

# CS615 - Aspects of System Administration

## The Whole Semester In One Class

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Department of Computer Science

Stevens Institute of Technology

Jan Schaumann

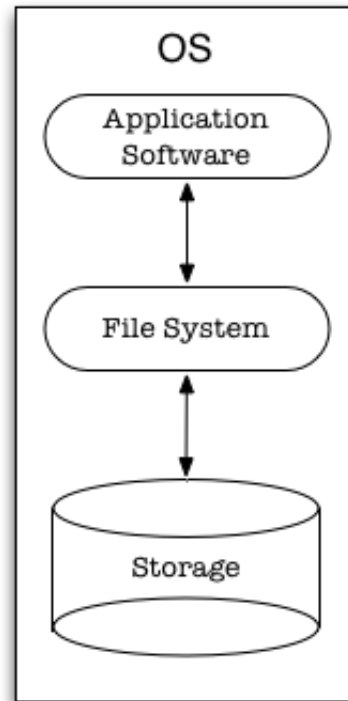
`jschauma@stevens.edu`

`https://stevens.netmeister.org/615A/`

## Basic Disk Concepts: Storage Models

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### Direct Attached Storage (DAS)

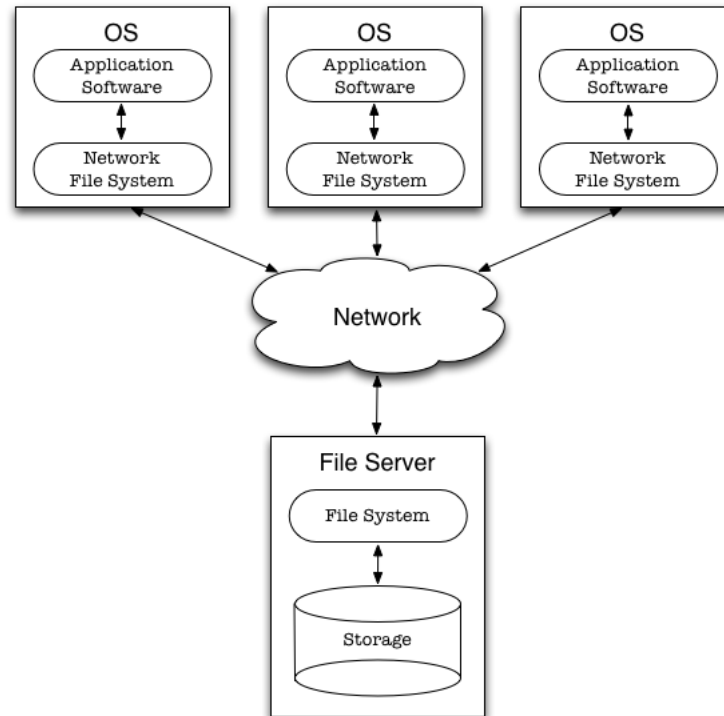


```
ssh lab 'df -hT /'
```

## Basic Disk Concepts: Storage Models

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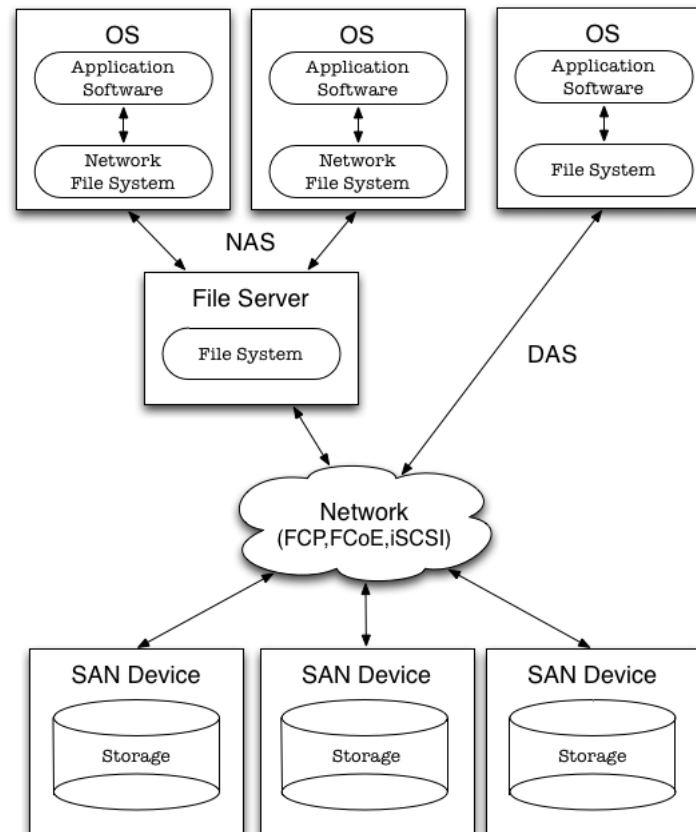
### Network Attached Storage (NAS)



```
ssh lab 'df -hT /home/$(whoami)'
```

