The use of Physics Based Predictive Analytics in Digital Twins

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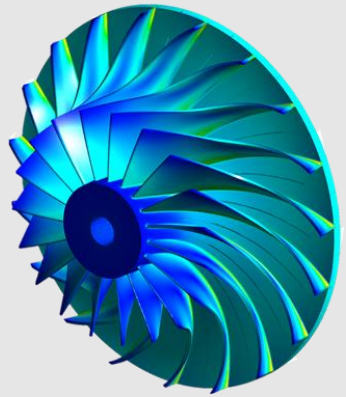
Outline

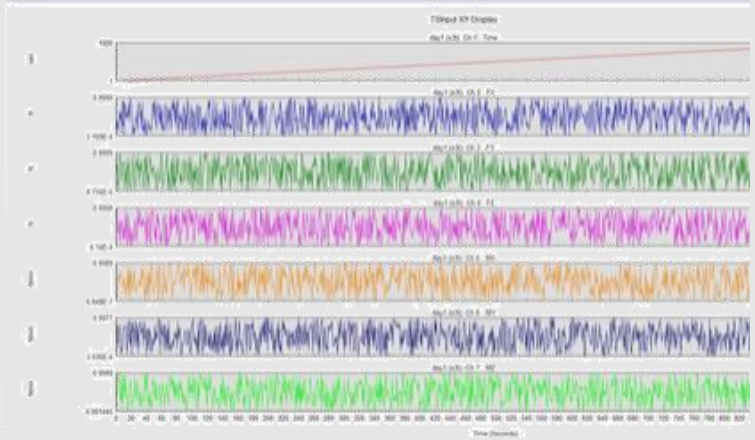
- Business motivation
- Enabling technology
- Customer cases

IoT Value Chain

Smart Product | Sensors | Connectivity | Platform | Applications | Customer



Industrial IoT by EDRMedeso



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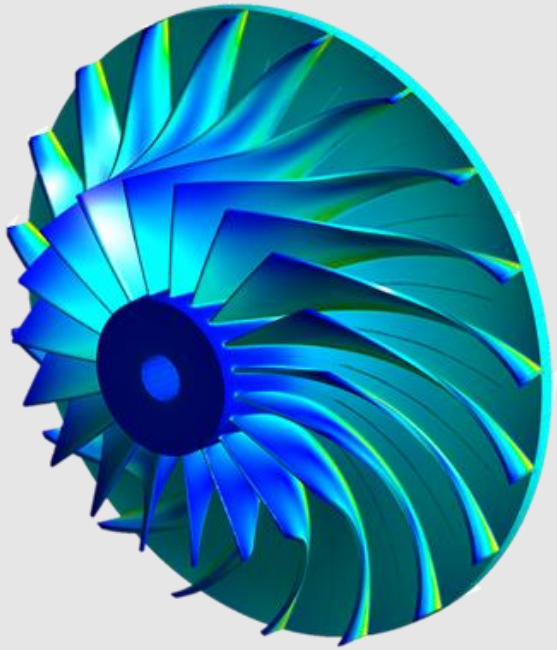

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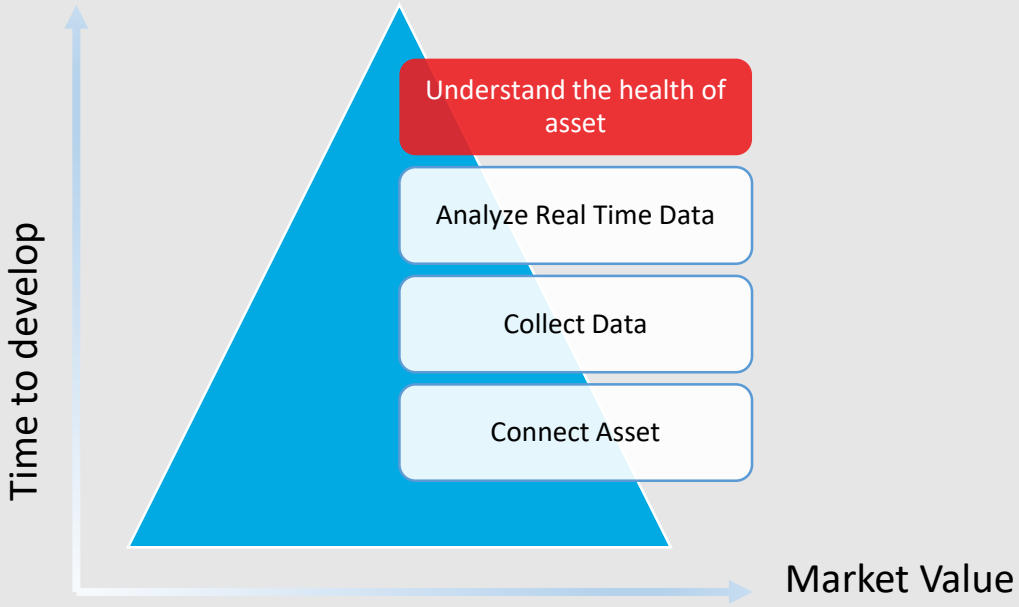
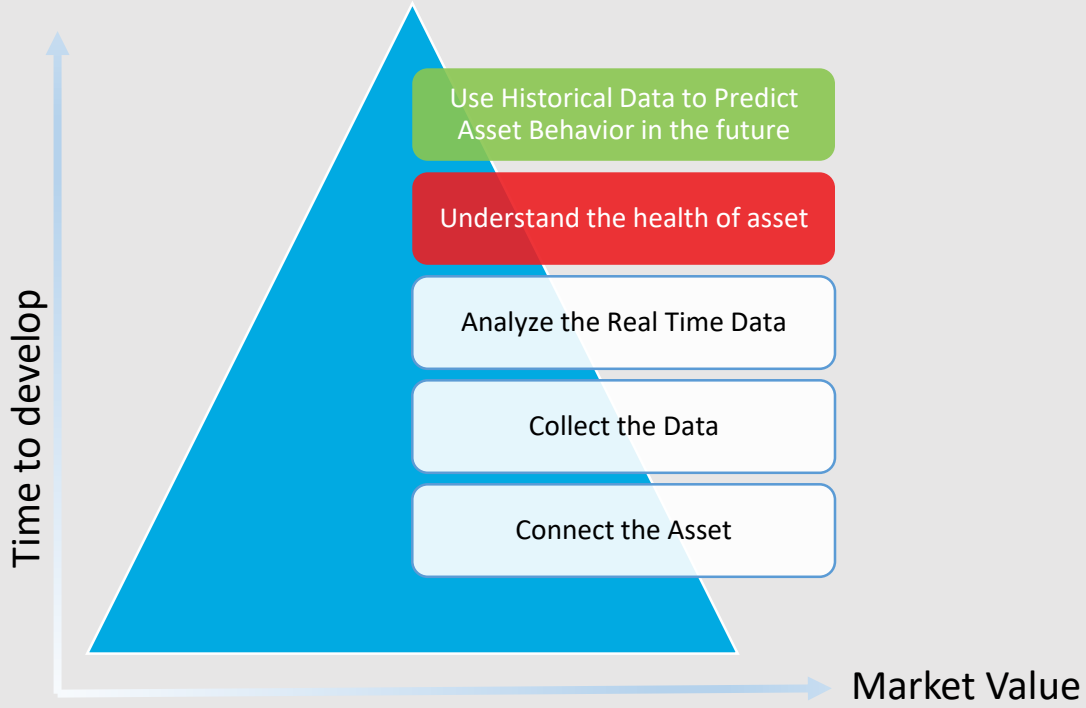
Service Level Agreements
Outcome Based Selling
Functional Sales

