



pSeven  
Enterprise



# Low-code platform to create, deploy and manage Digital Twins

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President at DATADVANCE

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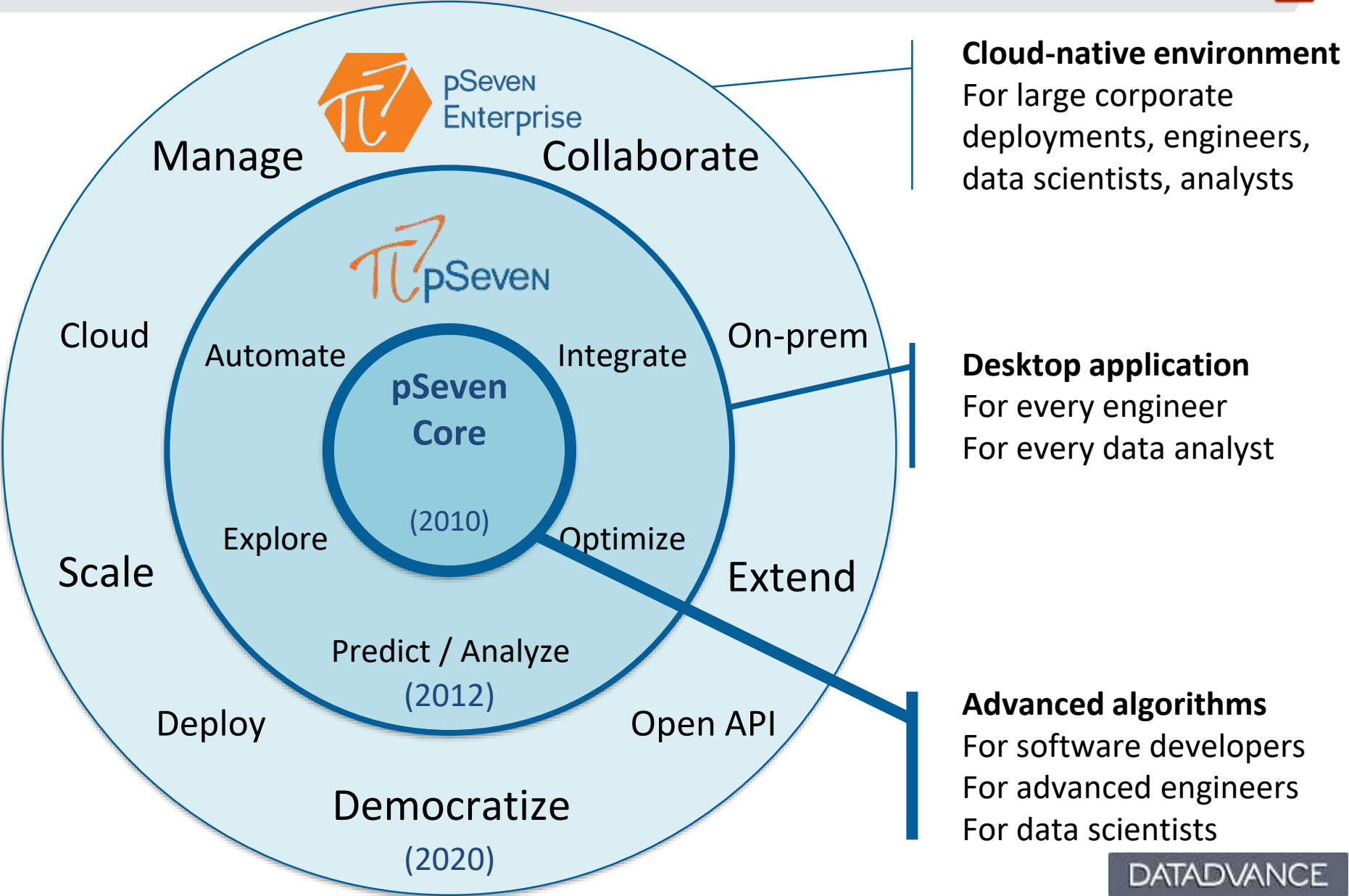
DATADVANCE

# What is a Digital Twin?

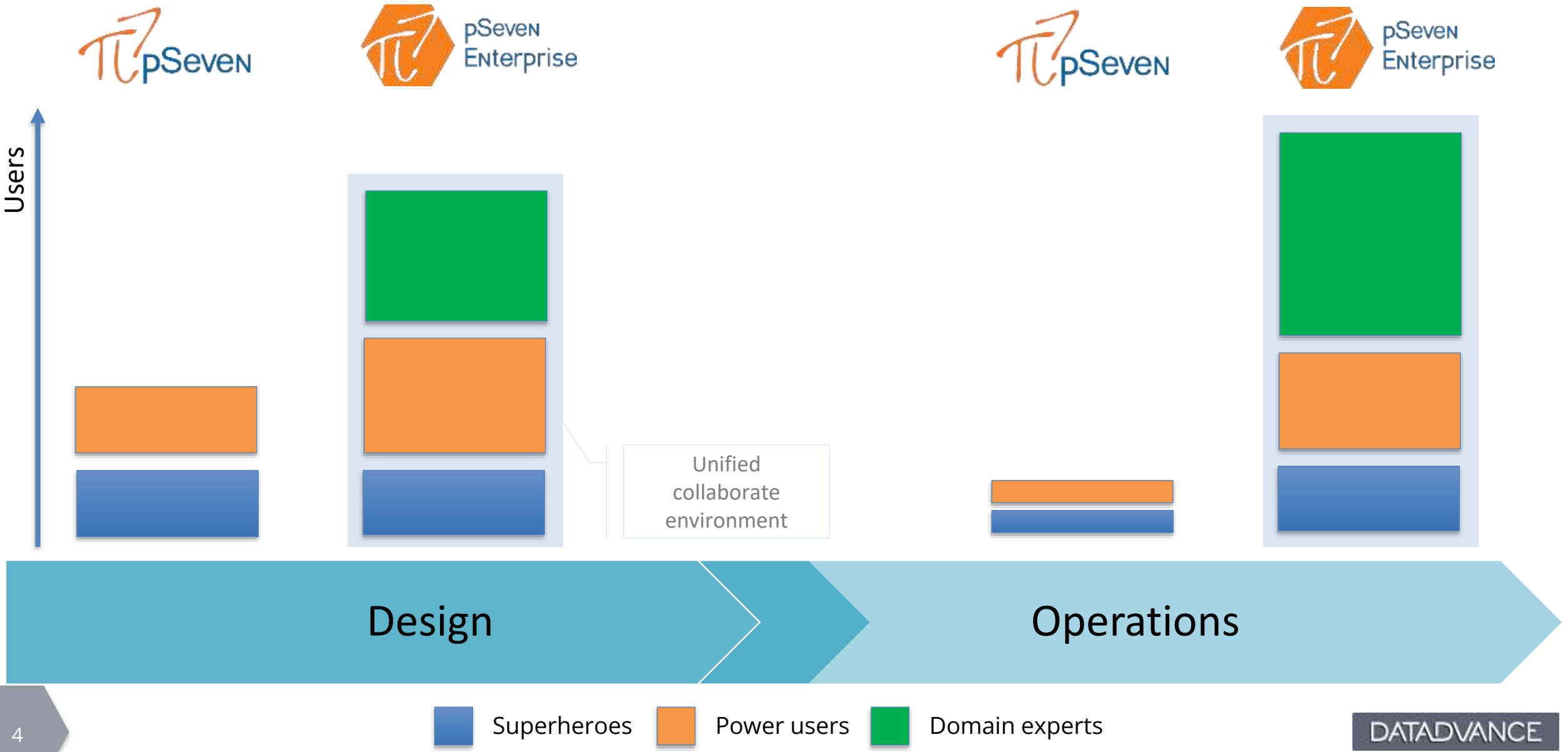
“**Digital Twin** is a virtual representation of a physical asset or collection of physical assets (physical twin) that exploits information flow to/from the associated physical asset(s).”

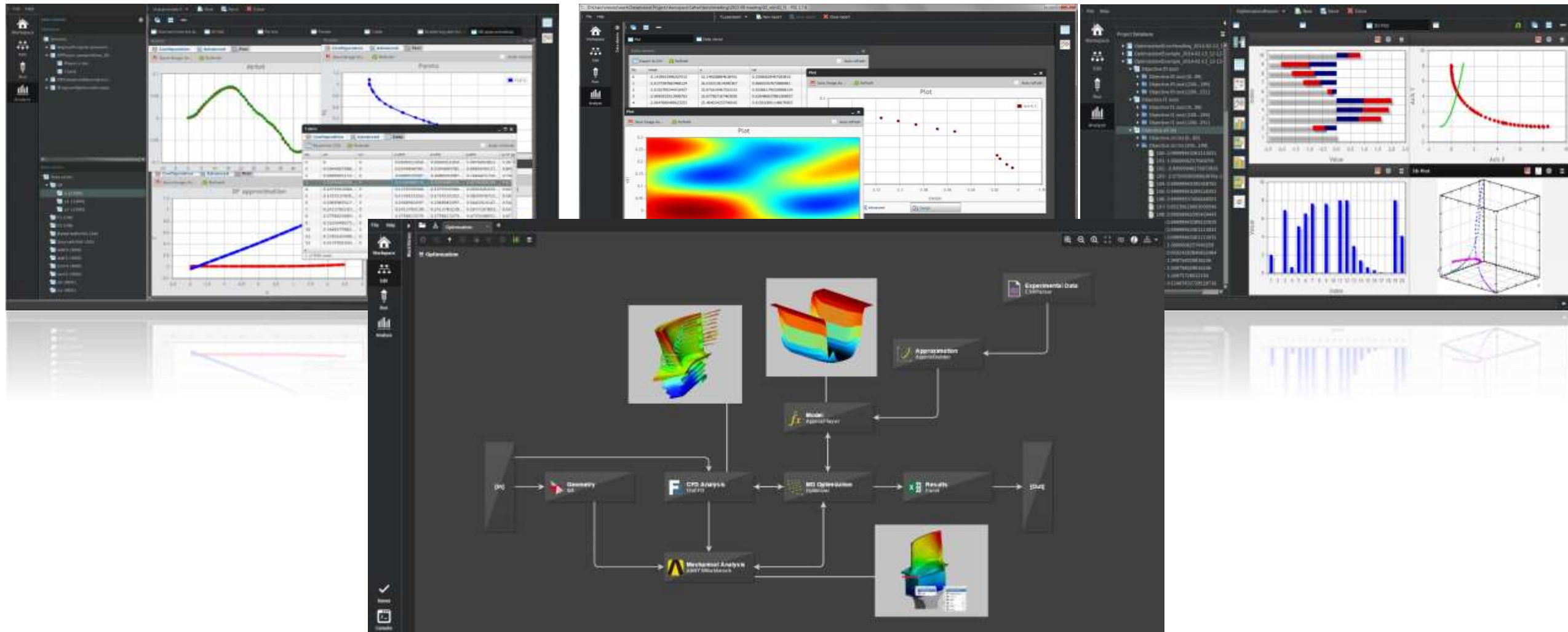
- CIMdata.





