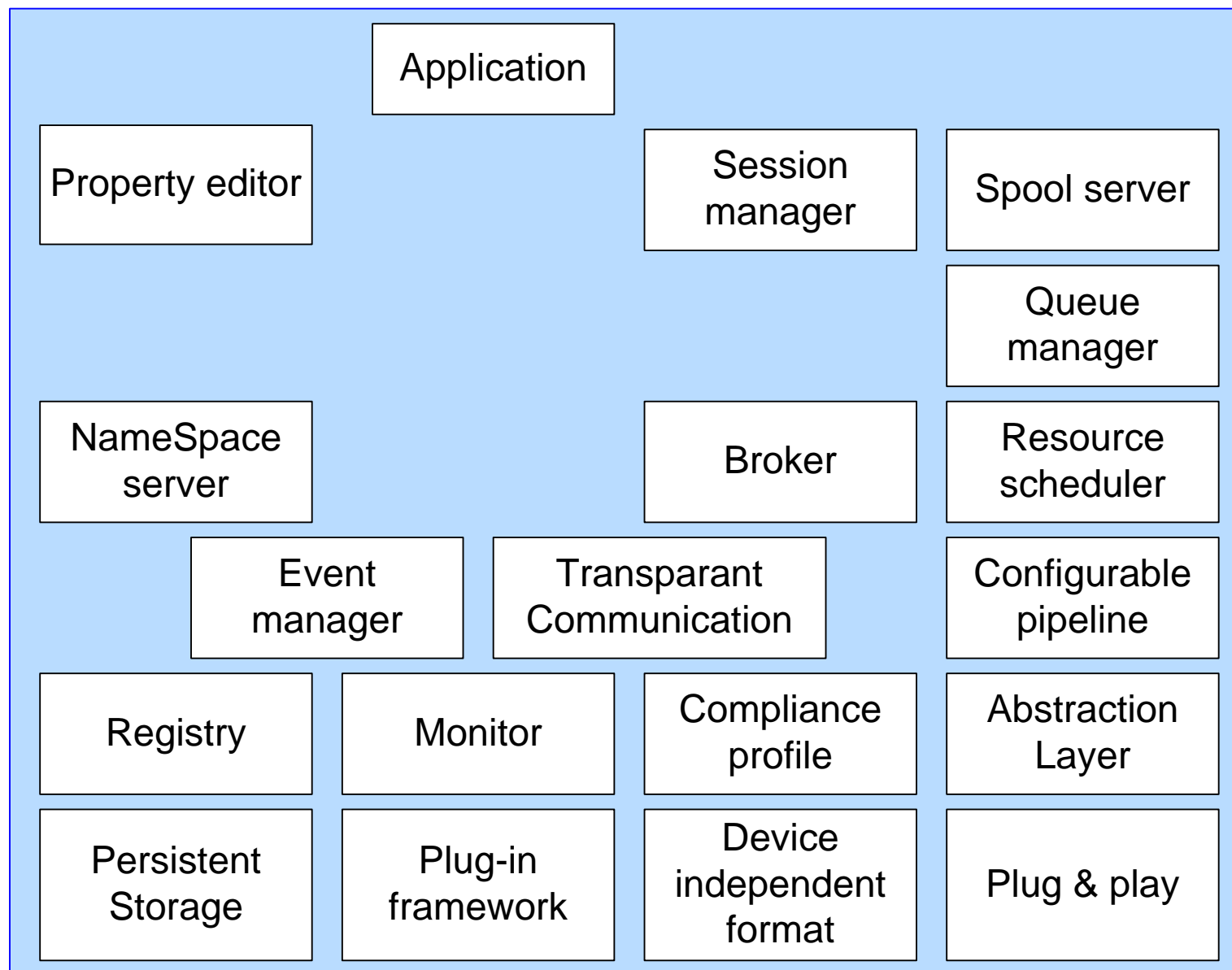
Block diagram view



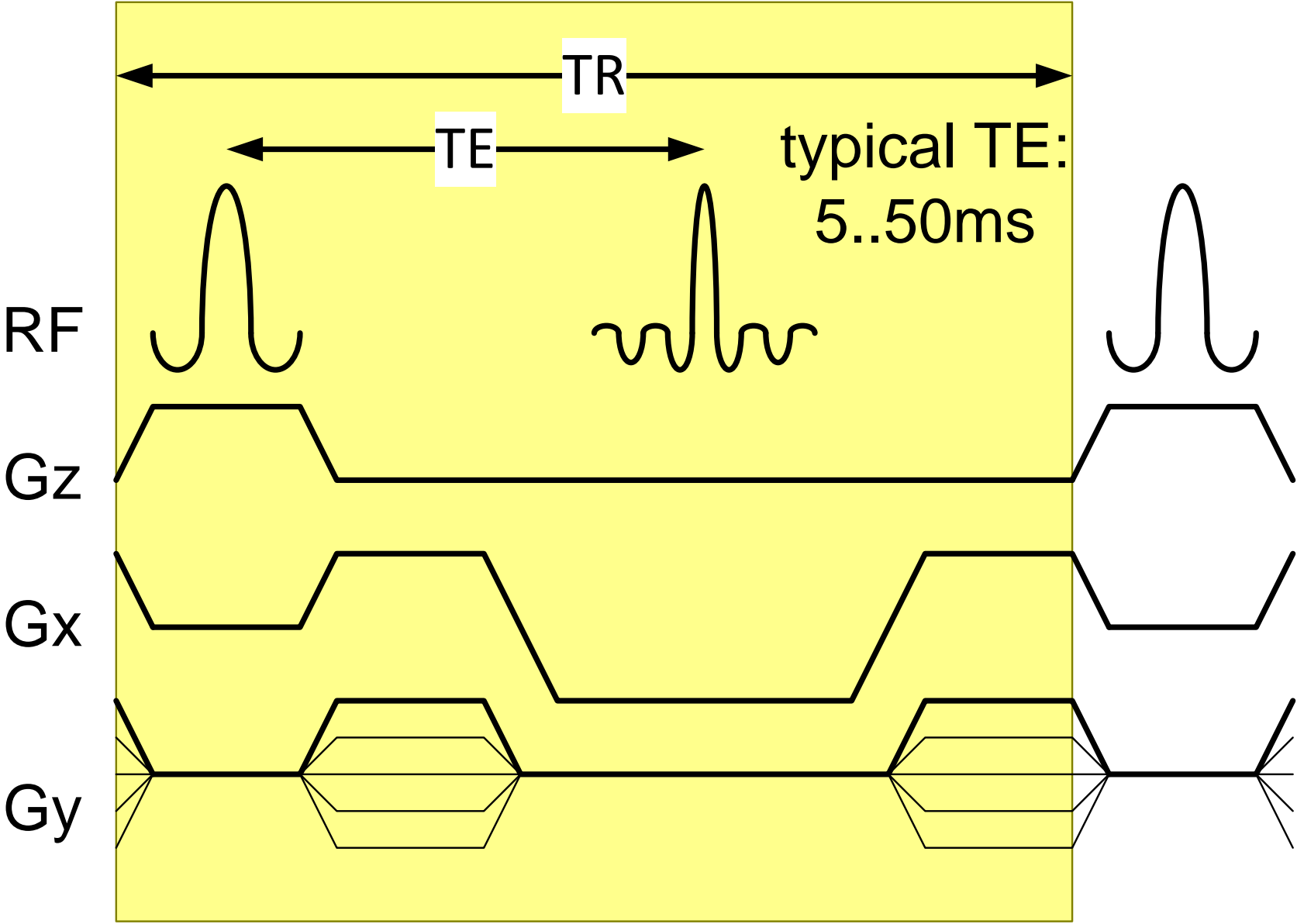
Physics view



Software architecture view



MR imaging methods view



Conceptual Work by the architect

- Most disciplines require multiple views, for instance circa 4 views in SW [Kruchten, Soni]
- Only a subset of disciplines has been shown (not shown are a.o. mechanics, logistics, project management)

