RO2: Building an office PC

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1 Assignment

Our working group's task was building an office PC. Aside from two major requirements, linux compatibility and staying within the budget, it was our responsibility to figure out which components and which vendors to choose.

2 Budget

Since we had to share EUR 3000 with two other groups[1] we had to bargain. After scanning through advertisments of off-the-shelf office PCs from Saturn, Cosmos and others we knew that it should be possible to build a PC for about EUR 550 including a flat screen. This was our lower limit.

Fortunately we got EUR 700. This enabled us to satisfy a wish of Prof. Haase: a CPU with hardware support for virtualization[2].

3 Choosing the components

When choosing the components we considered

- the fit for our purpose,
- linux compatibility,
- cost-performance ratio,
- availability and
- energy efficiency

It was hard to find the right configuration out of billions of possible (and impossible) combinations since there are many dependencies between the single components. We had to go through all the undermentioned components several times to ensure that they meet our requirements *and* work together well.

[1] "Big Memory PC" and "Low Noise PC"

[2] Of course this is unnecessary for an office PC. But in reality our PC will stay in the lab, being used by other students (experimenting with virtualization).

3.1 Graphics Processor

Most manufacturers of graphics processors don't provide open source drivers for their products. Nvidia and AMD/ATI don't even publish documentation that would allow third parties to do this work for them. Currently only Intel provides open source drivers for their graphics processors included in their chipsets. Those drivers are available for all currently sold chipsets and are stable[3]. Unfortunately there were no affordable mainboards available which also have a DVI-port. But this downside is outweighted by the ability to use every recent linux distribution out of the box.

3.2 Chipset

The decision to use an Intel graphics processor narrowed down the list of chipsets to three: 945G, G965 and G31/G33. Because we chose a CPU (see 3.4) with 333 MHz FSB, "G33" was the only candidate left. There are mainboards with G31 chipset that support 333 MHz, but this support is "inofficial". Intel only allows up to 266 MHz for this chipset[4].

3.3 Mainboard

There were about 20 mainboards with G33 chipset listed at http://www.geizhals.at/. About 10 of them were actually in stock. The cheapest board produced by a manufacturer trusted by the author[5] of these lines was only EUR 7 more expensive than the cheapest of all. So this was an easy choice.

3.4 CPU

The cheapest Intel CPUs that offer hardware support for virtualization are the Intel Core 2 Duo E6x00 and E6x50 series. Those series have the same cores and caches and only differ in the speed of the front side bus, E6x50 being the faster ones. All of those processors are more than fast enough for an office PC so the only remaining criteria was the price. Interestingly the E6x50 processors were marginally cheaper than their E6x00 counterparts with the same clock speed. So we chose the cheapest version of the E6x50 series, the E6550, even though we had to choose a more expensive mainboard because of this. The 25% faster front side bus should speed up memory access considerably.

3.5 Hard disc

We chose the SATA hard disc with the best per-gigabyte price. This was a 500 GB disc, which seems too much for an office PC, but when experimenting with virtualization it's nice to have a lot of space. Larger discs are also faster because of the higher data density.

[3] At the moment those drivers lack 3D- and video-acceleration. But we don't need this functionality.

[4] http://www.intel.com/products/chipsets/G31/index.htm

[5] Currently only Asus, Gigabyte and MSI.

3.6 Memory

Choosing memory was hard, because availabilty and prices usually change from one day to another. It was clear that 1 GB would be enough for an office PC but it wouldn't allow to run more than one virtual machine at any time. 4 GB would have been too expensive, so we chose to buy 2 GB. We had to choose a 2 x 1 GB-kit to allow dual-channel operation. We ordered 667 MHz, CL 4 DIMMs, which are cheaper but just as fast as 800 MHz, CL 5 DIMMs.

3.7 Remaining components

After choosing the above-named components it turned out that E-Tec was the cheapest dealer for them. Hence we chose the remaining (less important and easily interchangeable) parts out of the sortiment of this dealer.

Power supply: the cheapest one with more than 400 W and a fan with a diameter of at least 12 cm.

Case: the most attractive one of the cheapest 5.

DVD burner: the cheapest one with a black front (to fit our case).

Keyboard: the cheapest one from Cherry.

Mouse: the cheapest OEM, USB mouse from Logitech.

3.8 Monitor

TFTs differ in quality a lot, but it's hard to make an informed choice without actually testing them. There were hundreds of monitors in the price lists, but not even 10% of them were on stock. Since we were unable to determine the quality of any product anyway we chose a screen that looked good and fit our remaining budget.

