



# Analytic Alphabet Soup: IoT, AI & ESP

Big Data Analytics is a game changer in our Connected World

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Director Enterprise Solutions  
SAS

*“Great leaders are almost  
always great simplifiers,  
who can cut through  
argument, debate and doubt  
to offer a solution  
everybody can understand.”*

- Colin Powell

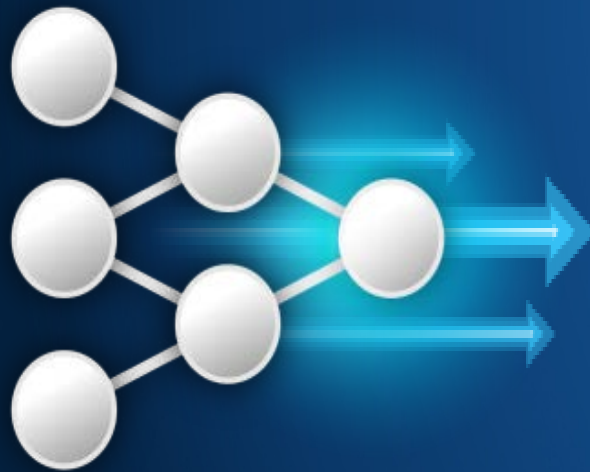
“A great idea at the wrong time, is the wrong idea.” – Author, Unknown

