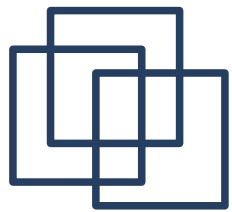




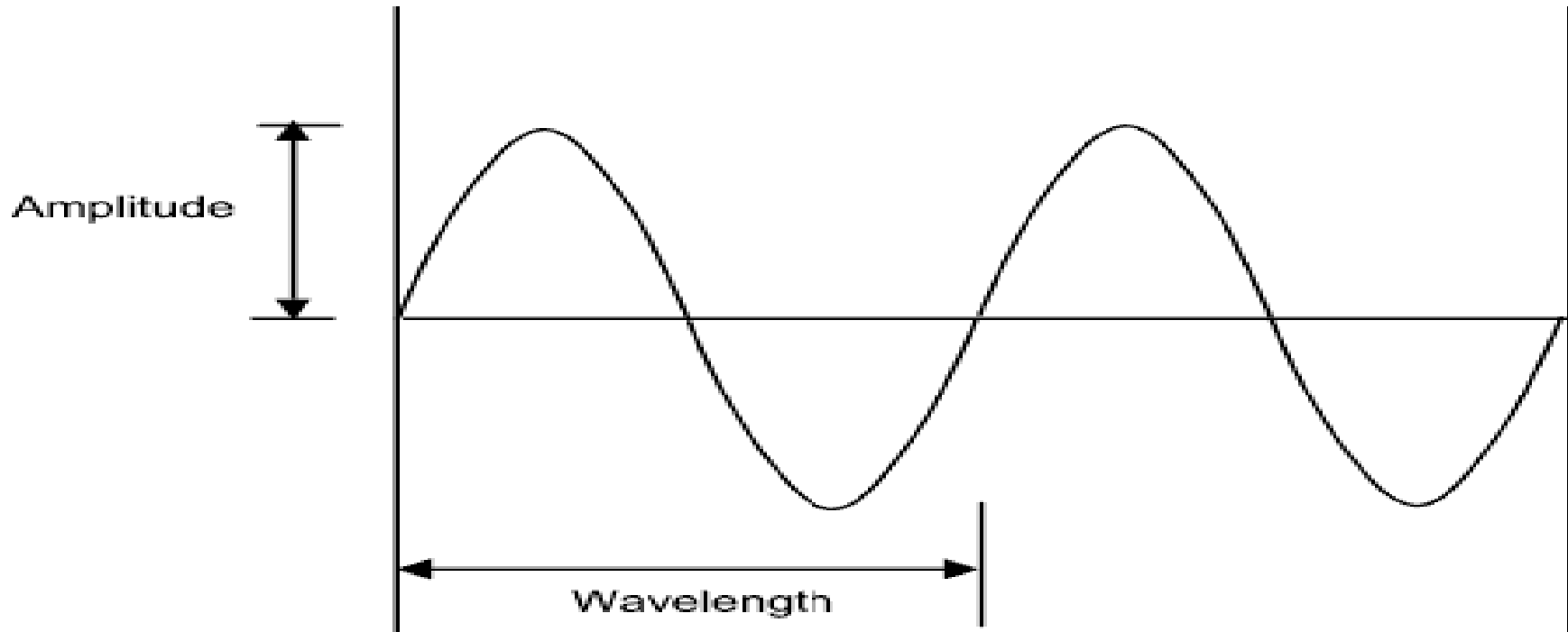
# Multimedia Production

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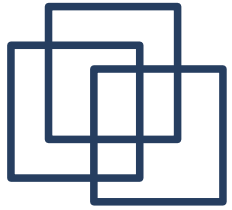
## Digital Multitrack Audio Recording & MIDI



# Suara: gelombang di udara



- Frekwensi: banyaknya perputaran per detik dalam Hertz (Hz)
- Panjang gelombang (Wavelength) berbanding terbalik dengan freq ( $1/\text{frequency}$ )



# Intensitas: Decibels (DB)

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- Mengukur intensitas = desibel (dB):

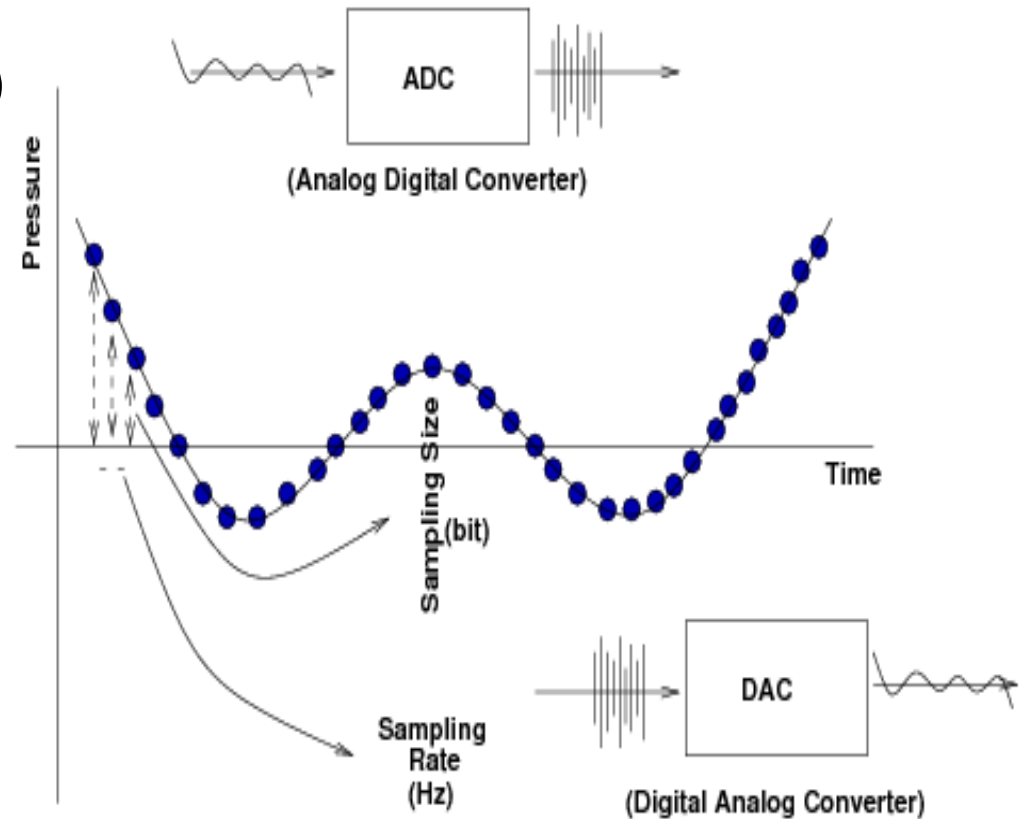
$$X_{dB} = 10 \log (X / X_0)$$

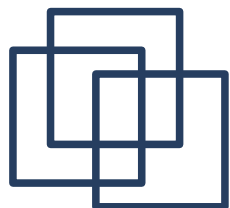
dimana:

- X : nilai yang diukur
- X<sub>0</sub> : reference level, 20 uPa (Udara), 1 uPa (Air)
- X dan X<sub>0</sub> harus diukur pada unit yang sama
- Reference level selalu ada pada 0 dB

# Sampling – Digitalisasi Suara

- Transformasi dari sinyal continuous (time-depended) ke data diskrit
- Quantized Amplitude Signal -> sampling size (bit)
- Sampling: interval antara pengambilan data
- Sample Rate / Frequency = banyaknya sampling per detik (Hz)

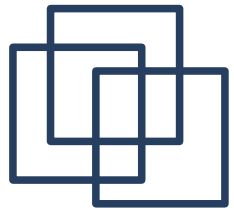




# Kualitas Sampling

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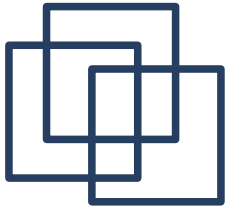
Quality	Sample Rate (KHz)	Bits per Sample	Mono/ Stereo	Data Rate (uncompressed) (kB/sec)	Frequency Band (KHz)
Telephone	8	8	Mono	8	0.200-3.4
AM Radio	11.025	8	Mono	11.0	0.1-5.5
FM Radio	22.05	16	Stereo	88.2	0.02-11
CD	44.1	16	Stereo	176.4	0.005-20
DAT	48	16	Stereo	192.0	0.005-20
DVD Audio	192 (max)	24 (max)	6 channels	1,200.0 (max)	0-96 (max)



# Teorema Nyquist Sampling

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- Sampling frekwensi harus minimum 2x dari komponen frekwensi sinyal tertinggi
- Menentukan akurasi dari gelombang suara yang akan diproduksi
- 8-bit terdengar kasar
- 16-bit OK !
- Q: Mengapa sample rate dari CD 44.1 KHz ?
- A: Karena manusia bisa mendengar suara: 20Hz – 22 Khz
- High Definition: 24-bit, 48 KHz
- Superb: 32-bit, 96 KHz

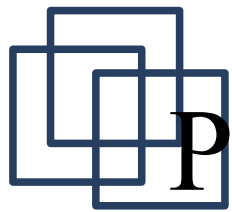


# Sound Card

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- ADC , DAC, MIDI, Sound Processor, Synthesizer, Surround Processor, etc
- Antar Muka : ISA, PCI(e), USB, Firewire, PCMCIA
- Internal, External, External Module + Internal Card
- End-User : Sound Blaster, AC97, Yamaha YM3812 aka OPL2, dll. 16 bit - 48Khz
- Professional Studio: M-Audio (Roland), Steinberg, dll. 32-bit – 96 Khz. ASIO Protocol (Cubase, Nuendo)

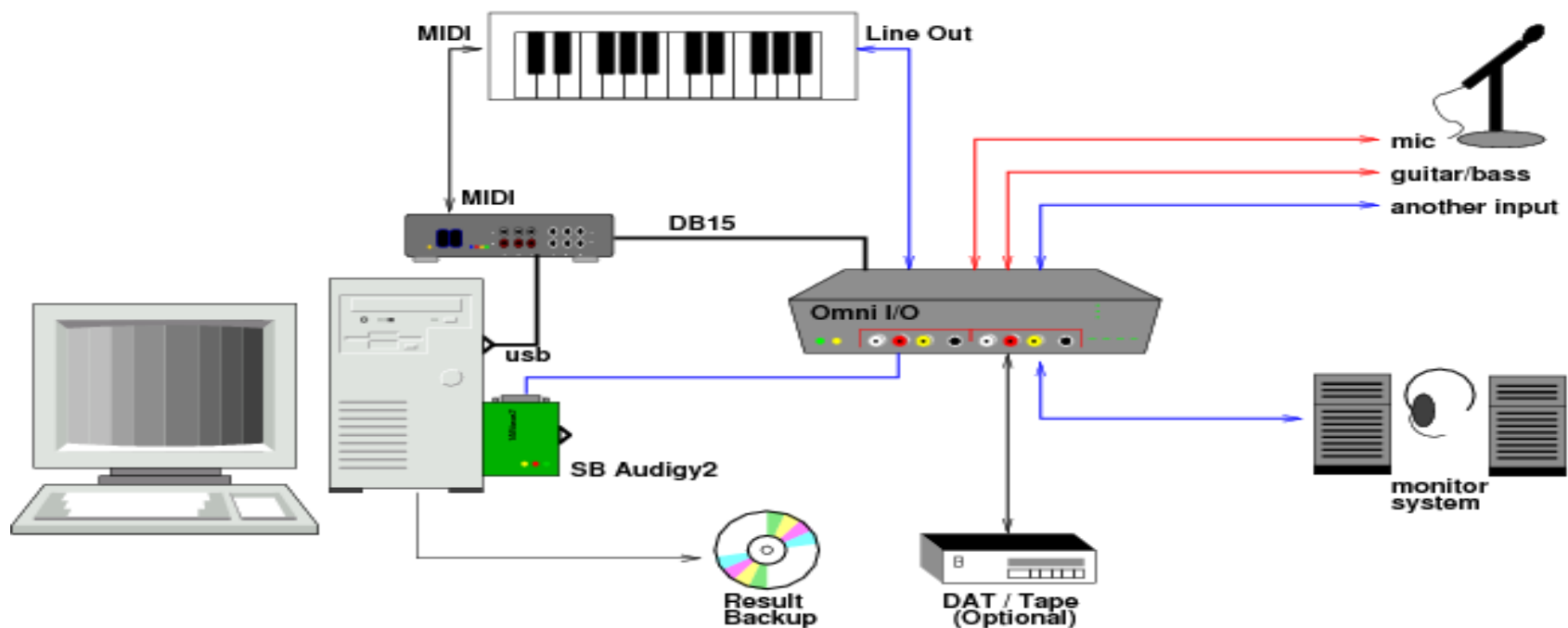


# PC-Based Multitrack Recording

— Digital

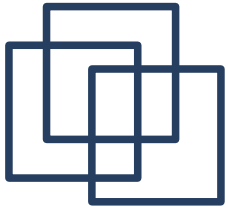
— Low Impedance Analog

— High Impedance Analog



- Proprietary: Cubase - Nuendo (Steinberg), Acid-Pro (Sony), dll
- OpenSource: Audacity, Ardour2 + LADSPA + Jack

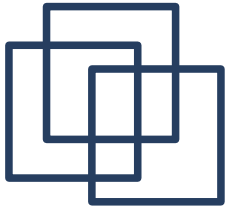




# Audio Format

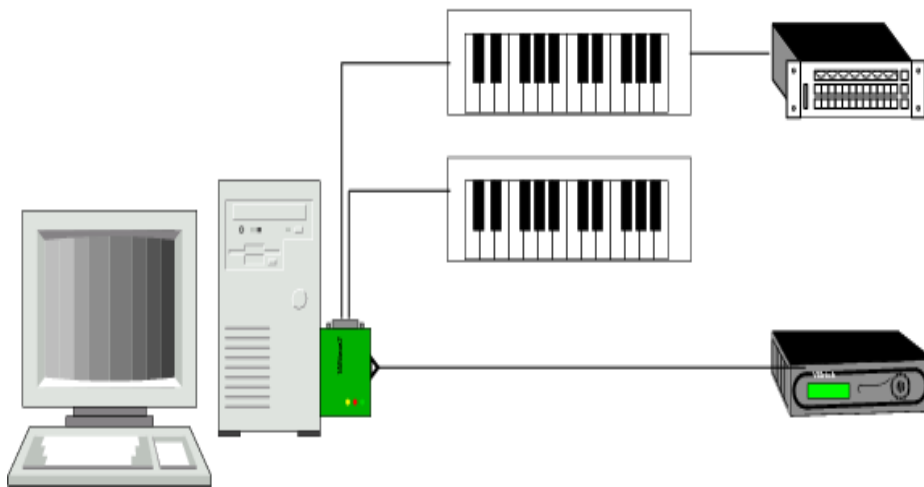
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- Not-Compressed
  - Au : (Unix, Sun)
  - Aiff: (Mac, SGI)
  - Wav: (PC, DEC)
- Compressed:
  - Soundblaster .voc
  - Microsoft .wma
  - Realaudio .ra
  - Ogg Vorbis .ogg
  - Fraunhofer .mp3
  - AAC, Apple, .mp4
  - Flac .flac
  - Dolby AC Coding

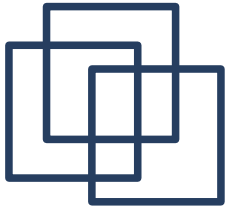


# MIDI

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- Pengatur: Sequencer
  - Sequencer Software: Voyetra, CakeWalk, dll
  - OpenSource: RoseGarden, MuSE, dll
- Musical Instrument Digital Interface
  - Data yang direkam / ditransmisikan adalah:
    - Nada: pitch, durasi (note-on, note-off), volume
    - MIDI event: pedal, pitch-bend, perubahan kontrol & program
    - SysEx (System Exclusive)



# MIDI

---

- 16 Channel, 1 Channel – 1 Suara (misalnya channel 10: Drum)
- File .mid / .smf
- Konsep Polyphony & Multitimbral
- General MIDI (GM):
  - Standard map 47 drum & perkusi
  - Minimum 24 Polyphony
  - 16 Channel
- 31.25 kbps Serial, DIN-8 socket
- Half-Duplex
- MIDI-In : hanya menerima (synth, sound module, drum machine)
- MIDI-Out : hanya mengirimkan (keyboard, sequencer)
- MIDI-Thru : melewatkan

tersiksa - Ardour

Session Transport Edit Select Regions View JACK Windows Options Help 48 kHz / 21.3 ms Buffers p:100% c:100% DSP: 13.4% Disk: 08h:22m:46s 23:40

stop % sprung 00:00:31:15 30 NDF 009 | 03 | 0259 4/4 65.00 Internal Punch In Auto Play Auto Input SOLO PUNCH OUT Auto Return Click AUDITION

Splice Edit 00:00:00:00 No Grid CD Frames Mouse 00:00:00:00

Regions: Audio 1-1 [2] (M), Audio 10-2 (MISS), Audio 10-3 (MISS), Audio 10-4 (MISS), Audio 10-5 (MISS), Audio 10-6 (MISS), Audio 2-1 (MISS), Audio 3-2 (MISS), Audio 4-1 (MISS), Audio 4-2 (MISS), Audio 4-4 (MISS), Audio 7-2 (MISS), Audio 8-2 (MISS), Audio 9-1 (MISS), Audio 9-2 (MISS), fill2-1 (MISSING), fill2-2 (MISSING), melodi-1 (MISSING)

Tracks/Buses: drum, arr gt, bass, fill, fill2, melodi, interlude, vocal, Audio 9, Bass Oct, master

Chunks: drum, arr gt, bass, fill, fill2, melodi, interlude, vocal, Audio 9, Bass Oct, master

tersiksa - Mixer - Ardour

Strips: drum, arr gt, bass, fill, fill2, melodi, interlude, vocal, Audio 9, Bass Oct, master

Strip	Mute	Solo	Level	Group	Post
drum			-11.9	>send 4	
arr gt			-1.9	>send 2	
bass			-5.9	>send 5	
fill			1.4		
fill2			-9.7		
melodi			-11.4		
interlude			-15.3		
vocal	Mute		-8.4		
Audio 9			-1.6		
Bass Oct			-10.0		
master			-4.2		

Group Acti: -all-

Output: Left

