



bug labs

Building open source gadgets with Linux

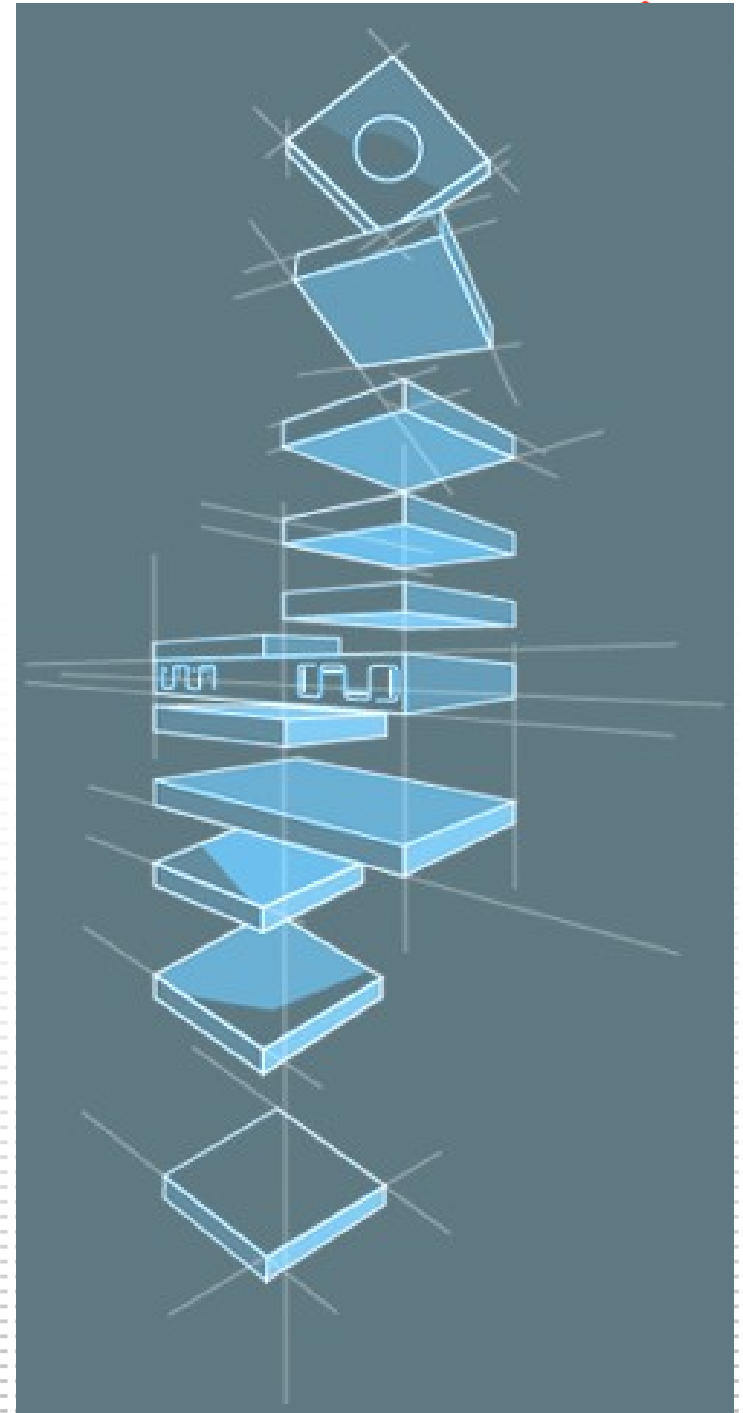
Ken Gilmer and Matt Isaacs

Bug Labs, Inc.

Overview

- BUG overview
- BUG modules
- SDK
- BUG app demo
- OTE tour and demo

BUG contest



Who are you?



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? !! ???!?!

