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Linux, Android,Chromebook, Raspberry Pi & SBC

Pushing at the edges of supported platforms

More Info: http://embt.co/DelphiSBC &
http://embt.co/DelphiChromeOS

Jim McKeeth, Advocate & Engineer
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Embarcadero Technologies

About Jim McKeeth

- Chief Developer Advocate & Engineer

- Long time software developer

  - Delphi, C#, Java, JavaScript, Objective-C & C++

- Invented and patented pattern and swipe to unlock

  - US Patent # 8352745 & 6766456, etc.

- Built thought controlled drone with Google Glass

- Host of Podcast at Delphi.org

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- Lives near Boise, Idaho, USA with family & dogs

Internet of Things and Data Analytics Handbook

- Examines cloud computing, data analytics, and sustainability and how they relate to IoT

- Covers the scope of consumer, government, and enterprise applications

- Includes best practices, business models, and real-world case studies

- My chapter:
  The Brain–Computer Interface in the Internet of Things

- Edited by Hwaiyu Geng, 800 pages, January 2017, $150
  http://embt.co/IoTDataHandbook

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INTERNET OF THINGS AND DATA ANALYTICS *Handbook*

EDITED BY HWAIYU GENG

with website

WILEY
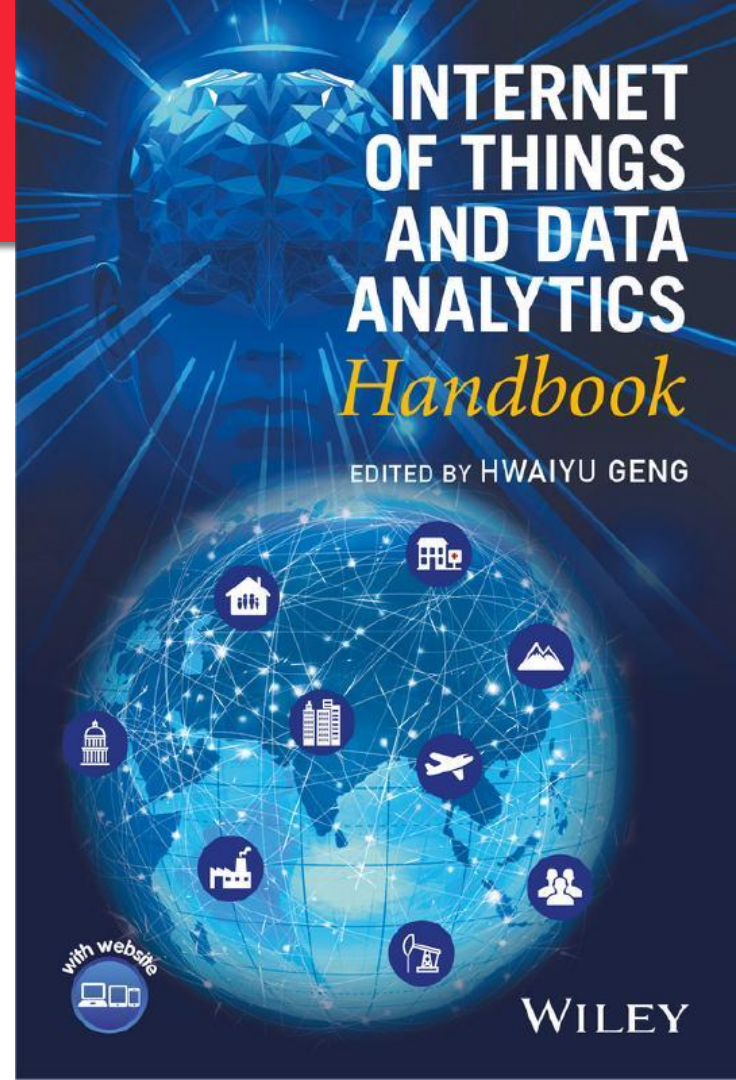
Agenda

- Overview of RAD Studio / Delphi & C++Builder

- Exploring CPU Architectures

- RAD Compiler Reminder

- Linux vs. Android vs. Windows

- List of SBCs

- Android & Linux on Chromebooks

- Other Delphi Linux Technologies

- The Future?

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RAD Studio, Delphi and C++Builder Overview

Delivering fast and powerful native applications for
Windows, Linux, macOS, iOS, Android, cloud and IoT

PRODUCTIVITY

Rapidly design, build, and run applications optimized for native performance, from a **single code base** across all platforms

USABILITY

Build amazing **user experiences** once with flexible components, and simply recompile for Windows, macOS, iOS and Android

SCALABILITY

Securely connect and embed any **data**, on any tier, in the **Enterprise**, or **cloud**

VELOCITY

Get to market **5x faster** using cross platform libraries for flexible cloud services, unified data access, IoT and more…
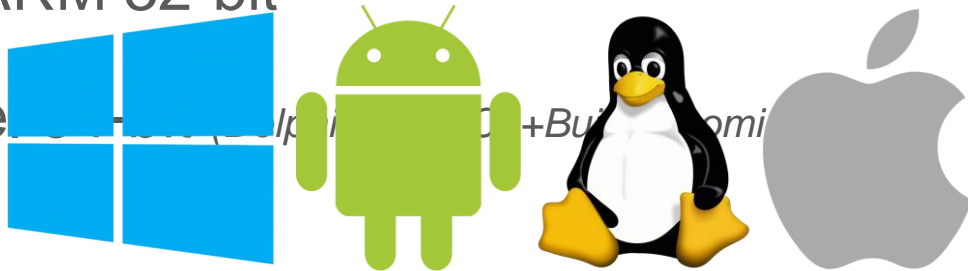
AGILITY

Develop using a **full-featured IDE**, integrated debuggers, code analysis, rapid prototyping, and much more…

The RAD Compilers

- Apple macOS / Intel 32-bit
- Apple iOS / ARM 32 or 64-bit

OS & Hardware sold together only

- Microsoft Windows / Intel 32 or 64-bit
- Android / ARM 32-bit
- Linux / Intel 64-bit *(Delphi RAD+Bug Romi...*


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What is an SBC?

- SBC = **S**ingle **B**oard **C**omputer

  - Processor, Memory, Storage, I/O, etc. on 1 board

- Usually very small form factor

- Also called hobby or project boards

- Typically priced around $100 USD or less

- Frequently use specialized chips

- More powerful than Arduino

- Usually runs Linux or Windows 10 IoT

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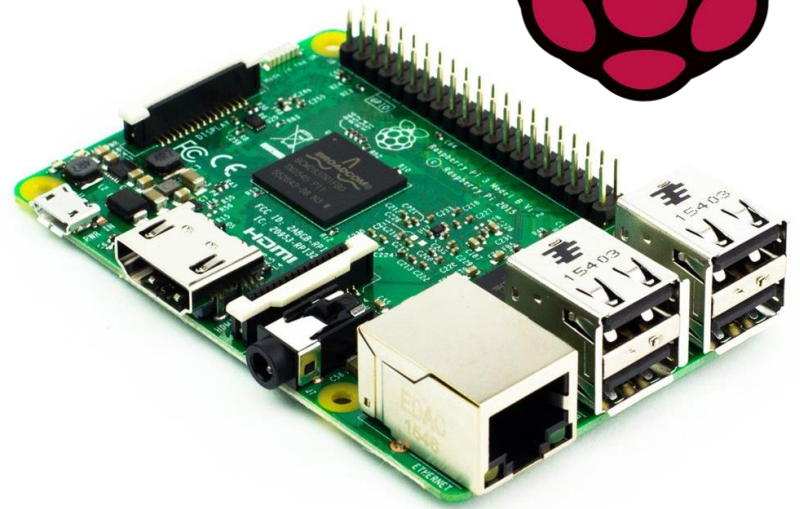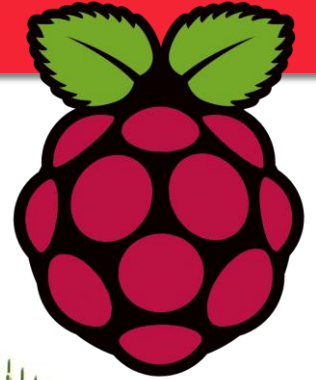
Some Use Cases

