

Adventures with a Single Board Computer

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1 Initial Thoughts

- 24x7 always on operation
- Quiet
- As low power consumption as possible
- Control Dial-up Access & act as Masquerade gateway for home network
- run a forwarding nameserver for home lan
- run DHCP for home lan
- run mail gateway and hold mailboxes
- run radio recorder stuff - sort of radio VCR

This document can be found at <http://www.comp.leeds.ac.uk/jj/linux/sbc.html>

2 The SBC chosen

- <http://www.lannerinc.com/iac-h553.htm>
- Spec at http://www.lannerinc.com/download/sbcs/Spec_h553.pdf
- Users manual at <http://www.lannerinc.com/download/users/M1h55300.pdf>
- UK suppliers <http://www.impulse-corp.co.uk>

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Web: <http://www.impulse-corp.co.uk>

3 IAC-H553 Features

- No CPU Fan needed
- CPU NatSemi Geode 200/233/266/300 MHz (default 233 on-board) <http://www.national.com/appinfo/solutions/> or <http://www.national.com/appinfo/solutions/> and follow Geode link.
- Chipset NS CS5530, Winbond 83977F: CS5530 - see above; Winbond 83977F - see <http://www.winbond.com>.
- BIOS 256KB Award License
- Cache Memory - 16KB L1
- System Memory - One DIMM socket, support up to 128MB of SDRAM
- VGA/LCD Interface NS GX5530, shared memory 2.5MB, support CRT display and 18-bit TFT LCD, resolution up to 1024x768 @64K colors, with VGA and 50-pin LCD connectors
- Ethernet Interface on board Realtek RTL8139C, support 10/100 Base-T interface, on-board RJ-45 connector, wake-on-LAN supported via ATX power supply

- Flash Memory Disk Reserved socket for DiskOnChip from M-System, support Interface - up to 144MB flash memory disk
- One PCI IDE port, support up to two IDE devices, supports PIO mode 4 and Bus Master, also supports Multi-word DMA and Ultra DMA/33
- One FDD ports, support up to two floppy devices
- Two COM ports, one RS-232 and one RS-232/422/485
- One Multi-mode parallel port (SPP/EEP/ECP)
- 2 USB ports
- one IrDA header
- One 6-pin mini-DIM PS/2 keyboard/moused connector on-board and one internal keyboard connector
- Internal RTC with Li battery
- ISA bus and PC/104 connector

- One 4-pin power connector with one ATX feature connector: for wake-on-lan,x2.54mm, GND, 5V standby, GND, PSON
- I/O peripheral devices support power saving and doze/standby/suspend modes. APM 1.2 compliant
- Power Consumption 233M CPU, 64MB RAM

+5V - 2.20A
-5V - 0.01A
+12V - 0.01A
-12V - 0.01A

- Given that the SBC is powered from a standard +5v,0v,0v,+12v power connector, I'm not sure how they measured the current consumption at -5v and -12v :-). I believe the board has no need of -5v and uses an on board -12v DC-DC inverter for the RS232 port.
- Watchdog Timer - Software 16-level time-out intervals: 0/2/4/6/8/10/12/14/16/18/20/22/24/26/28/30 sec
- Digital I/O - 4 bit digital input / 4 bit digital output at IO addr 440 Hex
- Temperature

Operating 0C - 60C
Storage -20C - 70C
233MHz CPU tends to run warm to hot.

- Net Weight - 250g (0.55 pounds)
 - Dimensions - 185 x 122mm (7 1/2 x 4 5/6 inches)
-

4 Final Configuration

- IAC-H553 - 233MHz CPU
- 32M Memory
- IBM Laptop Hard Disk
- ISA passive bus
- SoundBlaster SB16 soundcard
- external Modem
- external Network Hub
- fan-less silent PSU, rescued from an old 8086 PC

The setup that has run 24/7 for well over 2 years is shown in this photo... <http://www.comp.leeds.ac.uk/jj/linux>

