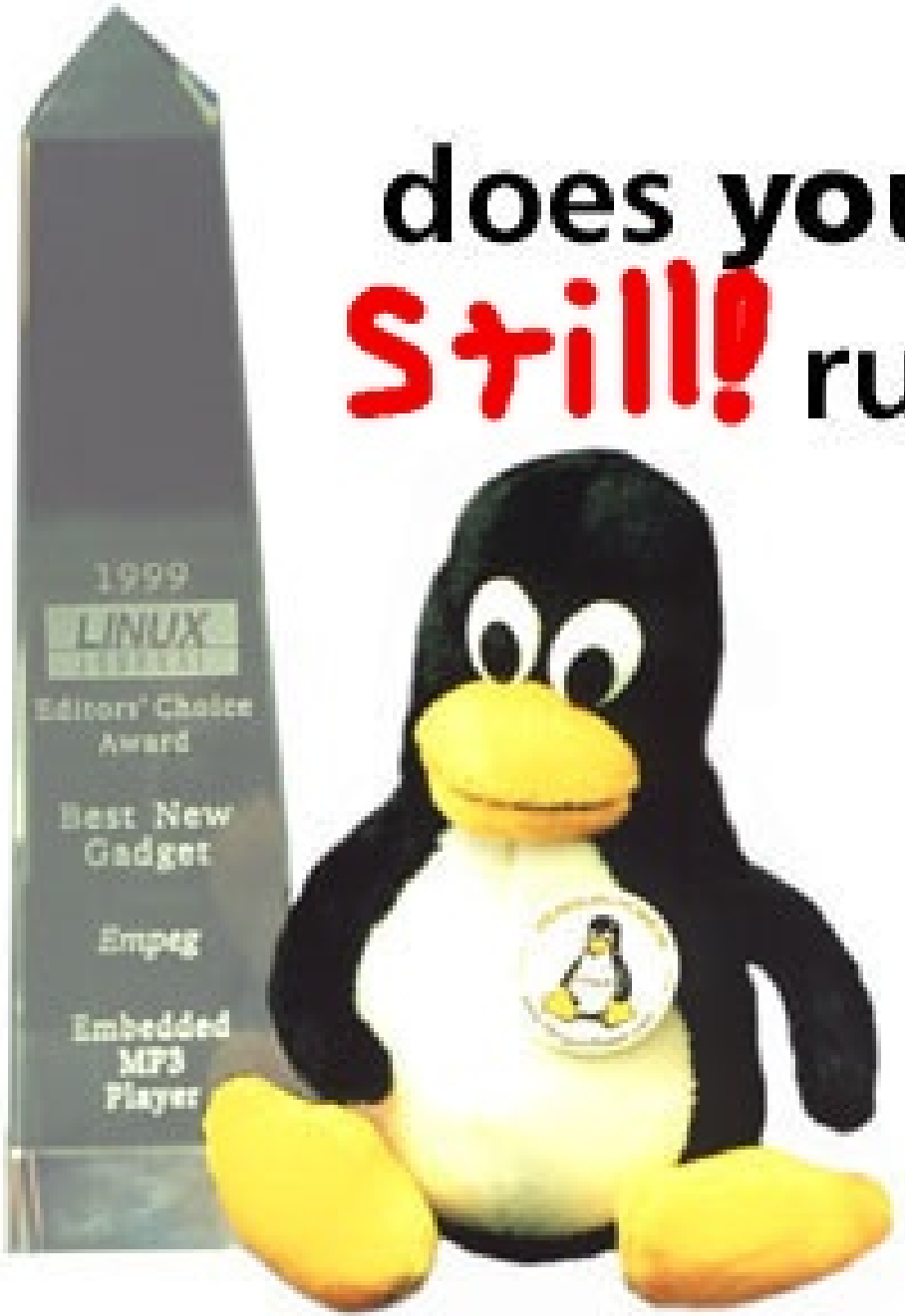


does your car stereo Still! run Linux?

