Developing an Embedded Digital Twin

for HVAC Device Diagnostics

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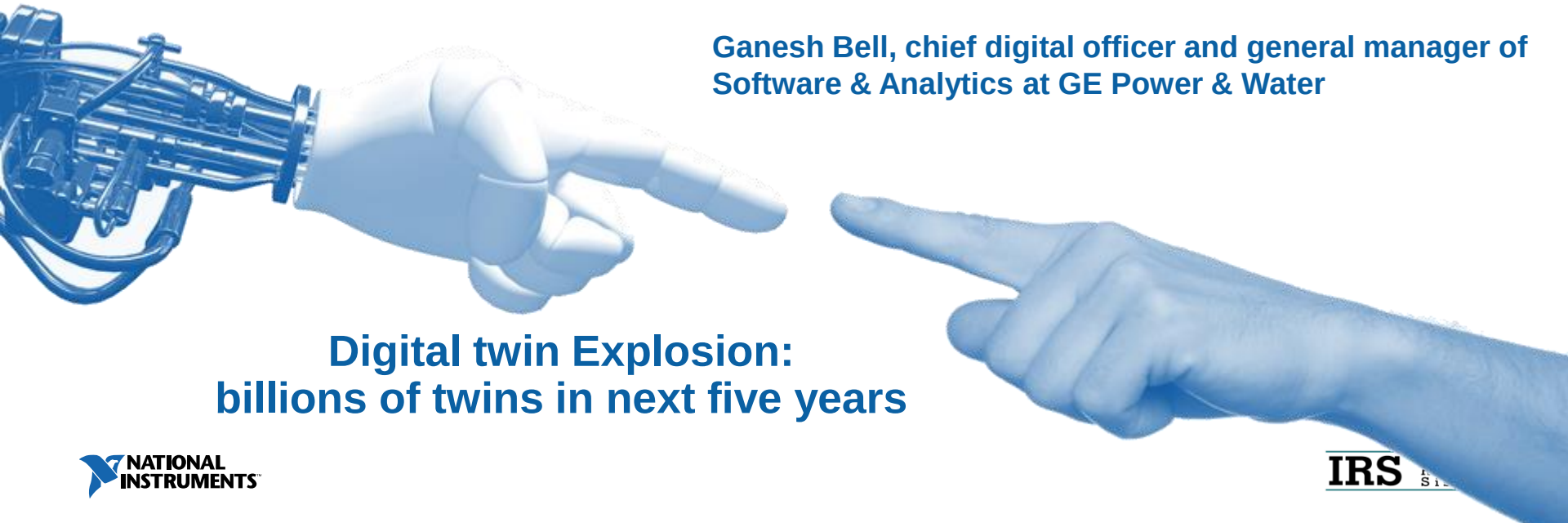
R&D manager at I.R.S.

“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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an Engineering Company

1. Digital twin: what ?
2. Embedded digital twin for HVAC diagnostic
3. A twin using model technology 4.0
4. Value and ROI of digital twins
5. Conclusion

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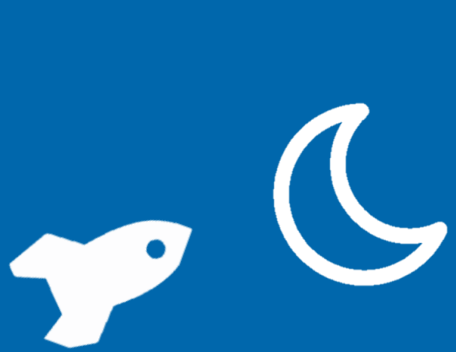
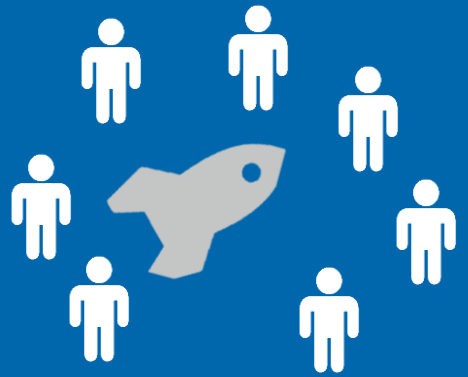
Digital twin: what ?

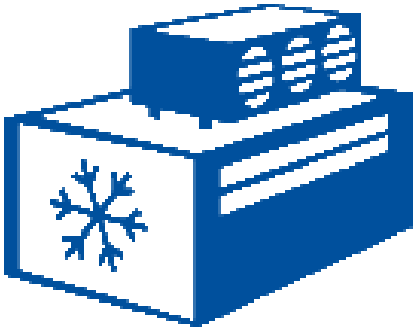
A digital twin is a real-time digital replica of a physical device.





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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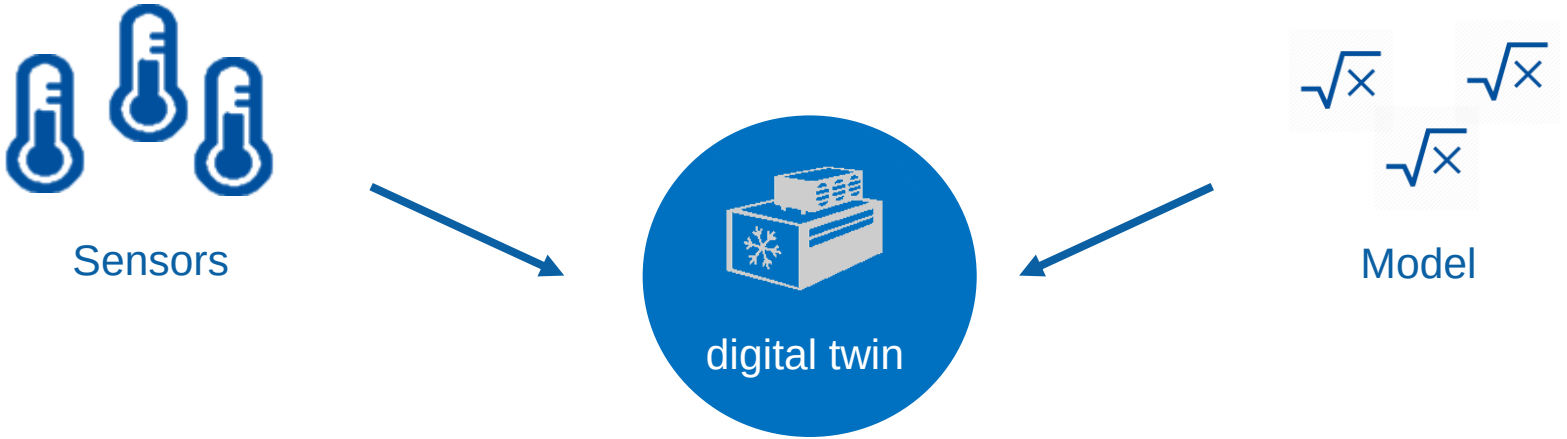


A simple digital replica ?

