BeagleBoard, Raspberry Pi

HTML5 and JAVA

BeagleBoard, Raspberry Pi

HTML5 and JAVA

FUN WITH

JavaFx

EMBEDDED

Gerrit Grunwald

canoo Engineering AG

TWITTER: @hansolo_

WEB: harmonic-code.org

first...

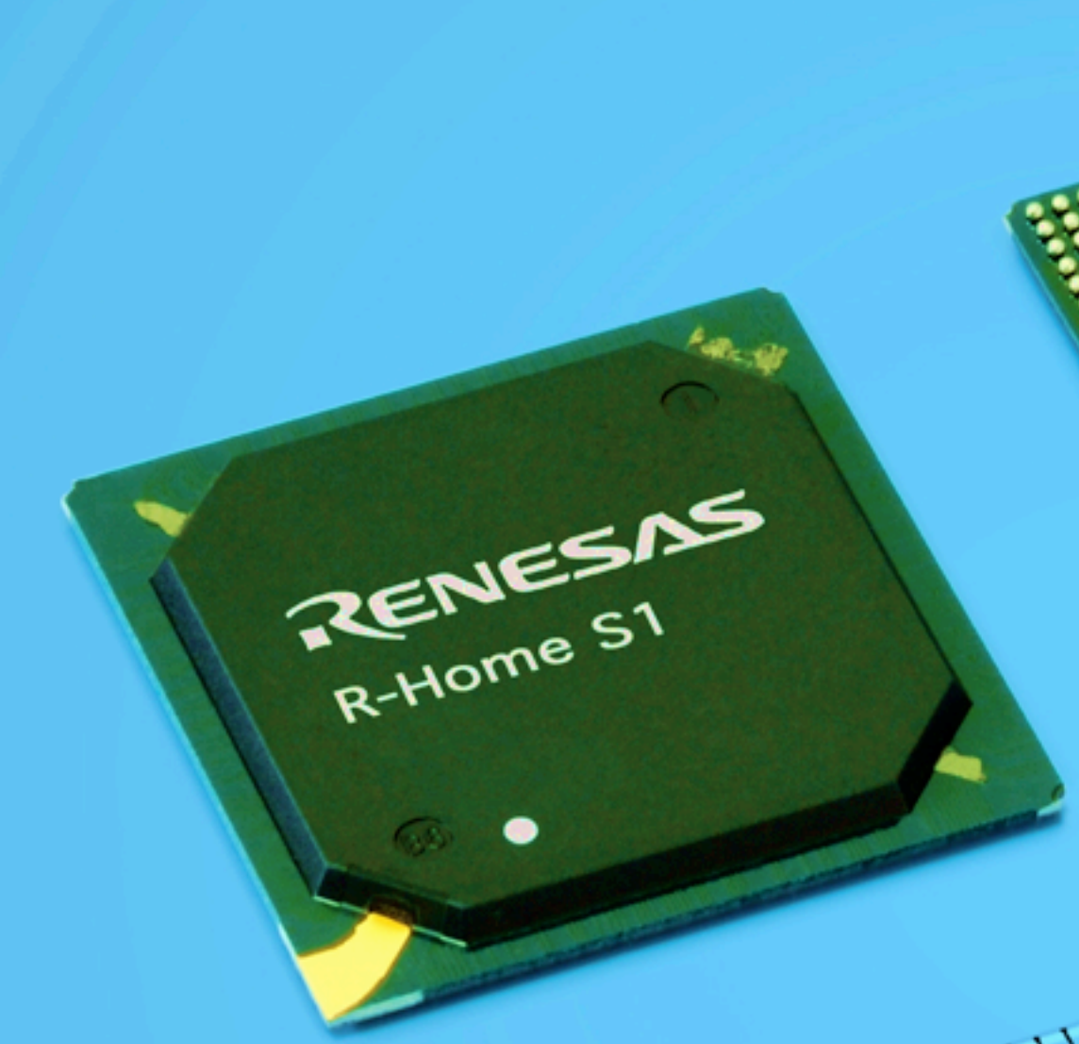
what embedded

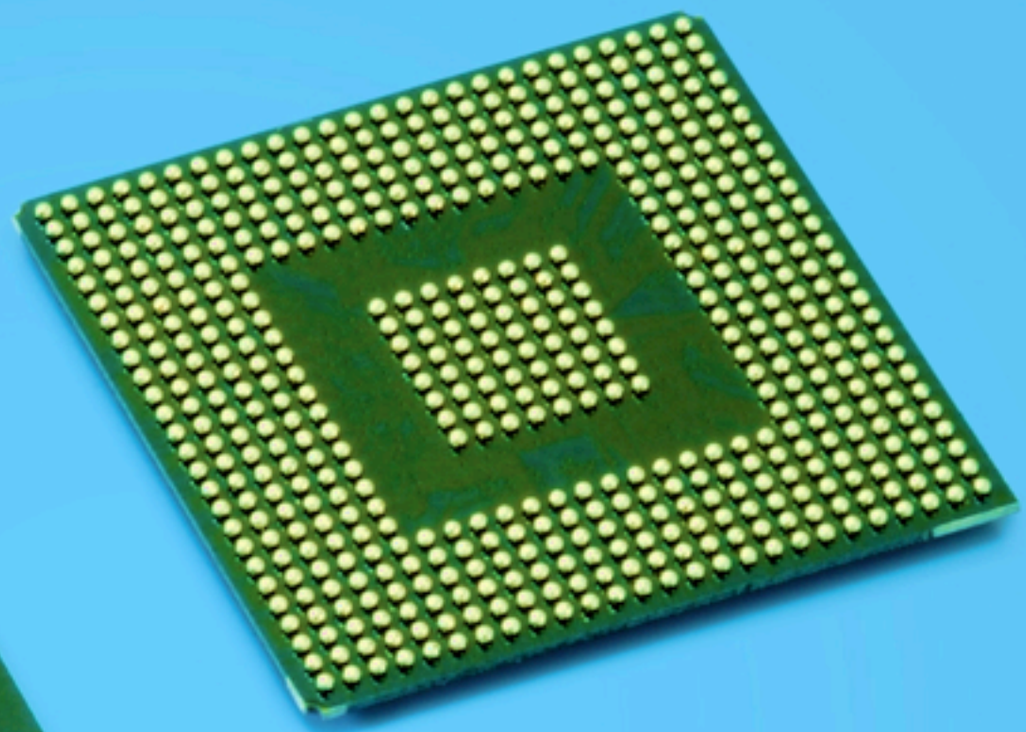
IS...