- Electronic Kiosk / Video dashboard

- Dedicated data collectors

- Automation control systems

- Edgeware & EdgePoints

- Point of sales systems

- Industrial automation

- Home media centers

- Digital assistants

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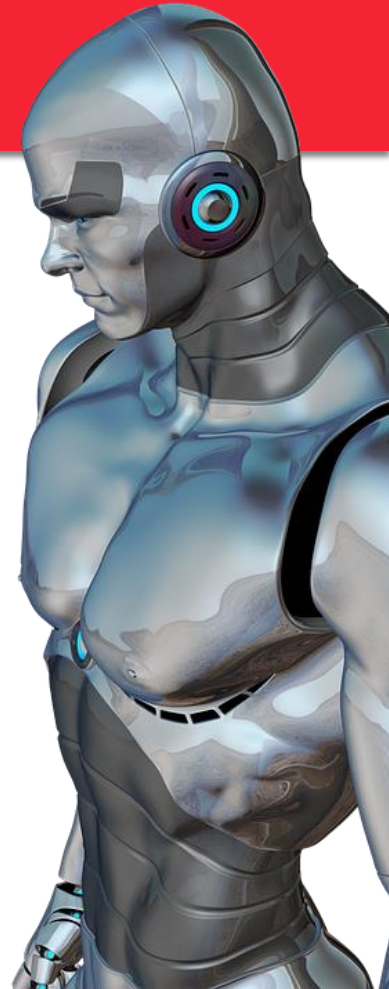
A Tale of Two Processor Families

intel

- Based on the x86 instruction set

- Includes the x86-64 extensions for 64-bit

- MMX, SSE and many other extensions are now standard

- Powers most desktops, servers & laptops

- The Atom is a low voltage line

- Atom powered some Android devices had ARM compatibility thanks to lik

- No longer used in Smartphones

ARM

- 32 & 64-bit RISC architectures

- Cortex is the ARMv7 family

- NEON and other extensions are now standard in v8

- Typically powers Smartphones, tablets, and smaller devices

- Many different lines for different uses

- Frequently used in System-on-Chip (SoC)

- Many different manufacturers

intel Atom inside™

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What about . . . ?

- Windows 10 IoT Core - Not supported

  - https://developer.microsoft.com/en-us/windows/iot

  - A scaled down and embeddable version of Windows,

  - Doesn't include all the libraries, and features of full Windows

- Android Things - Not supported

  - https://developer.android.com/things/

  - A scaled down version of Android

  - Doesn't include OpenGLES and other libraries

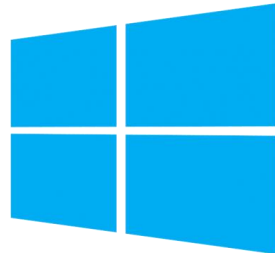- Linux ARM - *Not supported*

Linux vs. Android vs. Windows

- Android

  - Most basic - starter level

  - Good for if you need display

  - Video Kiosks, etc.

- Linux

  - Very versatile OS

  - Common use case is without a display

  - Data collection, networking, background processing, etc.

- Windows

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Android ARM SBC

- Raspberry Pi 3

  - www.raspberrypi.org

  - Usually Linux, but installing Android is easy - *details later*

- Banana Pi

  - www.banana-pi.org

  - Some models include Android images: M2, M3 & M64

- BeagleBone Black

  - beagleboard.org/black

  - Linux support via Rowboat beagleboard.org/project/rowboat/

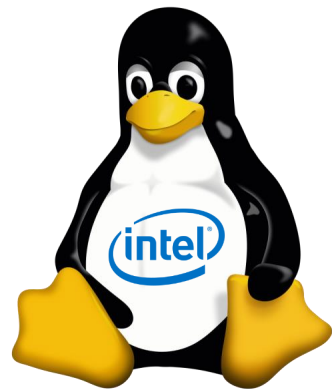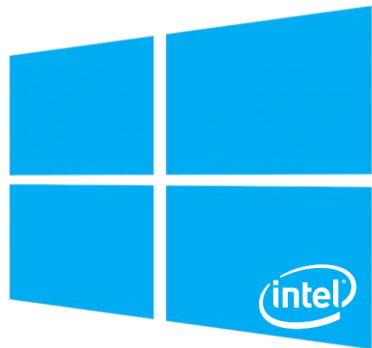# Intel SBC (Linux or Windows 10)

- LattePanda - www.lattepanda.com

- Udoo x86 Ultra - www.udoo.org

  - Works with any Windows or Linux (full x86-64)

  - Includes integrated Arduino

  - Full Windows 10 support

  } Very highly reviewed

- Others

  - Up-Board - www.up-board.org

  - MinnowBoard Turbot - minnowboard.org
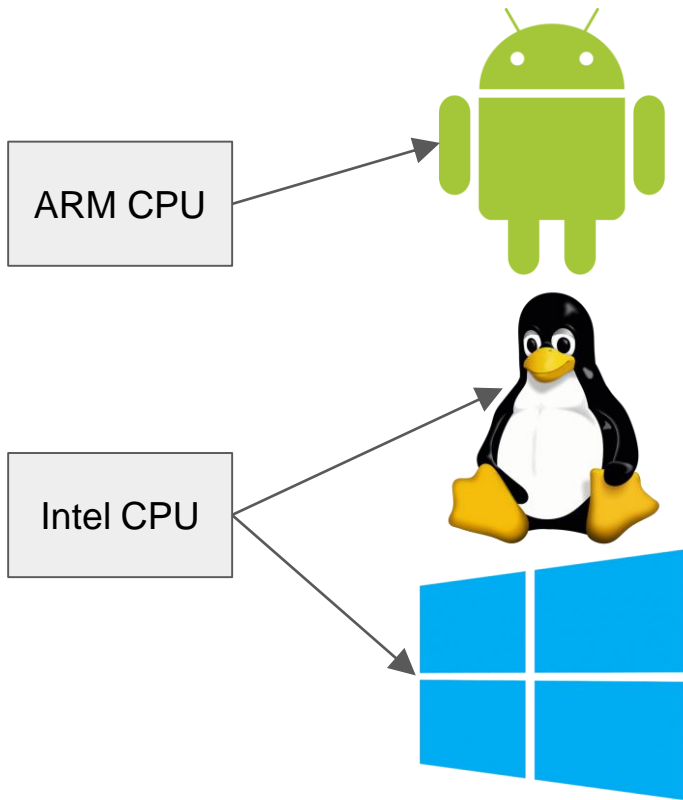
Also Intel Compute Stick

- Not as hobby or project focused as the other SBCs

- Powered by either Intel Core or Intel Atom processors

- Run Windows 10 or Ubuntu

- Wide range of configurations

- Similar physically to a Chromecast

- Micro SD Card, Bluetooth and USB port

- 4.5" long and plugs into a HDMI port

- Price $100 to $500 USD

Hardware + Operating System Guide

**Android on ARM**
- Raspberry Pi 3 Model B - raspberrypi.org
- Banana Pi - banana-pi.org
- BeagleBone Black - beagleboard.org/black
- Pine64.org
- ODROID from HardKernel.com
- Orange Pi - OrangePi.org

Linux or Windows on Intel
- LattePanda - lattepanda.com (What I used)
- Intel Compute Stick - embt.co/IntelComputeStk
- Udoo x86 Ultra - udoo.org (What I used)
- Up-Board - up-board.org
- MinnowBoard Turbot - minnowboard.org
- HummingBoard-Gate - solid-run.com
- Jaguar Board - jaguarboard.org

