

2019-09-03

Industrial AI for Autonomous Industries @ ABB

Dr. Christopher Ganz, ABB



Transformation in markets: energy and fourth industrial revolutions

The Energy Revolution



The Fourth Industrial Revolution



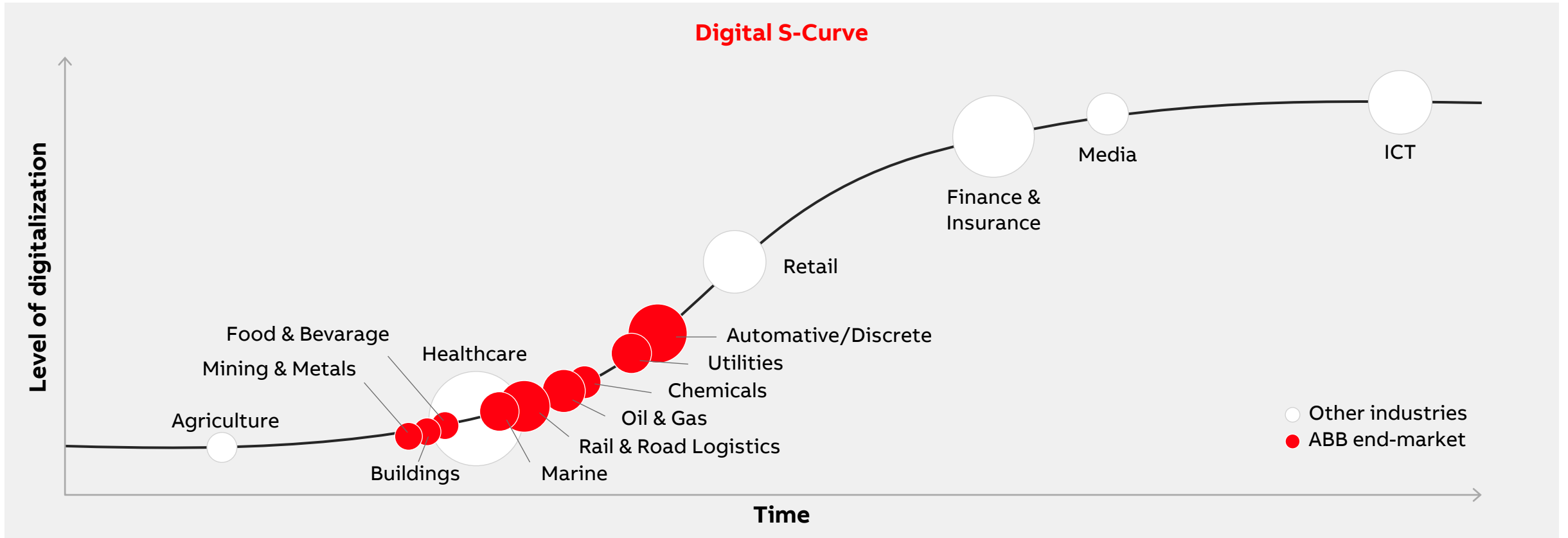
Utilities

Industry

Transport & Infrastructure

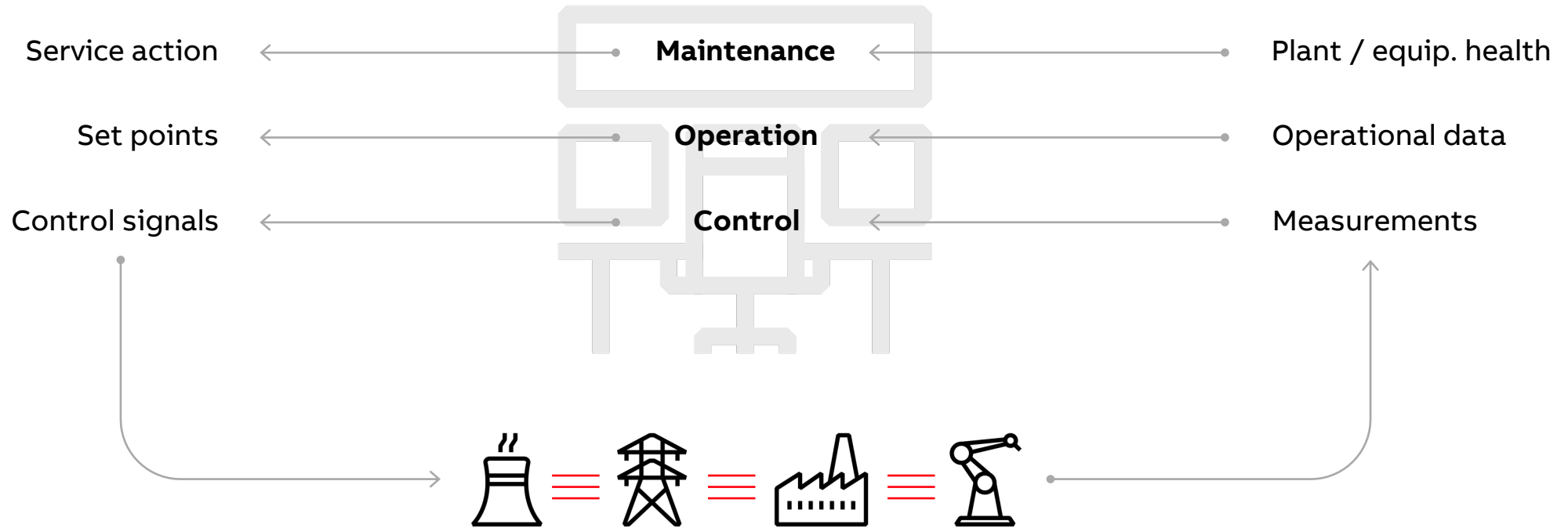
Industrial markets primed to adopt digital technologies

Computing + connectivity + cloud + analytics set to unlock value



What does it take to win in digital?

