The power of combining SPDM with engineering workflow automation

pSeven User Conference 2023| Oct. 18th

Michael S. Murgai, Executive Board Member, P|D|Tec.
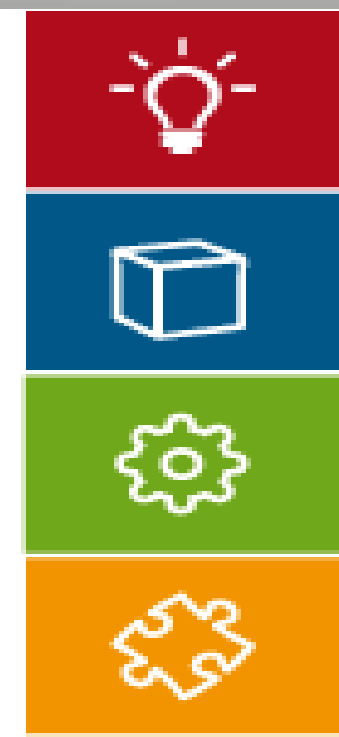
murgai@pdtec.de

Laurent CHEC, General Director, π

laurent.chec@pseven.io

Prozess- und IT-Beratung

Individual- Softwarelösungen

Integrationsplattformen und Werkzeuge

Standard- Softwarelösungen

P|D|Tec.

About PDTec

for Datadvance Annual Conference 2023

PDTec Group

- PDTec stands for … **P**roduct **D**ata **Tec**hnology

- Our MISSION: Innovation through integration

- Our DNA: Openness and agility is our identity

- Our FOCUS: Engineering Data Management & Data Xchange

- 25th anniversary April 2024
  - 25 years of engineering expertise captured in PDTec's Engineering Platform
  - Innovation „engineered in Germany"

- PDTec Goup is headquartered at Technology Park Karlsruhe, Germany, with a development site in Poland

