An Assessment of Approaches towards Integrated Enterprise PLM capabilities

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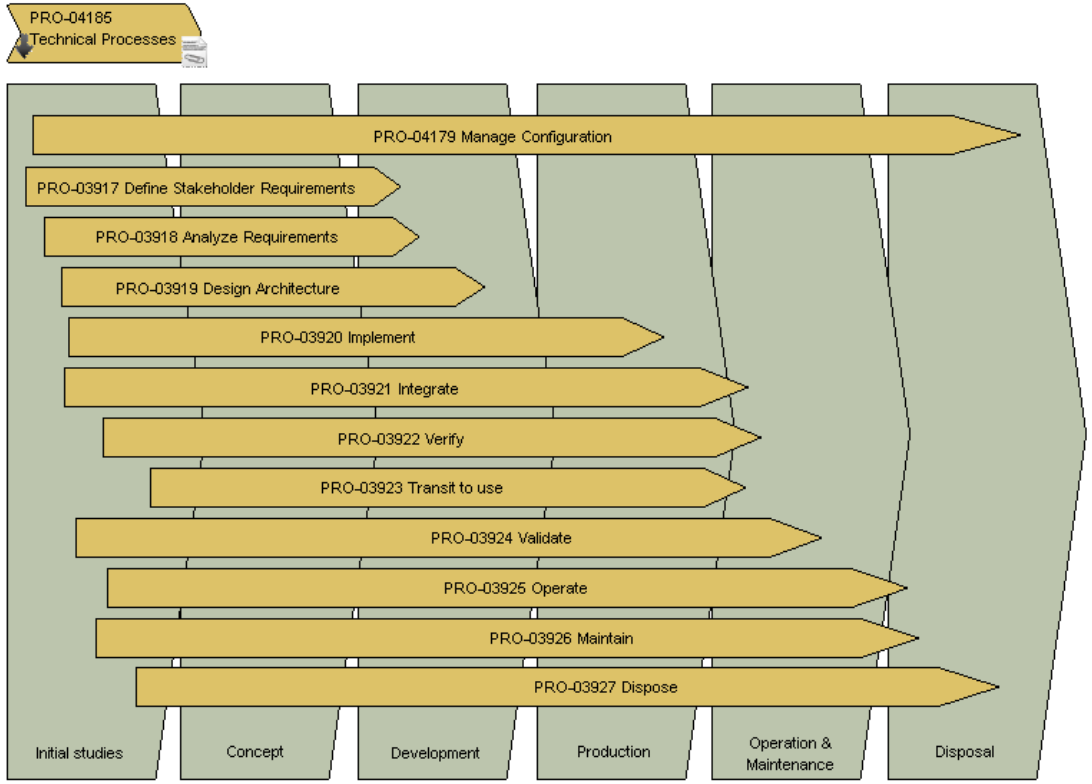
Agenda

- What is PLM?
- Scope of the change
- Why does it matter for Saab Aeronautics
- Approaches for enterprise PLM
  - Monolith
  - Back-bone
  - Federation
- Evaluation
- Discussion