## Basic Disk Concepts: Storage Models

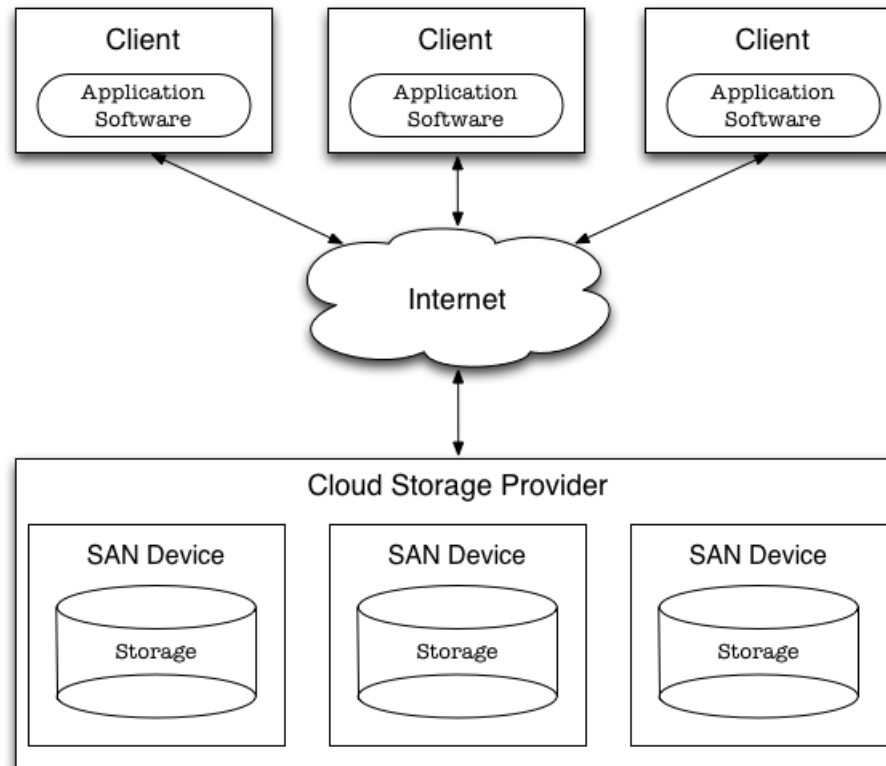
### Storage Area Networks (SAN)



## Basic Disk Concepts: Storage Models

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### Cloud Storage (Examples: EBS, S3)



