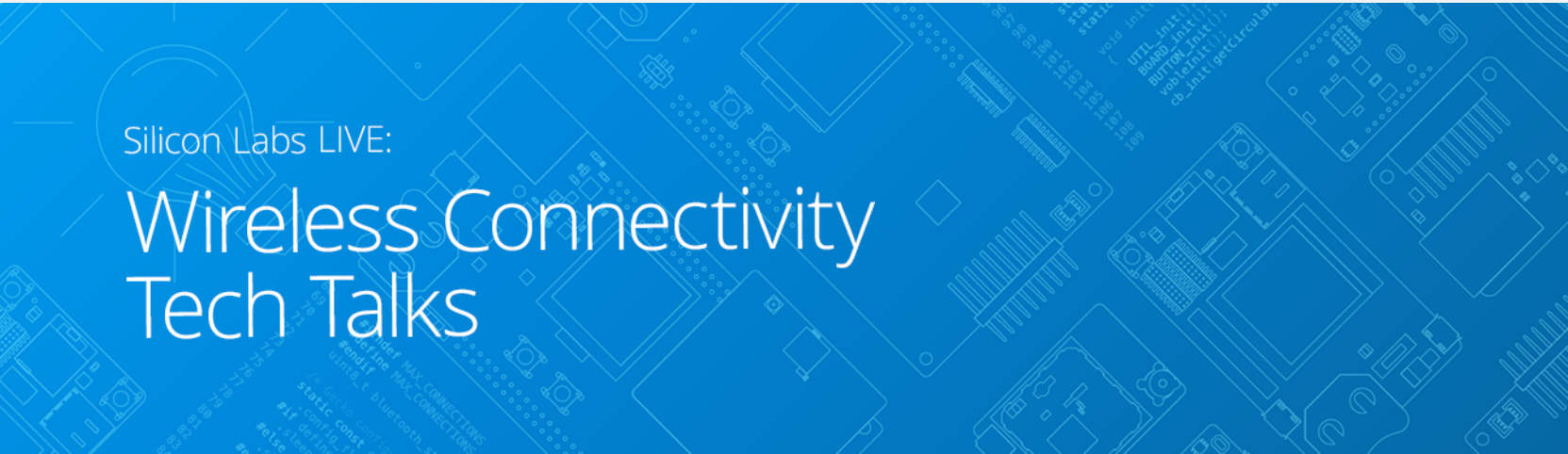
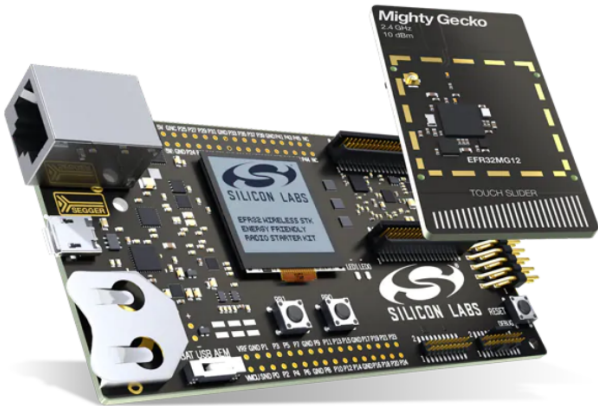


Tech Talks LIVE Schedule – Presentation will begin shortly



Topic	Date
Building a Proper Mesh Test Environment: How This Was Solved in Boston	Thursday, July 2
Come to your Senses with our Magnetic Sensor	Thursday, July 9
Exploring features of the BLE Security Manager	Thursday, July 23
New Bluetooth Mesh Light & Sensor Models	Thursday, July 30
Simplicity Studio v5 Introduction	Thursday, August 6
Long Range Connectivity using Proprietary RF Solution	Thursday, August 13
Wake Bluetooth from Deep Sleep using an RF Signal	Thursday, August 20

Please take the poll while waiting and be entered to receive a Mesh Starter kit.



Find Past Recorded Sessions at:
<https://www.silabs.com/support/training>



WELCOME



Silicon Labs LIVE:

Wireless Connectivity Tech Talks



Building a Proper Mesh Test Environment: How This Was Solved in Boston

JULY 2020



Agenda

- Why?
- Hardware
 - Wireless Starter Kit
 - Radio boards
 - Packet Trace Interface
- Software
 - SDKs
 - Tools
- Demo
- Documentation

Silicon Labs Boston Office Test Network



Why?

- Application Testing
 - Hardware Testing
 - Compliance Testing
 - Certification Testing
- Small Network
 - Table top prototyping
 - 3-6 nodes
 - Medium Network
 - Typical In Home sized network
 - 10-30 nodes
 - Large Network
 - Network algorithm testing
 - Protocol testing
 - Industrial/Commercial
 - 100 - 300 nodes

Hardware



Development Hardware

Radio pin access headers for prototyping

Integrate J-Link debugger
Connect via USB or Ethernet
Virtual Com Port support
Packet Trace
Energy Profiler