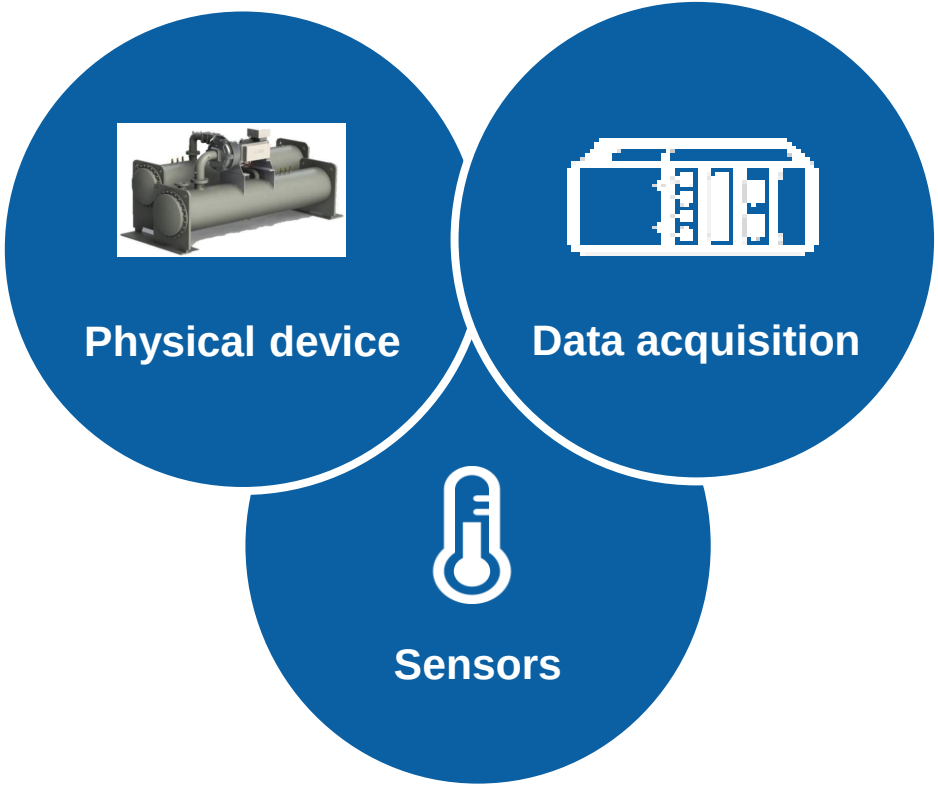
History

Log the device history

Future

Forecast device future

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



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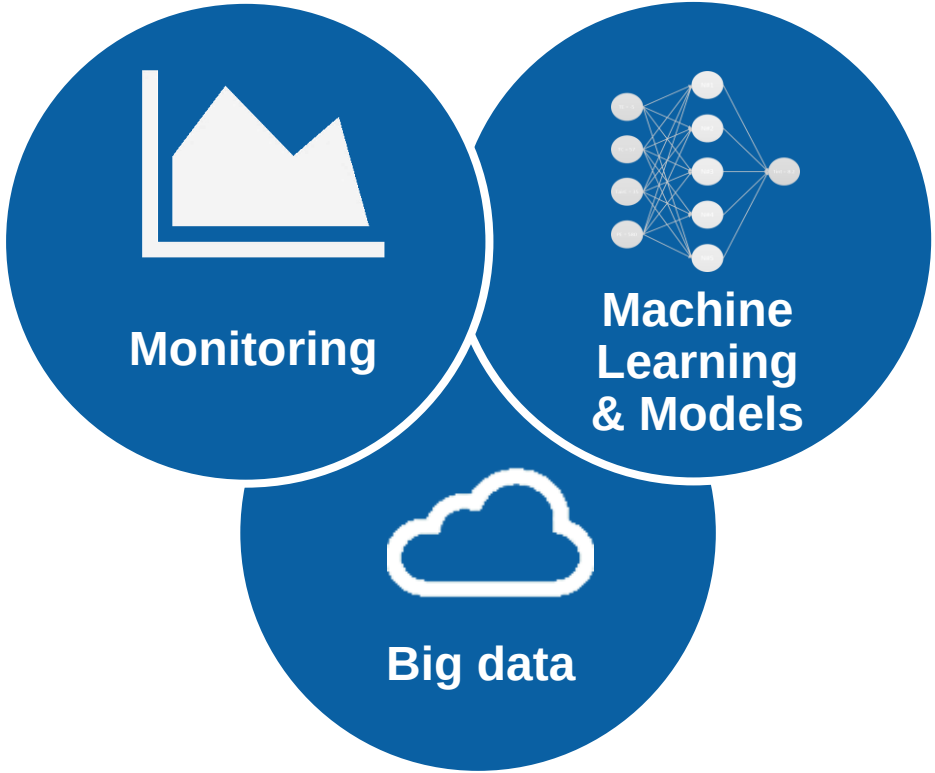
A bridge between the physical and **digital world**



