

# Zephyr ❤️ Internet

## How Zephyr Speeds Implementation for New IoT Devices

Jonathan Beri, CEO of Golioth

# About Jonathan

- Involved with Zephyr since 2017 (OpenThread)
- Participate in TSC & Marketing Committees
- Founder and CEO of Golioth, leading cloud for Zephyr

@beriberikix · jberi@golioth.io

# This is an intro talk

- We'll go over key topics
- Lots of links
- Time for questions, or find me after

# What is an IoT Device?

# Internet

- Some way to talk to the internet
- More than a modem
- Not just “big Internet”
- Direct and indirect internet

# Things

- Generally an MCU (or MCUs are involved)
- Sensor nodes, gateways, actuators
- Compute + Comms
- Integrated Connectivity

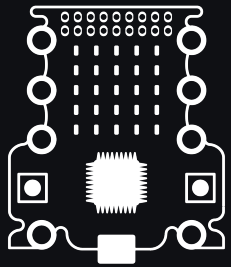
# Zephyr + IoT

# Zephyr is *batteries included*

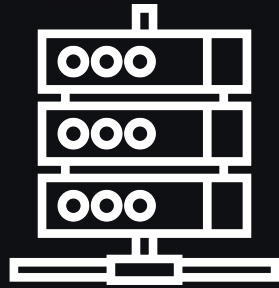
- Non-IoT bits
  - Kernel
  - OS Services
  - Device Drivers
  - Build system
- IoT bits (rest of this talk)



# IoT Features of Zephyr



Devices



Networking



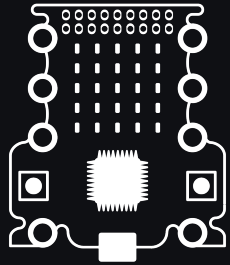
Modems



Protocols



Security



# Devices

# 400+ boards



# Vendor support

- Silicon members w/ official support
  - Non-members too
- Latest and greatest silicon
- Discord/mailing list moderated

intel®



NORDIC  
SEMICONDUCTOR

NXP



Qualcomm  
Innovation Center



TEXAS  
INSTRUMENTS



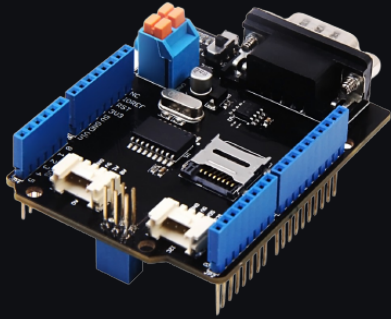
#ZephyrDevSummit



# Sensors

- Common sensor framework
- 30+ sensor families
- Easy to extend family or add new ones

