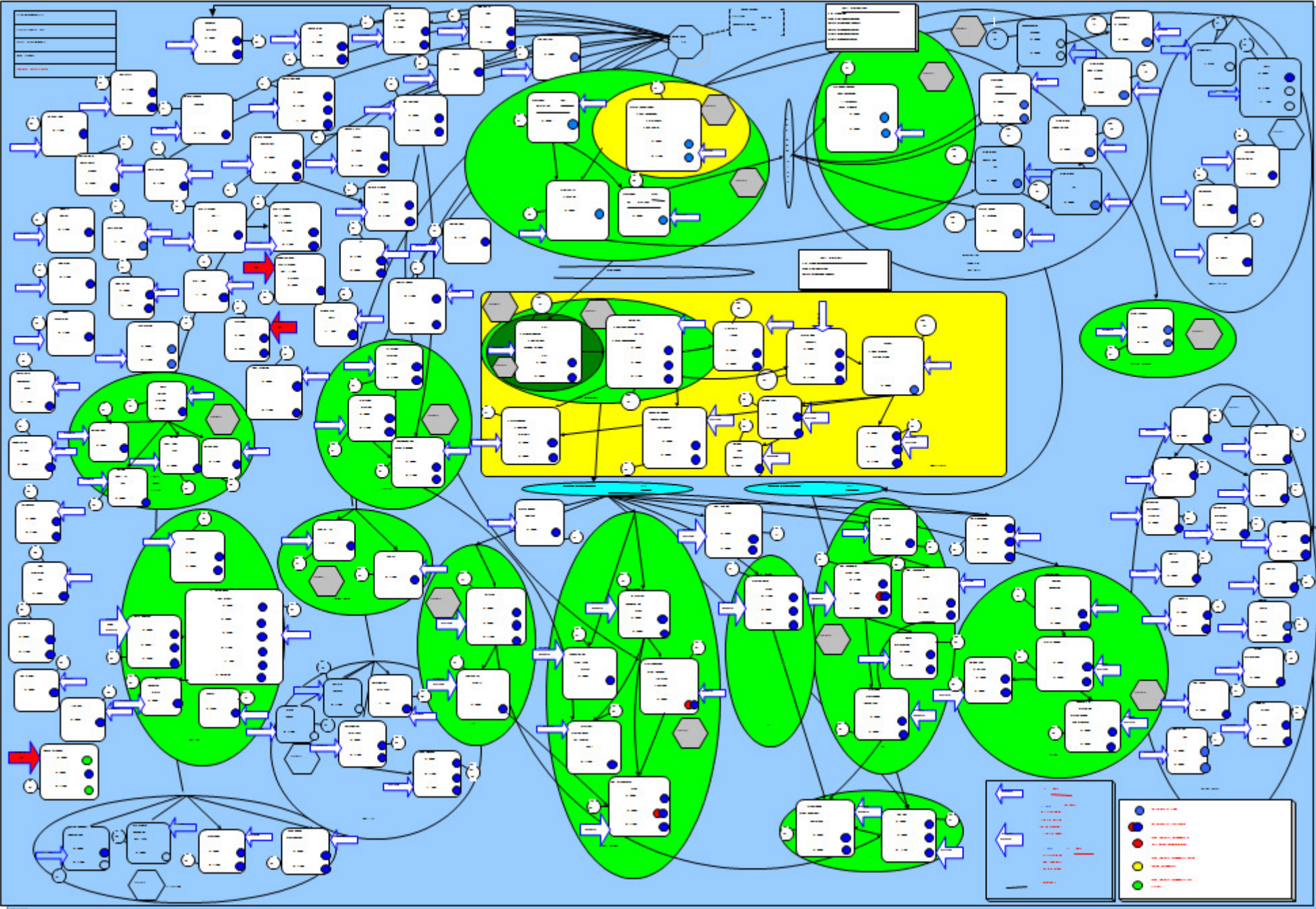


# PLM and incremental / parallel development

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University

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## Trends impacting PLM ...

- Complexity
- Change
- Diversification
  - outsourcing, mergers, acquisitions
  - new in-house functions, e.g. Marketing & Sales, Services
  - extended enterprise, networks

## ... cause emergent PLM problems

- Concepts, terminology
  - confusion about meaning and interpretation increases
- Interdependencies
  - increases btw. processes, product structures, information systems
- Product structures
  - separate structures in different areas
- Coordination
  - increased confusion about how coordination should be apprehended
- Commitments and agreements
  - unclear
- Information System architectures
  - evolve ad-hoc

## What is PLM?

*“PLM is a strategic business approach that applies a consistent set of business solutions in support of the collaborative creation, management, dissemination, and use of product definition information across the extended enterprise from concept to end of life – integrating people, processes, and information. PLM forms the product information backbone for a company and its extended enterprise.” (CIMdata, 2003)*



Must be useful in practice - operational

Must address emergent problem areas

# Elements of PLM

people  
collaboration  
information

extended enterprise  
company

# Integration

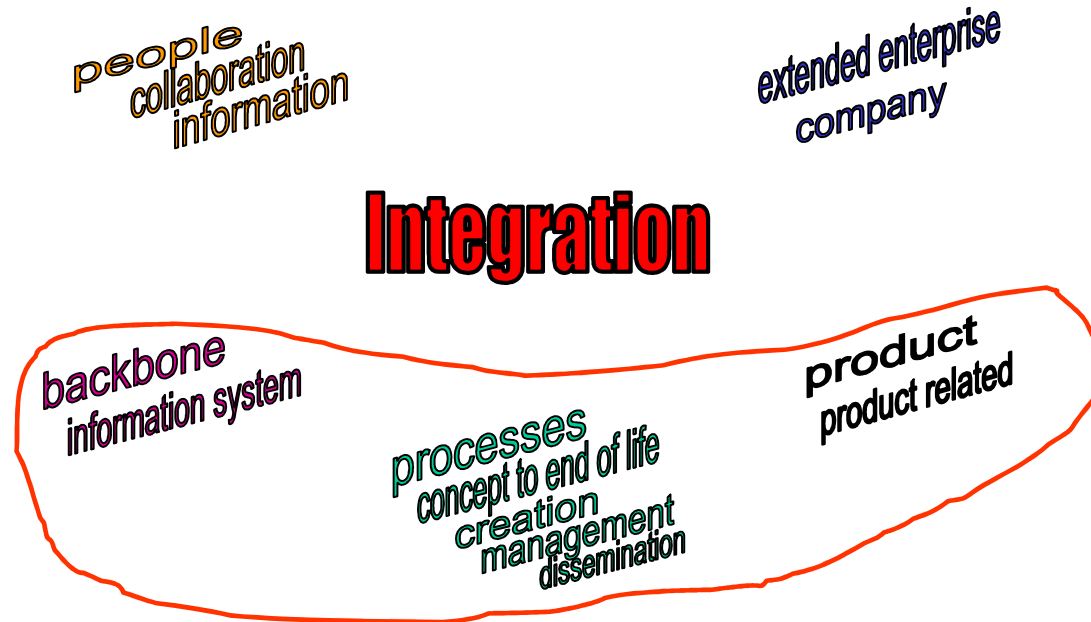
backbone  
information system

processes  
concept to end of life  
creation  
management  
dissemination

product  
product related

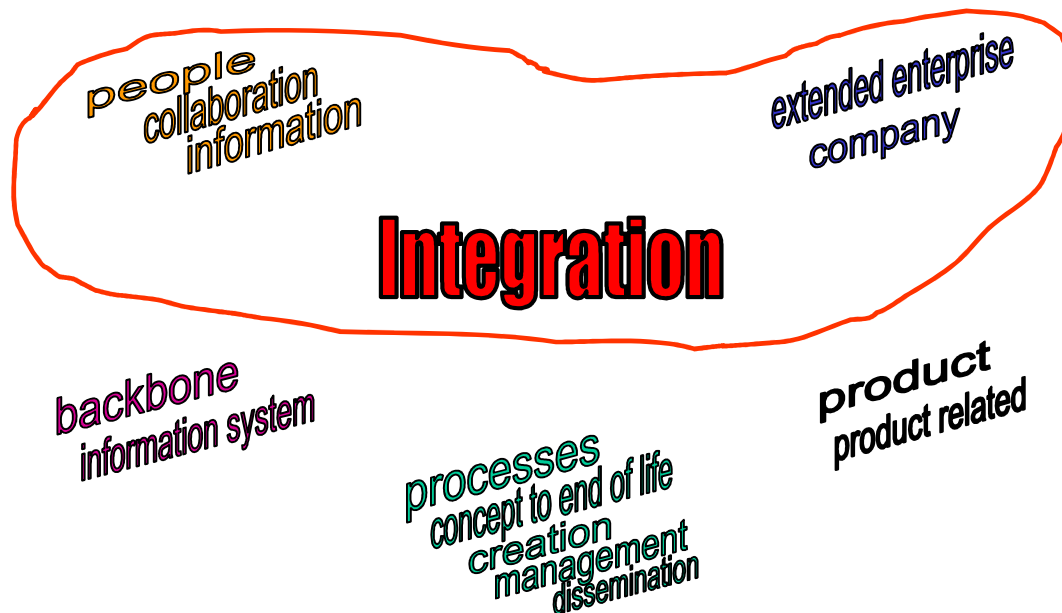
# Traditional perspective on PLM

- Processes (BPR)
  - Business Process Reengineering
- Information systems (ERP, PDM)
  - Enterprise Resource Planning, Product Data Management
- Product structures
- Mostly isolated initiatives



## Alternative perspective on PLM

- Coordination of cooperating practices
  - Coordination: “The management of dependencies between activities”
  - Practice: a group of actors producing something for other actors
- Shared meaning
- Interdependencies
- Commitments and agreements





## The starting point - theory

- A search light - illuminates what is important
- See how things are related
- A common, shared framework in discussions
- Grounded in trustworthy knowledge
- Practical purposes
  - Analyse a confused situation
  - Developing information systems

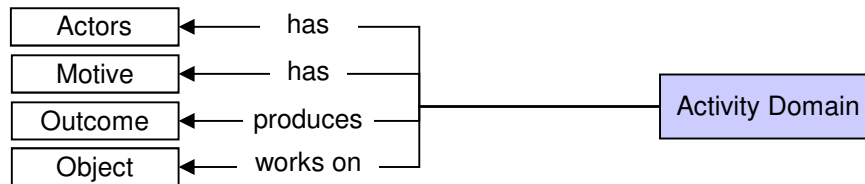
*“There is nothing so practical as a good theory.” Kurt Lewin*

# The Activity Domain Theory

Building a house



# The Activity Domain Theory ...



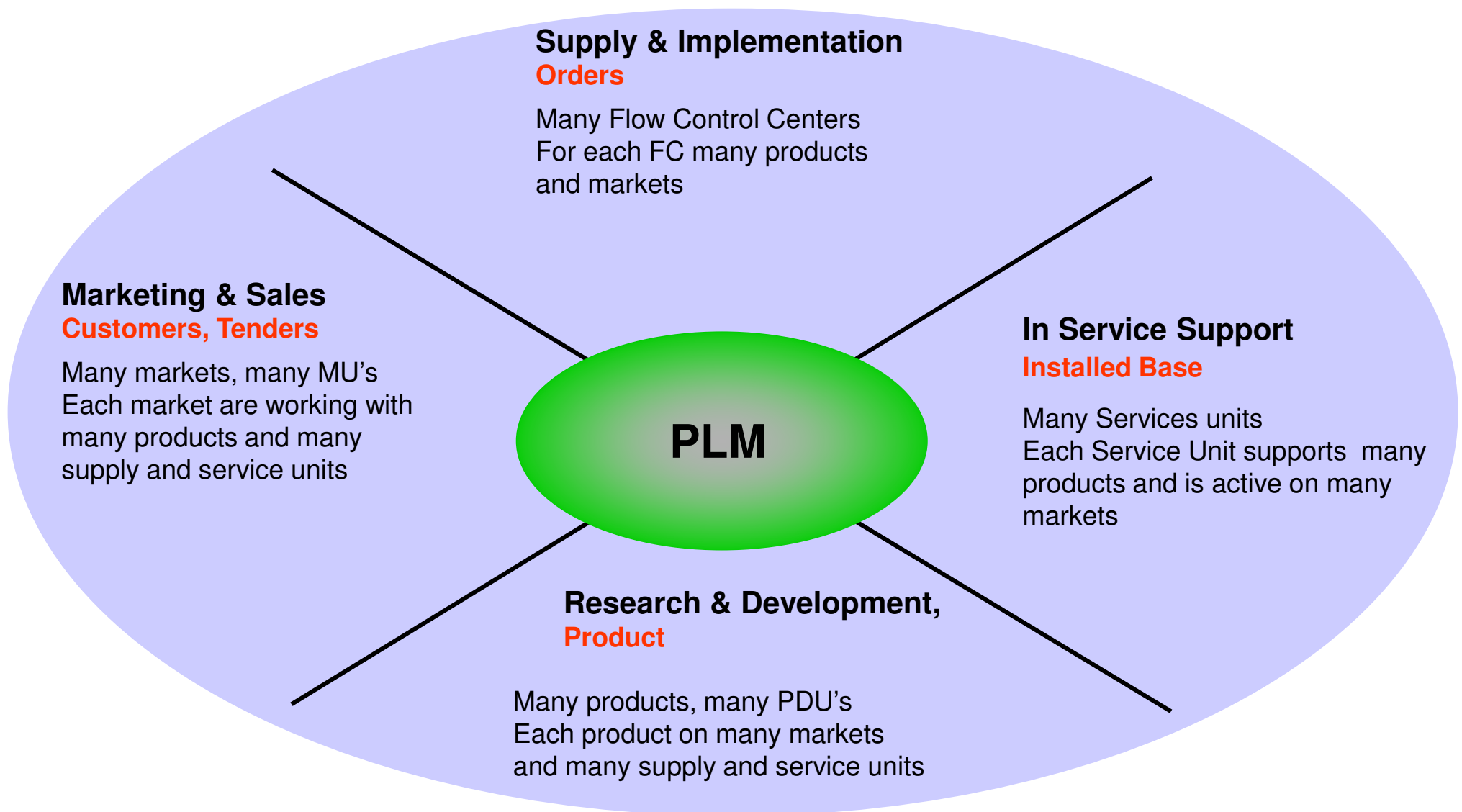
- Examples on Activity Domains
  - A restaurant
  - A carpenter
  - House manufacturing company
  - ...