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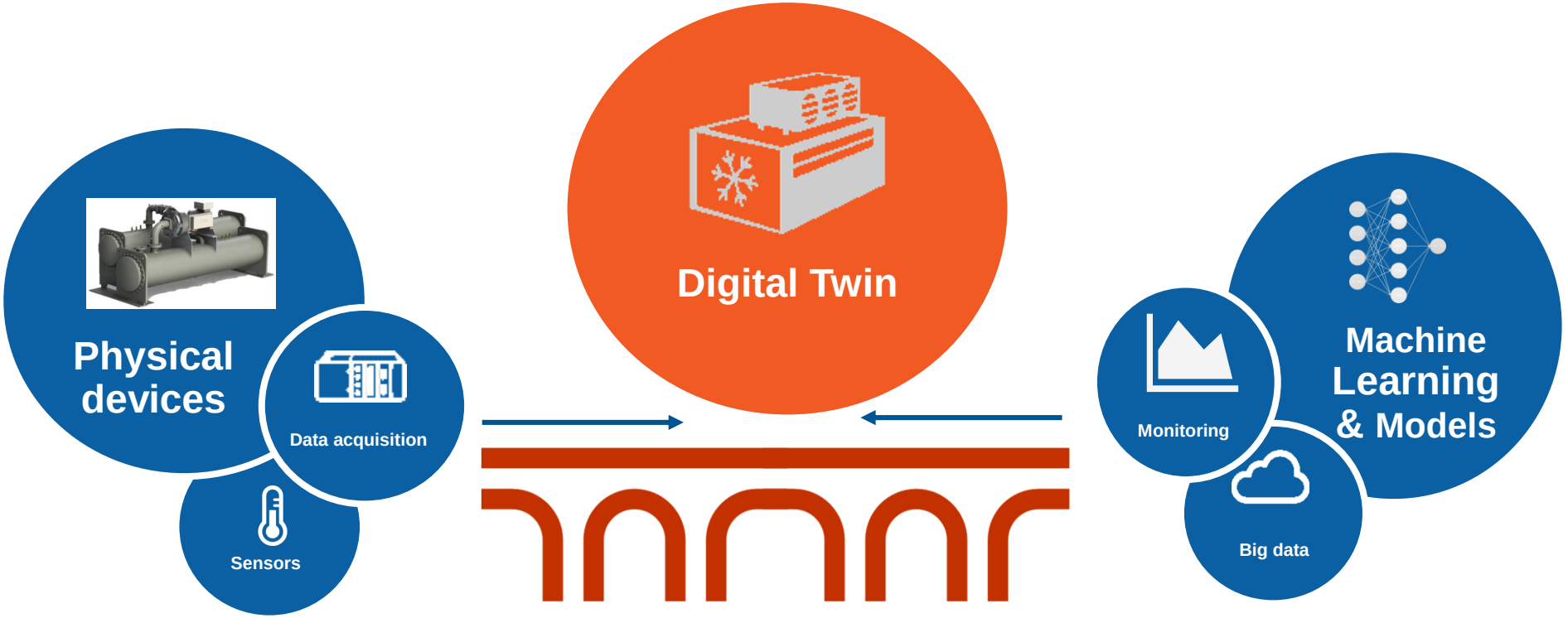
A bridge between the physical and digital world



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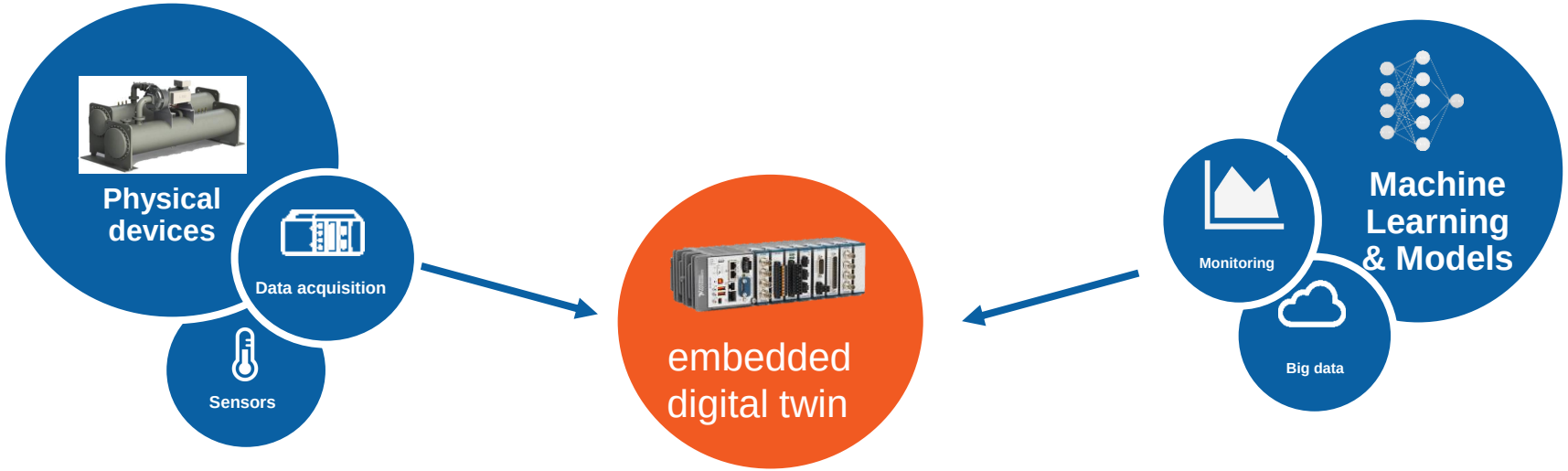
Embedded Digital Twin for HVAC diagnostic