ARM CPU

Intel CPU

Android *is* Linux
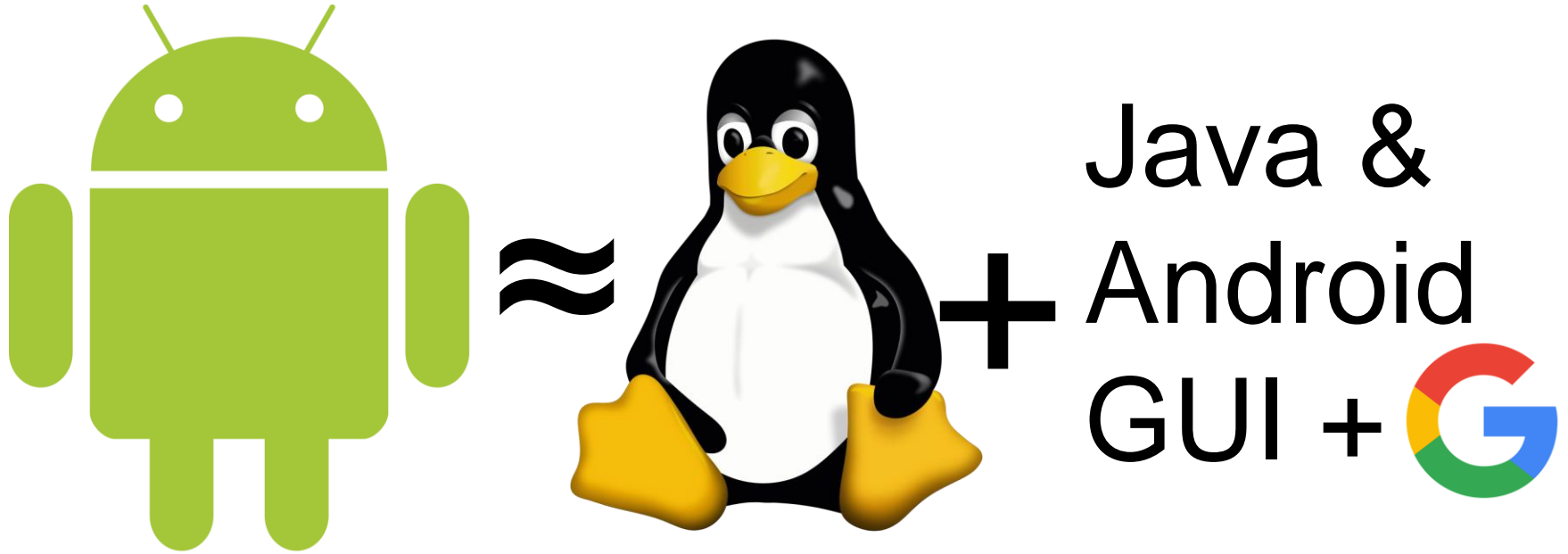
Raspberry Pi 3
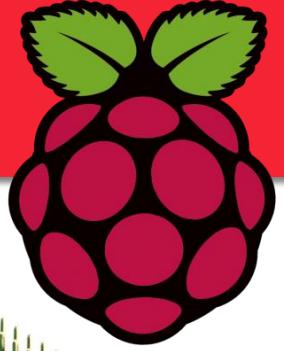
- On sale for $35 USD

- A 1.2GHz 64-bit quad-core ARMv8 CPU

- 802.11n Wireless LAN

- Bluetooth 4.1 & Bluetooth Low Energy (BLE)

- 1GB RAM & Micro SD card slot

- 4 USB ports, 40 GPIO pins, Camera interface (CSI), and Display interface (DSI)

- 10/100 ethernet, audio jack & composite video

Android on Raspberry Pi 3

- ASOP for RPi3

  - There is a branch in the official repository, but no code, *yet*

- Real-Time Android / Emteria

  - Commercial license

  - emteria.com

  - rtandroid.embedded.rwth-aachen.de/downloads/raspberry-pi/
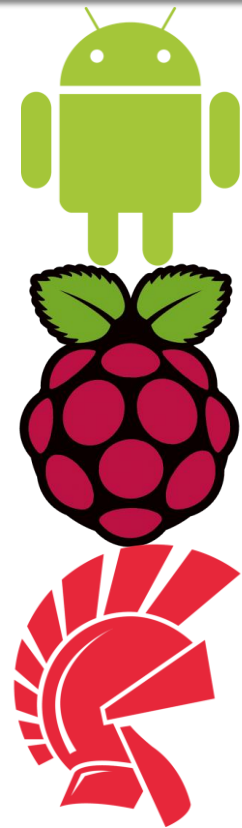
- Build from Code

  - github.com/android-rpi/device_brcm_rpi3

  - groups.google.com/forum/#!forum/android-rpi

Connect to RPi Android via ADB

- On Raspberry Pi running Android

  - Enable developer mode

  - Settings → About → Status → *Get the IP Address*

- On development machine

  -

  - List: adb devices

- In your IDE Switch to Android and Refresh

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Auto Starting Android App

- Done via a Broadcast Receiver

- Need to write a little Java stub

- Broadcast receivers can respond to a number of system events

- Requires permissions and your app to run first before it can be notified

- Can also start Android Services

- Danny Wind has a tutorial from XE5
  - http://dannywind.nl/auto-start-delphi-xe5-

Android System

Registers for Intents to Observe

Notification when Inten Occurs

Broadcast Receiver (in your app)
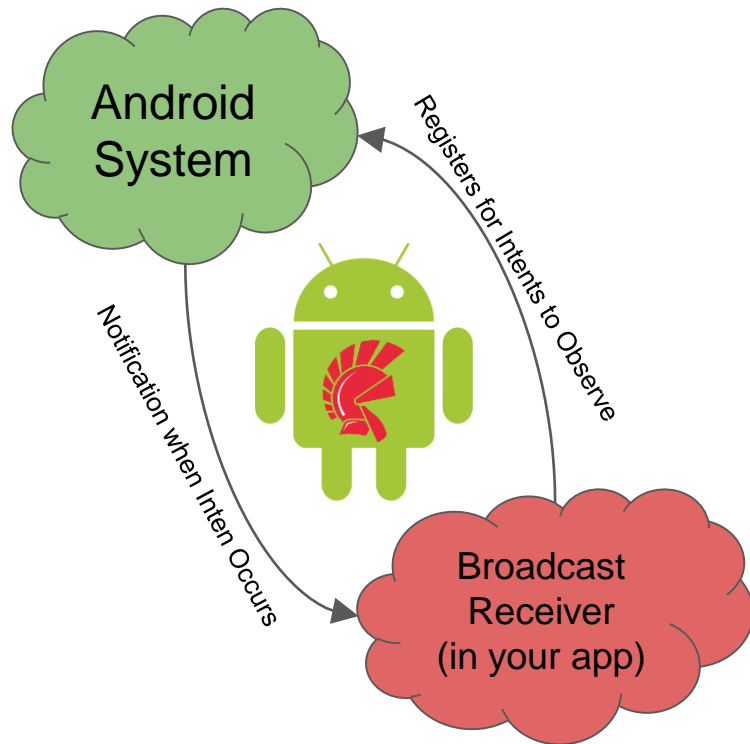
WebBroker Server on Raspberry Pi Android

