

4+1 View Model of Software Architecture



“Software architecture” course

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Outline

- About Kruchten and this paper
- Problem
- Solution
- 4+1 view model
 - Logical view
 - Process view
 - Development view
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About Kruchten and this paper

- Philippe Kruchten
 - Over 16 years of experience as the leader of RUP development team in Rational corp. (now owned by IBM)
 - Valuable experiences in industry (Telecom, Air traffic control system) which he used them for confirmation of his model
- The “4+1 view model” paper:
 - 60 citations according to ACM portal site

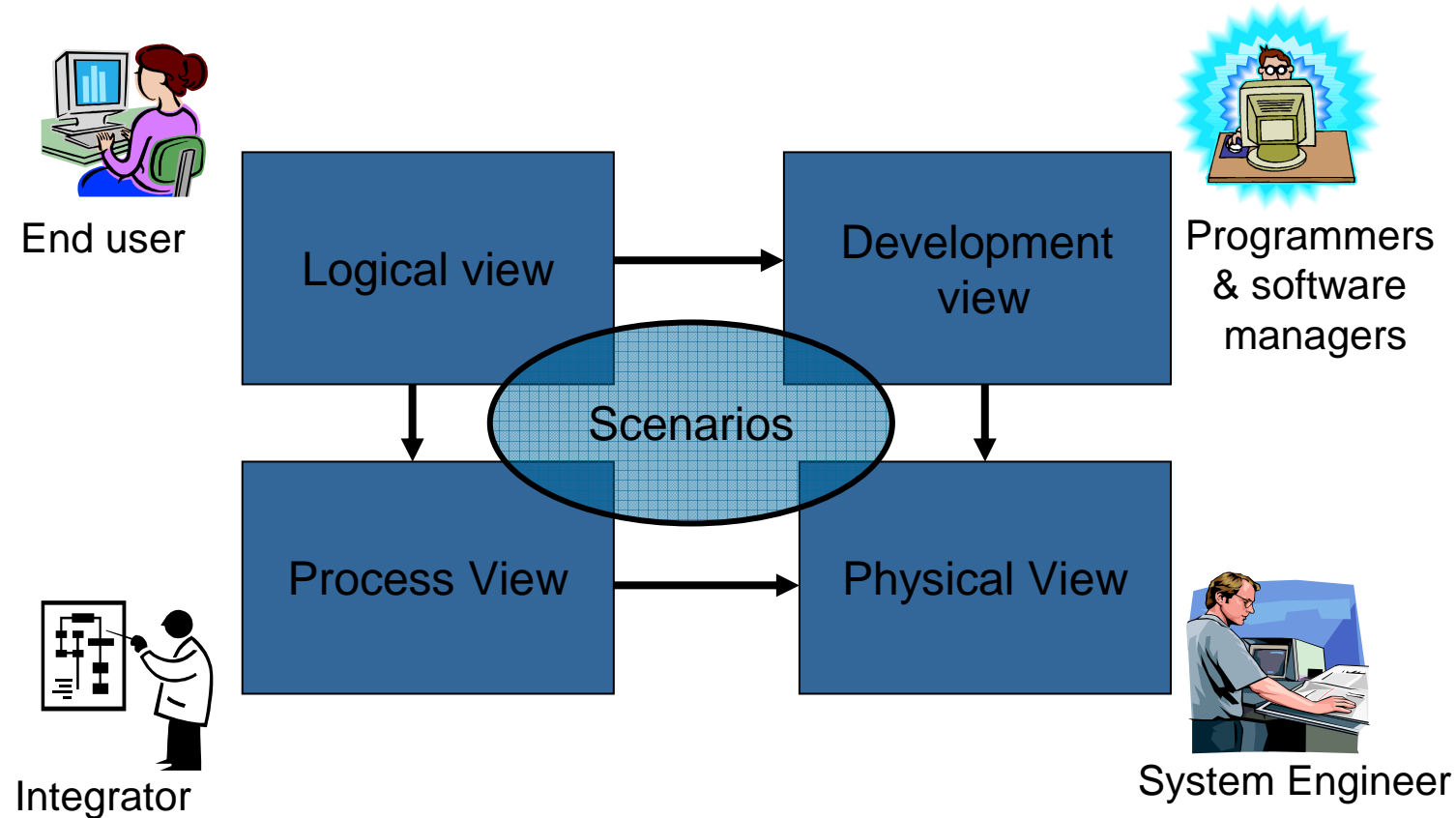
Problem

