



BREW 2005
conference

CMX for BREW[®] Developers

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Agenda

- **What Is CMX**
- **CMX for Games and Applications**
- **Multisequencer**
- **DLS**
- **Obtaining CMX Studio**
- **MIDI Out Messages**
- **3D Audio**
- **Q&A / Discussion**



CMX Powers Mobile Personalization

- Audio ringtones, animated ringtones, hybrid audio ringtones, personalized ringtones
- Wallpaper, animated wallpaper, screensavers
- Karaoke with text wipe
- Messaging
- And more



What is CMX?

Compact Media Extensions™ (CMX)

1. **Software in QUALCOMM's Mobile Station Modem™ (MSM™) chipsets**
2. **Provides the audio and multimedia capabilities used by handset manufacturers and application developers for mobile multimedia content**
3. **CMX Studio® authoring tool - used by content providers to create ringtones, karaoke files, wallpapers and screensavers**

CMF - acronym used by the worldwide standards bodies (3GPP2, OMA and IETF) to refer to the open, standardized CMX file format



What is CMX?

1. Handset Manufacturers

- We assist OEMs by providing support, files, etc. for full implementation
- OEMs can contact QUALCOMM directly for access to all such materials

2. Application and Game Developers

- Directly accessible by application and game developers
- Use CMX APIs to utilize all CMX-supported audio formats, including MIDI and WAV (QCELP-13K and ADPCM)
- Simultaneous playback of multiple MIDI, QCP and ADPCM tracks
 - Triggered by game and user input events
- Can also make use of the CMF File Format to create customized applications that utilize the functionality of CMX Studio



What is CMX?

3. Content Providers

- Time-synchronize many various multimedia elements and save them as one highly compressed CMF (also referred to as .pmd) file
 - Ready for download to wireless handsets
 - MIDI, WAV (compressed to QCP or ADPCM), still images, animation (SAF and GIF), vibration, LED control, looping, text and text wipe (used for karaoke text effects)



What is CMX?

- **Time-synchronized multimedia, combining:**
 - MIDI-Based music (up to 72 poly)
 - All standard MIDI formats:
 - General MIDI Level 1 and 2 (Standard MIDI Format), SP-MIDI, CMF (also known as CMX) format, XMF
 - Audio – AAC, aacPlus, QCELP, ADPCM
 - Animation – SAF, SVG, animated GIF, PNG
 - Graphics – PNG, GIF, JPEG
 - DLS with ethnic and game audio downloadable banks
 - Text and text wipe
 - Vibration
 - LED
- **Deployed on 150 million handsets worldwide**



CMX Features by CMX Version

Software release	CMX 2.2	CMX 3.0	CMX 3.1	CMX 4.0	CMX 4.1	CMX 4.3/4.4
chipset	MSM5100/3300	MSM6050	MSM6025/6050	MSM6100	MSM6100/ 6250/ 6500	MSM6100/ 6250/ 6300/ 6500
# polyphony	16 poly	32 poly	32 poly	72 poly (HP)	72 poly (HP) / 32 poly (HQ)	72 poly (HP)/ 32 poly (HQ)
Audio Codec	QCELP	QCELP, ADPCM: 8/16kHz	QCELP, ADPCM: 8/16kHz	QCELP, ADPCM: 8/16/32kHz	QCELP, ADPCM: 8/16/32kHz	QCELP, ADPCM: 8/16/32kHz, AAC
Wavetable	35kB/32kHz	128kB/32kHz	128kB/32kHz	128kB/32kHz	128kB/32kHz, 512kB/44kHz	128kB/32kHz, 512kB/44kHz
File Format Support	PMD, SMF, QCP	PMD, SMF, SP-MIDI, QCP, WAV	PMD, SMF, SP-MIDI, SMAF, QCP, WAV	PMD, SMF, SP-MIDI, QCP, WAV	PMD, SMF, SP-MIDI, QCP, WAV	PMD, SMF, SP-MIDI, SMAF, QCP, WAV



