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JCP IoT Inspiration Cocktail: Java, Embedded, D.I.Y., JSR's and Fun!

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Vinicius Senger (@vsenger)

- SouJava member since 2001
- Participated at 13 JavaOnes
- Oracle and Sun instructor in 2001-2002
- Founder of Globalcode
- Founder of The Developer's Conference
- Creator of jHome Project and Things API
- Duke's Choice Award 2011
- JavaOne Rock Star Speaker 2012
- Presenting talks related IoT since 2011
- Crazy for surfing and loves to cook

Yara Senger (@yarasenger)

- SouJava's president and member since 2001
- Participated at 11 JavaOnes
- Java Champion
- Founder of Globalcode
- Founder of The Developer's Conference
- Dozens of articles written for JavaMagazine Brasil and InfoQ Brasil
- Collaborated on ScrumToys project for JSF 1.2 RI and Glassfish
- JavaOne Rock Star Speaker 2012

Agenda

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- Introduce some IoT Projects & Scenarios
- Architecture Basis, Computer and Boards
- Share our IoT Experience
- Some Demos and Gadgets

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Our special thanks to JCP.org...

elétron livre

Globalcode

Internet of Things

Internet of Things

Internet of Things

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Our Past Experiences with **Things**….

Horse Telemetry

Sailboat Automation

Robots

Home Automation

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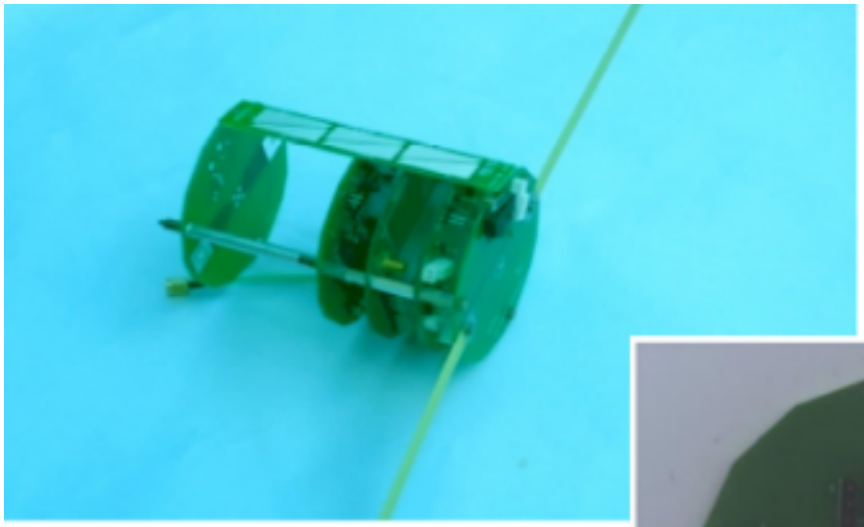
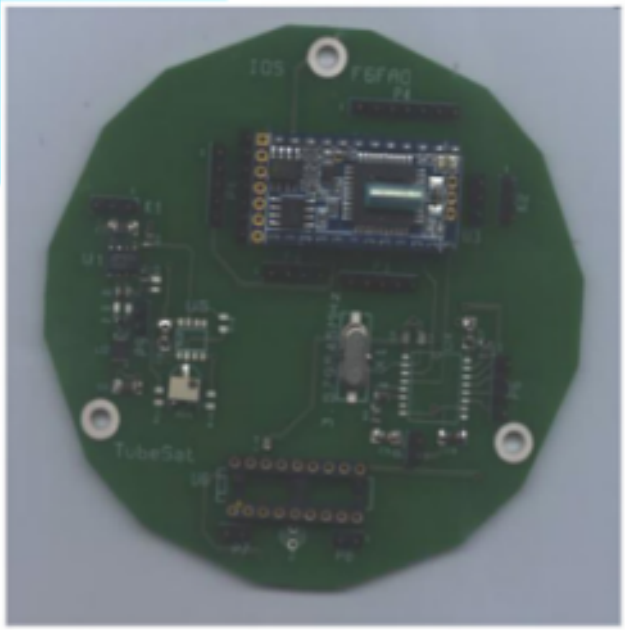
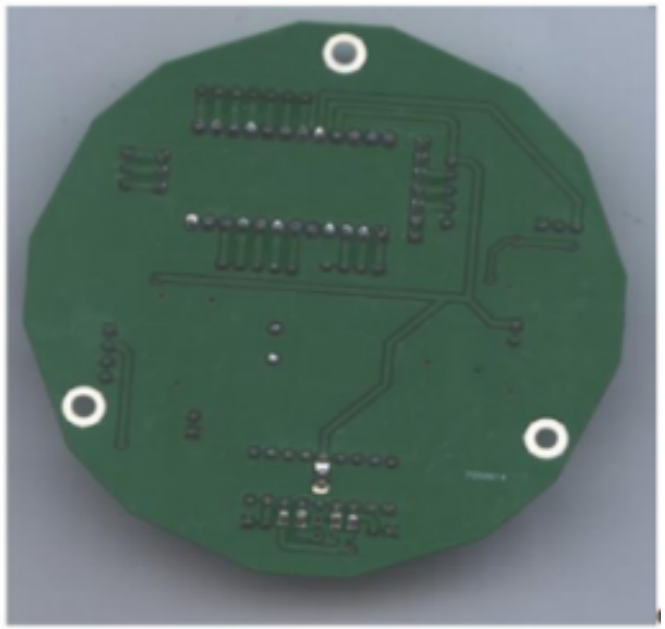
Student Satellite