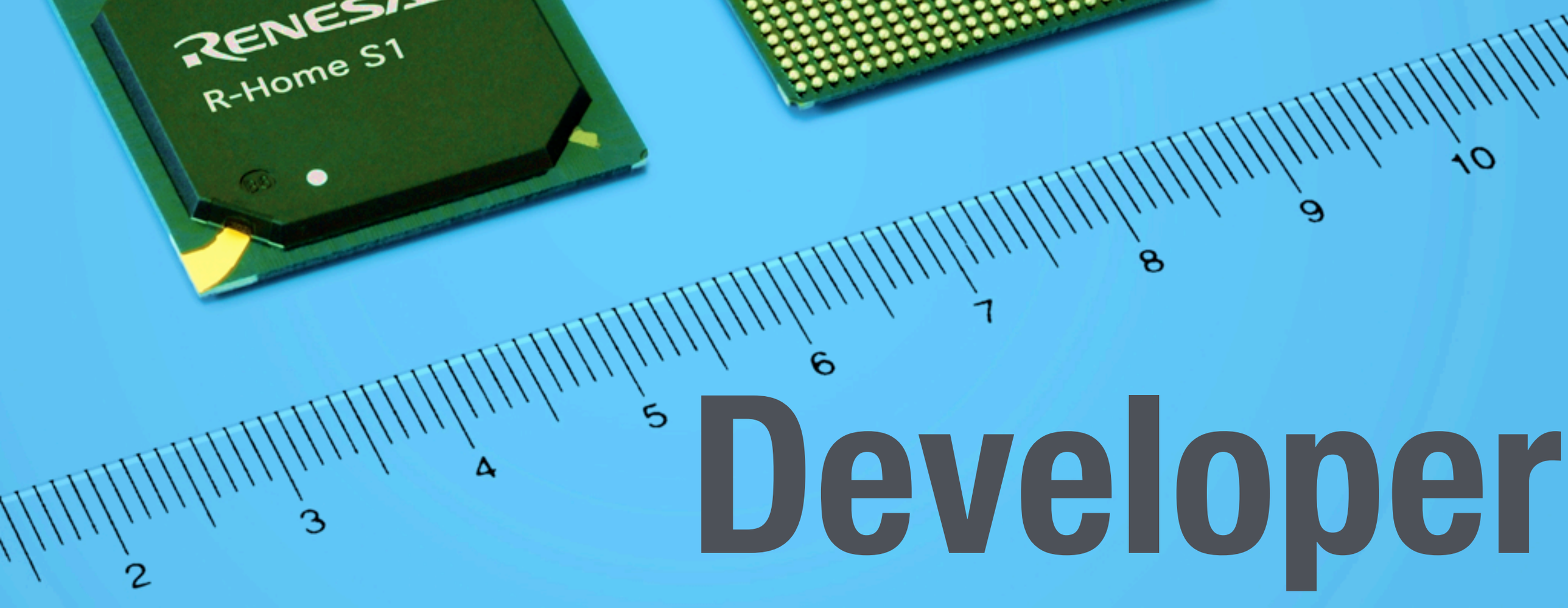
...depends on

the point of view

Hardware

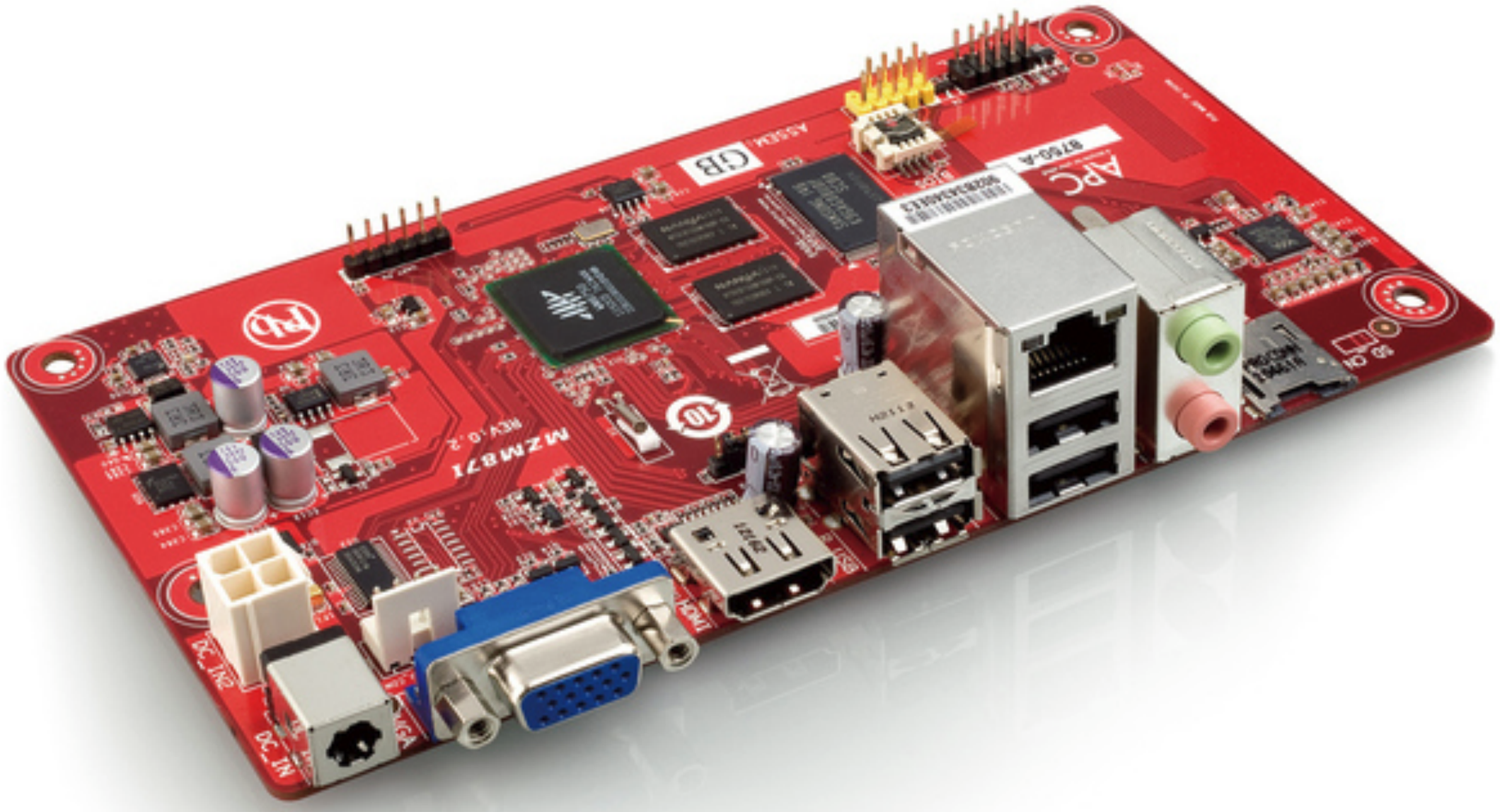






Developer

Software



Developer

JAVA ONE

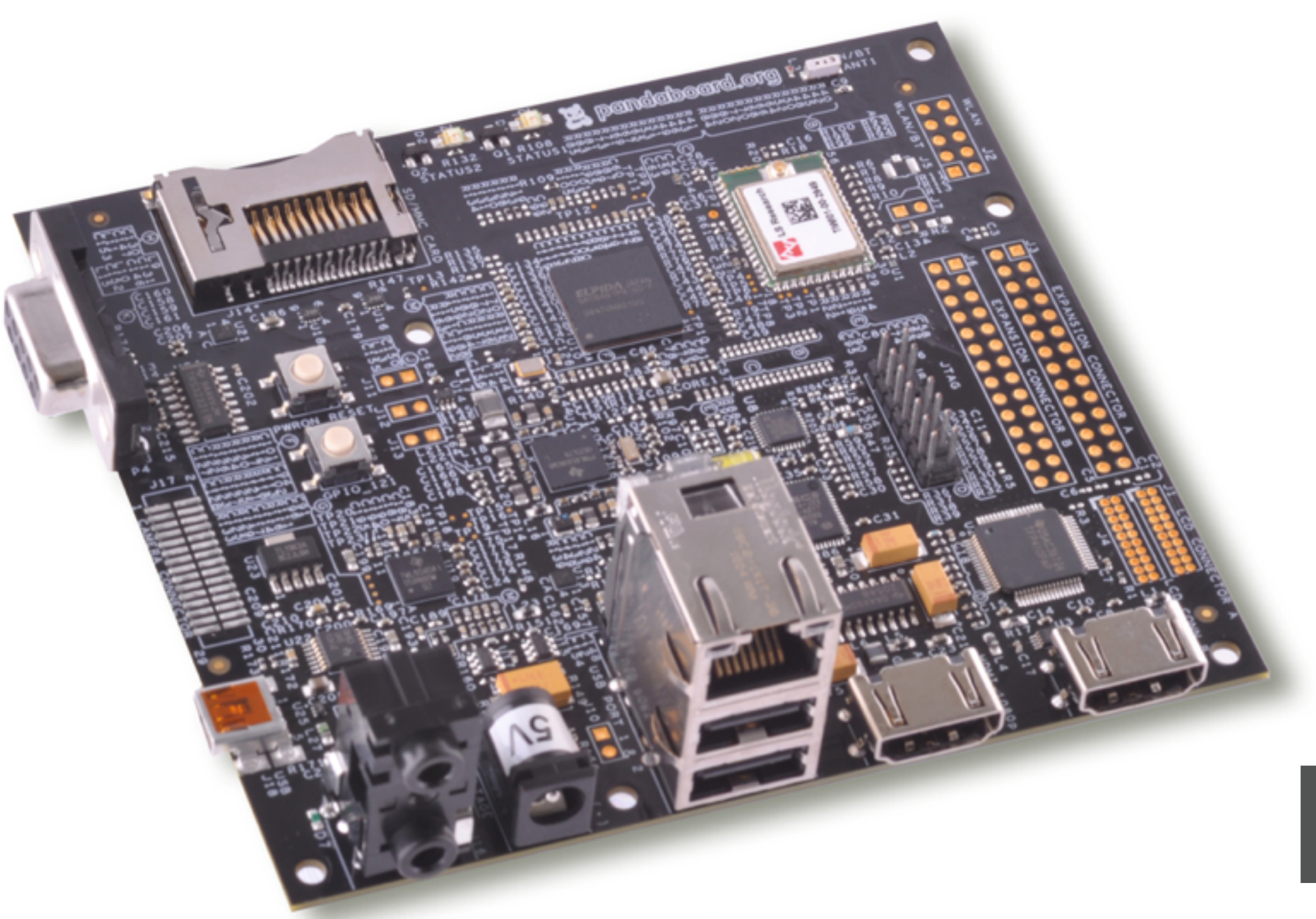
2012

JavaFX

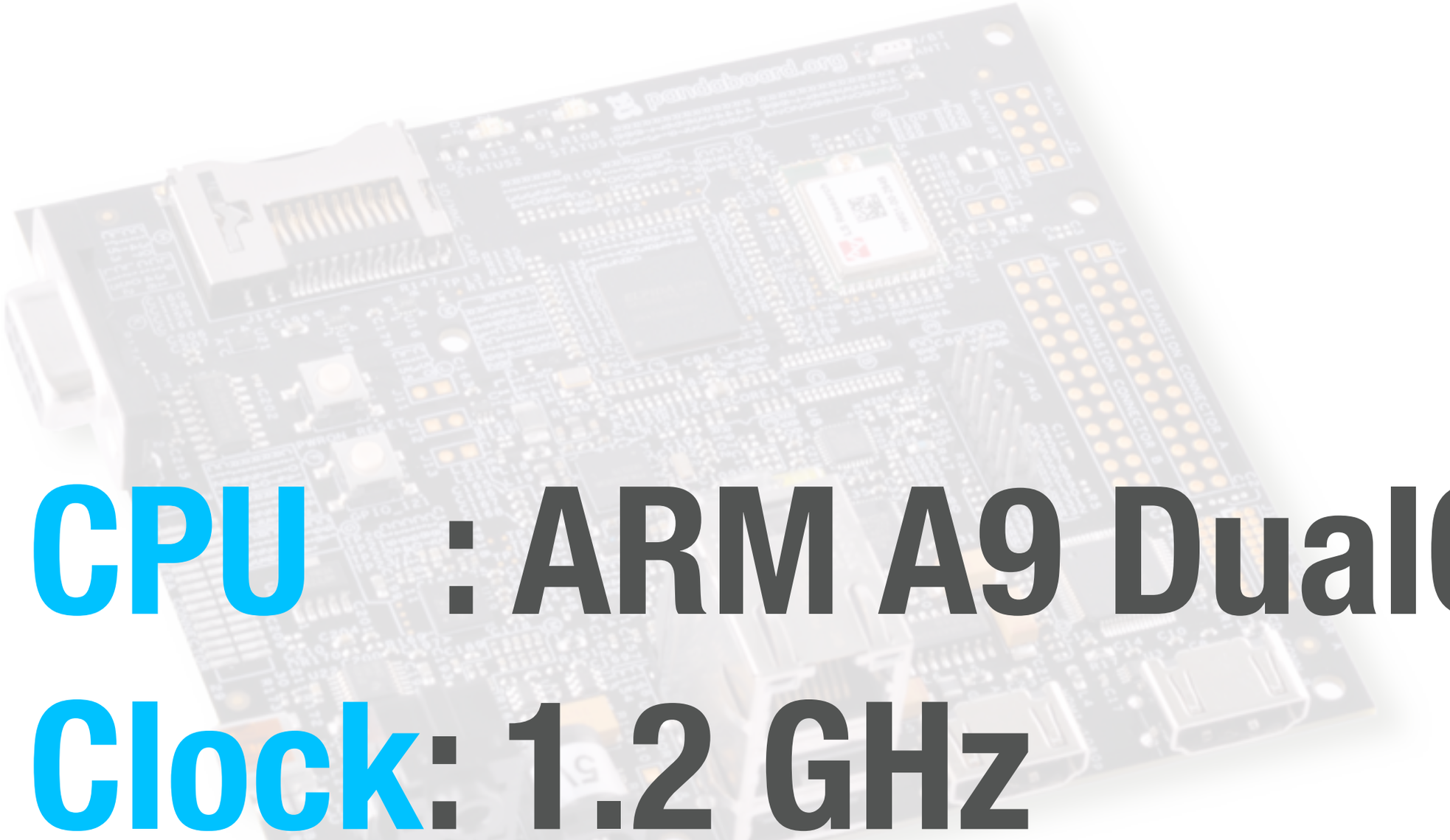
powered

Kiosk

running on...


pandaboard.org
EXPANSION CONNECTOR A
EXPANSION CONNECTOR B
JTAG
PWRON RESET
5V

Panda Board



CPU : ARM A9 DualCore

Clock: 1.2 GHz

Ram : 1 GB

GPU : Power VR SGX540

Why Java?

Benefits of Java

Benefits of Java

- **Superb developer toolchain**

Benefits of Java

- **Superb developer toolchain**
- **Mature, fast, widespread**

Benefits of Java

- **Superb developer toolchain**
- **Mature, fast, widespread**
- **Thousands of libraries**

Benefits of Java

- ★ **Superb developer toolchain**
- ★ **Mature, fast, widespread**
- ★ **Thousands of libraries**
- ★ **Huge community**

Benefits of Java

- ★ **Superb developer toolchain**
- ★ **Mature, fast, widespread**
- ★ **Thousands of libraries**
- ★ **Huge community**
- ★ **No standard on embedded**

JavaFX

WTF ?

JavaFX

5

Possible

USE CASES

★ *Home automation*

- *Home automation*
- *Home entertainment*

- *Home automation*
- *Home entertainment*
- *Medical devices*

- *Home automation*
- *Home entertainment*
- *Medical devices*
- *Information Kiosks*

- *Home automation*
- *Home entertainment*
- *Medical devices*
- *Information Kiosks*
- *Education*

WHAT IS JAVAFX ON EMBEDDED ?

A Subset of **F**

JAVAx

Without support for

Without support for

- **Swing/SWT**

Without support for

- **Swing/SWT**
- **System Menu**

Without support for

- **Swing/SWT**
- **System Menu**
- **Drag'n Drop**

Without support for

- ★ **Swing/SWT**
- ★ **System Menu**
- ★ **Drag'n Drop**
- ★ **WebView**

Available SDK's

Available SDK's

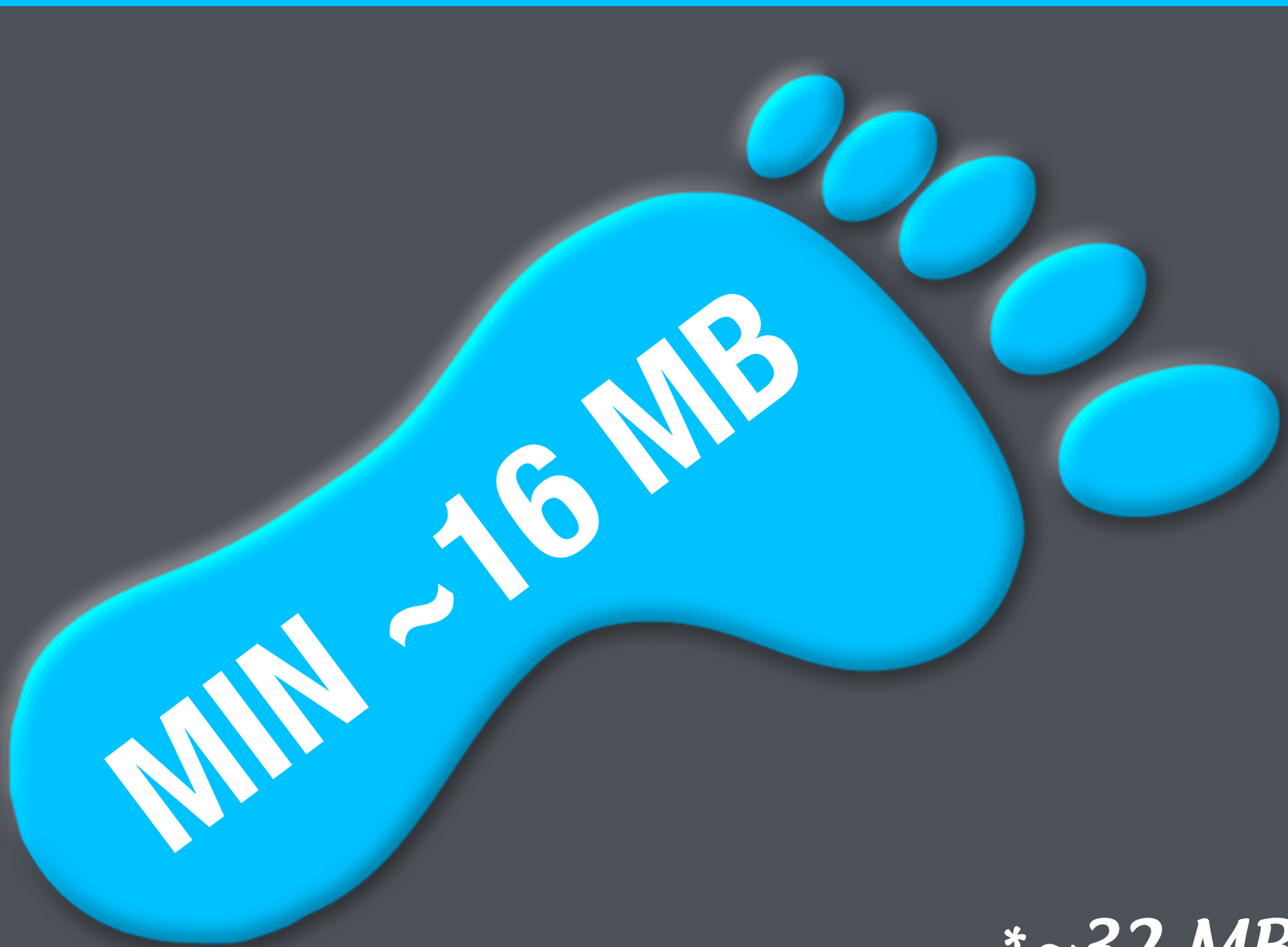
- JDK 7 (JFX 2)

Available SDK's

- JDK 7 (JFX 2)
- JDK 8 (JFX 8)

Target* footprint

Target footprint*

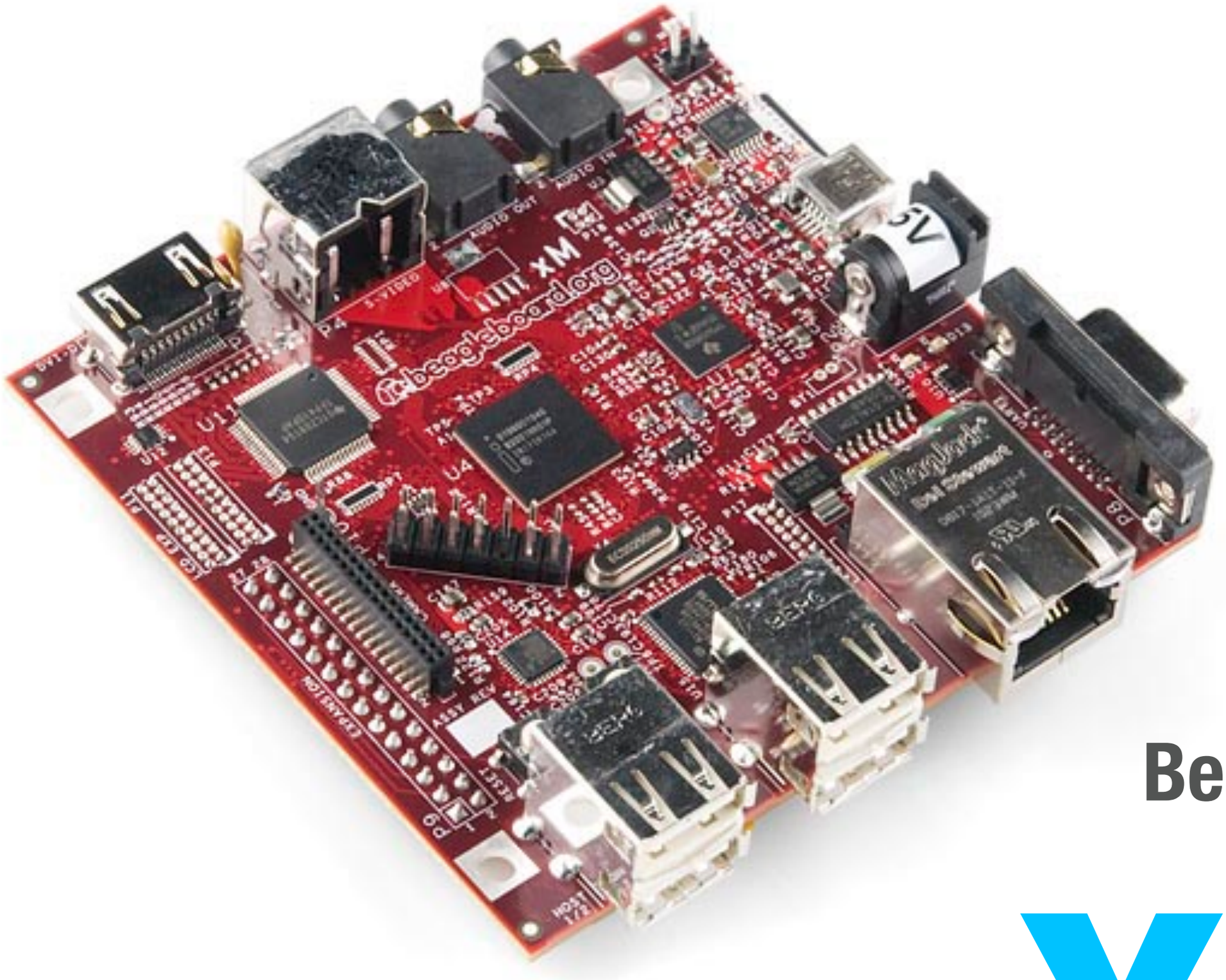


** ~32 MB today*

WHAT ARE THE SUPPORTED PLATFORMS ?