# The Importance of Infrastructure

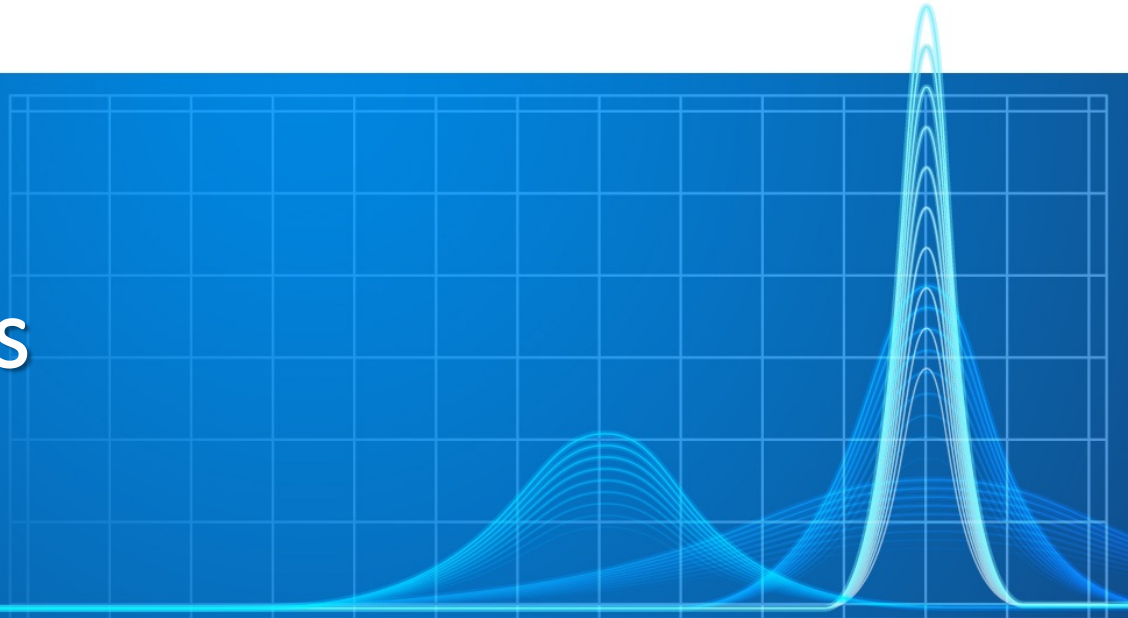


Puerto Rico - 2018





# Internet of Things



# Internet of Things



Communications



Smart Cities and Homes



Connected Customer



Surveillance



Connected Car/  
Transportation



Building  
Management



Energy



Agriculture



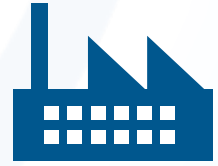
Insurance



Healthcare



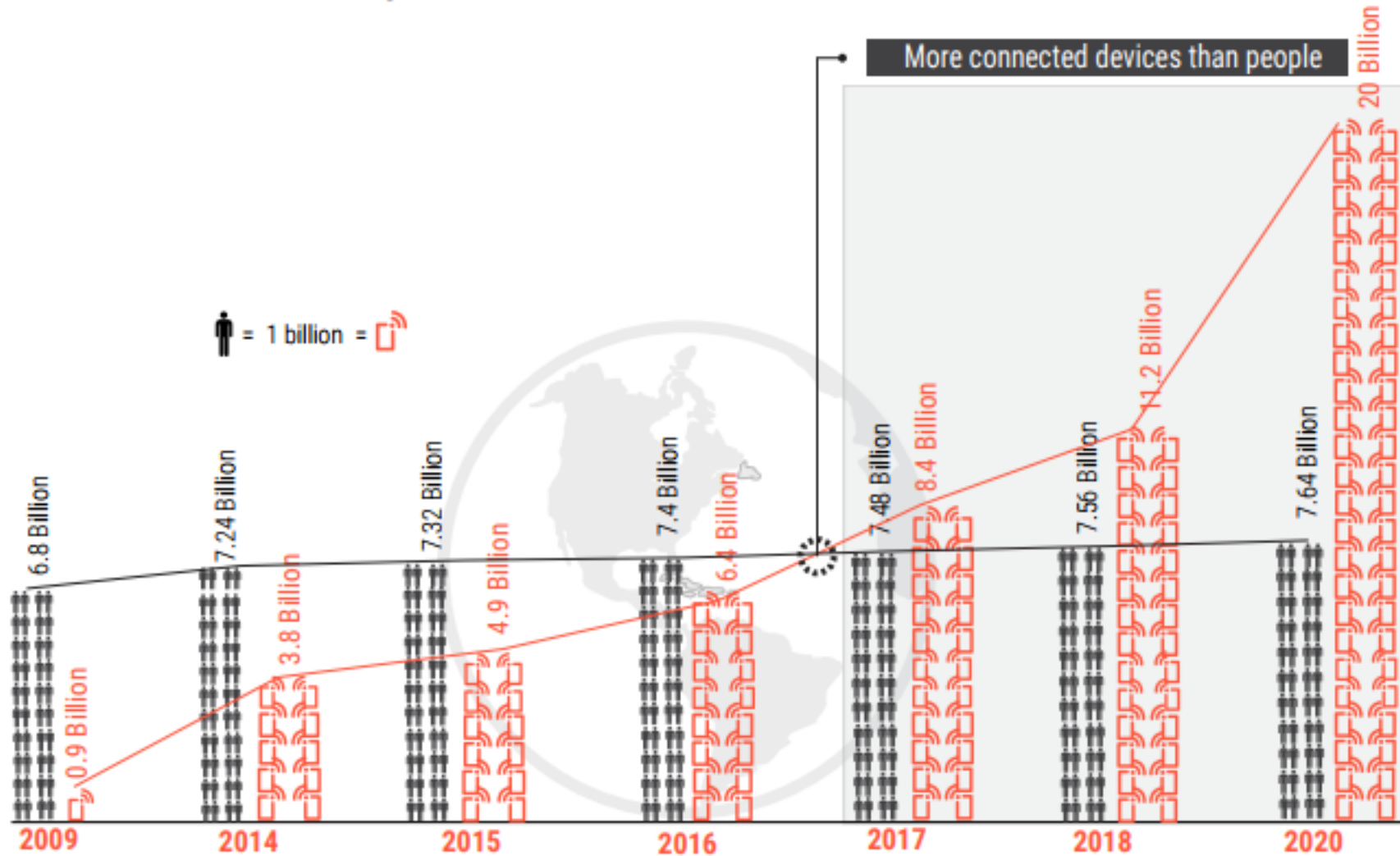
Retail



Manufacturing

# Humans have just been outnumbered by devices

## Growth of IoT Devices vs. Global Population

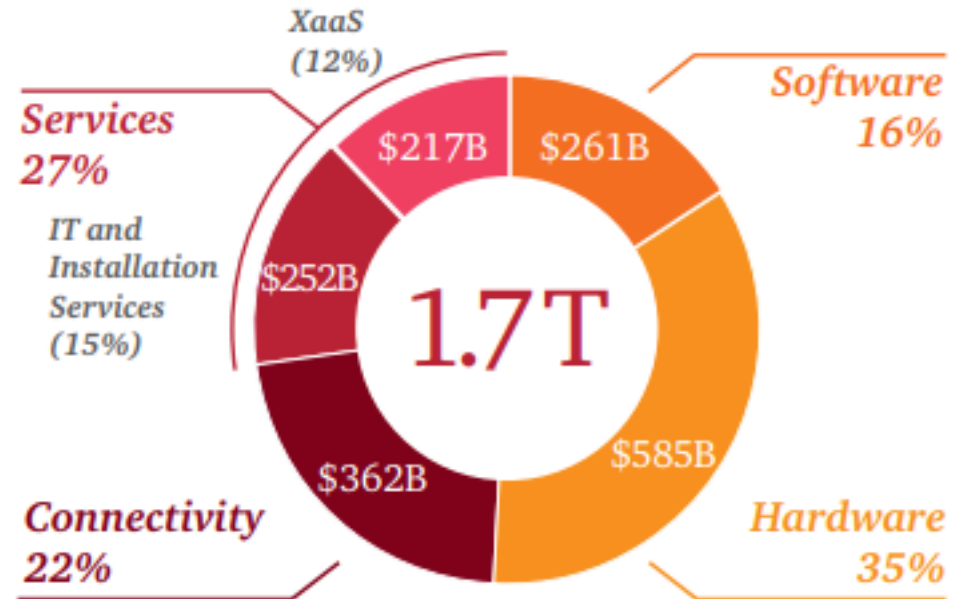


[Sources: Gartner/World Bank]