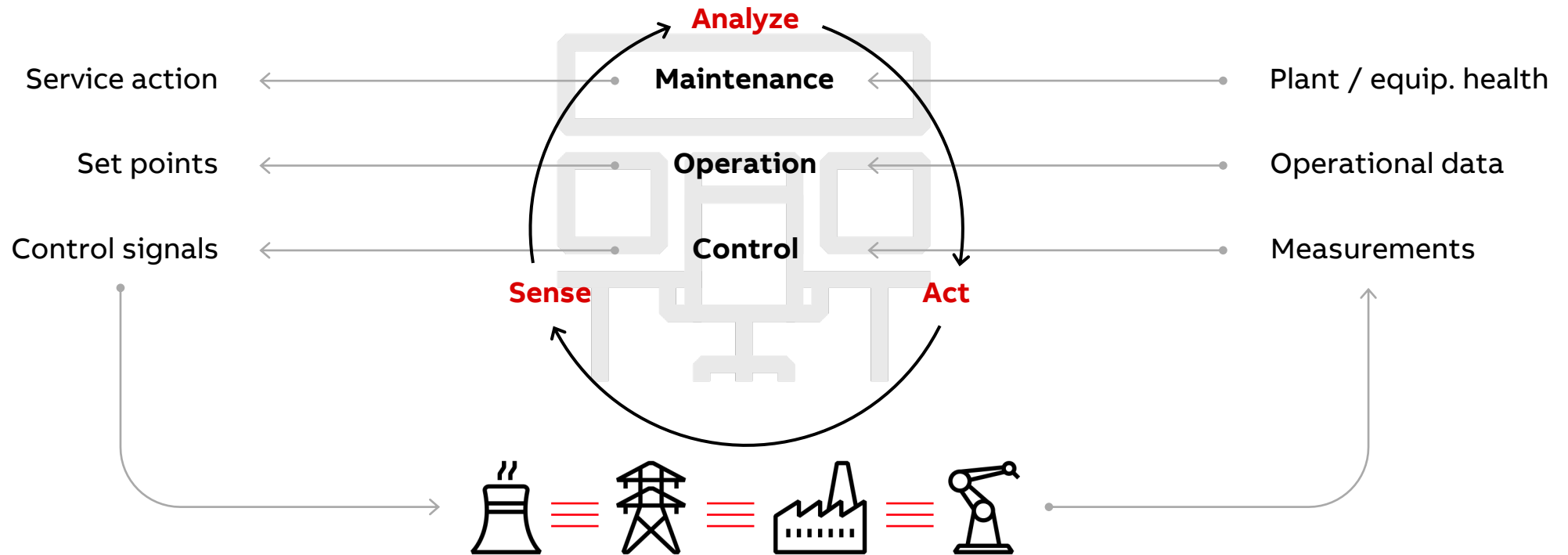
Mastering the control room



From physical to digital differentiation

What does it take to win in digital?

Mastering the control room



Sadara: largest petrochemical plant

150,000 connected devices



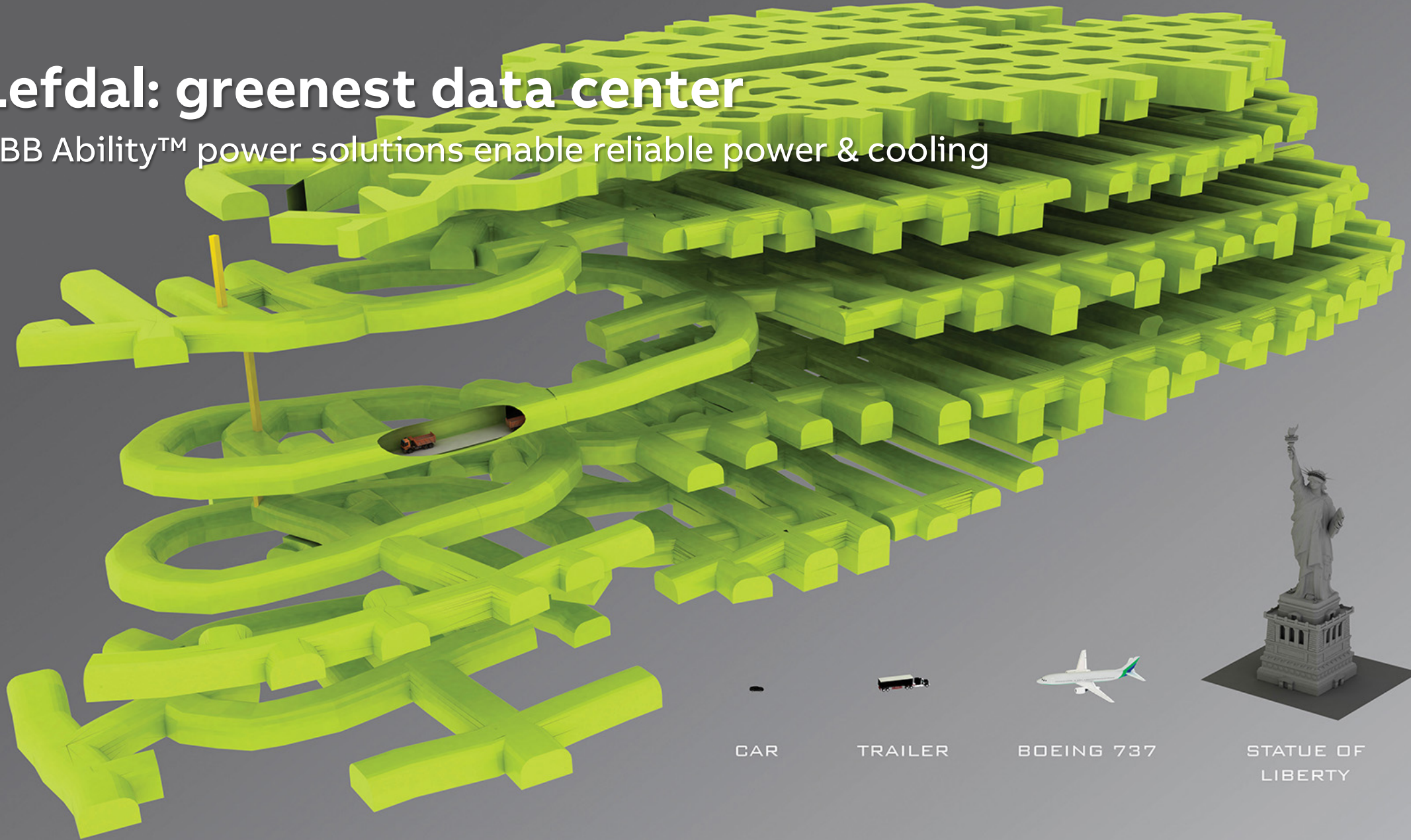
Garpenberg: world's most productive zinc mine

