MIDI: Musical Instrument Digital Interface

- **MIDI Overview**

  - (a) MIDI is a protocol adopted by the electronic music industry for controlling devices, such as synthesizers and sound cards, that produce music and allowing them to communicate with each other.

  - (b) MIDI is a scripting language — it codes "events" that stand for the production of sounds. E.g., a MIDI event might include values for the pitch of a single note, its duration, and its volume.

- (c) The MIDI standard is supported by most synthesizers, so sounds created on one synthesizer can be played and manipulated on another synthesizer and sound reasonably close.

- (d) Computers must have a special MIDI interface, but this is incorporated into most sound cards.

- (3) A MIDI file consists of a sequence of MIDI instructions (messages). So, would be quite small in comparison to a standard audio file.

MIDI Concepts

- • MIDI **channels** are used to separate messages.

  - (a) There are 16 channels numbered from 0 to 15. The channel forms the last 4 bits (the least significant bits) of the message.

  - (b) Usually a channel is associated with a particular instrument: e.g., channel 1 is the piano, channel 10 is the drums, etc.

  - (c) Nevertheless, one can switch instruments midstream, if desired, and associate another instrument with any channel.

- **System messages**
  (a) Several other types of messages, e.g. a general message for all instruments indicating a change in tuning or timing.

• The way a synthetic musical instrument responds to a MIDI message is usually by simply ignoring any **play sound** message that is not for its channel.

   – – If several messages are for its channel (say play multiple notes on the piano), then the instrument responds, provided it is **multi-voice**, i.e., can play more than a single note at once (as opposed to violins).

- **General MIDI**: A standard mapping specifying what instruments will be associated with what channels.

    - (a) For most instruments, a typical message might be a Note On message (meaning, e.g., a keypress and release), consisting of what channel, what pitch, and what "velocity" (i.e., volume).

    - (b) For percussion instruments, however, the pitch data means which kind of drum.

    - (c) A Note On message consists of "status" byte — which channel, what pitch — followed by two data bytes. It is followed by a Note Off message, which also has a pitch (which note to turn off) and a velocity (often set to zero).

• The data in a MIDI status byte is between 128 and 255; each of the *data bytes* is between 0 and 127. Actual MIDI bytes are 10-bit, including a 0 start and 0 stop bit.
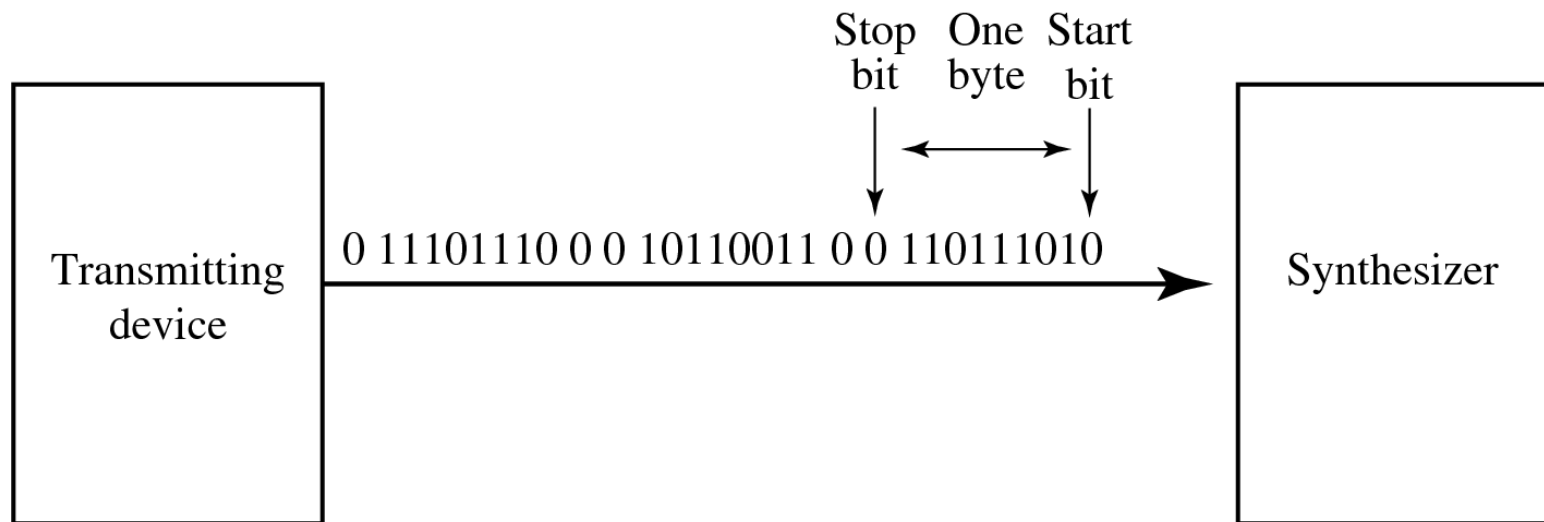
- Fig. 6.8

- • A MIDI device often is capable of **programmability**, and also can change the **envelope** describing how the amplitude of a sound changes over time.

• Fig. 6.9 shows a model of the response of a digital instrument to a Note On message:
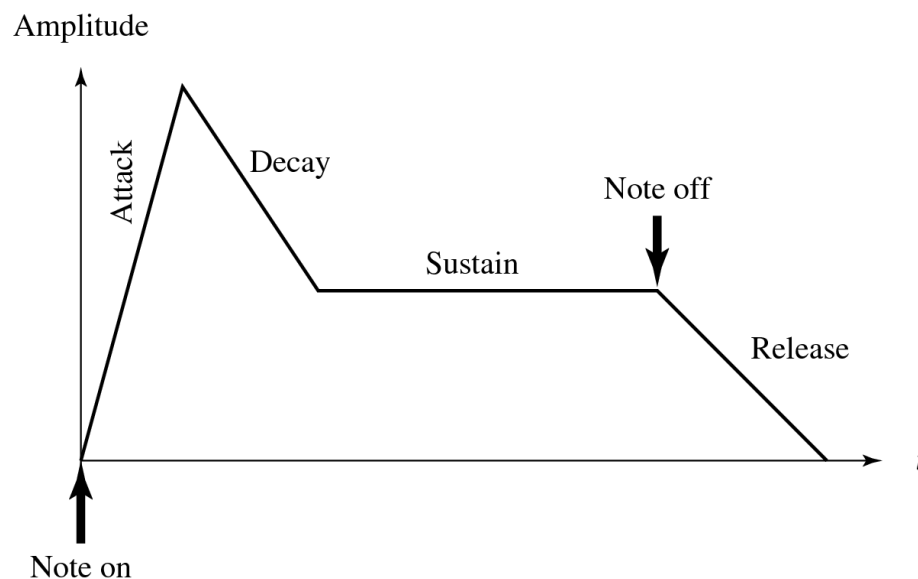
- Fig. 6.9: Stages of amplitude versus time for a music note