## Basic Disk Concepts: Disk Devices

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# Storage Models and Disks

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Aboubacar Diawara

<https://www.dnsstuff.com/storage-array>

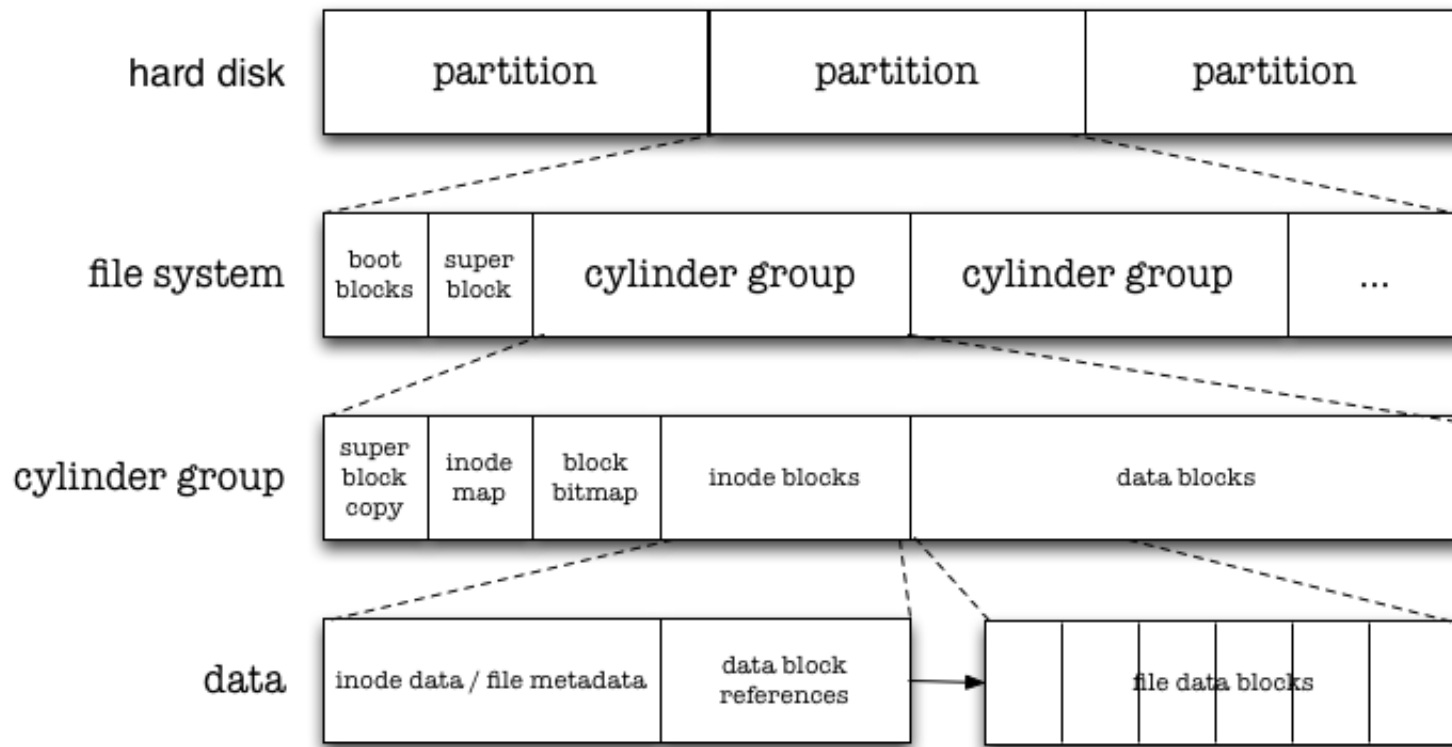
## Lecture 03

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# Filesystem Basics, Software Types



