Lesson Module Status

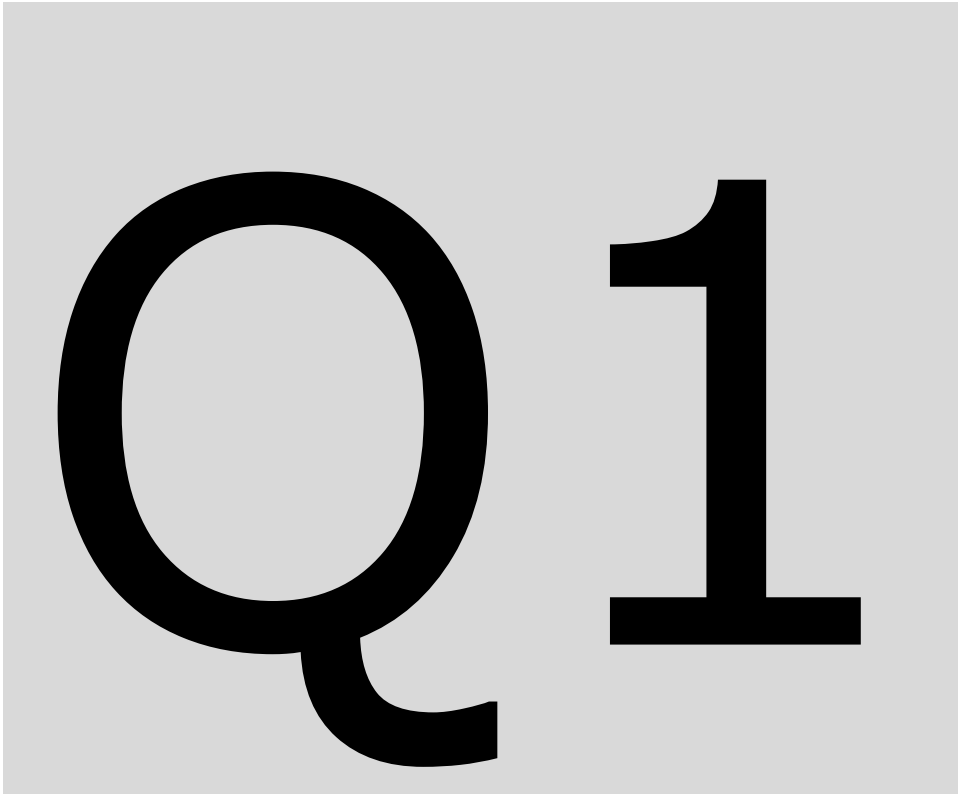
- Slides – draft
- Properties - done
- Flashcards -
- 1st minute quiz – done
- Web Calendar summary – done
- Web book pages – done
- Commands – done
- Howtos – done
- Surveys and PW sheet posted – done

- Lab tested – done
- Depot (Opus) – lab01 template - done
- Youtube Videos uploaded – done

- VM (Classroom PC) – done
- VMs (VLab) - done

- Headset charged –

- VTEA surveys -



- Introductions
- Pre-requisites
- How this class works
- Housekeeping

Introduction to TCP/IP and Network Access

Related Course Objectives	Agenda
• Use basic network terminology to describe the five layers of the TCP/IP Reference Model, and describe at least one major function of each layer. • Locate a specific Request For Comment (RFC) article on the Internet. • Install the device drivers and configure the network interface card (NIC) of a Linux system so that it may join a network.	• Introductions • CCC Confer • How this class works • Housekeeping • Linux Market, • Lab gear • Virtualization • VMware 101 • Network Review • Standards • NIC inventory • NIC Drivers • UNIX/Linux commands • Joining network (temp) • Testing • Dup IPs • IPv6 • Lab assignment tips • Q & A

If you are in the physical classroom,
feel free to power on your station and login as:
user: cis192
password: (on the whiteboard)

Course history and credits

Jim Griffin

- Jim created the original version of this course
- Jim's site: http://cabrillo.edu/~jgriffin/

Rick Graziani

- Thanks to Rick Graziani for the use of some of his great network slides
- Rick's site: http://cabrillo.edu/~rgraziani/

Introductions

Class Activity
Brief (30 seconds) Introductions

Go around the room starting with the instructor

1. Preferred first name?
2. Where have you studied prior to Cabrillo?
3. Where do you work or worked previously?

CIS 192A uses CCC-Confer

- Class meets every Tuesday afternoon:
  - 1:00PM to 5:10PM, Oct 25th to Dec 13th
- Attend in person or online
  - Option 1: Go to room 2501 on the Aptos Campus
  - Option 2: Attend class online
- Final exam on Dec 13rd
  - Room 2501 or arrange with instructor

October 2011

S	M	T	W	T	F	S
25	26	27	28	29	30	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

November 2011

S	M	T	W	T	F	S
30	31	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	1	2	3

December 2011

S	M	T	W	T	F	S
27	28	29	30	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Prerequisite Knowledge

CIS 81

Should have a high level understanding of the following:

IPv4 Addressing
Ethernet
Network stack (OSI layers)
Encapsulation
Subnetting
Utilities:
- Ping
- Wireshark

DNS
DHCP
NAT
Devices
- NICs
- Hubs
- Switches
- Routers

Routing

CIS 90

Should be comfortable with the following:

Navigating file tree
- ls, cd, pwd, find

File management
- cp, mv, rm, mkdir, rmdir

Edit configuration files
- vi

Working in a tty
- more, less, tty

Virtual terminals
- Ctrl-Alt-F1 …

Getting info
- man, google

Miscellaneous
- ssh/Putty, su, chmod, scp

Command line edits
- up arrow, tab

Showing file contents
- cat, grep, head, tail, file

Redirection
- >,>>, < , |

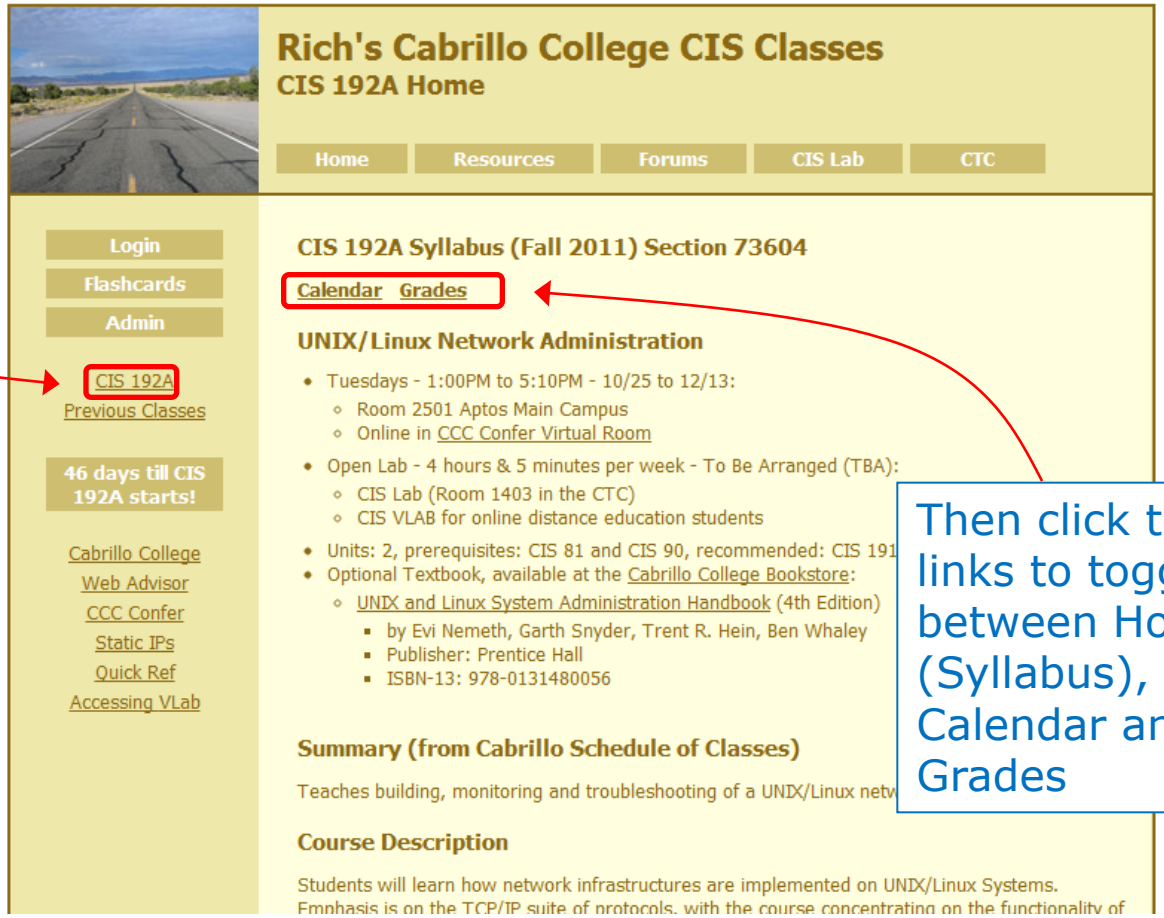
How this Class Works

Start here: **http://simms-teach.com/**

Class Exercise (class website)

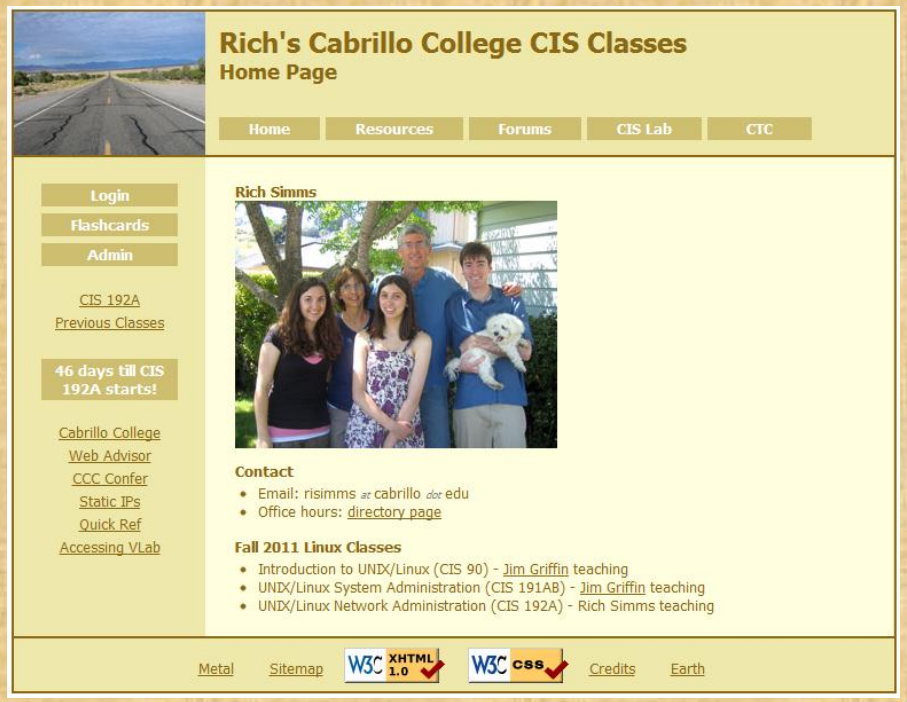
Please browse to: **http://simms-teach.com**

*First click on **CIS 192A** on left panel to see syllabus*



Then click these links to toggle between Home (Syllabus), Calendar and Grades

Class Activity
Website navigation



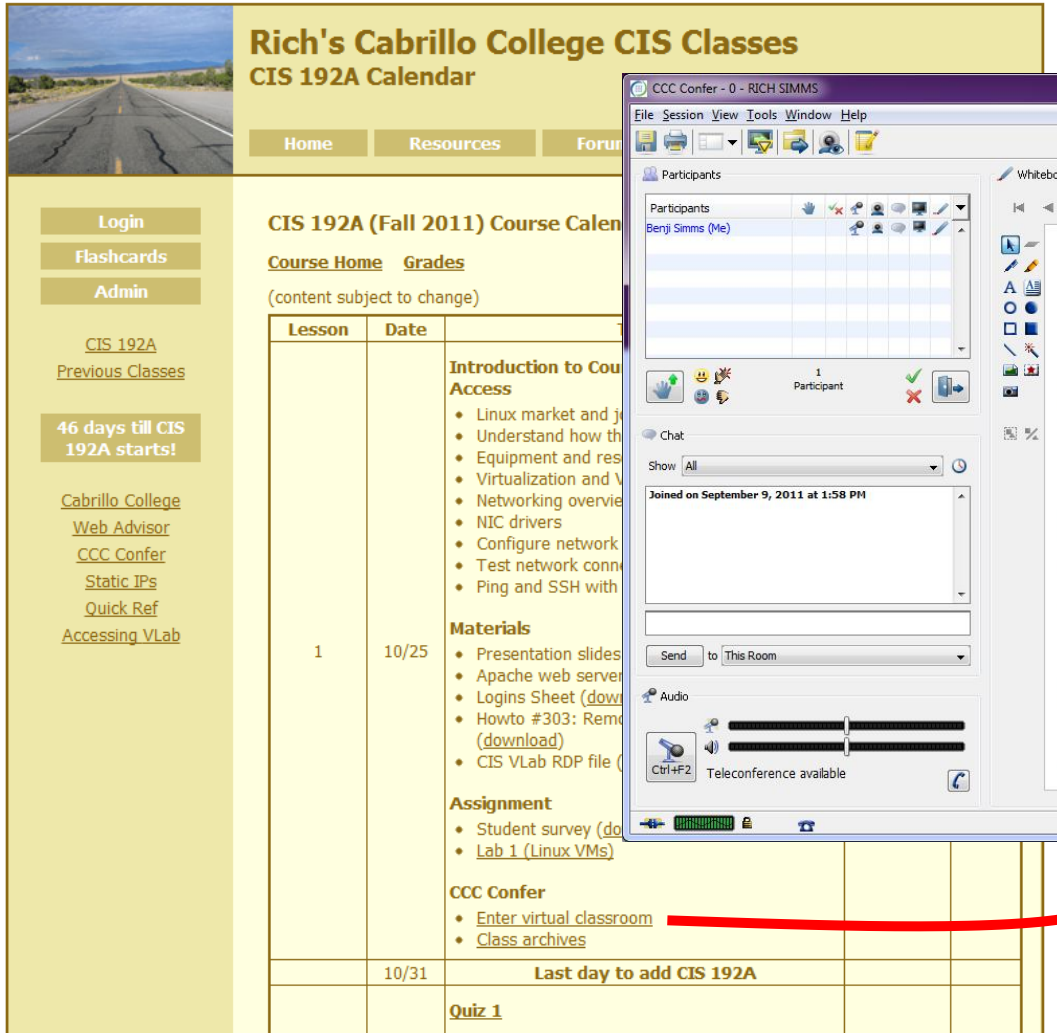
http://simms-teach.com

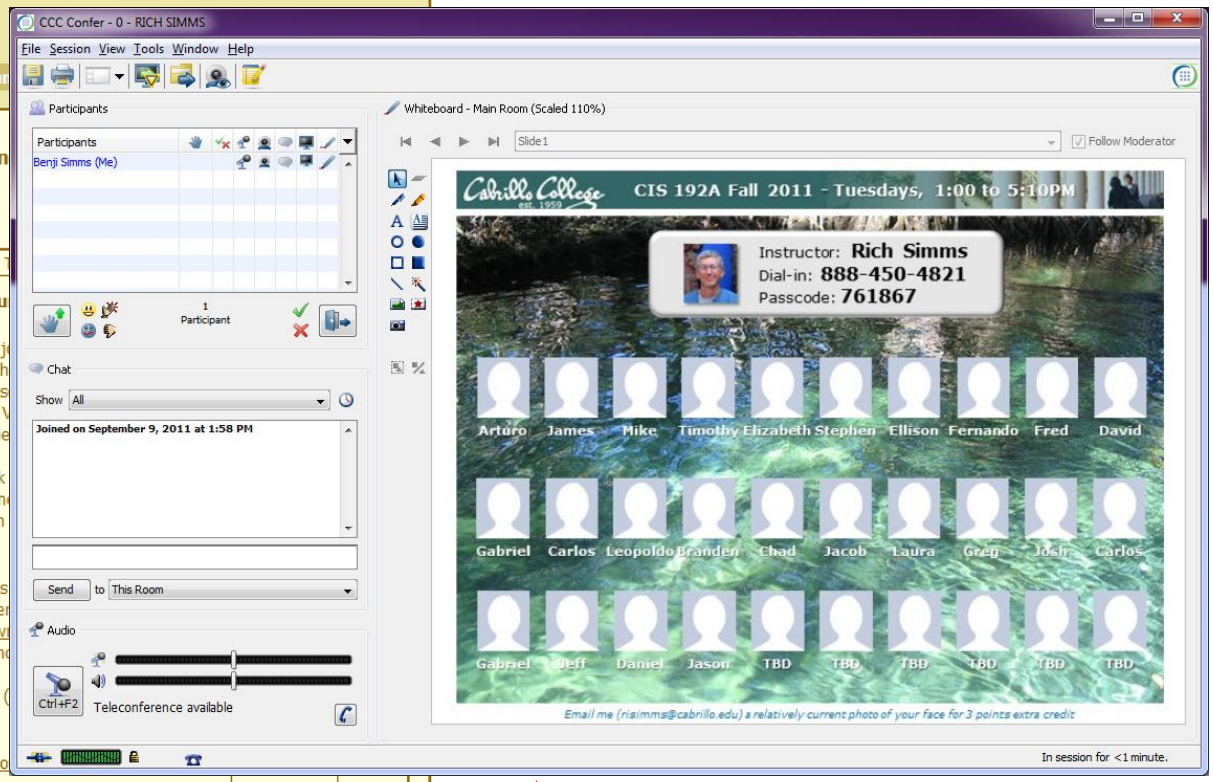
Make sure you can:

1. Get to the CIS 192A home page (syllabus)
2. Get to the Calendar page
3. Get to the Grades Page

http://simms-teach.com/cis192Acalendar.php

Attending class online

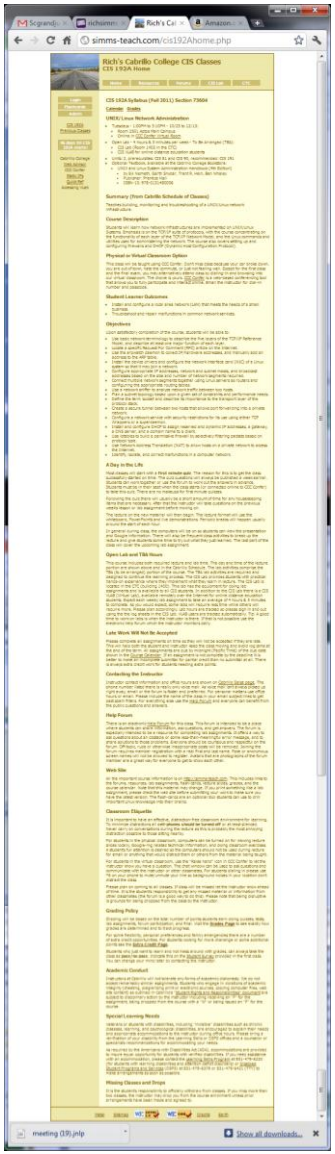




On the Calendar Page, just click on the link labelled "Enter Virtual Classroom" and follow instructions.

Class Activity
Enter the Virtual Classroom

- **http://simms-teach.com**
- Click **CIS 192A** link on left panel
- Click **Calendar** link in content area
- Click **Enter Virtual Classroom** link in Lesson 1
- Download Java applet, run it and follow instructions
- Listen via your computer's speakers (delayed) and ask questions via chat window
- Or listen via toll-free dial-in number (no lag) and ask questions by speaking. Phone/computer headset with mike makes this an ideal solution for long distance live training.



Course syllabus

It is a good idea to read through the syllabus carefully to avoid any surprises and get a good idea how this course works.

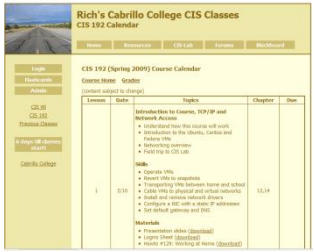
Weekly Cycle

http://simms-teach.com

Tuesday

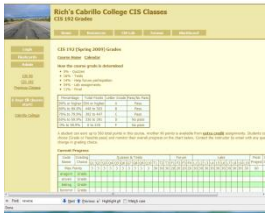
"First Minute" Quiz
Lecture on new material
Class Activities
Lab assignments due midnight

Use Forum to ask and answer questions

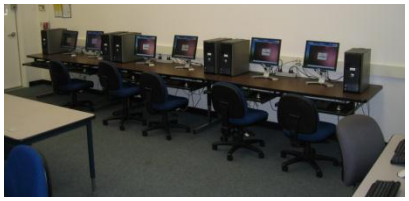


Calendar Page

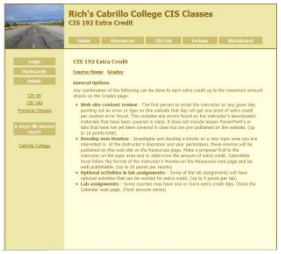
Wednesday
is grading day



Grades Page



Work Lab Assignments for TBA portion of class (4 hours 5 min) in CIS Lab or VLab



Extra Credit Page

Course outline and syllabus

Two important course policies to remember

In order to start classes on time, stay on the tight schedule, keep my own sanity, and to avoid log jams at the end of the term:

1) **No makeup's for missed quizzes**
2) **Late work (Labs assignments) will not be accepted**

If you have not completed a lab assignment, **please turn in what you have done for partial credit**

Don’t panic though -- there are **ample extra credit opportunities** for students wanting or needing any extra points.

Course Calendar

Lesson # and Date

Lesson slides and additional materials

References to material in the textbook

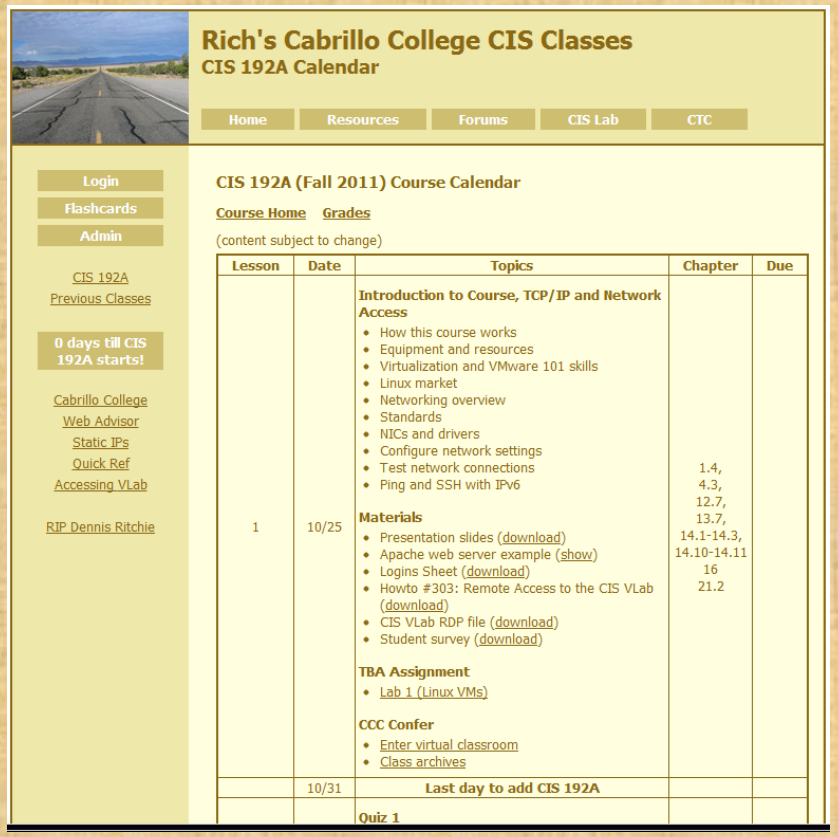
TBA Lab assignment

First minute quiz

What is due by midnight on that date

		• Configure network settings • Test network connections • Ping and SSH with IPv6 **Materials** • Presentation slides (download) • Apache web server example (show) • Logins Sheet (download) • Howto #303: Remote Access to the CIS VLab (download) • CIS VLab RDP file (download) • Student survey (download) **TBA Assignment** • Lab 1 (Linux VMs) **CCC Confer** • Enter virtual classroom • Class archives	1.4, 4.3, 12.7, 13.7, 14.1-14.3, 14.10-14.11 16 21.2	
1	10/25			
	10/31	**Last day to add CIS 192A**		
2	11/1	**Quiz 1** **ARP and the Internet Layer** • Permanent interfa • Red Hat and Debia • Understand how a • Manage and track • Sniff packets on th Wireshark • Understand the Internet layer (layer 3) and how addressing works • Understand how NAT/PAT works with private networks • Use several troubleshooting tools to diagnose problems **Materials** • Presentation slides (download) • IP address exercise (download)	12	Student survey Lab 1

Class Activity
Website Calendar page



Rich's Cabrillo College CIS Classes
CIS 192A Calendar

Home | Resources | Forums | CIS Lab | CTC

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Admin

CIS 192A
Previous Classes

0 days till CIS 192A starts!

Cabrillo College
Web Advisor
Static IPs
Quick Ref
Accessing VLab

RIP Dennis Ritchie

CIS 192A (Fall 2011) Course Calendar

Course Home Grades

(content subject to change)

Lesson	Date	Topics	Chapter	Due
1	10/25	**Introduction to Course, TCP/IP and Network Access** • How this course works • Equipment and resources • Virtualization and VMware 101 skills • Linux market • Networking overview • Standards • NICs and drivers • Configure network settings • Test network connections • Ping and SSH with IPv6 **Materials** • Presentation slides (download) • Apache web server example (show) • Logins Sheet (download) • Howto #303: Remote Access to the CIS VLab (download) • CIS VLab RDP file (download) • Student survey (download) **TBA Assignment** • Lab 1 (Linux VMs) **CCC Confer** • Enter virtual classroom • Class archives	1.4, 4.3, 12.7, 13.7, 14.1-14.3, 14.10-14.11 16 21.2	
	10/31	**Last day to add CIS 192A**		
		Quiz 1		

http://simms-teach.com

Browse to the Calendar page

1. When is the first test?
2. When is the first quiz?
3. When is the last day to add?
4. When is Lab 3 due?
5. When will the firewall lab (Lab 5) be assigned?
6. What time does the final exam start?
7. When are the first five forum posts due?

CIS 192
How grading works

Monitor this page to track your progress in the course.

