

Digital Twin for the Transportation Industry

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Digital Twin

What is Digital Twin?

Digital Twin is a software or virtual representation of a physical asset, with the objective of making the asset more valuable. The desired outcome can be improving reliability and uptime of the physical asset, gaining a better understanding of the asset's current state, response to changes and improving business operations.


“75 Percent of Organizations Implementing IoT Already Use Digital Twins or Plan to Within a Year” - Gartner (Feb 2019)

Why Digital Twin for Intelligent Transportation?

Intelligent Transportation

Digital Twins apply to all forms of Transportation

- Aircraft
- Train/Locomotive
- Ships / Offshore Structures
- Trucks / Cars

A collage of four different modes of transportation: a large cargo ship filled with colorful shipping containers sailing on the ocean, a large cargo plane in flight, a yellow freight train, and a red semi-truck. The background is a light blue sky with soft clouds.

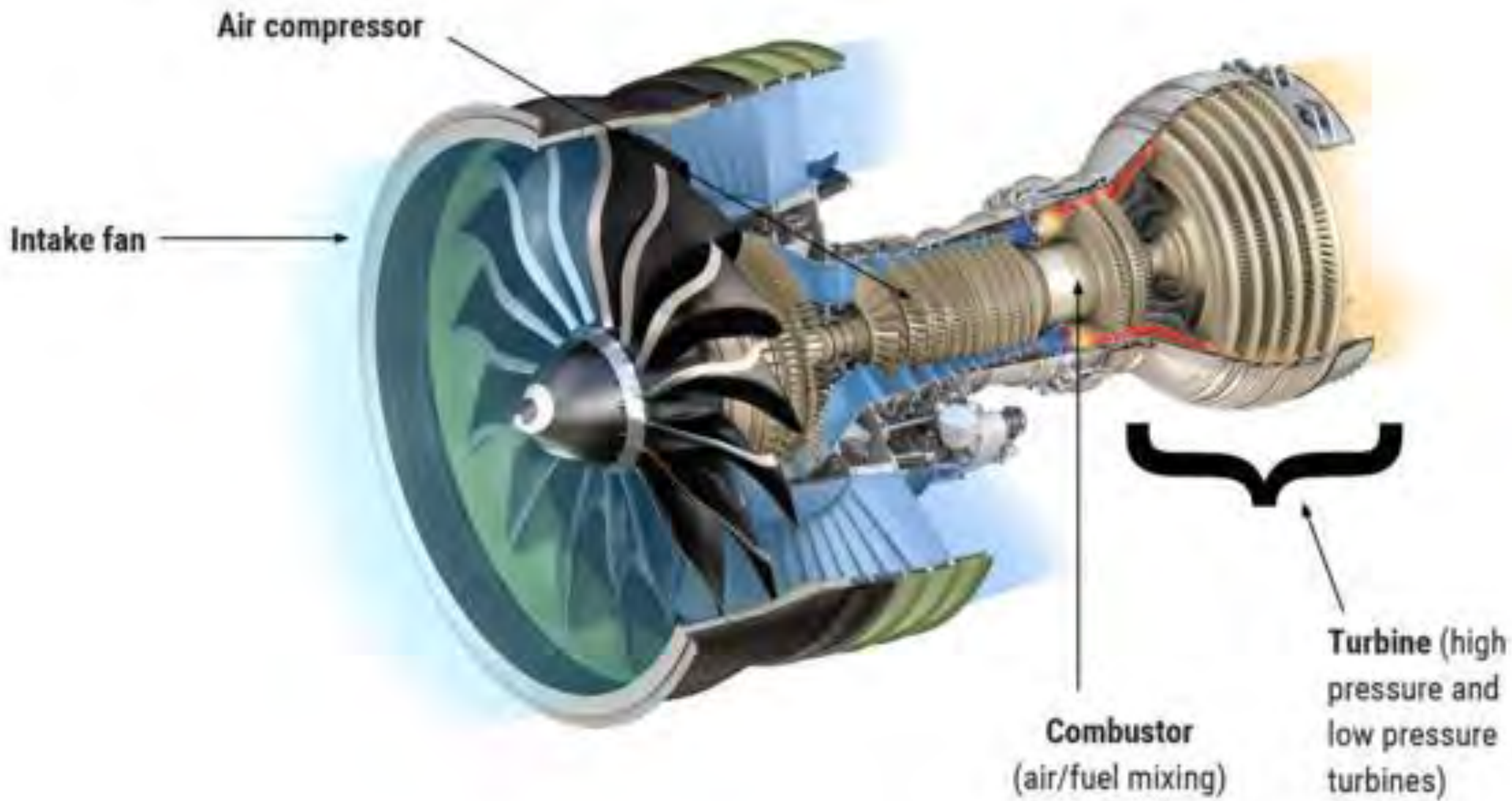
Door-to-Door Transportation



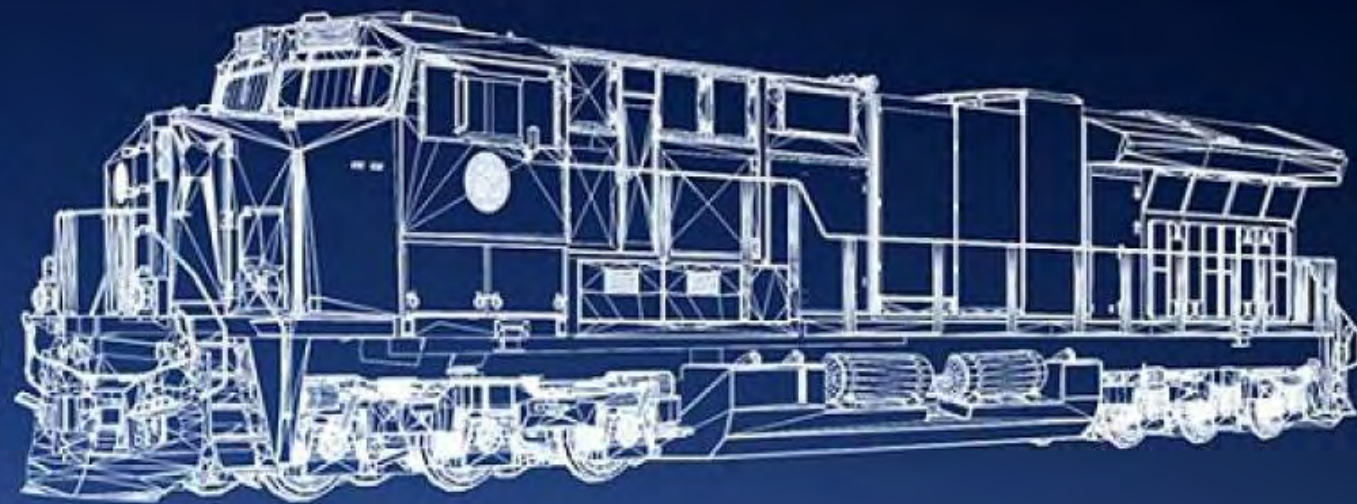
GEAR 1 JAIL
ONLINE
WITHIN THE AIRFRAME
SPINNING
GEAR 1 JAIL

GEAR 2 JAIL
ONLINE
WITHIN THE AIRFRAME
SPINNING
GEAR 2 JAIL

GEAR 3 JAIL
ONLINE
WITHIN THE AIRFRAME
SPINNING
GEAR 3 JAIL







Ships and Offshore Structures

One DIGITAL TWIN



Real time Digital
Links and
services
associated



One Physical Plant



Generate Value from Digital Twin





Digital Twin of Cars



Building the Digital Twin



(Some) TIME SERIES DATA

Altitude
Airframe
Barometric Pressure (electronic/visual)
Outside Air Temperature (OAT)
Fuel pressure (number of engines)
Fuel flow (number of engines)
Cabin air pressure (gusting)
Cargo air pressure, doors, bulkheads
Cabin temperature, doors, bulkhead
Cargo temperature
Fuel temperature, fuel tanks, fuel pumps
Radar air traffic - TCAS

