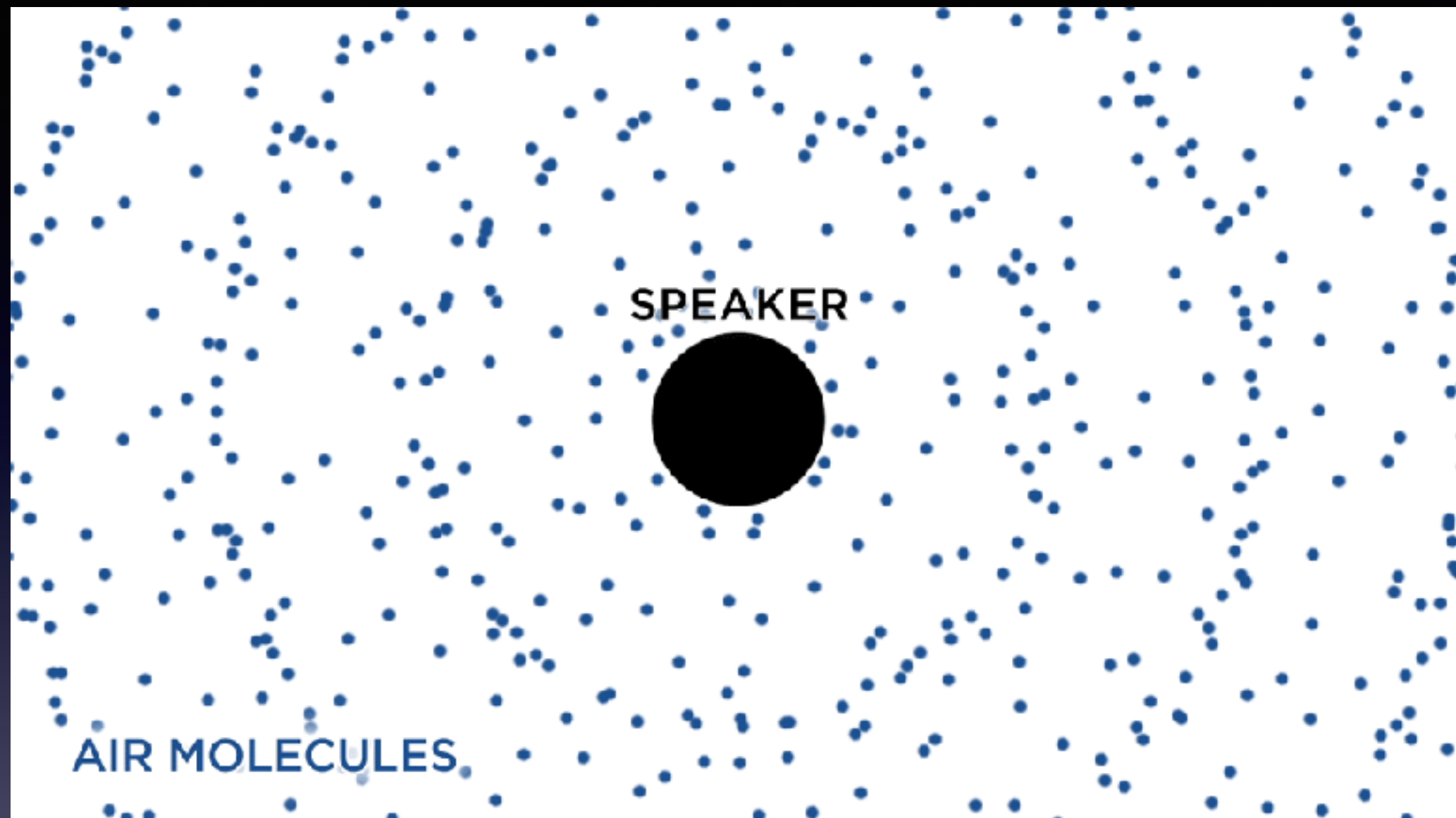


# Sound Synthesis

w/ Golang

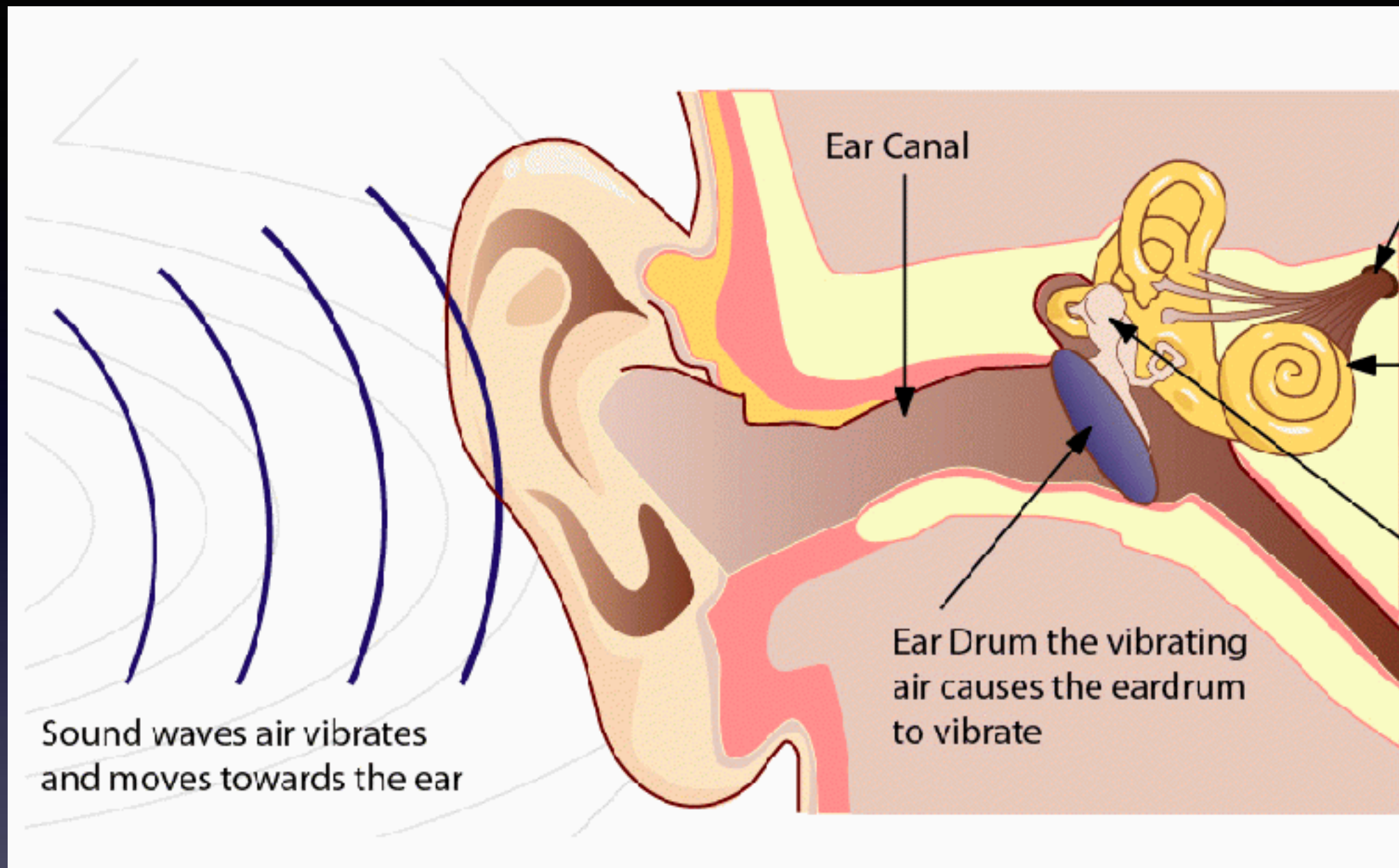
# Outline

- Introduction to sound (analog/digital).
- Making some digital sound.



# How sound works

wave

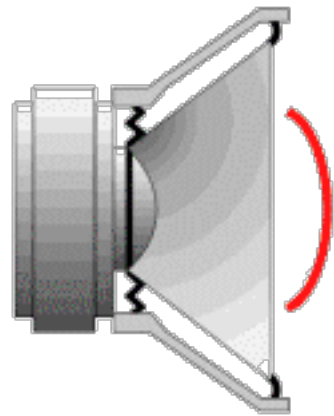


# Waves come to ears

make the ears vibrate.