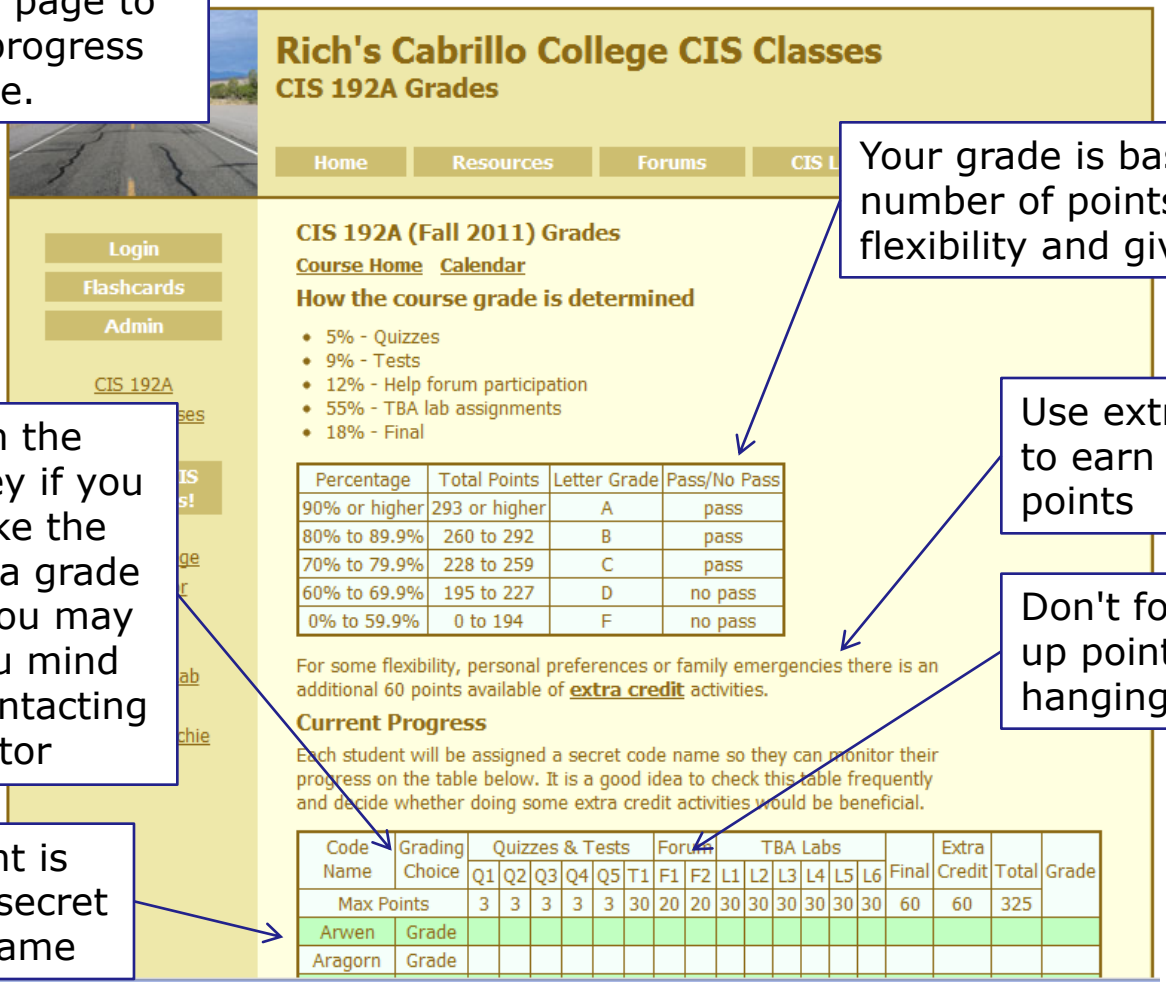
Your grade is based solely on the number of points you earn. It offers flexibility and gives you control.

Use extra credit to earn additional points

Don't forget to post! Racking up points the forum is "low hanging fruit"

Indicate on the class survey if you want to take the course for a grade or P/NP. You may change you mind later by contacting the instructor

Each student is assigned a secret LOR code name



Rich's Cabrillo College CIS Classes

CIS 192A Grades

Home | Resources | Forums | CIS L

Login
Flashcards
Admin

CIS 192A

CIS 192A (Fall 2011) Grades

Course Home Calendar

How the course grade is determined

- 5% - Quizzes
- 9% - Tests
- 12% - Help forum participation
- 55% - TBA lab assignments
- 18% - Final

Percentage	Total Points	Letter Grade	Pass/No Pass
90% or higher	293 or higher	A	pass
80% to 89.9%	260 to 292	B	pass
70% to 79.9%	228 to 259	C	pass
60% to 69.9%	195 to 227	D	no pass
0% to 59.9%	0 to 194	F	no pass

For some flexibility, personal preferences or family emergencies there is an additional 60 points available of **extra credit** activities.

Current Progress

Each student will be assigned a secret code name so they can monitor their progress on the table below. It is a good idea to check this table frequently and decide whether doing some extra credit activities would be beneficial.

Code Name	Grading Choice	Quizzes & Tests						Forum		TBA Labs						Final	Extra Credit	Total	Grade
		Q1	Q2	Q3	Q4	Q5	T1	F1	F2	L1	L2	L3	L4	L5	L6				
Max Points		3	3	3	3	3	30	20	20	30	30	30	30	30	30	60	60	325	
Arwen	Grade																		
Aragorn	Grade																		

Contacting the instructor

- Use the forum for the fastest response to questions on class material or TBA lab assignments.
- Use email for personal matters.
- Weekly office hours on the mornings (Tuesdays 11:40-12:50) in room 2501
- The instructor will be available in the CIS Lab to help students with TBA lab assignments or class material. See schedule at: http://webhawks.org/~cislab

- Leave a message on voice mail if you have no network access. Checked rarely so don't expect a fast response.

CIS 192 - How this class Works

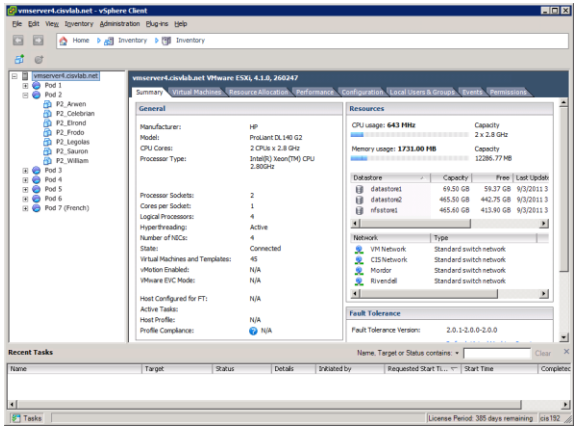
The TBA portion of this course is required

*Requires spending on average 4 hours and 5 minutes on **lab assignments** every week applying the skills learned during the lecture portion of the class.*

CIS Lab (in room 1403 of the CTC)

Please remember to always sign in and out on the log sheets!

CIS VLab (remote online access)



More on Grading

Lab Assignments (30 points each)

- Will be due at midnight (Opus time) on the date shown on the course Calendar. Each lab you submit is automatically time-stamped and the date be viewed by doing a long listing on the file.
- **Late work is not accepted**. There is no credit for any work turned in after the midnight deadline. If you don't complete a lab assignment, please turn in what you have, by the due date, for partial credit.
- Students may work together and collaborate on labs but they must submit their own work to get credit.
- Lab resources, instructors, and assistants are available in the CTC and CIS lab. In addition the Linux Opus server and the CIS VLab may be accessed from anywhere over the Internet.

The TBA portion of this course requires spending on average 4 hours and 5 minutes every week applying the skills learned during the lecture portion of the class.

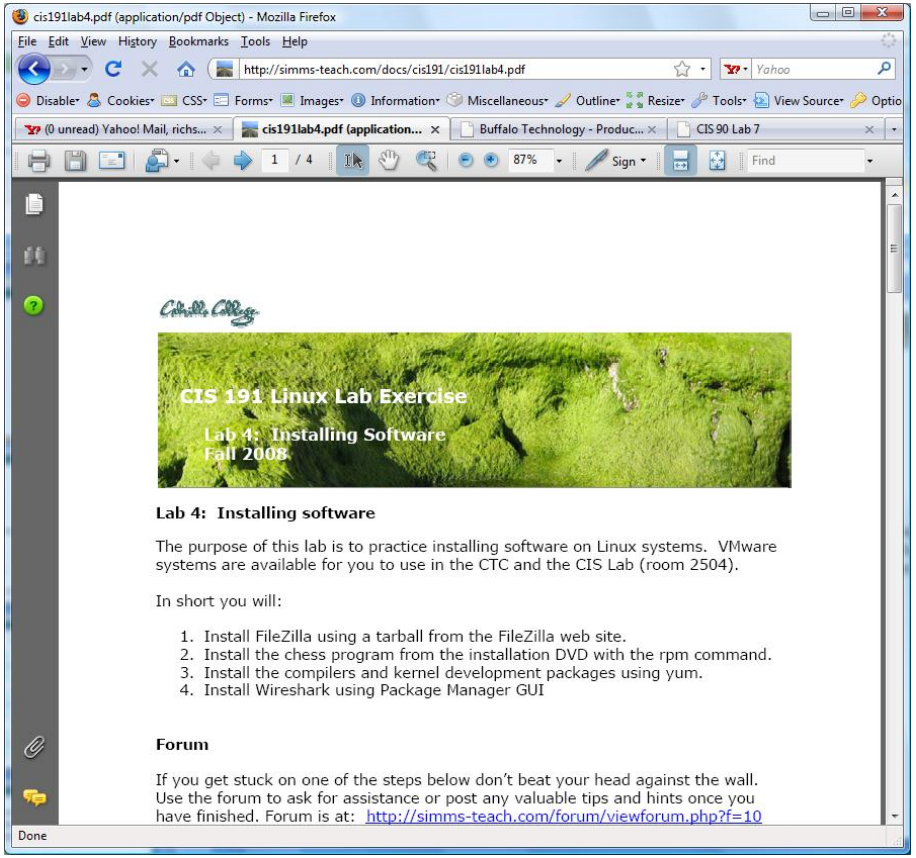
http://simms-teach.com/cis90calendar.php

		• Ping and SSH with IPv6 **Materials** • Presentation slides (download) • Apache web server example (show) • Logins Sheet (download) • Howto #303: Remote Access to the CIS VLab (download) • CIS VLab RDP file (download) **Assignment** • Student survey (download) • Lab 1 (Linux VMs) **CCC Confer** • Enter virtual classroom • Class archives		
1	10/25		12,14	
	10/31	**Last day to add CIS 192A**		
2	11/1	**Quiz 1** **ARP and the Internet Layer** • Review and use various tools for configuring an interface • Understand how address resolution works • Manage and track the arp cache • Sniff packets on the network with tcpdump and Wireshark • Understand the Internet layer (layer 3) and how addressing works • Hop from system to system using SSH • Understand how NAT/PAT works with private networks • Use several troubleshooting tools to diagnose problems **Materials** • Presentation slides (download)	12	Student survey Lab 1

Note: The first lab assignment and student survey is due by midnight of the next class meeting!

CIS 192

Lab Assignments



Pearls of Wisdom:

- Don't wait till the last minute to start.
- The *slower* you go the *sooner* you will be finished.
- A few minutes reading the forum can save you hour(s).
- Line up materials, references, equipment and software ahead of time.
- Use Google when trouble-shooting
- Late work is not accepted so submit what you have for partial credit.

More on Grading

"First Minute" quizzes (3 points each)

As an incentive to start class on time, 3 points are awarded for correctly answering 3 questions, in the correct order, at the very beginning of class.

- The quiz questions are shown on CCC Confer at **1:00PM** sharp.
- The quiz questions are given out in advance and students can use the forum to collaborate on answers prior to class.
- The **order of the questions** will not be known until the quiz is given! Emailed answers that are not in order will be marked as incorrect.
- Students may not give or ask others for assistance while taking a quiz.
- To take the quiz, students email the answers to the instructor.
- There are **no makeup's** for these quizzes and they **must be turned in within the first few minutes of class**.

More on Grading

Tests (30 points)

- Tests will be distributed by during the last half of the class.
- Full term courses like CIS 192AB or CIS 90 have three tests. Short term courses like 192A have one test.
- Tests are usually comprised of fill-in-the-blank type questions. Often you will have to use a Linux server to verify an answer.
- Tests are open notes, open book, and open computer.
- Tests are designed to take about an hour and be turned in at the end of class. To minimize "clock stress" you may continue to work on the test after class is over and turn it no later than midnight.

Students may not give or ask others for assistance while taking a test.

See the archived courses for an idea of what these tests are like

More on Grading

Final Exam (60 points)

- Students will deploy, configure and troubleshoot a network of Linux computers.
- There will be a list of network configuration specification tasks from which the student will choose a subset to implement for the exam.
- Final exams are open notes, open book, and open computer.

Students may not give or ask others for assistance while taking a final exam

See the archived courses for an idea of what these exams are like

More on Grading

Forum Posts (20 points per posting period)

- The end of each posting period is shown on the course calendar.
- Full term courses like 192AB or 90 have four posting periods. Short courses like 192A have two posting periods.
- Each post in the forum for this class is worth 4 points, up to 20 points maximum per period.
- The posts for the quarter will be due at midnight (Forum time) on the date shown on the course Calendar.
- Extra posts in one quarter do not carry over to the next quarter.
- Only posts in the forum for **this class** will be counted.

As far as earning points, forum posts are "low hanging fruit" !!

More on Grading

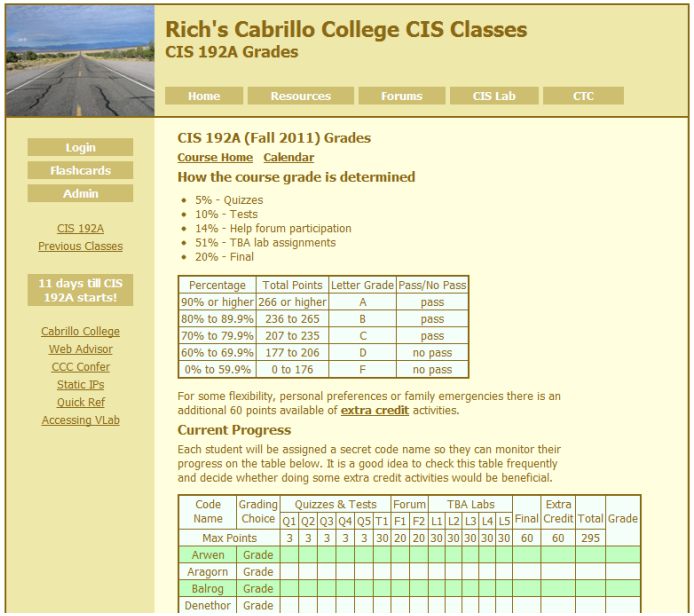
Extra credit

- You need to attend to a family emergency and can't turn in a lab assignment on time … don't worry!
- Your schedule/commute doesn't allow you to take any of the "first minute" quizzes …. don't worry!
- You crash and burn on a test … don't worry!
- You just don't like making forum posts … don't worry!
- There is a cap on extra credit points so plan carefully!

There are ample extra credit opportunities which provide you with the flexibility to get the grade you want.

Final word on Grading

- You control your grade for this course!
- Use the Grades web page to plan for the grade you wish to receive and track your progress.
- Use the Calendar web page to see due dates for all assignments.



Rich's Cabrillo College CIS Classes
CIS 192A Grades

Home | Resources | Forums | CIS Lab | CTC

Login | Flashcards | Admin

CIS 192A | Previous Classes

11 days till CIS 192A starts!

Cabrillo College | Web Advisor | CCC Confer | Static IPs | Quick Ref | Accessing VLab

CIS 192A (Fall 2011) Grades

Course Home Calendar

How the course grade is determined

- 5% - Quizzes
- 10% - Tests
- 14% - Help forum participation
- 51% - TBA lab assignments
- 20% - Final

Percentage	Total Points	Letter Grade	Pass/No Pass
90% or higher	266 or higher	A	pass
80% to 89.9%	236 to 265	B	pass
70% to 79.9%	207 to 235	C	pass
60% to 69.9%	177 to 206	D	no pass
0% to 59.9%	0 to 176	F	no pass

For some flexibility, personal preferences or family emergencies there is an additional 60 points available of **extra credit** activities.

Current Progress

Each student will be assigned a secret code name so they can monitor their progress on the table below. It is a good idea to check this table frequently and decide whether doing some extra credit activities would be beneficial.

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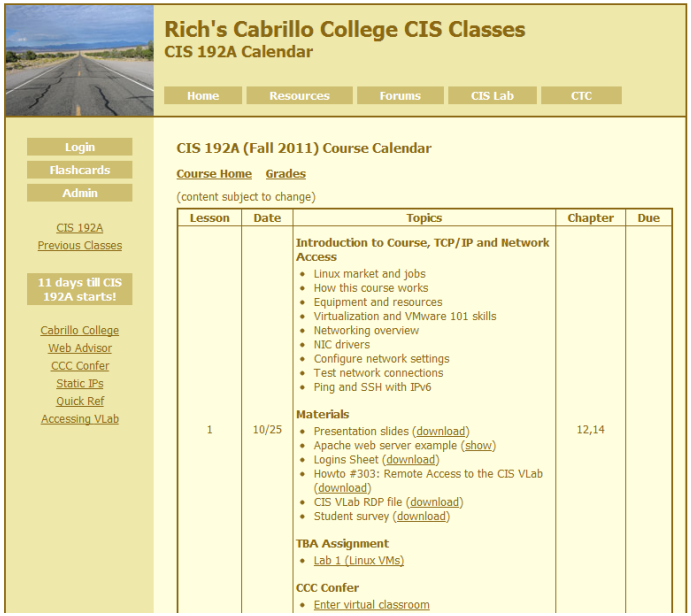
		Q1	Q2	Q3	Q4	Q5	T1	F1	F2	L1	L2	L3	L4	L5				
Max Points		3	3	3	3	3	30	20	20	30	30	30	30	30	60	60	295	
Arwen	Grade																	
Aragorn	Grade																	
Balrog	Grade																	
Denethor	Grade																	



Rich's Cabrillo College CIS Classes
CIS 192A Calendar

Home | Resources | Forums | CIS Lab | CTC

Login | Flashcards | Admin

CIS 192A | Previous Classes

11 days till CIS 192A starts!

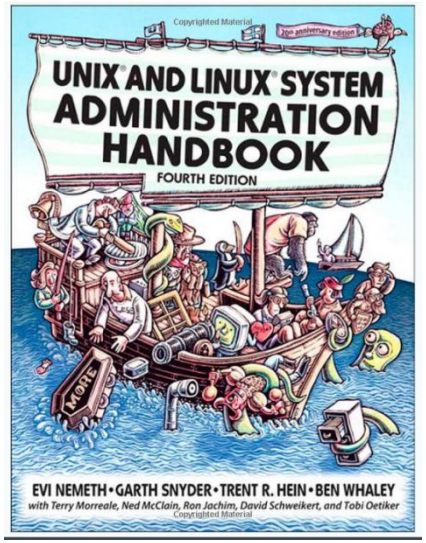
Cabrillo College | Web Advisor | CCC Confer | Static IPs | Quick Ref | Accessing VLab

CIS 192A (Fall 2011) Course Calendar

Course Home Grades

(content subject to change)

Lesson	Date	Topics	Chapter	Due
1	10/25	**Introduction to Course, TCP/IP and Network Access** • Linux market and jobs • How this course works • Equipment and resources • Virtualization and VMware 101 skills • Networking overview • NIC drivers • Configure network settings • Test network connections • Ping and SSH with IPv6 **Materials** • Presentation slides (download) • Apache web server example (show) • Logins Sheet (download) • Howto #303: Remote Access to the CIS VLab (download) • CIS VLab RDP file (download) • Student survey (download) **TBA Assignment** • Lab 1 (Linux VMs) **CCC Confer** • Enter virtual classroom	12,14	



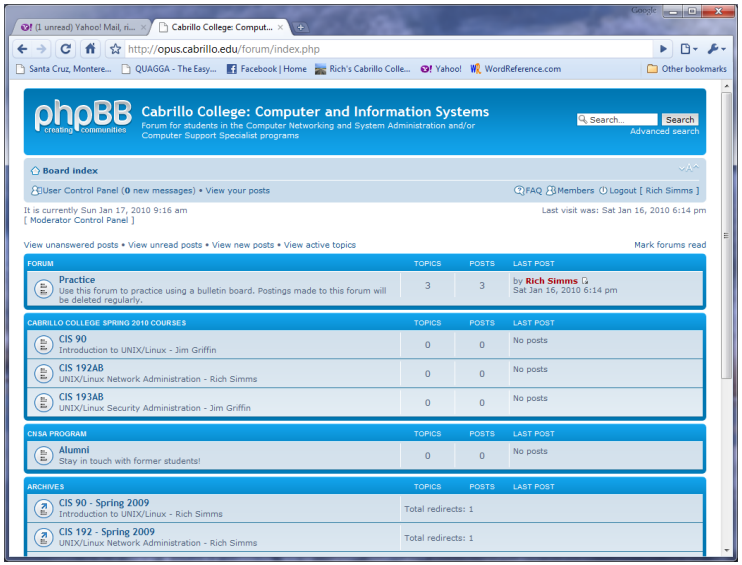
Optional Textbook:

UNIX and Linux System Administration Handbook (4th Edition)

- By: Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley
- Publisher: Prentice Hall
- ISBN-13: 978-0131480056

Help Forum

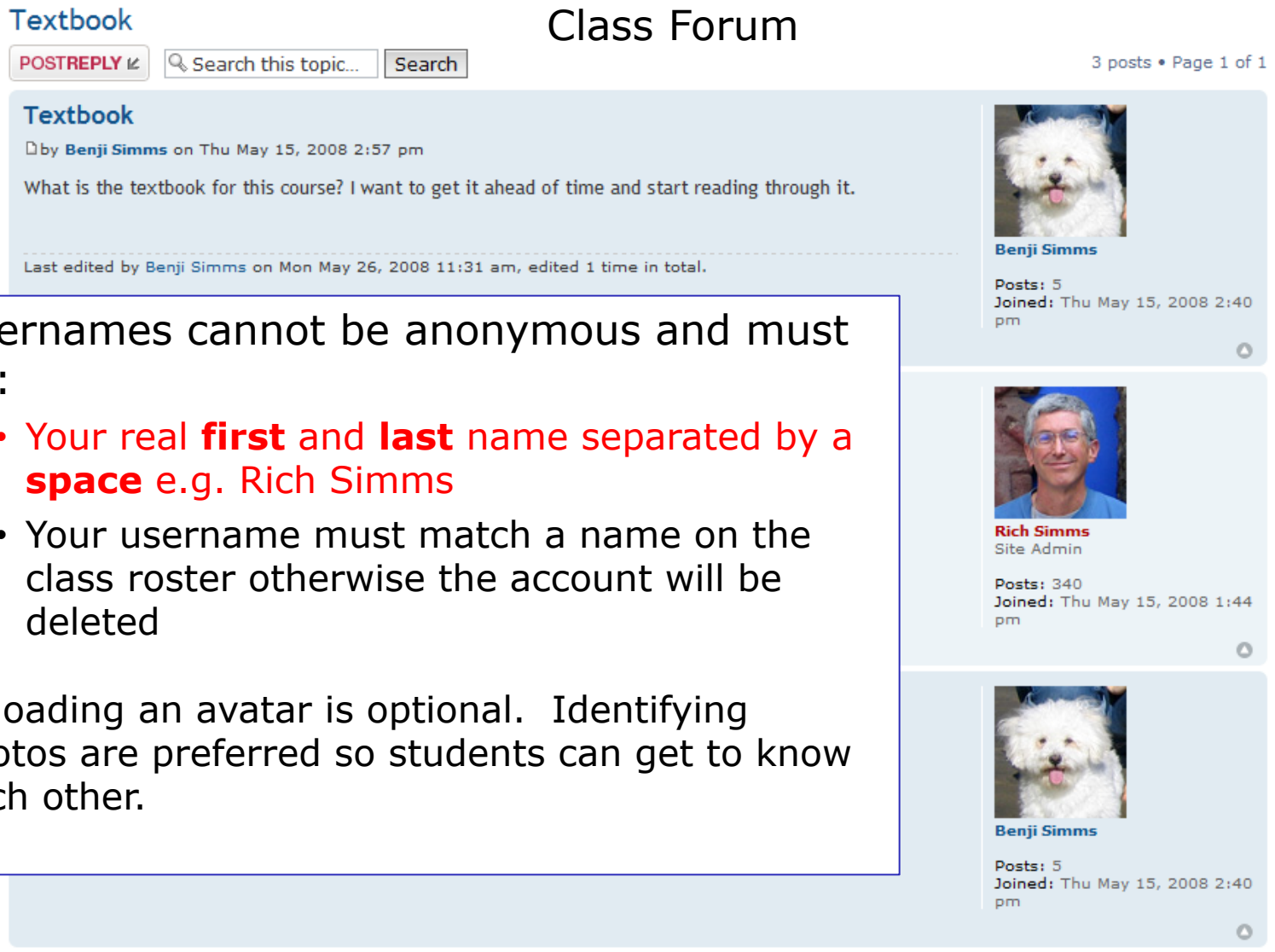
Online Help Forum



- Post questions and answers
- Share Linux information
- Post class notes for classmates who miss class
- Get clarifications
- Collaborate on quiz questions
- Share Linux information
- Never post passwords!

As an incentive to use the forum - students can earn 4 points per CIS 192A forum post (capped at 20 points for each posting period)

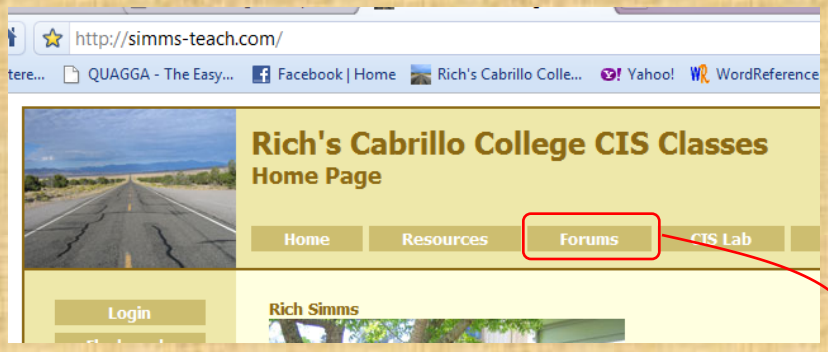
CIS 192
Class Forum



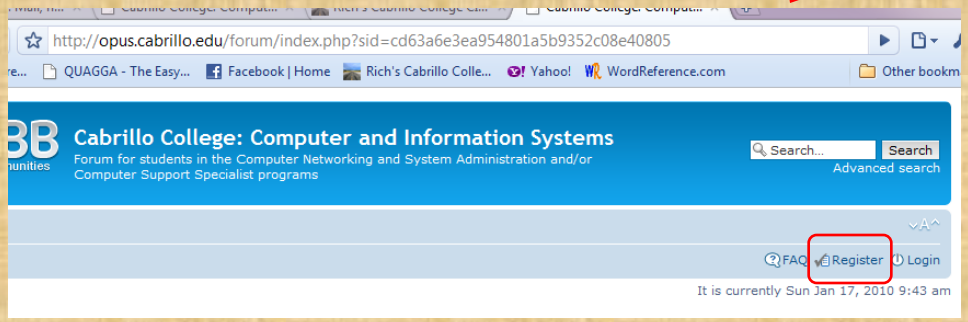
- Usernames cannot be anonymous and must be:
  - Your real **first** and **last** name separated by a **space** e.g. Rich Simms
  - Your username must match a name on the class roster otherwise the account will be deleted
- Uploading an avatar is optional. Identifying photos are preferred so students can get to know each other.