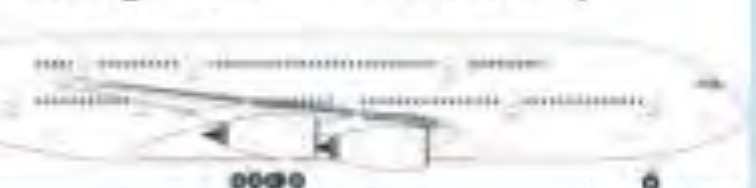
Hydraulic Pressure, brakes, flaps, spoilers, rubber, ailerons, landing gear pumps
Weight sensors - landing gear
Turbines, RPM (N1/N2), inlet turbine pressure, temperature, fuel burn
Voltage, cockpit, main bus, cabin, auxiliary power, cargo, engine, APU
Generator status (engines, APU)
Electric load (amp/hour) flight deck, cabin, cargo
Fuel sensors (cabin, cargo, engine, fuel, brakes, electronic bay)
Carbon dioxide, cabin, cargo
Magnetic compass
GPS (satellite) (in motion)
Radio Compass (RDB)
Doppler radar, weather, lightning, downburst (in motion)

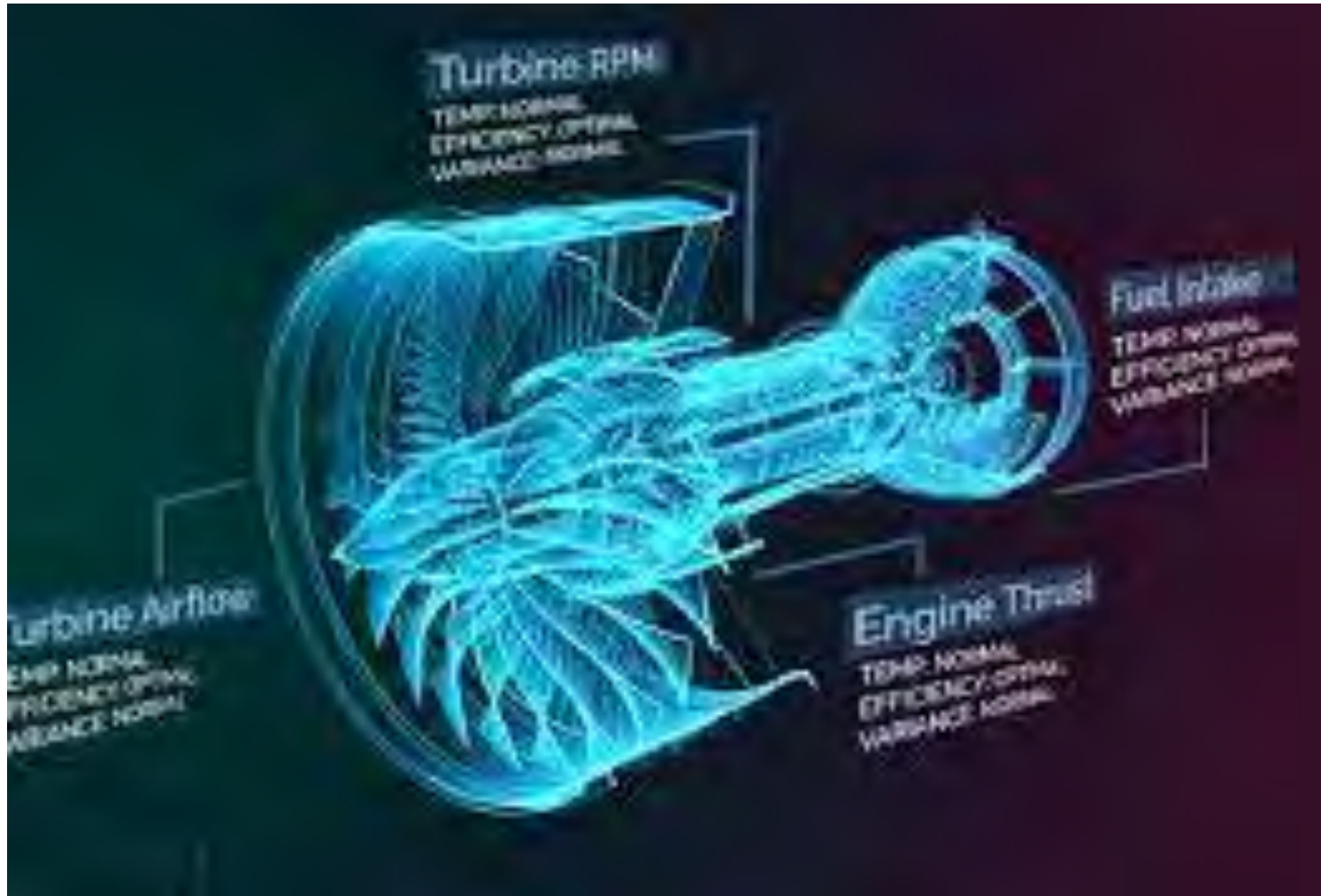
ANALYSIS



CONTEXT