Smart Helmet

End-to-end Java

- **Java ME:** low-end / edge devices
  - Gemalto ehs6, Freescale FRDM-K64F, ...

- **Java SE Embedded:** making every Java developer an embedded developer
  - ARM: Raspberry, Beagle, UDDO
  - Intel: Galileo, Edison, Minow

- **Java EE:** regular Java EE can perform in many different types of boards (or Java EE cloud)

Low-level development

- **Hard real-time*:** keeping drone direction, air-bags
- **Creating your own sensor:** making a regular analog sensor an I2C sensor
- **Fixing / adapting Linux:** implementing API for GPIO access

IoT Project Scenarios

- **Legacy device / gadget:** connecting old machines or devices to Internet
- **Startup project:** innovative projects that starts small but might need to scale fast
- **D.I.Y.:** solving your own problem
- **Industry:** production projects like gateways, health sensors, wearables, smart cities, automation, etc.

IoT Architecture Basis

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1. **Computers** SoC / microcontroller / hybrid single board computers
2. **Sensors** using I2C, UART, SPI, transistor, logic-level converter, RS-425
3. **Actuators like** sound, leds, motors, relays
4. **Energy &** power consumption
5. **Communication & Security:** 3g, wifi, cable, MQTT, Websockets, etc.
6. **Software:** platform, language, cloud, big data,

Energy Project Profiles

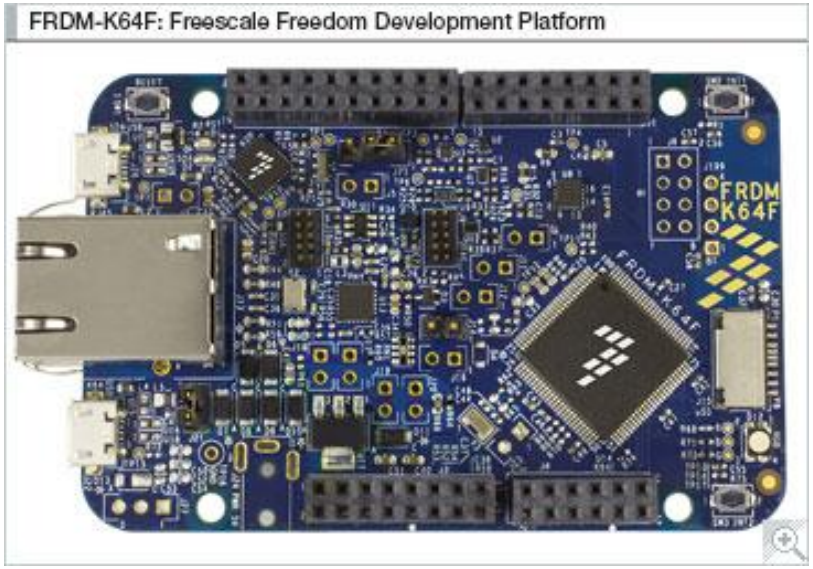
- Full power A/C (houses, building, offices)
- Battery High Profile (cars, boats)
- Battery medium (LIPO, lithium-ion)
- Battery low (coin)
- Recharging: solar panel / wind / dynamo
- Measuring:
  - Current: ACS712
  - Voltage: voltage dividers circuit