Class Activity
Forum Registration

There is a Forums link on **simms-teach.com**



Or browse to **opus.cabrillo.edu /forum**



To Register:

1. Browse to the forum
2. Click on the Register link
3. Review and agree to terms
4. For your **Username** to be accepted it **must** be:
   - your first and last name separated by a space e.g. Rich Simms
   - match a name on the class roster

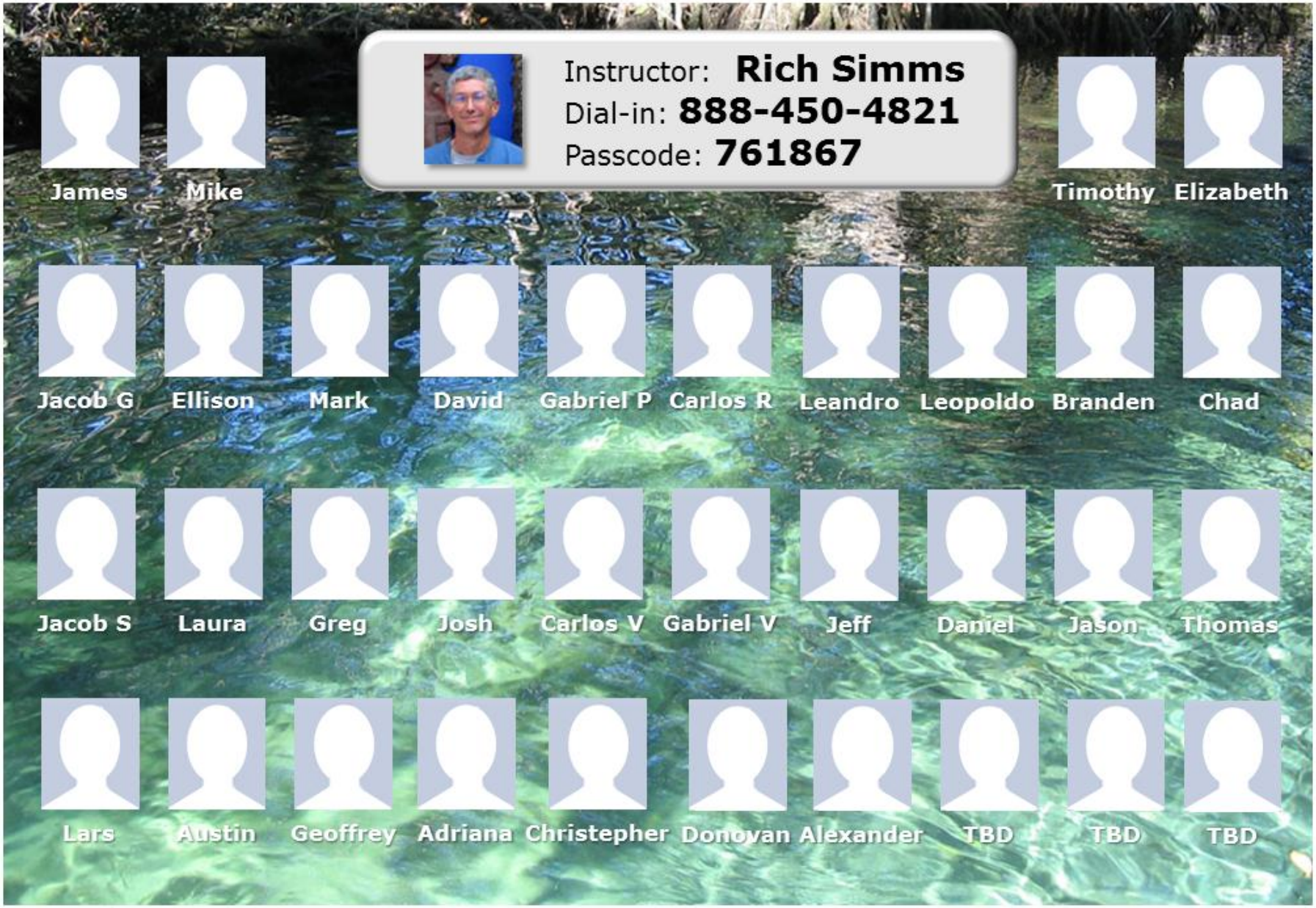
Note: Anonymous or incomplete user account names will be deleted!

Housekeeping

- Roll Call

Turn Recording Off

CIS 192A - Lesson 1



Email me (risimms@cabrillo.edu) a relatively current photo of your face for 3 points extra credit

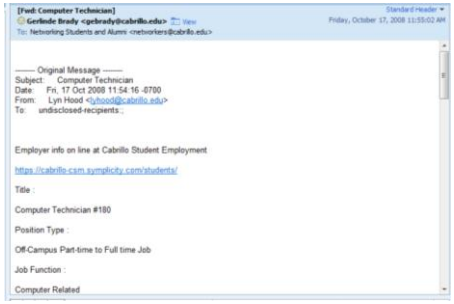
Turn Recording On

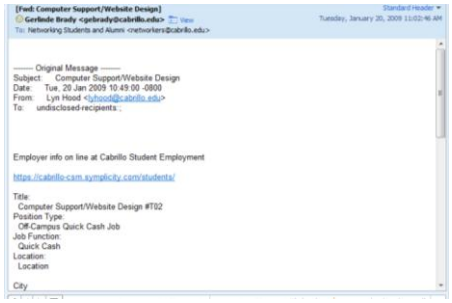
- Adds
- Last day to add is 10/31
- Classroom Perkins (VTEA) survey

Cabrillo Networking Program Mailing list

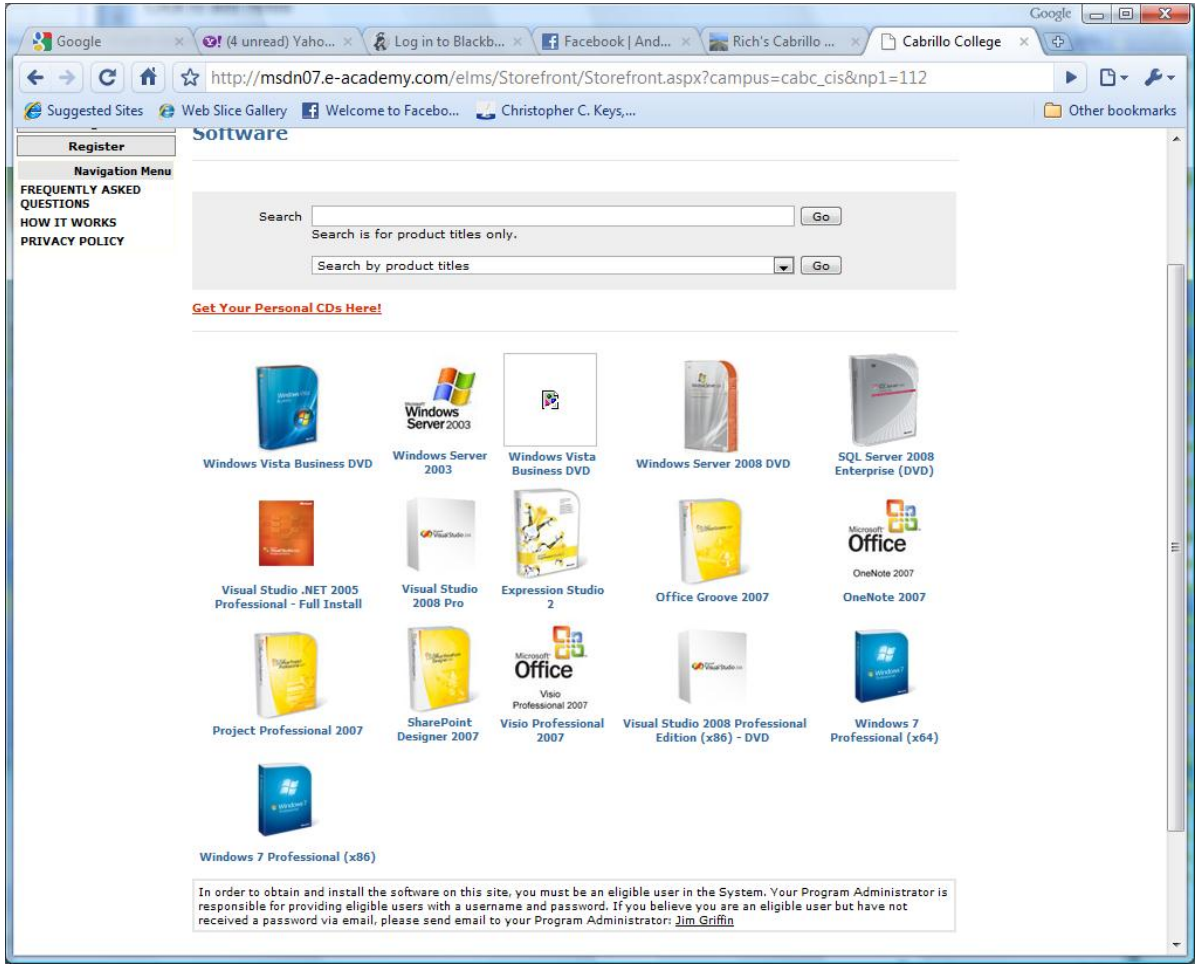
Subscribe to (no subject or body):

- **networkers-subscribe@cabrillo.edu**
- Program information
- Certification information
- Career and job information
- Short-term classes, events, lectures, tours, etc.
- Surveys
- Networking info and links





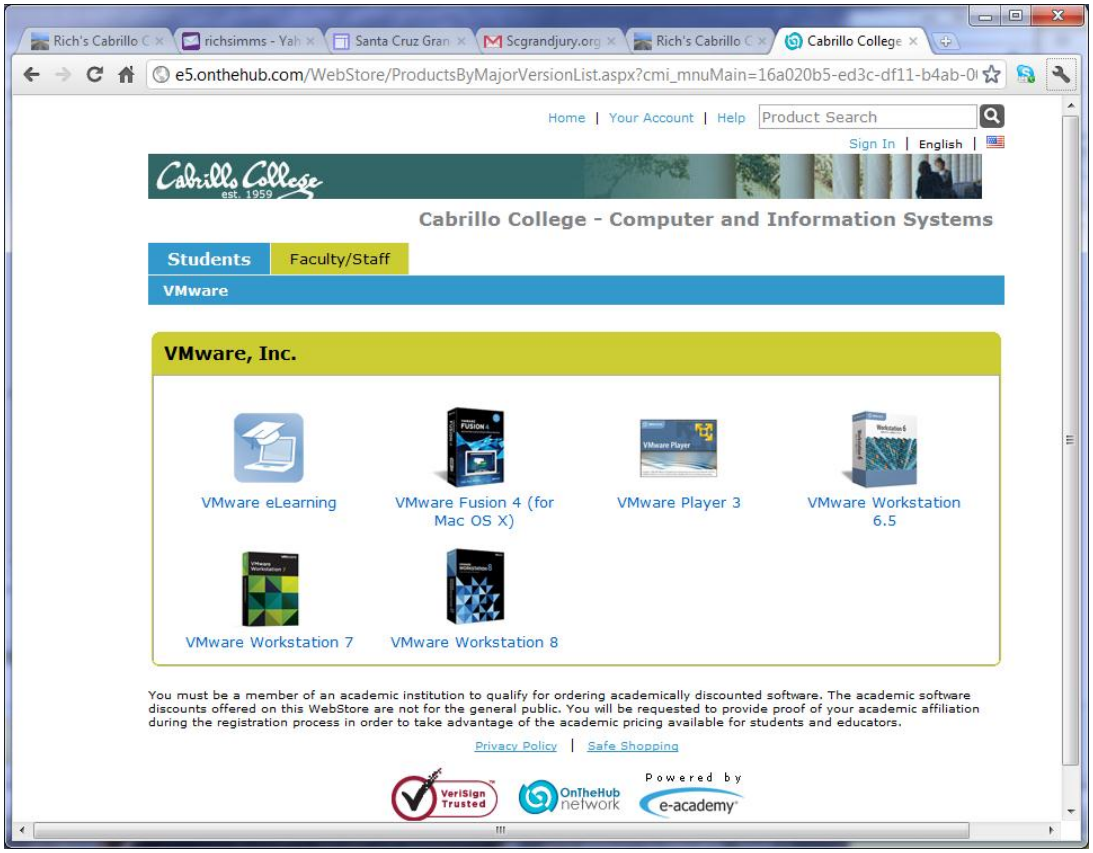
MSDN Academic Alliance



- Microsoft software for students registered in a CIS or CS class at Cabrillo
- Available after registration is final (two weeks after first class)

To get to this page, go to **http://simms-teach.com/resources** and click on the appropriate link in the Tools and Software section

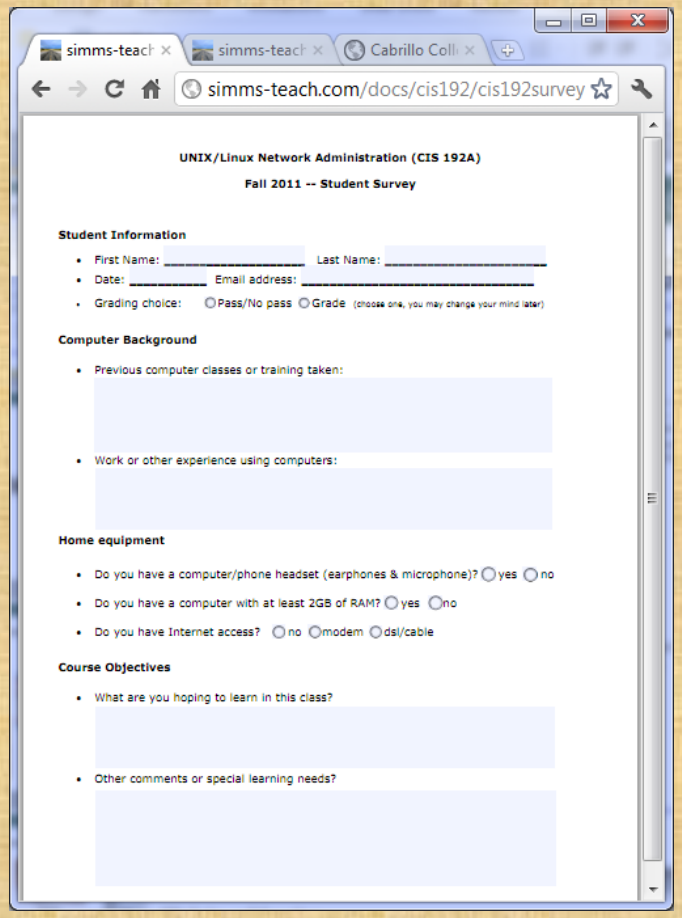
VMware e-academy



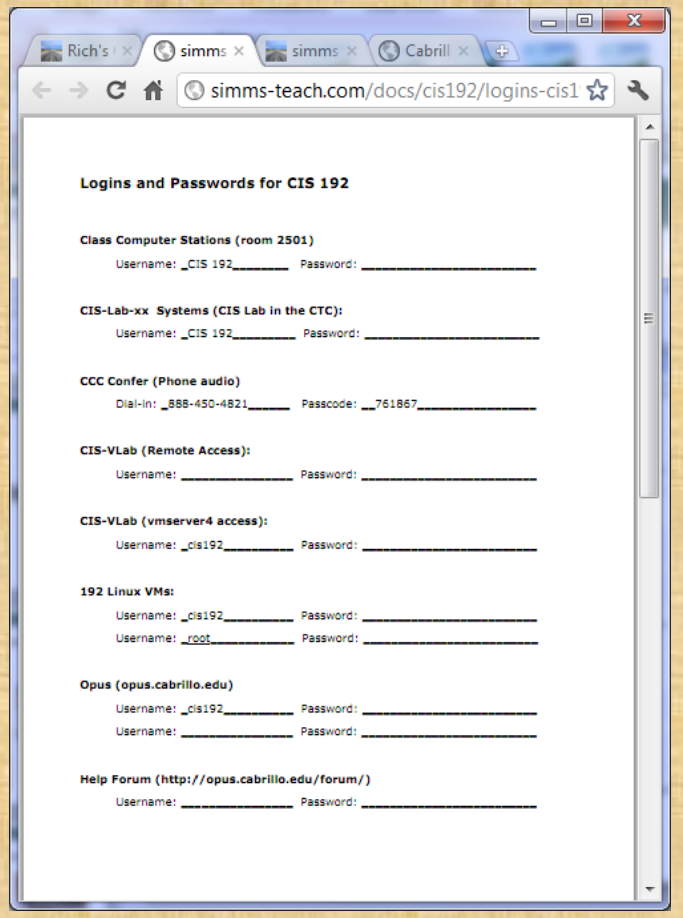
- VMware software for students registered in a CIS or CS class at Cabrillo
- Available after registration is final (two weeks after first class)

To get to this page, go to **http://simms-teach.com/resources** and click on the appropriate link in the Tools and Software section

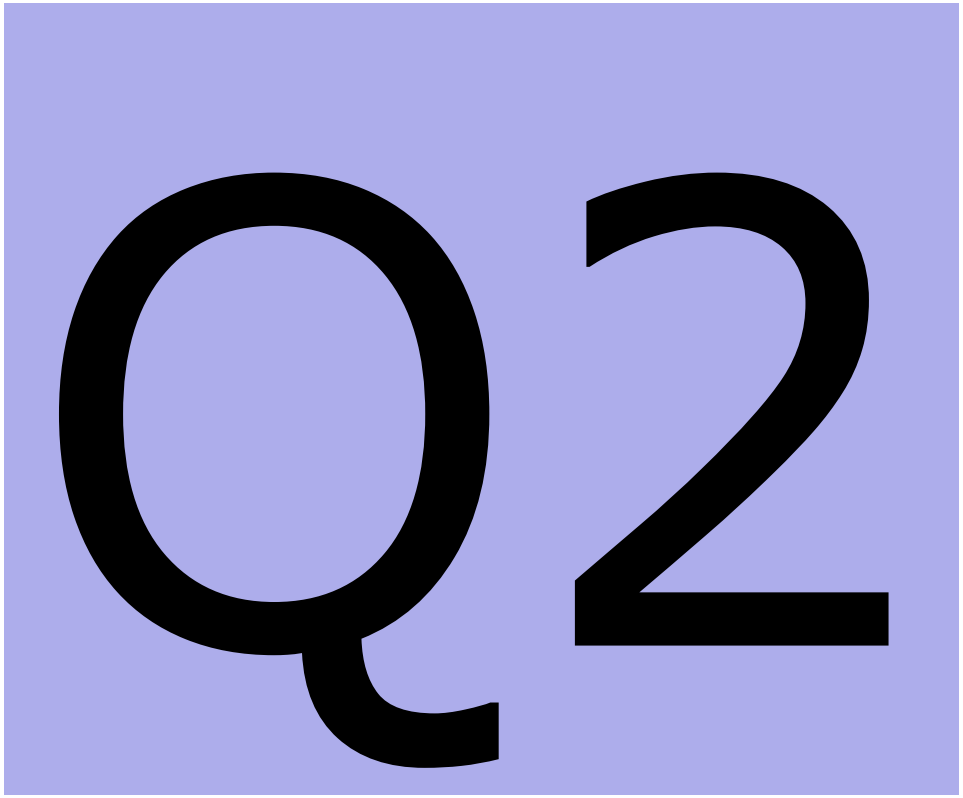
Student Survey and Logins Sheet



Download, fill out and email to risimms@cabrillo.edu



Download, fill out and keep for your own records



- UNIX/Linux market
- Equipment
- Login to Opus
- Login to CIS 192 VMs on school computers
- Login to CIS 192 VM remotely

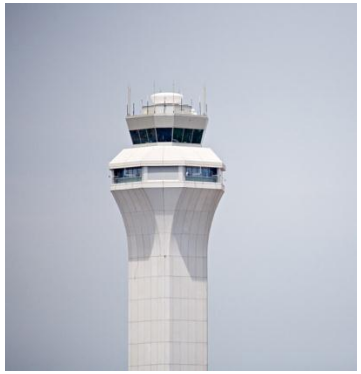
UNIX/Linux Market

Public Works Infrastructure

Roads

Water

Bridges



Airways

Power

Telecomunications

IT (Information Technology) Infrastructure

Network

Servers

Storage

Desktops

Mobile

Software

Computing Infrastructure
Where UNIX/Linux is used

- Internet services – Web servers, DNS, DHCP, Mail, etc.
- Enterprise and mission critical applications - Large databases, Enterprise Resource Management (ERM), Customer Relationship Management (CRM), data warehouse, manufacturing, supply chain management, etc.
- Hollywood - feature animation, visual effects, rendering farms.
- Scientific applications and number-crunching
- Embedded in smartphones and other appliances

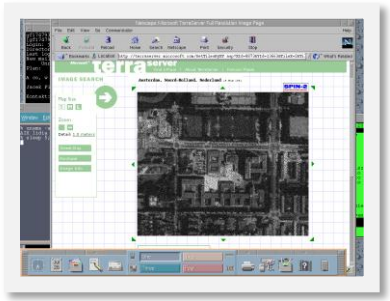
Operating Systems

Various UNIX Based Products

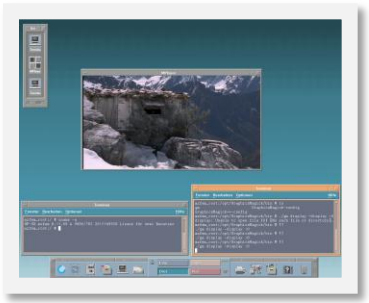
SCO UNIX

Berkeley Software Distribution

AIX



HP-UX



Solaris

Apple Mac OS X and iOS

The kernel is UNIX based

Operating Systems

Various Linux Distributions

OpenSUSE

Red Hat Enterprise Linux

Fedora

Debian

CentOS

Ubuntu

Mandriva

*Note: A distribution is built by a company or organization. They start with the **Linux kernel** then add a custom mix of open source components. They may then add some of their own unique software to differentiate their distribution.*

Tux, the penguin, is the Linux kernel mascot

Operating Systems
Embedding Linux in Products

Google Chrome OS
(coming soon)
for Netbooks and Tablets

Tivo

Buffalo
NAS storage

Android

MikroTik Routers

Operating Systems
Embedding UNIX in Products

Apple iOS

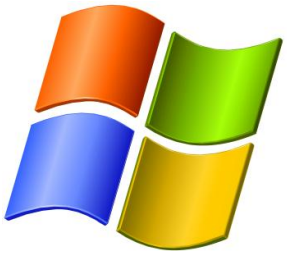
The Apple iOS, like Mac OS X, runs on a UNIX like kernel (Mach kernel + BSD components)

Source: http://en.wikipedia.org/wiki/Darwin_(operating_system)
http://en.wikipedia.org/wiki/IOS_(Apple)

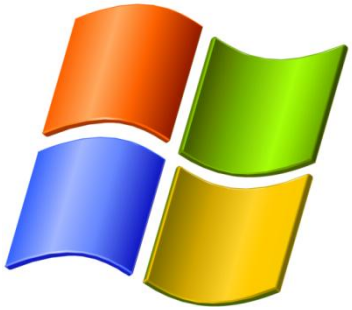
UNIX/Linux Overview

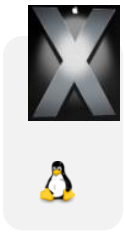
Server, PC, Smartphone markets

Servers



PC's

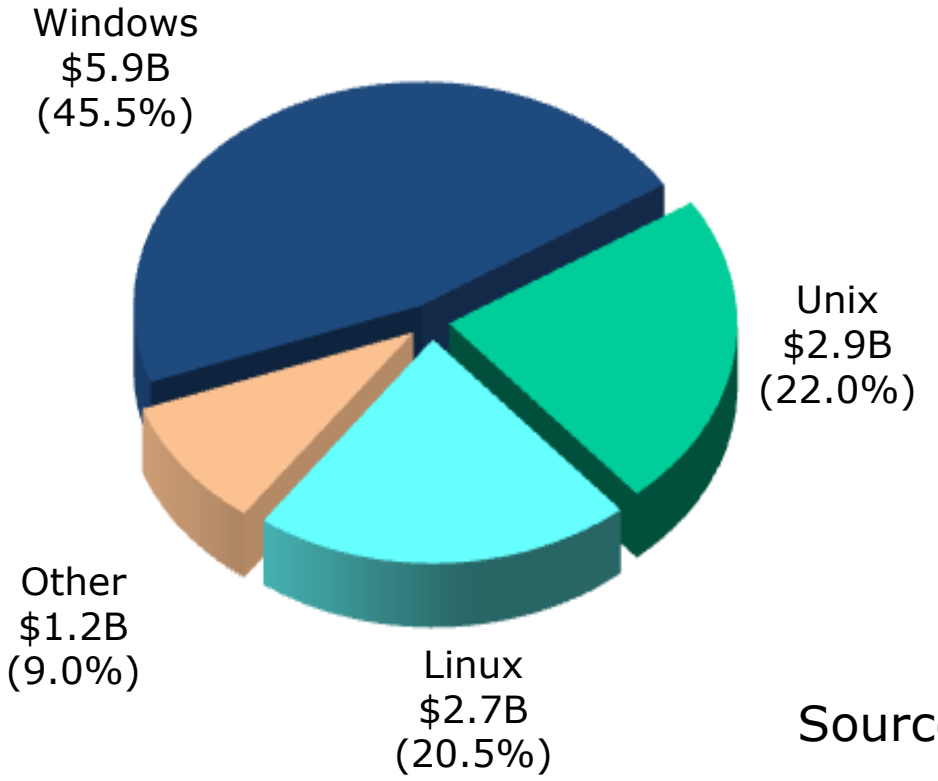




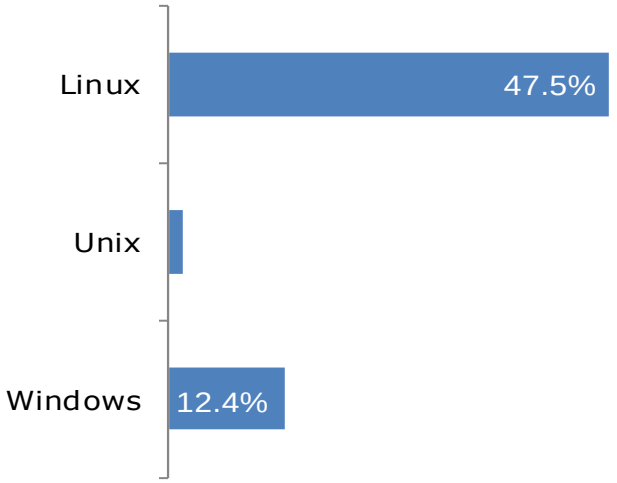
Smartphones

Worldwide Server Market

$13.2B Server Revenue 2Q 2011



Year over Year Change



Source: IDC, Aug 2011

http://www.idc.com/getdoc.jsp?containerId=prUS22998411

Worldwide "Ballpark" market for PCs

Website hits by OS

Jan 2009[1]

Operating Systems		
1	Windows XP	72.17%
2	Windows Vista	13.44%
3	Mac OS X	5.24%
4	Linux	2.13%
5	Windows 2000	2.12%
6	Windows 2003	0.68%
7	Windows 98	0.55%
8	Windows ME	0.22%
9	SymbianOS	0.12%
10	WAP	0.04%

Jul 2010[2]

Operating Systems		
1	Windows XP	48.17%
2	Windows 7	17.02%
3	Windows Vista	16.60%
4	Mac OS X	4.84%
5	Linux	1.45%
6	Windows 2003	1.02%
7	iPhone OSX	0.56%
8	Windows 2000	0.31%
9	WAP	0.12%
10	Android	0.08%

Aug 2011[3]

Operating Systems		
1	Windows XP	35.71%
2	Windows 7	33.77%
3	Windows Vista	10.34%
4	Apple OS X	8.69%
5	Apple iOS	2.88%
6	Linux	1.55%
7	Android	1.17%
8	BlackBerry	0.72%
9	SymbianOS	0.15%
10	Windows 2000	0.12%

1-This report was generated 12/31/2008 based on the last 53,892,847 unique visits to all tracked websites at that time. W3Counter's sample currently includes 19,174 websites. The last 25,000 page views to each website are analyzed to identify unique visits. Some visits may occur before the month of the report.