ABB Ability™ Mine Optimize delivers energy savings and improved uptime



Lefdal: greenest data center

ABB Ability™ power solutions enable reliable power & cooling



CAR

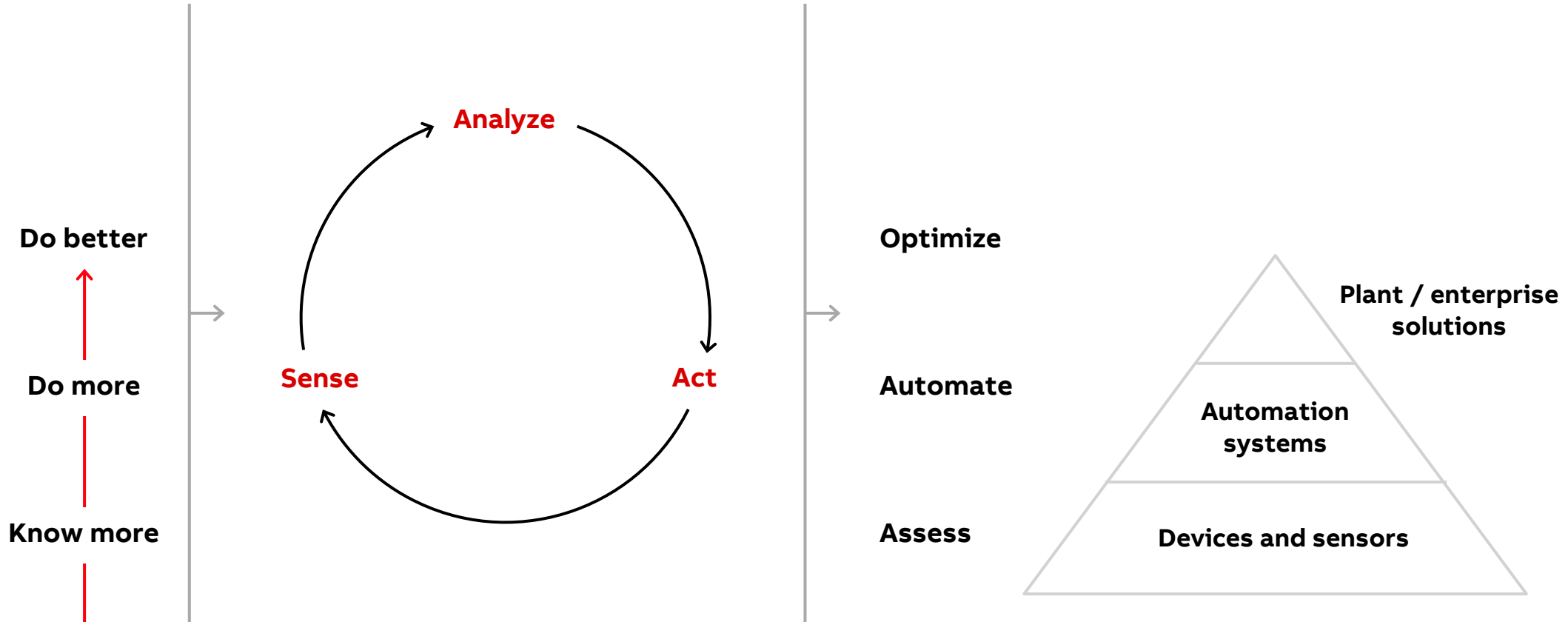
TRAILER

BOEING 737

STATUE OF
LIBERTY

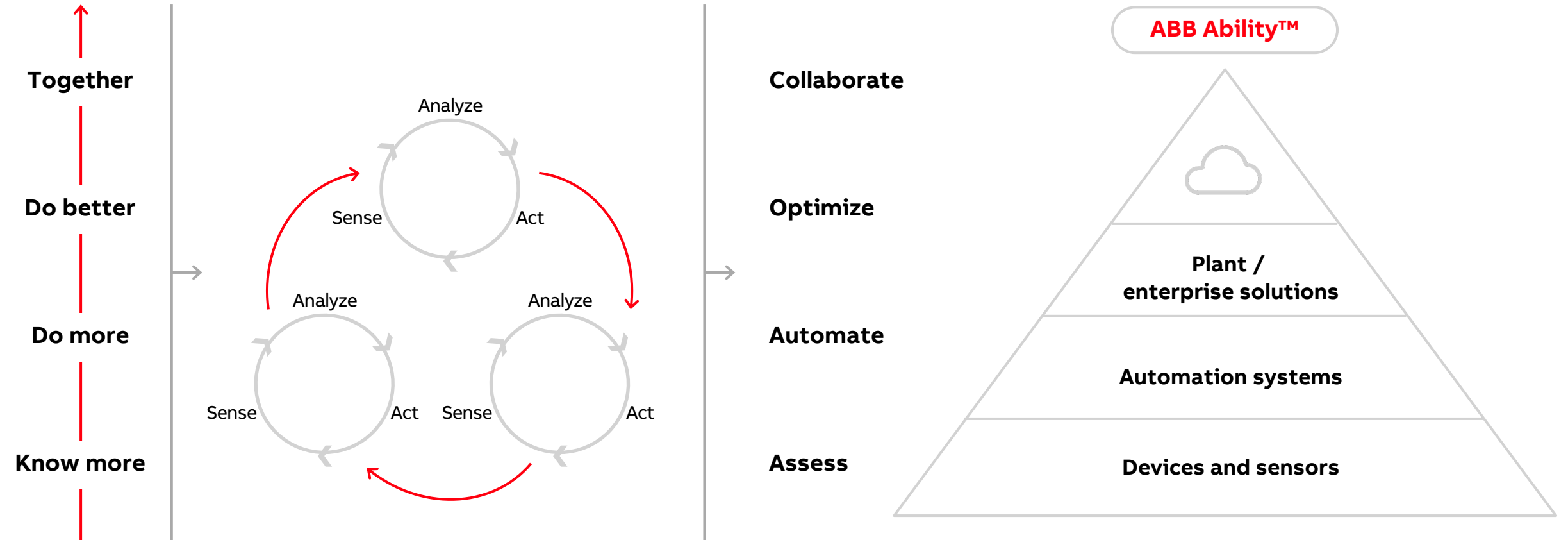
How ABB Ability™ solutions deliver value