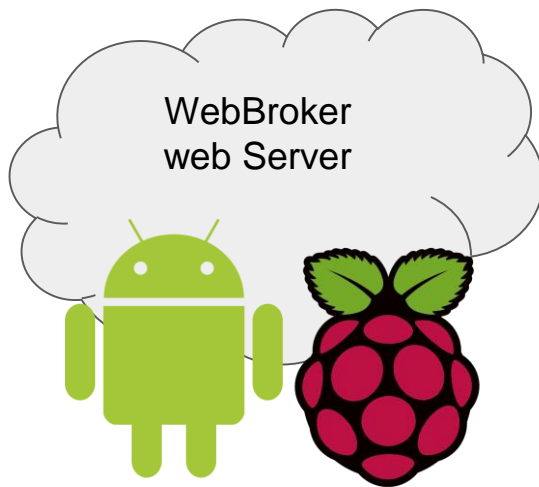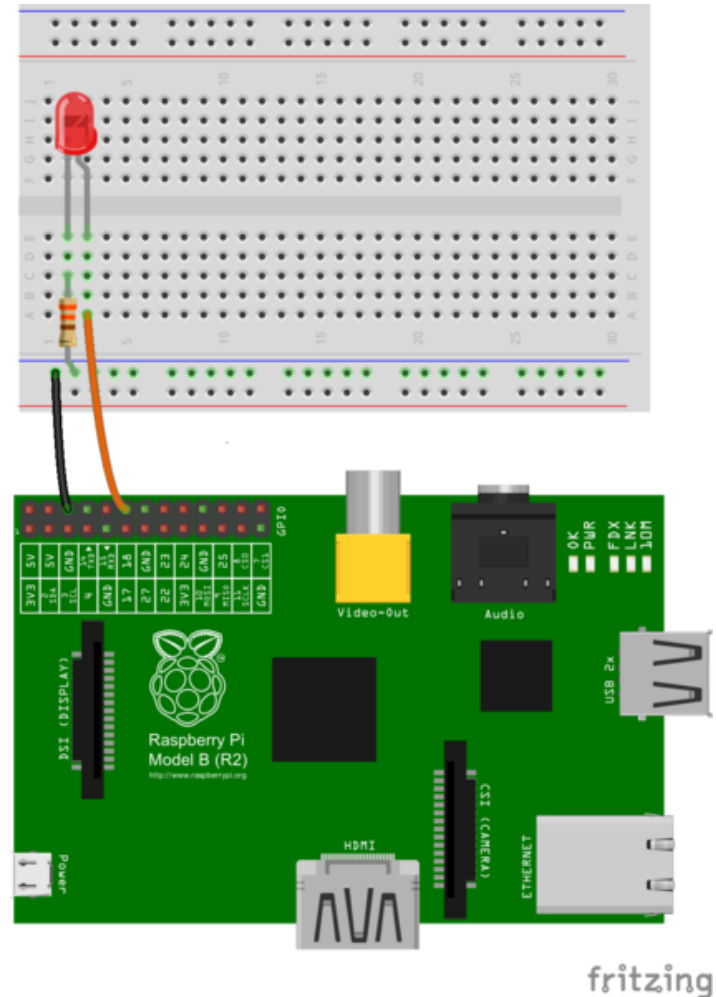- There is no WebBroker project for Android

- But you can take a web broker project and move it to Android

- Requires a little manipulation, but it works

- Could also be an Android Service

- Works because WebBroker and Indy also support Linux

- Could build other internet server projects with Indy too

WebBroker
web Server

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GPIO Pins

3V3	5V
2 SDA	5V
3 SCL	GND
4	14 TXD
GND	15 RXD
17	18
27	GND
22	23
3V3	24
10 MOSI	GND
9 MOSI	25
11 SCLK	8 CS0
GND	7 CS1
EPROM	EPROM
5	GND
6	12
13	GND
19 MISO	16
26	20 MOSI
GND	21 SCLK

Diagrams from http://fritzing.org/home/
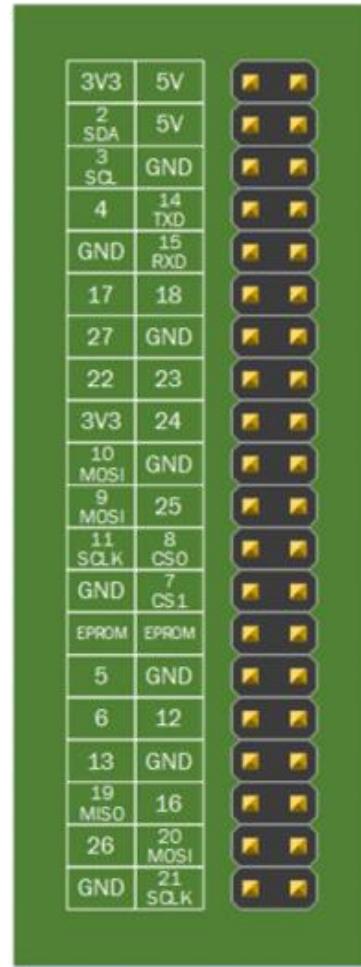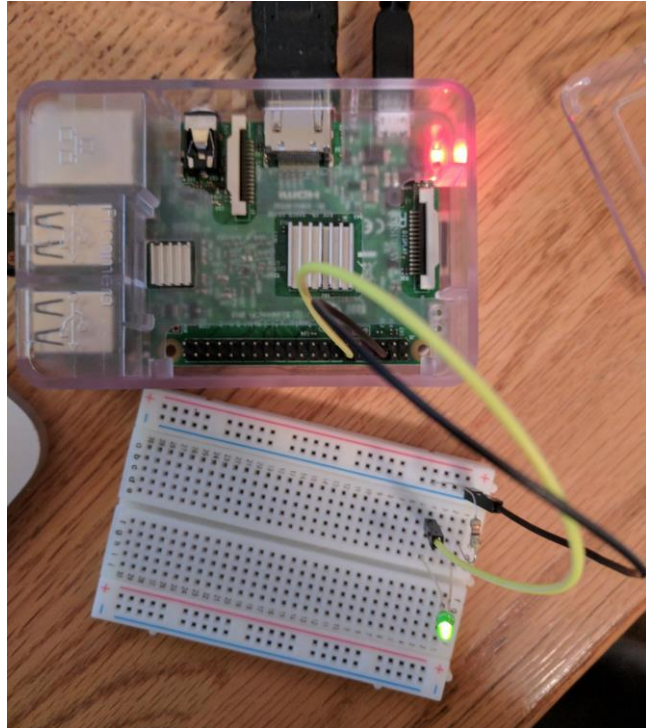
GPIO Pins

- Setup

  - `echo 18  > /sys/class/gpio/export`

    - Turns on pin 18

  - `echo out > /sys/class/gpio/gpio`**18**`/direction`

    - Sets pin 18 as output

- Write

  - `echo 1 > /sys/class/gpio/gpio18/value`

  - `echo 0 > /sys/class/gpio/gpio18/value`

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Steps to Create Web Broker on Android
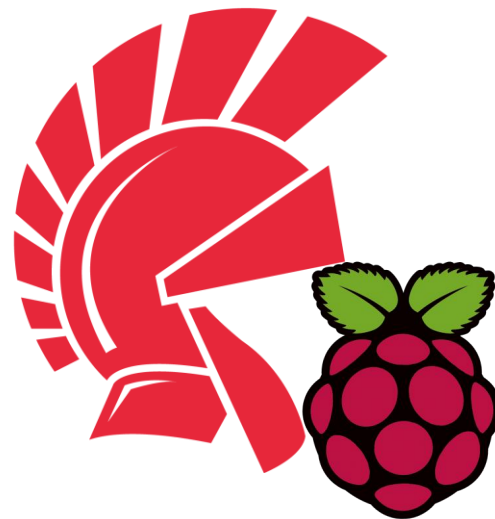
- Create regular FMX app

- Remove unit

- Save & Close project - this is going to be your Web Broker app

- Create new WebBroker server: Windows, Stand Alone, FireMonkey, Port 8080

- Save the units, but not the project

- Reopen FMX project. Add the units from the web broker project

- Add Web.WebReq & IdHTTPWebBrokerBridge to the project uses clause

- To the main block in the project add

Steps to Create WebBroker on Android (cont)

- Copy these files over into your project folder

    - Web.WebBroker.pas

    - IdHTTPWebBrokerBridge.pas

    - IdCompilerDefines.inc

    - Web.WebReq.pas

- Remove the Windows specific units from your main form

- Remove the ShellExec from the Launch Browser button

- Switch target to Android and deploy!