# Example: Activity domains for building a house

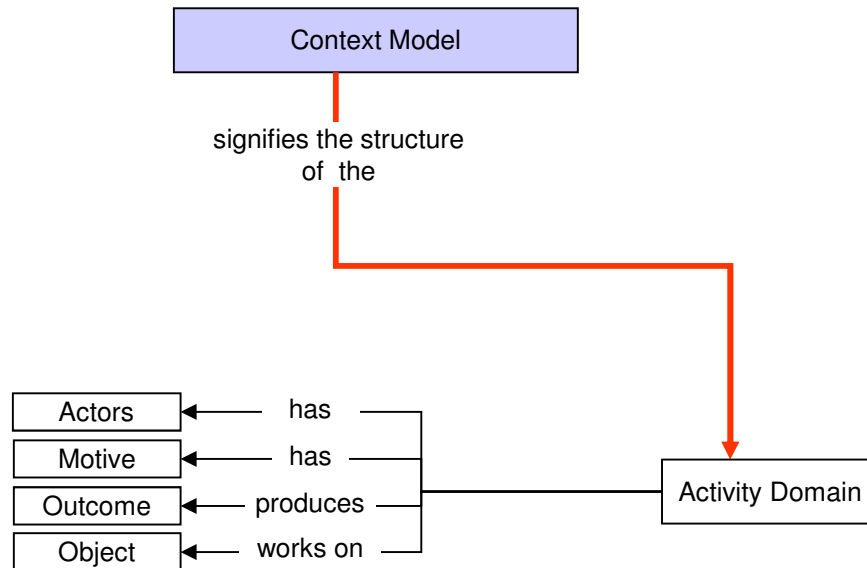
- Turnkey contractor
  - Masens House Ltd.
- Carpeting and cement work
  - Nail & Cement Ltd. A
- HVAC
  - HVAC Consulting B
- Electricity
  - Electricity Unlimited C



# Main Activity Domains at Ericsson

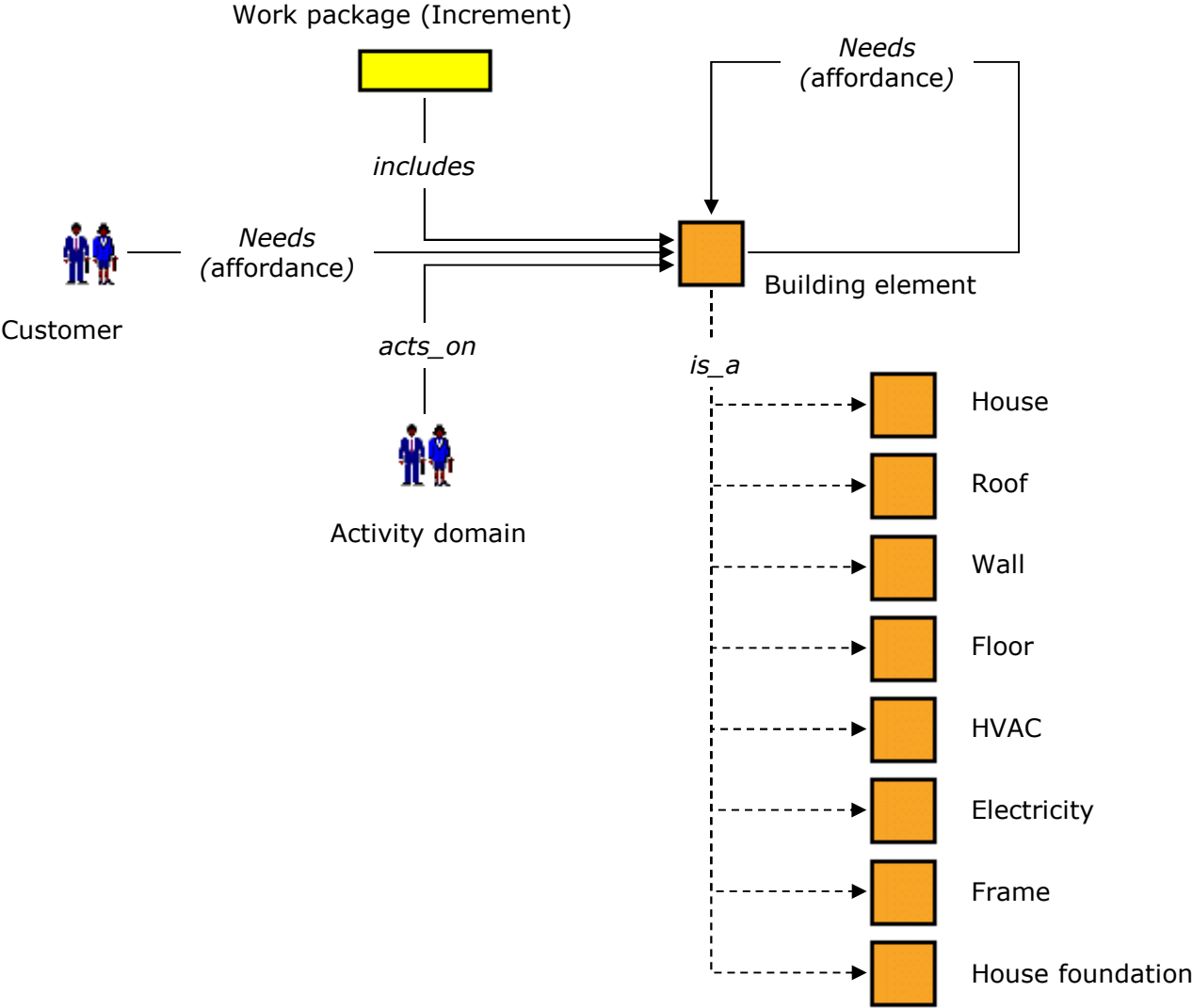


# ... The Activity Domain Theory ...

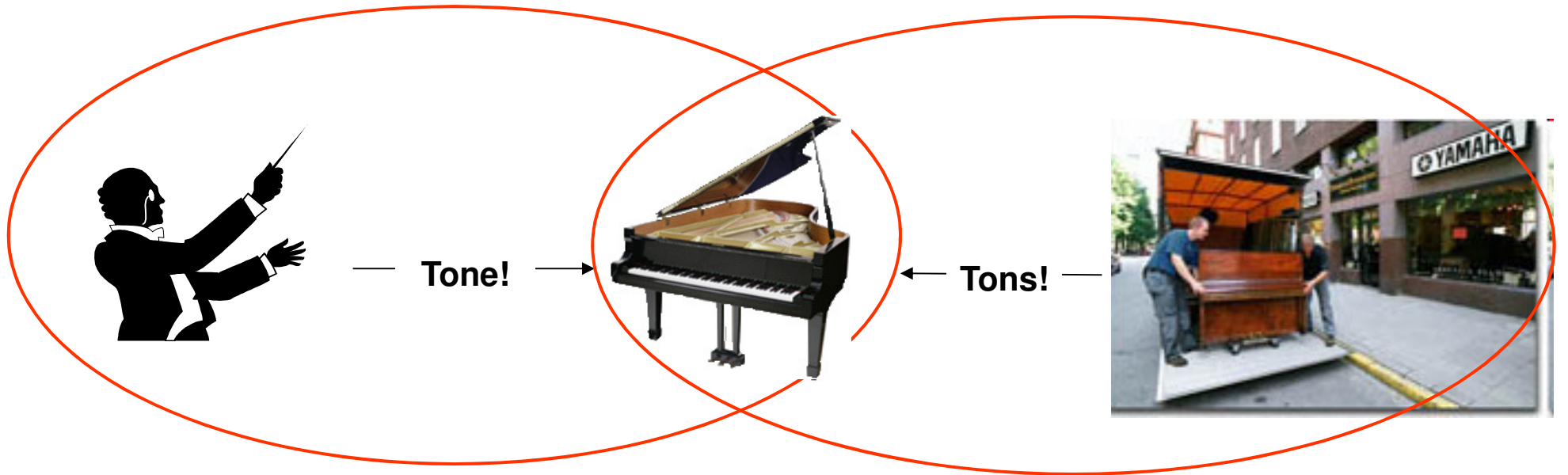


- Examples on Context Models
  - Information model
  - Business model
  - Product structure
  - Data model
  - Information Architecture
  - ...

# Context Model - Masens House Ltd.



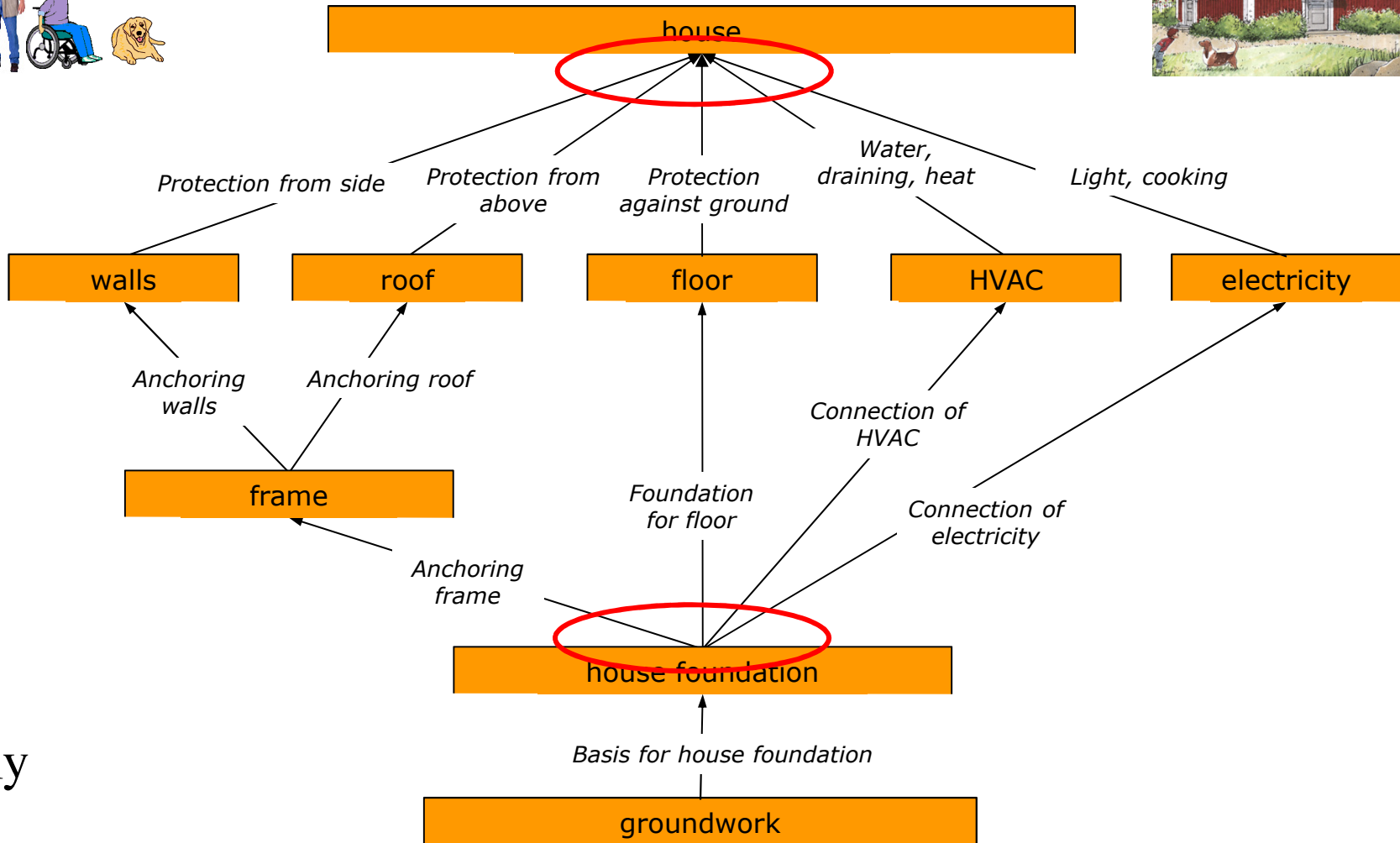
# Context - what is a grand piano?



Same object – different qualities depending on context

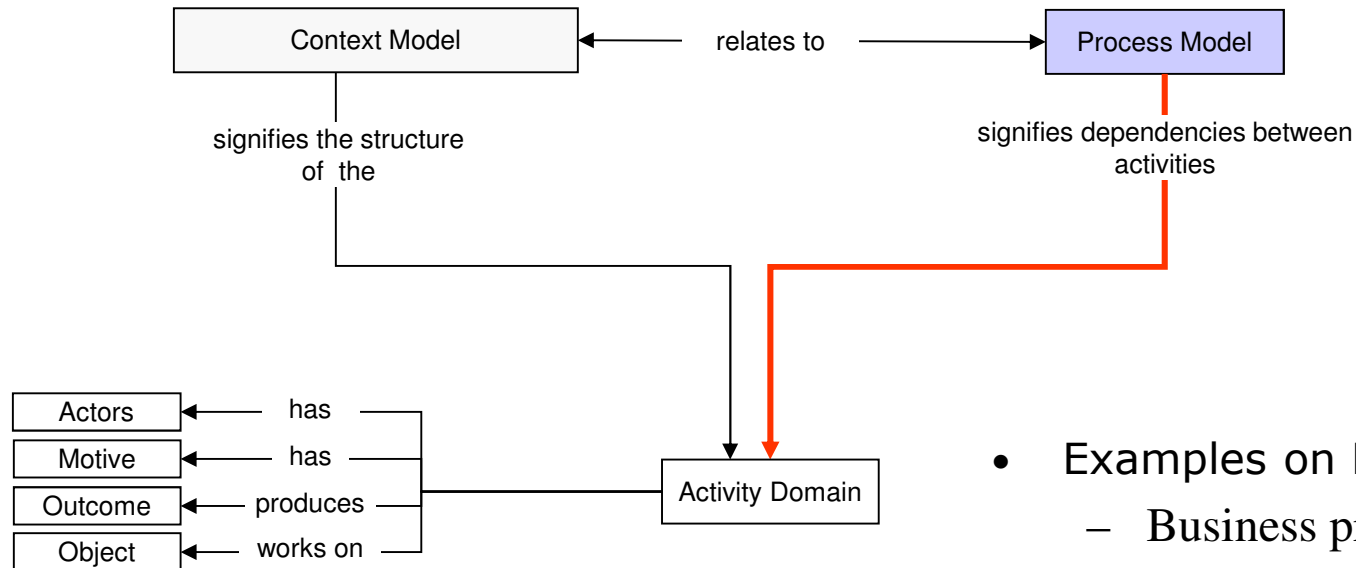


# Dependencies



Anatomy

# ... The Activity Domain Theory ...



- Examples on Process Models
  - Business process
  - Development process
  - Supply process
  - ...