Digitally connected products and services providing expertise



How ABB Ability™ solutions deliver value

Digitally connected products and services providing expertise



Collaboration in the data driven ecosystem

ABB Ability™ in action

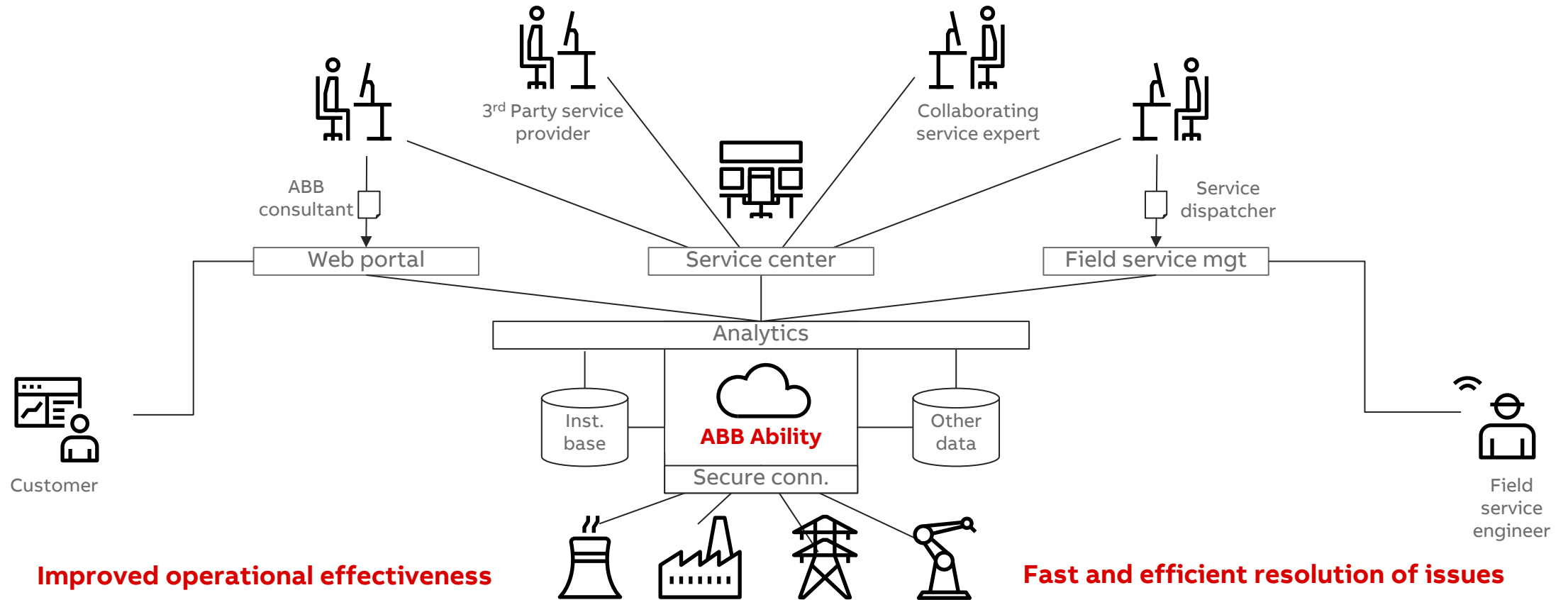


ABB Ability™ Collaborative Operations™

700 vessels connected, 24/ 7

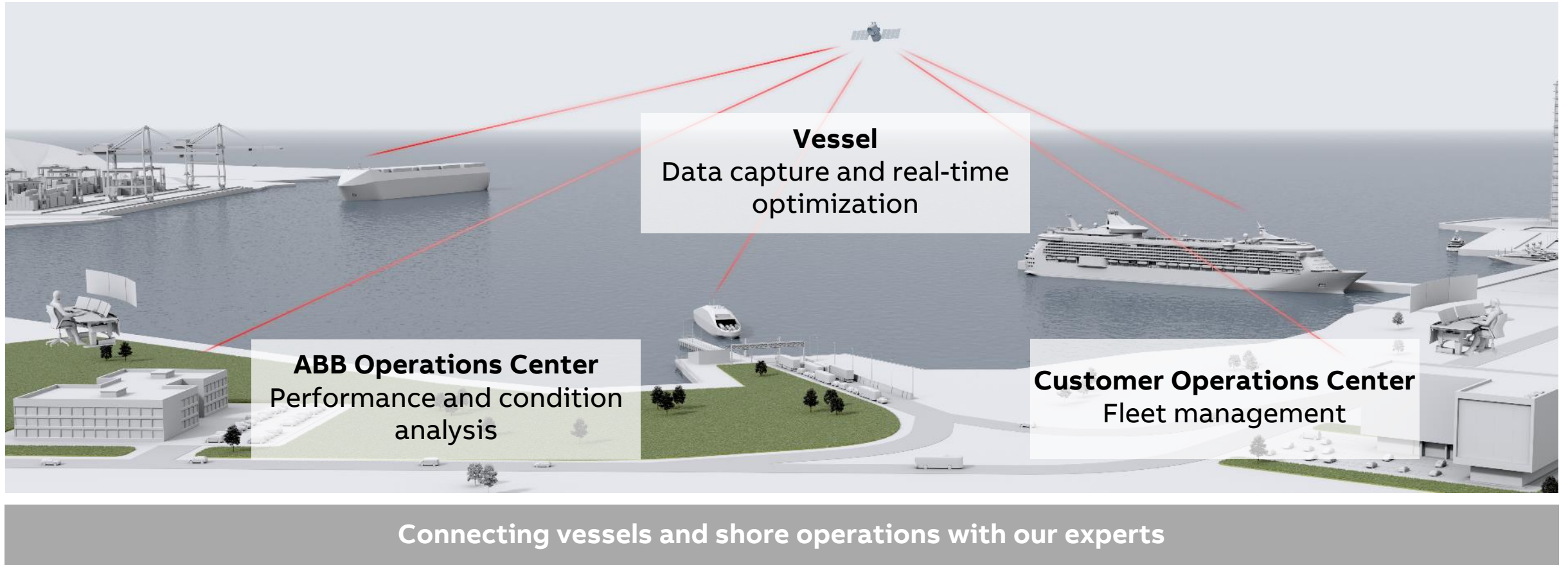


ABB Ability™ Collaborative Operations™

ABB Operations Centers

24/7 globally



Monitoring & Optimization

Energy efficiency and safety



Maintenance & Condition Monitoring

Availability



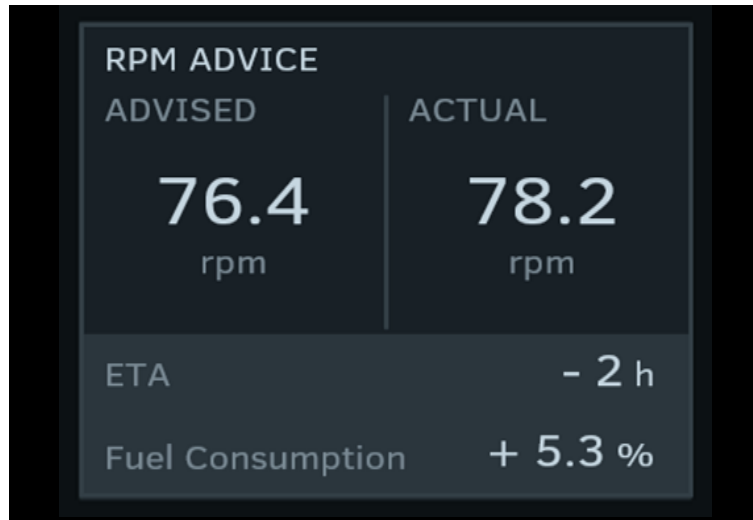
Our way of working. Today.

