King Training Resources

The THINGS are Here!
Using Oracle IoT Cloud Service

Presented by: John Jay King

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Session Objectives

- Discover the exploding opportunities of IoT
- Understand Oracle's Internet Of Things Cloud Service and how it can be used
- Fit Oracle Internet of Things Cloud Service into your overall cloud plans

Who Am I?

- John King – Partner, King Training Resources
- Oracle Ace Director
- Member Oak Table Network
- I help customers use technology through training and consulting in Oracle and other topics (http://www.kingtraining.com)
- "Techie" who knows Development, Java, Oracle, and SQL along with many other topics
- Member of AZORA, ODTUG, IOUG, and RMOUG
- One of those "dog-spoiling" people

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Who Are You?

- Future technical superstar from Pine Creek High School
- DBA
- Application Developer
- Cloud Developer
- Data Scientist
- Solutions Architect or Business Analyst
- Other?

“The Internet of Things?”

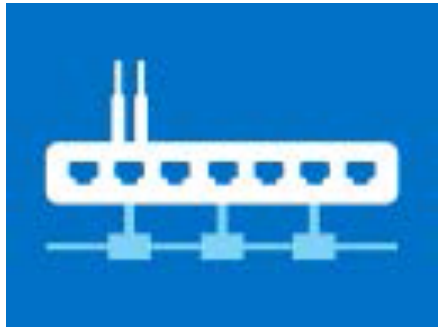
- What is “The Internet of Things?” What does it mean?
- The IoT refers to the connection of devices (other than computers, laptops, tablets, and smartphones) to the Internet/Intranet
- Devices might include: Jet engines, windmills, plant control systems, cars, kitchen appliances, TV sets, MRI devices, and even heart pacemakers
- As the IoT grows, more and more "things" will be added

Is IoT New?

- Kevin Ashton (British Technology Engineer at MIT) coined the term “Internet of Things” in 1999 to describe a system where the Internet is connected to the physical world via ubiquitous sensors

Evolution

- First there were sensors
- Then there was the internet
- Then humans could talk to each other
- Next humans and machines could "talk"
- Today, connected machines can talk to other connected machines and humans might not need to be in the middle



IoT "Starter" Glossary

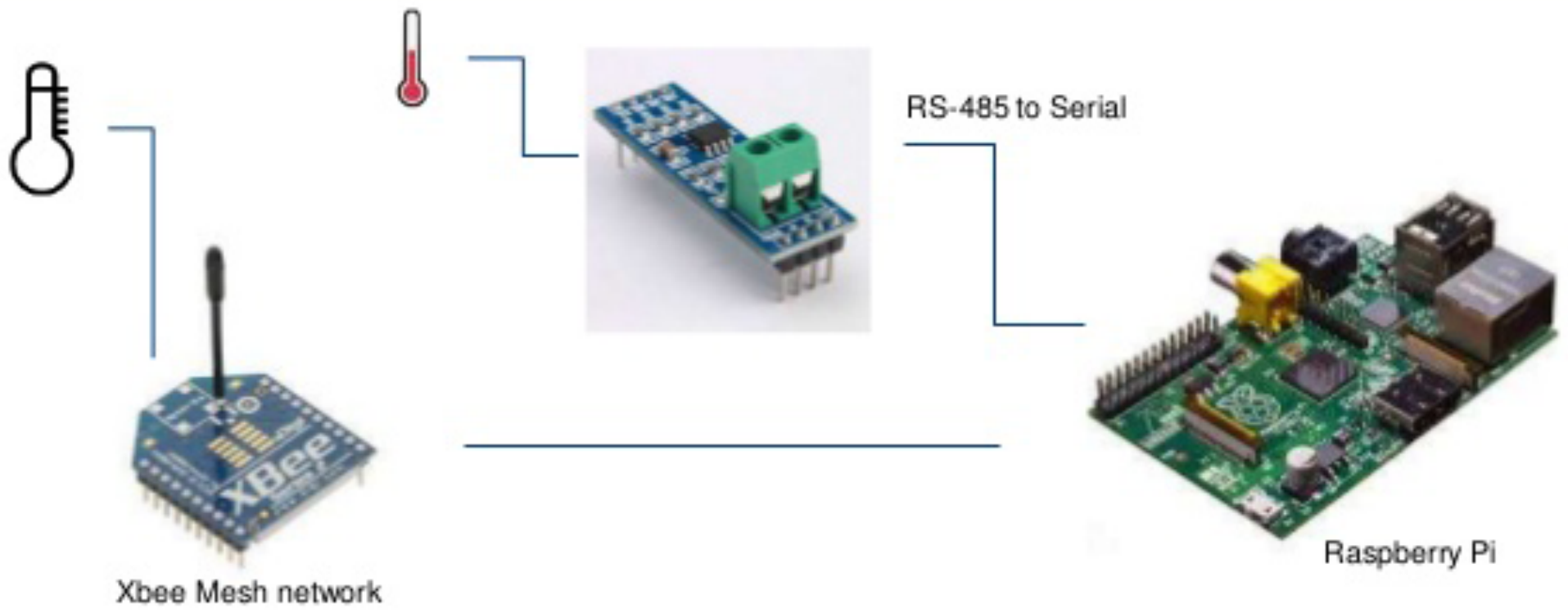
Term	Meaning
Internet of Things	Network of internet/intranet-connected objects able to collect and exchange data using embedded sensors
Sensor	An electronic device used to measure or collect data
Protocol	Standardized method for communication with IoT devices
IoT device	Internet-connected device or controller of sensors that may be monitored and/or controlled from a remote location
Edge Device	Sensors/IoT devices OUTSIDE of the cloud providing data
Edge Analytics	Software on edge devices to detect events requiring immediate attention or to filter/aggregate incoming data
Asset	Objects sensors/IoT devices are collecting information on
Data Store	Were data collected from sensors/IoT devices rests (probably filtered/aggregated somehow)
Analytics	Software and algorithms applied to data in the cloud providing traditional BI and allowing predictive algorithms
Dashboard	Display and control information about IoT devices

Some Sensors Are Not Online

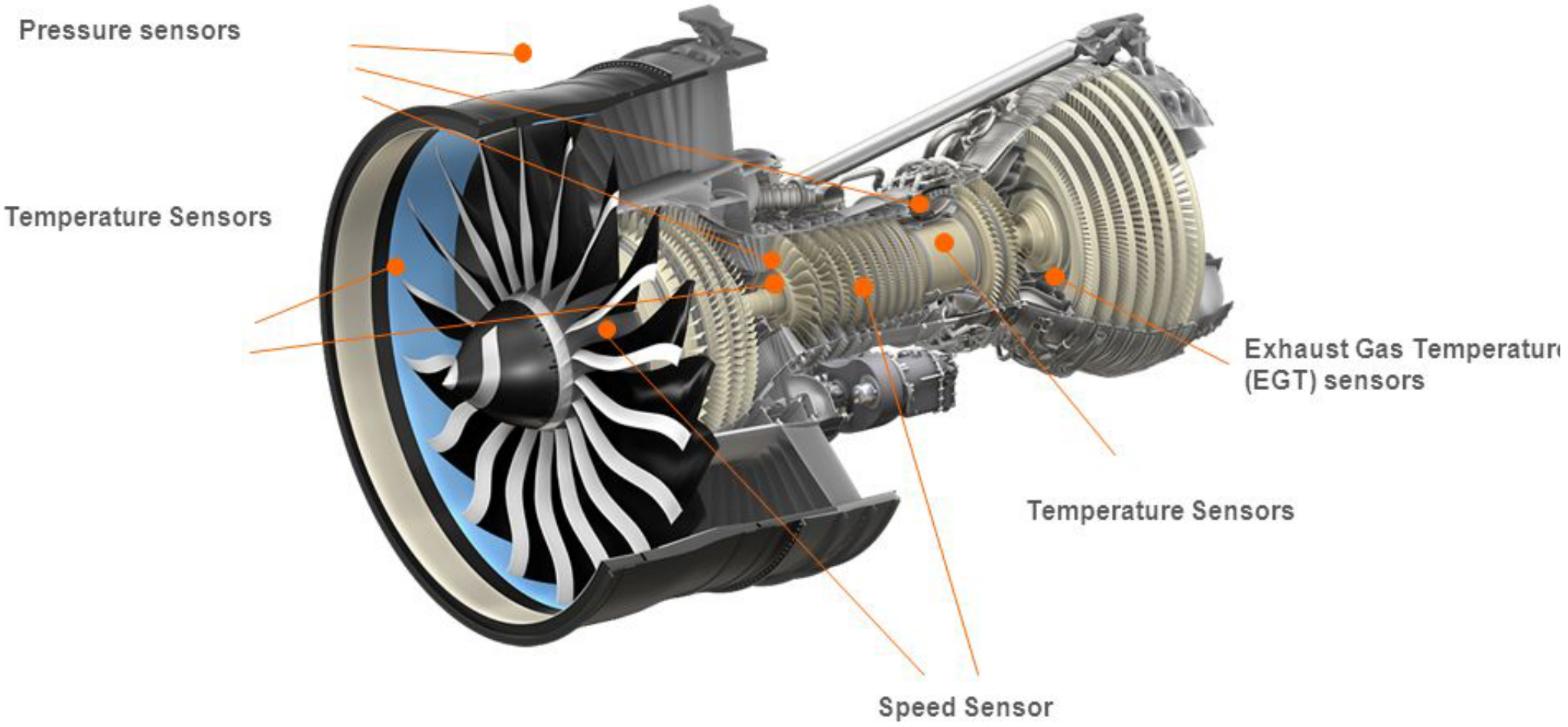
- Many existing sensors are in place and work every day not connected to the Internet; they might be connected to an IoT controller