We developed an Embedded Digital Twin …



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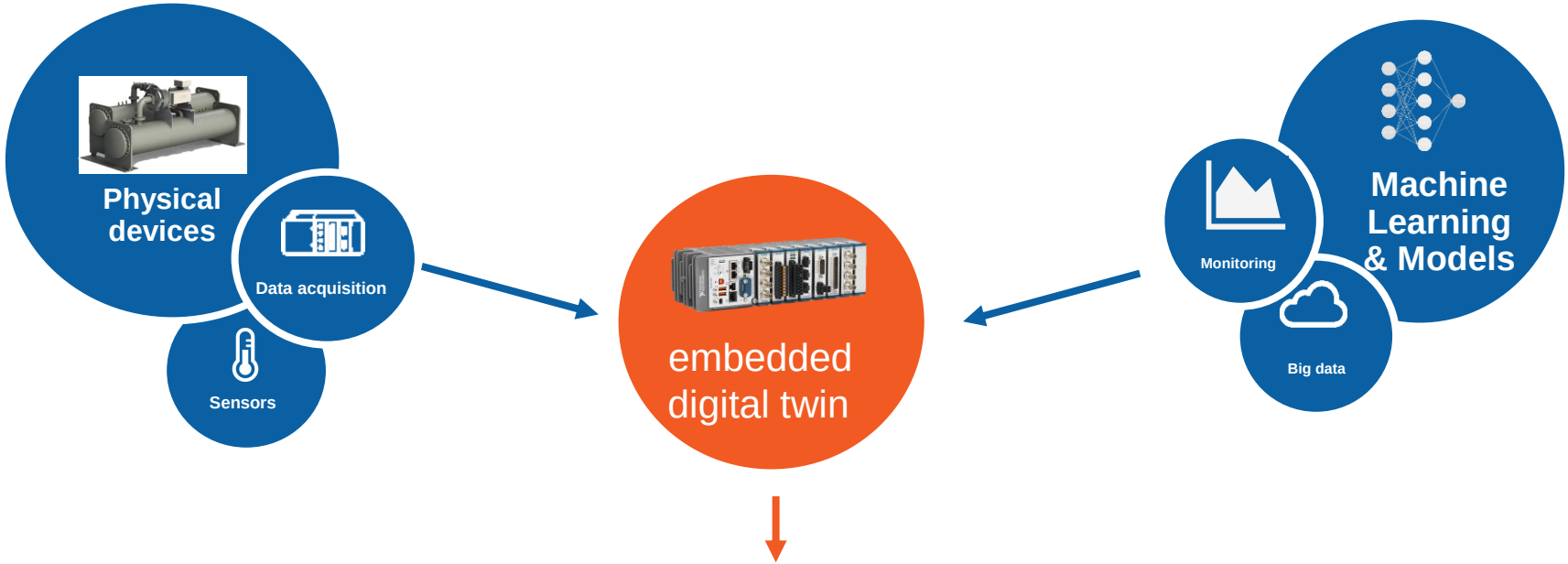
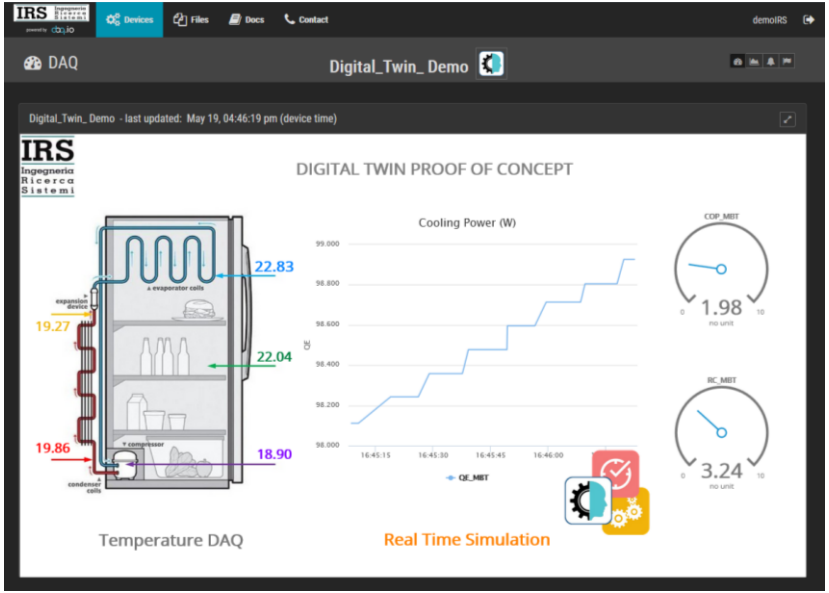
… for HVAC Device Diagnostics



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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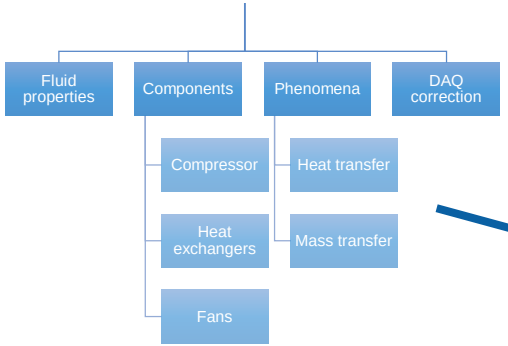
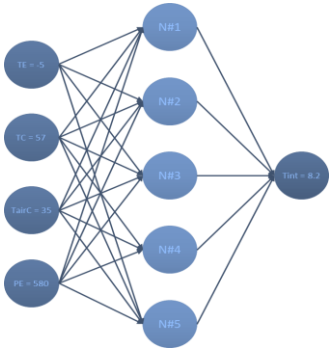
A twin using model technology 4.0

Model technology 4.0

Physical Model



Machine learning



embedded digital twin

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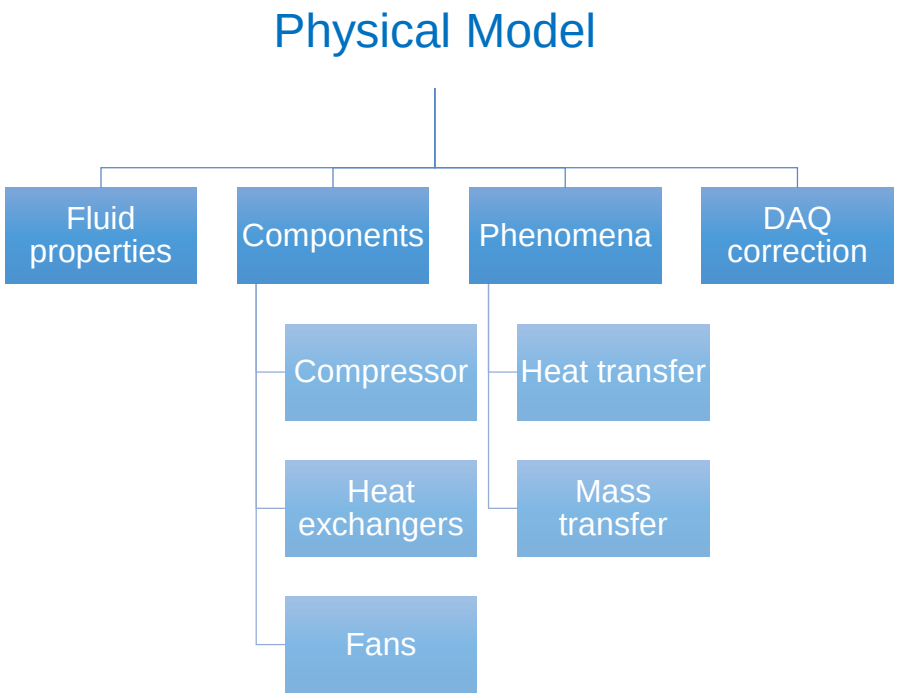
HVAC Physical Model