- ❑ Arch. documents over-emphasize an aspect of development (i.e. team organization) or do not address the concerns of all stakeholders
- ❑ Various stakeholders of software system: end-user, developers, system engineers, project managers
- ❑ Software engineers struggled to represent more on one blueprint, and so arch. documents contain complex diagrams

Solution

- ❑ Using several concurrent *views* or *perspectives*, with different notations each one addressing one specific set for concerns
- ❑ “4+1” view model presented to address large and challenging architectures

4+1 View Model of Architecture



Logical View

(Object-oriented Decomposition)

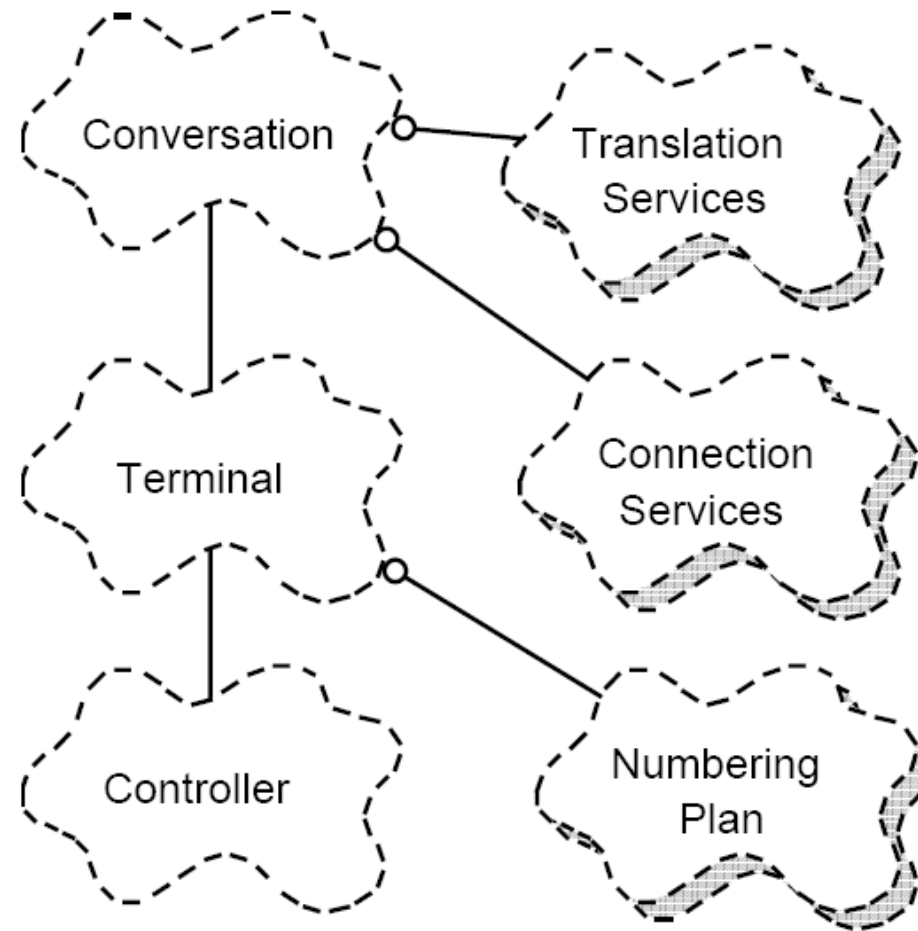
Viewer: End-user

considers: Functional requirements- What the system should provide in terms of services to its users.