Digital Twin + Digital Thread
configuration traceability





Building the
Digital Twin –
one part at a
time

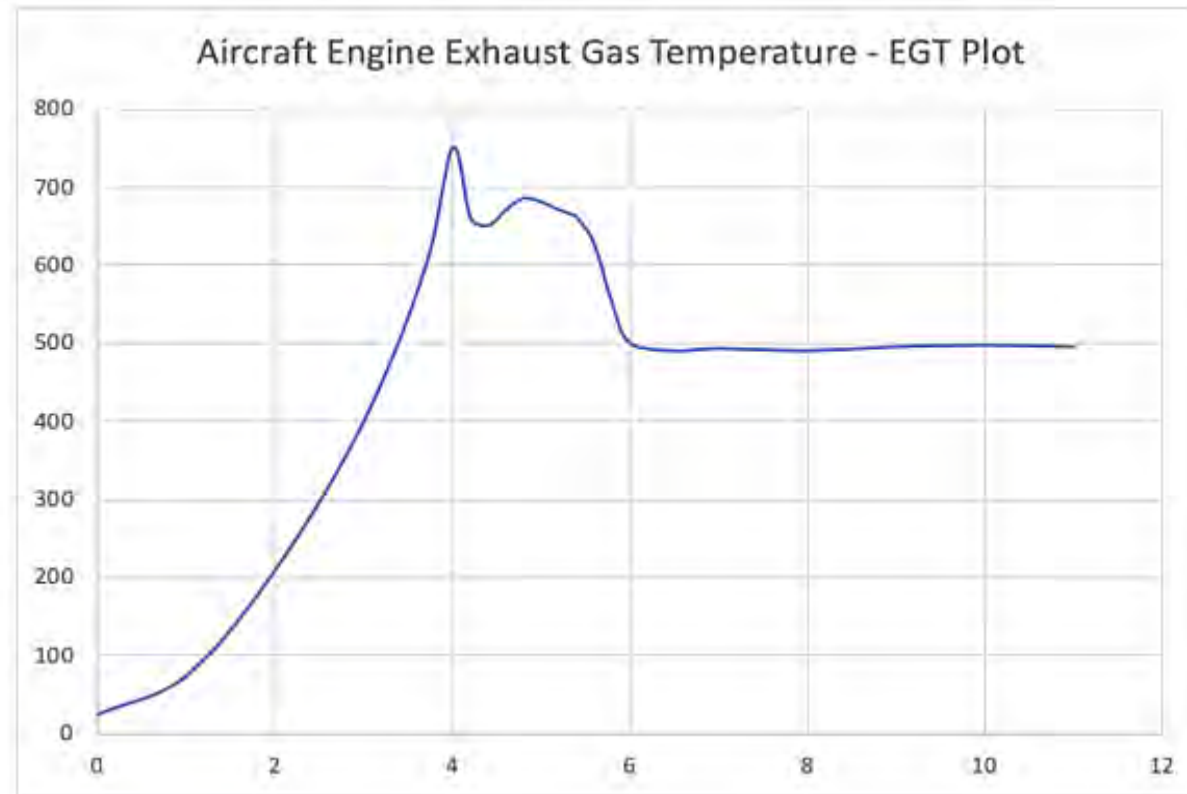
- a) Math-based
- b) Physics-based



USE CASES

Applying Industrial Data Science: A Use Case

Digital Twin: The Art of Bringing together the Physical World and the Sensor Data World



Pilot in Myanmar lands plane without front wheels

🕒 12 May 2019

🔗 Share



CHALLENGE

Prevent costly flight delays due to problems with aircraft landing gear.

PLAN

Apply sensors for early detection of pressure and temperature wear on brakes.

SOLUTION

Analyze data insights to minimize aircraft downtime and reduce expense.