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

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

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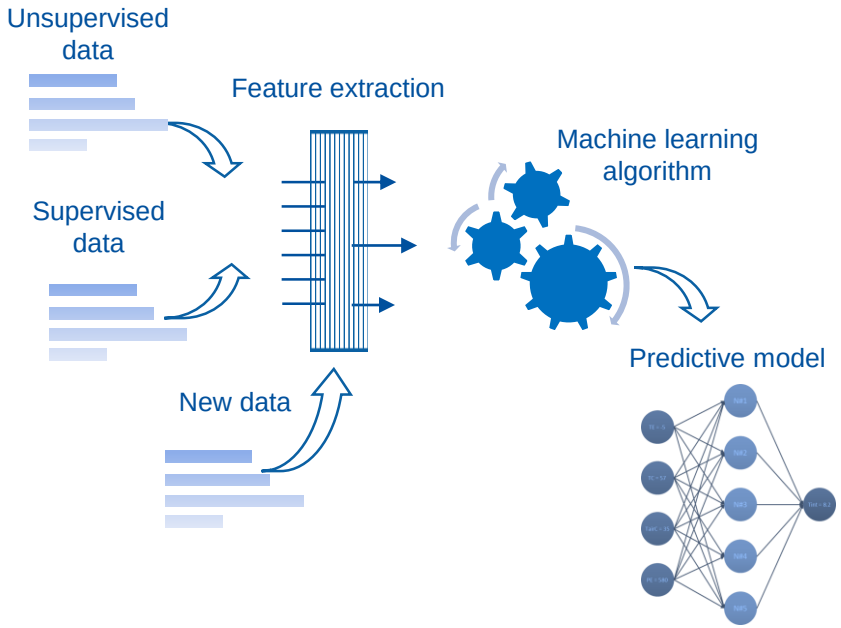
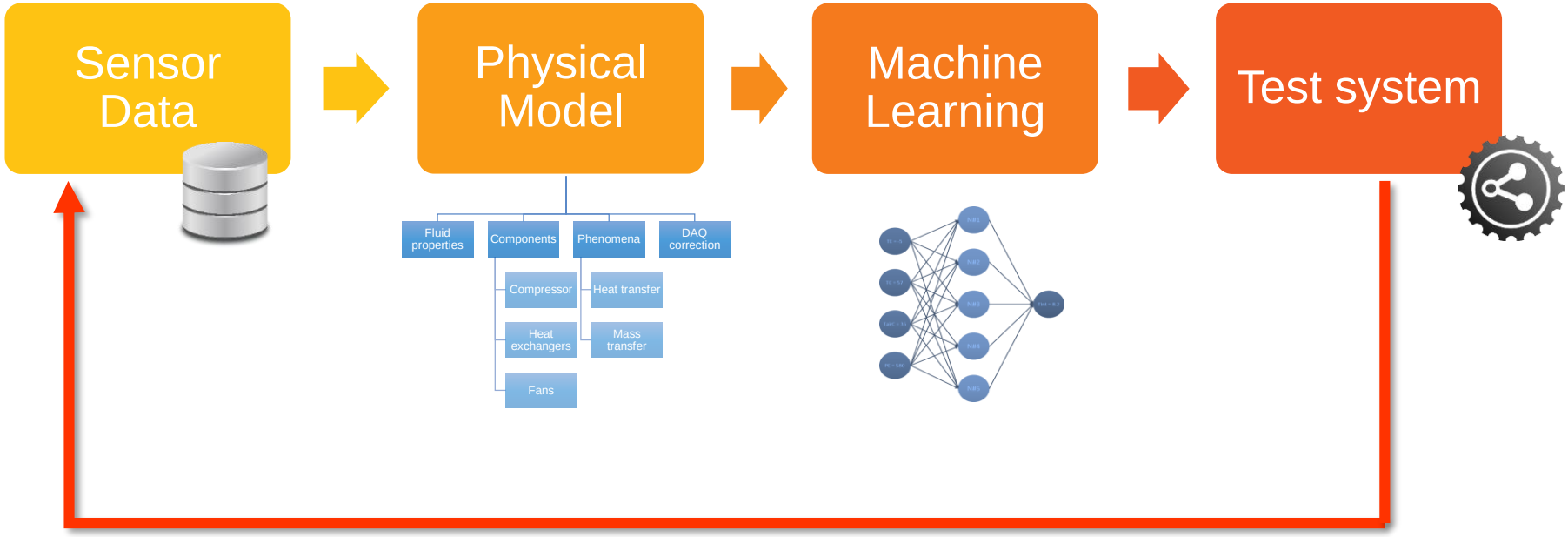
Machine learning



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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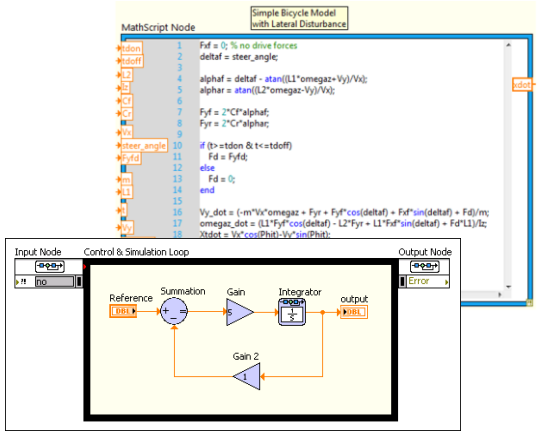
Merging model technology using NI platform