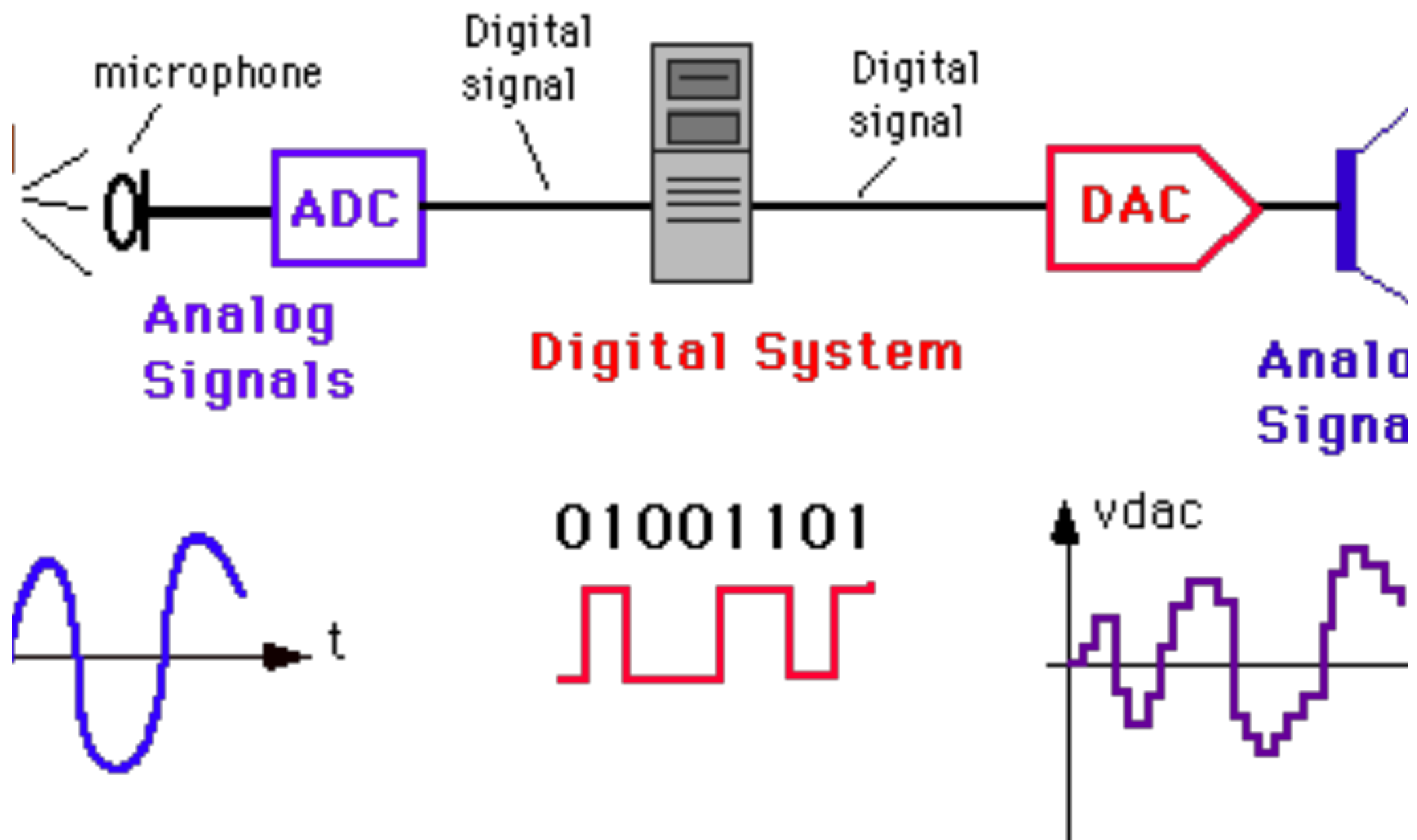


That's why we can hear sounds from space.



# A Speaker

Speakers make waves to simulate sounds.