Notation: The Booch notation (OMT) (object and dynamic models)

Tool: Rational Rose

Logical view Example



Process View

(The process decomposition)

viewer: Integrators

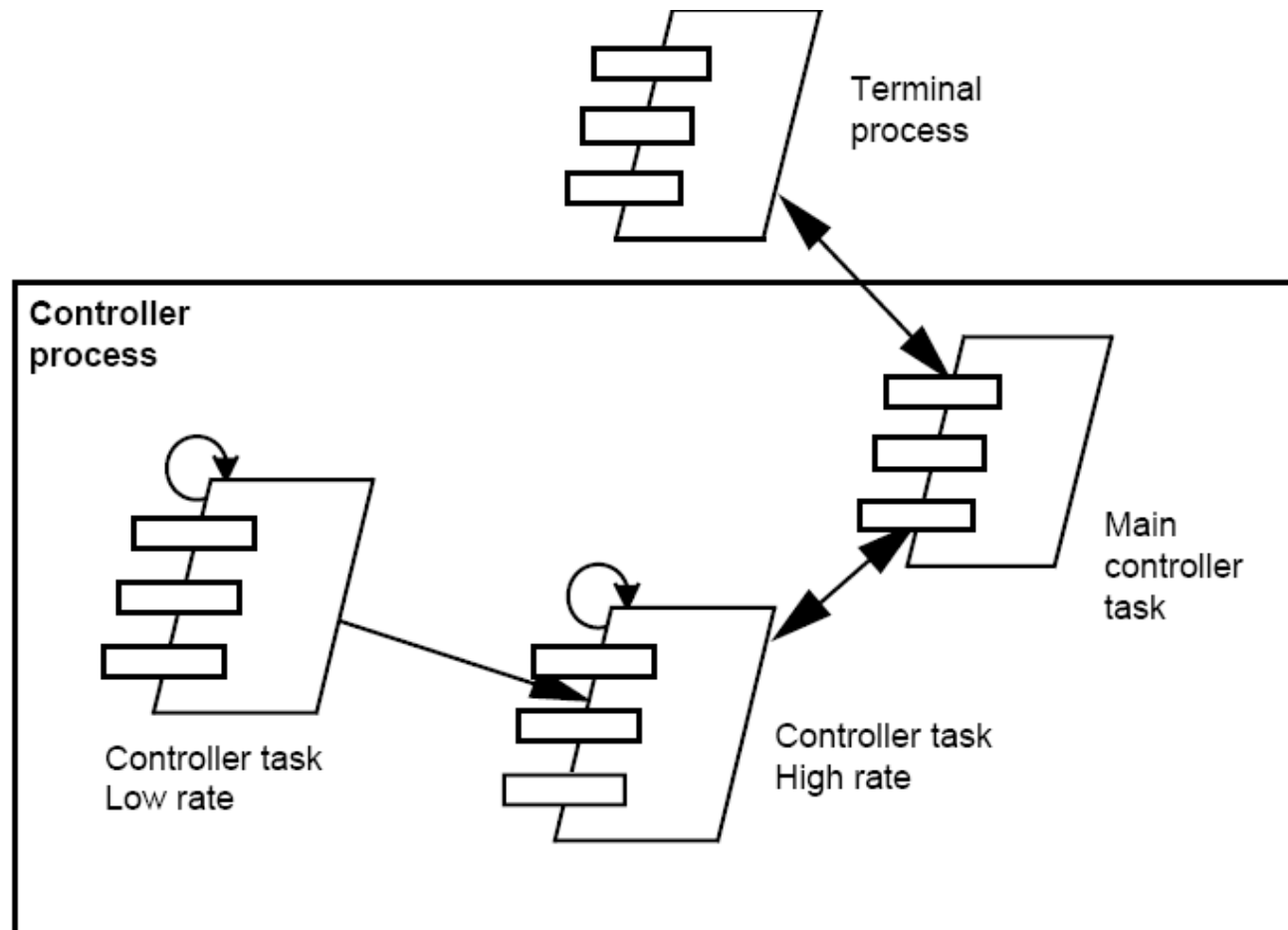
considers: Non - functional requirements
(concurrency, performance, scalability)

style: Several styles would fit in this view
(Garlan and Shaw `s Architecture styles)

Process view (cont.)

