

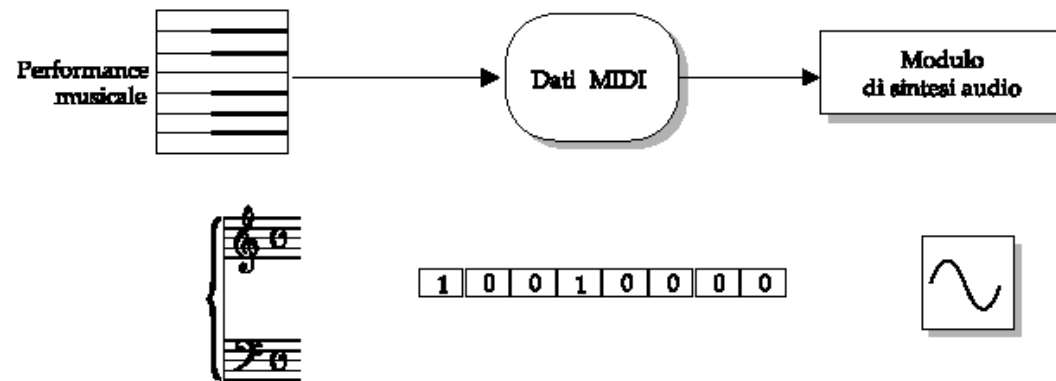
MIDI, Musical Instruments Digital Interface

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Musical Instruments Digital Interface

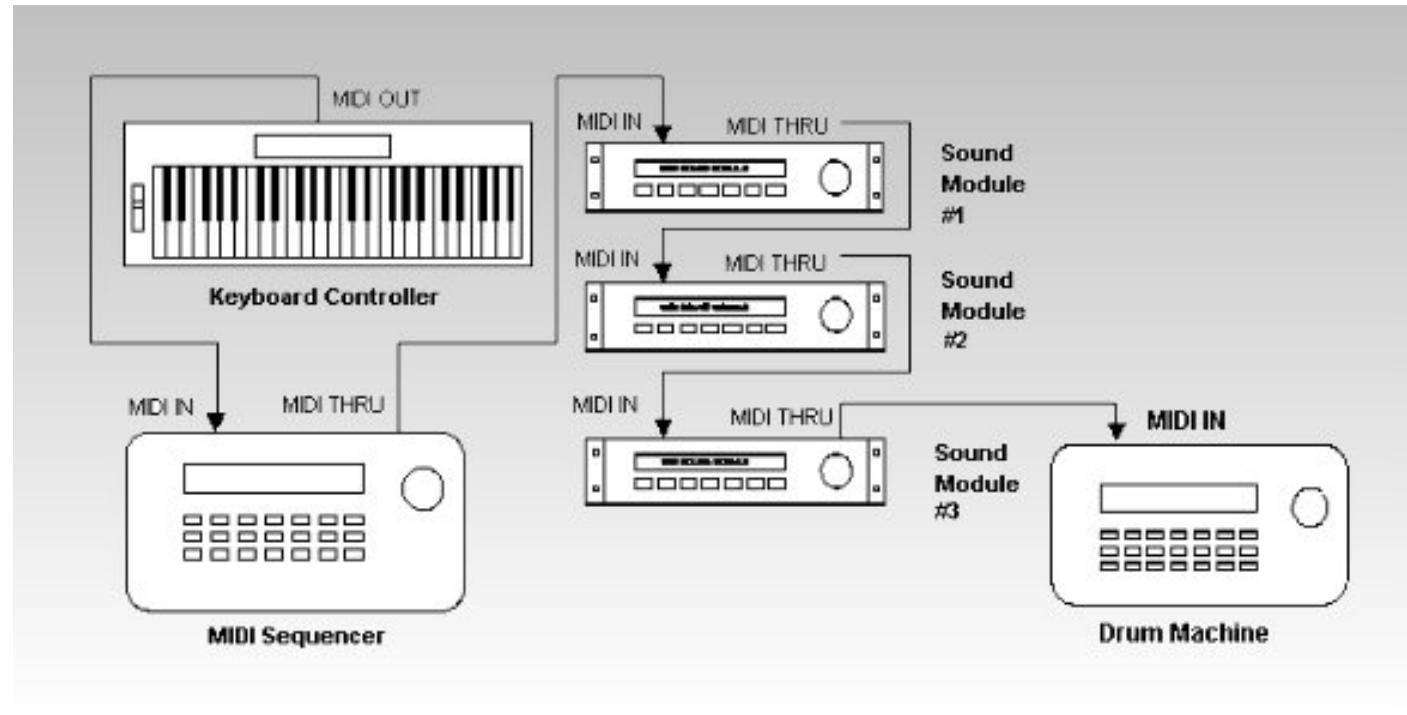
MIDI protocol (1983) provides a standard and efficient way to describe musical events

