Real-time IoT Applications
Design IoT applications with real-time data and custom visualizations
Robert Prochowicz
Main Topics

Where is MicroStrategy in the IoT landscape?

What’s the added value of MicroStrategy?
IoT is Everywhere

IoT is everywhere (consumer and enterprise landscape)

**Smart Thermostats**
- Nest
  - Save resources and money on your heating bills by adapting to your usage patterns and turning the temperature down when you're away from home.

**Connected Cars**
- Car2Go
  - Tracked and rented using a smartphone. Car2Go also handles billing, parking, and insurance automatically.

**Activity Trackers**
- Basis
  - Continuously capture heart rate patterns, activity levels, calorie expenditure and skin temperature on your wrist 24/7.

**Smart Outlets**
- Belkin
  - Remotely turn any device or appliance on or off. Track a device's energy usage and receive personalized notifications from your smartphone.

**Parking Sensors**
- Streetline
  - Using embedded street sensors, users can identify real-time availability of parking spaces on their phone. City officials can manage and price their resources based on actual use.
IoT
MicroStrategy 10 provides organizations with a platform to democratize IoT data

The Challenge

The emergence of the Internet of Things (IoT), a growing network of interconnected smart devices, gives organizations the ability to collect and analyze data from sensors on everything from manufacturing equipment, to pipelines, weather stations, smart meters, delivery trucks, and more. To maximize the value of this information, companies need to be able to aggregate and blend data from a variety of devices and sources and analyze it in a meaningful way.

The Solution

MicroStrategy 10 is an integrated platform that helps organizations harness streams of sensor-generated data, which comes in a variety of formats and is often stored in disparate systems. With MicroStrategy, organizations can build powerful analytical applications that combine real-time data with historical data and incorporate sophisticated machine learning algorithms. By enabling fast, continual analysis, these tools help organizations lower operational costs, increase productivity, improve product offerings, and expand to new markets.

Amazing applications

- Asset Tracking
- Automated Vehicles
- Fleet Management
- Predictive Maintenance
- Asset Utilization
- Smart Metering

Global customers

- GT Nexus
- vodafone
- Telefónica Soluciones
IoT
We provide an Enterprise Analytics Platform to get the most value out of all data aspects of your IoT infrastructure.
IoT Solution Map

Business applications include:

- **Asset Tracking**: Track key assets and machinery in real-time to maintain production levels, optimize logistics, and prevent quality issues. Monitor costs and profits through multiple layers of information.

- **Automated Vehicles**: Use advanced analytics to understand data generated by sensors, accelerometers, lights, and steering, engine, and drivetrain parts. Use these insights to fine-tune efforts to improve the performance of automated vehicles.

- **Fleet Management**: Analyze real-time reports on the location of vehicles and the quality of data generated by vehicles. Get visibility into technical conditions, fuel usage, driving habits, and productivity to ensure proper vehicle function and performance.

- **Predictive Maintenance/Failure Reduction**: Monitor diagnostic sensor data, analyze patterns and trends, and predict when a component is likely to fail. Move from a reactive maintenance model to a more cost-effective, proactive approach.

- **Asset Utilization**: Combine operational and configuration data, historical data, and real-time data to enable forecasting, monitoring, and evaluation. Gain a better picture of asset availability, reliability, and operational efficiency.

- **Smart Metering**: Predict water consumption for continuity of supply or assess seasonality, and identify any issue with the water usage to manage water usage more effectively.

- **Smart Parking**: Create comprehensive reports and monitor real-time availability of parking spaces, using embedded sensors. Manage and price city resources based on actual use.

- **Secure Digital Badge**: Improve building security and employee timekeeping; replace time cards and physical employee badges with digital badges delivered via location-aware smartphone app.
Customer Example: EDS
Solution for Wind Power Plants

Customer Example: Smart Dubai

http://www.smartdubai.ae/dubai_data.php
MicroStrategy Usher

Tracking employees or equipment

Uhser is a complete solution for IoT projects based on employees or equipment (like cars, containers, etc) location

- Device (smartphone)
- Sensors
- Identity
- Network/Connectivity
- Data streaming
- Analytics
MicroStrategy solution added value for your Enterprise

• Real-time analytics
• Connection to all your company data sources
• Data blending interconnects separated data sources
• Wrangle on data and parse information without depending on heavy ETL
• Open architecture for embedding and integration
• Fast response time on large volumes of data
• Integrated predictive analytics
• Self service – fastest time to analytics insights
• Comprehensive visualizations for immediate insights
• Any client, any time
Internet of Things
Driven by a combination of:

SENSORS
The Internet of Things connects billions of sensors and devices such as consumer objects and industrial equipment onto networks.

