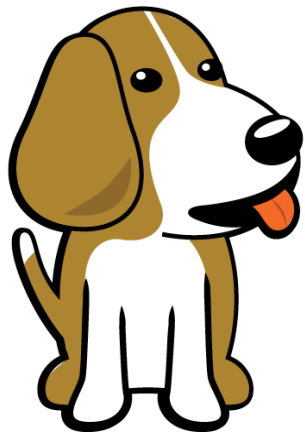


BeagleDust

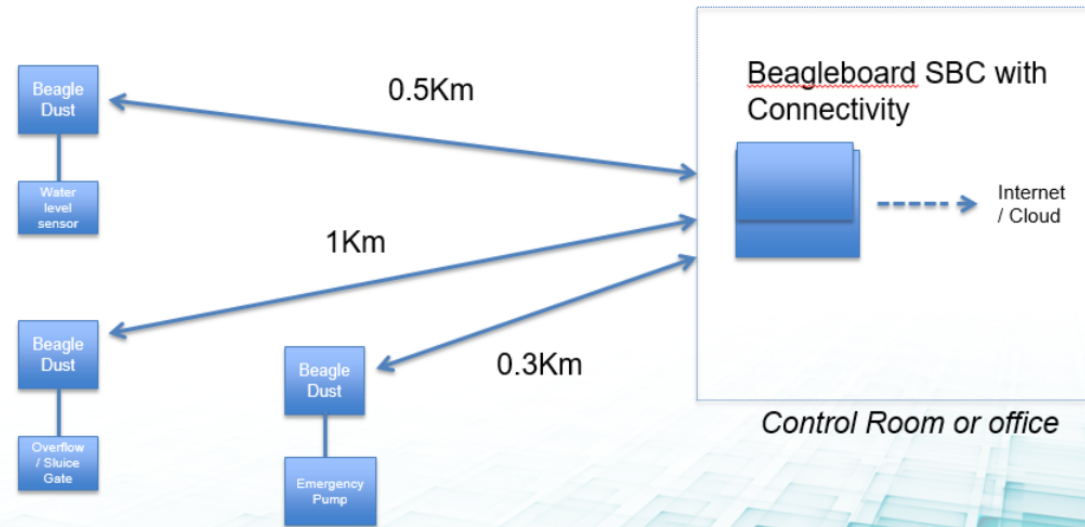
BeagleDust

*Concept and business case
Premier Farnell and BeagleBoard.org
December 2018*



The Concept

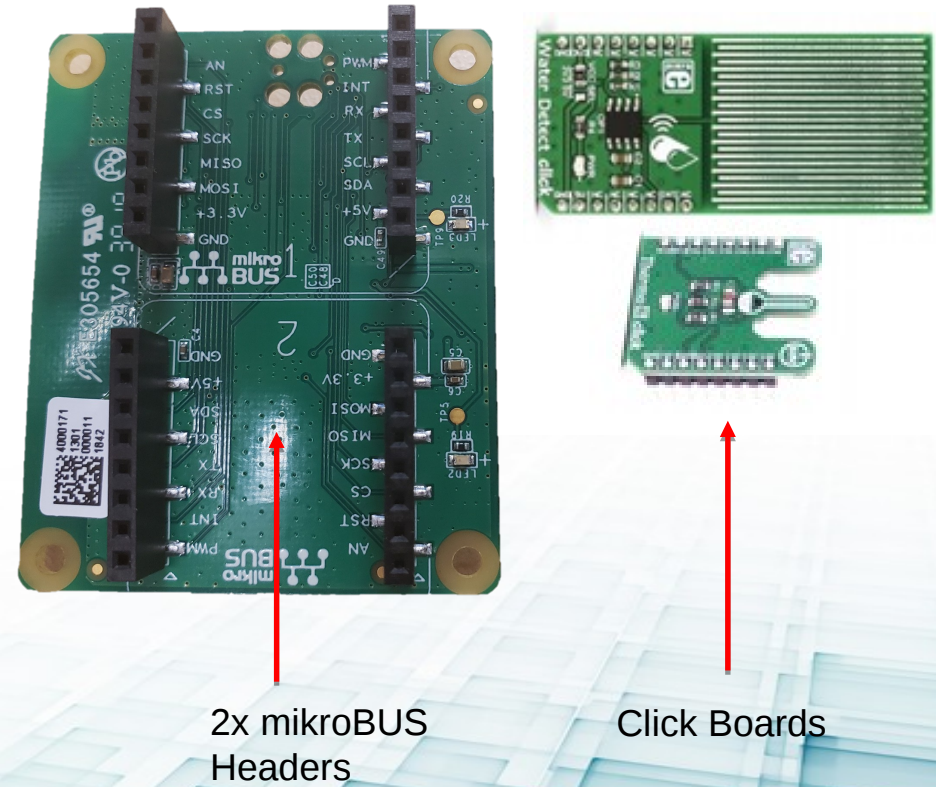
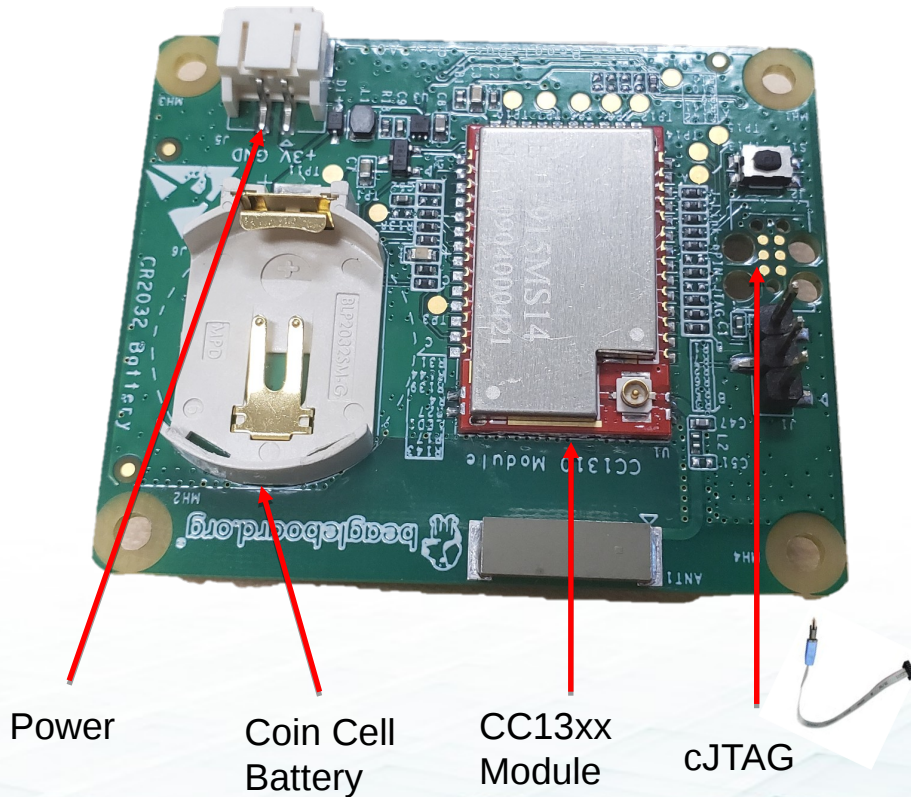
- **Digital Dust** -> A low cost sub \$10, low-profile edge node that is easily deployed almost anywhere
 - Sub 1GHz network based on TI-15.4 stack
- User experience is simple and seamless with out of box setup taking minutes
- Adaptable by Makers and Professionals alike for it's plug and play usability
 - Professionals would use for proof of concept, assume higher volumes would result in design / manufacturing customization opportunities and the wider portfolio of IoT services