ABB Ability™ Collaborative Operations™

Operation monitoring and optimization with Octopus

Speed and route optimization

2-5% saving opportunity



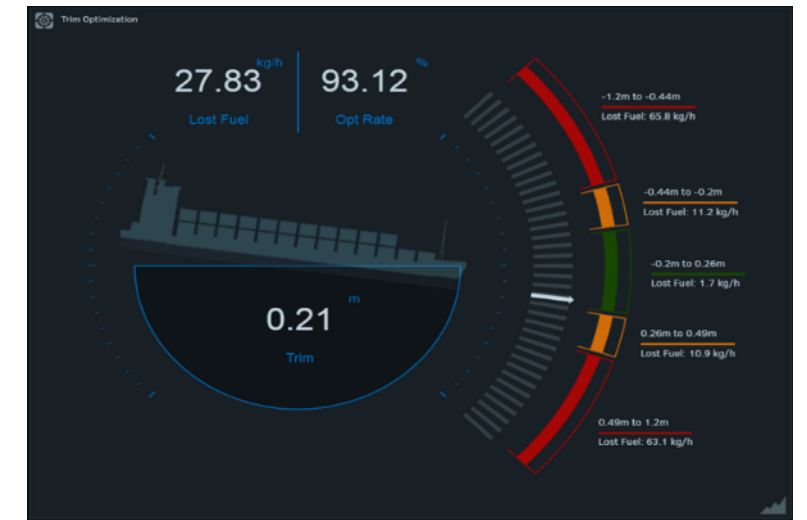
Motion forecasting

Zero damage to cargo



Trim optimization

2-5% saving opportunity



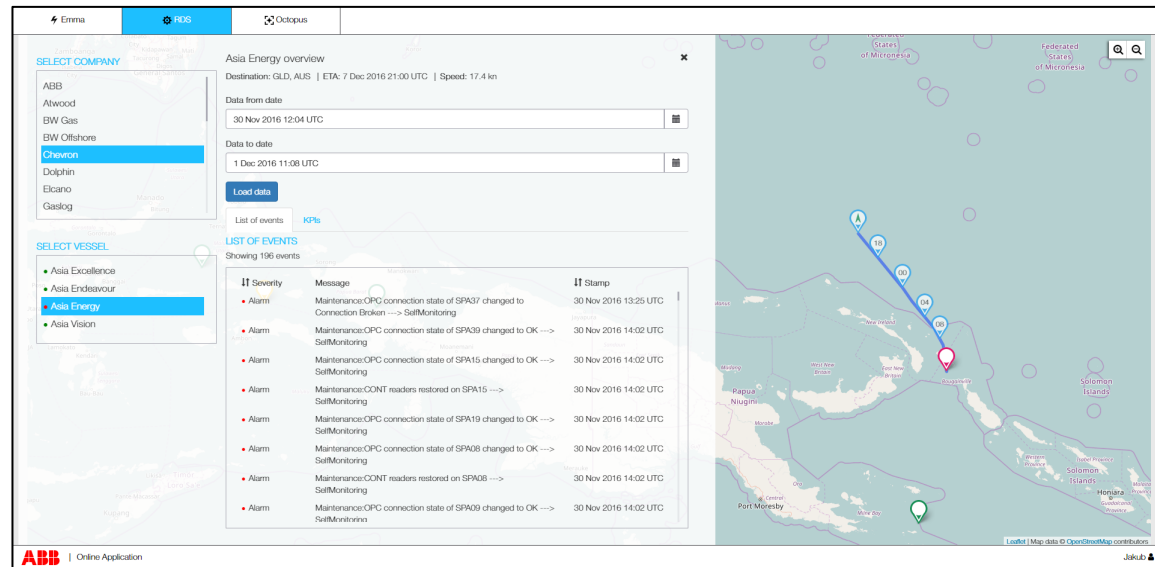
Digital benefits also goes beyond ABB equipment

ABB Ability™ Collaborative Operations™

Maintenance and condition monitoring with RDS

Asset health and dashboards

Avoid down-time



Remote diagnostics & Condition-based maintenance

Extend mechanical bearing lifetime from 3 to 5 years

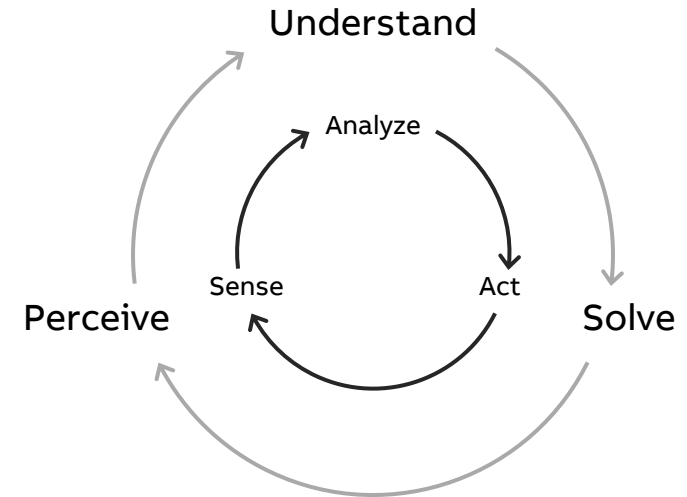
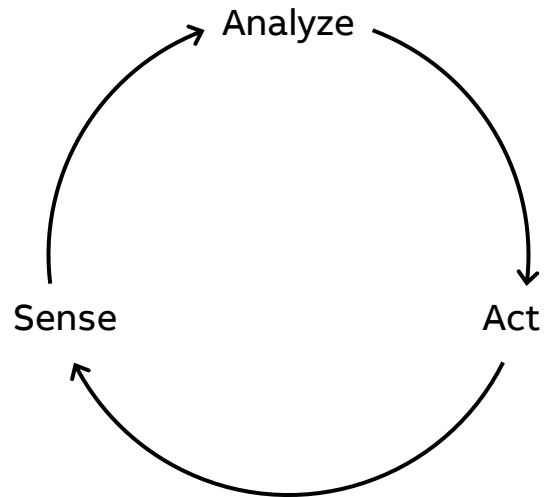


Maximizing equipment up-time

Automated systems move towards autonomous

Automated

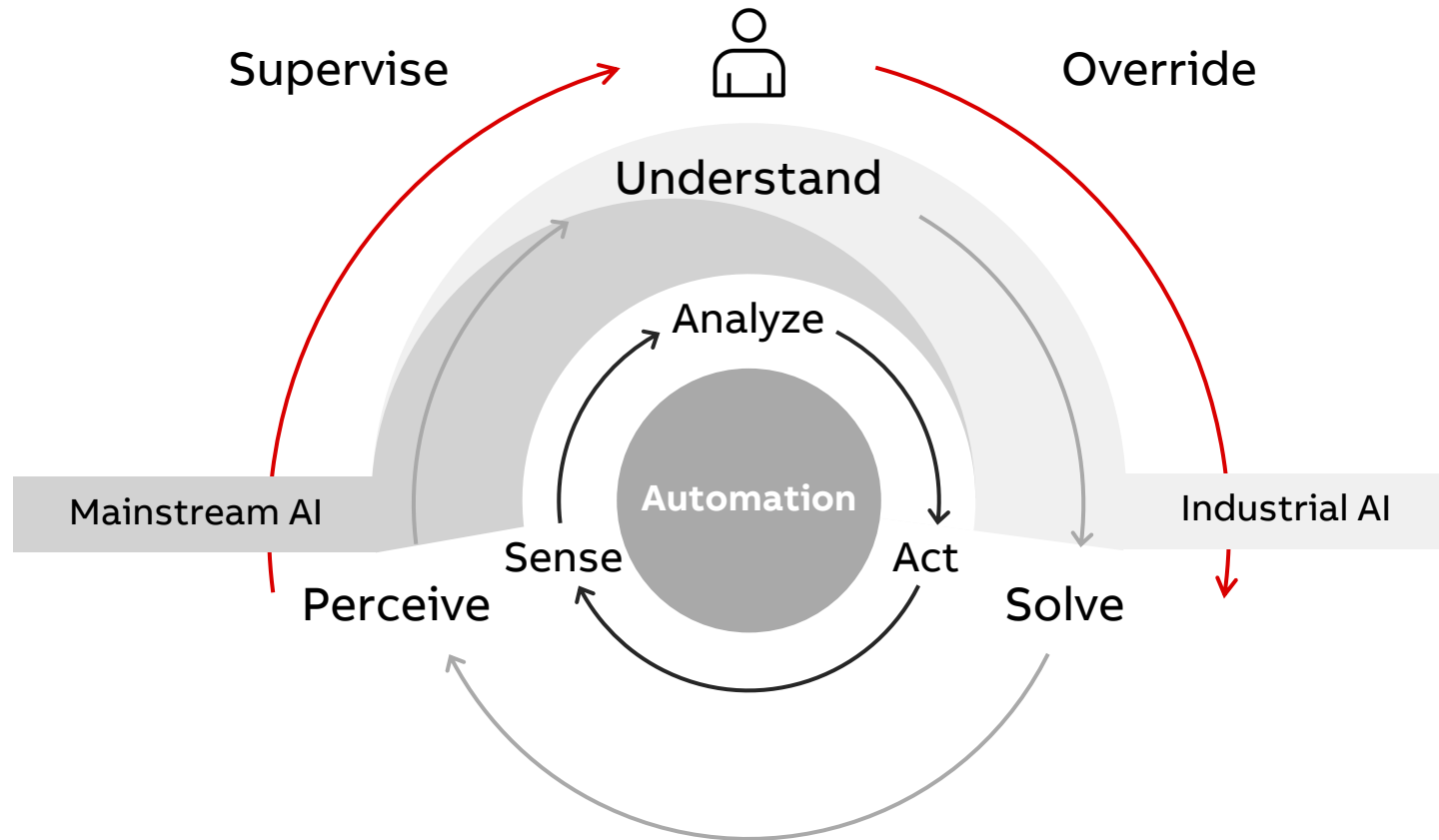
Autonomous



Steady state control → Normal operation – Start, transients, stop → Complete plant lifecycle →