2 - This report was generated 07/31/2010 based on the last 15,000 page views to each website tracked by W3Counter. W3Counter's sample currently includes 38,996 websites. The browser market share graph includes data from all versions of the named browser families, not only the top 10 as listed below.

3-This report was generated 08/31/2011 based on the last 15,000 page views to each website tracked by W3Counter. W3Counter's sample currently includes 50,382 websites. The browser market share graph includes data from all versions of the named browser families, not only the top 10 as listed below.

W3Counter

source: http://www.w3counter.com/globalstats.php

Worldwide Smartphone Market

Table 2
Worldwide Smartphone Sales to End Users by Operating System in 2Q11
(Thousands of Units)

	Operating System	2Q11 Units	2Q11 Market Share (%)	2Q10 Units	2Q10 Market Share (%)
Google	Android ↑	46,775.9	43.4	10,652.7	17.2
Nokia	Symbian ↓	23,853.2	22.1	25,386.8	40.9
Apple	iOS ↑	19,628.8	18.2	8,743.0	14.1
Blackberry	Research In Motion ↓	12,652.3	11.7	11,628.8	18.7
Samsung	Bada ↑	2,055.8	1.9	577.0	0.9
	Microsoft ↓	1,723.8	1.6	3,058.8	4.9
	Others ↓	1,050.6	1.0	2,010.9	3.2
	Total	**107,740.4**	**100.0**	**62,058.1**	**100.0**

Source: Gartner (August 2011)

http://www.gartner.com/it/page.jsp?id=1764714
http://www.mobiletechreview.com/smartphone.htm

iso.linuxquestions.org

15 Most Popular Downloads

15 Most Downloaded Distribution Versions (last 30 Days)	15 Most Downloaded Distributions (Ever)
1. Ubuntu 11.04 (4436)	1. Fedora
2. CentOS 5.5 (1193)	2. Mandriva
3. Damn Small Linux 4.4.10 (1116)	3. Red Hat Enterprise Linux
4. Slackware Linux 13.37 (689)	4. SUSE
5. Fedora 11 (607)	5. Ubuntu
6. Fedora 8 (603)	6. Damn Small Linux
7. CentOS 5.4 (602)	7. CentOS
8. Red Hat Linux 8.0 (Psyche) (577)	8. Linux XP
9. Ubuntu 10.04.3 (507)	9. Knoppix
10. openSUSE 10.2 Live DVD (495)	10. Debian
11. KNOPPIX 5.1.1 (466)	11. Slackware
12. Debian 3.0r2 (woody) (390)	12. MEPIS
13. Fedora 15 (378)	13. PCLinuxOS
14. MandrakeMove 9.2 (351)	14. Gentoo
15. openSUSE 10.3 Live (344)	15. Linspire

There are hundreds of Linux distributions. The one thing they have in common is they all use the Linux kernel.

distrowatch.com

Top Ten Sep 2011

1. Ubuntu 11.04
2. Linux Mint 11
3. Fedora 15
4. Debian 6.0
5. openSUSE 11.4
6. Arch Linux 2011.08.19
7. PCLinuxOS 2010.12
8. CentOS 5.6
9. Mageia 1
10. Slackware 13.37
11. FreeBSD 8.2

Top Ten Jan 2010

1. Ubuntu 9.10
2. Fedora 12
3. openSUSE 11.2
4. Debian 5.0
5. Mandriva 2010
6. Linux Mint 8
7. PCLinuxOS 2009.2
8. Slackware 13.0
9. Gentoo 10.1
10. CentOS 5.4
11. FreeBSD 8.0

Top Ten Jan 2009

1. Ubuntu
2. openSUSE
3. Fedora
4. Debian
5. Mandriva
6. Linux Mint
7. PCLinuxOS
8. Slackware
9. Gentoo
10. CentOS
11. FreeBSD

CentOS is a clone distro of Red Hat Enterprise

Linux distros mentioned by top server vendors

Server market share source: IDC 2Q11 report

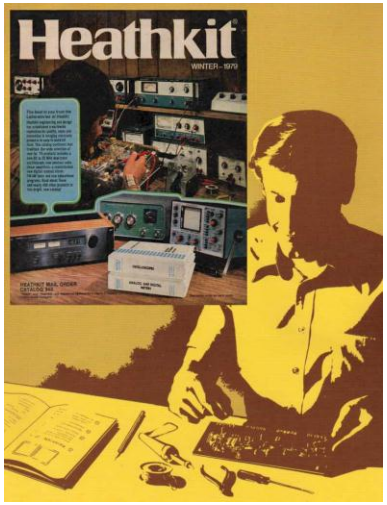
Vendor	IBM (30.5%)	HP (29.8%)	Dell (13.8%)	Oracle (7.2%)	Fujitsu (6.5%)
Red Hat Enterprise	✓	✓	✓	✓	✓
Novell SUSE	✓	✓	✓	✓	✓
Oracle Linux	✓	✓		✓	
Debian	✓	✓			✓
Asianux	✓	✓			
Ubuntu	✓	✓			✓
CentOS	✓	✓			
Fedora	✓	✓			
OpenSUSE	✓	✓			

For CIS 192 we will be using CentOS and Ubuntu VMs. Opus is a Red Hat Enterprise server. The Fang VM (for reserving VLab pods) is an openSUSE server. CentOS is built from Red Hat source code.

Equipment

Assembling components into solutions

Who likes building things?

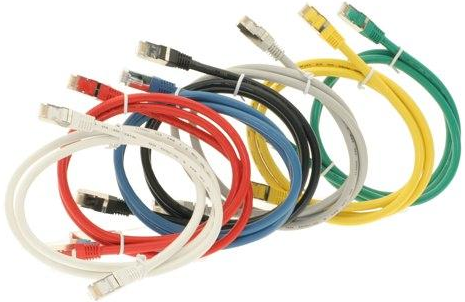


Assembling components into solutions

Servers and Clients

Rack

Routers



cables

Switches

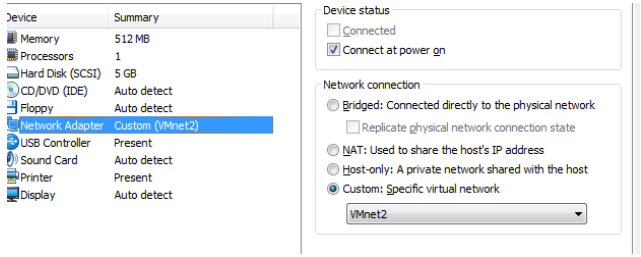
If you like building things, you will like this course!

Assembling components into solutions

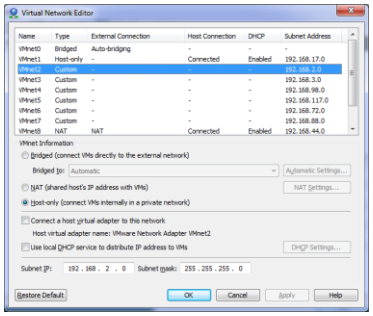
Servers and Clients
(using VMware VMs)

"Rack"
(Using one CIS Lab PC or one VLab VMware ESXi server)

Routers
(Using VMware Linux VMs)



Cables
(using VM Ethernet Settings)



Switches
(Using virtual networks)

We will use virtual equipment in this course so every student has lots of building blocks to play with!

Meet the CIS 192 Systems

Servers

Arwen

eth0 eth1

Elrond

eth0 eth1

Celebrian

eth0 eth1

Legolas

eth0 eth1

Opus

eth0

Clients

Frodo

eth0

Sauron

eth0

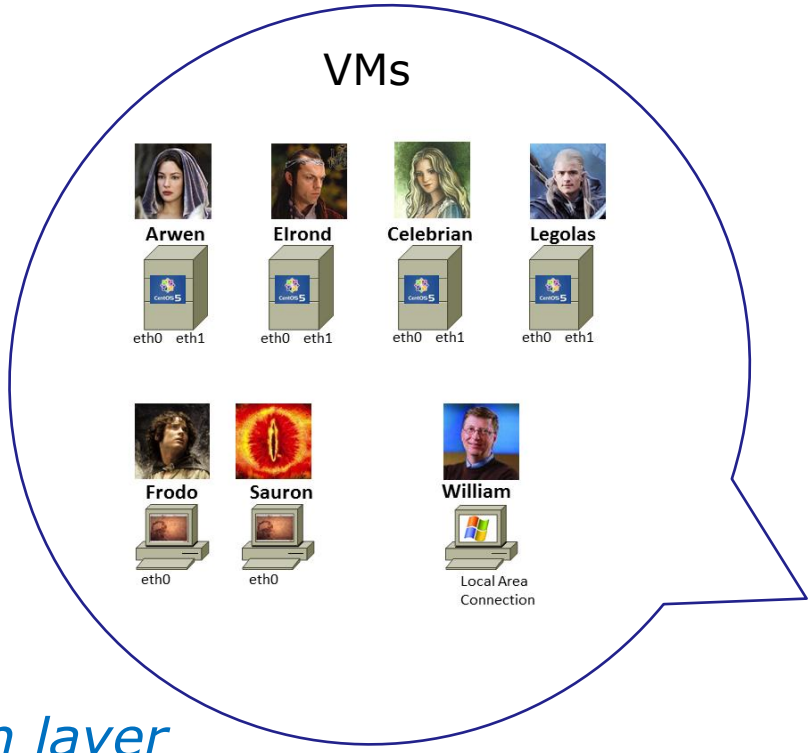
William

Local Area Connection

Fang

eth0

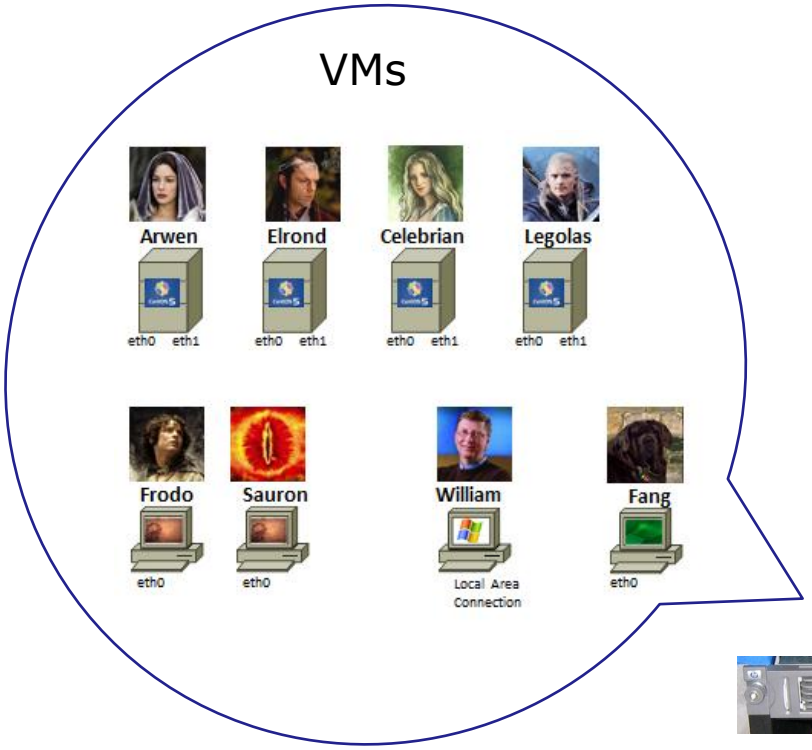
The VMs are located on each classroom and CIS Lab station (PC)



Classroom or Lab Stations (VMware Workstation station)

*The virtualization layer is provided by **VMware Workstation***

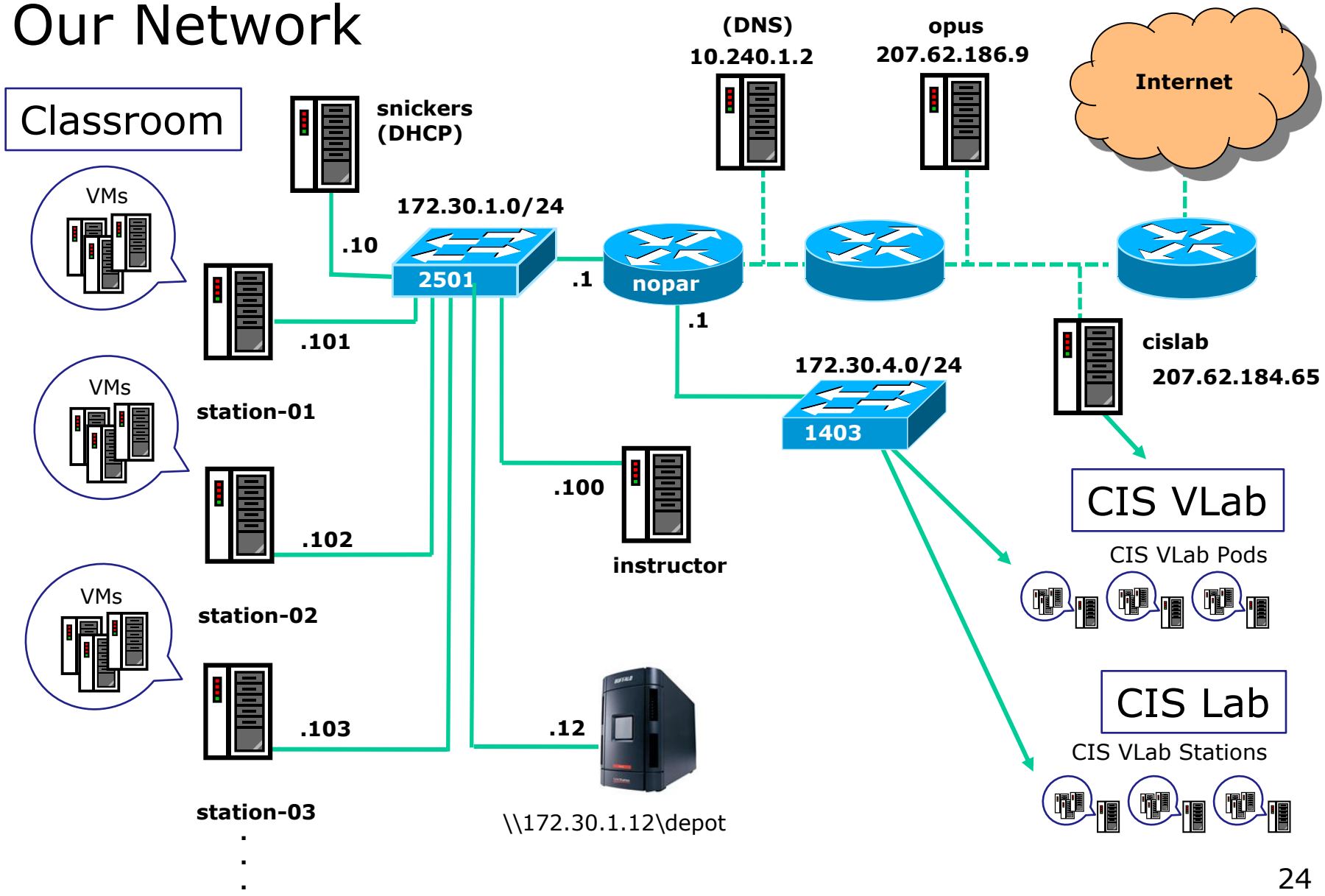
The VMs are also available remotely on a VLab server



Resource Pool "Pod" (VMware ESXi server)

*The virtualization layer is provided by **VMware ESXi***

Our Network


Classroom
snickers
(DHCP)
(DNS)
10.240.1.2
opus
207.62.186.9
Internet
VMs
172.30.1.0/24
.10
2501
.1
nopar
.1
.101
station-01
VMs
.102
station-02
VMs
.103
station-03
.
.
.
172.30.4.0/24
1403
cislab
207.62.184.65
.100
instructor
.12
\\172.30.1.12\depot
CIS VLab
CIS VLab Pods
CIS Lab
CIS VLab Stations

Lab Resources

CIS Lab (Room 1403 in CTC)

There are several **VMware Workstation stations** (labeled CIS-Lab-XX) along the walls in the CIS lab

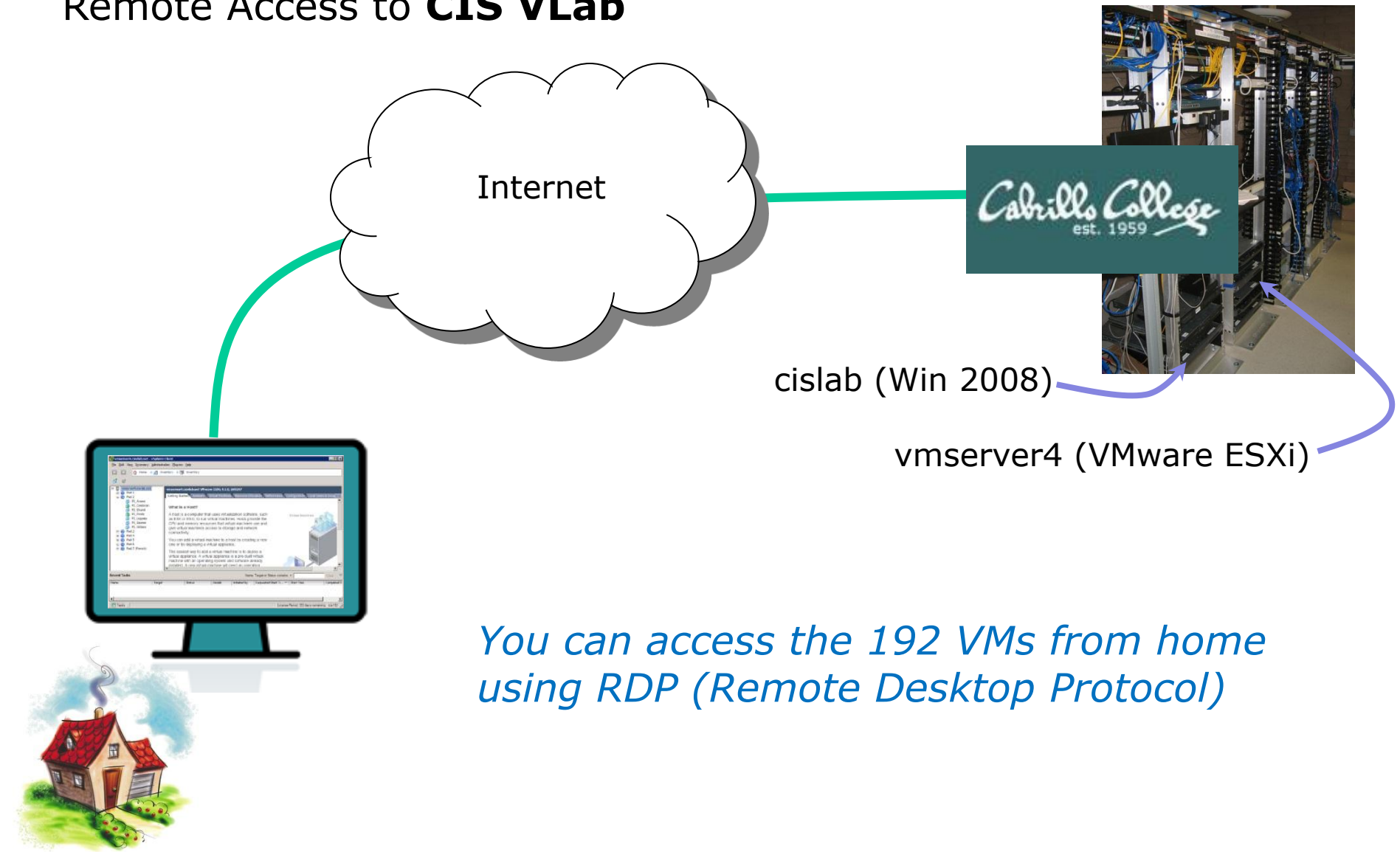
These systems are labeled as CIS-Lab-*XX*

Hours posted at: http://webhawks.org/~cislab/

Lab Resources

Remote Access to **CIS VLab**

Room 1403 on Aptos Campus



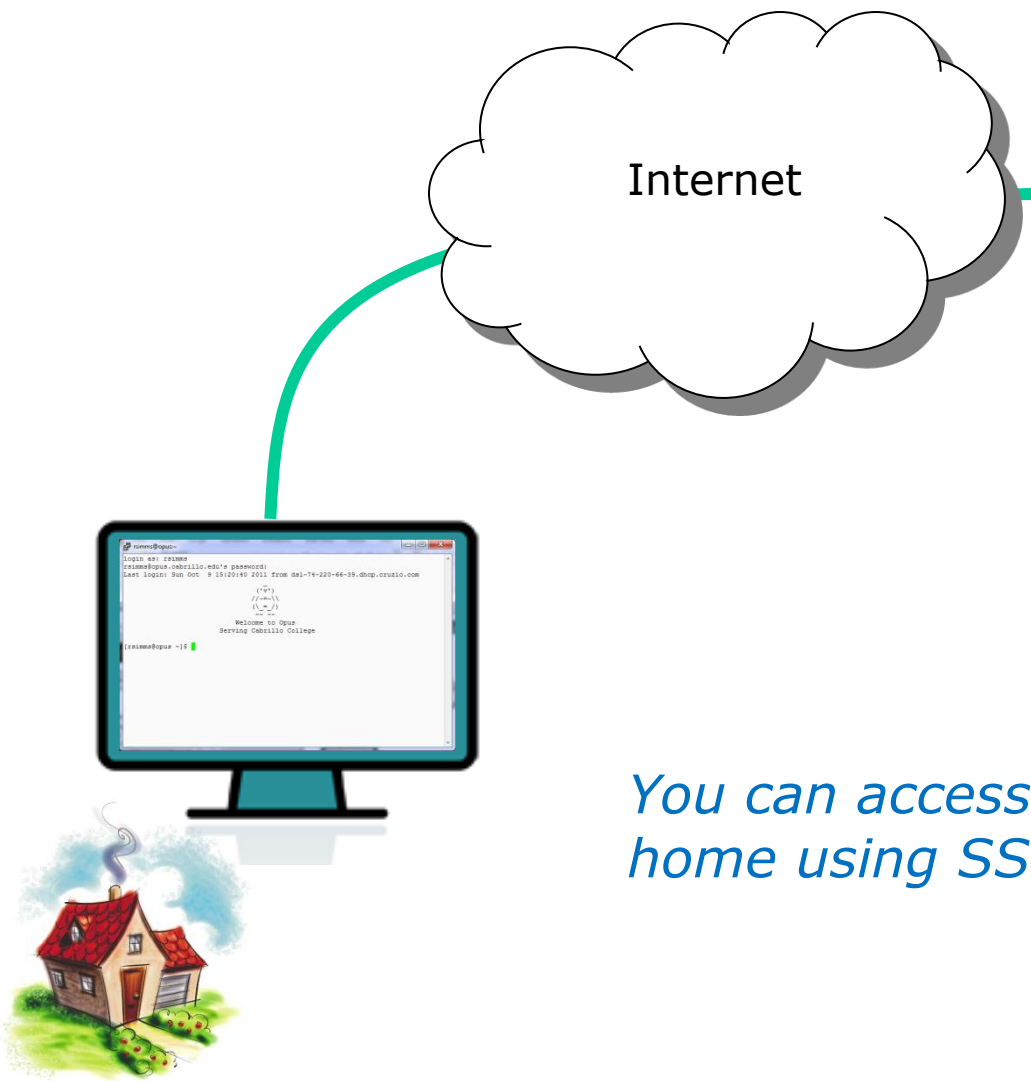
You can access the 192 VMs from home using RDP (Remote Desktop Protocol)

Lab Resources

Remote Access to **Opus**

Building 1200 on Aptos Campus

Red Hat Enterprise Linux Server



You can access the Opus server from home using SSH (Secure Shell protocol)