Analytics Solutions

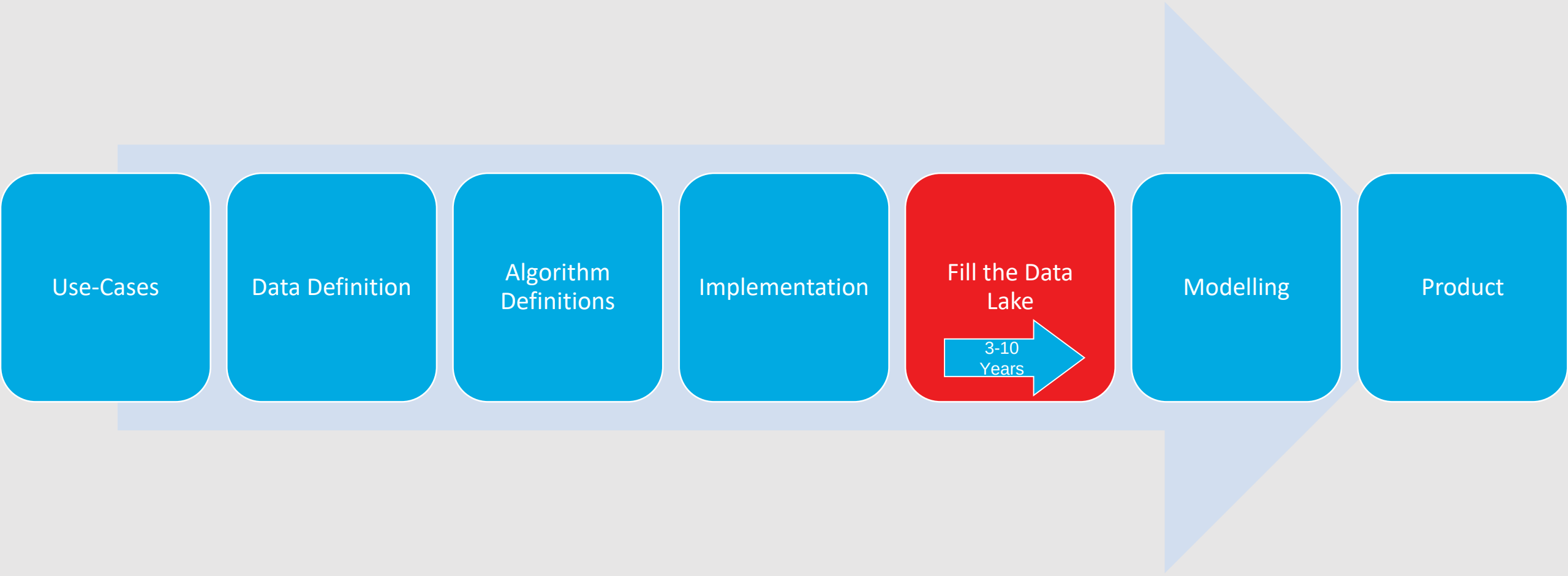
Condition Based Analytics



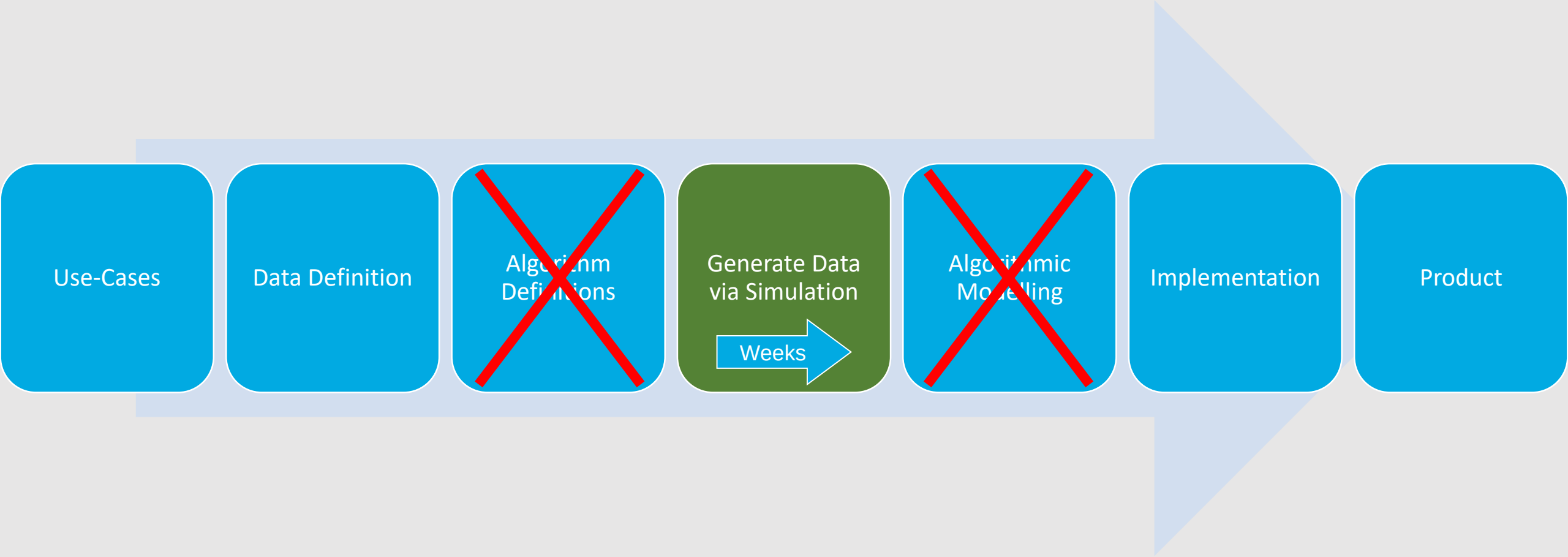
Condition & Prediction Based Analytics



Analytics Solutions



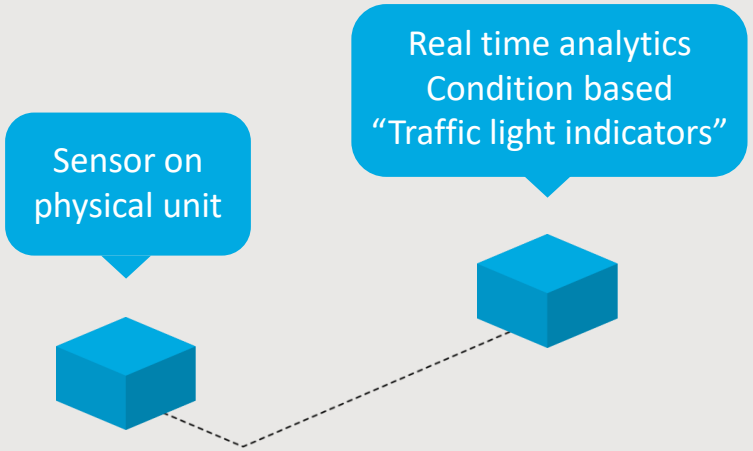
Accelerated Physics Based Solutions



The Digital Twin

Unpredictive

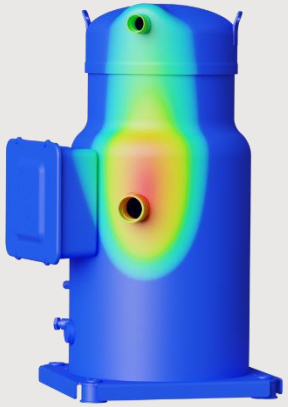
Physical unit

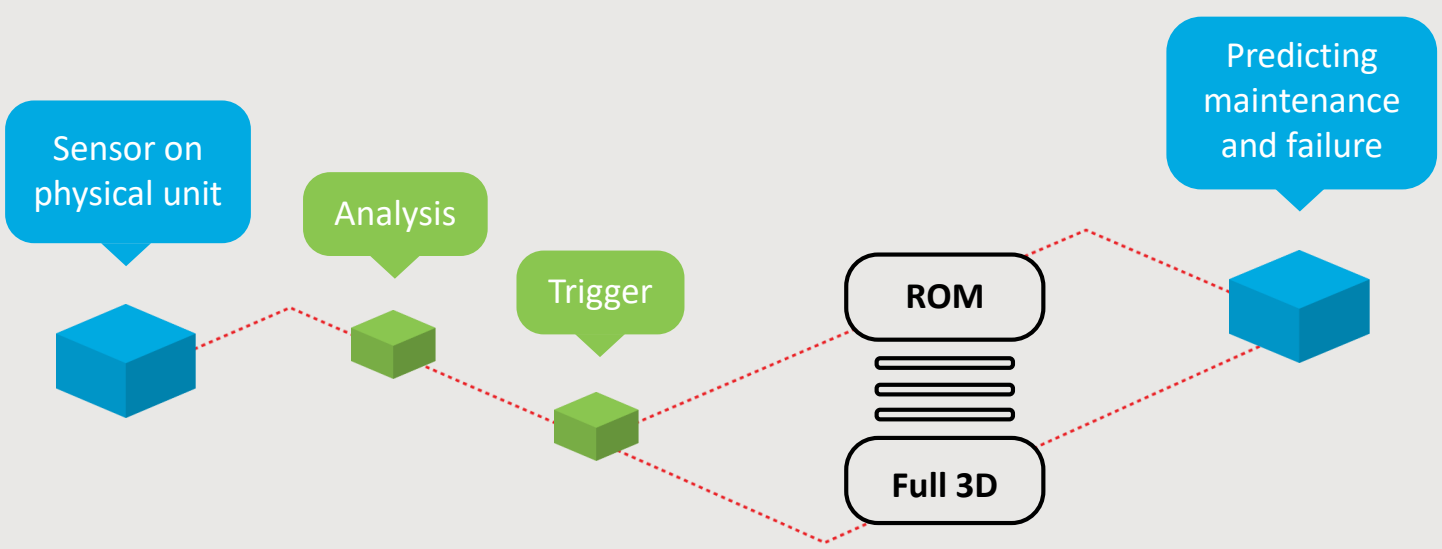


Realtime → **Future**

Predictive

Digital twin





Implementation

BLE

Mesh

Mobile

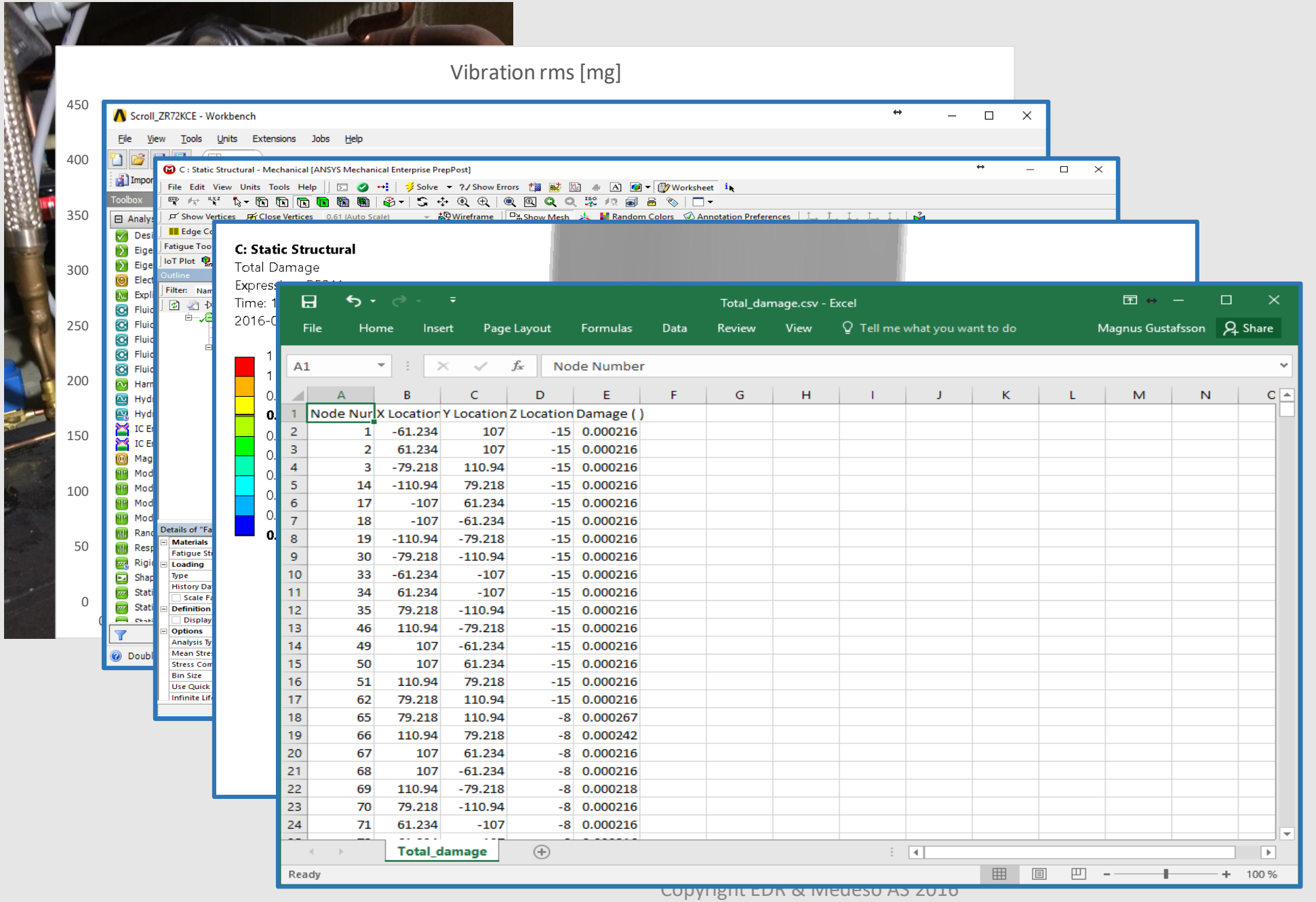
WiFi

Ethernet

SmartTags

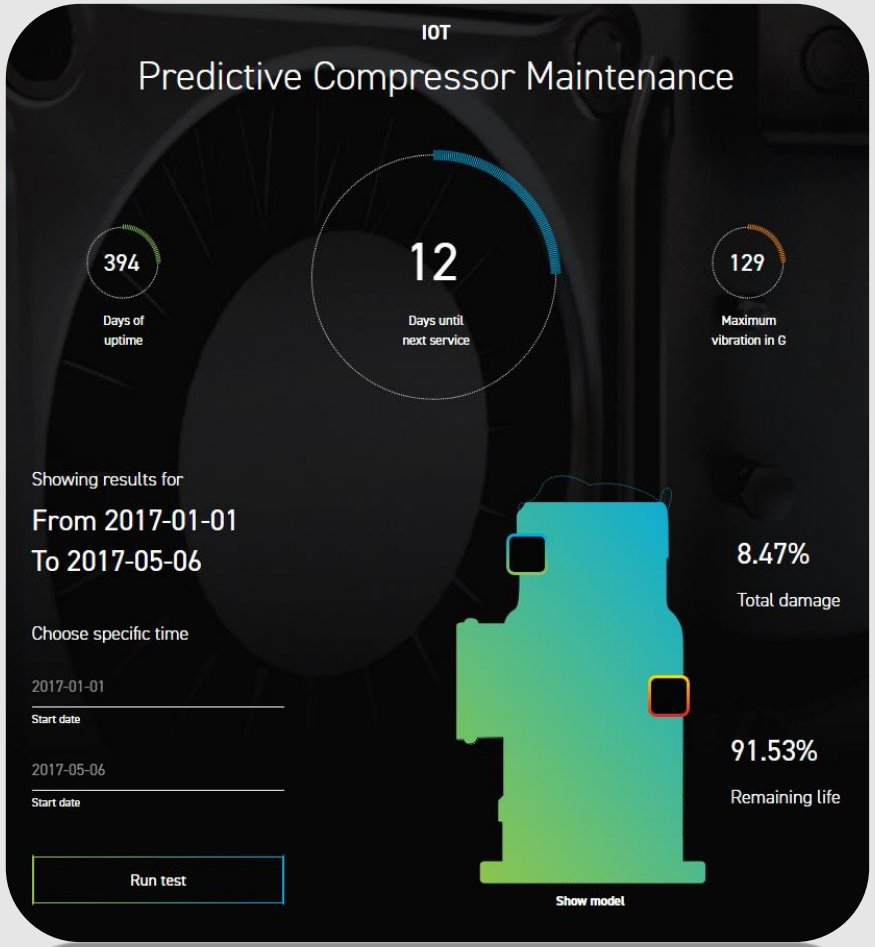
Local Gateway(s)

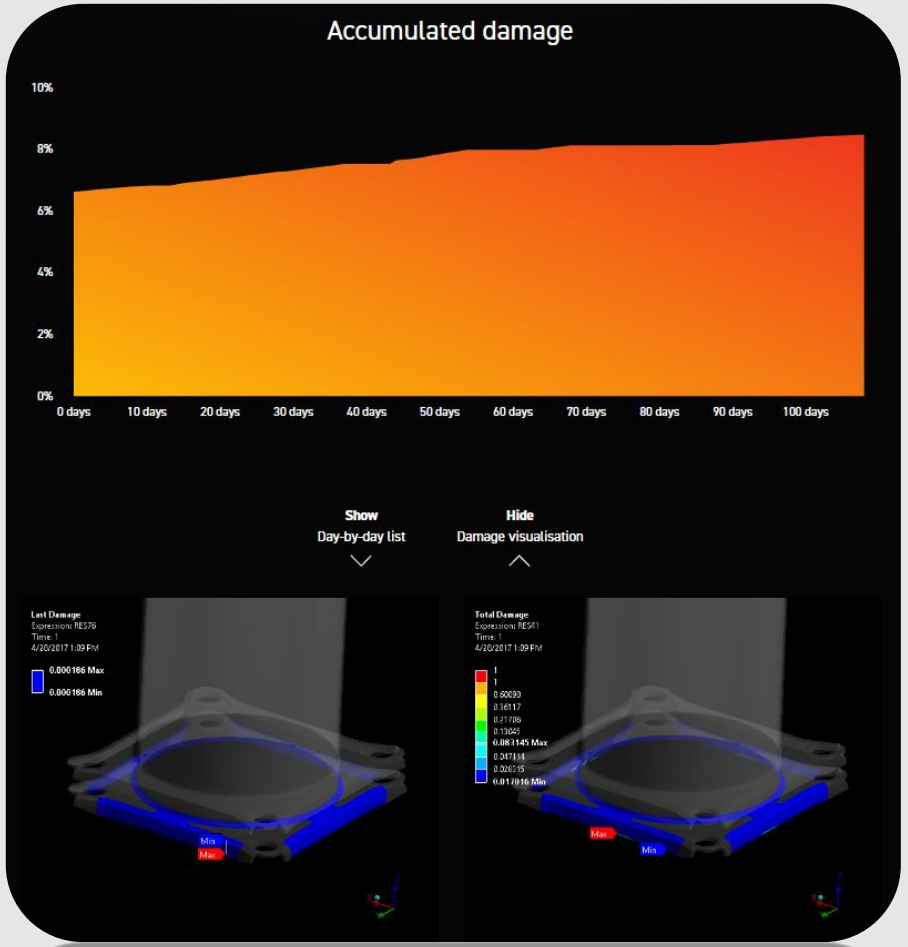
Cloud connect API



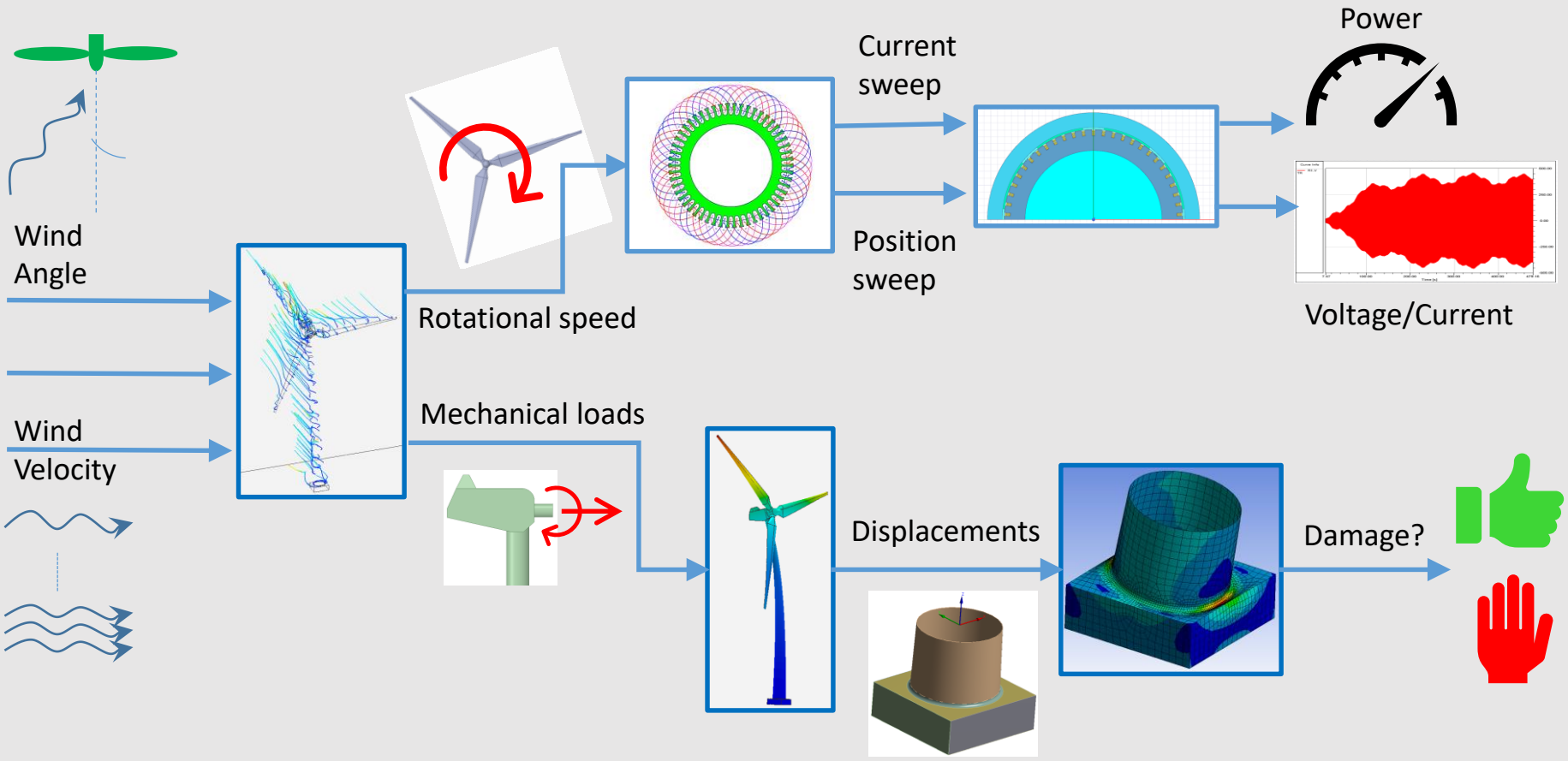
	A	B	C	D	E
1	Node Nur	X Location	Y Location	Z Location	Damage ( )
2	1	-61.234	107	-15	0.000216
3	2	61.234	107	-15	0.000216
4	3	-79.218	110.94	-15	0.000216
5	14	-110.94	79.218	-15	0.000216
6	17	-107	61.234	-15	0.000216
7	18	-107	-61.234	-15	0.000216
8	19	-110.94	-79.218	-15	0.000216
9	30	-79.218	-110.94	-15	0.000216
10	33	-61.234	-107	-15	0.000216
11	34	61.234	-107	-15	0.000216
12	35	79.218	-110.94	-15	0.000216
13	46	110.94	-79.218	-15	0.000216
14	49	107	-61.234	-15	0.000216
15	50	107	61.234	-15	0.000216
16	51	110.94	79.218	-15	0.000216
17	62	79.218	110.94	-15	0.000216
18	65	79.218	110.94	-8	0.000267
19	66	110.94	79.218	-8	0.000242
20	67	107	61.234	-8	0.000216
21	68	107	-61.234	-8	0.000216
22	69	110.94	-79.218	-8	0.000218
23	70	79.218	-110.94	-8	0.000216
24	71	61.234	-107	-8	0.000216

Operational Output





Digital Prototypes

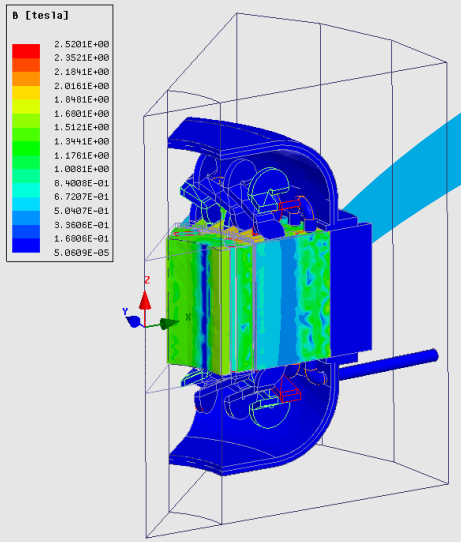


QUALITY

MAINTENANCE

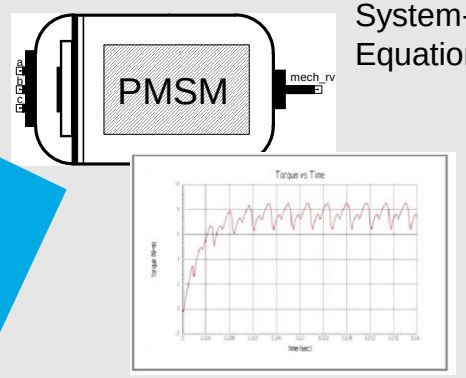
Traversing Physical Model Fidelity

How to get from here…



High-Fidelity 3D Physics

…to here?



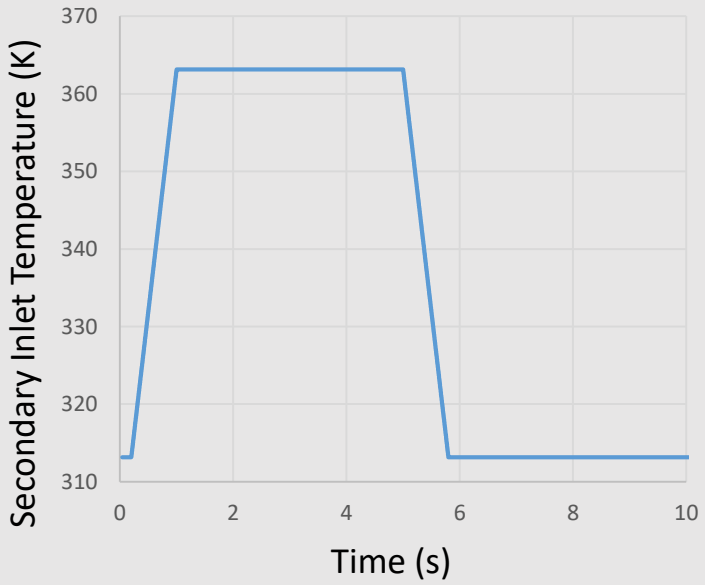
System-Level Behavior
Equation / Data-Based

Reduced-Order Modeling

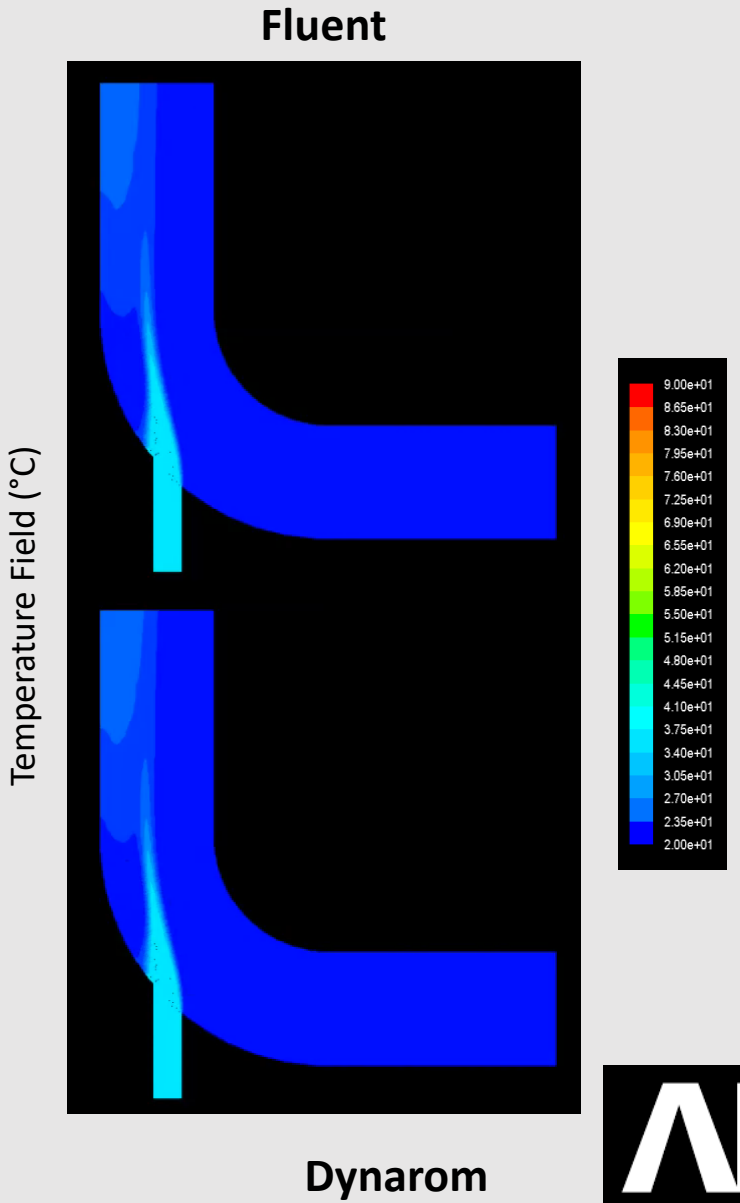
A simplification of a high-fidelity dynamical model that preserves essential behavior and dominant effects, for the purpose of reducing solution time or storage capacity required for the more complex model.

ANSYS DYNAROM – Step 1

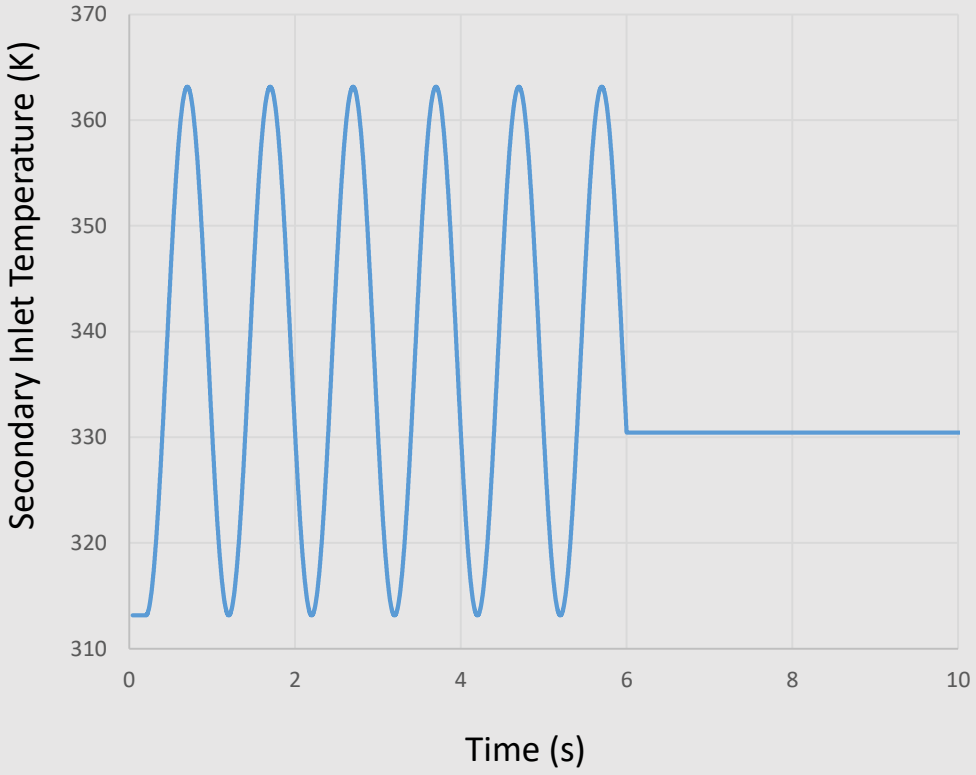
- 3 SVD modes only need to reconstruct the unsteady temperature field
- A temperature signal excitation is provided to cover the full temperature spectrum



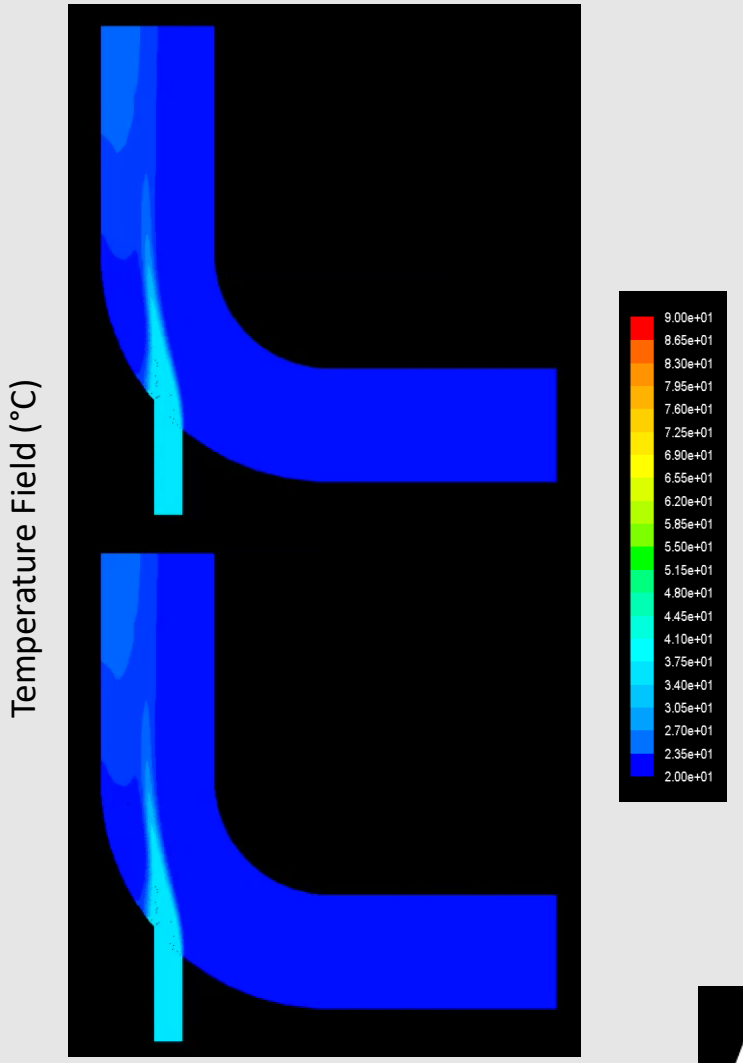
- Verification of the Dynarom model created



Step 2 – Arbitrary temperature field



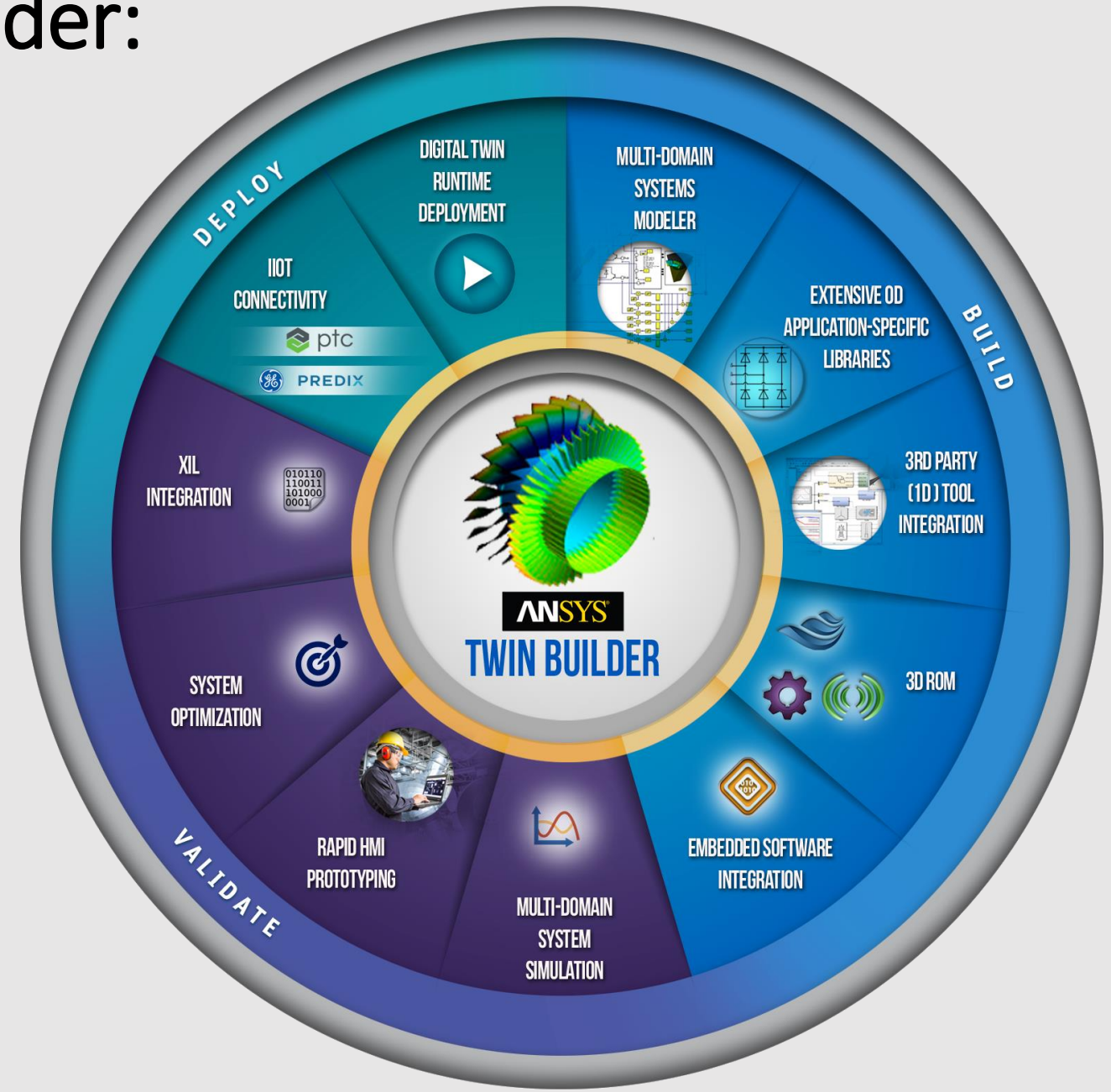
Fluent



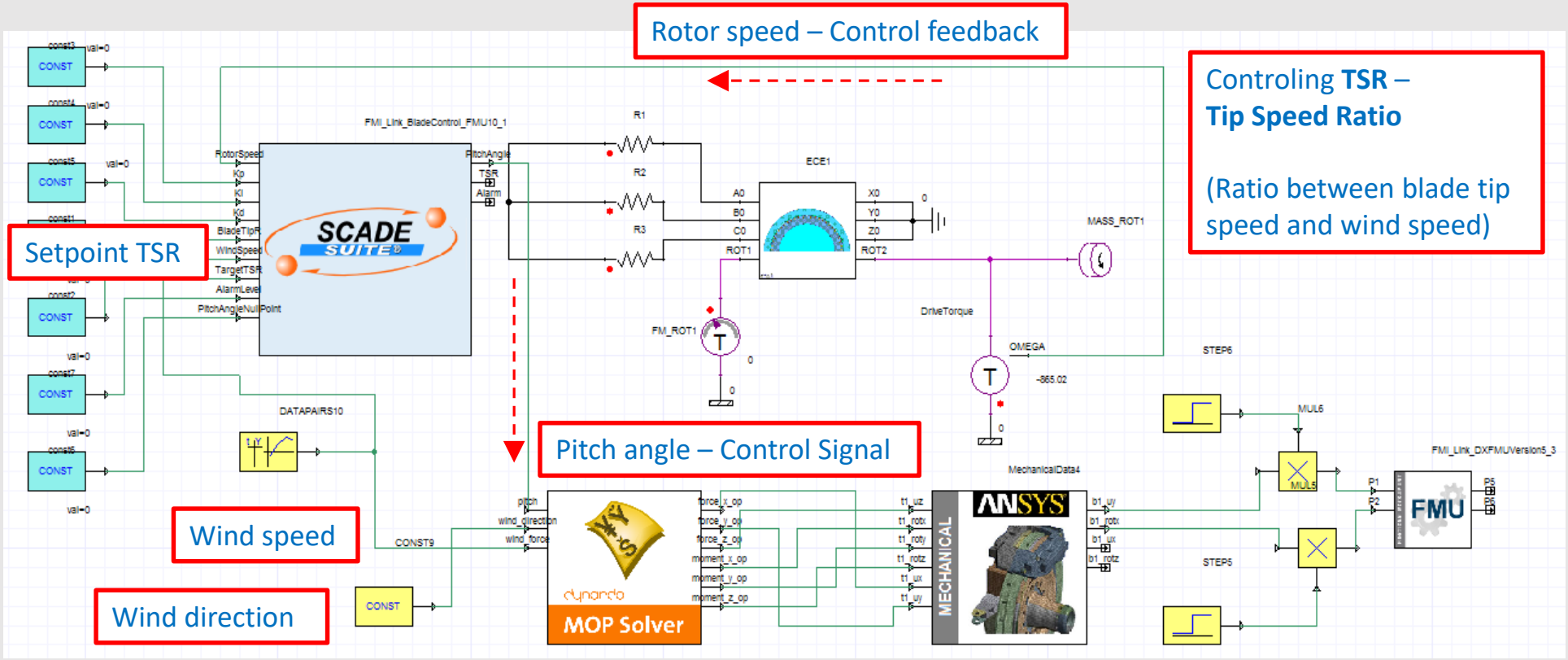
Dynarom

ANSYS®

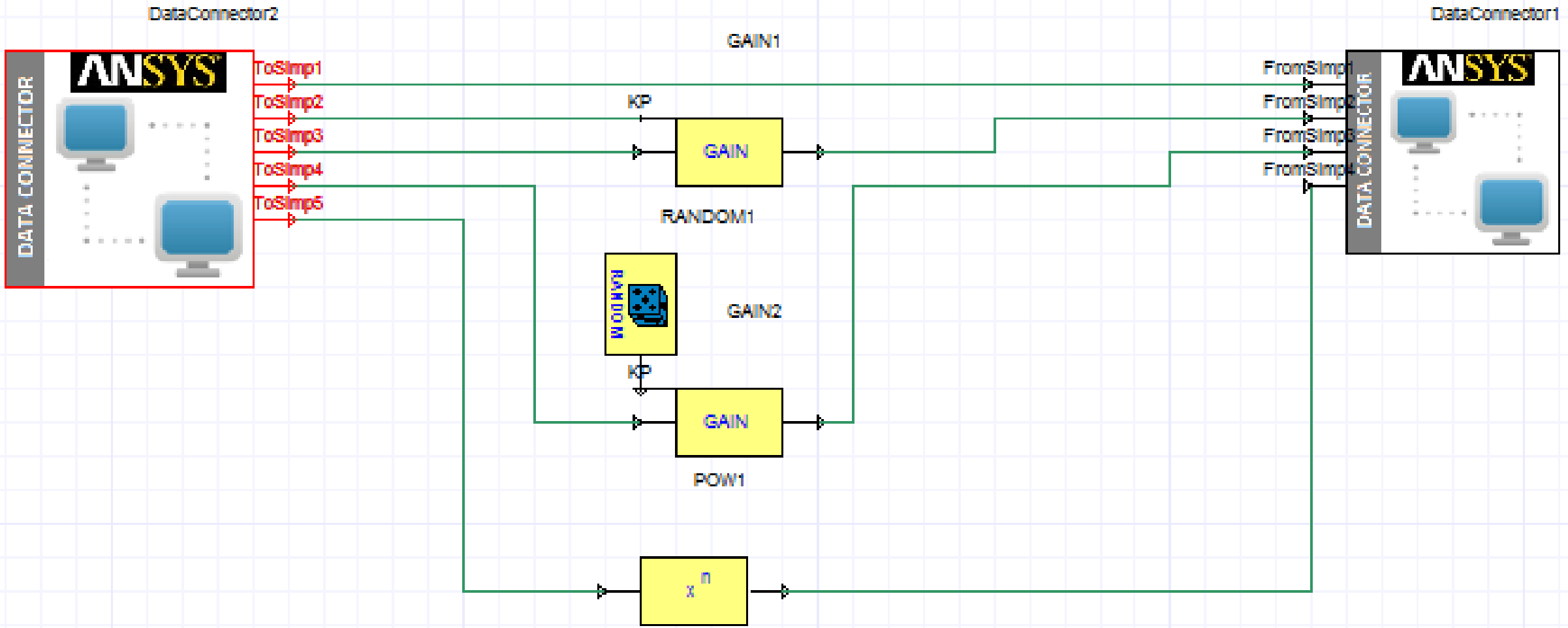
ANSYS Twin Builder:



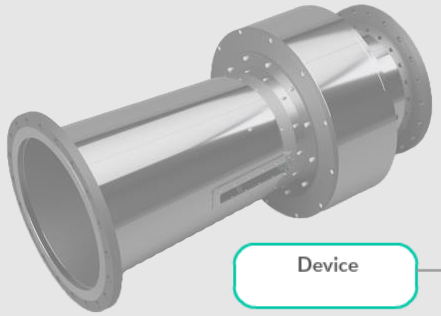
Digital Prototype

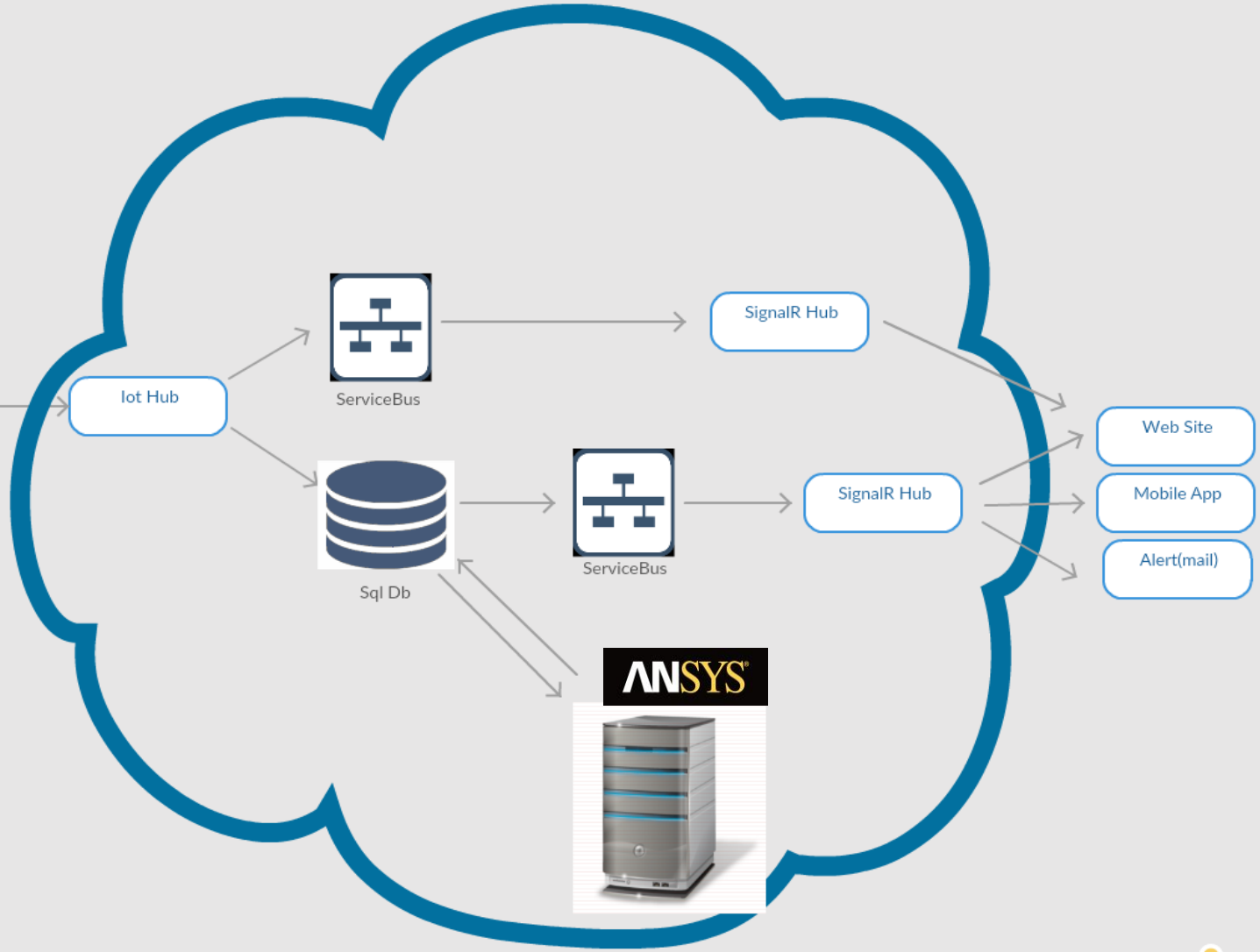


Digital Twins



ANSYS Digital Twins in the Cloud

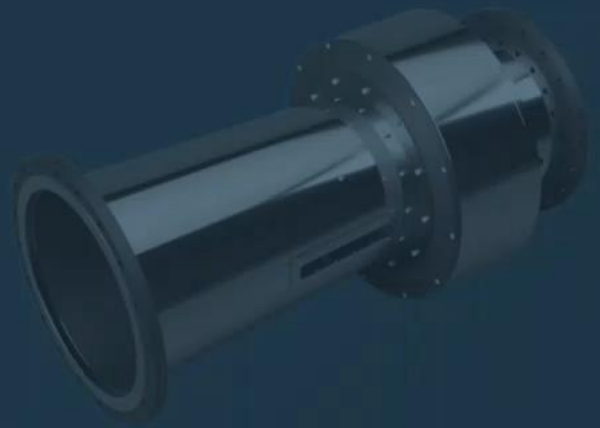




Azure

QRRNT
ENERGY RECOVERY

Welcome to your QRRNT dashboard.



37
days
Days until next service

121
Tons
Tons of CO2 saved

600 rpm
Revolutions per minute

0.2 bar
Pressure increases

Power of max		kW
Service intervals		days
Fuel saved (67,3)		tons

120 h
Running time/kilowatt

12000 watt
Live watt

SYSMON

ALARM DETAILS AND HANDLING

INSPECTION OF DATA

PERFORMANCE DETAILS

DIGITAL TWIN

REAL ASSET

Grundfos **SYSMON** **digital twins** - harness the power of IoT to optimize your life.

Grundfos, a global leader in design and manufacturing of pumps and water systems, brings advanced simulation and prediction capabilities to real-time in collaboration with simulation-powerhouse ANSYS and elite channel partner EDRMedeso. Grundfos will use digital twins to better serve its customers through improved product quality and performance, enhanced development productivity, optimized maintenance and reduced overall costs and risks associated with unplanned downtime.

GRUNDFOS ANSYS EDR MEDESO

Main Takeaways

- The key technologies are ready; implementation can start tomorrow
- Commercial solutions available on the market
- Physics based analytics offers an accelerated process compared to most predictive analytics
- Established and proven methods can be applied in new areas
- Numerous use cases already implemented; first runners are running