(ours does)

LJ 1999 "Gadget of the Year"

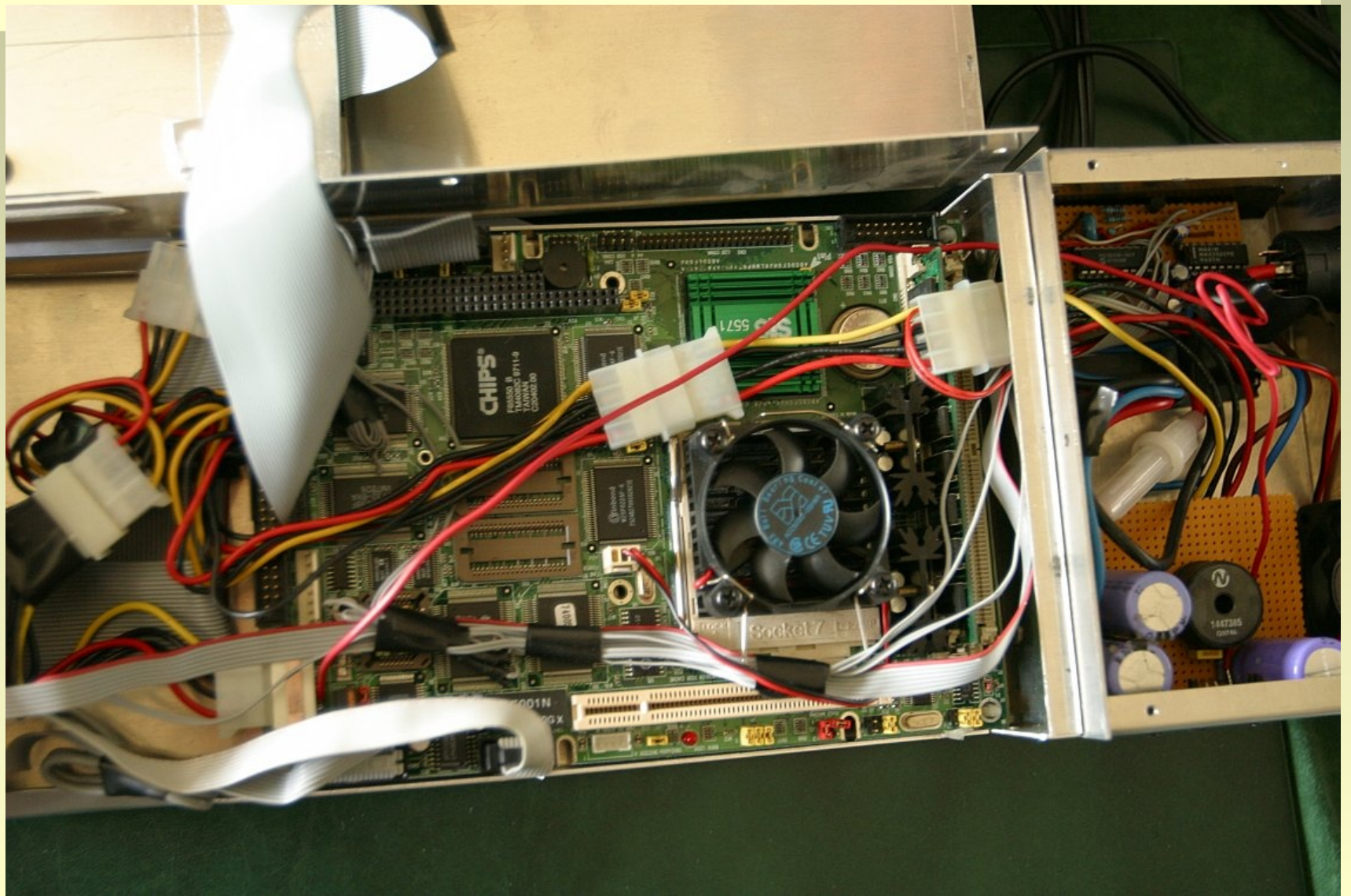
Best New Gadget: Empeg Embedded MP3 Player

