Agenda

- Introduction to Internet of Things (IoT)
- Industry Landscape
  - Internet of Everything
  - Internet of Your Things
  - Smarter Planet
  - Industrial Internet
- Use Cases & Value Proposition
- Machine Data and Big Data Analytics
- Wrap up
About Shyam

• Principal Architect – Analytics
• Board of Director (SIGs), 30K+ member User Group (IOUG)
• Founder of BIWA Special Interest Groups in 2006, Exadata SIG in 2008 (9200+ members)
• Worked in IBM, Deloitte, Oracle and Halliburton, prior to GE
• Regular speaker Oracle Openworld, Collaborate, BIWA Summit on IoT, Business Analytics and Data Warehousing / Engineered Systems related topics
• OCP since 1998 (RDBMS V7 and up)
• Awarded IOUG Oracle Contribution Award - 2007
GE and Chevron

Chevron, GE Form Technology Alliance

HOUSTON, Texas, Feb. 3, 2014 – Chevron Energy Technology Company and GE Oil & Gas announced today the creation of the Chevron GE Technology Alliance, which will develop and commercialize valuable technologies to solve critical needs for the oil and gas industry.

The Alliance builds upon a current collaboration on flow analysis technology for oil and gas wells. It will leverage research and development from GE’s newest Global Research Center, the first dedicated to oil and gas technology.

"GE brings its leading manufacturing capabilities, worldwide marketing, distribution, and extensive R&D capabilities not only for oil and gas, but also other business sectors to this alliance," said Paul Siegela, president of Chevron Energy Technology Company and chief technology officer. "Together, we hope to bring impactful new technologies to the industry."

"Chevron’s deep understanding of the oil and gas industry, combined with GE’s long tradition of technology development and close collaboration with strategic partners, will uniquely position this new alliance to address the industry’s technology needs," said Lorenzo Simonelli, president and CEO, GE Oil & Gas. "The solutions developed by this alliance will take on even more industry significance given Chevron’s proven leadership in being first to field-test and deploy new technology breakthroughs."

http://www.chevron.com/chevron/pressreleases/article/02032014_chevrongeformtechnologyalliance.news
The 2013 Hype Cycle features Internet of Things, machine-to-machine communication services, mesh networks: sensor and activity streams.

http://www.gartner.com/newsroom/id/2575519
Preview of 2014 – Hype Cycle

“...the strongest advantage to early adopters and fast-followers is when the technology is still on the Hype Cycle.”

https://www.gartner.com/doc/2816917?plc=ddp#a209530438
Hype Chart 2014 – Hot-off the Press!

http://www.gartner.com/newsroom/id/2819918
Oracle President Mark Hurd on the Internet of Things: 5 Takeaways

Oracle President Mark Hurd on the Internet of Things: 5 Takeaways

As the co-president of American multinational computer technology firm Oracle Corporation, Mark Hurd understands the Internet of Things. His views on the Internet of Things can help you understand this concept and how it'll impact the world.

1. The Internet of Things Isn’t Just About Computers

The Internet of Things describes a range of interconnected intelligent devices that go beyond computers, smartphones, and tablets.

“Home appliances, food, industrial equipment, pets, pharmaceutical products, pallets, cars, luggage, packaged goods, athletic equipment, and streaming data,” Hurd explained in his article “The Internet of Things is Really the Internet of People.”

Some of that data will be superfluous, but much of it will help businesses perform better and help individuals improve their health.

2. The Internet of Things will Affect Every Industry

Oracle Corporation’s recent acquisition of MICROS Systems Inc. was a strategic move made to extend Oracle’s current industry offerings. The MICROS’ integrated software and hardware solutions for the hospitality and retail sectors would pair perfectly with its more general business applications and cloud services.
...Mark Hurd on IoT

1. The Internet of Things Isn’t Just About Computers
2. The Internet of Things will Affect Every Industry
3. Companies Must Nurture Their Employees to Meet the Demand
4. Companies Aren’t Ready
5. Companies Need to Start Thinking about the Internet of Things Today
What are the “Things?”

Global Internet Device Installed Base Forecast

BI INTELLIGENCE

Number Of Devices In Use (In Thousands)

Source: Gartner, IDC, Strategy Analytics, Machine Research, company filings, BI estimates
Growing Number of Devices!