The **system architect integrates** the **complementing disciplinary views**

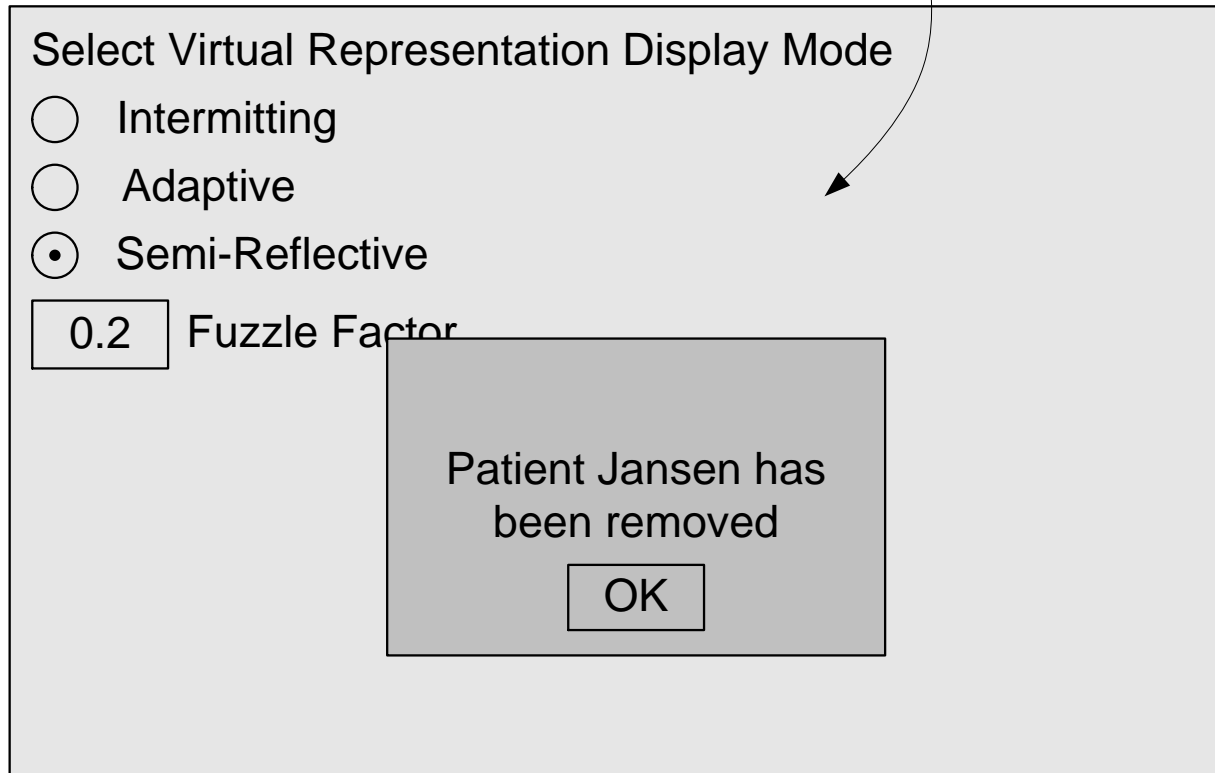
However

Decisions and trade-offs in the **conceptual view** are driven by **application**,
business and **operational** inputs