BeagleBoard xM

Raspberry Pi



BeagleBoard

xM

- *ARM A8, 1 GHz*

- *ARM A8, 1 GHz*
- *512 MB RAM*

- ARM A8, 1 GHz
- 512 MB RAM
- 4 x USB

- ARM A8, 1 GHz
- 512 MB RAM
- 4 x USB
- ETHERNET RJ45

- ARM A8, 1 GHz
- 512 MB RAM
- 4 x USB
- ETHERNET RJ45
- HDMI

- ***ARM A8, 1 GHz***
- ***512 MB RAM***
- ***4 x USB***
- ***ETHERNET RJ45***
- ***HDMI***
- ***I^2C, JTAG, SPI***

running on

Angström

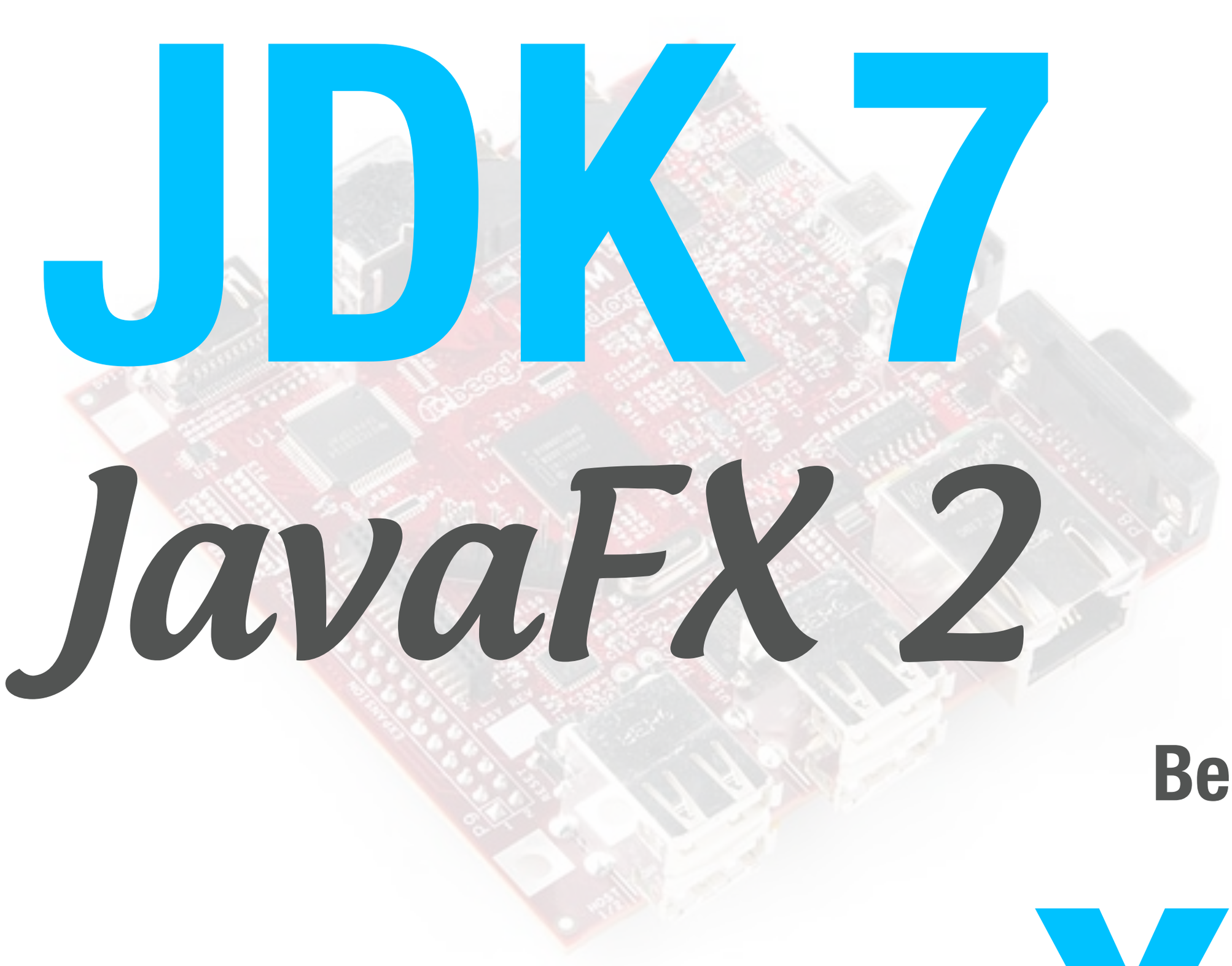
running on

Angström

based on Debian

JDK 7

JavaFX 2



BeagleBoard

xM

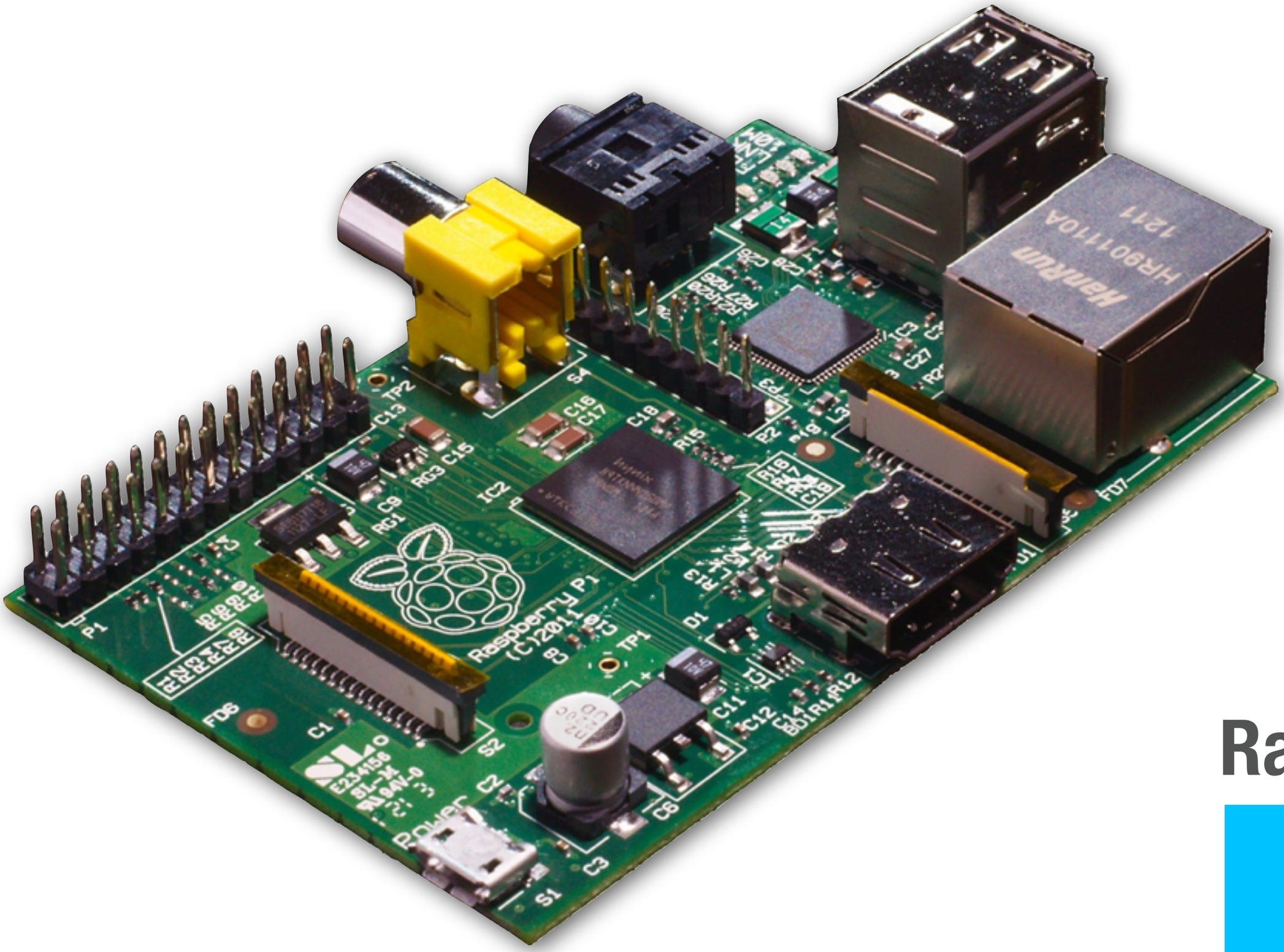
JDK 7

JavaFX 2

with SoftFloat support

BeagleBoard

xM



Raspberry Pi

- *ARM v6, 700 MHz*

- ARM v6, 700 MHz
- 512 MB RAM

- ***ARM v6, 700 MHz***
- ***512 MB RAM***
- ***2 x USB***

- ARM v6, 700 MHz
- 512 MB RAM
- 2 x USB
- ETHERNET RJ45

- ARM v6, 700 MHz
- 512 MB RAM
- 2 x USB
- ETHERNET RJ45
- HDMI, COMPOSITE

- ARM v6, 700 MHz
- 512 MB RAM
- 2 x USB
- ETHERNET RJ45
- HDMI, COMPOSITE
- GPIO, I^2C, UART, SPI

running on

Raspbian

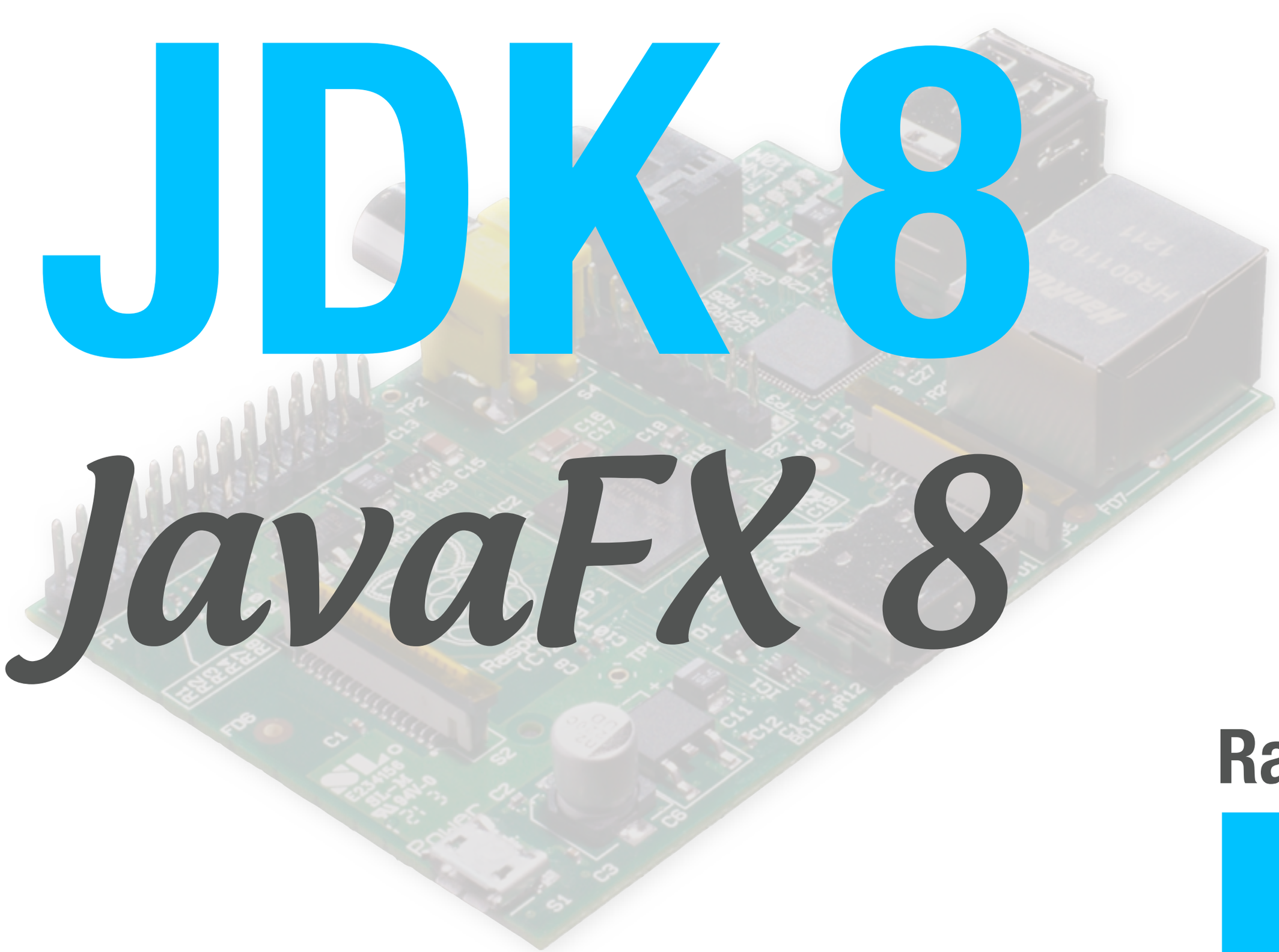
running on

Raspbian

based on Debian

JDK 8

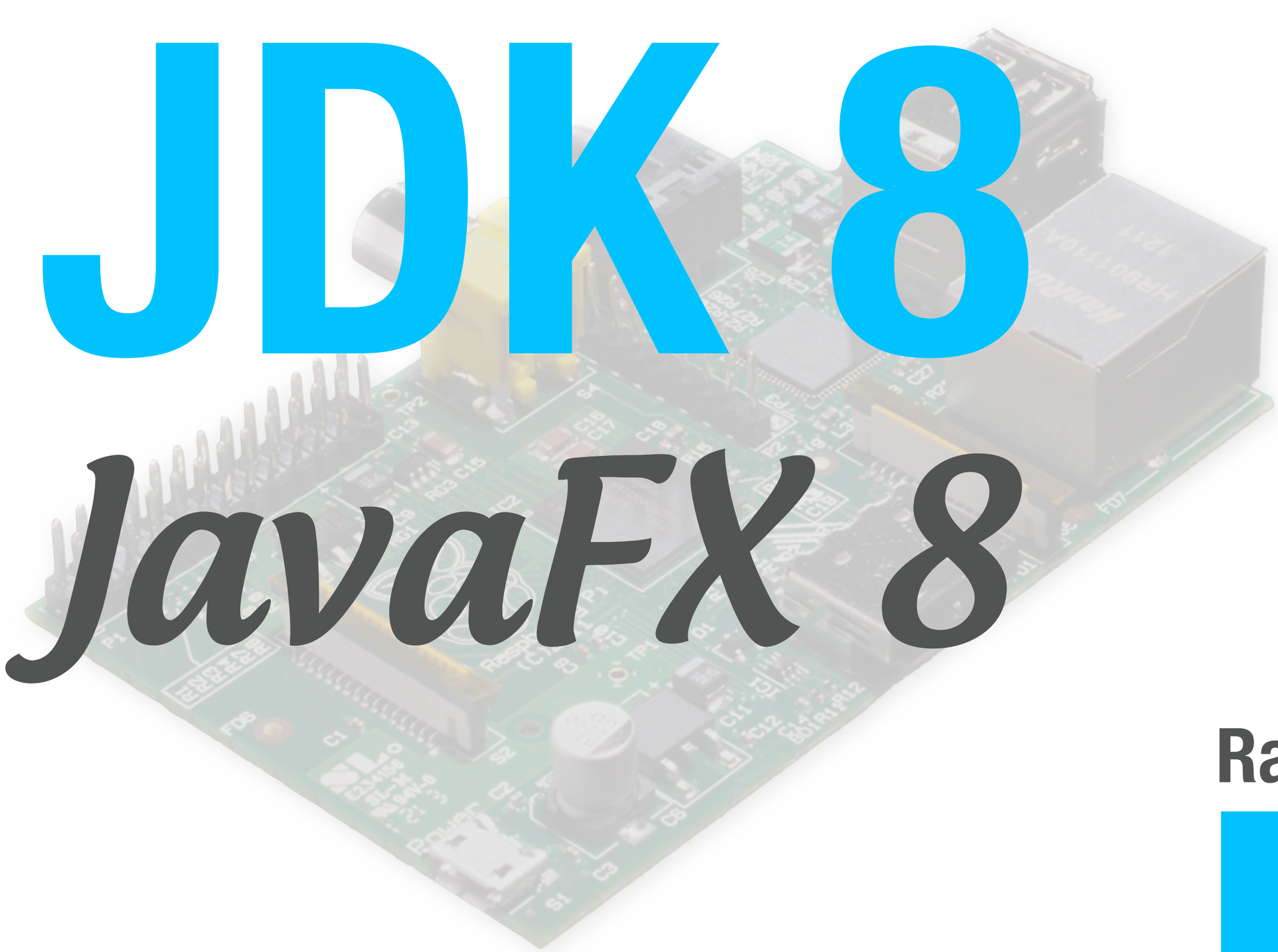
JavaFX 8



Raspberry Pi

JDK 8

JavaFX 8



with HardFloat support

Raspberry Pi

So....having

Java

means...