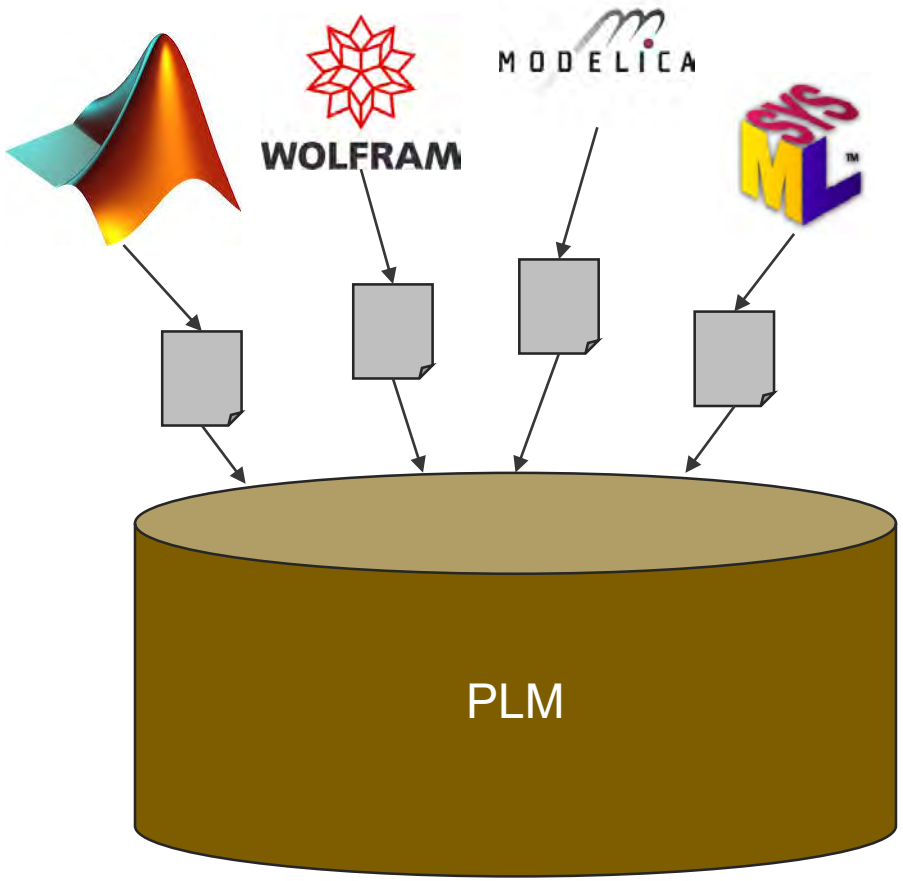
What is Product Lifecycle Management (PLM)?



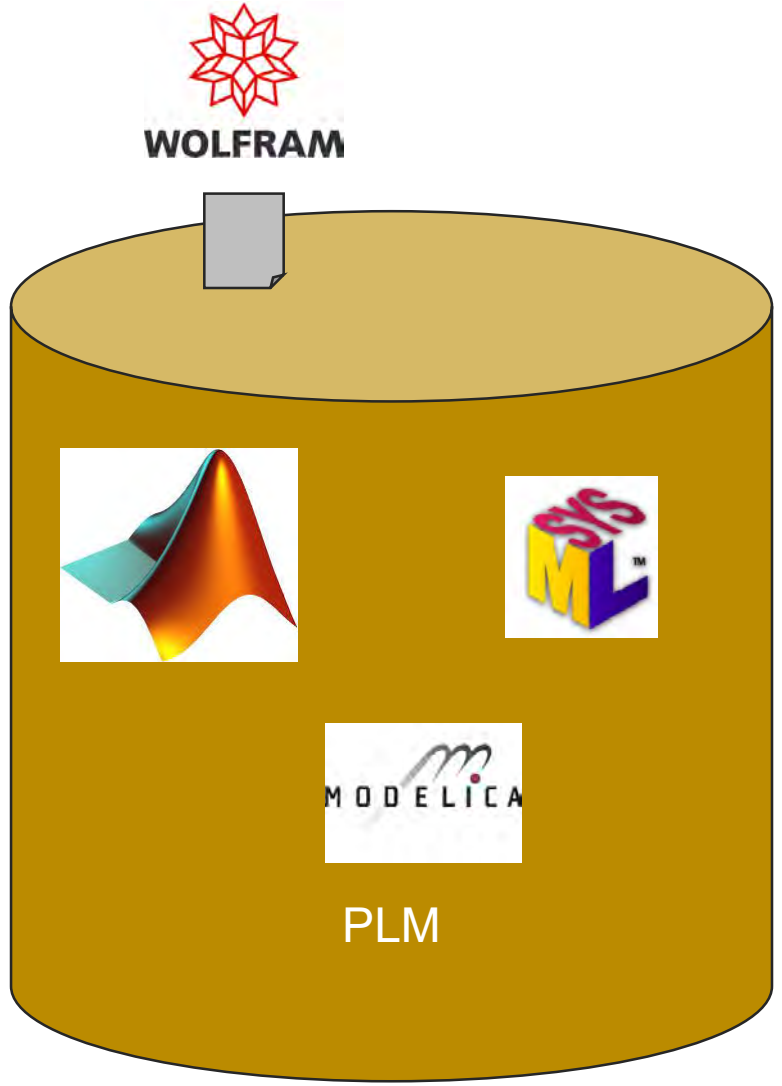
Management of all product information related to a system element over its life cycle