# Enabling Digital Twin strategy with pSeven







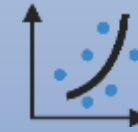
### Intelligent automation and workflow orchestration

- Capture and automate simulation and data processing workflow
- Integrate in-house and third-party CAD/CAE tools
- Perform multidisciplinary analysis



### Design Optimization

- Solve multidisciplinary optimization problems
- Access Robustness and Reliability
- Make smart design and operation decisions



### Machine Learning

- Build predictive models
- Identify model parameters
- Validate and Explore data-driven models



**SmartSelection** – automatic selection of the most efficient technique





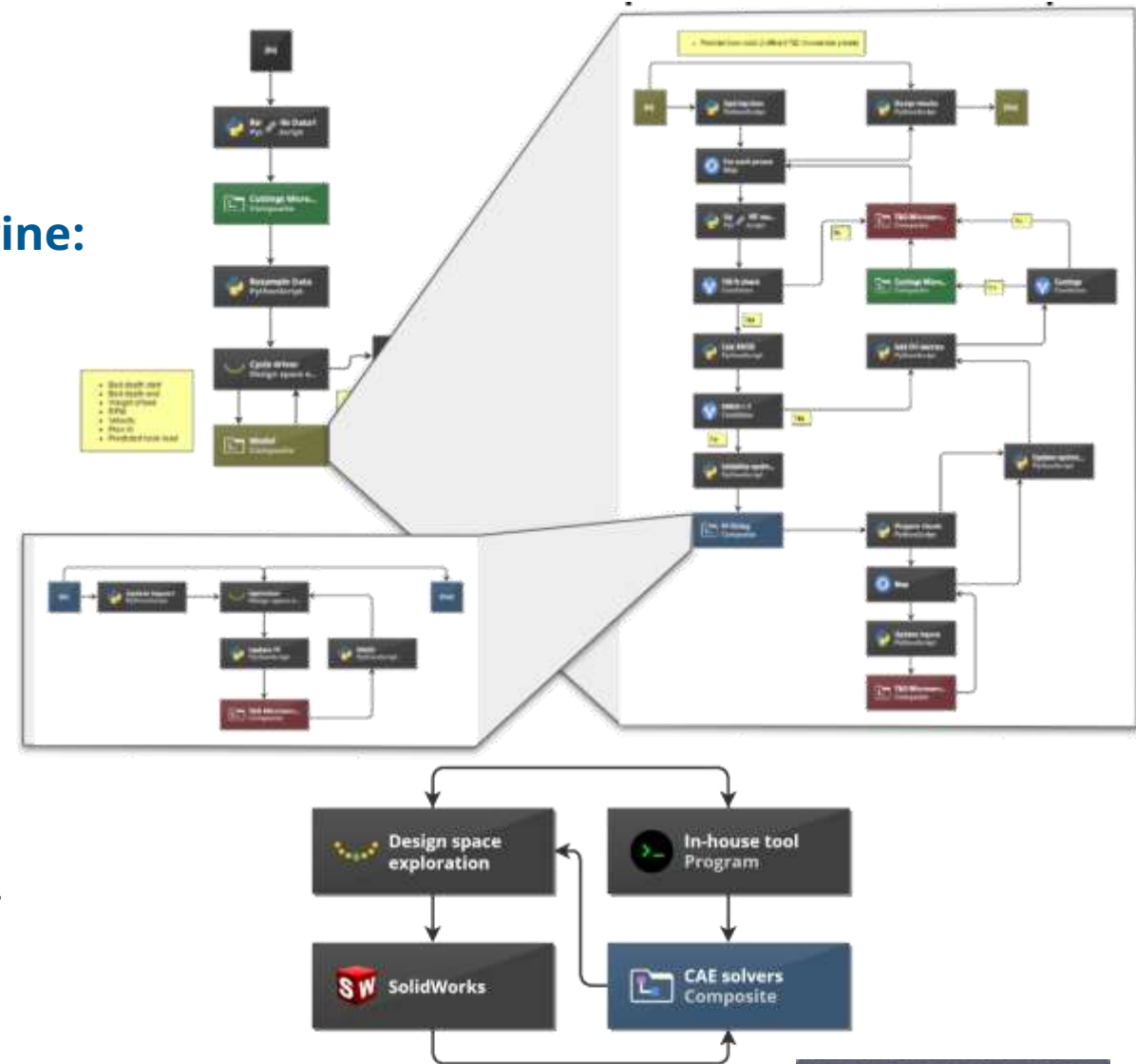
## Capture Simulation, Data Analytics and Optimization processes

### Powerful workflow automation and orchestration engine:

- Intuitive and visual definition of complex processes
- Implementation of logic operations and nested loops
- Local and *limited* remote execution
- Automatic parallelization
- Error handling, caching and data reuse

### Built-in library of blocks

- Native blocks for all major CAD and CAE software tools
- Generic integration for the most of other CAD/CAE third-party and in-house tools





# SmartSelection: You don't need to be math expert to use pSeven



Unlock Advanced  
Math for Every  
Engineer and Data  
Scientist



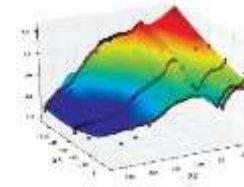
Problem  
description



SmartSelection



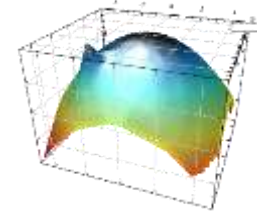
Predictive Modeling



13  
Techniques



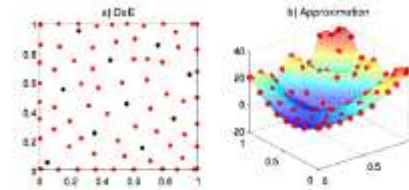
Optimization



20  
Algorithms



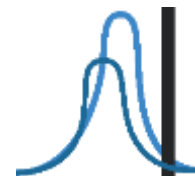
Design Of Experiment



16  
Techniques



Uncertainty Quantification



5  
Techniques





# Design Optimization → Better Decisions in Shorter Time

## Easy and effective solution for most of industry optimization problems:

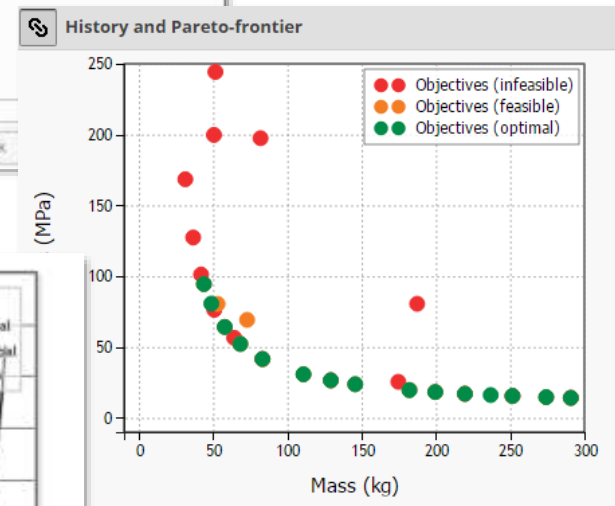
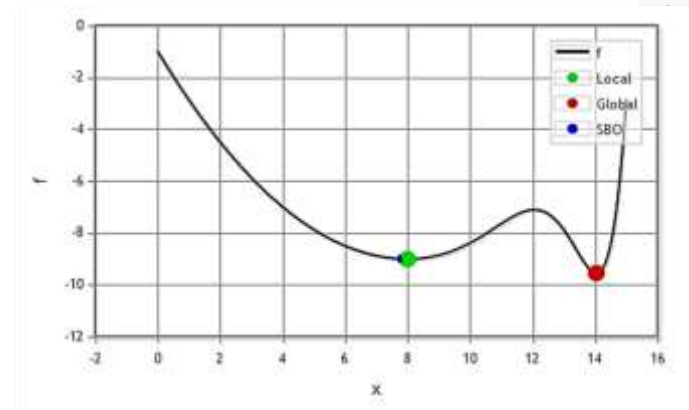
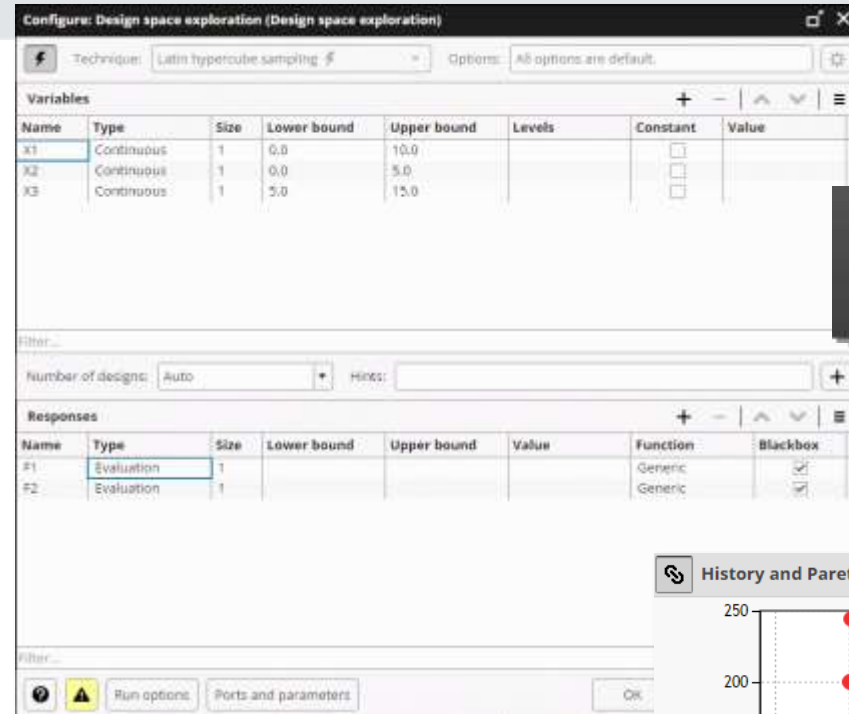
- Single- or multi-objective, robust optimization
- Large dimensionality\*
- Long model evaluation time\*\*
- Continuous and discrete input variables
- Nonlinear, multimodal or noisy objective functions and constraints
- Presence of implicit constraints and domains of undefined behavior
- Presence of uncertainties



SmartSelection chooses the optimization algorithms automatically and adaptively!

\* - Up to 100 design variables for nonlinear time-consuming models

\*\* - For example, any CAE model





# Predictive Modeling → Build and Validate Models in a Few Clicks

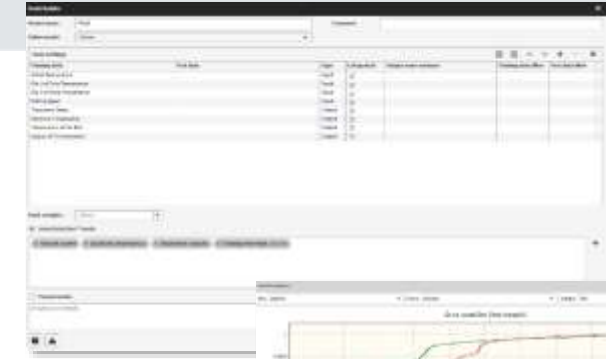


## Dedicated set of tools for building and managing predictive models:

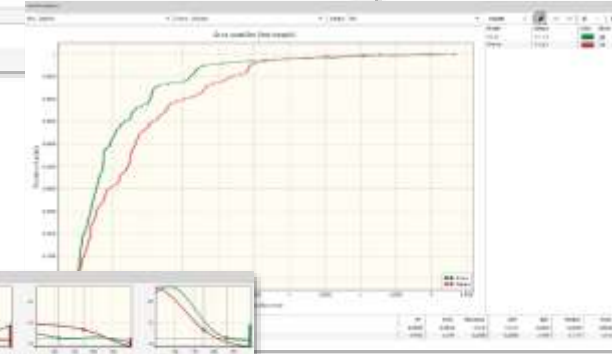
- Build fast and robust **predictive** models with **automatic** selection of technique – **SmartSelection** (similar to AutoML)
- **Validate**, test against reference data and compare models to find the **best** approximation quality
- **Explore** behavior of multidimensional models with studying input-output dependencies
- **Export** models to external **file**, including C source code, executable, Matlab/Octave, Excel and FMU/FMI
- Automate data processing using Workflows



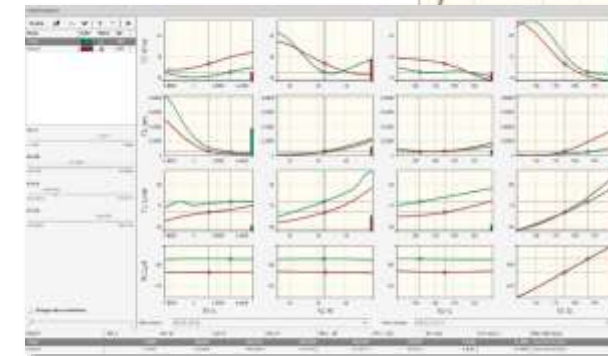
**SmartSelection** selects the most efficient **technique** for a given problem and data **automatically**!