- Industries
  - Automotive
  - Ship
  - Aerospace & Defence
  - Mechanical & Plant Engineering
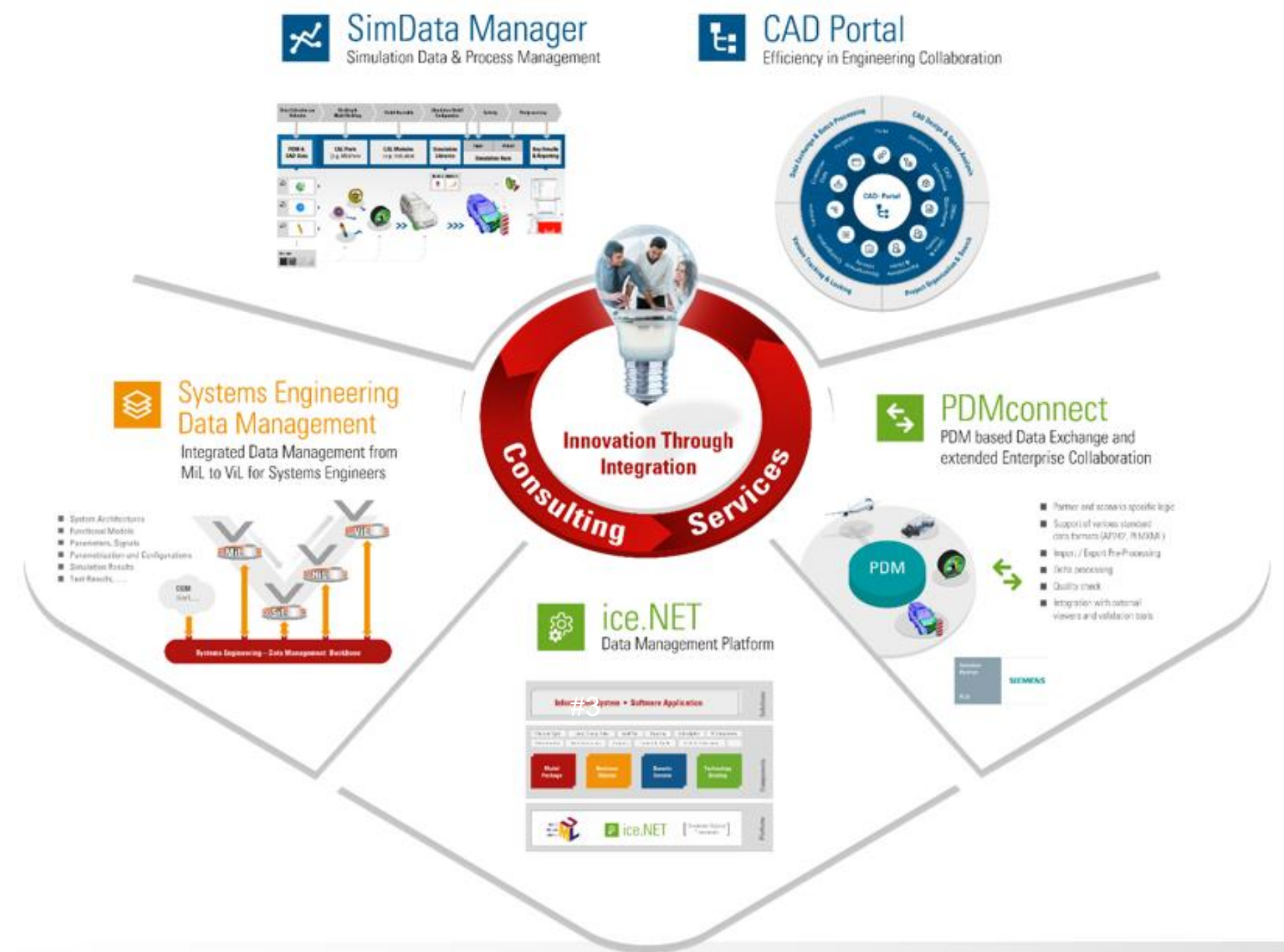
PDTec Key Customers (Excerpt)
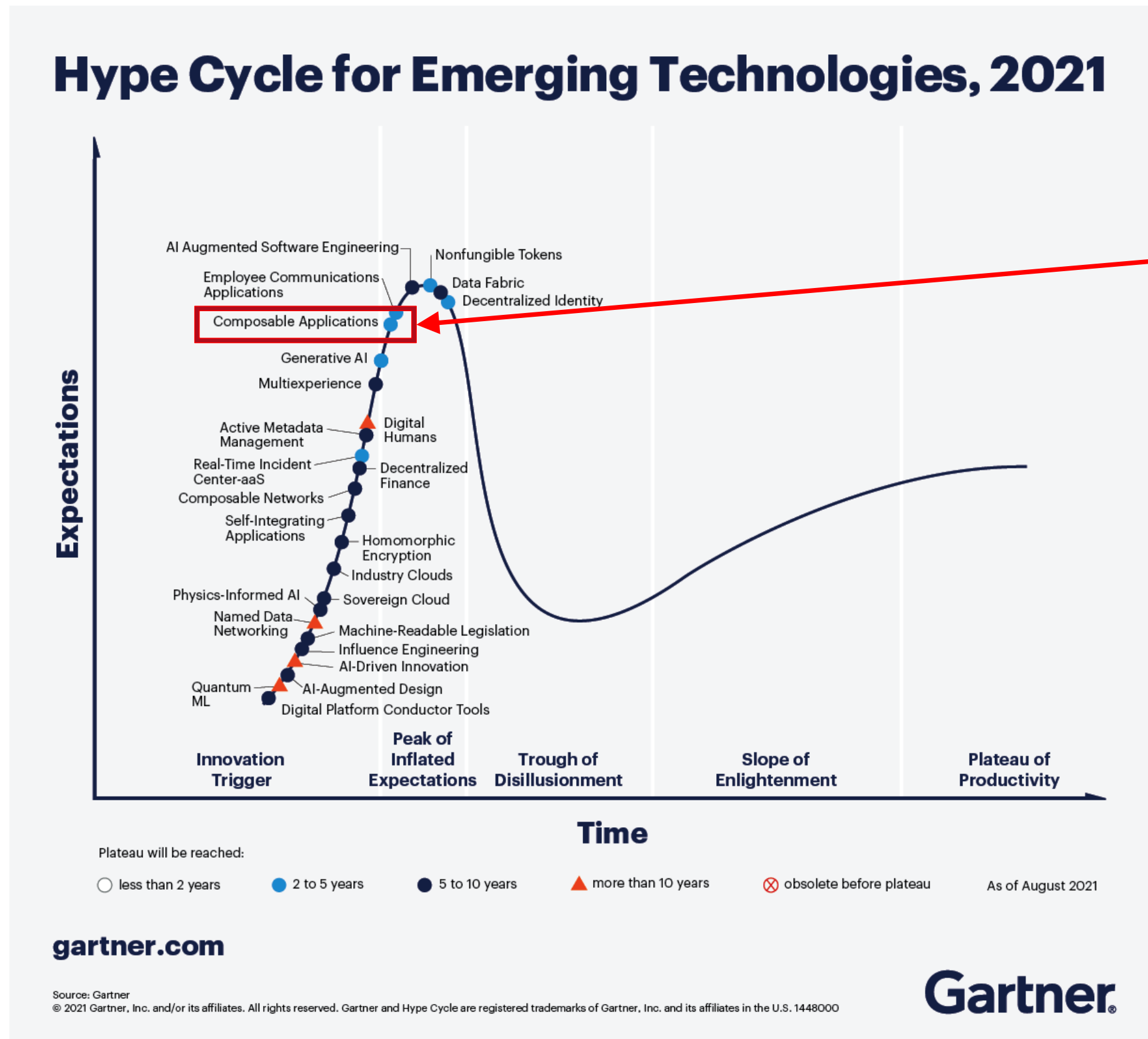