Moving towards autonomous industries

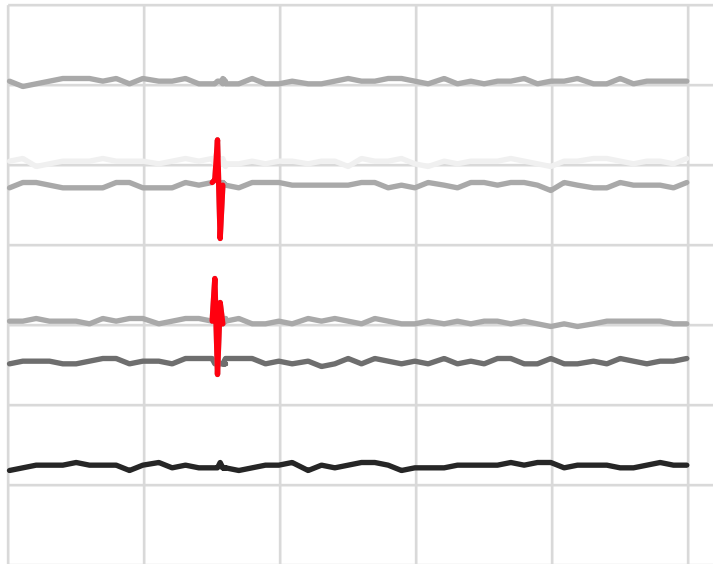
AI is the enabling technology



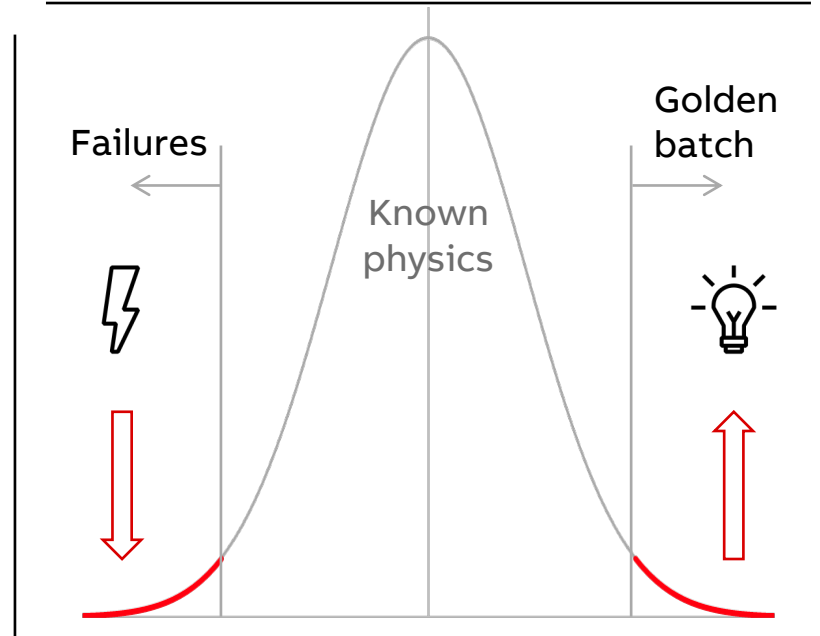
Properties of Industrial AI

Compared to mainstream AI – AI for consumer applications

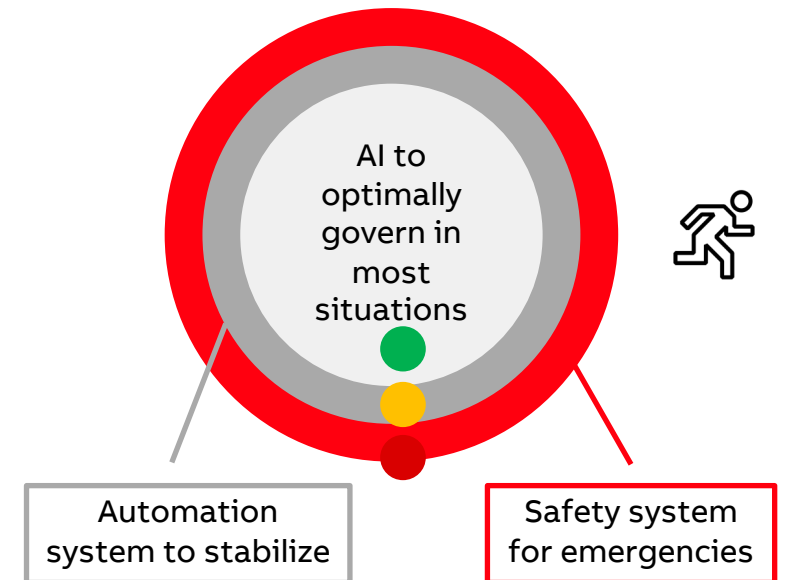
Perceive despite sparse information



Understand the small unknown



Solve without violating safety



Industrial AI requires approaches that extend the capabilities of mainstream AI

Complexity of the industrial reality

Life isn't playing a game

Well defined rules and limited states in games



Unlimited states in reality¹

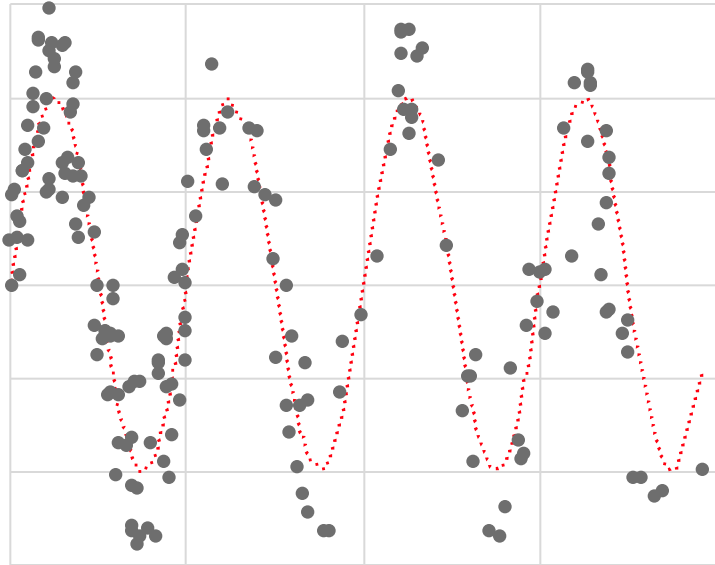


Moving from a closed world to reality requires Industrial AI

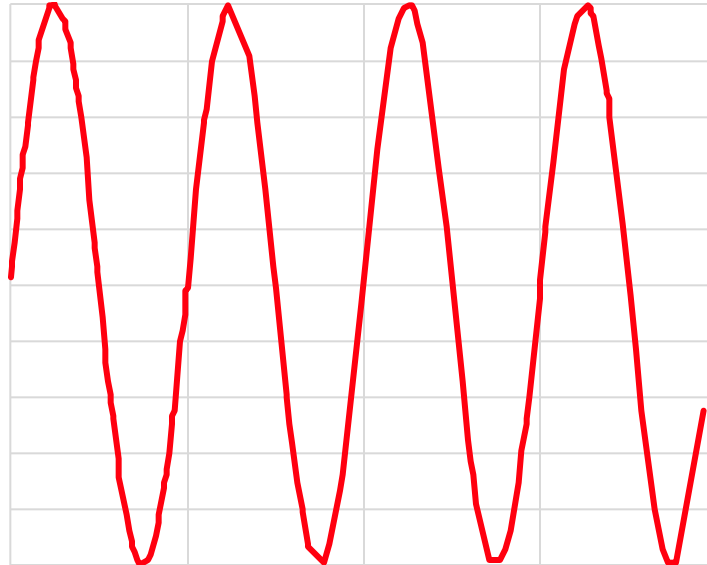
Hybrid algorithms

Use what you know

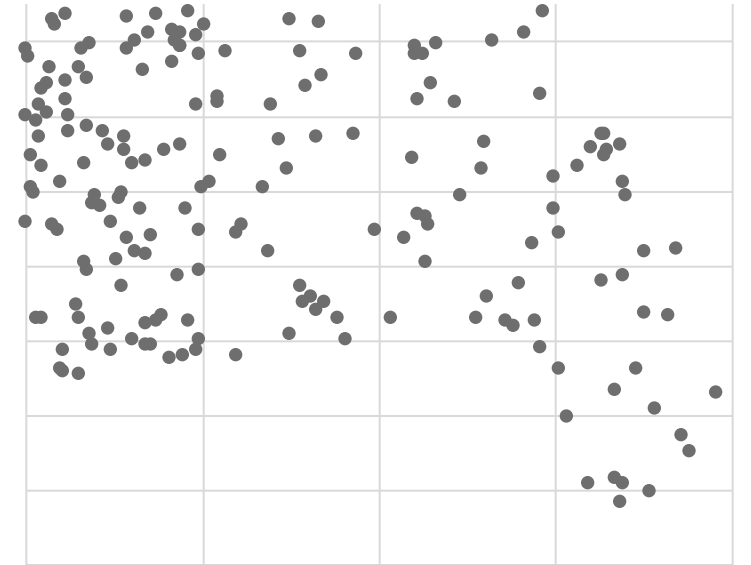
Measurements