# Basic Filesystem Concepts: The UNIX Filesystem



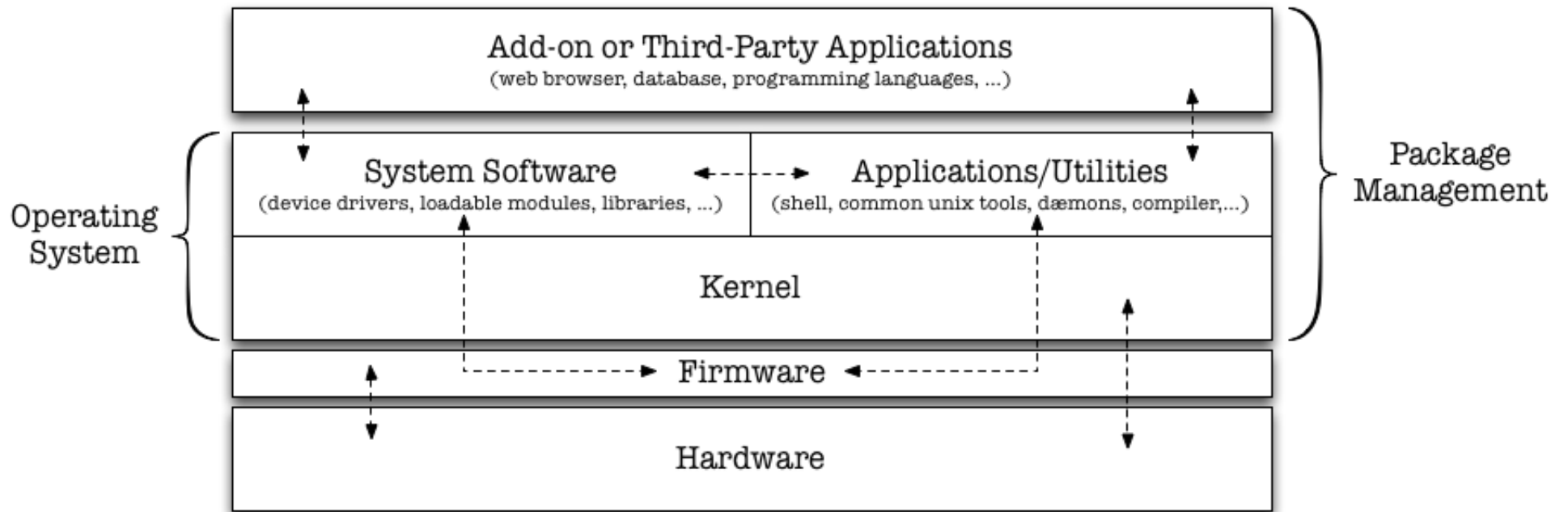
# Filesystem Basics

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Chirag Rana

- Filesystem Overview - <https://is.gd/HfT7rJ>
- File System Inconsistency - <https://is.gd/0usKSf>
- FSCK or Journaling - <https://is.gd/jlFt0Y>,  
<https://is.gd/YXrXir>

# Types of Software



# Software Installation and Package Managers

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David Sevilla

<https://is.gd/0g4J7w>

<https://lwn.net/Articles/712318/>

## Lecture 04

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# Software Installation, Multiuser Fundamentals

# Software Installation

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Harshala Yadav

<https://is.gd/1Mbj2q>

# Multiuser Fundamentals

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Elliot Wasem

<https://is.gd/DpcmI>

## Lecture 05 / Lecture 06

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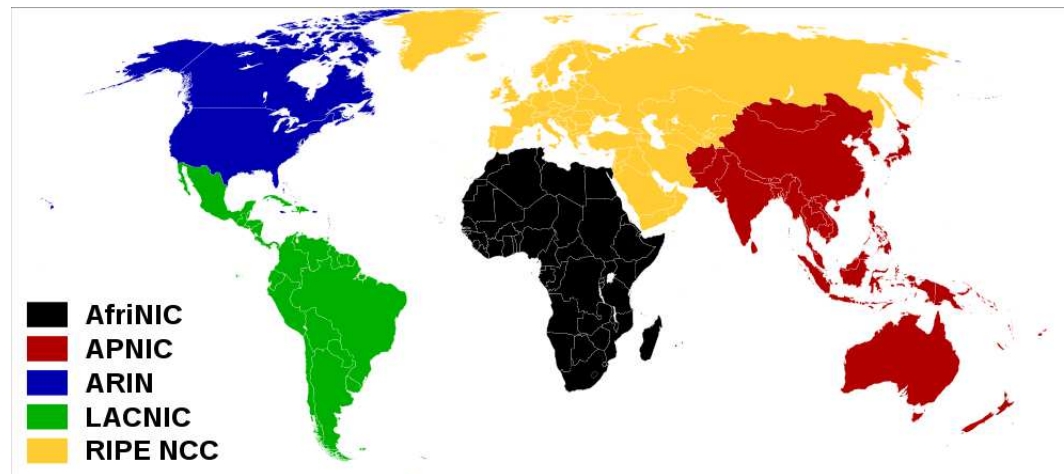
# Networking



## Mommy, where do IP addresses come from?

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The Internet Assigned Numbers Authority (IANA) oversees global IP address/AS number allocation, root zone management etc.



Regional Internet Registries (RIR) manage the allocation and registration of Internet number resources within a region of the world.

## WHOIS ASN?

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Autonomous System Numbers (ASNs) are assigned by IANA to the RIRs, see e.g. <ftp://ftp.arin.net/pub/stats/arin/>

You can query databases on the internet about e.g. IP block or ASN information via the WHOIS protocol:

```
$ whois 155.246.89.100 | more
NetRange:      155.246.0.0 - 155.246.255.255
CIDR:          155.246.0.0/16
NetName:       STEVENS
NetHandle:     NET-155-246-0-0-1
Parent:        NET155 (NET-155-0-0-0-0)
NetType:       Direct Assignment
Organization:  Stevens Institute of Technology (SIT)
RegDate:       1991-12-31
Updated:       2007-01-29
Ref:           https://whois.arin.net/rest/net/NET-155-246-0-0-1
```

## WHOIS ASN?

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Carriers connect their Autonomous Systems at *Internet Exchange Points* (IXPs) to route traffic between the different networks.

This *peering* happens amongst carriers on a tiered basis.