Radio card header for easy swapping

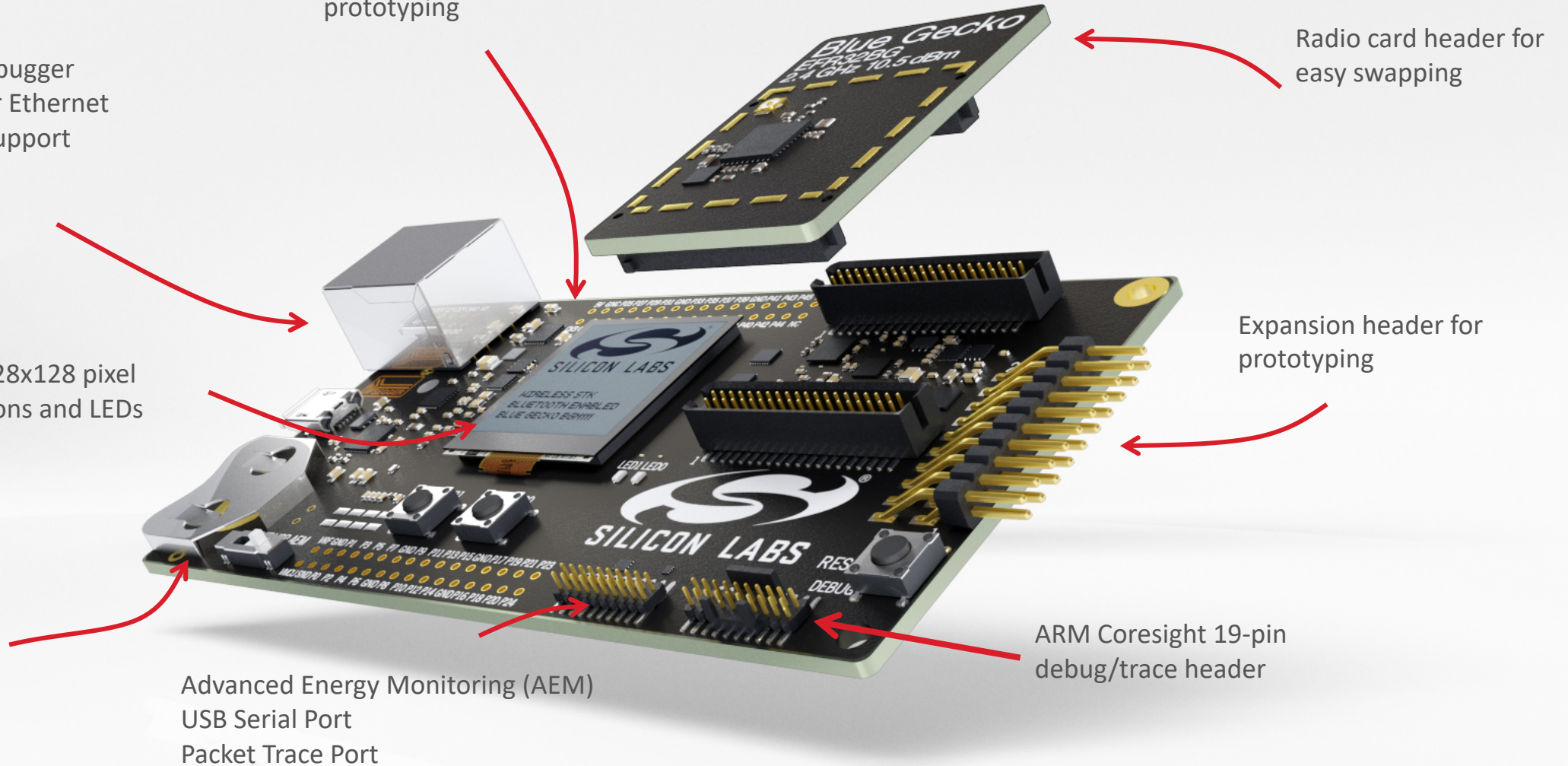
Ultra-low power 128x128 pixel
memory LCD, buttons and LEDs

Expansion header for prototyping

USB Power or
Battery Power

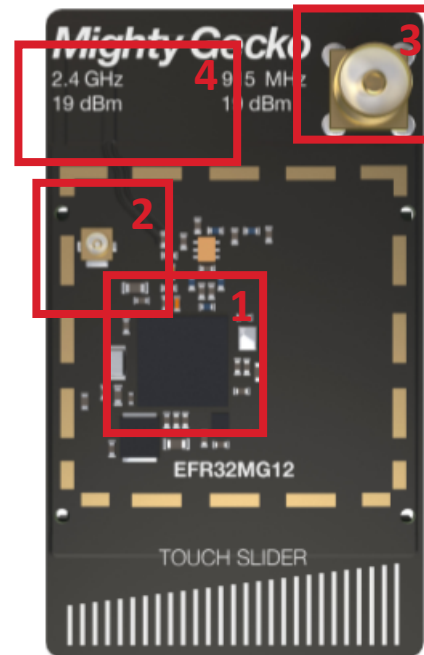
Advanced Energy Monitoring (AEM)
USB Serial Port
Packet Trace Port