Modeled component



Remaining stochastic part

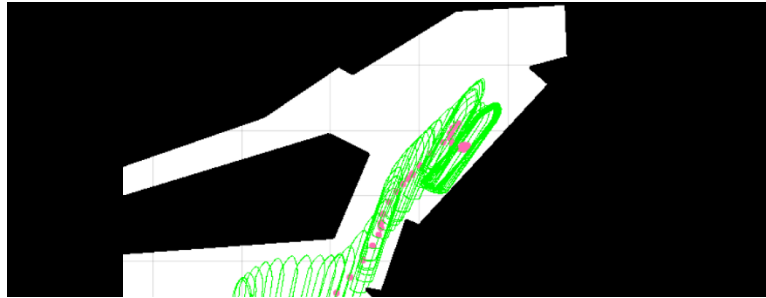


Removing the known from the data reveals the unknown

Industrial AI addressing the complexity in industrial reality

Combining domain knowledge with data

Know (foresight)



Domain knowledge

First principles models and simulation

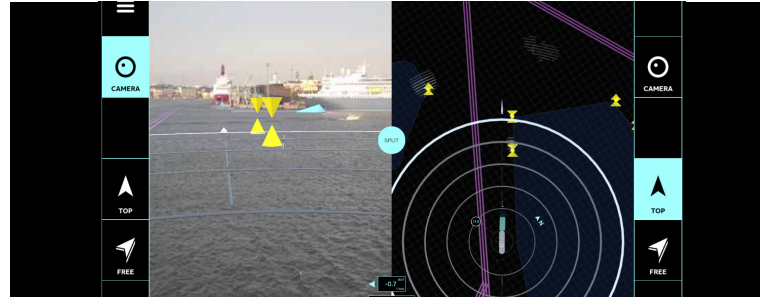
– Described, but not yet observed

Safety, control and optimization

– Engineered well-defined solutions



Observe (hindsight)



Data science

Data driven models

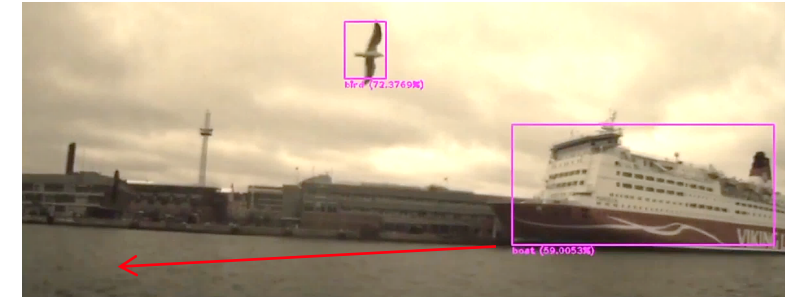
– Observed, but not a priori described

Industrial AI

– Complex scenarios



Combined approach



Build on what is known

Safely avoid known dangers

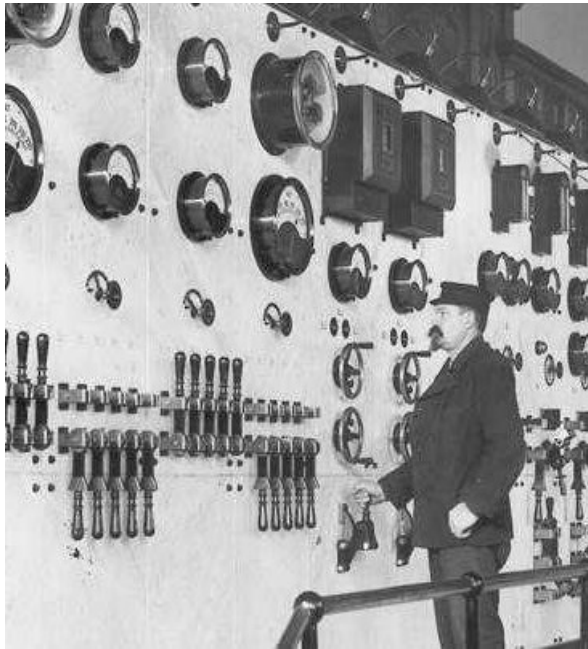
Explore the unknown through data analysis and simulation to increase flexibility