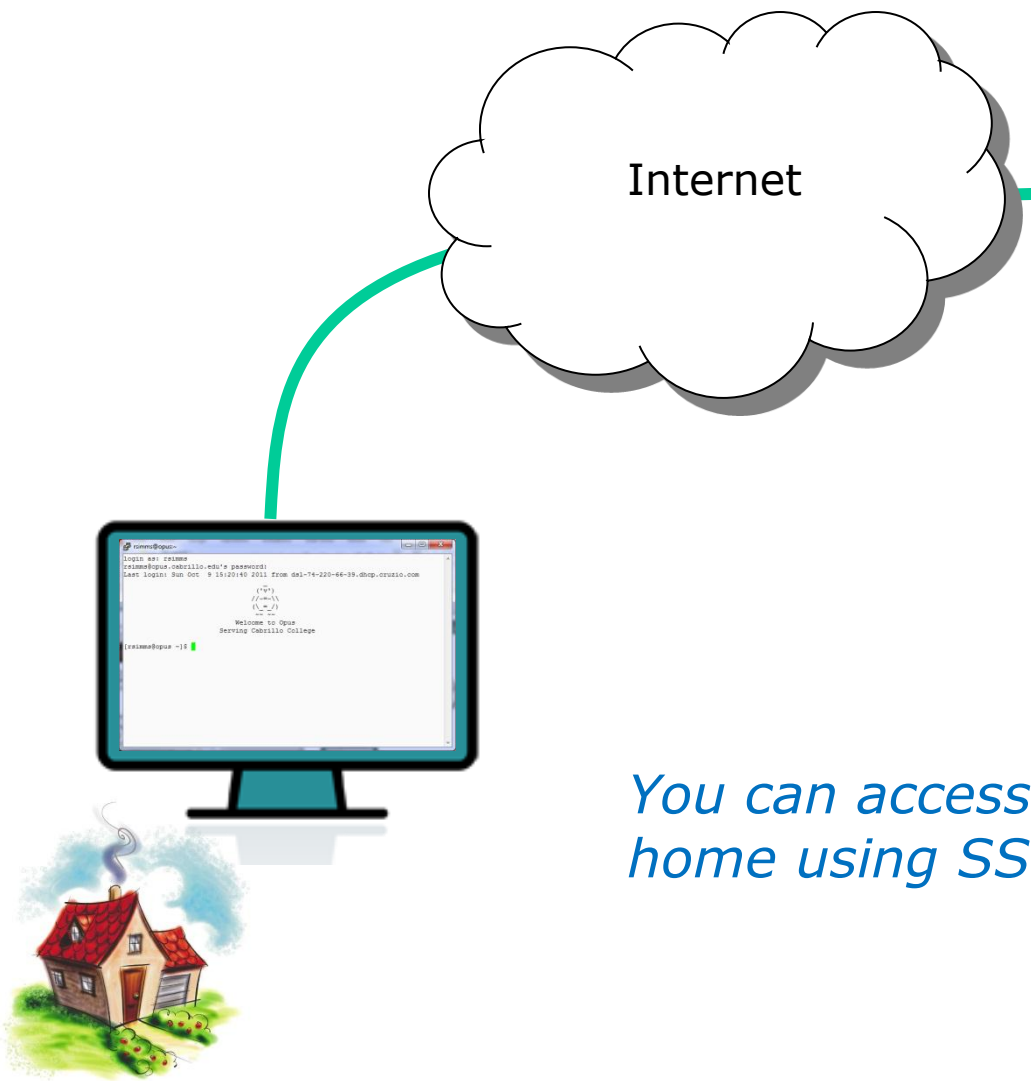
Opus

Lab Resources

Remote Access to **Opus**

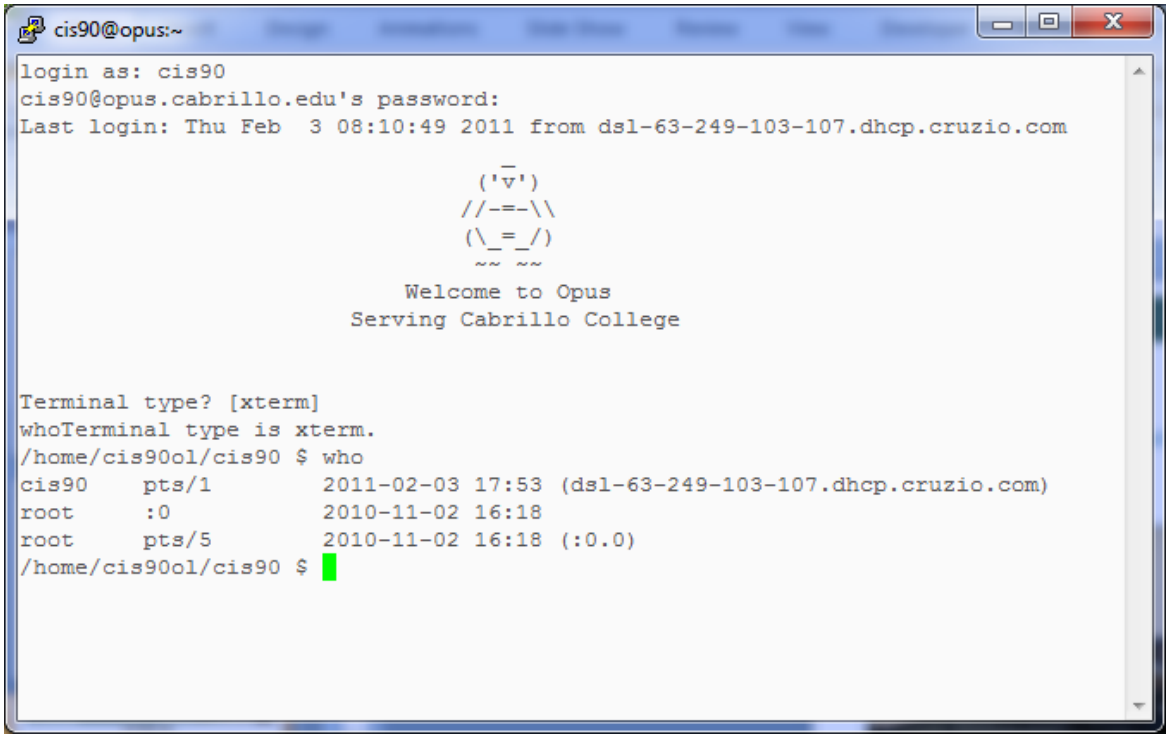
Building 1200 on Aptos Campus

Red Hat Enterprise Linux Server



You can access the Opus server from home using SSH (Secure Shell protocol)

Online Lab Resources
The Opus RHEL Server



Students can remotely log into Opus, a Red Hat Enterprise Linux server located on campus.

Students with Windows PC's will use Putty.

Students with Macs or Linux computers will use the ssh command from a terminal.

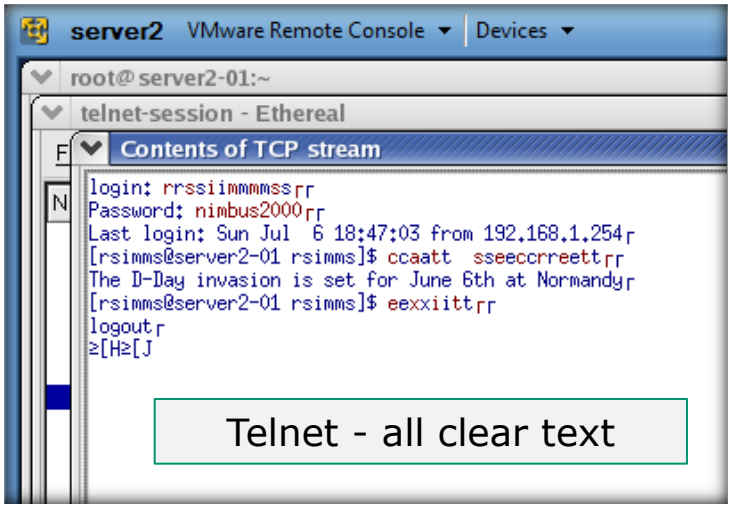
Note, all the lab assignments are submitted using Opus

Telnet vs SSH (Secure Shell)

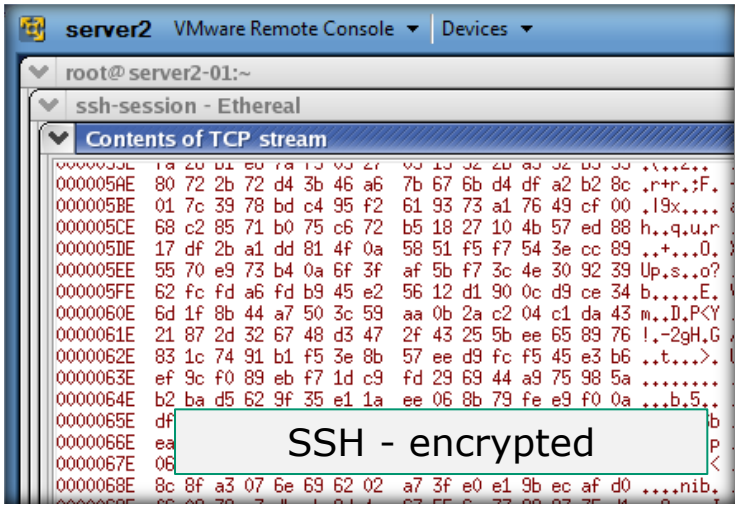
Remote computer

SSH is a network protocol that enables secure connections between computers

Sniffer view of a Telnet session



Sniffer view of a SSH session



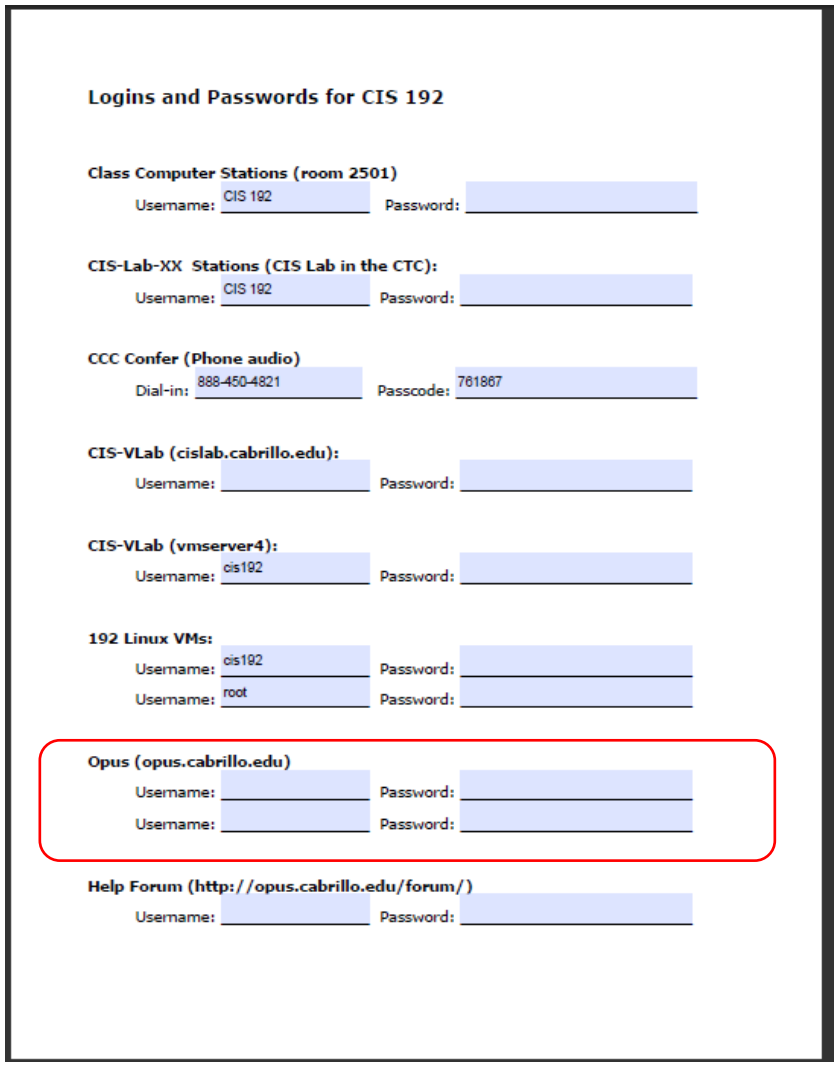
Local computer

With telnet, everything is transferred in clear text over the network

With ssh, it is encrypted.

Turn Recording Off

http://simms-teach.com/docs/cis192/logins-cis192.pdf



Logins and Passwords for CIS 192

Class Computer Stations (room 2501)
Username: CIS 192 Password:

CIS-Lab-XX Stations (CIS Lab in the CTC):
Username: CIS 192 Password:

CCC Confer (Phone audio)
Dial-in: 888-450-4821 Passcode: 761867

CIS-VLab (cislab.cabrillo.edu):
Username: Password:

CIS-VLab (vmserver4):
Username: cis192 Password:

192 Linux VMs:
Username: cis192 Password:
Username: root Password:

Opus (opus.cabrillo.edu)
Username: Password:
Username: Password:

Help Forum (http://opus.cabrillo.edu/forum/)
Username: Password:

Student Survey and Logins Sheet

You will need your Opus username and password for the next activity

You can use the logins sheet to record your account information

Turn Recording On

Class Activity
Logging into Opus

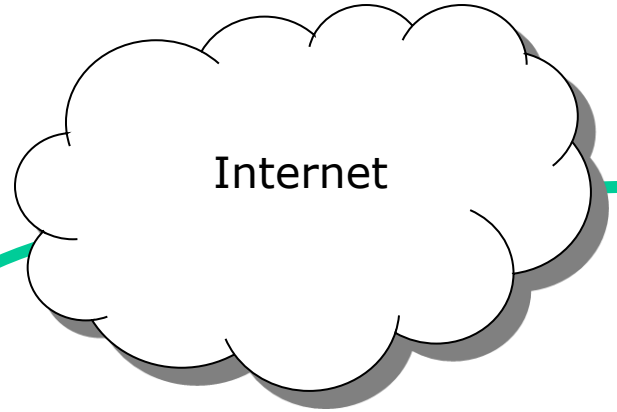
Live Opus Demo

VLab

Lab Resources

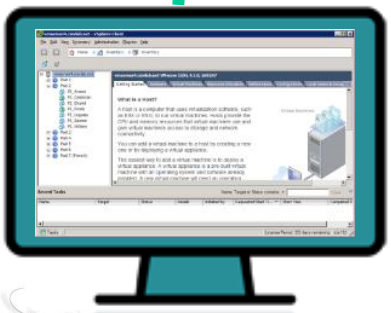
Remote Access to CIS VLab

Room 1403 on Aptos Campus



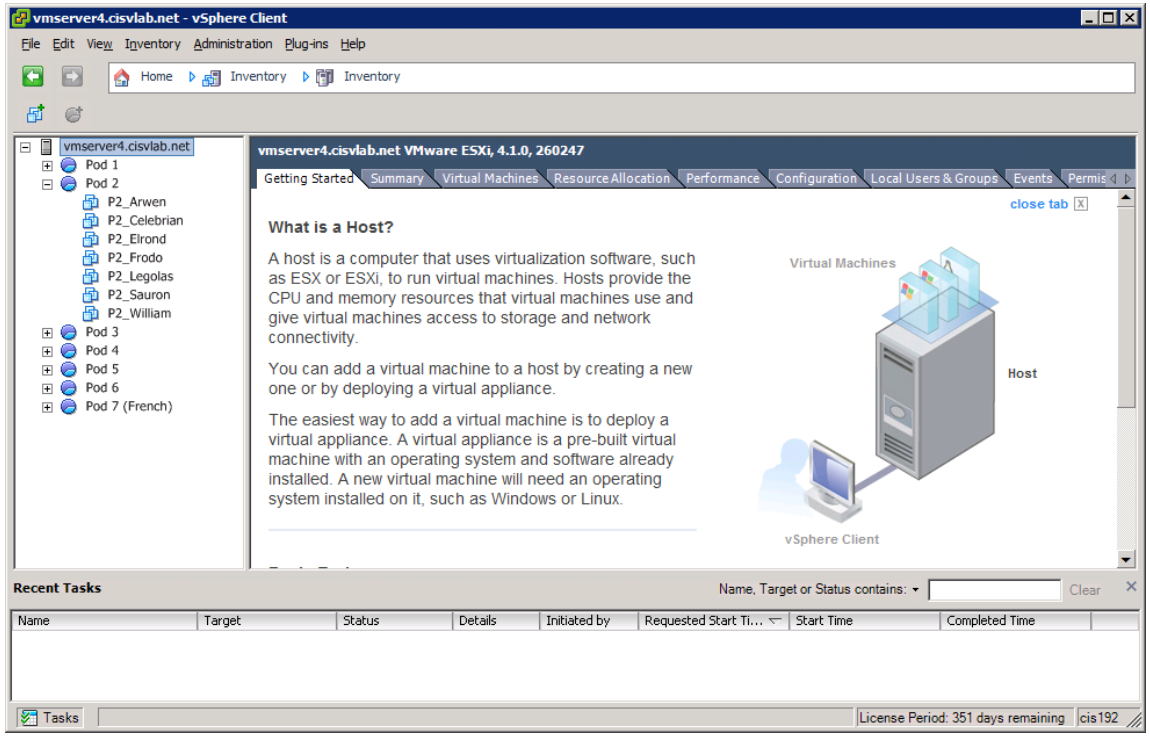
cislab (Win 2008)

vmserver4 (VMware ESXi)



You can access the 192 VMs from home using RDP (Remote Desktop Protocol)

Online Lab Resources
CIS VLab



VMware vSphere Client connected to VMware ESxi server

Students can remotely log into the CIS VLab

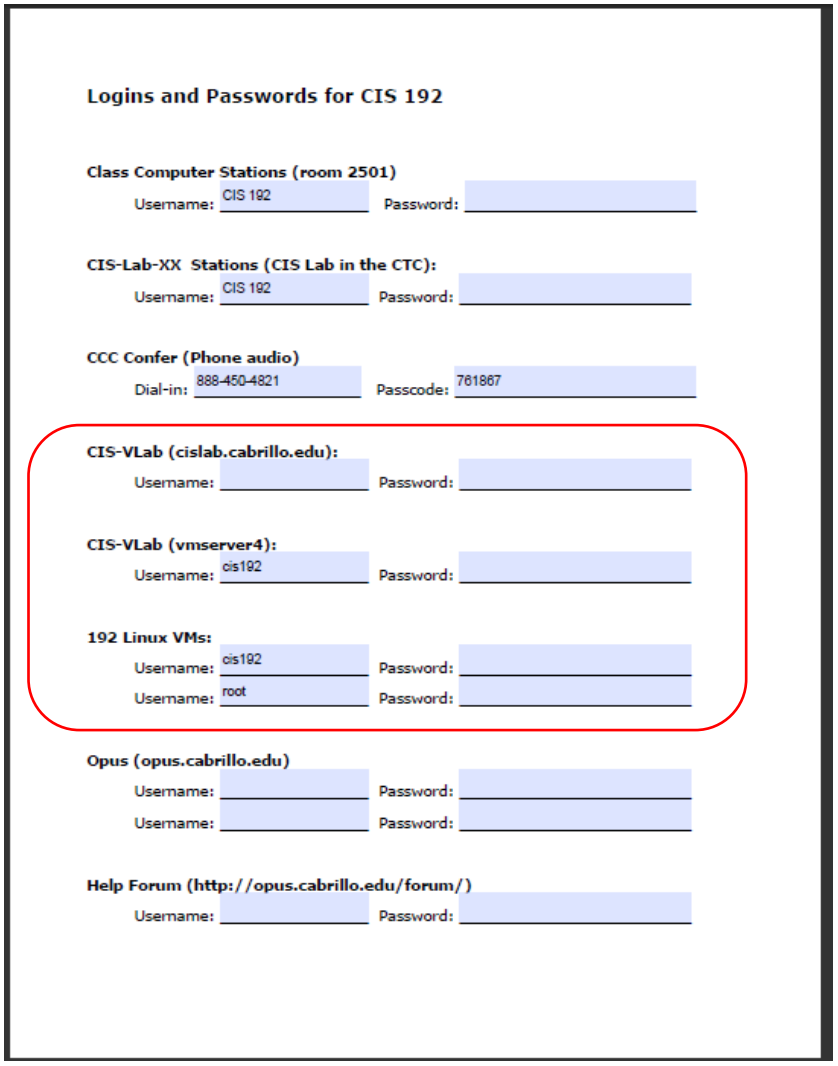
Students with Windows PC's need no additional software

Students with Macs will need to install CoRD

Note, all lab assignments are done using the 192 VMs in the CIS Lab (room 1403) or remotely using VLab

Turn Recording Off

http://simms-teach.com/docs/cis192/logins-cis192.pdf



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Username: cis192 Password:
Username: root Password:

Opus (opus.cabrillo.edu)
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Username: Password:

Help Forum (http://opus.cabrillo.edu/forum/)
Username: Password:

Student Survey and Logins Sheet

You will need your username and password for:

- CIS-Vlab
- vmserver4
- 192 Linux VMs

You can use the logins sheet to record your account information

Turn Recording On

Class Activity
Logging into CIS Vlab

Live Demo

Classroom and CIS Lab Workstations

Lab Resources

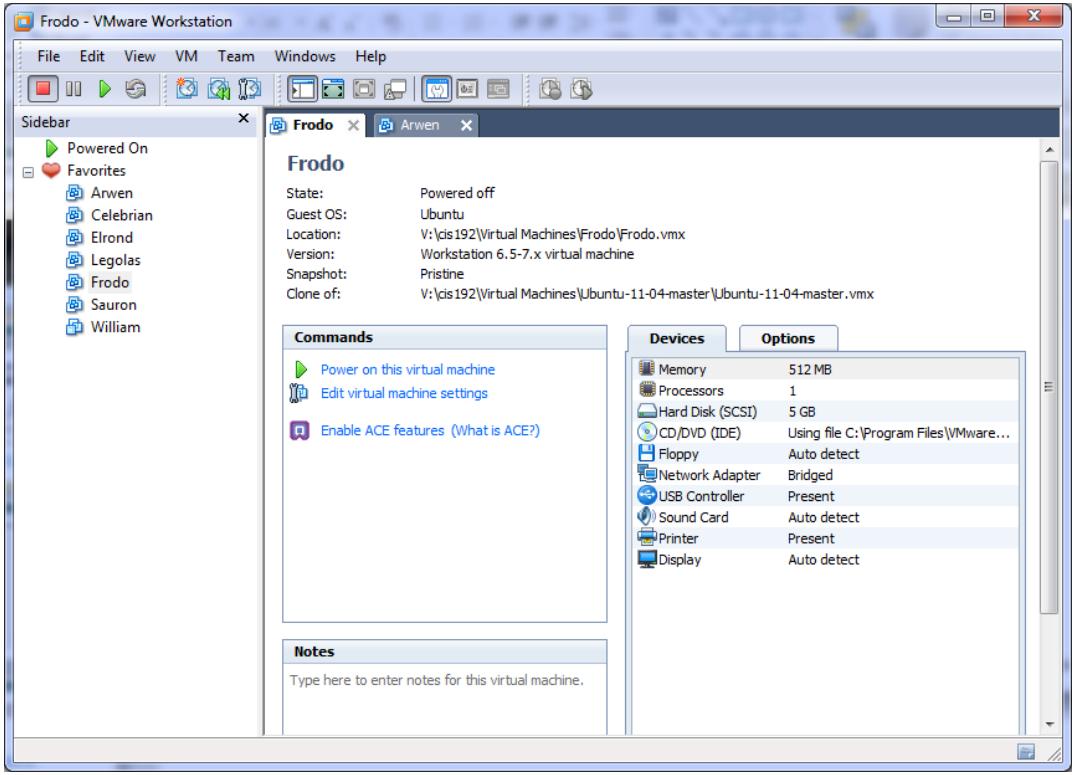
CIS Lab (Room 1403 in CTC)

There are VMware stations (labeled CIS-Lab-XX) along the back and side walls in the CIS lab

These stations are labeled as CIS-Lab-*XX*

Hours posted at: http://webhawks.org/~cislab/

CIS Lab Workstations



VMware Workstation

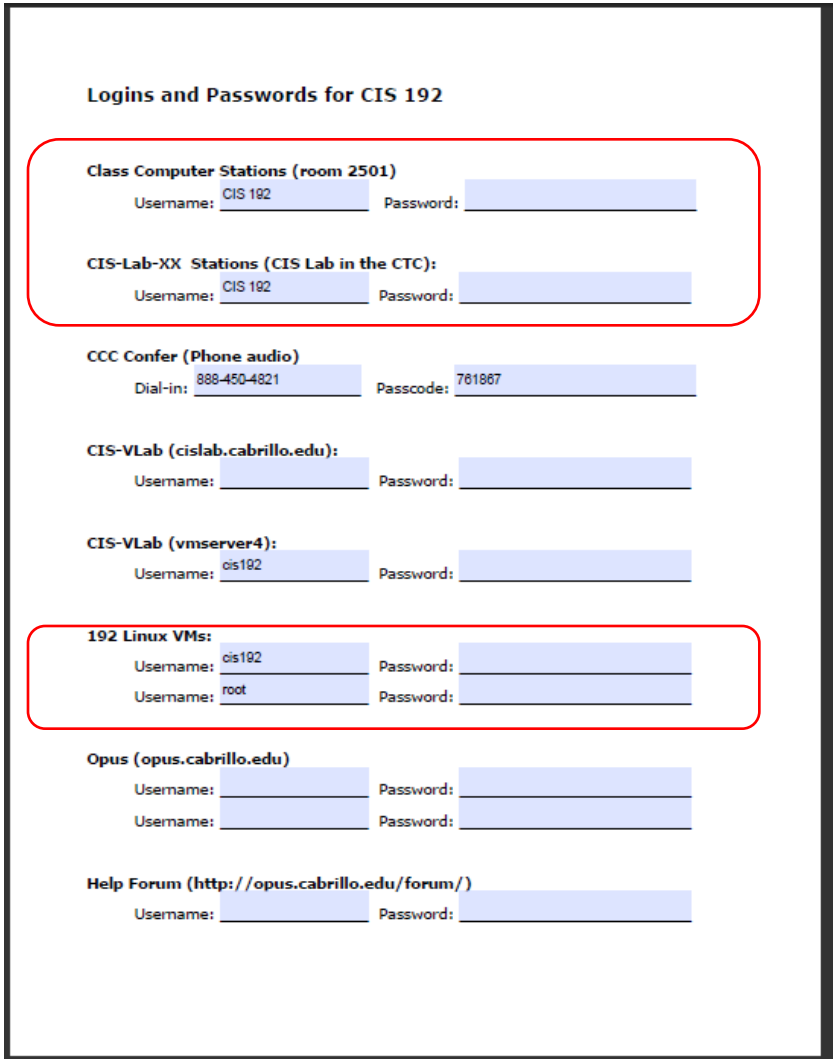
Each station in the classroom and CIS Lab has VMware Workstation installed

All the CIS 192 VMs are available

Instructors and lab assistants are available in the CIS Lab for help doing labs

Note, all lab assignments are done using the 192 VMs in the CIS Lab (room 1403) or remotely using VLab

http://simms-teach.com/docs/cis192/logins-cis192.pdf



Logins and Passwords for CIS 192

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Username: root Password:

Opus (opus.cabrillo.edu)
Username: Password:
Username: Password:

Help Forum (http://opus.cabrillo.edu/forum/)
Username: Password:

Student Survey and Logins Sheet

You will need your username and password for:

- Classroom stations
- CIS-Lab-XX stations
- 192 Linux VMs

You can use the logins sheet to record your account information

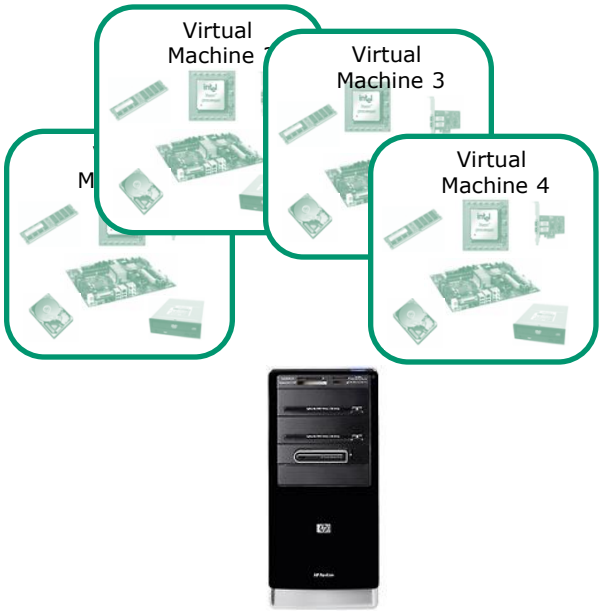
Class Activity
Using VMware Workstation VMs

Live Demo

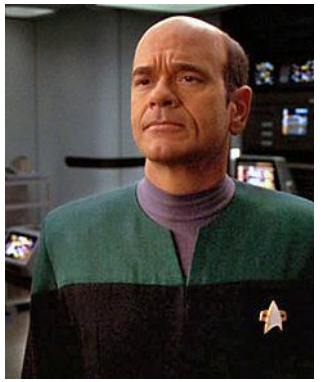
Virtualization

What is a virtual machine?

