SoftNet2013 MultiConference

Rethinking the Network Basics

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The *apocalypse of the two elephants*
No fashion in Science!
No legacy.
I HATE PERFORMANCE EVALUATION!
The value of a protocol, a language, an algorithm depends on:
- the range of problems it is able to solve
- and then its performance.
The best compression Algorithm

- Input: a file N bytes long (maybe GiB, TiB, PiB, EiB)
- Output size: 1 bit
- Time Complexity O(N)
Core Networking Questions

- how many protocol stacks/protocol stack implementations should exist in a system? (I mean for the same protocol family)
- which component of an operating system should provide networking services?
- what is the networking layer exposed to the processes?
- what should an IP address point to?
- should networking configuration be a privileged operation?
Networking

In the 80's

Today
One shared stack?
No! Multiple Stacks!
A Stack Implementation is a Library!

MONOLITHIC KERNEL

MICROKERNEL

V Networked appliances

KERNEL

TCP-IP

process

process

process

process

TCP-IP

TCP-IP

TCP-IP

VDE
What is an “Internet Node”?

- Network adapters are the “addressable entities” of the Internet.
Yesterday: historical view

Internet Server

- connect
  - IP addr/port
  - interface
  - Listening sockets
  - Service Daemon
Internet of Threads (IoTh)

- Processes, Threads can be Internet nodes (too).
- Each process can use all the networking stacks it needs.
Why the IoTh? Because some “hard” problems in multitasking multiuser systems become simple.

- Provide users working on the same system with user-specific IP addresses
- Provide different QoS/Routing to processes running on the same system
- Run several servers on the same interface+port.
- Use a VPN for some processes and the real network for others.
- Migrate a process to another system while keeping the status of the active connections.
Why the IoTh?

- Because we have IPv6!
- We have plenty of addresses
- We must start again from chalk and blackboards and design a new Internet
- IPv4 network concepts are obsolete
- (we must find an excuse to design IPv8, then IPvA, etc.)
Why the IoTh?

- It is the software counterpart of the Internet of Things.

- HW vs SW
- Special Purpose vs. General Purpose
- Consumer Electronics vs. Upgradability
Why the IoTh?

- Also Linux Containers (Solaris zones) provide several stacks... but just for sysadm!
- By the IoTh networking becomes “ordinary business” for users.
- Network stacks will be chosen as printers using menu items...
Virtual Square does it better!

- Virtual Square has developed a set of tools that permit the implementation of the “Internet of Threads” concept:
  - VDE: virtual distributed ethernet
  - LWIPv6: an entire IPv4/v6 hybrid stack as a library
  - View-OS: view-based operating system.
    - Umview/kmview: View-OS implementations as partial virtual machines running on GNU-Linux.
- This is a usable proof-of-concept test set!
Milestones

● VDE (Tridentcom 2005)
● Msockets (ACM SAC 2012)
● Internet of Threads (ICIW 2013)
● IPv6 Hash-Based Addresses (AFIN 2013)
● .... and now OTIP One Time IP (ICSNC 2013)
Msocket:

- We propose a clean interface to support multiple stacks:

```c
int msocket (char *stack, int domain, int type, int protocol);
```

- Stack is the pathname of a special file (or the path of an object).

- View-OS module named umnetlwipv6 provides a proof of concept implementation of this msocket support.
Client side IoTh

- This browser “lives” in its own view of networking.
- It runs on a hidden (masqueraded) network.
- It can change continent just by reloading the page (if we “migrate” the slirp process at the other end)
The virtual web appliance has its net stack onboard.

From the Internet it is (appears as) a web server.

It can migrate throughout the VDE.
We are still creating art and beauty on a computer:

the art and beauty of revolutionary ideas translated into (libre) code...

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