Empeg Ltd. of the UK has developed an mpeg player for your car, embedded with Linux. Why Linux? Because they “like it a lot, and worship Linus on a daily basis at our own personal shrine,” says their tech page. Empeg uses a StrongARM processor and a big hard drive and has a toolkit for Linux and an interface so that Windows users can load their favorite mpegs (depending on the model, up to 500 albums) into the player. Linux hackers, we're sure, can figure out what else to do with it. The system features 18-bit DACs, 5-band EQ for each of the 4 channels, an FM radio, bass, treble, loudness, balance and fader controls, and gold-plated connectors, among other things. Although the Windows interface is more full featured than for Linux, the developers use the Linux interface. Empeg proves the viability of Linux in small, embedded gadgetry.

Hugo Fiennes: *It's his fault!*

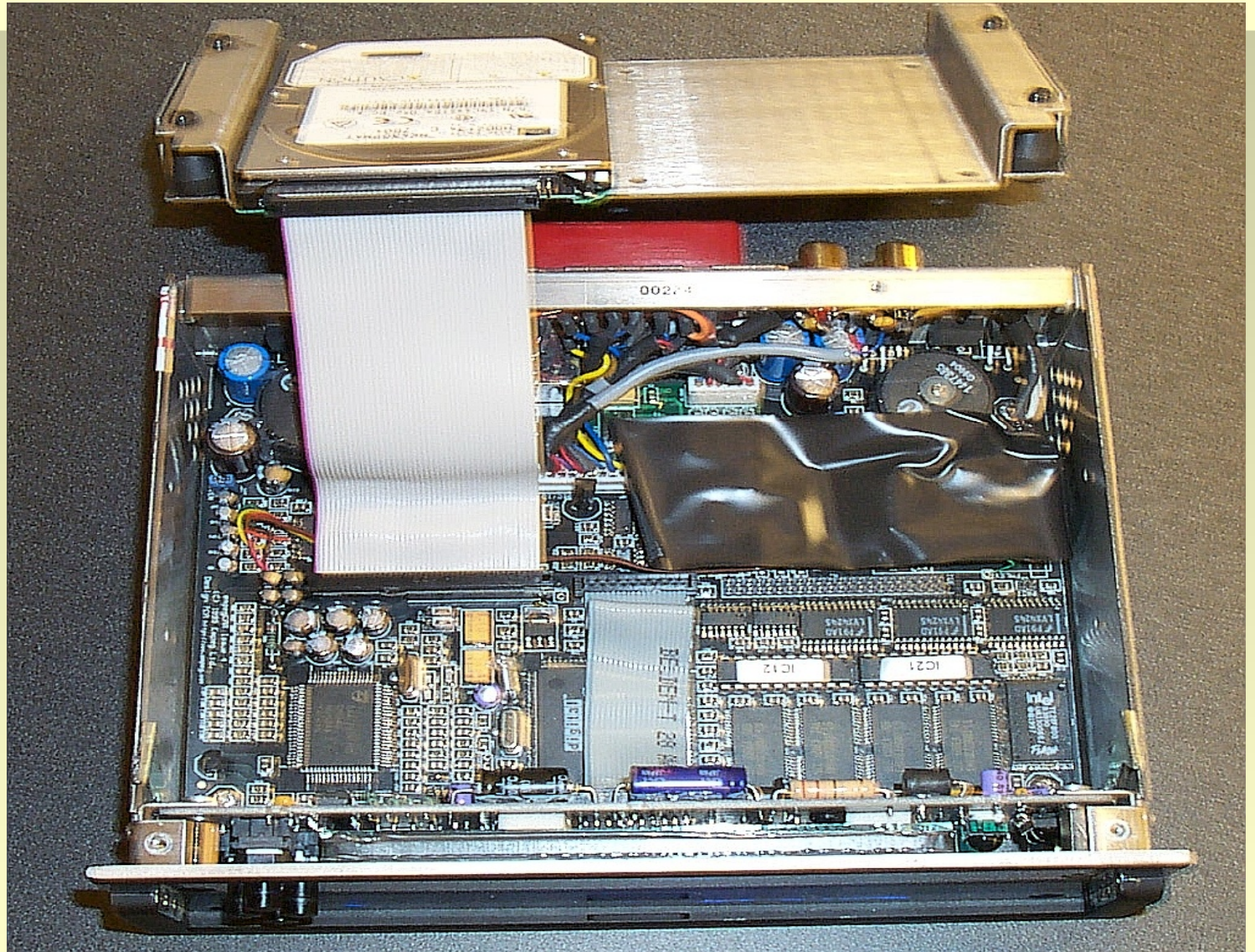
"mp3mobile"