Statement by the customers:
With the exception of one automotive OEM, all German automotive OEMs today rely on solutions from PDTec!

PDTec – *Inspiring || Engineering || Excellence*

PDTec Engineering Platform addresses Gartner's vision

Hype Cycle for Emerging Technologies, 2021

- **PDTec Engineering Platform is addressing Gartner's vision of „Composable Applications"**

- PDTec's Engineering Platform combines the advantages of an open, scalable, flexible and agile platform
  - Higher Resilience
  - Reduction of risks
  - Shorter Return-on-Invest
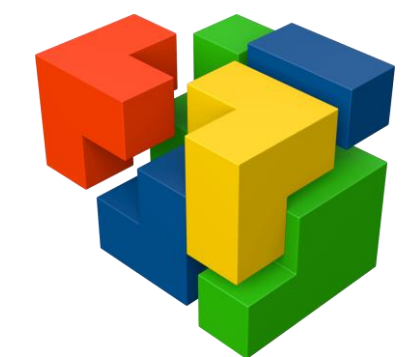
Background:
- Driven by innovation the industry is currectly facing an increasing complexity in their products and engineering processes
- Monolithic, inhomogeneous software solutions increase the overall complexity in the customers' business
- The result: Higher costs, less flexibility and agility, lower ability to adapt to new circumstances -> higher risks
- According to Gartner „Composable Applications" are the key to deliver more benefits to the industry

PDTec – *Inspiring || Engineering || Excellence*

PDTec Engineering Platform: Domain Map of Apps (Extract)