- **Virtualization software** or **Hypervisors** allow a real computer to create and simulate multiple virtual computers.
- The simulated computers are called **virtual machines** or **VMs**.
- VMWare, MS Virtual Server, VirtualBox, Xen and KVM are all examples of **Hypervisors**.



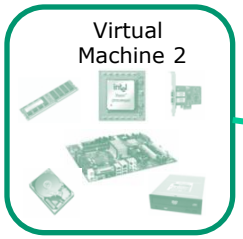
- You load an OS (operating system) and applications on a virtual machine just like you would any other computer.
- The OS and apps do not even know they are not running on a "real" computer.
- Over the network the virtual machines appear just like any other computer.

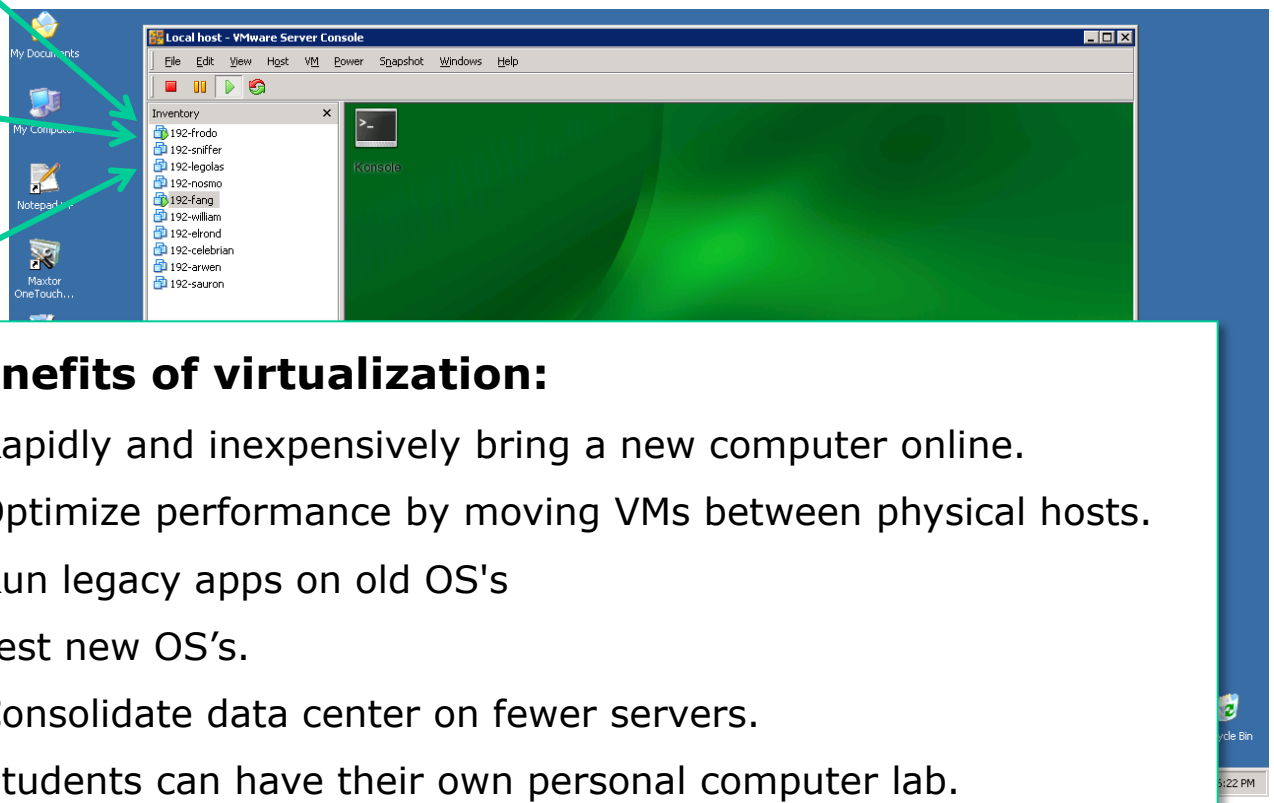


The EMH doctor on Star Trek Voyager was a simulation

Virtual Machines

Multiple OS's on one computer
… running at the same time
… sharing the same physical hardware

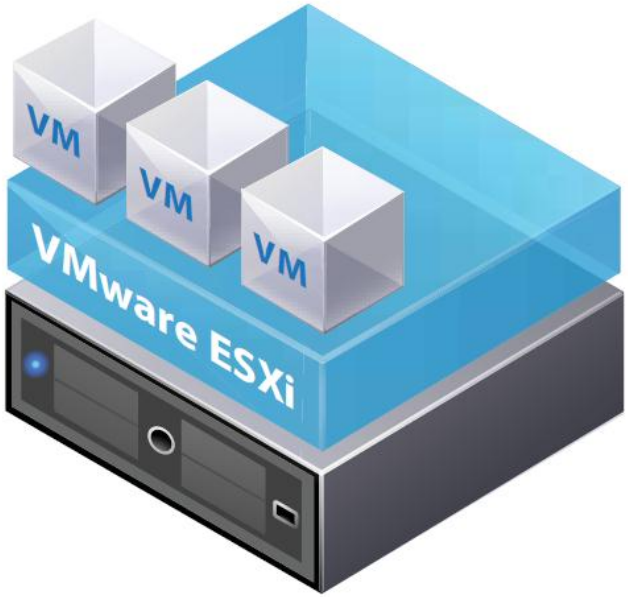




Benefits of virtualization:

- Rapidly and inexpensively bring a new computer online.
- Optimize performance by moving VMs between physical hosts.
- Run legacy apps on old OS's
- Test new OS's.
- Consolidate data center on fewer servers.
- Students can have their own personal computer lab.
- But, when the physical host goes down so do all the VMs!

VMware ESXi

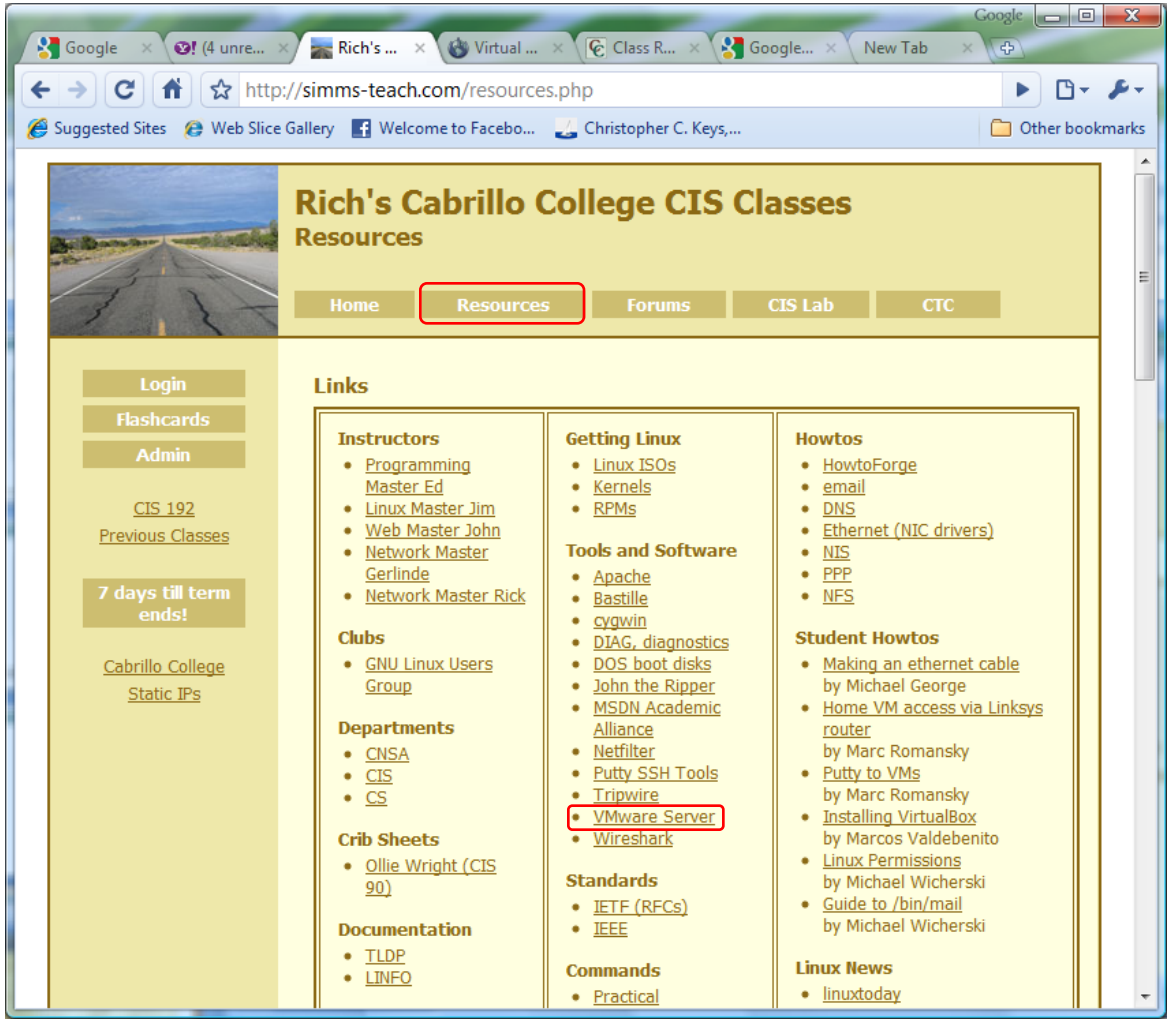


This is a "bare-metal" hypervisor

It is not installed on another OS

- ✓ Free download
- ✓ Multiple virtual networks
- ✓ Virtual serial ports

Looks very interesting!



There is a link on the Resources Page for downloading VMware Server

Look in the Tools and Software section

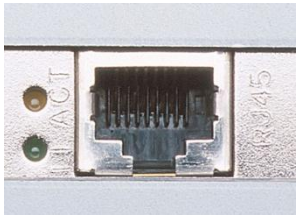
VMware 101

- Cabling
- Power on
- Move between
- Virtual Terminals
- Shutdown

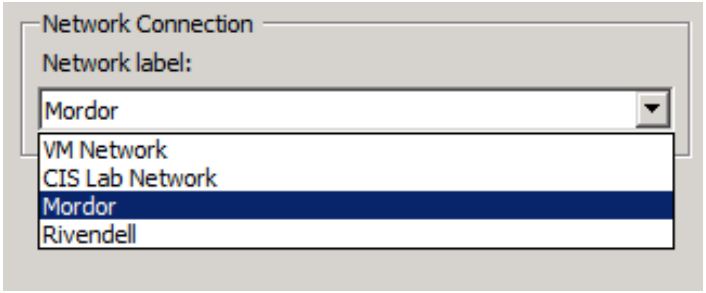
Cabling VMs

Physical and virtual cabling

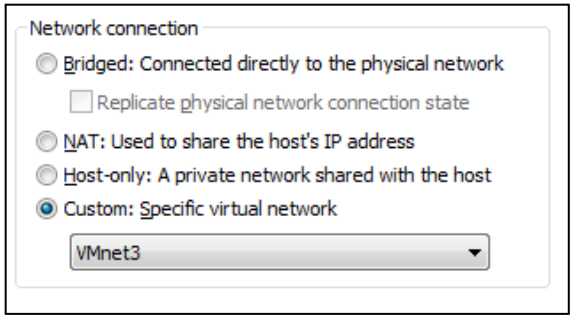
- In a physical environment we would connect Ethernet LAN cables between clients, servers, switches and routers.



- In a virtual environment cabling still must be done



On VMware ESXi



On VMware Workstation

Cabling Devices on a Physical Network

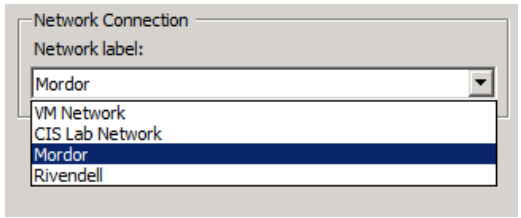
Desktop PC

Switch

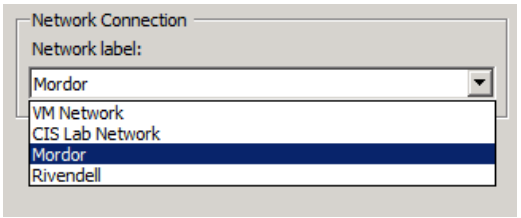
Router

Cabling a PC to a router using a switch

Cabling Devices on a Virtual Network



VMware provides multiple virtual networks. They function like virtual network switches



Network settings for the network adapter (NIC) on the client PC

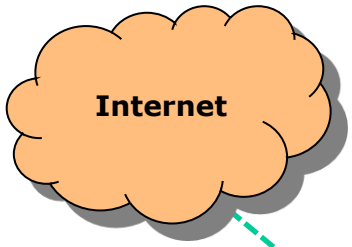
Network settings for the first network adapter (NIC) on the Linux router VM

*Cabling a **virtual PC ...***
*to a **virtual Linux router ...***
*via a **virtual switch***

Cabling VMs
VMware Workstation
Example

Cabling VMware Workstation VMs

Classroom Stations



NoPar (Cisco router)

SW-2501 (Cisco switch)
"Classroom Network"
172.30.1.x

Sauron
(Ubuntu VM)

Station 01
(Dell PC running
VMware
Workstation)

Elrond
(Centos VM)

VMnet3
(Virtual Switch)
"Rivendell Network"

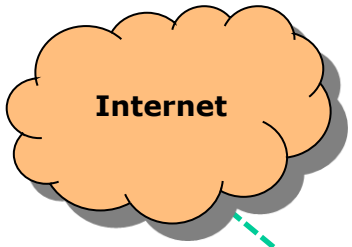
Arwen
(Centos VM)

VMnet4
(Virtual Switch)
"Mordor Network"

Frodo (Ubuntu VM)

Cabling VMware Workstation VMs

CIS Lab Stations



NoPar (Cisco router)

SW-1403 (Cisco switch)
"CIS Lab Network"
172.30.4.x

Sauron
(Ubuntu VM)

CIS-Lab-01
(Dell PC running
VMware
Workstation)

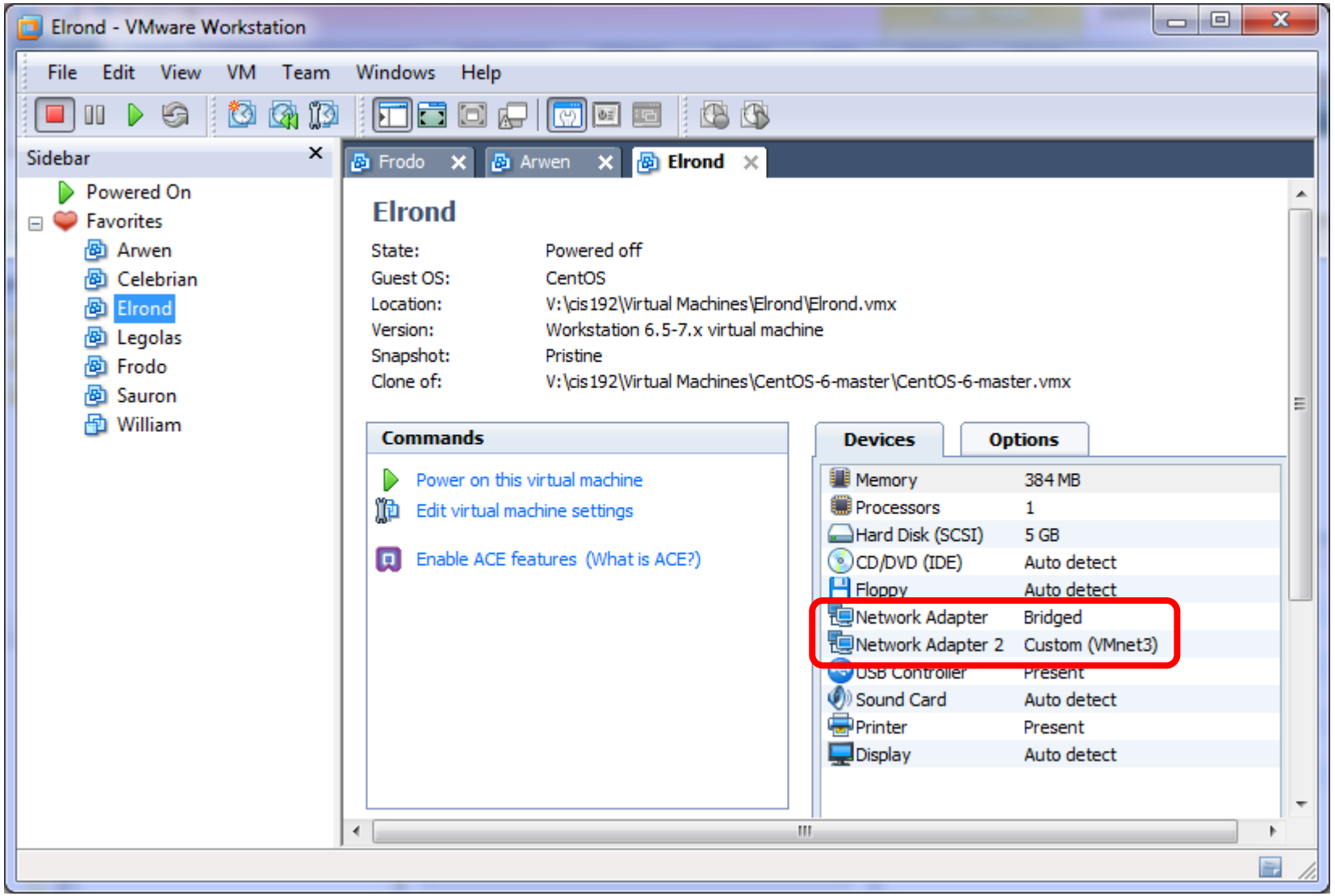
Elrond
(Centos VM)

VMnet3
(Virtual Switch)
"Rivendell Network"

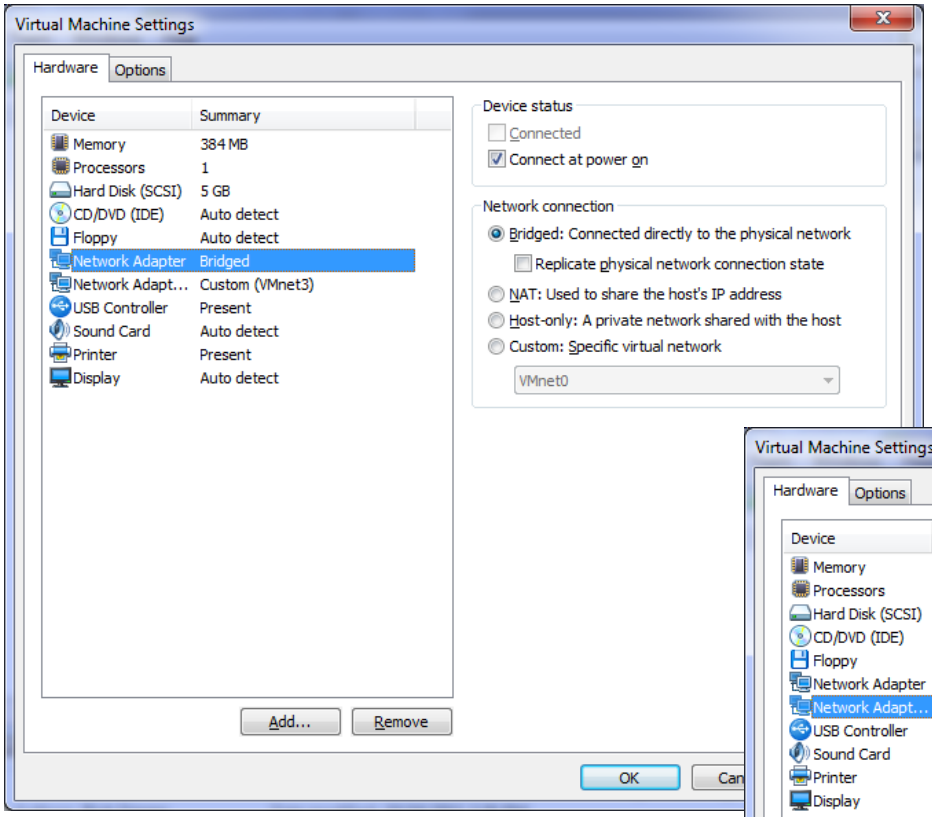
Arwen
(Centos VM)

VMnet4
(Virtual Switch)
"Mordor Network"

Frodo (Ubuntu VM)

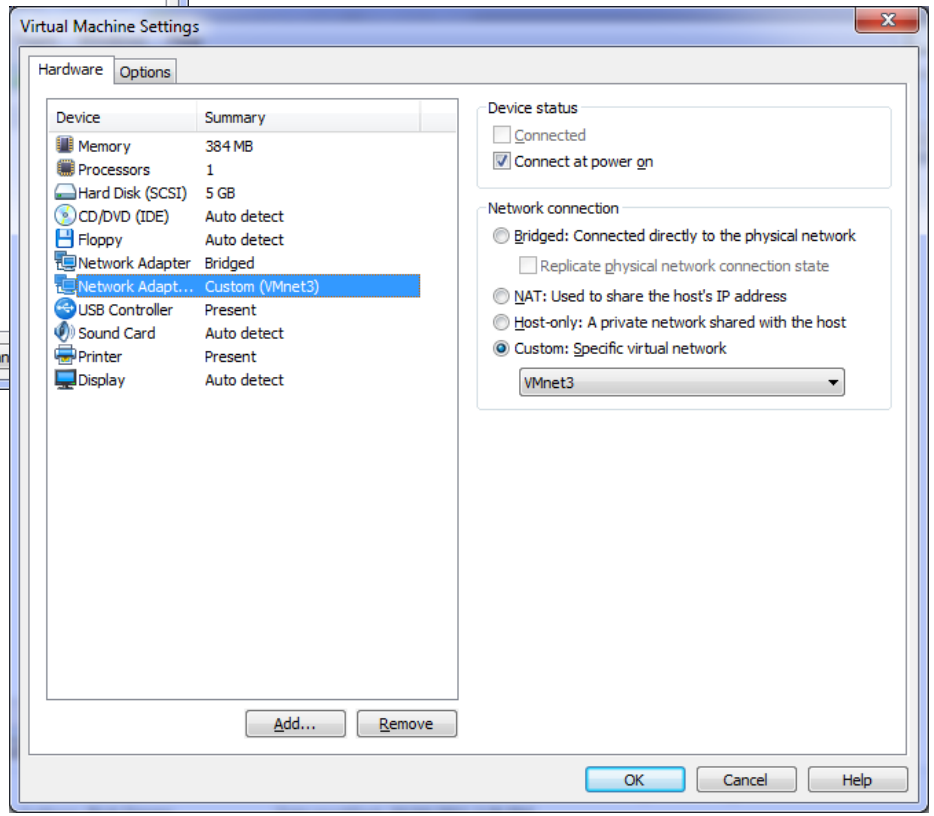


Elrond's network adaptors are cabled to the classroom or CIS Lab network (bridged) and the Rivendell network (vmnet3)

