Collaboration using Vehicle Sensor Data

Matthew Miller, Transportation Industry Principal

September 24th 2015

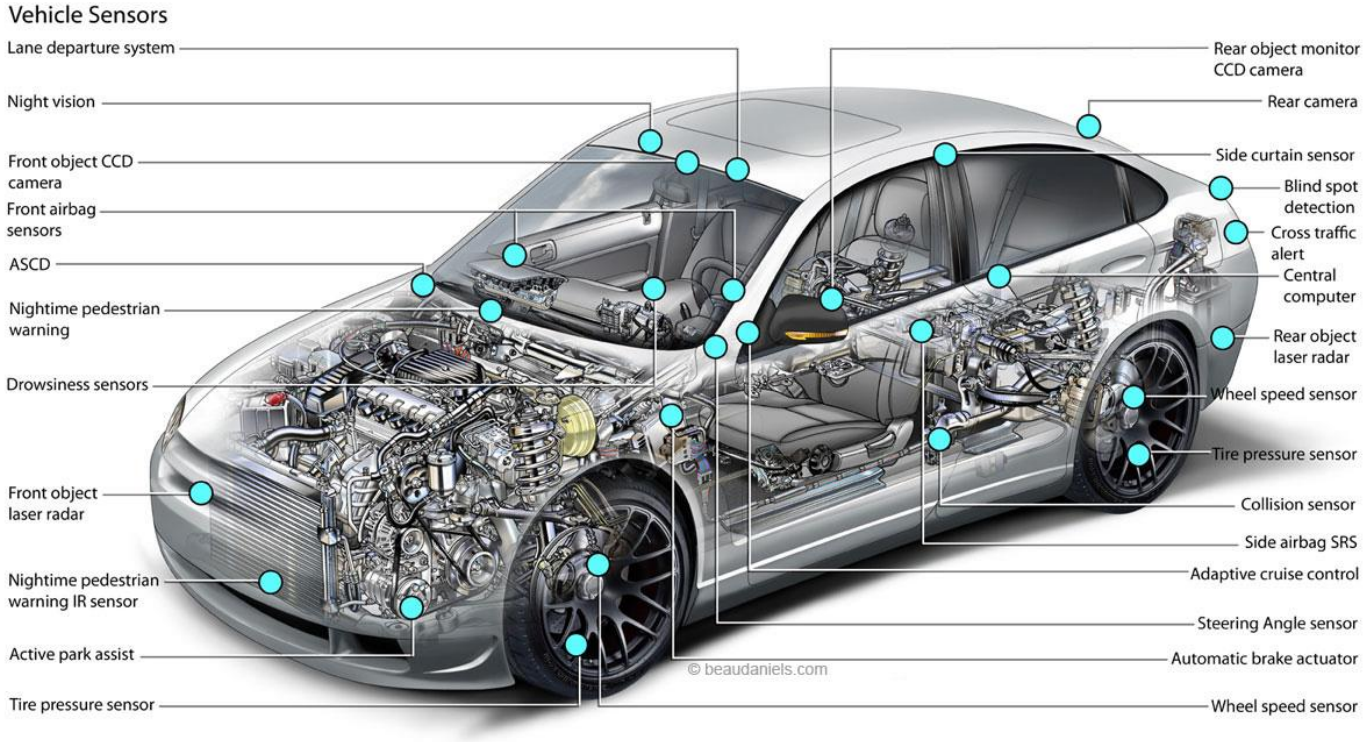
OSIsoft.

Agenda Topics

- Emerging complexity of real-time systems
- Operationalizing Data (Big and Small)
- Business Innovation through Data Ecosystems
- Breaking Down Information Siloes
- Realizing Value with Connected Products

Emerging complexity of real-time systems

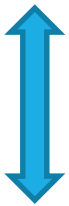
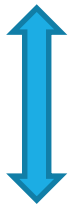
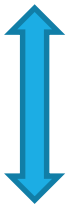
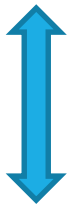
Expanding Real-time Sensing and Control



Emerging Real-time Complexity

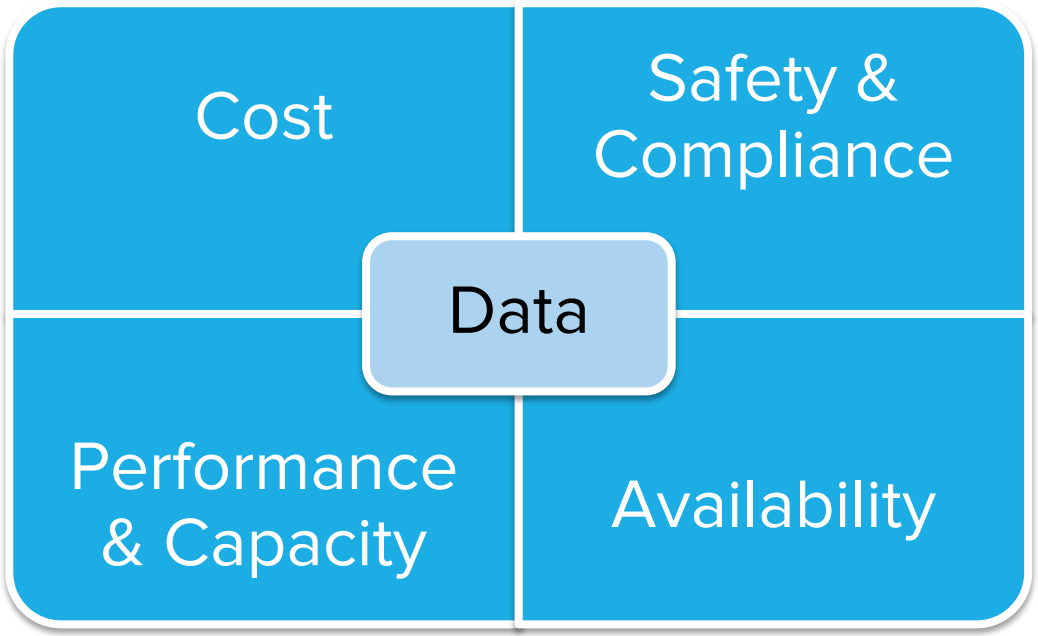



Modal Infrastructure




Industry Challenges – Balancing ROI & Risk



Operational Challenges in Transportation

Operations Performance

- Energy Optimization
- Capital Effectiveness
- On-time Arrival to Plan

Reliability and Availability

- Maintenance Costs
- Asset Health
- Asset Performance
- Replacement & Refurbish Planning

Safety and Security

- Structural Integrity
- Incident Management
- Cyber Security

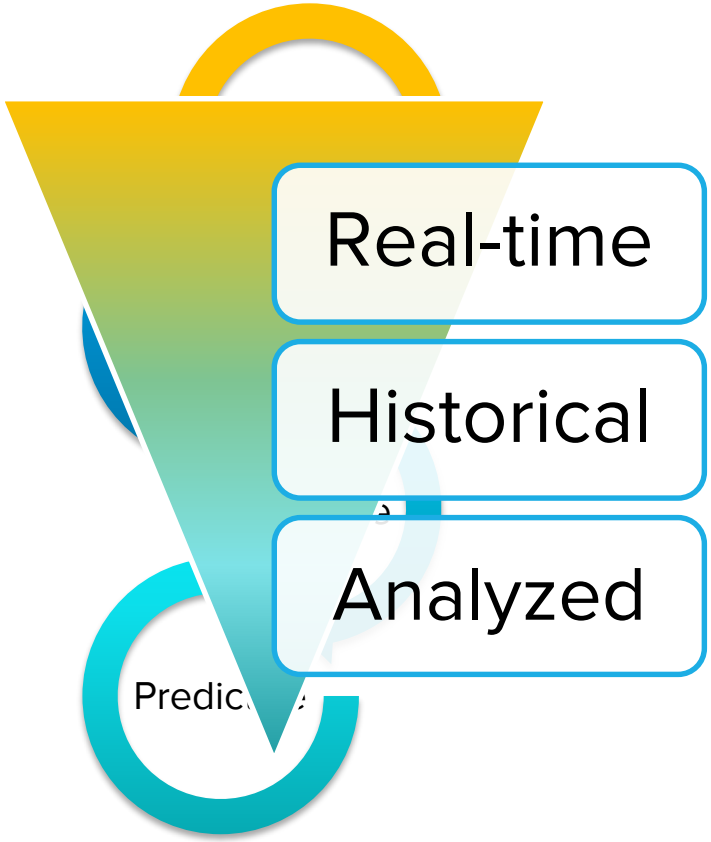
Regulatory Reporting

- Environmental Regulation
- Availability Reporting
- Emissions Monitoring

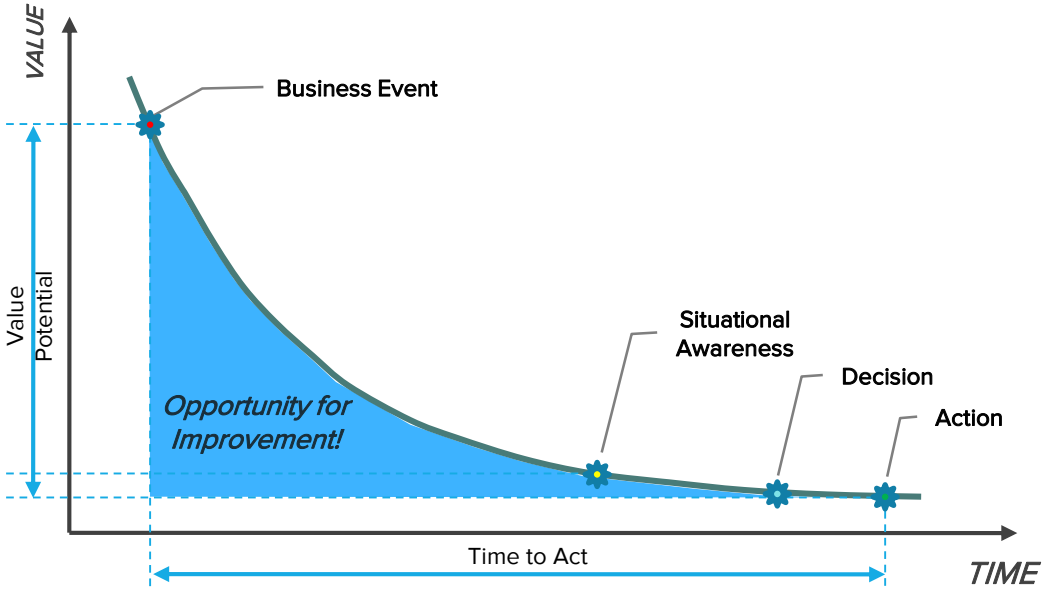
Operationalizing Data (Big and Small)