PMD File Features by CMX Version

chip software version		CMX 2.X	CMX 3.0	CMX 3.1	CMX 4.0	CMX 4.1	CMX 4.3
corresponding chipset(s)		MSM5100/3300	MSM6050	MSM602, 6050	MSM6100	MSM6100, 6250, 6500	MSM6100, 6250, 6300, 6500
Audio	MIDI (# poly)	16	32	32	72 (HP)	72 (HP)/ 32 (HQ)	72 (HP)/ 32 (HQ)
	QCP	√	√	√	√	√	√
	ADPCM 8		√	√	√	√	√
	ADPCM 16		√	√	√	√	√
	ADPCM 32				√	√	√
	AAC						√
Still Images	PNG	√	√	√	√	√	√
	JPG			√			√
Animation (frames per second)	PNG	1	2	2	5	5	5
	JPG			1			4
	GIF	1	2	2	5	5	5
	SAF	2	3	3	6	6	6
Other Features	Text	√	√	√	√	√	√
	Text Wipe	√	√	√	√	√	√
	Vibration	√	√	√	√	√	√
	LED	√	√	√	√	√	√
	Loop	√	√	√	√	√	√



Using CMX Content in Games & Applications

- **Audio**
 - MIDI music
 - QCELP/ ADPCM sound effects and voice dialogue
- **Graphics**
 - SAF Animation
 - PNG animation
 - Use for comic strip or magazine applications, applications for viewing blessings, or cut scenes in your game
- **Text and Wipe**
 - Text for dialogue in a storybook or comic strip
 - Karaoke applications
- **Vibration and LED**
 - Effects for games



CMX Enhances Game Audio

- **Quality game audio without expensive technologies and large file size**
- **Multisequencer**
 - **Simultaneous playback of up to 4 MIDI tracks, plus up to 4 WAV (QCP or ADPCM) segments**
 - **An example game could include**
 - 1st WAV - good guy human voice
 - 2nd WAV - criminal human voice
 - 3rd WAV – ambient background noise
 - 4th WAV – door slamming noise
 - 1st MIDI track – background sound track
 - 2nd MIDI track – game status tones
- **Game developers can create customized sound effects**
- **CMX time-synchronized vibration and LED**



Supported Features by CMX and BREW Version

Chip	5100	6050 / 6025	6100 / 6300	6250 / 6500	6250 / 6500	6100/ 6300/ 6500/ 6550/ 6250/ 6275
Software Release	CMX 2.2 BREW 2.0	CMX 3.0 / 3.1 BREW 2.1.2	CMX 4.0 / 4.1 / 4.3 BREW 2.1.2	CMX 4.3.3 BREW 3.1.2	CMX 4.4 BREW 3.1.3	CMX 4.4 BREW 3.1.4
Simultaneous Multiple Audio	No	Yes	Yes	Yes	Yes	Yes
Multi-Sequencer (Simultaneous MIDI)	No	Not supported through BREW	Not supported through BREW	Yes, but not emulated through the BREW emulator	Yes, but not emulated through the BREW emulator	Yes, but not emulated through the BREW emulator
DLS through CMF and XMF	No	No	No	No	Yes	Yes
Global loading of DLS	No	No	No	No	No	Yes, but not emulated through the BREW emulator



Using Multisequencer

- **BREW 2.1.X Releases on MSM6025/ 6050 with CMX**
 - **Support the simultaneous playback of:**
 - One MIDI object plus
 - Up to 4 QCP objects or 4 ADPCM objects
- **BREW 2.1.X and 3.X Releases on MSM6100/ 6250/ 6275/ 6300/ 6500/ 6550/ 6800 with CMX 4.4**
 - **Support the simultaneous playback of:**
 - Up to 4 MIDI objects, plus
 - Up to 4 QCP objects or 4 ADPCM objects



Using Multisequencer

- **Encoded WAV audio must all be in one format**
 - **No mixing of different formats**
- **QCP encoding at 8kHz, fixed full rate only**
- **4-bit ADPCM encoding at 8 or 16kHz for MSM6025/6050**
- **4-bit ADPCM encoding at 8, 16, or 32kHz for MSM6100/ 6250/ 6275/ 6300/ 6500/ 6550/ 6800**
- **Some MSM6100/ 6250/ 6275/ 6300/ 6500/ 6550/ 6800 handsets with BREW 2.1.X may only support one MIDI object instead of four**
- **Simultaneous audio playback is not emulated in the BREW SDK**



Multisequencer BREW API Call Sequence

1. Create MIDI media objects via
`ISHELL_CreateInstance(AEECLSID_MEDIAMIDI)`
Create QCP audio objects via
`ISHELL_CreateInstance(AEECLSID_MEDIAQCP)`
or
Create ADPCM audio objects via
`ISHELL_CreateInstance(AEECLSID_MEDIAADPCM)`
or
Create PMD audio objects via
`ISHELL_CreateInstance(AEECLSID_MEDIAPMD)`
2. Load each media file via `IMEDIA_SetMediaData()`
3. Share each media/audio object via `IMEDIA_EnableChannelShare()`
4. Play each object via `IMEDIA_Play()`

