Sun Small Programmable Object Technology (Sun SPOT)

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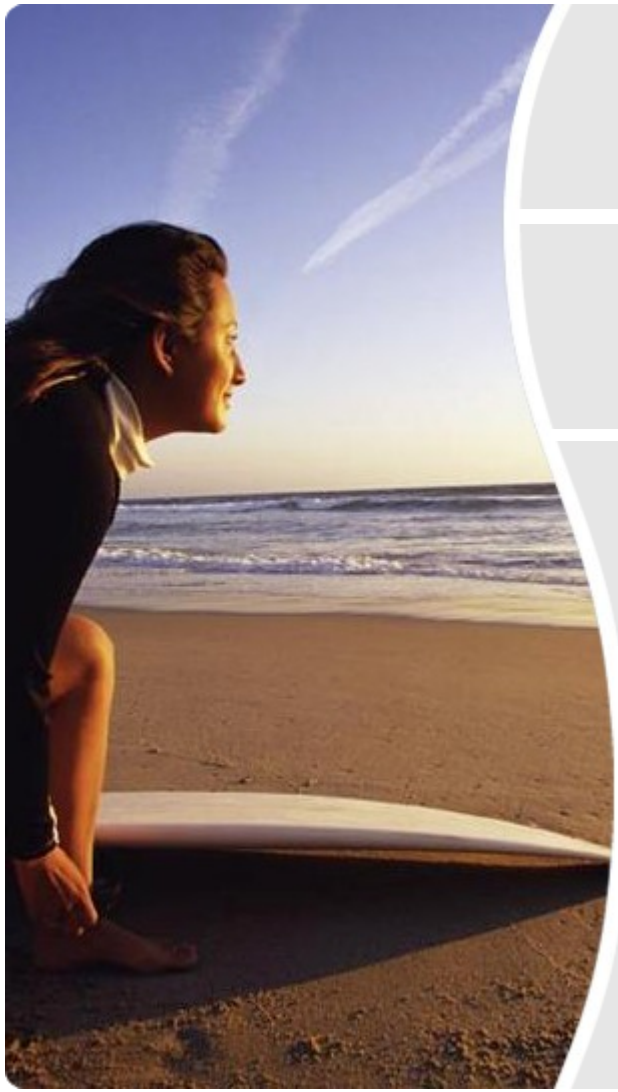
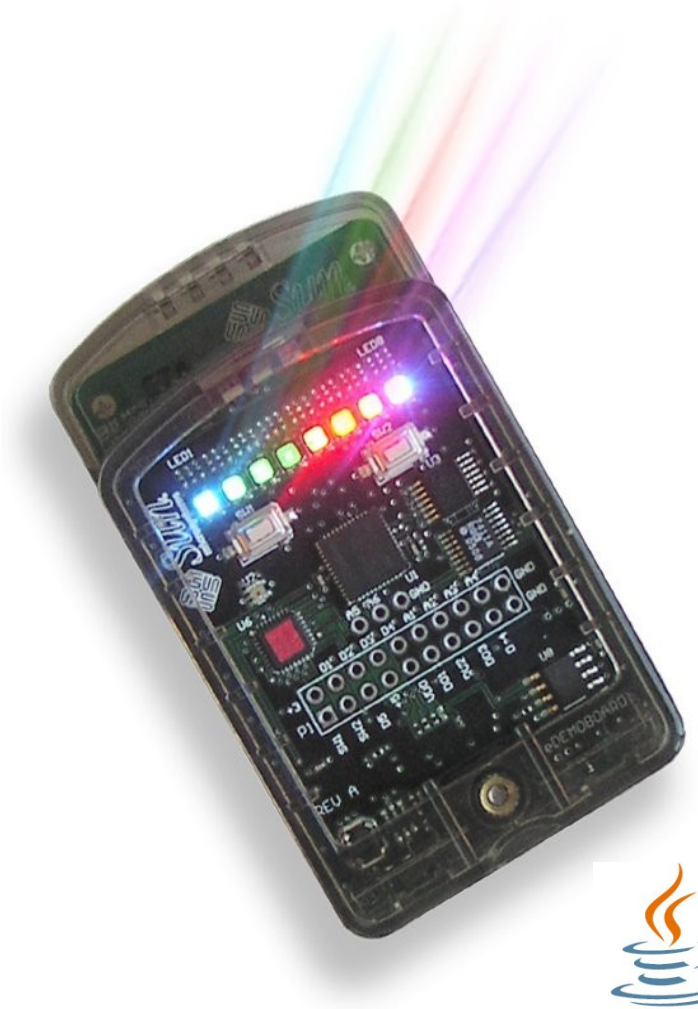
Agenda



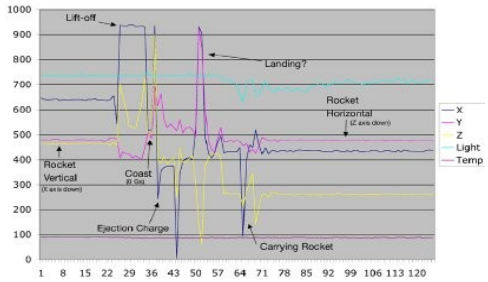
- What is Sun SPOT?
- The Squawk Java VM
- Java on Sun SPOT
- (Near) future of SPOT
- What To Do/Where To Go

Introduction: What is Sun SPOT?

