Industrial IoT: from Embedded to the Cloud using Java from Beginning to End

Simon Ritter
Deputy CTO, Azul Systems
azul.com
Industrial IoT
Industrial Revolutions

- **Industry 1.0**
  - 1st mechanical loom (1784)

- **Industry 2.0**
  - 1st assembly line (1913)

- **Industry 3.0**
  - 1st programmable logic controller (1969)

- **Industry 4.0**
  - Industrial Internet

Timeline:
- End of 18th Century
- Start of 20th Century
- Start of 1970s
- Start of 21st Century
Industrial Automation

The traditional segment drivers haven’t changed...

<table>
<thead>
<tr>
<th>Competitive edge</th>
<th>Production throughput</th>
<th>Enhanced quality</th>
<th>Manufacturing visibility and control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td>Energy and resource management</td>
<td>Government &amp; standards compliance</td>
<td>Safety and security</td>
<td>Business integration</td>
</tr>
</tbody>
</table>
Industrial Automation

Smart devices are key

Local intelligence and decision-making
Flexible networking
Performance and scalability
Security
Remote management
Functions become services
Industrial IoT: Edge to Cloud

Intelligent Edge Devices
- Minimal compute power
- Raw event filtering
- Programmable control
- Mesh networking

Gateways
- Complex event filtering
- Basic analytics
- Offline/online control

Cloud
- Data collection
- Analytics
- Machine Learning
- Command & control
Why Java For Industrial IoT?
Java Embedded Platform

- Hardware and Operating System independence
- Local database, web-enabled, event aware
- Optimised for embedded hardware
- Rich graphics support (JavaFX)
- Comprehensive protocol support
Java Language and Developers

- Standards-based, modern language
  - Simple concurrency
  - Access to native system resources (JNI)
- Strong tool chains
- Reusable code
  - Wide range of 3rd party libraries and frameworks
- Millions of developers, worldwide
Java Applications

- Write once, run anywhere
- High performance
- Dynamically optimised
- Consistent runtime environments
Java Security

- Proven security model
  - No Java viruses
- Strong cryptographic support
  - All modern standards
- Designed for distributed computing
  - Code moving around the network
Industrial IoT: Edge to Cloud

Intelligent Edge Devices
- Embedded Java
- Simple development
- Updateable
- Remote Management

Gateways
- Java SE
- High performance
- Simplified development
- Remote management

Cloud
- Enterprise Java
- Micro services
- Scalable
- Reliable
Azul's Zulu Java
Zulu Embedded Java

- Built from OpenJDK code base
- Passes all TCK tests
- Ports for Intel, ARM, PowerPC, MIPS
  - ARM v6, v7, v8
    - Soft and hard float
    - 32 and 64 bit
    - C2 and C1+C2 compiler enhancements
- Drop in replacement for other JVMs
- No licensing restrictions (FoU): GPLv2 with CPE
Customizable Packages

- Multiple OSs:
  - All Linux distros, Windows, Solaris, macOS, QNX
  - Also: Docker; Alpine Linux with musl libc
- CPUs: 32- and 64-bit x86, Arm, PPC, MIPS32
- Java versions: 6, 7, 8 and 11
  - 32-bit and 64-bit versions
  - Packages: ZIP, RPM, DEB, MSI
Customizable Packages

- JDK 8 bundles: 6 builds, including Compact Profiles 1/2/3

- JDK 11: jlink to build customised runtimes
  - Using module system
Zulu Embedded Support

- Dedicated Support team
  - Fault triage, root cause analysis and patch creation
- Deep Java Engineering capabilities
  - Strong Java runtime engineering expertise
  - Azul contributes and participates in JCP and OpenJDK
  - Zulu CPUs and security updates aligned with Oracle CPUs
  - Azul has visibility to upcoming Critical Patch Updates before the wider Java community
- Possibility to serve specific customer requirements:
  - Test on customer HW, or with customer’s applications
  - On-site support available
# Zulu Embedded Support SLA

<table>
<thead>
<tr>
<th>Support Hours</th>
<th>24 x 7 x 365</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Response</td>
<td>1 hour</td>
</tr>
<tr>
<td><strong>Product Downloads and Fixes</strong></td>
<td></td>
</tr>
<tr>
<td>• Regular quarterly releases</td>
<td></td>
</tr>
<tr>
<td>• Early Access to upcoming releases</td>
<td></td>
</tr>
<tr>
<td>• Hot Fixes</td>
<td></td>
</tr>
<tr>
<td><strong>Number of tickets</strong></td>
<td>Unlimited</td>
</tr>
<tr>
<td><strong>Support access</strong></td>
<td>Phone, email and web</td>
</tr>
<tr>
<td><strong>Forum access</strong></td>
<td>Read &amp; Write</td>
</tr>
<tr>
<td><strong>End Of Support (EOS)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>End Of Life (EOL = EOS + 2 years)</strong></td>
<td></td>
</tr>
<tr>
<td>• Minimum 10 years support for each major Long-Term-Support release (6, 7, 8, 11):</td>
<td></td>
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<tr>
<td>• 8 years active + 2 years passive support</td>
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Zulu Enterprise Java

- Azul’s binary distribution of OpenJDK
  - Passes all TCK tests
- JDK 6, 7, 8, 9, 10 and 11 available
- Wide platform support:
  - Intel 64-bit Windows, Mac, Linux
  - Intel 32-bit Windows and Linux

www.azul.com/downloads/zulu
Zulu Extended Support

- Backporting of bug fixes and security patches from supported OpenJDK release
- Zulu 8 supported until March 2026
- LTS releases have 9 years active + 2 years passive support
- Medium Term Support releases
  - Two interim releases between LTS releases (9, 13, 15...)
  - Bridge to LTS releases
  - Supported until 18 months after next LTS release
Summary
Java and Industrial IoT

- Java provides a consistent platform: Edge to Cloud
- One language to develop all code
- Extensive library and framework support
  - Simplify all areas
- Zulu Java
  - Cost-effective
  - Fully supported
  - Ideal across the whole enterprise
Questions?

Simon Ritter
Deputy CTO, Azul Systems
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