DIGITAL

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napster//best of ‘99

01_bawitdaba.mp3 (128 kbps) kid rock
02_i_want_it_that_way.mp3 (128 kbps) backstreet boys
03_...baby_one_more_time.mp3 (128 kbps) britney spears
04_what_do_you_want_me_to_say?.mp3 (128 kbps) the dismemberment plan
05_do_this_my_way.mp3 (128 kbps) blackalicious
06_nookie.mp3 (128 kbps) limp bizkit
07_the_secret_of_life.mp3 (128 kbps) faith hill
08_porcelain.mp3 (128 kbps) moby
09_u_understand_(album_version_(explicit)).mp3 (128 kbps) juvenile
10_i_try.mp3 (128 kbps) macy gray
11_candy.mp3 (128 kbps) mandy moore
12_single_white_female.mp3 (128 kbps) chely wright
13_steal_my_sunshine.mp3 (128 kbps) len
14_it’s_all_been_done.mp3 (128 kbps) barenaked ladies
15_livin’_la_vida_loca.mp3 (128 kbps) ricky martin
16_wait_and_bleed.mp3 (128 kbps) slipknot
17_man!_i_feel_like_a_woman!.mp3 (128 kbps) shania twain
18_lit_up.mp3 (128 kbps) buckcherry
19_sour_girl.mp3 (128 kbps) stone temple pilots
20_second_solution.mp3 (128 kbps) the living end
21_my_own_worst_enemy.mp3 (128 kbps) lit
22_all_my_little_words.mp3 (128 kbps) the magnetic fields
23_bug_a_boo.mp3 (128 kbps) destiny’s child
24_thong_song.mp3 (128 kbps) sisqó
25_give_it_to_you.mp3 (128 kbps) jordan knight
26_my_name_is.mp3 (128 kbps) eminem
27_coffee_and_tv.mp3 (128 kbps) blur
28_we’re_in_this_together.mp3 (128 kbps) nine inch nails
29_forgot_about_dre.mp3 (128 kbps) dr. dre
30_i_need_to_know.mp3 (128 kbps) marc anthony
31_genie_in_a_bottle.mp3 (128 kbps) christina aguilera
32_you_got_me.mp3 (128kbps) the roots
33_ms._fat_booty.mp3 (128 kbps) mosdef
34_how_do_you_like_me_now?!.mp3 (128 kbps) toby keith
35_deceptacon.mp3 (128 kbps) le tigre
36_believe.mp3 (128 kbps) cher
37_center_of_the_universe.mp3 (128 kbps) built to spill
38_heartbreaker_(featuring_jay-z).mp3 (128 kbps) mariah carey
39_no_scrubs.mp3 (128_kbps) tlc
40_what’s_my_age_again?.mp3 (128 kbps) blink-182
41_le_tombeau_de_couperin_/_states_of_art.mp3 (128 kbps) jason moran
42_sugar_coated_sour.mp3 (128 kbps) the dillinger escape plan

the grey album

01 public service announcement
02 what more can i say
03 encore
04 december 4th
05 99 problems
06 dirt off your shoulder
07 mement of clarity
08 change clothes
09 allure
10 justify my thug
11 interlude
12 my first song

A N A L O G - T O - D I G I T A L C O N V E R S I O N

Musmann:
But my real interest was in a different direction. At that time, we learned from publications that all kinds of information could be represented in digital form. This was fascinating. We learned how to represent a speech signal, and we learned about the effects of analog-to-digital conversions. We also learned that it is very complicated to convert video signals or any kind of moving images to digital representation. If you compare a TV signal with a speech signal, then you recognize that the transmission bit rate is about three thousand times that of the speech signal. But it was fascinating that all kinds of information could be represented in a digital form. My special interest at that time was the representation of visual information for future visual communications. But the problem was the very high bit rate.

Then I learned from the current literature how you have to sample the analog signal in order to convert it into a digital representation. If you have band limited signals, you can do it with perfect reconstruction, theoretically. Then, if you quantize the samples in order to have a completely digital representation, you introduce quantization noise. By sampling and then quantizing we call this PCM for Pulse Code Modulation—you come up with a bit rate for speech signals which is about sixty-four kilobits per second. You need an eight-kilohertz sampling rate, which is two times the bandwidth, in order to represent fast signal changes, and you need at least eight bits per sample, in order to avoid quantization noise. The first papers came out at this time from NASA and Bell Laboratories in the U.S., which showed that it was possible to represent this signal with fewer bits than PCM by processing the bits.

Nebeker:
Is this an audio signal you’re talking about?

Musmann:
Yes, at that time it was audio, because it was impossible to convert a video signal at that time. You would have needed a very fast sampling system that was not available.