Operationalizing Data (Big and Small)

- ✓ Asset Management
- ✓ Asset Maintenance
- ✓ Network Capacity
- ✓ Energy Management
- ✓ Safety
- ✓ Regulatory Compliance
- ✓ On-time performance



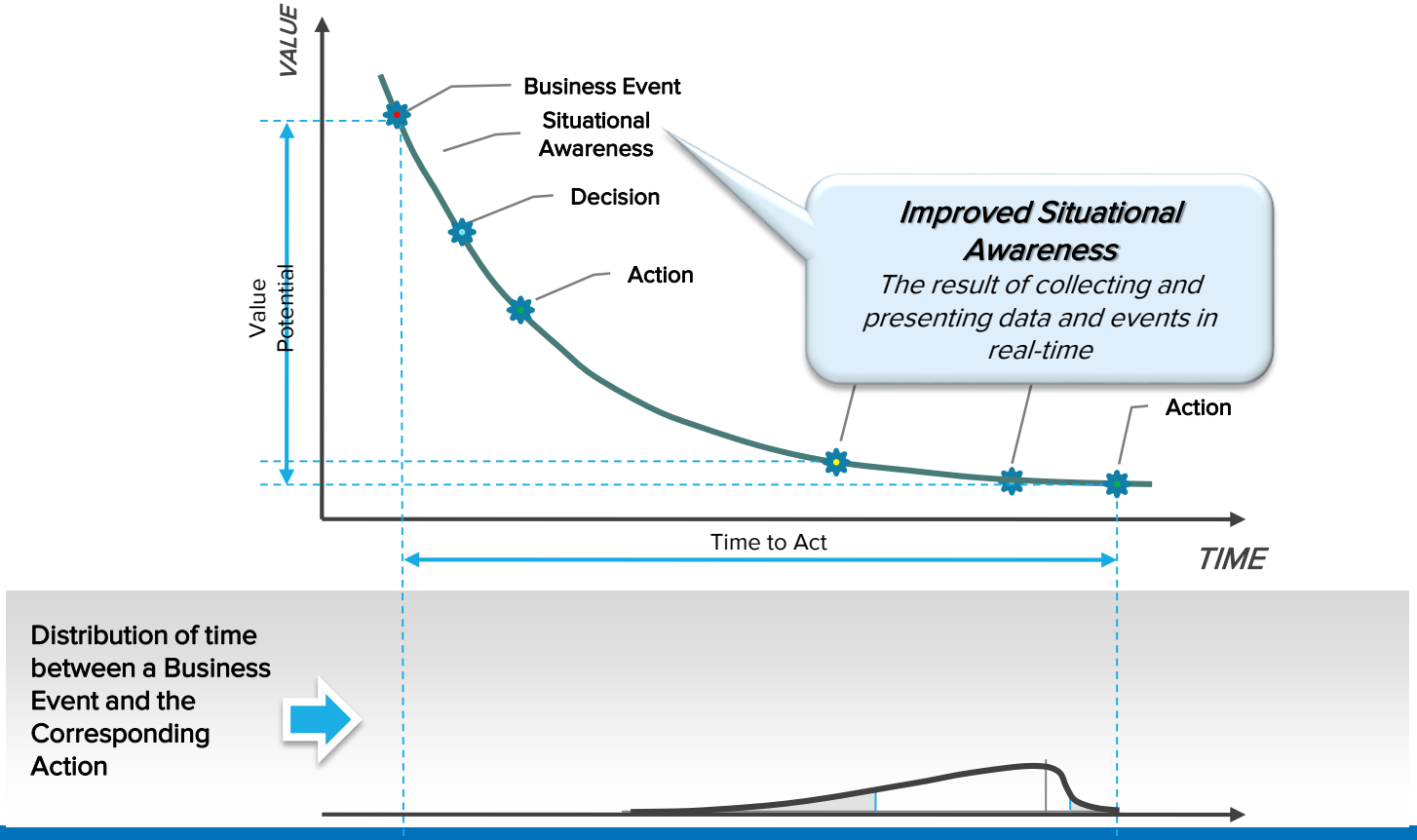
The time aspect of real-time



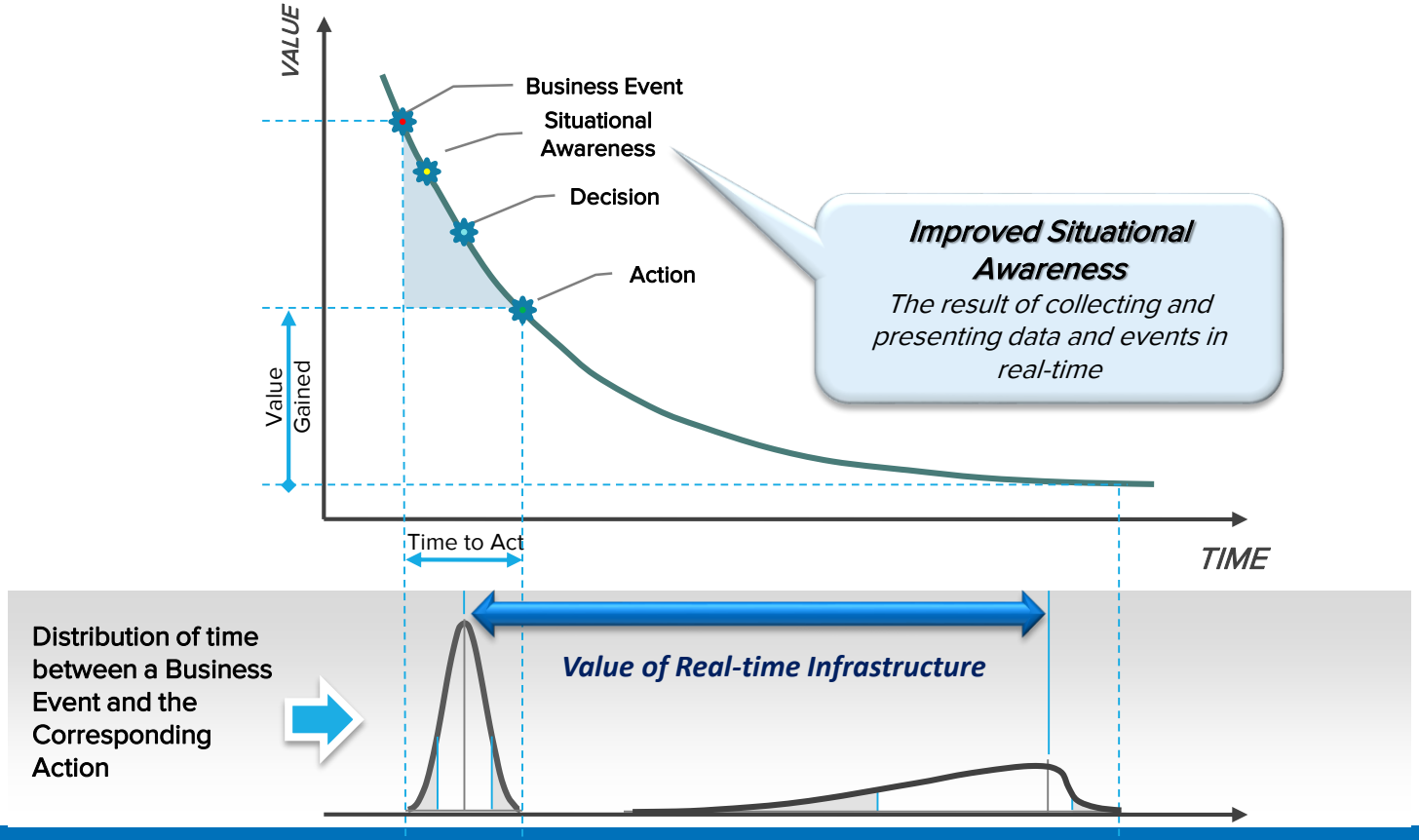
Ultimately, Value can be obtained from

- Reducing time to decision by improving situational awareness
- Situational awareness can be improved by having data available in real-time in their original resolution