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BUG: Reinventing Building Blocks

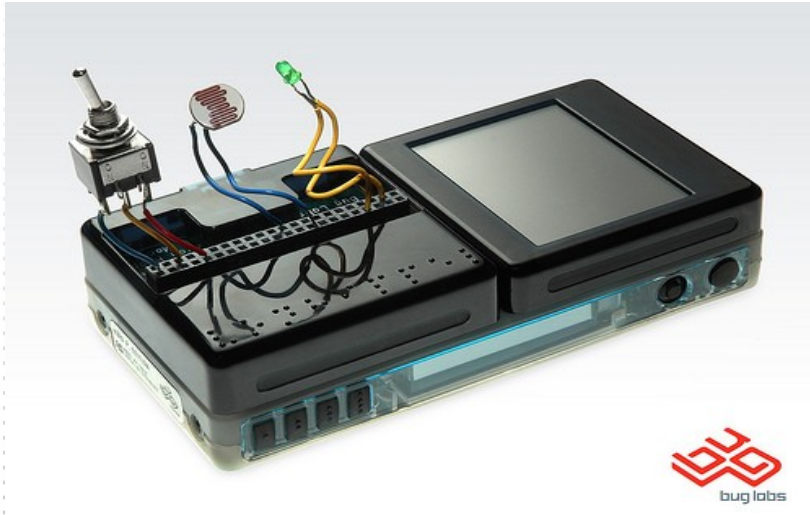
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- BUG provides users with electronic building blocks to build personalized hardware devices.
- Examples ~
 - GPS alarm clock, stereo camera system, online radar map, open source telemetry system
- Open and modular platform inspires users to tap into creative new devices at much lower costs than custom HW development.
- Use well known technologies
 - Linux, Java, OSGi, Web Services



Primary elements of BUG



- The BUG is:
 - BUGbase ~ Mobile Linux computer
 - BUGmodules ~ Audio, Video, GPS, Wifi, General IO, sensors, GSM, 802.15.4, Breakout Module, Touchscreen LCD
 - Eclipse-based SDK
 - Community App Repository ~ BUGnet
- 100% Open source software **and** hardware ((L)GPL, BSD, EPL)

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BUGbase

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- Mobile Linux computer
 - Freescale MX31 ARM1136-based SoC, Clocked at 532 MHz
 - 128 Mb RAM, 32 Mb Flash, 2Gb SD storage, USB 2.0, USB OTG
 - Simple integrated LCD menu system, navigation, buttons, LEDs
 - Internal Li-Polymer battery
- BUG Module Interface (BMI) connects modules to base.



BMI Interface

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- 4 ports on BUGbase.
- Exports I2C, I2S, SPI, UART, Camera Sensor Interface, Display Interface.
- 1 interrupt line per port.
- Presence pin signals module attachment.
- BMI kernel subsystem intended to ease driver development and management of exported interfaces.



BMI Interface

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BMI Interface - BUG Wiki - Mozilla Firefox

http://bugcommunity.com/wiki/index.php/BMI_Interface

Log in / create account

BMI Interface

SIGNAL	NETNAME	PIN
Ext Battery Power to Base	BAT_EXT_P1	01
Ext Battery Power to Base	BAT_EXT_P3	03
Module Present	MOD_PRSNT_N*	05
LCD: Serial Link MD0	MPL_MD0	07
LCD: Serial Link MD1	MPL_MD1	09
LCD: Serial Link Clock	MPL_MC	11
	GND	13
Serial Port: Receive Data	RxD	15
Serial Port: Transmit Data	TxD	17
Serial Port: Clear to Send	CTS	19
Serial Port: Ready to Send	RTS	21
GPIO Bit 0 (LSB)	GPIO0	23
I2S Clock	SCK	25
I2S Frame	SFS	27
I2S Transmit Data	STxD	29
I2S Receive Data	SRxD	31
	GND	33
USB: Data +	USBDP	35
USB: Data -	USBDN*	37
5V Power to Module	V5_P39	39

PIN	NETNAME	SIGNAL
02	V5_P2	5V Power to Module
04	SPL_MISO	SPI: Master-In Slave-Out Data
06	SPL_MOSI	SPI: Master-Out Slave-In Data
08	SPL_SS	SPI: Select
10	SPL_CLK	SPI: Clock
12	SPL_RDY	SPI: Ready
14	GND	
16	I2C_SCL	I2C: Clock
18	I2C_SDA	I2C: Data
20	GPIO3	GPIO Bit 3 (MSB)
22	MOD_INT_N*	Module Interrupt, active LOW
24	GPIO2	GPIO Bit 2
26	LCD_VSYNC	LCD Frame Signal
28	GPIO1	GPIO Bit 1
30	GND	
32	CSI_MCLK	Camera: Clock
34	GND	

Image:QTE BUG pins.jpg

http://bugcommunity.com/wiki/index.php/Image:QTE_BUG_pins.jpg



BUG Modules

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- Module Requirements
 - I2C EEPROM to store unique module ID.
- On Insertion:
 - Presence interrupt triggered
 - Module ID read.
 - Control passed to module device driver.