Model Builder



Model Validator



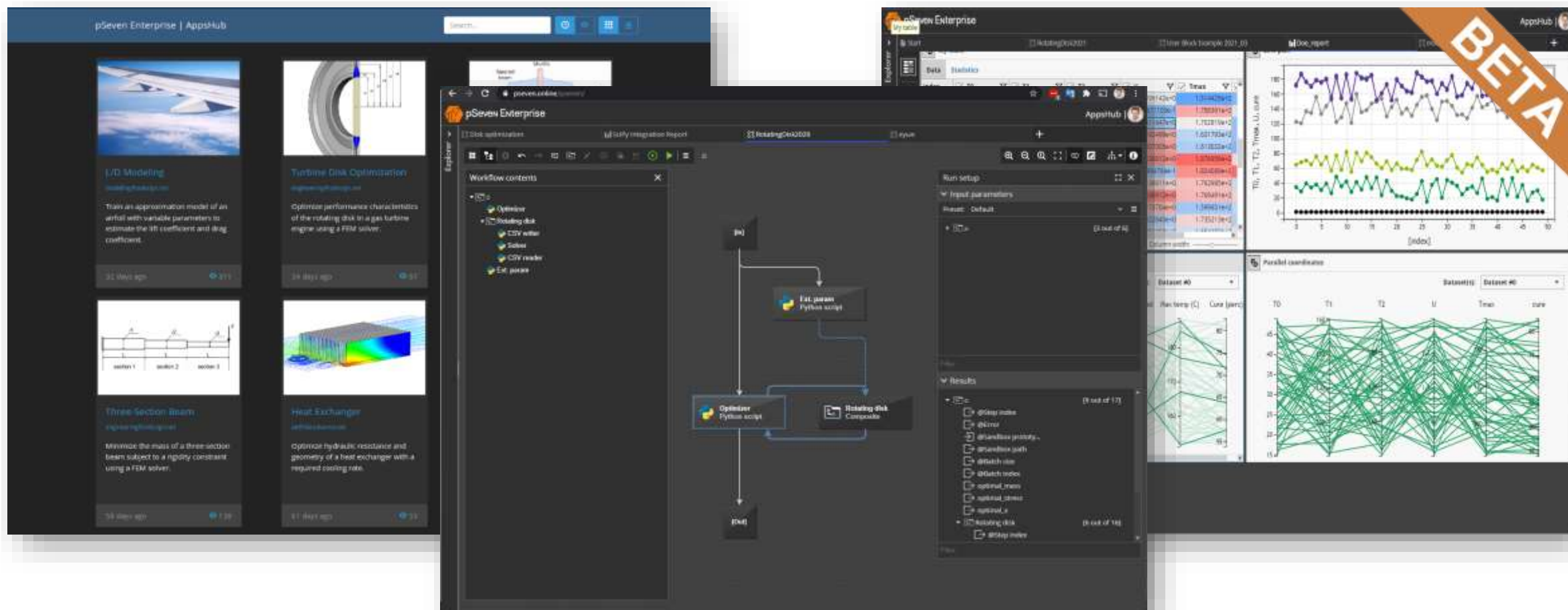
Model Explorer





## pSeven Enterprise AppsHub

## pSeven Enterprise Analyze



## pSeven Enterprise Studio



**Intelligent automation and  
workflow orchestration**



**Growing platform-native  
block library**



**Custom integrations,  
algorithms and block library**



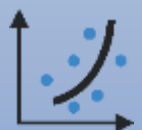
**App Development  
One-click Deployment**



**AppsHub**



**Interoperability / API**



**Machine Learning &  
Optimization**



**Multi-user collaborative  
environment**



**Cloud-native scaling**



## Full-fledge visual programming:

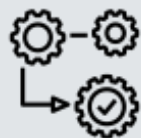
- Intuitive and visual definition of complex processes
- Implementation of logic operations and nested loops
- Automatic parallelization
- Error handling, caching and data reuse

## Very similar to pSeven except for:

- Execution in a multiuser distributed heterogeneous environment
- True collaboration environment
- Open API
- ...

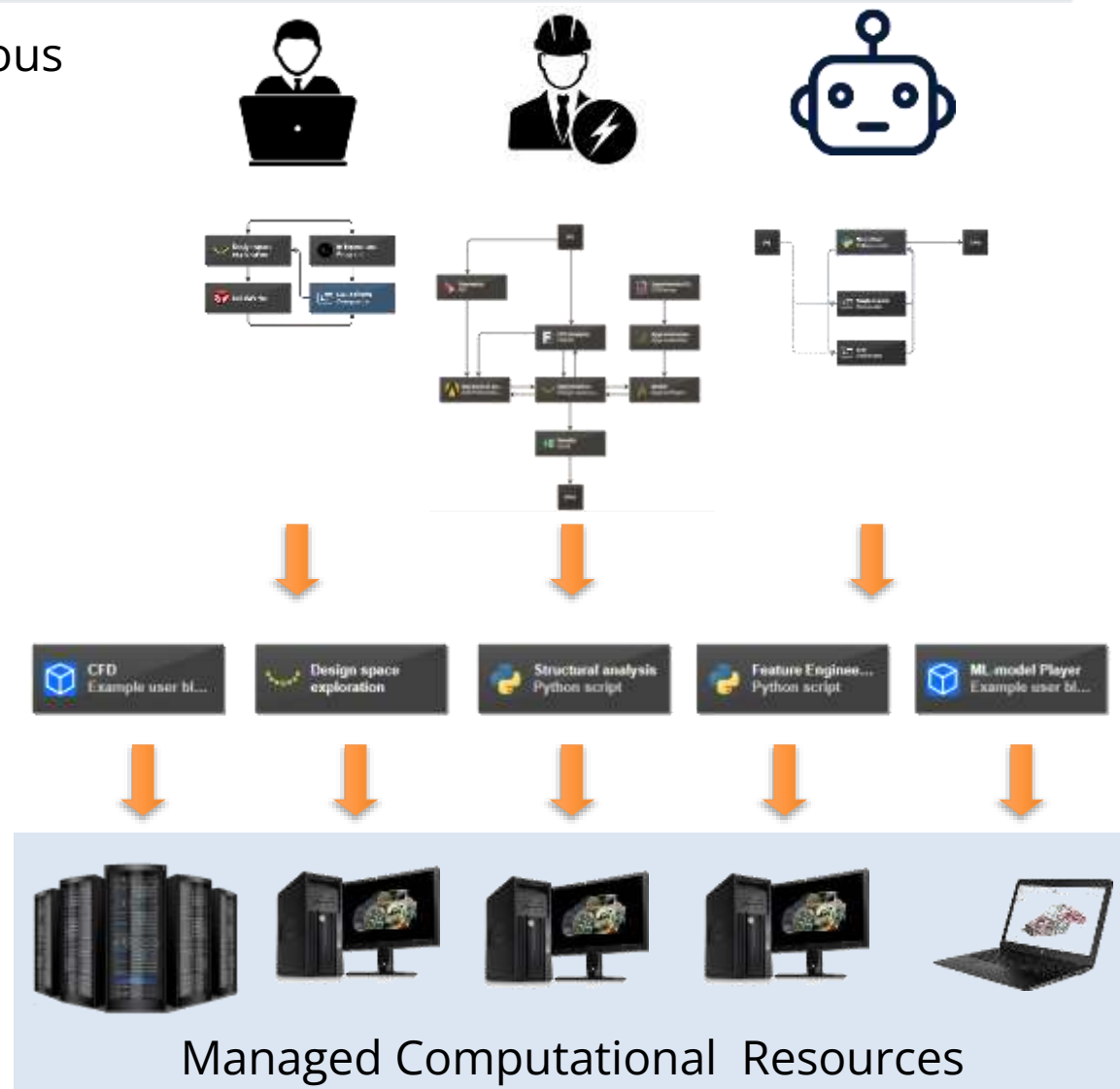






# Workflow Execution and Orchestration

- Execute workflows in a multiuser distribute heterogeneous environment (Linux + Windows)
  - Manage Computational Resources
- Many users run many resource-consuming processes simultaneously
  - Server will manage the demand for resources automatically
  - Number of concurrently running workflows is limited by your license
- Run as a Service
  - On schedule and based on triggers [coming soon]
- Monitor and manage running processes from anywhere
  - Status of all workflows is represented on Dashboard







## Use industry proven pSeven Core library

- Efficient proprietary Machine Learning algorithms
- Powerful Single- and Multi-objective Optimization algorithms
- SmartSelection technology

## Dedicated Optimization and ML blocks

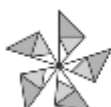
- “Design Space Exploration” block (since 2022.05)
- “Approx Builder” and “Approx Player” blocks [coming soon]

## Use your favorite Python ML/optimization library

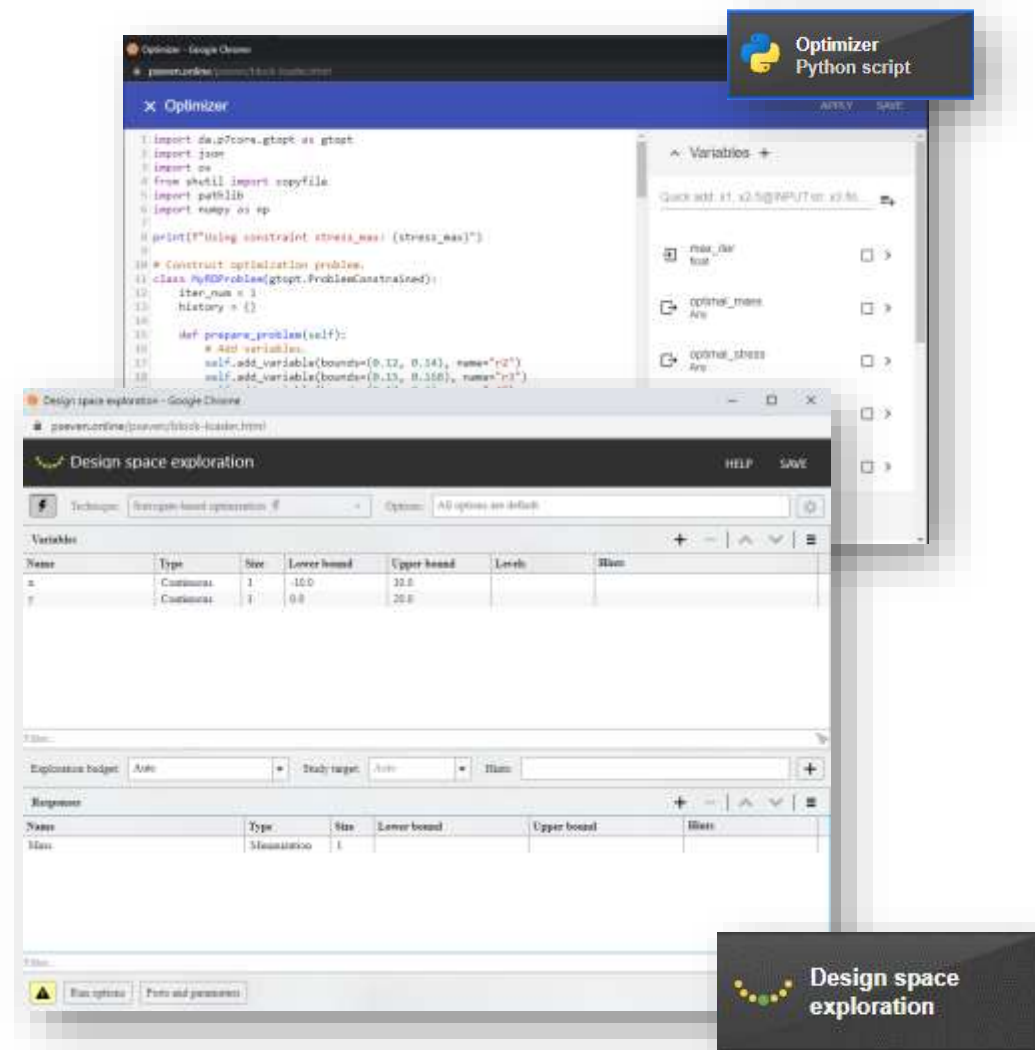
- scikit-learn, TensorFlow, Keras, ...
- Nevergrad, Gurobi, ...