Alternatively, `IMEDIAUTIL_CreateMedia()` can replace the calls to `ISHELL_CreateInstance()` and `IMEDIA_SetMediaData()`



Downloadable Sounds (DLS)

- **What is DLS?**
 - Standardized banks of audio samples and articulation data
 - Allows CP to create custom sounds for overriding existing GM instruments, adding specialized instruments, and creating new sound effects
- **How to make DLS**
 - Use software like Microsoft Direct Music Producer or Awave
 - Import WAV file and set parameters for modifying WAV file to create an instrument
 - Save the file as a .dls file
- **Available on CMX v4.4 handsets**
- **New CMX Studio Authoring Tool v4.0.0 supports importing of DLS files to use in .pmd files**



Using Downloadable Sounds (DLS)

- **Alternatively, use the open standard eXtensible Music Format (XMF)**
 - XMF file format bundles a MIDI and DLS
 - DLS files are organized into instrument banks with Bank Select values (MSB, LSB, program number)
 - Use Bank Selects in MIDI to invoke a DLS instrument
 - Playback of XMF files are supported on CMX handsets
- **Advantages over using QCP/ADPCM audio segments:**
 - **Flexibility**
 - Control of instrument via MIDI commands
 - Sound can be manipulated across whole keyboard by using adjustable pitch and volume – even with drum instruments
 - **Efficient File size**
 - One audio wav sample may be used for multiple instruments
 - Samples are relatively small compared to average ADPCM, QCP sound samples



Using Downloadable Sound (DLS) via BREW APIs

- **Global Load and Unload of DLS via BREW APIs**
 - available on MSM6100/ 6300/ 6250/ 6275/ 6500/ 6550/ 6800 handsets with BREW 3.1.4 and later
- **Use APIs to globally load and unload DLS files**
 - Globally loaded DLS can be referenced by multiple MIDI files
 - One copy of the DLS file is kept instead of duplicate copies kept with each .pmd or XMF file
- **BREW API call sequence:**
 - Load the DLS media object with IDLS_Load()
 - All subsequent IMEDIA_Play() commands will utilize the globally-loaded DLS



How to Obtain CMX Studio

- Contact cmx.contact@qualcomm.com
- Or use the link on our public site:
 - http://www.cdmatech.com/about_us/contact_cmx.jsp
- Get a CMX Studio Developer Connection (web site) account
 - Send the following information to cmx.contact@qualcomm.com:
 - User's full name
 - User's email address
 - Company name
- CMX Studio Developer account and software are free of charge



MIDI Out Messages

- **Can send MIDI commands from within the Game app, rather than from within MIDI software**
- **Used to dynamically provide MIDI commands from within the program file**
 - **Send MIDI commands after something happens in the game**
 - **e.g., note on after person runs across screen**
- **Having all the MIDI notes embedded in the code prevents the developer from having to manage many separate MIDI files**
- **Can dynamically change the lead instrument in a song based on character, mood, level, etc.**
- **Simply call the API and put the command within the parentheses**



Using MIDI Out Messages

- **CMX audio engine can handle MIDI messages sent via BREW API calls**
- **A maximum of 32 MIDI commands may be issued**
- **MIDI commands will affect any MIDI/WebAudio file currently playing**
- **Globally loaded DLS files can also be triggered and controlled via MIDI Out messages**
- **Example MIDI Commands**
 - **Note on (0x90) , Note off (0x80) , Polyphonic after touch (0xA0), Control change (0xB0), Program change (0xC0), Channel after touch (0xD0), Pitch wheel (0xE0)**
- **Use IMEDIAMIDIOUTMSG_SetMIDImsg() to set the buffer containing the MIDI command**



3D Audio: QConcert & QAudioFX

- **QConcert – MSM 6500 and higher**
 - Enhanced stereo experience available for handsets with dual speakers and/or headphones
 - OEM implements QConcert natively
 - Enhanced effect is used for all stereo audio on the device, including streaming audio, video, and ringtones
- **QAudioFX – MSM 6550 and higher with BREW 3.1.4**
 - Positional audio for games
 - Developers use APIs to precisely position and move sounds within and through 3D space
 - Sound movement and positioning can be dependent on game character actions and movement



Q & A

Thank you for your time!