Connecting Sensors

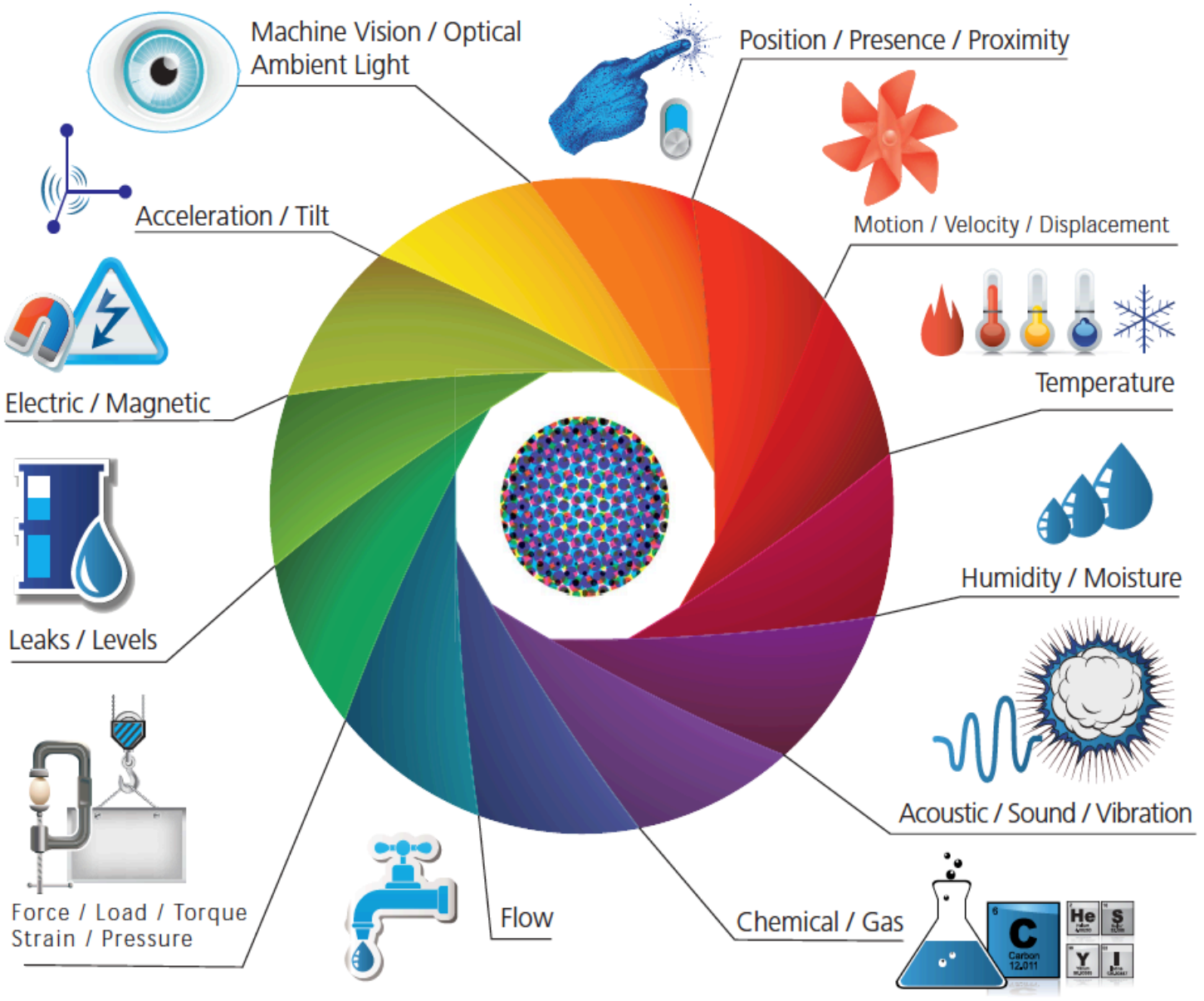
- Sometimes existing/new sensors may be connected to “collector” devices communicating with: Bluetooth, Zigbee, XBee, etc.