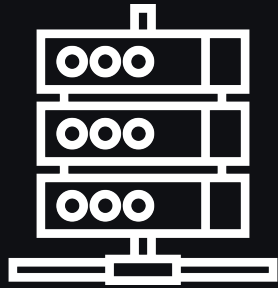
# Shields



- Daughter boards / Add-ons
- Native support
- Great for rapid prototyping

# Links

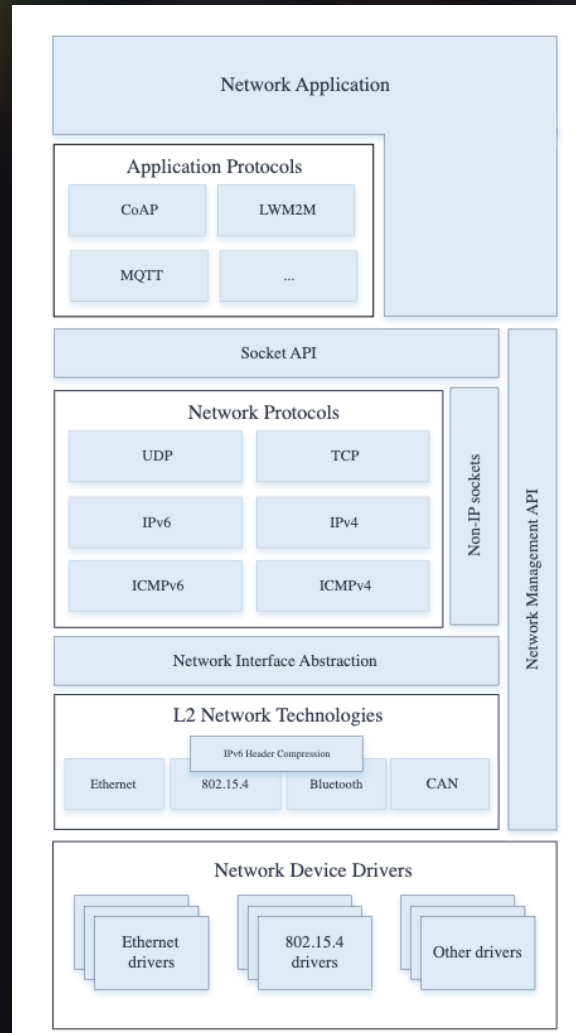
- **Supported boards:** [docs.zephyrproject.org/latest/boards/index.html](https://docs.zephyrproject.org/latest/boards/index.html)
- **Members:** [zephyrproject.org/project-members](https://zephyrproject.org/project-members)
- **Available Sensors:** [github.com/zephyrproject-rtos/zephyr/tree/main/drivers/sensor](https://github.com/zephyrproject-rtos/zephyr/tree/main/drivers/sensor)
- **Supported Shields:** [docs.zephyrproject.org/latest/boards/shields/index.html](https://docs.zephyrproject.org/latest/boards/shields/index.html)



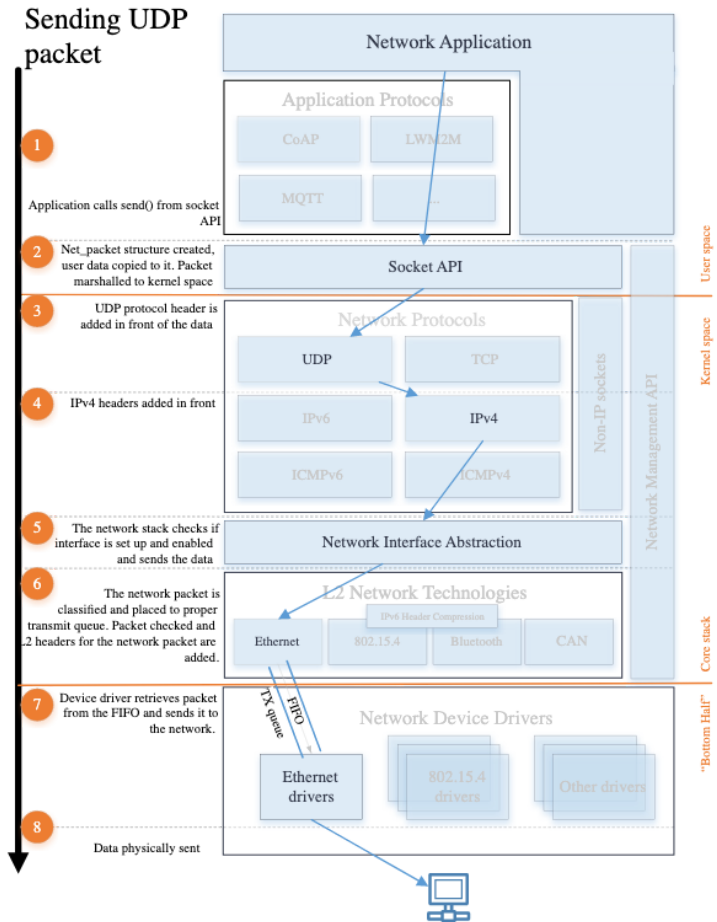
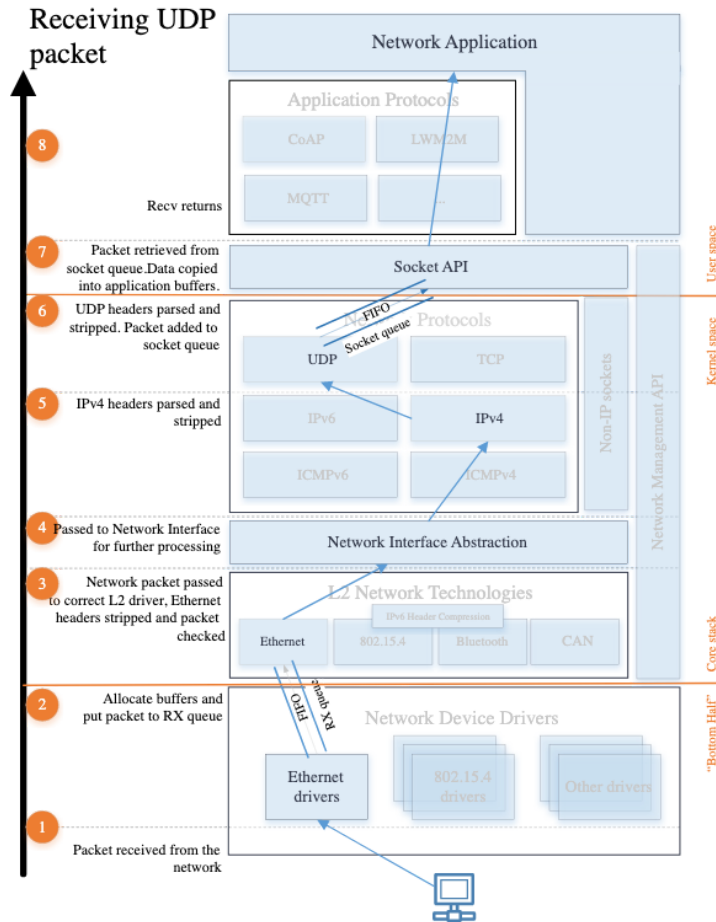
# Networking



