SMP FAQ

David Mentré, David.Mentre@irisa.fr

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Contents

1 Introduction

Linux can work on SMP (Symetric Multi-Processors) machines. SMP support has started with the 2.0 family and has been improved in the 2.1 (future 2.2) saga.

FAQ maintained by David Mentré (`David.Mentre@irisa.fr`). The latest edition of this FAQ can be found at `http://www.irisa.fr/prive/mentre/smp-faq/`.

If you want to contribute to this FAQ, I would prefer a diff against the `http://www.irisa.fr/prive/mentre/smp-faq/smp-faq.sgml`SGML version of this document, but any remarks (in plain text) will be greatly appreciated.

This FAQ is an improvement of a first draft made by **Chris Pirih**.

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2 Questions related to any architectures

2.1 Kernel side

1. **Does Linux support multi-threading? If I start two or more processes, will they be distributed among the available CPUs?** Yes.

2. **What kind of architectures are supported in SMP?** As far as I (David Mentré) know, only Intel Pentium and UltraSparc architectures are supported.

3. **How do I make a Linux SMP kernel?** Uncomment the `SMP=1` line in the main Makefile (`/usr/src/linux/Makefile`).

   AND

   enable "RTC support" (from **Robert G. Brown**). Note that inserting RTC support actually doesn't afaik prevent drift, but according to a discussion [Robert G. Brown] remember from a year ago or so it can prevent lockup when the clock is read at boot time.

4. **How do I make a Linux non-SMP kernel? Comment** the `SMP=1` line in the Makefile (and not set SMP to 0).

5. **How can I tell if it worked?**

   ```
   cat /proc/cpuinfo
   ```

   Typical output (dual PentiumII):

```
processor       : 0
cpu             : 686
model           : 3
vendor_id       : GenuineIntel
stepping        : 3
fdiv_bug        : no
hlt_bug         : no
fpu             : yes
fpu_exception   : yes
cpuid           : yes
wp              : yes
flags           : fpu vme de pse tsc msr pae mce cx8 apic 11 mtrr pge mca cmov mmx
bogomips        : 267.06

processor       : 1
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model           : 3
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```

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bogomips        : 267.06
```

---

6. **What is the status of converting the kernel toward finer grained locking and multithreading?** 2.1.x has signal handling, interrupts and some I/O stuff fine grain locked. The rest is gradually migrating. All the scehduling is SMP safe

7. **Does Linux SMP support processor affinity?** No and Yes. There is no way to force a process onto specific CPU's but the linux scheduler has a processor bias for each process, which tends to keep processes tied to a specific CPU.

8. **Do I really need SMP?** If you have to ask, you probably don't. `:)`

2.2 User side

1. **How does one display mutiple cpu performance?** Thanks to **Samuel S. Chessman**, here is some useful utilities:

   Character based:

   `http://www.cs.inf.ethz.ch/\~{}rauch/procps.html`

   Basically, it's procps v1.12.2 (top, ps, et. al.) and some patches to support SMP.

   Graphic:

   xosview-1.5.1 supports SMP. And kernels above 2.1.85 (included) have the /proc/stat/cpuX entry.

   The official homepage for xosview is: `http://lore.ece.utexas.edu/\~{}bgrayson/xosview.html`

   The various forissie kernel patches are at: `http://www-isia.cma.fr/\~{}forissie/smp\_kernel\_patch/`

2. **How can I program to use two (or more CPUs) ?** Use a kernel-thread library. A good library, the `http://pauillac.inria.fr/~xleroy/linuxthreads/`pthread library made by Xavier Leroy.

   LinuxThread is now integrated with glibc2 (aka libc6).

   From **Jakob Oestergaard**: Also consider using MPI. It's the industry standard message passing interface. It doesn't give you shared memory like threads, but it allows you to use your program in a cluster too.

3. **What has changed in the threads packages, linuxthread, etc.** Glibc is the big change. glibc is threadsafe and includes linuxthreads Posix.4 threads by default. Real time signals are in so POSIX AIO should also be in glibc2.1 (I hope)

4. **How can I enable more than 1 process for my kernel compile?** use:

```
# make [modules|zImage|bzImages] MAKE="make -jX"
where X=max number of processes.
WARNING: This won't work for "make dep".
```

With a 2.1.x like kernel, see also the file `/usr/src/linux/Documentation/smp` for specific instruction.

3 Intel architecture specific questions

3.1 Why it doesn't work on my machine?

1. **Can I use my Cyrix/AMD/non-Intel CPU in SMP? Short answer:** no.

   Long answer: Intel claims ownership to the APIC SMP scheme, and unless a company licenses it from Intel they may not use it. There are currently no companies that have done so. (This of course can change in the future) FYI - Both Cyrix and AMD support the non-proprietary OpenPIC SMP standard but currently there are no motherboards that use it.

2. **Why doesn't my old Compaq work?** Put it into MP1.1/1.4 compliant mode.

3. **Why doesnt my ALR work?** Beats us too (see Alan Cox for this answer).

4. **Why does SMP go so slowly?** If one of your CPU's is reporting a very low bogomips value your vendor probably provides a buggy BIOS. Get the patch to work around this or better yet send it back and buy a board from a competent supplier.

5. **I've heard IBM machines have problems**

   Some IBM machines have the MP1.4 bios block in the EBDA, allowed but not supported by <2.1.80. Please update to the right kernel.

   There is an old 486SLC based IBM SMP box. Linux/SMP requires hardware FPU support.

6. **Is there any advantage of Intel MP 1.4 over 1.1 specification?** Nope (according to Alan `:)`), 1.4 is just a stricker specs of 1.1.