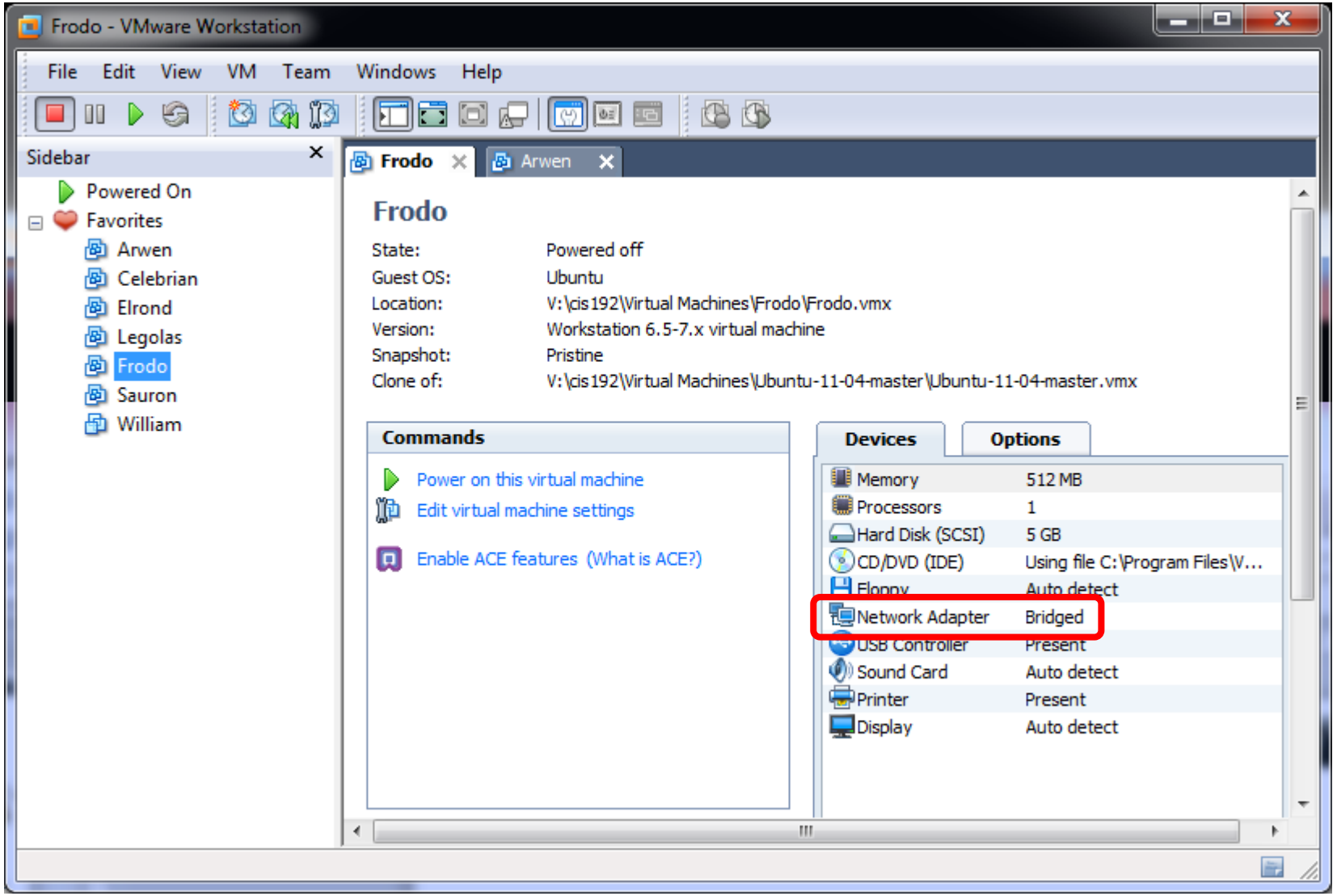


VMware Workstation

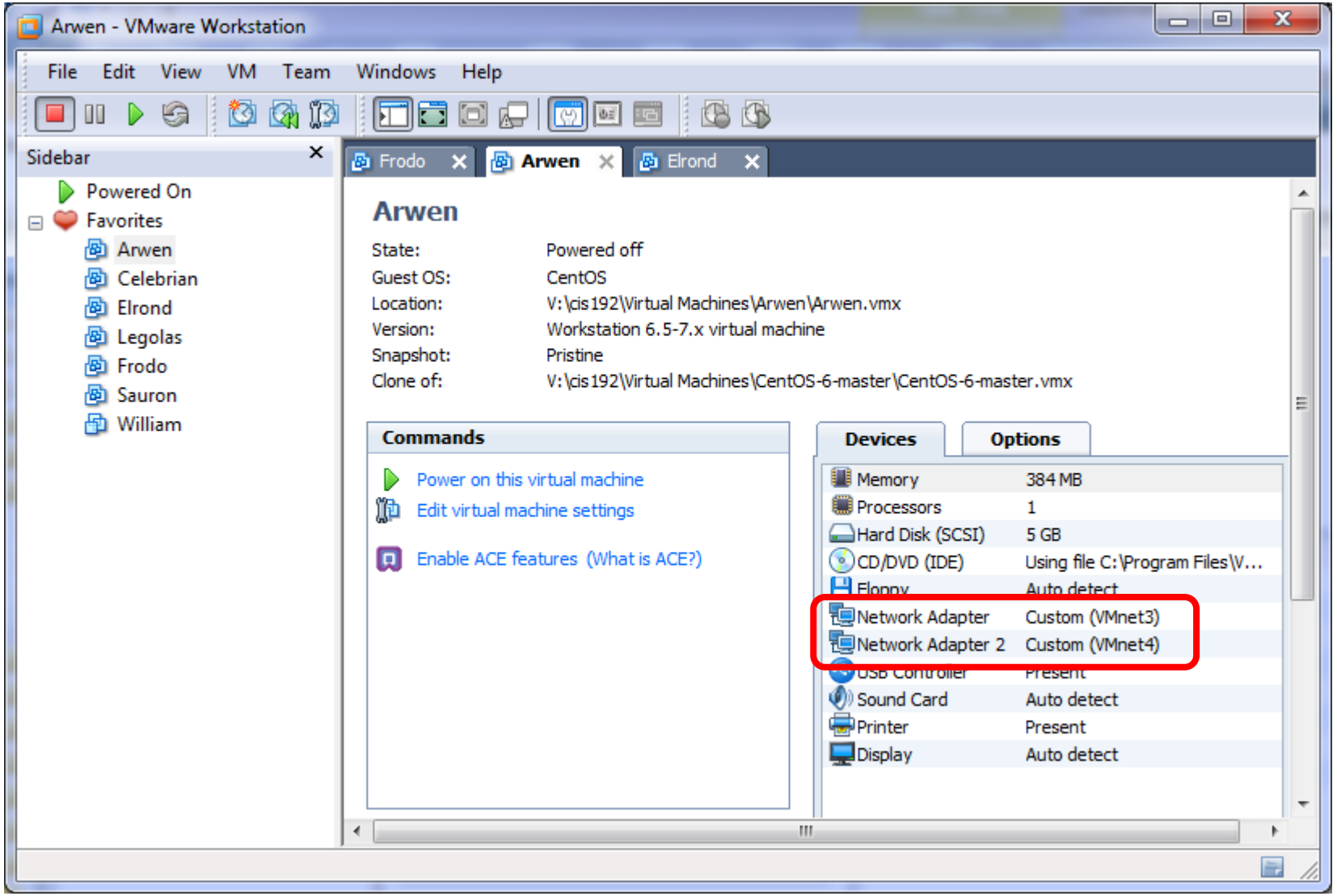
Use Edit Virtual Machine Settings to connect network adapters



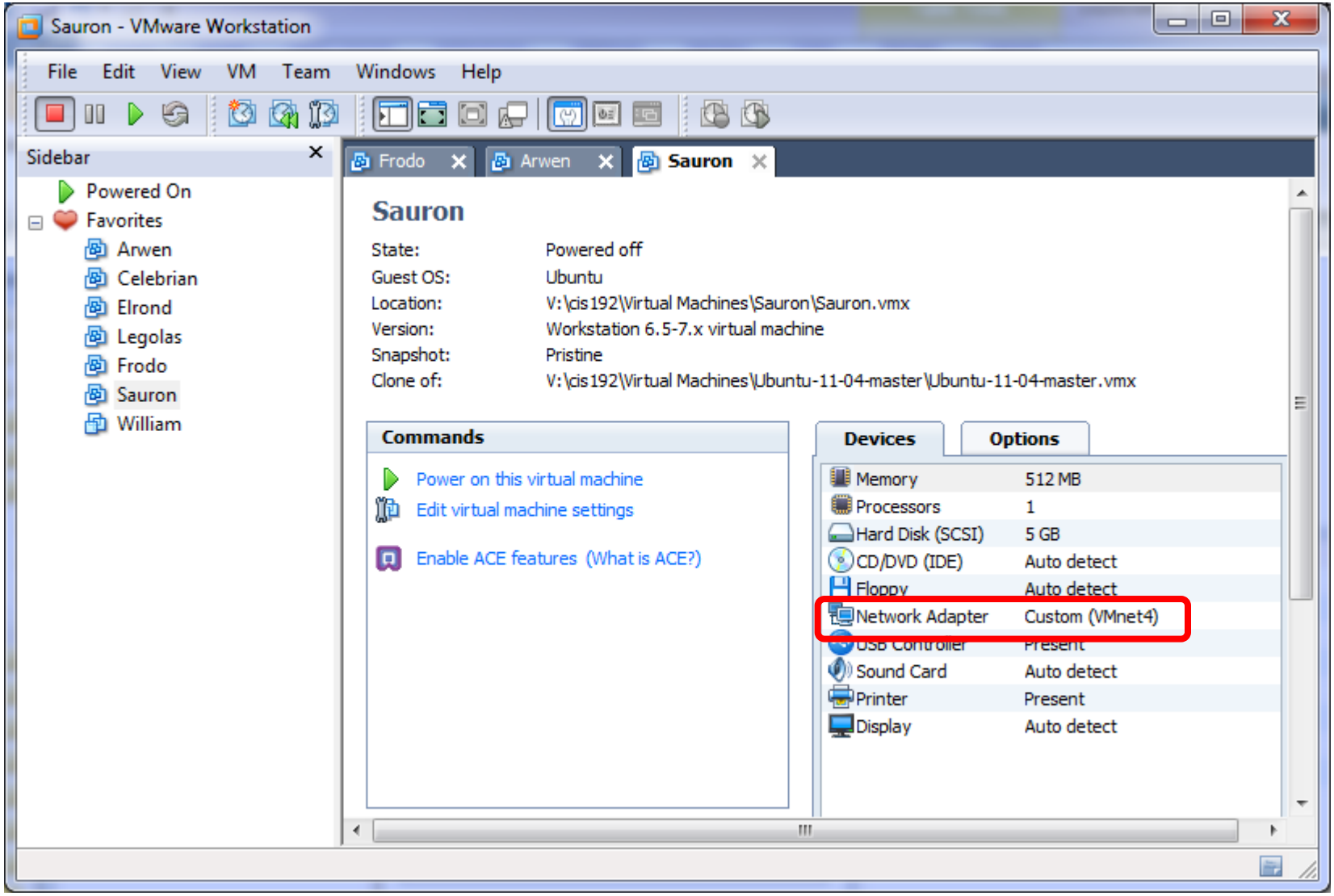
Elrond's network adaptors are cabled to the classroom or CIS Lab network (bridged) and the Rivendell network (vmnet3)



Frodo's network adaptor is cabled to the classroom or CIS Lab network (bridged)



Legolas' network adaptors are cabled to the Rivendell network (vmnet3) and the Mordor network (vmnet4)

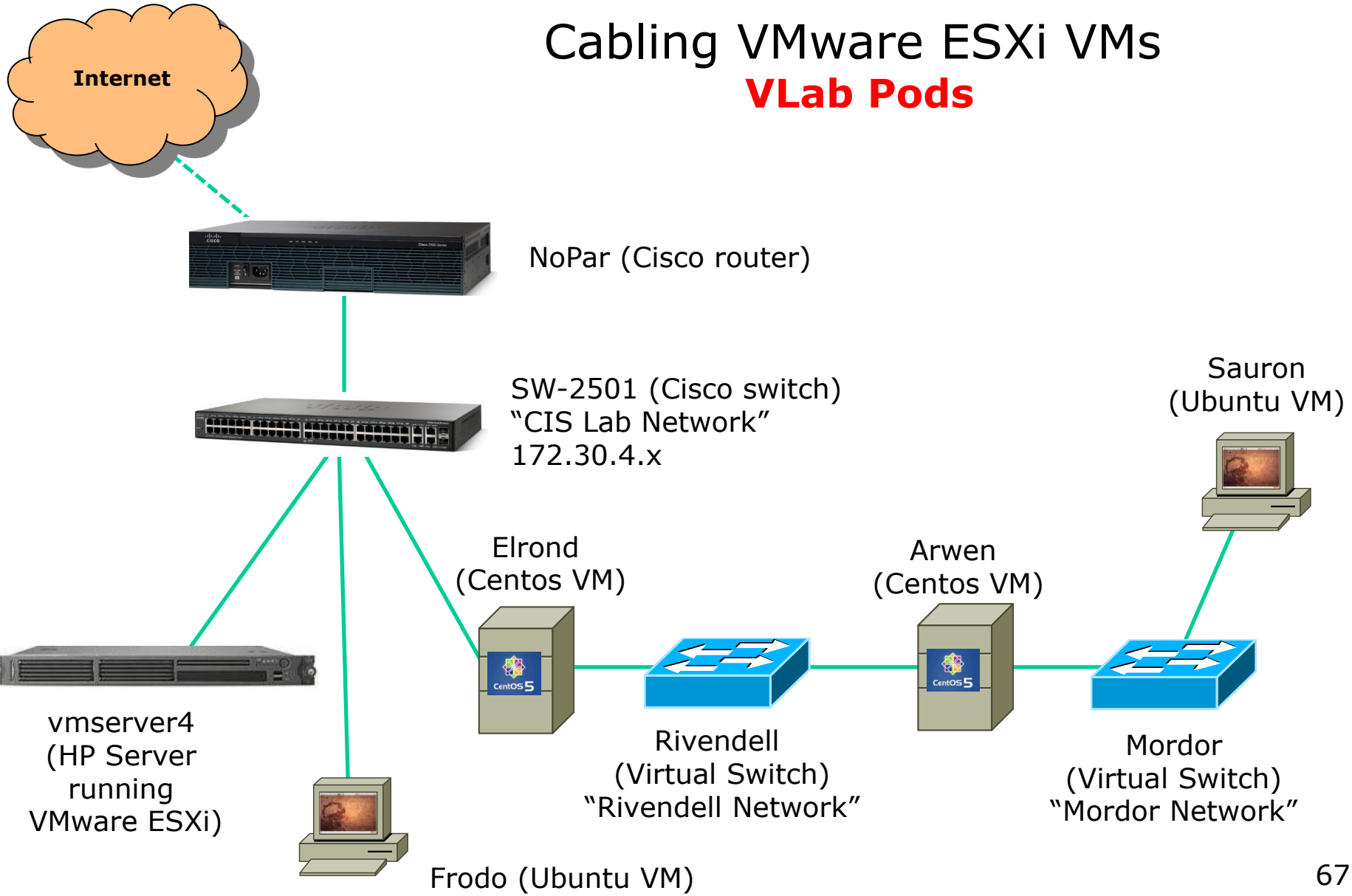


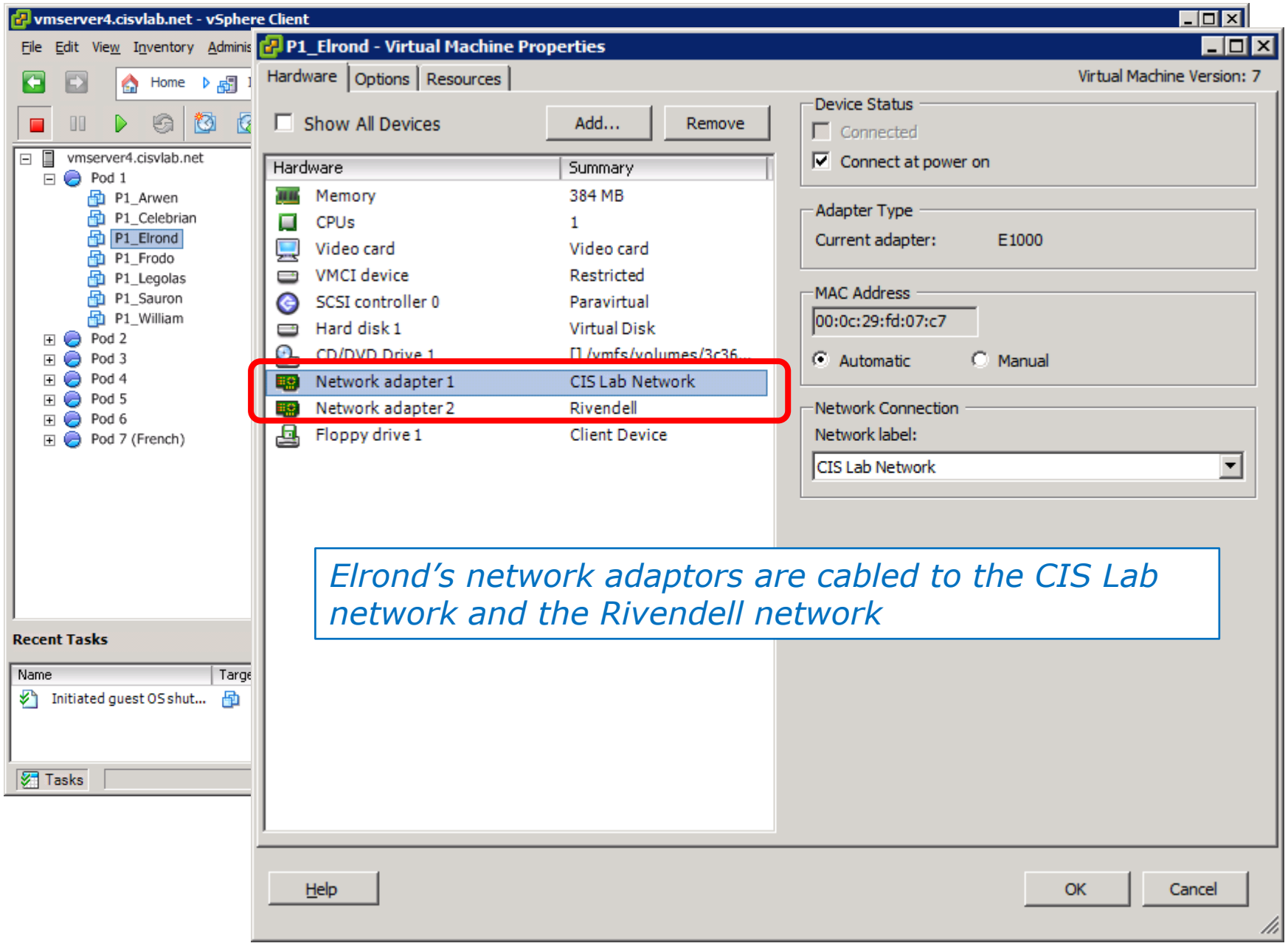
Sauron's network adaptor is cabled to the Mordor network (vmnet4)

Cabling VMs VMware ESXi Example

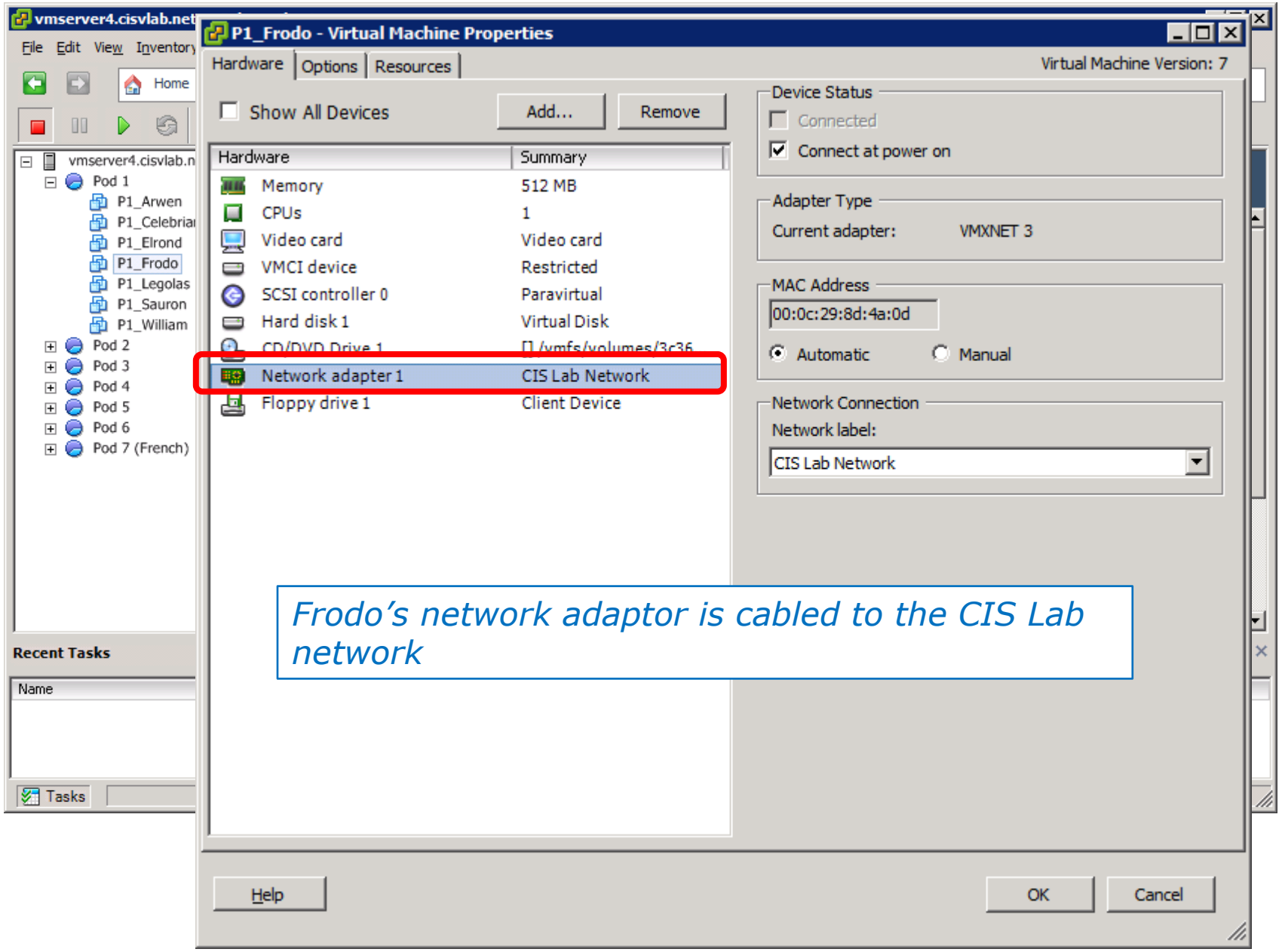
Cabling VMware ESXi VMs

VLab Pods

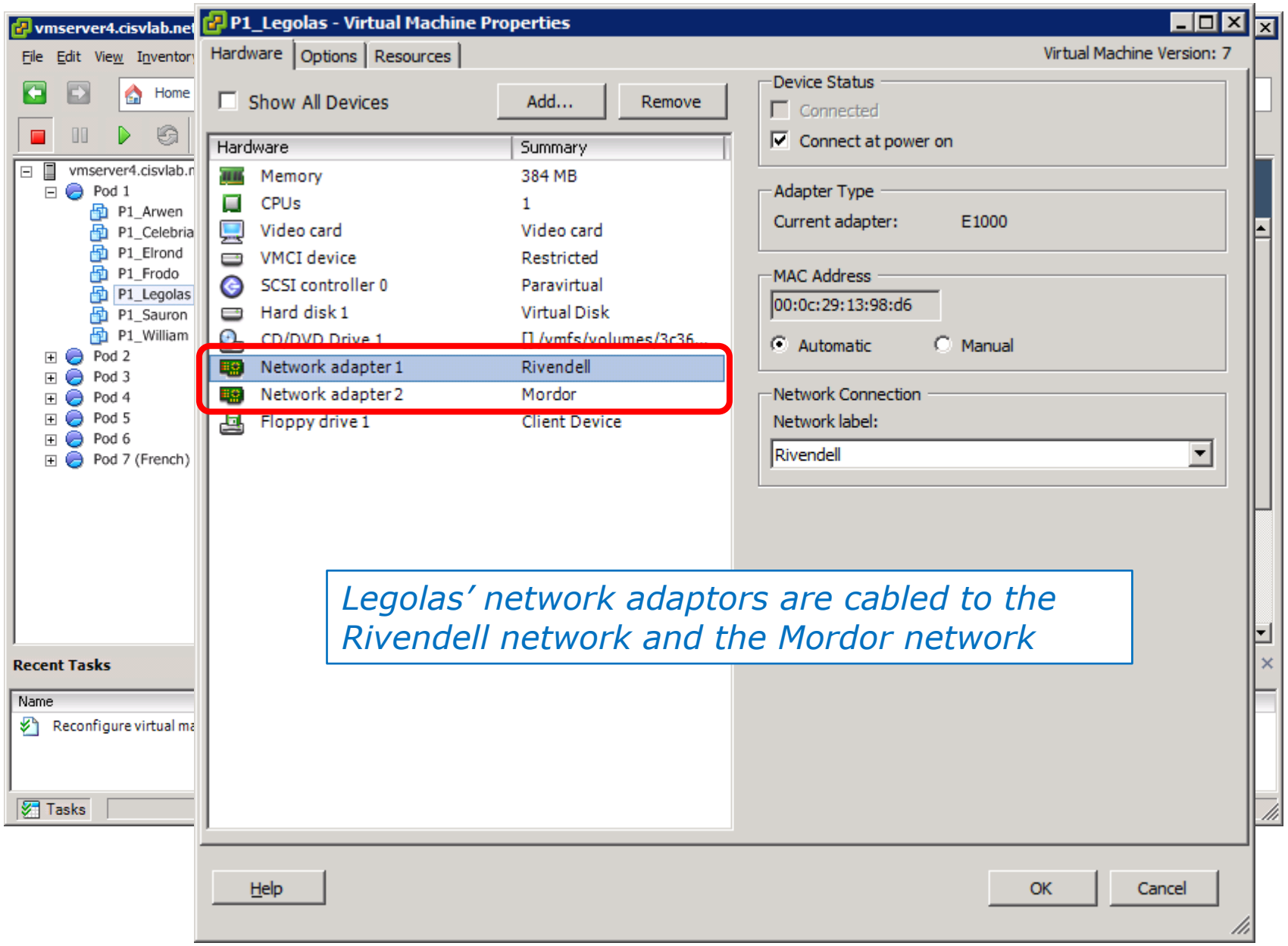




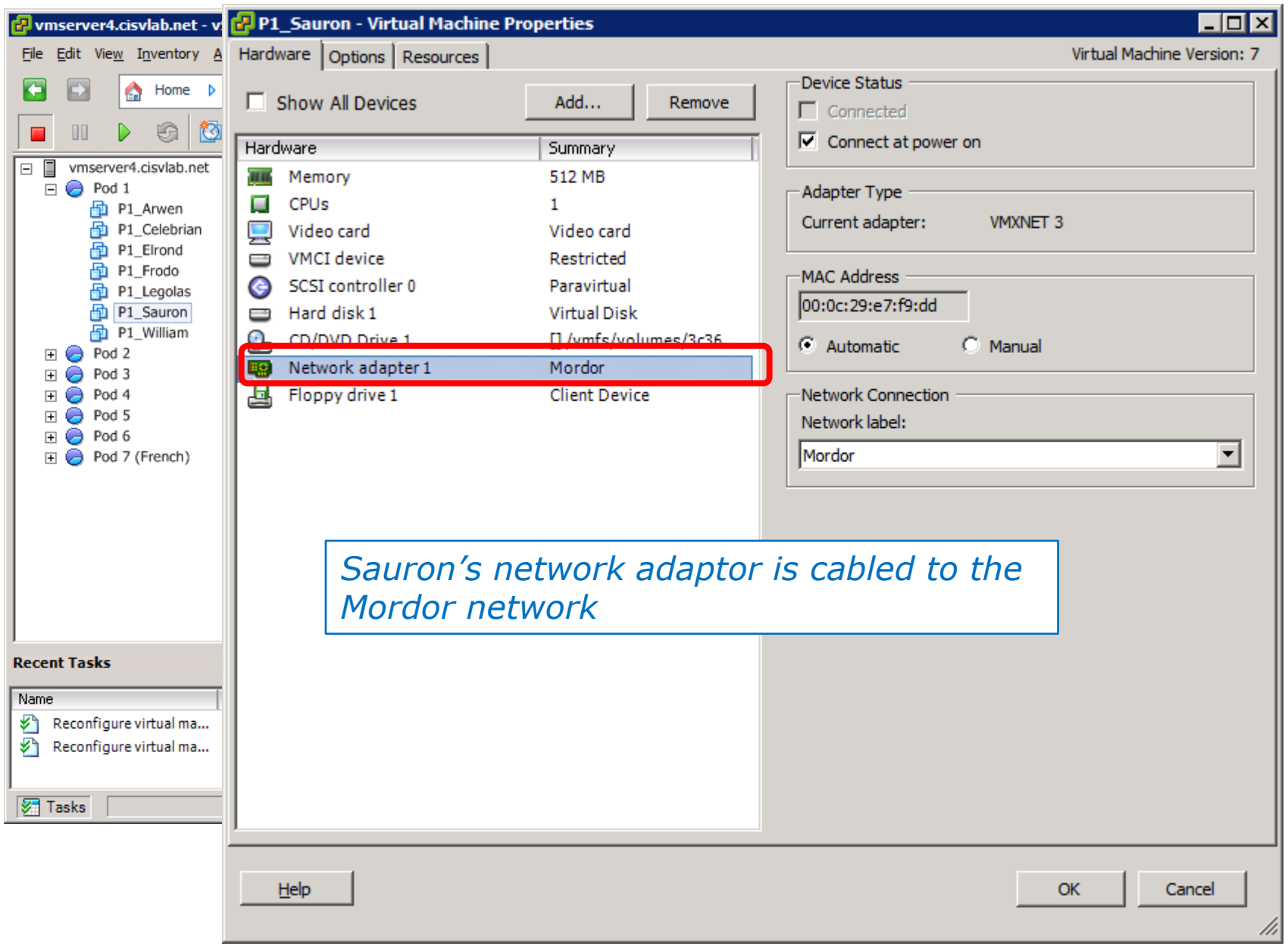
Elrond's network adaptors are cabled to the CIS Lab network and the Rivendell network