Modern Devices Come with IoT

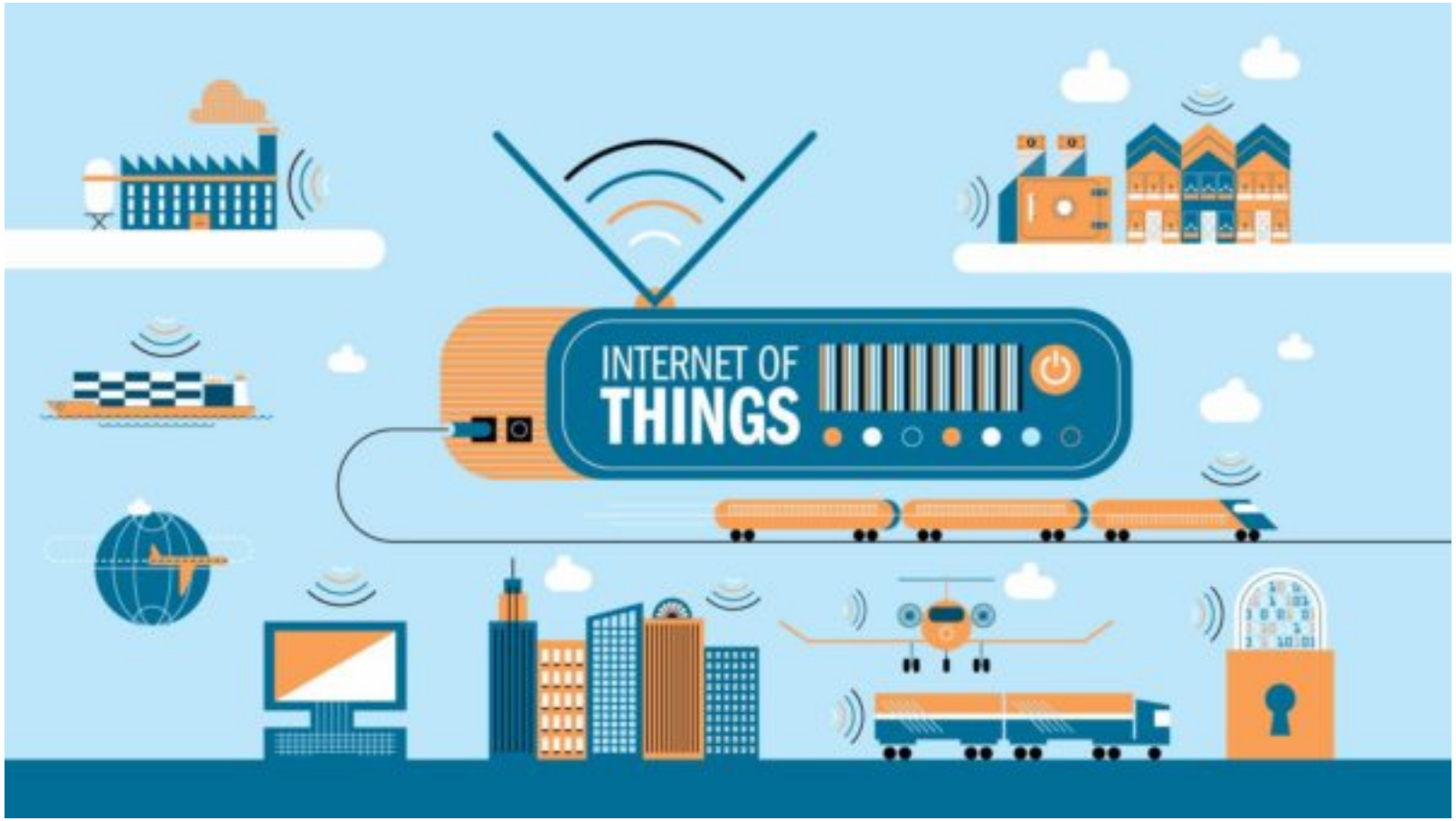


What Can Be Measured?



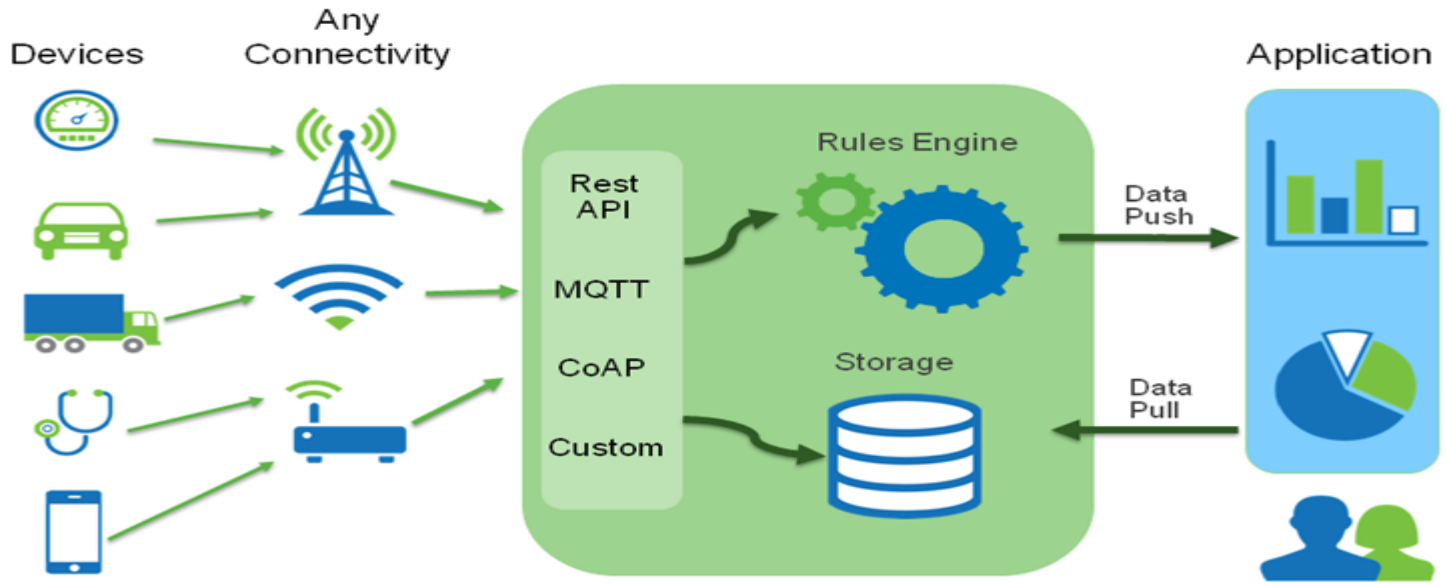
IoT Web of Things

- Today the IoT allows connection of many “things” and the possible analysis of related data



Getting Data Into the Cloud

- How does data get into the cloud?



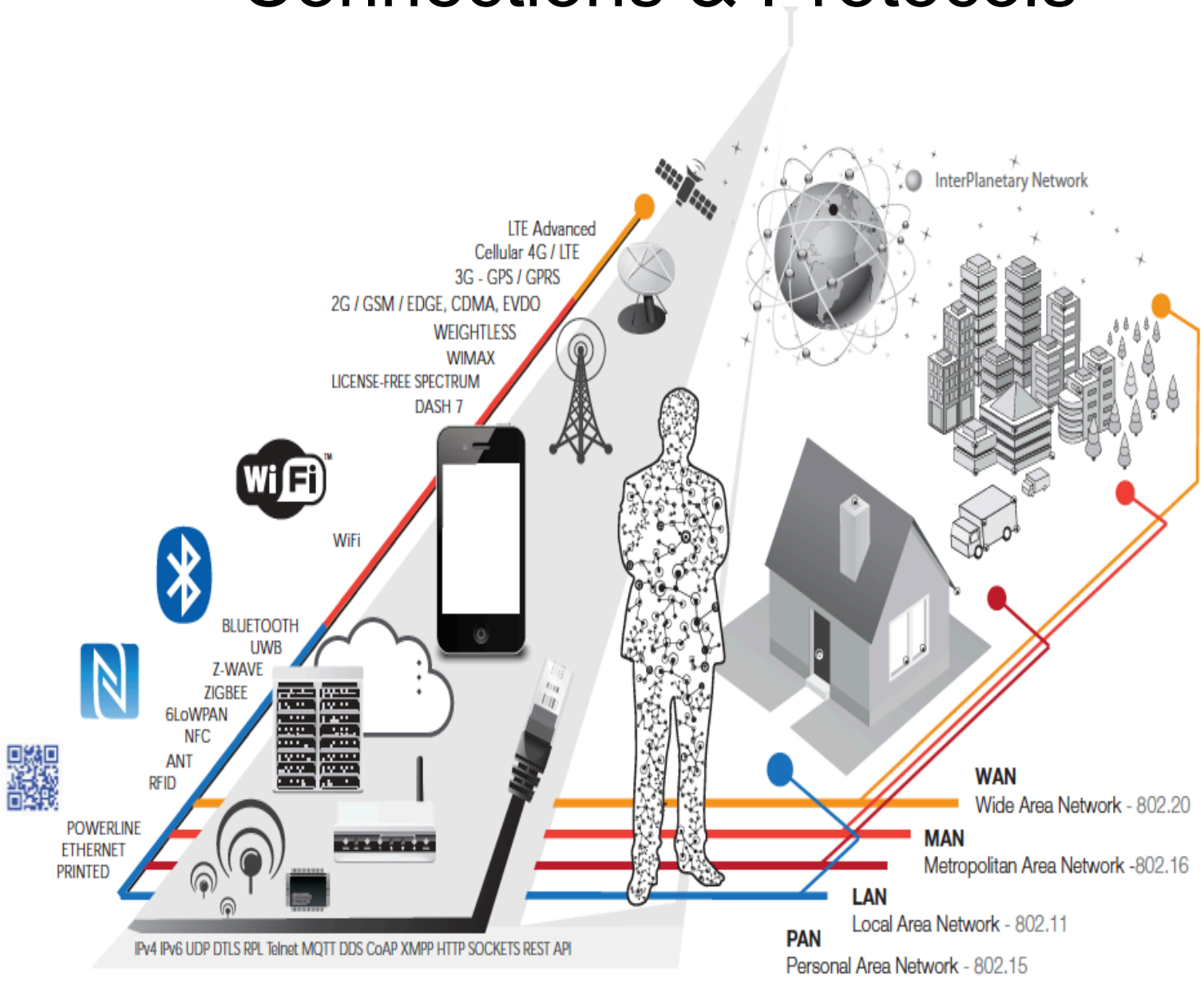
  - Directly via HTTP?
  - Directly via Secure Sockets?
  - Indirectly using Gateway hardware/software (see some of the protocols on next page)

IoT Protocol Standards

- Some of the more-common ways to connect IoT devices and their controller via gateways

Standard/Protocol	Description
OSGi	Open source protocol for communicating with devices
SCADA, DCS, PLCs	Industrial Control Systems
OPC-UA	Secure, encrypted, heavy, designed for interconnectivity
Modbus	Lightweight, insecure, around since 1978!
MQTT	Can be secured requires MQTT on both sides
DDS Adapter	Secure, Data-centric
TCP Socket	TCP/IP may use HTTPS
CoAP	Constrained Application Protocol designed for M2M
Bluetooth, Zigbee, Zwave, XBee	Lightweight protocols allowing sensors to communicate directly without need for a controller

Connections & Protocols



Lots of Data!