Useability and main stakeholders

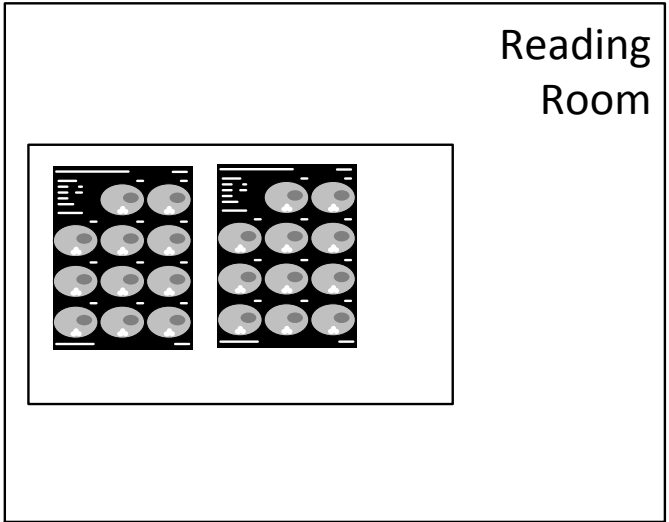
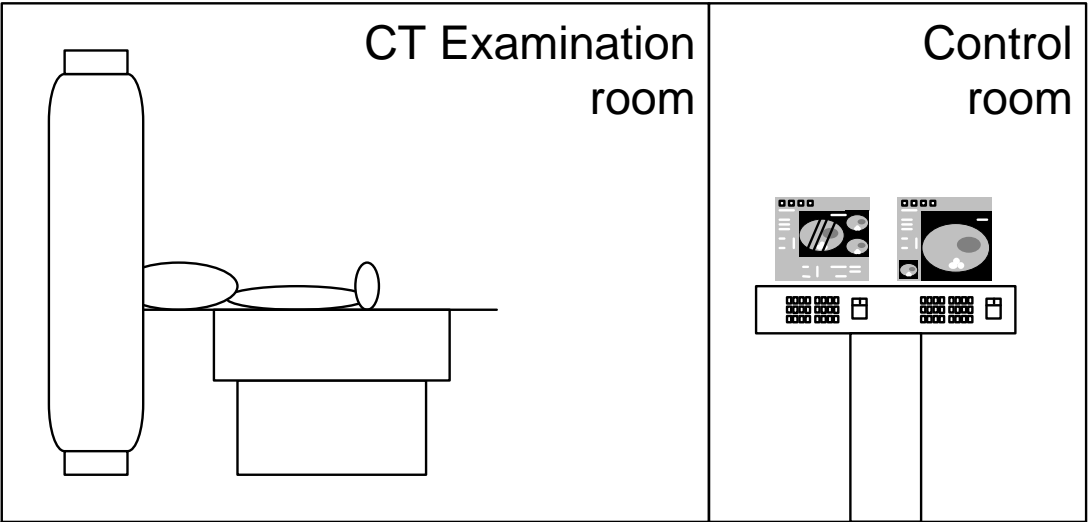
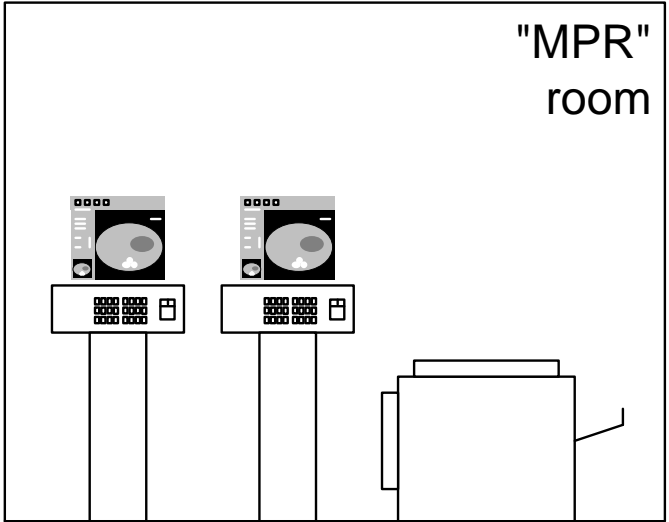
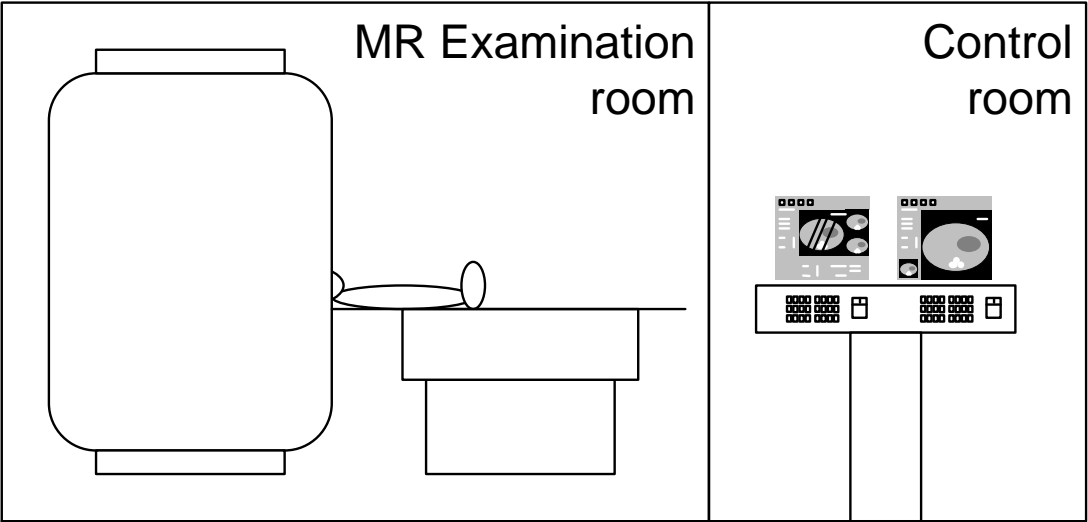
The engineer creates a technological UI...

without imagining the clinical reality

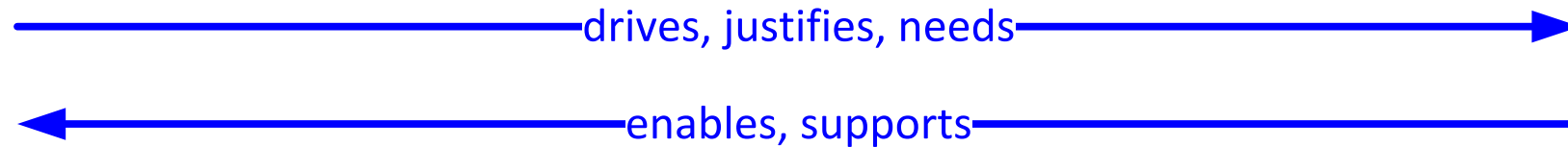


"In the meantime the patient is horrified by the intimidating system, the weird cage around his body and the EKG leads attached to his breast..."