Keras



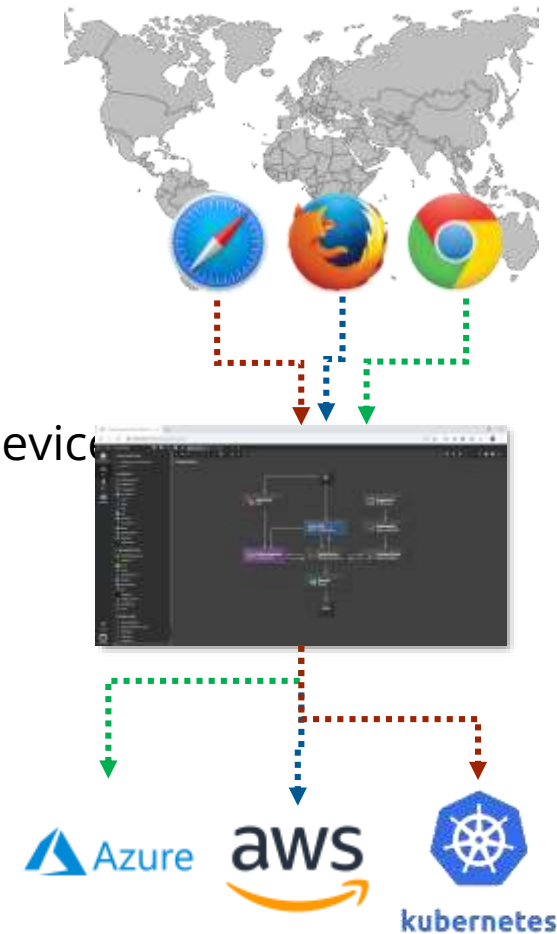
ONNX  
RUNTIME





## Install once and access from anywhere

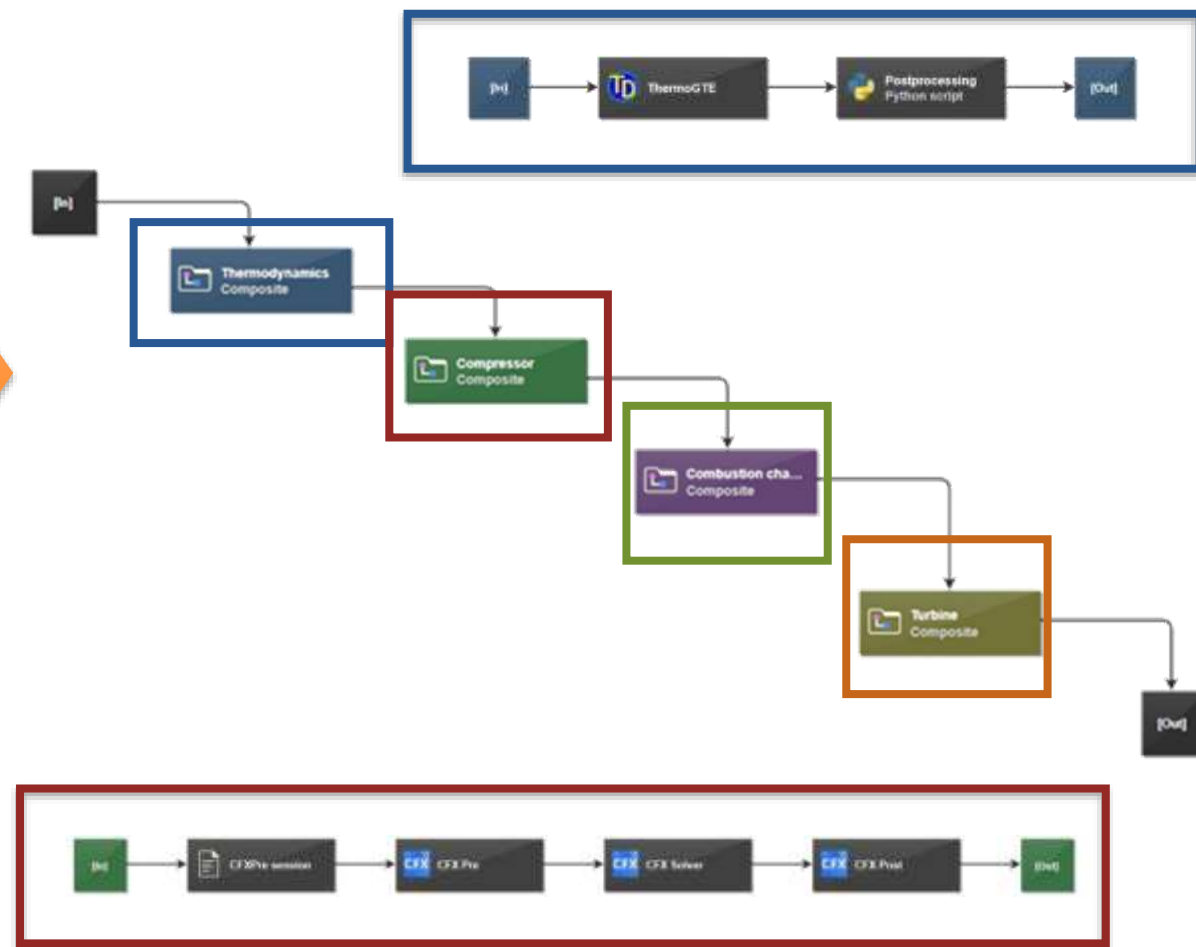
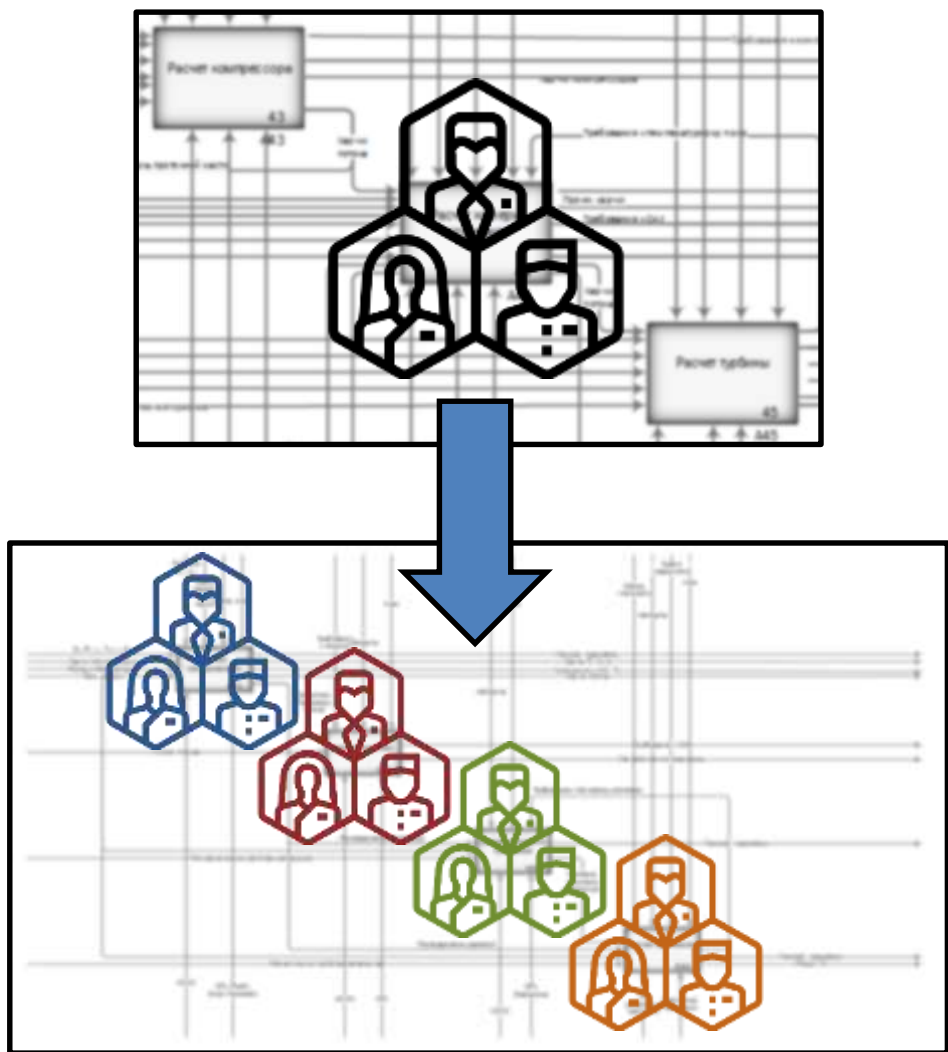
- pSeven Enterprise runs in a predefined and well-controlled IT environment :
  - On-premises (Bare metal + Kubernetes + ...)
  - Private cloud (AWS, Digital Ocean, Azure, Google Cloud etc.)
- Platform independence - Access from any browser and any device
- Single-Sign-On and AD/LDAP integration (using [Keycloak](#))
- One installation to support:
  - Simple installation with HELM on any Kubernetes cluster
  - Seamless version update (zero downtime update is coming soon)



- Access through browser
- pSeven Enterprise web application
- On-premises (k8s)
- Private or Public cloud