Examples:

`https://peeringdb.com/net?asn=6939`

`https://peeringdb.com/net/27`

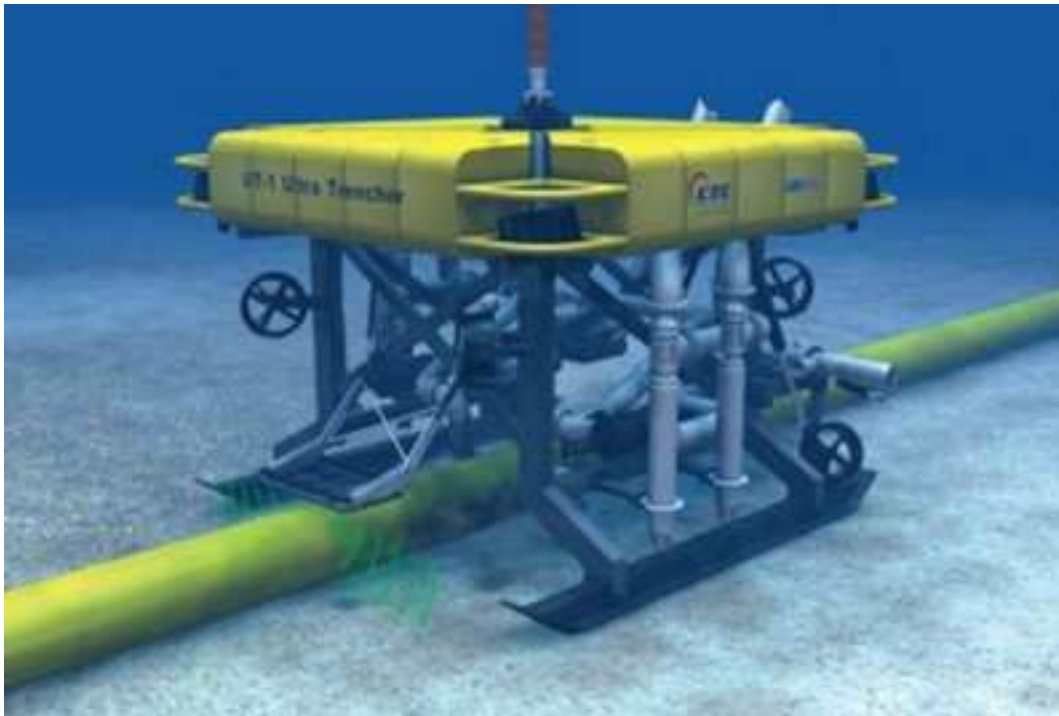
`https://peeringdb.com/net/433`

`https://peeringdb.com/net/457`

## Networking

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Stringing cables across the oceans' floors since 1866!