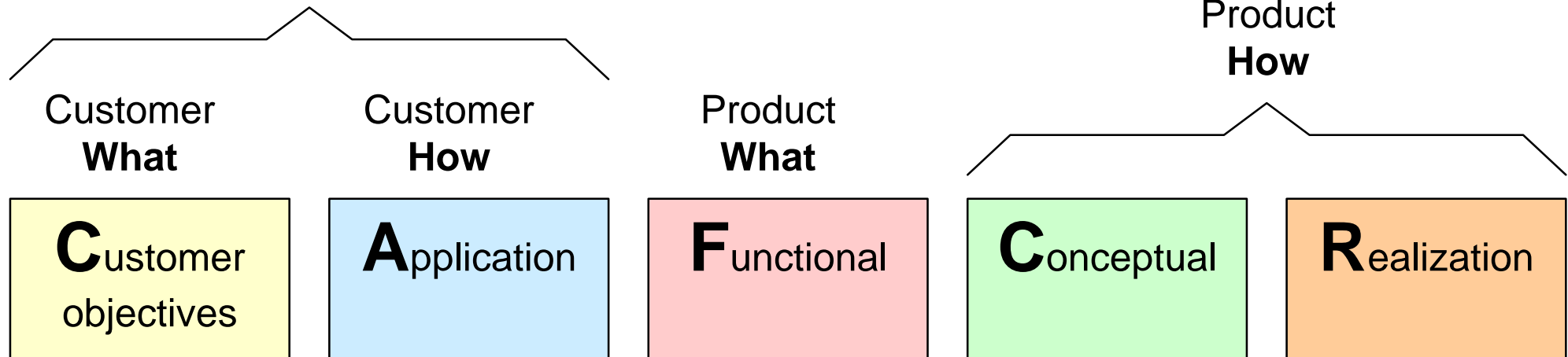
Radiology department view



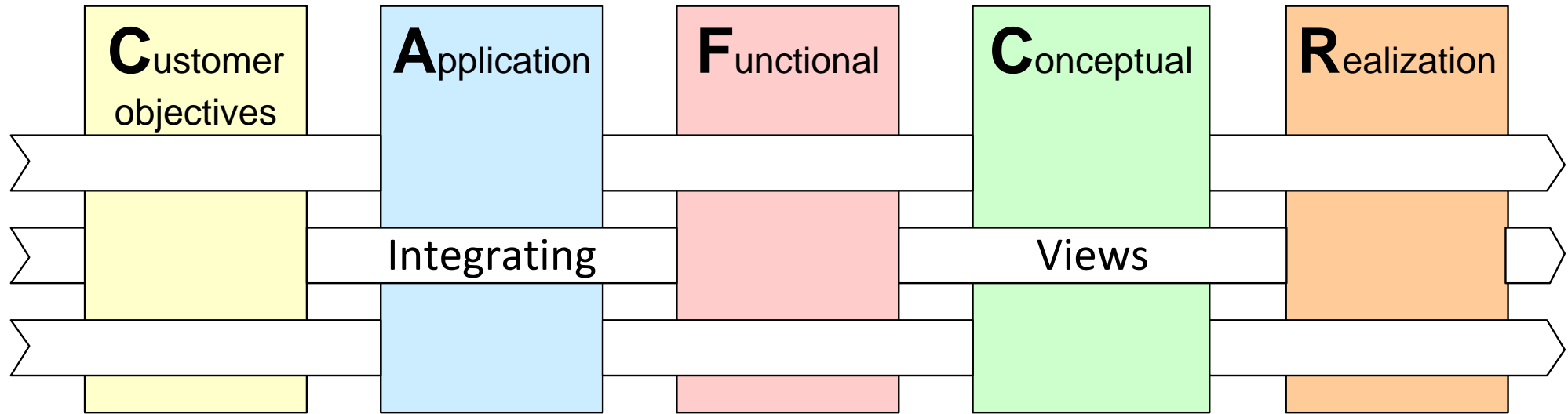
System Architect integrates 5 viewpoints



