2018 Fall

CTP431: Music and Audio Computing

Musical Interfaces and Sequencers

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Musical Instrument

- Performers interact with instruments in various ways
  - key striking, plucking, blowing, bowing
  - Expressions: continuous/discrete, dynamics, subtlety
  - Monophonic / polyphony
  - Learning curve, virtuosity, challenge/boredom for different musical instruments

Digital Musical Instrument (DMI)

- In DMI, controller and tone generator are de-coupled
  - Controller: capture gesture data and convert them to musical events
  - Tone generator: synthesize musical tones

Musical Controllers

MIDI Keyboard

AXiS-64

https://www.youtube.com/watch?v=pQ4nPcGCGIs

Haken Continuum

https://www.youtube.com/watch?v=PnBhR8RLJN8

Pad Controller

Musical Controllers

Wind Controller

Drum
Controller

Guitar Controller

New Controllers

Radio Baton (by Max Mathews)

https://www.youtube.com/watch?v=3ZOzUVD4oLg

Virtual Slide Guitar

https://www.youtube.com/watch?v=aIJ-8kd8rFs

New Controllers

Reactable

https://www.youtube.com/watch?v=Mgy1S8qymx0

Guthman Musical Instrument Competition:
http://www.guthman.gatech.edu/

NIME (New Inferfaces for Music Expressions):
http://www.nime.org/

Inside the Controllers

- Sensors
  - Button (or switch), potentiometer (knob), resistive (rubber, photo-resister), optical, accelerometer, gyro, microphone, camera…
  - Physical actions: push, rotation, velocity, pressure, location, …
  - http://www.sensorwiki.org/doku.php

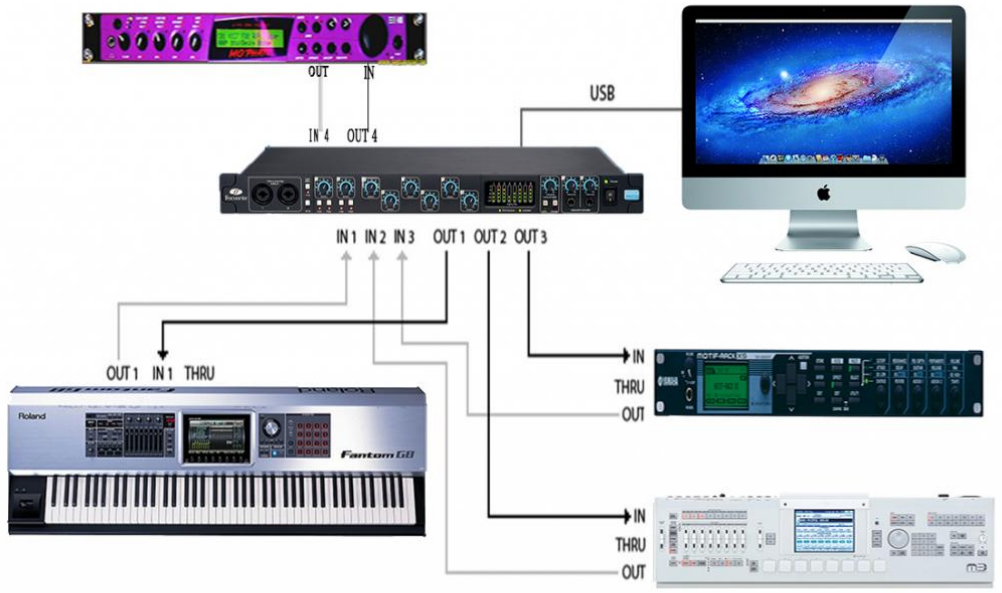
- Micro controllers
  - AD converter (continuous input), input port (discrete input)
  - Map the captured input to musical protocols: MIDI, Open Sound Control (OSC)

Musical Instrument Digital Interface (MIDI)

- Standard protocol of musical events

- Why MIDI?
  - Need of musical communication among different vendors' instruments
  - Store music events (score or performance) for composers

- Hardware
  - 5-pin cables, separate in/out in co
  - 31250 bits per second



- Software (Protocols)
  - Note number/velocity, control data

MIDI Message Format

	Status Byte	Data Byte1	Data Byte2
Note Off	1000 xxxx	Note Number	Velocity
Note On	1001 xxxx	Note Number	Velocity
Note Pressure	1010 xxxx	Note Number	Velocity
Control Change	1011 xxxx	Ctrl. Number	Ctrl Value
Program Change	1100 xxxx	Prog. Number	-

xxxx: channel number (0-15)