- Requirements, design, realisations, V&V, declaration
- Change management
- Product structure
- Baselines
- Configuration management
- Approvals
- Acquire/Supply
- Evolution, not a snapshot
- …

The scope of the change



Coarse grain PLM integration



Fine grain PLM integration

Why does it matter för Saab Aeronautics?

The present

- Gripen – CPS – complex and heterogeneous
- Many engineering disciplines
- Safety critical, certification and traceability
- Long development lifecycles
- Even longer operational and maintenance
- Many customers, configurations and increments
- Strict change management – rule enforced

The future

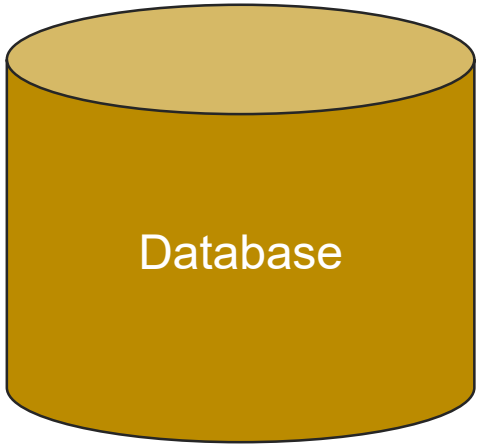
- Adapt PLM capabilities to a changing environment
  - It won’t be only Gripen in the future
- Improved support to individual engineering disciplines
  - Ability to follow the latest trends within each discipline
- Improved cross engineering discipline integration
- Increased need to integrate partners and suppliers in development
- Information security
- Ability to change at low cost

Approaches to Integrated Enterprise PLM capabilities

Over simplified…

Monolith

- Design principle: All engineering applications within a single environment
- Integrated information model
- Supplier ensures consistent application integration
  - Dependency on the applications integrated by the suppliers