What does Customer need
in Product and **Why?**



Integration of 5 views



High margin
Cardiology
market

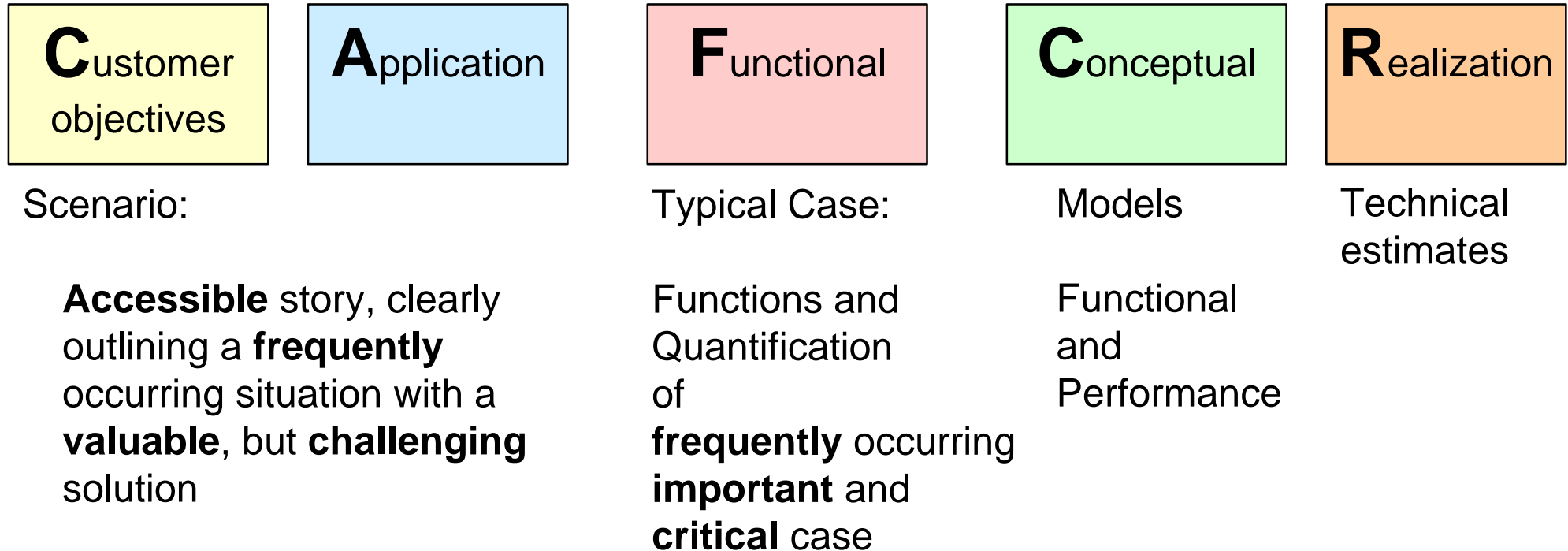
Cost per
examination
model

Patient
throughput
features

System
throughput
model

Budget in
seconds

From scenario to budget

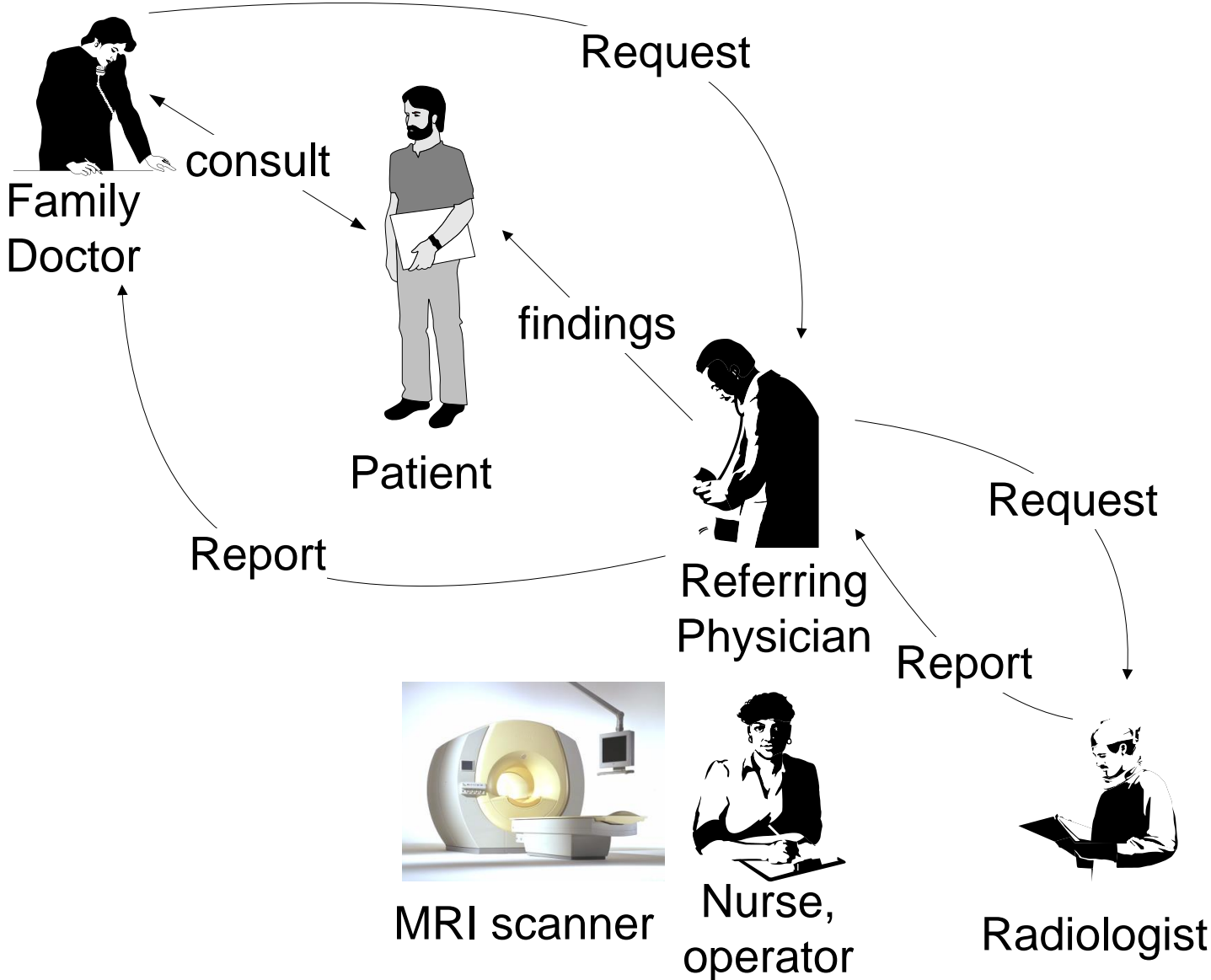


Several iterations are required. In later iterations worst cases and exceptional cases are taken into account. The technical estimates are then transformed in budgets.

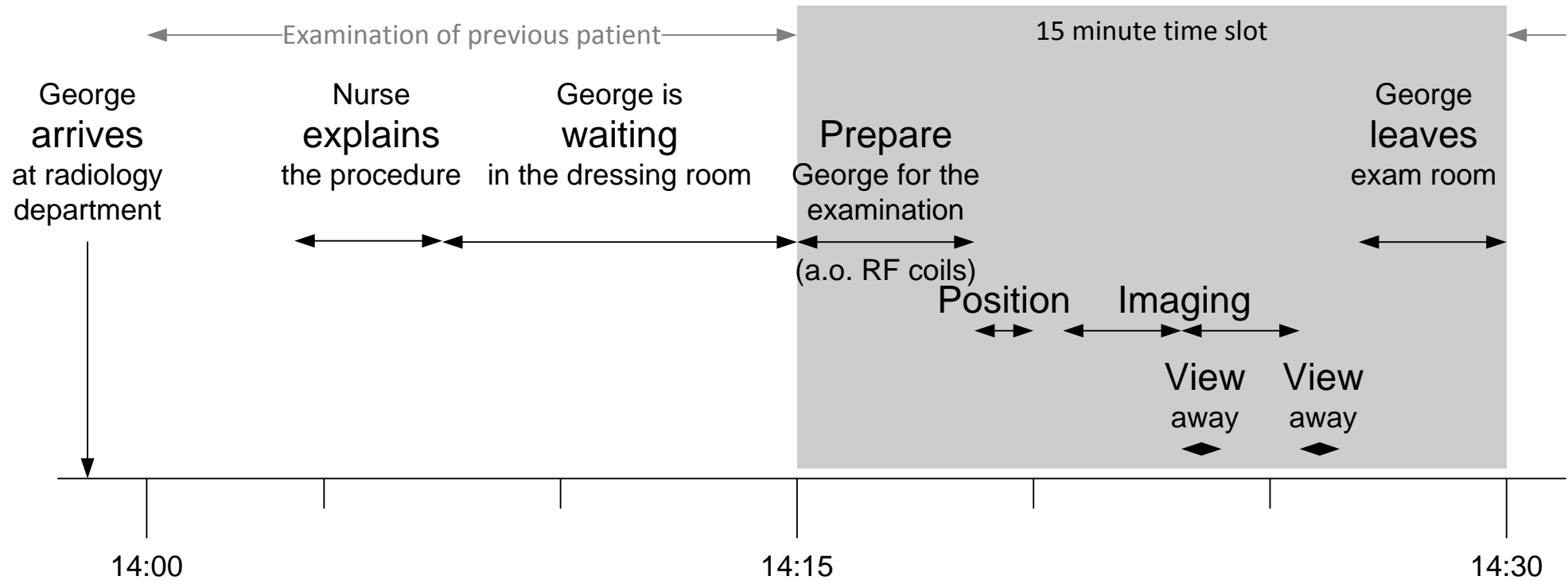
MR neuro scenario

- Patient George has continuous headache.
- His family doctor has send him to the Neurologist.
- The Neurologist wants to exclude the possibility of a tumor and requests an MRI examination.
- The Radiologists does not see any indication for a tumour.
- The Radiologist sends his report to the Neurologist.
- The Neurologist discusses his findings with the patient and sends a report to the family doctor.