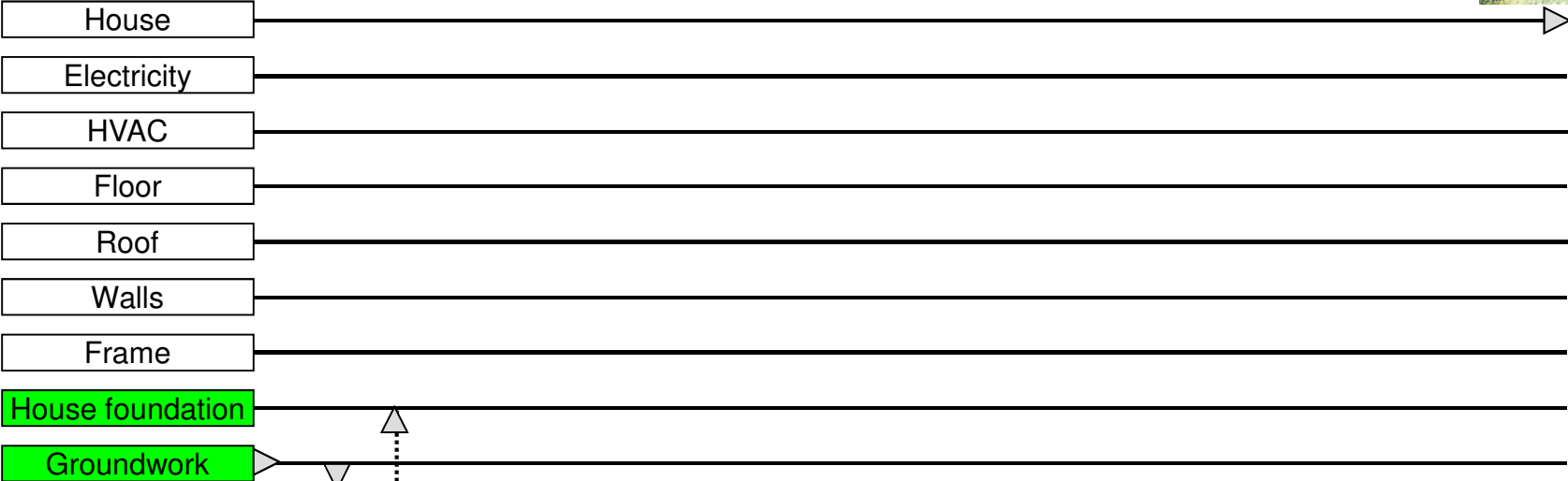
# Events – time dimension



- Not started
- Delayed
- On-going
- Finished

- A Nail & Cement Ltd.
- B HVAC Consulting
- C Electricity Unlimited

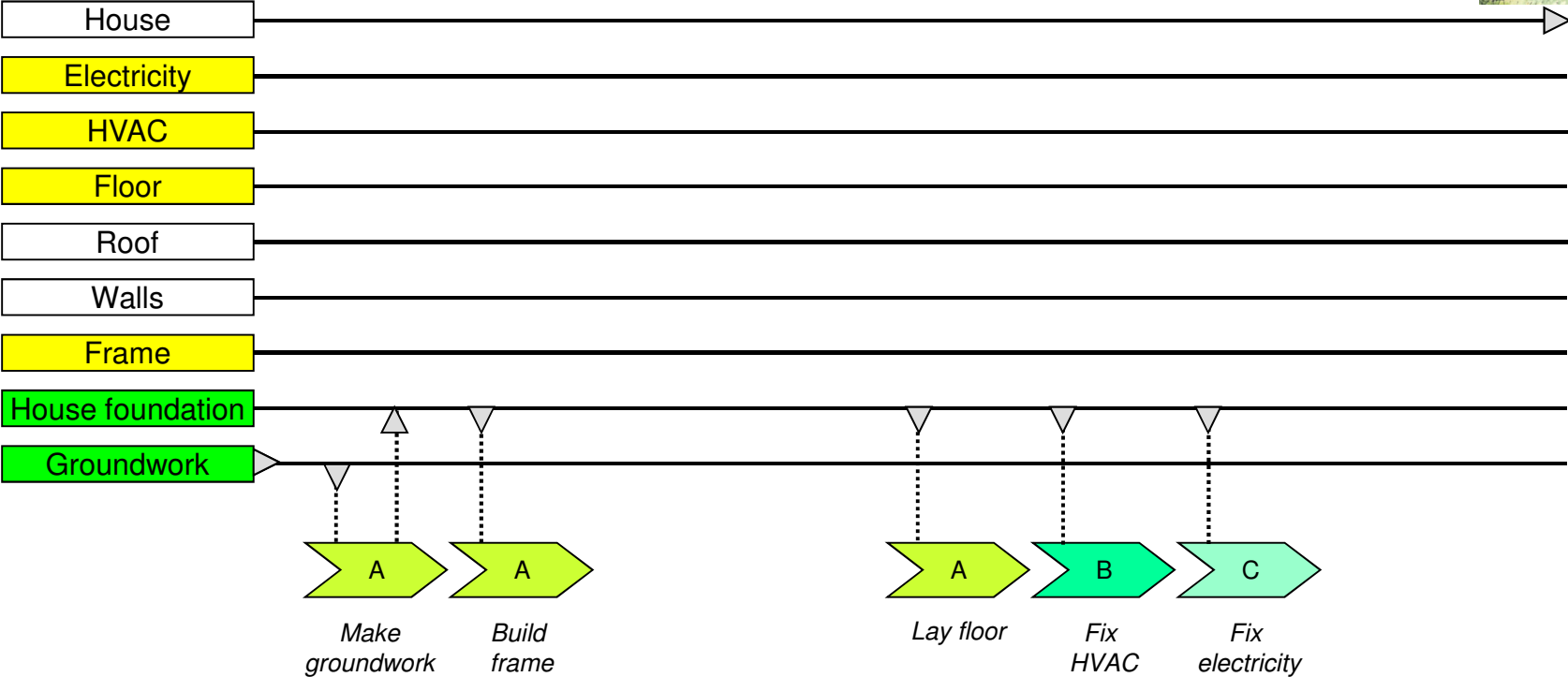
# Events – time dimension



- Not started
- Delayed
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- Finished

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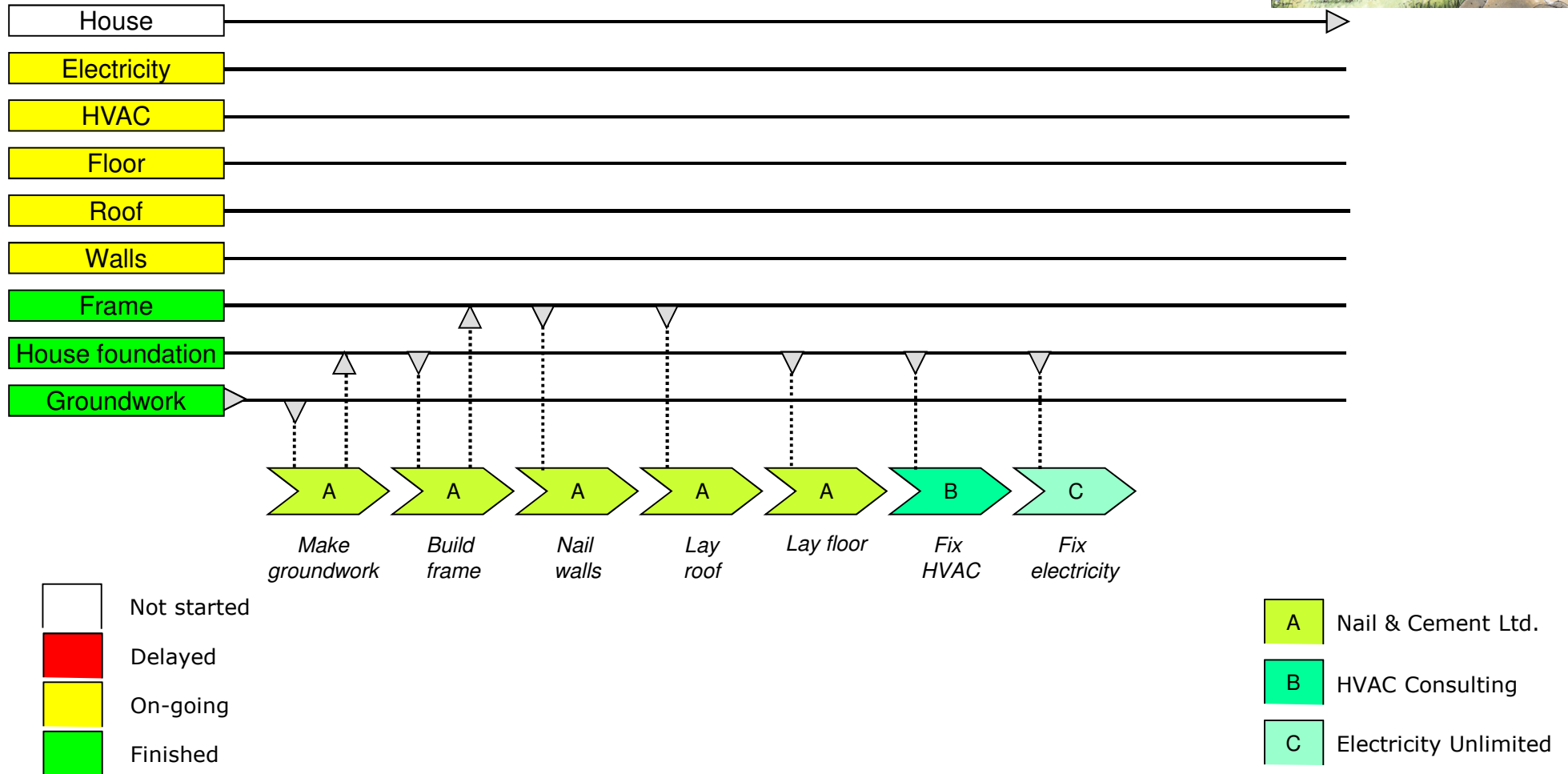
# Events – time dimension



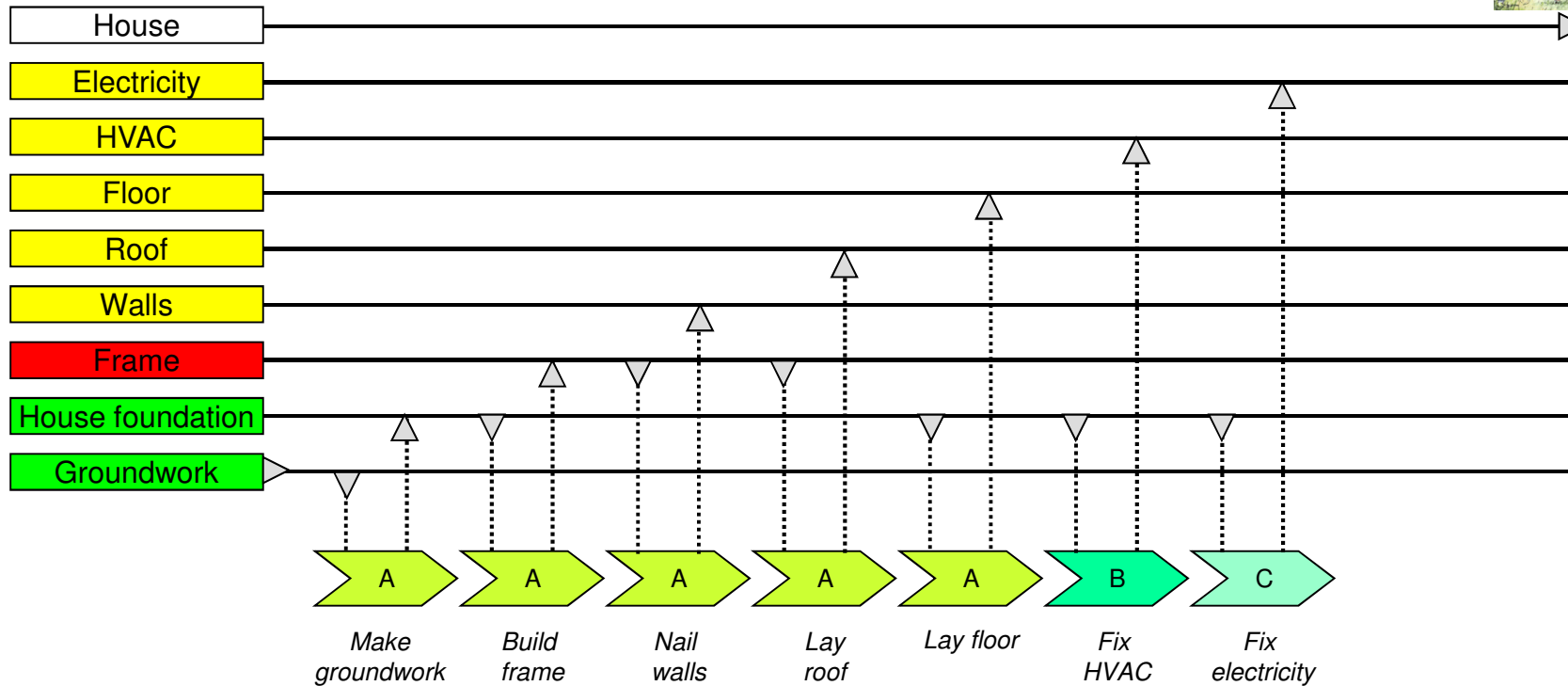
- Not started
- Delayed
- On-going
- Finished