Improved Situational Awareness

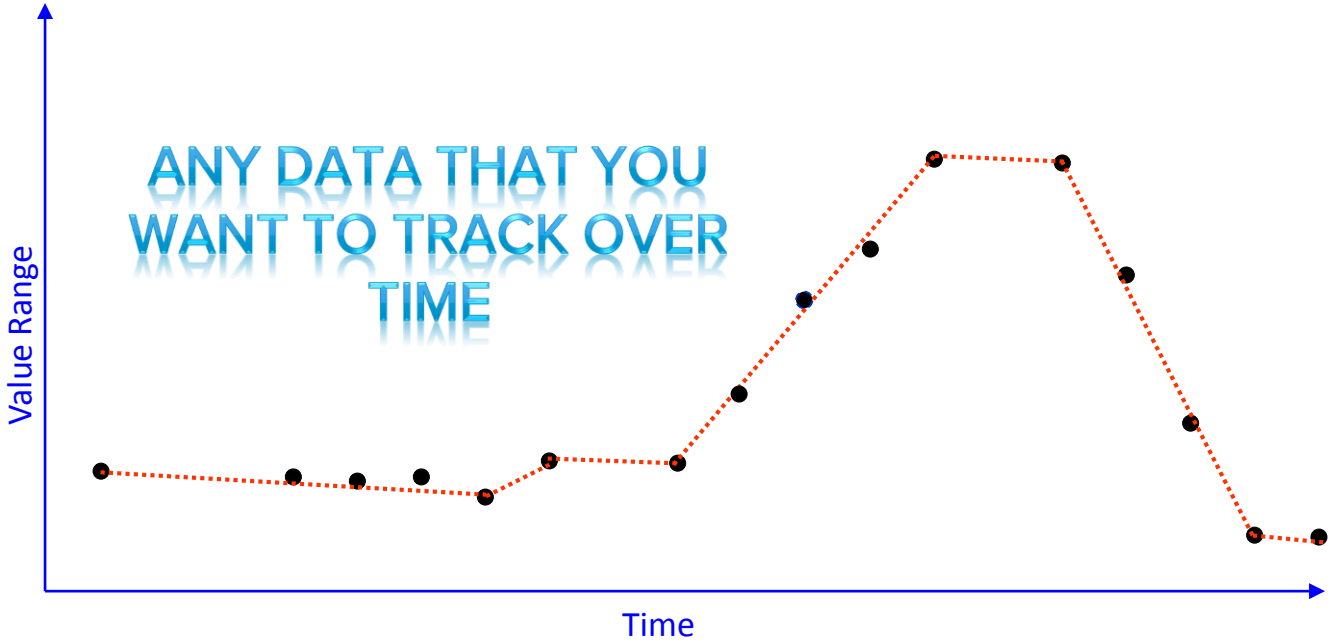


Improved Situational Awareness



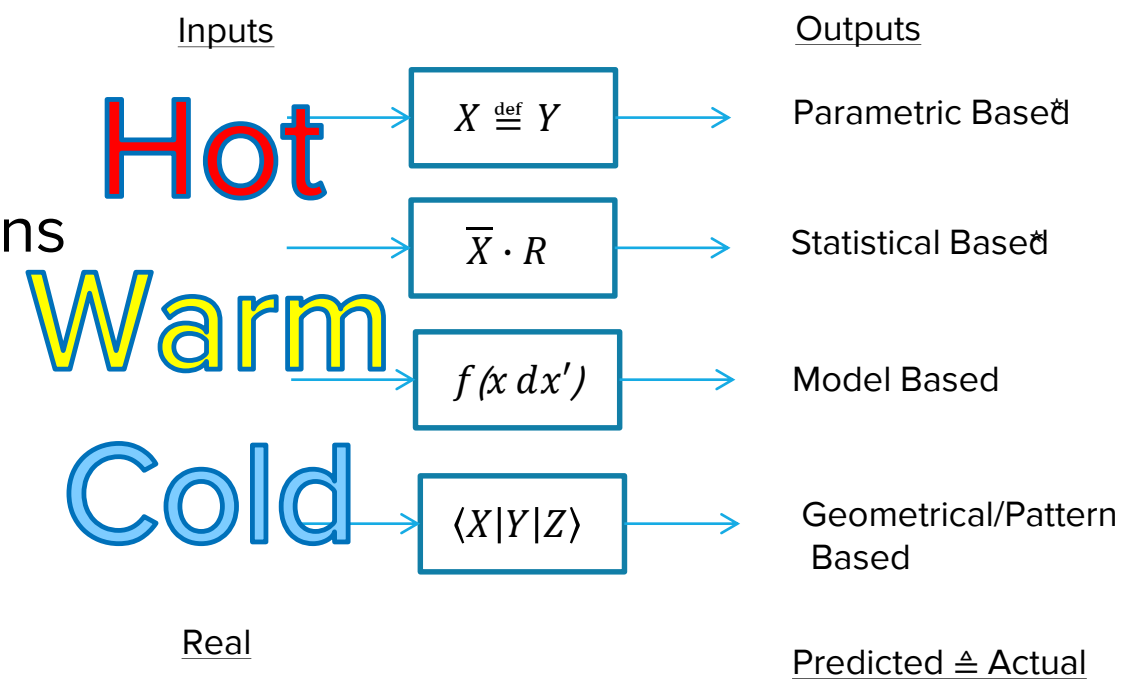
Getting fidelity in your history…

The PI System focuses on TIME-SERIES information.
Store and retrieve highly accurate data VERY quickly.



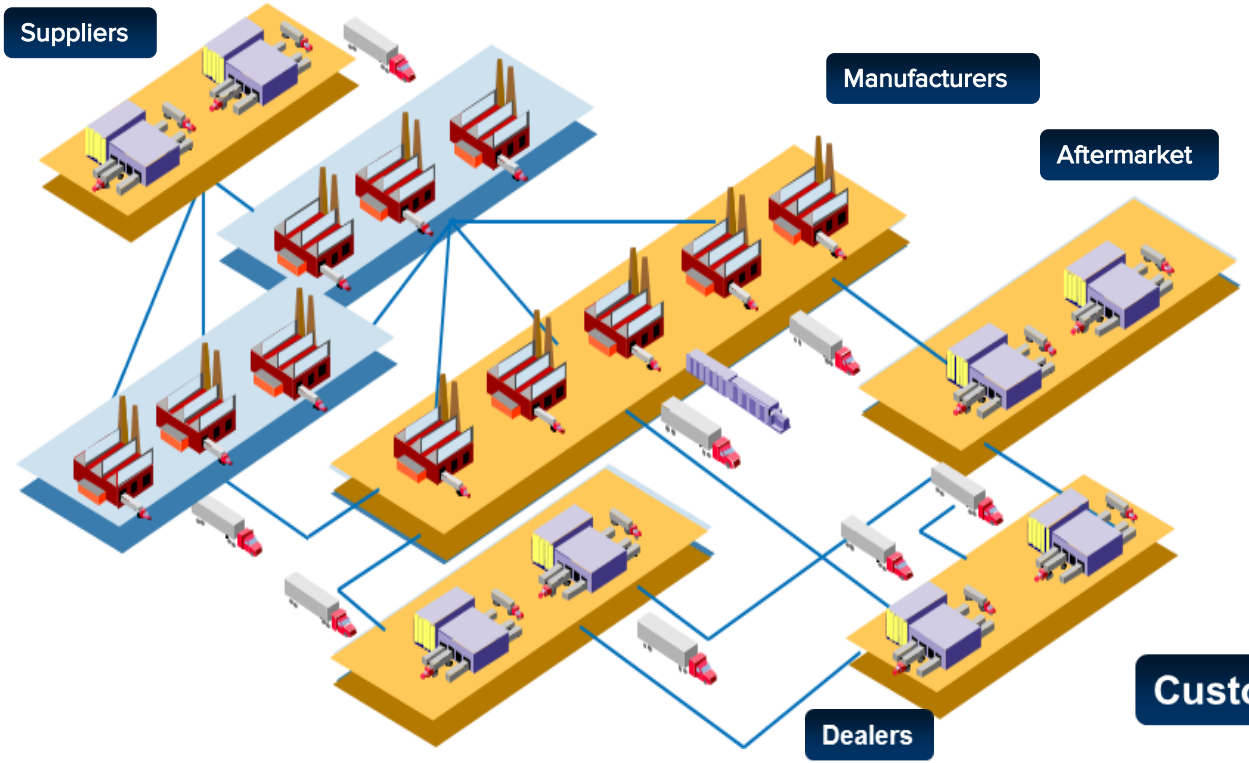
Analyzed Data

- Aggregated
- Summarized
- Asset Calculations
- Future Data
- Predictive



Business Innovation through Data Ecosystems (Value Chains)

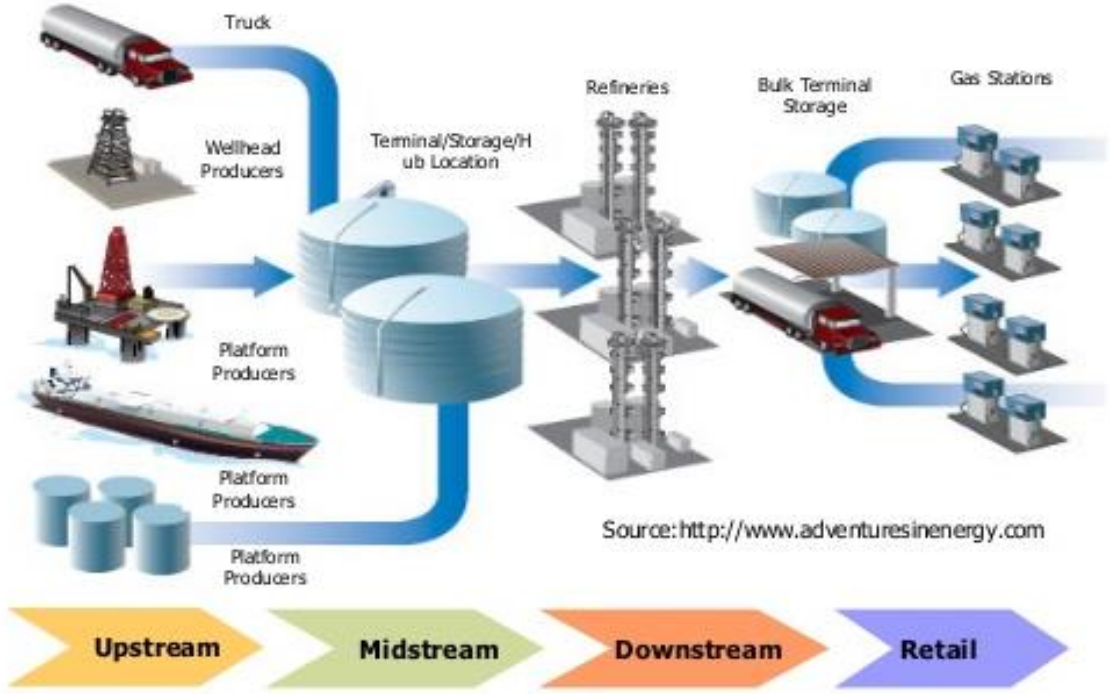
Information enables the Material Value Chain



- Right Product
- Right Time
- Efficiently
- Safely
- Securely
- In Compliance

Every time!