IIC Testbed – Digital Twin of a Landing Gear

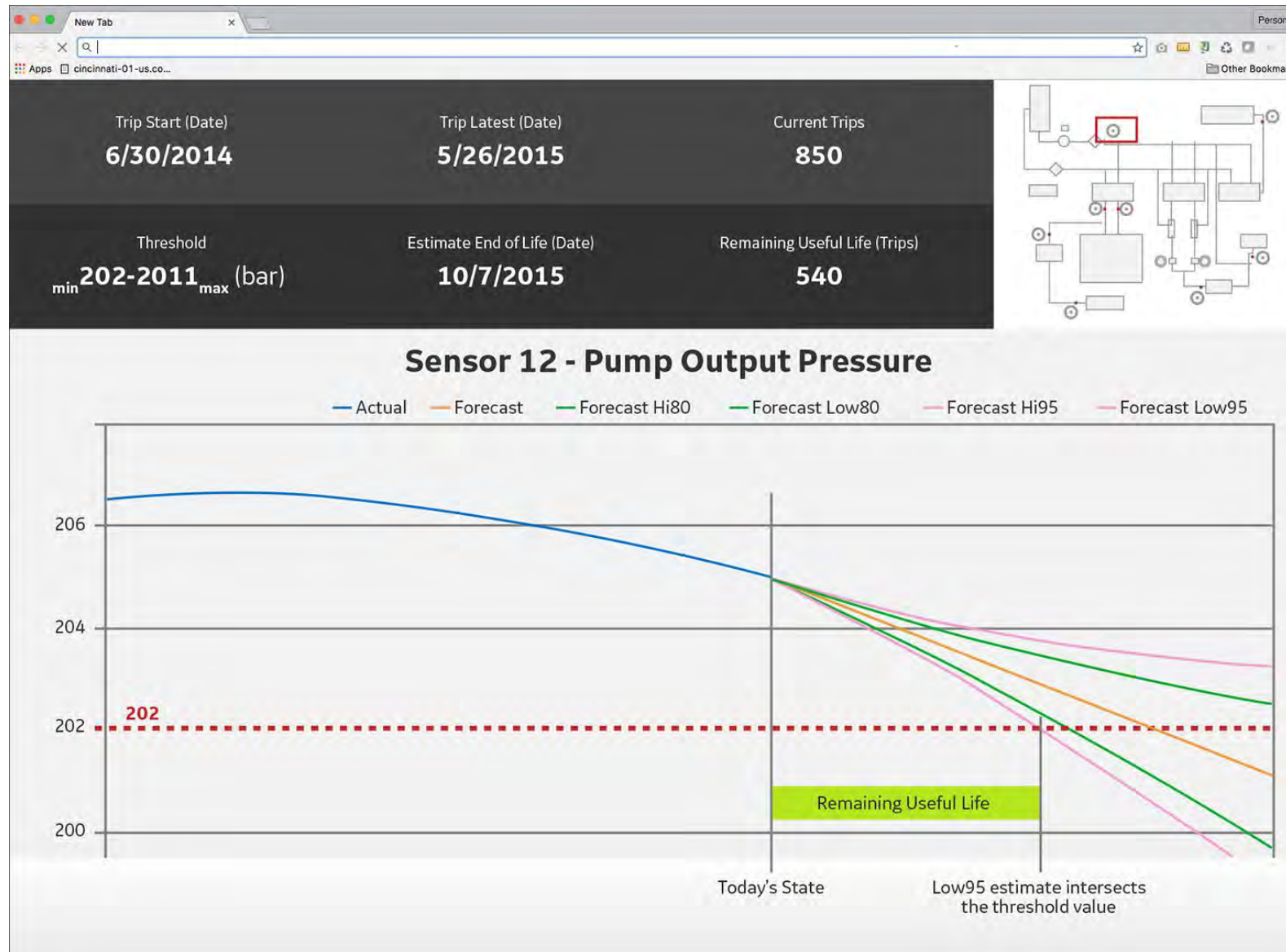
Challenge

Before takeoff, crew members run through a number of checks to ensure that the aircraft is ready. Typically, problems with landing gear can't be detected until after pushback from the gate. Uncovering problems with the landing gear at this late stage usually results in a flight delay. Each flight delay costs the airline between \$25,000 and \$40,000, not to mention the impact on customer satisfaction. And if the delay occurs in the morning, it can have a cascading effect that impacts the entire day's flight. In addition to this, when problems are detected with the landing gear, minimal information is provided and the exact cause cannot be determined until repair crews begin working.

"Each flight delay costs the airline between \$25,000 and \$40,000. With the digital twin, current landing gear issues can be diagnosed and the remaining useful life can be based on historical data."

The blending of Landing Gear (Physical World) to the Temperature and Pressure Sensor Data (Digital World)





Why Connected Cars?