5 Power Saving

- Run the Hard Disk in spindown mode when inactive
 - Try and use the APM features to run the processor at lower speeds when inactive
 - Modify low voltage power feed to network Hub so it can be powered from +5v, from same supply as SBC
 - Build a mains switch to turn on modem when DTR line on RS232 port goes live. Modem will only be powered up when being used.
 - Power used by SBC, SB16, HardDisk and HUB is aprox 20 watts, saving aprox 2 watts when disk spins down. There is a further aprox 2 watts difference in CPU power consumption between it working flat out and being “idle”. It is worth not using the “no-hlt” kernel option.
-

6 Hard Disk Spindown control

6.1 Configuring Spindown

- `/sbin/hdparm -S 180 /dev/hda`

sets disk to spindown on `/dev/hda` after $180 * 5$ secs = **15 mins** of inactivity. The -S value is multiples of 5 secs for 1-240, and multiples of 30mins for 241-251, see man page for other values.

The IBM disk I use responds within 2-3 secs to disk accesses when spundown.

6.2 Minimising Spinup time

Many services continually write to or access the hard disk and prevent spindown from kicking in, or mean it spins up too frequently. Run just the services you need is always a good plan. Here are some services that I tamed.....

- **syslogd** - add “-m 0” to startup parameters, in `/etc/init.d/syslogd` on debian, to prevent time stamps in syslog file.
- **crontab** - change entries to all run at aprox the same daily time. Change the daily, weekly and monthly run time to aprox. coincide. Here’s my `/etc/crontab`

```
SHELL=/bin/sh
```

```
PATH=/usr/local/sbin:/usr/local/bin:/sbin:/bin:/usr/sbin:/usr/bin
```

```
# m h dom mon dow user  command
25 21  * * *   root    run-parts --report /etc/cron.daily
30 21  * * 7     root    run-parts --report /etc/cron.weekly
35 21  1 * *     root    run-parts --report /etc/cron.monthly
```

- **atd** - Don’t run “at” jobs, for some reason they keep the disk active. Having the **atd** service running but no active “at” jobs seems fine.
- **sendmail** - Don’t run it in daemon mode. Put an entry in `/etc/inetd.conf` so it only runs when needed.....

```
#:MAIL: Mail, news and uucp services.
```

```
smtp      stream  tcp     nowait  root    /usr/sbin/tcpd  /usr/sbin/sendmail -bs
```

- **named** - Alter configuration to limit logging of stats etc, here’s relevant bits from my `named.conf`

```
cleaning-interval 0;
heartbeat-interval 0;
statistics-interval 0;
```

```
dialup yes; notify no; forward only;
```

```
forwarders {
    129.11.144.1;
};
listen-on port 53 {
    127.0.0.1;
    192.168.10.80;
};
```

```
// reduce log verbosity on issues outside our control
logging {
    category lame-servers { null; };
```

```
category statistics { null; };  
category cname { null; };  
};
```

7 Monitoring state of Harddisk

Use `/sbin/hdparm hdparm -C /dev/hda | grep state` to show active/spindown state.

But by executing `/sbin/hdparm` you've just spun the disk up :-)

You need a RAM disk populated with enough so that a **chroot** to the mount point of the ramdisk can execute enough to monitor the state of the disk.

See details and example scripts etc at <http://www.comp.leeds.ac.uk/jj/linux/disklog.html>

8 Controlling the Modem

A bit of electronics needed to make a mains switch controlled by the DTR line of the modem comms port. When the comms port is made active, the DTR line goes from -12v to +12v, triggering the mains switch to power up the modem. The circuit takes a little while to change state.

Circuit diagram of switch is at <http://www.comp.leeds.ac.uk/jj/linux/mainswitch.png>

Because the modem doesn't come on immediately, some form of "initialise" is needed to make sure the modem is powered up and ready by the time pppd and the chat script is running.

When the ppp link is taken down, the DTR line returns to -12v switching off the modem after a delay.

9 Radio Recording.....

Another time.

As of stock Linux kernel 2.2.18, this SBC and the SB16 sound card give periodic glitches, making recording a bit noisy. I've not bottomed the problem or tried the low latency patches.

HomePage <http://www.comp.leeds.ac.uk/jj>