WRITE ONCE RUN ANYWHERE ?

FIRST...

SOME FACTS

Macbook Pro

Intel i7 Quadcore

2.3 GHz

16 GB ram

Nvidia GeForce

GT 650m

BeagleBoard xM

ARM A8

1 Ghz

512 MB ram

Power VR

SGX series 5

Macbook Pro

Nvidia GeForce GT 650m

BeagleBoard xM

Power VR SGX series 5

Macbook Pro

Nvidia GeForce GT 650m

- ★ 384 Cores
- ★ ~15 GPixel/s
- ★ ~600 GFlops

BeagleBoard xM

Power VR SGX series 5

- ★ 1 Core
- ★ ~500 MPixel/s
- ★ ~1.6 GFlops

Embedded

REQUIREMENTS

Requirements

Requirements

- **touchable user interface**

Requirements

- touchable user interface
- reasonable controls

Requirements

- ★ **touchable user interface**
- ★ **reasonable controls**
- ★ **no mouse and keyboard**

Requirements

- ★ **touchable user interface**
- ★ **reasonable controls**
- ★ **no mouse and keyboard**
- ★ **restriced screen estate**

CONCLUSION

NO

WRITE ONCE RUN

ANYWHERE !

But you can

RECYCLE A LOT

60 cm

34 cm

50 mm

90 mm

And learn

FROM MOBILE

EXAMPLE

Temperature Monitoring

Requirements

Requirements

- **Measure the temperature**

Requirements

- **Measure the temperature**
- **Monitor on site**

Requirements

- **Measure the temperature**
- **Monitor on site**
- **Monitor on desktop**

Requirements

- **Measure the temperature**
- **Monitor on site**
- **Monitor on desktop**
- **Monitor on mobile**

Requirements

Requirements

- **Feedback on site**

Requirements

- **Feedback on site**
- **Feedback on desktop**

Requirements

- **Feedback on site**
- **Feedback on desktop**
- **No platform dependency**

and...

NO

SOLDER

Hardware

Hardware

★ Raspberry Pi for measuring the temperature

Hardware

- **Raspberry Pi for measuring the temperature**
- **BeagleBoard xM with lcd for on site monitoring**

A Raspberry Pi for

measuring ?

Isn't it

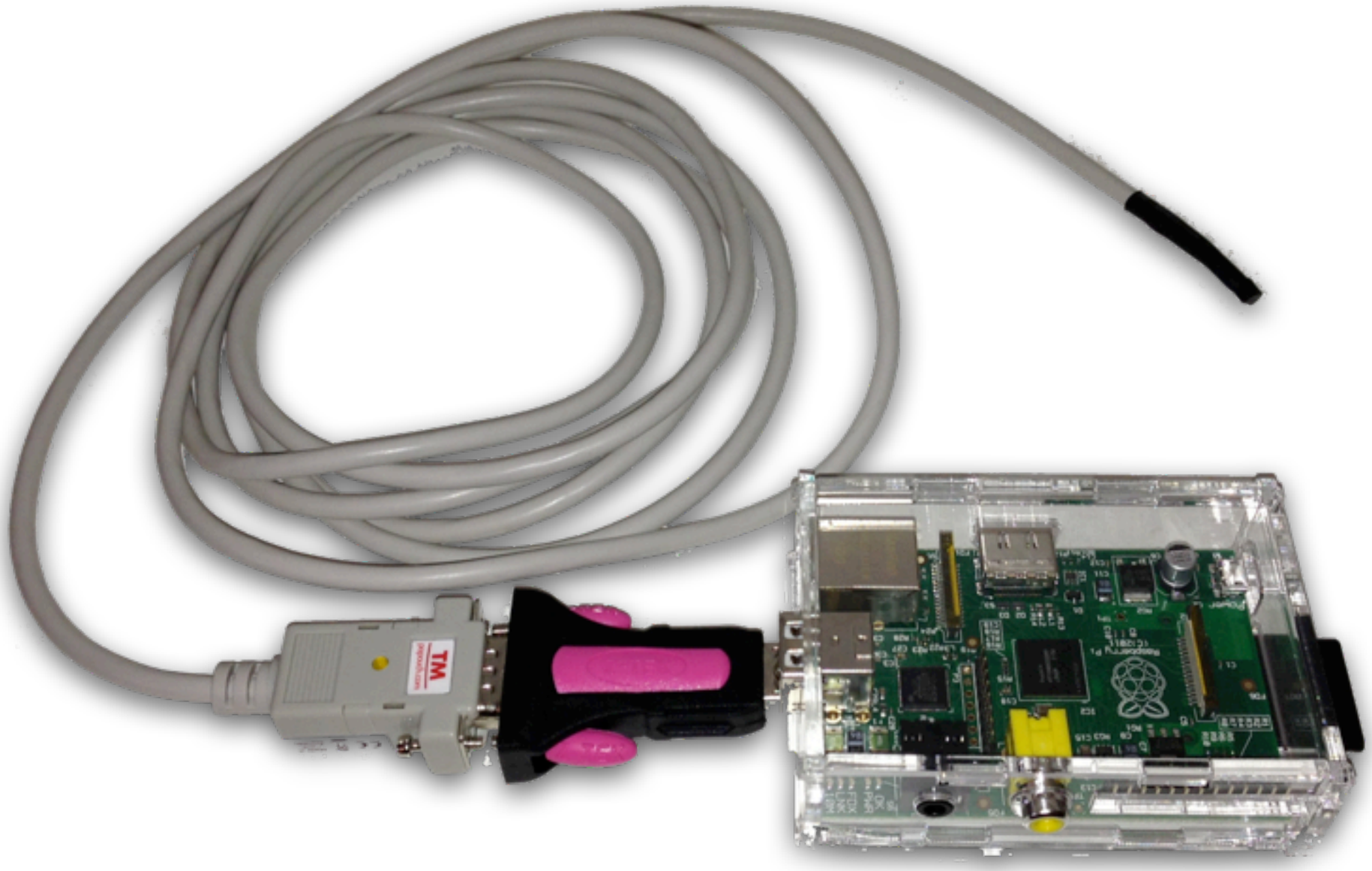
Overkill ?

Isn't it

Overkill ?

OF COURSE

but it's cheap...



Raspberry Pi

Raspberry Pi

★Raspberry Pi

Raspberry Pi

- ★ **Raspberry Pi**
- ★ **Case for the Pi**

Raspberry Pi

- ★ **Raspberry Pi**
- ★ **Case for the Pi**
- ★ **Power Supply**

Raspberry Pi

- ★ Raspberry Pi
- ★ Case for the Pi
- ★ Power Supply
- ★ Serial to USB Converter

Raspberry Pi

- ★ Raspberry Pi
- ★ Case for the Pi
- ★ Power Supply
- ★ Serial to USB Converter
- ★ Industrial serial temp sensor

Raspberry Pi

- ★ Raspberry Pi
- ★ Case for the Pi
- ★ Power Supply
- ★ Serial to USB Converter
- ★ Industrial serial temp sensor
- ★ Network connection

Estimated

100 $

BeagleBoard

xM

BeagleBoard

BeagleBoard

★ Beagleboard xM

BeagleBoard

- Beagleboard xM
- 10" LCD touchscreen

BeagleBoard

- Beagleboard xM
- 10" LCD touchscreen
- Case

BeagleBoard

- Beagleboard xM
- 10" LCD touchscreen
- Case
- Power Supply

BeagleBoard

- Beagleboard xM
- 10" LCD touchscreen
- Case
- Power Supply
- USB relay board

BeagleBoard

- Beagleboard xM
- 10" LCD touchscreen
- Case
- Power Supply
- USB relay board
- Some indicator (Werma design42)

Estimated

350 $

Estimated

350 $

excl. the Signaltower


JavaFX Desktop Temp Monitor
18.14
Temp. pi1
20.00
19.30 °C
cold
20.00
pi1
pi2

Desktop

Desktop

Desktop

- **Windows, OS X or Linux**

Desktop

- ★ Windows, OS X or Linux
- ★ Java Virtual Machine (> JDK 7u6)

Desktop

- Windows, OS X or Linux
- Java Virtual Machine (> JDK 7u6)
- Network connection

Mobile

Mobile

Mobile

- iOS, Android, ...

Mobile

- ★ **iOS, Android, ...**
- ★ **HTML5 capable browser**

Mobile

- **iOS, Android, ...**
- **HTML5 capable browser**
- **Network connection**

Software

Platforms

Platforms

- ## Raspberry Pi on Java 8

Platforms

- **Raspberry Pi on Java 8**
- **BeagleBoard xM on Java 7**

Platforms

- **Raspberry Pi on Java 8**
- **BeagleBoard xM on Java 7**
- **Desktop Client on Java 7**

Platforms

- **Raspberry Pi on Java 8**
- **BeagleBoard xM on Java 7**
- **Desktop Client on Java 7**
- **Mobile Client on HTML5**

What about

COMMUNICATION

Communication

Communication

- **xmpp** (extensible messaging and presence protocol)

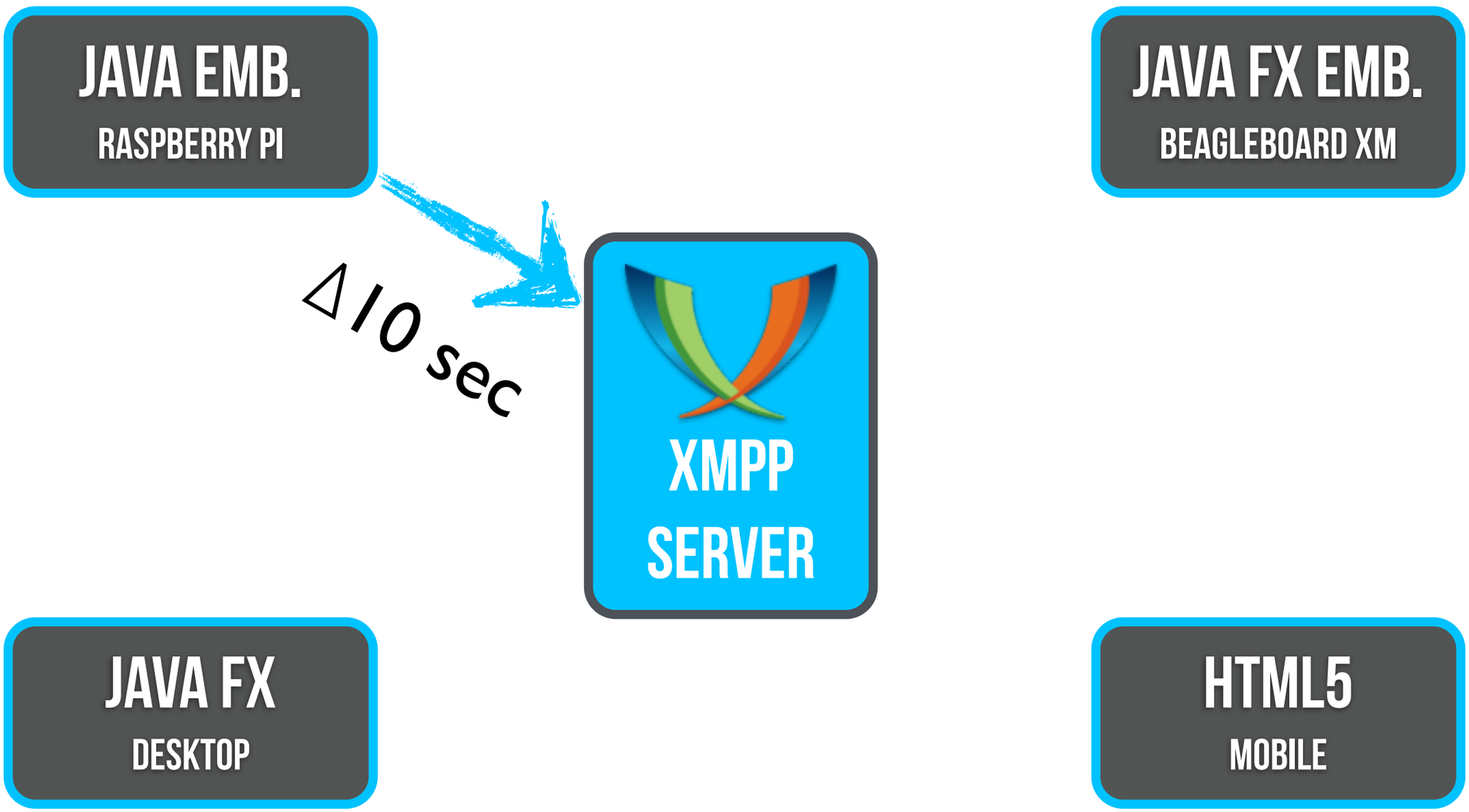
Communication

- **xmpp** (extensible messaging and presence protocol)
- **smack xmpp java library**

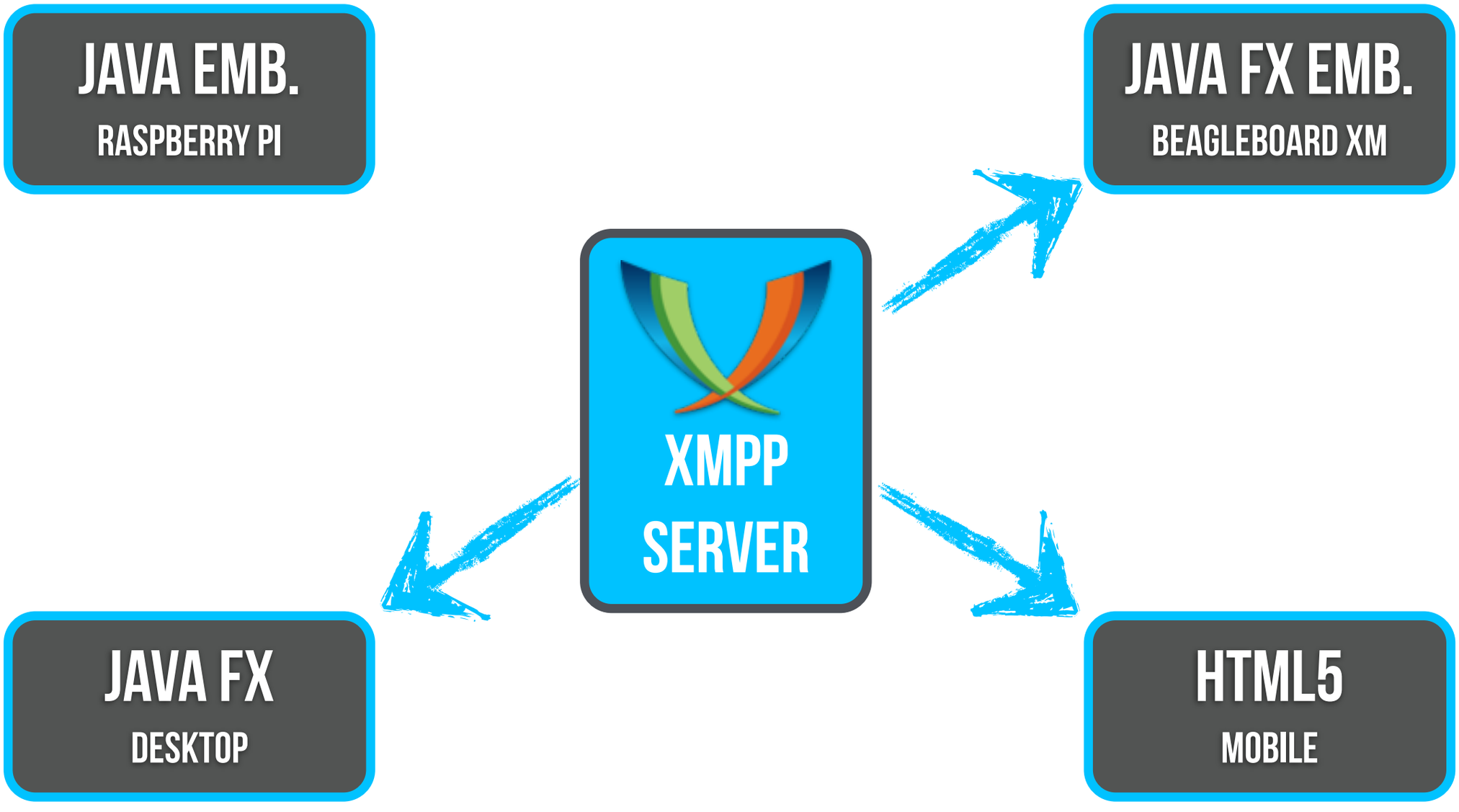
Communication

- **xmpp** (extensible messaging and presence protocol)
- **smack xmpp java library**
- **bosh** (bidirectional streams over synchronous http)