- World Population:
  - 2003: 6.3 Billion
  - 2010: 6.8 Billion
  - 2015: 7.2 Billion
  - 2020: 7.6 Billion

- Connected Devices:
  - 2003: 500 Million
  - 2010: 12.5 Billion
  - 2015: 25 Billion
  - 2020: 50 Billion

- Connected Devices Per Person:
  - 2003: 0.08
  - 2010: 1.84
  - 2015: 3.47
  - 2020: 6.58

Source: Cisco IBSG, April 2011
Big Data and IoT

Diagram:

- **Big Data by Size**
  - Emails, Documents
  - Photos, Videos
  - Web logs, click logs, sensor data

- **ERP/CRM**

- Human generated data
  - Machine generated data
Examples from Different Domains

America’s Cup: Yacht as a “Thing” embedded with sensors

- **300** Sensors
- **3,000** Variables running 10 times per second
- **500 GB** Raw data every sailing day

Ref: [http://medianetwork.oracle.com/video/player/3597777548001](http://medianetwork.oracle.com/video/player/3597777548001)
Wind Farms Explained Via Visuals!

**Altamont Pass Wind Farm**

Turbines near Livermore, California

**Location**
- Altamont Pass, Alameda County, California

**Coordinates**
- 37°43′57″N 121°39′9″W

**Commission date**
- 1981

**Power generation**

- **Primary fuel**: Wind
- **Units operational**: 4930
- **Nameplate capacity**: 576 MW
- **Annual generation**: 1.1 TWh
Remote Service Monitoring

Figure 2: Remote Service Monitoring

1. Equipment sends temperature data at regular intervals to gateways.

2. Gateway becomes Smart with local analytics to analyze temperature data and identify fluctuations.

3. Send breach alerts and temperature readings in real-time.

4. Secure Gateway and Identity Management to secure services and manage access.

5. Event processing identifies sustained threshold breaches and raises critical alerts.

6. Event-driven Process gets triggered to resolve the issue.

7. Technician
   - Analyzes equipment service history using BI Analytics on his mobile app
   - Performs remote troubleshooting
   - Orders part replacement
   - Based on order cost, process update ERP

IoT and SF Parking

Figure 11: SFPark Architecture

Business Impact

• Sfpark’s new parking management system:
  • 7,000 of SF’s 28,800 metered spaces
  • 12,250 spaces in 15 of 20 City-owned parking garages
• Goal: reducing traffic by helping drivers find parking with Meters that accept credit and debit cards
• Demand responsive pricing helped encourage drivers park in underused areas and garages, reducing demand in overused areas.
• Improved Muni operations by reduced congestion, increasing citizen satisfaction

Chicago turns light poles into data collectors

The light poles along Chicago's Michigan Avenue will soon do more than illuminate the city's famous street.

The "Array of Things" initiative by the Urban Center for Computation and Data will install data-collecting systems on eight light poles along Michigan Avenue next month, the Chicago Tribune reports.

The sensors will be used to measure air quality, heat, light intensity, precipitation, sound volume, and wind.

The number of people near the light poles will also be measured by tracking wireless signals from mobile devices.

Continuous Query Language (CQL)

Standards-Based Continuous Query Language (CQL) – Oracle Event Processing’s design environment and runtime execution supports standards-based, continuous query execution for IoT applications needing answers in microseconds to discern patterns and trends that would otherwise go unnoticed. Oracle Continuous Query Language (Oracle CQL) is a query language based on SQL with added constructs that support streaming data. From the example as described in Figure 2: Remote Service Monitoring, a sample CQL query to detect temperature alerts from remote machines occurring at least 5 times per minute and classify them as a “sustained temperature alert” would look like this:

```
SELECT SUM(alert) as c, sensorID, “sustained” as alerttype
FROM AlertsInputChannel
WHERE range 60 minutes
GROUP BY sensorID
HAVING SUM(alert)>5
```

http://docs.oracle.com/cd/E16764_01/doc.1111/e12048/intro.htm
Pattern Match

http://www.slideshare.net/adcalves/speeding-up-big-data-with-event-processing
Oracle Internet of Things Platform

Value Creation by Industrial Internet

- Things, Objects, Processes
- Connect
- Function, Service, Value
The value to customers is huge
Connected machines and data could eliminate up to $150 billion in waste across industries

<table>
<thead>
<tr>
<th>Industry</th>
<th>Segment</th>
<th>Type of savings</th>
<th>Estimated value over 15 years (Billion nominal US dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aviation</td>
<td>Commercial</td>
<td>1% fuel savings</td>
<td>$30B</td>
</tr>
<tr>
<td>Power</td>
<td>Gas-fired generation</td>
<td>1% fuel savings</td>
<td>$66B</td>
</tr>
<tr>
<td>Healthcare</td>
<td>System-wide</td>
<td>1% reduction in system inefficiency</td>
<td>$63B</td>
</tr>
<tr>
<td>Rail</td>
<td>Freight</td>
<td>1% reduction in system inefficiency</td>
<td>$27B</td>
</tr>
<tr>
<td>Oil and Gas</td>
<td>Exploration and development</td>
<td>1% reduction in capital expenditures</td>
<td>$90B</td>
</tr>
</tbody>
</table>