ARM Coresight 19-pin
debug/trace header



EFR32 Radio Board

1. EFR32MG12
2. SMA Connector (2.4GHz)
3. UFL Connector (Sub-GHz)
4. Printed Inverted-F antenna



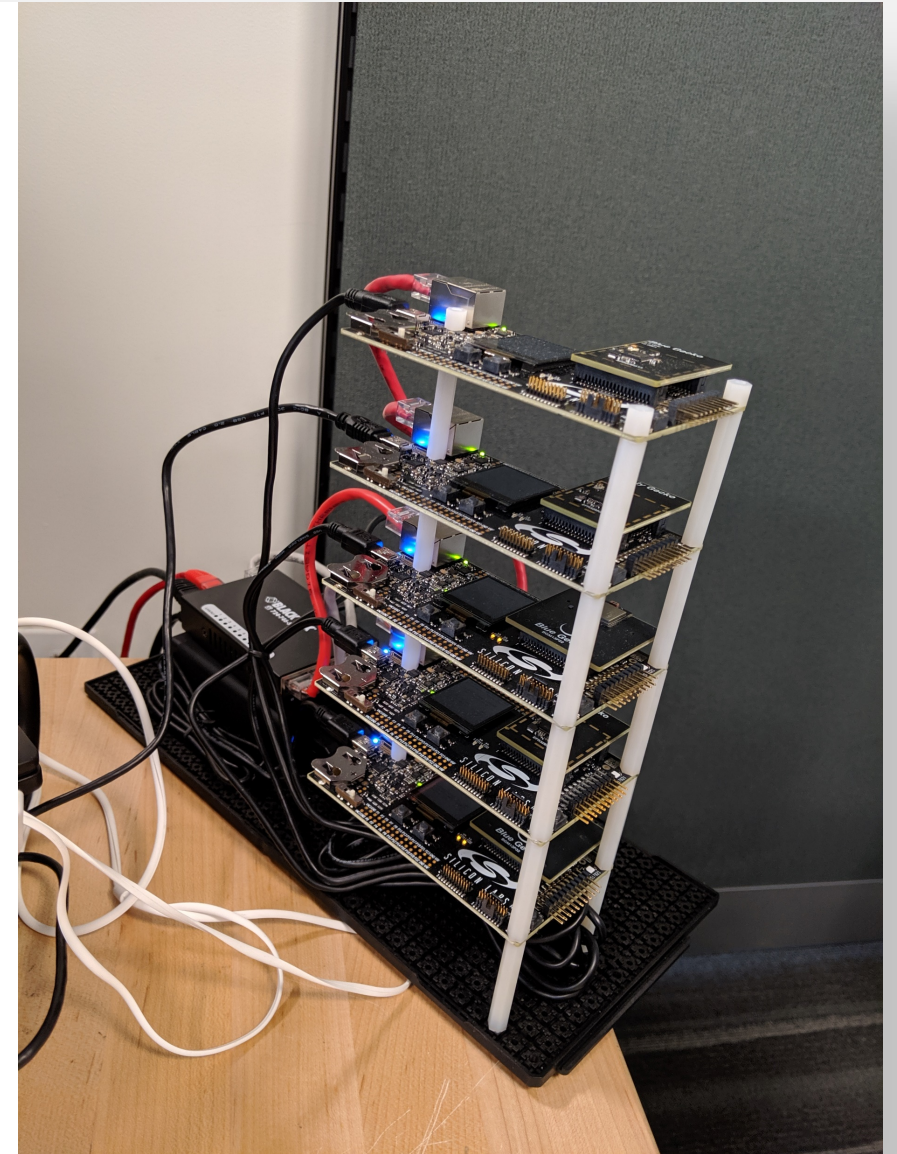
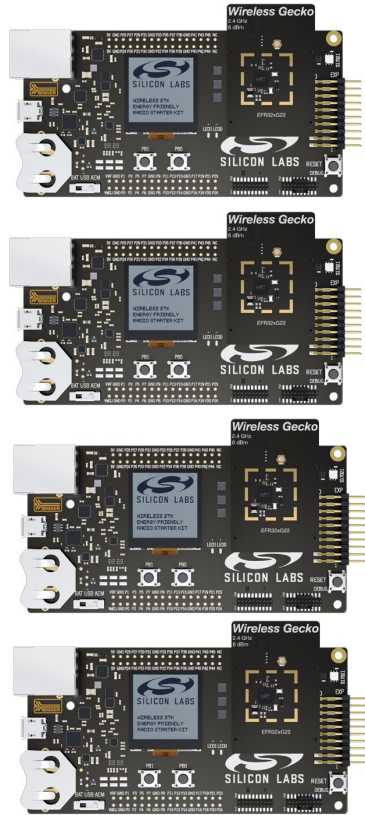
Prototyping test setup

- WSTKs connected to USB and ethernet

USB Power

Ethernet

WSTKs + Radio Boards

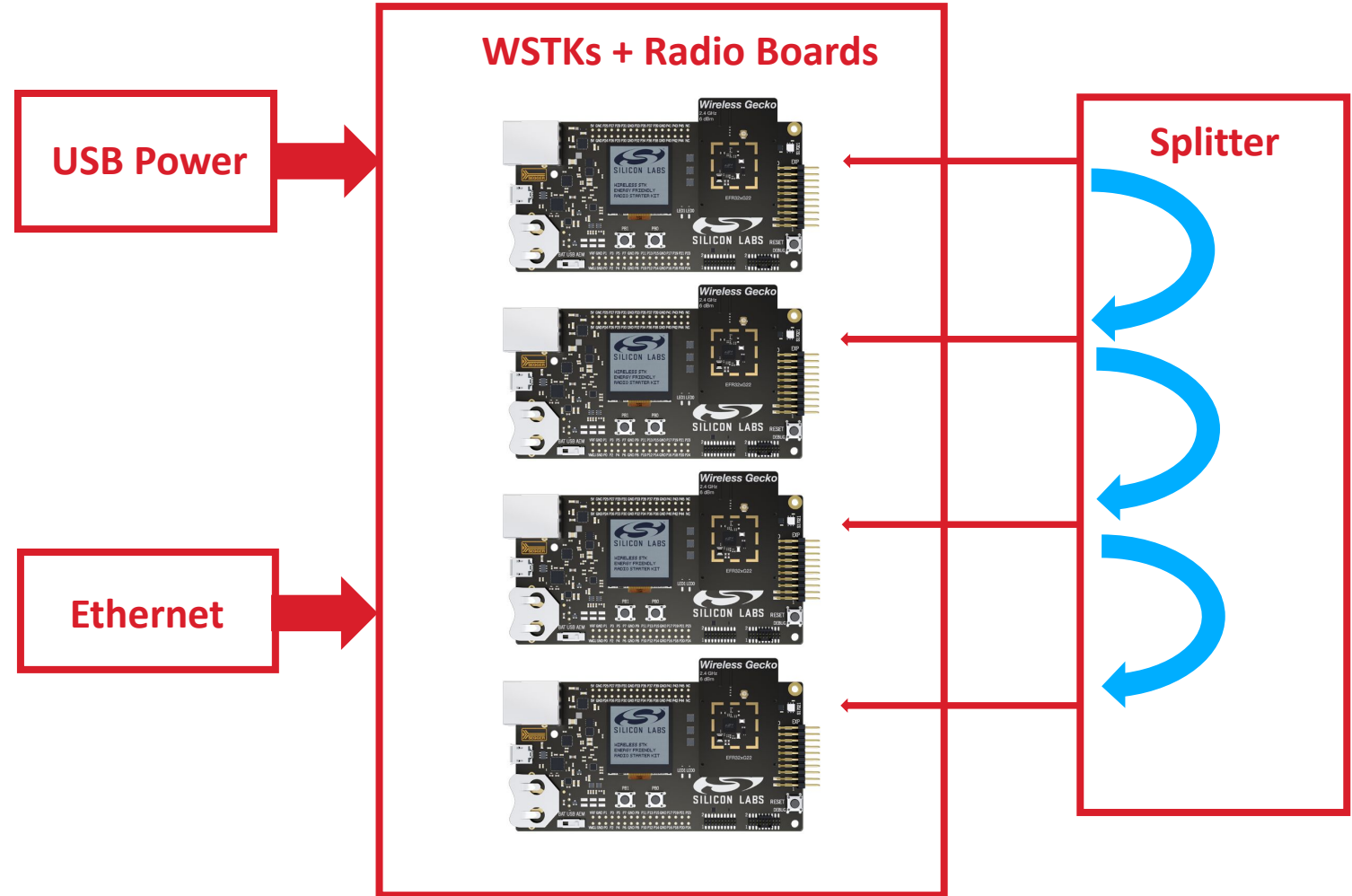


Parts list

- [Hex Standoff 1-3/4" Nylon #4-40](#)
- [Hex Nut 1/4" Nylon #4-40](#)
- [Machine Screw Pan Phillips #4-40](#)

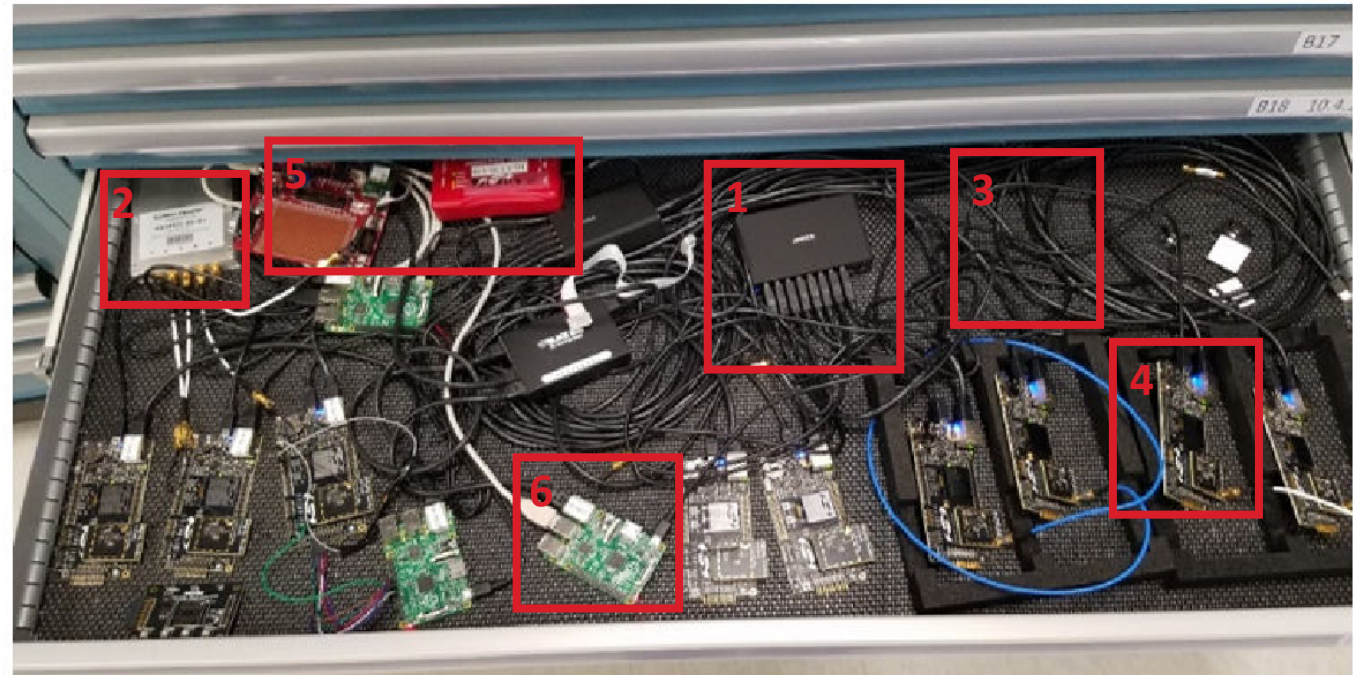
SQA Testing Drawer

1. WSTKs
2. Radio Boards
3. USB Hub
4. Ethernet Switch
5. Attenuator Cable Splitter



SQA Testing Drawer

1. USB Hub
2. Attenuator Cable Splitter
3. Ethernet Cables
4. WSTK
5. ISA3 and EM35x
6. Raspberry Pi



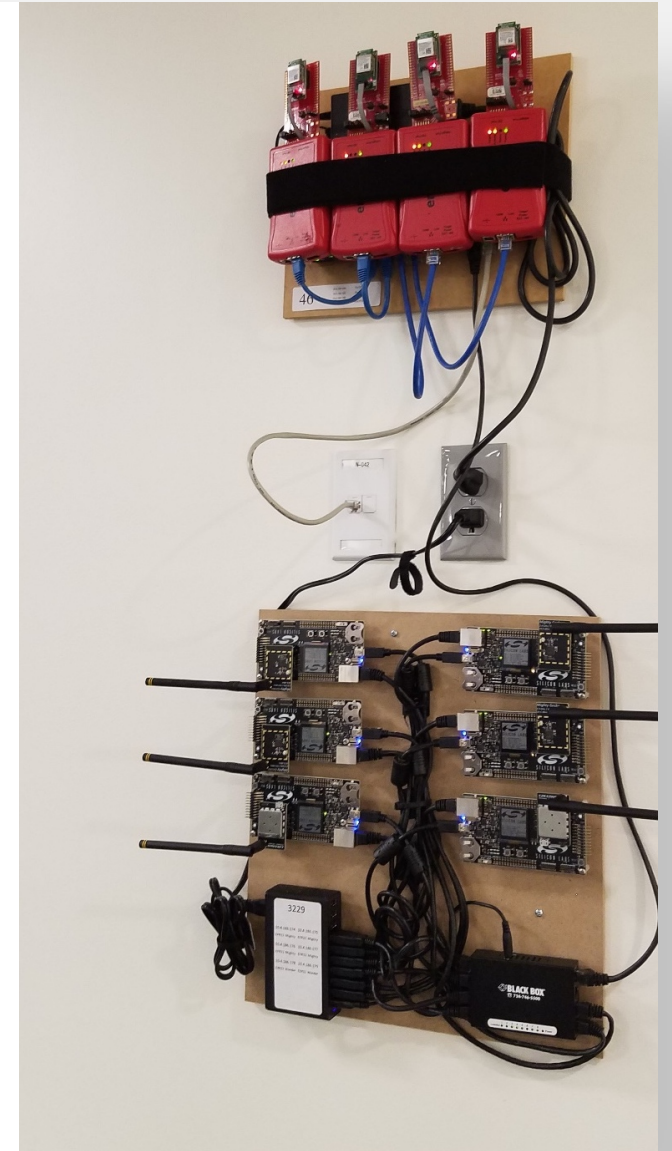
Parts list

- [Connector from chip to SMA cables](#)
- [SMA cables](#)
- [SMA connects to power splitter](#)
- [Attenuators – inline SMA](#) (20 dBm example)
- [Terminators on unused power splitter ports](#) (to prevent RF bleeding)

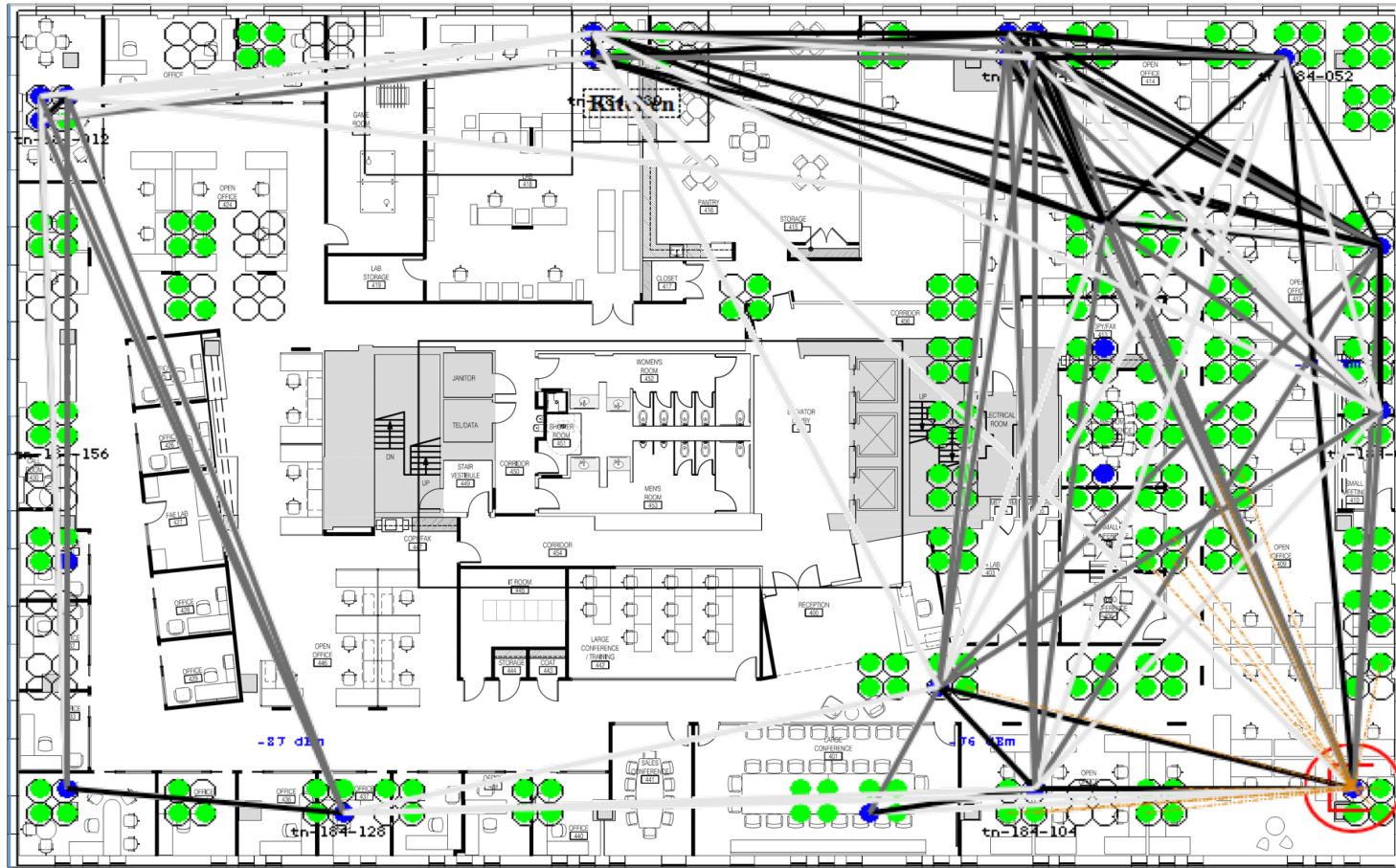
By default the output of the matching network is connected to the printed Inverted-F antenna by a series component.

Silicon Labs Office Test Network

- 500+ node test network for QA and performance testing
- Ability to configure various network topologies
- Consists of device clusters spaced over entire office
- Controlled over Ethernet backchannel

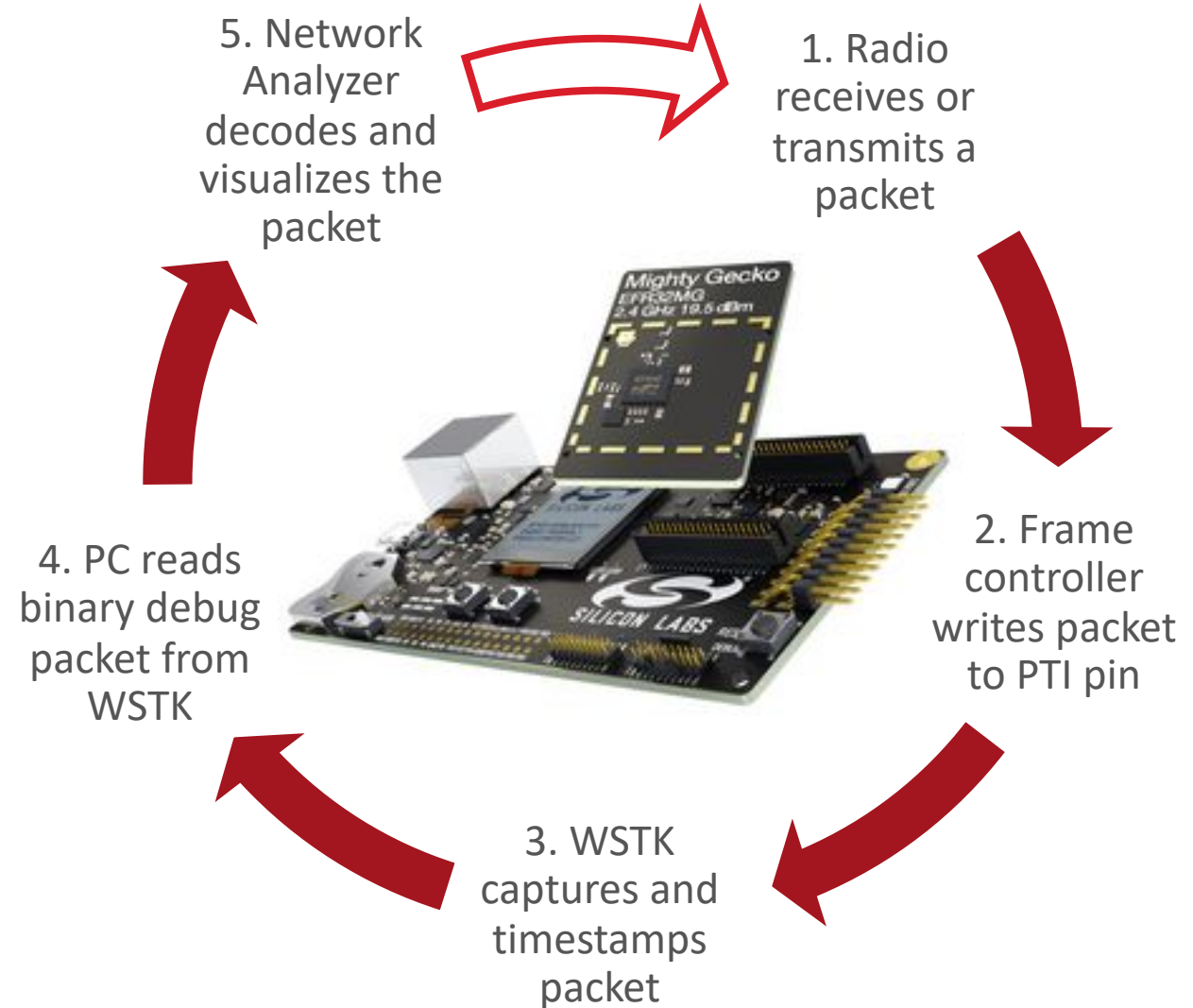


Where's my sniffer?



Packet Trace Interface (PTI)

- Direct feedback from baseband radio
 - Raw TX and RX packet
 - Timestamp, RSSI, channel, protocol, etc.
- Implemented in hardware and radio sequencer
 - Dedicated UART/SPI interface
 - Zero overhead to Cortex code
- Captured and timestamped by Wireless Starter Kit (WSTK)






Direct capture with PTI vs Sniffer



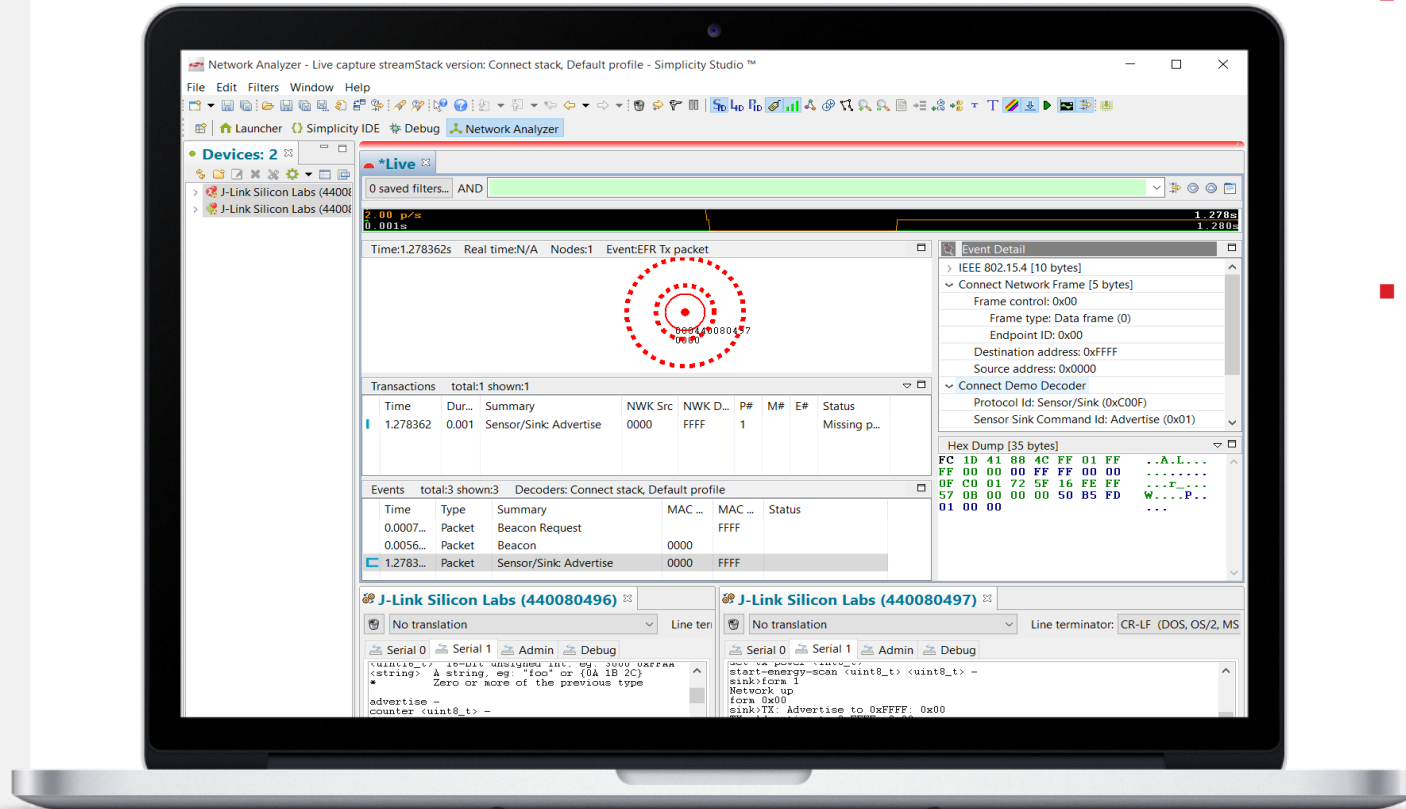
Software



A Common Platform

	 Bluetooth®	OPENTHREAD <small>released by Google</small>	 zigbee	FLEX SDK  Proprietary		
Application	Customer Application		Customer Application	Customer Application		
	GATT (profiles / services)	Mesh Models (e.g. lighting)	Application Layer (e.g. Project CHIP, OpenWeave, CoAP)	Application Profile (e.g. Zigbee 3.0, ZLL, SE)		
Network / Transport	Bluetooth LE Core	Bluetooth Mesh Core	UDP	Zigbee Core Stack	Connect Stack	Customer Proprietary Stack
			IPv6, Mesh Routing			
			6LoWPAN			
Link	Bluetooth Link Layer		IEEE 802.15.4 MAC	IEEE 802.15.4 MAC	IEEE 802.15.4 like MAC	
Physical	Bluetooth PHY (2.4 GHz)		IEEE 802.15.4 PHY (2.4 GHz)	IEEE 802.15.4 PHY (2.4 GHz)	Proprietary PHY (2.4 GHz or Sub-GHz)	
Platform	RAIL		RAIL	RAIL	RAIL	
	Common Bootloader		Common Bootloader	Common Bootloader	Common Bootloader	

Network Analyzer



- Network-wide view of all packet activity
- Correlates network traffic into events
- Custom decoding and filtering options
- Log files accelerate Silicon Labs support
- Uses unique Packet Trace Port feature
- 2-wire interface
- Outputs every packet TX/RX with link quality
- Can be used to output application debug statements



Advanced system-wide network debug and support

Stack Software

- Plugins for Zigbee
 - Throughput
 - Manufacturing Library CLI
 - Stack Diagnostics
 - Debug Extended Library
- docs.silabs.com
 - [App Framework CLI](#)

Plugin: ➡ Throughput

Quality: 🧪 Test Tool

Description:

This plugin provides support both for generating traffic when doing coexistence testing, and for measuring network throughput. Packets are sent periodically on a CLI-programmable interval unless the packets-in-flight limit is exceeded.

Plugin: ➡ Manufacturing Library CLI

Quality: 📄 Sample Code

Description:

The CLI for running manufacturing library commands.

Plugin: ➡ Stack Diagnostics

Quality: 🧪 Debug Tool

Description:

CLI commands for printing various information about the stack, such as the child table, neighbor table, and routing table.

Plugin: ➡ Debug Extended Library

Quality: ✅ Production Ready

Description:

This library provides extended debug support for the stack to send messages to the backchannel, which can be captured by Insight Desktop and displayed. The features are: (1) API Call Trace Output, (2) Debug Error Output, (3) Debug Printf Output.

IoT Utility Scripts

- Command-Line PTI Capture Utility (supported)
 - [GitHub pti_capture](#)
 - [Knowledge Base Article: Command-Line PTI Capture Utility](#)
- [Network testing Python Scripts](#) (for fun)

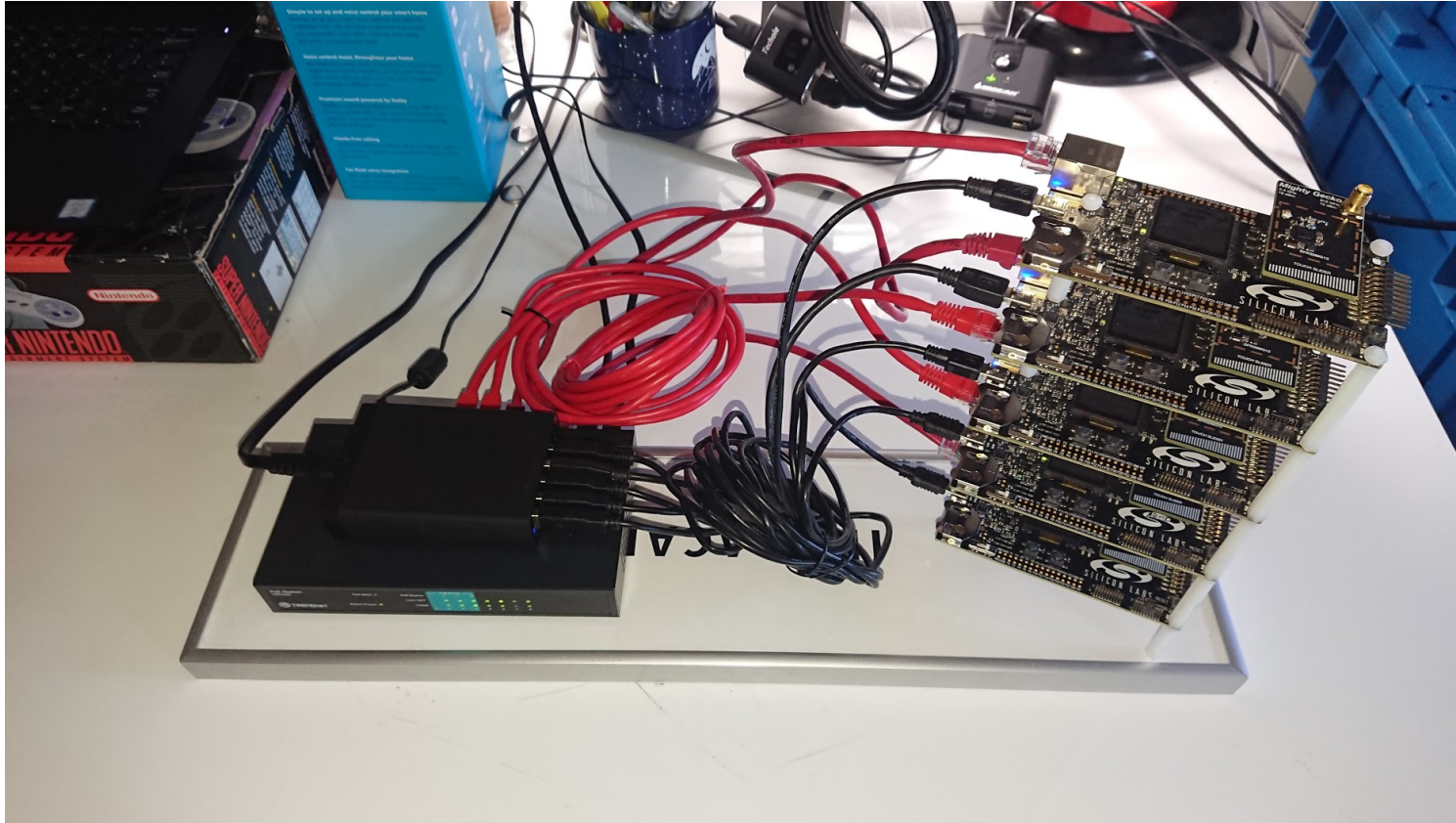
```
szup@bl-helium:~/TechTalk$ java -jar silabs-pti-capture.jar -ip=10.4.180.142
INFO: 10.4.180.142:4905 =>> Connect.
null
[ 02 00 E5 1D AF 29 24 00 03 00 A6 19 ]
[ 02 00 06 1E AF 29 24 00 03 00 A7 22 40 ]
[ 02 00 2A 1E AF 29 24 00 03 00 A8 19 ]
[ 02 00 4F 1E AF 29 24 00 03 00 A9 22 40 ]
[ 02 00 73 1E AF 29 24 00 03 00 AA 19 ]
```

```
szup@bl-helium:~/TechTalk$ python send_message.py demo_csv/config_bind_report.csv
Debugging print disabled
Instruction print enabled
{'input_csv': 'demo_csv/config_bind_report.csv', 'debug': False, 'disable_print': False, 'logging_ip': None}
```

Network Capture Live Demo



Prototyping test setup



Documentation

- Learn more at www.silabs.com/mesh-peformance or check out the following application notes:
 - [AN1137: Bluetooth Mesh Network Performance](#)
 - [AN1138: Zigbee Mesh Network Performance](#)
 - [AN1141: Thread Mesh Network Performance](#)
 - [AN1142: Mesh Network Performance Comparison](#)
- [EFR32MG12 2.4 GHz 10 dBm Radio Board BRD4162A Reference Manual](#)
- [UG104: Testing and Debugging Applications for the Silicon Labs EM35x and EFR32MG Platforms](#)

Summary

- Exercise products in expected conditions
 - Test for your use case
- PTI is our friend
- Silicon Labs offers hardware, software stack, and tools to get you up and running quickly
 - Tested in real environments

BG22 Virtual Workshop



Learn how to develop and deploy more powerful, efficient, and secure IoT products with your own BG22 Thunderboard – free for all registrants!

New Session Open for July 28th – 30th

10:00AM –11:30 AM CST - T, W, Th

Register today! <https://www.silabs.com/about-us/events/virtual-bluetooth-workshop>



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