BeagleDust Feature Set

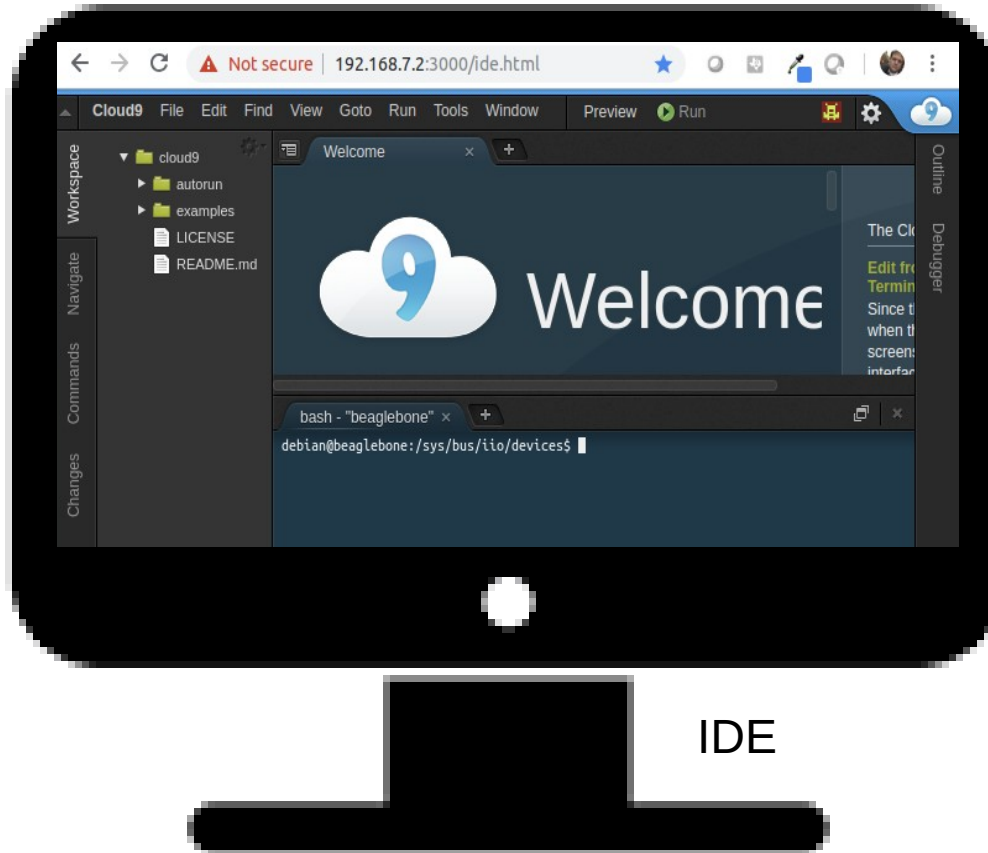
FRONT

BACK



The User Experience

Step 1 – Gateway login



IDE



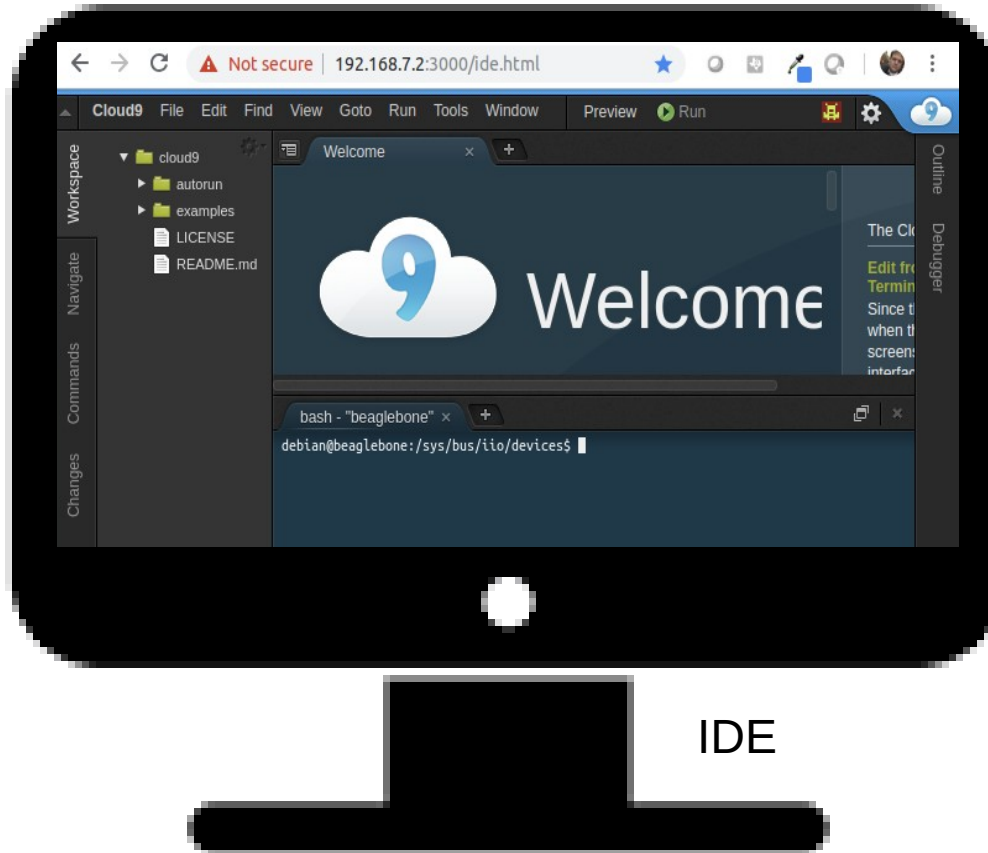
Gateway



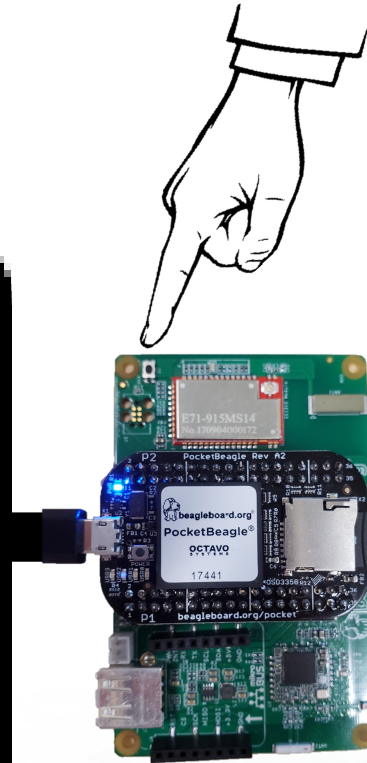
SensorTag

The User Experience

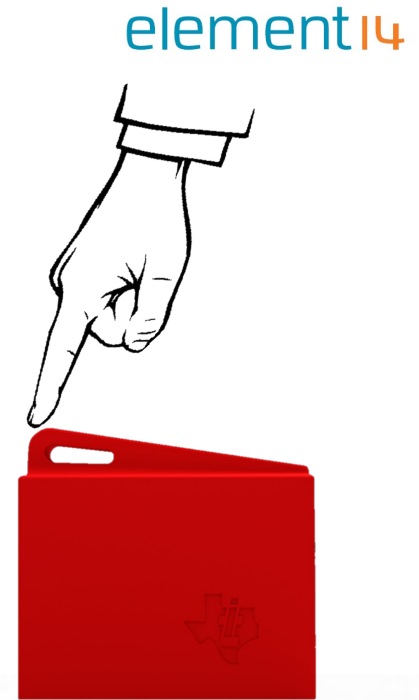
Step 2 – Connect with button push



IDE



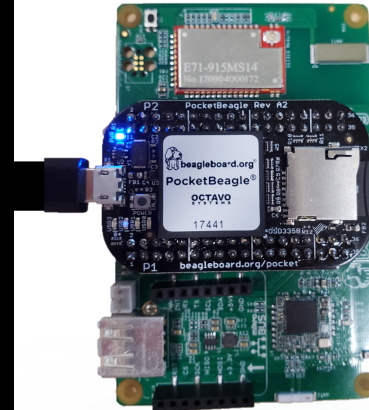
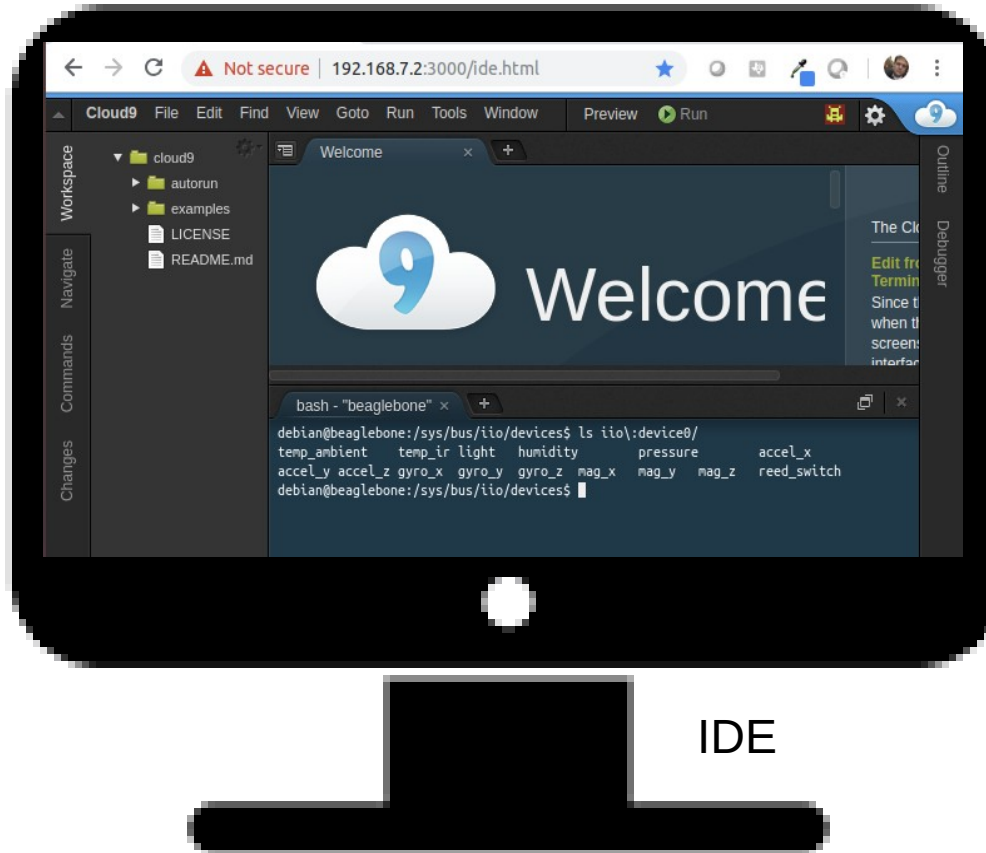
Gateway