# Investment in IoT solutions: An exponential growth path

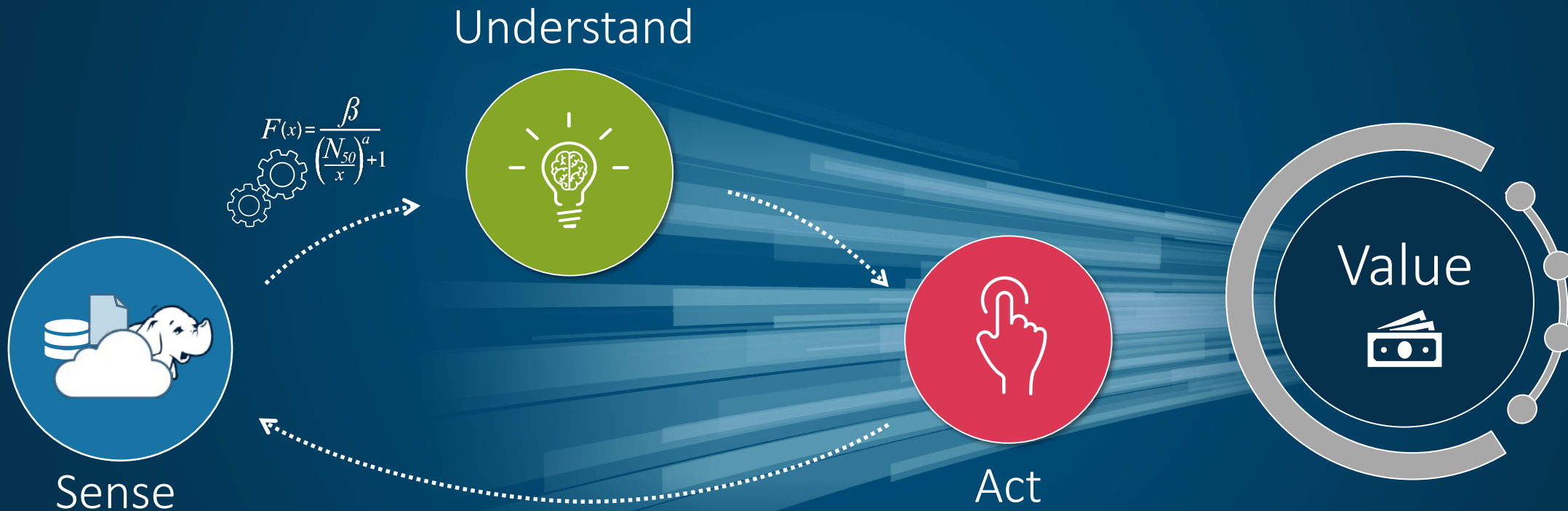
According to current projections:

- A cumulative total of US\$6 trillion will be spent on IoT solutions between 2015 and 2020.
- IoT investments by businesses will grow from US\$215 billion in 2015 to US\$832 billion in 2020, while consumer spending on IoT solutions will rise from US\$72 billion to US\$236 billion.
- According to IDC, the IoT marketplace will be worth US\$1.7 trillion in 2020, with the biggest portion being hardware, followed by services, connectivity and software.



Sources: "IDC's Worldwide Internet of Things Taxonomy, 2015," IDC, May 2015;  
"Worldwide Internet of Things Forecast, 2015 - 2020," IDC, May 2015.

# “Intelligence of Things”



\$11 Trillion in Economic Impact by 2025 -McKinsey



# Intelligence for the Connected world

## Connected Car



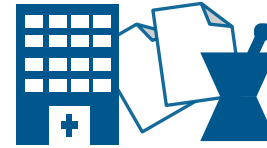
Predict issues in the fleet before failures occur and provide new value added services. IoT Analytics uses data vehicle sensors and customer information to develop and deploy models that provide proactive information leading to better customer service.

## Connected Customer



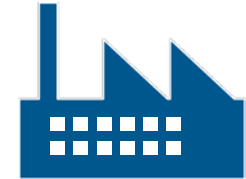
Provide your customers with the right content and offers in real time. IoT Analytics leverages data from connected devices to predict customer preferences, in real time. The result is timely suggestions and offers customers are more likely to accept.

## Connected Health



Improve patient care and drive better patient outcomes. IoT Analytics allows health care organizations to leverage electronic medical records with health sensors to establish optimal care and monitor conditions in real – time to minimize risks.