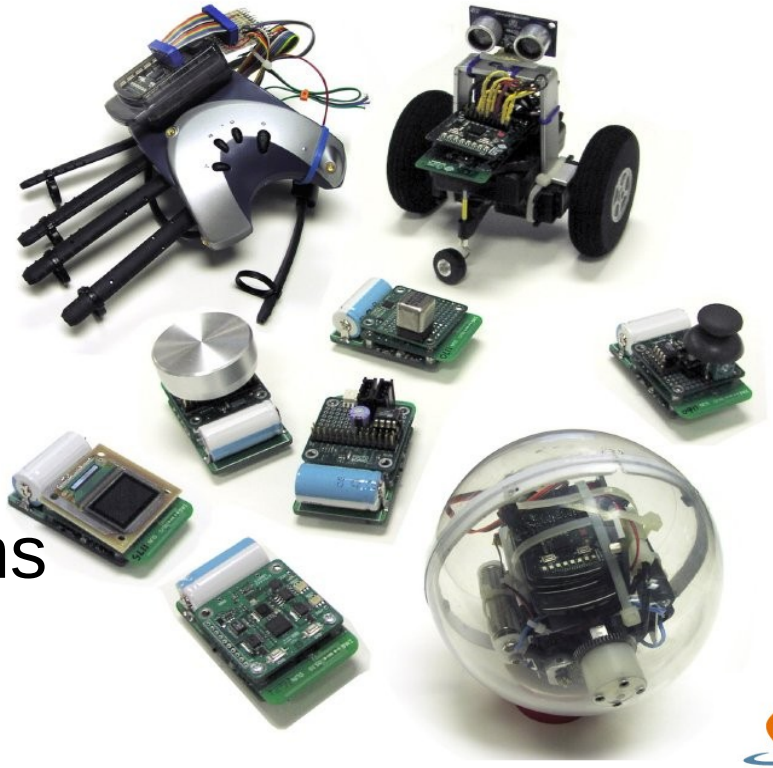
- Java on small devices
  - Sun has licensed Java on over 1.5 billion cell phones
- Programming the world with Java



What is Sun SPOT?

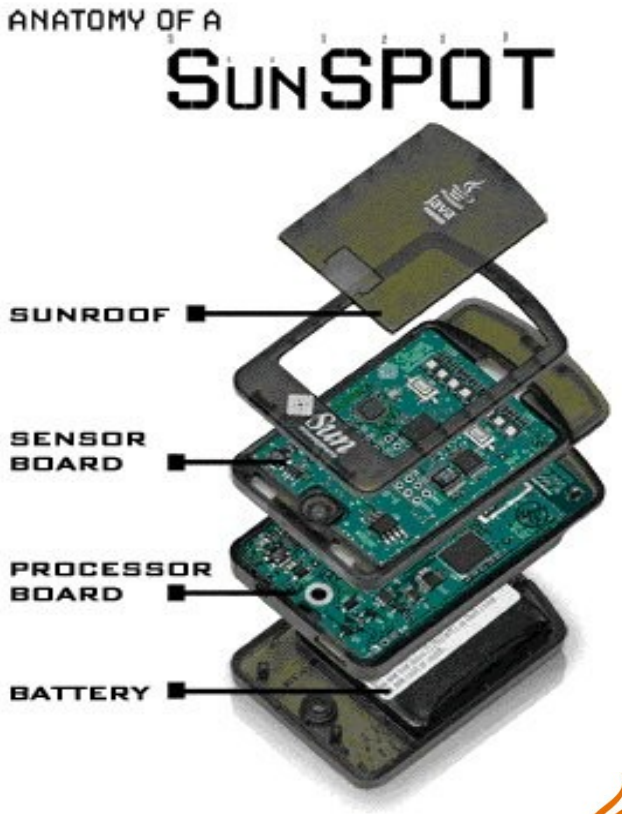


- A Java platform for developing applications for wireless networks and small devices
- Applications such as:
  - Robotics
  - Art
  - Toys
  - Personal electronics
  - Commercial Applications
  - Telemetries



Sun SPOT Device

- Basic device has three layers
  - Battery
  - Processor Board with Wireless Communication
  - Sensor Board (add-on card)
- Processor Board alone acts as a base-station
- User programs the device entirely in Java using Netbeans.