**We don't operate pSeven Enterprise! You install and operate it!**

# Enabling true Multidisciplinary Digital Twins through Collaboration



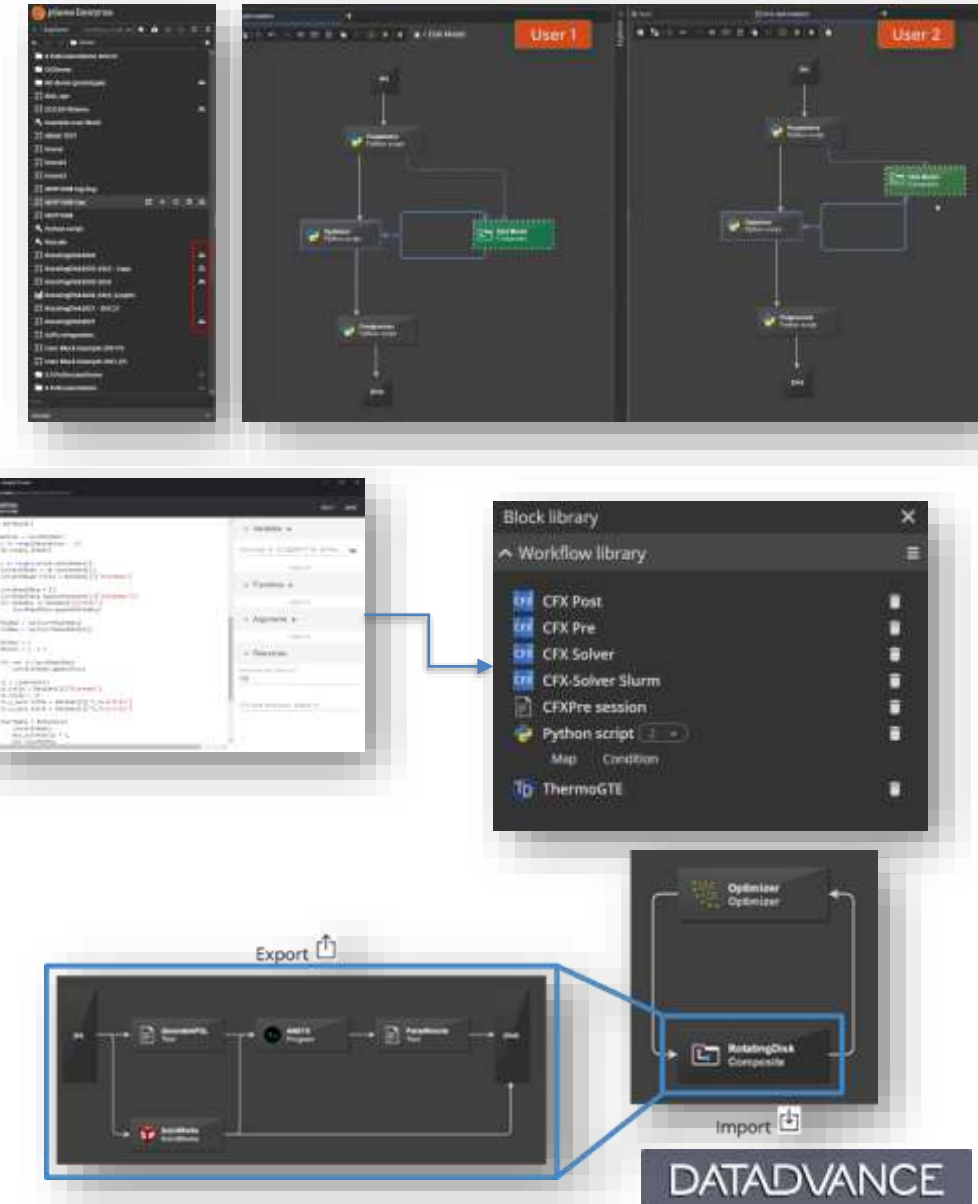
# Enabling true Multidisciplinary Digital Twins through Collaboration

## Levels of Collaboration

- Team level → Department level → Enterprise level → External Ent
- Superheroes → Power users → Domain Experts

## Key features to Enable Collaboration

- Multiuser environment
  - Co-authoring in real time and Sharing → No moving files
- Develop and Share User-defined/Custom blocks
  - Wrap and Embed in-house software tools → Block
  - Block → Workflow → Master Workflow
- Workflow and Common Library
  - Standardize tools across Enterprise
- Versions & Snapshots [coming soon]
- Workflow cross-reference [coming soon]
- [Open architecture](#) → PLM/SPDM
- [AppsHub](#)
  - Publish ready-to-use Apps and Services
  - Reuse as building blocks in Workflows





## Superheroes

- Create and share a framework and a library of tools tailored to specific business domain, for example, by wrapping and striping general purpose CAD/CAE/ML tools
- Ensure enterprise-wide automation principles, e.g. by providing workflow templates
- Define and formalize/standardize development, deployment and operation principles

Superheroes alone  
Simply do not Scale

## Power users

- Solve business problem using visual programming / low-code, macro-blocks and, maybe, a bit of programming, but without direct involvement of “superheroes”
- Easily build, deploy and manage ML models
- Automate problem solution, build applications and services, faster and at scale

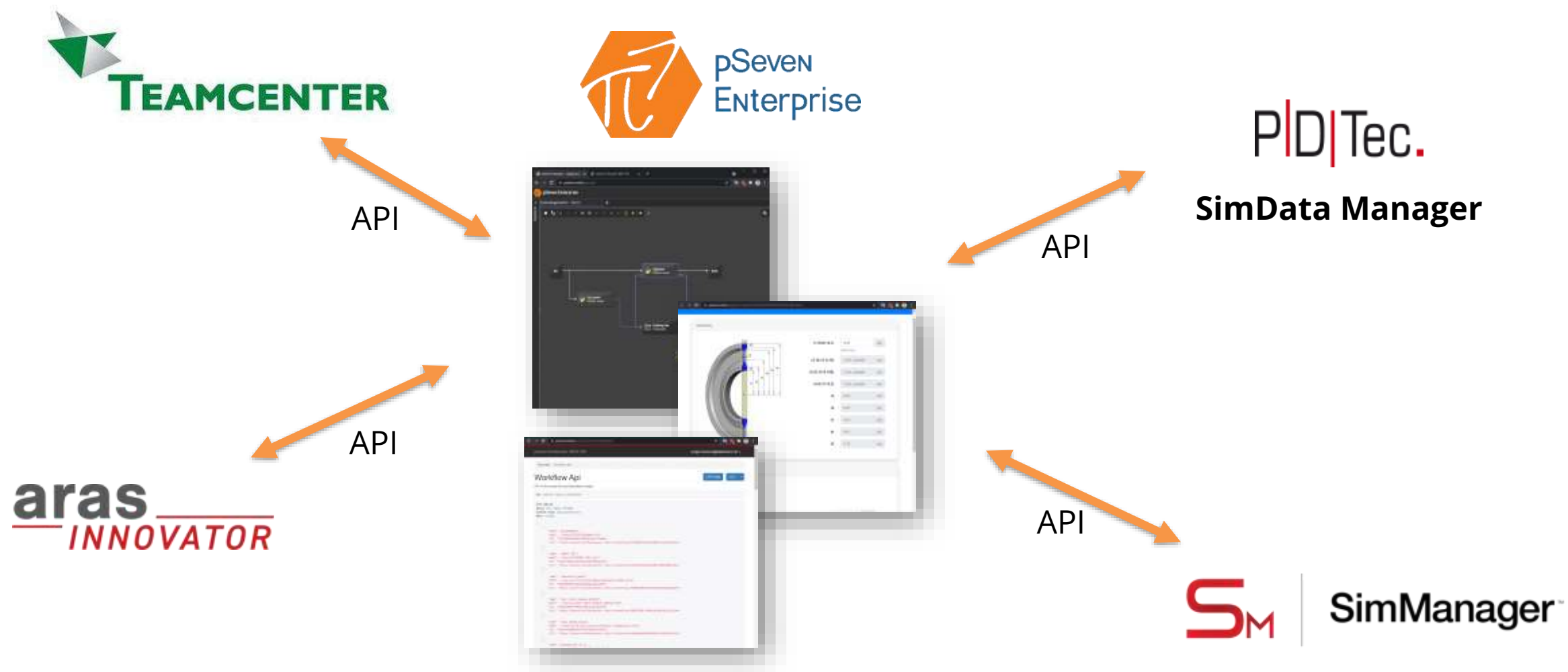
### GARTNER PREDICTS:

“By 2024, low-code automation and application development will be responsible for more than 65% of application development activity”

## Domain Experts

- Solve business problem using problem specific / dedicated applications and services without even a single line of code

Only “No-code”  
Just does not Work

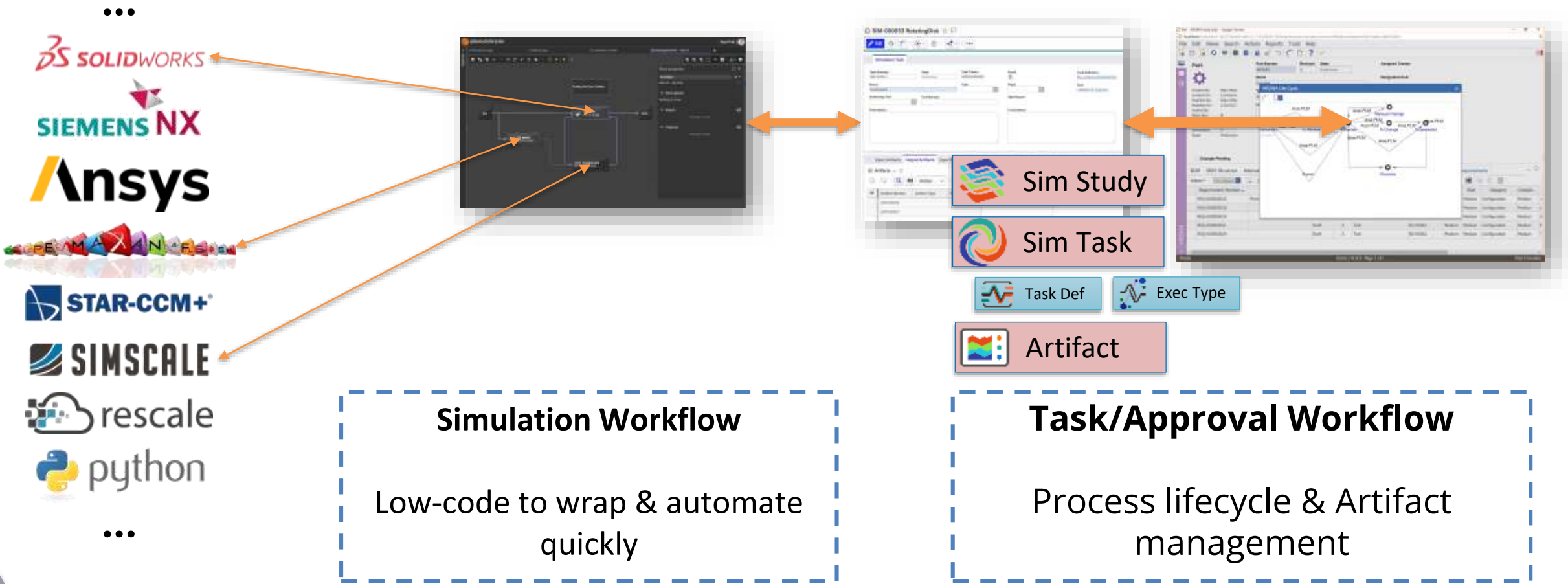




# Extending Simulation Process and Data Management Platforms: ARAS Innovator use case

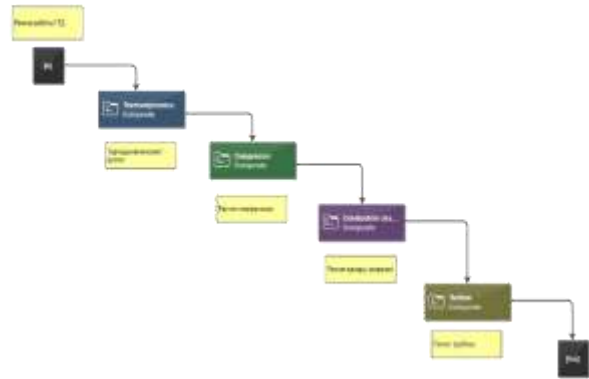


CAD/CAE  
In-house tools



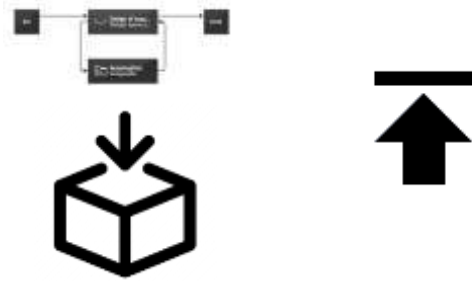


## Power Users



Create automated workflows

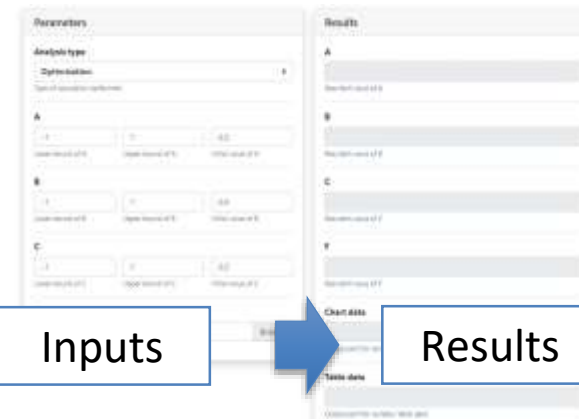
Setup simulations, load data, tune algorithms, ...