- Uses multiple levels of abstractions, a logical network of processes at the highest level
- A process is a grouping of tasks that form an executable unit:
 - Major Tasks: Arch. relevant tasks
 - Minor Tasks: Helper tasks. (Buffering)

Process View example



Development View

(Subsystem decomposition)

Basis of a line of product

Viewer: Programmers and Software Managers

considers: software module organization
(Hierarchy of layers, software management,
reuse, constraints of tools)

Style: layered style

Notation: the Booch notation (module, subsystem,
layer)

Physical View

(Mapping the software to the Hardware)

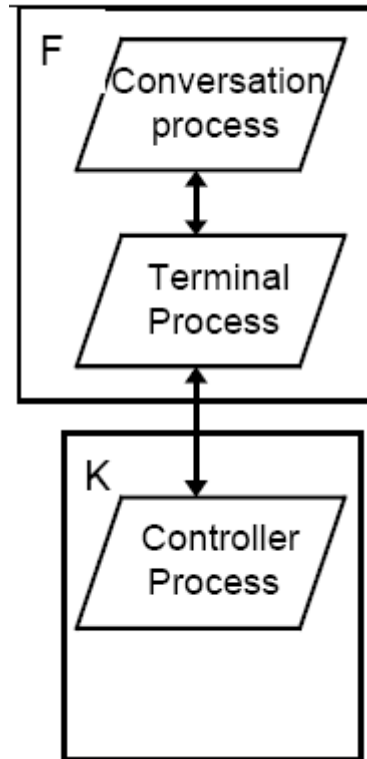
Viewer: System Engineers

Considers: Non-functional req. regarding to underlying hardware (Topology, Communication)

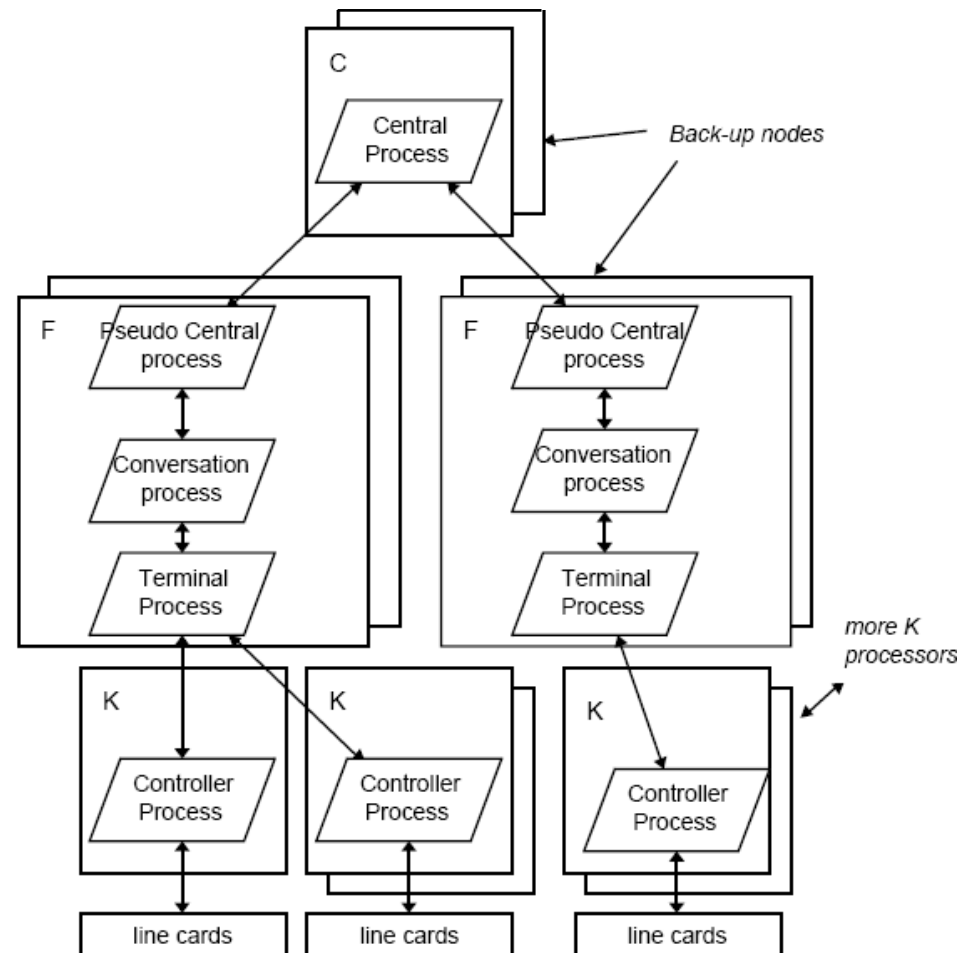
Notation: May have several forms and may be tightly connected to the process view

