Hacking the TiVo for Australia

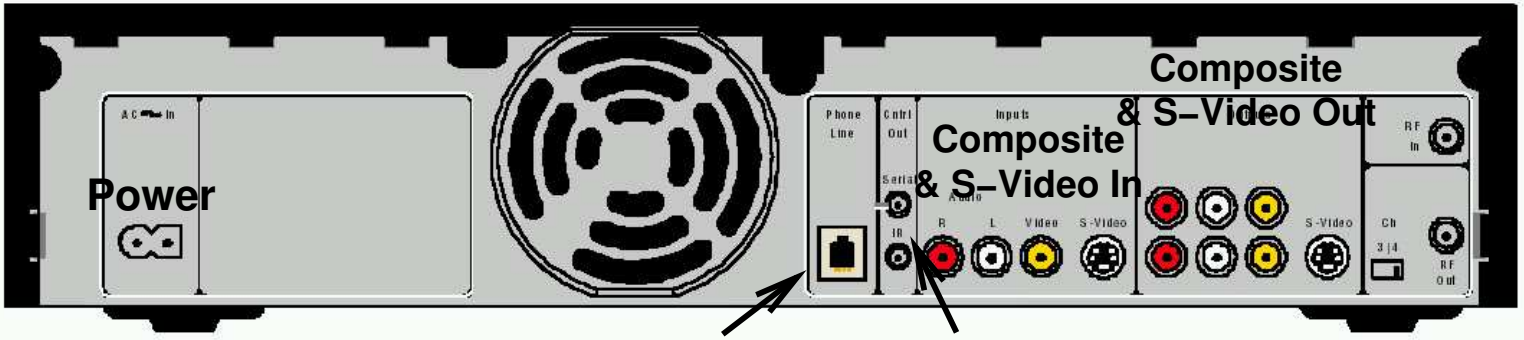
Dr. Warren Toomey,
Faculty of IT, Bond University
wtoomey@staff.bond.edu.au

This presentation will look at how the TiVo, a disk-based consumer video recorder, was reverse-engineered and modified to suit Australian conditions.

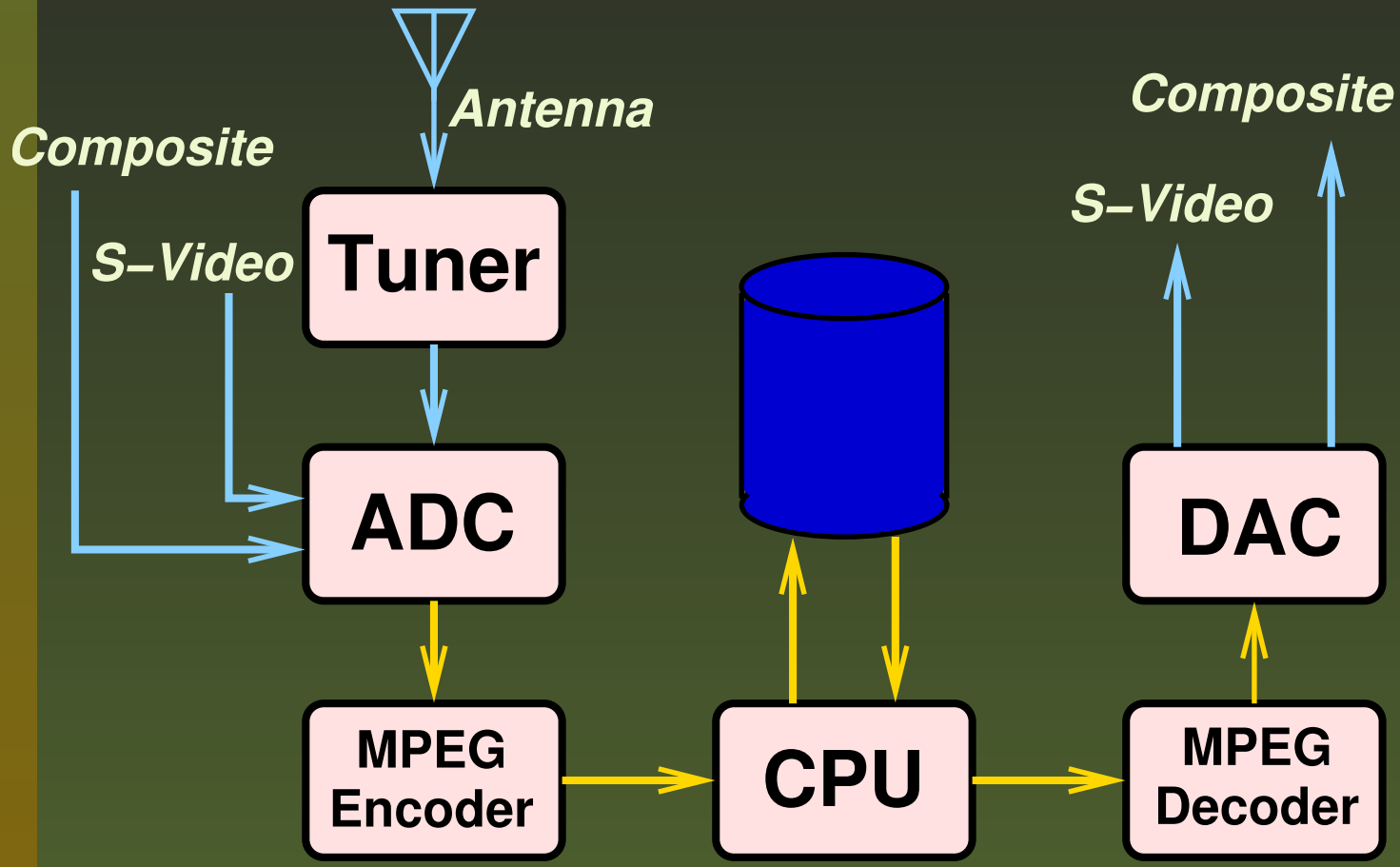
What is a TiVo?