SensorTag

The User Experience

Step 3 – Live edge data automatically appears

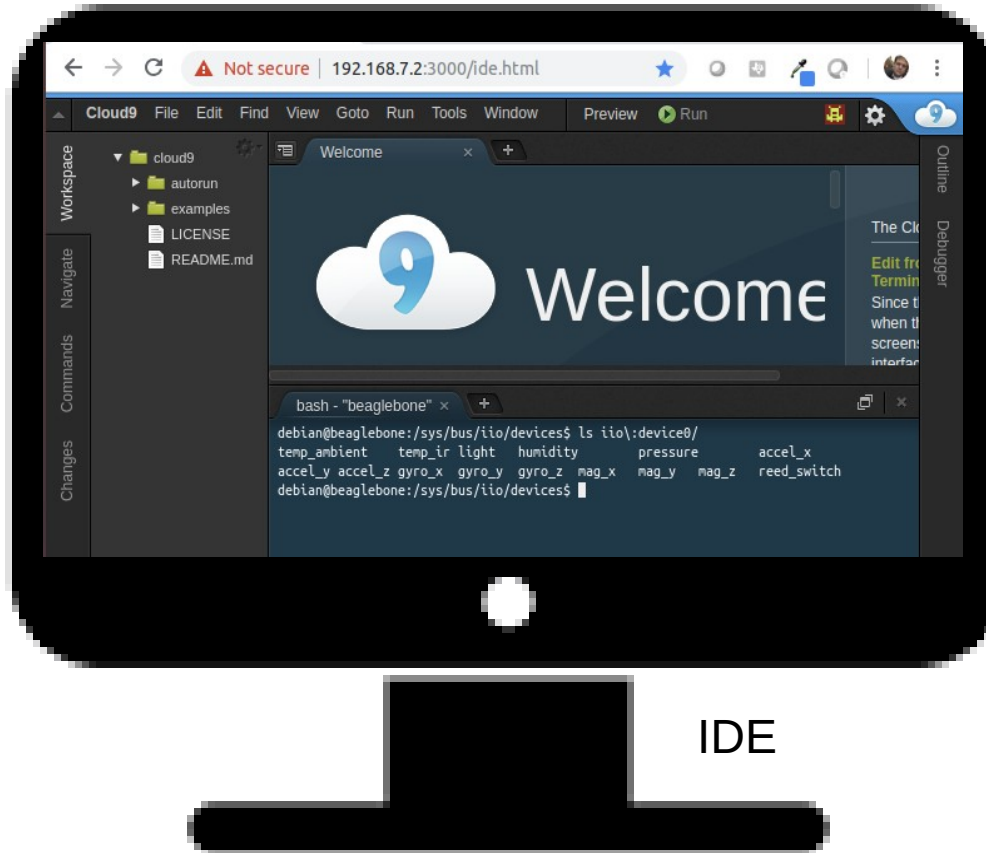


Gateway

SensorTag

The User Experience

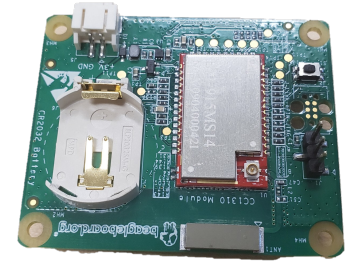
Same firmware, infinite sensors



IDE



Gateway



BeagleDust



SensorTag

User Experience Value Proposition

1. Automatic provisioning for I2C, SPI, GPIO, UART, ADC, and PWM
2. No cut-and-paste
 1. No device specific code lives my program
 2. Driver maintenance is owned by Linux kernel
3. No “firmware” development
 1. Everything a developer needs to do sits above the OS in any language
4. All sensor data is readily accessible in read and write files
5. Every programming language supported
 1. No language specific libraries
6. Out of the box support for ecosystem of 500+ mikroElektronika click boards

The Ask

1. Marketing Support

1. How can TI drive market awareness – what does TI need from BB.org to do this?

2. Software and Hardware Development

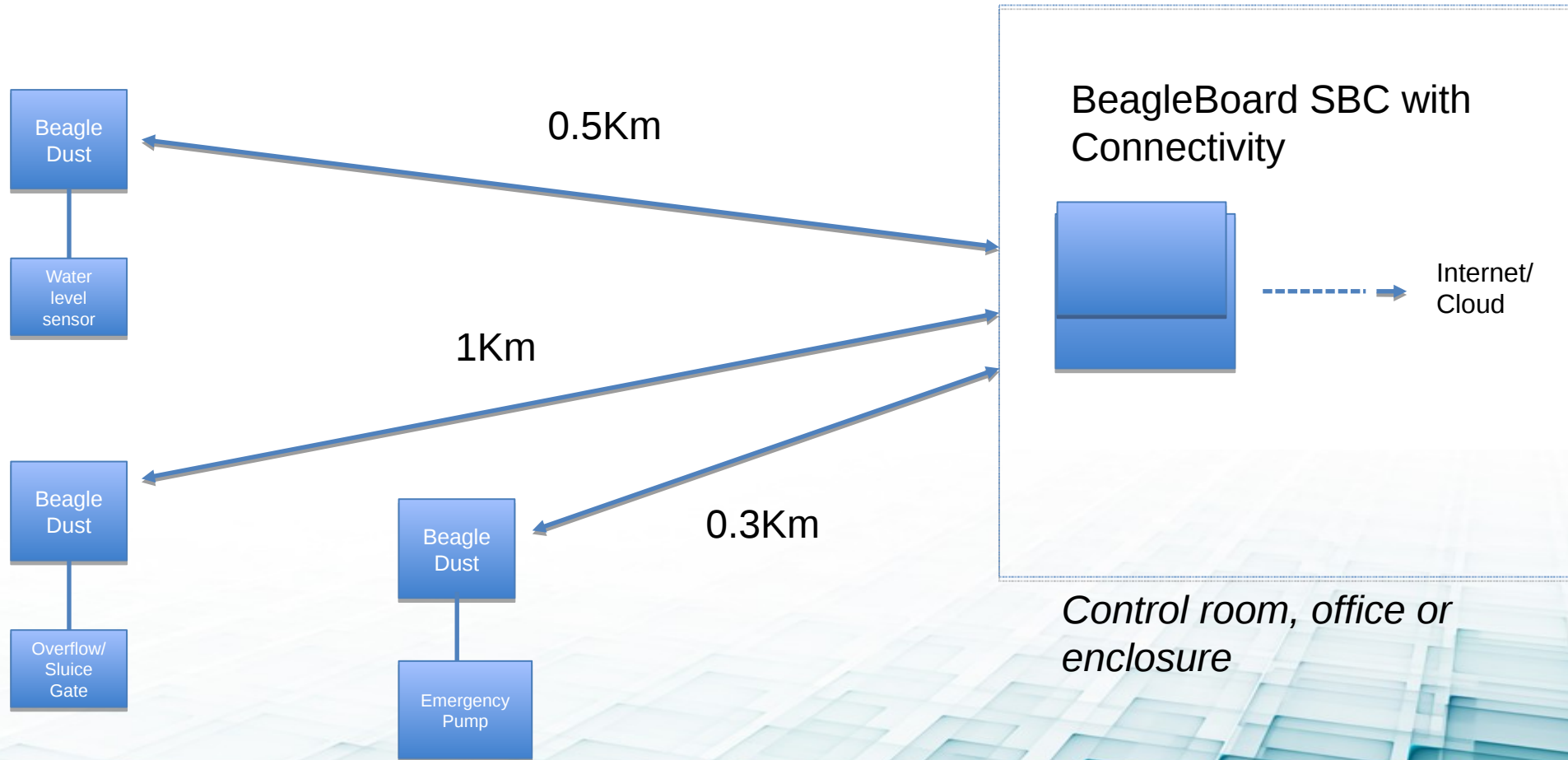
1. Design support and consultancy for discrete implementation of CC13xx
 1. Required to achieve pricing targets
 2. Split cost of 6 months firmware development, ~\$150k