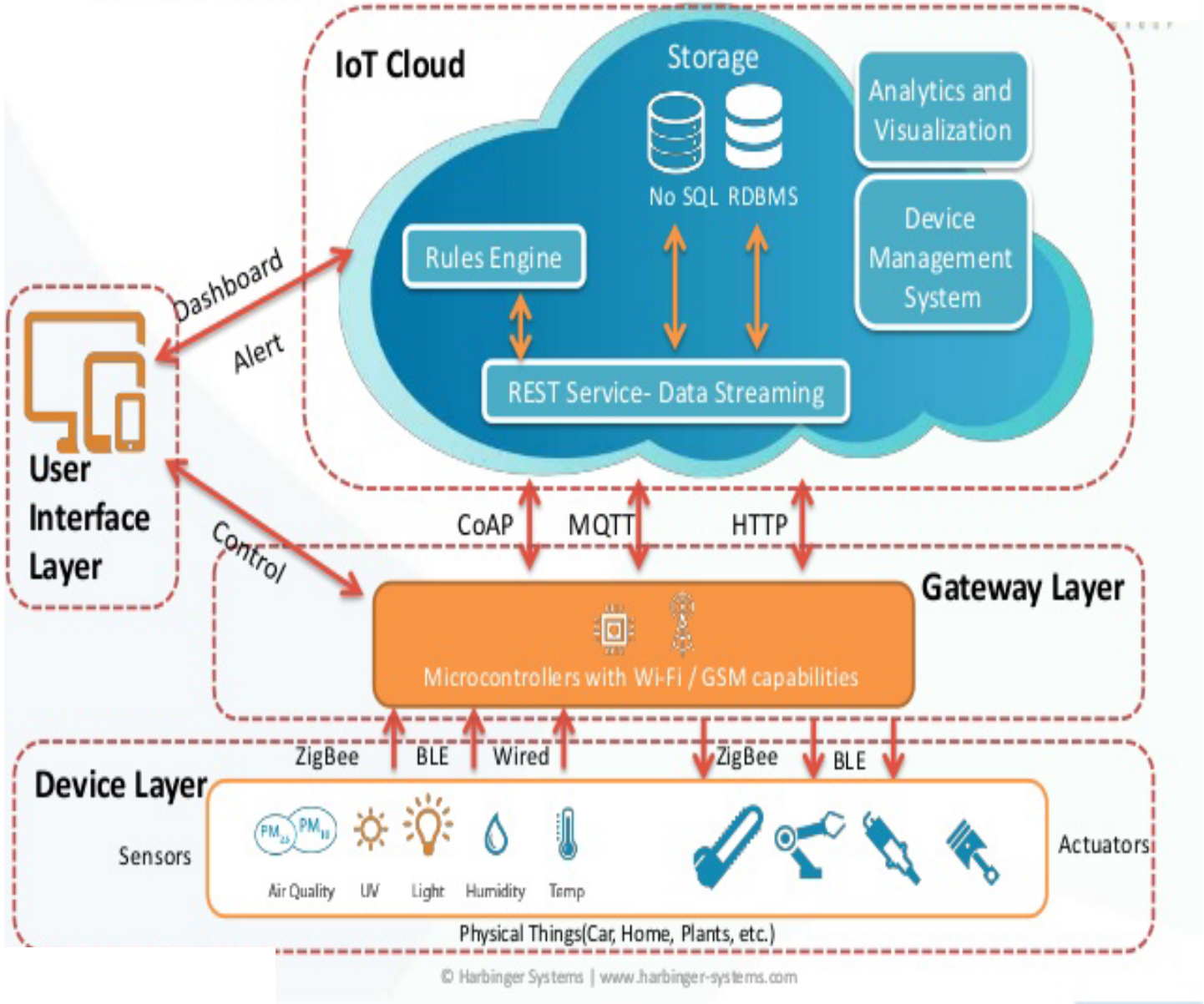
- A single GE jet engine produces about 2 terabytes of data per day
- There are 2-4 Jet Engines per airliner and approximately 87,000 airline flights per day

- A consideration: How much is each engine's 2 terabytes per day worth? As always, “it depends”

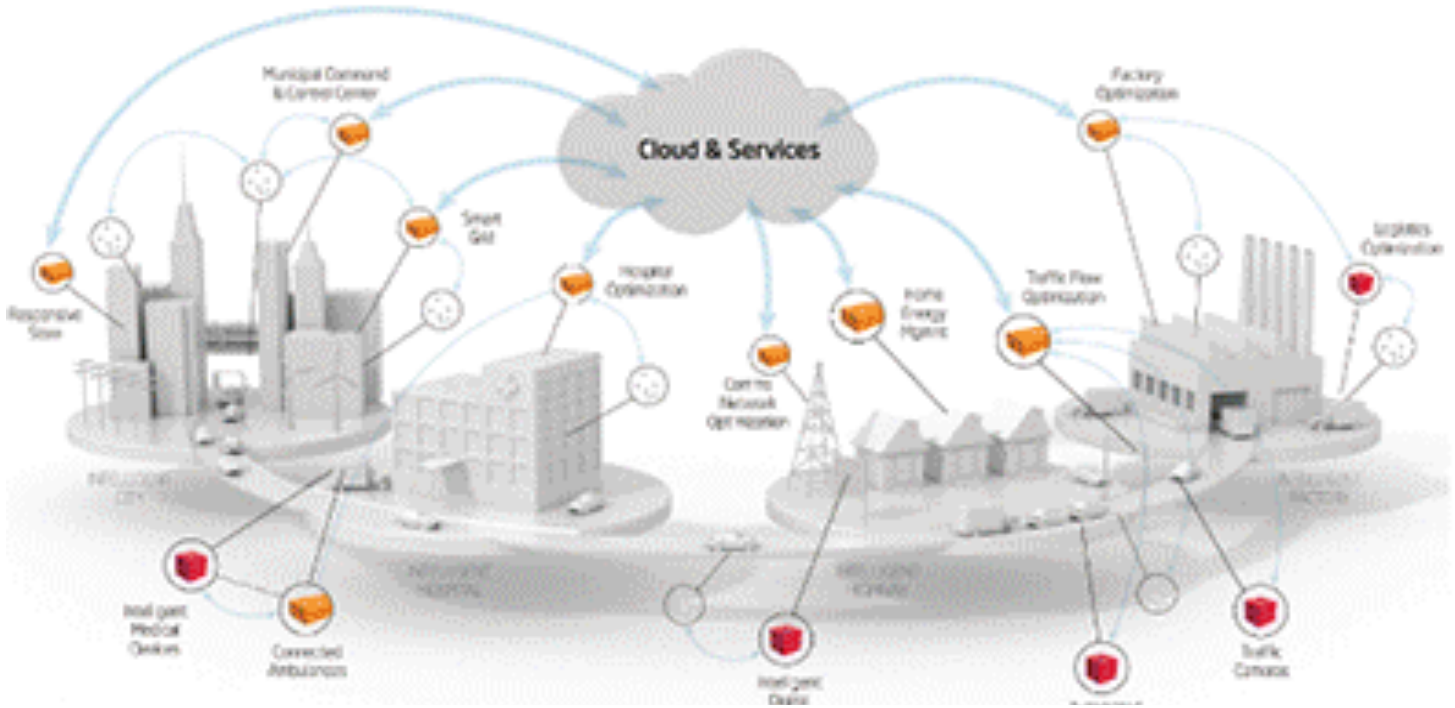
Storing the Data

- Most IoT systems use “big data” data stores such as “time-series” but any data store may be used