- A Nail & Cement Ltd.
- B HVAC Consulting
- C Electricity Unlimited

# Events – time dimension



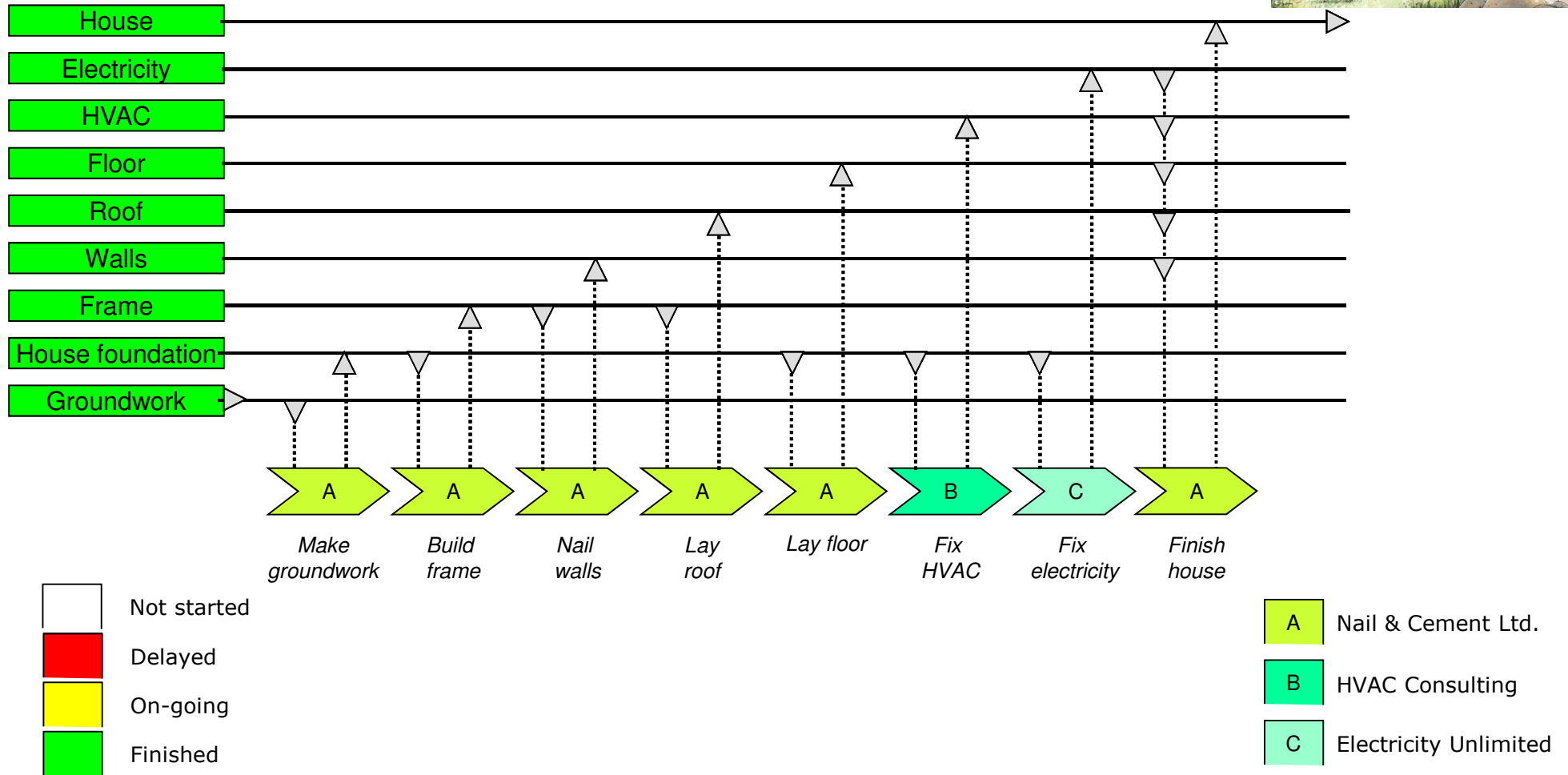
# Events – time dimension



- Not started
- Delayed
- On-going
- Finished

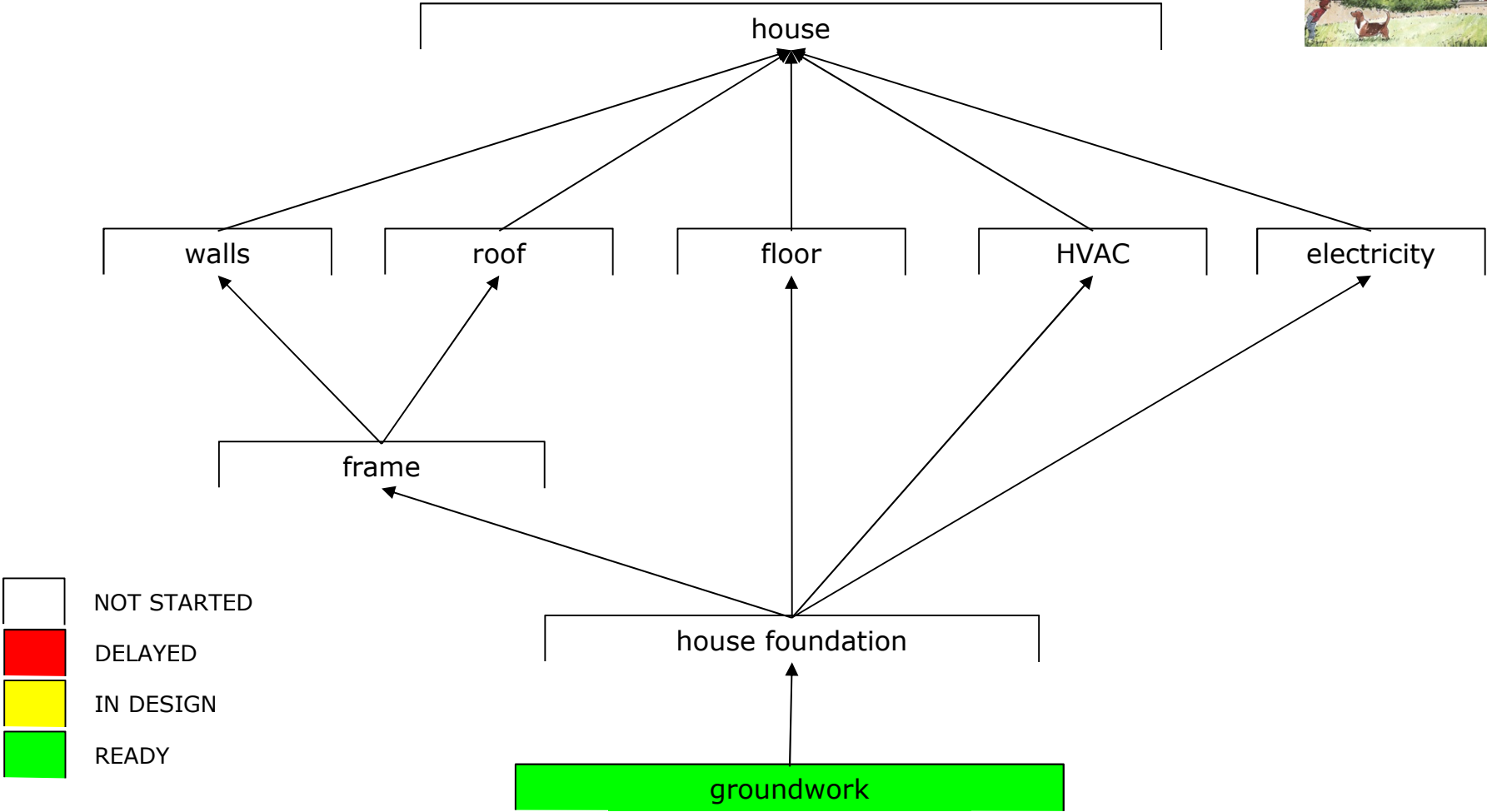
- A Nail & Cement Ltd.
- B HVAC Consulting
- C Electricity Unlimited