More Resources

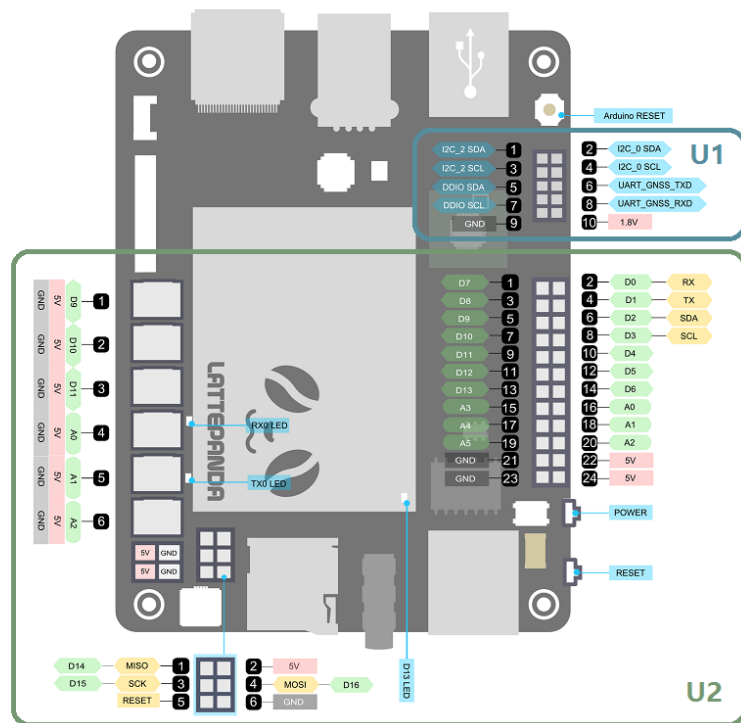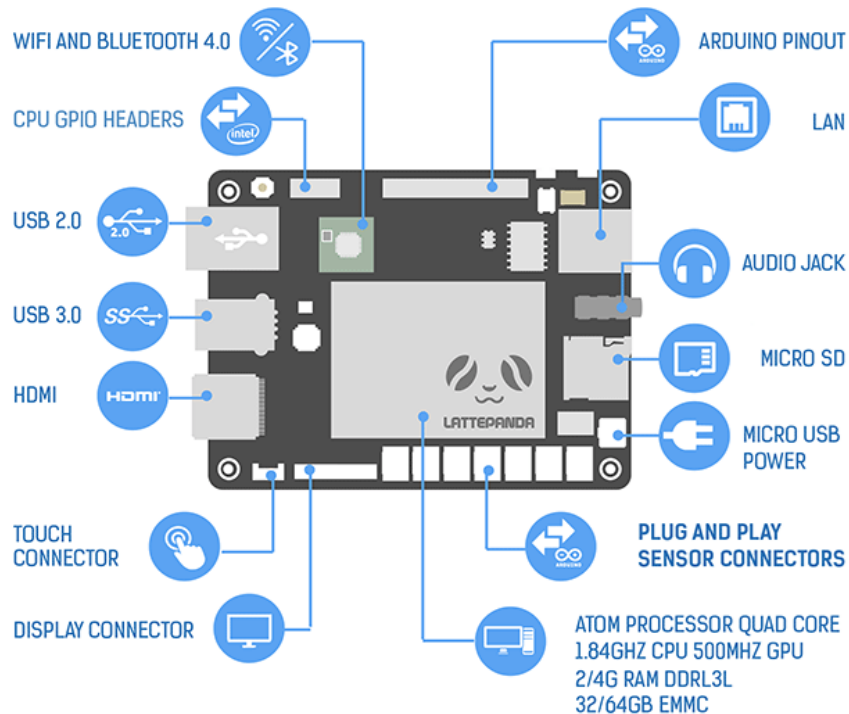- Create a shortcut on Android

  - http://www.fmxexpress.com/install-shortcuts-on-the-android-home-screen-with-delphi-xe5-firemonkey/

- Autostart

  - http://dannywind.nl/auto-start-delphi-xe5-android-app-after-boot/

- Object Pascal Android Wrappers

  - https://github.com/FMXExpress/android-object-pascal-wrapper

- Part 1 & 2 of this webinar with code and more

  - http://embt.co/DelphiSBC

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LATTEPANDA

WIFI AND BLUETOOTH 4.0

CPU GPIO HEADERS

ARDUINO PINOUT

LAN

USB 2.0

AUDIO JACK

USB 3.0

MICRO SD

HDMI

MICRO USB POWER

TOUCH CONNECTOR

DISPLAY CONNECTOR

PLUG AND PLAY SENSOR CONNECTORS

ATOM PROCESSOR QUAD CORE
1.84GHZ CPU 500MHZ GPU
2/4G RAM DDRL3L
32/64GB EMMC

Arduino RESET

U1

I2C_2 SDA	1	2	I2C_0 SDA
I2C_2 SCL	3	4	I2C_0 SCL
DDIO SDA	5	6	UART_GNSS_TXD
DDIO SCL	7	8	UART_GNSS_RXD
GND	9	10	1.8V

GND	5V	D9
GND	5V	D10
GND	5V	D11
GND	5V	A0
GND	5V	A1
GND	5V	A2

D7	1	2	D0	RX
D8	3	4	D1	TX
D9	5	6	D2	SDA
D10	7	8	D3	SCL
D11	9	10	D4
D12	11	12	D5
D13	13	14	D6
A3	15	16	A0
A4	17	18	A1
A5	19	20	A2
GND	21	22	5V
GND	23	24	5V

RX0 LED

TX0 LED

POWER

RESET

D13 LED

D14	MISO	1	2	5V
D15	SCK	3	4	MOSI	D16
	RESET	5	6	GND

U2

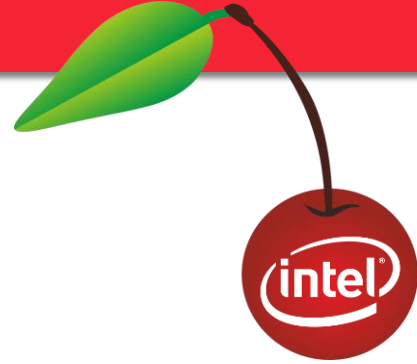# LATTEPANDA

- Processor: Intel Cherry Trail Z8300 Quad Core 1.8GHz

- Operation System: Pre-installed full edition of Windows 10

- Ram: 4GB DDR3L

- Storage Capability: 64GB + Micro SD card

- GPU: Intel HD Graphics, 12 EUs @200-500 Mhz, single-channel memory

- One USB3.0 port and two USB 2.0 ports

- WiFi, Bluetooth 4.0 & 100Mbps Ethernet

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- Built-in Arduino Co-processor: ATmega32u4 (like Arduino Leonardo or Micro)
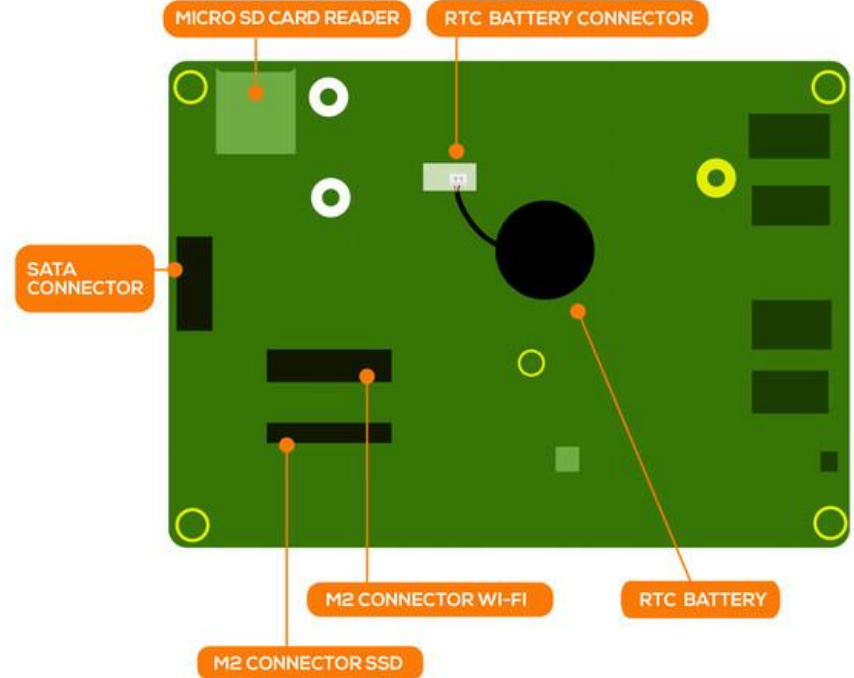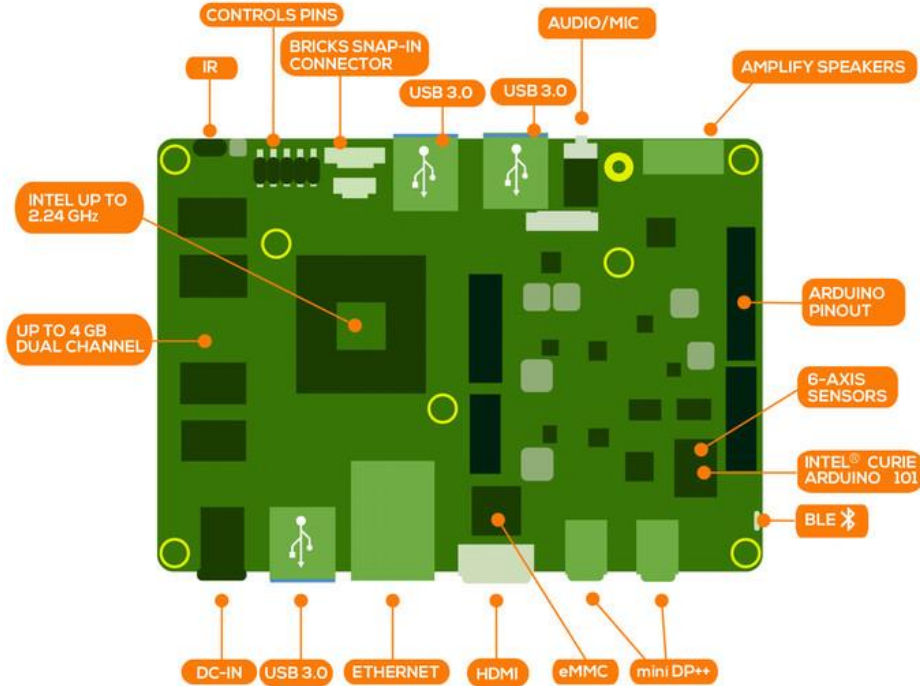
LATTEPANDA