3. Pricing

1. Target BOM cost is \$3 to achieve a MSRP of <\$10

Appendix

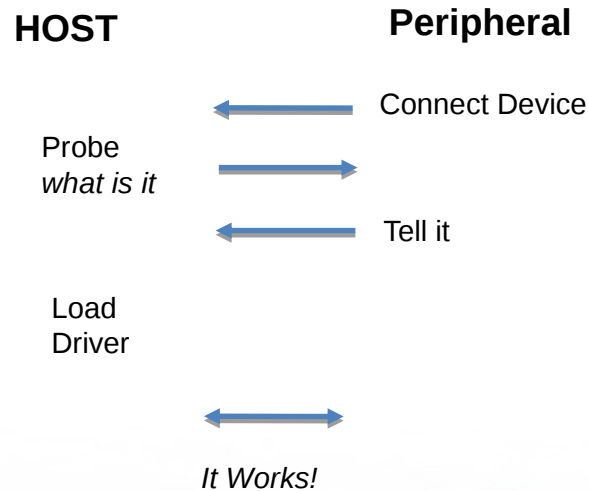
Example: flood mitigation system



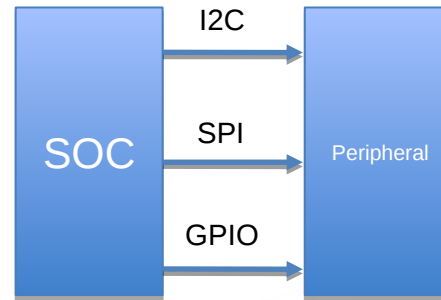
Software Proposition

- Greybus: automatic provisioning for I2C, SPI, and GPIO

USB in Linux Today

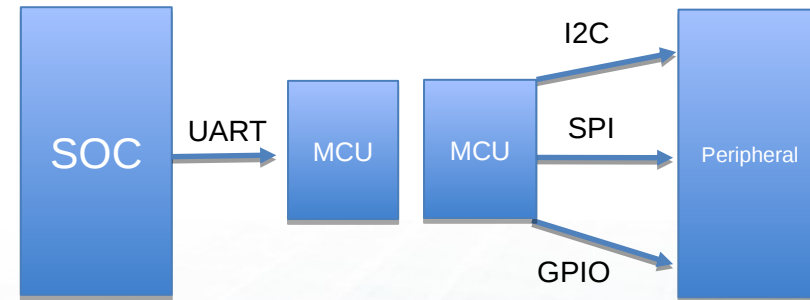


Before Greybus



Specific device tree required

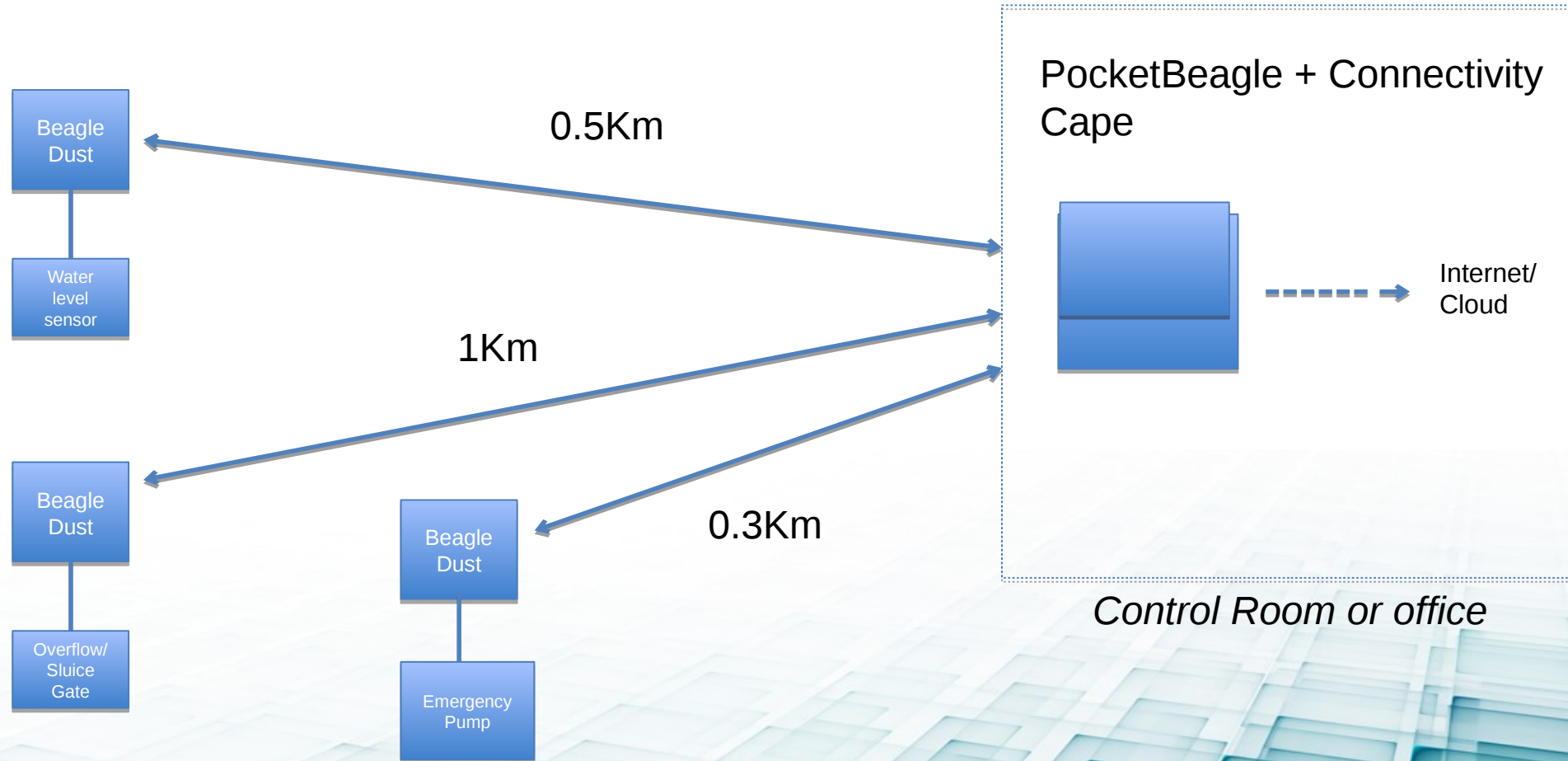
With Greybus



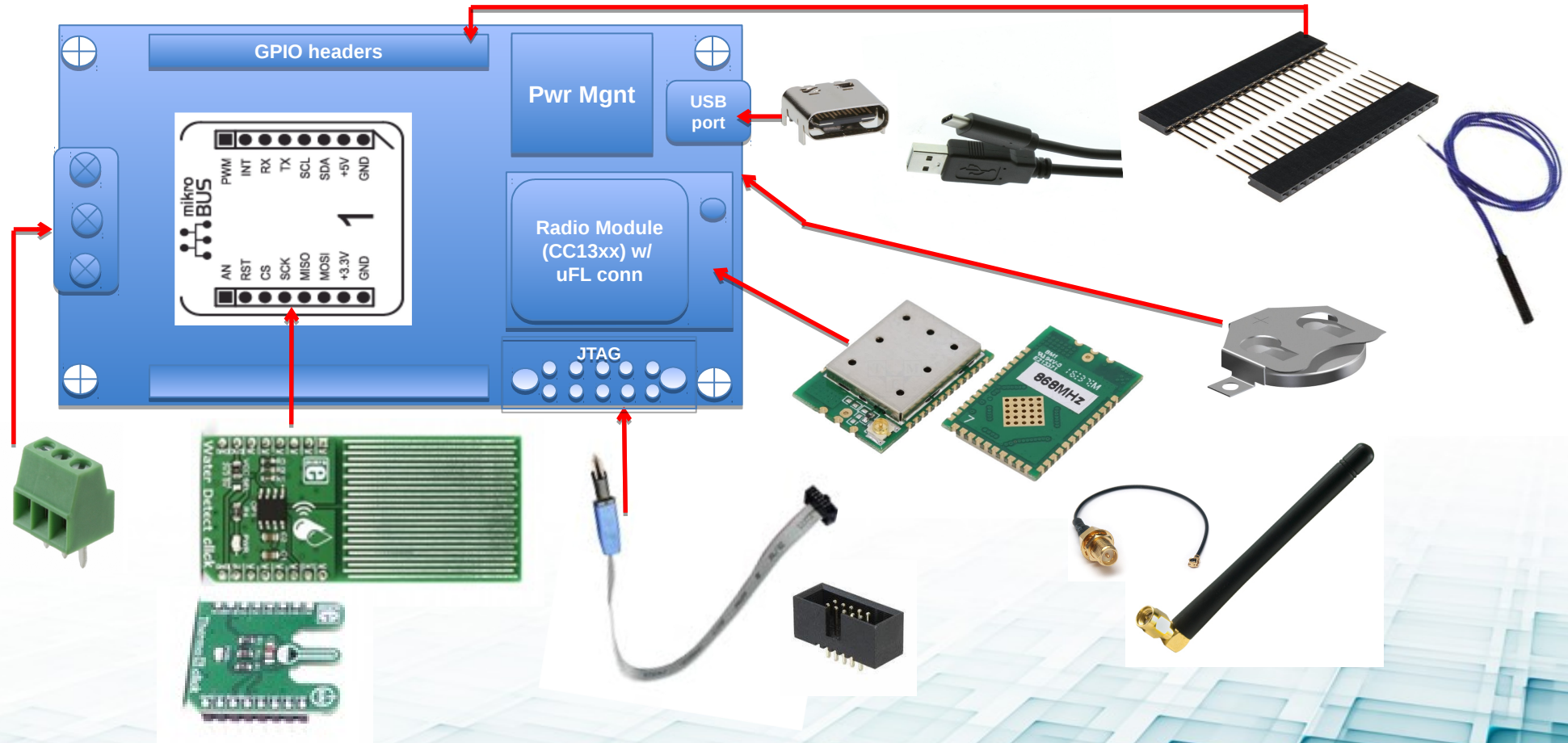
- Low cost (< \$10), low-profile edge node that is easily deployed almost anywhere
- Adaptable by Makers and Professionals alike for it's plug and play usability
 - Professionals would use for proof of concept, assume higher volumes would result in design / manufacturing customization opportunities and the wider portfolio of IoT services
- Features Long Range Radio comms (Sub-GHz TI 15.4 compare with LoRA) module with on-board MCU for control and uFL connector
- Low power with ample GPIO for easily sensor attachments
- Compatible with MikroBus interface, allowing for deployment of MikroE click sensor & actuator boards
- Works (& communicates) out-of-the-box with PocketBeagle or BBB, enabled with their respective Long Range Comms cape
- Debug / Programming via header / JTAG connector / USB option(s)
- Battery-holder for Li-Ion coin-cell
- Power-management with appropriate voltage translations