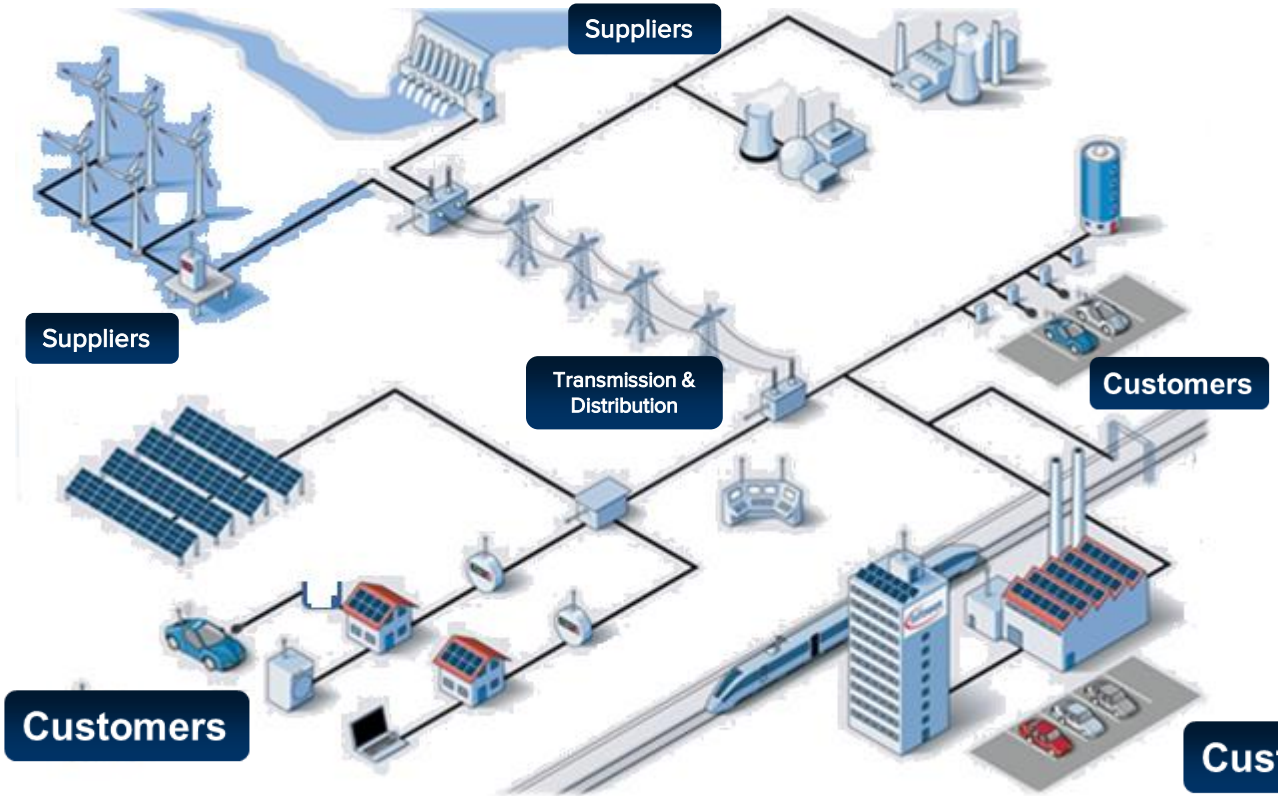
Information enables the O&G Value Chain



- Right Product
- Right Time
- Efficiently
- Safely
- Securely
- In Compliance

Every time!

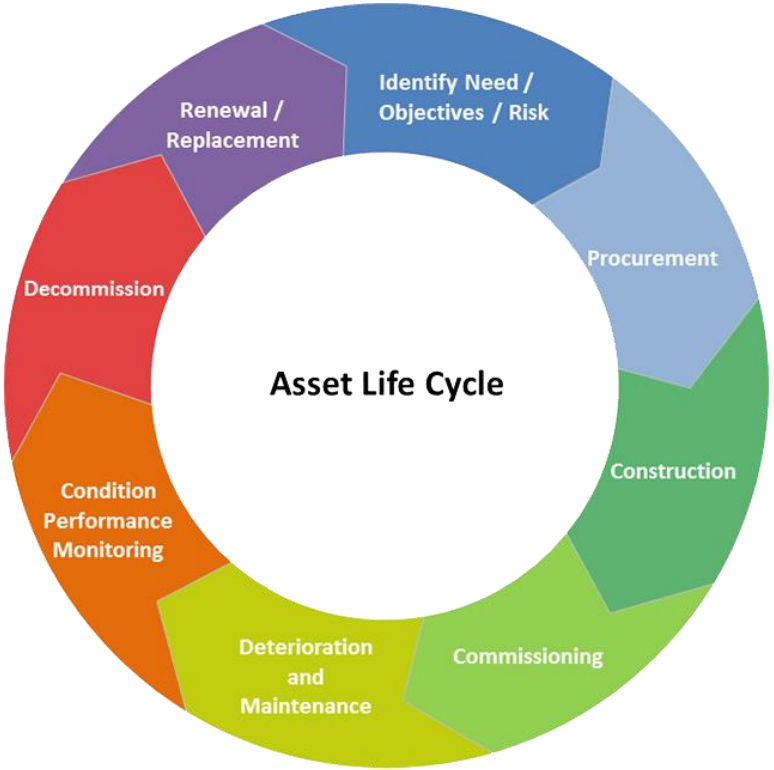
Information also enables the Energy Value Chain



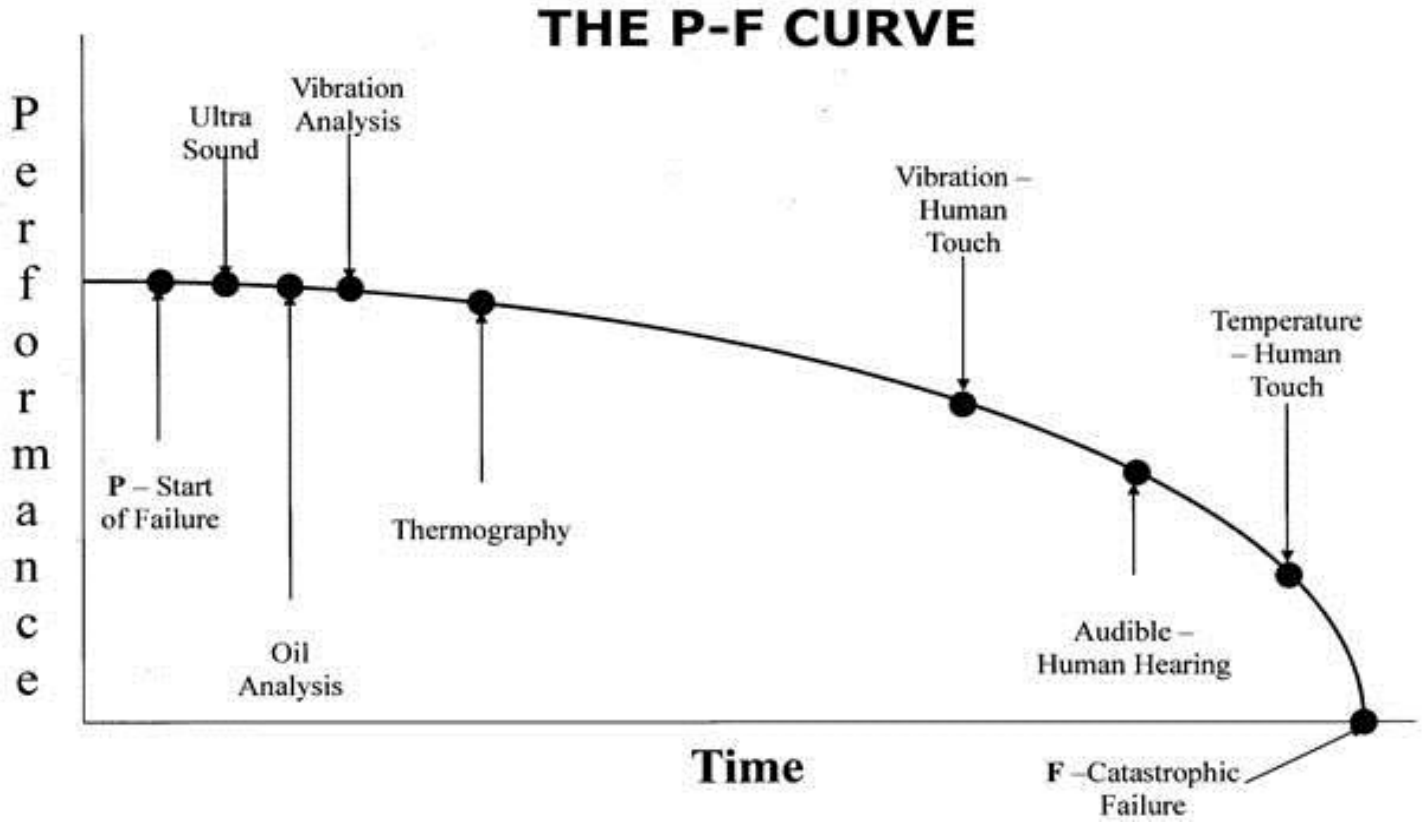
- Right Product
- Right Time
- Efficiently
- Safely
- Securely
- In Compliance

Every time!