- To install Linux

  - Create USB Install media - I used Ubuntu 17.04 (Zesty Zapus) Desktop

  - [ESC] to enter BIOS and change boot order

  - To get WiFi working (didn't work for me)

    - http://www.lattepanda.com/forum/viewtopic.php?f=6&t=58&start=90

- To reinstall Windows 10 Home

  - Download image and follow instructions

    - http://www.lattepanda.com/docs/#How_to_re-install_LattePanda_Windows_system
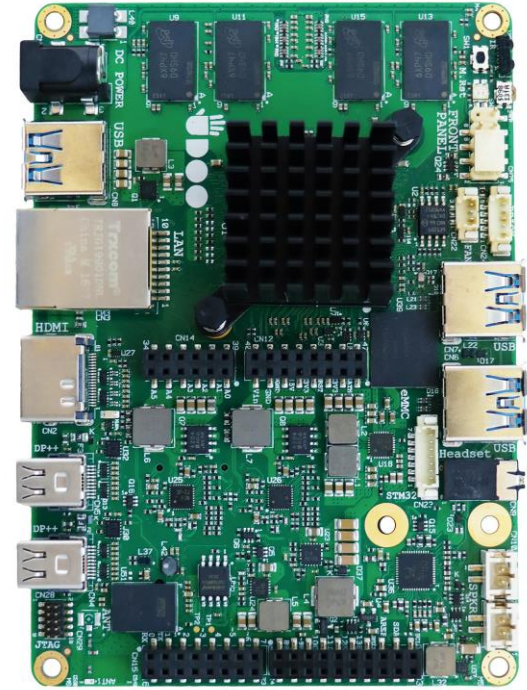
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Udoo x86 Ultra

Udoo x86

- Starts at $125 USD

- Intel Atom, Celeron or Pentium processor

- 2.0 Ghz to 2.56 Ghz SOC CPU

- 2 GB to 8 GB DDR3L RAM

- Onboard storage options

- Includes SSD and SATA storage

- Integrated Arduino (101 compatible)
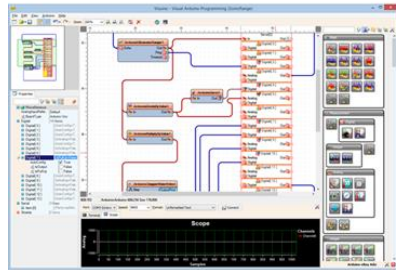
- GPIO Pins for Arduino and x86 processor

Arduino Boards

- Very low cost
- Very small
- Limited functionality
- Microcontrollers
- Extensible
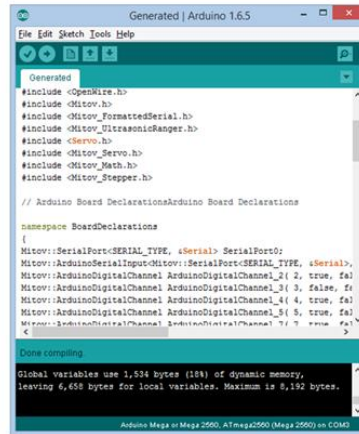 - Sensors
  - I/O
  - Wireless

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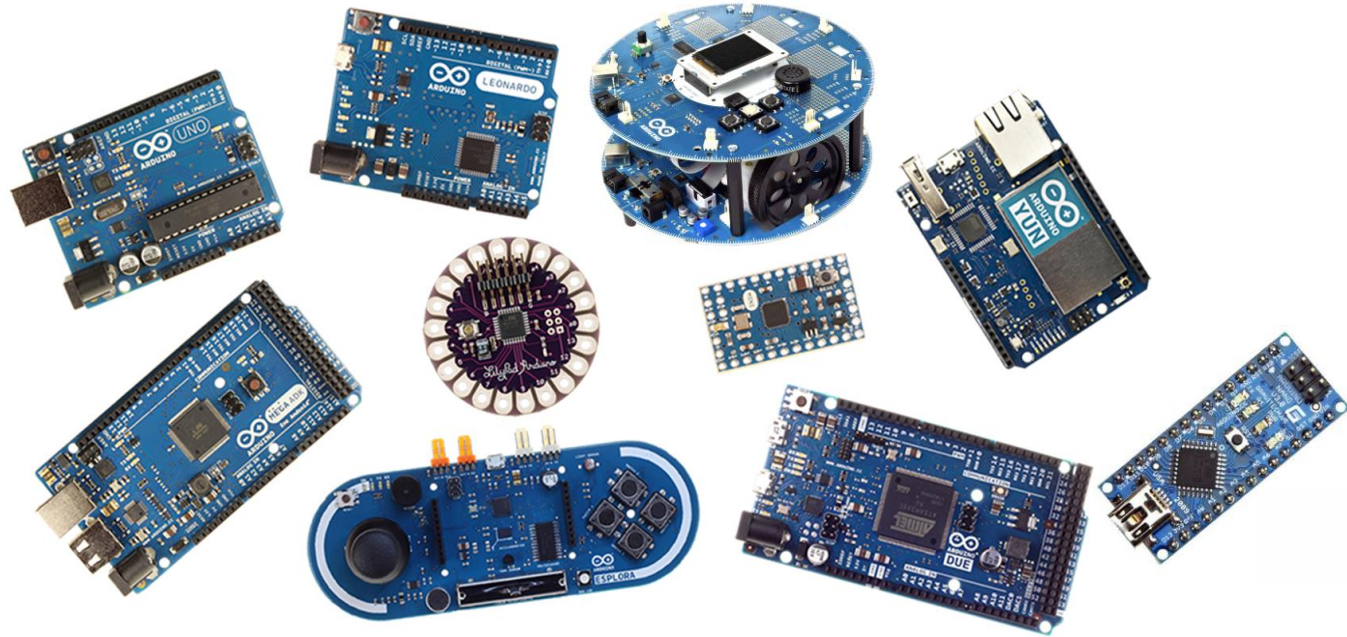
The Visuino IDE -- www.visuino.com

$9.99 USD
www.visuino.com

Works with Mitov Software's Communication lab or other serial
components to connect to your Delphi & C++Builder apps
http://www.mitov.com/products/communicationlab

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The Future (predictions)

- RAD Compilers

  - C++Builder compiler for Intel Linux is coming very soon

  - Linux ARM compiler is a possibility

  - Windows 10 IoT and Android Things may get direct support too

- SBCs will get smaller and more powerful

- The importance of connected projects will continue to increase

- Microservices on SBCs to created distributed

This is all speculation by Jim and not an official Embarcadero Road Map

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Emoji by Twitter https://twitter.github.io/twemoji/

What is Chrome OS

- Chrome OS is Google's entry into the OS work

- Linux running a modified Chrome browser

- Most use ARM CPUs

- Halfway between a tablet and a laptop

  - Lightweight with a keyboard and usually a touch screen

- Designed around the cloud

- Supports offline work and local storage

- Sold by Google and 3rd Parties

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Why Chrome OS?