PDTec – *Inspiring || Engineering || Excellence*
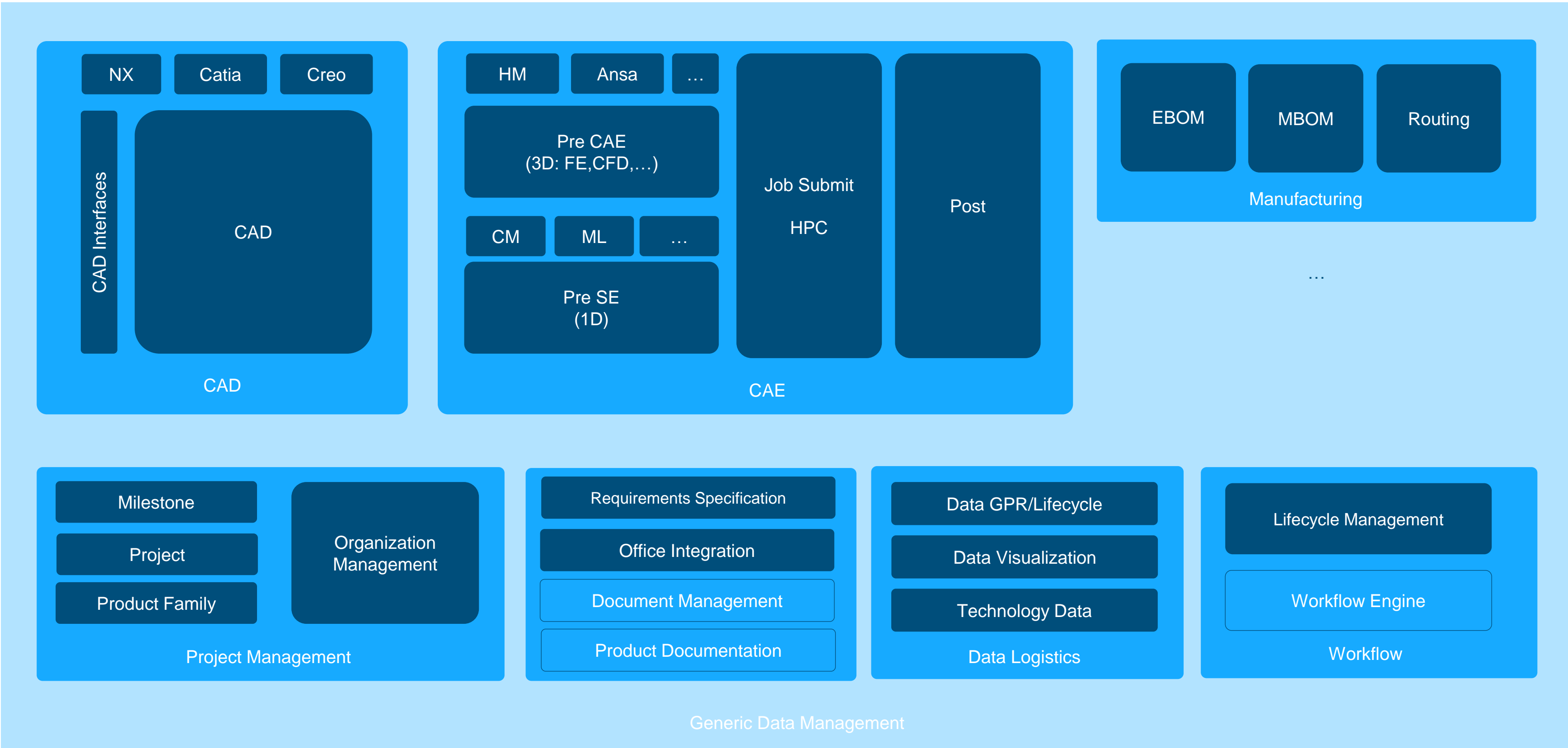
PDTec Engineering Platform driving Business Benefits

PDTec.

- SimData Manager — Expertise in CAE
- PDMconnect — PDM based Data Exchange and extended Enterprise Collaboration
- CAD Portal — Efficiency in Engineering Collaboration
- Systems Engineering Data Management — Integrated Data Management from MiL to ViL for Systems Engineers
...

Partner Solutions

- **GL TIS** - Ship Technical Information System
- **TP+** - Truck Strategic Product Planning
- **FDM** – Functional Model Data Management
- **Emission Manager** – Ship Operation/Journey Management System
- **Green Server** – Hazardous Material Inspection Management
...
- PDTec. & π — Empowering Simulation by Engineering Workflow Automation

Tools

- ice.NET Studio UML Modeling
- Business Objects Builder
- Service Builder
- Unit Testing FW
...

Base Components

- Access Control List
- User Management
- Versioning
- History / Audit Trail
- Document /Content Management
- Lifecycle Management
- Fulltext Search
- Batch Processing
- Unit of Measure Configuration
...

