Formalization of an integrated system/project design framework: First models and processes

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Outline

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The problem to solve

ATLAS project situation:

- many studies about aiding system design,
- many studies about aiding project planning,
- few studies interested in the interaction between these two processes.

Decisions made in one of the two processes $\Rightarrow$ a strong impact on the other.

Aims of the study:

propose an integrated tool allowed to support such an integrated process and based on industrialists' requirements and needs.

Results

Companies sample:

15 enterprises of the world competitiveness cluster Aerospace Valley

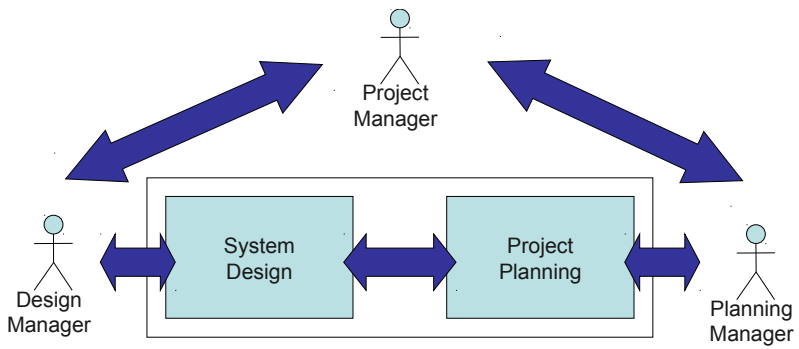
Results:

- all the interviewed enterprises are confronted to this coupling problem,
- but they do not have any specific tools to support it:
  - 50% makes integrated decisions during meetings with human interactions,
  - 22% uses procedures and standards,
  - 18% uses collaborative tools.

Integrated coupled design/project environment

Our proposition:

- three actors: project manager, planning manager and design manager,
- bijection or one-to-one mapping between system and project,
- decomposition, at the same time, of the system and of the project, depending of their complexity.

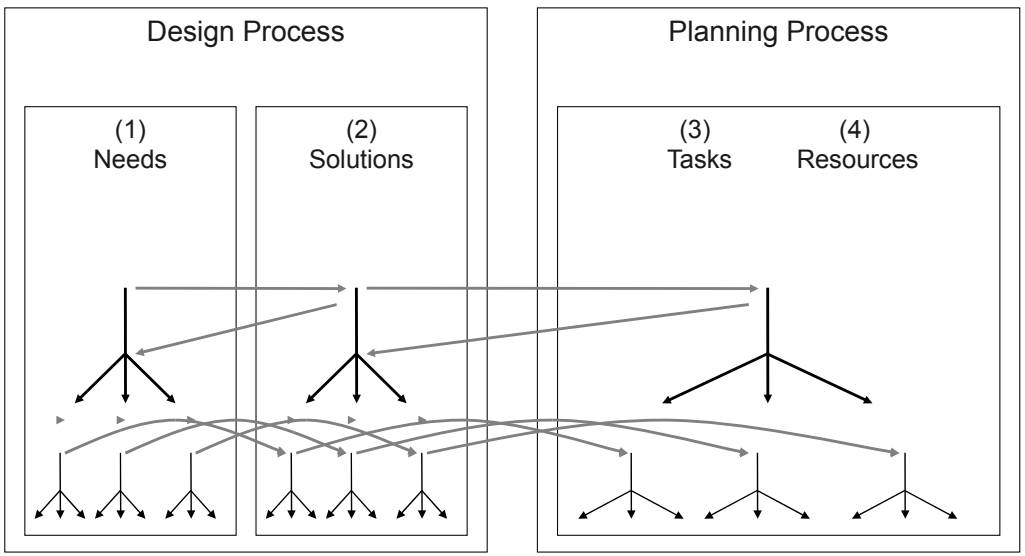


Outline

Axiomatic design

Four interacting domains (Eppinger 1991 and Suh 2001, Steward and Tate 2000: AD and Microsoft project):

- needs, requirements or specifications,
- solutions,
- tasks and activities,
- resources.