Overview


JAVA EMB.
RASPBERRY PI
JAVA FX EMB.
BEAGLEBOARD XM
Δ10 sec
XMPP
SERVER
JAVA FX
DESKTOP
HTML5
MOBILE

Overview


JAVA EMB.
RASPBERRY PI
JAVA FX EMB.
BEAGLEBOARD XM
XMPP
SERVER
JAVA FX
DESKTOP
HTML5
MOBILE

Advantage of xmpp

Advantage of xmpp

- **free infrastructure**

Advantage of xmpp

- **free infrastructure**
- **widely used**

Advantage of xmpp

- **free infrastructure**
- **widely used**
- **extensible**

Advantage of xmpp

- ★ **free infrastructure**
- ★ **widely used**
- ★ **extensible**
- ★ **presence**

Advantage of xmpp

Advantage of xmpp

- **use one account on different resources**

Advantage of xmpp

- **use one account on different resources**
- **fast**

Advantage of xmpp

- **use one account on different resources**
- **fast**
- **mature**

1

Raspberry Pi

APPLICATION

Requirements

Requirements

- measure the temperature

Requirements

- measure the temperature
- distribute the data via xmpp

running on

JDK8

using

JavaFX 8

JavaFX
ON
HEADLESS

Sensor Class

XMPP Class

Sensor Class

```
DoubleProperty celsius = new SimpleDoubleProperty();

public ReadOnlyDoubleProperty celsiusProperty() {
    return celsius;
}
```

XMPP Class

Sensor Class

```
DoubleProperty celsius = new SimpleDoubleProperty();

public ReadOnlyDoubleProperty celsiusProperty() {
    return celsius;
}


...
  BufferedReader br =
    new BufferedReader(new InputStreamReader(is));
  while (running) {
    try {
      while((br.ready() && (line = br.readline) != null)) {
        celsius.set(Double.parseDouble(line));
    } catch (Exception exception) {}
  }
...
```

XMPP Class

Sensor Class

```
DoubleProperty celsius = new SimpleDoubleProperty();

public ReadOnlyDoubleProperty celsiusProperty() {
    return celsius;
}
```

XMPP Class

```
sensorClass.celsiusProperty().addListener(
  new ChangeListener<Number>() {
    @Override public void changed(
      ObservableValue<? extends Number> ov,
      Number oldC, Number newC) {
        sendMessage(newC.doubleValue(), RECEIVER);
      }
  });
```

xmpp is

extensible

xmpp is extensible

```
// Exchange data with others
public void sendData(String id, double celsius, double fahrenheit,
                     double humidity, double pressure, double latitude,
                     double longitude, String signalTowerColor,
                     String JID) throws XMPPException {

  Message message = new Message();
  message.setProperty("id", id);
  message.setProperty("celsius", celsius);
  message.setProperty("fahrenheit", fahrenheit);
  message.setProperty("humidity", humidity);
  message.setProperty("pressure", pressure);
  message.setProperty("latitude", latitude);
  message.setProperty("longitude", longitude);
  message.setProperty("signalTowerColor", signalTowerColor);

  Chat chat = chatManager.createChat(JID, messageListener);
  chat.sendMessage(message);
}
```

xmpp == jabber

why not chatting

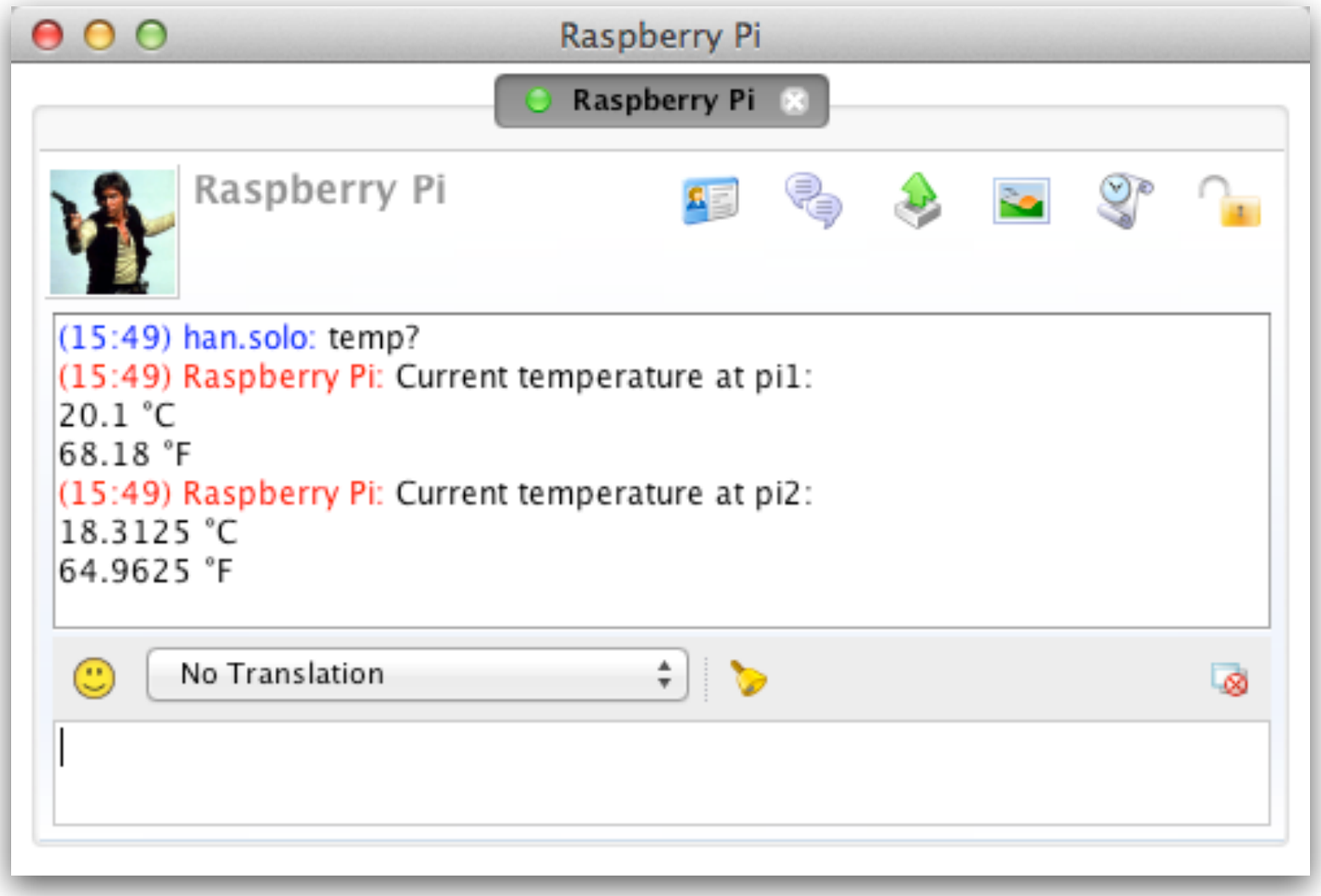
Chat with the Pi

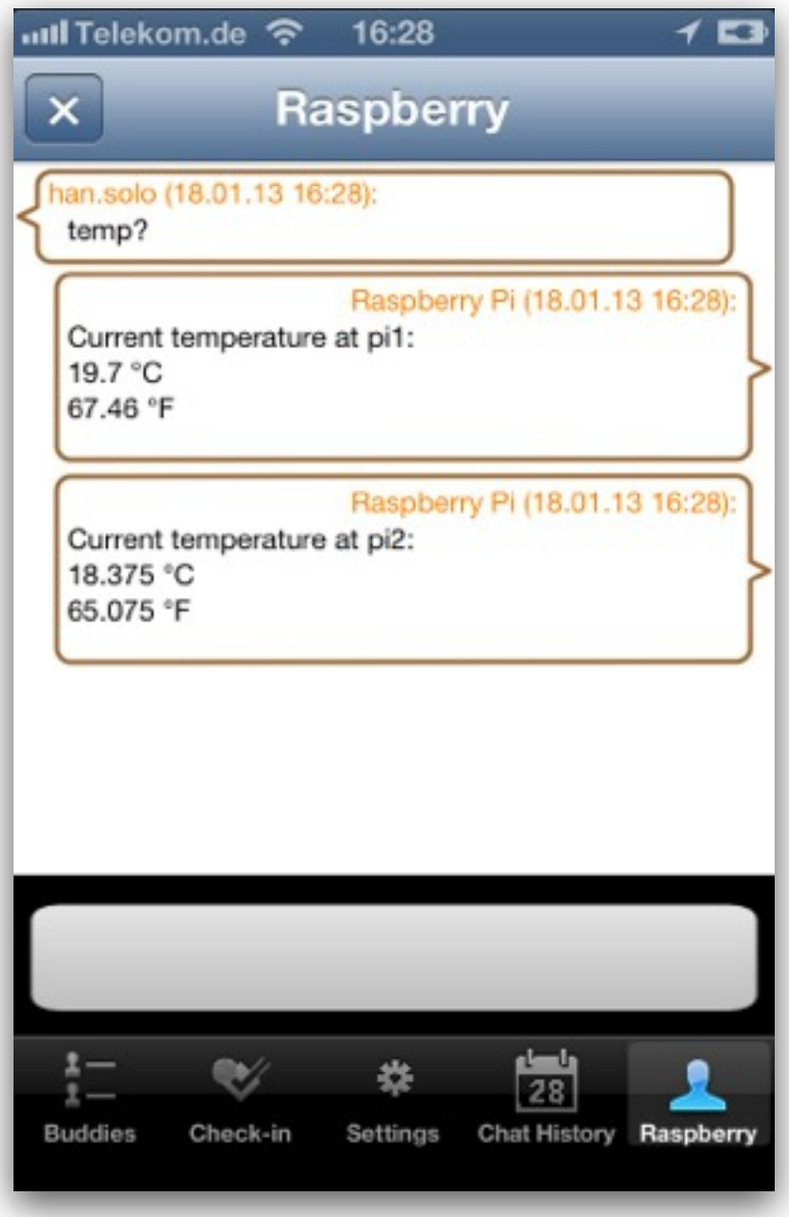
```
// The XMPP Packet listener running on the Raspberry Pi
private class XmppPacketListener implements PacketListener {
  @Override public void processPacket(Packet packet) {
    String from = ((Message) packet).getFrom();
    String body = ((Message) packet).getBody();

    if (body.toLowerCase().equals("temp?")) {
      answerTempRequest(from);
    } else if (body.toLowerCase().equals("location?")) {
      answerLocationRequest(from);
    } else if (body.toLowerCase().equals("history?")) {
      answerHistoryRequest(from);
    } else if (body.toLowerCase().equals("humidity?")) {
      answerHumidityRequest(from);
    } else if (body.toLowerCase().equals("pressure?")) {
      answerPressureRequest(from);
    }
  }
}
```

Chat with the Pi

```
// Answering the temperature request
public void answerTempRequest(final String JID) {
  new Thread(new Runnable() {
    @Override public void run() {
      try {
        Message message = new Message();
        message.setBody("Current temperature at " + id + ":\n" +
                        celsius + " °C\n" +
                        fahrenheit + " °F");
        Chat chat = chatManager.createChat(JID, messageListener);
        chat.sendMessage(message);
      } catch (XMPPException exception) {...}
    }
  }).start();
}
```

Chat with the Pi





2

BeagleBoard

APPLICATION

running on

JDK7

using JavaFX 2

Requirements

Requirements

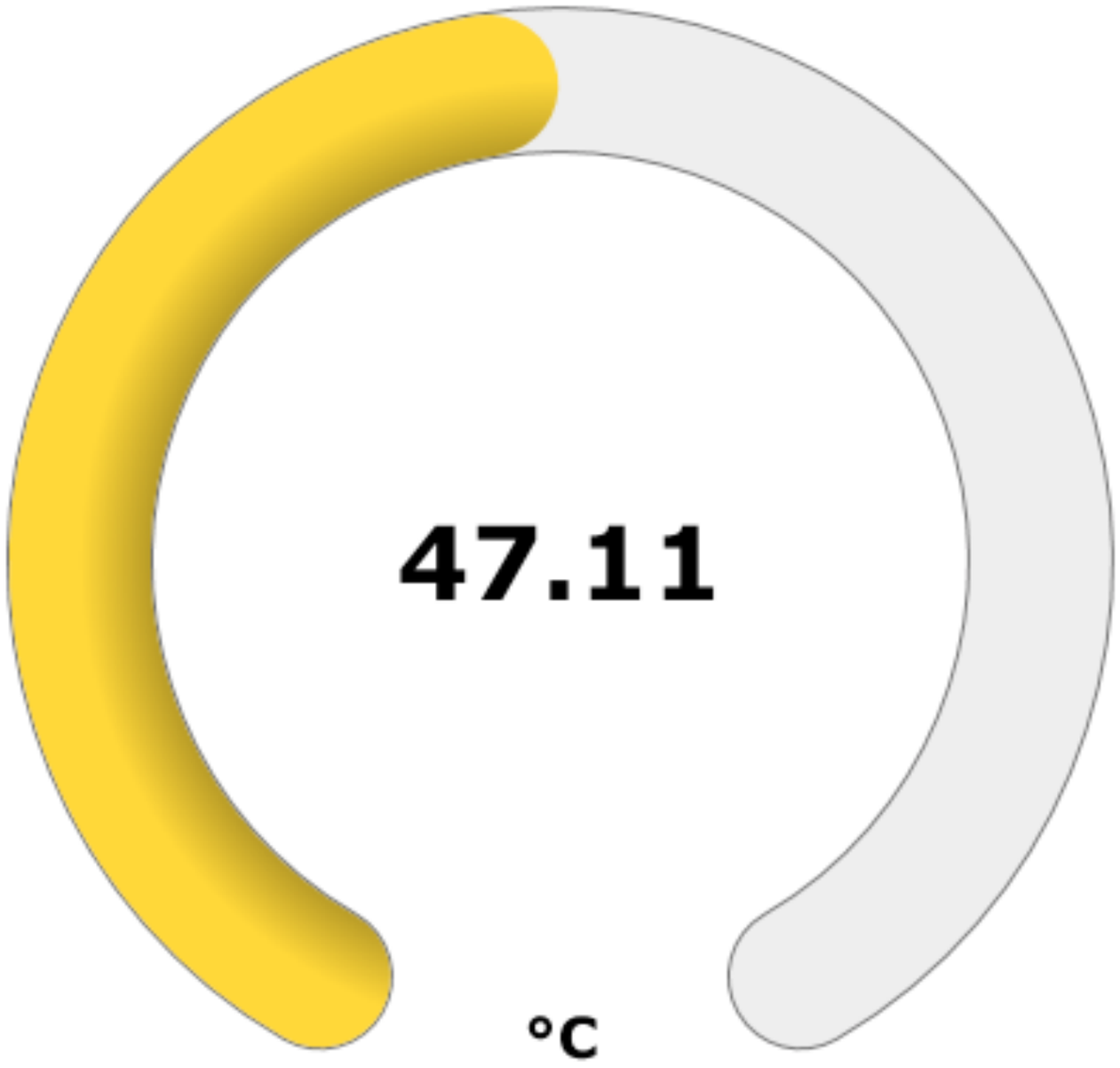
- **Visualize the temperature on connected lcd**