How it Fits Together



“Perfect Storm” for IoT



- Decreasing cost of sensors
- Increased connectivity
- Incredible computing power

IoT Platforms

- Many vendors provide platforms for IoT
  - Amazon Web Services
  - Microsoft Azure
  - ThingWorx IoT Platform
  - IBM's Watson
  - Cisco IoT Cloud Connect
  - Salesforce IoT Cloud
  - Google IoT Solutions
  - Oracle IoT Cloud

Consumer vs. Industrial IoT

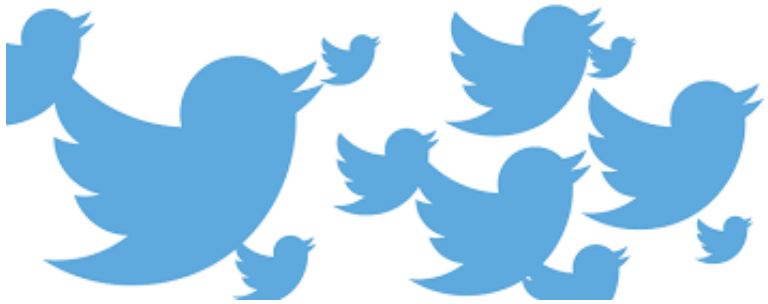
- Today's IoT discussion frequently involves "Consumer" IoT including door locks, light bulbs, thermostats, and more

- Tomorrow's growth will be in the "Industrial" IoT of sensors, controllers, and other devices

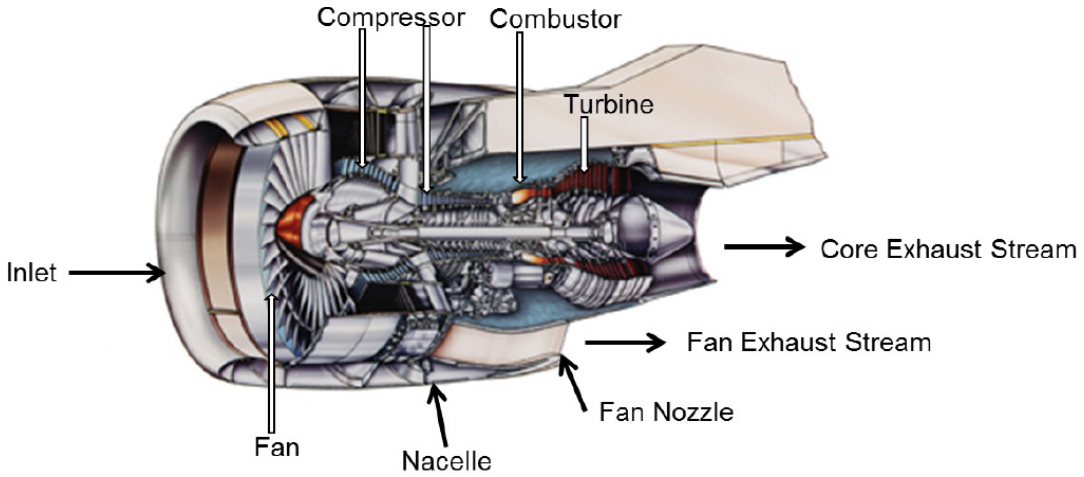
  Billions of “things” helping manage cities, infrastructure, power generation, manufacturing, aviation, and more

Comparing Data Generation

- Collecting every tweet yields about 80GB of Twitter data per day (sounds like a lot)



- The data from a single commercial jet engine can generate over 500GB per day



IoT Devices By Category

- Gartner published these numbers in Jan 2017 (millions of units)

Category	2016	2017	2018	2020
Consumer	3.963.0	5,244.3	7,036.3	12,863.0
Business: Cross-Industry	1,102.1	1,501.0	2,132.6	4,381.4
Business: Vertical-Specific	1,316.6	1,635.4	2,027.7	3,171.0
Grand Total	6,381.8	8,380.6	11,196.6	20,415.4

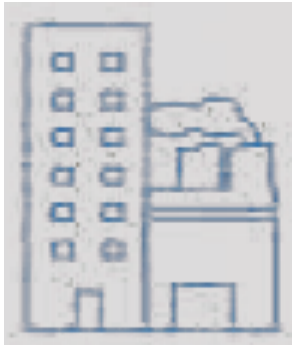
IoT Endpoint Spending

- Gartner published these numbers in Jan 2017 (millions of dollars)

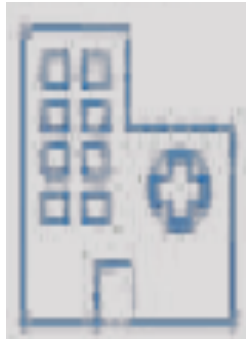
Category	2016	2017	2018	2020
Consumer	532,515	725,696	985,348	1,494,466
Business: Cross-Industry	212,069	280,059	372,989	567,659
Business: Vertical-Specific	634,921	683,817	736,543	863,662
Grand Total	1,379,505	1,689,572	2,094,881	2,925,787

Industry Spread

- Estimated breakdown of devices per industry

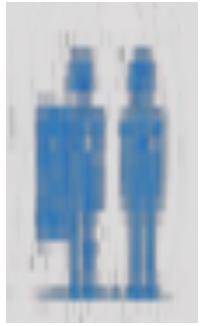


40.2%
Business & Manufacturing



30.3%
Healthcare

8.3%
Retail



7.7%
Security

IoT Security Concerns

- As more devices are connected, security and privacy have become a major concern
- Cyber attacks are a growing threat as more connected devices pop up around the globe
- Intruders might:
  - Penetrate connected cars
  - Manipulate traffic
  - Grab photos/video
  - Steal industrial secrets
  - More…

IoT Security

- IoT devices are vulnerable; this topic is too complex to cover fully today; maybe a future talk
- The Cloud Security Alliance is a good source

https://downloads.cloudsecurityalliance.org/whitepapers/Security_Guidance_for_Early_Adopters_of_the_Internet_of_Things.pdf

Analytics

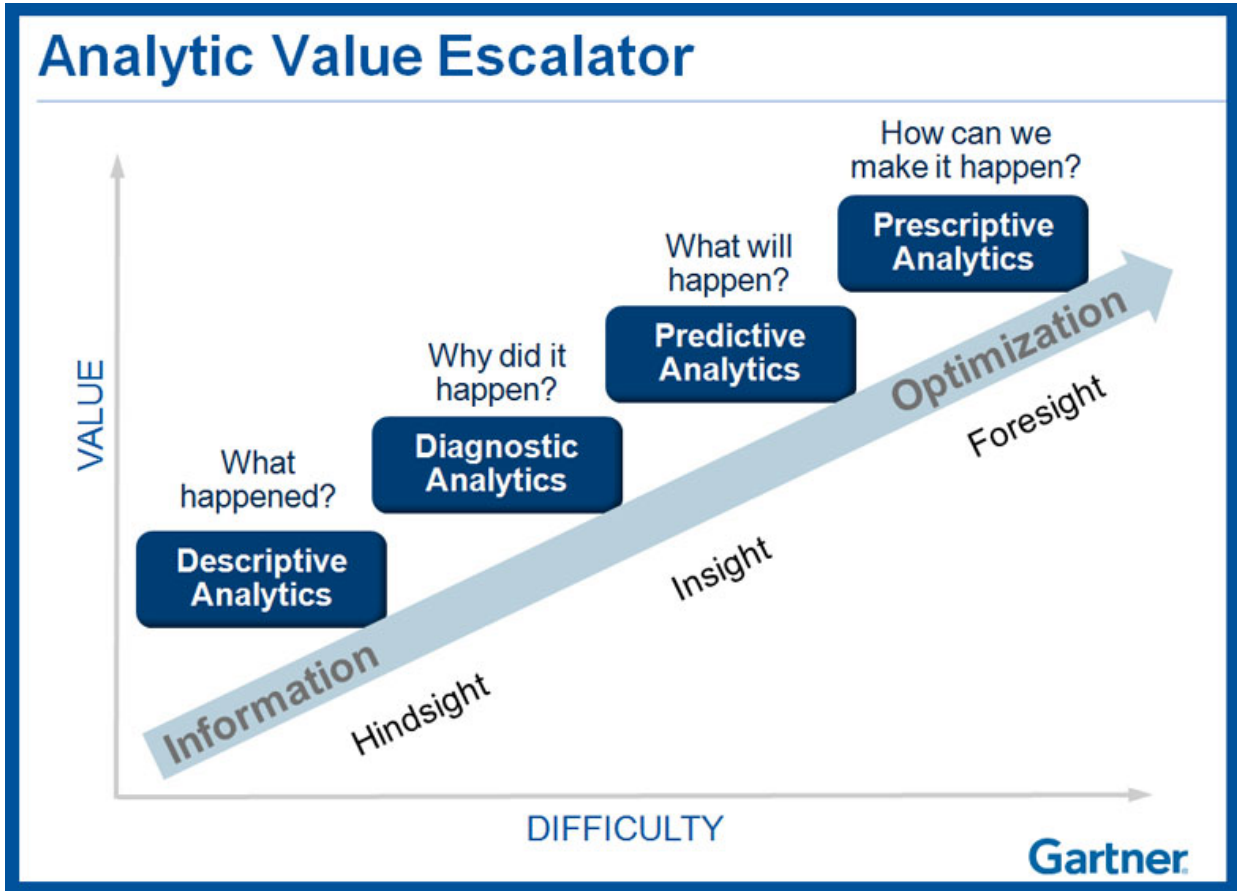
- IoT's masses of disparate data demands the use of sophisticated analytics in IoT applications
- While traditional BI (Business Intelligence) will still be useful; IoT provides new opportunities
- Machine Learning may be used to evaluate data as it arrives in edge devices to detect trends and anomalies quickly
- Analytics may combine data from various sources
- Analytics are usually created by “Data Scientists” using languages like R, Java, Matlab, C++, Python, and more…