- What is probing and a probable bus?
-

Example: flood mitigation system

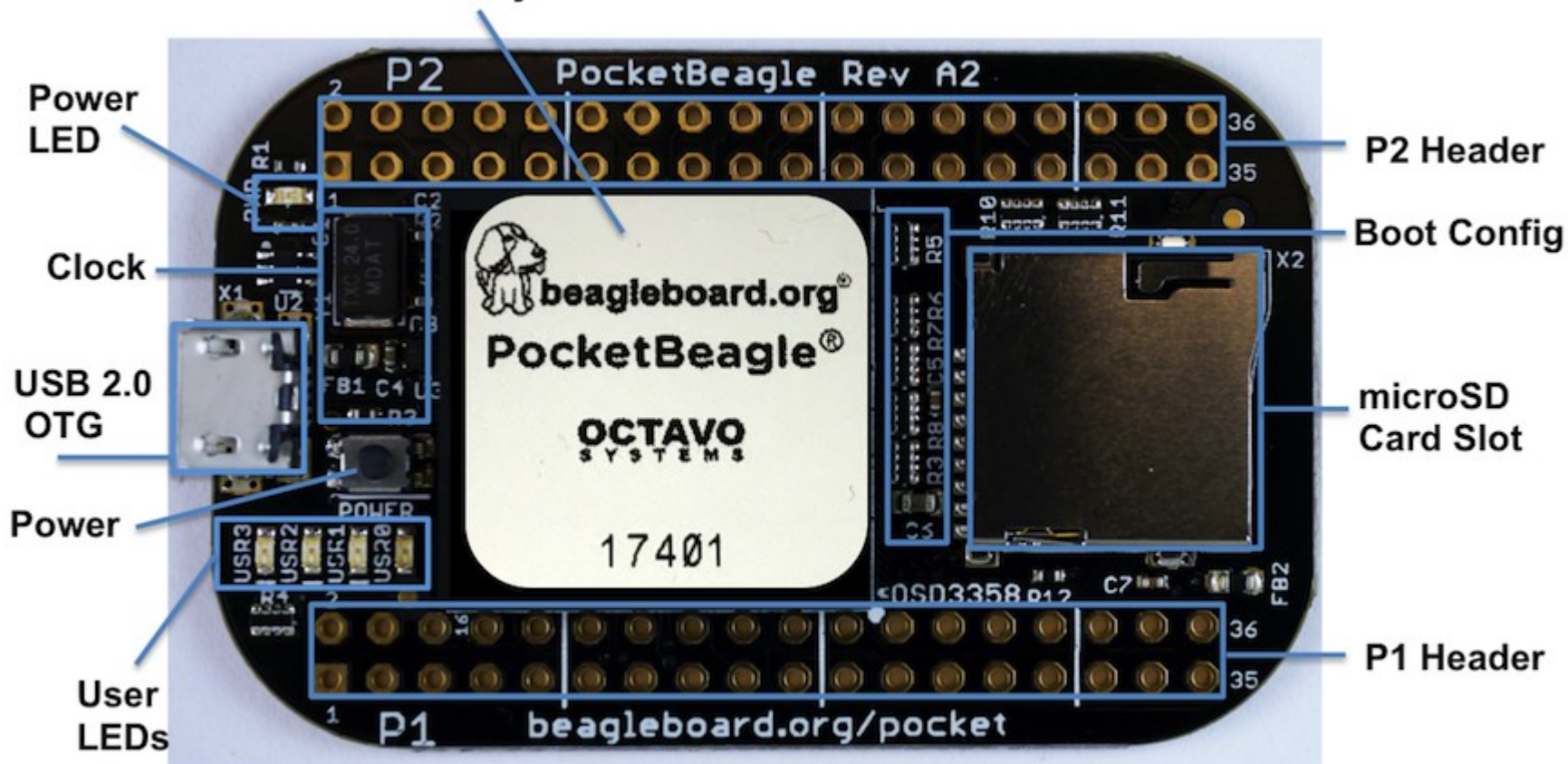


Digital Dust feature-set



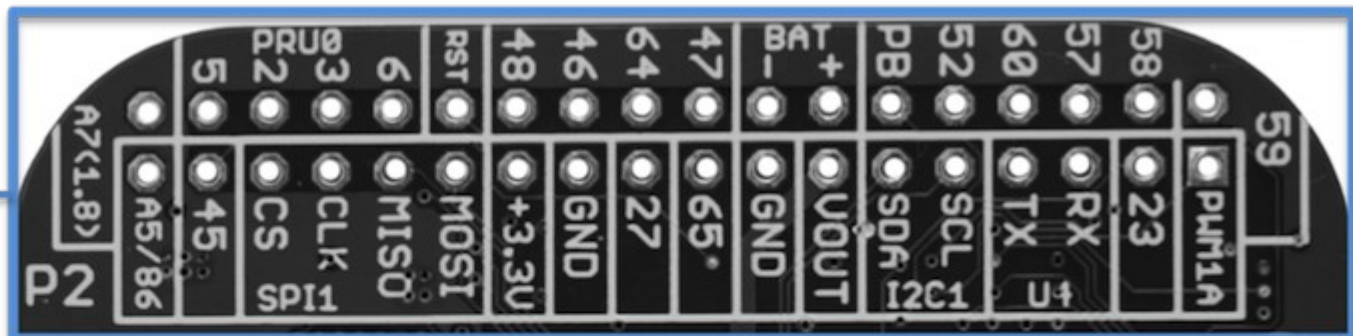
PocketBeagle top

Octavo Systems OSD3358-SM

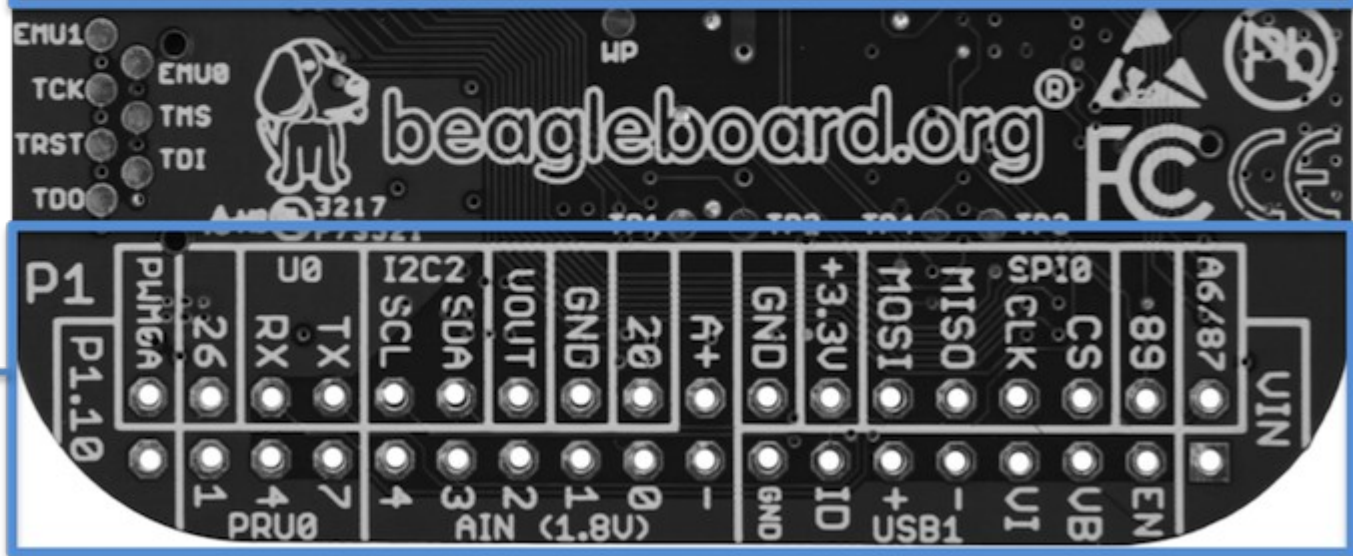


PocketBeagle bottom

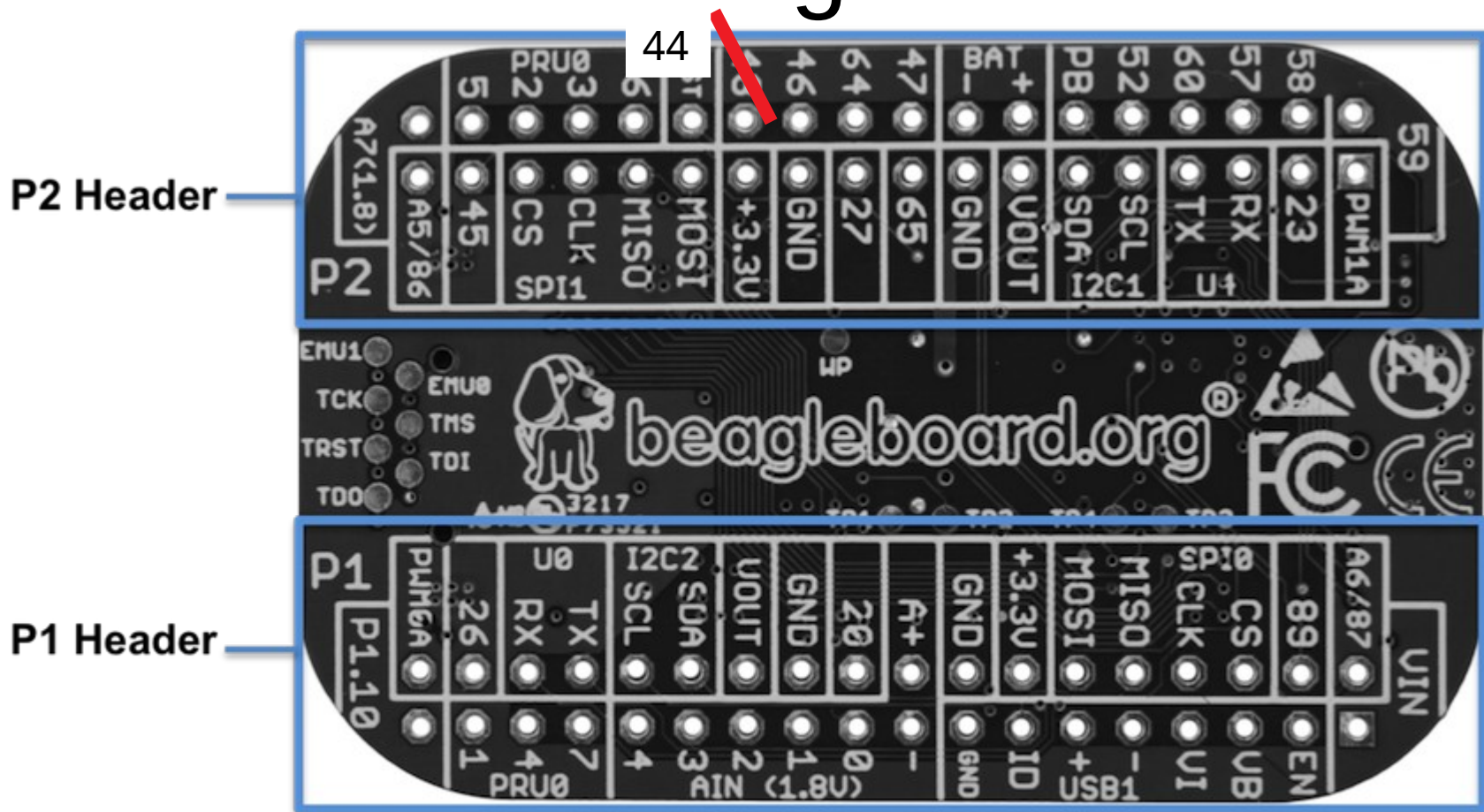
P2 Header



P1 Header



PocketBeagle bottom





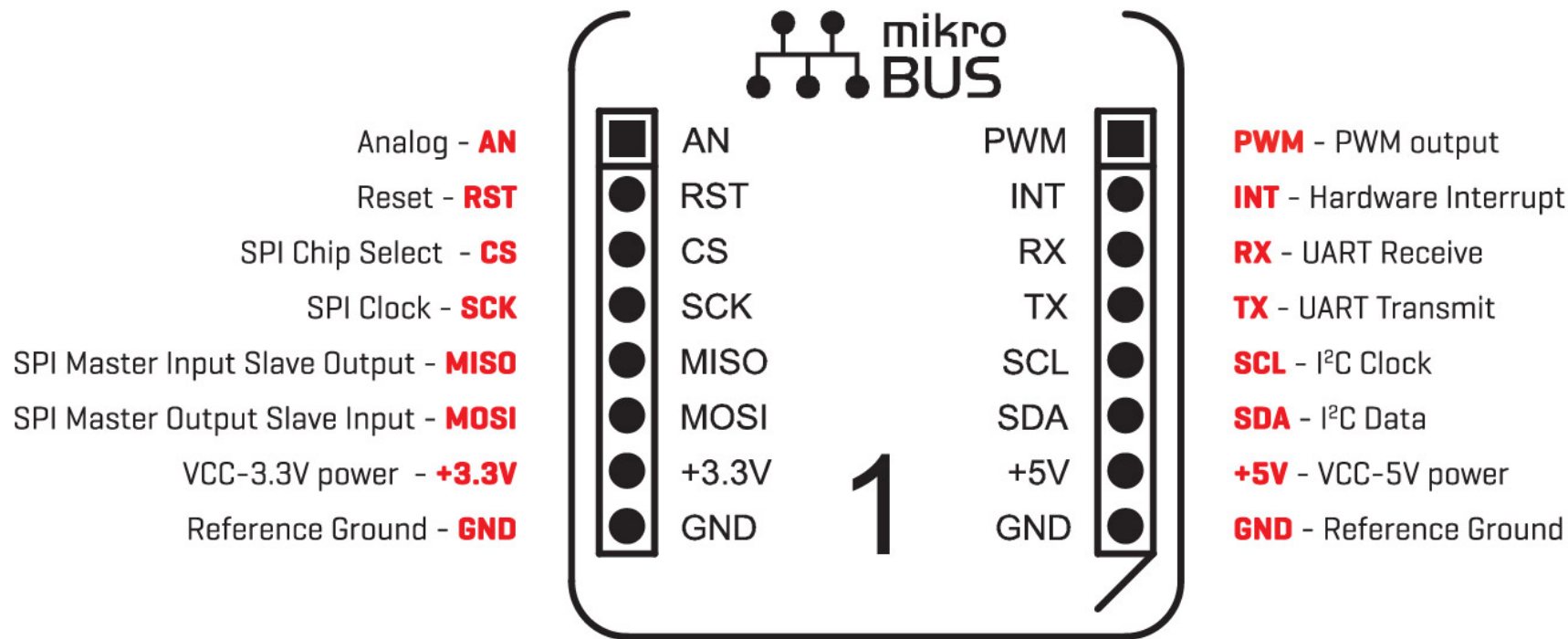
PocketBeagle expansion

PocketBeagle Expansion Headers (Rev A2a)

P1											
SYS			VIN	1	2	87		6	AIN 3.3V	9	PRU1
USB1	V_EN	GPIO	109	3	4	89				11	PRU1
USB1	VBUS	5	6	5			GPIO	CS		TX	PRU
	VIN	7	8	2				CLK		RX	UART2
	DN	9	10	3				MISO	SPI0	TX	
	DP	11	12	4				MOSI		RX	PRU
	ID	13	14	3.3V							
	GND	15	16	GND							
			REF-	17	18	REF+			AIN 1.8V		
			0	19	20	20	GPIO			16(in)	PRU0
			1	21	22	GND					
			2	23	24	VOUT					
			3	25	26	12		SDA	I2C2	TX	CAN0
			4	27	28	13		SCL		RX	
PRU0	7	QEP0	STRB				GPIO	TX		15	PRU1
	4		A					RX	UART0	14	
	1	PWM0	B								
PRU1	10										
				117	29	30	43				
				114	31	32	42				
				111	33	34	26				
				88	35	36	110		A	PWM0	0
											PRU0