Application Components

- Data Exchange Framework
- Subscription / Notification
- ECM (Engineering Change Mgmt.)
- CAD Integration, Distributed Vaults
- Reporting Framework
...

Platform

UNIFIED MODELING LANGUAGE ML

[Business Objects Framework]

Microsoft .NET Framework	HTTP/S	SOAP/REST Web Services	XML	SQL (RDBMS)

Thank you!

PDTec AG
Albert-Nestler-Str. 21
76131 Karlsruhe

Phone: +49 (0)721-6 18 44-0
E-mail: info@pdtec.de
Web: www.pdtec.de

Follow us on

Automate engineering processes at scale

SPDM, Eng. Workflow automation
Strengths and challenges…

PDTec/SDM high level strengths and challenges

■ Strengths:
- Manage all CAE data & projects
- Collaborative environment
- Traceability
- Versioning
- Break silos
- Avoid rework
- Knowledge capture
- Reduces time spent on searching info (Search engine and data pedigree)

■ Challenges:
- SPDM need to interoperate with a zoo of CAE software
- Embeds business workflow logic but misses engineering workflow automation/execution.
- Gathers engineering data but doesn't embed AI.
- Doesn't include design exploration capabilities (DoE, Optim, Stochastic, etc.)
- User adoption can be challenging (seen as a burden by engineers)

pSeven Enterprise high level strengths & challenges

- Strengths (from SPDM standpoint):
  - Low-code collaborative engineering
  - Engineering tool agnostic
  - Automates engineering workflows
  - Predictive analytics suite
  - Design Exploration suite
  - Knowledge capture
  - Owns simulation context info

- Challenges:
  - Generates a lot of data
  - No traceability
  - Limited version control
  - No contextual search engine
  - Limited metadata management
  - No business workflow logic

Automate engineering processes at scale
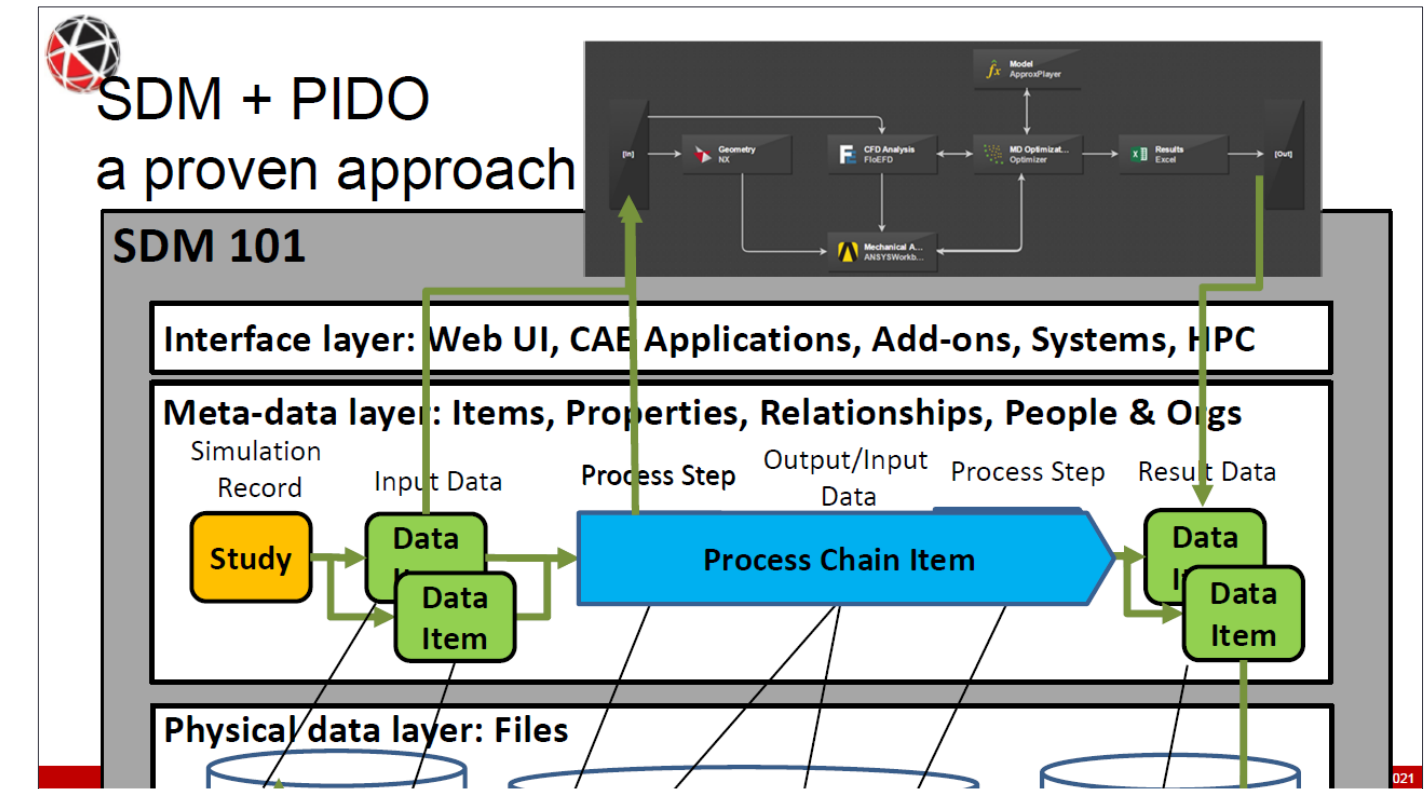
NWC 2021
NAFEMS WORLD CONGRESS
A WORLD OF ENGINEERING SIMULATION
INCORPORATING
spdm INTERNATIONAL CONFERENCE Simulation Process & Data Management
Multiphysics Simulation Conference

