

# Introduction to BSD Unix

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# What is BSD?

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- Version of Unix developed at UC Berkeley, under contract from DARPA
- BSD = Berkeley Software Distribution
- FreeBSD is based on 4.4BSD; all the source code is available
- **THE** research OS of the 1980's and early 1990's



# Why not Linux?

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- Both have freely-available code
- The BSD kernel stems from a small group and a focused design philosophy; code was only ever put in by 4 people
- More modular kernel makes programming easier to understand



# Ok, But Why FreeBSD?

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- Widely available and used implementation based on 4.4BSD
- Could have used
  - OpenBSD: secure, reliable; not widely used
  - NetBSD: also widely-used
- FreeBSD has its own version of the book!
- FreeBSD used in a leading OS



# A Few BSD Innovations

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- TCP/IP networking
- Virtual Memory
- the C shell
- the vi editor
- fast file system
- freely-available Unix (non-AT&T code)



# UNIX Philosophy

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- timesharing
- multiple processes (processes are cheap)
- replaceable user interface (shell)
- file system is a tree
- files are sequences of bytes
- ``everything is a file''



# Unix Philosophy II

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- simple priority scheduling
- swapping
- later versions had demand paging
- algorithms and data structures selected for simplicity
  - algorithms and data structures selected for simplicity
    - algorithms and data structures selected for simplicity



# Unix Philosophy III

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- build simple, basic tools
- construct complex tools out of simple tools



# BSD Design Overview

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# 4BSD Design Goals

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- Some of these came about in the early 80's
- Virtual memory support: support for processes with large, sparse address spaces
- 3rd-party device support
- Terminal-independent support libraries for screen-based applications



# 4BSD Design Goals II

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- Standardized research operating system; first DARPA, then POSIX
- TCP/IP protocol stack promoting easy sharing of resources (r-commands, telnet, ftp)
- Modularized kernel
- Sockets for network programming (flexible, simple base)



# 4BSD Design Goals III

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- First, solid basic functionality, then:
  - Performance improvements after implementing basic functionality (Chapin's law of optimization: Make it work, then make it fast.)
  - Diversity into heterogeneous support (multiple processors, file systems)



# FreeBSD Development

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- Unlike the CSRG @ UCB, FreeBSD doesn't have dedicated staff
- Elected core members must answer to committers
  - Allows for turnover/refreshing the core
- New stable release about every two years



# BSD Layers

users		
shells and commands compilers and interpreters system libraries		
<i>System call interface to the kernel</i>		
signals terminal handling character I/O terminal drivers	file system swapping block I/O disk and tape drivers	CPU scheduling page replacement demand paging virtual memory
<i>kernel interface to the hardware</i>		
terminal controllers terminals	device controllers disks and tapes	memory controllers physical memory

# Four Basic Facilities

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- Processes
- File Systems and devices
- Communications
- System Startup