- There may be two architectures:
 - Test and development
 - deployment

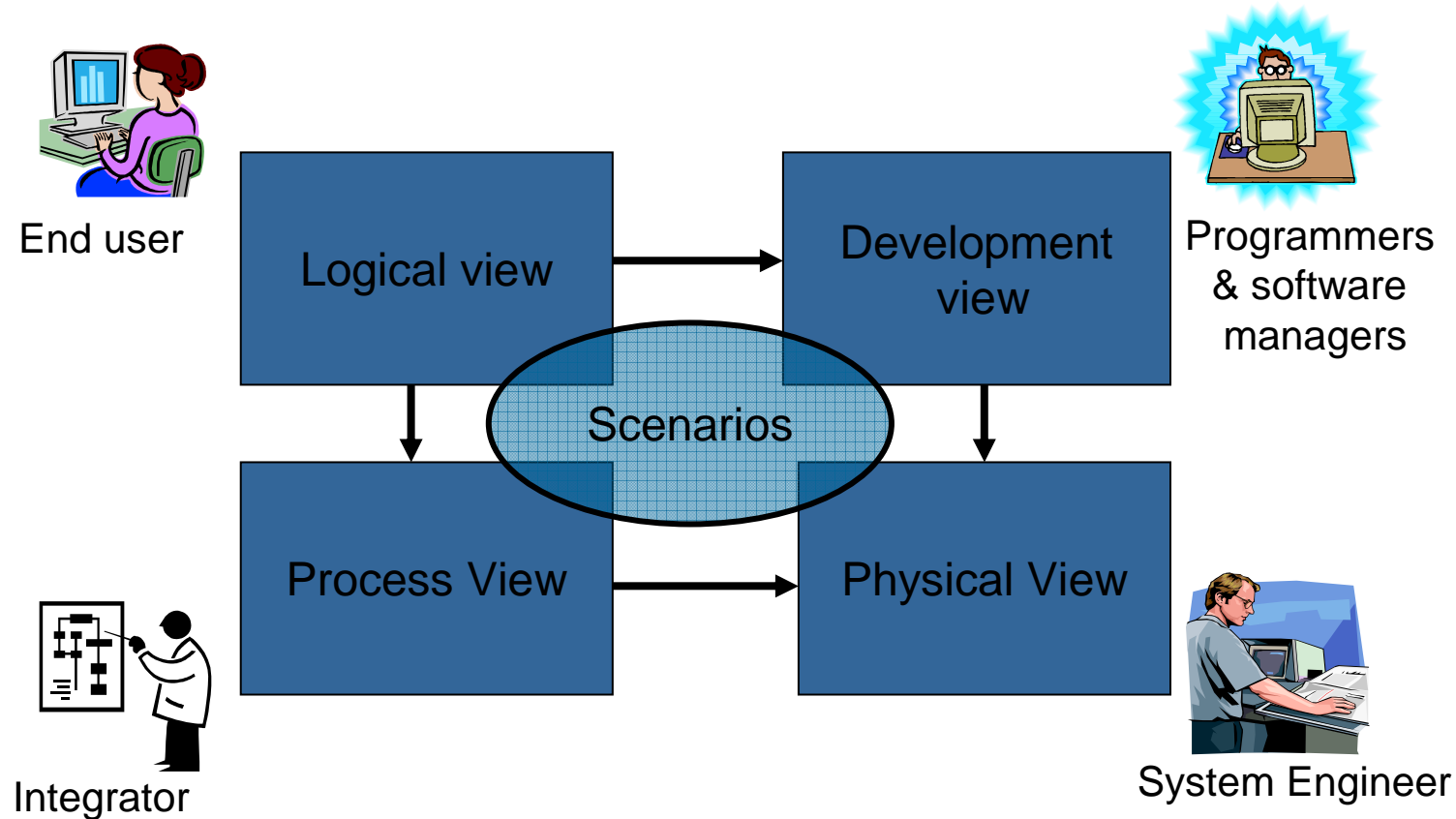
Physical view example



Physical view example (cont.)