Sun SPOT Hardware

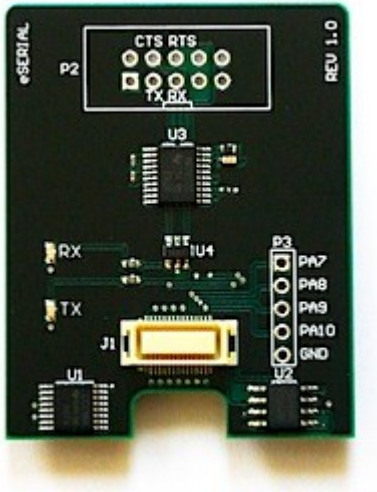
- Processor Board
  - 180 Mhz 32-bit ARM920T core, 512K RAM, 4M Flash
  - 2.4 Ghz 802.15.4 radio with integrated antenna
  - USB interface
- Sensor board
  - 2G/6G 3-axis accelerometer
  - light and temperature sensors
  - 8 3-color LEDS, 2 momentary switches, 6 analog inputs, 5 GPIO pins and 4 high current output pins and a ADC.

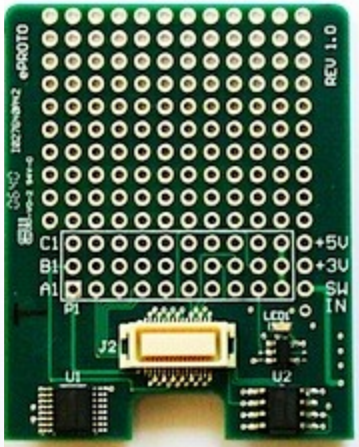
Sun SPOT Hardware

- Open Source Hardware!
  - https://spots-hardware.dev.java.net/
- Hardware and Firmware are open source
  - for SPOT Mainboard
  - for eDemo board (shipped in the kit)
  - for other boards (ongoing development)
- https://spots.dev.java.net/

Sun SPOT add-on boards

- Demo board
- Flash board
- Serial board
- Proto boards
- USB Host board (toDo)



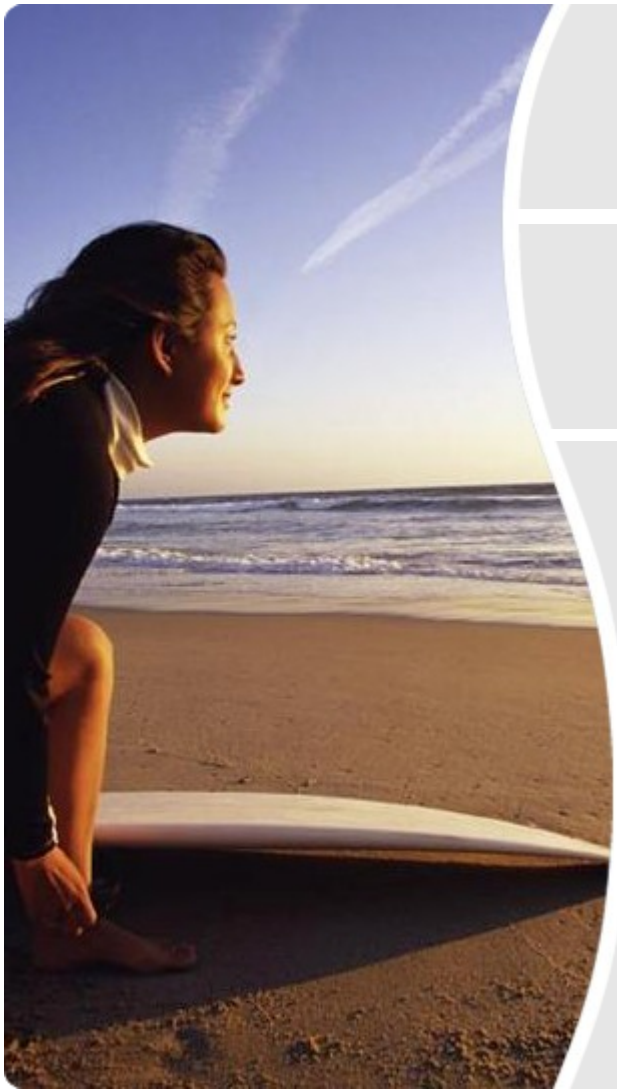


Why Sun SPOT?