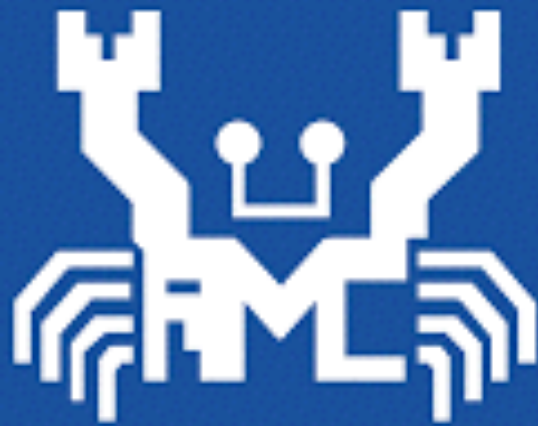


# Digital Sound

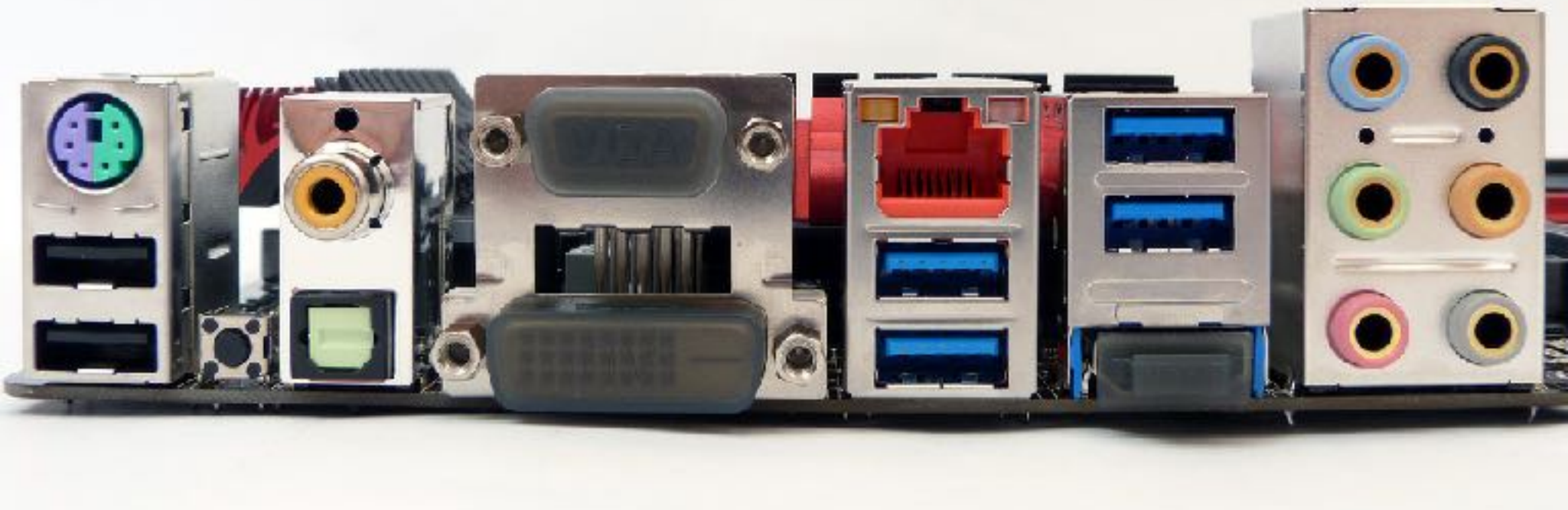
ADC convert analog to digital.  
DAC convert digital to analog.