Industrial AI needs a combination of domain and data expertise to be successful

Operator environments: Increasing amount of data presented

Complexity beyond human comprehension

~1910



~1990



~Today



Future



Decision making: human operator – Data based support: artificial intelligence

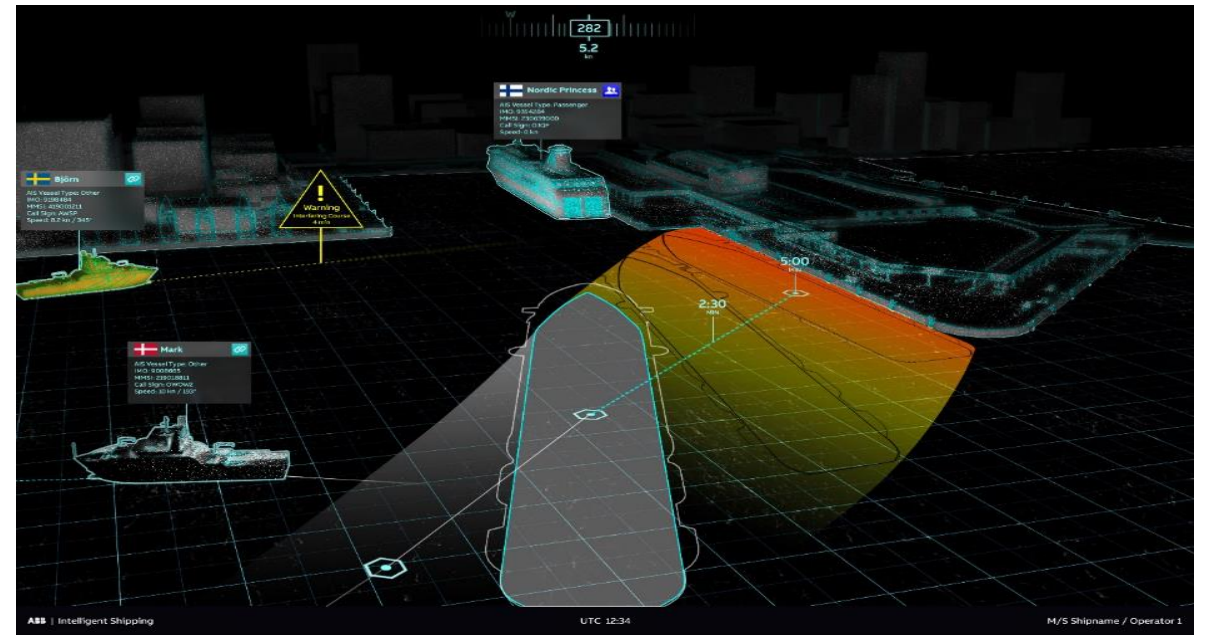
Steering towards autonomous ships

Revolutionizing transport with AI

From...



To...



Changing the view of the captain

Manipulate and move

Autonomous robots designed for target segments

“Data center sheriff”



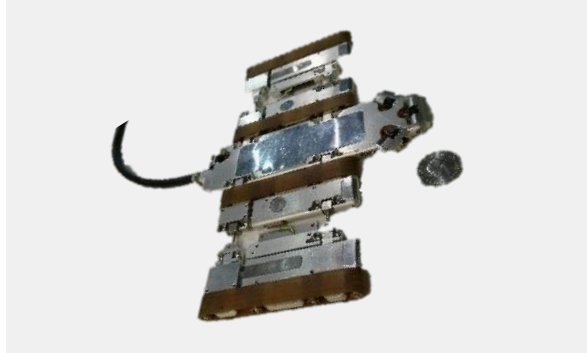
“Motor crawler”



“Transformer diver”

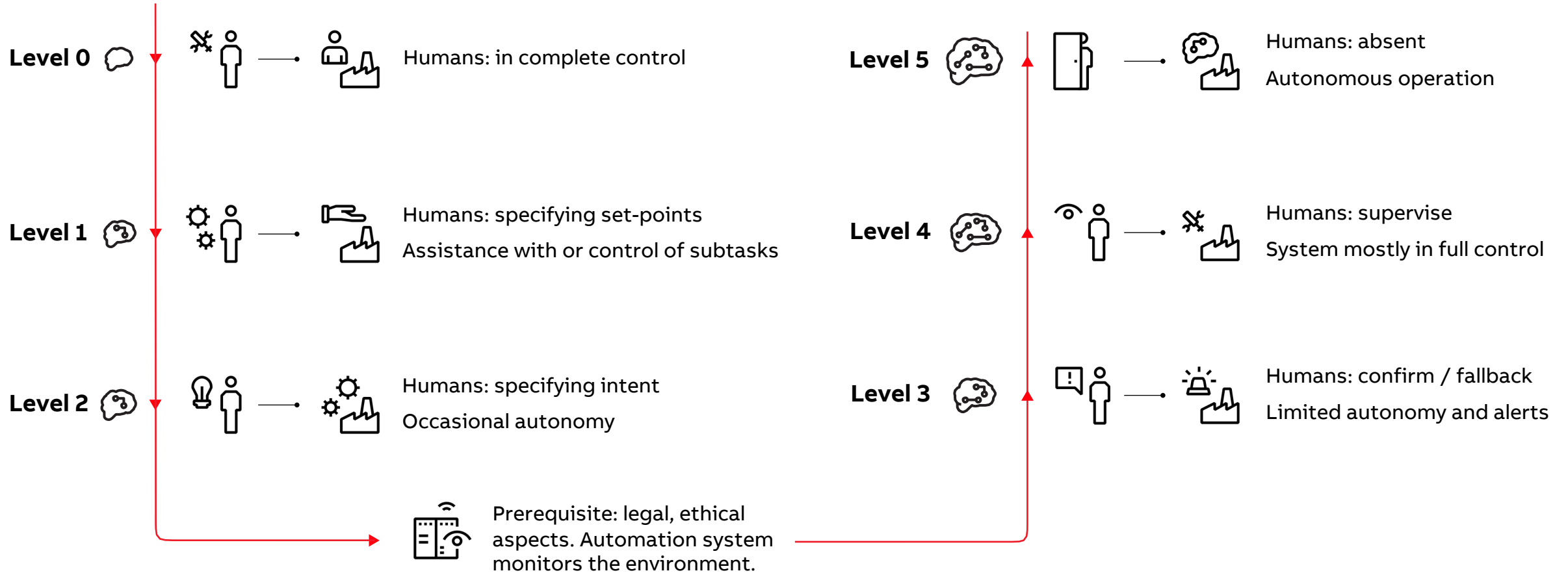


“Plant helicopter”



Moving towards autonomous industries

Increasing the level of autonomy



Conclusions

AI helps expanding automation systems' capabilities towards handling more unplanned situations

Seamless interaction between deterministic, reliable control algorithms and AI solutions are key to success

The availability of complete, correct, and consistent data to train AI algorithms is essential

The interaction between humans and AI systems lead to the creation of the augmented expert, combining best of both worlds



The key focus shall always be the customer's challenge, AI is just one of the tools to be applied

ABB is building a bridge to the future



AABB