# Events – time dimension

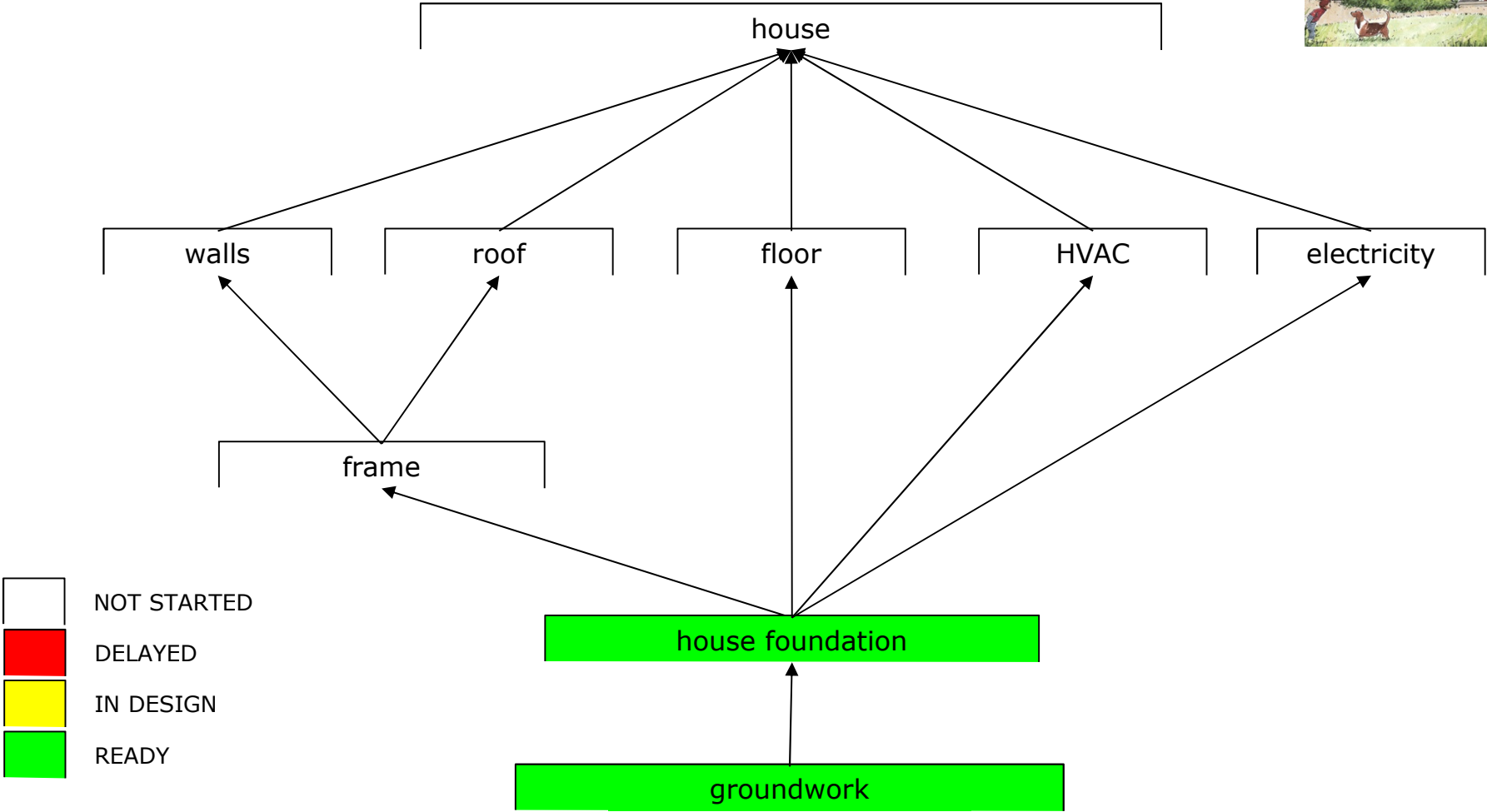




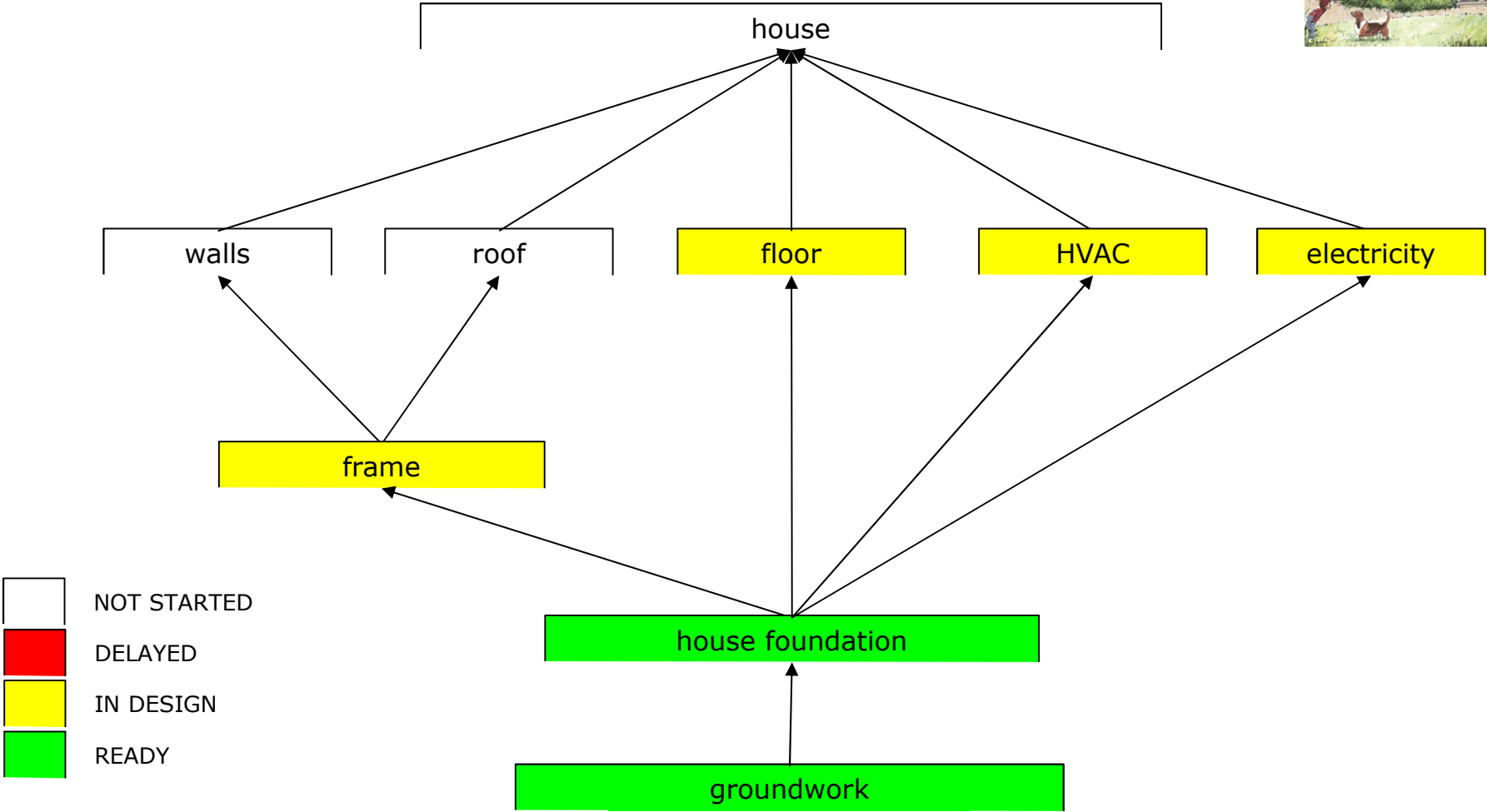
# Progress



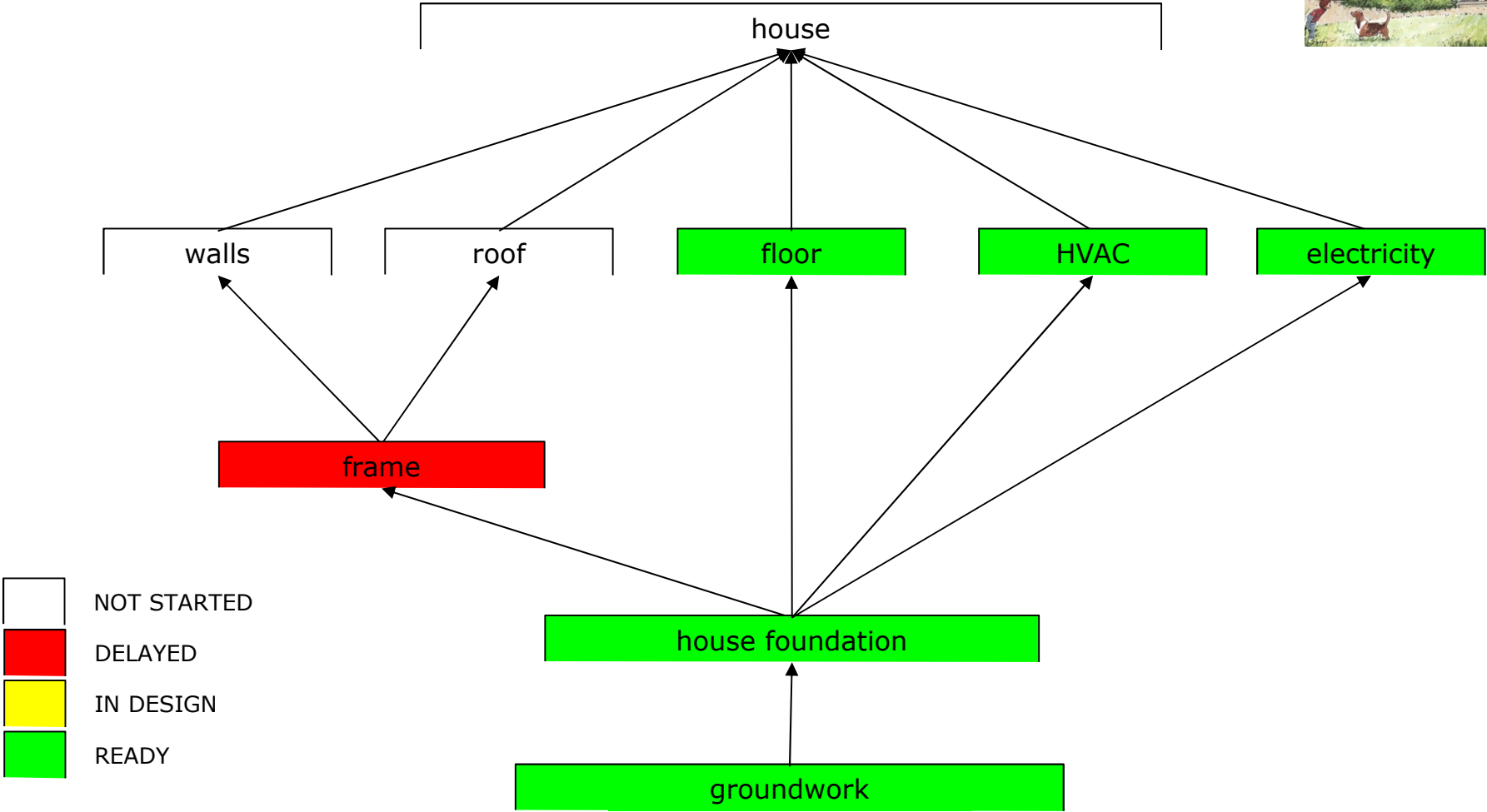
# Progress



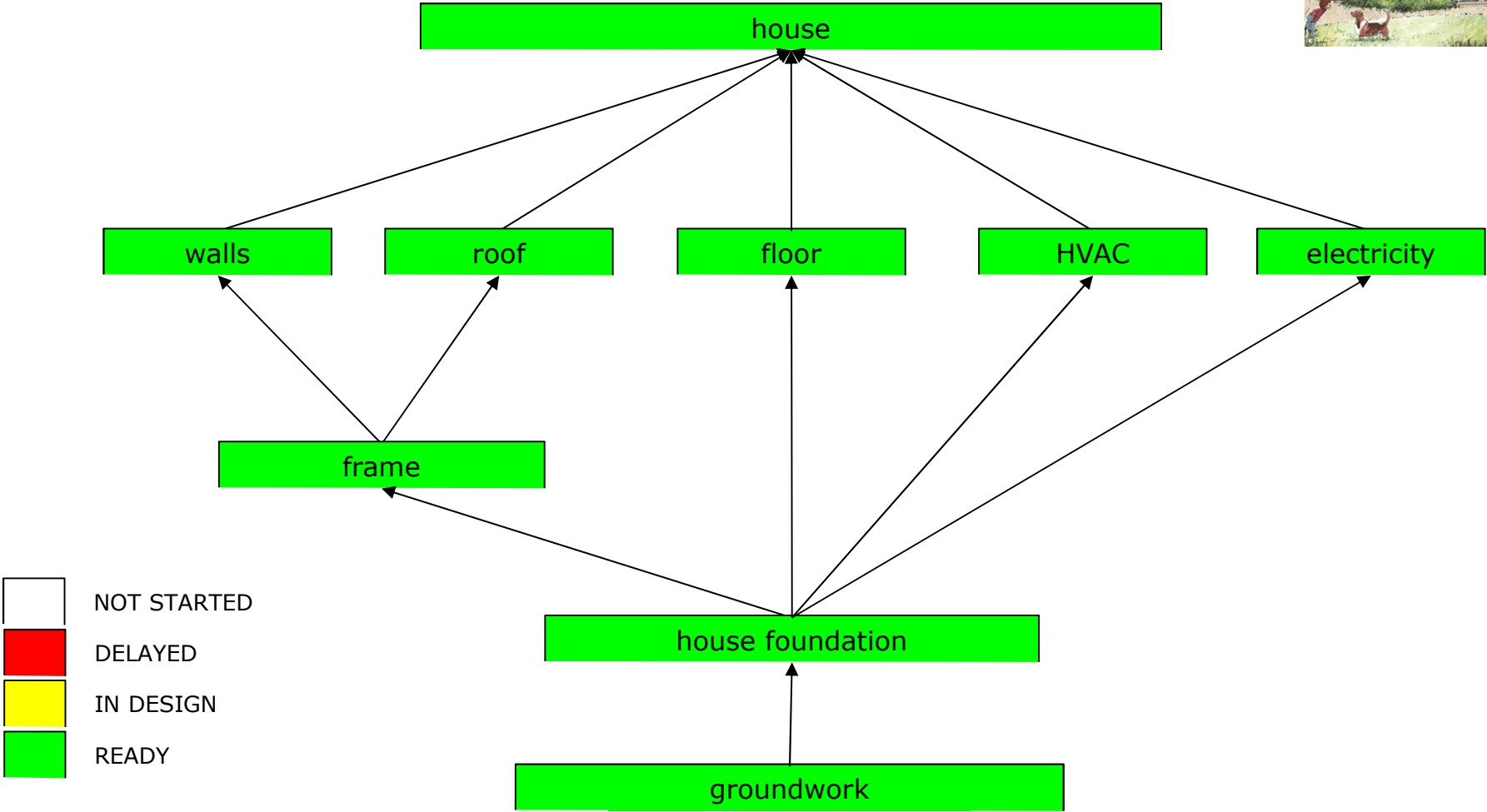
# Progress



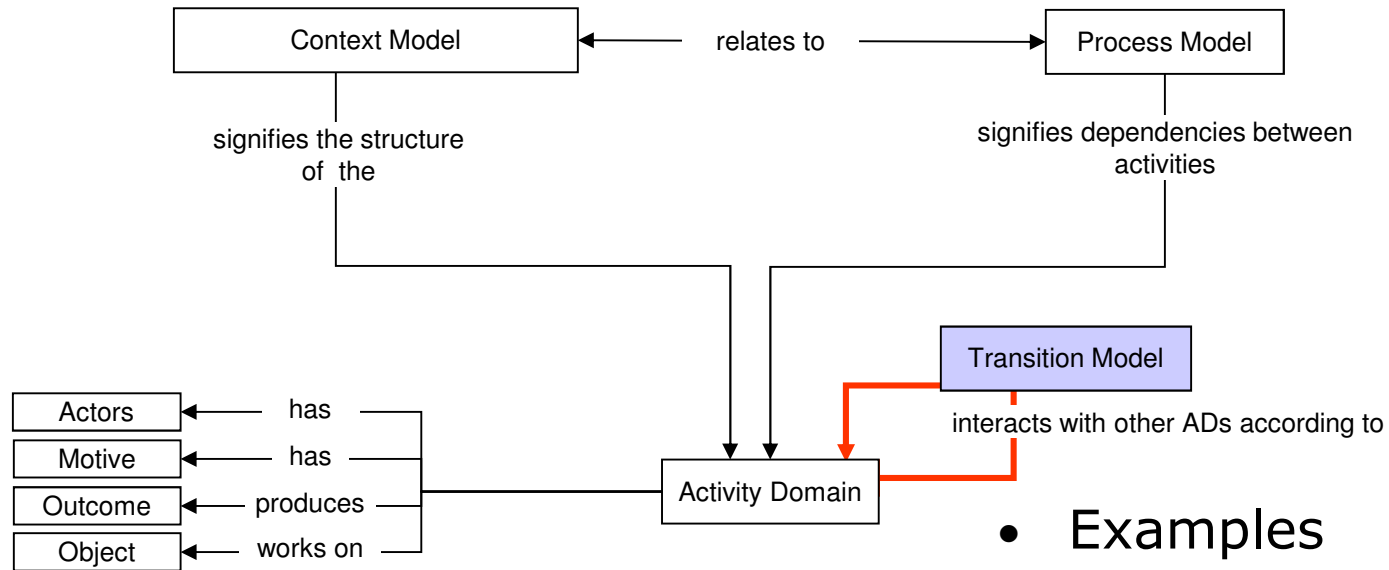
# Progress



# Progress



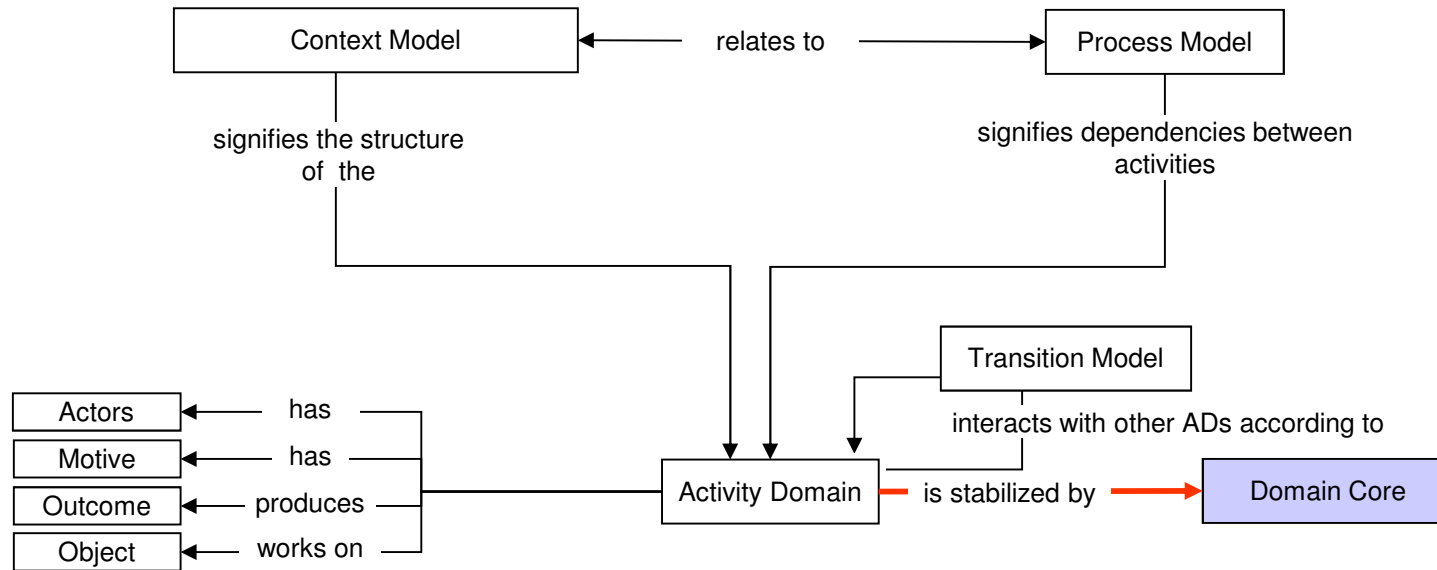
# ... The Activity Domain Theory ...



- **Examples**

- Different languages
- Cultural differences
- Different currencies
- Product identification rules
- ...

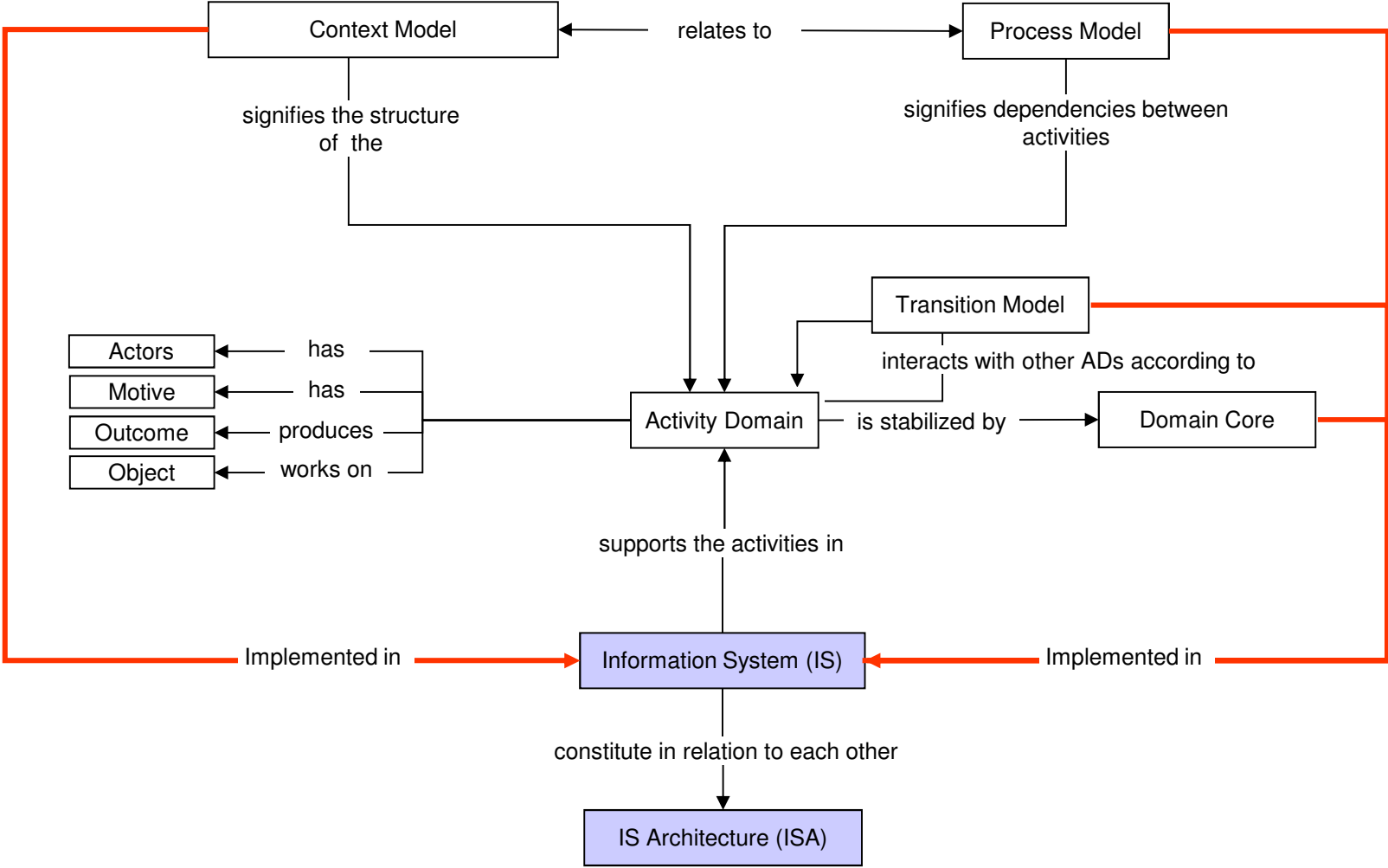
# ... The Activity Domain Theory ...