- Chromebooks are very affordable computing options

- Yet another platform you can target with your Android development

- They are very, very popular in education around the world

- They are outselling Apple Macbooks (per IDC as of May 2016)

- Super Safe OS *(when not in developer mode)*

- There are also desktop, set top and dongle variants

- Neverwear is repackaging Chrome OS as CloudReady for existing systems
  - https://www.neverware.com/#getcloudready

Android Compatible Chromebooks

- May 2016

    - Google announces plans to bring Android (Play Store) to Chrome OS

- Jan 2017

    - Google confirms "all Chromebooks launching in 2017 and after" will support Android apps "in the coming future."

    - At CES Google and Samsung announce two new Chromebooks built around Android + Chrome OS

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Android compatible Chromebooks (cont)

Play Store available in **Stable** Channel

- Acer Chromebook R11

- Acer Chromebook Spin 11

- AOpen Chromebook Mini

- AOpen Chromebase Mini

- ASUS Chromebook Flip C100PA

- ASUS Chromebook Flip C213

- Google Chromebook Pixel (2015)

- **Samsung Chromebook Plus**

- **Samsung Chromebook Pro**

Play Store available in **Beta** Channel

- Acer Chromebook R13, 11 N7 & 15
- ASUS Chromebook C202SA & C300SA
- CTL NL61 Chromebook
- Dell Chromebook 11, 11 Convertible & 13
- HP Chromebook x360 11 G1 EE, 11 G5 EE & 13 G1
- Lenovo ThinkPad 11e Chromebook (Gen 4) & Yoga
- Lenovo Flex 11 Chromebook
- Lenovo N23 Yoga, N22, N23 & N42
- Mercer Chromebook NL6D
- Samsung Chromebook 3

Official Complete List:
https://www.chromium.org/chromium-os/chrome-os-systems-supporting-android-apps

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Chrome OS Developer Mode

- Useful links

    - http://embt.co/DelphiChromeOS-DevMode

    - https://www.chromium.org/chromium-os/poking-around-your-chrome-os-device

- It would appear the steps can vary from device to device, but it seems like most of them support these steps . . .

- Recovery mode: hold down the **[ESC], [Refresh]** and poke the Power button

- To enter Dev-mode press **[Ctrl]-[D]** (there's no prompt)

- It will ask you to confirm, then reboot into dev-mode.

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Setting Up ADB

- Useful link: http://embt.co/DelphiChromeOS-ADB

- From the terminal shell

  - sudo crossystem dev_boot_signed_only=0

  - sudo /usr/libexec/debugd/helpers/dev_features_rootfs_verification

  - sudo reboot

  - sudo /usr/libexec/debugd/helpers/dev_features_ssh

- Go to settings

  - Enable Play Store

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- Manage Android Preferences

Resizable Apps on Chrome OS

- Modify your AndroidManifest.template.xml

- Replace the <uses-sdk … /> line with

  - `<uses-sdk android:minSdkVersion="24" android:targetSdkVersion="24" />`

- And you will also want to add savestate persistence support

  - http://docwiki.embarcadero.com/RADStudio/en/FireMonkey_Save_State

- On Intel Chromebooks the libHoudini layer causes an offset of touches equal to the height of the status bar. To work around this set the FullScreen property on your form to True.

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What About C++Builder?

This all works with C++Builder
Android apps on Chromebooks too!

Wait, You Said Linux Too!

- Easiest way is to use "crouton" which is a *chroot*

  - Instructions & Info https://github.com/dnschneid/crouton

- Copy LinuxPAServer19.0.tar.gz to the downloads folder of your Chromebook via Google Drive.

- Via the shell ([Ctrl][Alt][T] + shell)

  - ```cd ~/Downloads```

  - ```wget https://goo.gl/fd3zc -O crouton```

  - ```sudo sh ~/Downloads/crouton -t cli-extra```

  - ```sudo startcli```

Delphi only supports Intel 64-bit Chromebooks!
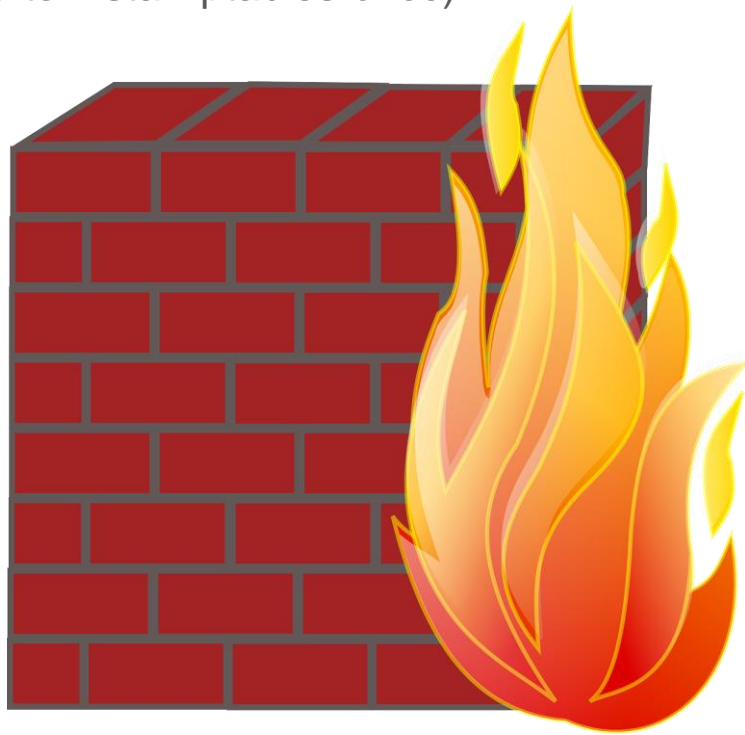
embarcadero®
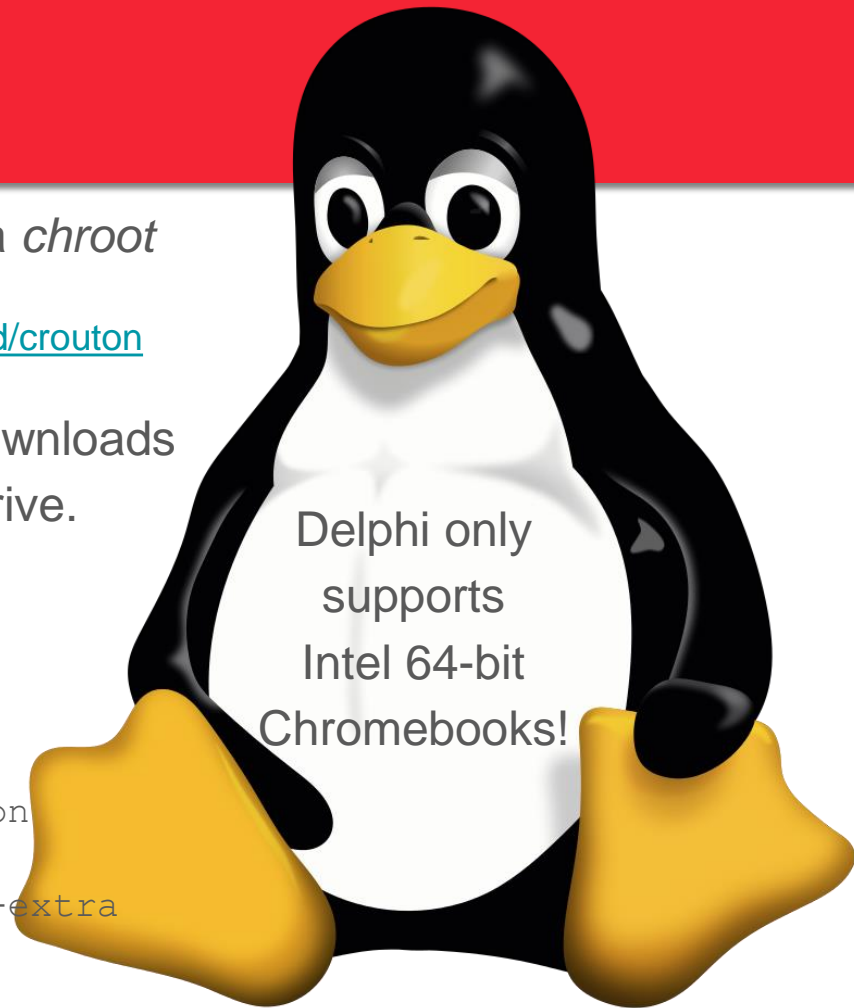
Temporarily Disabling the Firewall

- From the shell ([ctrl][alt][t]+shell) (you only need to install iptables *once*)

    ○ `sudo startcli`

    ○ *sudo apt-get install iptables*

    ○ `sudo iptables -F`

    ○ `sudo iptables -P INPUT ACCEPT`

    ○ `sudo iptables -P FORWARD ACCEPT`

    ○ `sudo iptables -P OUTPUT ACCEPT`

- Now run PAServer

    ○ `~/Downloads/PAServer-19.0/paserver`

What About the Future?