Information enables the Asset Lifecycle Value Chain



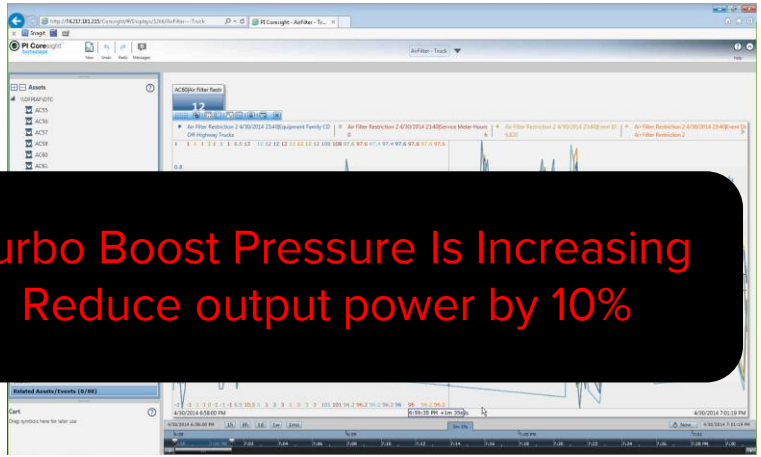
Stakeholders in the “Bathtub Curve”



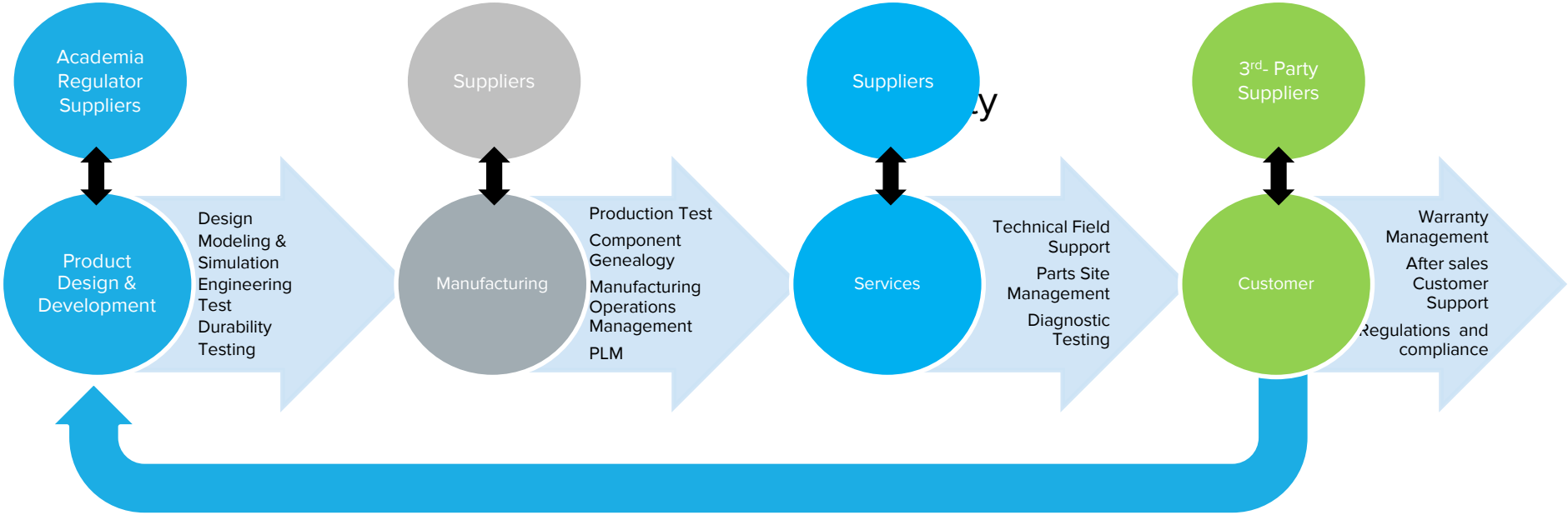
How can PI data increase equipment availability?

Reliability - PI provides the underlying data fidelity that makes information actionable

- Real-time vehicle health & condition monitoring
- More accurate remote diagnostics (DTC codes to Data)
- Accounting for operating modes for parameter limits
- Common data structures for analytic applications
- Improved operator behavior
- Aligning JIT service and parts with needs
- Put asset data into modal infrastructure cont
- Monitor cargo environmental equipment



Intelligent Lifecycle Asset Management
‘Cradle to Grave’ Data Utilization



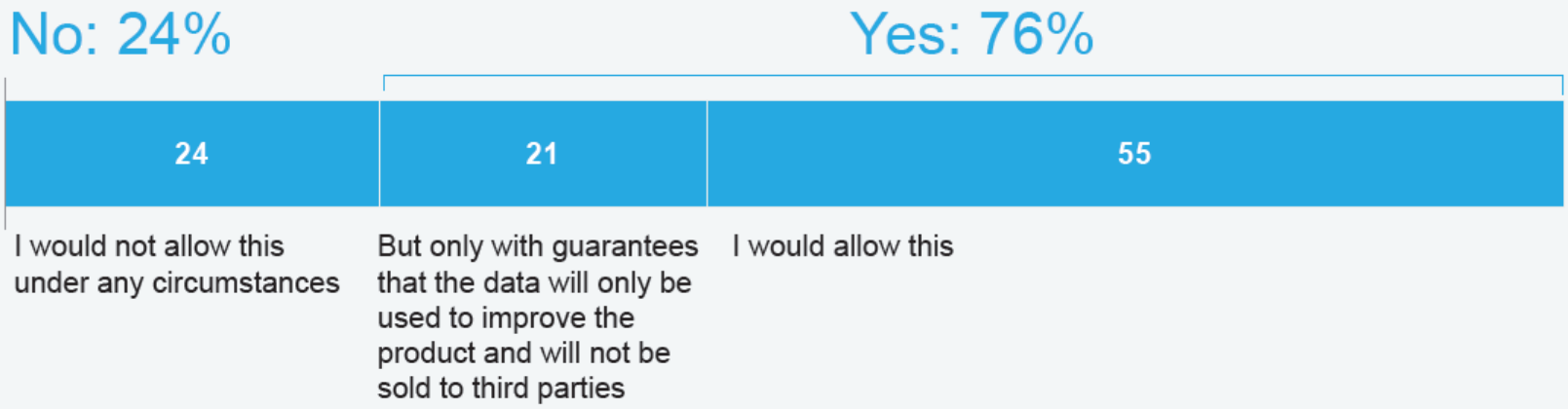
Product Usage Insights

Better Service & Support

What if you had all the data?

76% of respondents are willing to allow their cars to send data to their manufacturer to improve the product under certain conditions

Would you allow your car to track your location and report it anonymously (e.g., to enable your carmaker to improve the next generation of your car)?

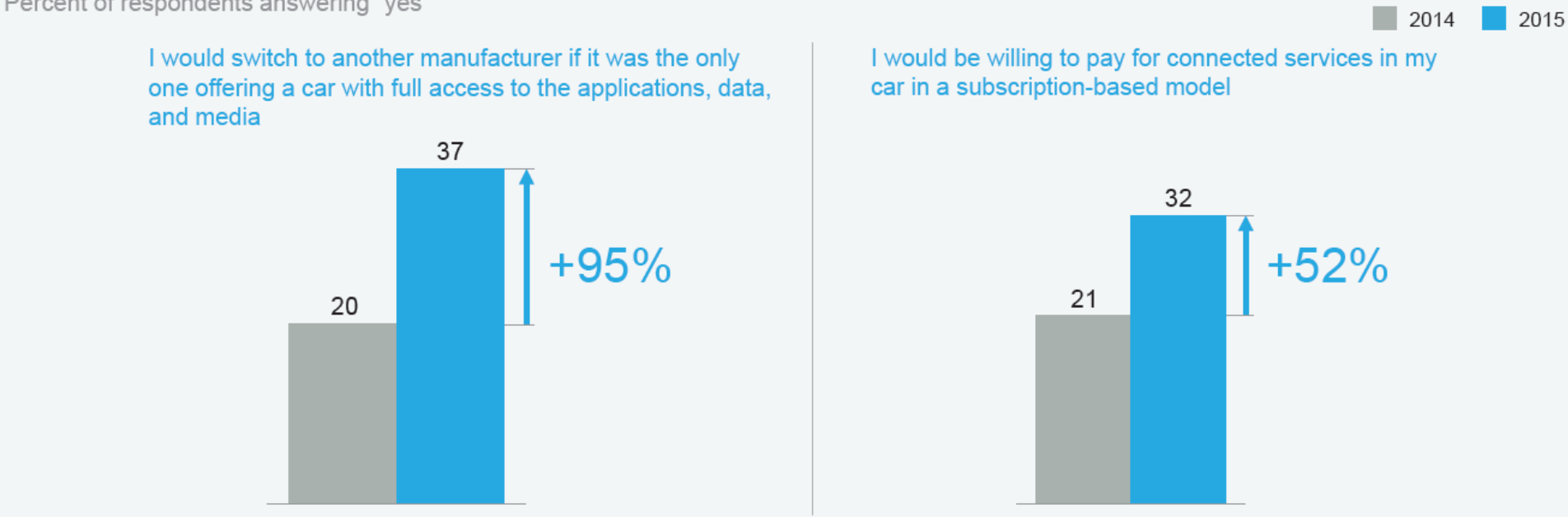


SOURCE: McKinsey Connectivity and Autonomous Driving Consumer Survey 2015

Still think open data is “no big deal”?

Both willingness to switch manufacturer and to pay a subscription fee for connected car services has increased significantly in the past year

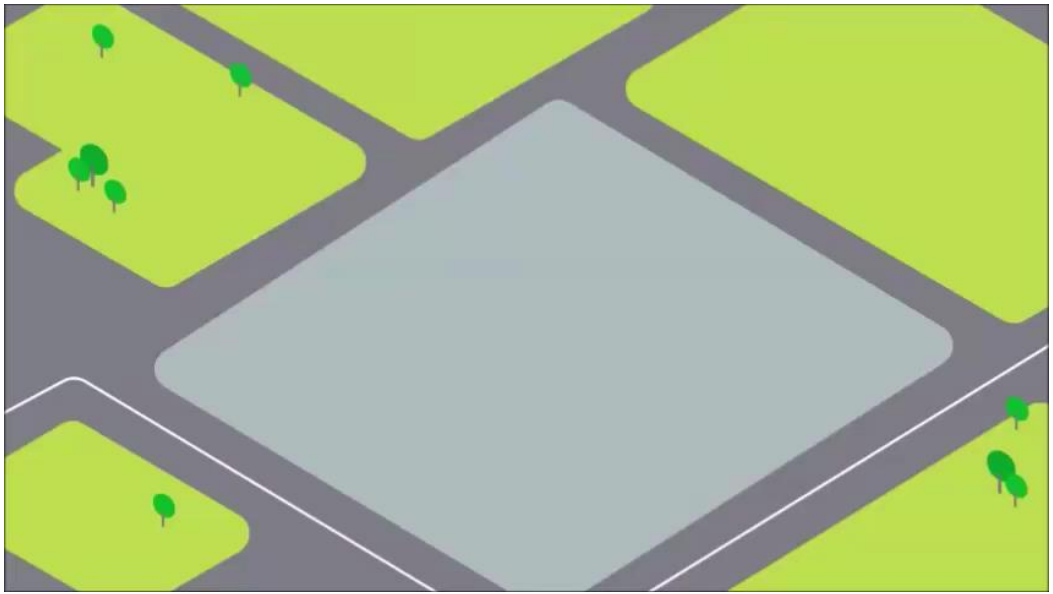
Percent of respondents answering "yes"