Under the hood



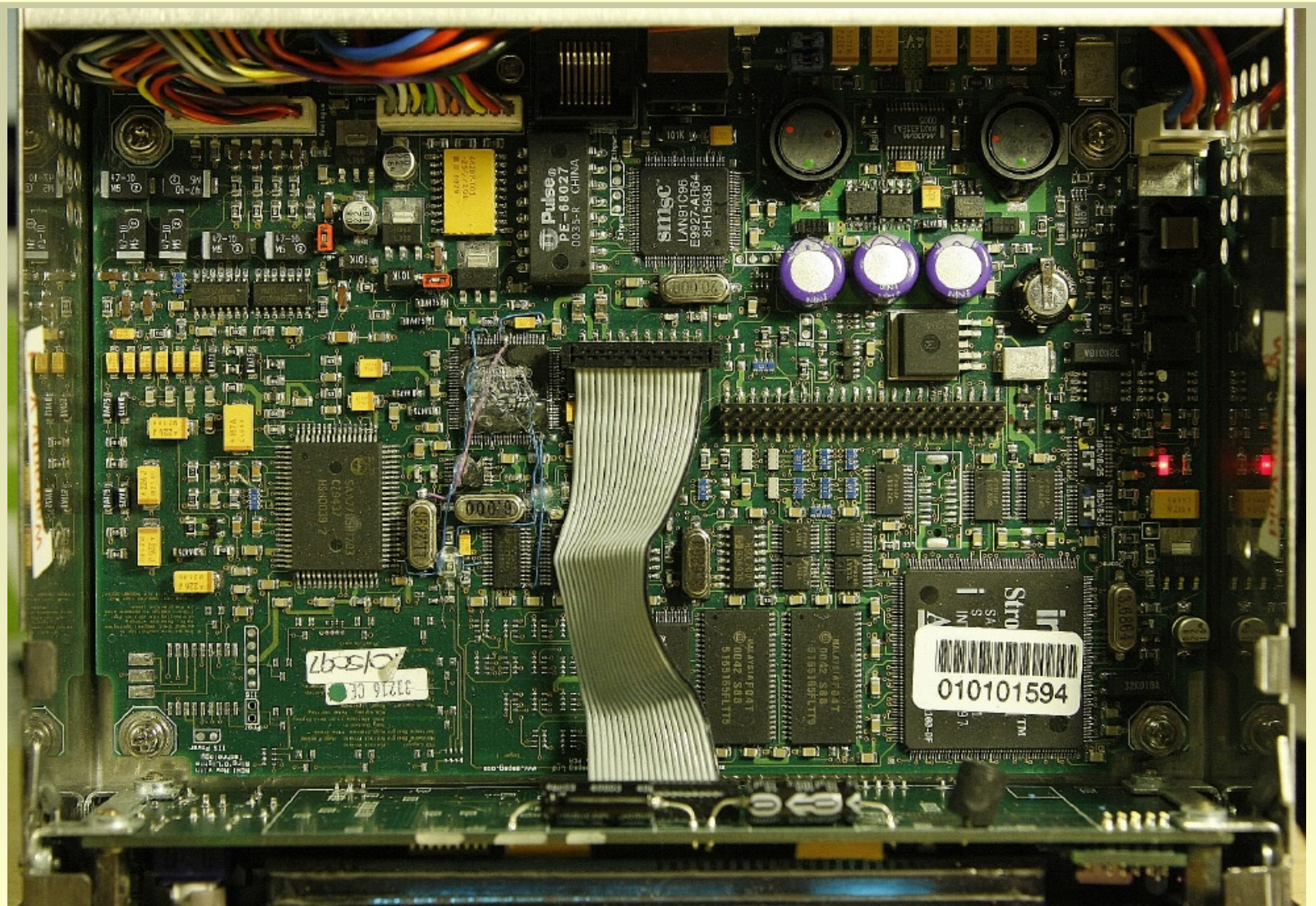
Mk1 empegCar

Under the hood



Mk2 empegCar

Under the hood



Bought and Sold

Empeg Ltd was the first company to bring to market an in-dash MP3 player, the empeg car, first shipped to customers in 1999. On November 1st 2000 Empeg was acquired by SONICblue Incorporated, who continued to market an updated version of the car player - Rio Car - until it was discontinued in January 2002.