Requirements

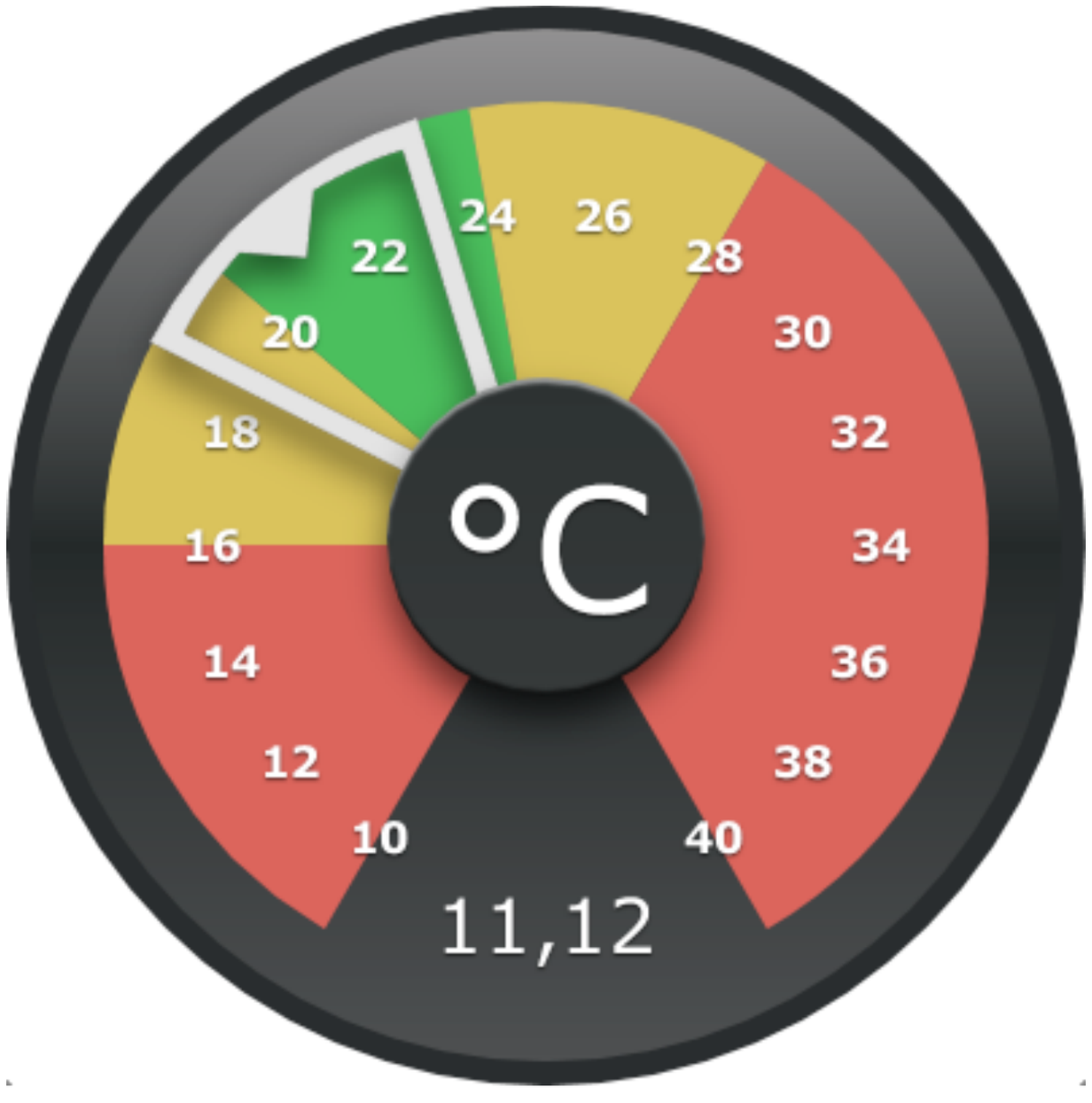
- **Visualize the temperature on connected lcd**
- **Indicate the status on the outside**

Do we need this ?

Isn't this enough ?