- It enables a computers, synthesizers, keyboards, and other musical devices to communicate each other
- MIDI is a scripting language – it codes "events" that stand for the production of sounds
- Sound generation is local to the synthesizers
- Messages describe the type of instruments, the notes to play, the volume, the speed, the effects, ...



(V. Lombardo, A.Valle, "Audio e multimedia", Apogeo)

MIDI systems can be very complex ...



... but most of the soundcards come with all the necessary hardware

MIDI sequencer

- A recording and execution system for storing and editing a sequence of musical events, in the form of MIDI data
- It receives data from the input device, allows editing, and creates the music sending data to the synthesis device (example, sound card)
- It does not influence the quality of the sound. The quality totally depends on the synthesis device (or the synthesizer)

Channels

- They allow to send and receive music data
- Method to differentiate timbres and send independent information: different channels for different instruments
- MIDI protocol provides 16 channels numbered from 1 to 16

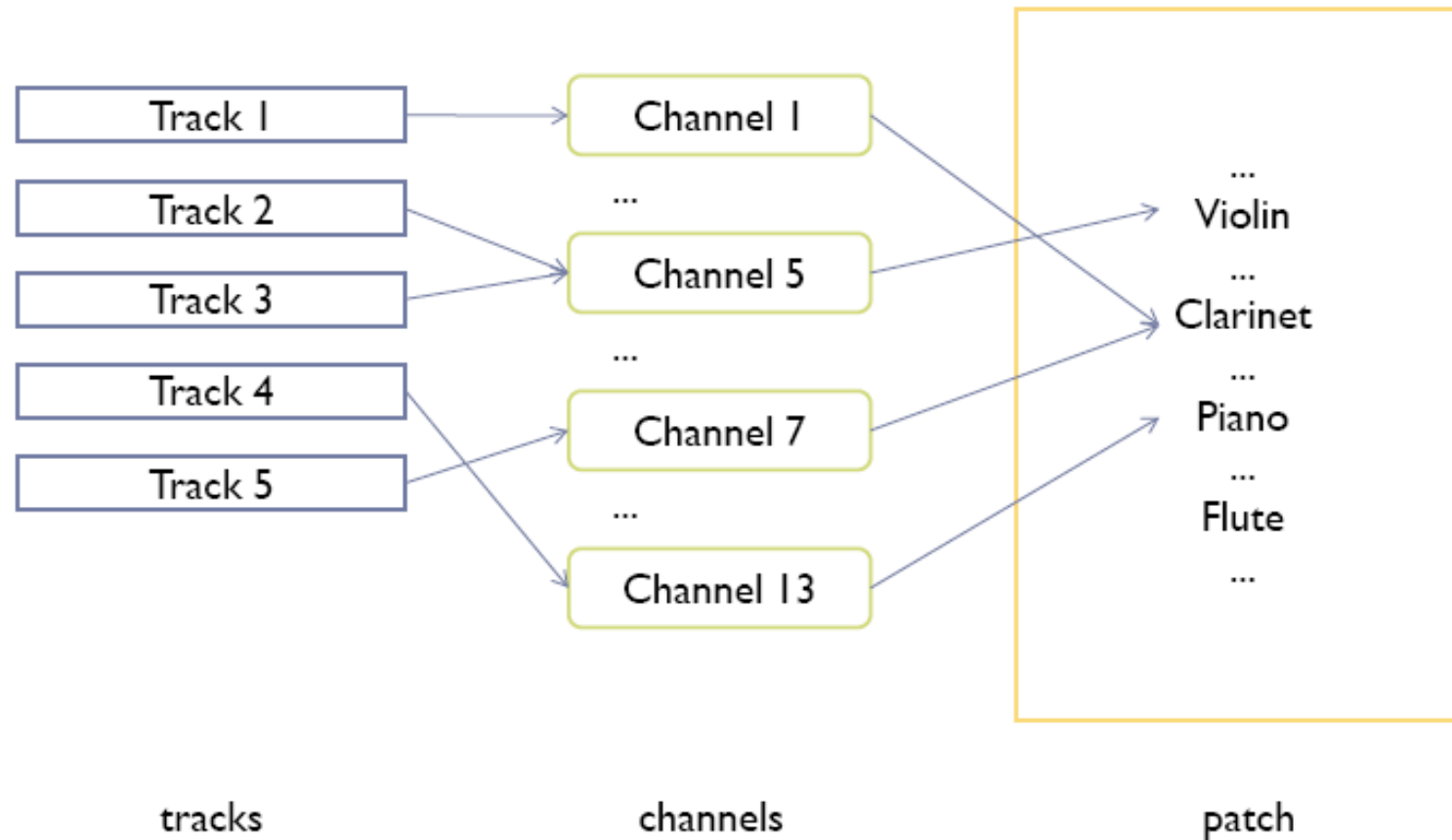
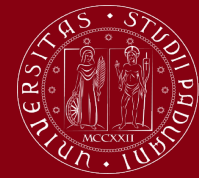
Tracks