# DAC devices



REALTEK





# DAC devices



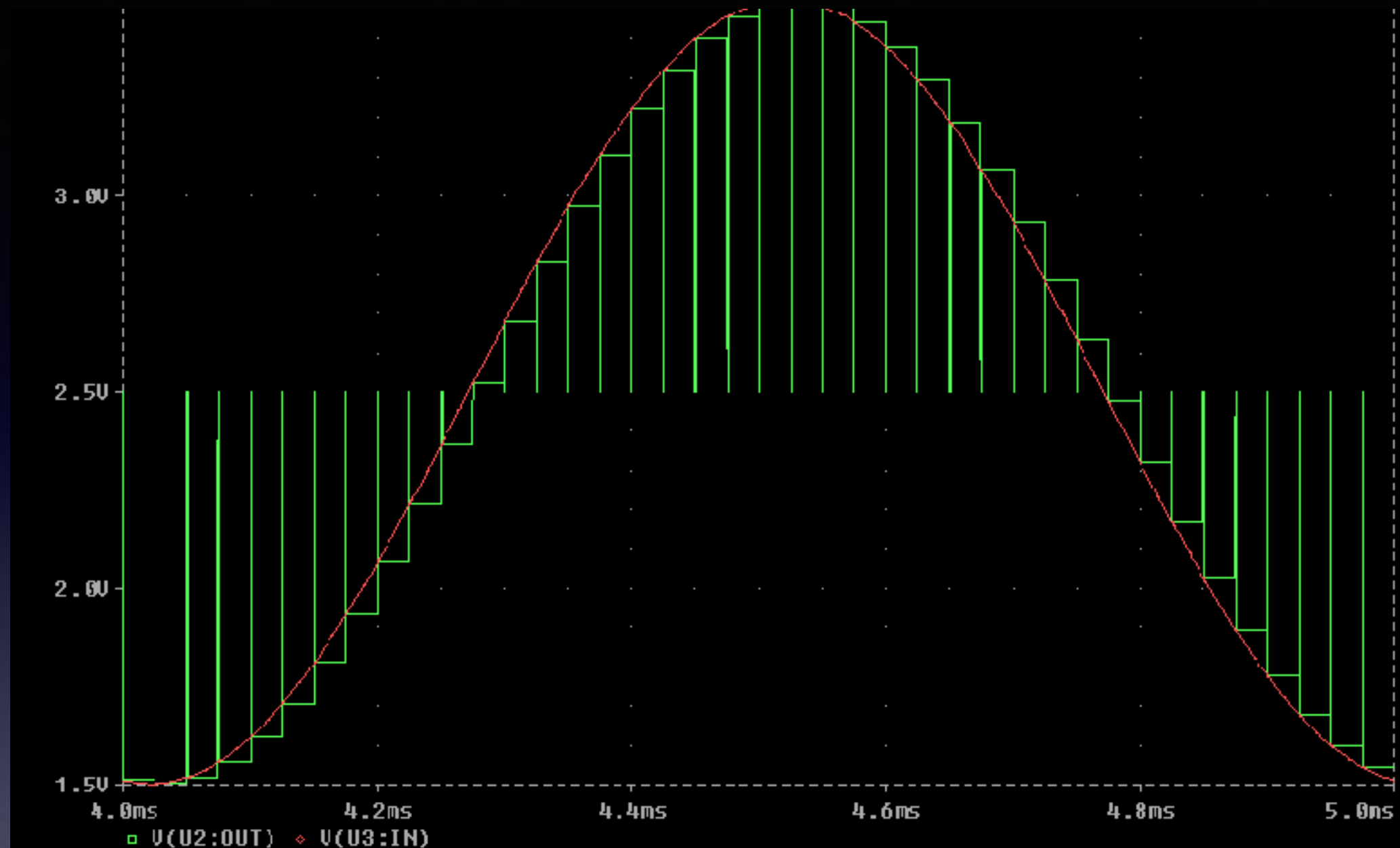
# DAC devices



# DAC devices



bluetooth head/earphones



# DAC

Convert binary to voltage

# 16bit 44100 Hz

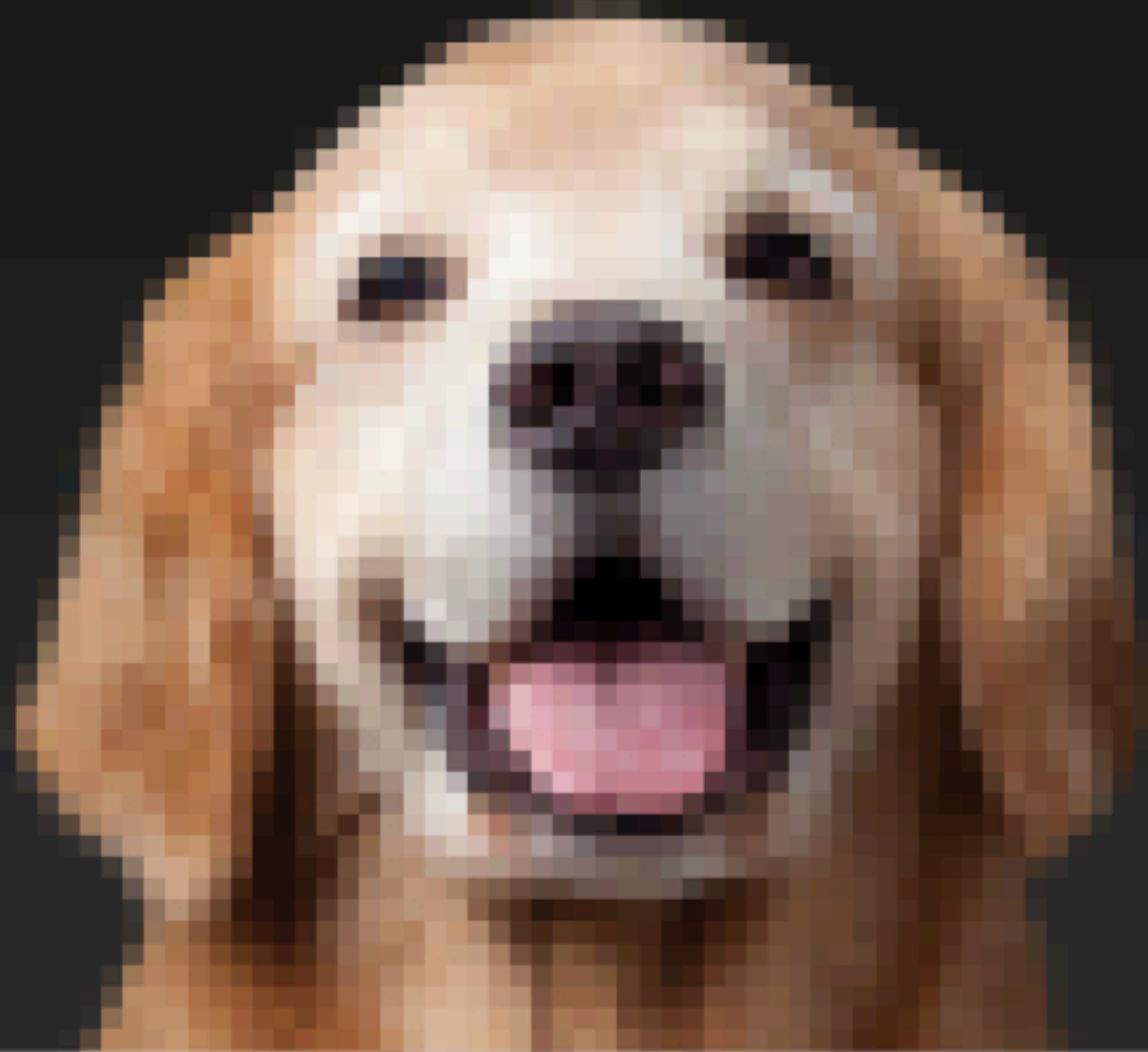
- 44100 samples per second.
- 1 sample is 16bit number (can be float / int).
- If the sound has LEFT + RIGHT channels, it contains 88200 samples per second.

=> 1s ~ 176 kbytes

# Several formats

- WAVE: 16bit 44kHz (~1411 kbps)
- WAVE: 24bit 96kHz (~4600 kbps)
- MP3 128/256/512 kbps (lossy formats)
- AIFF: like WAVE (but data chunk use big endian)





0	1	1	0	0	1	0	0
---	---	---	---	---	---	---	---

$2^7$   $2^6$   $2^5$   $2^4$   $2^3$   $2^2$   $2^1$   $2^0$

**Big Endian**  
= 0x64 = 100

0	1	1	0	0	1	0	0
---	---	---	---	---	---	---	---

$2^0$   $2^1$   $2^2$   $2^3$   $2^4$   $2^5$   $2^6$   $2^7$

**Little Endian**  
= 0x26 = 38

# Big/Little Endian

# Audio driver

- Read buffer memory
- Send to DAC

# We have to

- Read or generate samples.
- Write to buffer when the callback is called.