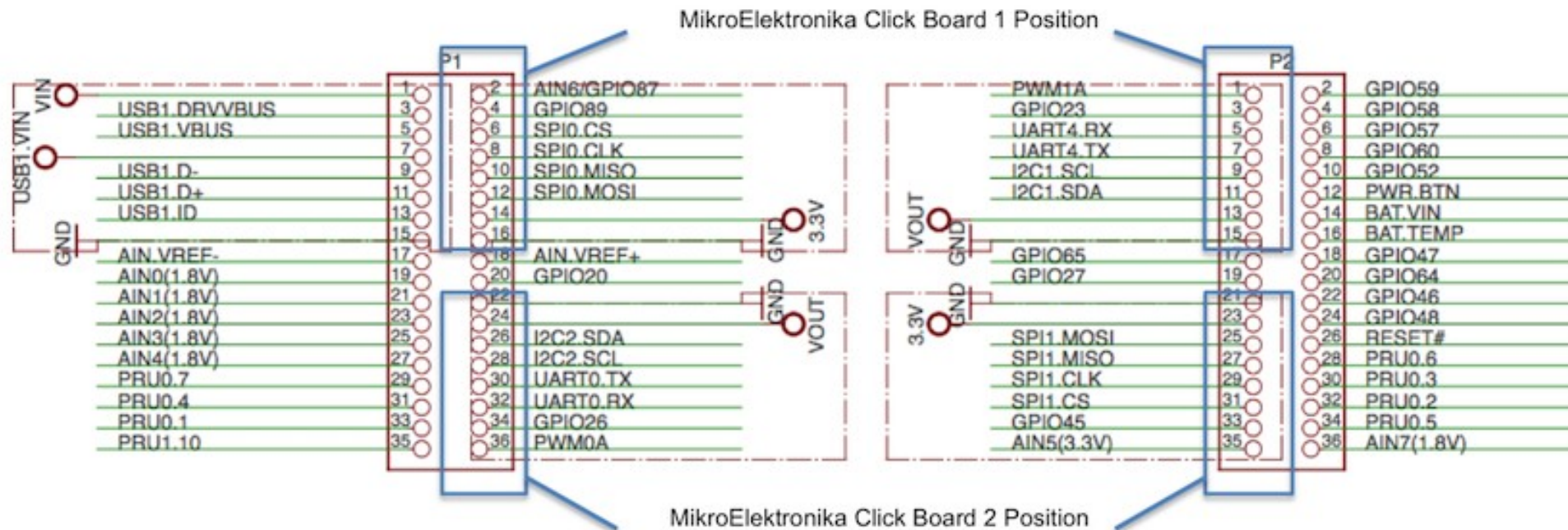
P2											
PWM1			A		50	1	2	59			
PWM2			B		23	3	4	58			
					30	5	6	57	GPIO		
UART4			RX		31	7	8	60			
			TX								
CAN1	RX		I2C1	SCL	15	9	10	52			
	TX		SDA		14	11	12	PWR BTN	SYS		
						13	14	VIN	BAT		
						GND	15	16	TEMP		
					65	17	18	47	STRB	QEP2	15i
					27	19	20	64			PRU0
									GPIO		
						21	22	46	IDX	QEP2	14(in)
						3.3V	23	44	A		14(out)
											PRU0
CAN1	RX				41	25	26	NRST	SYS		
	TX				40	27	28	116		IDX	QEP0
PRU	eCAP		SPI1	MOSI	7	29	30	113			6
PRU1	16(in)			MISO					GPIO		3
				CLK	19	31	32	112			2
PRU0	15(out)			CS							PRU0
					45	33	34	115	B	QEP0	5
PRU1	8	AIN 3.3V			86	35	36	7		AIN 1.8V	

mikroBus Click





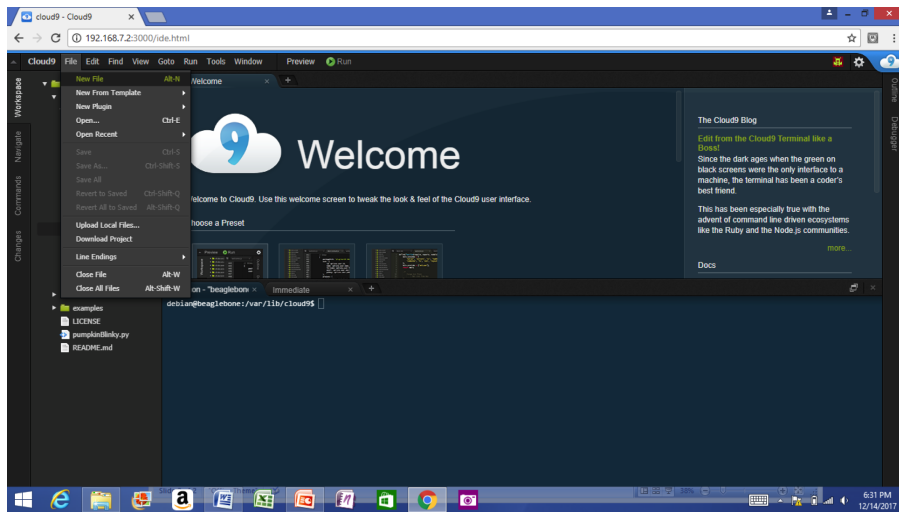
Connecting mikroBus Clicks





Single cable development

- Power, network, develop
- You can add a network and power many other ways



Download image



×

https://beagleboard.org/latest-images

beagleboard.org®

f t in YouTube 8+

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BeagleBoard.org > latest-images

BeagleBoard.org Latest Firmware Images

Download the latest firmware for your BeagleBoard, BeagleBoard-xM, BeagleBoard-X15, BeagleBone, BeagleBone Black, BeagleBone Black Wireless, BeagleBone Blue, SeeedStudio BeagleBone Green, SeeedStudio BeagleBone Green Wireless, SanCloud BeagleBone Enhanced, element14 BeagleBone Black Industrial, Arrow BeagleBone Black Industrial, Mentorl BeagleBone uSomiQ, Neuromeka BeagleBone Air, or PocketBeagle

See the [Getting Started guide](#) and the [community wiki page](#) for hints on loading these images.

Recommended Debian Images

Stretch IoT (non-GUI) for BeagleBone and PocketBeagle via microSD card

- ▶ Debian 9.2 2017-10-10 4GB SD IoT image for PocketBeagle, BeagleBone, BeagleBone Black, BeagleBone Black Wireless, BeagleBone Blue, SeeedStudio BeagleBone Green, SeeedStudio BeagleBone Green Wireless, SanCloud BeagleBone Enhanced, element14 BeagleBone Black Industrial, Arrow BeagleBone Black Industrial and Mentorl BeagleBone uSomiQ - more info - bmap - sha256sum: be1eac7a5e526930155520215329a6c39071b82199c0745c300e68b7e6c7180b

Stretch for BeagleBone via microSD card

- ▶ Debian 9.1 2017-08-31 4GB SD LXQT image for BeagleBone, BeagleBone Black, BeagleBone Black Wireless, BeagleBone Blue, SeeedStudio BeagleBone Green, SeeedStudio BeagleBone Green Wireless, SanCloud BeagleBone Enhanced, element14 BeagleBone Black Industrial, Arrow BeagleBone Black Industrial and Mentorl BeagleBone uSomiQ - more info - bmap - sha256sum: bc8292d97458987481d45da025ef9868b8ccf8477a72f11b541bf97d329a6d7e

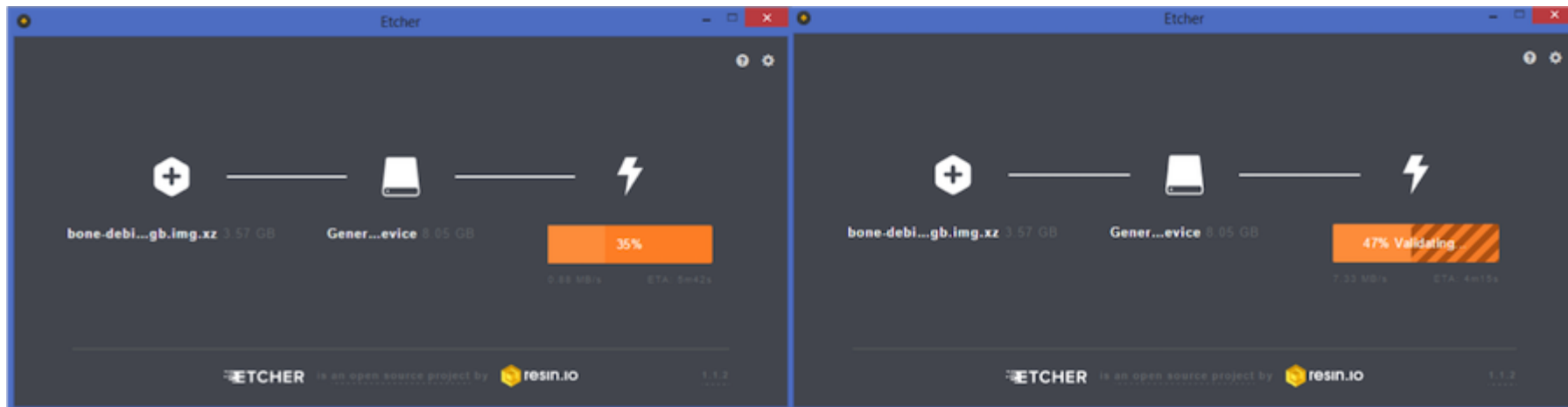
Jessie for SeeedStudio BeagleBone Green Wireless via microSD card