- A track is a structured autonomous flow of MIDI messages
- Example: in a piano song, there are two tracks, the melody and the arrangement
- It can be considered as a messages container that can be assigned to different channels

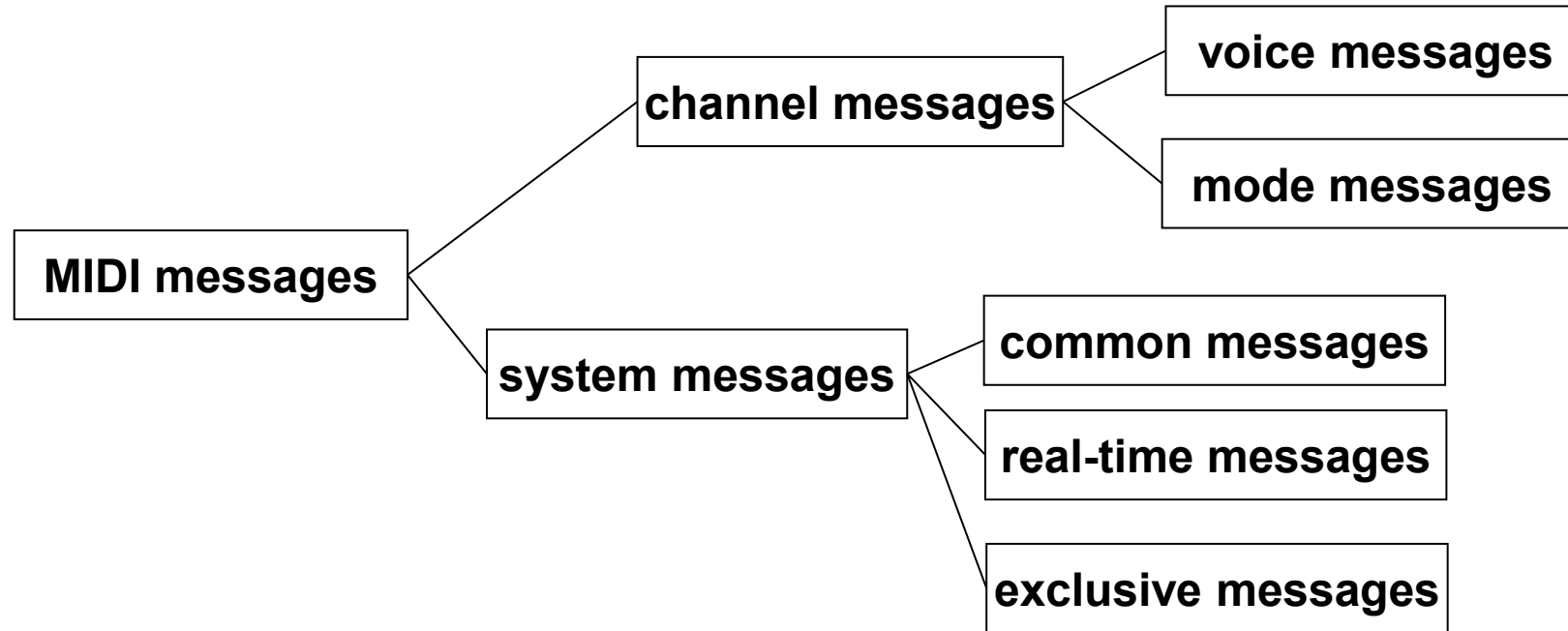
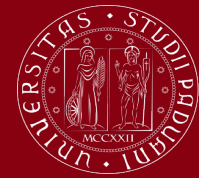
Patch