- Need for higher level programming language
  - With good development tools and IDEs. eg. Netbeans.
- higher level proramming language
  - Java vs. C
- Separate developer from low level hardware
  - Focus on application functionality and features.

Why Sun SPOT?

- Abstraction of low level details through VM
- Protection of hardware by VM
  - Memory protection from bad code
  - Security protection from malicious code
- 802.15.4 wireless communication
  - upto 250Kbps, ZigBee support
  - adhoc, mesh, cluster tee and star topologies.
- A simple device with sensors and wireless operates at low power



What is Sun SPOT?

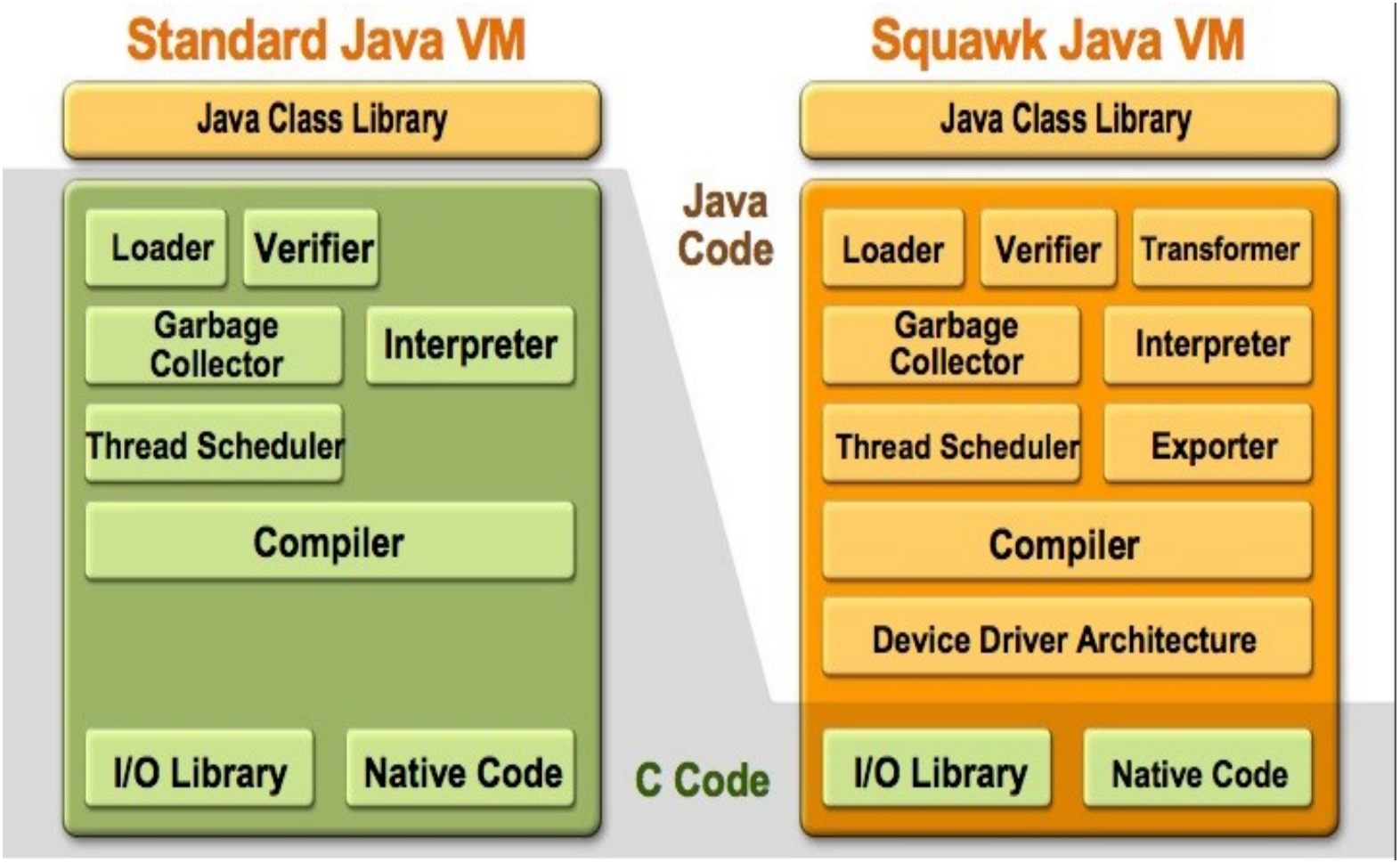
The Squawk Java VM

Java on Sun SPOT

Sun SPOT Demo

What To Do/Where To Go

The Squawk virtual machine



Sun SPOT Build and Deploy Flow

Java Source File

*.java

Javac

*.class