LabVIEW Machine Learning Toolkit

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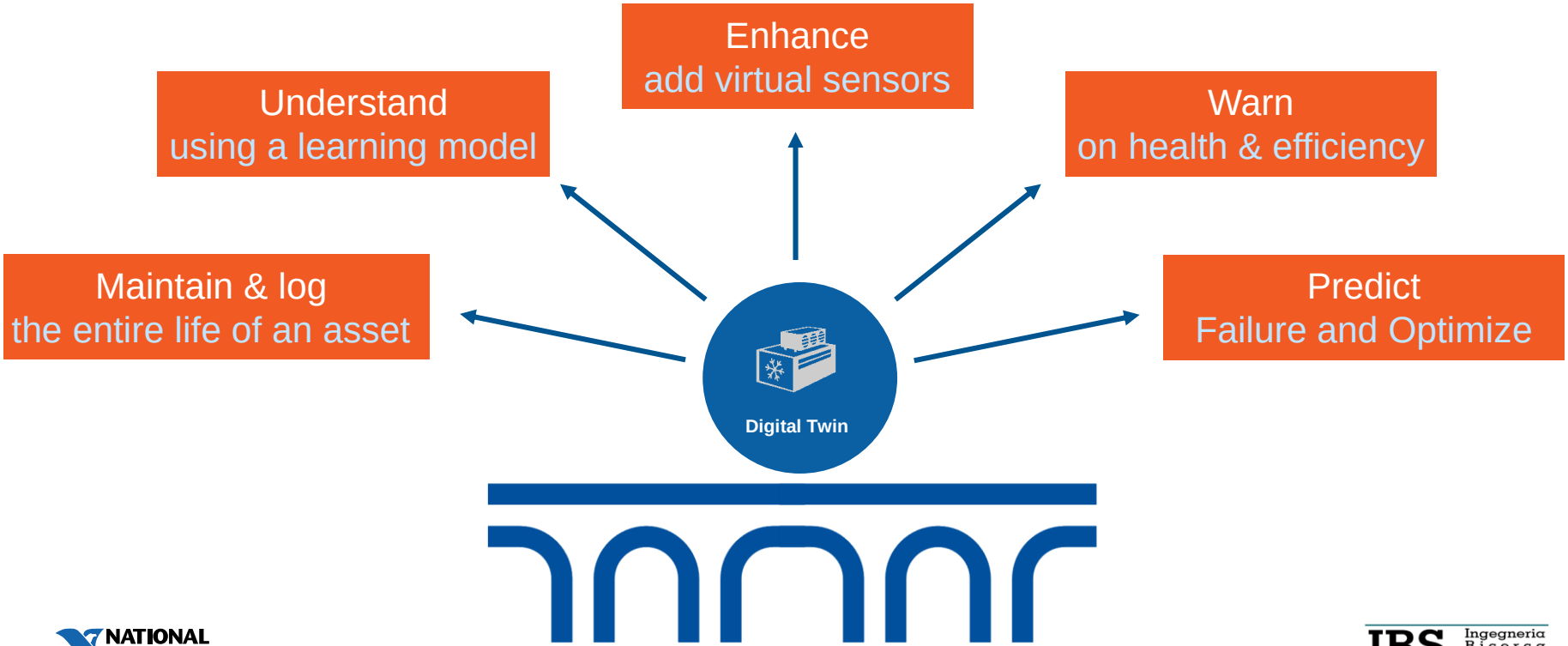
Value and ROI of digital twins

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



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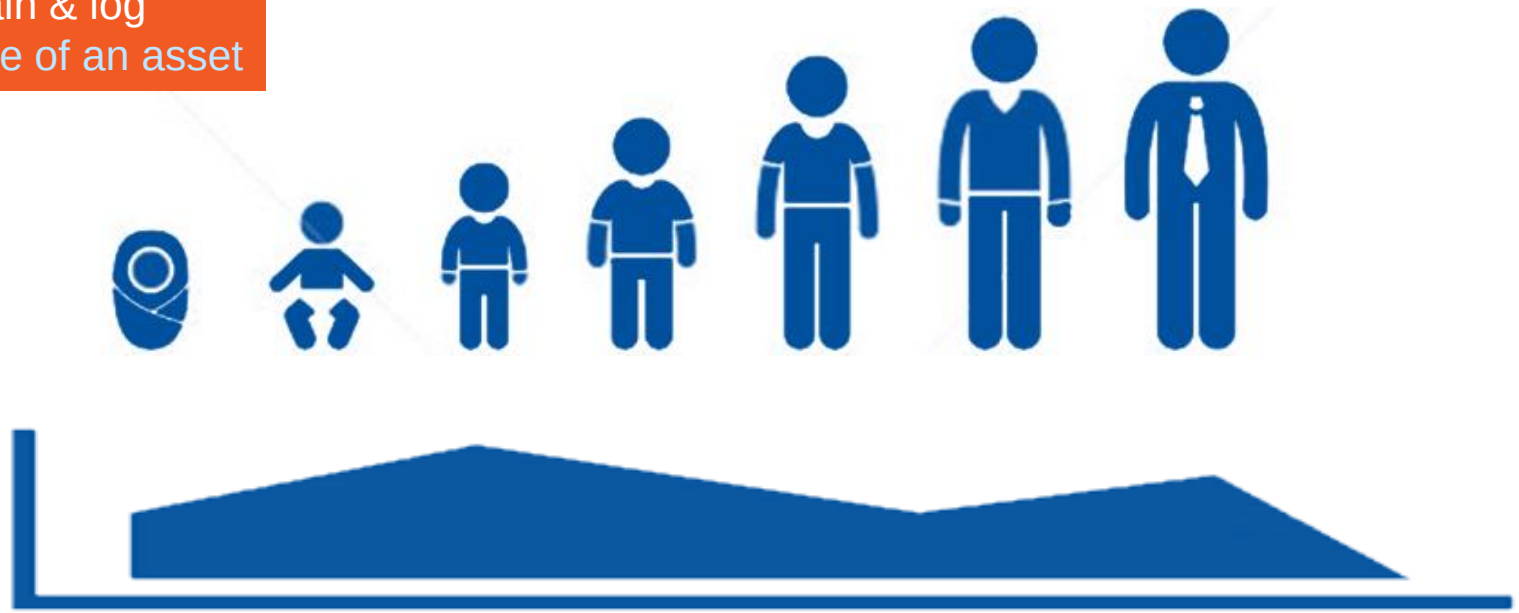
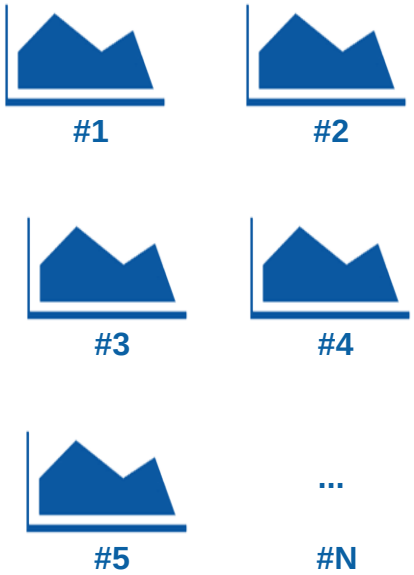
Value and ROI of digital twins

