

*MD vs MP3*

# *Agenda*

- Why and what is Audio Compression?
- What is MP3?
- Why MP3 is so popular?
- What is MiniDisc ATRAC?
- How ATRAC compares to MP3?
- Pro and Cons to the users

# Why do we need of Audio Compression?

1-minute song (CD quality) on your Hard Disc

$$\begin{array}{ccccccc} \boxed{44.1 \text{ kHz}} & & \boxed{\text{stereo}} & & \boxed{16 \text{ bits / sample}} & & \\ 44.100 & \times & 2 & \times & 2 & \times & 60 \\ \text{samples/second} & & \text{(2 channels)} & & \text{(2 bytes/sample)} & & \text{(60 sec/min)} \\ & & & & & & = \boxed{10 \text{ Mbytes}} \end{array}$$

1-minute song (CD quality) over the Internet

$$\begin{array}{ccc} \boxed{10 \text{ Mbytes}} & \xrightarrow{\text{Internet}} & \boxed{28.8 \text{ modem}} \\ 10.000.000 & \times & 8 \\ \text{(bytes)} & \text{(8 bits/byte)} & \div \left( \begin{array}{c} 28.800 \\ \text{(bits/s)} \end{array} \times \begin{array}{c} 60 \\ \text{(60 s/min)} \end{array} \right) \\ & & = \boxed{49 \text{ minutes}} \end{array}$$

# *What is Audio Compression?*

- The process of minimizing the storage space (or channel bandwidth) requirements for audio data.
- Modern perceptual audio coding techniques exploit the properties of the human ear to achieve size reduction, with little or no perceptible loss of quality (ie. MP3 & ATRAC).

# *What is Audio Compression?*

- The key technology for high quality low bit-rate applications
  - soundtracks for CD-ROM games
  - solid-state sound memories
  - Internet audio
  - Digital audio broadcasting systems

# What is MP3?

- MP3 = MPEG Layer-3
- A 4-minute song is about 4MB and takes about 20 minutes to download at 28.8k baud. MP3 music is typically sampled at 44.1kHz and 128k/sec.
- Some typical performance data of MP3 are:

Sound Quality	Bandwidth	Mode	Bit rate	Compression Ratio
telephone sound	2.5 kHz	Mono	8 kbps	96:1
better than shortwave	4.5 kHz	Mono	16 kbps	48:1
better than AM radio	7.5 kHz	Mono	32 kbps	24:1
similar to FM radio	11 kHz	Stereo	56...64 kbps	26...24:1
near-CD	15 kHz	Stereo	96 kbps	16:1
CD	>15 kHz	Stereo	112..128kbps	14...12:1

# *Why MP3 is so popular?*

- MP3 Software Players are free on the Web.
- Music on the Web has become a popular pastime.

# *Why MP3 is so popular?*

- Approximately 31 music sites are added daily about 930 each month.
- Fast to download.
- Music is free.

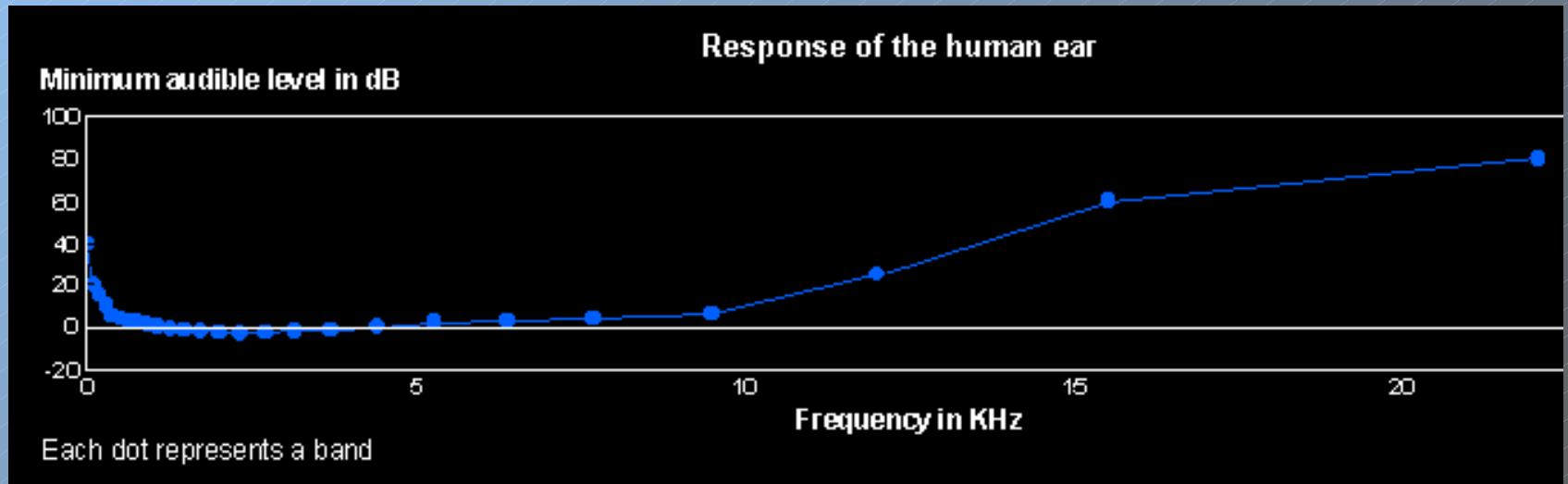


# *What is MiniDisc ATRAC?*

- Adaptive Transform Acoustic Coding.
- Audio coding system based on psychoacoustic principles.
- ATRAC reduces the bit rate of the 16 bit 44.1KHz input signal from 1.4Mbps to 292KBps.

# What is MiniDisc ATRAC?

- Compresses CD audio to approximately 1/5 of the original data rate with virtually no appreciable loss in sound quality.



# *ATRAC Improvement over the Years*

- ATRAC 1 compression and noisy ADC and DAC introduced quite a few digital artifacts and noise into recordings.
- ATRAC 2 was greatly improved and was possibly one of the biggest leaps in improvement, with noise and digital artifacts greatly reduced.
- ATRAC 3: 3 improved to 24/16-bits for word and coefficient length (previous to ATRAC 3 it was entirely 16-bit).

# *ATRAC Improvement over the Years*

- ATRAC 3.5 was improved with a input width of 20-bits.
- ATRAC 4 works entirely in 24-bits and has a neat feature that Sony calls Wide Bit Stream.
- ATRAC 4.5 has an improved "Wide Bit Stream" audio resolution of 20- and 24-bits.
- ATRAC Type-R has two times more signal processing power than the 4.5 version.

# *Other MiniDisc Benefits*

- It has a User TOC (table of contents) area which allows the user to program track names and track information.
- It has a special memory buffer of up to 40 seconds to ensure uninterrupted play. The data is read from the disc at 1.4MBps whereas the data rate is only 292KBps, so it reads faster than it needs to.

# *How ATRAC compares to MP3?*

- ATRAC provides 292kbit/sec, giving “CD like” audio fidelity (5/1 compression).
- Mp3 provides “CD like” fidelity at 128kbit/sec (12/1 compression).

# *Pros and Cons to the users*

- Advantages of MD over portable MP3 Players:
  - MP3 Player's sound quality is not as good as that from an MD. This is because MP3 players use a 12:1 (approx.) compression ratio while MD uses a 5:1 compression ratio.
  - An MD holds up to 80 minutes of audio, MP3 players only hold approximately 1 minute per megabyte of RAM space in the highest-quality audio mode.

# *Pros and Cons to the users*

- Advantages of MD over portable MP3 Players:
  - MD uses removable media so you can quickly swap discs while on the go. To change the music in the Saehan's mp-man requires uploading new music to it via a PC.
  - Diamond Multimedia's Rio supports removable flash RAM cartridges, but they are relatively expensive.



# *Pros and Cons to the users*

- Advantages of MD over portable MP3 Players:
  - An MD recorder can record from any audio source in real-time. MP3 players cannot record audio, they require the user to obtain MP3 music, then upload it to the MP3 player via a PC.

# *Pros and Cons to the users*

- Advantages of MD over portable MP3 Players:
  - MP3 music is most commonly obtained by downloading via the Internet (at least 25 minutes per 4-minute song with a 33.6 modem), or going through the process of 'grabbing' the track digitally from a CD and using an MP3 encoder to encode the CD audio track into an MP3 file.
  - Most late model MD players are already as small as the Saehan mp-man. Some MD are smaller than the Saehan mp-man.

# *Pros and Cons to the users*

- Disadvantages of MiniDisc over portable MP3 Players:
  - MP3 players are solid-state, no moving parts means better reliability.
  - Although MD's shockproof memory system makes MD virtually skip-resistant, it is nowhere as skip resistant as solid-state media.

# *Pros and Cons to the users*

- Disadvantages of MiniDisc over portable MP3 Players:
  - MP3 files must be recorded in realtime with MD.
  - A soundcard with Digital Audio Output is required to make noise-free digital copies.