SOURCE: McKinsey Connectivity and Autonomous Driving Consumer Survey 2014 and 2015

Breaking Down Information Siloes

Information Siloes Across the Enterprise

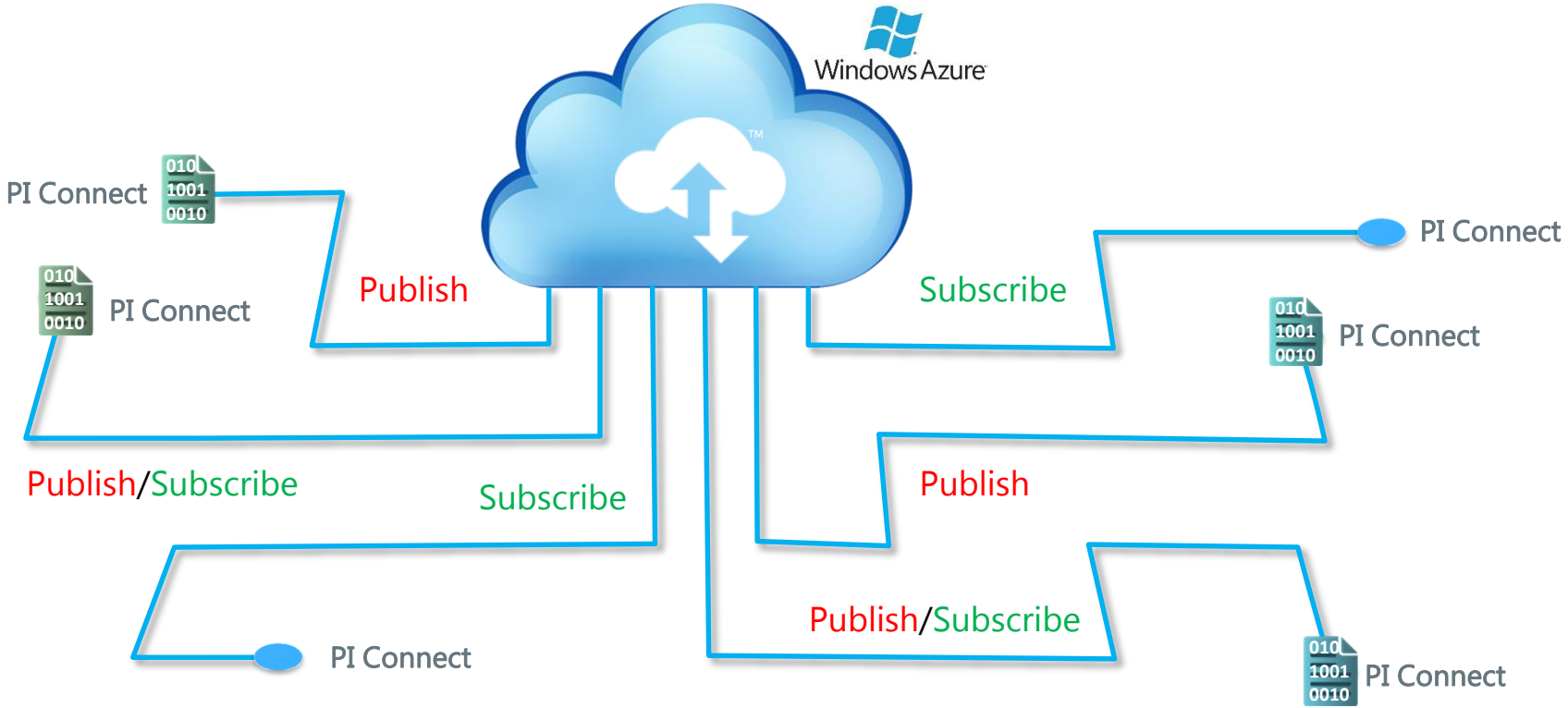


- Functional Applications
- Process Workflows
- Disparate data sources
- Different Context
- Limited Access

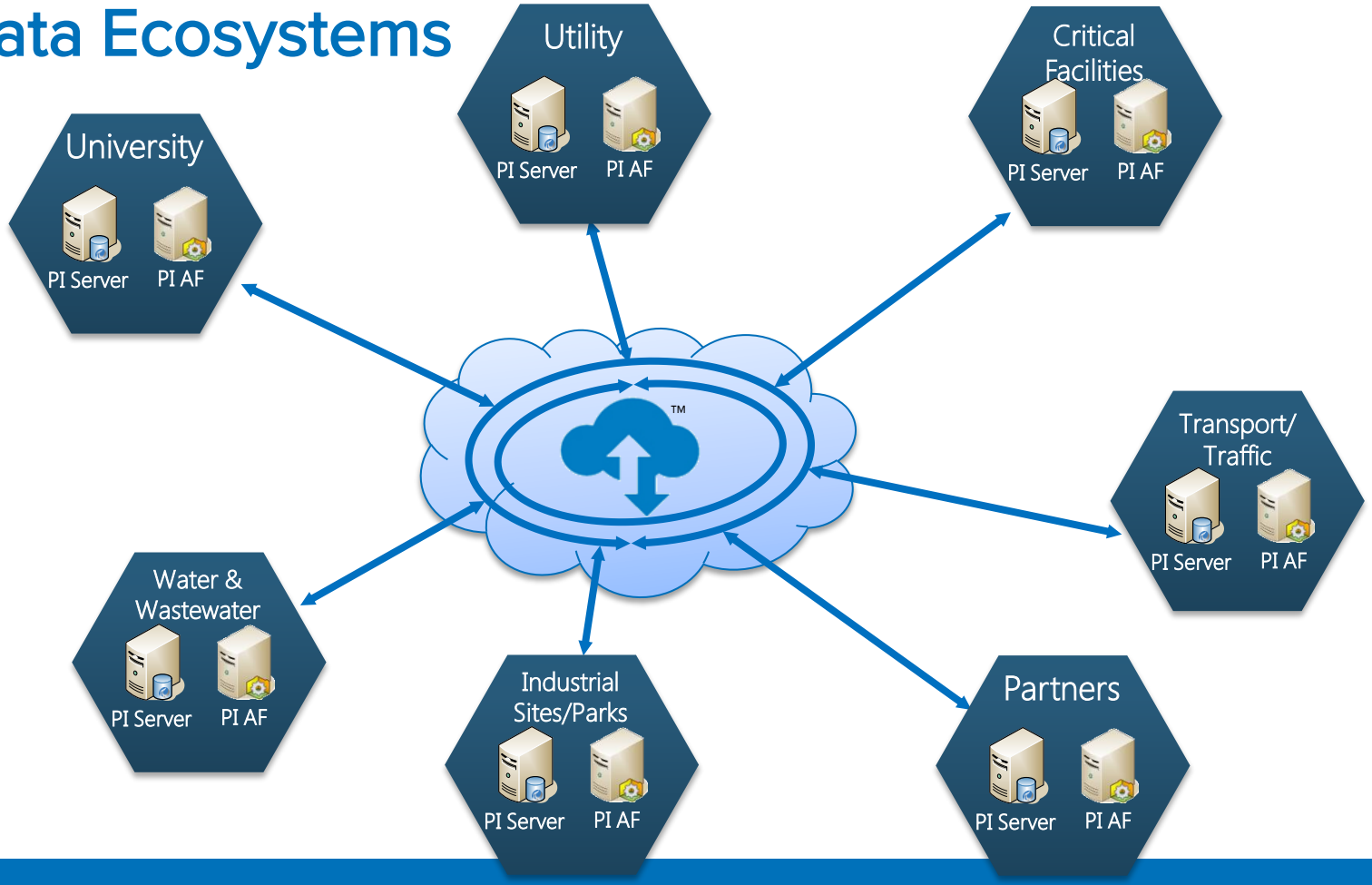
Exchanging Information with the Ecosystem

- Supplier Collaboration
- Resource Planning
- Scheduling
- Consultants
- Integrators

Exchanging Data with the Ecosystem



New Data Ecosystems



Realizing value through the data ecosystem

Data is changing the way people think… and act!

Customers are more interested in driving-related car features than they are in driving-unrelated car features

Percent of respondents willing to switch, stating that the given functionality would make them switch

Would you switch from your current car manufacturer to another manufacturer you trust if it was the only one offering these functionalities? Which functionalities would make you switch?