## Connected Factory



Identifies hidden patterns that predict failures improving production yield and product quality. IoT Analytics leverages equipment sensor and tag data to develop and deploy early warning models.

# Argentinian Highway Operator



## Key Challenges

- The company, owned by the City Government, wanted to ensure the safety of travelers by predicting highway traffic flow and tracking data from sensors.

## How SAS® supported the process



## Expected Results

- Able to forecast by category the number of vehicles traveling through the city using sensors from 8 highways.
- Visualize forecasts to more efficiently and effectively plan for the future.
- Real-time insight into highway issues, allowing them to take remedial action more quickly.
- Optimize toll levels and locations to maximize revenue.
- Better and safer experience for citizens traveling the highways.

Powered by

SAS® Solutions for IoT

# Smart Country: Internet of Things

## BUSINESS ISSUE

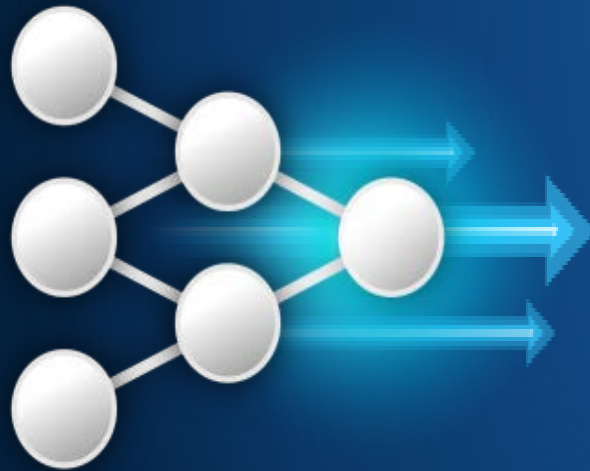
- Government responsible for monitoring roads, bridges, tunnels, water ways and water systems
- Population density one of highest in Europe
- Transportation infrastructure management is critical for commerce and public

## RESULTS

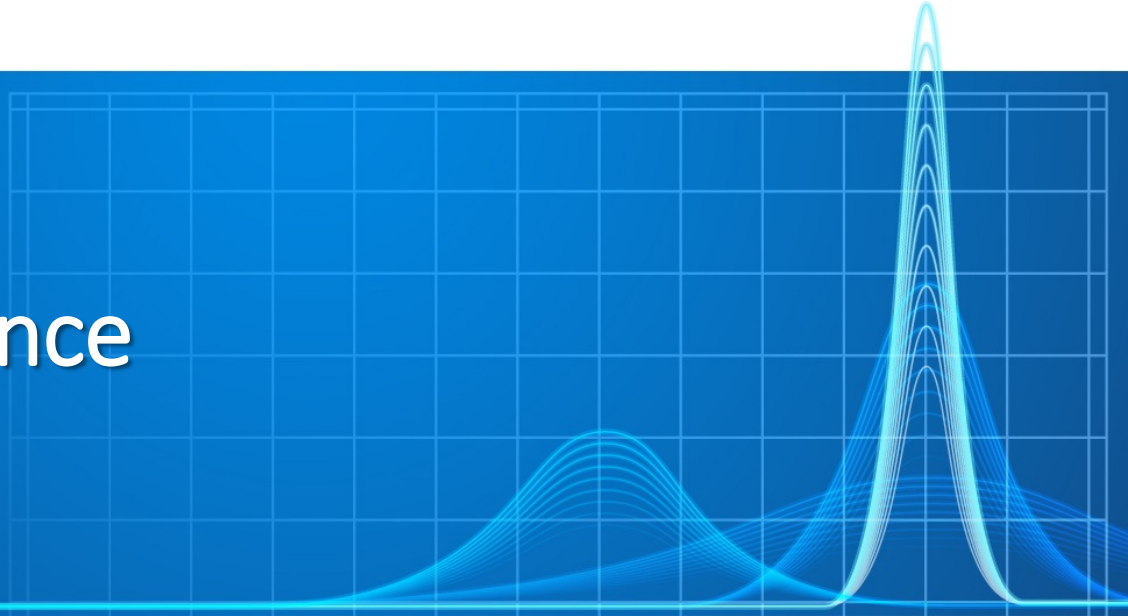
- Using real time analytics on streaming data from bridges for improved management and optimization of transportation flow
- Efficient use of limited public resources
- Expanding to monitor real time sensor data from sensors on water system infrastructure for public safety

## INFRASTRUCTURE MONITORING



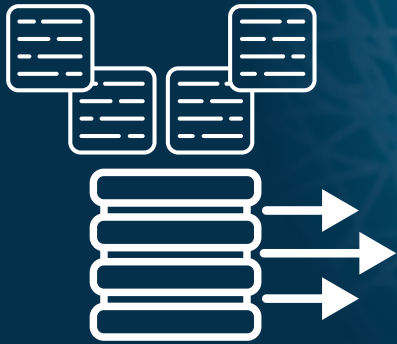


# Artificial Intelligence



# Artificial Intelligence (AI)

is the science of training computers to perform tasks that typically require human intelligence to complete.