- **Examples**

- Rules
- Standards
- Norms
- ...

# ... The Activity Domain Theory ...





# Demo - Information system support

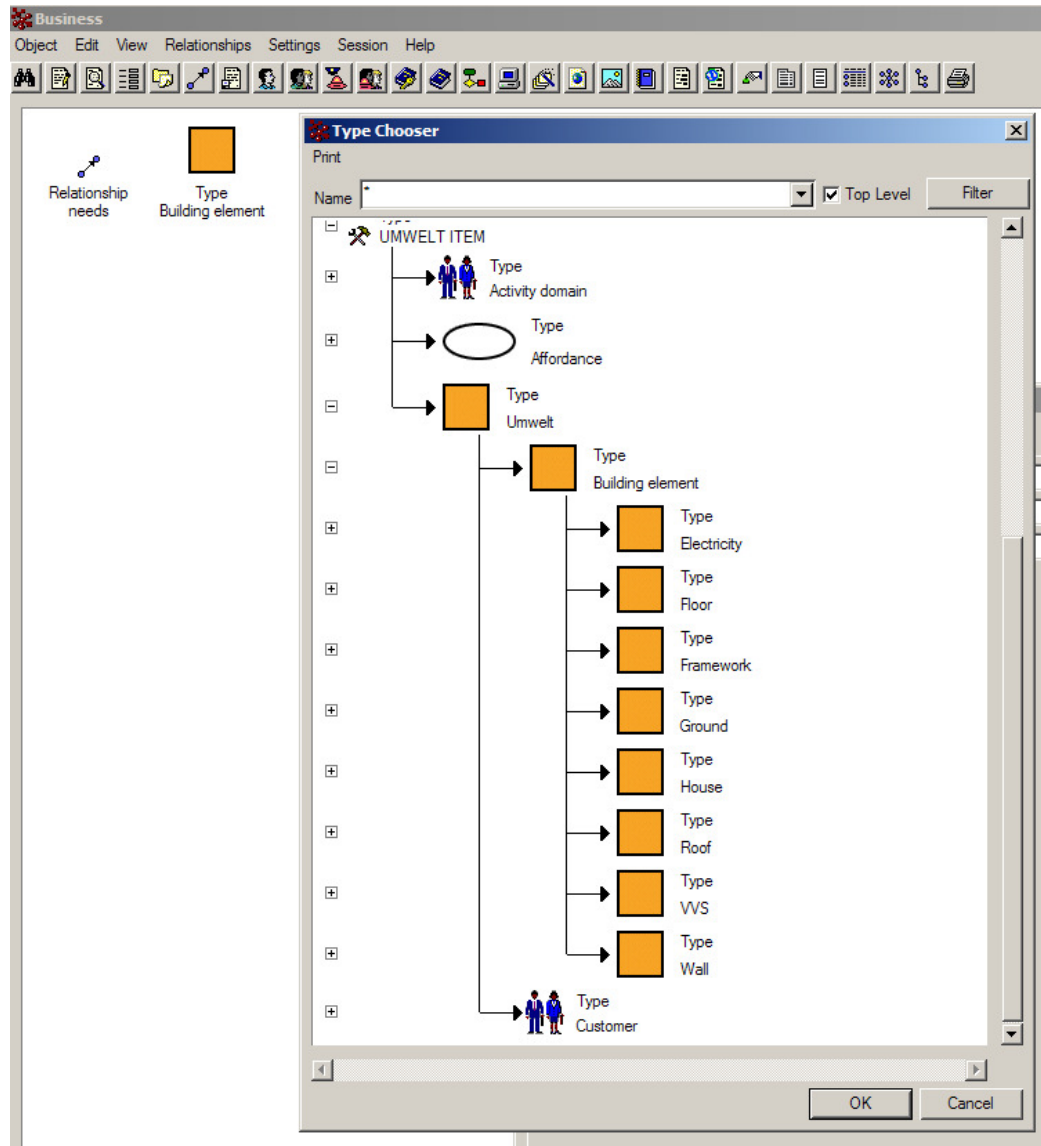


**eMatrix**

**MatrixOne**

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# Information system - context model definition



# Information system - related objects, data

**Navigator - Customer Andersson**

Object Edit View Properties Files Relationships

Object: <Personal>    REQUIREMENT\_INCREMENT: To&From

Object	Description	State	Activity Domain	Inkrement	Klart
Customer Andersson	Beställare av hus	New			
House Andersson Hus P1A	Hus som byggs för familjen Andersson	IN DESIGN	Masens Hus AB	Andersson 5	03-11-01
Electricity Andersson el P1A	El i familjen Anderssons hus	READY	Elbyrån	Andersson 4	03-10-01
Floor Andersson golv P1A	Golv i familjen Anderssons hus	READY	Spik & Cement	Andersson 2	03-09-01
VVS Andersson VVS P1A	VVS i familjen Anderssons hus	READY	VVS-konsulten	Andersson 3	03-09-15
Roof Andersson tak P1A	Tak i familjen Anderssons hus	IN DESIGN	Spik & Cement	Andersson 2	03-09-01
Framework Andersson stomme P1A	Stomme i familjen Anderssons hus	DELAYED	Spik & Cement	Andersson 2	03-09-01
Ground Andersson grund P1A	Grund i familjen Anderssons hus	READY	Spik & Cement	Andersson 1	03-08-01
Building element Anderssons tomt P1A	Marken som familjen Anderssons hus står på	READY		Andersson 1	03-08-01
Wall Andersson vägg P1A	Väggar i familjen Anderssons hus	IN DESIGN	Spik & Cement	Andersson 2	03-09-01

# Beroendematris



file:///localhost/C:/DOCUME~1/lars/LOCALS~1/Temp/HTML\_Report.htm    Visa    Googlesökning    100%

## No name

## Matrix HTML Relation Viewer

**Relation:** Floor(Column) Roof(Column) House(Column) Electricity(Column) Framework(Column) Ground(Column) VVS(Column) Wall(Column) Building\_element(Column) *needs* Floor(Row) Roof(Row) House(Row) Electricity(Row) Framework(Row) Ground(Row) VVS(Row) Wall(Row) Building\_element(Row)

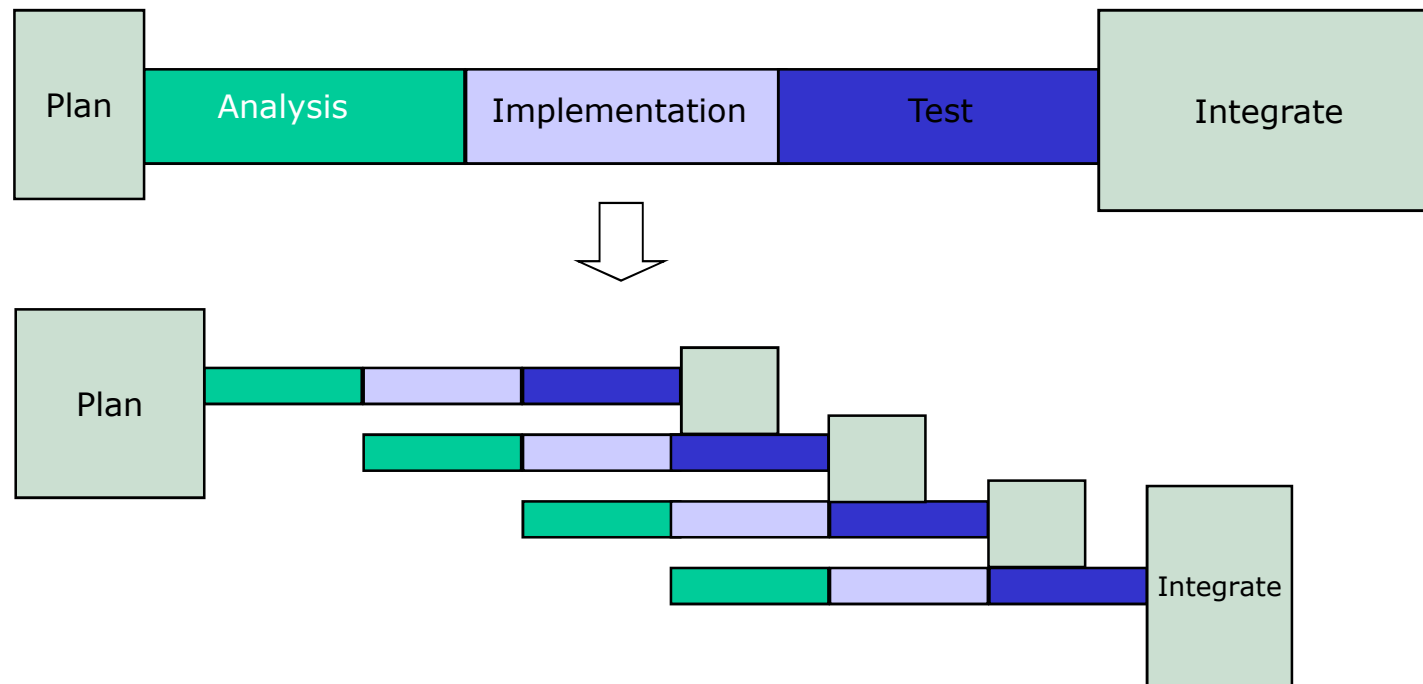
Created 2003-11-11 11.03.57 by Lars Taxen

NOT STARTED | IN DESIGN | DELAYED | READY

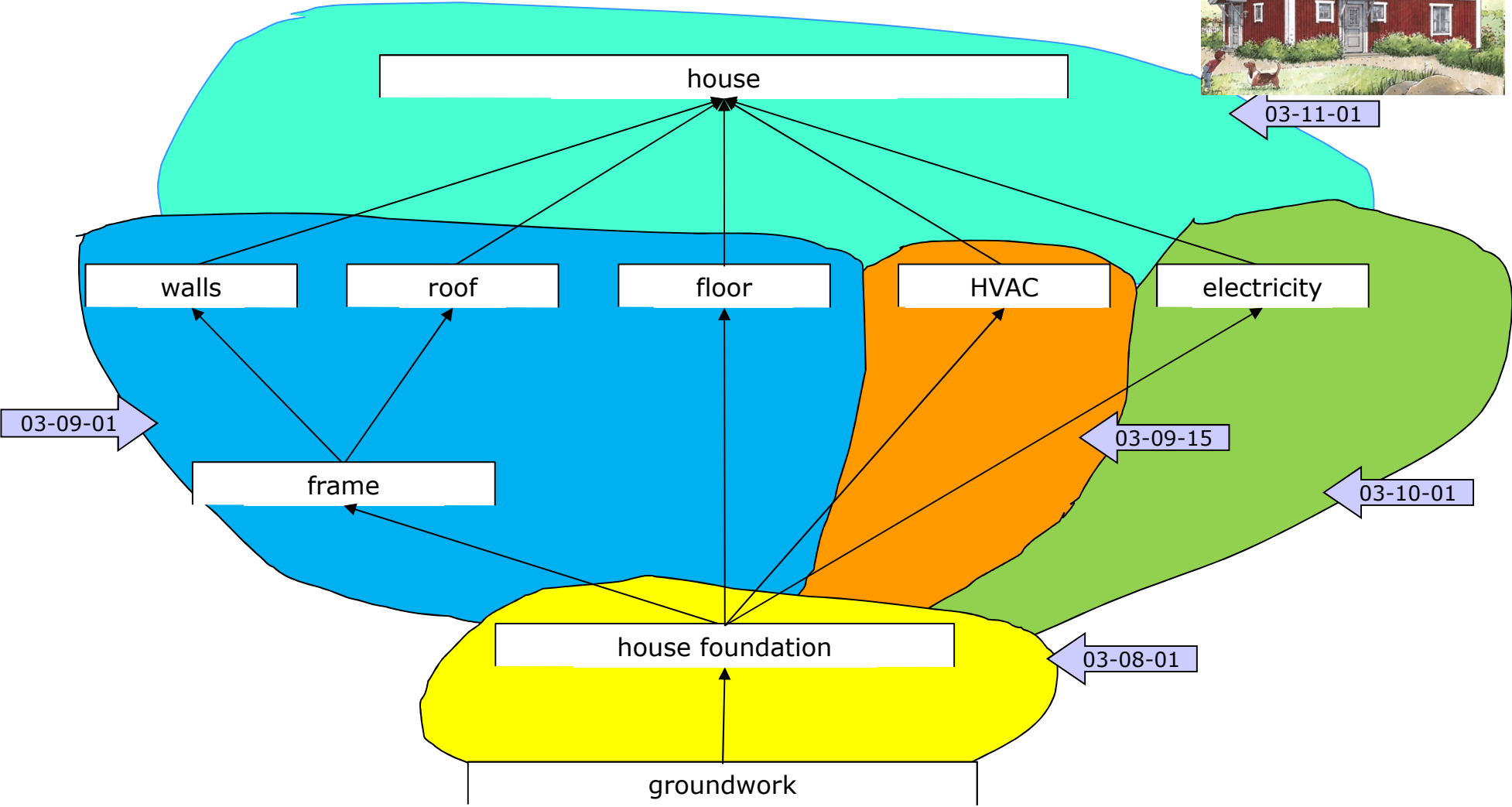
	Floor, Andersson golv, P1A	Roof, Andersson tak, P1A	House, Andersson Hus, P1A	Electricity, Andersson el, P1A	Framework, Andersson stomme, P1A	Ground, Andersson grund, P1A	VVS, Andersson VVS, P1A	Wall, Andersson vägg, P1A	Building element, Anderssons tomt, P1A
Andersson golv, P1A			READY						
Andersson tak, P1A			IN DESIGN						
Andersson Hus, P1A			READY						
Andersson el, P1A			READY						
Andersson stomme, P1A		DELAYED						DELAYED	
Andersson grund, P1A	READY		READY	READY	READY		READY		
Andersson VVS, P1A			READY						
Andersson vägg, P1A			IN DESIGN						
Anderssons tomt, P1A						READY			