In the mean time the empeg development team has grown in size and in August 2002 took responsibility for all audio software development at SONICblue. Products developed by the team include Rio Receiver, Rio Central, Rio S Series, Rio Karma and Rio Carbon.

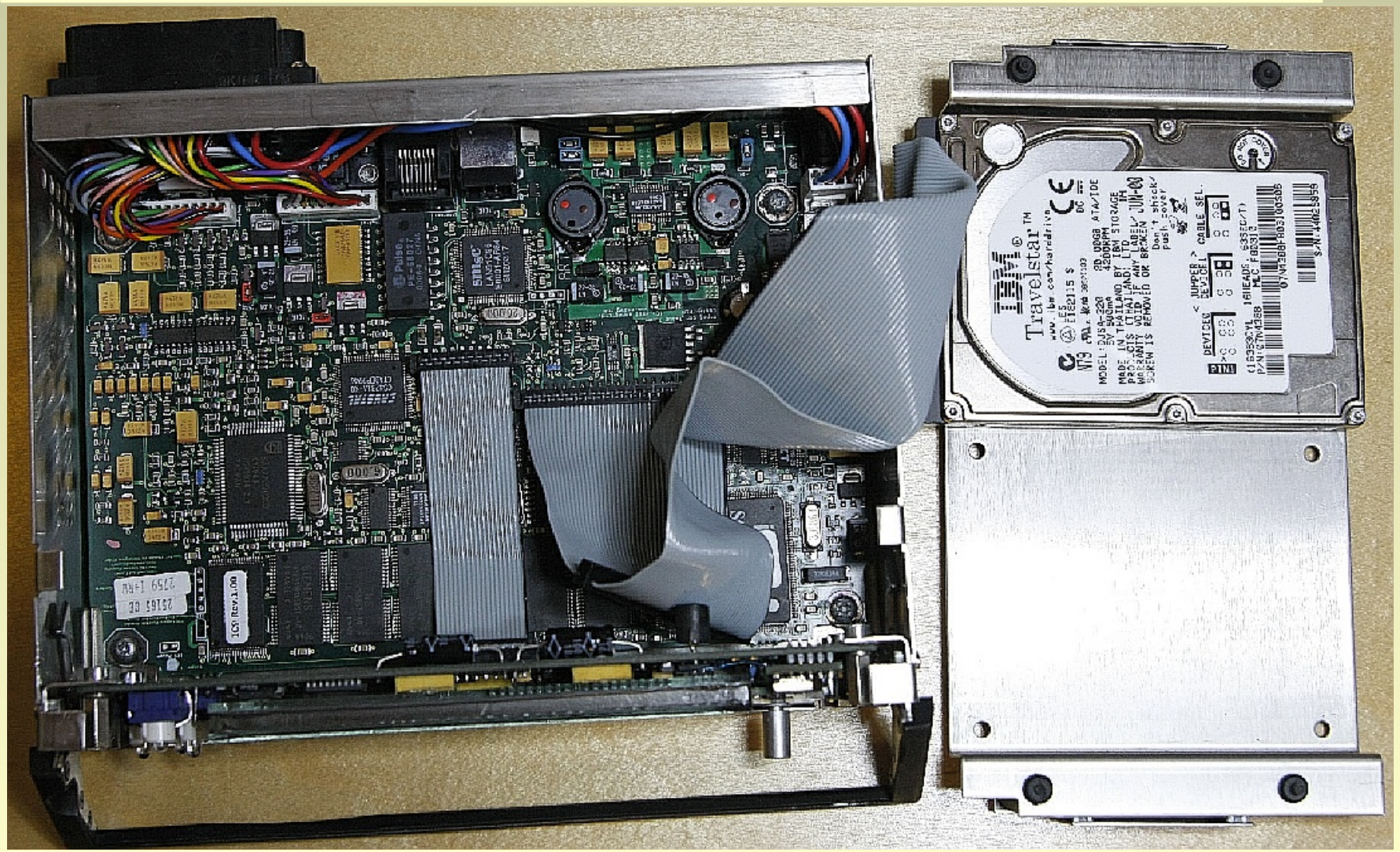
Following the sale by SONICblue of its Rio and ReplayTV divisions to D&M Holdings in April 2003, the Cambridge software team transitioned to Digital Networks North America, a wholly owned subsidiary of D&M Holdings.