# Strategic AI Applications

## Banking



Fraud Detection

Credit Analysis

Automated  
Financial Advisors

## Government



Smart Cities

Sensor Fusion

Facial Recognition

## Health and Life Sciences



Predictive  
Diagnostics

Biomedical  
Imaging

Health Monitor

## Manufacturing and Energy

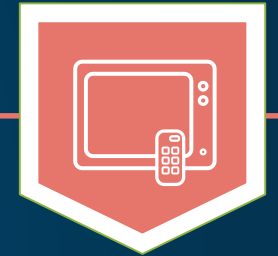


Supply Chain  
Optimization

Automated Defect  
Detection

Energy Forecasting

## Communications



Conversational  
Chat Bots

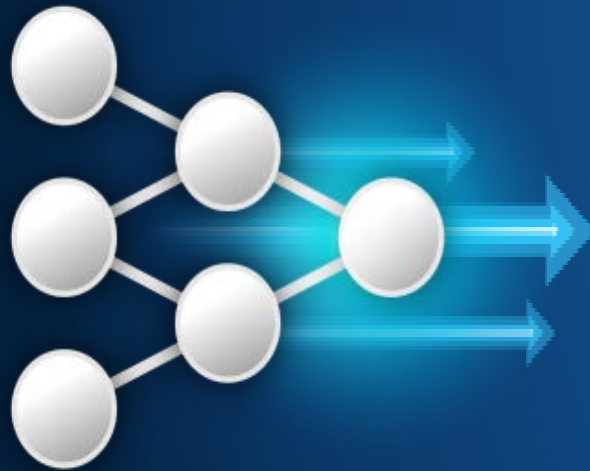
Contextual  
Marketing

Network Analytics

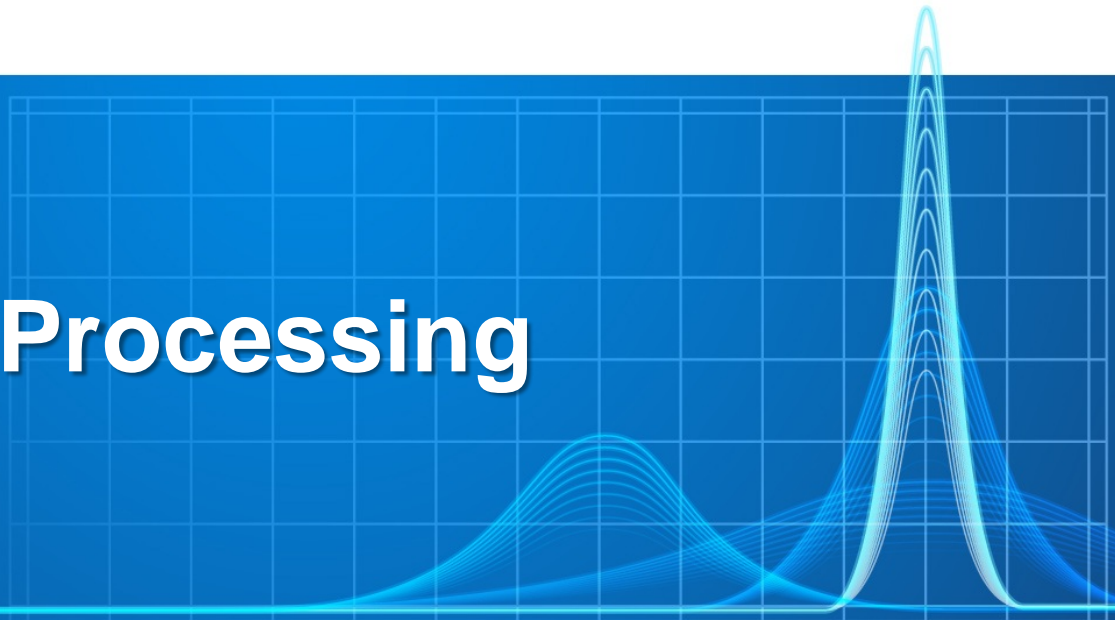


Our approach to AI is

augmenting human efforts



# Event Stream Processing





*Event Streams are **high throughput, low latency** data flows*

Event Stream Processing provides:

**Millions of events per second** throughput

**Millisecond-microsecond** response latency

On standard **commodity hardware**

*Continuous in-memory  
processing*

*OS native application*

*Threaded pool - clustering*

*Linear scalability*

*Fastest ESP on the market*

**Throughput** - *how many events per second can be ingested*

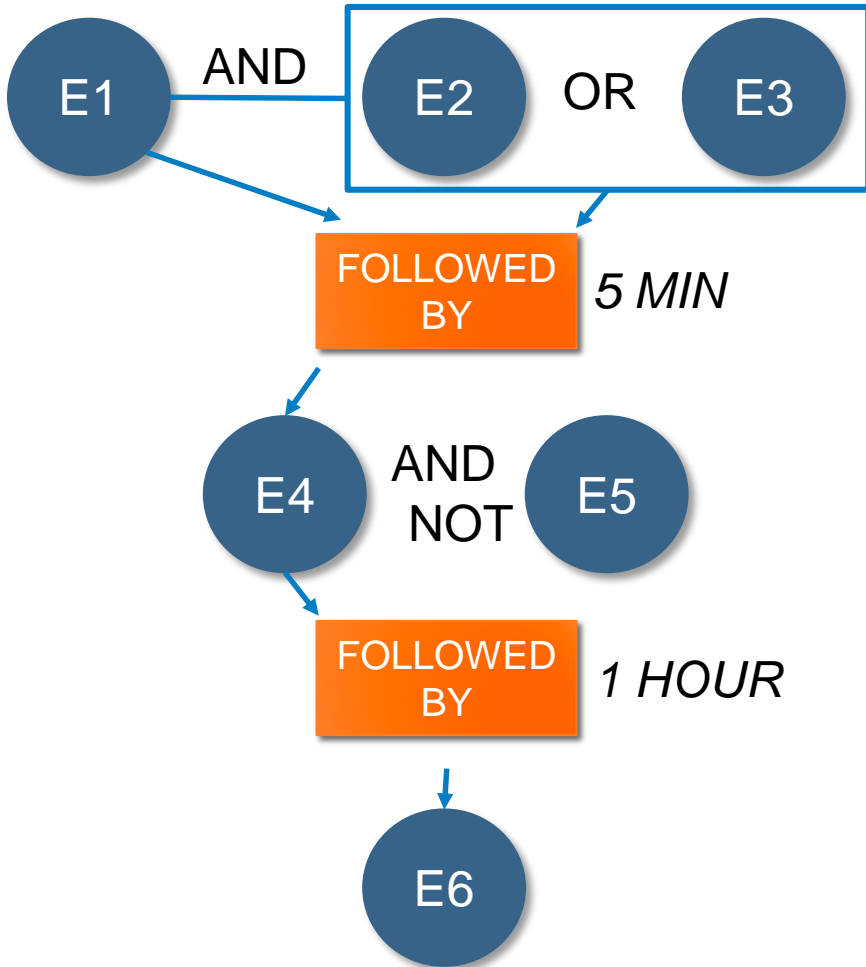
**Latency** - *the time it takes for an event to be processed through the defined workflow*