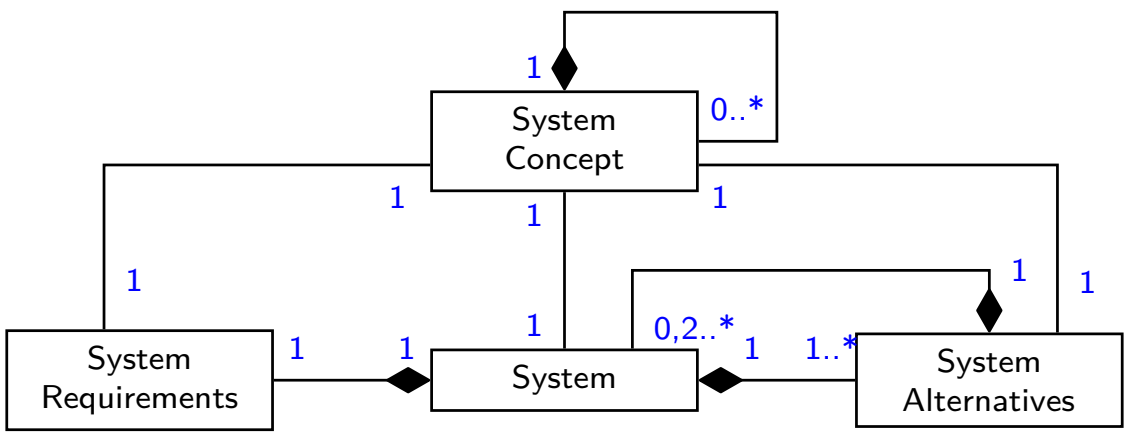


Outline

EIA632 - System and concept

System:

- associated to a *system concept* described by a set of variables to define the requirements and characterize the solutions (weight, cost, ...),
- composed of :
  - the *system requirements*,
  - one or many *system alternatives*



System requirements

System requirements definition:

- associated to a *system concept*,
- composed of :
  - **needs:** expression of the stakeholders'requirements or specifications stemming from the upper level if it exists,

    N1: the component C must be as light as possible
  - **requirements:** translation of the needs to a set of variables (system concept or designers' ones) and unary constraints.

    R1: weight of C in [10, 20]grammes

System alternative

System alternative definition:

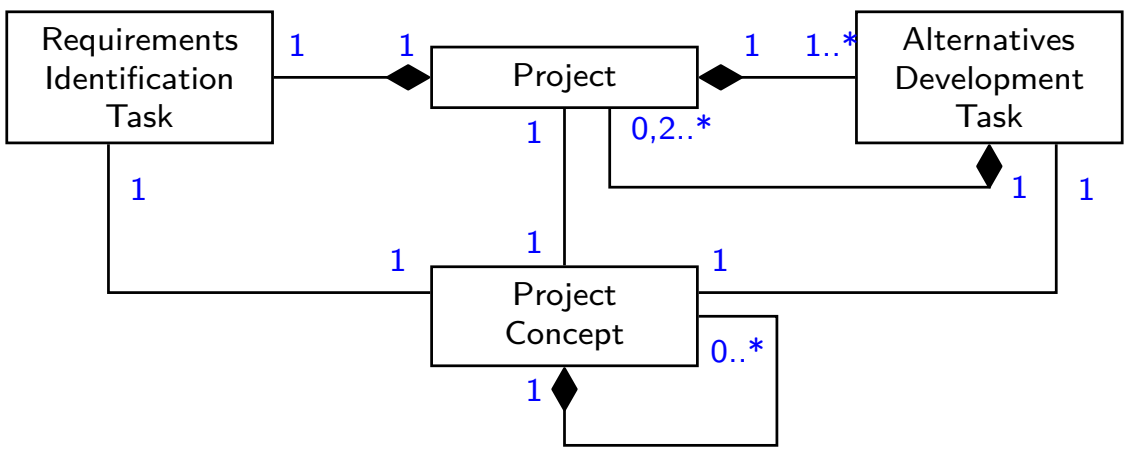
- associated to a *system concept*,
- composed of :
  - **logical solution:** description of the principles of functioning of the system and decomposition into sub-systems,
  - **physical solution:** description of of the physical components needed thanks to pairs of variables (system concept or designer's ones) and values.

S1: weight of *C_carbon* in [10, 12]grammes

EIA632 - Project and concept

Project:

- associated to a *project concept* described by a set of variables to define the requirements and characterize the project (delay, costs, ...),
- composed of :
  - the *requirements identification task*,
  - one or many *alternatives development tasks*



Requirements identification task

Requirements identification task definition:

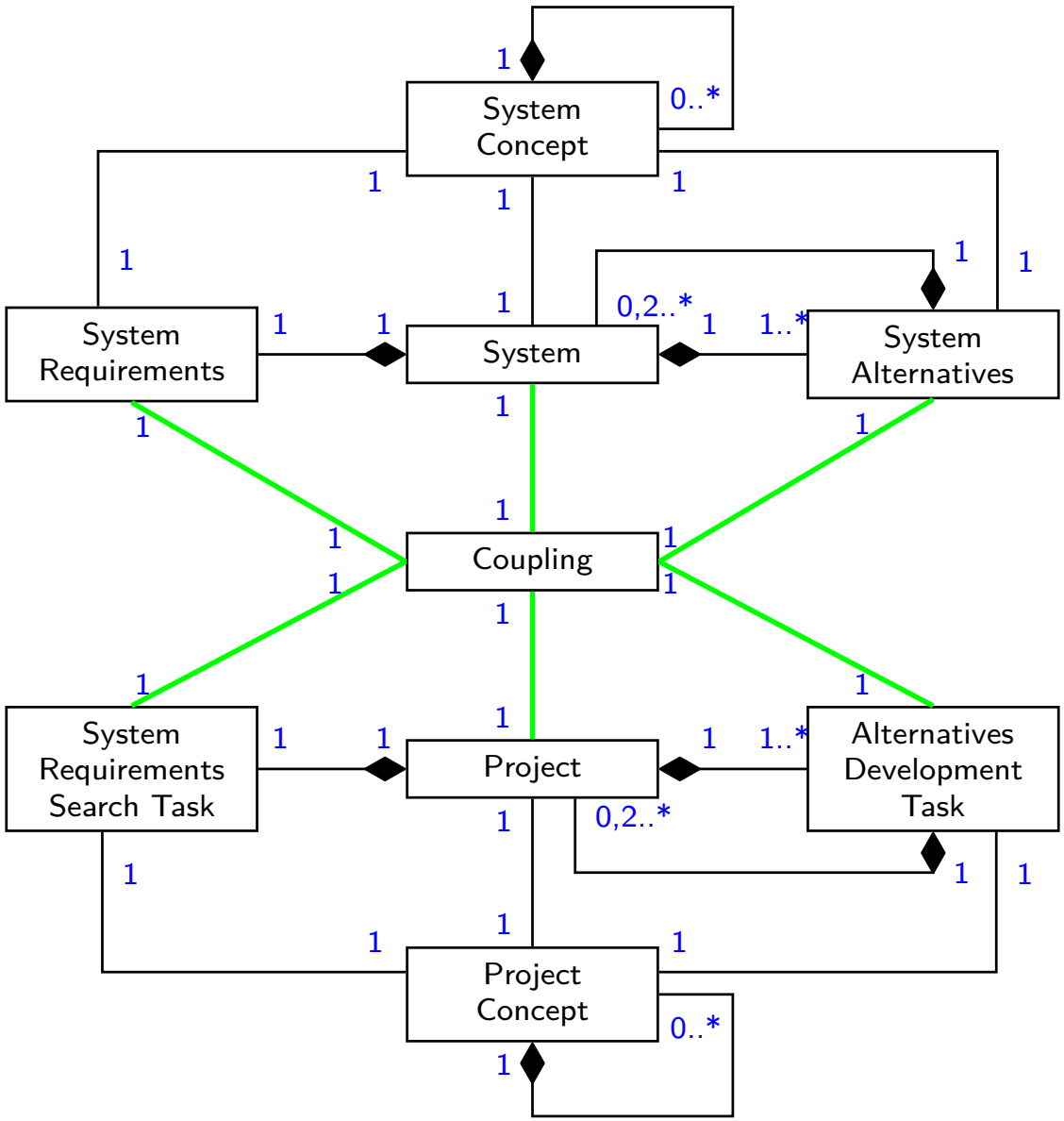
- associated to a *project concept*,
- composed of :
  - recording of the stakeholders'needs and requirements ,
  - search of the different design alternatives.

Alternative Development task

Alternative development task definition:

- associated to a *project concept*,
- carried out in two different ways:
  - integrated design, if the system is simple enough,
  - modular design, if the system is decomposed into sub-systems.