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Scenarios

(Putting it all together)

Viewer: All users of other views and Evaluators.

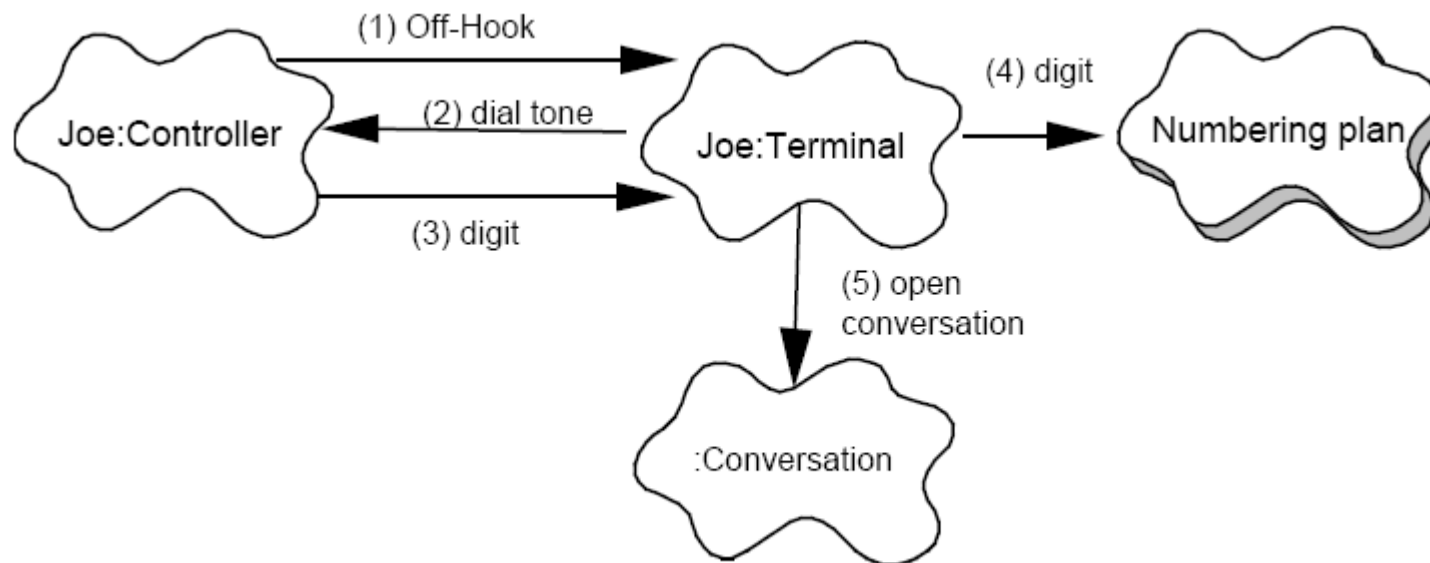
Considers: System consistency, validity

Notation: almost similar to logical view

Tool: Rational Rose

- Help illustrate and validate the document
- Help Architect during the architecture design

