Java and IoT from a MicroDoc perspective
MicroDoc Profile

- Founded in 1991
- Privately owned software engineering company
- Offices in Munich, Berlin, Stuttgart
- International, cross industry, customer base
- Focus on Java Software technology
Some Industries we are working in

- Automotive (Telematics, Headunits)
- Telecom (Networking equipment, Phones)
- Home automation
- Smart Energy
- Looking into industry automation
- Some examples ...
Banksys C-Zam Smash/Xentra

- Payment terminals
- „Smash“ Porting Project
  - VM for x86 and Sun Chorus Operating System
- „Xenta“ Porting Project
  - VM for ARM and RYO Linux (Samoa)
  - First Linux payment terminal on the market
Telit (ex. NXP) ATOP

- Dual processor design,
  - 150MHz, 32MB ARM for Java
- Hardware crypto support
- Various interfaces, like CAN, GSM, GPS
- JVM on „bare metal“
- Greenthreads Implementation
- Implementation of Java VM for headless telematics platform („Smallest OSGi Platform on the Planet“)
Daimler FleetBoard

Innovative Telematics Solutions

Example of a workflow using standard components

A. Order acceptance and consistent with navigation
B. Loading and processing the order items
C. Exchange of loading lists and completion of loading
D. Unloading with status messages in a predefined sequence
E. Exchange of loading lists and return trip
Daimler Fleetboard

- Telematics & Fleet Management for Commercial Vehicles
  - Mobile Frontends (WinCE, Windows Mobile, Android, iOS etc.)
    - Seamless Integration of Nav System
  - OnBoard Unit (Linux/Headless)
  - Backend Components (Java EE)

- OSGi based architecture
  - „over the air“ SW update & maintenance
  - Support for partial bundle updates
  - OSGi, custom backend system
Telematics Unit Component Architecture

Application Domain

Trusted Domain
- Trusted Services
- Java VM
- OS (Linux/QNX/...)

Sandbox Domain 1
- Untrusted Services
- Java VM
- OS (Linux/QNX/...)

Sandbox Domain N<
- Untrusted Services
- OS (Linux/QNX/...)

Realtime Domain

Diagnostics
Message Buffering
Power Mgmt
...

Realtime OS / CAN Stack

Virtualization (eg Hypervisor, cgroups)

IPC Protocol

Comm. Bus
The EnergyBASE

**Transparency & Security**
- Energy-flow - Monitoring
- Surveillance of equipment (Inverter, Battery,\ldots)
- Local data-management

**Optimisation of private consumption**
- Self-learning intelligent algorithms
- Online weather information as well as consumption / generation forecasts
- Optimization suggestions
- Software Updates
- Remote access via web and apps APP (Android & iOS)
System overview EnergyBASE

- EnergyBASE Backend (Java / OSGi)
- Mail-Server
- https://energybase.enbw.com
- Android App / iOS App
- local
- remote
- EnergyBASE (Java / OSGi)
So, why Java?

- Of course Robustness, Standards, Security, ….
- Back in the days: Software was a necessary evil when building an embedded product
- Today: Software itself is part of the value proposition and business model
  - “Quick” development but still high quality to avoid expensive field problems
  - Deployed edge devices are considered an asset, where new service can be deployed
  - Over time there will be different platforms in the field that have to be supported – even for one product/service
What has changed over the last years?

- Fast, ubiquitous, cheap and (sometimes) reliable communication technology drives new business models
  - Telematics, Connected home,

- Embedded hardware (that we target) gets more powerful and cheaper every year (GHz processors, 100s MB of RAM).
  - Hardware designs are getting more and more complex

- Security is becoming very important
Challenges when using Java in this space

- Size – Flash and RAM are always short.
  - Getting „better“ over time

- Startup speed – still a significant problem
  - All kinds of tricks to achieve to required performance
  - Java 9 may improve things.

- JNI access is too slow for some use cases

- GC interruption can interfere with timing critical functions
  - Eg Animations

- Lots and lots of different processors, HW designs, Operating Systems, Tool chains, …

- Heisenbugs due to faulty drivers, buggy JNIs, buggy hardware, etc

- Specific VM versions are typically supported for multiple years
More on Java One

- CON9759
  Energy Revolution: Smart IoT Devices Enable New Business Models for Utilities

- CON5106
  Enabling Your Device to Be Part of the Internet of Things