



### CCRMA Open House 2021, April 9, 2021 **Gregory Pat Scandalis, Nick Porcaro, Julius Smith**

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## **MIDI 2.0 The Big Picture**

- MIDI 2.0 is bidirectional. It changes MIDI from a monolog to a dialog
- channels.
- be used to configure devices for specific applications.
- Compatible with MIDI 1.0
- Ethernet, Bluetooth and future transport mechanisms.

 MIDI 2.0 Protocol mirrors and extends the MIDI 1.0 Protocol. There is a new Universal MIDI Packet (UMP) which offers higher resolution performance controllers (32 bit), more controllers (32k) and 16 channel groups for 256

MIDI-CI (Capability Inquiry) supports profile and property exchange which can

Future Proofing, UMP is transport agnostic and can be implemented on USB,

# Where To Get Info

- This deck : http://www.moforte.com/midi-2-0/
- Info on MIDI 2.0: and-property-exchange
- MIDI 2.0 specifications: https://www.midi.org/midi/specifications/midi-2-0-specifications

https://www.midi.org/midi-articles/details-about-midi-2-0-midi-ci-profiles-



### **MIDI 2.0 Environment**

## MIDI-CI

- Profile Configuration
- Property Exchange
- Protocol Negotiation







### **MIDI 2.0 Environment**

## **Profile Configuration Auto Configuration**

- Two Devices Agree to use a **Predetermined** Set of Messages for a specific application
- General MIDI
- Organ Drawbar
- Piano
- MPE

Feature

• Profile types: Instrument, Effect,



### "Hi! I Speak MIDI 2.0, how about you?

### "Yes! I'm a mixer. Nice to meet you."





## **Property Exchange** Get, Set, Recall, Can be used to share UIs across devices

- Device Specific information (JSON inside SysEx)
- Presets

. . .

- Controller Mappings
- Parameters



## **Protocol Negotiation** MIDI 1.0 is a part of MIDI 2.0

- MIDI 2.0 falls back to MIDI 1.0 if:
  - Profiles not supported
  - Property Exchange not supported
  - Protocol test failure
  - Well defined rules for mapping between MIDI 2.0 and MIDI 1.0

### **MIDI 2.0 Environment**



## MIDI 2.0 Protocol Extends the MIDI 1.0 Protocol

- Uses existing MIDI 1.0 semantics and mechanisms
- New Universal MIDI Packet (UMP) which offers higher resolution performance controllers (32 bit), more controllers (32k) and 16 channel groups for 256 channels, better NRPNs and full 8 bit SysEx.
- Based on 32bit words. There are 32,64,96,128 bit UMPs

<b>MIDI 2.0</b>	Note On -	64 bit pa	cket
mt=4	group	status a	channel
	velo	city	



# MIDI 1.0 encoded in UMP

### MIDI 1.0 Note On - 3 bytes



### MIDI 2.0 Note On - 64 bit packet

mt=4	group	status & channel	note number	attribute type
	velo	city	attri	bute





## Groups 16 groups of 16 channels, up to 256 channels

- 16 groups of 16 channels, put to 256 channels
- Each group can be either MIDI 1.0 or MIDI 2.0
- Groups are equivalent to ports or virtual cables



## Note On

- Velocity is 16 bits
- Attribute Type, per note. Example: pitch for temperaments
- Attribute Data

### MIDI 2.0 Note On - 64 bit packet



**~ 1** 

Attribute Type	Definition	Notes
0x00	No Attribute Data	Sender shall set Attribute Value to 0x0000 Receiver shall ignore Attribute Value
0x01	Manufacturer Specific	Interpretation of Attribute Data is determined by manufacturer
0x02	Profile Specific	Interpretation of Attribute Data is determined by MIDI-CI Profile in use
0x03	Pitch 7.9	See Section 4.2.14.3
0x04 – 0xFF	Reserved	Do not use

### Table 5 Defined Attribute Types for MIDI 2.0 Note On & Note Off

## **Registered Per-Note Controllers** Works like Poly Aftertouch

### **Registered Per-Note Controller**



### Appendix A MIDI 2.0 Registered Per-Note Controllers

The following table lists the MIDI 2.0 Registered Per-Note Controller numbers whose application/function has been defined.

### Table 11 MIDI 2.0 Registered Per-Note Controllers

RPNC Number	Registered Per-Note Controller Name	Default	Reference
1	Modulation	_	-
2	Breath	-	-
3	Pitch 7.25	-	Section 4.2.14.2
4–6	Reserved	_	-
7	Volume	-	-
8	Balance	-	-
9	Reserved	-	-
10	Pan	-	-
11	Expression	1	-
12–69	Reserved	_	-
70	Sound Controller 1	Sound Variation	-
71	Sound Controller 2	Timbre/Harmonic Intensity	-
72	Sound Controller 3	Release Time	-
73	Sound Controller 4	Attack Time	-
74	Sound Controller 5	Brightness	-
75	Sound Controller 6	ntroller 6 Decay Time	
70	Cound Controllor 7	Vibrata Data	[MMA04]

## **Jitter Reduction Timestamps**

- Uses MIDI-CI to check for availability
- Both devices agree to use JR Timestamps
- Sender based clocked
- JR Timestamp prepended to every message
- 32 times more accurate than MIDI 1.0 timestamps
- One tick is 32 micro seconds

<b>JR Time</b>	stamped	<b>MIDI 2.0</b>	Note-
mt = 0x0	group	status	
mt = 0x4	group	sta	tus





## **Controllers** 32k High Resolution (32 bit) Controllers

### **Assignable Controller**



## **System Messages (clk, start, stop ...)** The Same as MIDI 1.0, but 32 bits

### **UMP System Messages**

mt=1	group	status

MIDI 1.0 byte 2 or reserved MIDI 1.0 byte 3 or reserved

.