CONNECTIVITY
Increasing amounts of data produced by those sensors and connected devices are hence acquired, logged, and stored onto networks.

PEOPLE AND PROCESSES
Networked inputs are then combined into bi-directional systems for better decision-making, increased efficiency, new services, or environmental benefits.

Sensors

- Position / Presence / Proximity
- Motion / Velocity / Displacement
- Machine Vision / Optical Ambient Light
- Temperature
- Humidity / Moisture
- Acoustic / Sound / Vibration
- Electric / Magnetic
- Acceleration / Tilt
- Leaks / Levels
- Force / Load / Torque / Strain / Pressure
- Flow
- Chemical / Gas
Connectivity

MQTT / JSON / REST API

GPS

GPRS / LTE

WiFi

Bluetooth

City Networks

WAN

Powerline Ethernet
Processes

- Location and Tracking
- Customer Relationship and Support
- Mobile Devices and Apps
- Analytics
- Remote Monitoring / Maintenance
- Energy
- People and Processes
- Security
- Control and Automation
- Supply Chain Management
MicroStrategy in IoT Landscape

Devices (Sensors)

Analytics

Connectivity
Added Value of MicroStrategy
Over 80 Out-of-the-box Gateways
Build applications using your existing enterprise assets, investments, and infrastructure

• New visual interface to find and connect to data sources
• Intuitive filtering options to search for connectors by type (OLAP, big data, …)
MicroStrategy Desktop: Self-Service Data Discovery for Business Users

The power of enterprise analytics available in an easy-to-use, stand-alone tool

MicroStrategy Desktop is an easy-to-use tool for self-service data discovery that allows business users to connect to multiple data sources, create dashboards, and make insightful decisions. It allows teams to start small and scale up as needed with governance, making it truly enterprise-grade.

- **Data Connectivity**: MicroStrategy Desktop offers easy and instant access to multiple data sources from Excel spreadsheets, to relational databases, cloud services, Hadoop and more with native connectors.

- **Data Preparation and Blending**: Data exploration is enhanced by empowering analysts to be able to easily blend data across multiple sources and with the ability to transform and profile data to help make better decisions with built-in data preparation capabilities.

- **Visualizations and D3**: MicroStrategy provides native access to the most popular charts and graphs to identify trends and outliers. Beyond that, it also offers workflows to include D3, Highcharts, Google charts, and other third-party libraries.

- **Promotion and Governance**: Desktop offers easy ways to share dashboards with colleagues with export to PDF and email options. Additionally, users can also promote content to a centralized Server to generate personalized and certified dashboards, leverage governance capabilities, help secure user access and distribution, and scale and integrate into mobile apps.
Multiple Hadoop Gateways

Hadoop is often used in IoT projects
MicroStrategy Taps into Hadoop Natively

Much faster than ODBC connection

Big Data Engine / Hadoop Gateway gives us higher performance, as we bypass the Hive / MapReduce layer and use YARN

Ability to consumer unstructured data natively from Hadoop!

No ODBC or other overhead
Powerful Built-in Data Preparation
End users can perform “data massage” right on the spot

Streamlined workflows
to parse and prepare data

Hundreds of built-in functions
to profile and clean data

Multi-table in-memory support
from different sources

Automatically parse and prepare
data with every refresh

Create custom groups
on the fly, no coding required
Data flow: from Sensor to Visualization

Freedom of choice

IoT Sensors

Enterprise-wide data model

Intelligent Cube

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High Performance Architecture
In-memory cubes for the best performance

Sub-second response time through:
• Parallel loading
• Parallel processing
• Precalculated aggregations – faster analytics
No Big Data is Too Big

Asymmetric Configuration with 0.9 avg. response time

<table>
<thead>
<tr>
<th>Nodes</th>
<th>Throughput (rpm)</th>
<th>Active users</th>
<th>Total users</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Node</td>
<td>1,052</td>
<td>3,412</td>
<td>17,059</td>
</tr>
<tr>
<td>4 Nodes</td>
<td>4,166</td>
<td>13,511</td>
<td>67,557</td>
</tr>
<tr>
<td>8 Nodes</td>
<td>7,272</td>
<td>25,061</td>
<td>125,303</td>
</tr>
</tbody>
</table>

Results

- Response time for all user actions were under one second.
- Nearly linear user and throughput scalability across multiple Server nodes.
- ~25,000 active users (~125,000 total users) were able to execute dashboards and publish cubes without experiencing slowness in response time.
Augment Big Data with Powerful Predictive Analytics
Leverage sophisticated algorithms, data mining functions, and advanced analytics

- **Optimization**: What do we want to happen?
- **Projections**: What is likely to happen based on past history?
- **Relationship Analysis**: What factors influence activity or behavior?
- **Benchmarking**: How are we doing versus competition?
- **Trend Analysis**: What direction are we headed in?
- **Data Summarization**: What is happening in the aggregate?