Coupling part



Monitoring part: dashboard

Variable	Requirement	Alternative 1	Alternative 2
Weight	R1: [10, 20]gr	S1: [10, 12]gr	S2: 18gr
Duration	d<30	40	60
Project progress	50	40	60
System project	60	80	50

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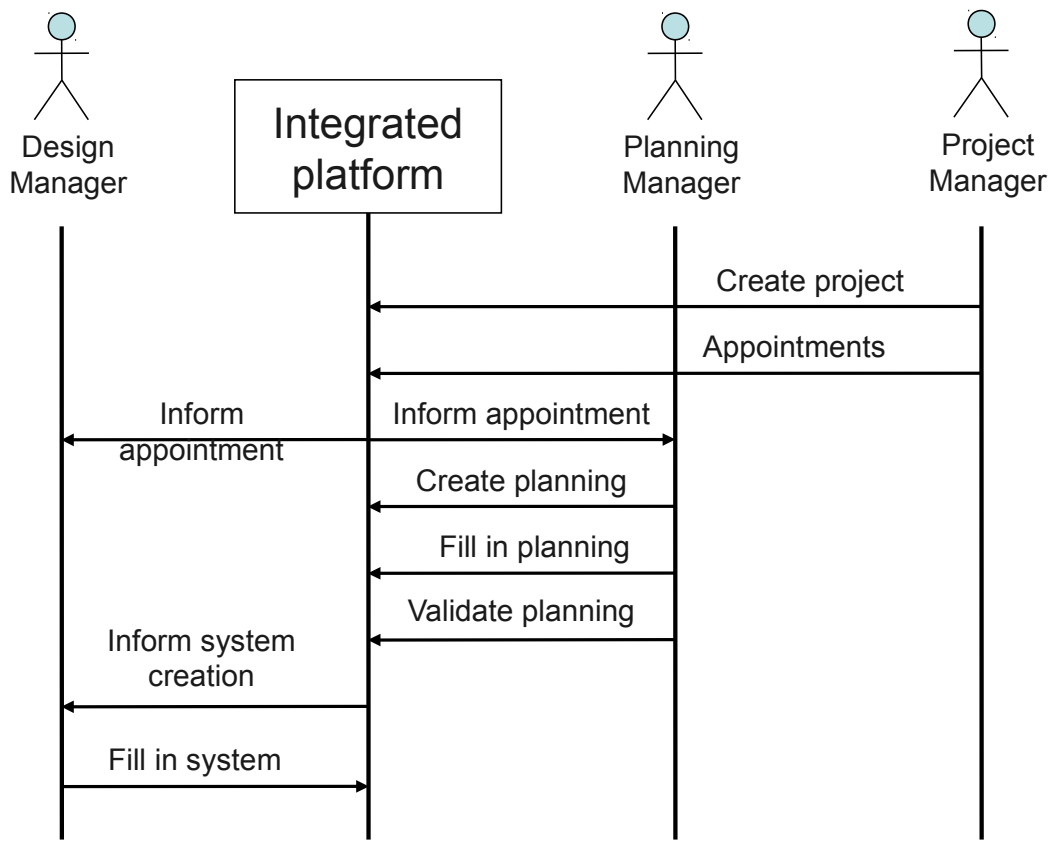
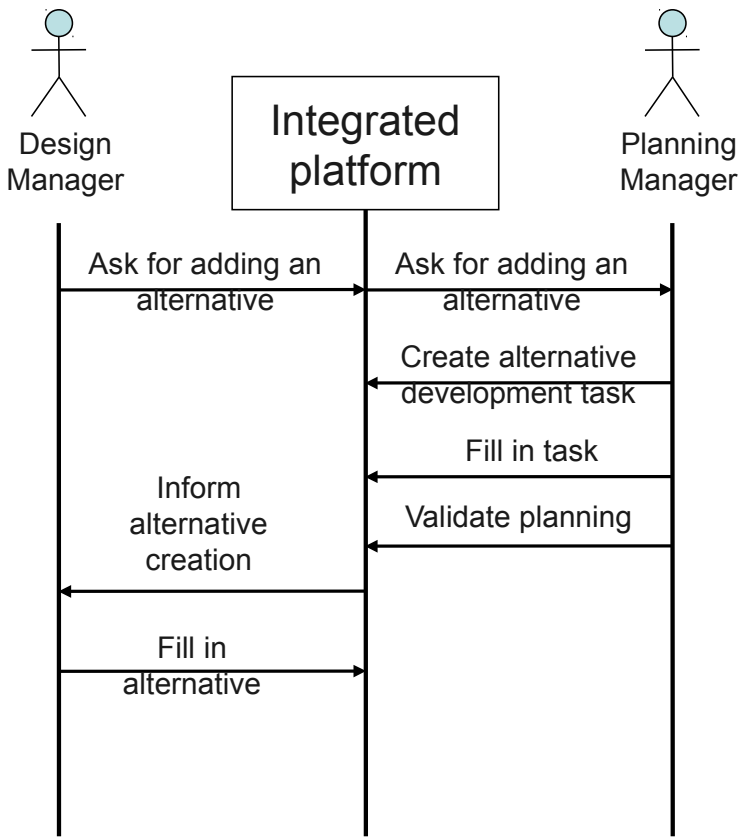
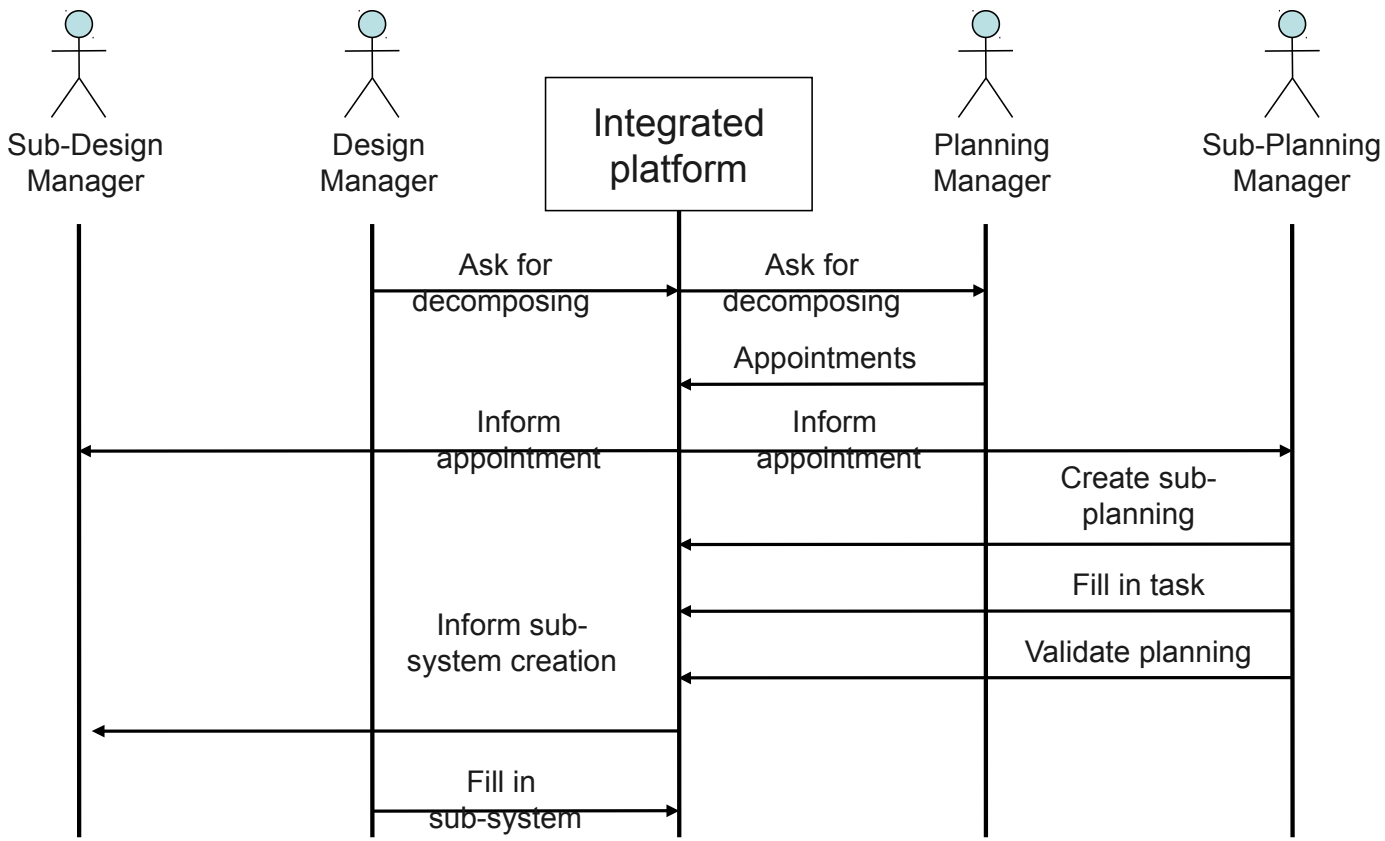
Ex nihilo system creation



Addition of alternatives



Splitting into sub-entities



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Summary

Synthesis:

- definition of a coupling between design process and planning process based on state-of-art and industrialists'needs,
- proposition of an architecture able to support such a coupling :
  - hypothesis: bijection between system and project,
  - proposition of a UML class diagram,
- illustration of such a coupling on sequence diagram.

Perspectives:

- mock-up under development,
- proposition of new coupling types (informational one, exploiting knowledge: past cases and experts'know-how),
- validating industrial example to be done.

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