NISummit

AUTOMOTIVE

AEROSPACE AND DEFENSE

INDUSTRIAL IoT

SOFTWARE DEVELOPMENT

Milan, Italy

8.11.2018

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INSTRUMENTS™

Next IIoT wave:
embedded digital twin for manufacturing

Gianluca Bacchiega - I.R.S. srl

www.irsweb.it

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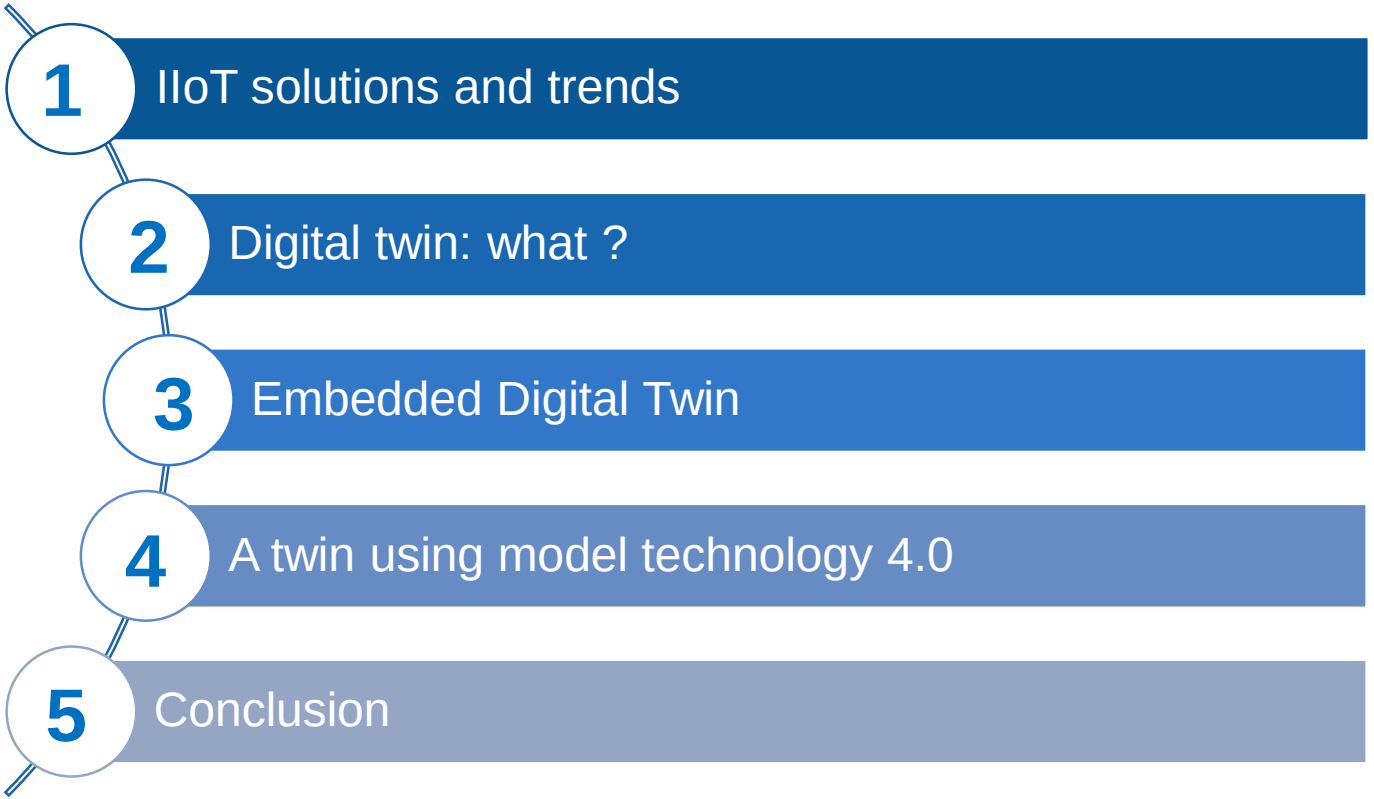

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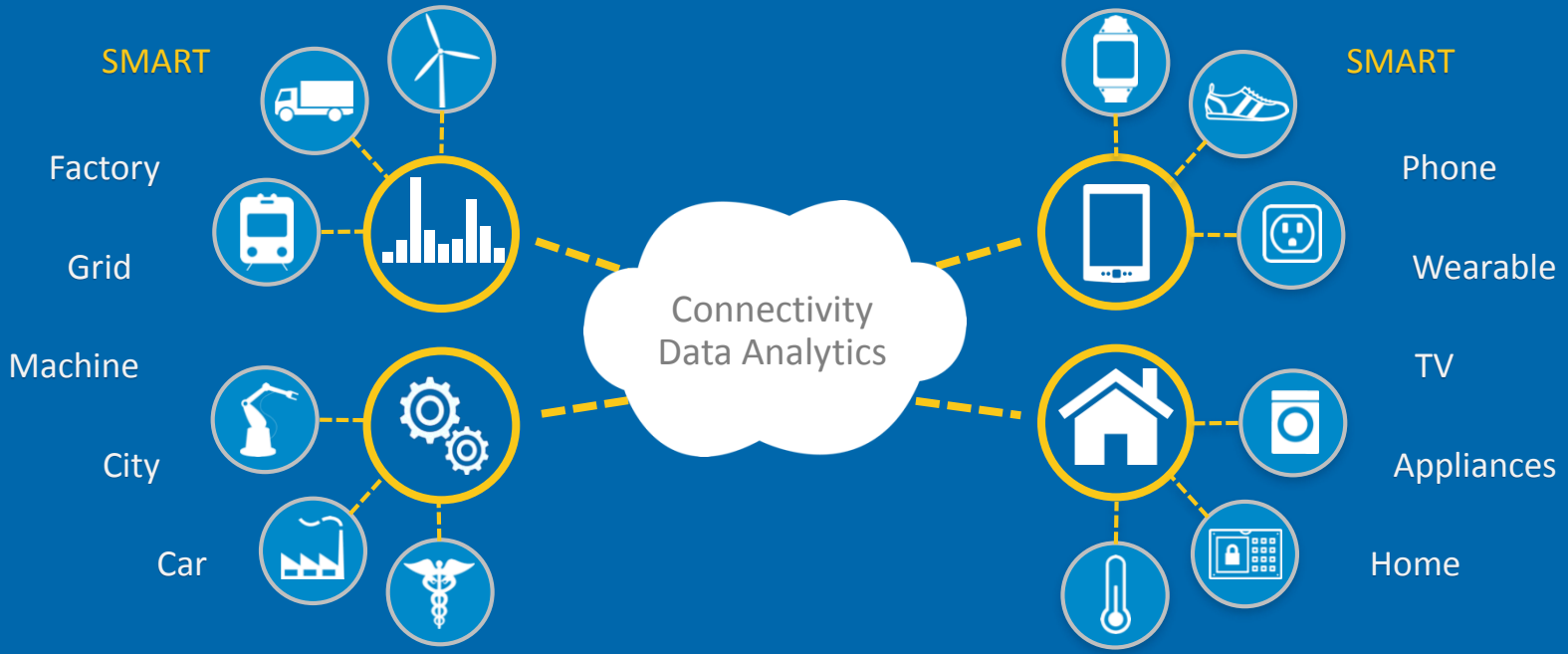
IIoT solutions and trends