<http://www.submarinecablemap.com/>  
<http://is.gd/CjanOu>

# Networking I

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Jared Bass

<https://is.gd/bP8dZU>

<https://is.gd/EA2Ddy>

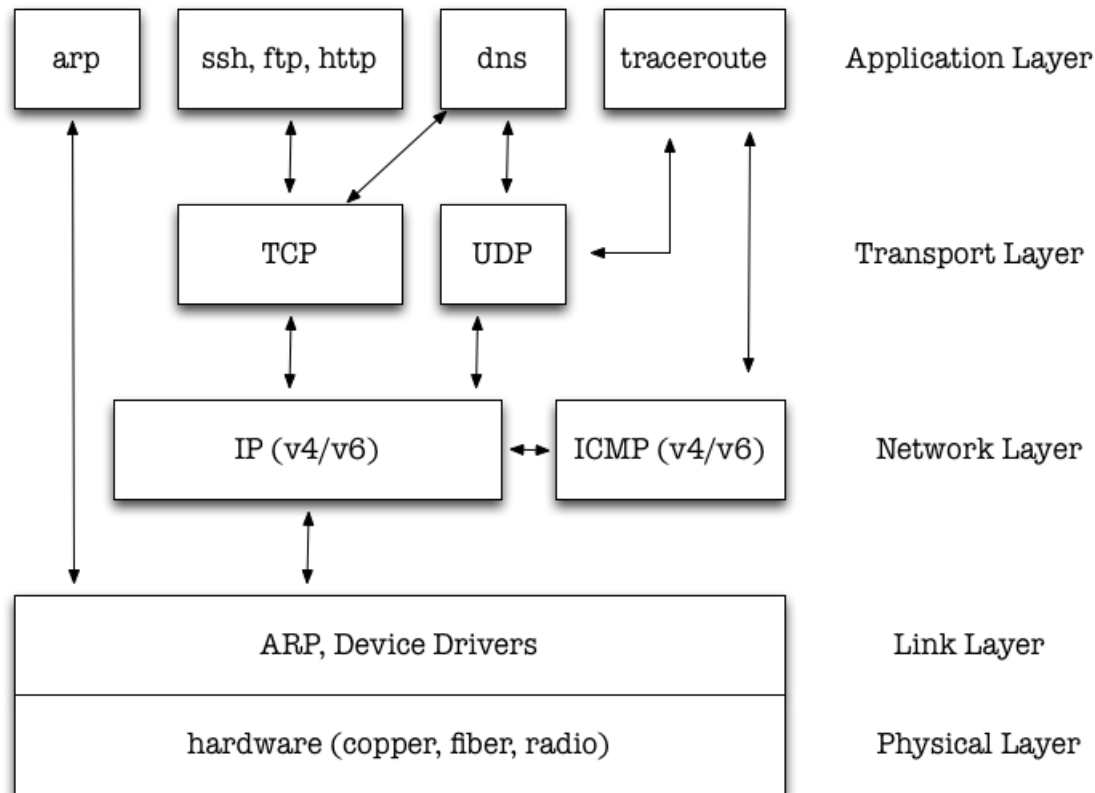
## A simple example

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```
$ strace -f telnet www.google.com 80 2>strace.out
Trying 173.194.73.99...
Connected to www.google.com.
Escape character is '^]'.
GET / HTTP/1.0

[...]
```

# TCP/IP Basics: Putting it all together



## Networking II

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Jiahan Liu

<https://skerritt.blog/how-does-tor-really-work/>



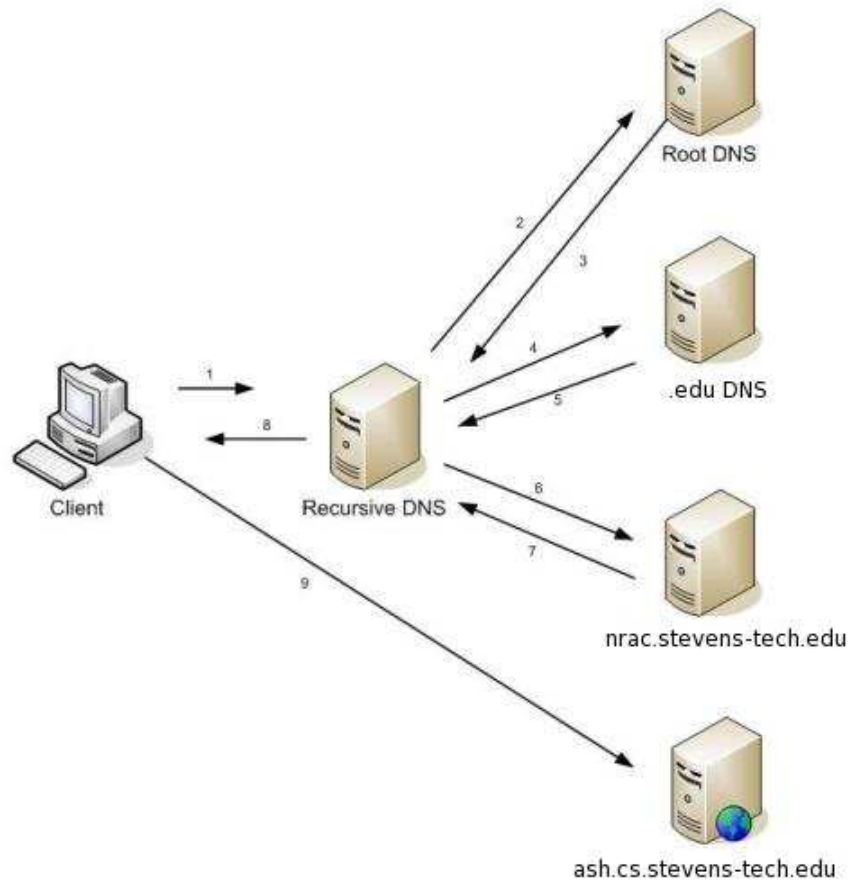
# Lecture 07

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## DNS; HTTP

# Hostname resolution

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# DNS

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Michael Appiah

<https://securitytrails.com/blog/8-tips-to-prevent-dns-attacks>

<https://www.esecurityplanet.com/network-security/how-to-prevent-dns-attacks.html>

# The Hypertext Transfer Protocol

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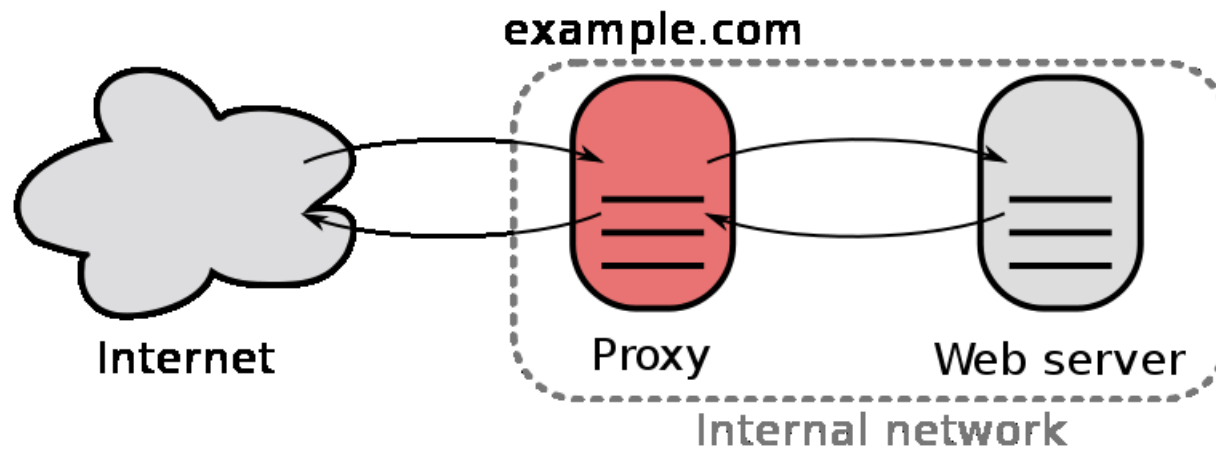
HTTP is a request/response protocol:

1. client sends a request to the server
  - request method
  - URI
  - protocol version
  - request modifiers
  - client information
2. server responds
  - status line (including success or error code)
  - server information
  - entity metainformation
  - content

## HTTP Proxy Servers

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- HTTP traffic usually is very asymmetric
- a lot of the content is static
- network ACLs may restrict traffic flow



# Lecture 08

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## SMTP / HTTPS

# TLS

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## Transport Layer Security

- set of cryptographic protocols
- operates on layer 6 of OSI stack (Presentation Layer)
- independent of HTTP
- RFC5246 (TLS 1.2)

Two distinct security mechanisms:

1. encryption of data in transit
2. authentication of parties

# HTTP/HTTPS

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Mark Freeman

`https://web.stanford.edu/class/cs253/`

`https://www.cloudflare.com/learning/ssl/how-does-public-key-encryption-work/`



## SMTP: Sending...

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```
# tcpdump -i xennet0 -w /tmp/t.out port not 22 2>/dev/null &  
# mail -s "CS615 - SMTP Exercise" jschauma@stevens.edu -f jschauma@stevens.edu
```