# What about incremental development?

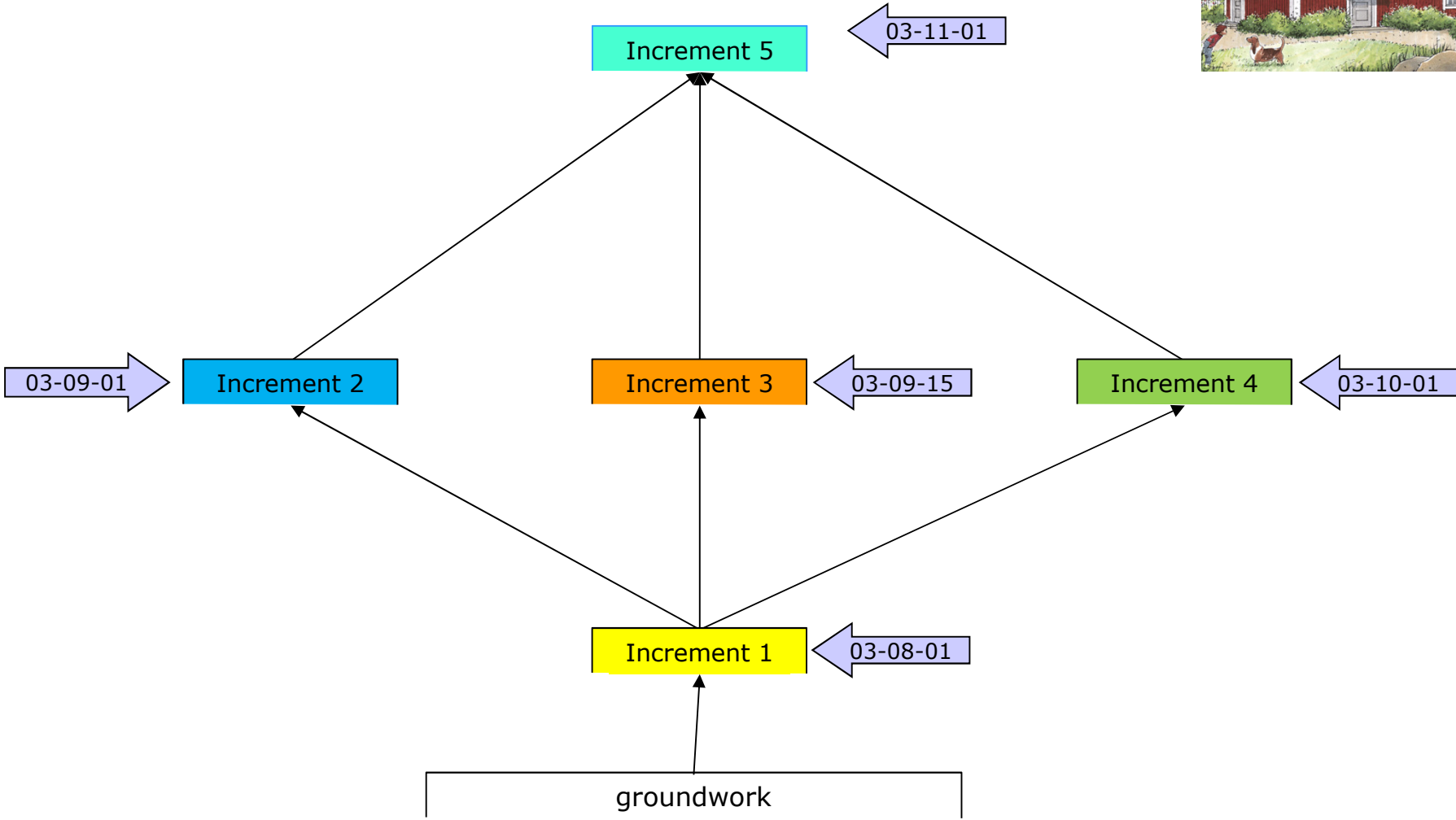
- Increment
  - a development task split in smaller parts
  - builds on a verified base
  - is a verifiable addition to the system
  - is a development task: a “mini-project”
  - has a ready date



# Possible increments



# Dependencies - increments



# Coordination of 3G development projects



- Four Activity Domains (Sweden, Germany)
- Global information system support (eMatrix)
- Continuous change of information system implementation
  - ~500 / year
- Used by ~140 main and sub-projects between 1998-2002



# Profound impacts



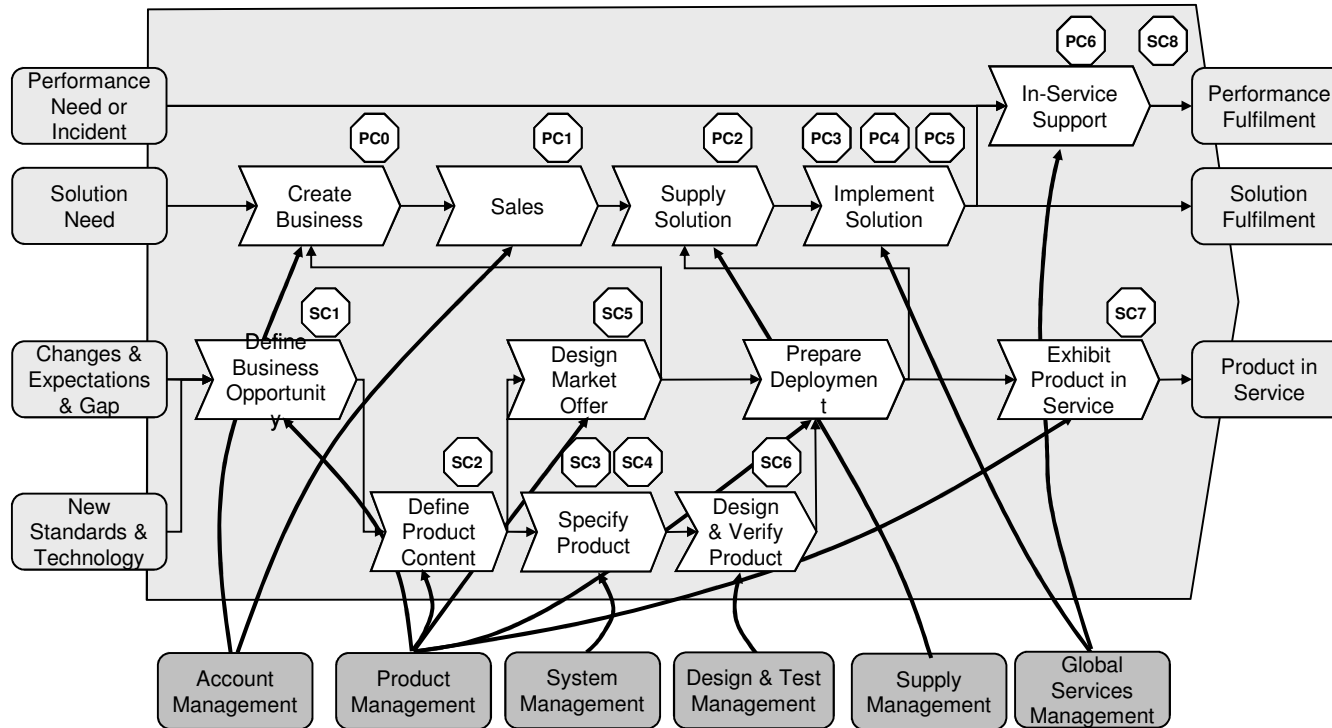
*“Especially for the execution part I think we **would not have been able to run this project without the tool.** I think if you simply look at the number of work packages, the number of products that we have delivered, the number of deliveries that we have had, if we would have had to maintain that manually, that **would have been a sheer disaster.**”*  
(Project manager, MSC node, 3G mobile system)

# Restructuring PLM

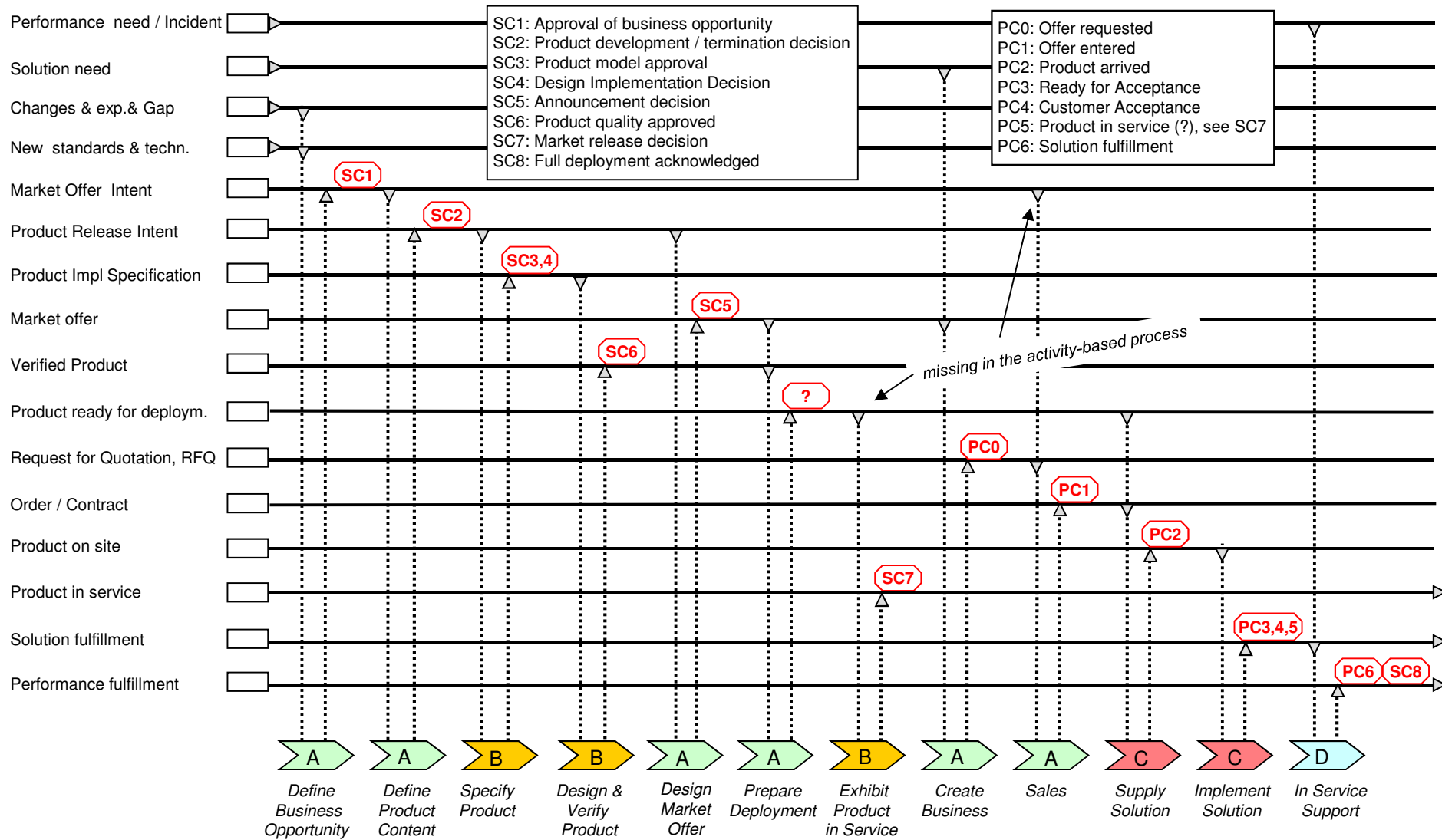


- Activity domains in the organisation
- Clean-up of terminology
- Multi-domain product structure
- Prototype of a core information system
- Balancing between control and autonomy
- Alternative business process model