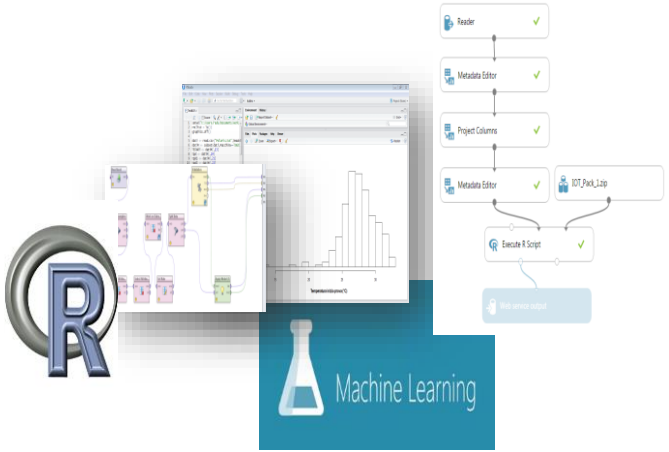
Maintain & log
the entire life of an asset



Value and ROI of digital twins

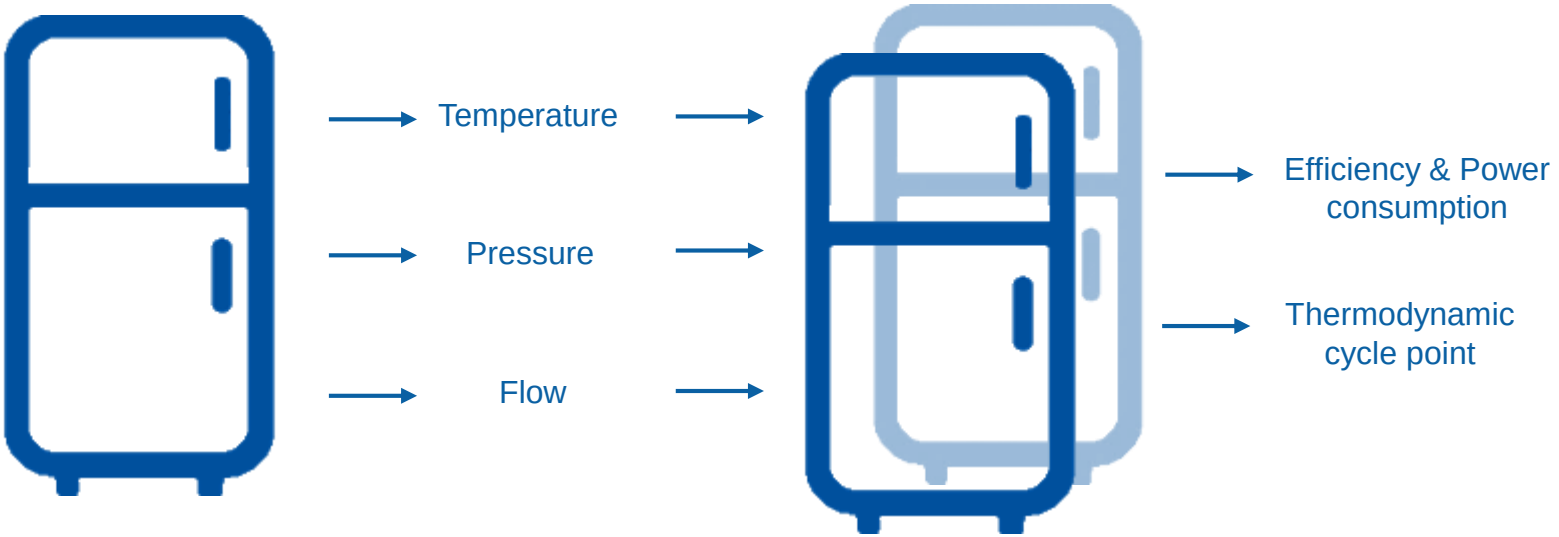
Understand
by learning model





Value and ROI of digital twins

Enhance
add virtual sensors



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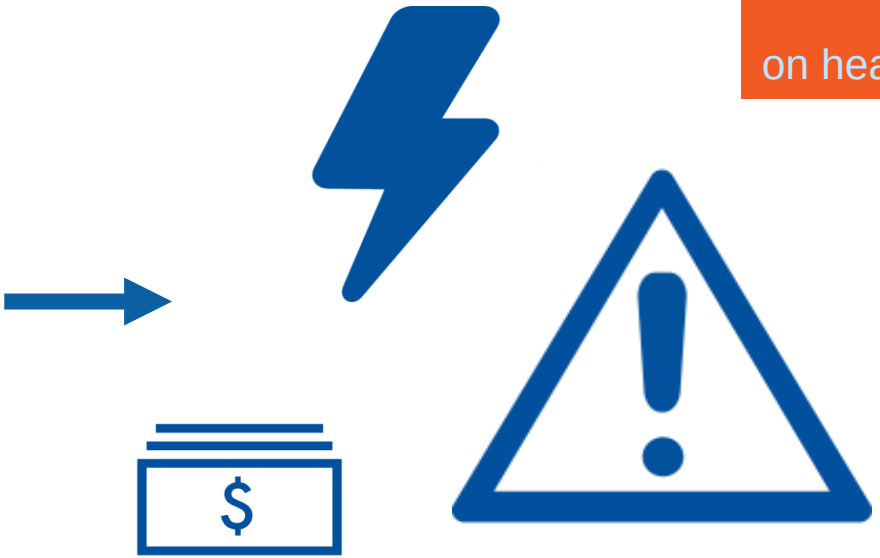
Value and ROI of digital twins