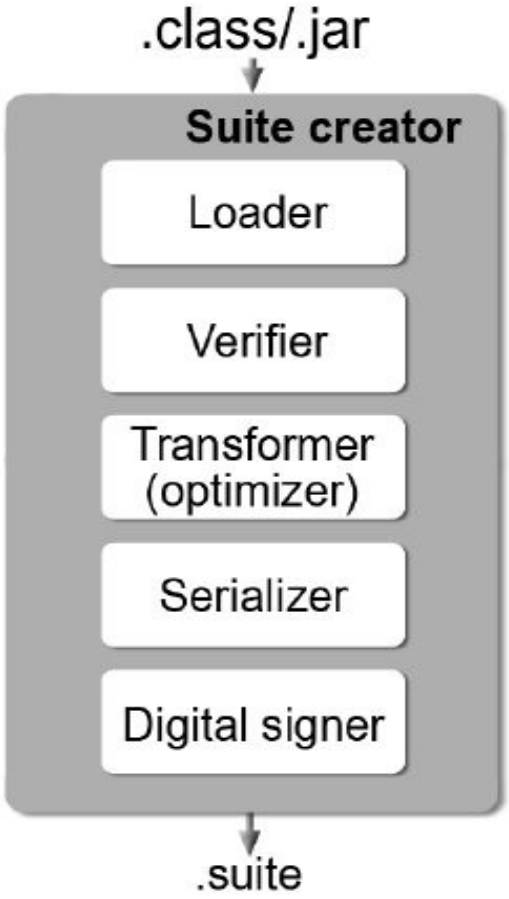
Squawk Suit Converter

*.suite

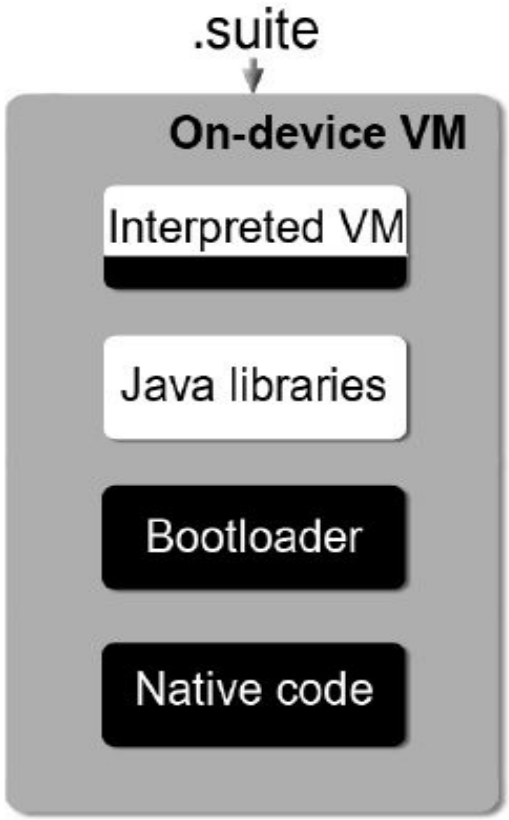
Sun SPOT Build

*.bin

The Squawk Java VM

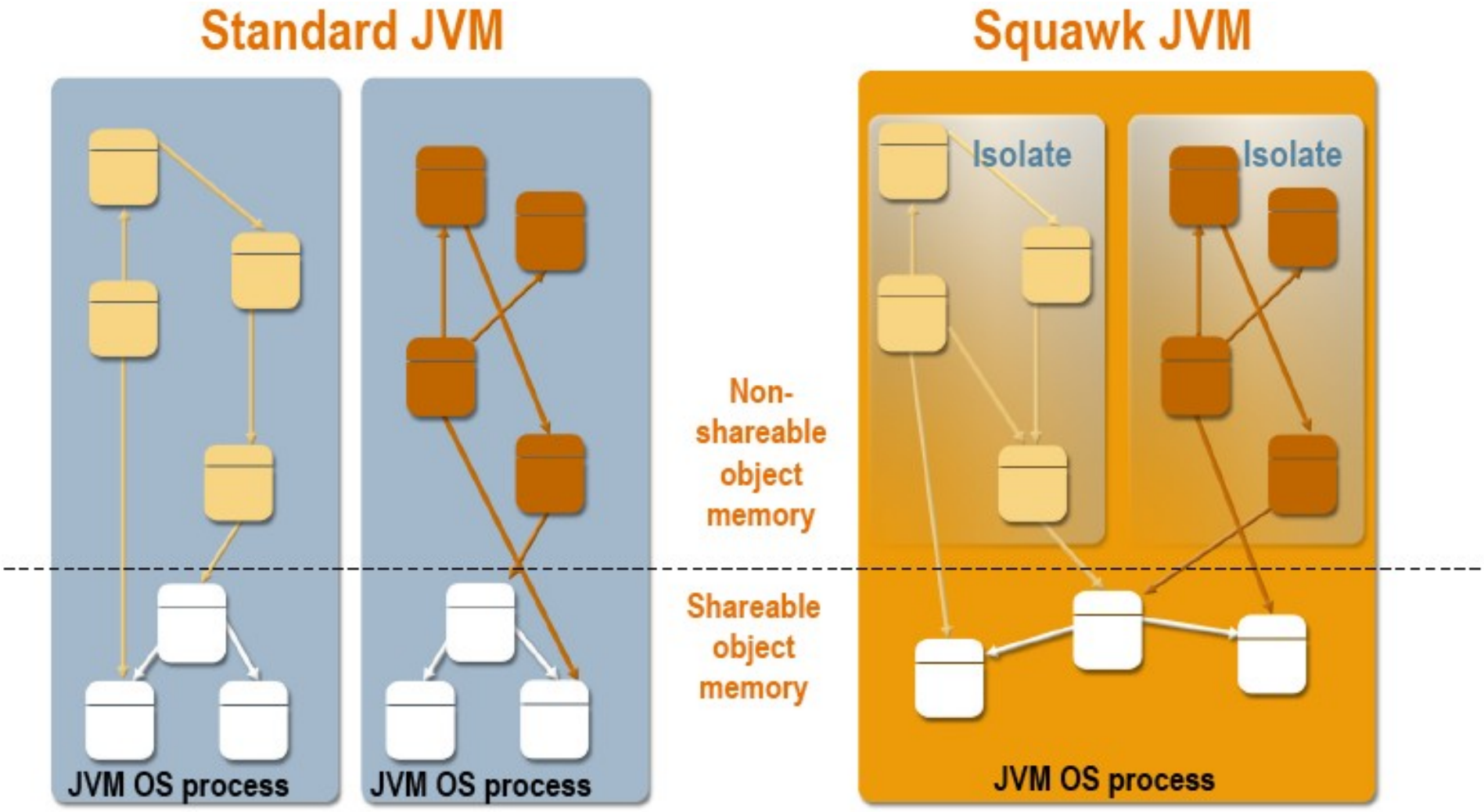


Host (Desktop)



Device (SunSPOT)

Design Overview



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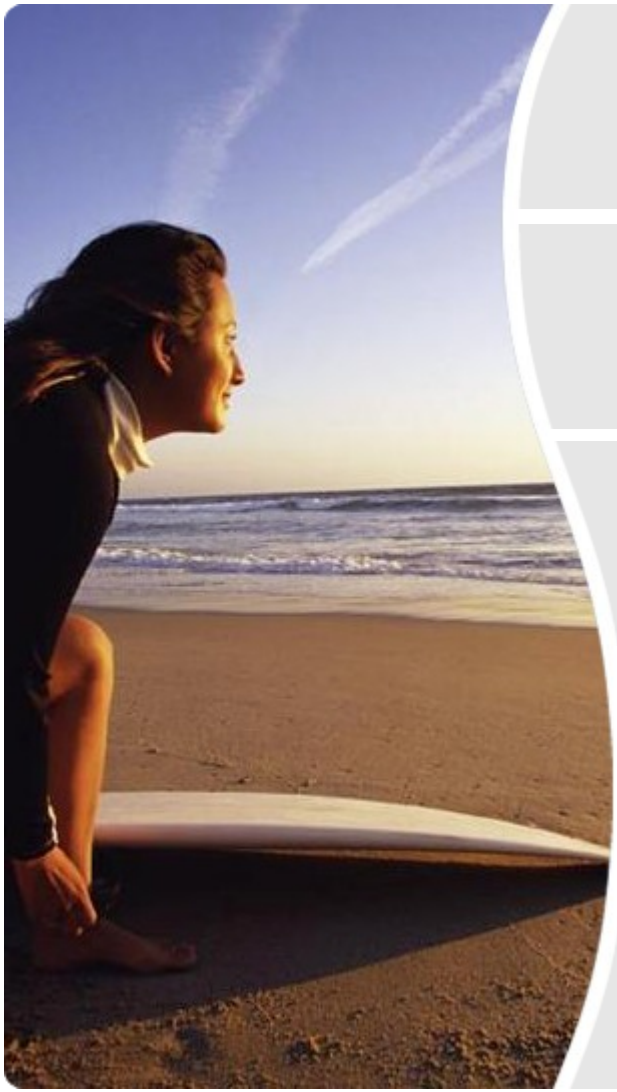

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Sun SPOT Software Development Kit

