Teaching Using Multi-Core Xinu

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XinuPi3?

XinuPi3 is the first open source lightweight instructional operating system that uses multiple cores

- **It is much easier and much more effective to teach using a <u>real</u> operating system rather than a simulation**
- **It is more important than ever to teach multi-core concepts to the younger generation,**
  - **Even smartphones run on multiple cores**
- **XinuPi3 can assist, not only in teaching these very important multi-core concepts, but also in teaching typical operating system concepts in a new way.**

How it looks

Running a core is as simple as:

```
*(volatile fn *)(CORE_MBOX_BASE +
CORE_MBOX_OFFSET * num) = Core1Setup;
```

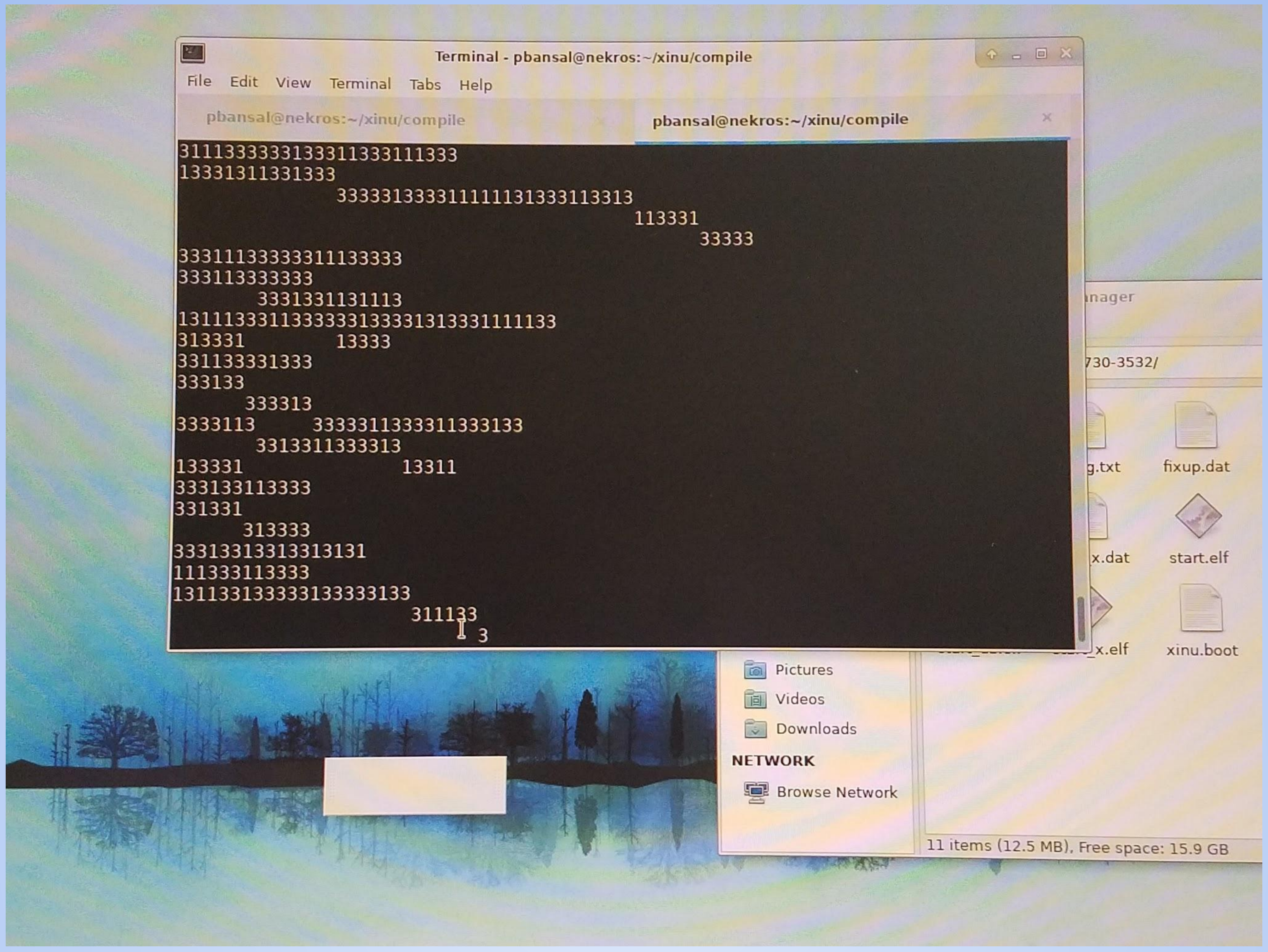
This line of code instructs a core numbered 1 - 3 to execute at address Core1Setup

Once a core has been awoken,

```
ldr r0, =core_init_sp
ldr sp, [r0, #4]
```

The stack must be set up in ARM assembly code. This is the only requirement needed to start running code on a core, but if this requirement isn't *immediately* met, the core will be stuck.

Using just 3 lines of code (in reality, only 2 of those three lines are needed), any student can run code on multiple cores. Cool!


Terminal - pbansal@nekros:~/xinu/compile
File Edit View Terminal Tabs Help
pbansal@nekros:~/xinu/compile
pbansal@nekros:~/xinu/compile

```
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```

Numerical soup, caused by multiple cores printing at the same time

It's Easier

- **Can teach concepts about processes without having to first teach how to switch between processes**
- **Easier to think about processes running concurrently**
  - **Helps students understand why mutexes are necessary and how they work**

It's Harder

- **Mutexes and semaphores don't work the same way**
- **Harder to control what is running and when**
- **Processes *actually* running at the same time, which is cool but can get messy**

It's Worth It

- **Old ways of using mutexes and semaphores will become unnecessary to know**
- **Students become more satisfied if knowing they are working on new, unchartered territory**
- **Employers would rather hire employers with experience with multi-core systems**

References

Brown, Richard, Elizabeth Shoop, Joel Adams, Curtis Clifton, Mark Gardner, Michael Haupt, and Peter Hinsbeeck. "Strategies for Preparing Computer Science Students for the Multicore World." Proceedings of the 2010 ITiCSE Working Group Reports on Working Group Reports - ITiCSE-WGR '10 (2010): n. pag. Web. 26 July 2017.

Yazici, Ali, Alok Mishra, and Ziya Karakaya. "Teaching Parallel Computing Concepts Using Real-Life Applications." International Journal of Engineering Education 32.2 (2016): 772-81. ResearchGate. Web. 26 July 2017.

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