7. **Why does the clock drift so rapidly when I run linux SMP?**

   This is known problem with IRQ handling and long kernel locks in the 2.0 series kernels. Consider upgrading to a later 2.1 kernel (not garenteed to work).

   From **Jakob Oestergaard**: Or, consider running xntpd. That should keep your clock right on time. (I think that I've heard that enabling RTC in the kernel also fixes the clock drift. It works for me! but I'm not sure whether that's general or I'm just being lucky)

8. **Why are my CPU's numbered 0 and 2 instead of 0 and 1 (or some other odd numbering)?** The CPU number is assigned by the MB manufacturer and doesn't mean anything. Ignore it.

9. **Why does one CPU show a very low bogomips value while the first one is normal?** The cache is not enabled on the second CPU. Check your BIOS configuration for problems. If all else fails report the problem to linux-smp. (I'm not clear on the proper answer to this one).

10. **My SMP system is locking up all the time. Black screen, nothing in the logs. Help!** If you're running a 2.0 kernel, consider upgrading to later 2.0.32+ kernels or apply Leonard Zubkoff's deadlock patch. If you still have deadlocks, apply Ingo Molnar's deadlock detection patch and post the results (against your System.map) to linux-smp or linux-kernel. You might also consider running a 2.1 kernel.

3.2 Possible causes of crash

You'll find in this section some **possible** reasons for a crash of an SMP machine (credits are due to **Jakob Oestergaard** for this part). As far as I (david) know, theses problems are Intel specific.

- **Cooling problems** Get a huge casing with lots of fans.

- **Bad memory** Don't buy too cheap RAM and don't use mixed RAM modules on a motherboard that is picky about it.

- **Bad combination of different stepping CPUs** Check `/proc/cpuinfo` to see that your CPUs are same stepping.

- **You are running 2.0.33 aren't you ?** If you run 2.0.31 or 2.1.xx you can't be sure that SMP is stable. 2.0.33 is the right kernel for a production system. 2.1.xx kernels perform better, but they are development releases and should NOT be considered stable!

- **If your system is unstable, then DON'T overclock it!** Overclocking works great for a lot of people, but if your system is unstable, overclocking may very well be the reason.

- **2.0.x kernel and fast ethernet** (from **Robert G. Brown**) 2.0.X kernels on high performance fast ethernet systems have significant (and known) problems with a race/deadlock condition in the networking interrupt handler.

  The solution is to get the latest 100BT development drivers from CESDIS (ones that define SMPCHECK).

- **A bug in the 440FX chipset** (from **Emil Briggs**) If you had a system using the 440FX chipset then your problem with the lockups was possibly due to a documented errata in the chipset. Here is a reference

  References: Intel 440FX PCIset 82441FX (PMC) and 82442FX (DBX) Specification Update. pg. 13

  `http://www.intel.com/design/pcisets/specupdt/297654.htm`

The problem can be fixed with a bios workaround (Or a kernel patch) and in fact David Wragg wrote a patch that's included with Richard Gooch's mttr patch. For more information and a fix look here.

`http://nemo.physics.ncsu.edu/\~{}briggs/vfix.html`

Some hardware is also known to cause problems. This includes:

- **Adaptec SCSI controllers** Don't buy them, Adaptec is unsupportive to the linux developers. This is not a SMP problem, but a general high-performance Linux problem.
- **3Com 3c905 cards** Some work, some don't. Try disabling busmastering if your system is unstable.

3.3 Motherboard specific information

Some more specific information can be found with the `http://styx.phy.vanderbilt.edu/smp/mainboards.html`survey of SMP motherboards

3.3.1 Motherboards with known problems

- Gigabyte Solution: BIOS upgrade
- EPoX KP6-LS From **Christopher Allen Wing** (16 march 1998): It appears to have the same BIOS related BogoMIPS problem as other motherboards. (one CPU only gives about 3 BogoMIPS, the other gives the full amount) All 2.0.x kernels lock up soon after booting, late 2.1.x kernels run slowly but don't seem to lock up. There is no BIOS upgrade available (yet). I wrote the manufacturer but have not received a reply.

3.3.2 Motherboards with no known problems

4 Useful pointers

4.1 Various

- **(outdated)** `http://www.uk.linux.org/SMP/title.html`Linux SMP home page
- linux-smp mailing list To **subscribe**, send `subscribe linux-smp` in the message body at `majordomo@vger.rutgers.edu`

  To **unsubscribe**, send `unsubscribe linux-smp` in the message body at `majordomo@vger.rutgers.edu`
- `http://pauillac.inria.fr/~xleroy/linuxthreads/`pthread library made by Xavier Leroy
- `http://www.linuxhq.com/lnxlists/linux-smp/`Linux SMP archives
- `http://styx.phy.vanderbilt.edu/smp/mainboards.html`Survey of SMP motherboards
- `http://www.cs.inf.ethz.ch/~rauch/procps.html`procps
- `http://lore.ece.utexas.edu/~bgrayson/xosview.html`xosview

4.2 SMP specific patches

- http://www-isia.cma.fr/~forissie/smp_kernel_patch/Forissie kernel patches
- http://nemo.physics.ncsu.edu/~briggs/vfix.htmlPatch for a bug in the 440FX chipset

5 Glossary

- **SMP** Symetric Multi-Processors
- **APIC** Advanced Programmable Interrupt Controler
- **thread** A thread is a processor activity in a process. The same process can have multiple threads. Those threads share the process address space and can therefore share data.
- **pthread** Posix thread, threads defined by the Posix standard.

6 List of contributors

Many thanks to those who help me to maintain this FAQ.

- Robert G. Brown
- Samuel S. Chessman
- Alan Cox
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- Byron Faber
- Tony Kocurko
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- El Warren
- Christopher Allen Wing