Using Analytics

- IoT analytics help companies understand IoT data to reduce maintenance costs, avoid equipment failures, and improve operations
- Analytics can provide game-changing results allowing predictive and eventually actions
- Analytics helps people question traditional ways of operation and can lead to positive change
- Analytics help identify unproductive activities, redefine them, remove waste and optimize improving efficiency, productivity and profitability
- Analytics can help predict future trends leading to better performance and decision making

Evolution of Analytics

- Again, the Gartner team has provided a great graph to illustrate the growth of Analytics; today we use analytics to predict failures (saving money & time); some systems actually prescribe actions so that failures never occur!

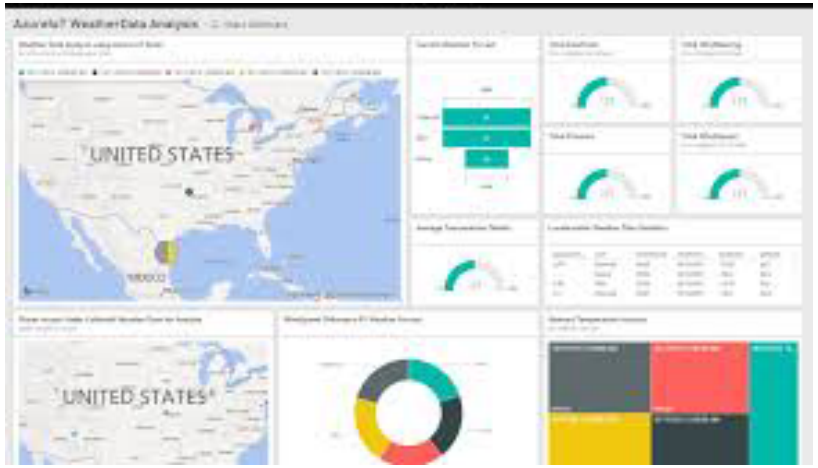


Analytics in Motion

- Collect
- Filter
- Aggregate
- Analyze
- Extrapolate
- Display

IoT Analytic Dashboards

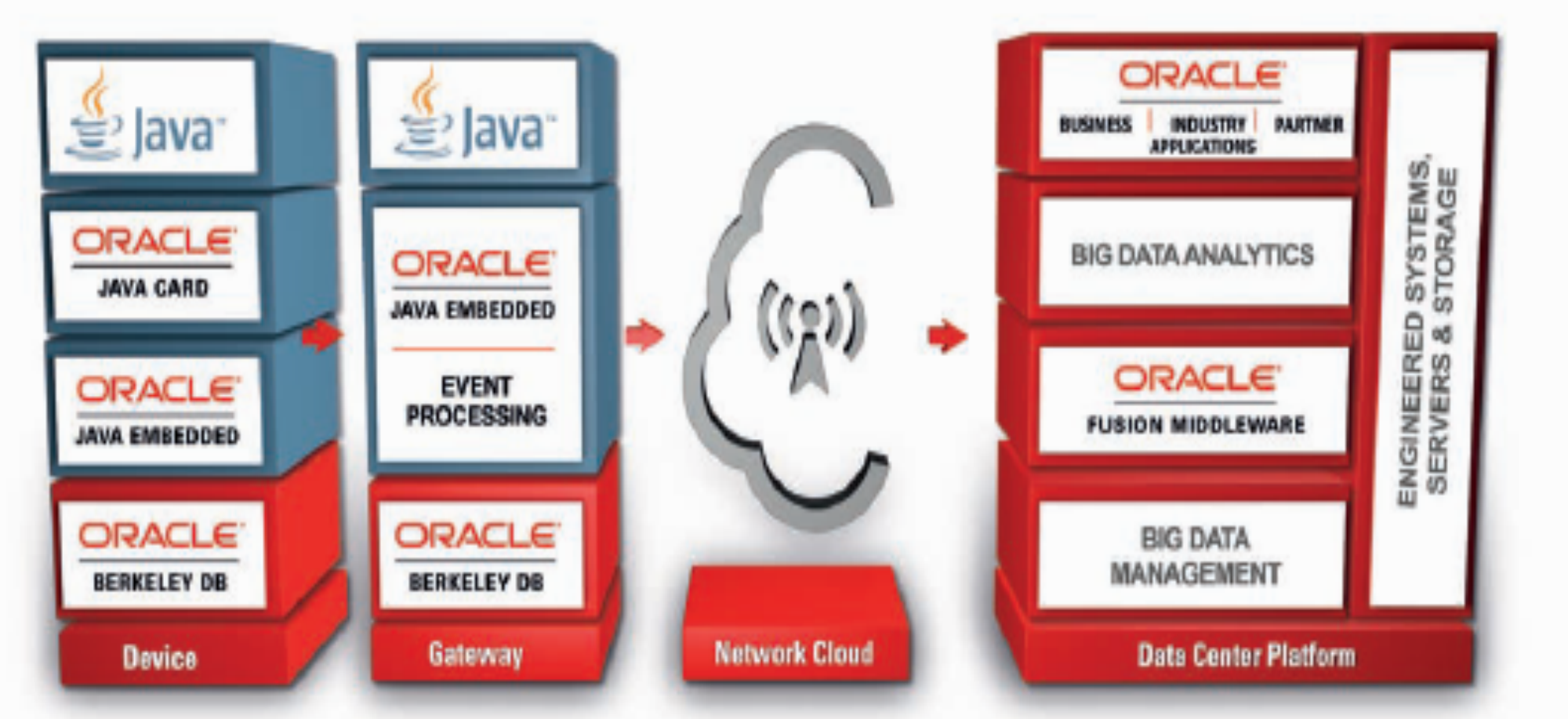
- IoT provides a lot of data!
- A "Dashboard" is useful in communicating asset and business performance
- Charts and other data visualizations help make the torrent of data comprehensible
- Dashboard information (and their drill-downs) can be transformed into decision-making information



Oracle Internet of Things Cloud

- From Oracle Docs: http://docs.oracle.com/en/cloud/paas/iot-cloud/index.html
- Oracle Internet of Things (IoT) Cloud Service is a managed Platform as a Service (PaaS) cloud-based offering that helps you make critical business decisions and strategies by allowing you to connect your devices to the cloud, analyze data from those devices in real time, and integrate your data with enterprise applications, web services, or with other Oracle Cloud Services, such as Oracle Business Intelligence Cloud Service.