Mark Norris, international SPDM consultant

Cost of integrations between 100's of CAE desktop applications and platforms is a **major obstacle**

SDM/PLM1
SDM/PLM2
SDM/PLM3
SDM/PLM4
SPDM 1
SPDM 2
SPDRM
BdD Metier
BdD Metier

Data Management Platforms ← connectors → Data Preparation, Simulation, Post-Processing

Current Technology:
- Development of point to point, API to API, connectors
- 30 to 80 connectors need to be developed for an enterprise project
- Connectors need multiple versions and frequent updates
- Competences on both data platform and CAE application APIs are rare
- Conflicts between vendors, difficult to test
- Connectors specific to a platform
- ~800 connectors needed for industry coverage
- A major obstacle to digital engineering

NAFEMS World Congress 2021

SDM + PIDO a proven approach

SDM 101

Interface layer: Web UI, CAE Applications, Add-ons, Systems, HPC

Meta-data layer: Items, Properties, Relationships, People & Orgs

Simulation Record   Input Data   Process Step   Output/Input Data   Process Step   Result Data

Study   Data Item   Data Item   Process Chain Item   Data Item   Data Item

Physical data layer: Files

Conclusion

- Levering P7's process modelling and integration framework will accelerate SDM deployment
  – CAE application integrations already available
  – Integrate 1 application instead of 30+
- Simulation results can be used directly to build surrogate models in P7
- Direct CAE application integration can then support ad-hoc simulation activities