BUG Camera Module

- 2 Megapixels
- Flash LED
- 3 Hardware buttons accessible via control device node.
- Pictures and overlay handled by V4L.



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BUG LCD Module

- QVGA Resolution
- Resistive touchscreen
- Built-in accelerometer
- Control device node used to adjust screen brightness and module LEDs



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BUG GPS Module

- Serial-based GPS device
- Internal or external antenna



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Motion and Accelerometer Module

- Passive IR Motion Detector
- 3-axis Accelerometer
- Built-in microcontroller for real-time like performance



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Audio Module

- Audio in and out
- Mic, Headphone, Line-in, Line-out
- Two hardware buttons



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Von Hippel Module

- Named for MIT professor Dr. Eric von Hippel
- Breakout module exposes most hardware interfaces, plus additional GPIOs.
- Allows for rapid prototyping of modules, and connection to other devices.



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Post Singularity BUG modules

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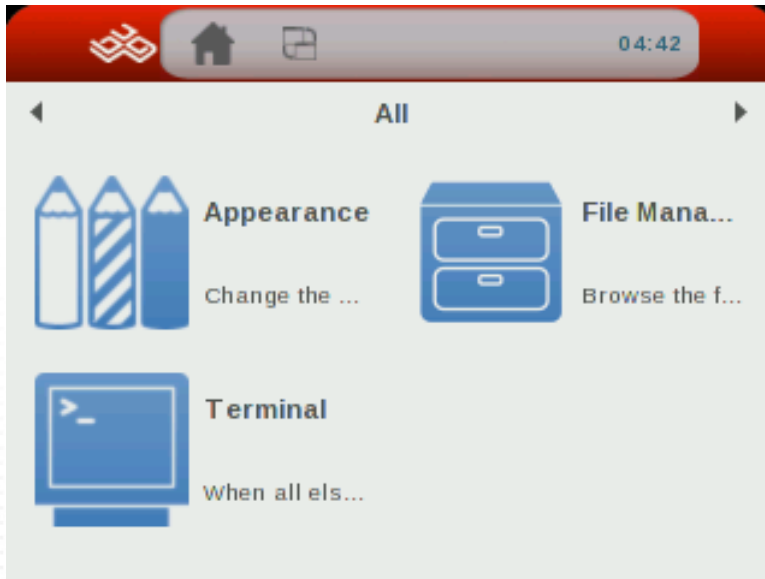
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- Bar code scanner (1d, 2d), RFID
- GSM/CDMA, Geiger counter, Servo controller
- Health Monitor, FPGA, Software Radio
- Battery, Solar Cell, Fuel Cell
- Breathalyzer, LED bank, keyboard
- MIDI, Audio, Video, PICO projector
- GNU Radio?

- BUG allows for and encourages user-built modules



Full Linux 2.6.27 Distro (BUG-Poky)



- BUG runs a full featured Linux kernel and rootfs
 - Gnome Mobile optimized for small devices with small screens
- Thousands of user-space packages available
- Vibrant mobile Linux community: OpenEmbedded
- User in complete control from boot loader to web services.

