The Next Big Thing in the Internet of Things: Real-time Big Data Analytics

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VITRIA®
The Operational Intelligence Company
Internet of Things (IoT)

Devices > People
In 2008, # of internet devices exceeded # of people on earth.

20 - 50 Billion
Estimated # of connected devices by 2020.

$32 Trillion
Value-generated by Industrial Internet of Things -- GE and World Bank

30 - 40%
Value attributed to Analytics
How Analytics Generates Value in IoT

Three tiers of value

- Cyber Security
- Fraud Detection
- Situational Awareness
- Safety
- Weather

Asset Protection, Loss Prevention & Reduction
How Analytics Generates Value in IoT

Three tiers of value

1% Increase in Operational Efficiency

$100’s Billions in Savings

Operational Efficiency
- Asset Optimization
- Service Assurance
- Outage Mgmt
- Predictive Maintenance
- Failure Prediction

Resource Optimization
- Operational Health
- Cost Reduction

Security & Surveillance
- Cyber Security
- Fraud Detection
- Situational Awareness
- Safety
- Weather

Asset Protection
- Loss Prevention & Reduction
How Analytics Generates Value in IoT

*Three tiers of value*

**Business Initiatives**
- Real-time Customer Experience
- Demand/Supply Optimization
- Real-Time Pricing
- Revenue Optimization
- Predictive 1-1 Marketing
- Revenue Customer Sat., Brand Loyalty

**Operational Efficiency**
- Asset Optimization
- Service Assurance
- Outage Mgmt
- Predictive Maintenance
- Failure Prediction
- Resource Optimization, Operational Health, Cost Reduction

**Security & Surveillance**
- Cyber Security
- Fraud Detection
- Situational Awareness
- Safety
- Weather
- Asset Protection, Loss Prevention, & Reduction
Streaming Analytics provides …

- **Big Data Ingestion**: Ingest data at speed and volume
- **Contextual Awareness**: Correlate and enrich the data with location, business, and social data to make better decisions
- **Operational Analytics**: Real-time analytics to optimize resources and processes
- **Predictive Analytics**: Anticipate threats and opportunities using models generated by Machine Learning
- **Intelligent Action**: Trigger automated processes that dynamically adapt based on situational awareness

**REAL-TIME**

- Fast – In-memory
- Continuous – Event-based
- Efficient – Incremental algorithms
Smart Meter – Revenue Assurance
Real-time Fraud Detection

Meters can be bypassed or manipulated to make them under-register usage.

Patterns for detecting potential fraud:

- **Tampering**
  Smart Meter cover open and no Field Service Request is active

- **Energy Reversal**
  reverse energy events are detected and customer is not an energy producer

- **Unusual Voltage Fluctuations**
  meter has N energy voltage fluctuation events in X minutes
Smart Meter – Fraud Detection

**Real-time Analysis, Pattern Detection, and Action**

- **Volume of Data**
  - **1,000,000’s events per second**

- **Velocity of Data**

- **Detect Anomalous Events**
  - e.g., Cover opened, voltage spike

- **Correlate & enrich contextual data**
  - Service Tickets, Grid Topology, …

- **Continuous Real-time Analytics**
  - # voltage fluctuations over X minutes

- **Match Fraud Patterns**
  - e.g., tampering, energy reversals

- **Automated Actions (in seconds)**
  - e.g., nearby field person is dispatched
Smart Meter – Fraud Detection

Multi-stage event processing network

Smart Meter Events
e.g. 1,000,000 Events per Second (EPS)

Events of Interest
~10,000 EPS

Significant Events
~1,000 EPS

Actionable Events
<100 EPS

Smart Meter

Data Ingestion

Filter, Correlate, Enrich

Multi-dimensional Analysis

Pattern Detection

Actions (BPM)

Low latency processing (<1 Sec.)

Contextual Data

Service Req.