- Squawk Java VM: Desktop and Sun SPOT
- Libraries
  - Java ME CLDC 1.1 libraries
  - Hardware libraries
    - SPI, AIC, TC, PIO drivers all written in the Java programming language
    - Demo sensor board library
  - Wireless layer libraries
  - Network layer libraries
    - 802.15.4 MAC layer written in Java
  - Desktop libraries

Sun SPOT Radio Communication

Example: A Java Snippet for Sending

```
try {
    //   Broadcast a message on port 52
    DatagramConnection conn = (DatagramConnection)
        Connector.open("radiogram://broadcast:52");

    Datagram packet =
        conn.newDatagram(conn.getMaximumLength());

    packet.writeInt(someValue);

    conn.send(packet);
} catch (IOException ioe) { /* Handler */ }
```

Sun SPOT Radio Communication

Example: A Java Snippet for Receiving

```
try {
    //   Listen on port 52
    DatagramConnection conn = (DatagramConnection)
        Connector.open("radiogram://:52");

    Datagram packet =
        (Radiogram) listenerConn.newDatagram(0);
    conn.receive(packet);

    //get the address of the sending SPOT
    String address= packet.getAddress();
    int rssi = packet.getRssi(); //get signal strength
} catch (IOException ioe) { /* Handler */ }
```

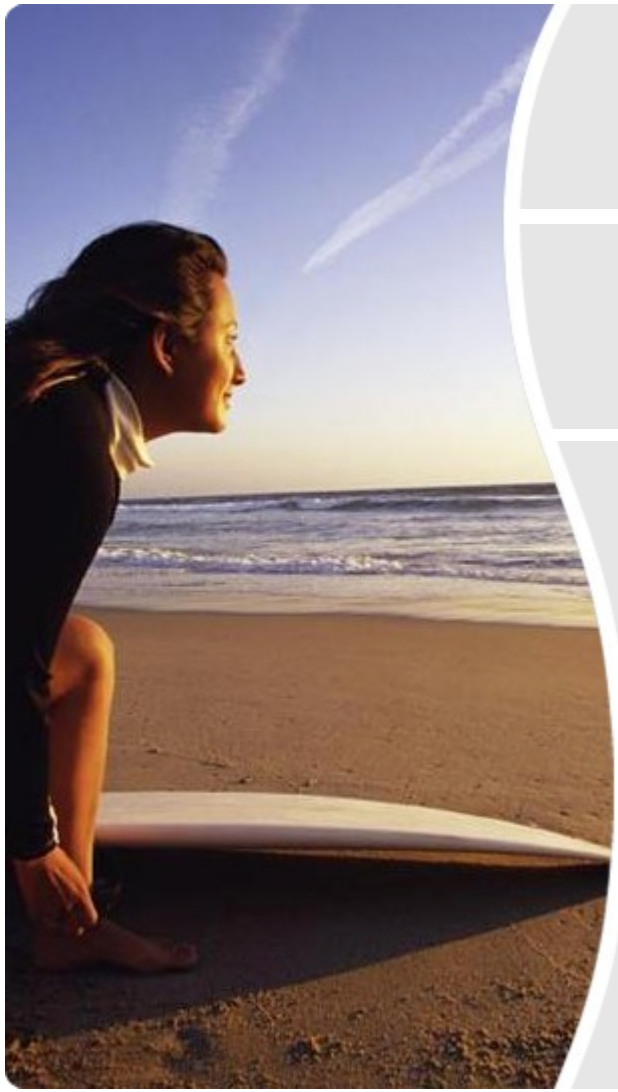
Sun SPOT Sensor Code Snippet

```
RangeInput light = SensorBoard.getLightSensor();
RangeInput temp = SensorBoard.getTemperatureSensor();
ISwitch switch1 = SensorBoard.getSwitch1();
Accelerometer3D accel = SensorBoard.getAccelerometer();
// Set accelerometer to 6G scalling
( (LIS3L02AQAccelerometer) accel).set6GSScale();

SensorBoardColouredLED led1 =
    SensorBoardColouredLED.getLed1();
led1.setOn();
// Change LED colour as SPOT is tilted
int xAccel = accel.getX().getValue();

if(xAccel > 0)
    led1.setRGB(xAccel, 0, 0);
else
    led1.setRGB(0, 0, xAccel);
```

