Linux-tiny revival

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Linux-tiny revival

- Introduction to Linux-tiny project
- History
- Status
- Recent work
Intro to Linux-tiny

- What is Linux-tiny?
  - A collection of patches to reduce the memory size of the Linux kernel
  - Currently, a collection of about 40 patches
    - Had as many as 110 patches at one time
    - Some patches mainlined, some are out-of-date
Linux-tiny Patch Areas

- Configurable static data structure size
- Configurable code elimination
  - Eliminate a subsystem or feature, depending on kernel configuration
- Moving inlines into stand-alone functions
- Kernel instrumentation and analysis tools for memory usage reporting
Linux-tiny History

- Started in 2003 by Matt Mackall
- CELF sponsored Matt in 2005/2006
- Matt mainlined the top 17 patches from Linux-tiny
- Project was mostly abandoned in 2006
  - For a while, was not maintained relative to recent kernels
Current status

- CELF is reviving the project
- New maintainer volunteered at Ottawa Linux Symposium, 2007:
  - Michael Opdenacker
- Michael is an experienced embedded Linux trainer
  - Has his own training company, Free Electrons
• Have not formally announced the new maintainer
  – Watch celinux-dev or kernel mailing list next week

• Lots of work recently by Sony
  – Up-port to 2.6.22.5
  – Converted kmalloc-accounting feature to slab-accounting
    • Fixed lots of bugs
    • instrument all cache-related dynamic allocations
<table>
<thead>
<tr>
<th>Config option</th>
<th>PC size</th>
<th>OSK size</th>
</tr>
</thead>
<tbody>
<tr>
<td>NET_SMALL</td>
<td>8192</td>
<td>6368</td>
</tr>
<tr>
<td>PROC_KCORE</td>
<td>2556</td>
<td>0 ?</td>
</tr>
<tr>
<td>SYSENDER</td>
<td>7029</td>
<td>not applicable</td>
</tr>
<tr>
<td>AIO</td>
<td>8114</td>
<td>10396</td>
</tr>
<tr>
<td>XATTR</td>
<td>3780</td>
<td>0 error (have fix)</td>
</tr>
<tr>
<td>FILE_LOCKING</td>
<td>116228</td>
<td>442840 (error in test code?)</td>
</tr>
<tr>
<td>ETHTOOL</td>
<td>5340</td>
<td>7328</td>
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<tr>
<td>INETPEER</td>
<td>2848</td>
<td>3188</td>
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<tr>
<td>NET.SK_FILTER</td>
<td>3988</td>
<td>4008</td>
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<tr>
<td>NET_DEV_MCAST</td>
<td>2098</td>
<td>2152</td>
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<tr>
<td>IGMP</td>
<td>0 error</td>
<td>13112</td>
</tr>
<tr>
<td>BINFMT.ELF.AOUT</td>
<td>1416</td>
<td>2032</td>
</tr>
<tr>
<td>IDE_HWIFS</td>
<td>9216</td>
<td>6208</td>
</tr>
<tr>
<td>(others: MAX_SWAPFILES_SHIFT, NR_LDISCS, MAX_USER_RT_PRIO, SERIAL_PCI, PCI_QUIRKS )</td>
<td>25456</td>
<td>5152</td>
</tr>
<tr>
<td>Total</td>
<td>196261</td>
<td>59944</td>
</tr>
</tbody>
</table>
Slab Accounting Feature

- Records all callers to dynamic memory allocation system (slab cache) in kernel
- Tracks statistics for each caller
- To use:
  - Turn on `DEBUG_SLAB` and `DEBUG_SLAB_ACCOUNT`
  - On the Kernel Hacking menu
  - `cat /proc/slab_account`
Slab Info Analysis Programs

• Slabalyze
  – Collects information from /proc/slabinfo
  – Shows overhead used by different caches
  – Can sort by total memory, overhead, etc.

• casort - Cache accounting sort
  – Collects information from /proc/slabaccount
  – Shows callers, sorted by different fields
Demonstration

• On OSK machine in US test lab
  – if we are lucky…
What is next?

- Update documentation:
  - Linux kernel size tuning guide
  - Linux-tiny patch status matrix
    - Have automated tool for testing Linux-tiny patches
- Want to get cache_accounting working on slob allocator
- Want runtime testing of existing patches
- Please download and test the code
  - Every bug report is important
- Will start trying to mainline sub-patches again, this fall!
Resources

• Web site:
  – http://elinux.org/Linux_Tiny

• Instructions:
  – http://elinux.org/Kernel_Size_Tuning_Guide
    • Will update soon (goal is by next week)

• Mailing List:
  – linux-tiny@selenic.com
Open Discussion