Small Computers

Computer / Controller	Platform / Language
Atmega / Arduino	C / C++ / AVR GCC
PIC	C / C++
Electric Imp	Squirrel
Freescale FRDM-K64F	Java ME 8.1
Gemalto Concept Board	ME 3.2 / 3.3
Keil Board	ME 3.3
Dragon Board Qualcomm	Java ME 8

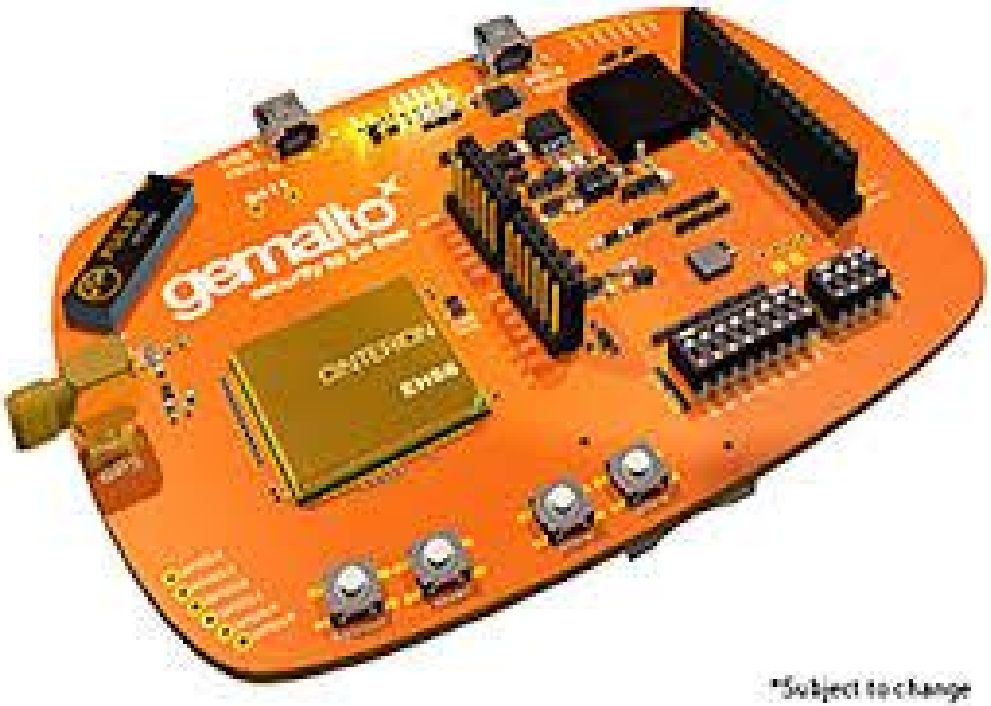
Freescale Freedom

- First Java ME Board Arduino Compatible
- Arduino Capabilities + Java + Ethernet + SD Card
- Same price, KUDOS Freescale!



Gemalto Concept Board

- EHS6 module
- Low-power consumption
- 2g / 3g connection
- Arduino compatible
- Updates over the air
- Affordable price



*Subject to change

Medium Size

Single-board	SoC	Processor
Raspberry Pi	BCM2835	ARM1176JZFS
UDDO Board	Freescale iMX6	ARM Cortex-A9
pcDuino	AllWinner A10	ARM Cortex-A8
Beagle Bone Black	Sitara AM335	ARM Cortex-A8
Intel Galileo	Intel Quark x1000	Pentium 32 bits
Intel Edison	Intel 22nM	ATOM 500mhz + Quark 100mhz

Sensors

- I2C Sensors is always the best choice
- SPI used for high-volume data sensor
- UART legacy and serial communication like GPS, Bluetooth, RS-232, RS-485
- Sometimes a dedicated microcontroller is required!
- Avoid UART 115200 BPS communication

Device I/O API

- http://openjdk.java.net/projects/dio/

- Standard API for peripheral
  - General Purpose Input/Output (GPIO)
  - Inter-Integrated Circuit Bus (I2C)
  - Universal Asynchronous Receiver/Transmitter (UART)
  - Serial Peripheral Interface

- It's being developed!!!