**Analytics at the Edge** – *Bring analytics to the event source*

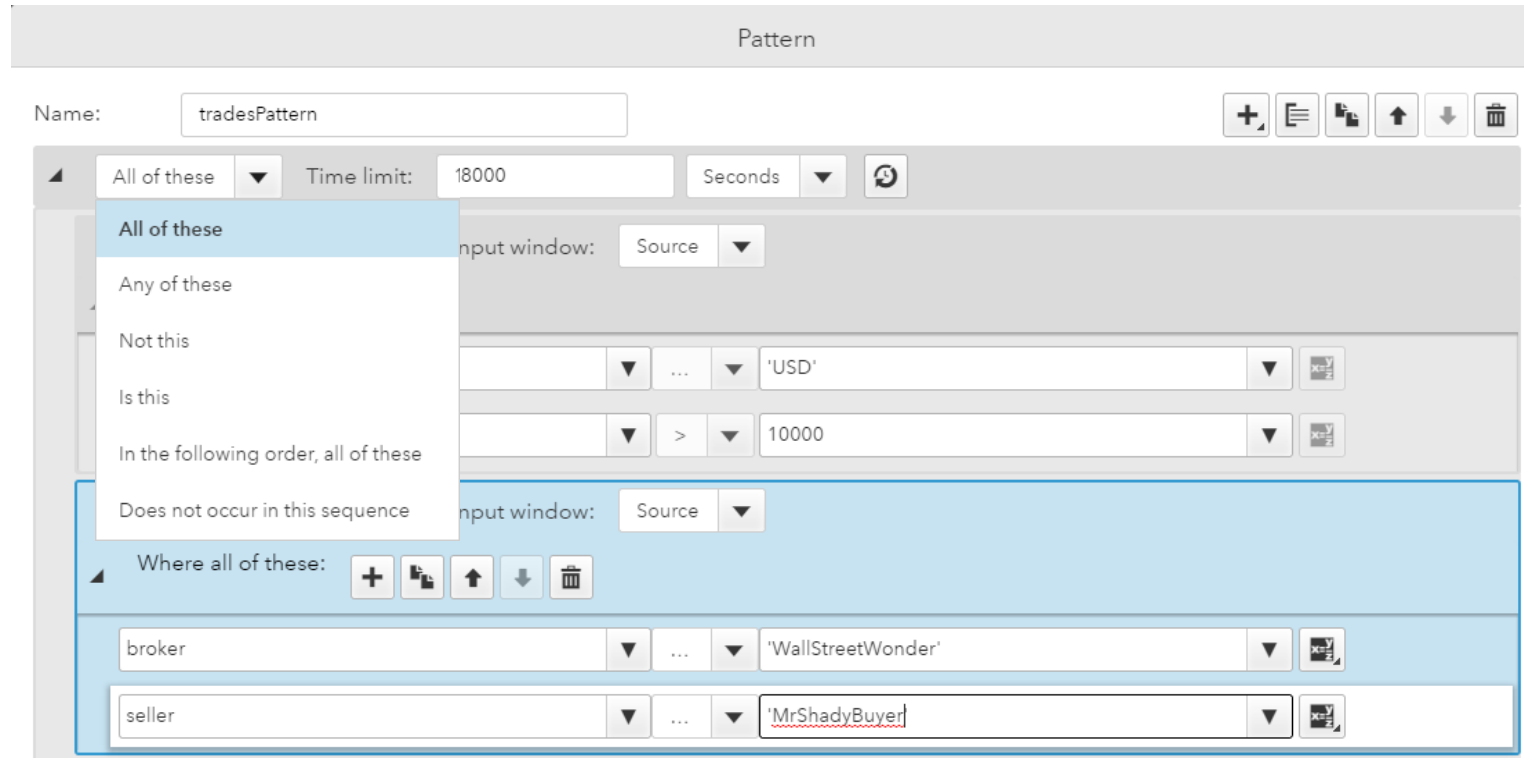




*“Detect when event A is followed by event B and not Event C in a 3min time frame”*



Build complex network of events using temporal conditions  
Multiple events in can produce one event out



# SAS® EVENT STREAM PROCESSING

## SAMPLE USE CASES

### E-Commerce Optimization



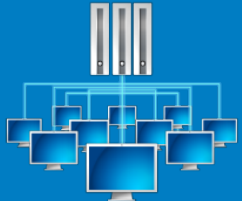
- Clickstream analysis
- Optimize user experience
- Real-time marketing and advertising

### Fraud Detection



- Real-time transaction analysis
- User behavior detection
- Customer profile correlation
- Real-time alerts and case management

### Connected Devices (IoT)



- Real-time sensors survey
- Real-time anomaly detection
- Critical asset monitoring
- Activity triggers & instruction

### Telecommunications



- Real-time transaction analysis
- User behavior detection
- Customer profile correlation
- Real-time alerts and case management

### Decision Management



- Real-time governed operational decisions
- Real-time tactical directives to systems and employees

### Capital Markets



- Continuous calculations & risk monitoring
- Reduce time from trading to reporting