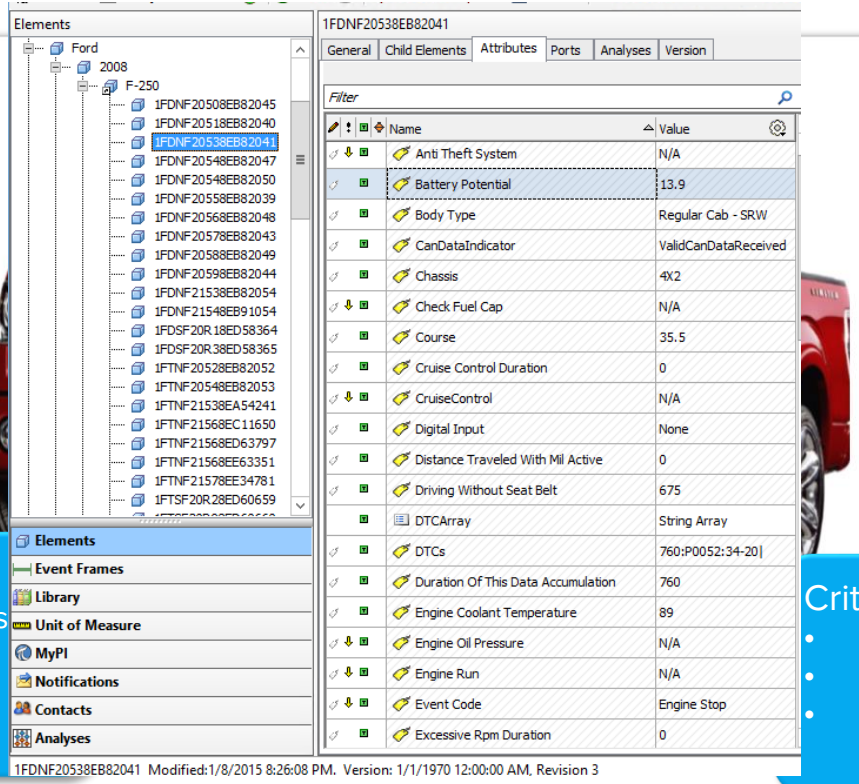
SOURCE: McKinsey Connectivity and Autonomous Driving Consumer Survey 2015

Asset Context is Paramount to making it actionable

Real-time Values
- Engine Speed
- Coolant Temperature
- Ambient temperature

Asset Details
- VIN
- Year
- Model

External Databases
- Performance curves
- Last service date
- Design documents
- SDN



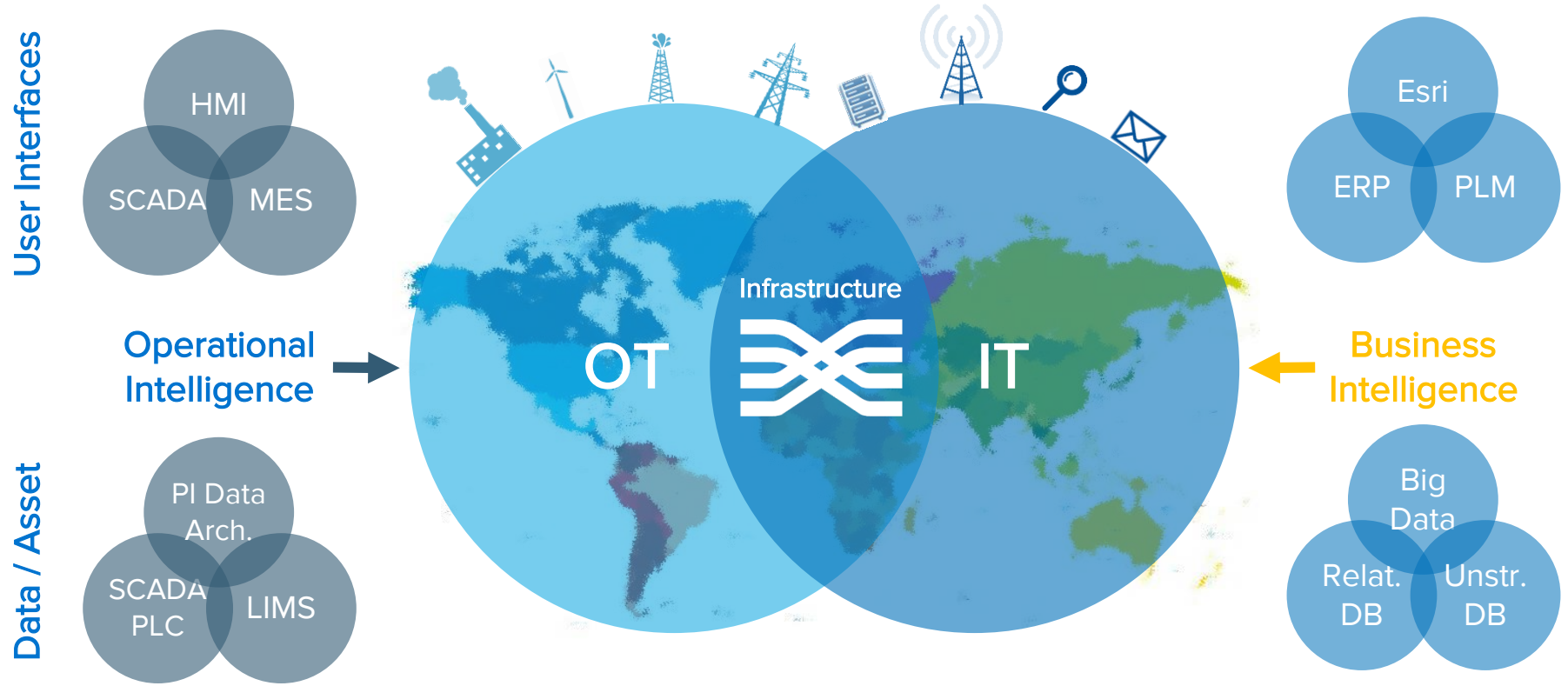
Real-time Values
- Exhaust temperature
- Vehicle Speed
- Steering Angle

Notifications
- Performance excursions
- Temperature difference
- High temperature

Critical Events
- DTC's
- Trips
- Operating Exceptions

Space and Time Context

Infrastructure context joins Enterprise data

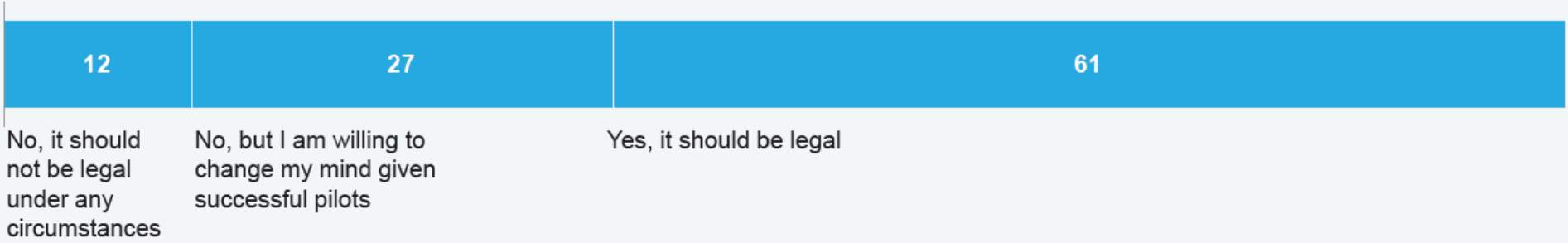


Operationalizing the data
Automation and Autonomous Operation

Only a small majority of consumers are willing to accept cars with autonomous functions; however, additional successful pilots will help increase their acceptance

Percent

Do you think the government should legalize the use of cars with autonomous functions? If not, would favorable accident statistics from pilot projects or the successful introduction of autonomous cars in other countries be likely to change your mind?