Oracle IoT Environment



Oracle IoT and Security

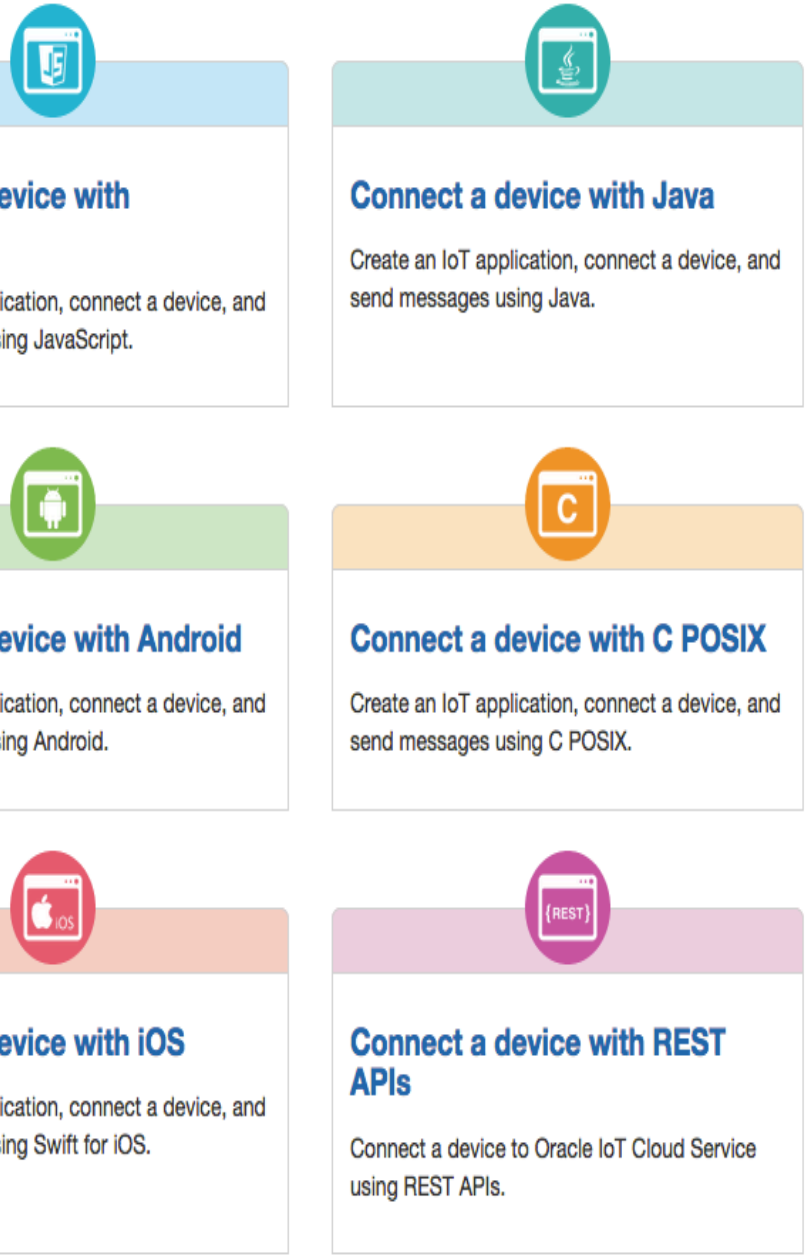
- Oracle's security protects everything including IoT devices
  - SSH security protects transmissions
  - Devices are assigned OAuth tokens (expiration may be configured from 5 min to 1 month)
  - An Oracle IoT Security Best Practices document may be found at:

    http://docs.oracle.com/en/cloud/paas/iot-cloud/iotgs/security-best-practices-oracle-iot-cloud-service-gateway.html

Steps to Oracle IoT

- Here's a brief synopsis of what is needed for IoT:
  1. Create/Identify SSH public/private key pair
  2. Purchase Oracle Database as a Service, Java as a Service, and Internet of Things Service
  3. Create Storage service, Database service, Java service, and IoT service
  4. Create Oracle IoT application instances
     a. Asset Monitoring
     b. Production Monitoring
     c. User IoT applications

Oracle IoT Devices



Connect a device with Javascript

Create an IoT application, connect a device, and send messages using JavaScript.

Connect a device with Java

Create an IoT application, connect a device, and send messages using Java.

Connect a device with Android

Create an IoT application, connect a device, and send messages using Android.

Connect a device with C POSIX

Create an IoT application, connect a device, and send messages using C POSIX.

Connect a device with iOS

Create an IoT application, connect a device, and send messages using Swift for iOS.

Connect a device with REST APIs

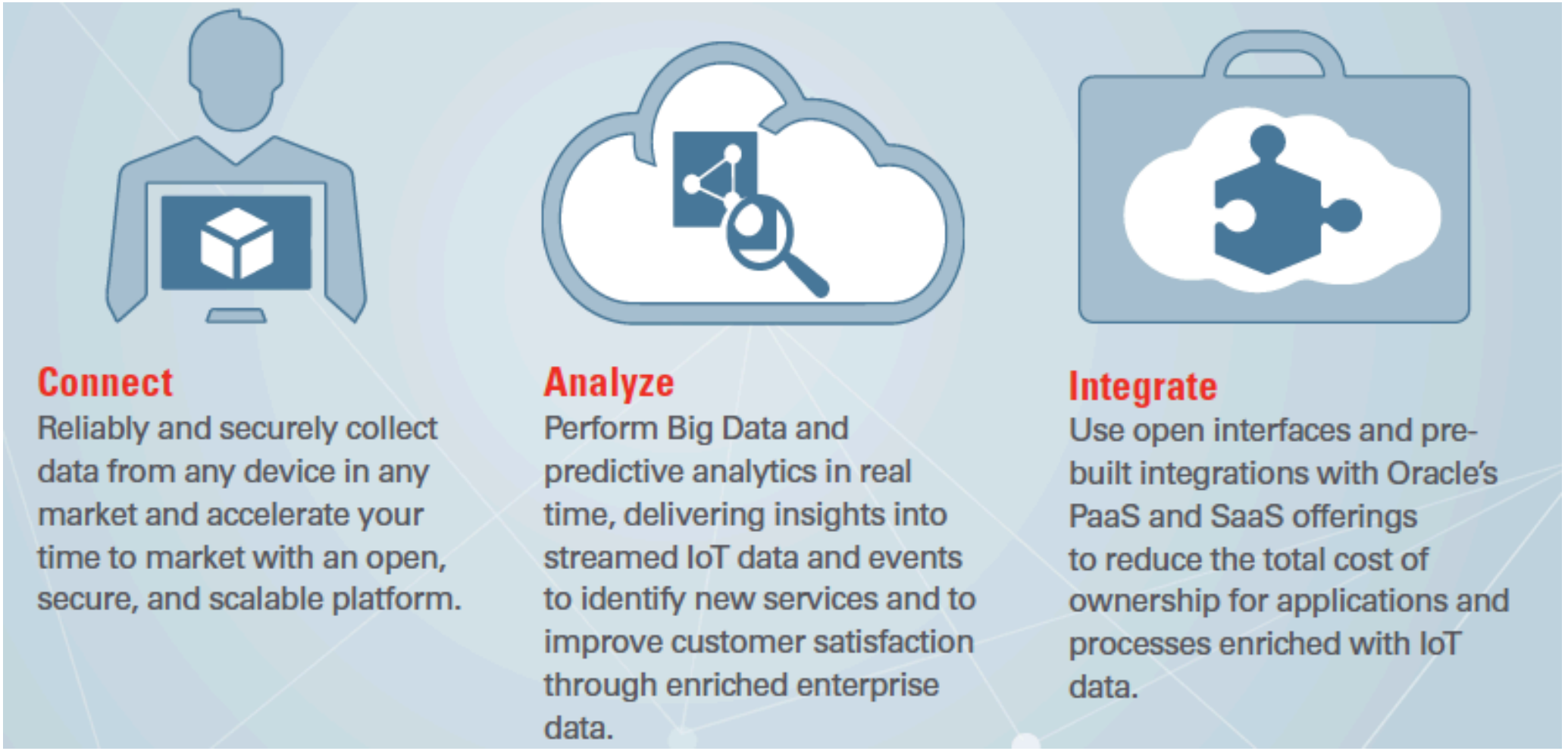
Connect a device to Oracle IoT Cloud Service using REST APIs.