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Physical Universe as Services

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- The BUG contains an OSGi runtime environment on a CDC JVM (Concierge on phoneME)
- BUGbase and each hardware module provide dynamic OSGi software services
- BUG applications are collections of OSGi bundles that bind to hardware via abstract software services.
- Software services can sometimes be derived from multiple hardware devices.
- Example: Motion detector

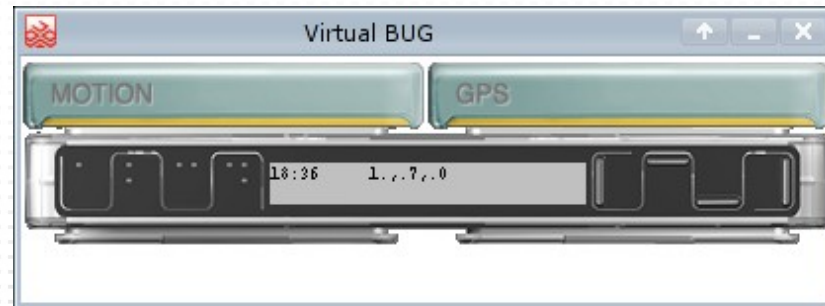


Dragonfly, BUG SDK

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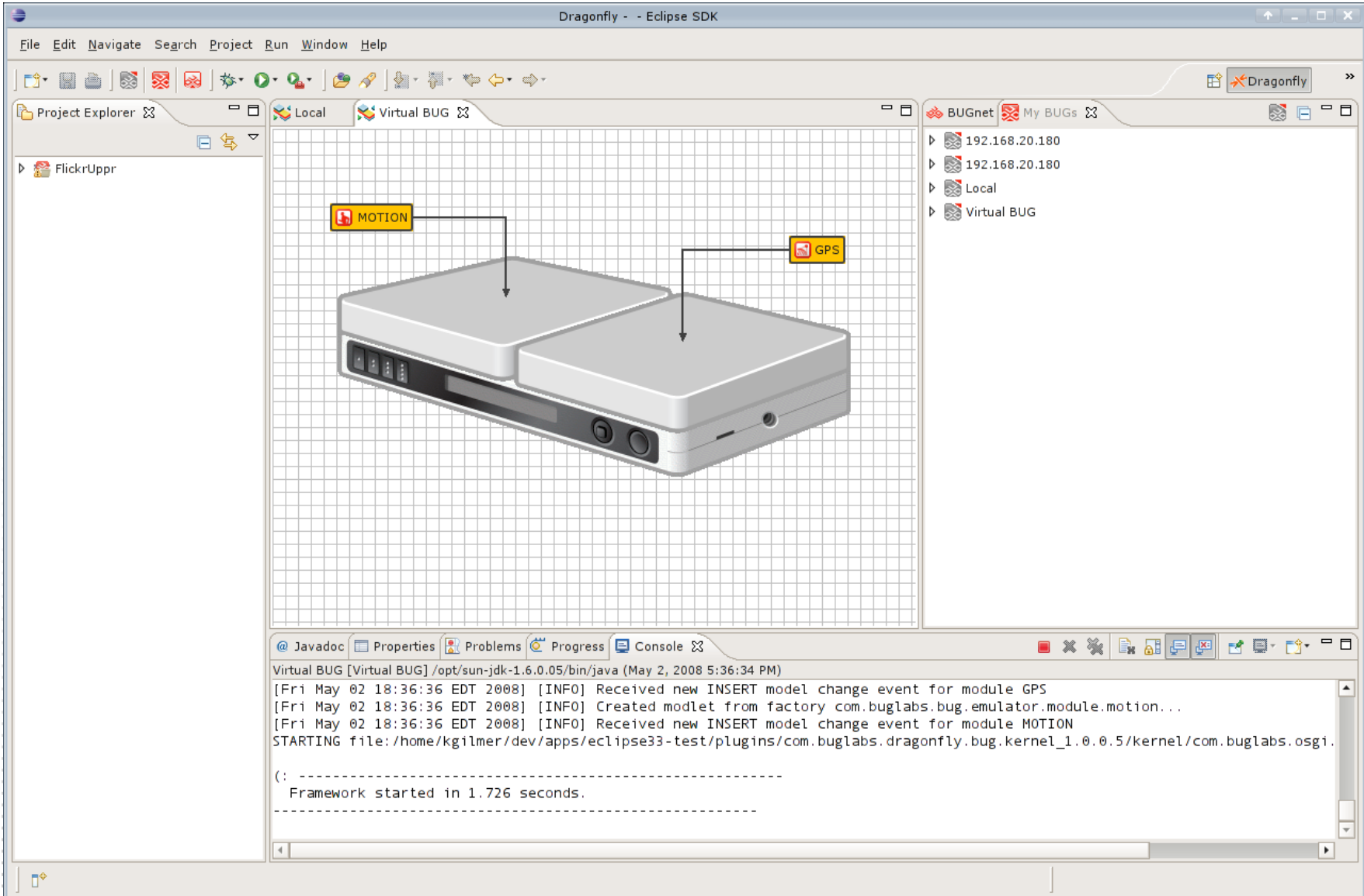
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- Software development kit to build BUG apps
- Eclipse-based plug-ins, open source
- Virtual BUG emulator to create and test applications without hardware