Note: Illustrative examples based on potential one percent savings applied across specific global industry sectors. Source: GE estimates
Industrial Internet: Big Data Analytics

Delivering sharper insights to users

- Ingest massive volumes of data – with parallelization
- Bring analytics to data – and vice versa
- Elastically execute on large-scale requirements
- Innovative analytics models

Various data sources
Enterprise (operational and business) Data, Industrial Data & External Data
Smarter Supply Chain

1. Train delivers fruit to distribution center
2. Sensors monitor ripening levels
3. “Levels above normal”
   - Train communicates to The Cloud
4. “re-route in progress – adjusting schedule”
   - The Cloud Communicates to train
5. “re-route to nearest distribution center”
   - The Cloud Communicates to distribution centers
6. Automated transport redirection and cost savings

freescale

Ripening of Climacteric Fruit

- rate of respiration and ethylene
- climacteric rise
- climacteric peak
- max. size but green
- ripening
- ripe
- senescence (rotting)
Smarter Transportation Infrastructure

Smart Bridge

1. Snow storm compromises safety of smart bridge
2. Bridge communicates with gateway
3. “Send warning actions”
4. The Cloud communicates safety measures
5. “Detour activated”
6. “Snow plow approaching bridge”
7. Automated vehicle response
8. Bridge communicates with gateway
9. Gateway communicates with The Cloud
10. “Icy conditions”
11. “Dispatch...snow plow”
12. “Sending...vehicle detour”
Remote monitoring of Patients, e.g. pregnant ladies with gestational diabetes in a town with no doctors.

Glucose level can alter blood pressure.

Monitoring of blood pressure via wearable that can be transmitted to health care monitoring facility that can route the nearest ambulance. (Uber!!!)

Hospital / doctor is ready for the patient by the time patient arrives.

Ref: http://medianetwork.oracle.com/video/player/359777548001
From Home to Hospital
Smarter Grid and Homes

Different “Views” of Aircraft as Asset Model (Data Mart)

http://www.flightglobal.com/cutaways/civil/phenom-300/
Data from Jet Engine

We Used to Get...

- Takeoff Diagnostics Data (Averaged)
- Cruise Diagnostics Data (Averaged)
- Landing Diagnostics Data (Averaged)
Making “Sense” of the “Sensors”

EGT = Exhaust Gas Temperature
The temperature of the exhaust gases as they enter the tail pipe, after passing through the turbine

A good indicator of the health of engine (just like human body temperature)
Recording and interpreting the EGT can help to detect several jet engine problems.
Other Innovations Driven by IoT

A Batteryless Sensor Chip for the Internet of Things

Requiring so little power means PsiKick’s chip can function even with the small amounts of power that can be scavenged without using a battery.

Wentzloff and Calhoun have tested their chip design in a wearable EKG monitor that runs entirely on body heat.

The device required 0.1 percent of the power consumed by a typical EKG monitor, Wentzloff says.

In the future, the energy could come from a small solar panel; an antenna that collects ambient radio wave energy; a thermoelectric material that absorbs body heat; or piezoelectric devices that collect energy from movement.

Value Of Big Data Analytics

1 Gas Turbine Compressor Blade Monitoring Potential: 500 Gigabytes Per Day
David Gilford @dgilford · 20h
"A single power generating unit creates 1 TB of data each day" - @JeffImmelt on Industrial Internet #IIoT #BNEF2014 pic.twitter.com/OPt9Hend3e
Forces shaping the Industrial Internet

1. **Internet of things**
   - A living network of machines, data, and people

2. **Intelligent machines**
   - Increasing system intelligence through embedded software

3. **Big Data**
   - Transforming massive volumes of information into intelligence

4. **Analytics**
   - Generating data-driven insights and enhancing asset performance
Apply Batch or Real-Time Analytics to the Machine-Generated Data

Intelligent Solutions
- Learns from Data
- Evolves with Automated Updates
- Employs Unifying Theory
- Delivers Insights
- Uses Probabilistic Models Applied in Unique Ways

Prior Knowledge
Historical Data
Experiential Learning

Analysis
Cloud for efficiency and agility

Going mobile: anytime/anywhere Access

End-to-end Security

Industrial Internet computing requirements

Predictive insights from Big Data

Transition to “Brilliant machines”

Consistent and meaningful User experience

Cloud based Integrated Asset Management

021010308
013161090
040109010
104078050
Software-defined Machines

Anytime/Anywhere software running on virtual machines

Allows machines to be improved without mechanical modifications

Can be applied to any device/machine

Decouples machine software from hardware

Intelligence is distributed from machine controllers to backend servers conducting analytics

Software Defined Machines

On machine

Virtual machine

On cloud

Virtual partitions

Machine apps
How babies will be born in future
Q&A
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Thank You!

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