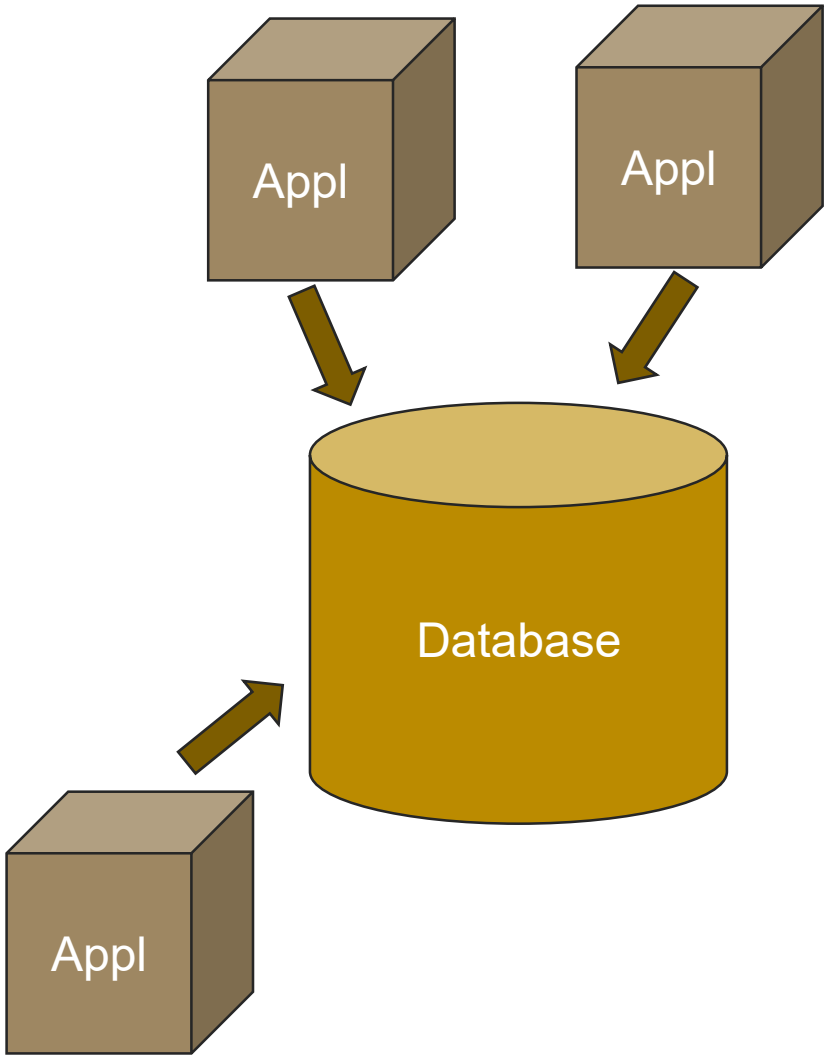


- Example Siemens TeamCenter, Dassault 3DExperience

Backbone

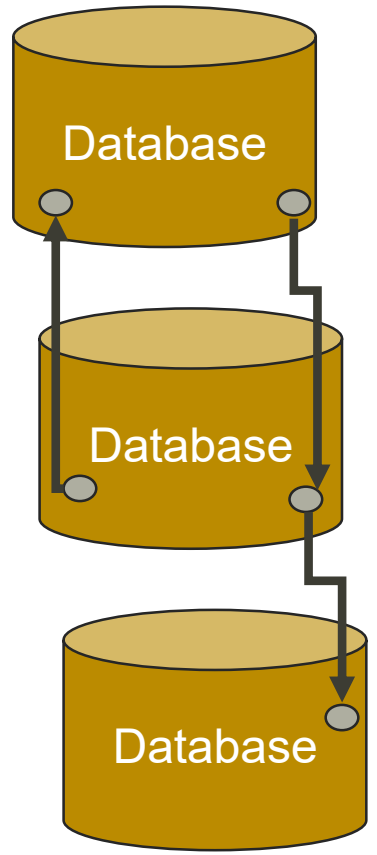
- Design principle: All engineering data is stored in a single backbone (database)
- Information model can be heavily tailored by end user organisations
- Heterogeneous set of front end applications
- The actual data integration is the task of the end user