Package and Publish fully automated workflows to **AppsHub**

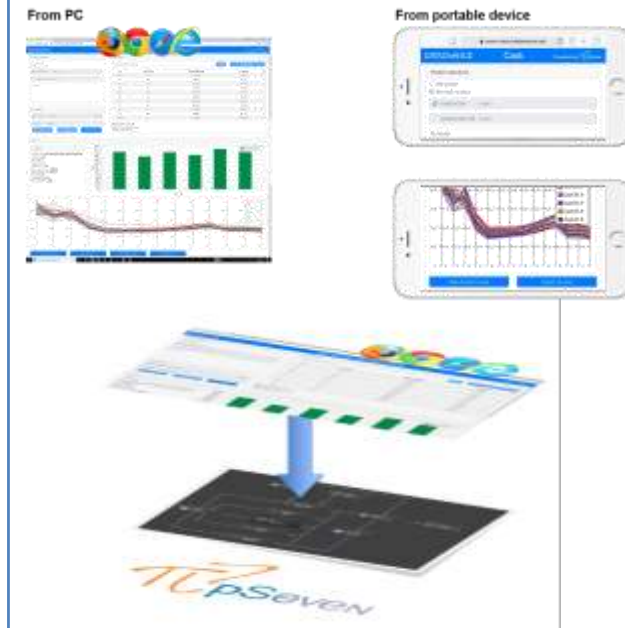
Experts can build Custom UI themselves, using any web UI framework

## Domain Experts



Run Workflow-Powered Apps using auto generated UI

Specify inputs, run and analyze results, ...

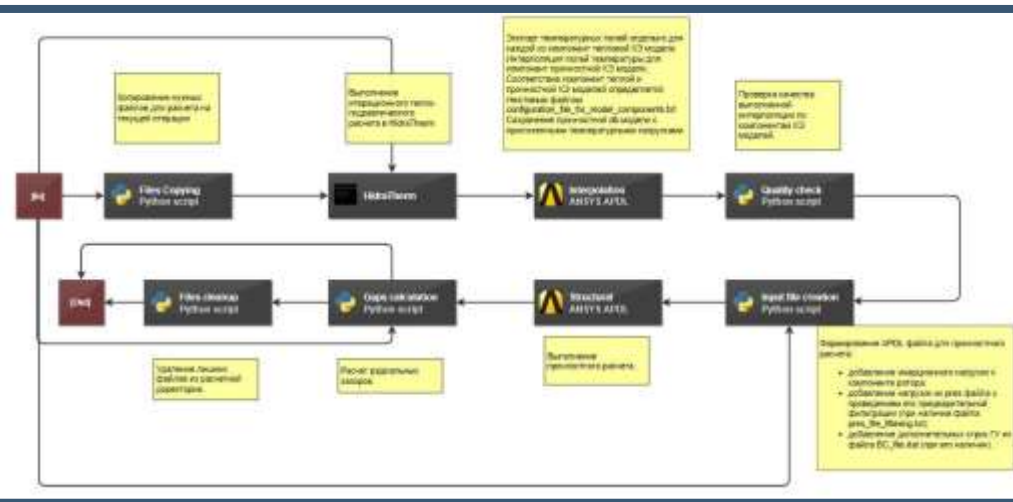


Use Workflow-powered Apps with Custom User Interface

## pSeven Enterprise Studio

## AppsHub

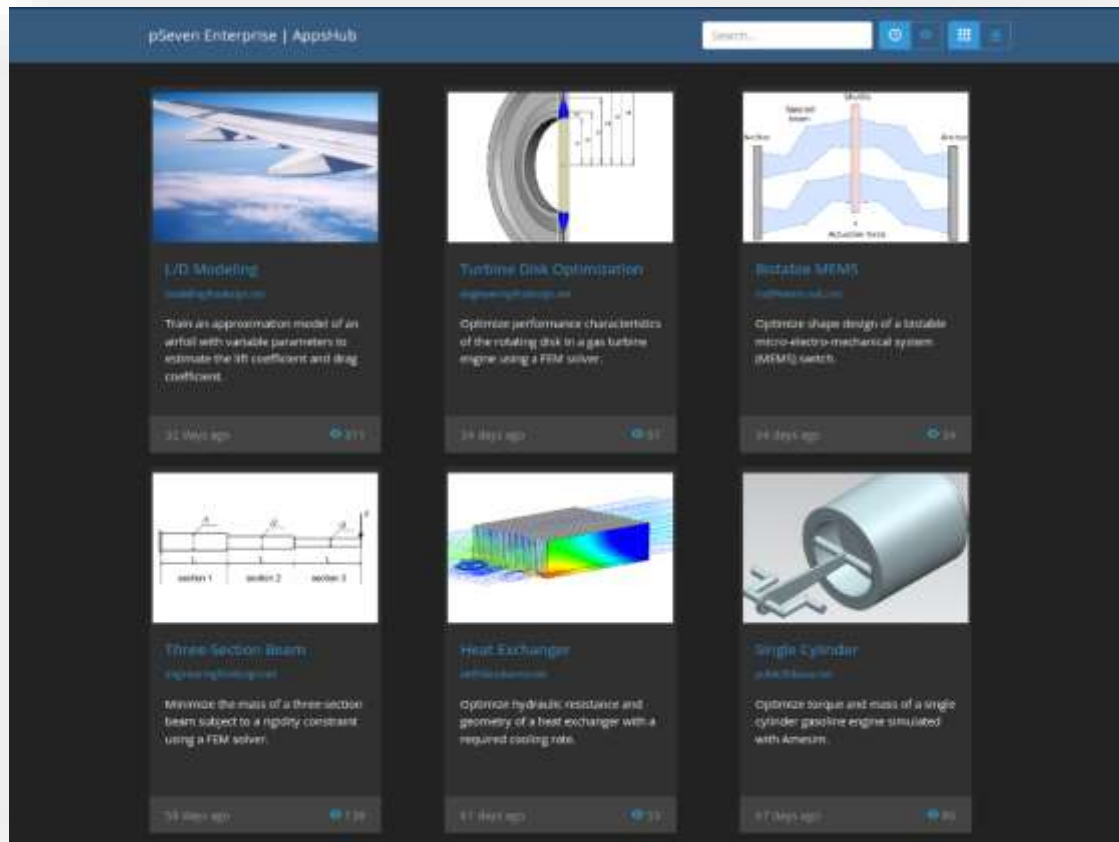




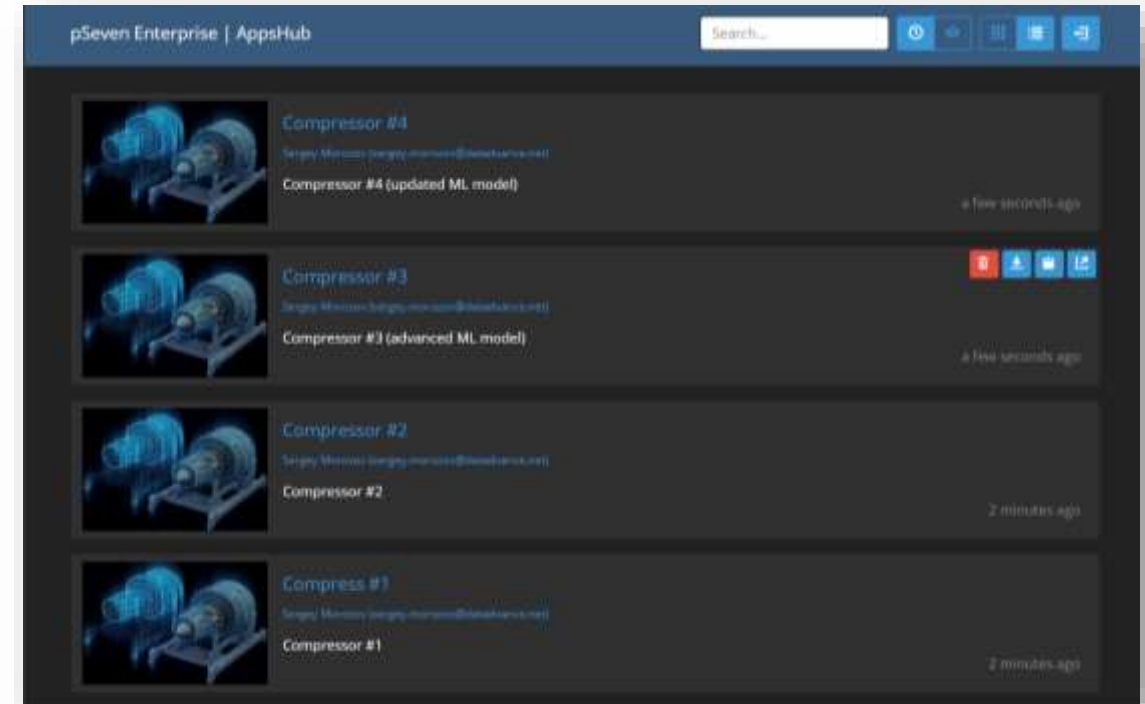
- **Capture Multidisciplinary Analysis using Low-code → x4 productive gain compared to traditional approaches**
- **Massive simulation campaigns by Domain experts is enabled by Engineering Application**



# AppsHub – a Gallery of Apps and Services

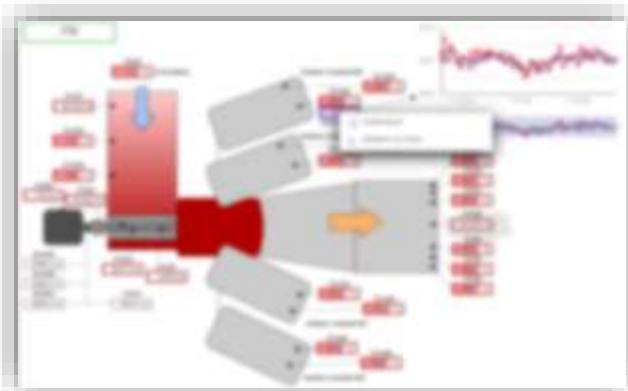
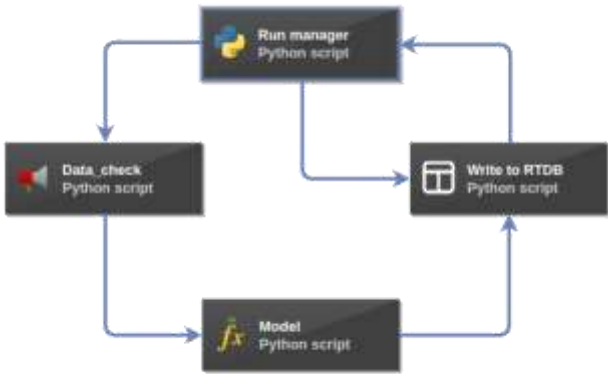