Internet Connection

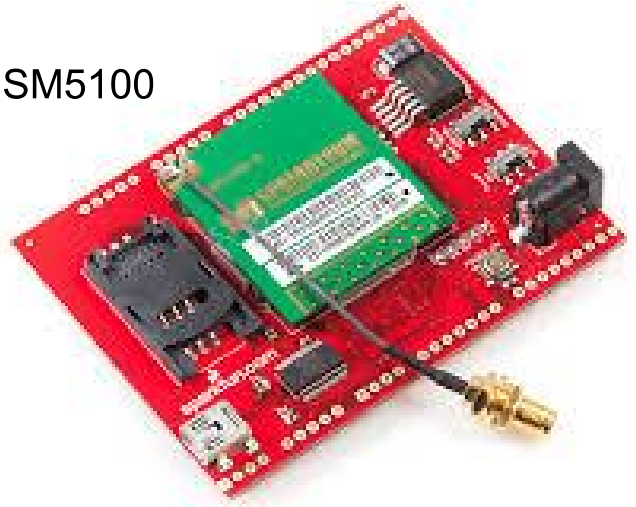
RICH

POOR

Solution
Ethernet cable
Full Wifi
Wifi w/ Tethering
Wifi w/ GPRS modem
GPRS Module
GPRS Board
Bluetooth bridge
Zigbee gateway
Generic RF gateway

Gemalto

SM5100



Transportation

- REST = user-friendly, good for humans
- WebSockets = good for fluid communication in browser
- MQTT = message-oriented
- COAP = Light REST?

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Practical Examples

Combike: Smart Helmet

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- Medium battery
- Raspberry Pi B+
- Camera
- Wifi + 3g tethering
- GPS + Leds
- Audio
- Java SE Embedded

https://github.com/vsenger/things-api/tree/master/raspberry/Samples/PiPicture

This code is a sample code to create a generic Raspberry Pi Java camera.
Combike software / code is not available!

IoT Sandbox Gateway

- A/C Power
- Raspberry Pi
- Arduino + Any sensor
- Ethernet cable
- Java SE Embedded
- Apache Camel + MQTT

Thanks Tomas @tomkriech!

