MIDI Weaver

Network to USB MIDI 2.0 with Zephyr RTOS

Titouan Christophe

Zephyr Project Meetup Brussels FOSDEM 2026

2026-01-30

mind

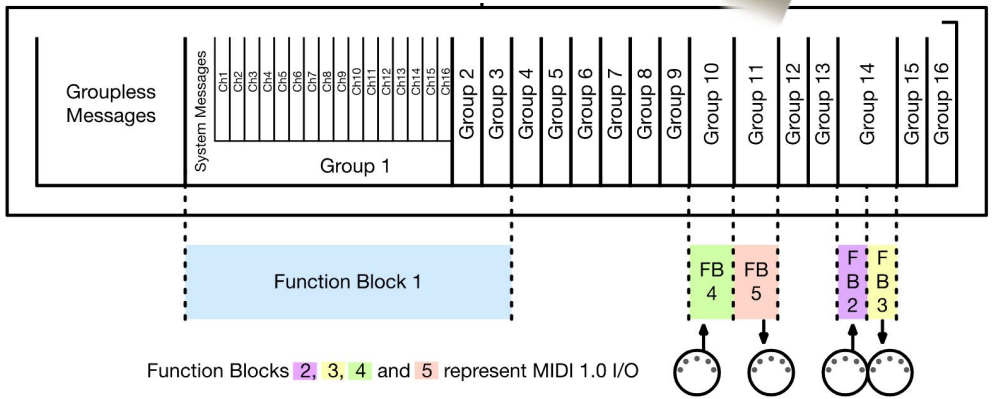
an open source of wisdom

Hi, I’m Titouan !

- Embedded soft. engineer @ Mind OSS
- “The MIDI guy” in Zephyr
  - MIDI 2.0 USB device class
  - Network MIDI 2.0 Host
- Buildroot LTS steward

Short recap: MIDI

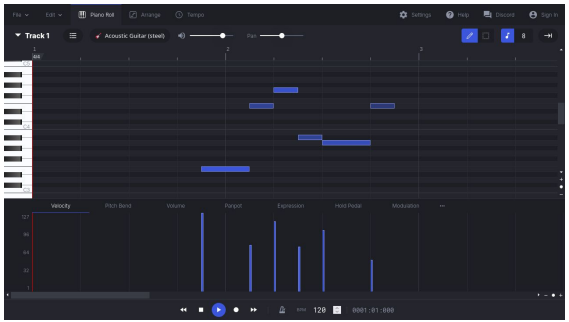
- Musical Instruments Digital Interface
- Interconnect controllers, computers, synthesizers
  - Send notes, performance events (and much more)
- MIDI2.0 introduced in 2020's
  - Universal MIDI Packet (UMP)
  - UMP Endpoint across various transports