Engineering Applications



Workflows and Models as Services

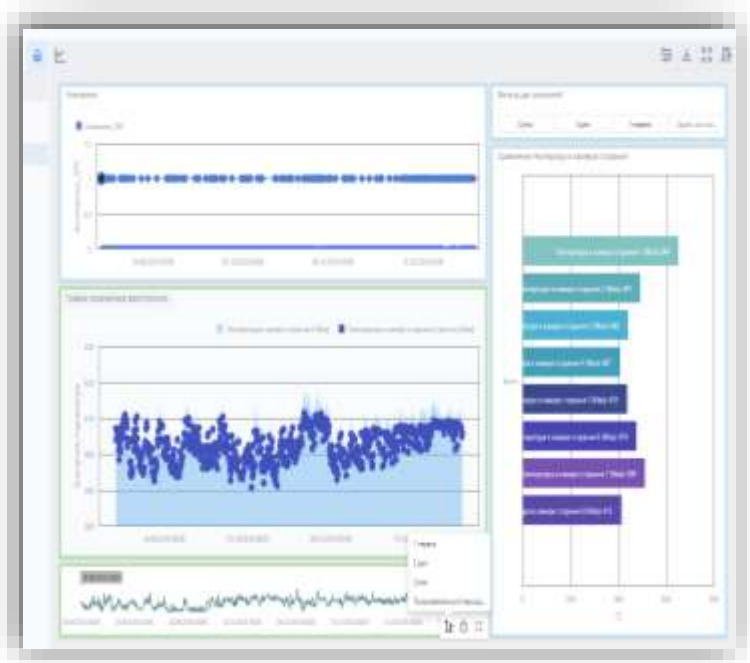
# Fast and Accurate Models as Services are essential for Operational Digital Twins



Fast and Accurate Model  
for the given purpose



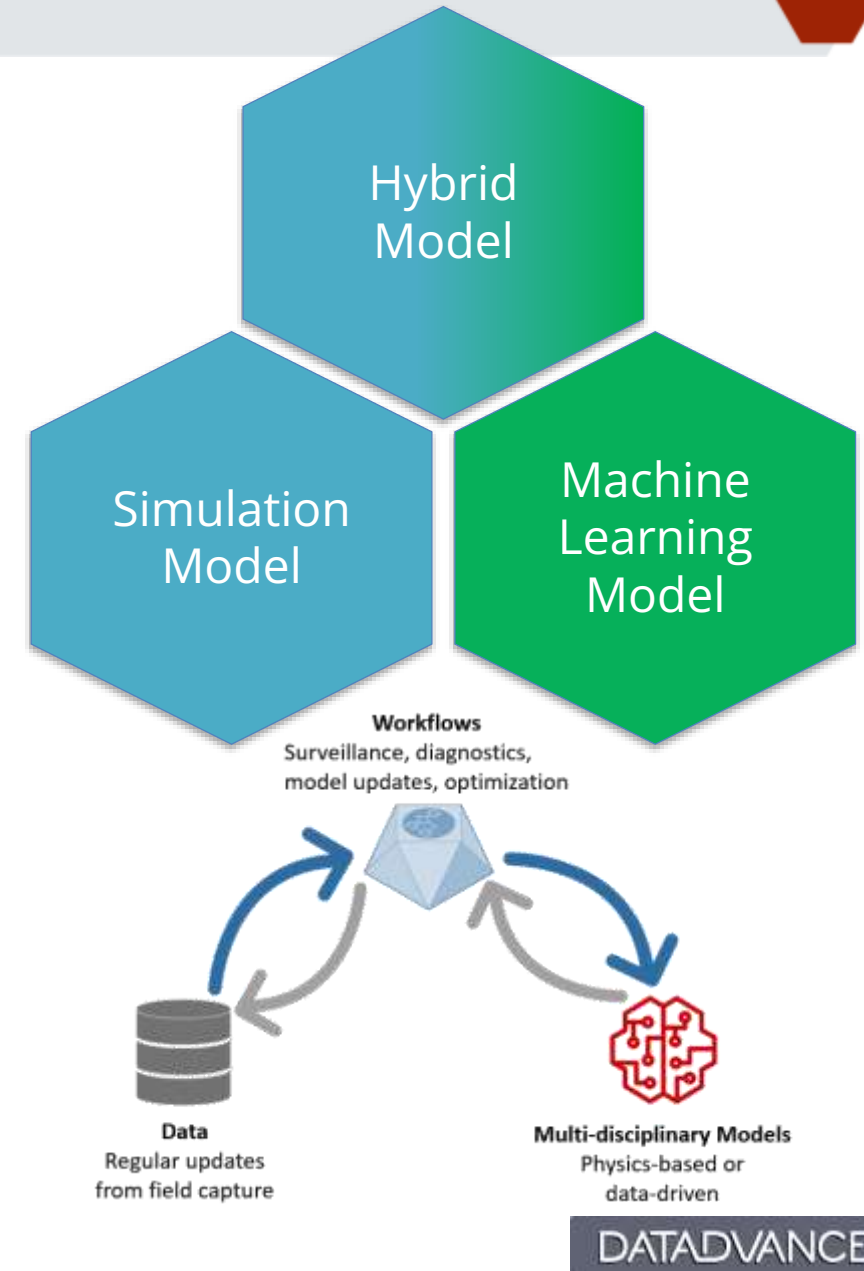
Feedback, Commands,  
Process Optimization



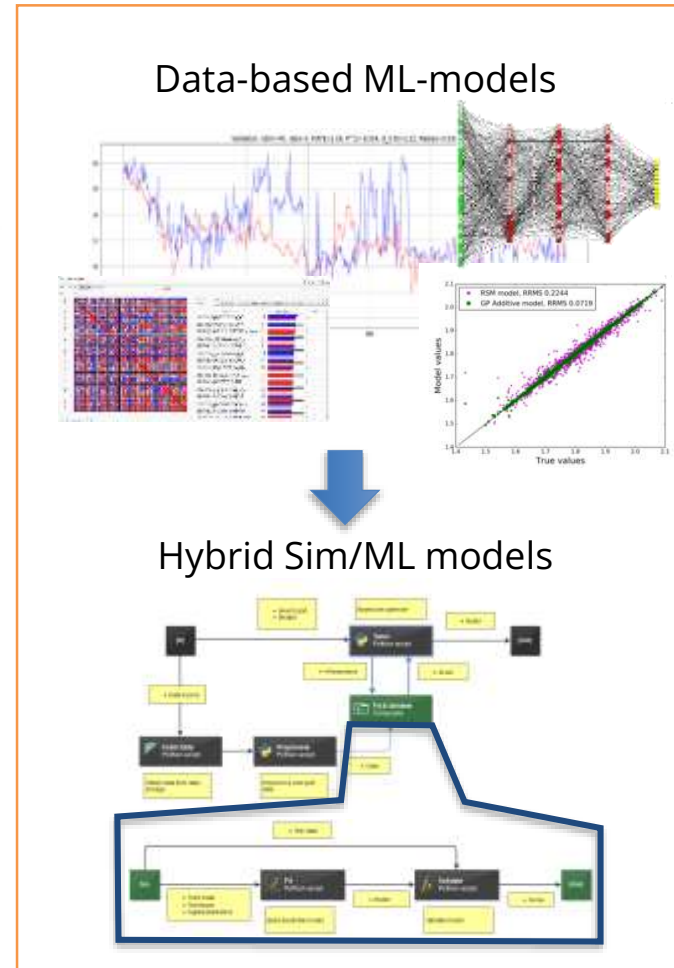
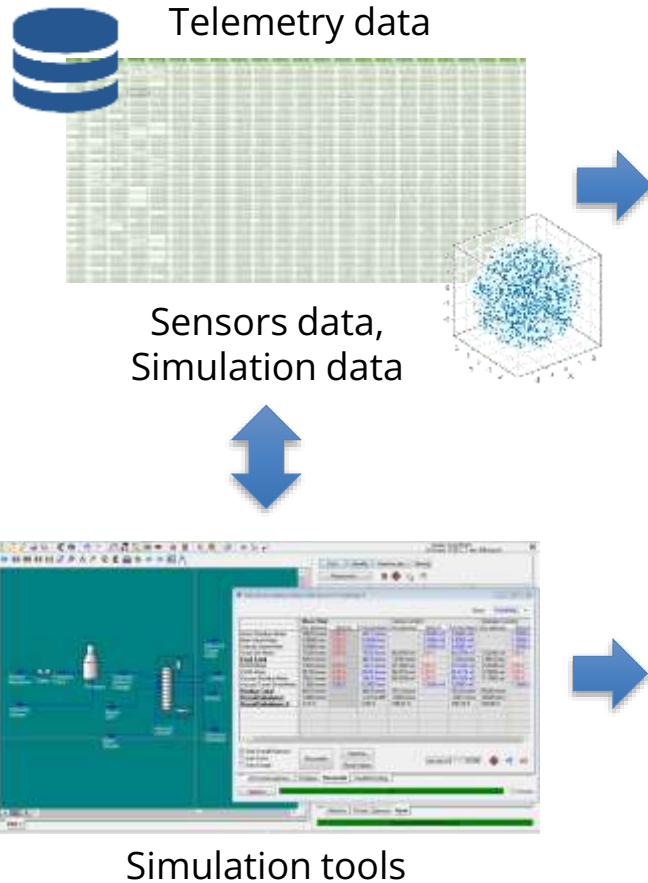


## Fast and Accurate Models → Hybrid Digital Twins

- Hybrid digital twin combines the benefits of **simulation** and **machine learning**.
- Simulation models** can be used directly (or exported from specialized software, for example in FMU/FMI format).
- Adaptation of **simulation models** to real operational data without the involvement of engineers to manually fine-tune **simulation models**. **ML models** embedded into **simulation models**.
- Building models using **machine learning** methods based on operational data and/or synthetic data obtained from **simulation models**.
- Re-training of **ML models** is carried out constantly, allowing you to give relevant recommendations when changing operating modes.







## Applications

...

Planning & Scheduling  
with fast and accurate  
process models

Real-Time Process  
Optimization

Fast and reliable  
prediction of the  
resources

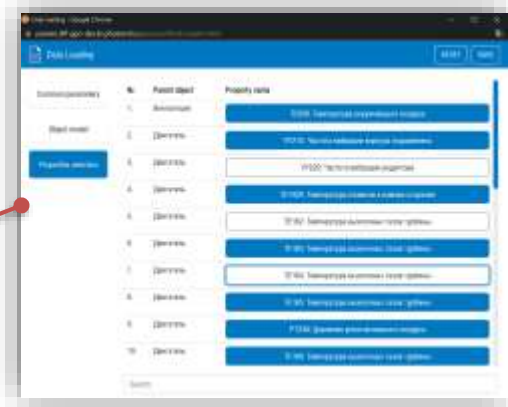
Adaptive design of  
experiments to find  
optimal process  
parameters with less  
experiments

...