Data Drives the Connected Car



INSURANCE
COMPANIES

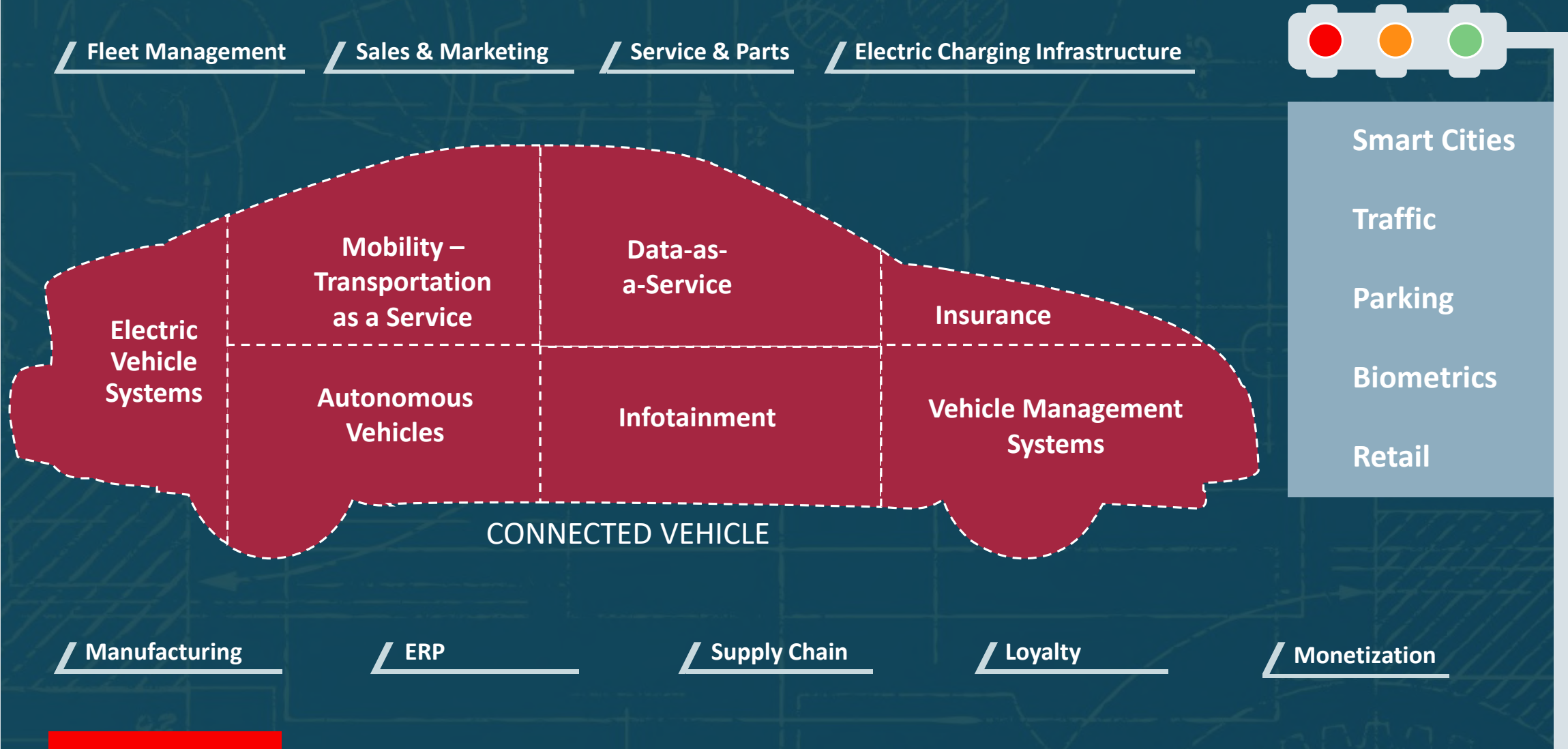
GOVERNMENT
AGENCIES

INFOTAINMENT
PROVIDERS

SOFTWARE
COMPANIES

AUTO
MAKERS

Oracle Connected Vehicle



Oracle
Magazine
May/June
2018

ORACLE®

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MAGAZINE

MAY/JUNE 2018

INTERNET OF THINGS

THE BUSINESS OF EVERYWHERE

How data from myriad IoT devices is
driving unprecedented innovation

CREATE BUSINESS
FROM DATA

BLOCKCHAIN BUILDS TRUST

BUILDING COMPLEX BOT
RESPONSES WITH EASE



Concentrix

Fremont, California

INDUSTRY:

Business services

ORACLE PRODUCTS:

Oracle Internet of Things

Cloud Enterprise

Oracle Service Cloud

Oracle Marketing Cloud

Oracle Social Cloud

Oracle CPQ Cloud Service

Oracle Integration Cloud

Oracle Monetization
Cloud

Role of IoT in Auto Industry

- “With the IoT data, automakers have the opportunity for **greater engagement with the owners of the vehicles**, and they’re able to educate them on the vehicle features.”
- **VP Connected Car at Concentrix**

Digital Twin of Cars



The Power of Real Time Digital Twin / OTA - 2018

“Tesla is releasing more battery capacity and giving free Supercharging to owners in Hurricane Florence’s path”

Owners on the Carolina coast received this notification from Tesla inside their cars when Category 4 Hurricane hit them:

“We are temporarily enabling your car to access additional battery capacity, as well as free Supercharging, in preparation for Hurricane Florence. We hope this gives you the peace of mind to get to a safe location, and will notify you before returning your car to its original configuration in mid-October. Badging on your display may adjust during this period. Safe travels.”

Tesla did the same thing in Florida last year when Hurricane Irma hit the region.

Results in unlocking 15 kWh of battery capacity for approx 30 to 40 additional miles

<https://electrek.co/2018/09/12/tesla-releasing-more-battery-capacity-free-supercharging-hurricane-florence/>

Summary & Wrap Up

- Defined Digital Twin - DT
- How it applies to Intelligent Transportation
- How to build DT – aircraft example
- Consumer Engagement – Tesla car example
- Q&A

Integrated Cloud

Applications & Platform Services

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