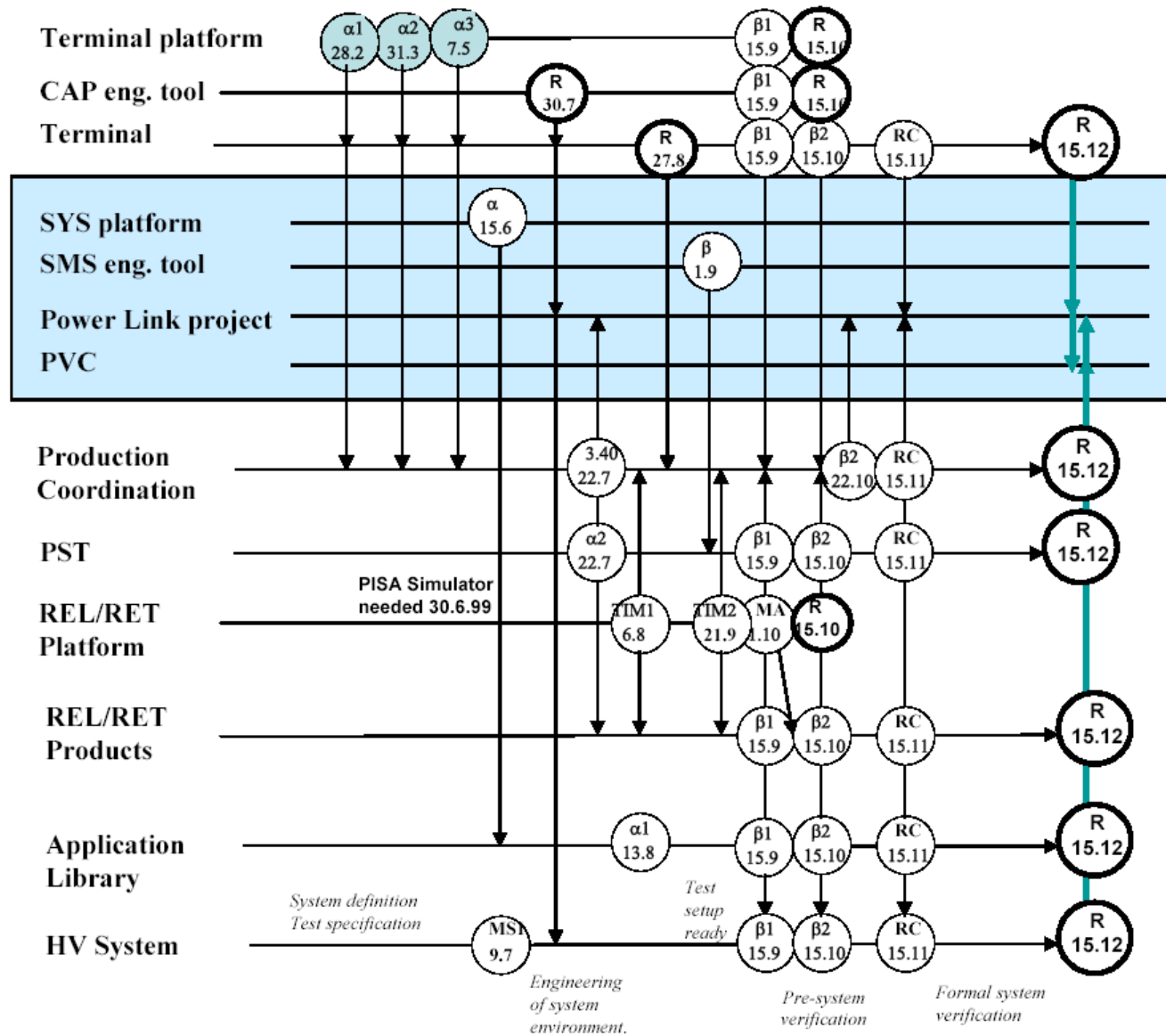
# Business process - traditional



# Business process - alternative



# Dependency diagram ABB



Courtesy: Joakim Lilliesköld, KTH

# Towards an alternative PLM foundation

people  
collaboration  
information

extended enterprise  
company

## Integration

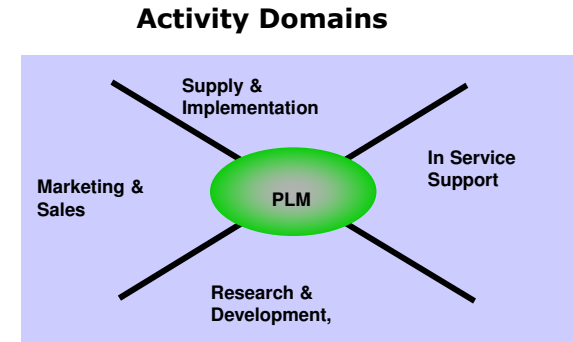
backbone  
information system

processes  
concept to end of life  
creation  
management  
dissemination

product  
product related

# Towards an alternative PLM foundation

people  
collaboration  
information



# Integration

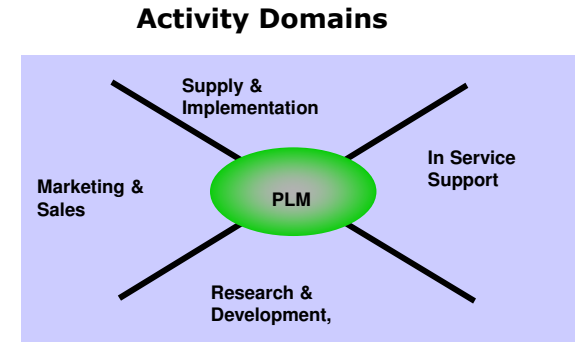
backbone  
information system

processes  
concept to end of life  
creation  
management  
dissemination

product  
product related

# Towards an alternative PLM foundation

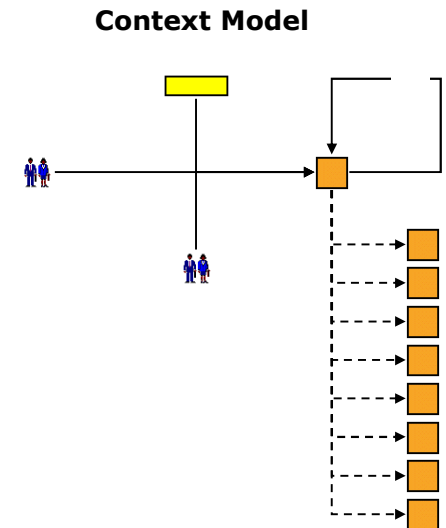
people  
collaboration  
information



# Integration

backbone  
information system

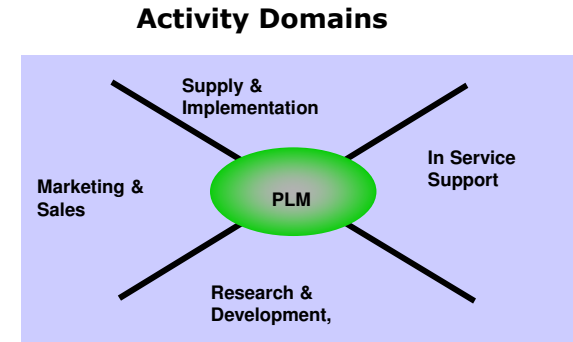
processes  
concept to end of life  
creation  
management  
dissemination





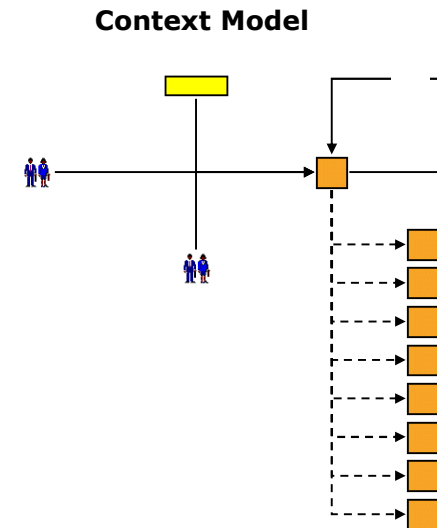
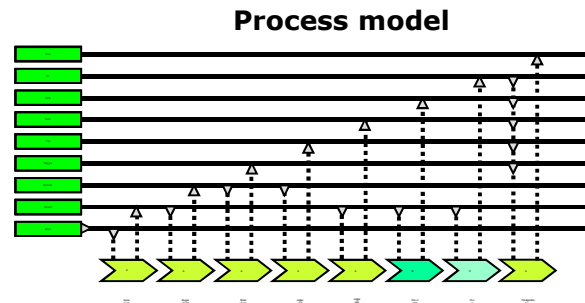
# Towards an alternative PLM foundation

people  
collaboration  
information



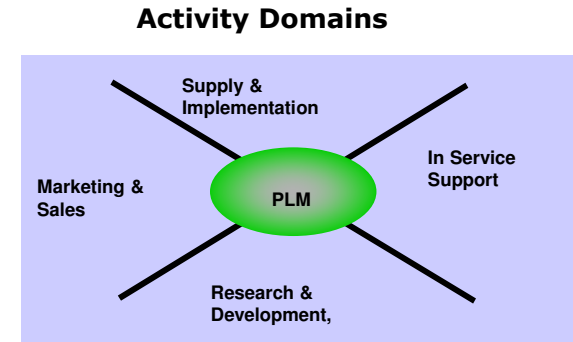
# Integration

backbone  
information system



# Towards an alternative PLM foundation

people  
collaboration  
information

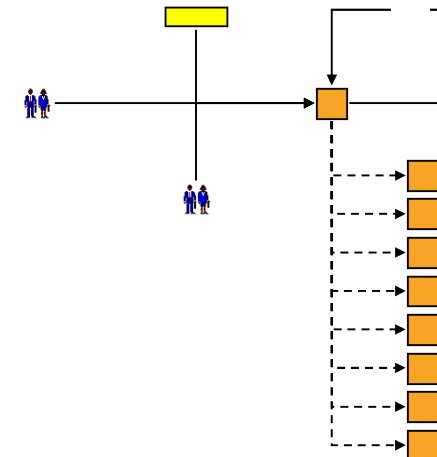


# Integration

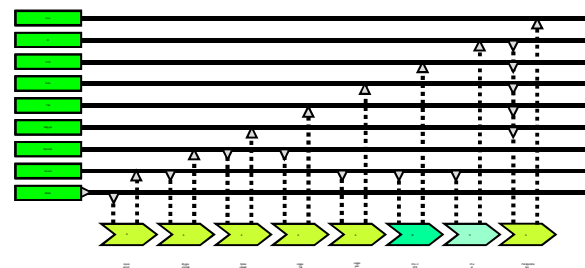
### Information System

Object	Relation	Description
Customer Andersson		Beställare av hus
House Andersson Hus P1A	needs	Hus som byggs för familjen Andersson
Electricity Andersson el P1A	needs	El i familjen Anderssons hus
Ground Andersson grund P1A	needs	Grund i familjen Anderssons hus
Building element Anderssons tomt P1A	needs	Marken som familjen Anderssons hus står på

### Context Model



### Process model

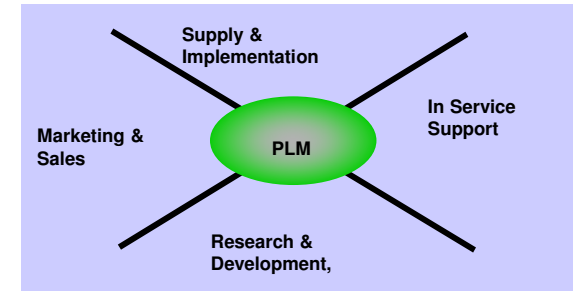


# Towards an alternative PLM foundation

Focus on shared meaning



Activity Domains

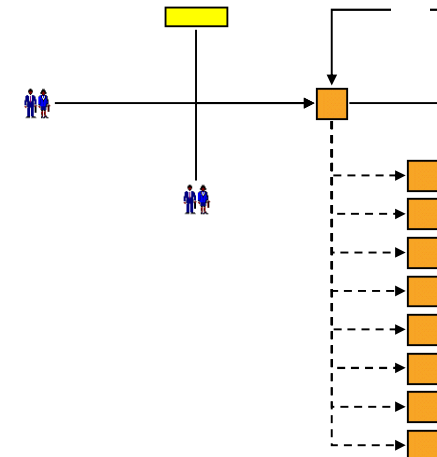


# Integration

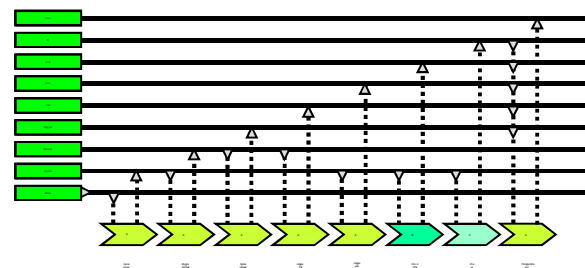
Information System

Object	Relation	Description
Customer Andersson		Beställare av hus
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Ground Andersson grund P1A	needs	Grund i familjen Anderssons hus
Building element Anderssons tomt P1A	needs	Marken som familjen Anderssons hus står på

Context Model



Process model

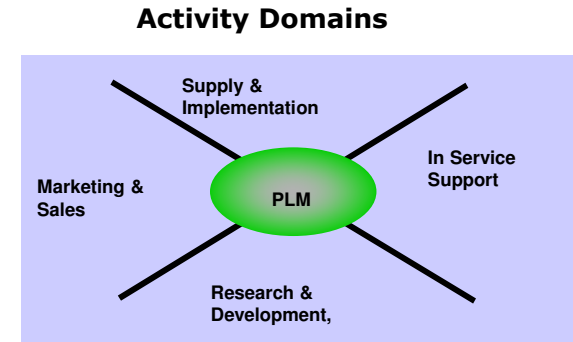


# Towards an alternative PLM foundation

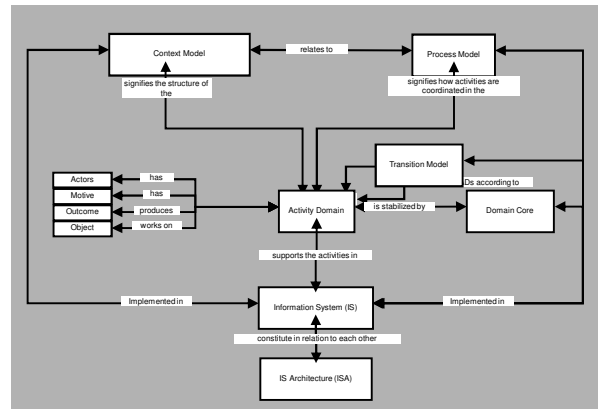
Focus on shared meaning



- Confusion about meaning ?
- Control of dependencies ?
- Different product structures ?
- Confusion about coordination ?
- Commitments and agreements ?
- IS architectures ad-hoc ?



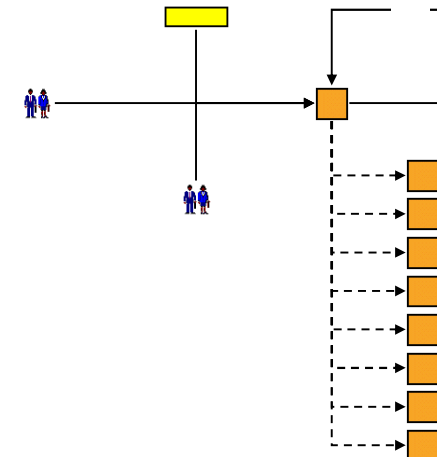
## The Activity Domain Theory



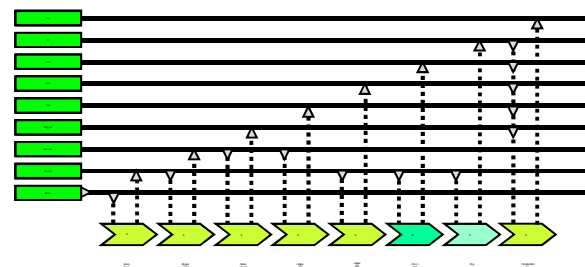
## Information System

Object	Relation	Description
Customer Andersson		Beställare av hus
House Andersson Hus P1A	needs	Hus som byggs för familjen Andersson
Electricity Andersson el P1A	needs	El i familjen Anderssons hus
Ground Andersson grund P1A	needs	Grund i familjen Anderssons hus
Building element Anderssons tomt P1A	needs	Marken som familjen Anderssons hus står på

## Context Model



## Process model



# References

- Taxén L (2003) *A Framework for the Coordination of Complex Systems' Development*, Dissertation No. 800. Linköping University, Dep. of Computer & Information Science, 2003. Downloadable from [http://www.ep.liu.se/diss/science\\_technology/08/00/index.html](http://www.ep.liu.se/diss/science_technology/08/00/index.html)
  - The Activity Domain Theory
  - A framework for coordination (includes the PDM system eMatrix)
  - The history of the framework at Ericsson
  - Experiences from using the framework in the 3G systems development
- Taxén L, Svensson D (2005) *Towards an Alternative Foundation for Managing Product Life-Cycles in Turbulent Environments*, *International Journal of Product Development (IJPD)*, 2(1-2), 24-46.
  - Results from the PLM restructuring initiative at Ericsson
- Anderstedt J&U, Karlsson M, Klasson M (2002) *Projekt och Helhet - att leda projekt i praktiken*, Stockholm: Författarna
  - Integration driven development, anatomies
- Taxén, L. (2009). *Using Activity Domain Theory for Managing Complex Systems*. Information Science Reference. Hershey PA: Information Science Reference (IGI Global). ISBN: 978-1-60566-192-6.