Agenda



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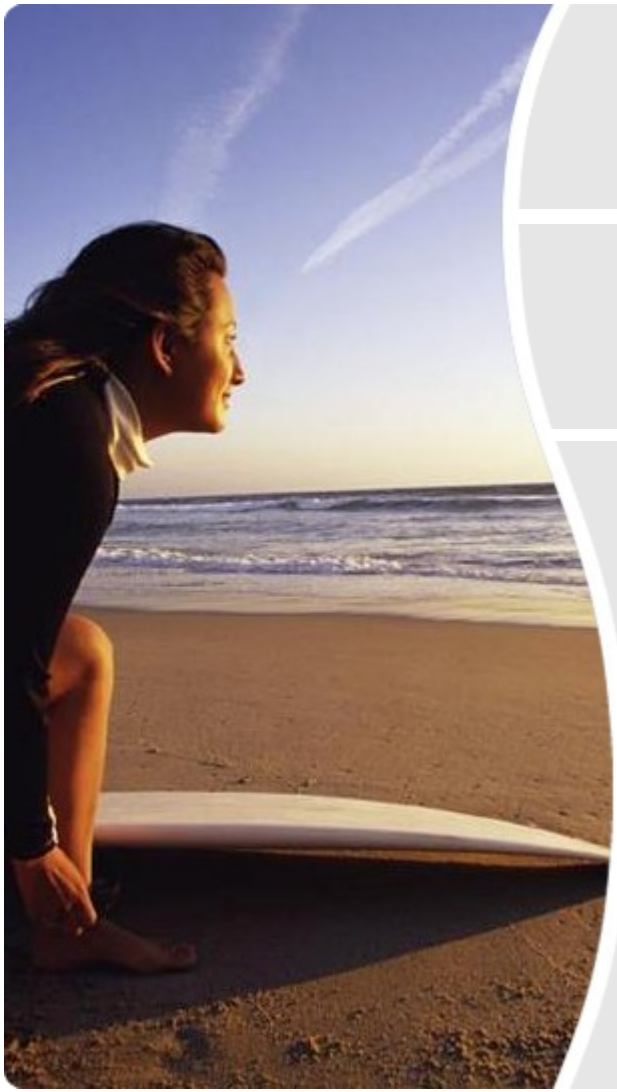
(Near) future of SPOT

- 6LoWPAN
  - IPv6 over Low power Wireless Personal Area Networks
  - use SPOTs as regular network nodes
  - standard tools (ping, traceroute etc)
  - still a standard draft

(Near) future of SPOT

- Real Time
  - one of the design goals is RT support
  - starting with a subset of the Real-Time Specification for Java

Agenda



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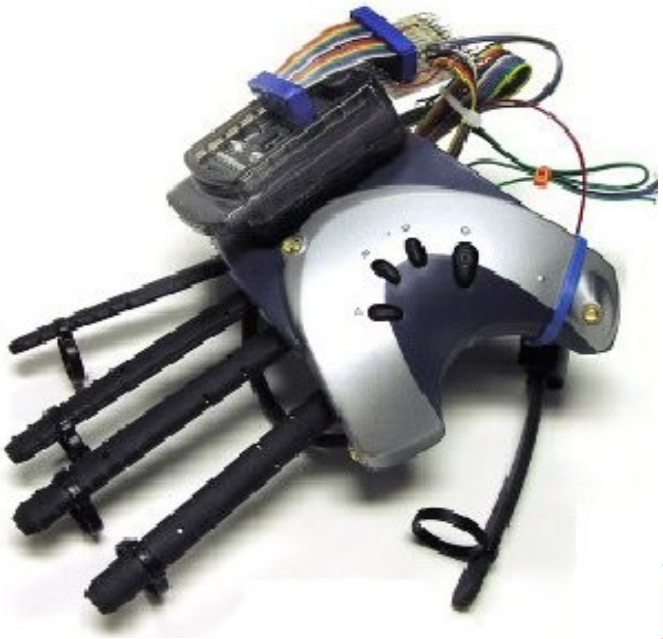
Visit http://www.sunspotworld.com/

- submit a proposal for classroom curriculum using Sun SPOTS
- obtain a Sun SPOT development kit
- Watch some cool Sun SPOT video demos
- Participate in Sun SPOT forum
- Create something cool!



Sun SPOT Resources

- Project Sun SPOT http://www.sunspotworld.com/
  - Sun SPOT documents and applications notes
  - Short Video demos
  - Classroom Curriculum
  - Discussion Forum
- David's Blog: http://blogs.sun.com/davidgs/
  - Latest news, other informal information on Sun SPOT
- The Squawk Project http://research.sun.com/projects/squawk/
  - Sun Microsystems official Squawk research project page
- NetBeans IDE
- https://spots.dev.java.net/

Project Sun SPOT

http://www.sunspotworld.com

THANK YOU!

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JUG - Karlsruhe

- Web-Seite:
  - http://jug-ka.de/
- Kommuniziert mittels Google Group:
  - http://groups.google.com/group/jug-karlsruhe/

- 22.4.2008 – Groovy
- 07.5.2008 - SAP Memory Analyzer