- It specifies the timbre produced by the generator
- MIDI can contain up to 128 different patches

MIDI music representation



MIDI messages



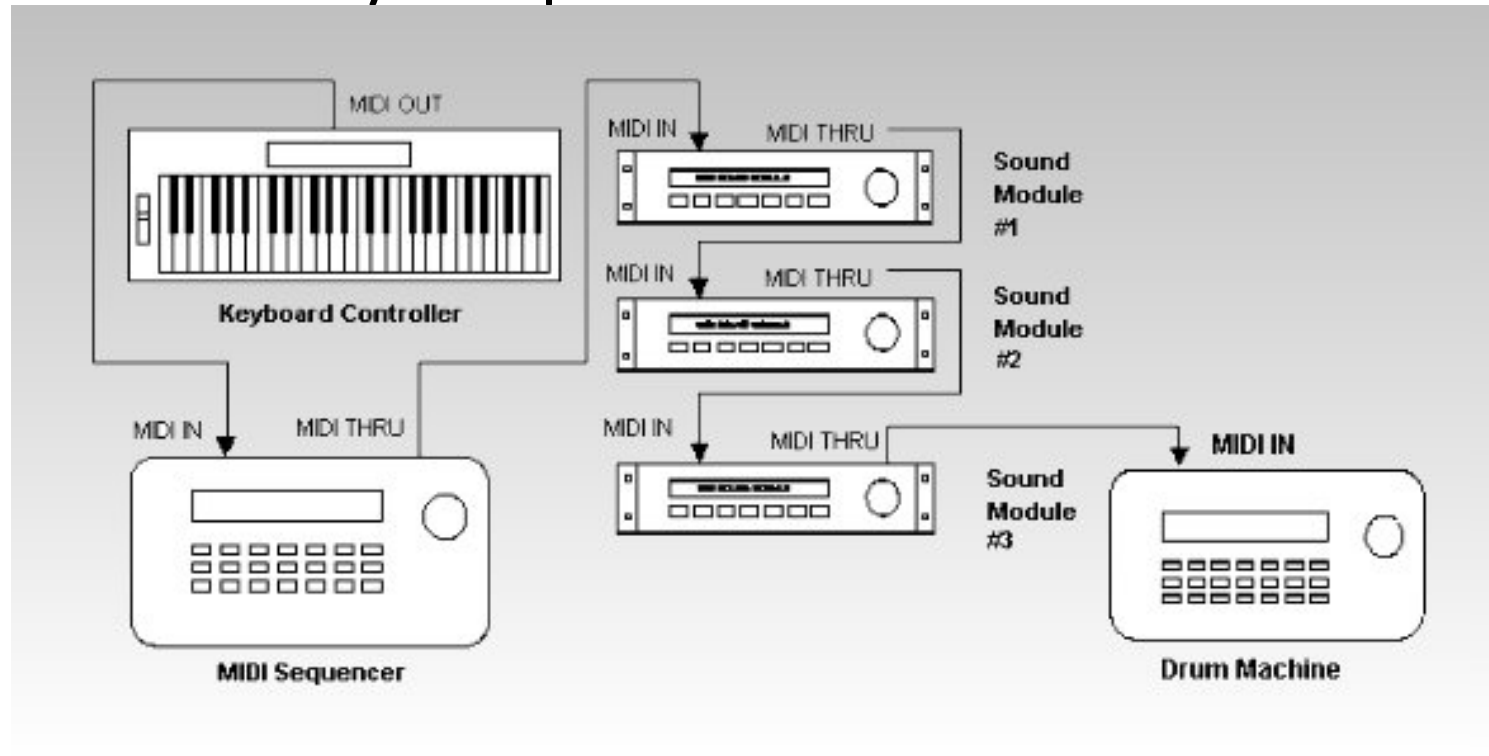
Channel messages describe which note to play (**voice**) and how to play it (**mode**)