World's most popular advanced analytics tool.
Free, open source.

Industry's most powerful SQL engine and 300+ native analytical functions

Specialty Tools

What is likely to happen based on past history?

What factors influence activity or behavior?

How are we doing versus competition?

What direction are we headed in?

What is happening in the aggregate?

and more...
Multiple Interfaces
Freedom of choice

**MicroStrategy Web**
A browser-based interface for building and consuming analytical applications.

**MicroStrategy Desktop**
A self-service single user tool for data discovery.

**MicroStrategy Mobile**
A platform for deploying BI to tablets and smartphones and building custom mobile productivity applications.
Embed Directly into Business Applications
Inject reports, dashboards, or advanced analytics into your business applications

MicroStrategy lets organizations build a broad range of analytical applications. These apps match their business brand, processes, information structure, and workflows. Organizations can develop custom white labeled apps on both web and mobile, across a wide range of departments and use-cases, on top of existing assets and investments.

- Easy to customize and extend out-of-the-box functionality to suit various business needs
- Integrated with business applications from Salesforce to Microsoft Office
- Seamlessly embed MicroStrategy functionality with IBM WebSphere, Oracle WebLogic, Microsoft SharePoint, SAP NetWeaver, and Salesforce.com, among others
- Customize branding with MicroStrategy SDK. 100% white-labeling options for web and mobile, and copy iFrames directly into portals
RESTful API
RESTful APIs
Push and Pull data in the most popular standard

Sensors
Logs
Applications

Raw Data (push)

Webpages
Custom Apps
Tableau, Qlik…

Analytics (pull)

Push Data API
Cube/Report API
MicroStrategy 10 is Built as an Open Architecture
A comprehensive set of APIs allows you to integrate, embed, and extend MicroStrategy functionality with your existing investments.
JSON Format

REST and JSON are the most popular standards
Deploy Artificial Intelligence with ChatBots
MicroStrategy’s JSON API allows integration with ChatBots via Skype, Facebook Messenger, iOS Messenger, and more

- **Type in your questions** using natural language in a messenger on standard devices
- Machine learning techniques allow the messenger to **understand the context of the question** to retrieve the answer
- The messenger then invokes MicroStrategy’s JSON API to **provide the relevant responses**

Type business questions and get answers on the same messenger tool
Charts, Graphs, and Advanced Visualizations
Get to the insights fast

Dozens of OOTB graphs and charts available to create dashboards

Code a new visualization from scratch using the Visualization SDK

Highly interactive to allow users to perform ad-hoc actions for data exploration

Native charts and graphs

Density Map
Bar Chart
Line Graph
Pie Chart
Heatmap
Area Graph

Third-party custom visualizations*

Parallel Coordinates
Sunburst and parse.com
Fisheye distortion
Voronoi Diagram
Sunburst and parse.com

Sequences sunburst
Radial Progress
Streamgraph
BiPartile Visualization
Collision Detection

Hierarchical Edge Bundling
Population pyramid
Zoomable Pack Layout
Rounded Rect
Calendar View

*D3 visualizations, courtesy of D3.org
Visualization SDK: Build Custom HTML5 Visualizations
When a standard library is not enough

MicroStrategy provides APIs, tools, samples, and documentation that allow users to build custom HTML5 visualizations using open-source and commercial libraries like D3 and Google. Importing these outside visualizations is simple and fast.
Real-time Visualizations
Several scenarios

2-4 seconds response time

• Intelligent Cube
• Data Push REST API (HTTP Requests)
• OOTB chart
• Dossier with 1 second auto refresh setting
• Customization to disable flickering (page reloading)

Linking to schema objects (filters!)

Less than 1 second response time

• Publish/Subscribe technology
• Socket.io (Node.js, Java Script)
• Custom D3 visualization
• Runs on browser (access to ports!)
IoT Platforms
Amazon and Azure IoT Solutions
Strong IoT infrastructure often lacks strong analytics
Gateways
Out-of-the-box gateways to AWS and Azure
DEMO – IoT Car
IoT Projects with MicroStrategy

Summary

IoT is everywhere
Sensors + Connectivity + Processes. MicroStrategy is a key actor in the Process part

MicroStrategy has great customers and projects using IoT and MSTR for analytics

Added value: Data gateways, Self-service capabilities, Hadoop HDFS native connectivity, Data prep, Freedom to choose how to access data, Performance, Advanced analytics, Interfaces, Embedded, Rest APis, Visualizations

MicroStrategy is compatible with industry IoT standards, such as AWS or Azure
Thank You