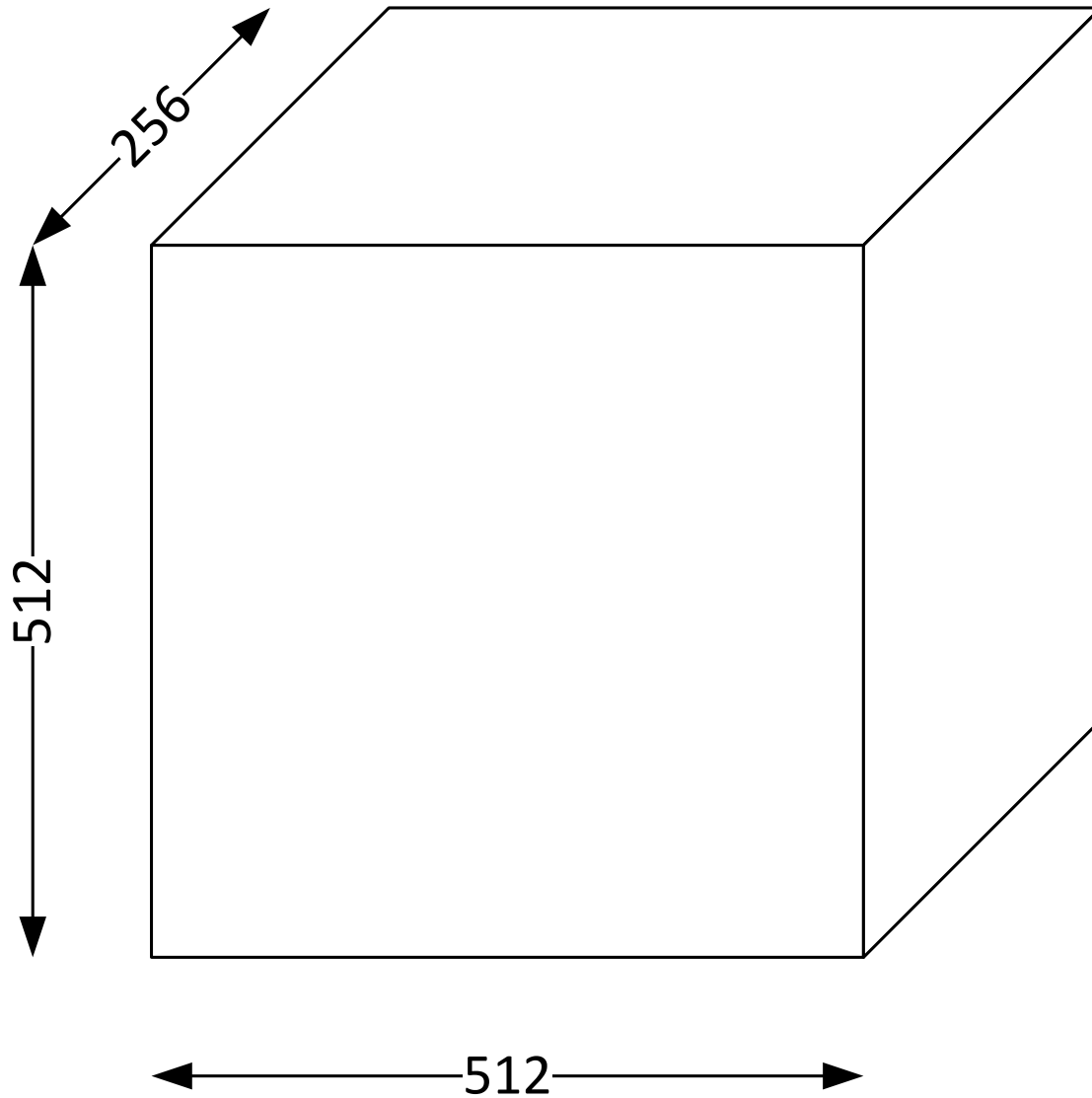
Clinical Stakeholders



Typical timing of Neuro examination



Typical amount of Images: 2 Volumes



Data in bytes =

$$2 * 512 * 512 * 256 * 2 =$$

Volumes

x

y