Systems messages define set-up and synchronization information

All MIDI messages are a sequence of 10 bits (1 byte of useful data)

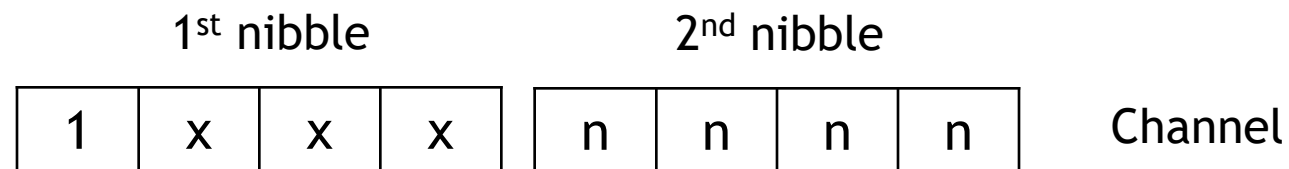
MIDI systems

MIDI systems can be very complex ...



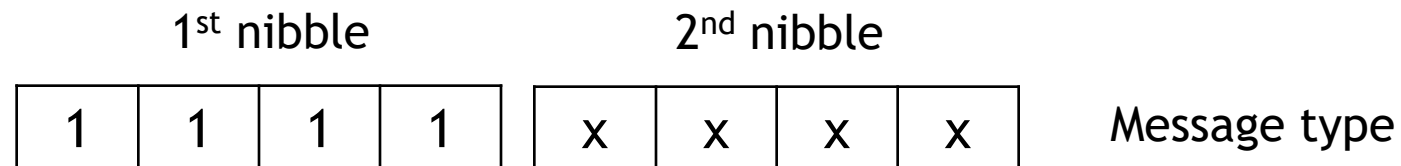
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Channel Messages

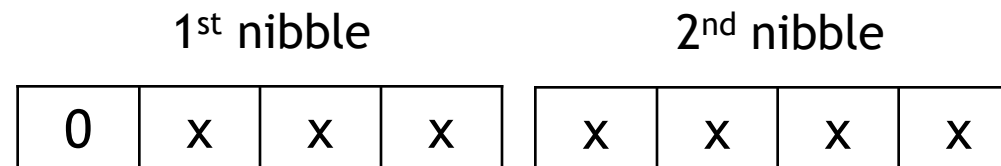


Message type

System messages



Following bytes



They contain the number of the channel through which the information is sent

Voice messages define what an instrument plays:

- Which note to play(*Note on*)
- Which note to turn off(*Note Off*)
- Potential controller effects (ex. vibrato) (*Pitch Bend Change*)
- Force measure for the keys on a specific channel(*Channel pressure*)
- ...

Mode messages describe how the instrument behaves when a voice message arrives

- Omni On/Off
- Poly/Mono
- General MIDI Mode

System messages (1)



They do not use a channel because they are meant for commands that are not channel-specific.

Each device responds only to the messages it is enabled to answer

System common messages

- Carry out general functions that involve the entire system (ex., song synchronization when played by different devices)
- Set up a common clock
- Positioning inside a song (*Song Position Pointer*)
- Track selection (*Song Select*)

System messages (2)



System real-time messages

- Related to real-time synchronization of the different modules of a system
- Device synchronization based on a relative time (24 messages every quarter)
- Start or stop the playback of a song (*Start/Stop/Continue*)
- Reset functions

System exclusive messages

- Allow to manufacturers to extend the MIDI standard, sending messages that apply to their own product.

The MIDI standard is an efficient way to encode musical sounds inside Web documents

- MIDI files are compact and have temporization information (there are no *hard real-time* constraints)
- Sound encoding is based on predefined discrete events, not on the waveform of the sound
- Complex musical songs take a small amount of storage

Particularly suitable for background music

MIDI: why & when (2)



But...

- Only traditional western music can be encoded (tonal scale)
- It is not possible to represent sounds like noise, voice, other acoustic phenomena
- Computers and/or devices must have appropriate soundcards
- Quality depends on MIDI equipment (synthesizer)
- Channels and messages coding is not completely standard (ex. Roland, Yamaha, ...)