INDUSTRIAL
Internet of Things

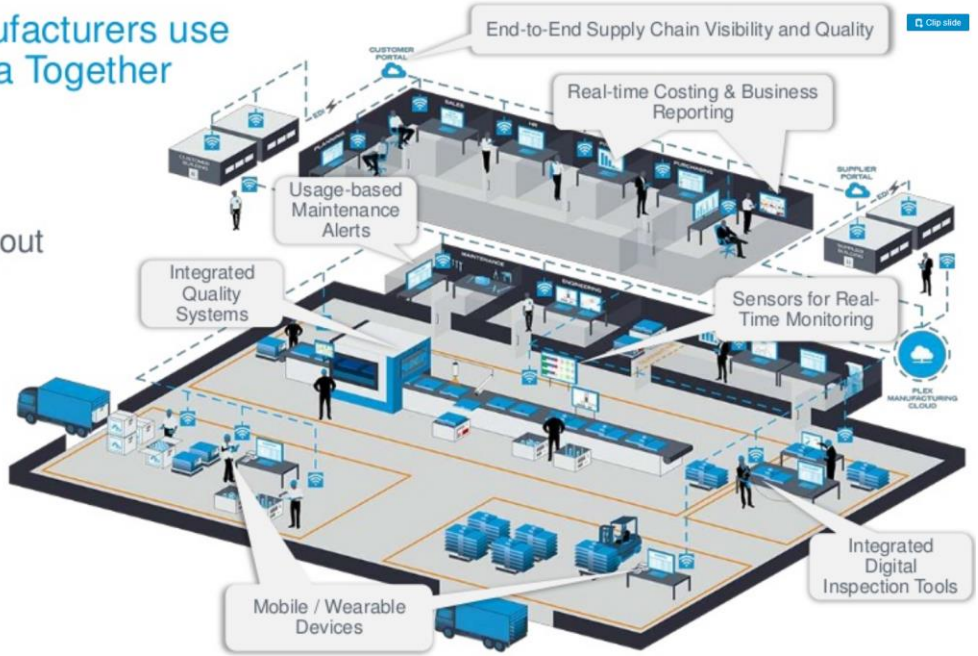
CONSUMER
Internet of Things



Based on Moor Insights & Strategy's report "Segmenting the Internet of Things (IoT)"

Connected Manufacturers use Cloud to Tie Data Together

Fully connected enterprise delivers data points throughout the enterprise



Manufacturing is the #1 IoT Opportunity

- $1.2-$3.7 trillion of economic impact
- IIoT isn't "technology looking for a problem" – this is a solution to existing needs

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NI's End-To-End Solution Architecture for IIoT

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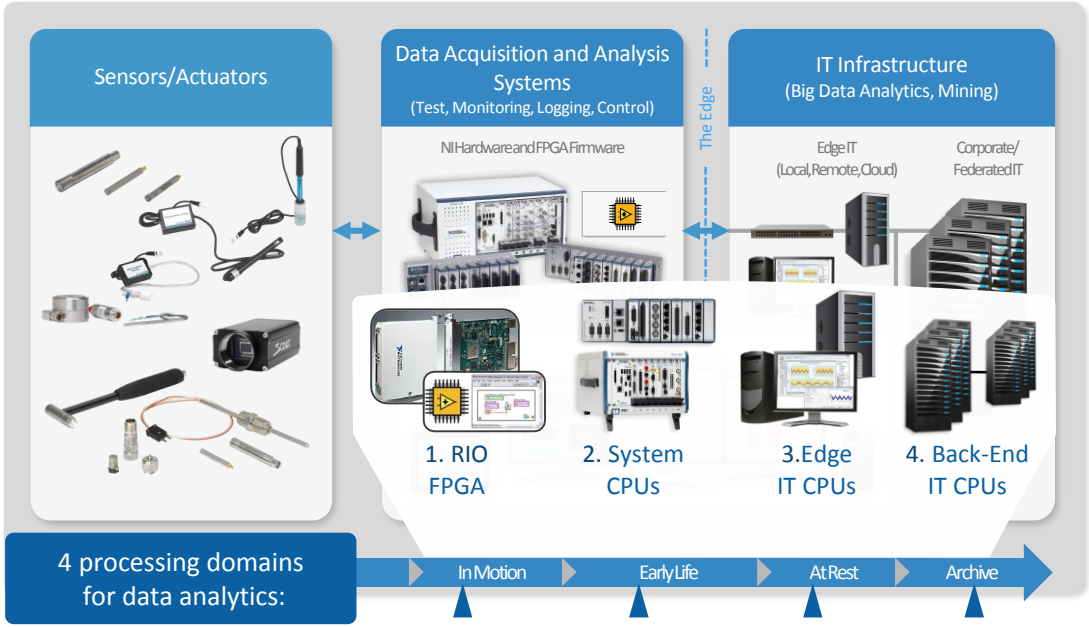
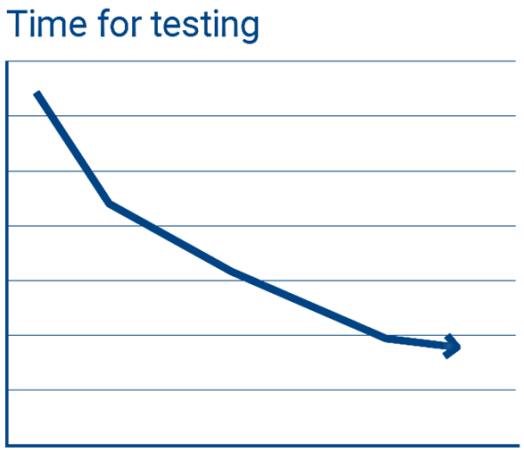
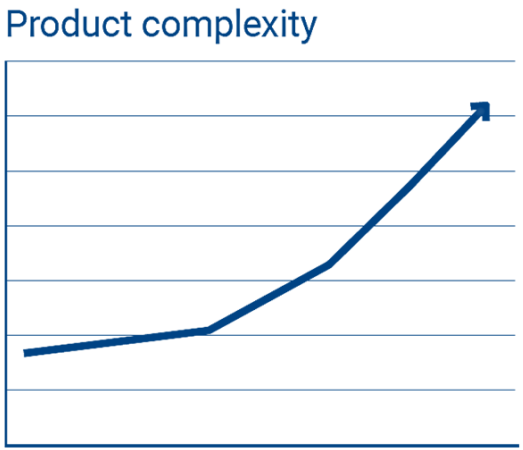
NI's End-to-End Solution Architecture for IIoT