Let's start making  
some noise

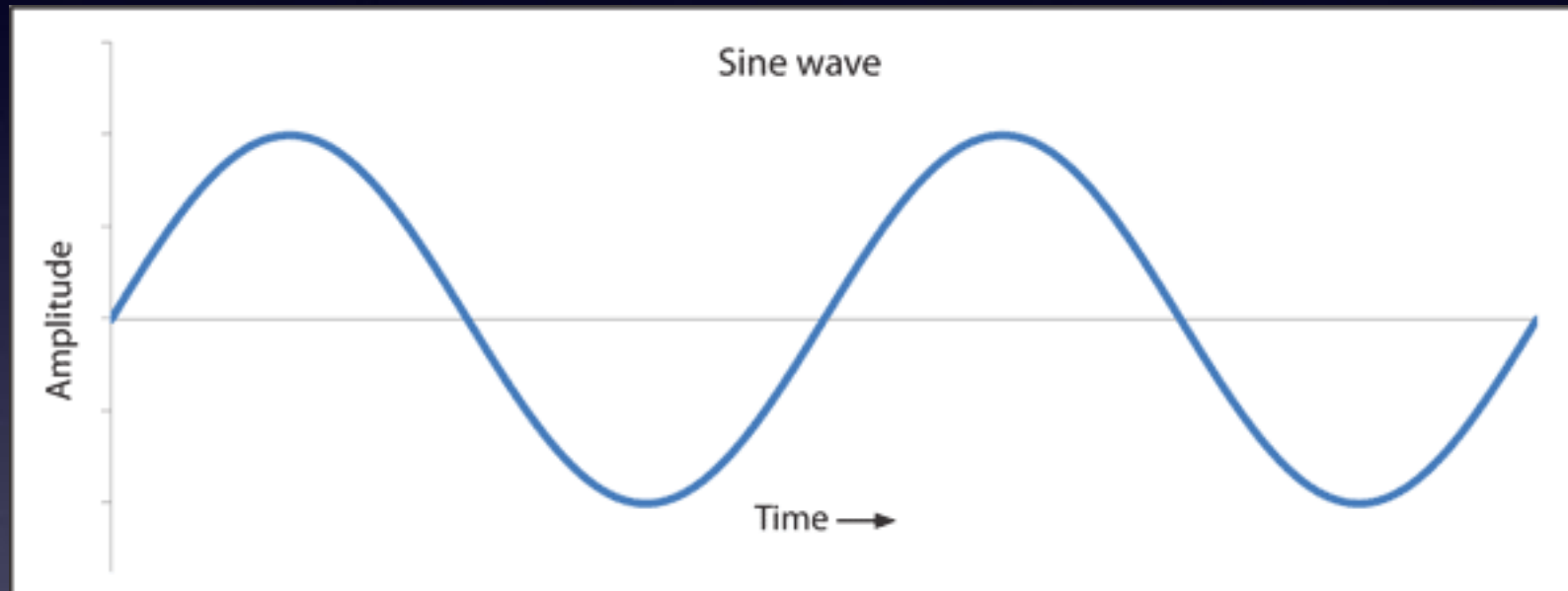
(real noise)







# Sine wave



$$f(x) = \sin(x)$$

# Wave File

foo.wav

## *The Canonical WAVE file format*

endian	File offset (bytes)	field name	Field Size (bytes)	
big	0	ChunkID	4	The "RIFF" chunk descriptor
little	4	ChunkSize	4	
big	8	Format	4	
big	12	Subchunk1 ID	4	The "fmt" sub-chunk
little	16	Subchunk1 Size	4	
little	20	AudioFormat	2	
little	22	NumChannels	2	
little	24	SampleRate	4	
little	28	ByteRate	4	
little	32	BlockAlign	2	
little	34	BitsPerSample	2	The "data" sub-chunk
big	36	Subchunk2 ID	4	
little	40	Subchunk2 Size	4	
little	44	data		Indicates the size of the sound information and contains the raw sound data



Let's build a basic Keyboard

Thank you!