In July 2005 the remaining engineering team and associated “intellectual property” was acquired by Sigmatel. Today the original development team are spread across many companies but remain in contact with each other and the active empeg owner community.

Development team

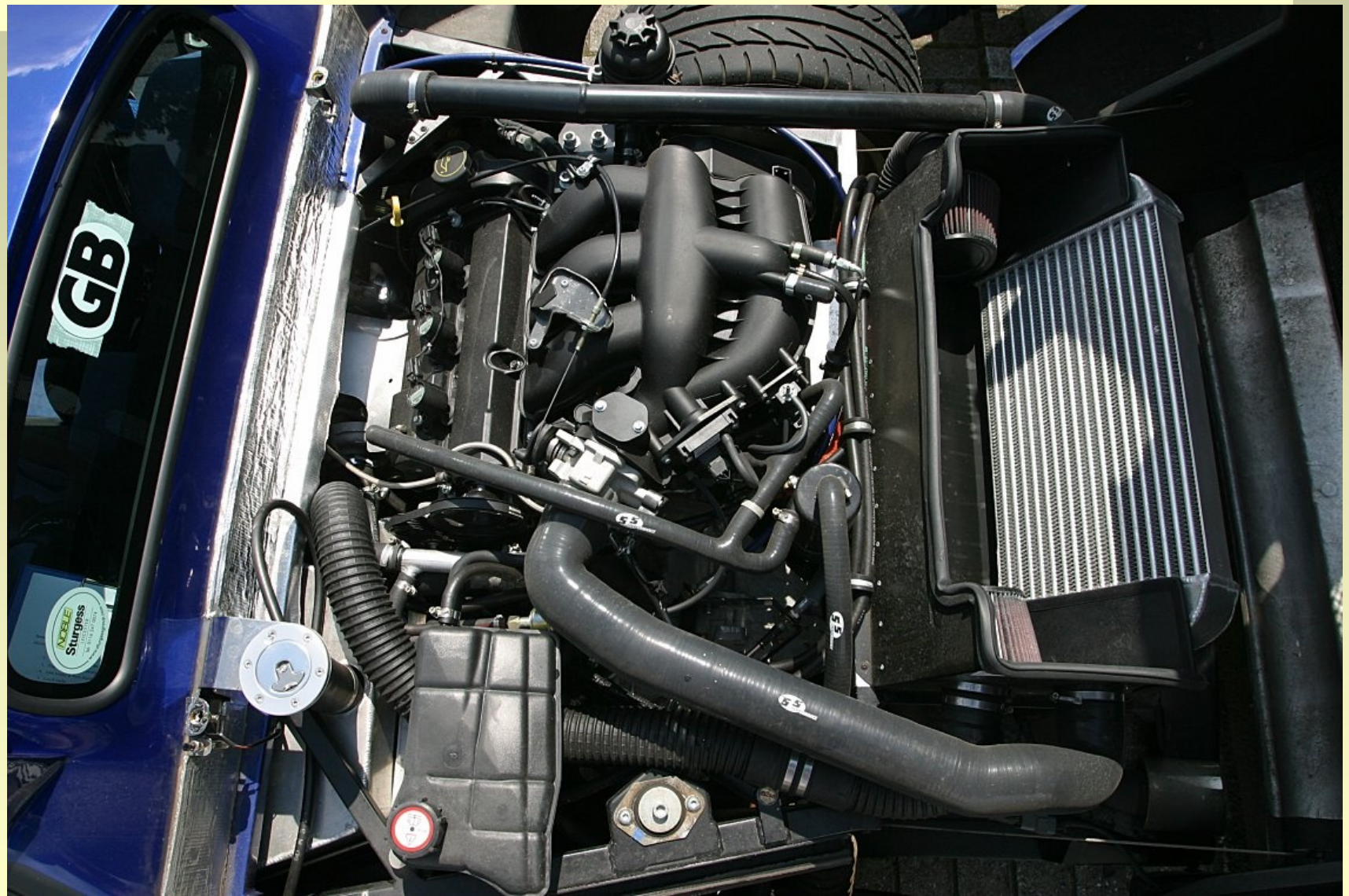
Mk2a RioCar

Under the hood



Noble effort

Under the hood



Software/Firmware

- Based off Debian 2.2 Potato (arm)

- Combination of open and closed source:
    - closed loader, init, player
    - open everything else
    - full/proper GPL compliance!

Closed: init

- init handles fsck, s/w updates
- launches player, and babysits it

Closed: player

- the heart of the "IP"
- plays mp3, wma, wav, flac, ogg
- manages UI: screen, buttons, remote
- elaborate "visuals"
- wma library licensed from MS
- very much a black box
- not hackable.. ?

Open: userland + kernel

- Two versions:
  - consumer load: no userland
  - developer load: bash, etc..
- Linux 2.2 Kernel, with patches
  - 2.2.14-rmk5-np17-empeg55

Something done Right(tm)!

- closed player goes through kernel device drivers for just about everything it does..

Early hacks

- empeg enhancements via kernel spac
- isolated *one of* efforts from community
  - displayserver
  - IR translator
  - voladj
- no access to UI, so no integration. :(

How I got targeted by the TSA

- 2001: tech crash == bored kernel hacker