Ok, let's take this



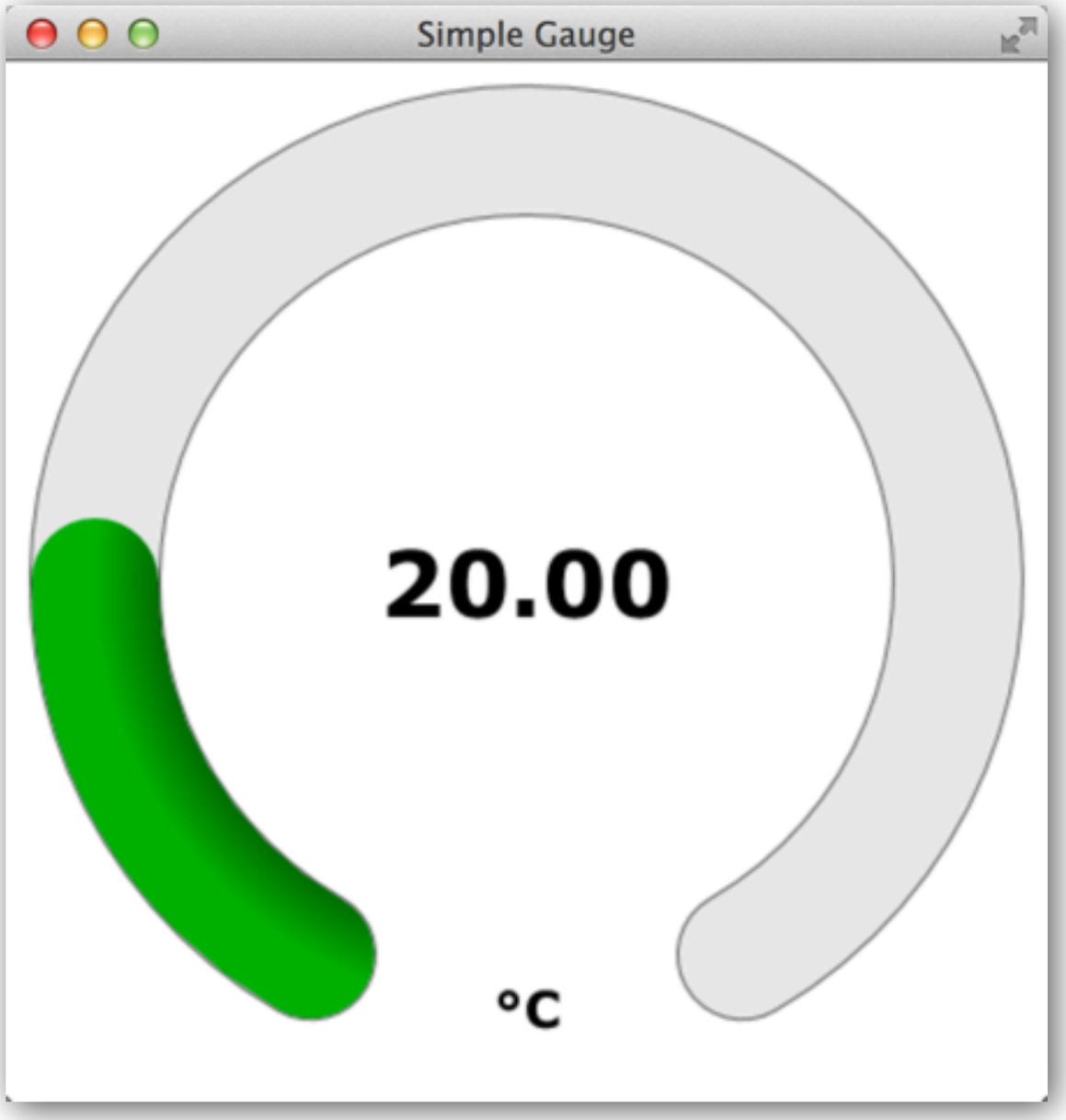
IT'S ABOUT

IT'S ABOUT

CONTENT OVER CHROME

CONTENT

CHROME

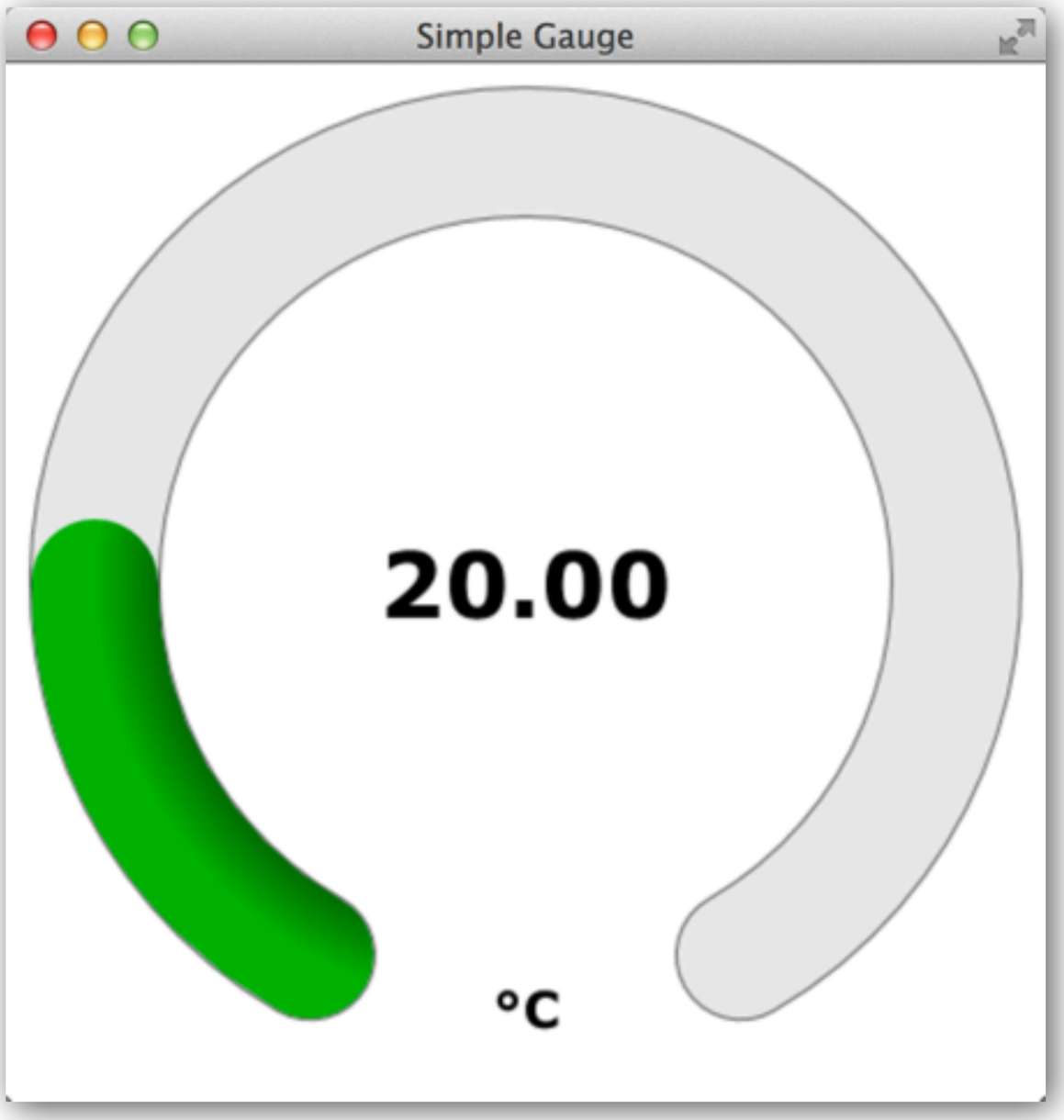


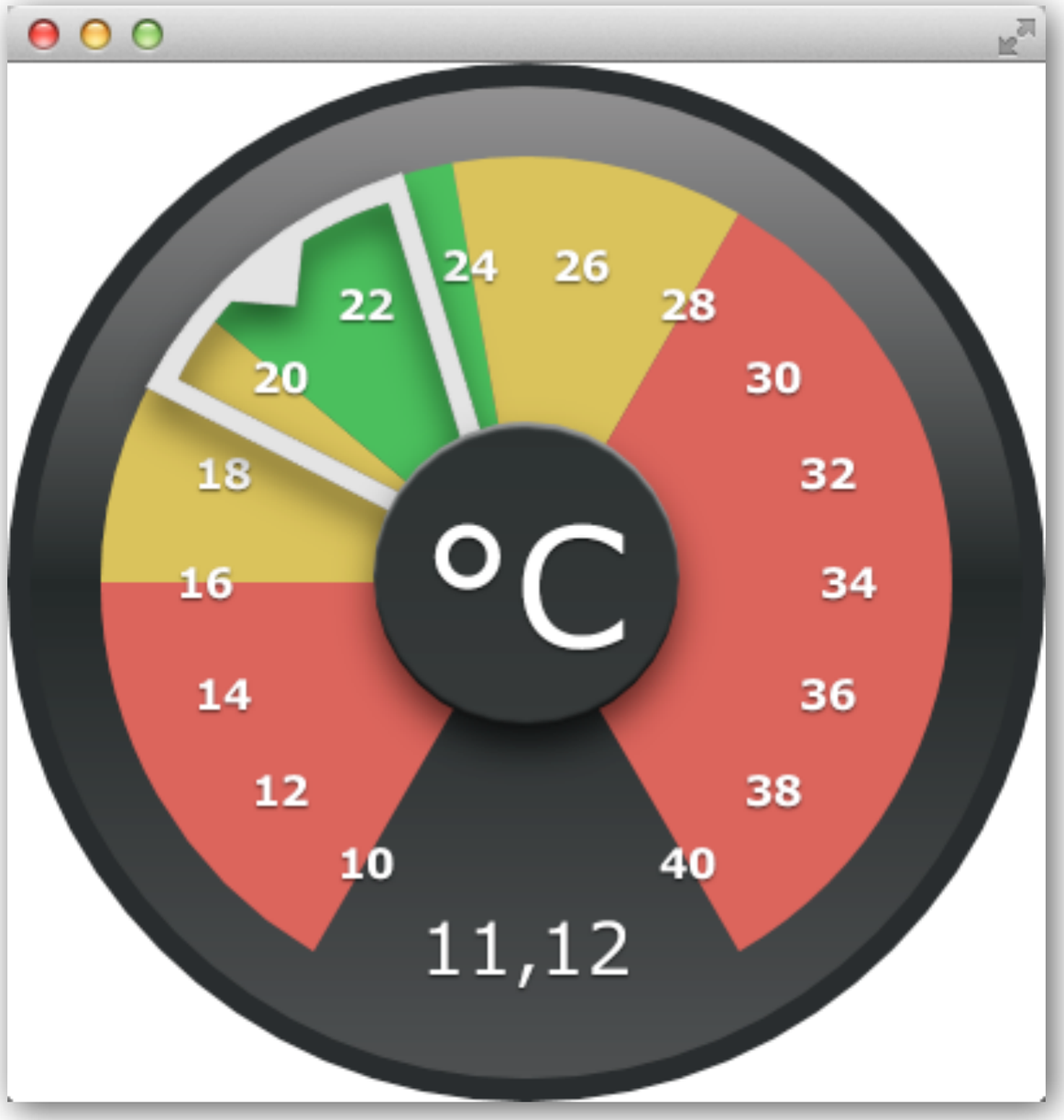
3 Nodes

245 Nodes

CONTENT

COMPROMISE

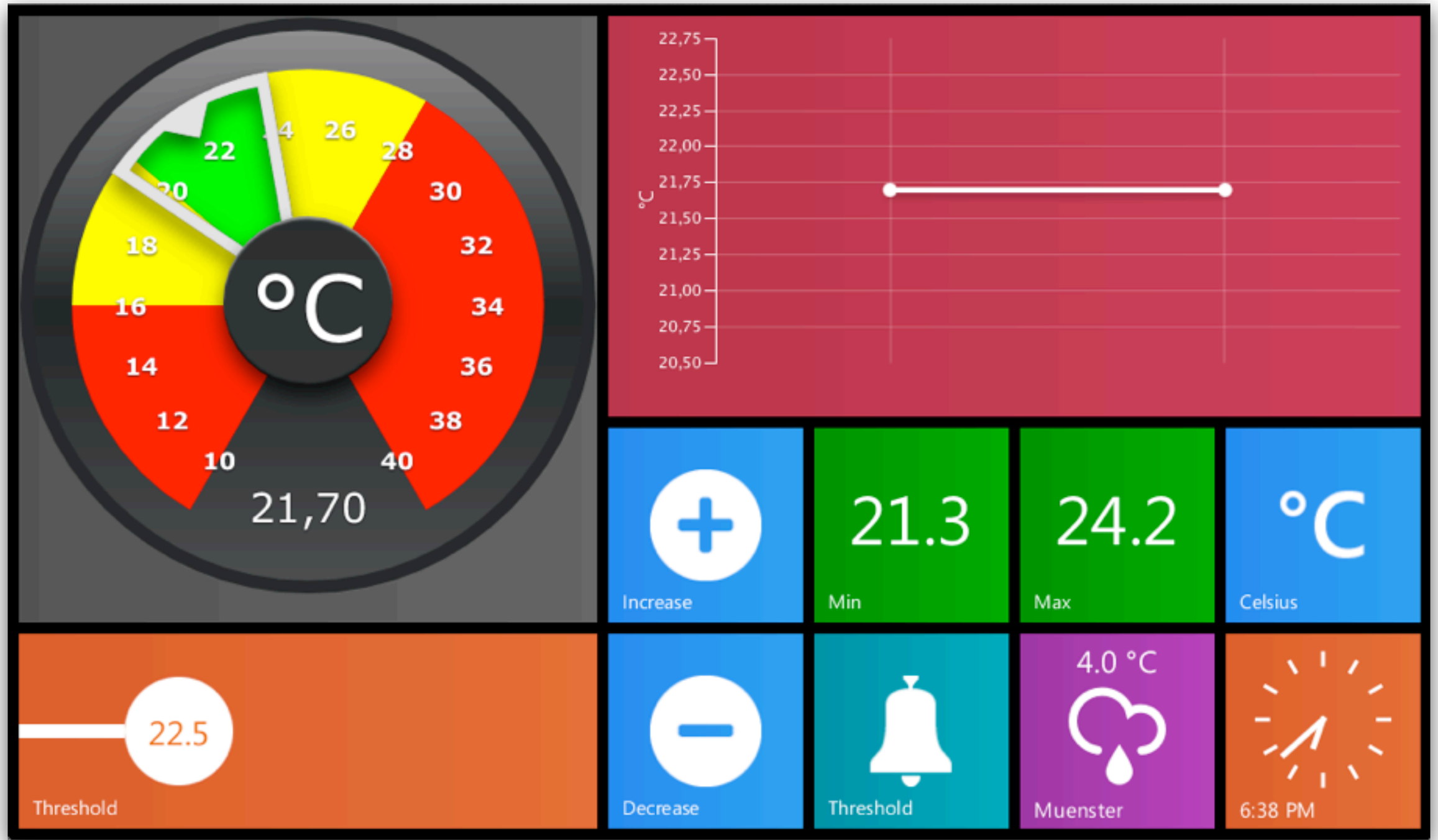




3 Nodes

33 Nodes

BeagleBoard xM



3

Desktop

APPLICATION

running on

JDK7

using JavaFX 2

Requirements

Requirements

- **Visualize the temperature**

Requirements

- **Visualize the temperature**
- **No platform dependency**

Requirements

- Visualize the temperature
- No platform dependency
- Feedback on current value

JavaFX Benefits

JavaFX Benefits

- **Cross platform**

JavaFX Benefits

- **Cross platform**
- **Good graphic support**

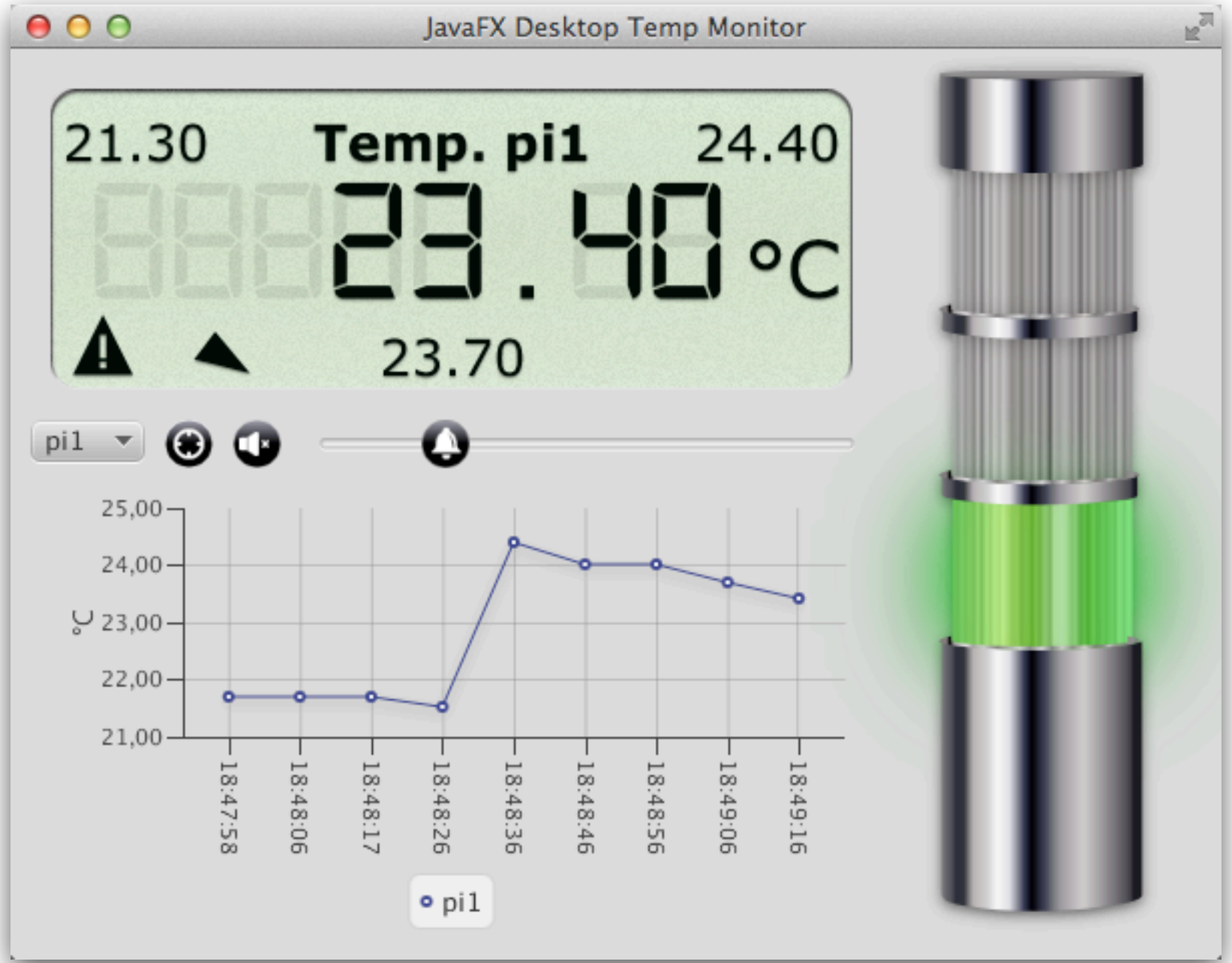
JavaFX Benefits

- **Cross platform**
- **Good graphic support**
- **Good audio support**

JavaFX Benefits

