Dynamic M2M Event Processing
Complex Event Processing and OSGi on Java Embedded

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1. The Vs of Big Data
2. CEP – Predictive Analytics
3. OSGi – Dynamic Behavior
4. Demo – Dynamic Behavior In Action
The Vs of Big Data

- Volume
- Variety
- Velocity

How fast data is produced and processed to meet demand.

Includes:
- Structured tables
- Documents
- Email
- Metering data
- Video/Audio
- Stock ticker data
- & more

Growing volumes of data & how much data needs to be processed within a time window.

Ability to respond once a problem or opportunity is detected.
The missing “V” of Big Data

Extracting VALUE from VIABLE Data
WHERE It Matters and WHEN It Matters
Rise of The Intelligent Device
Key Elements of Connected Intelligence

1. **Intelligent Devices**
   - Always-on devices connected to variety of sensors and running multiple software applications

2. **Real-Time Analytics**
   - High-frequency data analysis for instant decision making and automation of information flows

3. **Big Data**
   - Integration of data from connected devices with enterprise applications and historical data
Dynamic Predictive Analytics

• Local analytics and business rules are controlled by global analytics
  – In-flight data analytics on the device
  – Near real time response on the device
• Global Analytics for the Big Patterns
  – Big Data post processing
  – Discover Hidden Patterns/dependencies
• Dynamically Adjust the Rules
  – Update new rules to the local device
  – Enhances the devices local analytics
• Rinse and Repeat
The Solution

Dynamic Predictive Analytics
OEP – Predictive Analytics
What Is Oracle Event Processing (OEP)?

Event Stream Processing

- Event-driven Architecture
- A generic data management infrastructure for processing in-flight data before data is potentially stored to deliver results in near real-time
- Continuous queries based (CQL)
- It allows users to Aggregate/Correlate/Enrich/Detect Patterns in high speed streaming data
- OEP Embedded is subset of OEP
- Based on Java and OSGi
Oracle Event Processing
Event Processing Architecture

- Programming language for defining rules – Continuous Query Language (CQL)
- Developer toolset – based on Eclipse
- Java-based runtime engine
Oracle Event Processing
Event Capture

- Events generated at sources
- Adaptor captures event and sends it into the Event Processing Network
- Java-based Adaptors - can capture events from anything Java can talk to includes JNI
Oracle Event Processing

Event Processing

- Events processed using Continuous Query Language or Java
- Merging multiple event sources and types
- Data enrichment by accessing external data sources (e.g. databases)
Oracle Event Processing
Event Dispatch

- Processing produces events
- Adaptor receives event and sends it into the downstream clients
- Java-based Adaptors can send events to anything Java can talk including JNI
OEP Embedded and Data Center
Adding real-time capabilities with OEP & BAM

1. Filter out useless, redundant data, correlate; find and focus on events that matter
2. Analyze and act; execute critical decisions in real-time, complementing historical approaches
Oracle Event Processing and “IoT in Motion” Demo
Dynamic M2M Event Processing
Oracle Event Processing and OSGi on Java Embedded.

3. OSGi – Dynamic Behavior
Dynamic Environment

- Devices do not operate in a static environment
- Inputs change
- Knowledge is gained from analytics
- Additional systems want to receive the output
Dynamic Behavior

- Our Predictive Analytics Engine needs to be dynamic
- Ability to change behavior without stopping the flow
- Allow higher level system to change the processing rules
OSGi

- Dynamic Modular System for Java
- Mature Lightweight Application Framework
  - Ideal for embedded environments
- Supports Module Lifecycle
  - Install/start/stop/uninstall/upgrade
  - Remotely manageable
  - Versioning
- Services Model
  - Advertise and discover services
  - Modules are dependent on service not implementation

Powered by OSGi Alliance
OSGi Deployment Environment

OSGi Management System & Repository

Remote Device

Data/Msg. Feeds

EDA Java Application Container

- Data Feed Adapters
- Process Events (CEP)
- Listener/SINK: User Code (Plain Java)

OSGi Framework

Java
Dynamically Changing Behavior
Deployed System. Happily processing…

OSGi Management System & Repository

Remote Device

Data/Msg. Feeds

EDA Java Application Container

- Data Feed Adapters
- Process Events (CEP)
- Listener/SINK: User Code (Plain Java)
Oracle Event Processing
The Data Inputs Change
Dynamically Changing Behavior
Update the adaptor

OSGi Management System
& Repository

Remote Device

EDA Java Application Container

Data/Msg. Feeds

Data Feed Adapters
Process Events (CEP)
Listener/SINK: User Code (Plain Java)

Update the adaptor
Dynamically Changing Behavior
Process the Events Differently

OSGi Management System & Repository

Remote Device

Data/Msg. Feeds

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Remote Device
Dynamically Changing Behavior
Forward to additional locations for processing

OSGi Management System & Repository

Remote Device
Dynamically Changing Behavior
Happily processing again…

OSGi Management System
& Repository

Remote Device

Data/Msg. Feeds

EDA Java Application Container

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4. Demo – Dynamic Behavior In Action
Dynamic Behavior In Action

The components

- LCD Display
- Phidget Temp Sensor
Dynamic Behavior In Action
Start reporting temperature changes above ambient temperature
Dynamic Behavior In Action
Change the rules and redeploy remotely
Dynamic Behavior In Action
Now reporting temperature changes below ambient temperature
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Back Ups
2012

3,006,477,107,200 GB added to the “digital universe”
~30% of it generated by machines

42,949,673,000,000 GB – 15 x increase
42% will be generated by devices

According to IDC’s “Digital Universe in 2020” study published in December 2012
What Happens in an Internet Minute?

- 639,800 GB of global IP data transferred
- 204 million emails sent
- 47,000 app downloads
- 585,000 in sales
- 20 million photo views
- 320+ new Twitter accounts
- 3,000 photo uploads
- 100,000 new tweets
- 20 new victims of identity theft
- 100+ new LinkedIn accounts
- 6 million Facebook views
- 2+ million search queries
- 6 New Wikipedia articles published
- 1,35 Iceland residents infected
- 1,000 new mobile users
- 277,000 logins
- 30 hours of video uploaded
- 1.3 million video views
- 61,141 hours of music

And Future Growth is Staggering

Today, the number of networked devices = 2 today, the global population
By 2015, the number of networked devices = 2× today, the global population
In 2015, it would take you 5 years to view all video crossing IP networks each second
### Web and Social Media
- Clickstream Data
- Twitter Feeds
- Facebook Postings
- Web Content

### Machine-to-Machine
- Smart Meters Readings
- RFID Readings
- Oil Rig Sensors
- GP Signals

### Big Transaction Data
- Healthcare Claims
- Telecommunication Call Details Record
- Utility Billing Records

### Biometrics
- Facial Recognition
- Genetics

### Human Generated
- Call Center Voice Recording
- Email
- Electronic Medical Records
Intelligence Is Real-Time, Event-Based Analytics

Complex Events Processing enables real-time business insights from edge devices

Communication Events  Machine Events  Security Events  Environmental Events  Business Logic Events
Getting Ahead of the Curve

- Move time-sensitive analysis to the front of process
- Identify certain critical conditions on the edge in real-time