- If all UI goes through kernel, then we can intercept.. no wait.. *hijack* the UI!
- began with simple button chords to control the voladj hack
- then added a Pong game

Hijack kernels

- added font rendering for in-kernel menus
- added menus
- added kitchen sink..
- currently at v496 (linear version numbering)

kftpd & khttpd

- Christmas at the in-laws == bored kernel hacker (again)
- Why in-kernel?
  - serial downloads to flash
  - no other easy-enough method for getting new code into the player.
- In-kernel servers == solution!

Hardware hacks, too!

- Illuminated buttons
- Internal fan w/thermostat
- Interface with GPS, car computer, ..
- Docking stations
- Digital audio outs (coax, optical, ..)
- Doorbell

Doorbell?

empeg
Fire door keep shut
3C
PLEASE RING
PLEASE RING THE BELL FOR 3C TECHNOLOGY ONLY
THANK YOU
empeg

empegBBS.com

- centre of the empeg universe
- very active discussion forums
- lots of creative, intelligent people, including the empeg developers

Yearly "Meets"

developers, owners, fans
every summer in Cambridge and/or Amersfoort

tips, tricks, tutorials, new gadgets, panel discussions

lots and lots of (British!) beer

Yearly "Meets"

Yearly "Meets"

Yearly "Meets"

Yearly "Meets"

..and Hugo?

Demos

- Player software
- emplode
- emptool
- jEmplode
- config.ini

Demos and hacking

- Hijack menu
- kftpd
- khttpd
- ktelnetd ?

The end (until 2018)