NAFEMS World Congress 2021

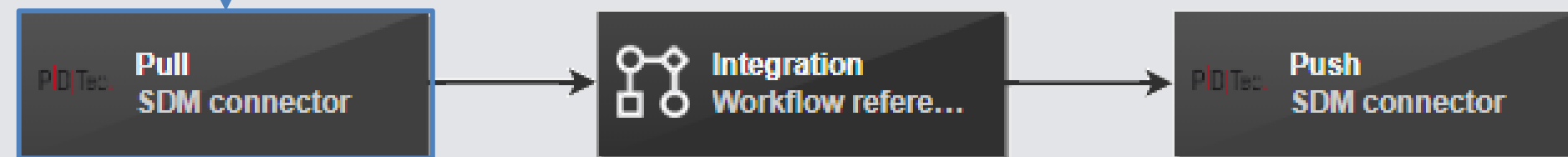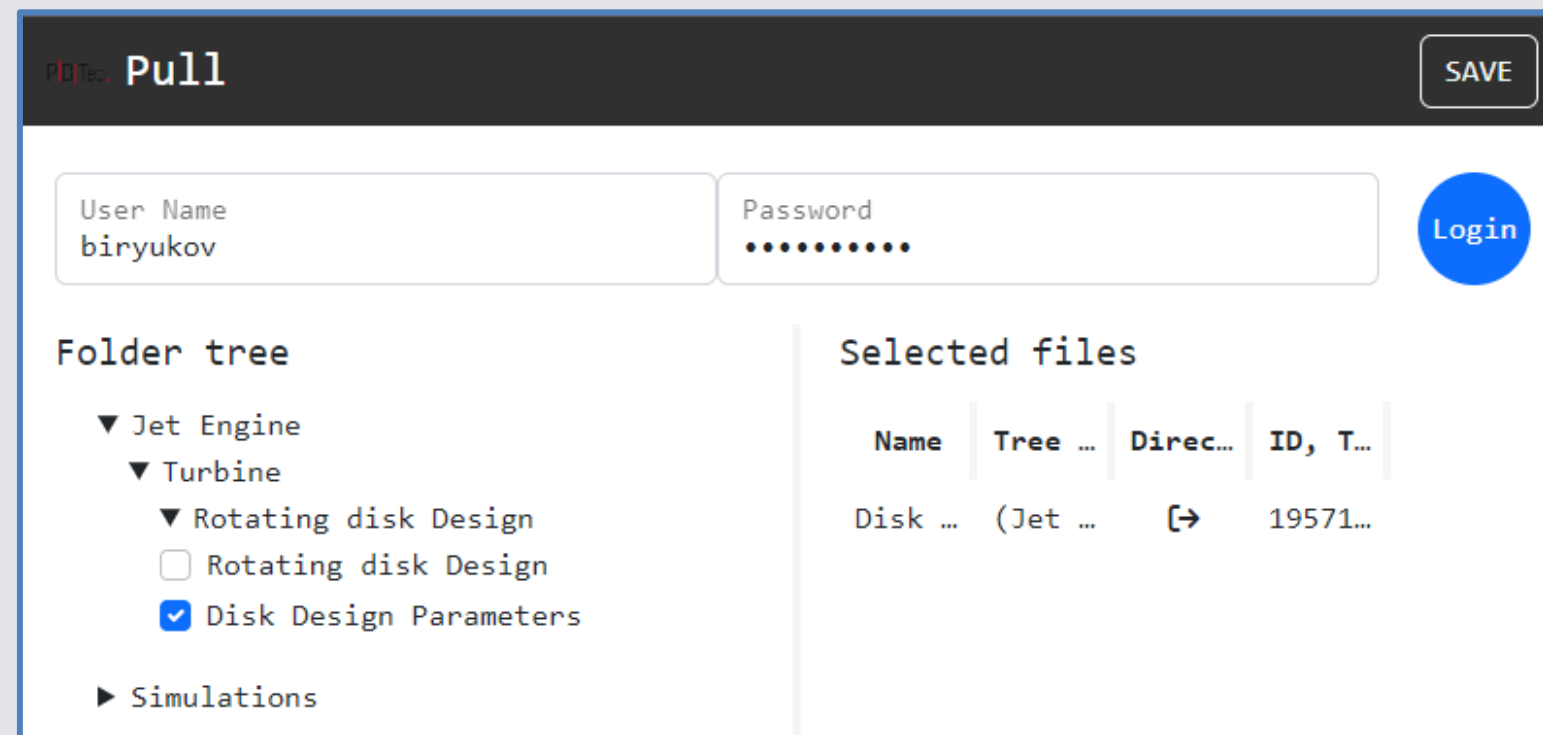Mark Norris CEng MIMechE MBA
mark.norris@theSDMconsultancy

SPDM + "Eng. Workflow Automation", a winning combination!

Interoperability

- pSeven Enterprise is universal plug, for SPDM solutions, to a zoo of software and models.