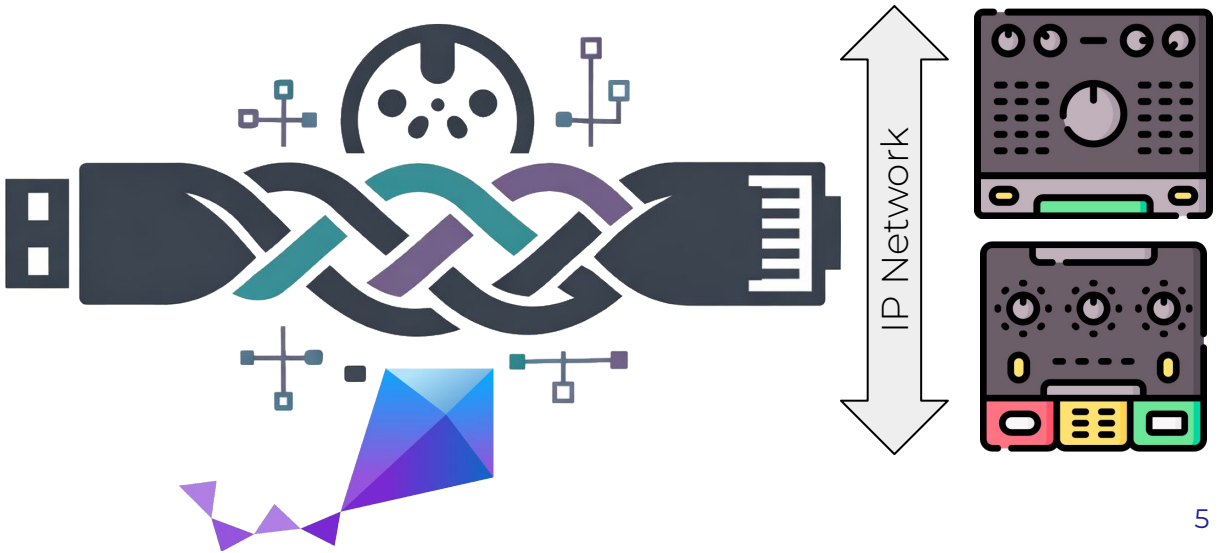



File
Edit
Piano Roll
Arrange
Tempo
Settings
Help
Discord
Sign In
Track 1
Acoustic Guitar (steel)
Pan
8
1
2
3
4/4
C5
C4
C3
Note number
Note on
Note off
Velocity
Pitch Bend
Volume
Panpot
Expression
Hold Pedal
Modulation
127
96
64
32
1
Velocity
Controls
Clock
BPM
120
0001:01:000

Why MIDI Weaver ?

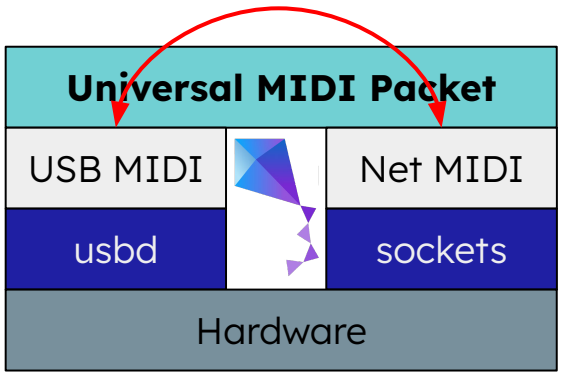
- Network MIDI 2.0 is “very new” (January 2025)
  - Not supported (yet) by your favorite Digital Audio Workstation
  - Your desktop already support USB-MIDI (2.0) for some time





Leveraging Zephyr MIDI 2.0 stack

Simple forwarding between existing subsystems




```
void rx_net_midi(struct netmidi2_session *session,
                 const struct midi_ump ump) {
     usbd_midi_send(usb_midi, ump);
}

netmidi2_set_ops(&net_midi, &((const struct netmidi2_ops) {
    .rx_packet_cb = rx_net_midi,
}));

void rx_usb_midi(const struct device *dev,
                 const struct midi_ump ump) {
    if (established_session != NULL)
        netmidi2_send(established_session, ump);
}

usbd_midi_set_ops(usb_midi, &((const struct usbd_midi_ops) {
    .rx_packet_cb = rx_usb_midi,
}));
```