# Network Stack



# Network Data Flow



# Advanced Features

(that we use)

- Network Traffic unloading
- Network Statistics
- Network Packet Filtering
- Network Shell

Using the  
Zephyr  
i2c  
Shell



# Links

- **Networking docs:** [docs.zephyrproject.org/latest/connectivity/networking/index.html](https://docs.zephyrproject.org/latest/connectivity/networking/index.html)
- **Networking APIs:** [docs.zephyrproject.org/latest/connectivity/networking/api/index.html](https://docs.zephyrproject.org/latest/connectivity/networking/api/index.html)
- **Networking samples:** [docs.zephyrproject.org/latest/samples/net/net.html](https://docs.zephyrproject.org/latest/samples/net/net.html)



# Modems

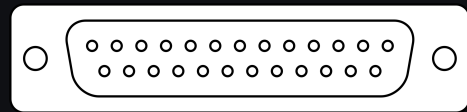
# Internet-enabled



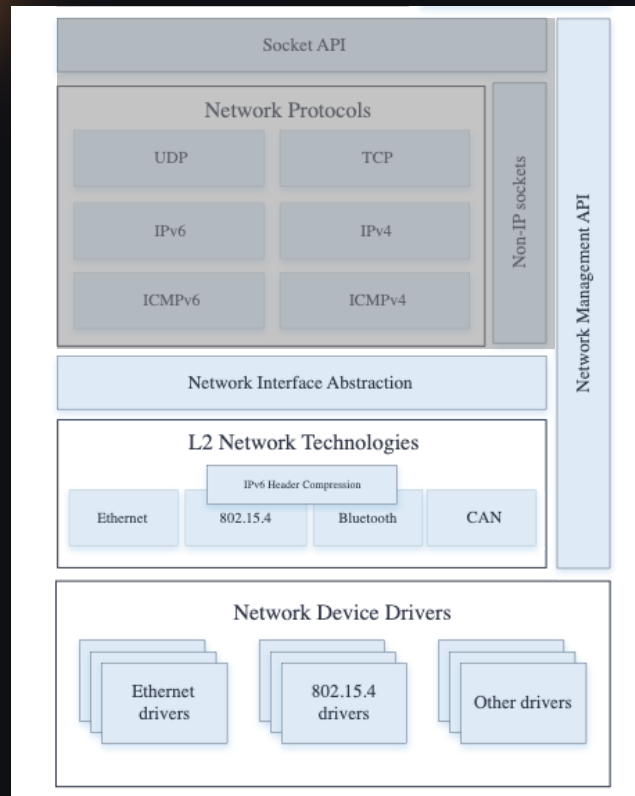
- Cellular
- Wi-Fi
- Ethernet

# Other connectivity

- BLE
- IEEE 802.15.4
- LoRa
- CAN
- RS232 / RS485



# Write One





# Links

- See specific boards for Cellular & Wi-Fi:

- nRF9160 DK:

[docs.zephyrproject.org/latest/boards/arm/nrf9160dk\\_nrf9160/doc/index.html](https://docs.zephyrproject.org/latest/boards/arm/nrf9160dk_nrf9160/doc/index.html)

- ESP32: [docs.zephyrproject.org/latest/boards/xtensa/esp32/doc/index.html](https://docs.zephyrproject.org/latest/boards/xtensa/esp32/doc/index.html)

- BLE: [docs.zephyrproject.org/latest/connectivity/bluetooth/index.html](https://docs.zephyrproject.org/latest/connectivity/bluetooth/index.html)
- Ethernet: [docs.zephyrproject.org/latest/connectivity/networking/api/ethernet.html](https://docs.zephyrproject.org/latest/connectivity/networking/api/ethernet.html)
- IEEE 802.15.4: [docs.zephyrproject.org/latest/connectivity/networking/api/ieee802154.html](https://docs.zephyrproject.org/latest/connectivity/networking/api/ieee802154.html)
- CAN: [docs.zephyrproject.org/latest/hardware/peripherals/canbus/index.html](https://docs.zephyrproject.org/latest/hardware/peripherals/canbus/index.html)

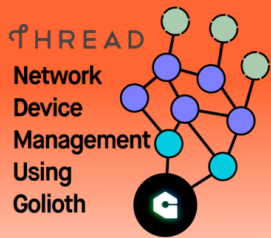


# Protocols

# "Big" Internet

- IPv4/IPv6
- HTTP
- WebSocket
- DHCP, DNS, DNS-SD

# Specialized Protocols



- MQTT, CoAP, LoRaWAN
- 6LoWPAN, Thread, LwM2M
- Modbus

# Links

- **IP-related:** [docs.zephyrproject.org/latest/connectivity/networking/api/apis.html](https://docs.zephyrproject.org/latest/connectivity/networking/api/apis.html)
- **Protocols:** [docs.zephyrproject.org/latest/connectivity/networking/api/protocols.html](https://docs.zephyrproject.org/latest/connectivity/networking/api/protocols.html)
- **DHCPv4:** [docs.zephyrproject.org/latest/connectivity/networking/api/dhcpv4.html](https://docs.zephyrproject.org/latest/connectivity/networking/api/dhcpv4.html)
- **Modbus:** [docs.zephyrproject.org/latest/services/modbus/index.html](https://docs.zephyrproject.org/latest/services/modbus/index.html)



# Security

# Secure components

Yes, even your IoT prototype  
should be secure



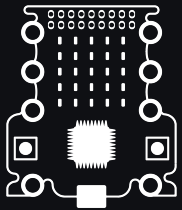
- (D)TLS
- Secure Bootloader
- Trusted Execution Environment

# Links

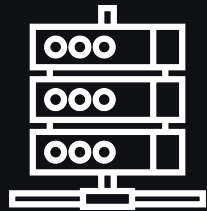
- **Mbed TLS:** [docs.zephyrproject.org/latest/connectivity/networking/api/sockets.html](https://docs.zephyrproject.org/latest/connectivity/networking/api/sockets.html)
- **MCUboot:** [docs.zephyrproject.org/latest/services/device\\_mgmt/dfu.html#mcuboot](https://docs.zephyrproject.org/latest/services/device_mgmt/dfu.html#mcuboot)
- **Trusted Firmware-M:** [docs.zephyrproject.org/latest/services/tfm/index.html](https://docs.zephyrproject.org/latest/services/tfm/index.html)



# Wrapping Up



Devices



Networking



Modems



Protocols



Security

# Made for IoT

- Pretty much everything needed for an IoT device
- Extensible
- Great vendor support
- LOTS of documentation and samples (little hard to find)

# General Resources

- [github.com/zephyrproject-rtos/zephyr](https://github.com/zephyrproject-rtos/zephyr)
- [docs.zephyrproject.org](https://docs.zephyrproject.org)
- [Discord](#) / [Mailing List](#)
- [Zephyr YouTube](#)

# Resources from Us

- [blog.golioth.io/category/zephyr](https://blog.golioth.io/category/zephyr)
- [youtube.com/goliothio](https://youtube.com/goliothio)
- [golioth.io](https://golioth.io)

*Workshop today @ 3:20pm in Lovelace*

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@beriberikix · jberi@golioth.io