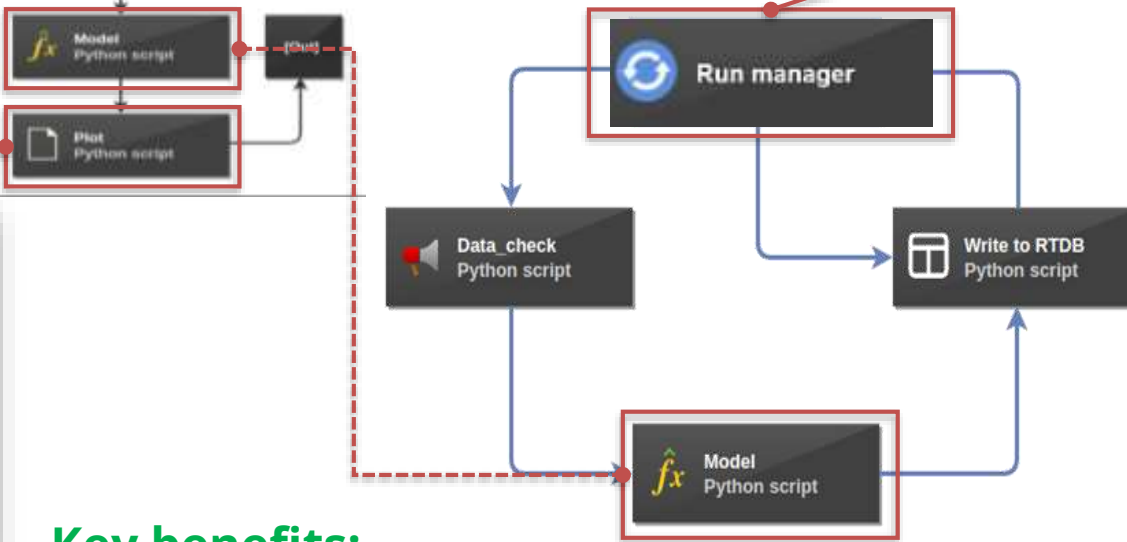
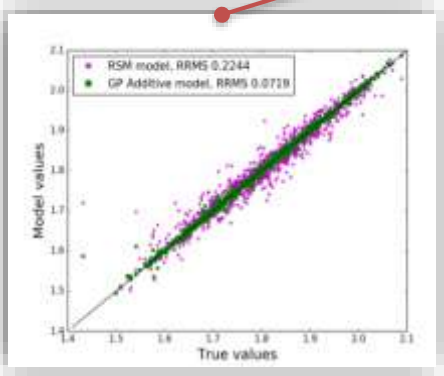
# Build, Validate, Deploy and Manage Models at Scale using Low-code



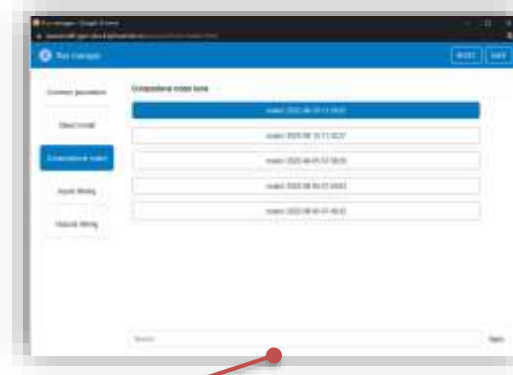
## 1. Build



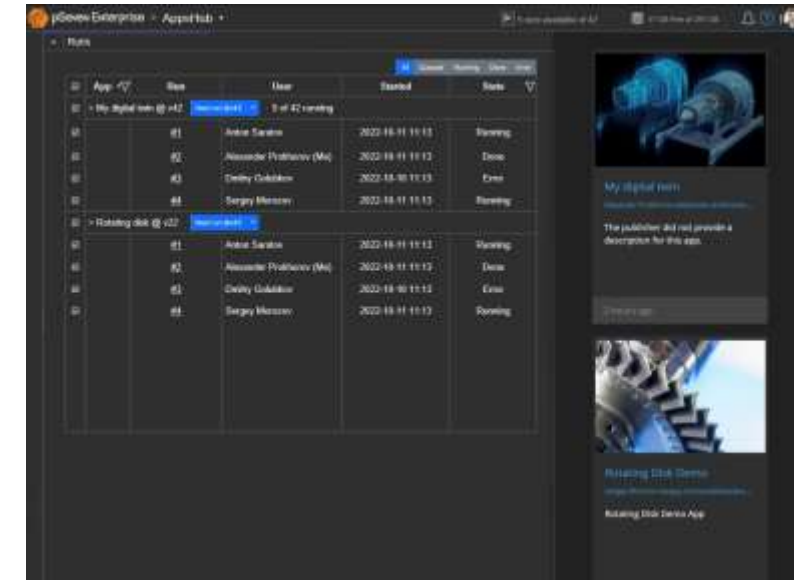
## 2. Validate



## 3. Deploy



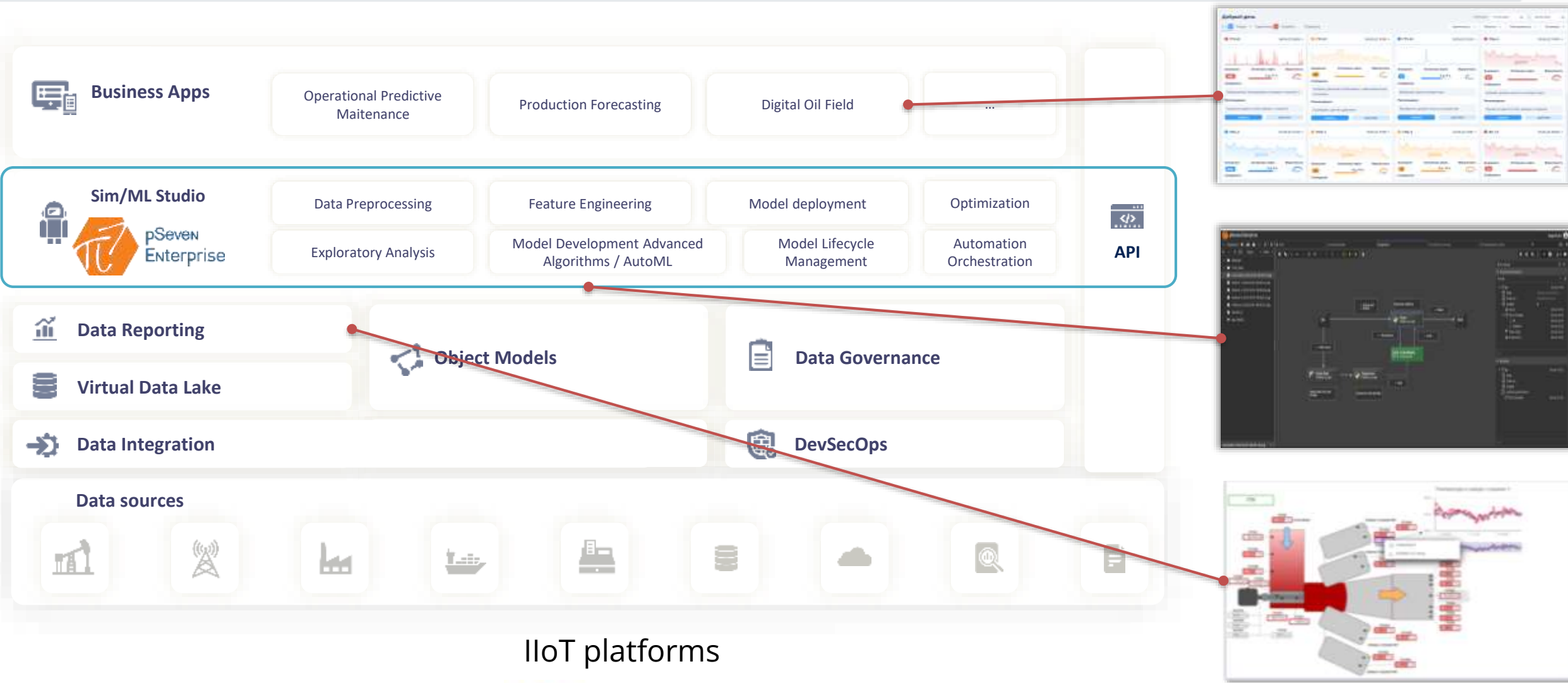
## 4. Manage



### Key benefits:

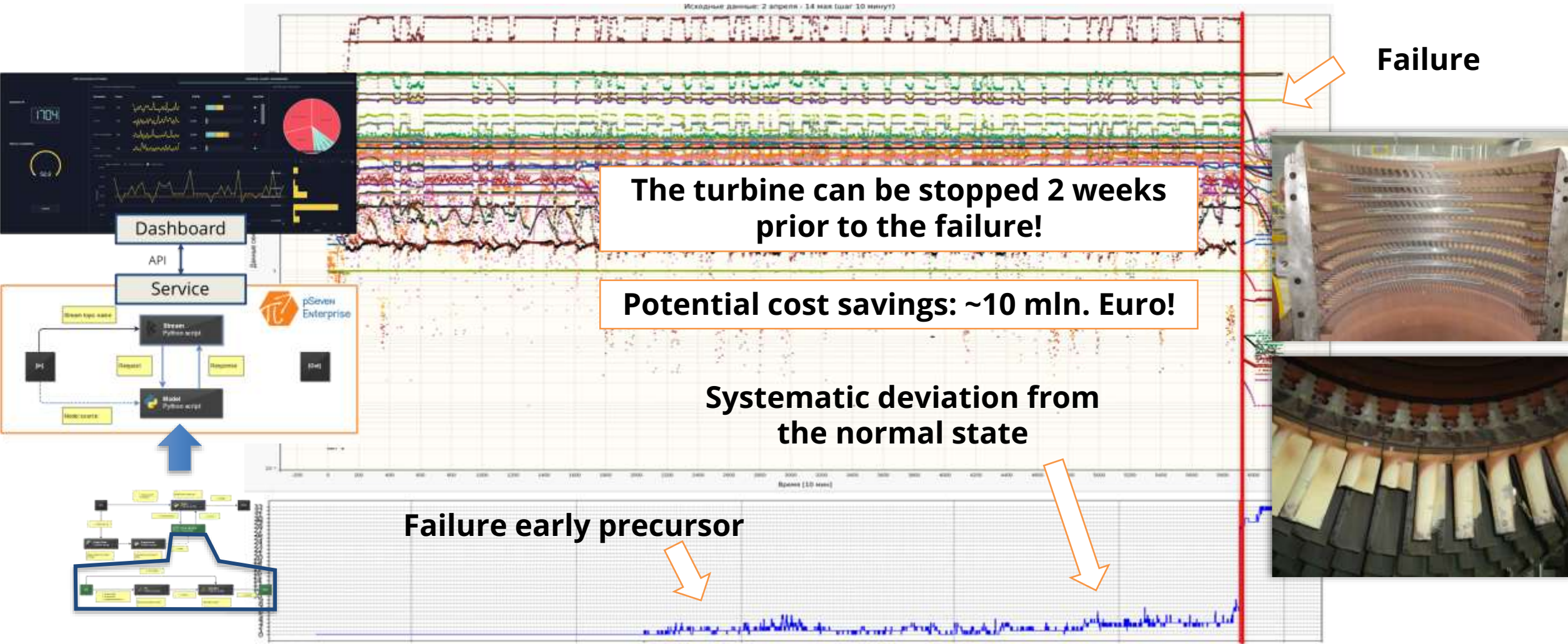
- x2 engineers productivity gain
- x2 time reduction to bring Sim/ML models to production

# (Sophisticated) Infrastructure for Operational Digital Twins



IIoT platforms







## Productivity Gain, Rework Reduced

- Rapidly build and deliver models, processes and apps to your business needs with existing talents.
- Share best practices elaborated by experts and make sure they won't be altered once spread within organization.
- Improve superheroes and power users productivity.



## Automation at Scale

- Easily scale development process. Deliver to production a wide range of solutions from simple ML-models to sophisticated mission-critical apps.
- Be more flexible in operations. Leverage internal and external (cloud) IT means to change business model without disruption.
- Improve collaboration between teams and enable multidisciplinary (CAE/ML) approaches.



## Knowledge Capture and Transfer

- Reduce loss of knowledge. Make engineering organizations more profitable. Democratize technology.
- Capitalize on engineering knowledge and avoid loss due to employee turnover.



**Any questions?**  
**Are you ready to try pSeven Enterprise?**





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