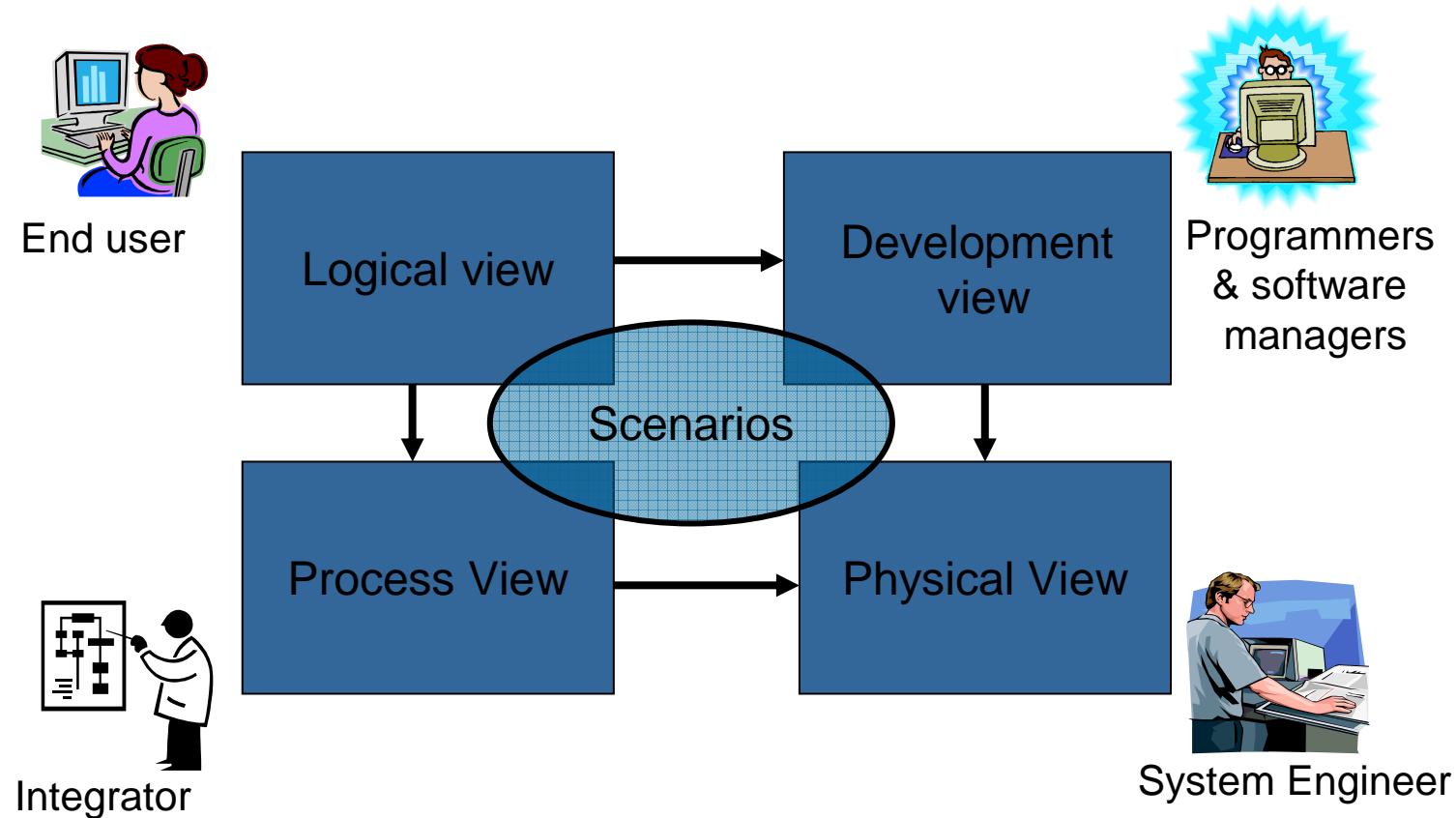
Scenario example



Correspondence between views

- ❑ Views are interconnected.
- ❑ Start with Logical view (Req. Doc) and Move to Development or Process view and then finally go to Physical view.

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From logical to Process view

- Two strategy to analyse level of ***concurrency***:
 - Inside-out: starting from Logical structure
 - Outside-in: starting from physical structure

From Logical to development

- They are very close, but the larger the project, the greater the distance
- Grouping to subsystems based on:
 - Classes
 - Class packages
 - Line of codes
 - Team organization

The Iterative process

- Not all software arch. Need all views.
- A scenario-driven approach to develop the system
- Documentation:
 - Software architecture document
 - Software design guidelines

Remarks

- Methodology successfully used in the industry
 - Air Traffic Control
 - Telecom
- Comprehensive: All other views are reducible to one of the 4 views
- In this paper there is no tools to integrate views. So there is an inconsistency problem in this model which is more tangible in the maintenance of the architecture.

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