IoT Cloud Service Gateway

- Oracle IoT cloud provides a Cloud Service Gateway to bring data in from “edge” devices to Oracle IoT
  - Secured
  - Measured
  - Dependable

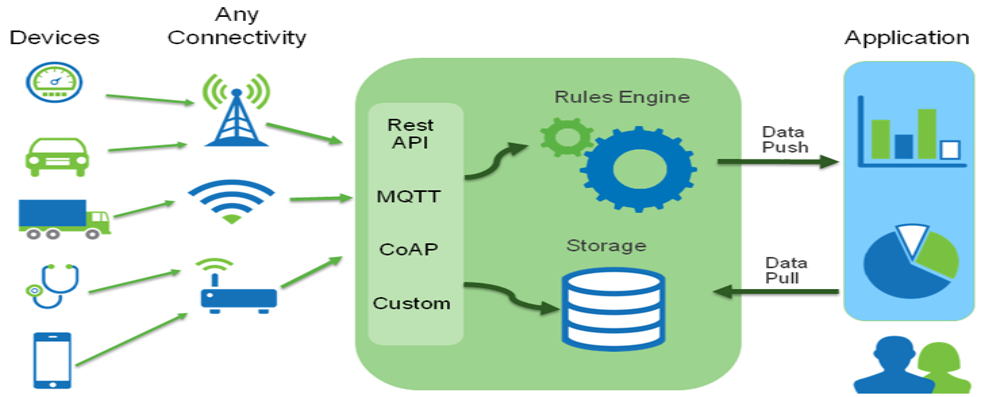
Collect/Analyze/Integrate

- Oracle Marketing has a nice synopsis:



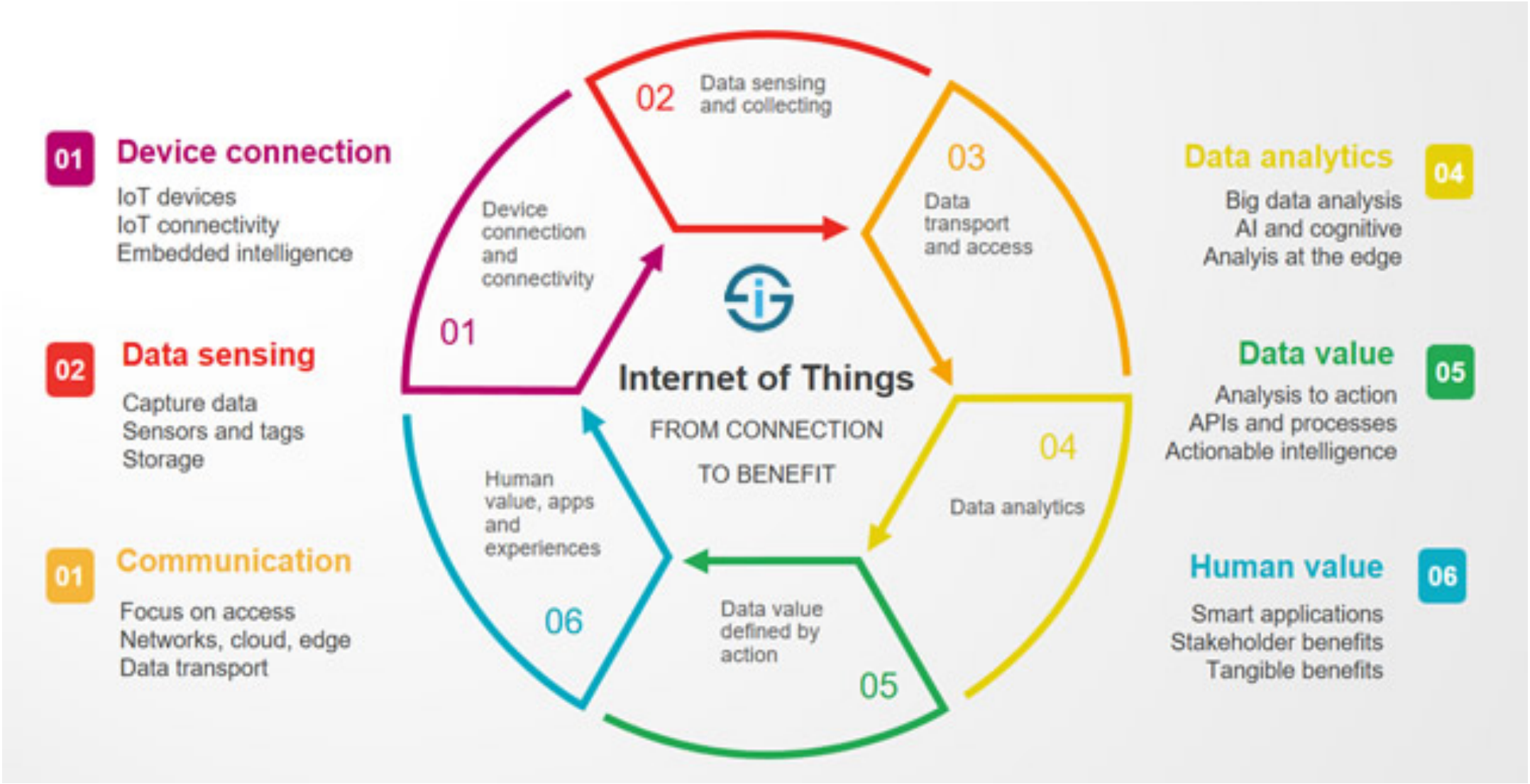
Oracle Cloud and IoT

- On "The Edge"
  - Oracle Mobile Cloud Service
  - Oracle IoT Cloud Service Client Library
  - Oracle IoT Cloud Service Gateway
  - Edge Analytics
- Streaming
  - Oracle Big Data Cloud Service
  - Oracle IoT Cloud Service
  - Kafka
- Integration
  - Oracle Integration Cloud Service
  - Oracle Messaging Cloud Service



- More Integrations
  - Other (non-Oracle) Cloud Services
  - Enterprise Applications
  - Oracle SOA Cloud Service
  - Oracle Process Cloud Service
  - Oracle Big Data Cloud Service
  - Oracle IoT Cloud Service
  - Oracle BI Cloud Service

Connecting People to Things



Conclusions

- IoT is here and it is growing; more data sources every day…
- IoT provides LOTS of new data to store, analyze, and make decisions with
- IoT is expanding in both Consumer and Industrial sectors
- IoT allows us to use data in new ways to improve processes and increase productivity
- Modern Analytics enable expanded decisions and processing
- Integration of IoT data with existing systems maximizes its value
- Oracle's Internet of Things Cloud Service provides an end-to-end IoT solution

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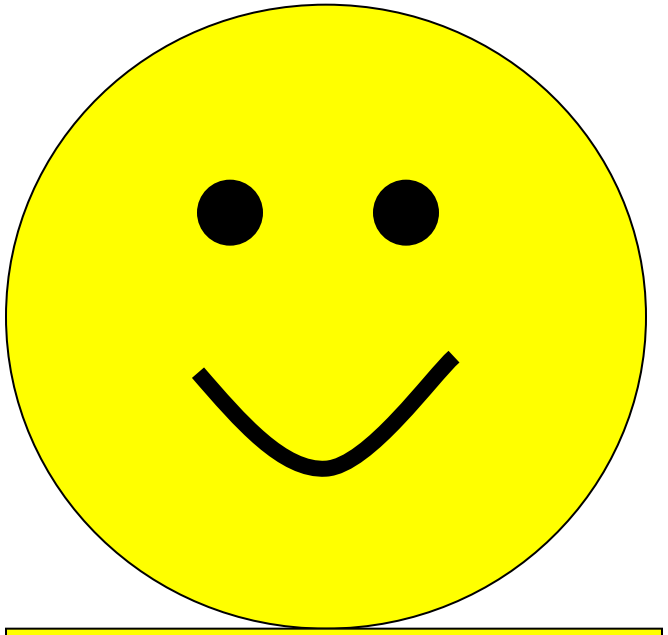

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