- A disk-based digital video recorder.
  - PowerPC CPU, MPEG encoder & decoder.
  - Linux kernel, proprietary apps & database.
- Parallel input & output sections: record & playback at the same time.
- Record/browse by program name. You can set "Season Passes" on series.
- TiVo learns your viewing habits: records extra programs with similar 'genre'.
- Several models in the US, plus a UK model.
- Storage capacity depends on internal disk, e.g two 120G drives = ~200 hours.

What is a TiVo?



TiVo's Internal Design



Why Did It Need Hacking?

- The US model only supported the NTSC standard.
  - Hardware can cope with composite PAL, but there is no PAL tuner.
  - Software did not know that PAL existed.
- The UK model came out ~3 years after the US model. Supports PAL but not stereo in Oz.
- All TiVos "phone home" to get guide data: without guide data, they act as crippled VCRs.
- Biggest hard disk supplied by TiVo is 30G; need to upgrade the capacity of the system.
- Most important reason: *because we can!* It is, after all, a Linux box.

The Pioneering Hacks

- Several ACT people worked on the conversion of US TiVos to the PAL standard.
  - Bob Edwards found a compatible PAL tuner to replace the NTSC tuner.
  - Andrew Tridgell & Paul Mackerras worked on "palmod", a Linux kernel module to drive the PAL tuner.
- tridge & Paulus also did work on reverse engineering the MPEG encoder & decoder chip programming.
- Palmod inserts itself into execution path of original kernel code, to convert NTSC channel changes to the PAL tuner; ditto for MPEG chip programming.

Extending Palmod

- Original palmod had hard-coded ACT channel frequencies. Not suitable for other states or countries.
- Hackers in other countries also needed palmod: NZ, UK, Europe, parts of Africa.
- Ron Davis, Andrew Palm, myself and Keith Wilkinson extended tridge's original code to do this.
- We now have several load-time parameters:
  - type of tuner, which country, hue, saturation, brightness, screenwidth in pixels etc.
- Also a hardware hack to have separate audio inputs for S-Video and Composite input.

Getting Guide Data for Australia

- In US UK, TiVo users pay a subscription to download weekly TV guide data. Not so in Australia.
- Guide format is proprietary, depends on internal TiVo database schema.
- tridge & others did the early work on decoding the database schema.
- tridge & Chris Yeo wrote the first tool to download Australian TV data from web sites and convert it into TiVo ‘slice’ format.
- tridge didn’t want to distribute the code to others: it would allow US users to avoid paying for a subscription.

Getting Guide Data for Australia

- While waiting for tridge to release his guide code, I wrote my own. Wktivoguide is now into 3rd version.
- Scrapes data from several websites. Removes HTML. Heuristically converts raw data into something useful.
- Problems: titles, episode titles, actors, warnings, program duration.
- Genres are a problem: used by TiVo to categorise programs. We keep an on-line database now.
- 60+ ‘slices’ produced each week: most combinations of state, provider, FTA, cable, satellite, digital. Slices go to the Emulator for when TiVos “phone home”.

TiVo Phone Home!

- Early TiVo hacks required a high clue level: ability to code in C, Tcl, shell script.
- Owners used PPP over serial to Bash console to manually configure their TiVo.
- Had to convince TiVo it was regularly “phoning home”, set up channels etc.
- Canada hackers reverse-engineered the “phone home” protocol, wrote a ‘Mothership emulator’.
- This allows TiVo owners to setup TiVo from their TV screen; is also used to download TV guide data each week.
- Still moderate clue: getting the initial setup of TiVo to be PAL-aware.

The New 3.0 OzTiVo Software Image

- Michael Edwards has spent several months hacking the 3.0 TiVo software to be PAL-ready.
- Simply restore an image to disk, put disk in TiVo, connect to network. TiVo phones home & performs normal setup.
- The 3.0 image supports several network types:
  - built-in modem dialup to ISP
  - external modem
  - PPP over serial port to NAT gateway
  - Ethernet to NAT gateway
  - Airnet to NAT gateway
- Everything but the built-in modem was hacked in.

OzTiVo - An On-line Community

- Early on it was a case of who you knew. The ACT had a bunch of keen & proximate hackers.
- It became important to build a communication infrastructure. I set up the *oztivo* mailing list. But e-mail isn't good for a knowledge database.
- Andrew Palm set up the OzTiVo Twiki: a user-editable web site.
- Users now contribute FAQs, Hints and Howtos. We still have the mailing list.
- Finally, non-hackers can now buy a TiVo and set it up. Once set up, a TiVo should be "grandparent friendly".

Conclusion

- Without good, keen hackers, TiVos would be useless in Australia.
- tridge is *THE* reverse-engineer hacker!
- So many people contributed on so many fronts to make the TiVo work outside of the US and UK:
  - palmod, Emulator, simple configuration, networking, TV guide data.
- We also needed a communication infrastructure, and a knowledge base for new users.
- Once you get a TiVo, you will wonder how you survived without it.