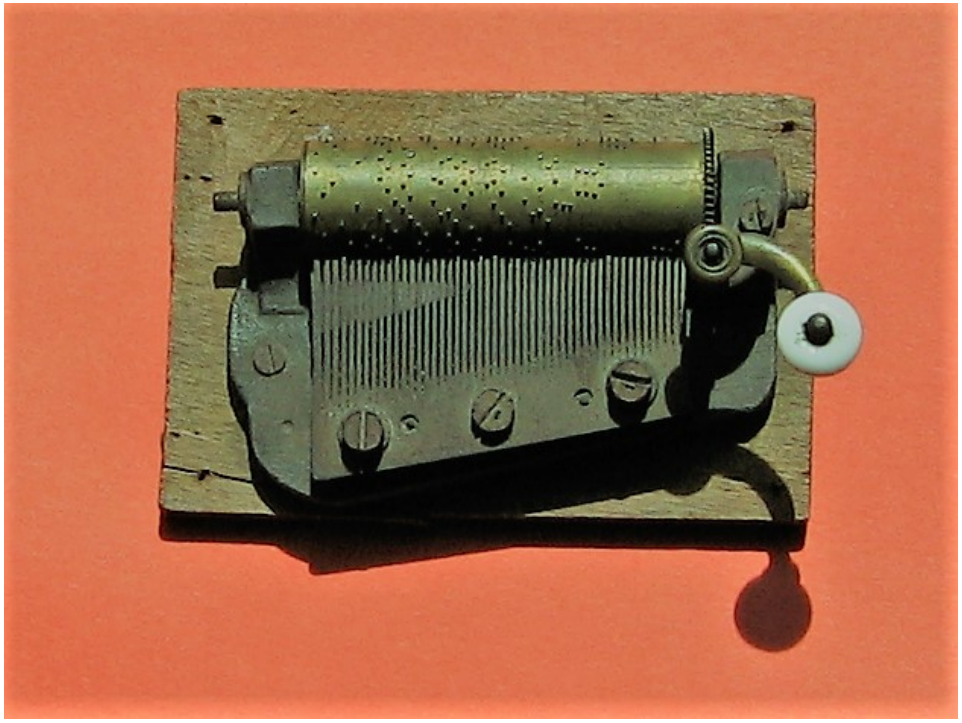
Data byte: 0-127 (MSB is 0)

Web MIDI

- Support MIDI on web browsers
  - W3C Editor's draft: http://webaudio.github.io/web-midi-api/

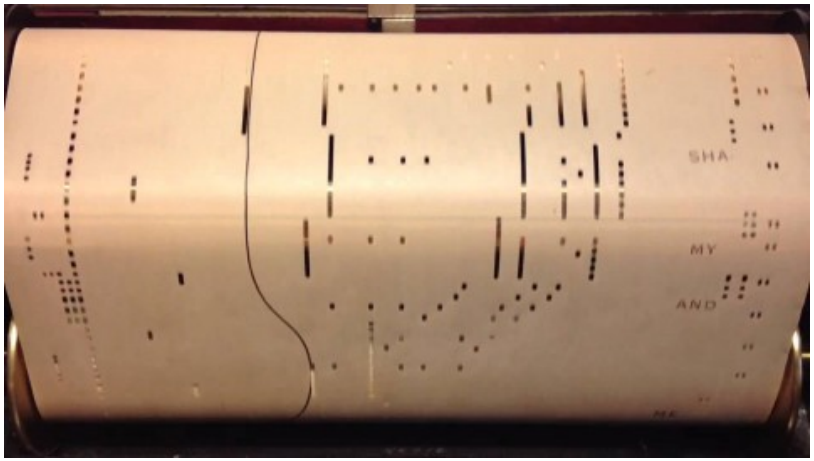
Sequencer

- Music Box: the oldest sequencer?



Sequencer

- Piano Roll (in player piano)



Piano Roll

Disklavier

Step Sequencer

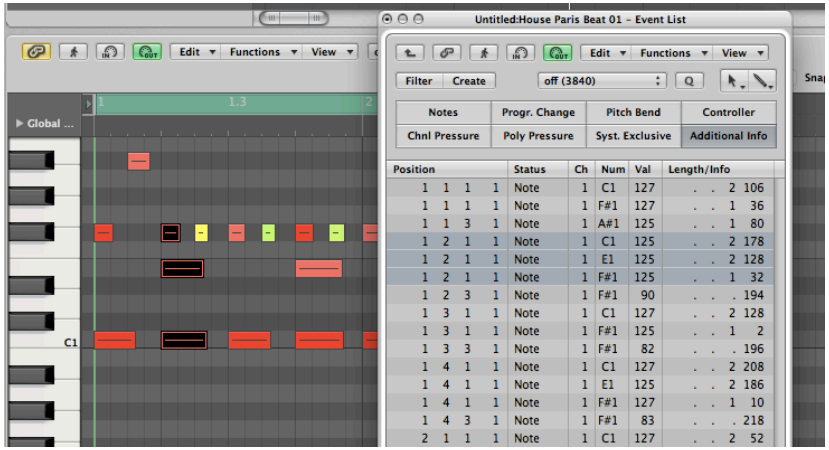
Roland TR-808
(Analog Sequencer + Drum Machine)

https://www.youtube.com/watch?v=YeZZk2czG1c

MIDI Sequencer

- Record, Edit and Playback MIDI Messages
  - Tempo (BPM) and time stamps are added
  - Time-stamped MIDI messages are stored as a MIDI file

- MIDI Representations
  - MIDI Events
  - Piano Rolls
  - Music Notation (Music Score)



- Most DAWs have MIDI sequencers
  - Sonar, Cubase, Logic, …

Web Examples

- Step Sequencers
  - http://webaudiodemos.appspot.com/MIDIDrums/index.html
  - http://patternsketch.com/
  - https://io808.com/
  - https://mohayonao.github.io/cubic-sequencer/
  - https://experiments.withgoogle.com/drum-machine
- Piano-Roll-type Sequencers
  - https://onlinesequencer.net/
- LaunchPad
  - https://intro.novationmusic.com/analogue-jewels