- ▶ Debian 8.6 2016-11-06 4GB SD SeeedStudio IoT image for SeeedStudio BeagleBone Green Wireless - more info - bmap - sha256sum: 48582b8a1a134679ff324eacc1e0b4af612cdabfb56dafb6b932fe11129b404f

Stretch for BeagleBoard-X15 via microSD card

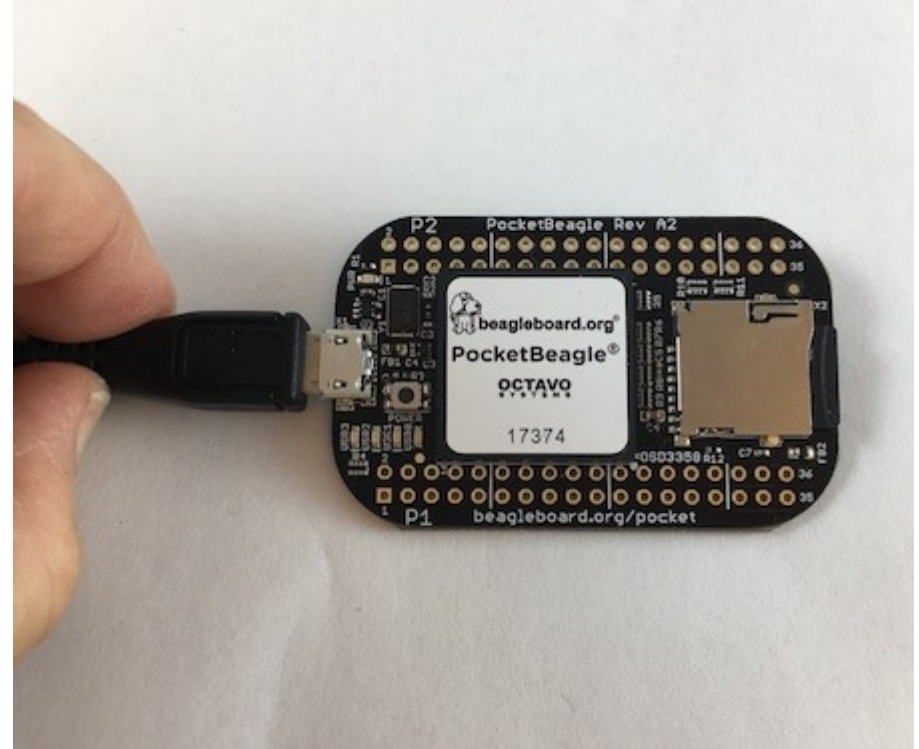


Write image to microSD with Etcher



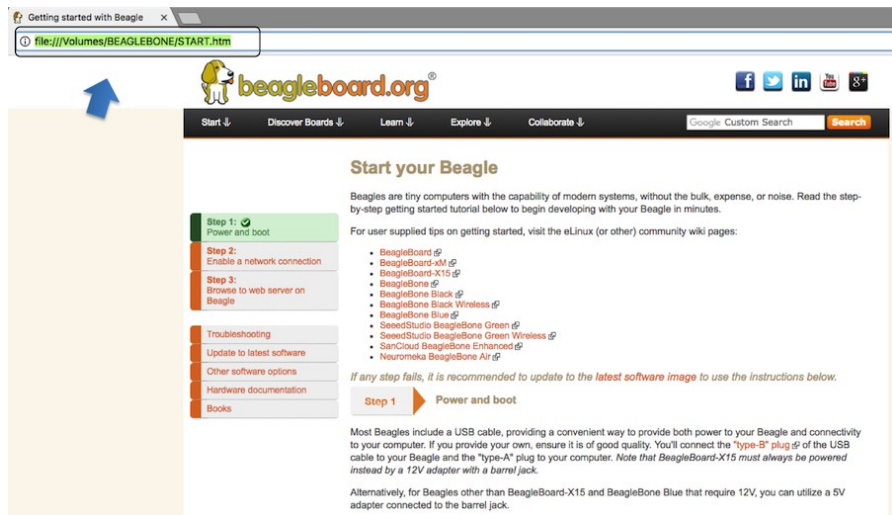


Insert microSD and boot





Connect to the USB network



Getting started with Beagle x

file:///Volumes/BEAGLEBONE/START.htm

beagleboard.org®

Start ↓ Discover Boards ↓ Learn ↓ Explore ↓ Collaborate ↓ Google Custom Search Search

Start your Beagle

Beagles are tiny computers with the capability of modern systems, without the bulk, expense, or noise. Read the step-by-step getting started tutorial below to begin developing with your Beagle in minutes.

For user supplied tips on getting started, visit the eLinux (or other) community wiki pages:

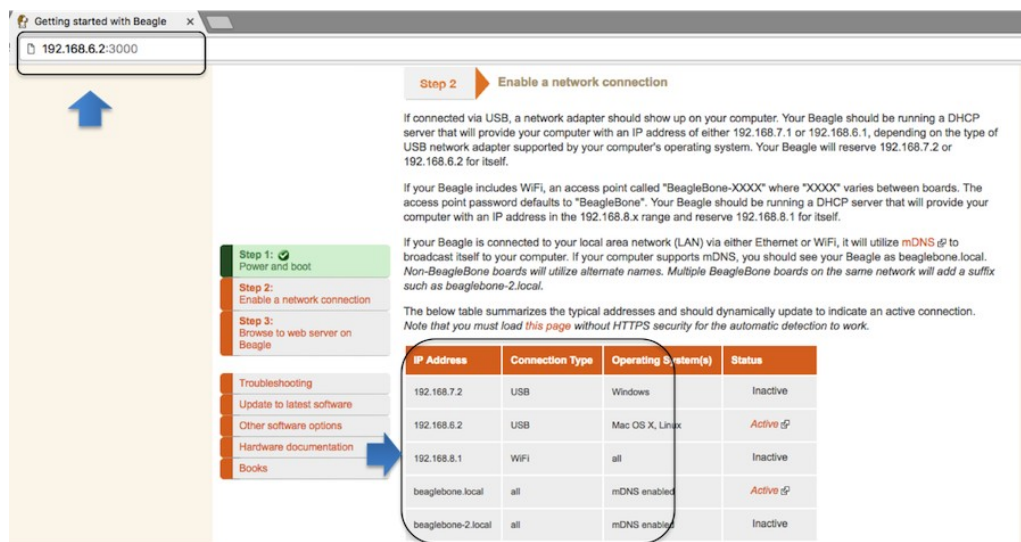
- BeagleBoard ⚡
- BeagleBoard-xM ⚡
- BeagleBoard-X15 ⚡
- BeagleBone ⚡
- BeagleBone Black ⚡
- BeagleBone Black Wireless ⚡
- BeagleBone Blue ⚡
- SeedStudio BeagleBone Green ⚡
- SeedStudio BeagleBone Green Wireless ⚡
- SanCloud BeagleBone Enhanced ⚡
- Neuromeka BeagleBone Air ⚡

If any step fails, it is recommended to update to the latest software image to use the instructions below.

Step 1 ▶ Power and boot

Most Beagles include a USB cable, providing a convenient way to provide both power to your Beagle and connectivity to your computer. If you provide your own, ensure it is of good quality. You'll connect the "type-B" plug ⚡ of the USB cable to your Beagle and the "type-A" plug to your computer. Note that BeagleBoard-X15 must always be powered instead by a 12V adapter with a barrel jack.

Alternatively, for Beagles other than BeagleBoard-X15 and BeagleBone Blue that require 12V, you can utilize a 5V adapter connected to the barrel jack.



Getting started with Beagle x

192.168.6.2:3000

Step 2 ▶ Enable a network connection

If connected via USB, a network adapter should show up on your computer. Your Beagle should be running a DHCP server that will provide your computer with an IP address of either 192.168.7.1 or 192.168.6.1, depending on the type of USB network adapter supported by your computer's operating system. Your Beagle will reserve 192.168.7.2 or 192.168.6.2 for itself.

If your Beagle includes WiFi, an access point called "BeagleBone-XXXX" where "XXXX" varies between boards. The access point password defaults to "BeagleBone". Your Beagle should be running a DHCP server that will provide your computer with an IP address in the 192.168.8.x range and reserve 192.168.8.1 for itself.

If your Beagle is connected to your local area network (LAN) via either Ethernet or WiFi, it will utilize mDNS ⚡ to broadcast itself to your computer. If your computer supports mDNS, you should see your Beagle as beaglebone.local. Non-BeagleBone boards will utilize alternate names. Multiple BeagleBone boards on the same network will add a suffix such as beaglebone-2.local.

The below table summarizes the typical addresses and should dynamically update to indicate an active connection. Note that you must load this page without HTTPS security for the automatic detection to work.

IP Address	Connection Type	Operating System(s)	Status
192.168.7.2	USB	Windows	Inactive
192.168.6.2	USB	Mac OS X, Linux	Active ⚡
192.168.8.1	WiFi	all	Inactive
beaglebone.local	all	mDNS enabled	Active ⚡
beaglebone-2.local	all	mDNS enabled	Inactive

Open the IDE