- Example
  - ARAS Innovator

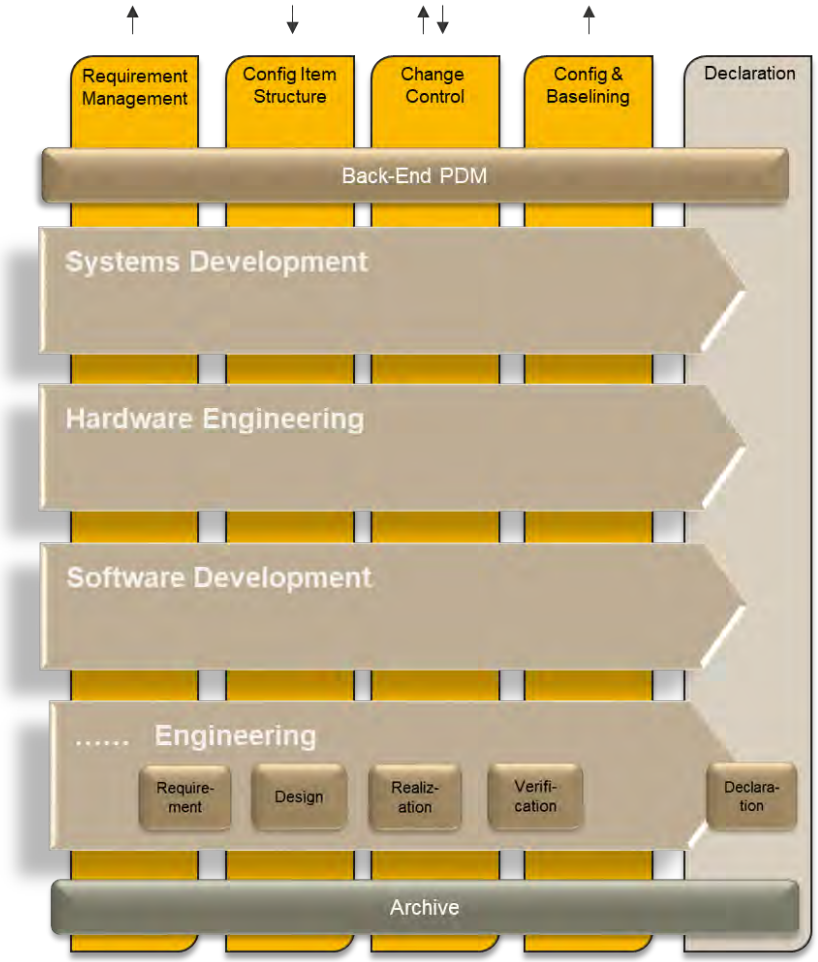


Federation

- Design principle: Integrate a number of engineering discipline specific development environments with PLM capabilities to create an enterprise PLM solution
- Heterogeneous information model
  - Defined per engineering environment
  - Establish interfaces between information elements in the different environments
  - Integration is the task of the end user
    - Emergence of integration standards - OSLC
- Heterogeneous set of front end applications – per engineering domain



PDM Landscape Model



- Engineering Disciplines
- Engineering Deliverables

- Design Traceability Dimensions
  - We believe there are four of them only
- Virtual Back-End PDM Functionality

Evaluation

Evaluation criteria

- Information architecture
- Application management
  - normal operation
  - modifications
- Integration/interfaces
- Ease of use/Management
- Information lock-in
- Adaptations
- Engineering efficiency
- Thru-life cost
  - licenses
  - integration
- Risk

Evaluation

Criteria	Monolith	Backbone	Federation
Information architecture	Central information model (total)	Central information model (partial)	Distributed model with common concepts
Application management– normal operation	A centralised organisation	Backbone management + individual applications	Management of the individual environments
Application management – modifications	Change all, or nothing. Follow the strategy of the supplier	Easy to change applications, the backbone is given.	Exchange individual environments. Individual environments may co-exist
Integration/interfaces	Always integrated	Many interfaces to stand-alone tools	Relatively few interfaces to carry central concepts
Ease of use/Management	Harmonised DB + Apps	Single DB, multiple Apps	Multiple DBs, harmonised Apps
Information lock-in	Yes	Ownership of DB information model	Per unit in the federation
Adaptations	Limited	Few constraints	As per the individual environment
Engineering efficiency	Single front end tools for all users	As per integrated tools	As per the individual environments
Thru-life cost – licenses	High – partnership contract	Situation dependent	Situation dependent
Thru-life cost – integration	Low	High	Medium
Risk	Alignment/ Dependency to supplier	Selection of backbone, application + integration cost over time	Maintaining capability over time, stability of integration mechanism