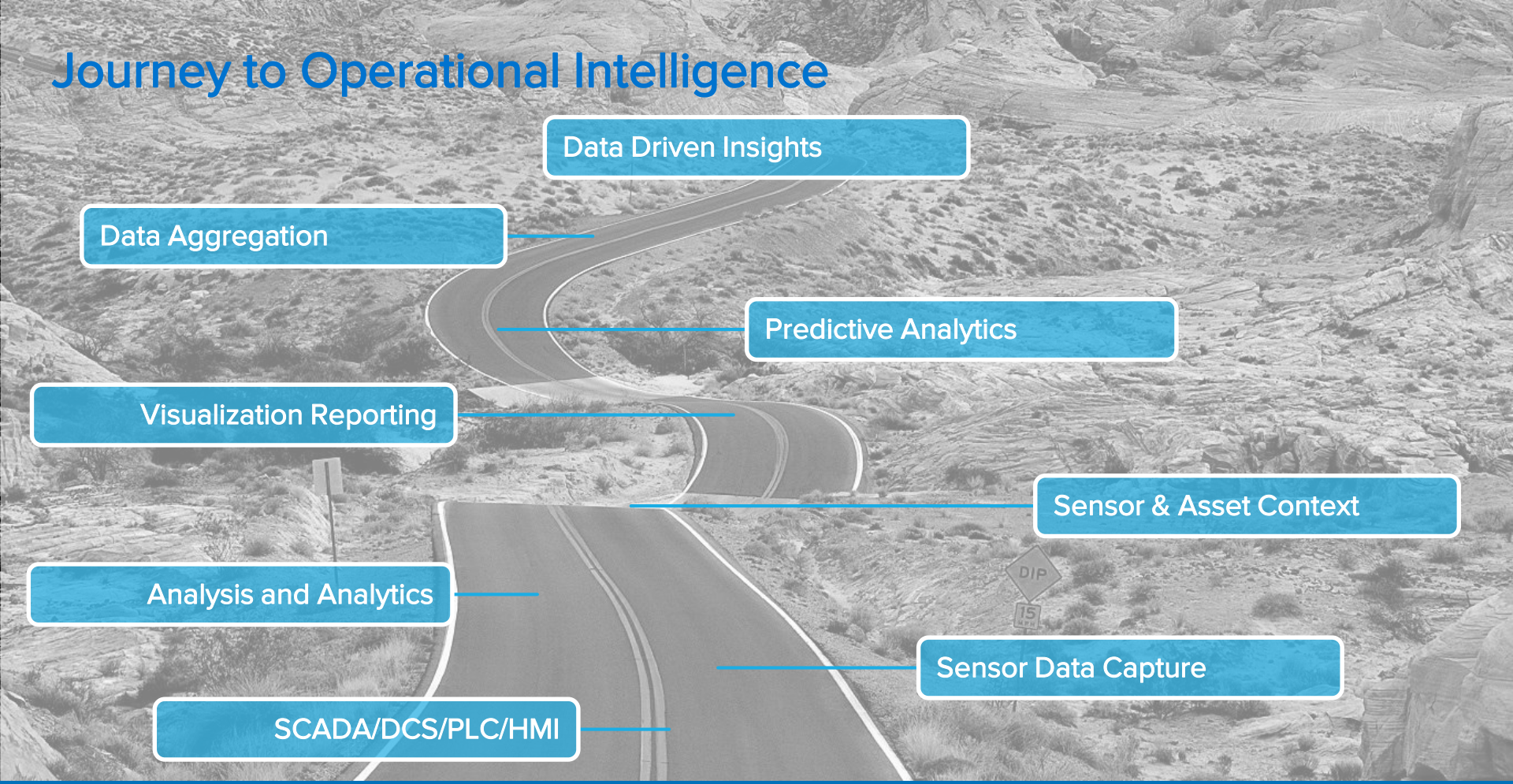


SOURCE: McKinsey Connectivity and Autonomous Driving Consumer Survey 2015

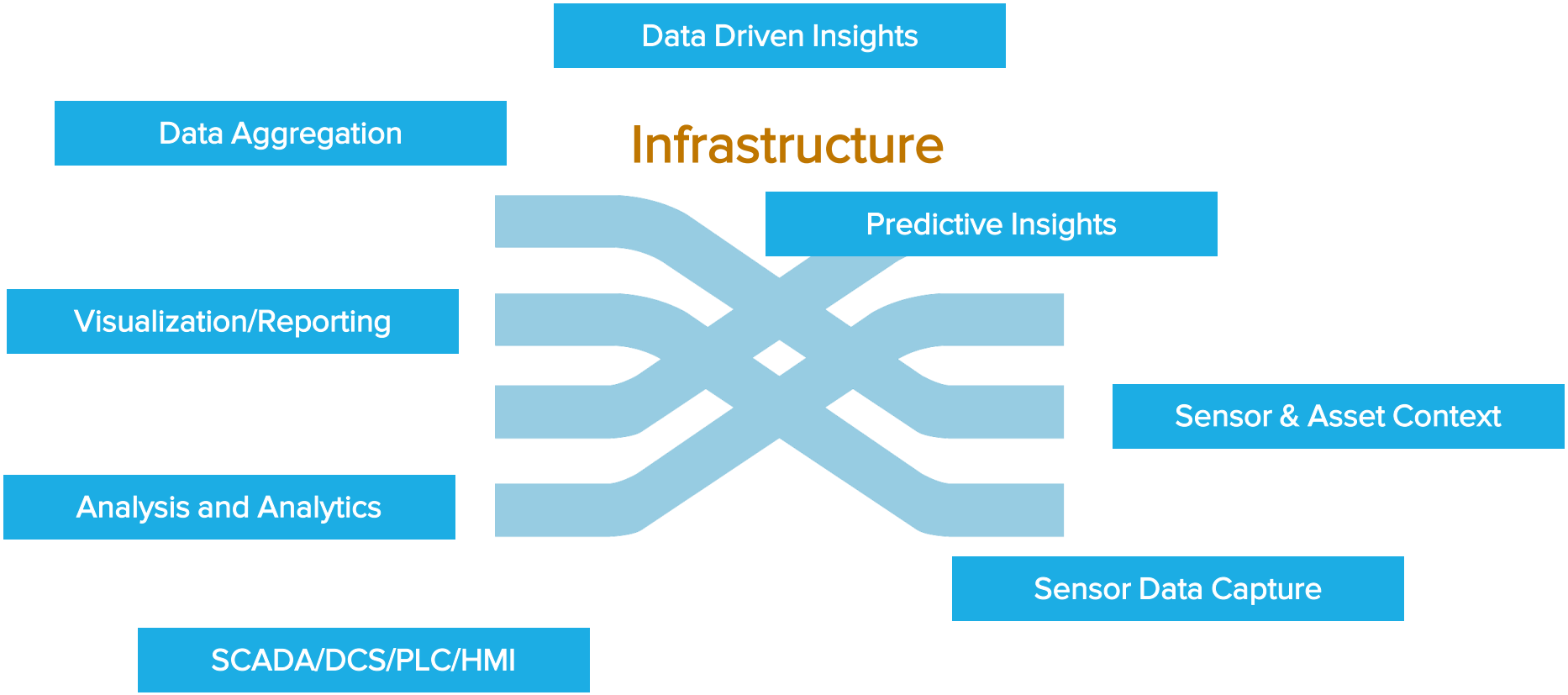
Operationalizing the data
Automation and Autonomous Operation

- Building insights into action
- Metrics & Oversight
- Knowledge at the edge
- Operationalize continuous improvement
- At scale!

Journey to Operational Intelligence



Journey to Operational Intelligence



Mapping 'Big Data' revenue streams to vehicle data

Step 3 – Identify likely vehicle data requirements

GSMA Automotive

Category	Revenue stream name	Vehicle data																									Customer data				
		Vehicle info	Braking	Steering	Time	Location	Front camera	Navi route	Suspension	Windscreen wiper	Light sensor	Outside temperature	Inside temperature	Airbag	Mileage	Acceleration	Speed	Diagnostic data	Emissions	Fuel consumption	Feature usage statistics	VR data	Preference profiles	Occupancy	Fuel gauge	Tyre wear	Navi search	Customer info	Customer payment	Smartphone location	Calendar	Public transport info
vehicle	Pothole alert				✓	✓			✓																						
	Enhanced weather alerts				✓	✓				✓	✓	✓					✓														
	Black spot alert		✓	✓	✓	✓								✓		✓	✓														
	xFCD		✓	✓	✓	✓				✓	✓	✓					✓														
	New road alert				✓	✓																									
	Speed camera locator				✓	✓	✓																								
	Predictive xFCD		✓	✓	✓	✓		✓		✓	✓	✓					✓														
	Street view crowdsourcing				✓	✓	✓																								
Crowdsourcing vehicle data	In-house PAYD/PHYD	✓	✓	✓	✓	✓				✓		✓		✓	✓	✓	✓	✓									✓	✓			
	Broker-based PAYD/PHYD	✓	✓	✓	✓	✓				✓		✓		✓	✓	✓	✓	✓									✓				
	Insurance trend analysis	✓			✓	✓																									
	FNOL alerts	✓			✓	✓								✓													✓				
	Fraud detection alert	✓	✓	✓	✓	✓	✓			✓		✓		✓	✓	✓	✓	✓									✓				
Data-based improvements	Navigation usage analytics																	✓			✓					✓					
	Other parts analytics																	✓			✓										
	Voice Recognition analytics																					✓									
Consumer-based services	Child/Pet alert												✓											✓			✓				
	Late arrival alerts					✓		✓																			✓				
	Travel companion	✓	✓	✓	✓	✓		✓	✓			✓	✓		✓	✓	✓		✓	✓							✓				✓
	ETC aggregator	✓			✓	✓																		✓				✓			
	Business mileage tracker				✓	✓									✓												✓				
	Find My Driver					✓																	✓				✓		✓	✓	
	Navigation profiler				✓	✓																	✓				✓			✓	
	On-the-road photos						✓																				✓				
Advertising solutions	Fuel price discounts	✓				✓														✓					✓						
	Parking operator discounts				✓	✓		✓																		✓						
	Restaurant discounts					✓		✓																		✓						
	Supermarket discounts					✓		✓																		✓						
	Concert recommendation																						✓				✓				
	Spare parts bidding	✓				✓									✓			✓							✓						
	Music recommendation																						✓				✓				
	Dealer maintenance bidding	✓				✓									✓			✓													

Global Mining Standards and Guidelines Group

Equipment Data Class	Owner Operator Value Drivers						OEM Value Drivers		3rd Party Value Drivers
	Process Productivity • *Implement best practices across locations* • *Vehicle Cycle Times* • *Reduce Idle Time* • *Improve Overall Equipment Effectiveness* • *Increase Asset Utilization* • *Optimize Haul Weights*	**Asset Health & Condition** • *Increase asset availability* • *Obtain the lowest total cost of ownership* • *Reduce Unplanned downtime* • *Predictive Analytics - failure prevention* • *Condition Monitoring -*	**Quality & Genealogy** • *Optimize mine operations based on geological parameters* • *Improve product grading and production planning* • *Map payload to stockpile / blending*	**Safety** • *Ensure equipment is used within design limits* • *Reduce risky behaviors* • *Identify training needs* • *Manage interaction between people and equipment* • *Eliminate site events*	**Regulatory Compliance & Reporting** • *Assess water quality & levels* • *Spill, recycle, reclaim incidents* • *Water treatment and usage* • *Dust and wind levels (blastin)* • *Noise levels*	**Energy & Water Management** • *Fuel Optimization* • *Water conservation* • *Power monitoring and management* • *Renewables and Microgrids*	**Product Improvement (OEM)** • *New equipment options* • *Improve Account Management with OEMs* • *Faster warranty claim resolution* • *Feature usage vs cost*	**Aftermarket Services (OEM)** • *Condition Maintanance Services* • *Performance Optimization Services* • *Finance / Lease Services* • *Refurbish / Replace Recommendations*	**Third party Technology & Applications** • *Dispatch Applications* • *Geospatial (GIS)* • *Geo Tech Services* • *Telemetry Services* • *Scheduling and Planning* • *Site Modeling*
Engine Information									
Hydraulic / Pneumatic Systems									
Asset / Equipment Information									
Operator/Console Systems									
Frame and Suspention Systems									
Payload Information									
Trip Information									
Drive Train/Transmission(s)									
Health Conditions / Faults & Events									
Wheels/Tracks/Tires Information									
Brake Systems									
Steering Systems									
Electrical Systems									

Workshop group activity…

● OEM ● Suppliers ● End Users &SI

Data Group	Research, Design & Develop	Manufacturing	Service	Use	reuse, recycle, scrap
	Deisgn *Model & simulation* *Engineering* *Qualify Test* *Durability Test*	*Component Geneology* *Operations Management* *Automation* *PLM* *MES* *Production Test*	*Diagnostics* *Repair* *Rebuild* *Update* *Support* *Parts Management*	*Warrenty Management* *Extended Warranties* *Compliance* *Energy Consuption* *Driver safety* *Productivity/Utilization* *Traffic, weather* *Navigation* *Maintenance* *Safety*	*resale price* *component salvage* *environmental compliance*
Vehicle Information					
Powertrain/Engine (temp, pressure, torque etc.)					
Battery/Electrical System					
Braking System					
Stearing					
Location (GPS)					
Camera/Radar					
Navi/Route					
Suspention/Frame					
Windshield Wipers					
Lights & Light sensors					
Outside Temp					
Inside Temp					
Airbags					
Safety Systems (DSRC)					

We believe **People**
with **Data**
can **Transform** their world

Matthew R Miller
mmiller@osisoft.com
+1 734 944-2484
Transportation Industry Principal
OSIsoft, LLC

Enrique Herrera
eherrera@osisoft.com
+1 734 377-6080
Market Principal
Connected Services and New Markets
OSIsoft, LLC

감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado