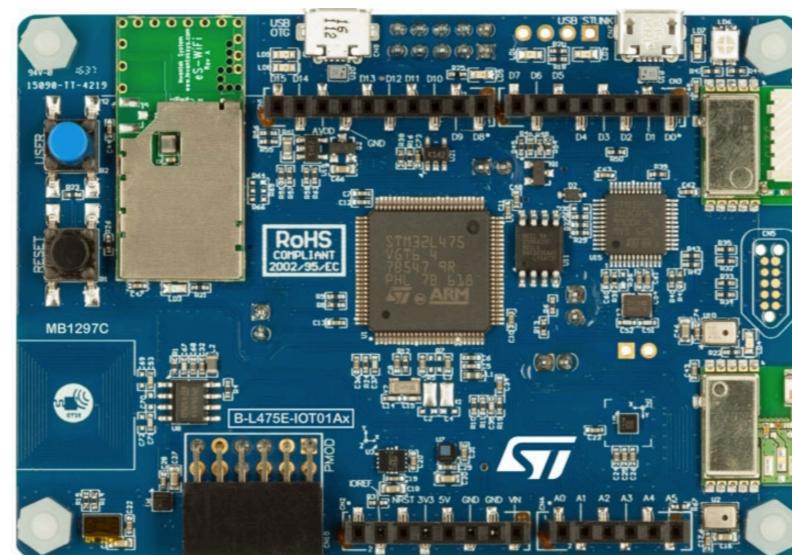


Embedded Systems Hardware Interfacing Introduction

Norman McEntire



Opening Remarks

- Welcome!
- Thank you for attending!
- My promise to you...(see next slide)

My Promise to You

- Make this one of the best and most exciting courses you have ever taken!
- Provide you great presentations and code demos to make your learning fast and complete
- Make sure you leave this course with lots of Embedded Hardware Interfacing Skills

About Myself

- Norman McEntire
- BS/MS Computer Engineering
 - USC - University of South Carolina
- 35+ Years Computer Engineering Experience
 - Hardware (chips, boards, systems) Engineering
 - Software Engineering (device drivers, systems programming, GUI apps)
- Founder of Servin Corporation
 - Since 1995, Software Development and Training.
 - Current Focus: Embedded IoT (Internet of Things)

Some of My Recent Projects

Itron Riva Dev Edge

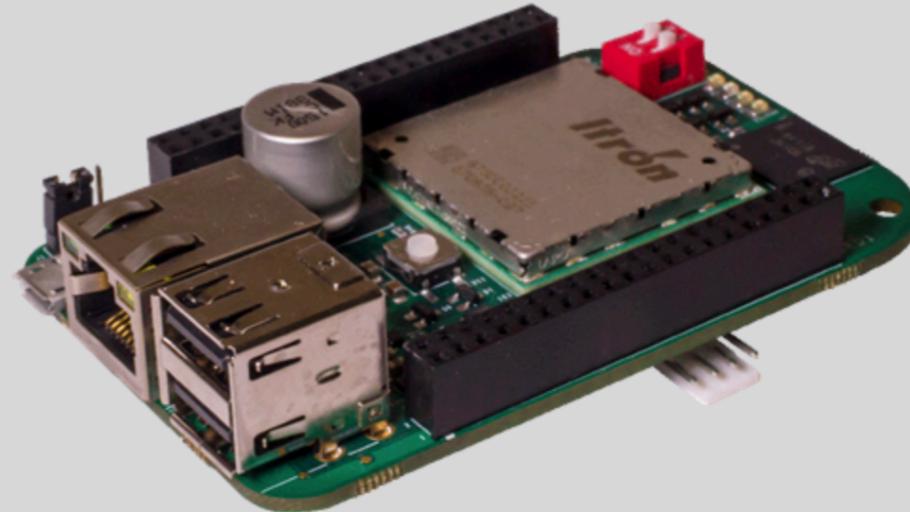
Linux Based Dev Board

Itron Riva Dev Edge Board

The Itron® Riva Dev Edge board is the processing core for the Itron Riva Dev Edge stack and includes the memory and control logic for the stack. This Linux based system can be used in a root or node configuration. In the *root* configuration, this board hosts the DHCP server. The root acts as a router for the network, supporting Ethernet, WiFi, and a Skyus 4G cellular modem. In the *node* configuration, the board relies on a root for an IP address, and can operate locally. The board requires the root and the addition of an Itron Riva Dev Edge RF board to communicate on the RF mesh network. *A fully compatible Itron Riva Dev Edge RF board can be purchased separately below.*

Board features include:

- 10/100 MBPS Ethernet Port
- 4-pin connector as a serial console for the Linux-based firmware shipped with the board
- Two USB A Host ports
- Two 40-pin expansion connectors for all major I/O types (serial, GPIO, A/D, I2C, SPI)
- iSOM module containing the TI AM335X ARM Cortex Microprocessor, FLASH, RAM, power supply control, clock and other features
- additional 4GB of eMMC Flash memory



Itron Riva Dev Mini Linux Based Board

Itron Riva Dev Mini Board

The Itron Riva Dev Mini is a complete Linux system on a module, running a special Linux-distribution named Muse (created by Itron). While the Mini has a smaller footprint than the Edge, the Mini and the Edge boards are software compatible. The Mini provides the ability to embed Itron Riva's adaptive radio frequency communications capability (to support 870 MHz and 920 MHz bands) in a prototype product.

Board features include:

- TI AM335X ARM Cortex Microprocessor
- 900 Mhz 802.15.4g radio
- 1 mini-USB connector
- 40 pin expansion to bring control and communications off the board
- iSOM module containing the processor, FLASH, RAM, power supply control, clock and other features



Resources

- [Getting Started: Itron Riva Dev Mini board](#)

Itron Riva Dev LE

STM32 Embedded Board

[Order an Itron Riva Dev Mini with compatible components >](#)

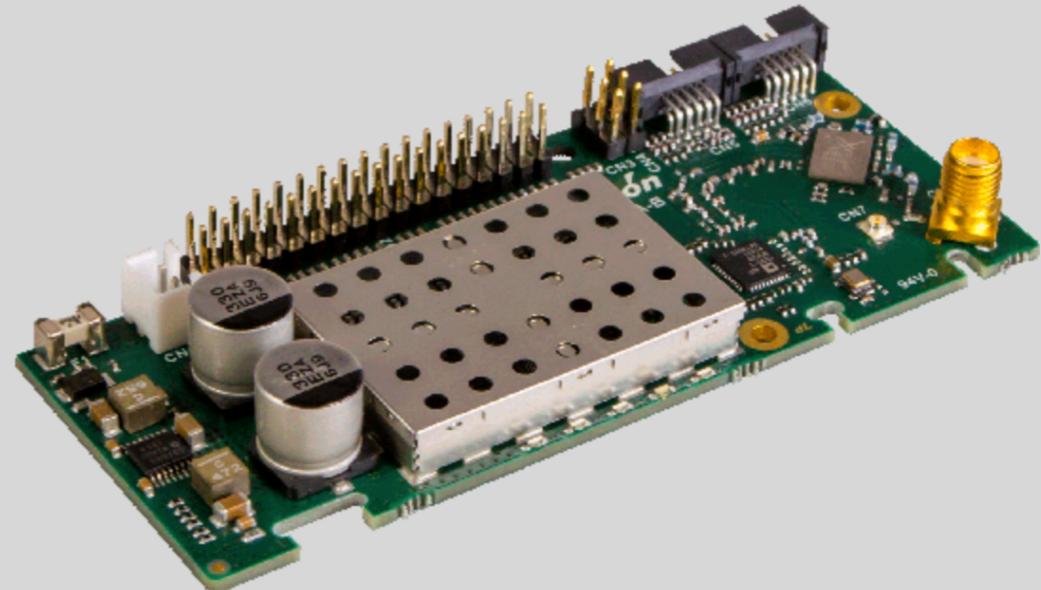
Itron Riva Dev LE Board

With a 900 Mhz 802.14.5g radio, the Itron Riva Dev LE board operates at a fixed bandwidth (FSK - 12.5Kbps) which is ideal for low-powered or battery-powered devices.

The board has

- STM32L486 processor
- 1 MB of memory
- 128KB of RAM
- 32-pin I/O expansion connector
- Multiple expansion options (Serial, GPIO, A/D, I2C, SPI)

To achieve this low energy operation, the Dev LE has a very small memory footprint and does not have Ethernet or USB.



Course Roadmap

- **Part 1 - Core**

- Lesson 1. **GPIO** - General Purpose I/O
- Lesson 2. **ADC** - Analog to Digital Conversion
- Lesson 3. **Serial** UART

- **Part 2 - Serial**

- Lesson 4 **I2C** - Inter Integrated Circuit
- Lesson 5 **SPI** - Serial Peripheral Interface
- Lesson 6 **USB** - Universal Serial Bus

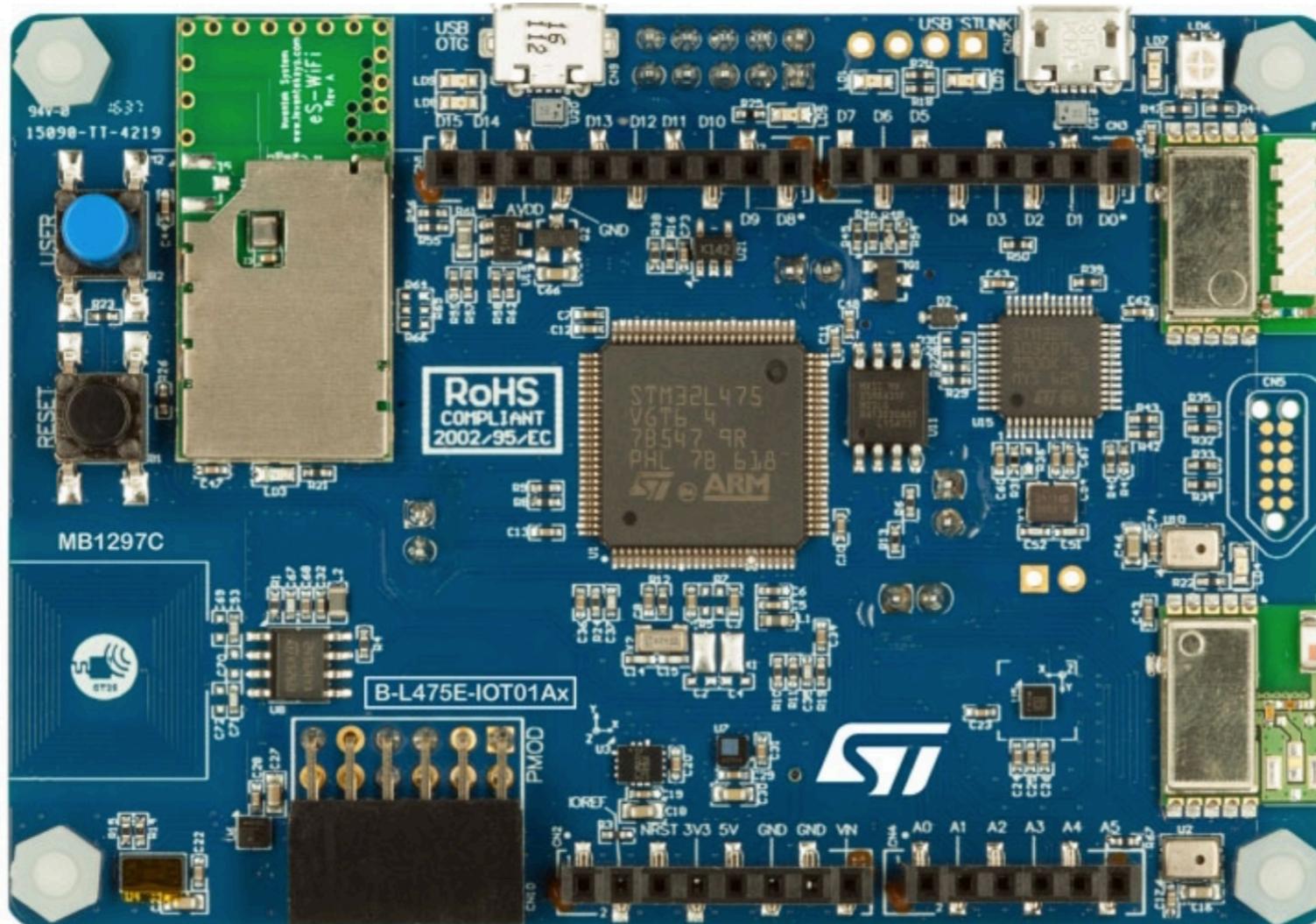
- **Part 3 - Wireless**

- Lesson 7 **Wifi**
- Lesson 8 **Bluetooth**
- Lesson 9 **NFC**

For Every Lesson

- Concepts
- Data Sheet - STM32L475
- User Manual - UM2153 - STM32L Discovery Kit for IoT
- Schematics - STM32L Discovery Kit for IoT
- API - STM32L HAL
 - Data Structures
 - Functions
- Hands-On Project

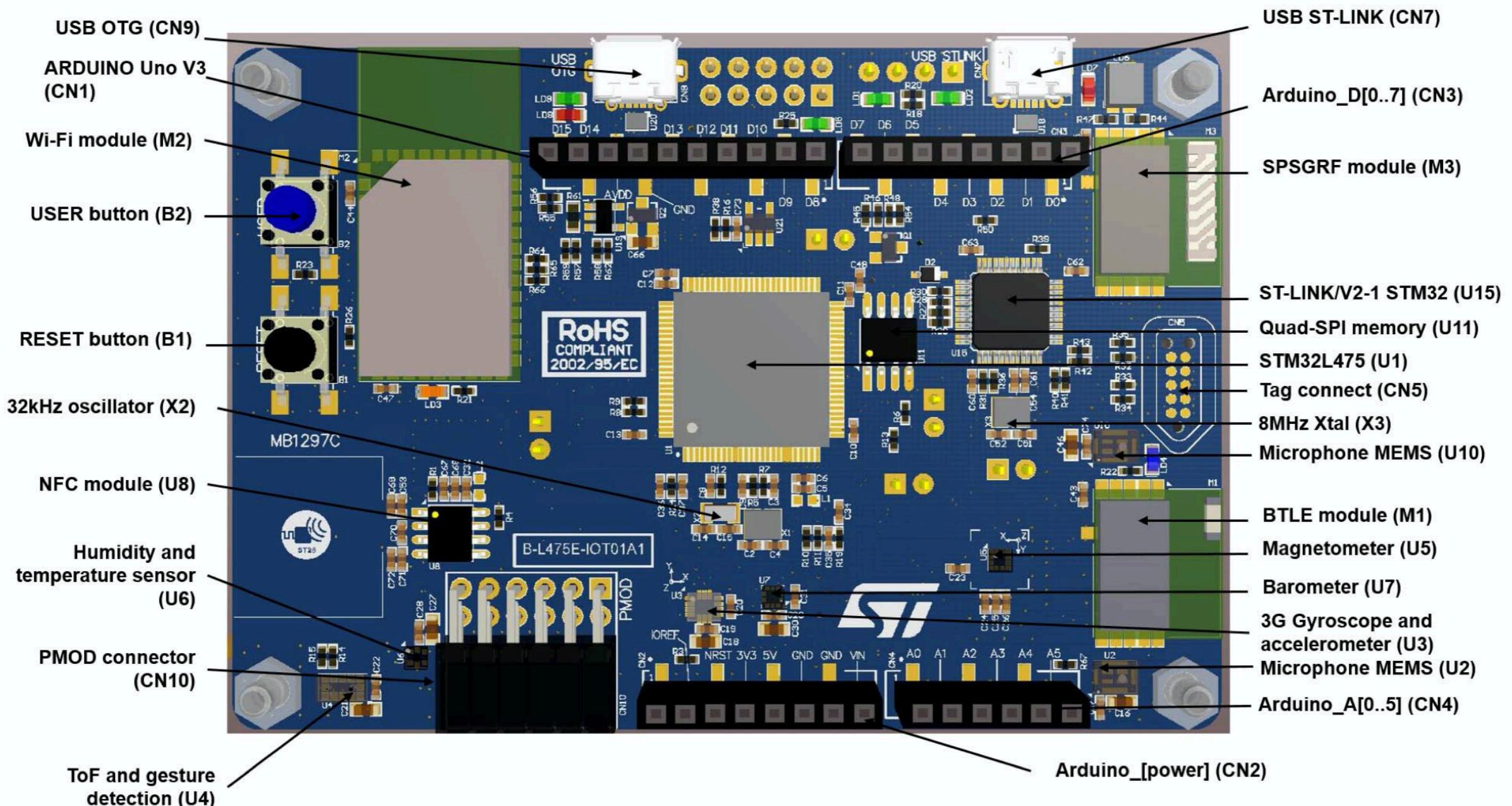
STM32L Discovery Kit IoT Node



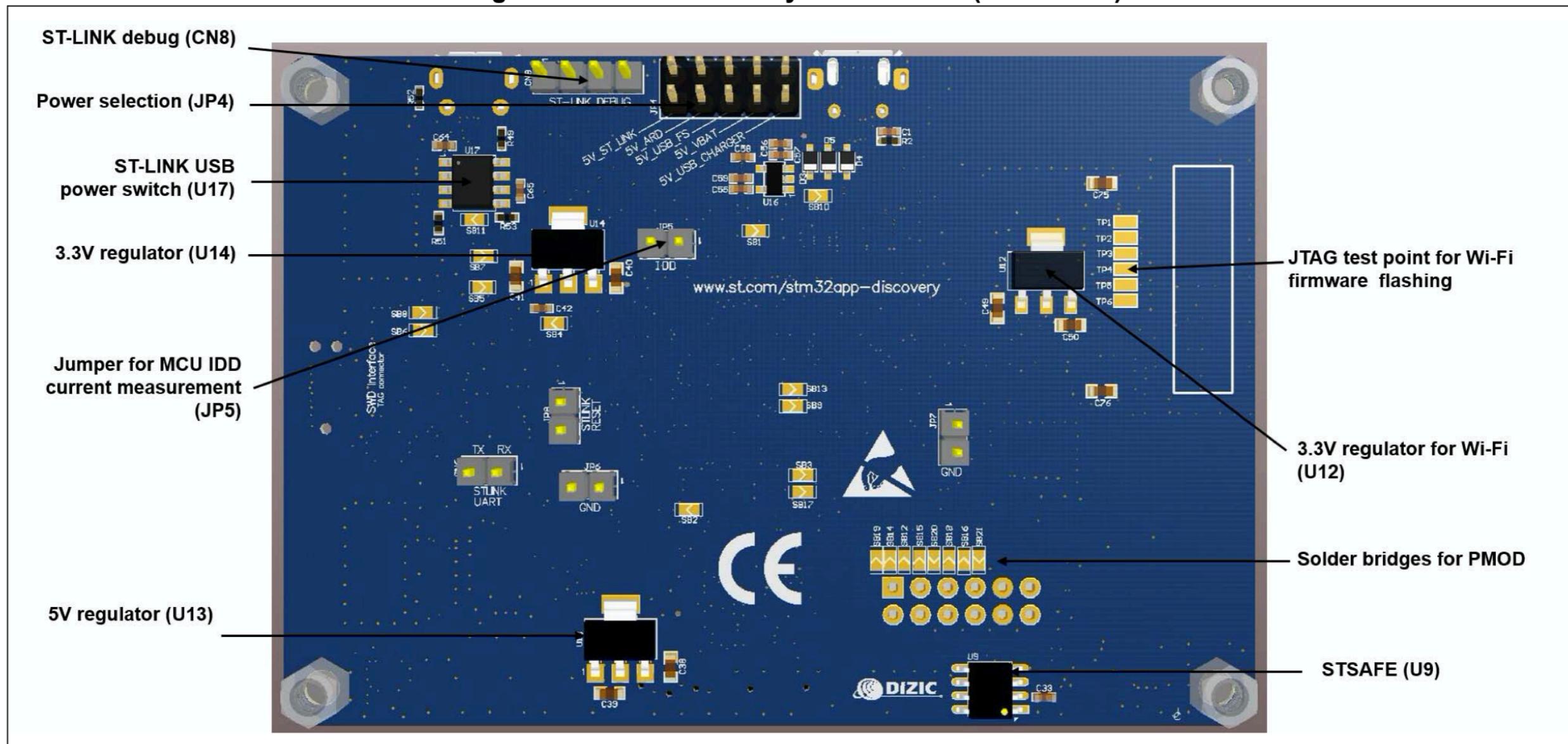
STM32L475

Connectivity USB OTG 1x SD/SDIO/MMC, 3x SPI, 3x I ² C, 1x CAN, 1x Quad SPI, 5x USART + 1 x ULP UART, 1 x SWP	ARM® Cortex®-M4 CPU 80 MHz FPU MPU ETM	Timers 17 timers including: 2 x 16-bit advanced motor control timers 2 x ULP timers 7 x 16-bit-timers 2 x 32-bit timers
Digital TRNG, 2 x SAI, DFSDM (8 channels)	DMA ART Accelerator™ Up to 1-Mbyte Flash with ECC Dual Bank 128-Kbyte RAM	Analog 3x 16-bit ADC, 2 x DAC, 2 x comparators, 2 x Op amps 1 x Temperature sensor
I/Os Up to 114 I/Os Touch-sensing controller		Parallel Interface FSMC 8-/16-bit (TFT-LCD, SRAM, NOR, NAND)

STM32L Discovery Kit IoT Node - Top Side of Board



STM32L Discovery Kit IoT Node - Back Side of Board



Use Discussion Board for All Questions

- Posting your questions on Discussion Board is the fastest way to get an answer
 - Other students can answer
 - Instructor can answer (if students do not answer)
- You can also email instructor if question is of personal nature and not suitable for Discussion Board (e.g. sickness issue, travel issue, etc.)

Let's Get Started!