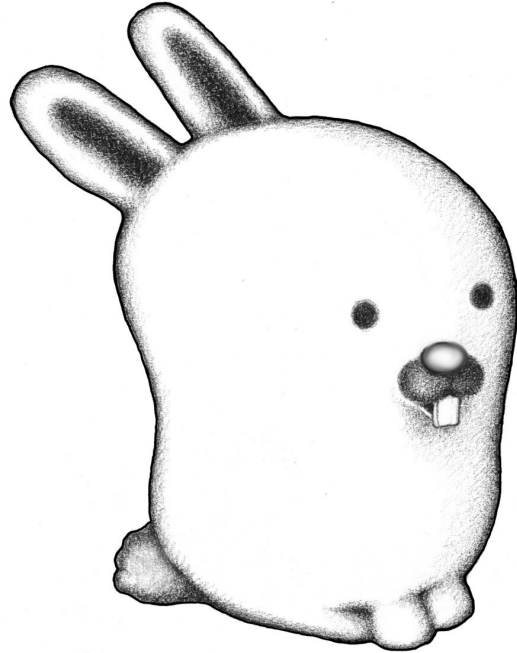


Plan 9 from Bell Labs



John Floren

- Motivations/History
- Important features and concepts
- Implementations and Use
- Demonstration
- Getting into Plan 9

Motivations/History

- By late 80s, UNIX was getting old
 - Poorly integrated graphics, networking
 - Designed for minicomputers, not PCs
 - “Not only is UNIX dead, it's starting to smell really bad” -- Rob Pike
- UNIX group at Bell Labs decided to try again
 - Some parts of UNIX were too broken to fix, but good parts could be brought along.
 - Where others were making UNIX clones (Minix, Linux), Bell Labs would make a completely different OS.

Plan 9 is born

- Plan 9 would incorporate from the beginning:
 - Graphics
 - Pervasive networking
 - Distributed approach
 - New features
- Unfortunately, not open-sourced until 2000, resulting in low adoption

Important Plan 9 concepts

- Division of services
- Small, portable kernel
- Everything is a file
- Make networking pervasive
- Eternal storage
- C language
- Coherent, non-GNU utilities
- Powerful graphical capabilities

Division of Services

- Plan 9 runs best on a network of machines
 - CPU server provides heavy computation
 - File server stores files
 - Auth server authenticates users for CPU and file servers
 - Terminals provide individual workstations.
- Made possible by the rise of cheap, powerful PCs

Kernel

- The Plan 9 kernel is tiny
 - 46K lines of portable C
 - 83K lines PC-specific C and assembly
- Written in C as much as possible, minimal assembly
- Hacking on the kernel is easy
- Small # of syscalls compared to Linux
- Customized in several common ways for CPU servers, file servers, auth servers, terminals

Everything is a File

- Already a UNIX design
- Extended in Plan 9
 - Private namespaces
 - Binding
 - Devices accessed through data and control files (no ioctls)
 - Network connections represented as files in directories
 - Origin of /proc

Pervasive Networking

- Plan 9 was designed with networks in mind
- Configuration files make it easy to define and set up a network
- 9P2000 protocol allows seamless cross-computer file access
 - Secure
 - Fully integrated
 - 9fs, import, etc.

Eternal Storage

- Plan 9 uses 2 filesystems on the fileserver:
 - Fossil: acts as a cache for new data (typically a few gigabytes)
 - Venti: very large archival storage (hundreds of gigabytes)
 - Backups made based on blocks
 - Similar in concept but technically superior to Time Machine
 - Old files accessed in /n/dump (ex: /n/dump/2007/1125/usr/john/foo.c)
 - Can provide diffs and history of any file

Venti Example

```
% rm importanthw.txt # oops
```

```
% 9fs dump # we have the technology
```

```
% cp
```

```
  /n/dump/2009/0114/usr/john/importanthw.txt .
```

```
# Now you have the file from Jan. 14, 2009
```

C Language

- Nearly the entire OS and most utilities are in C
- Plan 9 has its own “dialect”
 - Shunned exact POSIX/ANSI compliance in favor of Kernighan, Ritchie, et. al.'s judgment
 - Simple yet feature-rich libraries
 - Powerful “mk” system
 - Includes POSIX-compatible compiler, shell, etc. for compatibility (deprecated)

Hello World

```
#include <u.h>
```

```
#include <libc.h>
```

```
void
```

```
main() {
```

```
    print("hello world\n");
```

```
    exits(nil);
```

```
}
```

Utilities

- No GNU software
- Plan 9 utilities are simple, fast, and true to the original UNIX ideas
 - Read from stdin and write to stdout
 - Assume output will be sent to another program
- Written in either C or the shell, rc

Graphics

- Uses devdraw system
- Extremely easy to write graphical programs
- “snake” game only takes about 200 lines of C, including comments and whitespace
- Windowing system and editors focus on effective mouse use
 - Source of much contention on mailing list!

Uses

- Plan 9 currently runs on:
 - 386 architecture
 - AMD64
 - BlueGene/L and /P
- Used in:
 - Embedded systems (Coraid storage)
 - Supercomputing (Fast-OS)
 - Personal use

Demonstration!

Plan 9 Community

- 9fans mailing list
- Annual International Workshop on Plan 9
- Plan 9 jobs/co-ops
 - Bell Labs
 - IBM
 - Sandia National Labs

Getting Plan 9

- Plan 9 is now free to download under the Lucent Public License
- Official site at <http://plan9.bell-labs.com/plan9>
 - 9fans.net redirects there
- The CD image can be installed on many PCs and QEMU; VMWare and Parallels need workarounds.

Plan 9 at RIT

- csplan9
 - On-campus server for students
 - Open to GCCIS and KGCOE
 - csplan9.rit.edu
 - I use it for:
 - Mail
 - Writing papers
 - Programming
 - Convenient shell access