Digital twin



Warn
on health & efficiency

Value and ROI of digital twins

Optimize

Predict
Failure and Optimize

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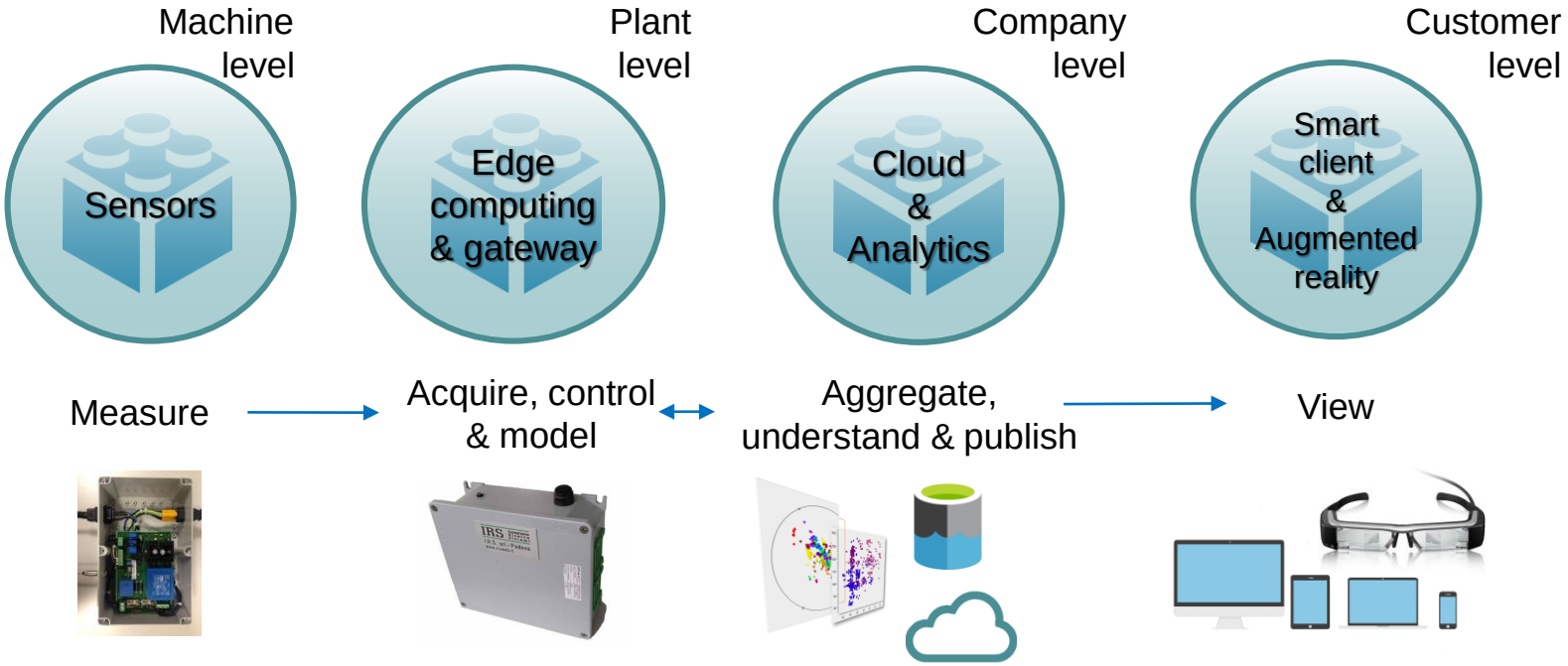
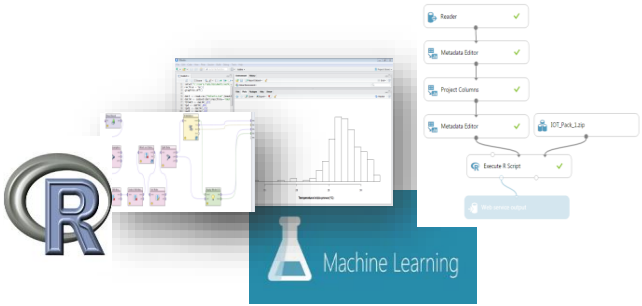
Conclusion

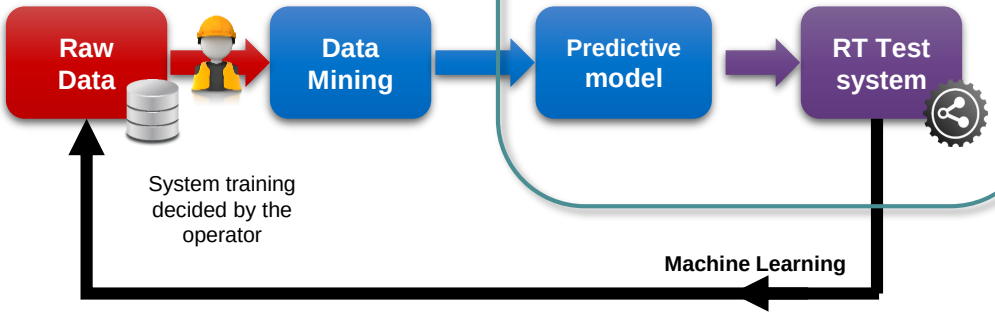
Conclusion : smart monitoring



Conclusion: Artificial Intelligence and physical model



Intelligence at the edge



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Implement digital twin using NI platform and partner like IRS Ingegneria Ricerca Sistemi

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Thank you for your attention.

any question or inquiry

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