Nebeker:
One could certainly understand why NASA was interested in digital communication. What was your interest?

Musmann:
I saw the advantage of having every kind of information represented in one form by bits. This is really a big advantage; it offers the opportunity to transmit different kinds of information all on one line. At that time the different kinds of communication services had separate lines. Digital representation, however, allows sound, speech, video, and facsimile to be transmitted by bits on one and the same line. This was fascinating. The main question for me was whether it is possible to reduce the number of bits of the PCM representation. What is the real theory behind this?

Nebeker:
Were you more mathematically inclined?

Musmann:
Yes. I wanted to understand what the theoretical background [of digital representation] was. So I studied the work of Claude Shannon. I think he had prepared the fundamentals of information theory, including source coding which addresses the problem of “How many bits are required for representing information?” At that time we did not have digital communications, with the exception of space probes. That was about 1966, 1967. Since I was looking especially for representation of visual information, I started with facsimile.

D I G I T A L A U D I O

Musmann:
But in digital audio the development was much faster. You know the compact disc. Compact discs present a digital sound signal of 1.5 megabits per second, providing excellent quality. That’s why the compact disc is growing so rapidly and records are vanishing. Of course there will be a need for multimedia communications in the future—we haven’t talked about that—so that the bit rate for sound coding, 1.5 Mbit/s, has to be reduced. There was also a standardization initiative on coding of audio and video for broadcast and computer applications, which is still going on. It was initiated in 1990. The ISO (International Standardization Organization) has established a special group, MPEG (Moving Picture Experts Group). The first aim of this standardization group was to represent a sound signal by two times 128 kbit/s (which is 256 kbit/s) instead of 1.5 Mbit/, providing a sound quality that cannot be distinguished from the original. The second aim was to develop a video coding standard that cuts down the bit rate of a TV signal with reduced resolution to 1.1 Mbit/s in a first step, and that of a full resolution TV to 4 to 8 Mbit/s in a second step.

The first step—we call it MPEG-1—was finished two years ago. I was chairman of the audio part. My colleague Dr. LeGall was responsible for the video. The best researchers from industries and universities contributed to the standardization, and we succeeded.

I wanted to mention this because in this audio coding technique there is a special processor that simulates the processing of the ear. The sound signal is split into frequency bands as our ear does in the cochlea. The signals of the frequency bands are then sampled, and the quantization introduced is controlled by a special model called the psycho-acoustic model. The model simulates the perception thresholds of the ear.

Nebeker:
Which are derived from physiological information?

Musmann:
Yes. So the model of the ear is continuously calculating the sensitivity thresholds for additional noise...

ANALOG

December 1991 – The Moving Pictures Experts Group ch
hofer Society with input from AT&T and Thomson to se
converted into small computer files.
June 1992 – RFC 1341 establishes the Multipurpose In
the way for the alt.binaries hierarchy on Usenet.
1992 – Software Publishers Association runs an anti-
July 1994 – The Fraunhofer Society released the l3en
September 1995 – The Fraunhofer Society released Win
June 1996 – Mp3 warez group Rabid Neurosis founded.
mp3’s available for others to download. Mirabilis de
1997 – Scour Inc. is founded by five UCLA Computer Sc
as well as a multimedia web search engine released i
declaring bankruptcy in October 2000.
April 1997 – Winamp audio player is released, incluc
May 1997 – AOL launches AOL Instant Messenger with f
August 1997 – Hotline is announced at MacWorld, and
September 1997 – Windows Media Player 6.1 includes s
November 1997 – MP3.com is founded by Michael Robert
for unsigned artists. It serves 4 million audio file
release of My.MP3.com in January 2000, which allowed
would be ruled in favor of the record labels. MP3.co
January 1998 – Musicmatch Jukebox is released provic
March 1998 – The MPMan F10, the first portable MP3 pl
July 1998 – SoundJam MP released allowing mp3 playba
it as the basis for iTunes.
September 1998 – Rio PMP300 MP3 player is shipped by
in October, without success.
October 1998 – Digital Millennium Copyright Act is u
net Service Providers cannot be sued for the activit
November 1998 – Audiogalaxy is created by Michael Me
1 million downloads in 2001. In May 2002, a suit by
Audiogalaxy would settle the suit for an undisclosed
P2P services in favor of Rhapsody, a pay streaming s
December 1998 – MP3 Newswire, the first digital media
February 1999 – China’s Tencent launches QQ, a chat
June 1999 – Napster was created by Shawn Fanning. Na
that indexed the files, and carried out the searches.
from peer to peer.
November 1999 – The Direct Connect network is create
November 1999 – iMesh is launched.
December 1999 – The first lawsuits filed against Napst