Comments

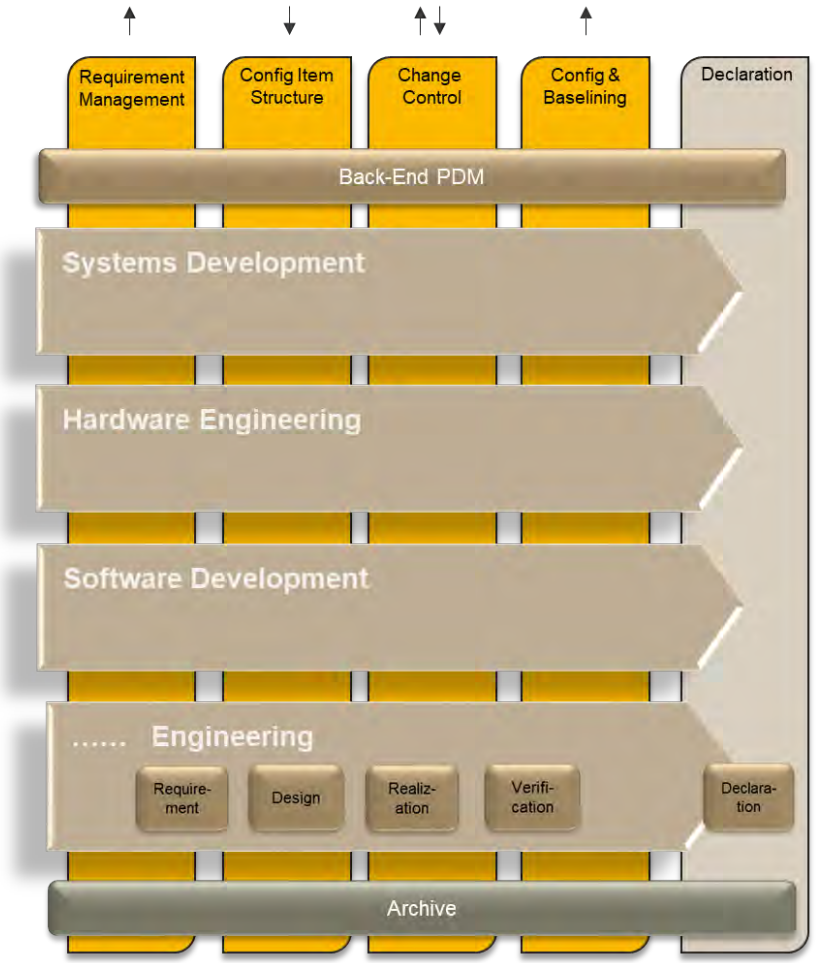
- Naturally, the actual PLM offerings on the market are not as stereotyped as the cases presented
- Monoliths certainly have interfaces for integrating 3rd party tools
- Backbones provide front end application support

Discussion

- The selection of fine granularity PLM will have a large impact on the tools used and integrated and consequently the whole organisation
- Selection of PLM architecture will depend on multiple parameters
  - Product complexity and heterogeneity
  - Life cycle – length
    - How long will the relationship with the supplier last?
  - Existing application set and support organisation setup
  - Supplier – end user alignment
- We have to be very precise defining tool requirements, to understand the consequences of a choice.
  - How restrictive are the general principles chosen by the supplier?
  - How easy is it to implement a modified workflow?
  - Data migration possibilities?
  - Support for extending with new concepts?
- Fine grain PLM will also radically change the interaction with product data
  - The product structure will be the key to obtaining information
  - Fewer documents and reference lists
- PLM will be used in daily work
  - Not just for baselining when work is completed

Current state at Saab Aeronautics

- Document granularity PLM system
  - Radically extended – difficult to upgrade
  - No longer actively developed by supplier
- Multiple, poorly integrated, engineering discipline applications
  - Much non-value added work for engineers to keep information consistent
- Work on new PLM strategy and roadmap initiated



Conclusion

- In the transition to fine granularity PLM organisations need to define strategies and roadmaps capturing
  - Basic architecture
    - Monolith
    - Back bone
    - Federation
  - Transition from current tool set to integrated environment
- It will have a radical impact on engineers daily work
  - Higher capability at the cost of lower flexibility
- Selection will have long lasting effects on IT strategy and investments