Grid Topology

Geospatial
Smart Meter Fraud Detection

Elastic, Scalable Event Processing Grid

Each use case defined as a multi-stage “Event Processing Network” (EPN)

Each EPN is scaled-out over an elastic grid of commodity HW servers.

Each Stage is scaled independently using a streaming version of Map-Reduce.

All event processing and event flows are performed in memory.

- Contextual data is preloaded into memory.

Intelligent BPM triggers an immediate action.

Streaming Meter Data

1,000,000 EPS
Severe weather events can cause equipment failure and outages.

Equipment failure prediction with timely action can:

- Prevent failures or reduce their impact,
- Lessen the probability of a catastrophic failure.

Defensive measures include: shutdown equipment, re-route electricity, dispatch work crews.

A map of all current weather alerts (showing details for one alert). To the right, aggregated alert counts are shown by both alert type and asset type.

Predictive models can pinpoint likely failures.
Smart Grid – Predictive Equipment Failure

Real-time Predictive Analytics

- Volume of Data
  - 1,000,000’s events per second

- Equipment Health & Anomalies
  - e.g., voltage fluctuations, status

- Correlate Grid Topology, Equipment Profile, Failure History

- Geospatial Correlation with Real-time Weather Data and Forecasts

- Continuous Predictive Analytics
  - based on machine learning

- Automated Actions ( < 1 second)
  - e.g., shutdown, dispatch workforce
Vitria OI Platform for IoT

Powered by Streaming Analytics

Vitria OI Platform

Streaming Analytics
- Context & Situational Awareness
  - Anomaly Detection
  - Activity Tracking
  - Pattern Detection
  - Geo-spatial Analysis
  - Predictive Analytics
  - Statistical Analytics

Intelligent Actions
- Decision Rules
- Intelligent Processes

Machine Learning & Historical Analytics
- Machine Learning
- Historical Analysis
- SPARK
- Hadoop

Streaming Ingestion & Integration
- Protocols
- Transformation
- Connectors

Data Lake

Your Tools
- Machine Learning
- Analytic Tools

Your Data Warehouses, Big Data Stores

Sources
- Devices
- Enterprise
- Weather
- Social

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Vitria OI Platform for IoT

*Powered by Streaming Analytics*

Predictive Models discovered using open Machine Learning tools can be immediately imported and operationalized in our Streaming Analytics Processor.
Real-time, Predictive 1:1 Marketing

How does your telco know you leaving the country?

O₂ – Largest Mobile Telco in UK

10 million passengers/year travel on Eurostar trains between UK and Europe via Channel Tunnel.

Most turn off data roaming just before leaving the UK.

Opportunity:
Text customers a great data roaming offer just before leaving UK.

Challenge:
- How to detect customers on the train?
- Highways next to train routes & stations
- Local Javelin trains share same routes

Problem: Javelin Trains share UK routes
Real-time, Predictive 1:1 Marketing

Volume of Data

Velocity of Data

250,000 events per second

Correlate and enrich with context
Customer, ...

Correlate location with train route
Geospatial (location) context

Track & trace passenger over time
Ensure that this is a train passenger

Correlate with train schedule
Only track Eurostar passengers

Automate actions
Text the roaming offer

In-Time – between Ashford & Tunnel

Mobile Network

CRM

Route
In Summary

STREAM
Continuously ingest massive volumes of events and data.

ANALYZE
Correlate and analyze at scale and speed.

PREDICT
Real-time Prediction based on machine learning.

ACT
Respond proactively. Seize Opportunities. Squash threats.

Streaming Analytics yields tremendous value for IoT

Scalable, high performance at extreme event rates

Real-time operational analytics to secure and optimize IoT networks

Combines machine learning with real-time predictive analytics

Vitria Operational Intelligence is a streaming analytics platform designed for IoT
Operational Intelligence for IoT

Powered by Streaming Analytics

Try our Interactive Streaming Big Data Demos on vitria.com