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VISIONS OF DIGITAL THREADS THROUGH CONFIGURATION MANAGEMENT SYSTEMS

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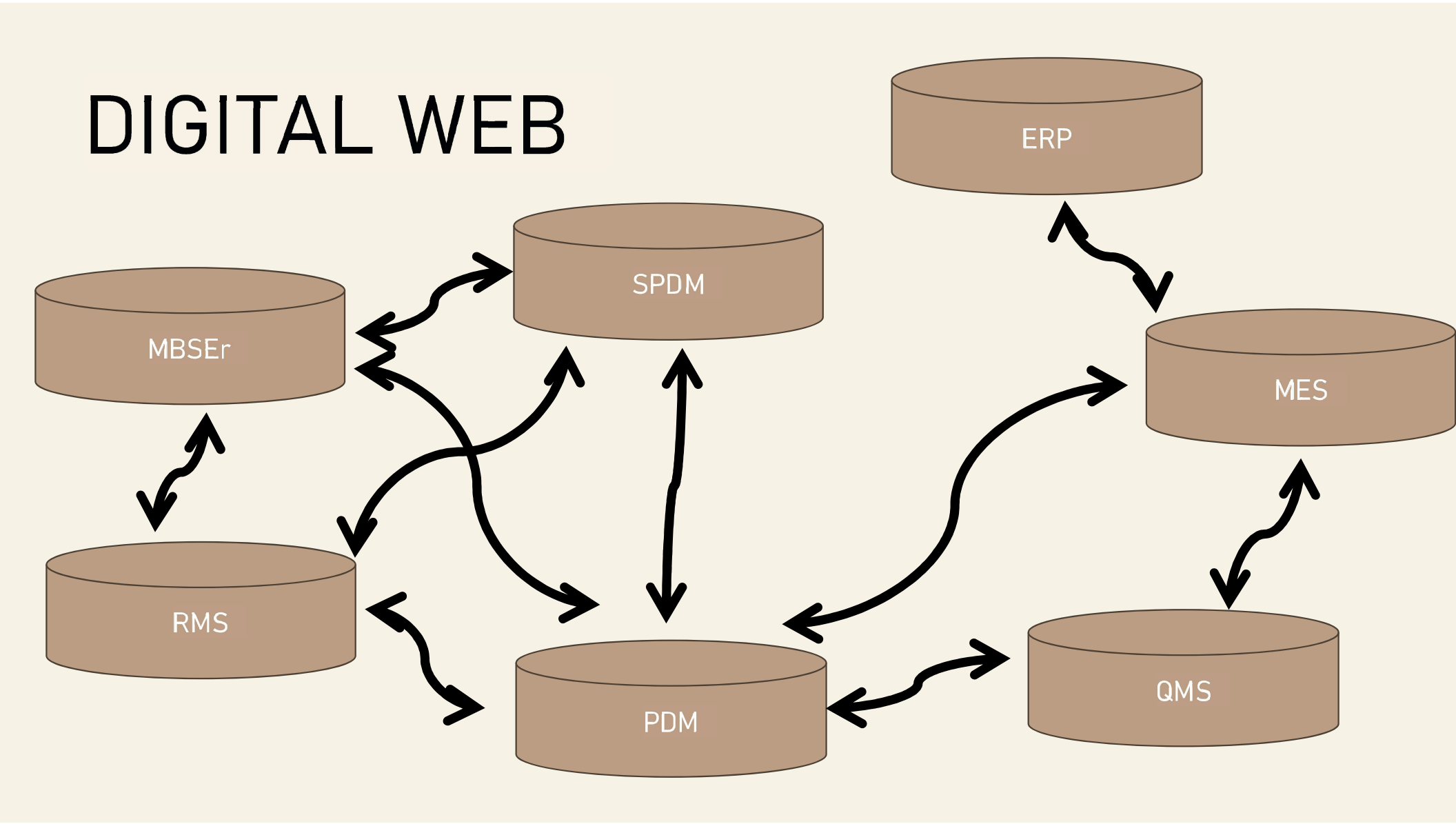
GOALS

Discuss use cases for *digital threads* across a product's lifecycle

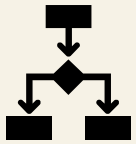
Identify key challenges for defining and maintaining *digital threads*

BACKGROUND

- Modern enterprise use a variety of data management platforms for engineering
- There are specialized platforms for specific domains or product lifecycle stages
  - Requirements Management Systems (RMS)
  - Models-Based System Engineering model repository (MBSEr)
  - Simulation Process Data Management (SPDM)
  - Product Data Management (PDM)
  - Enterprise Resource Planning (ERP)
  - Manufacturing Execution System (MES)
  - Quality Management System (QMS)
- Typically, these systems are siloed and disconnected
  - Documents and static files are transmitted from system to system through manual or semi-automated processes
- *This presentation is theoretical and these ideas have not been fully developed or deployed.*


DIGITAL WEB
ERP
SPDM
MBSEr
MES
RMS
PDM
QMS

PRIMARY BENEFITS



Informed decision-making

Elimination of copy-paste error propagation

Automated impact analysis for change management

Foundation for Artificial Intelligence (AI) applications

DIRECTLY DEFINED RELATIONSHIPS

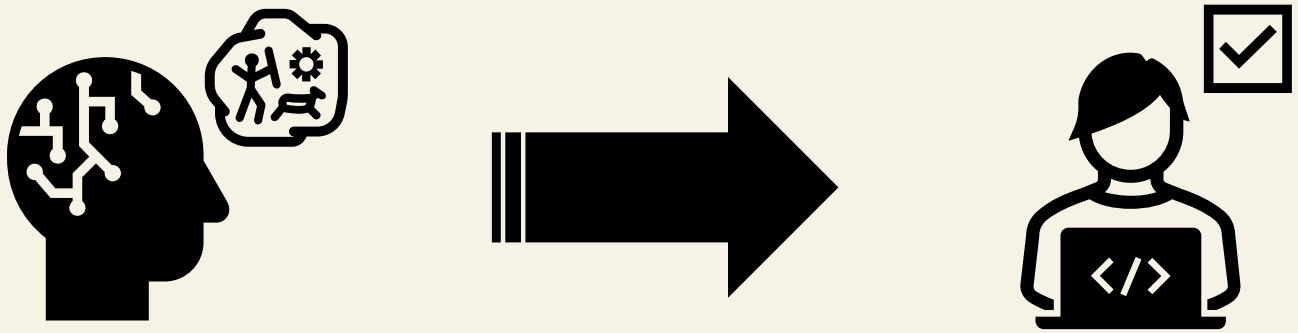
- Directly defined relationships are created by the user to link or trace information across platforms
- Examples
  - Between requirements (e.g. system to subsystem allocation)
  - Between component requirements and key design definition features (e.g. dimensions, feature shapes)
  - Between requirements and test reports
  - Between simulation reports and test reports
  - Between WIP CAD models and design review feedback
  - Between product definition datasets and downstream manufacturing definition (e.g. manufacturing process CAD models, manufacturing Bill-of-Material)
  - Between resources managed in ERP and processes defined in MES
  - Between product definition and as-built serialized instances
  - Between test reports and as-built prototypes

What are other relationships and what benefits do they have?

INDIRECTLY DEFINED RELATIONSHIPS

- Indirectly defined relationships are the next level from directly defined relationships
  - Personnel defining relationships is not a scalable method for maintaining digital threads
- Indirectly defined relationships are proposed by AI based on prior learning and knowledge graphs
- Users then must confirm the relationship
- Examples:
  - In developing a new system, additional requirements are suggested based on similar past systems
  - MBSE models have suggested functional to physical architecture
  - When a new revision of a component product definition is released, reference links are suggested to upstream architecture and requirements
  - Suggesting relationships between test product definition and full-rate production product definition

What are other relationships and what benefits do they have?



APPLICATIONS

- AI Chatbot to answer specific questions on system development
- In the similar product line, if new customer requirements are elucidated, system developers do not have to start from scratch
- In the similar product line, tailored template for a test qualification plan is generated based on conceptual design
- Automated final design reports
- Automated requirement verification reports
- Automated simulation workflows based on WIP design definition

What are other applications that could benefit you or your organization?

KEY CHALLENGES

- Machine readable models and references are the foundation
  - There is not strong agreement in standardized models across a large enterprise
  - There can be large learning curves for learning how to articulate ideas in models
- Delineating different types of references and links
- Integration of data with third-party organizations

What are other challenges?