LITES – The 4.4 BSD Lite Server

Free Unix Emulation under Mach 3.0

Johannes Helander
<jvh@cs.hut.fi>
Helsinki University of Technology

Binary Compatibility with

- **i386:** Linux, NetBSD, FreeBSD, 386BSD, UX (4.3 BSD)
- **pc532:** NetBSD, UX
- **PA-RISC:** Utah BSD (4.3/4.4 hybrid)

Work is being done on ext2fs (Linux), HP-UX (PA), Ultrix (R3000), and SysV (i386).

The code comes from

- 4.4 BSD Lite
- HUT by Johannes Helander
- CMU by Randall Dean and others

- PA port by Utah
- pc532 port by Ian Dall

No Net2 or 4.3 code

Lites was produced at HUT by adding new code to 4.4 BSD Lite.

Goals

- Leverage the strengths of Mach
- Reuse of a huge existing code base
- Easy to debug through source level gdb
- Easy to port
- Flexible and modular

The Lites **Server**

- **Single task implementation of BSD**
  i.e. 'single server' model.
- **Event driven**
- **Garbage collected objects**
- **Handles multiple concurrent system calls from any process**
- **Vnode paging to and from files**

The Lites **Emulator**

A completely new emulation library

- **Provides personality view to applications**
  (argument decoding; errno, signal, bitmask, ... translation).
- **Untrusted**.
- **May provide services directly (efficient!)**

- **Loads application binaries and shared libraries**.
- **Multiple ways of interfacing to an application binary:**
  (direct linking, through shared library, through trap fixup, through the exception mechanism, and soon shared library linking & on-the-fly binary rewriting).

- **No emulator stacks. The emulator is a 'normal' library.**
- **Many security issues present in earlier emulators fixed.**
  The system is still vulnerable to resource attacks due to exposing Mach to user programs.
- **Signal management is being moved into the emulator**.

Performance

Open gzipped gcc-2.6.2 tar

Linux	260 s
UX	190 s
Lites	335 s

Gettimeofday μs/call

Linux	native	24
FreeBSD	native	34
UX		275
Lites	BSD	285
Lites	BSD mapped time	14
Lites	Linux special libc, mapped time	8
Lites	Linux -static, mapped time	1300
Lites	Linux -static	1620

Approximate Breakdown μs

BSD syscall trap fixup	10
Linux syscall trap fixup	1300
Server RPC and associated overhead	230

Depends strongly on how a particular mechanism has been implemented.

Currently Lites is usable but not fast.

Status

- **Running since May on the x86**
  - **Self-hosting**
  - **Has bugs**
- **Running since October on the pc532**
- **Running since October on PA**
  - **Runs multiuser**
  - **Cannot link** (requires HP-UX 'ld')
  - **Signal problems**
  - **Very Unstable**
  - **Very slow**

Availability

- **Public release within 1994**
- **Distributed by HUT and others**