4 Ordering

On October, 30th we sent an email with a spreadsheet (Figure 1 on page 3) listing all components, their price, lead time, and links to actual pricing to our tutor for approval.

price	dealer	lead time	component	article	link
23.98	E-Tec, Graz	2 days	case	ASUS TA-883	http://geizhals.at/a229389.html
100.05	E-Tec, Graz	1 week	mainboard	ASUS P5K-VM	http://geizhals.at/a259991.html
86.30	E-Tec, Graz	2 days	HDD	Samsung SpinPoint T166 500GB 16MB SATA II	http://geizhals.at/a224182.html
147.98	E-Tec, Graz	2 days	CPU	Intel Core 2 Duo E6550	http://geizhals.at/a261878.html
47.83	E-Tec, Graz	1 week	memory	Corsair XMS2 DIMM Kit 2048MB PC2-5300U CL4	http://geizhals.at/a178581.html
25.87	E-Tec, Graz	2 days	DVD-writer	ASUS DRW-1814BLT SATA schwarz	http://geizhals.at/a244804.html
5.86	E-Tec, Graz	2 days	Mouse	Logitech OEM Optical Wheel Mouse White, USB	http://geizhals.at/a120897.html
16.00	E-Tec, Graz	on stock	Keyboard	Cherry G83-6105, PS/2, DE	http://geizhals.at/a566.html
47.08	E-Tec, Graz	on stock	power supply	LC-Power Silent Giant LC6420G Black 420W ATX 2.0	http://geizhals.at/a156817.html
205.66	amazon.at	2 weeks	TFT-Display	Belinea 2025 S1, 20.1", 1400x1050, VGA, Audio	http://geizhals.at/a208282.html
706.61	Total				

Figure 1: Ordered Parts

As the list was approved by Mag. Liebman on November, 13th our work was done until delivery of the parts.

Article	excl. VAT	incl. VAT
Mainboard ASUS P5K-VM	79,93	95,92
Samsung SATA2, 500 GB, 16 MB, 7200 rpm	71,92	86,30
Intel Core 2 Duo E6550, 2 x 2,33 GHz, 4 MB	120,77	144,92
Corsair 2048 MB, DDR 2, PC2-667	37,42	44,90
Asus DRW-1814BLT, intern, retail	21,58	25,90
LC-Power, 420 W, 14 cm	37,38	44,86
Samsung SyncMaster 205BW, 20.1"	184,92	221,90
Asus TA-883 black/white	19,98	23,98
Logitech S96 Optical Wheel PS/2	6,58	7,90
Cherry G83-6105, PS/2	14,08	16,90
Total	594,56	713,48

Table 1: Delivered parts and prices according to the delivery note.

5 Delivery

Our parts arrived on January, 17th. It took some time to separate the belongings of the different groups and to check the delivery note. We noticed that we got a different mouse than ordered. Instead of the wanted USB connector it had a PS/2 connector which is unusable with our mainboard since it has only one PS/2 connector which is already used by the keyboard. Also Mag. Liebmann changed our TFT due to delivery problems. That was good, we got a better and bigger screen with DVI and D-SUB from Samsung while still staying within budget (Table 1 on page 4).

Figure 2: Delivery

After unpacking we saw that our case has been damaged in transport (Figure 3 on page 5). Since the case is worth less than EUR 30 and the deficiency was only optical we chose to keep it.

6 Assembly

We built the PC the same day in less than 2 hours. Everything went fine.

Figure 3: damaged case

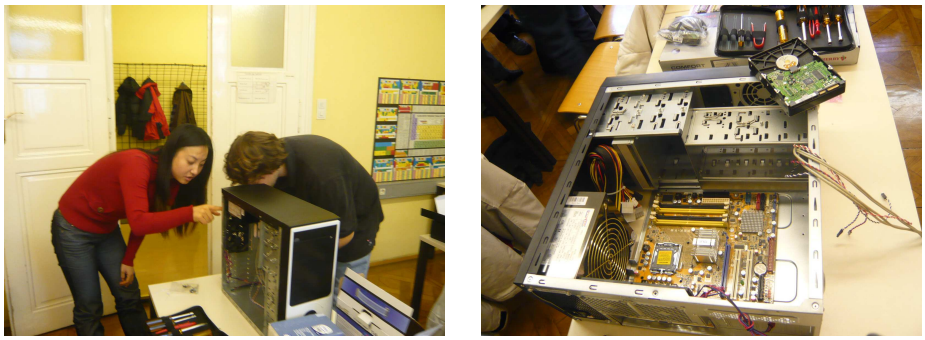

Figure 4: Assembly

7 Setup

One week later, there was some time left to install Windows XP and Ubuntu 7.10. Ubuntu worked out of the box, Windows would need some drivers that we didn't have time to install. We were able to get an internet connection in both operating systems using the network settings provided by ZID.

8 Conclusion

This course showed us the complex of problems related to systems configuration. We saw how the required linux compatibility drastically narrowed the choice of components and we noticed how many products are advertised but aren't available. It proved to be important to gather lots of information from magazines and technical websites and to exchange experiences with colleagues.