IBM XT-BIOS COMPILATION AND TESTING ON TEMPORARY SYSTEMS

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Compile the IBM XT-BIOS from source

Dedicated to my friend Peer (as he loves the IBM PC and not the Mac, he just doesn't know that he does)

Prerequisites

- Original IBM XT-BIOS Source listing `XTBIOS.ASM`
- Original Intel Toolchain for 80(1)86/80(1)88 CPUs
- Bochs or equivalent emulator for the toolchain
- Support for 360K floppies is helpful
- PCE – PC Emulator for IBM 5150 http://www.hampa.ch/pub/pce/pre/pce-20170208-df19414/pce-20170208-df19414.tgz

- MS-DOS 6 (earlier version will also work)

Steps

1. Create a hard disk for your toolchain environment

We will create a virtual harddisk with 3000 cylinders, 6 heads and
19 sectors per track, giving a total of `3000*6*19*512` Bytes.

```
$ dd if=/dev/zero of=hdd.img bs=512 count=$((3000*6*19))
```

2. Create a boot disk image file for later use with the IBM PC

MS-DOS 6 will not like it, when you create a partition with parted, because the partition has a too big offset. Just take a bootable disk and start with this floppy to natively format the hard drive with MS-DOS.

3. Now create a floppy that we will later use to boot the emulated IBM PC

```
$ dd if=/dev/zero of=bootdisk.img bs=512 count=$((40*2*9))
```

4. Boot the virtual machine with MS-DOS 6 and the `bootdisk.img`.

MS-DOS will start and you can run `fdisk`.

```
A:\>fdisk
```

Tell fdisk that you want to use the whole fixed disk and the system should restart.

Boot from floppy again and run

```
A:\>format C: /s
A:\>md C:\DOS
A:\>copy A:*.* C:\DOS
```

Assuming that the DOS binaries and files are all in the root directory of A:. If not, adapt the last command accordingly.

5. Stop the simulator and copy the Intel toolchain into the hdd image

First get the offset of the partition on `C:`

```
$ parted hdd.img
(parted) p
```

This will display the offset of the partition, which was `9728B` for my case. Then you can mount the partition in linux having this offset.

```
sudo mount -o offset=9728 hdd.img /mnt
```

Please only work with 8.3 file names now in capital letters, just because!

```
mkdir /mnt/INTEL
cp <intel-toolchain-dir>/* /mnt/INTEL
```

6. Copy the source listing of the BIOS to `C:\BIOS`

```
mkdir /mnt/BIOS
cp <bios-listing>/XTBIOS.ASM /mnt/BIOS
```

Now you can either unmount and change the BIOS listing later with `edit` in MS-DOS or in Linux with vim.

7. Patch the source code

The following changes must be made to the source:

In the part ‚DTERMINE CONFIGURATION AND MFG. MODE', line 616, there is

```
MOVE DATA_WORD[OFFSET EQUIP_FLAG],AX
```

Change it to

```
MOVE DATA_WORD[OFFSET EQUIP_FLAG],0000000000101101B
```

This means that there is one floppy drive and that we can boot from it
as well as we have CGA and start with 80×25.

At line 1237, I had a

```
AND AL, 00000001B ; ‚LOOP POST' SWITCH ON
JNZ F15B ; , CONTINUE WITH BRING-UP
```

Which is nonsense. Since ‚LOOP POST' will do a loop in the post and NOT continue bring up, the jump should be executed when the bit is 0 and not non-zero. However, only the comment is wrong,

because the switch is not ‚LOOP POST' but ‚BOOT FROM FLOPPY' or something like this. The function would be okay. However in my case, I patched this, before I touched the config switches read-in, so I had patched this to

```
OR AL, 00000001B
JNZ F15B ; , CONTINUE WITH BRING-UP
```

So that it will always continue booting here, no matter what any switches value says.

Furthermore, there is a checksum function, that also checks the non-existant BASIC ROM at `F6000` which must be faked to always return true for the moment (the BASE ROM also has a wrong / non existing checksum).

At line 5246 in the `ROS CHECKSUM SUBROUTINE` we have

```
OR AL, AL ; SUM = 0?
```

Change this to

```
XOR AL, AL
```

Then every checksum test will be successful.

8. Compile the code

Now we can compile this code. For future changes to the code it is conveniant to have a DOS batch file for not always having to type in all the commands.

```
\INTEL\ASM86 XTBIOS.ASM
\INTEL\LINK86 XTBIOS.OBJ
\INTEL\LOC86 XTBIOS.OBJ
\INTEL\OH86 XTBIOS
\INTEL\DXC XTBIOS.HEX
```

This will produce an `XTBIOS.IMG` with a siye of `1FFE` or `8190 bytes`.

9. Deploy the image for the emulator

Copy it out of the image. By the way, it is easier if you copy the file to a floppy in the emulator, i.e. to the bootdisk and then use

```
$ mcopy -i bootdisk.img ::/XTBIOS.IMG .
```

The `mcopy` tool is written to work with DOS drive letters in linux and the `::` special drive letter means, that it refers to the image file.

10. Create a test boot disk for the emulated IBM PC

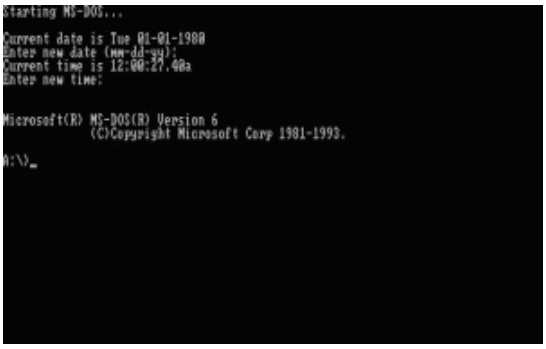
Install the MS-DOS system files and boot sector on the previously created 360K floppy image:

```
C:\>format /s /f:360 B:
```

Thats it.

11. Run the PC emulator with the `XTBIOS.IMG` and the 360K boot disk image.

```
./pce-ibmpc -c my.cfg
```



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