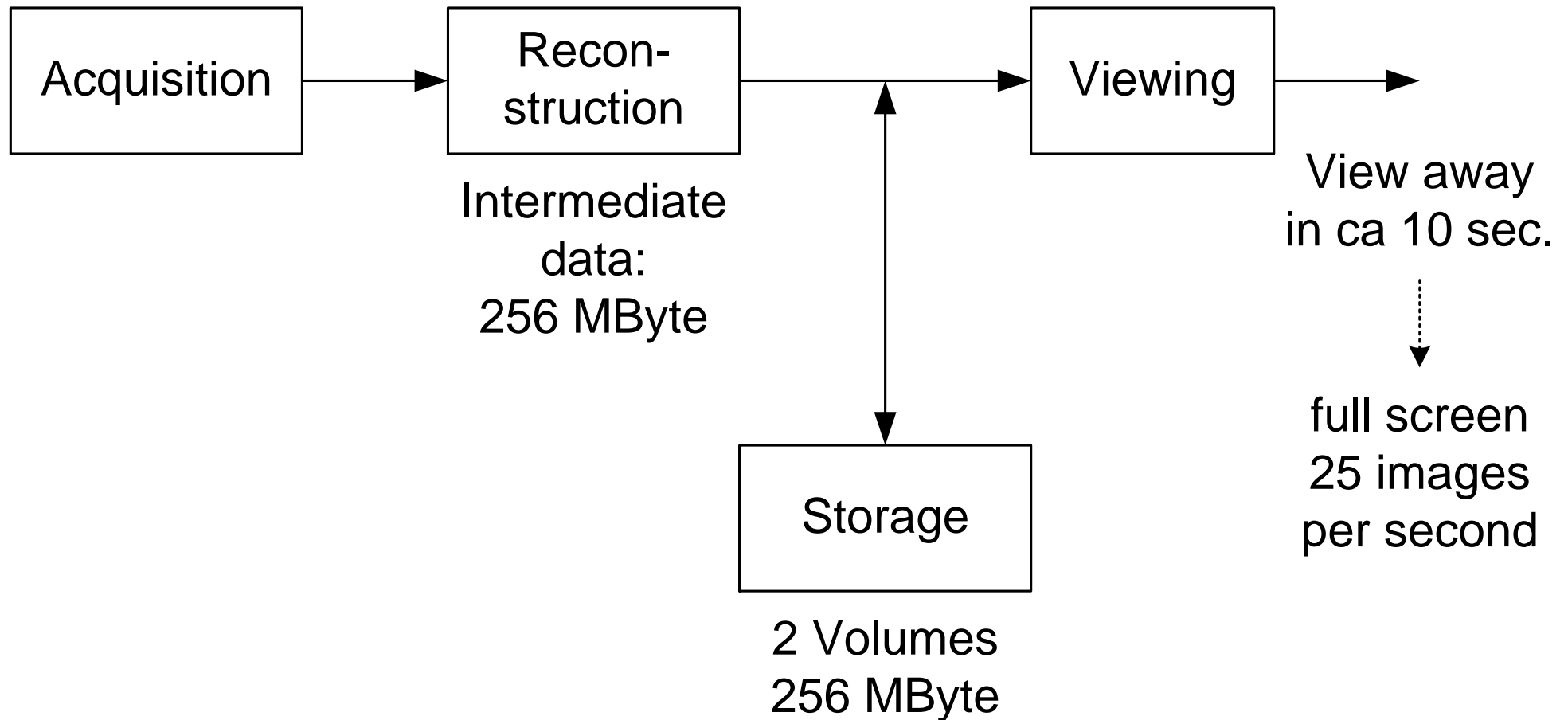
z

bytes per pixel

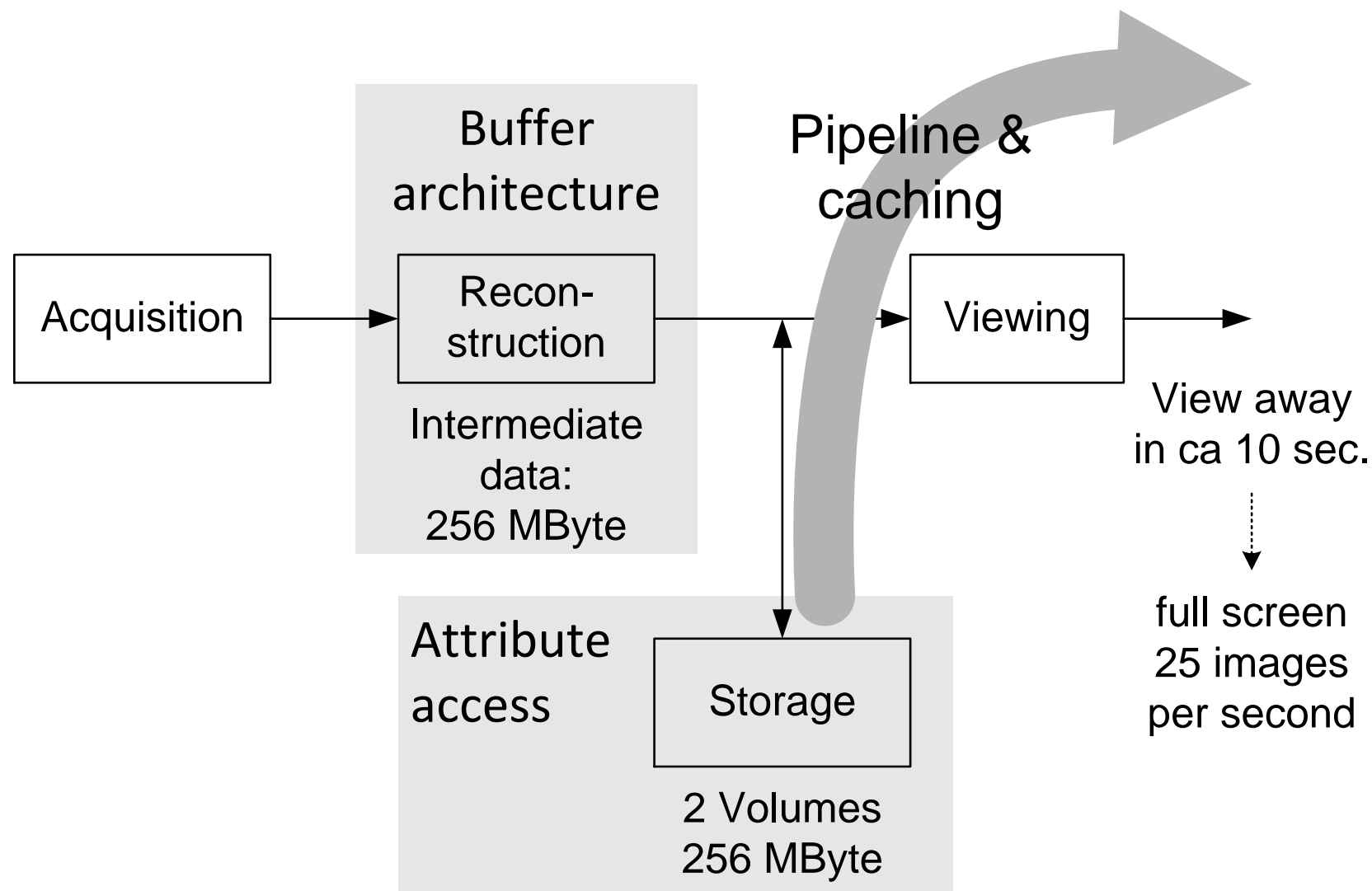
256 MBytes

in 2 * 2 minutes =
240 seconds

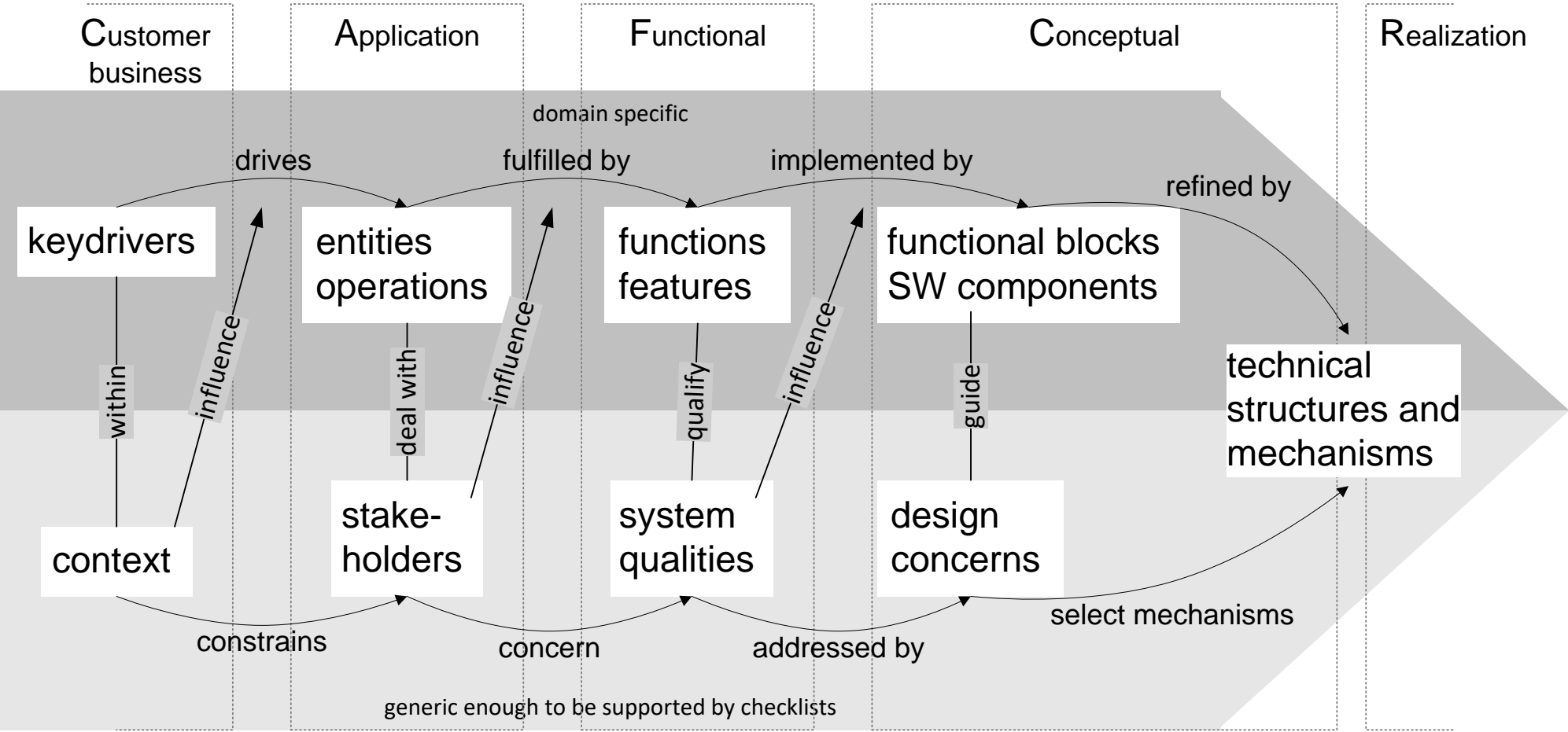
MR resource model



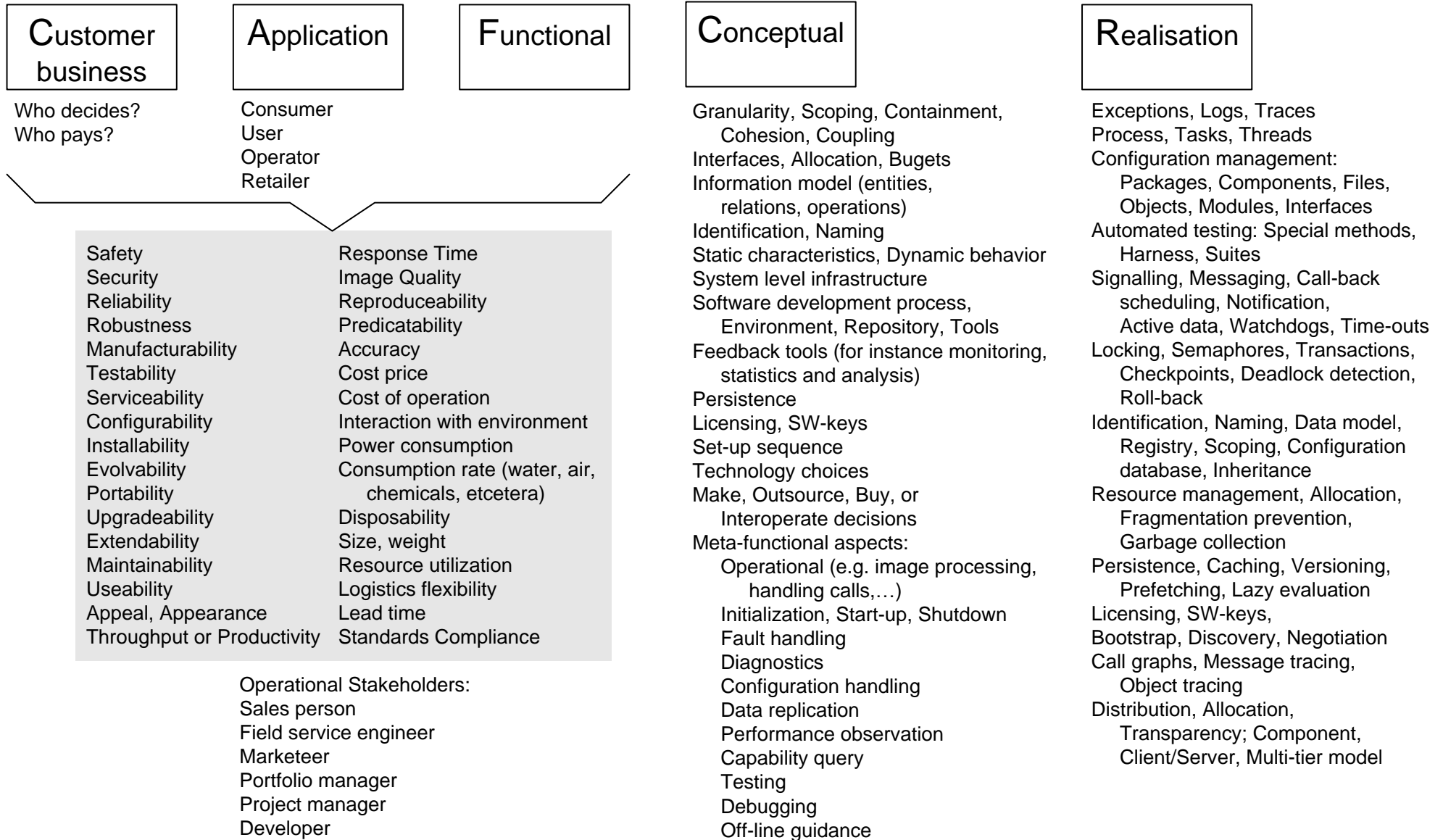