- Chrome OS is not an officially supported platform yet

- It is not on the official public roadmap

- My test show it is working fairly well today
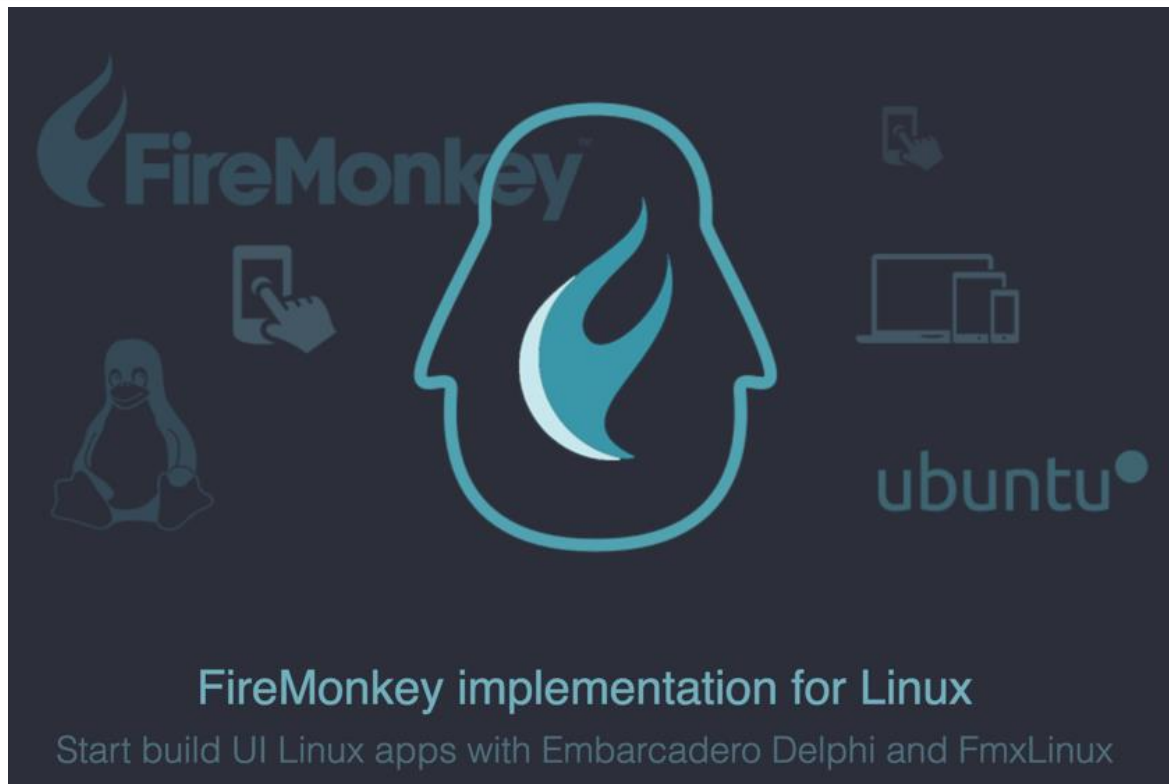
- It may show up on road~~__~~lates in the future

This is all speculation by Jim and not an official Embarcadero Road Map

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FmxLinux ver 1.141

- New implementation of FireMonkey for Linux

- Full IDE Designer integration

- Cross-Platform compatible

- Includes Ubuntu styles

- 3rd party offering

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fmxlinux.com

FireMonkey implementation for Linux

Start build UI Linux apps with Embarcadero Delphi and FmxLinux

CrossVCL ver 0.95 (beta)

- Bridge for VCL to macOS 10 and Linux

- Low-level Windows API bridge

- Native controls on each platform
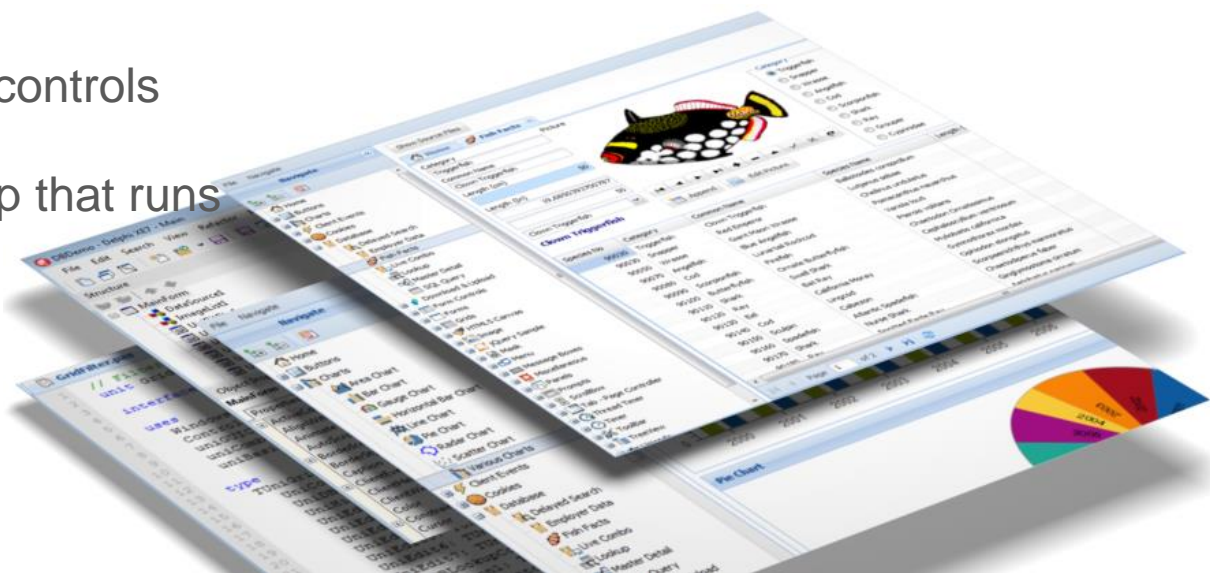
- Many custom controls

- 3rd party offering

www.crossvcl.com

Build VCL application for macOS and Linux
Start building macOS and Linux apps with Embarcadero Delphi and CrossVcl
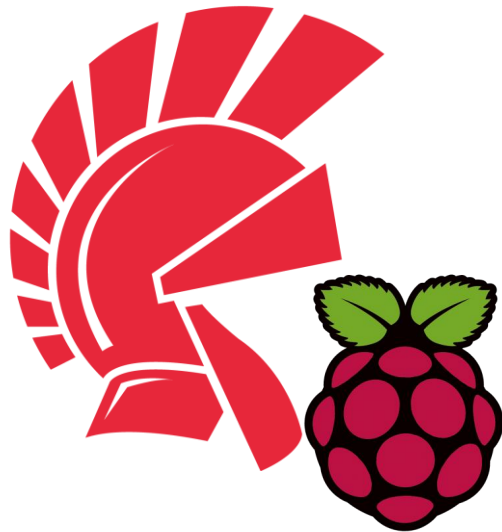
uniGUI

- Web framework modeled on VCL that uses Sencha ExtJS

- Includes data driven controls

- Builds server side app that runs over web

- 3rd Party Offering
  - www.unigui.com

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