Standard SPDM block linked
to any other block/workflow

- How?
  - One single SPDM block ensures communication from/to SPDM.
  - SPDM block can be linked to any other block of the engineering workflow.

Traceability

- pSeven Enterprise naturally owns simulation context information:
  - User data (who runs what)
  - Which application, in which version
  - Hierarchy (Object B is derived from Object A)
- Context information can then be captured in SPDM as metadata and dependencies (parent/children relationship).
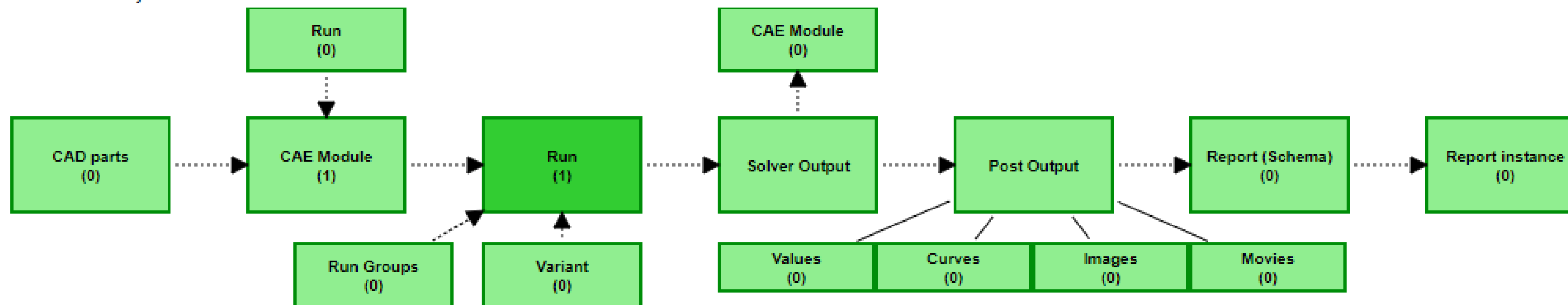
Change management

- Facilitate SPDM adoption by engineering teams
- Make SPDM deployment not intrusive
- Allow engineers to use SPDM transparently

- How?
  - Seamless integration with SPDM at workflow level.
  - No need to step out of engineering framework to manage data.
  - Special synchronization block ensures communication with SPDM (push/pull).

Version control of engineering workflows

- pSeven Enterprise workflows can be stored as version-controlled objects in SDM.
- Workflows can be redeployed on-demand to pSeven Enterprise.

- pSeven Enterprise workflows can be packaged and pushed to SDM manually or via REST API.
- Workflow blocks are also version controlled.

Run engineering workflows from SPDM as "black box"

- Engineering workflow is available as a selectable method in SPDM.
- Project manager can trigger workflow execution created by domain experts.

- How?
  - List of available workflows (method) is built **dynamically** by querying server.

Build predictive models

- Build predictive model by leveraging historical data gathered in SPDM.
- Triggering from SPDM environment.
- Predictive model can be deployed at scale or reuse in other engineering workflows.

- How?
  - pSeven Enterprise:
    - Pulls historical data from SPDM
    - Trains model
    - Validates model
    - Pushes back model to SPDM
    - Predictive model is version controlled

SDM & pSeven integration demo

- The following demo demonstrates a collaborative work on structural analysis of a turbine disk
  - *SimData Manager (SDM)* is used as an SPDM platform for storing models and simulation data.
  - *pSeven Enterprise* is used as a web-based platform for simulation processes automation.

- Two usage scenarios are observed:
  1. User works in *pSeven Enterprise* and automatically pull/push data from/to *SDM* during runs.
  2. User works in *SDM,* he selects a Pre-created *pSeven Enterprise* workflow and triggers batch execution.

THANK YOU

Visit us:
- pseven.io

Contact us:
- info@pseven.io
- 42 Avenue du Général de Croutte, 31100, Toulouse, FRANCE
- Tel: +33 (0) 6 03-84-62-92

Follow us:
- youtube.com/datadvance
- linkedin.com/company/datadvance