- Cross platform
- Good graphic support
- Good audio support
- Easy to implment

Desktop Client



HTML5

4

APPLICATION

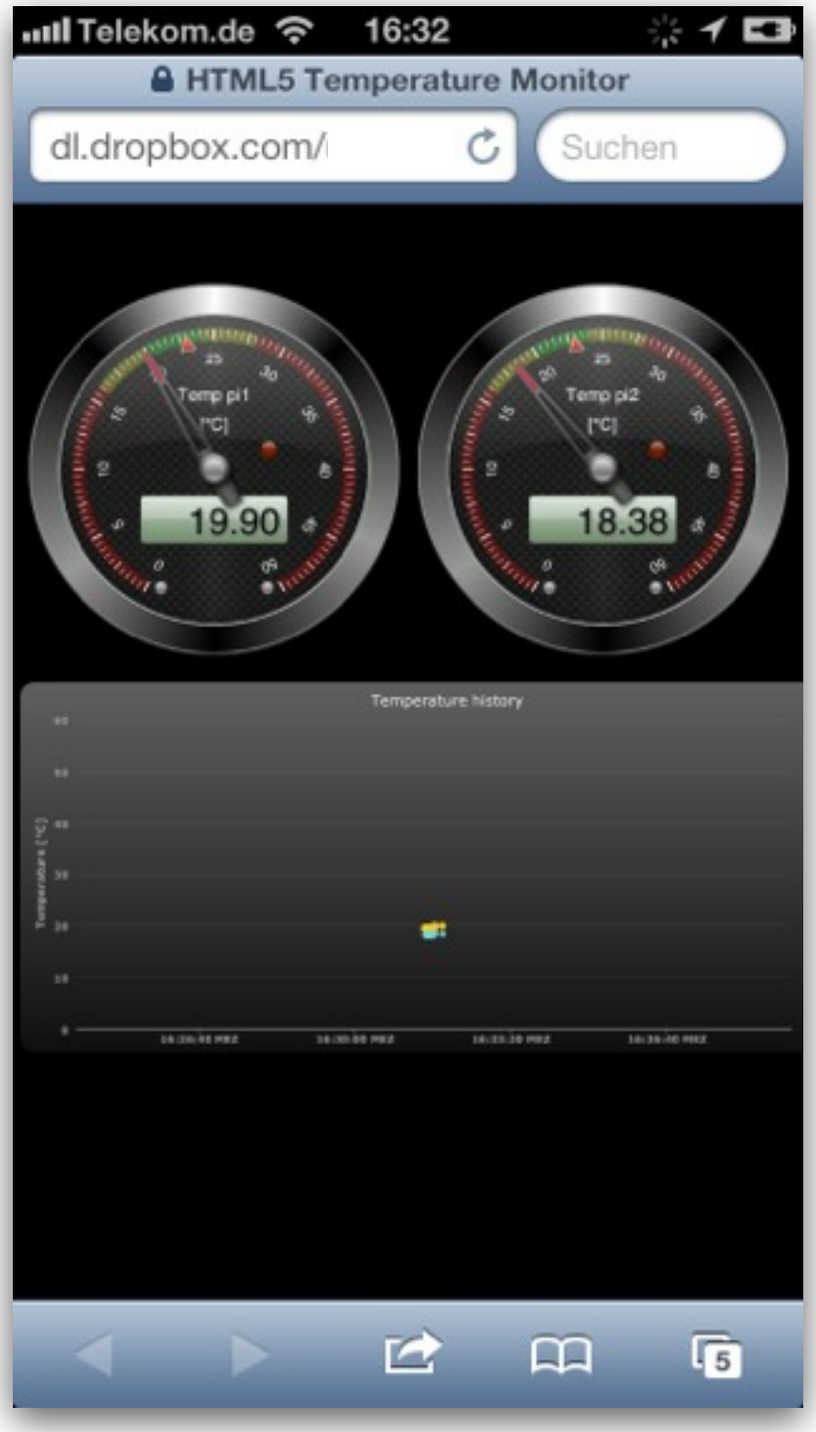
running on HTML5

using CANVAS

Requirements

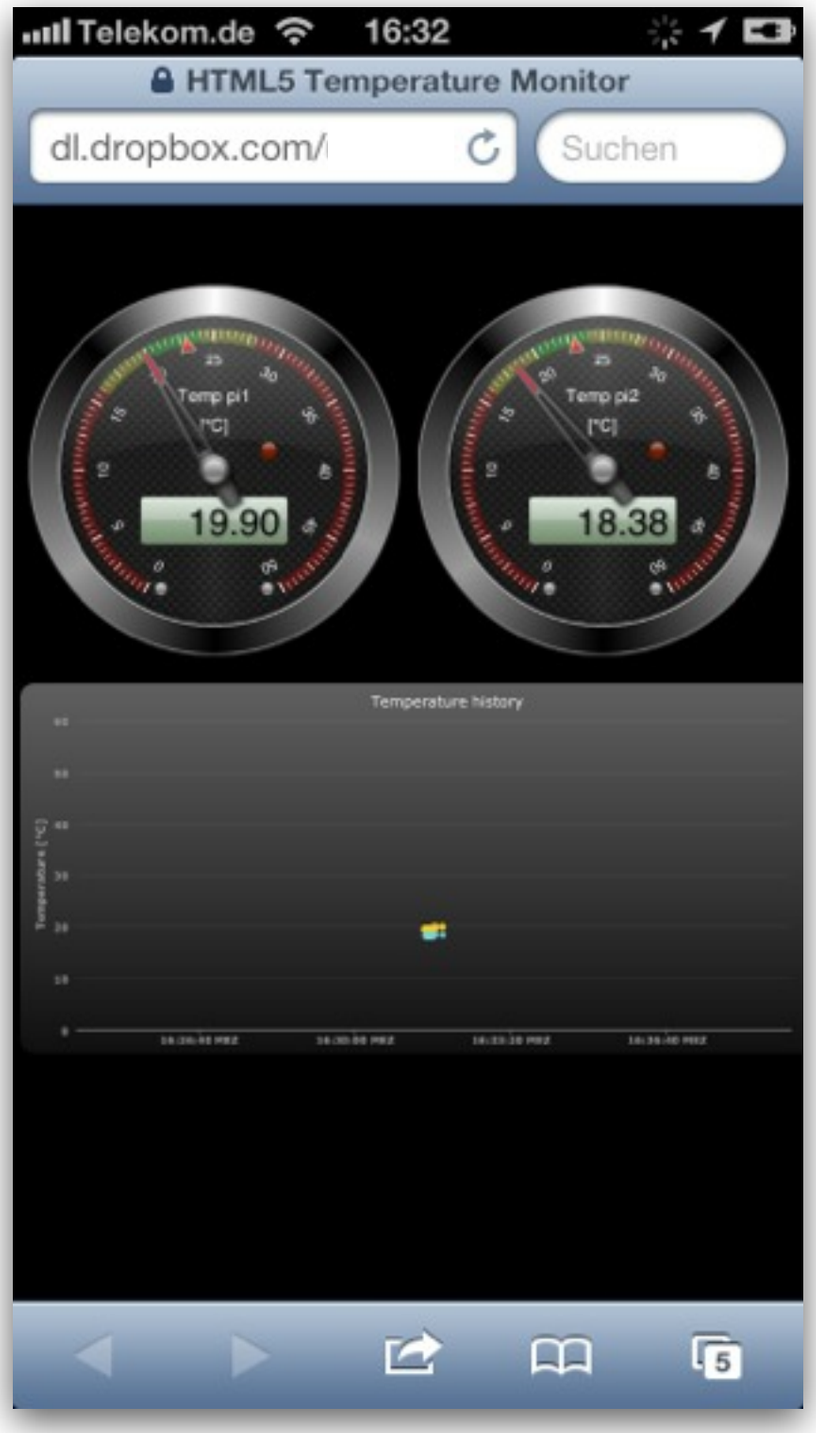
- **Monitor the temperature**

HTML5 on Phone



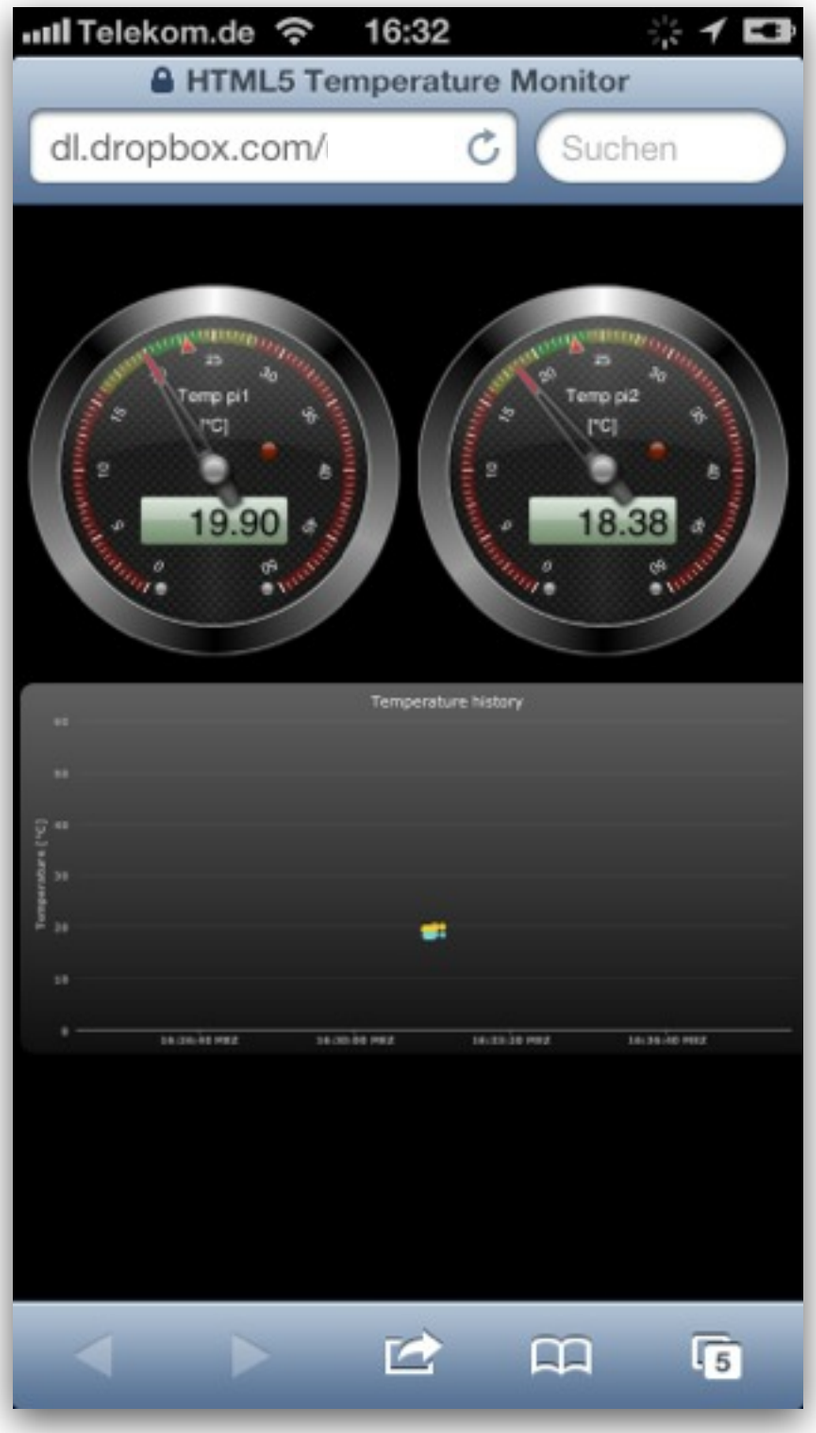
HTML5 on Phone

- **Pure JavaScript**



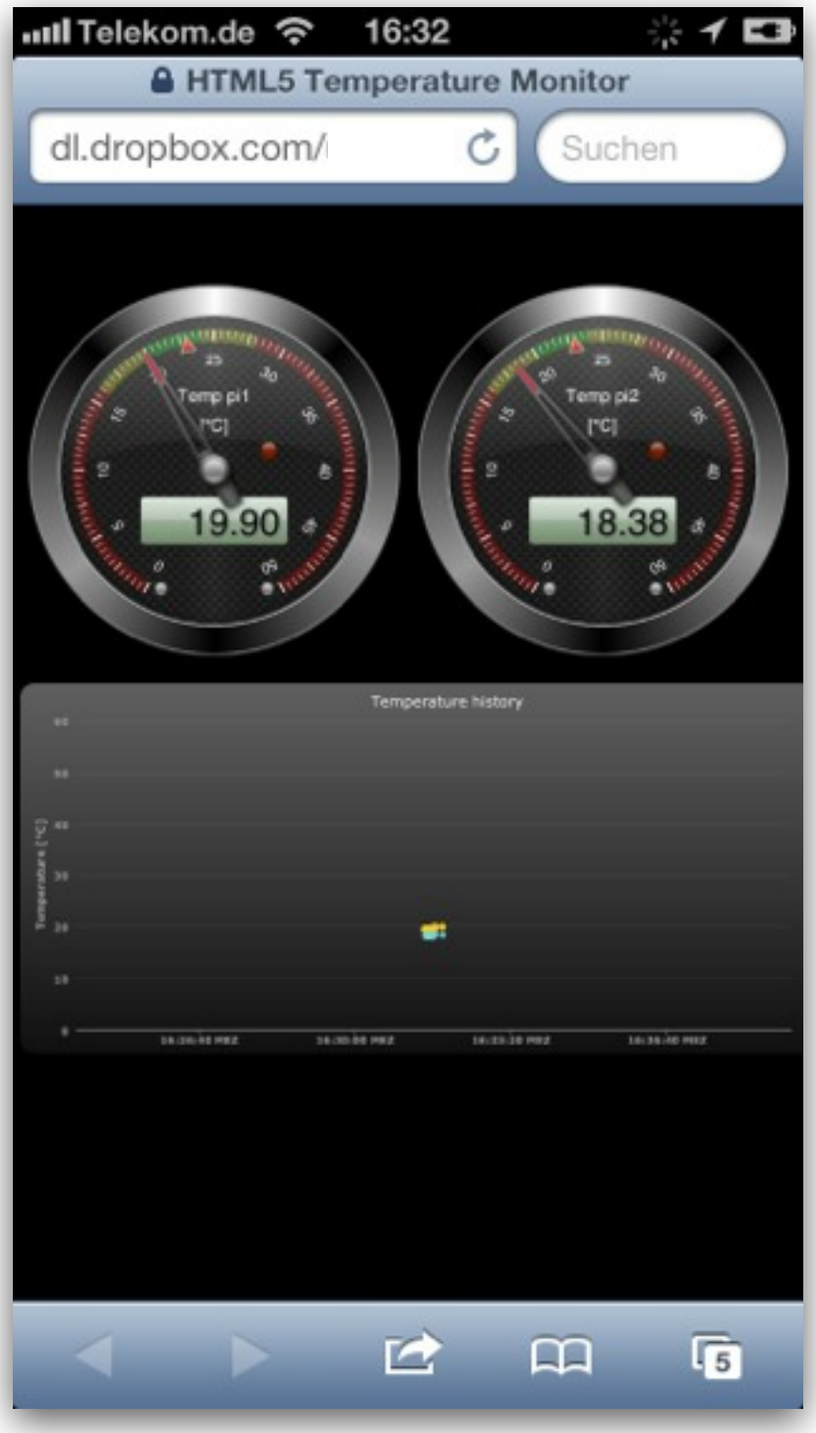
HTML5 on Phone

- **Pure JavaScript**
- **Using SteelSeries**

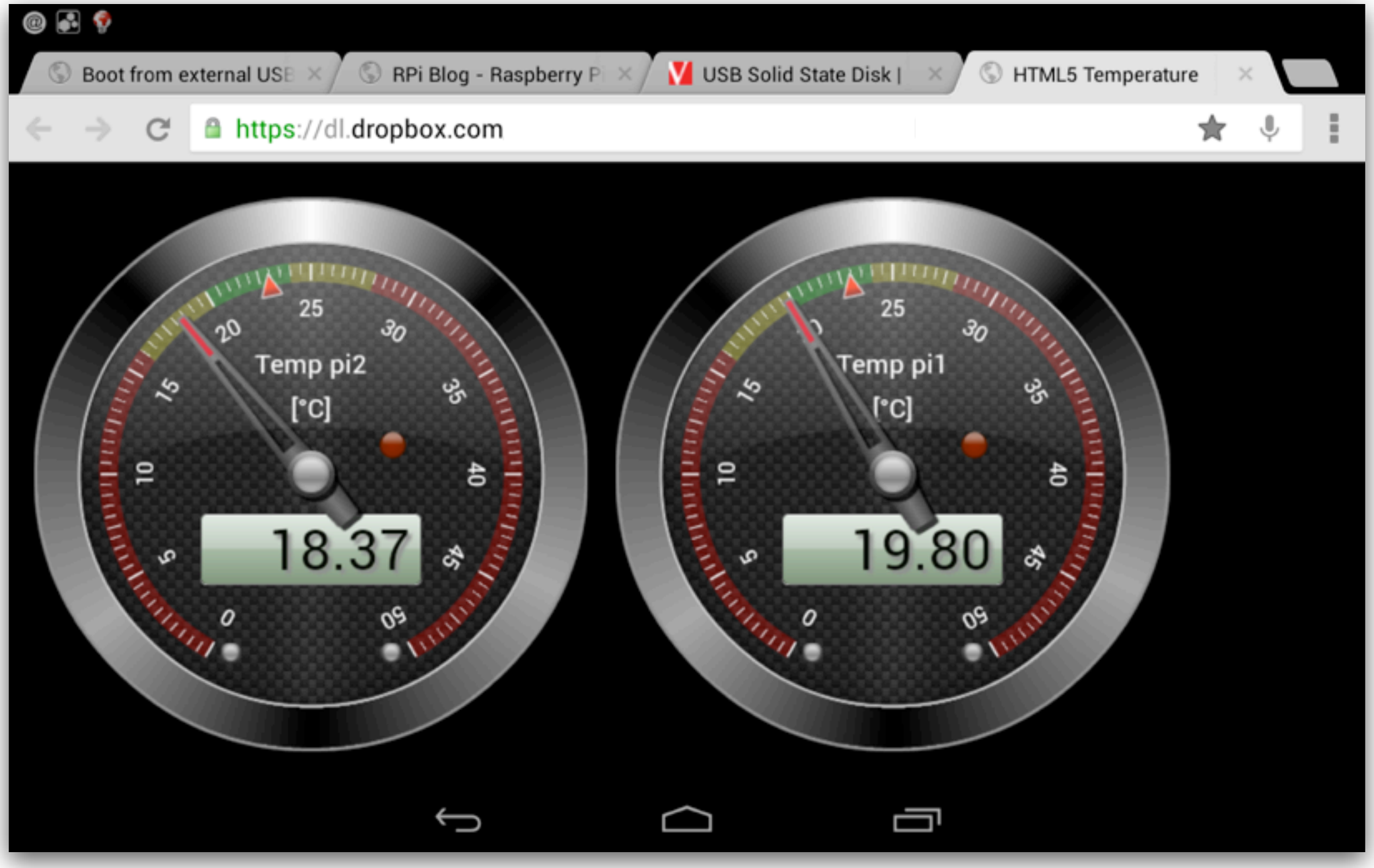


HTML5 on Phone

- Pure JavaScript
- Using SteelSeries
- Using Highcharts



HTML5 on Tablet



HTML5 on ???

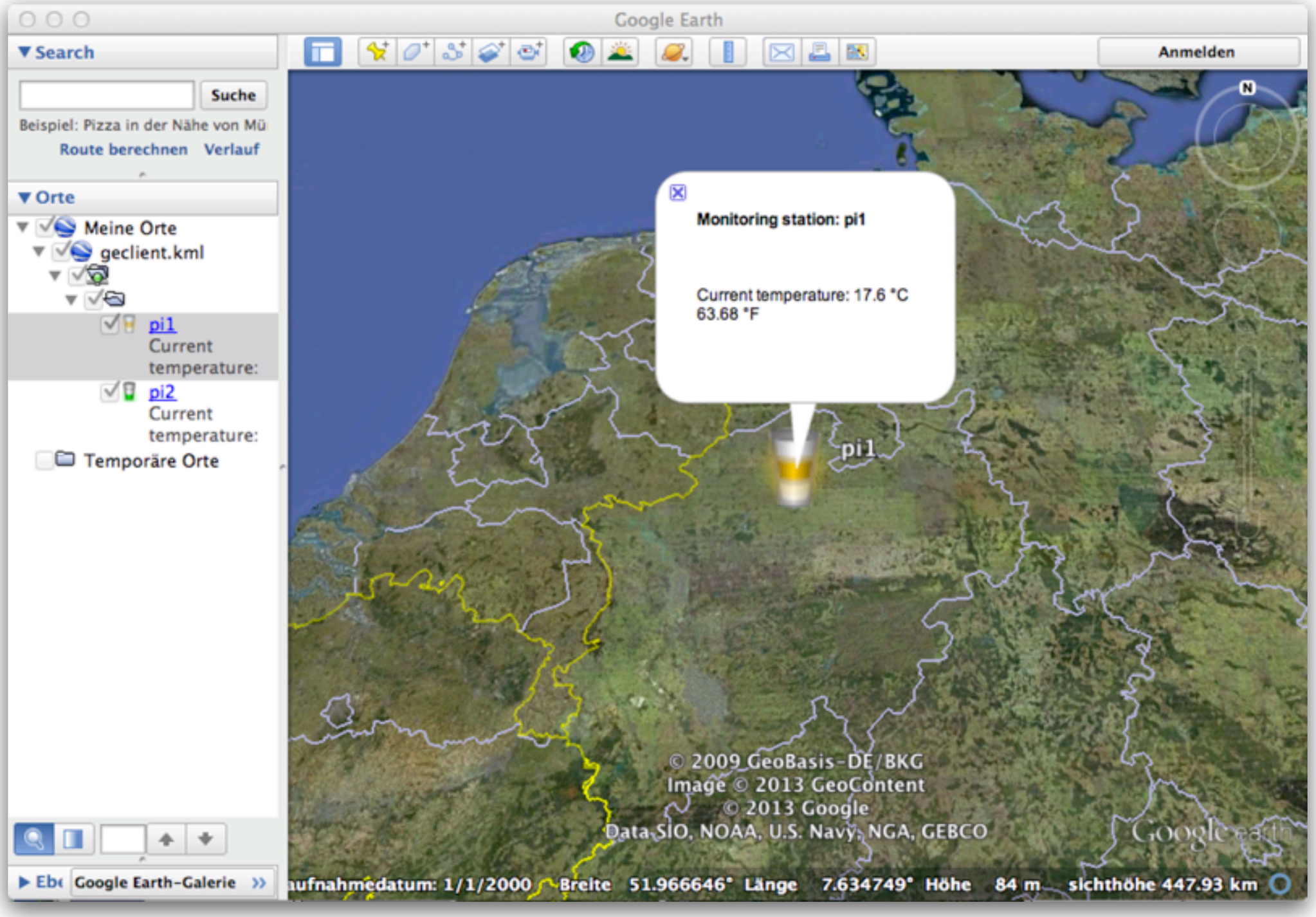

d.dropbox.com
Temp pi1
[°C]
16.30
Temp pi2
[°C]
16.38
START
SELECT
Wii U
MIC
HOME
TV
BATTERY
CONTROL
POWER

5

Just for the

FUN OF IT...

Google Earth client



Conclusion

JAVA(FX) ON EMBEDDED

really rocks...

Demo


keep coding...