MR critical design choices



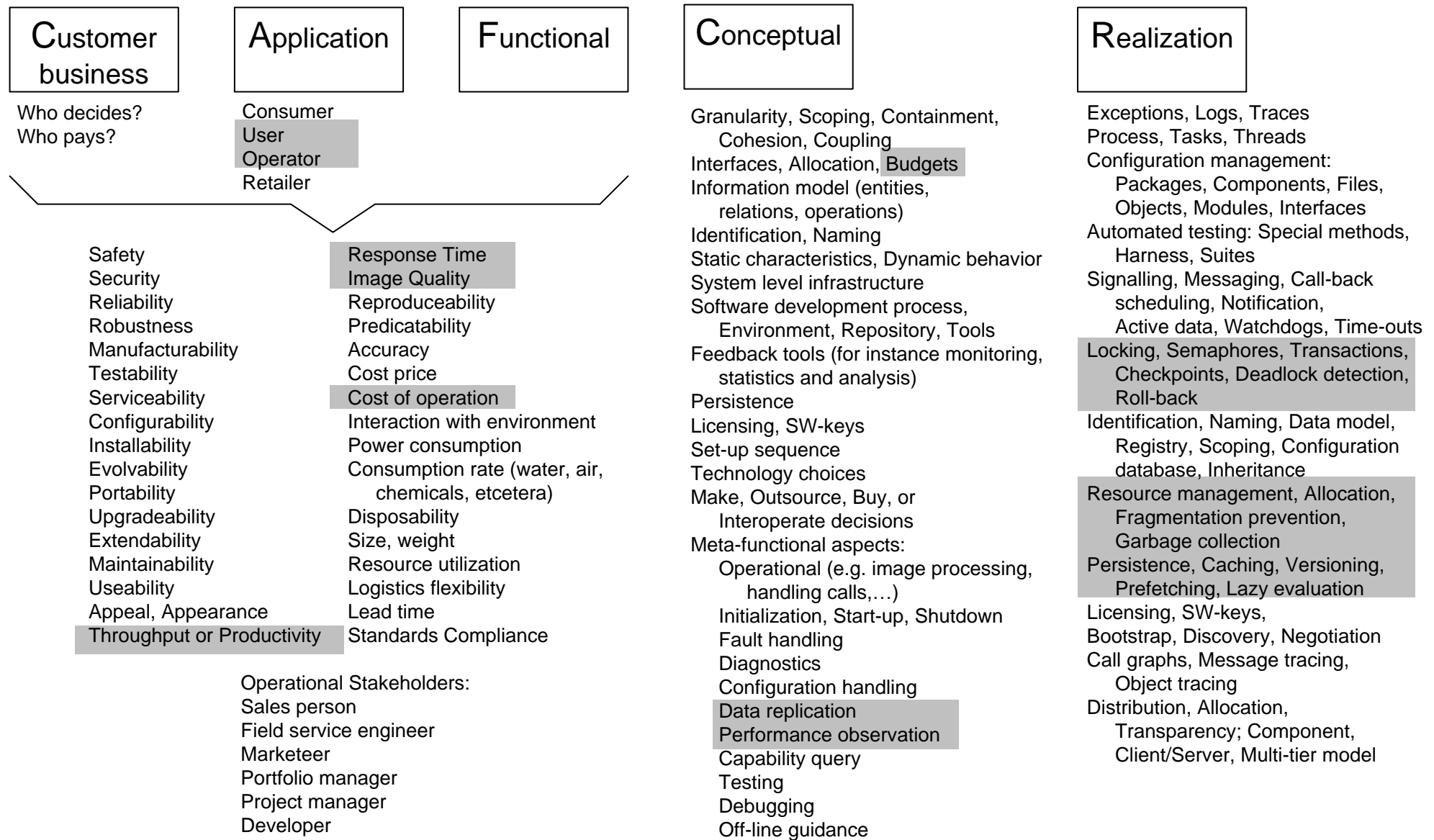
Checklists for integrating 5 views



Actual checklists



Coverage of MR neuro view



Architects must increase customer side contribution