Dragonfly SDK



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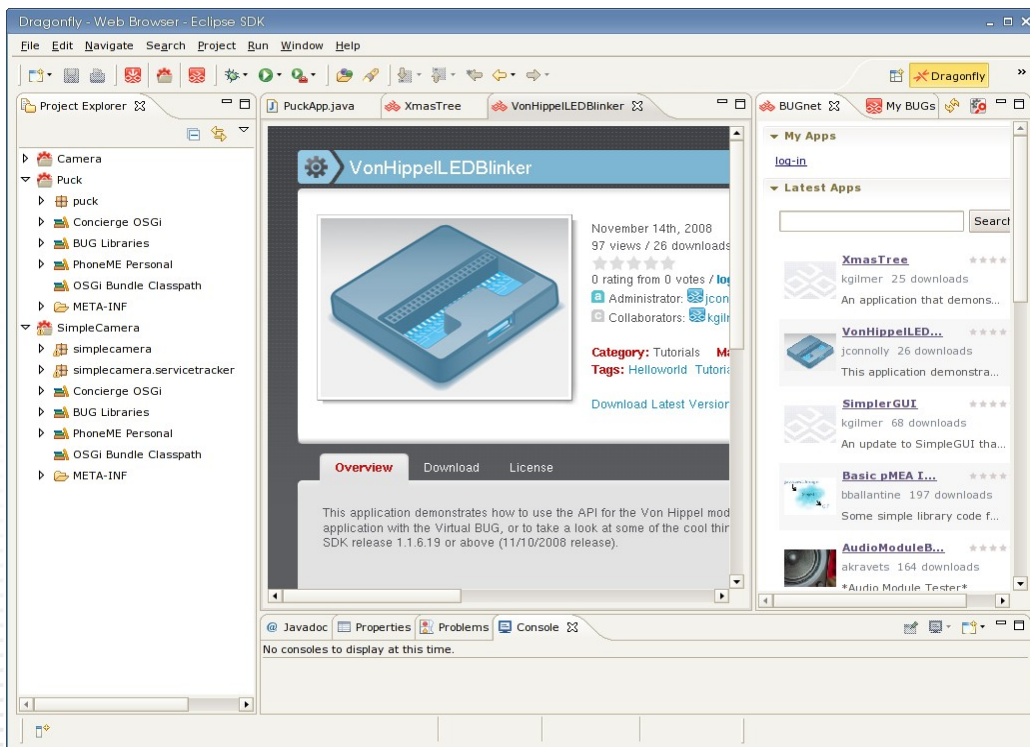
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Easy Collaboration and Deployment

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- One click to download community apps
- One click to install app on BUG



BUG App Demo



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OpenEmbedded Tools for Eclipse

- An Eclipse feature for editing BitBake recipes, building packages, and managing distros.
- Custom File System to ignore TMPDIR and DL_DIR
- Recipe editor with syntax coloring, templating, and variable inspection.
- Shell to BitBake, build, clean recipes and images.
- Utilize core Eclipse features: visual diff, file history, etc.
- Integrates with other Eclipse plugins like SVN, Python, etc.
- Future Ideas
 - Integrate with CDT
 - Recipe cross referencing and dep visualization
 - GIT integration
 - OE/Poky/* installer



BitBake Commander demo

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Thanks! Questions?

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community.buglabs.net



- **Thanks to projects ~**

OpenEmbedded

Linux

Poky Linux

Eclipse

Jalimo

Gnome Mobile

OpenJDK

PhoneME

GNU Classpath

Concierge

MidPath