# SysEx is now full 8 bit

### SysEx 8 in UMP

mt=5	group	status	# of bytes stream id		data / reserved
data / re	eserved	data / reserved		data / reserved	data / reserved
data / re	eserved	data / reserved		data / reserved	data / reserved
data / re	a / reserved data / reserved		data / reserved	data / reserved	





# Well Defined MIDI 1.0/2.0 Mapping Rules

MIDI 2.0 Note Off, Note C	On, Poly Pressure, Contro	I Change	
mt group	status & channel	byte_3	byte_4
byte_5	byte_6	byl 7	byte_8
			byte_5
			++++++-
MIDI 1.0 Channel Voice N	lessage	ŢŢ	
1	status & channel	) byte_2	0 byte_3

Figure 48 Translate MIDI 2.0 Note Off, Note On, Poly Pressure, and Control Change to MIDI 1.0



### Figure 55 Translate MIDI 1.0 Note On and Note Off to MIDI 2.0

1	I	

0		
I	I	

# **Core Specifications**

- Specifications are here: https://www.midi.org/midi/specifications/midi-2-0-specifications
- Register at <u>MIDI.org</u> to enable specification downloading:
  - M2-100-U v1.0 MIDI 2.0 Specification Overview
  - M2-101-UM v1.1 MIDI-CI Specification
  - M2-102-U v1.0 Common Rules for MIDI-CI Profiles
  - M2-103-UM v1.0 Common Rules for MIDI-CI PE
  - M2-104-UM v1.0 UMP and MIDI 2.0 Protocol Specification

## **Developer Tools**

## MIDI 2.0 Workbench

File MIDI Debug Keyboard About

miji

MIDI Workbench

### MIDI Workbench

### Use this to test and develop your MIDI device

This application is in **alpha** and is use for MMA/AMEI members only. A public version may be released in the future. Please see the about page for support and T&C's.

Start a New Project

Project Name

Enter name

Load Existing Project:

- 0 🔘

Example MIDI Device

Example MIDI Software

Create

Please note that the this Workbench is based on the following documents and versions

- MIDI 1.0 Detailed Specification ver 4.2
- MIDI 2.0 Protocol Specification ver 0.40
- Prop 079 MIDI-CI + Prop073 SysEx Packing
- MIDI-CI ver 1.091
- Common Rules for MIDI-CI Profiles ver 0.24
- Common Rules for Property Exchange ver 0.53
- Property Exchange Foundational and Basic Resources ver 0.3
- Property Exchange Controls: Get and Set Device State ver 0.2
- Property Exchange Controls: Active Controller Messages, Interfaces ver 0.1

	205	CODE
	Midi2Scope	
Message Type	Note On	~
Group	3 Channel	3
Note Number	20 Velocity	52828
AttributeType	2 Attribute	30303
Program/Index	Bank	
Detach Per-Note	Bank Valid	0
Reset Per-Note		
Controller Data	0	
Hex Message	42 92 14 02 ce 5c 76 5f	
	Send	
	Continuous controller	
Transmit Receive Time	d test	

# **Developer Support**

- Many developers will gain access to MIDI 2.0 services through SDKs, Windows, macos, iOS
- MIDI Association working with ALSA on Linux
- Reference code for embedded devices TBD
- Existing MIDI 2.0 products
  - Roland MK-88
  - Embodme Erae Touch
  - Multitracks Studio
- MIDI 2.0 is currently being tunneled through MIDI 1.0 SysEx







Song Add Track Mix Down Studio	Touch Pen	Input > Mon	Punch Sos 🔫	° Ripple Snap <mark>Fo</mark>	edit	II: Э bar beat	Ф <sup>586</sup>	
0 8	32					8,0	88	
			Solo					
• Vocal mono audio (.aem) -	1 → Play Rec		M P ■ S	Ö 🔁 🚍		-50 -20 -	-10 -5 Ó +	
Vocal 2 mono audio (.aem) -	l → Play Rec		<u>.</u> Ш		EQ	-50 -20 -	10 -5 ó +1	
Organ midi	Play Rec o		·↓·· ■ M P		Organ	-50 -20 -	io -5 0 +5	
Solo Guitar mono audio (.wav) -	l → Play Rec			🙄 🕤 🔚	Amp Comp	-50 -20 -	i0 -5 0 +5	
Handclaps mono audio (.wav) -	1 ► Play Rec			ے 🛇 🖕		-50 -20 -	10 -5 ó +5	
Brass midi	Play Rec					-50 -20 -	10 -5 ó +5	
Acoustic Guitar mono audio (.wav)	Play Rec			S 🖸 😑		-50 -20 -	io -5 o +5	
EGuitar mono audio (.aem)	1 ↓ Play Rec .				Amp	-50 -20 -	10 -5 Ó +5	
+							12	
		All a gard						
		PASTE SEL						
Effect Return 1			П. т. т. С. М. Р. 	Verb		-50 -20 -	10 -5 ó +1	
Master			<u>-</u> ∎ □^ *	So Mono Comp	EQ Lim	-50 -20 -	io -5 ó +1	5
×				1:12	8 1/16 note	Automat	tion Help	ŀ







# Academic Support

- Academic Institutions can apply to the MIDI Association to form a working group.
- Working groups are granted a SysEx ID needed for MIDI 2.0
- Working groups have access to the MIDI association git repo with the MIDI 2.0 tools.
- McGill currently has a working group for a number of Canadian universities.



Questions?