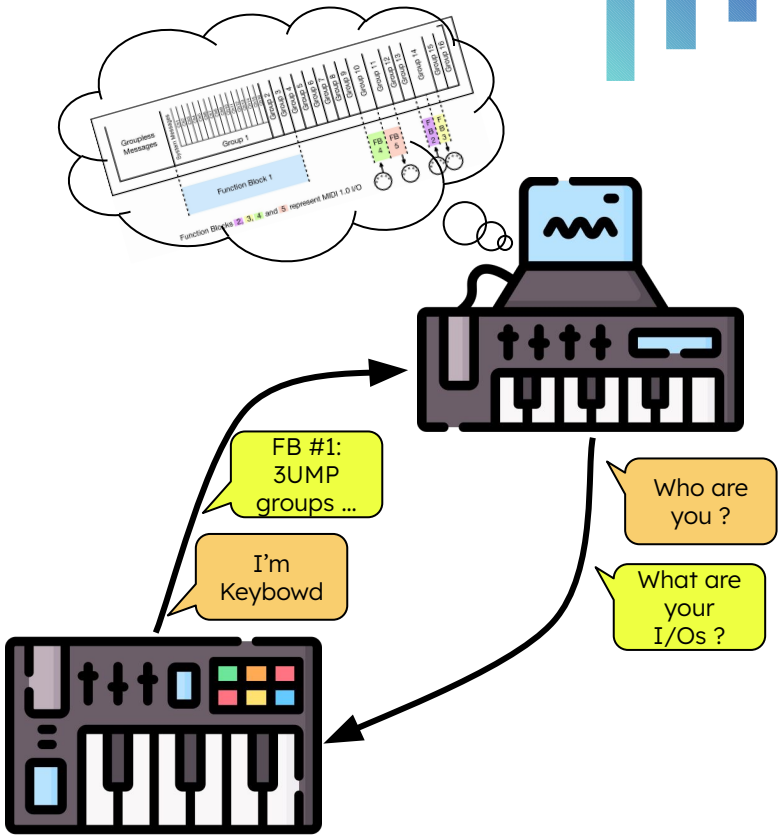
Mode of operation

1. Initial boot in “configuration mode”
   - Currently: shell on zephyr,console
   - Possibly WebUSB in the future ?
2. Scanning for Network MIDI2 hosts with DNS-SD
   - (Thx to #91689 new in Zephyr 4.3 and nice improvements on main)
3. User chose Network MIDI host to invite
4. When session established, enumerate as USB-MIDI2.0
   - Forward all packets USB<->Net
   - The host PC is responsible for probing the MIDI interface and performing UMP Stream discovery

Endpoint discovery: UMP Stream

- Discover characteristics and topology of a UMP endpoint
- Standard UMP messages
  - => works on all transports
  - => forward as any other message

- Usually done by host USB-MIDI



Updates to Zephyr net/midi

- **New Network MIDI shell**
  - **Network MIDI endpoints in iterable sections**
- **Building upon existing Host Network MIDI 2.0 stack**
  - **Add new hook callbacks for session management**
    - netmidi2_ops: {.session_established, .session_closed}
  - **New inviter role (“client”)**
    - netmidi2_ep_invite() -> session

Hardware requirements

- Any Zephyr supported board with
  - USB device controller (with USB device_next)
  - Ethernet interface

- => native_sim is a perfect candidate too
  - Ethernet over TAP interface
  - USB over IP (over TAP)

Side quest: zcompose

- Frustration: connecting multiple native_sim apps
  - Creating taps/bridges, re-building & running together, etc…
- Proof of concept inspired by docker compose
  - ZCompose.yml
  - Applications + build configuration
  - Networks
  - `zcompose {up,build,run,menuconfig,usbattach,…}`
- Ideas for extensions:
  - Flash volumes
  - Babblesim

What's coming next ?

- Upstreaming
  - Updates to Zephyr Network MIDI 2.0 stack
  - MIDI Weaver repository
  - Zcompose ???
    - Maybe as a `west` subcommand
- NAMM 2026 (Music tech conference) happened last week
  - Confirmed BLE-MIDI 2.0 spec is under development
    - Do you know a modern RTOS with good BLE support ?
  - New revision of Network MIDI2.0
    - Mainly: "Session Manager" role

Thank you !

MIDI2 is kinda new

Let’s fly kites !

titouanc

iTitou

iTitou

mind

an open source of wisdom

mind
an open source of wisdom

Arenberg Science Park
Gaston Geenslaan 10
3001 Leuven
Belgium
+32 16 28 65 00

General enquiries
info@mind.be

Employment enquiries
jobs@mind.be