Hello,

SMTP is simple.

-Jan

.

EOT

```
# fg
```

```
tcpdump -i xennet0 -w /tmp/t.out port not 22 2>/dev/null
```

```
^C
```

## Sending...

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```
$ telnet 155.246.14.37 25
Trying 155.246.14.37...
Connected to spamfilter01.stevens.edu.
Escape character is '^]'.
220 spamfilter01.stevens.edu ESMTP (fe32969a29a5f461e53bf93b18c8fdb5)
EHLO ip-10-235-167-232.ec2.internal
250-spamfilter01.stevens.edu Hello ec2-54-205-68-41.compute-1.amazonaws.com
    pleased to meet you
250-SIZE 50000000
250-PIPELINING
250-8BITMIME
250 HELP
MAIL FROM:<jschauma@stevens.edu> SIZE=380
250 Sender <jschauma@stevens.edu> OK
RCPT TO:<jschauma@stevens.edu>
250 Recipient <jschauma@stevens.edu> OK
```

## Sending...

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DATA

**354 Start mail input; end with <CRLF>.<CRLF>**

Received: by ip-10-235-167-232.ec2.internal (Postfix, from userid 0)  
id 2A17275438; Mon, 4 Apr 2016 15:42:33 +0000 (UTC)

To: jschauma@stevens.edu

Subject: CS615 - SMTP Exercise

Message-Id: <20160404154233.2A17275438@ip-10-235-167-232.ec2.internal>

Date: Mon, 4 Apr 2016 15:42:33 +0000 (UTC)

From: jschauma@stevens.edu (Charlie Root)

Hello,

SMTP is simple.

-Jan

.

**250 Ok: queued as 6A9C76F4004**

# SMTP

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Nan Cui

<https://is.gd/LJAYTT>

## Lecture 09

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# Writing System Tools

# Tools

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## Unix Philosophy

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Write programs that do one thing and do it well.

Write programs to work together.

Write programs to handle text streams, because that is a universal interface.

## Writing System Tools

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Ritvik Tiwari

<https://www.linuxjournal.com/content/sysadmin-101-automation>



## Lecture 10

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# Backup and Disaster Recovery / Monitoring

## Backup and Disaster Recovery

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### **Schrodinger's Backup**

“The condition of any backup is unknown until a restore is attempted.”

@nixcraft

# Backup and Disaster Recovery

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Sai Gudivada

<https://is.gd/ih10np>

<https://is.gd/dBFPdn>

# Events and Metrics

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Event



Metric



You

## Events and Metrics

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Timothy Steinberg

<https://is.gd/B2MwMU>

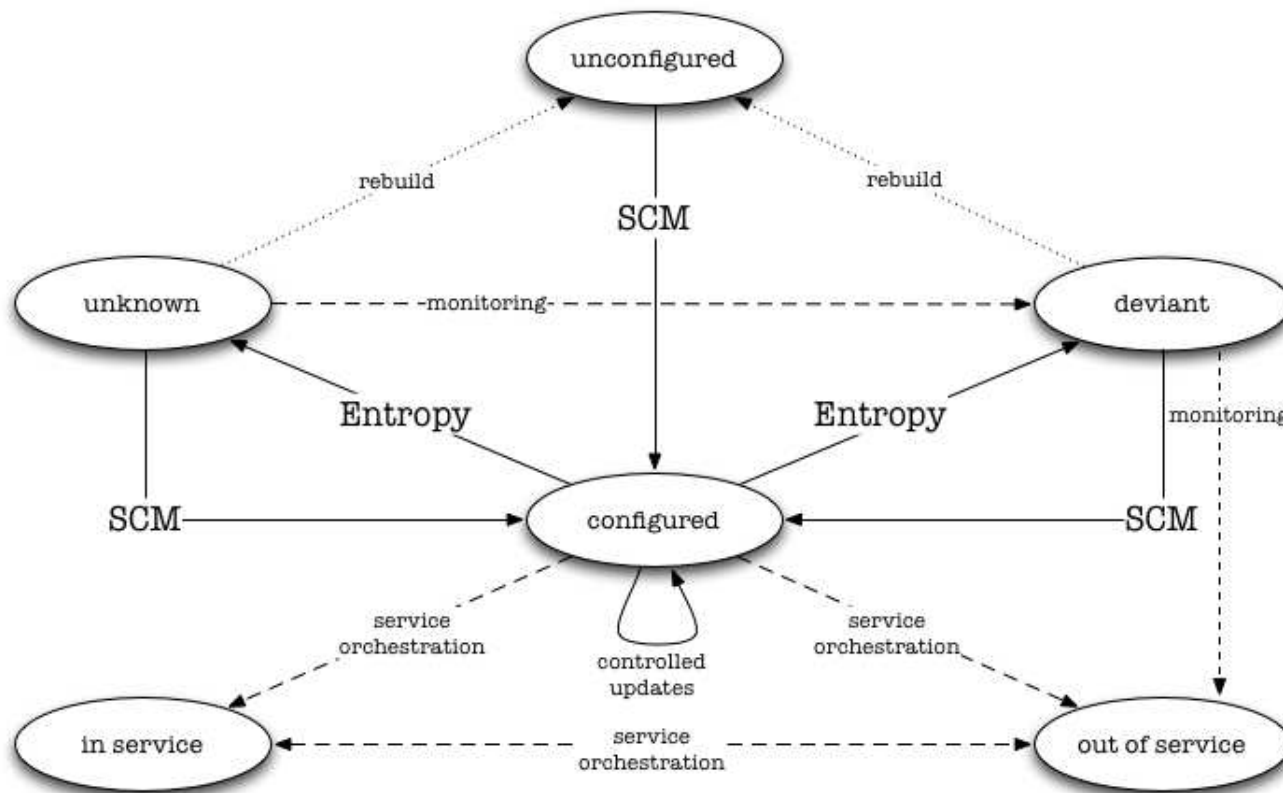
<https://is.gd/qDTBKG>

# Lecture 11

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## Configuration Management

# CM States



# Configuration Management

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Zhipeng Zhang

`https://is.gd/aZRvit`

`https://www.upguard.com/articles/ansible-vs-chef`



## This Whole Semester in One Slide

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System Administration is a unique, constantly developing profession.

It can be fun, satisfying, interesting, and impactful, but it's not easy.

Don't be lazy.