# PREDICTIVE ASSET MAINTENANCE

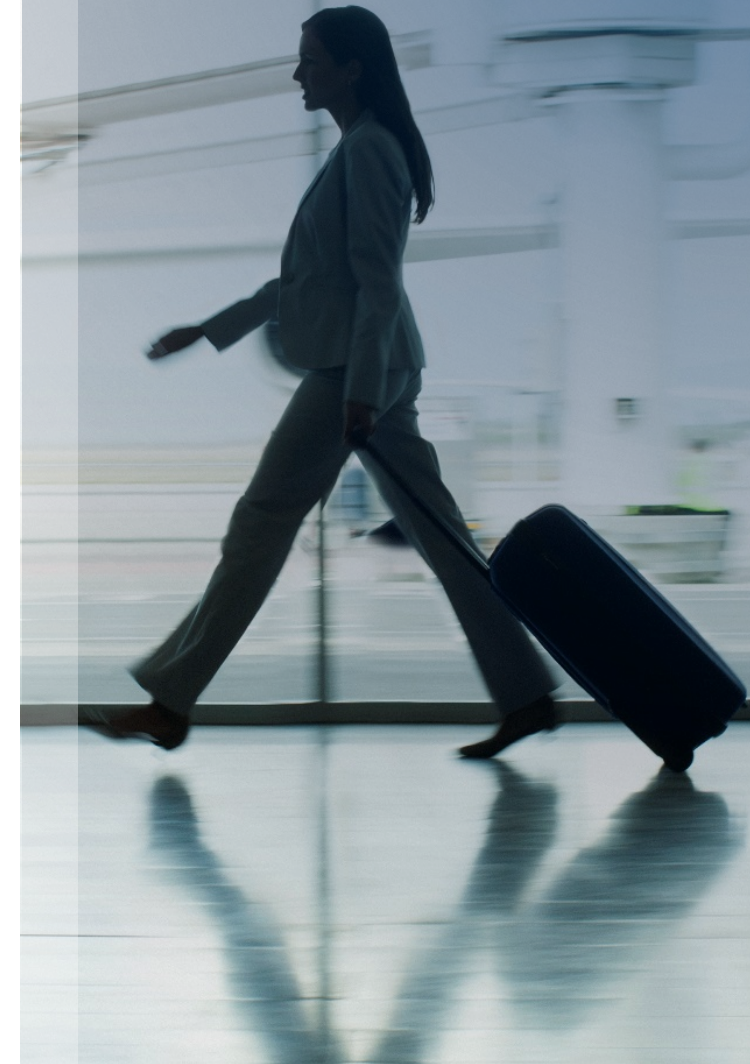
## BUSINESS CHALLENGE

- Predict maintenance needs of individual trucks before failures occur
- Proactively service trucks at opportune time
- Provide new service offering with high fleet SLA

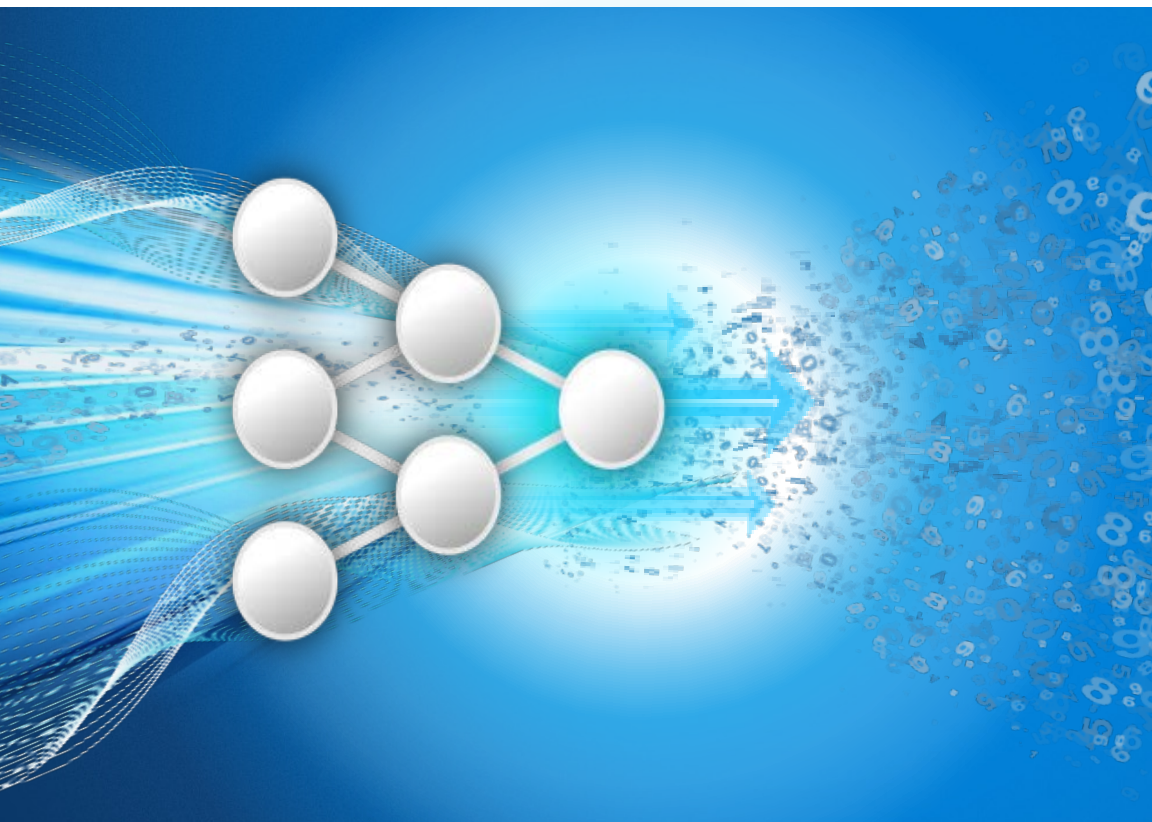
## SOLUTION

- Now monitoring data from 60+ sensors / truck
- Integrated data with product details, warranty claims, and related data sources
- Analytic models predict the likelihood of specific failures within 30 days with 90% accuracy
- Better root cause insight led to higher productivity

## TRAVEL AND TRANSPORTATION



# ANALYTICS KEY TAKEAWAYS

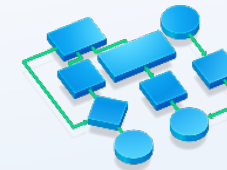


## Internet of Things



Sensors linked by network connectivity to collect & exchange data

## Artificial Intelligence



Machine learning from data by identifying patterns & relationships with data

## Event Stream Processing



Processing high volumes of data with low latency ... moving the analytics to the events

THANK YOU



THE  
POWER  
TO KNOW<sup>®</sup>