Shorter time for develipinging while product complexity increase



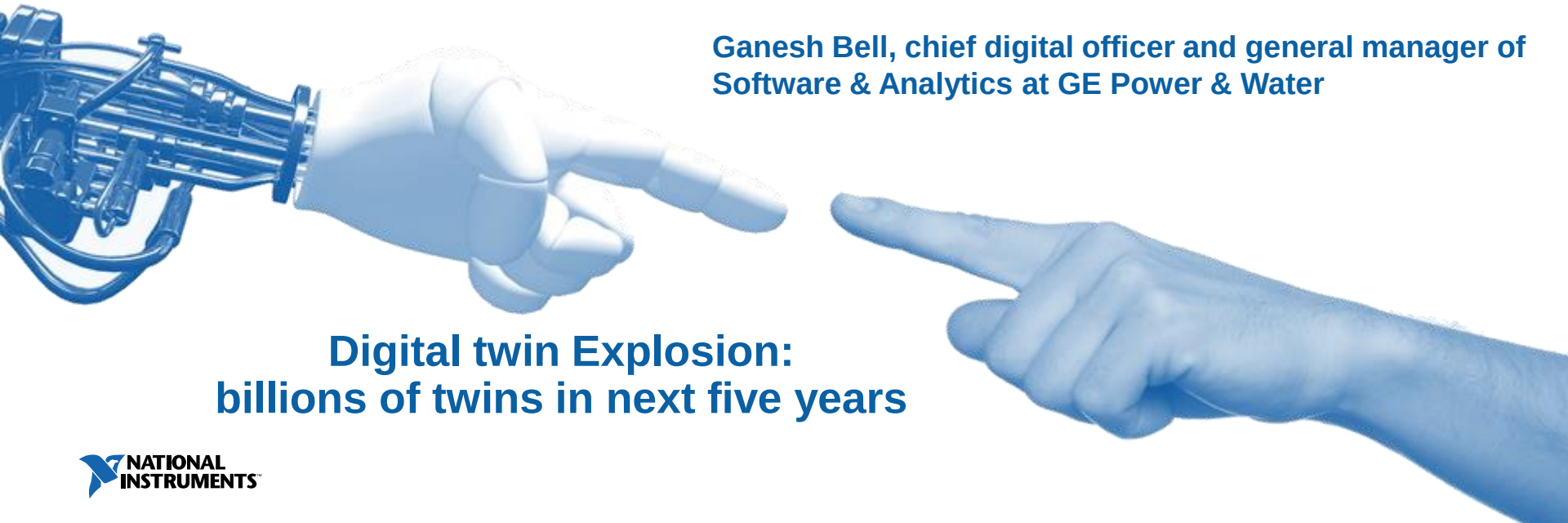


“Digital twins are becoming a business imperative, covering the entire lifecycle of an asset or process and forming the foundation for connected products and services. Companies that fail to respond will be left behind.”

Thomas Kaiser, SAP Senior Vice President of IoT

“For every physical asset in the world, we have a virtual copy running in the cloud that gets richer with every second of operational data

Ganesh Bell, chief digital officer and general manager of Software & Analytics at GE Power & Water



Digital twin Explosion: billions of twins in next five years

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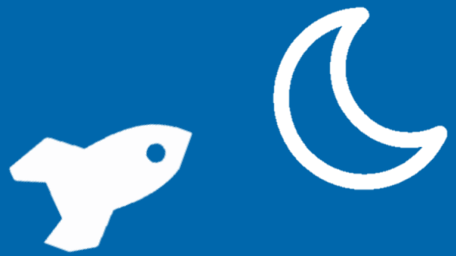
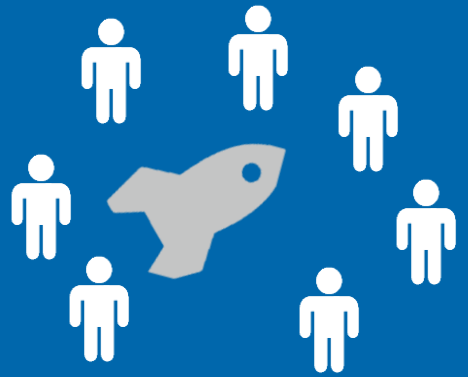
Digital twin: what ?

A digital twin is a real-time digital replica of a physical device.





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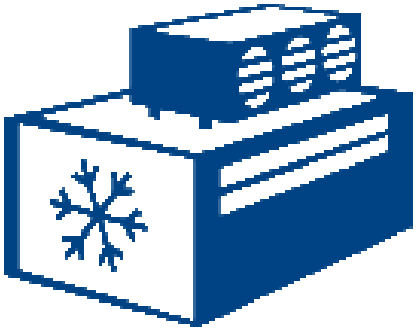
A digital twin is a real-time digital replica of a physical device.

chiller



chiller
digital twin

It’s more than a model

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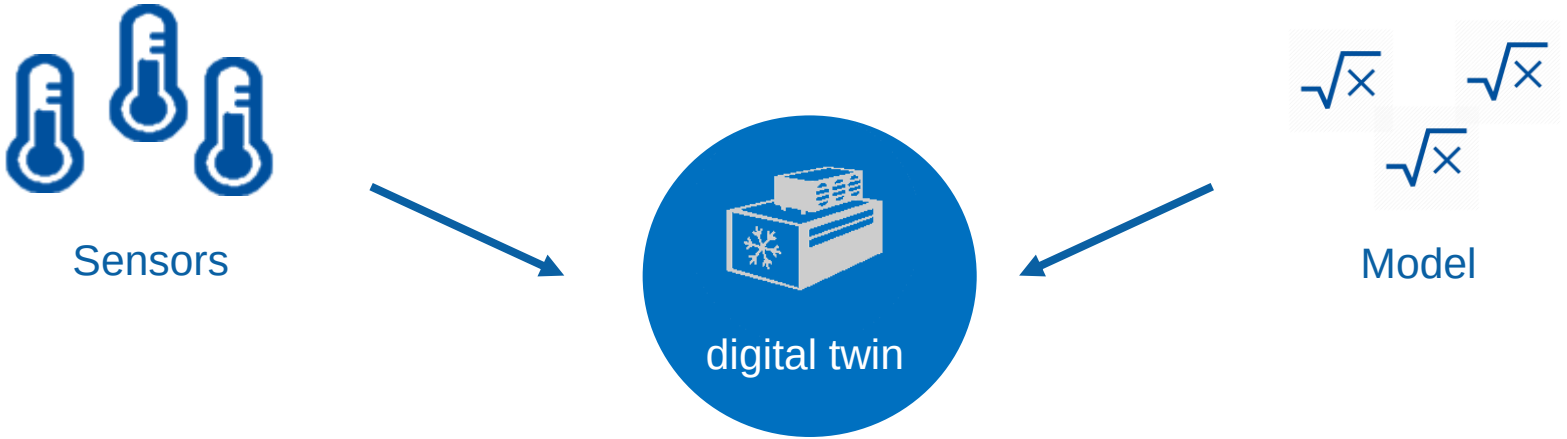


A simple digital replica ?

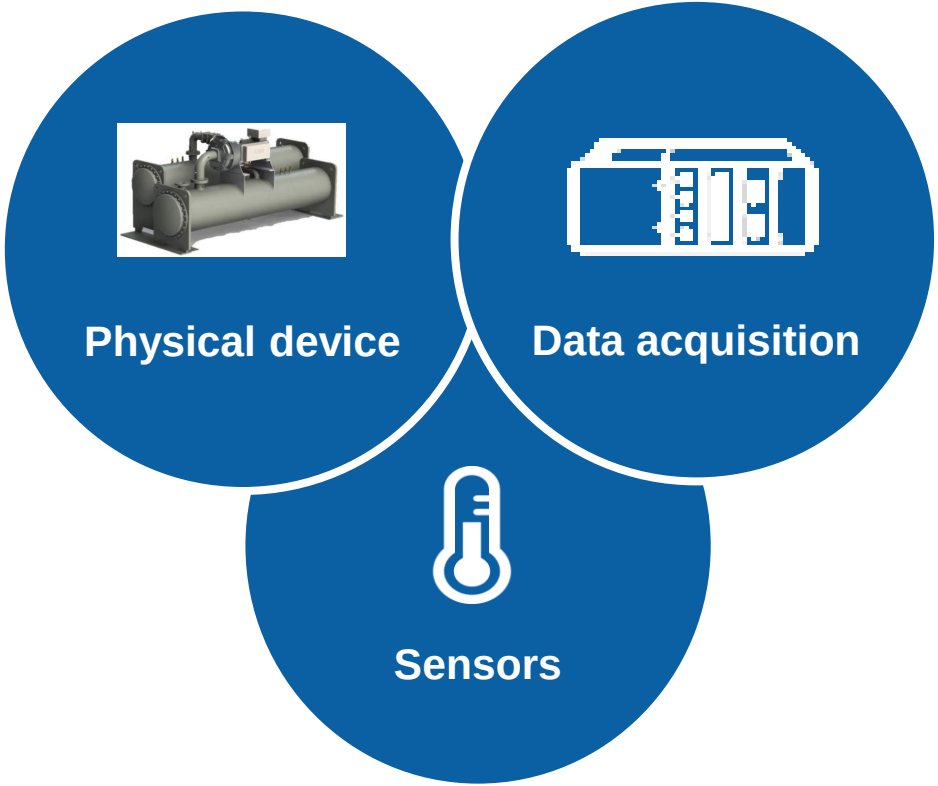
History

Log the device history

Future

Forecast device future

A bridge between **the physical** and digital **world**



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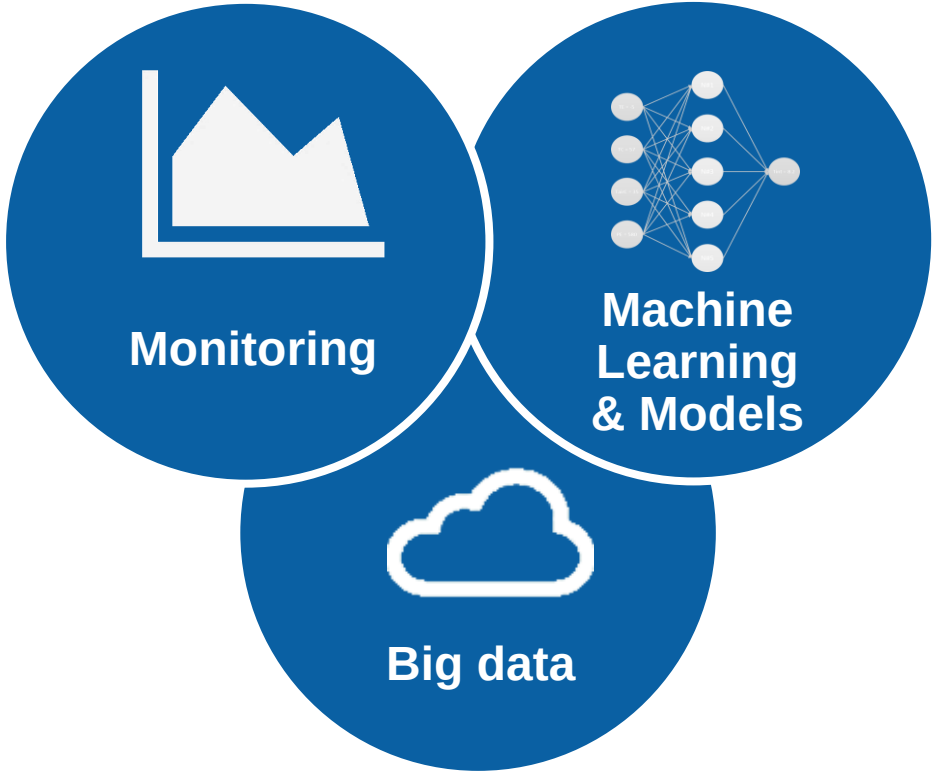
A bridge between the physical and **digital world**



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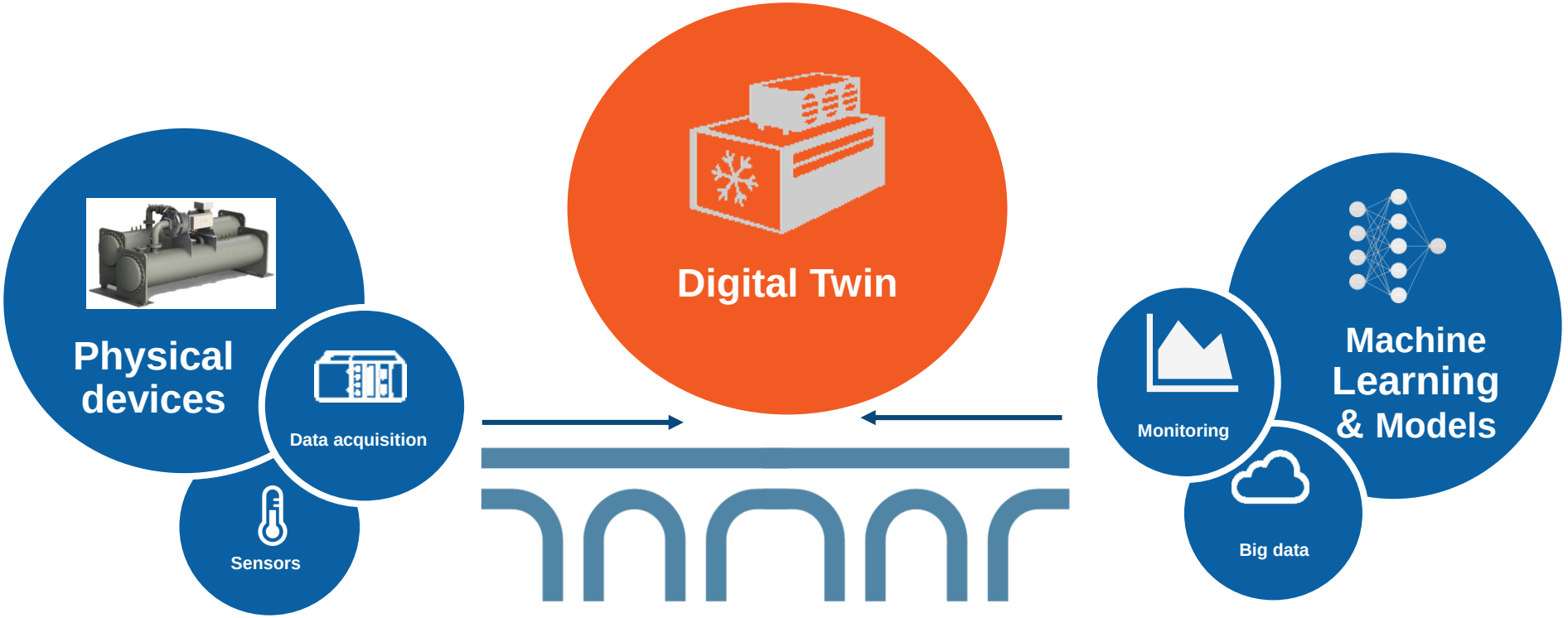
A bridge between the physical and digital world



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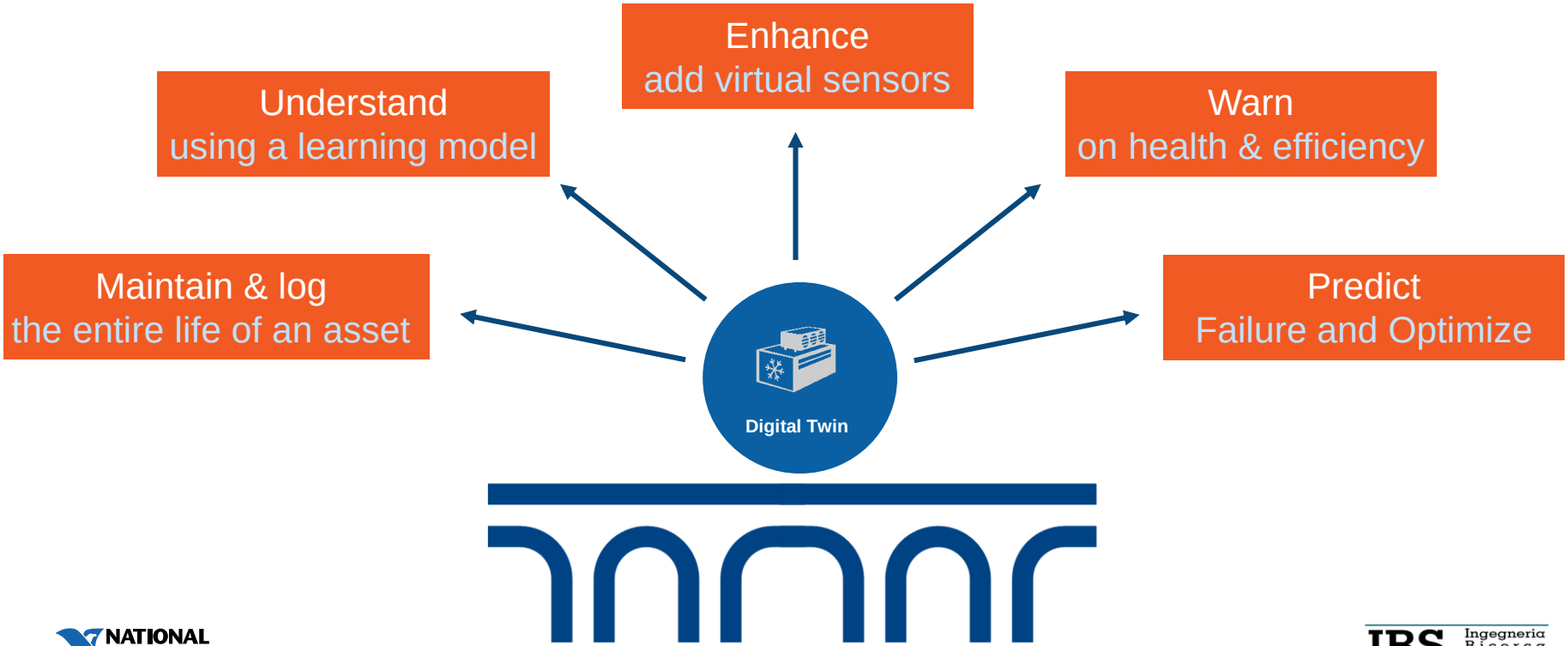
A bridge between the physical and digital world with Value and ROI embedded



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Embedded Digital Twin

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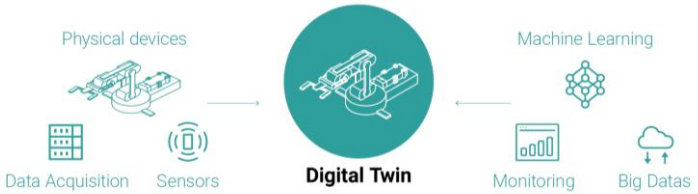
A Digital Twin is a real-time digital replica of a physical device



It is a bridge between the physical and digital world.

It is more than just a digital replica

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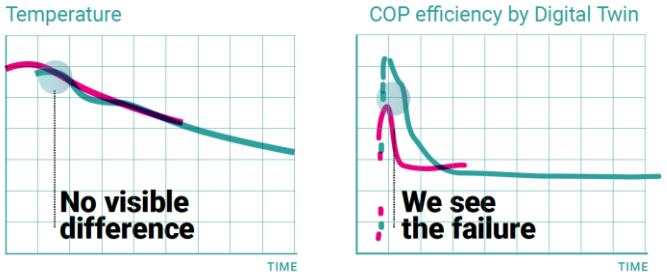
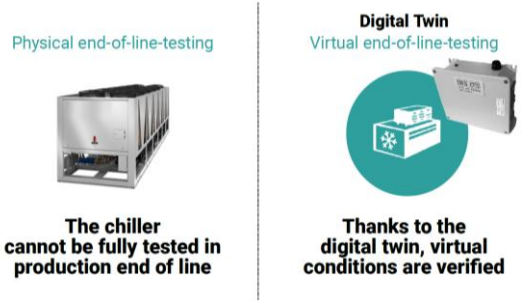
Example of embedded digital twin for product testing

Shorter testing time



Better accuracy and quality



Testing in unfeasable conditions

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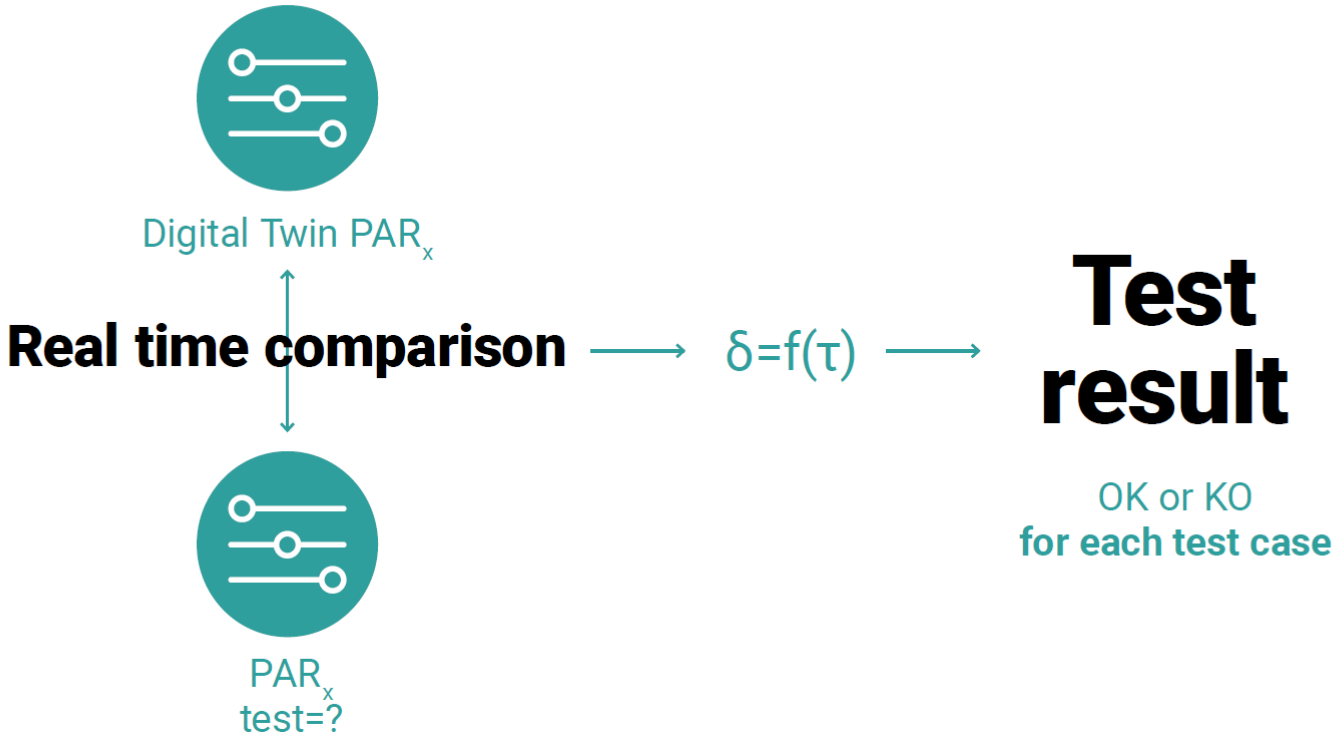

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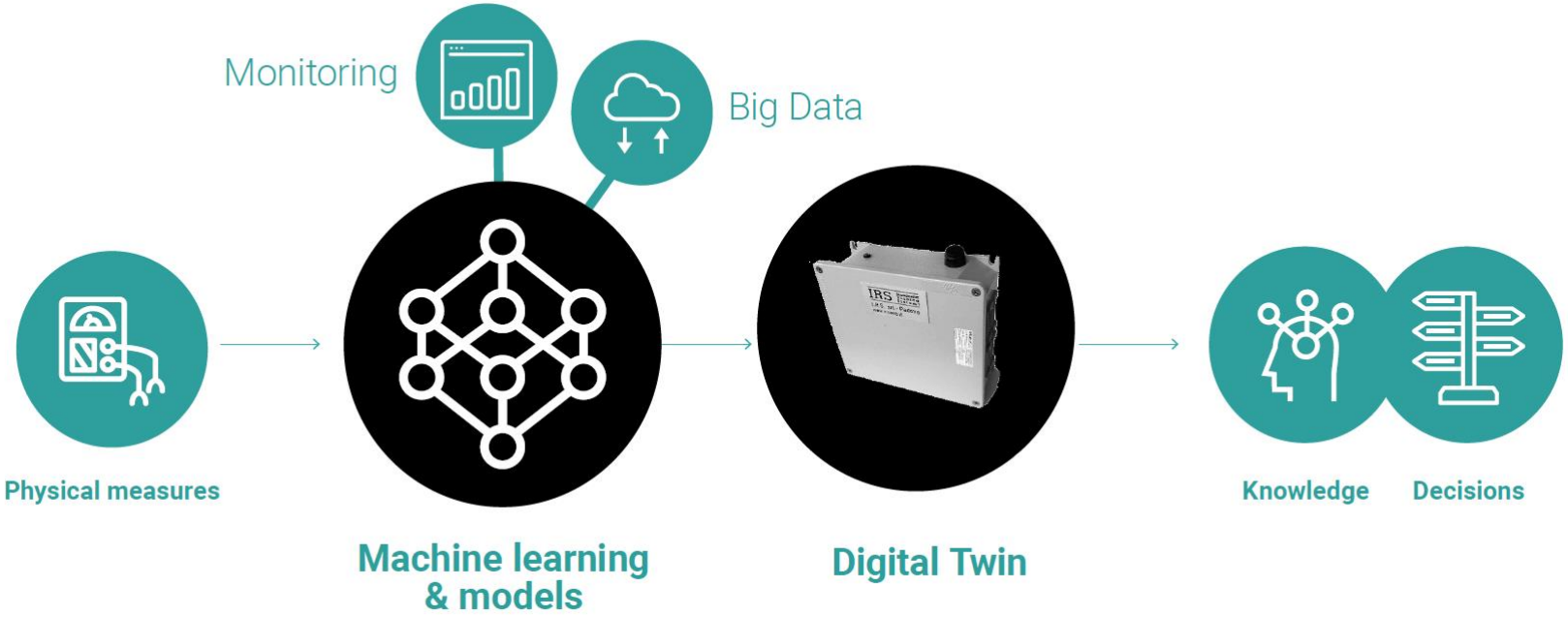

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A platform ready for change

Productive Software

Our extensive portfolio of software, from LabVIEW to TestStand, helps you translate your programming ideas into reality, reduce project development times, improve system performance, and deliver business insights based on collected data.

Flexible, Modular Hardware

NI modular hardware, which ranges from high-performance RF instrumentation to low-cost measurement devices, has flexible I/O that helps you to reconfigure hardware in software and avoid buying new equipment every time application needs change.

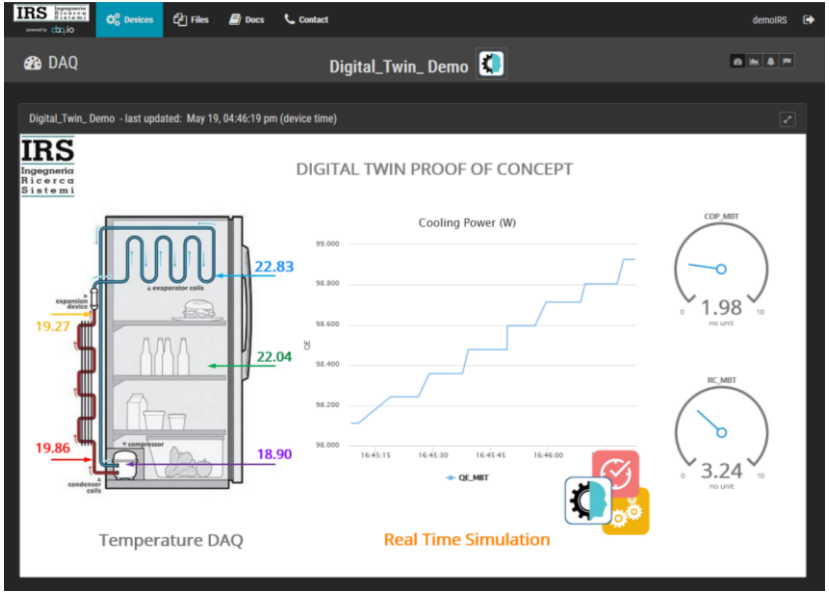
Seamless Integration

With seamless integration of flexible hardware and productive software from one vendor, you can design measurement and control systems more rapidly. NI software and I/O hardware work together so you can stop sweating the details and focus on designing better systems faster.

Openness and Interoperability

The openness and flexibility of the NI platform allows you to choose to use NI software and hardware or third-party tools in multiple different combinations. You can accelerate your system design to reduce complexity, innovate faster, and continually integrate new technologies based on the tools that you prefer.

From monitoring to embedded digital twin



1. Lifelong Device history
2. Real time model computed virtual sensor
3. Real Time predictive alert

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Real time online measurement platform

Machine learning models

TwinMind®

CompactRIO
Single-Board inside

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A twin using model technology 4.0

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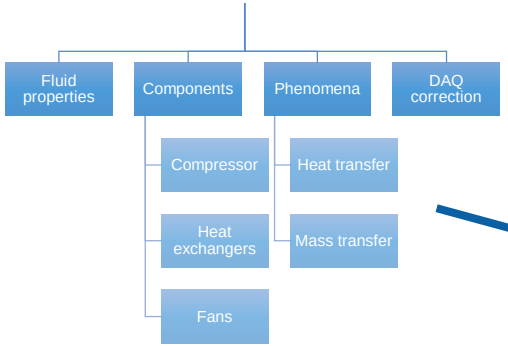
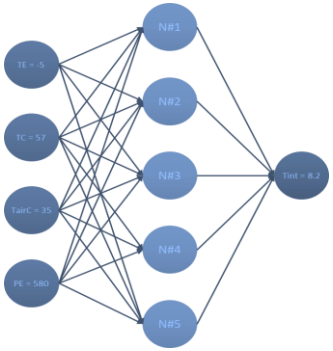
Model technology 4.0