https://github.com/thomas-kriechbaum/iot-sandbox/tree/master/mqtt-my-raspi

Tiziu: Smart Sailboat

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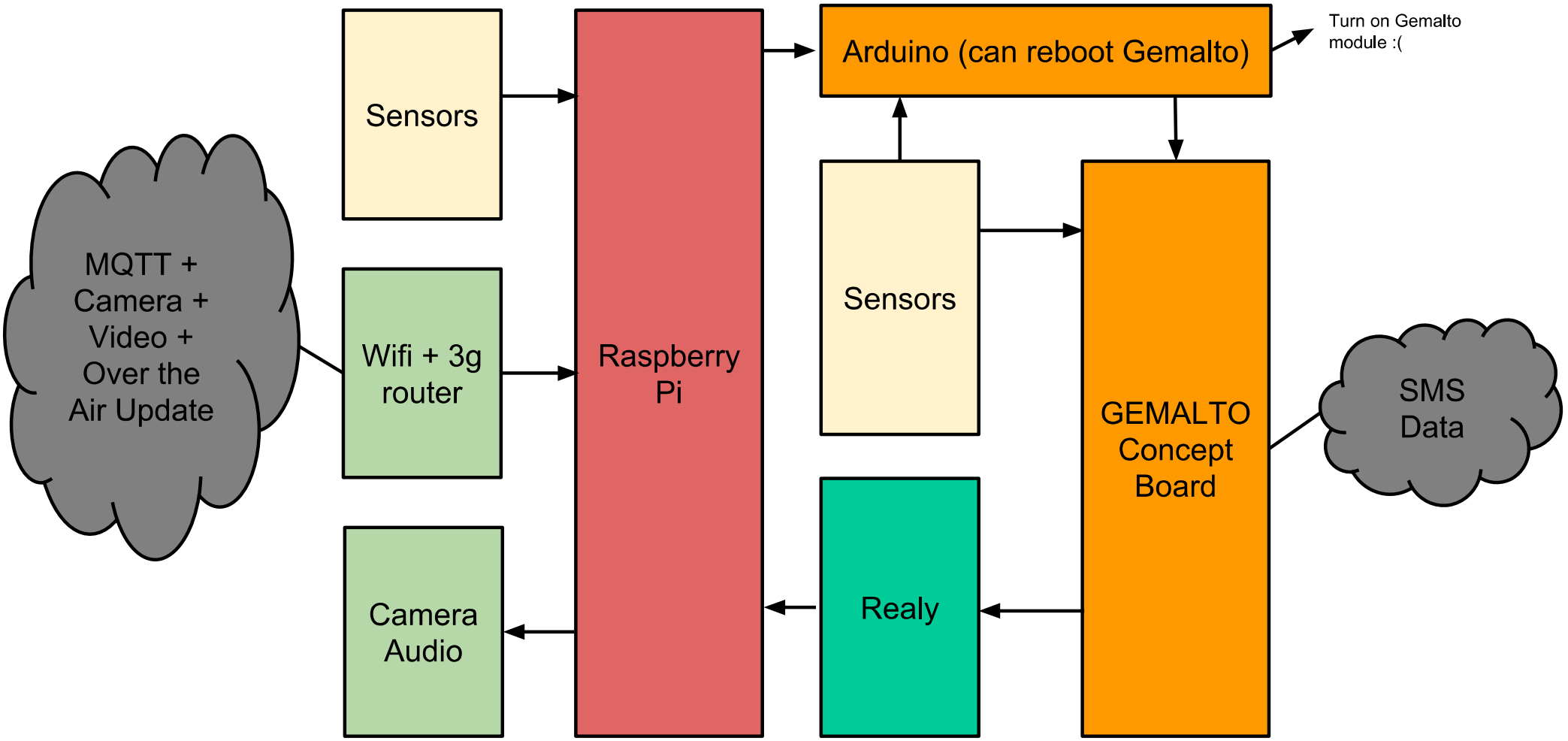
- Big Battery + Solar Panel
- Raspberry Pi B+
- Arduino
- Gemalto Concept Board
- Camera, Wifi, Audio
- GPS + Leds + Gas + Presence + Reed + Current
- 3g tethering
- Java SE Embedded + Tomcat + MQTT
- Pi4J and Things API

Tiziu Smart Sailboat



Tiziu: Smart Sailboat

- All sources available now: https://github.com/vsenger/boat-gateway
- Using Arduino MK to remote update firmware
- Continuous deployment in a sailboat!

IoT Hacking Panel

- Raspberry Pi
  - Camera
  - Relays
  - Wifi
- Arduino Nano
  - Temperature
  - Humidity
  - Distance
  - Presence
  - Light

DEMO

IoT Surf Board

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- Temperature
- Humidity
- Light
- Alcohol
- 4 Transistors
- RTC
- Relay + current
- RGB LED
- IR Emitter Receiver
- ZigBee or Wifi or Bluetooth

IoT Surf Board

- Controlled by Arduino Nano;
- Easy integration with any single board computer:
  - Voltage level converter for I2C, SPI, Serial
  - Can integrate with Raspberry Pi, Galileo, Beagle,UDOO, etc.
- Educational proposal;
- High-level prototyping;
- Designed by Globalcode Brazil;
- Made in California!
- May change Arduino to FRDM-K64F

THANKS!

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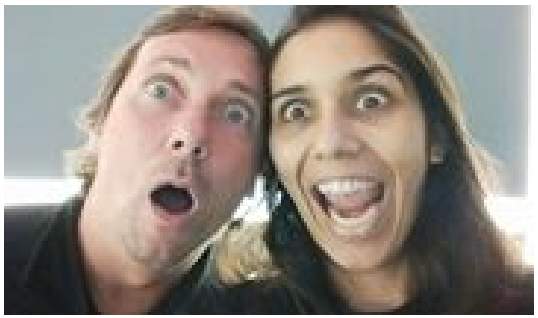

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