HelenOS

Operating Systems Seminar Report | Shreya Gokani (121053)

Introduction

HelenOS is a state-of-the-art operating system based on microkernel multi-server design principles. HelenOS decomposes key operating system functionality (including device drivers and file systems) into many isolated but intensively communicating server processes that reside entirely in user space. HelenOS thus provides a computing environment that has several virtues, such as flexibility, increased robustness, well-defined explicit interfaces between isolated software components and reduced complexity as compared to other operating system architectures. What makes HelenOS unique among the other multi-server operating systems is its multiplatform and multiprocessor microkernel and understandable source code. HelenOS runs on 7 different processor architectures, ranging from a 32-bit uniprocessor little-endian ARMv4 and a commodity PC with x86 and x86-64 processors to a 64-bit multi-core big-endian UltraSPARC T1.

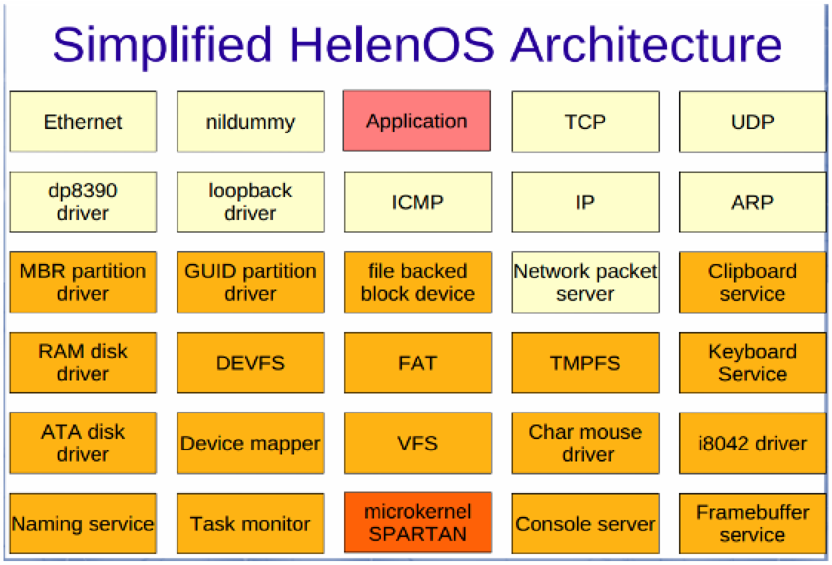
Approach

”simple design, smart code”

Languages used:

93% C language, 3% assembler

Architecture



Simplified HelenOS Architecture

Ethernet	nildummy	Application	TCP	UDP
dp8390 driver	loopback driver	ICMP	IP	ARP
MBR partition driver	GUID partition driver	file backed block device	Network packet server	Clipboard service
RAM disk driver	DEVFS	FAT	TMPFS	Keyboard Service
ATA disk driver	Device mapper	VFS	Char mouse driver	i8042 driver
Naming service	Task monitor	microkernel SPARTAN	Console server	Framebuffer service

It consists of three major parts:

- Kernel
- User space layer
- Boot infrastructure

Comparison with other OS:

- While the Linux kernel alone is over 15 million lines of code, HelenOS is just over 822 thousand lines of code and has been developed by just over three dozen contributors over the past decade. The hardware support for HelenOS is better than GNU Hurd and includes support x86/x86_64, Intel Itanium, ARM (in the form of the Neo FreeRunner and BeagleBoard), MIPS (SGI Indy), PowerPC (Apple iMac G4), and SPARC (Sun Ultra) hardware. The operating system is written in C and is mostly BSD licensed.

- One of the several goals of HelenOS is to have a working, yet simple and easily extensible platform for operating system research. The source code of HelenOS (and SPARTAN kernel) is written from scratch and is thus not cluttered by the various ”hacks” which are present in many established operating systems (i.e. Linux) and which render them almost unusable for any major architectural redesign. Another benefit of having a system written from scratch is the ability to calibrate the success metrics, both on the initial development and on any (real or artificial) incremental change.

Services:

- Command line which allows manipulating files, running applications, mounting file from disks, and disk images.
- Can play Tetris or edit text files.
- Supports multinational text throughout using Unicode
- Provides services such as device drivers, file systems, networking and user interface
- Most services are composed of multiple independent server processes, modular operating systems

Future work:

- Currently, an early prototyping of the component framework in HelenOS is in progress. Objective C has been chosen as the implementation language mostly because it is a strict superset of C, which makes it very suitable for doing the success metrics calibration. Objective C also nicely joins the high-level features and the presence of low-level C constructs as discussed earlier.

- To become a complete and usable modern application
- Offering room for experimenting and research

References:

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