Physical Model



Machine learning



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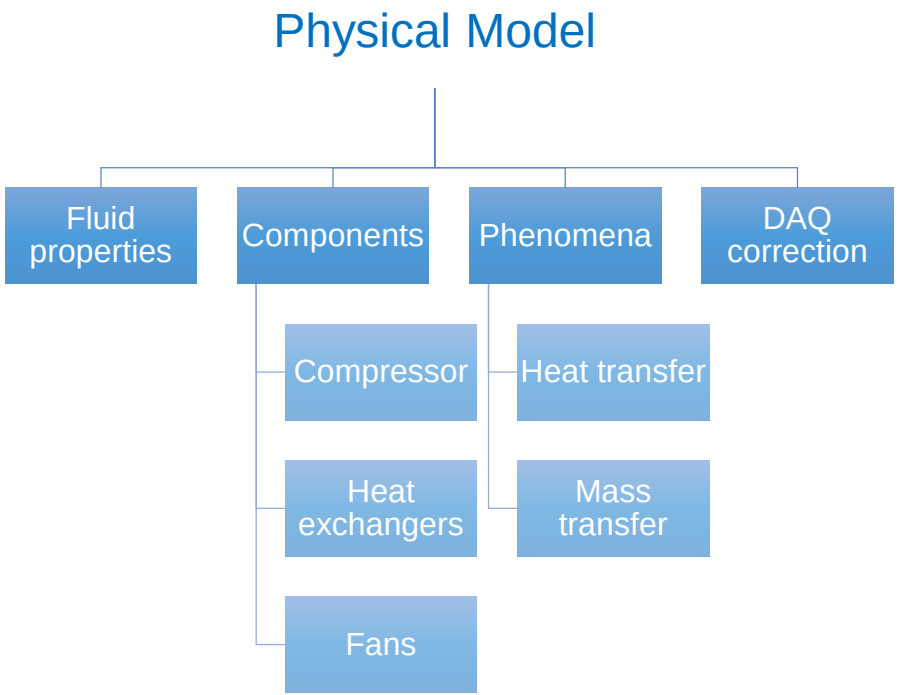
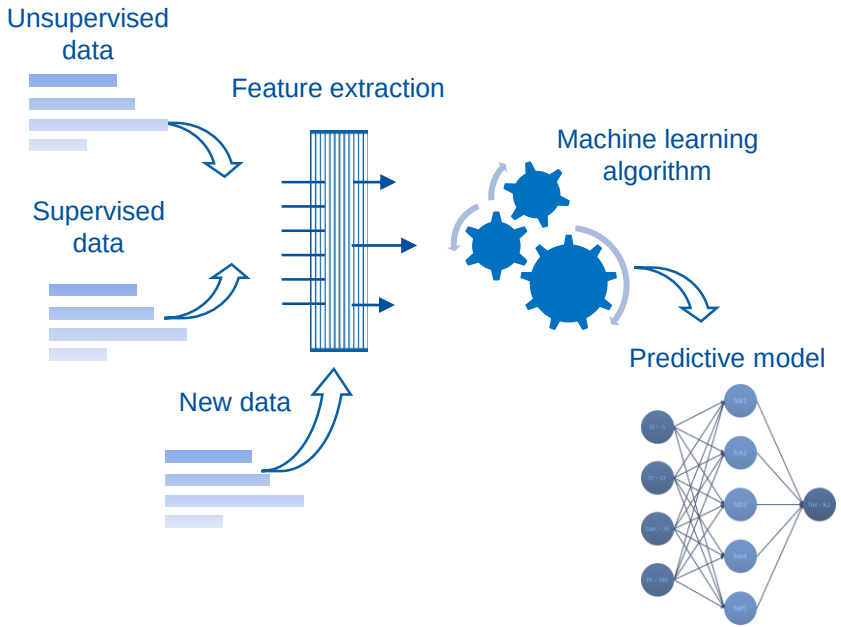
Physical Model



The **phenomenological model**, based on equations,

can **identify the causes** of a possible malfunction

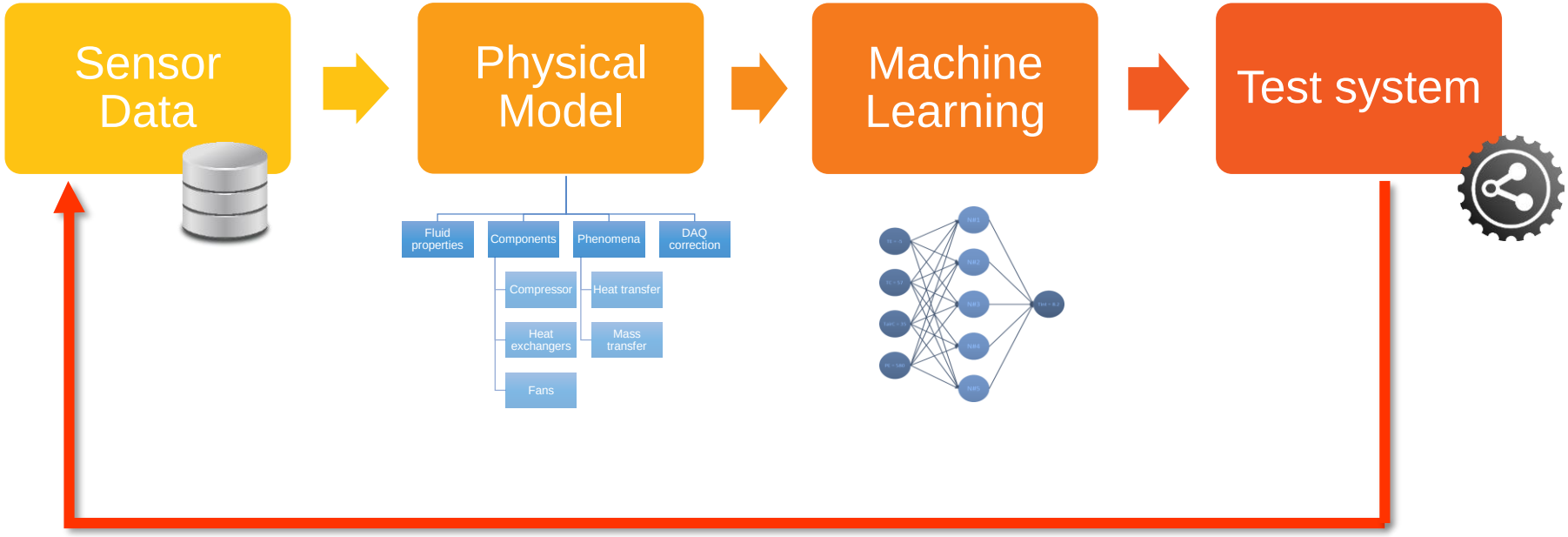
Machine learning



The **machine learning approach** needs no detailed knowledge about machine operation.

It needs a learning phase to be able to predict the system performance.

Diagnostic detail and easy implementation



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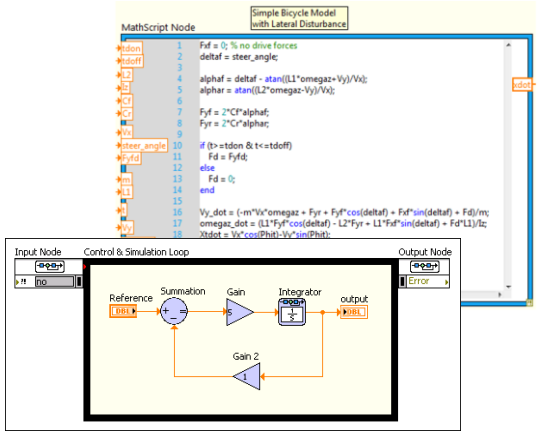
Merging model technology using NI platform



LabVIEW Machine Learning Toolkit

embedded digital twin

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Test systems for fridge testing on 100 % production

- NI CompactRIO testing 4 appliance simultaneously
- Sensor optimization
- Digital twin for shortening testing time

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Conclusions

Lower complexity, reduce development time, and add machine learning to your IIoT device using NI platform and digital twin technology

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any question or inquiry

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