Frodo's network adaptor is cabled to the CIS Lab network



Legolas' network adaptors are cabled to the Rivendell network and the Mordor network



Sauron's network adaptor is cabled to the Mordor network

CRAZY Network Names

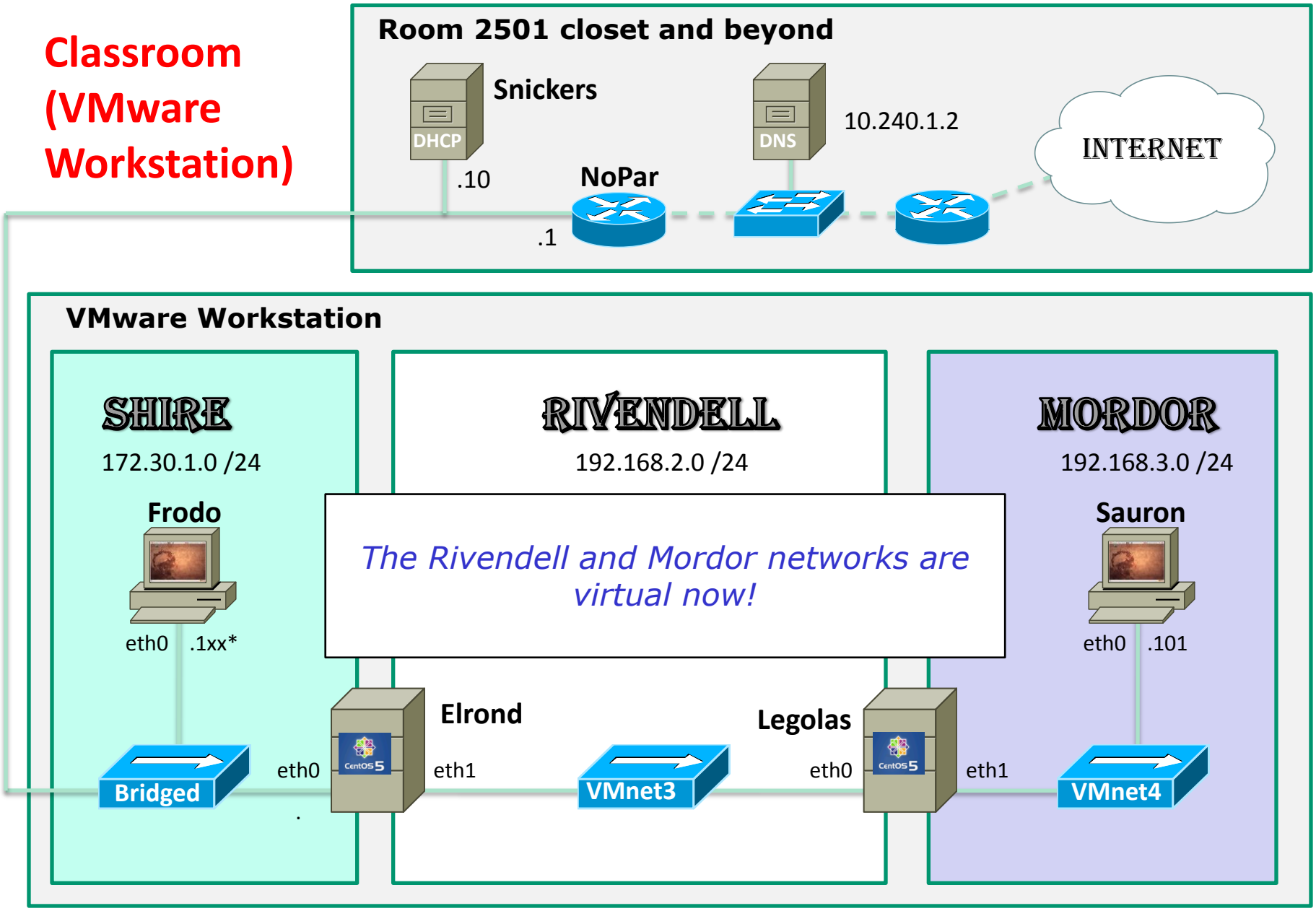
The crazy network names we use in this course

- Tradition is behind naming the networks used in the labs that goes back to when Jim created this course.
- The **Shire** network will refer to the physical LAN in either the classroom or the lab. On VMware Workstation we will use the **bridged** connection for this network.
- The **Rivendell** network will refer to the network that is one hop away. On VMware Workstation we will use **vmnet3** for this network.
- The **Mordor** network will refer to the network that is two hops away. On VMware Workstation we will use **vmnet4** for this network.

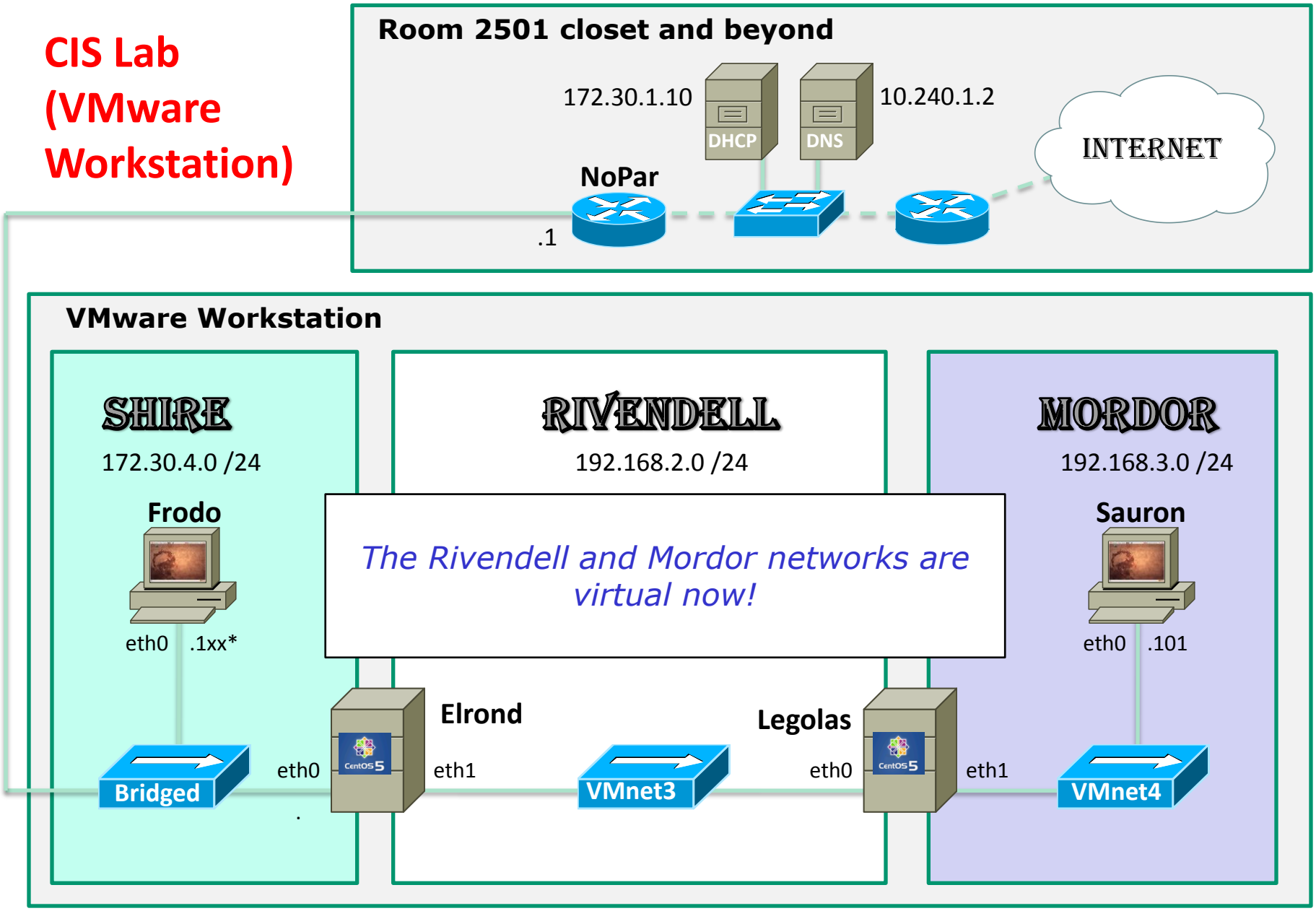
These networks used to be three physical networks in Room 2504, complete with banners hanging from the ceiling. The Rivendell and Mordor networks now are virtual.

CRAZY Network Names being used in one of the future lab assignments

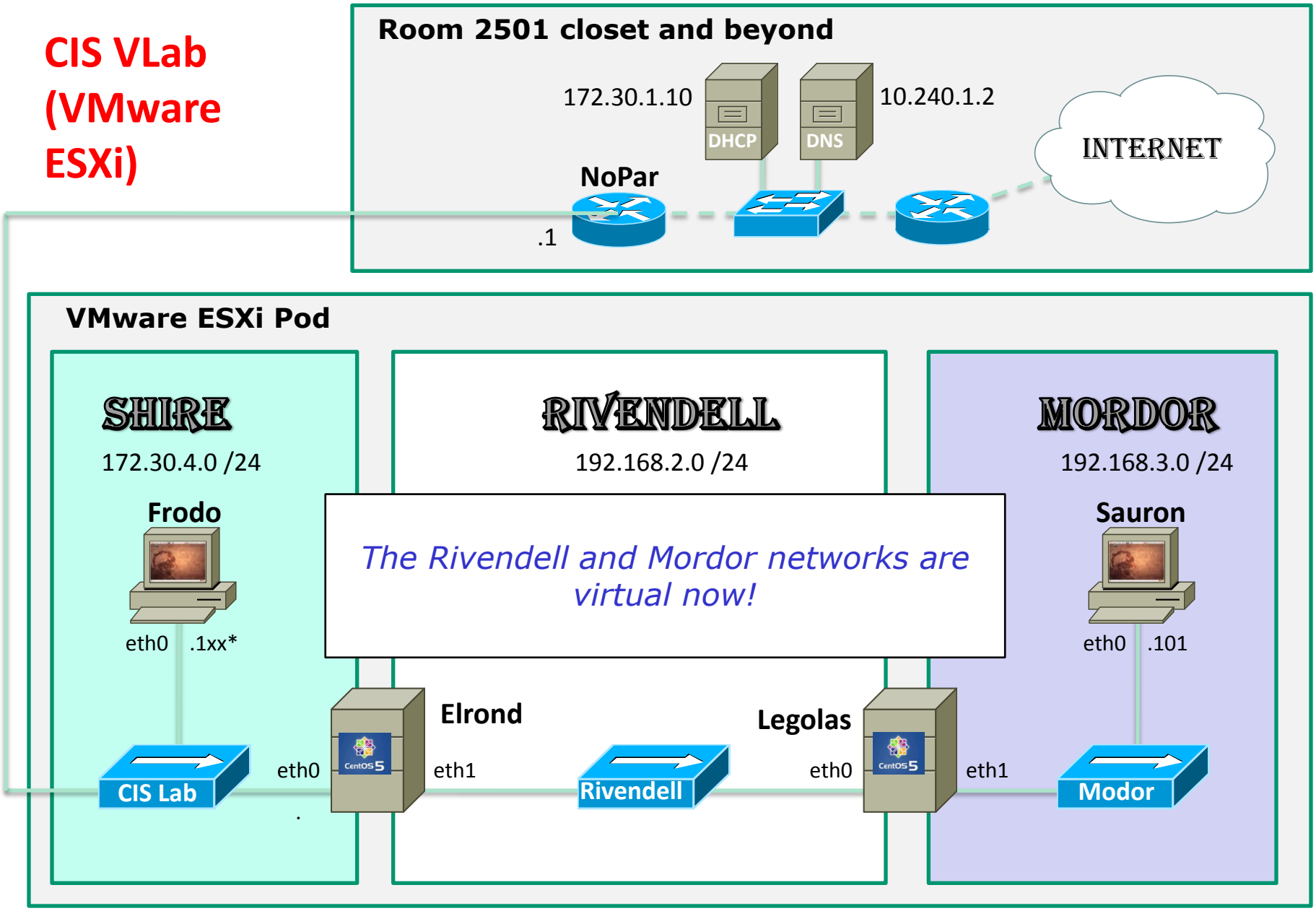
Classroom (VMware Workstation)



CIS Lab (VMware Workstation)



CIS VLab (VMware ESXi)

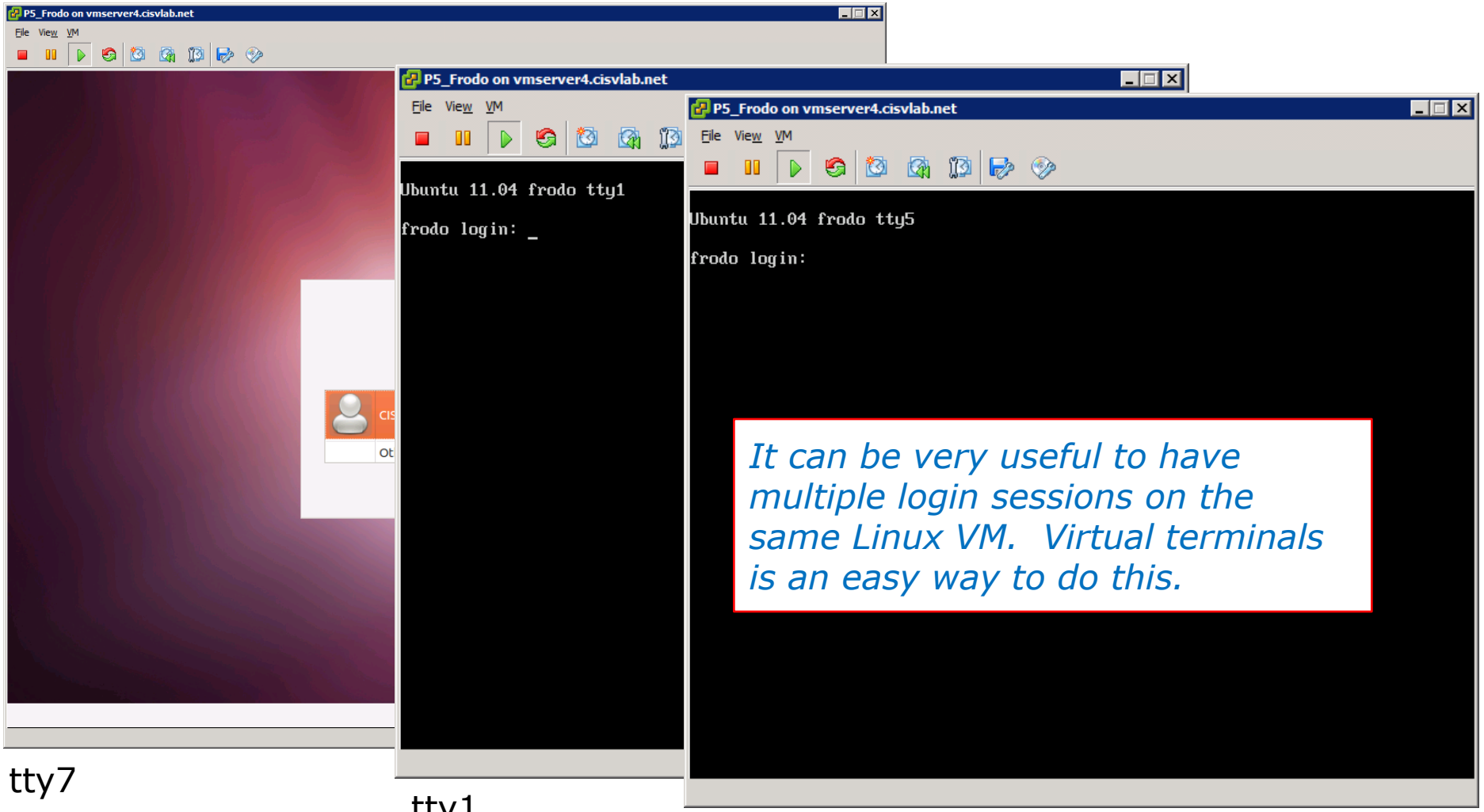


Class Activity
Cabling VMs

Live Demo

Changing Virtual terminals

VMware VM Operations
Changing Virtual Terminals



Changing Virtual Terminals on VMware Linux VMs

VMware operations	
On PC Keyboard:	While holding down the Ctrl-Alt keys, tap spacebar then tap f1, f2, ... or f7.
On Mac keyboard:	Hold down Control and Option keys, tap the spacebar, hold down fn key (in addition to Control and Option keys) and tap f1, f2, ... or f7.

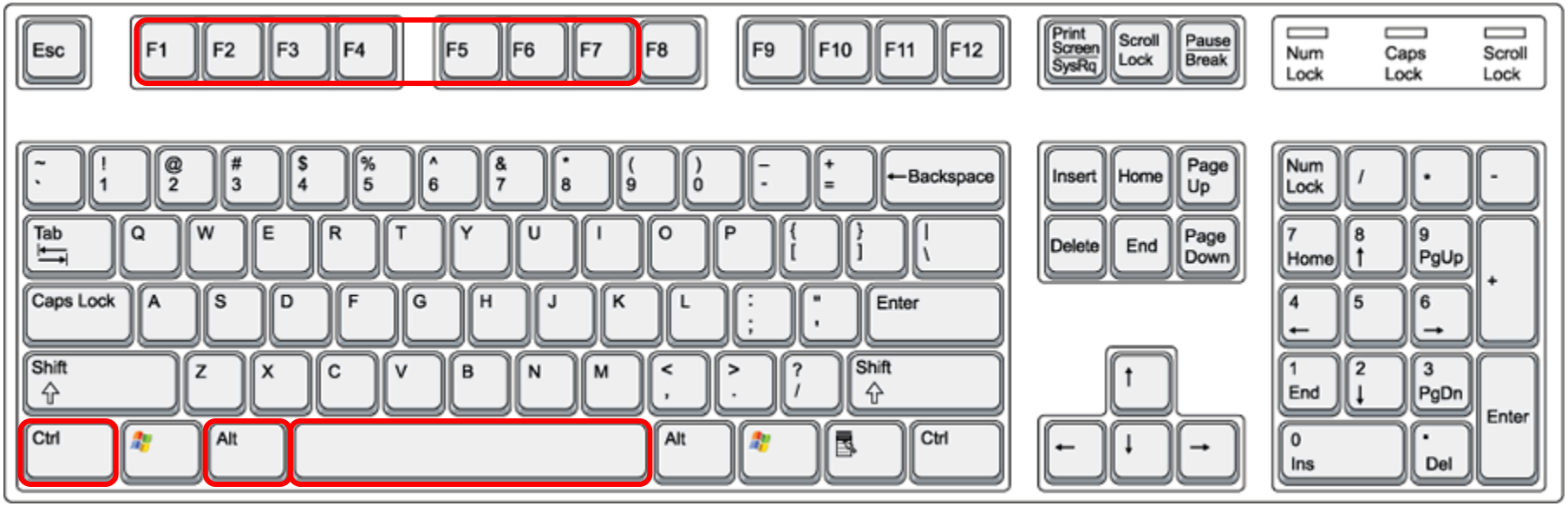
F7 is graphics mode for the Ubuntu VMs.

The Centos VMs do not have a graphics mode components installed (init level 3 only)

Note: the spacebar does not need to be tapped on a physical (non-VM) system. This is only required when changing virtual terminals on VMware VMs.

VMware VM Operations

Changing Virtual Terminals with a PC keyboard



On PC keyboard:

While holding down the **Ctrl-Alt** keys,
tap **Spacebar** then tap **F***N* key
(where *N*=1-7 to specify a function key)

VMware VM Operations

Changing Virtual Terminals with a Mac keyboard

On Mac keyboard:

While holding down the **control-option** keys

tap **Spacebar** then tap **fn-F*N*** keys

(where *N*=1-7 to specify a function key)

Class Activity
Using VMs

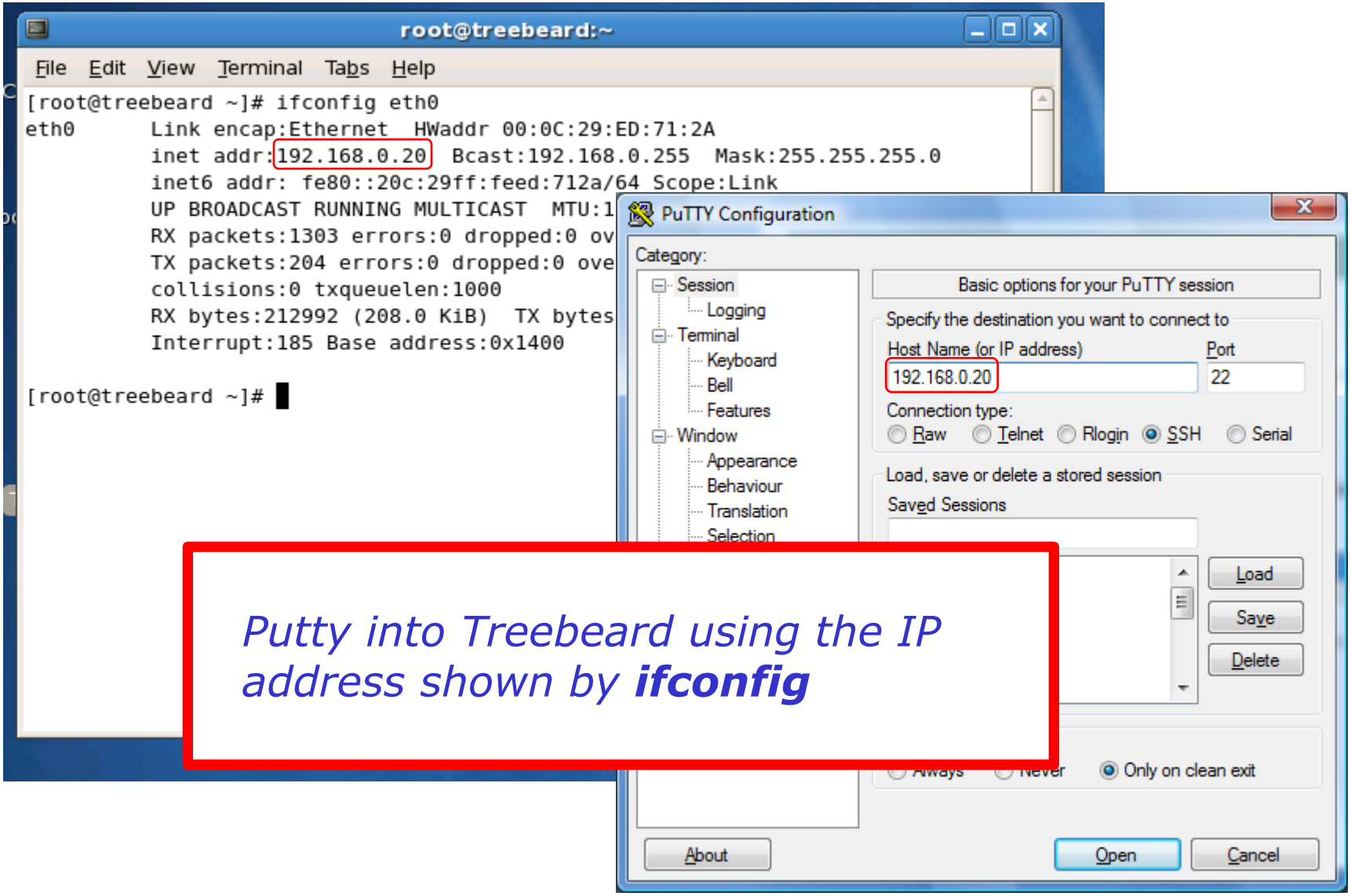
Live Demo

SSH Hopping

SSH (Secure Shell)

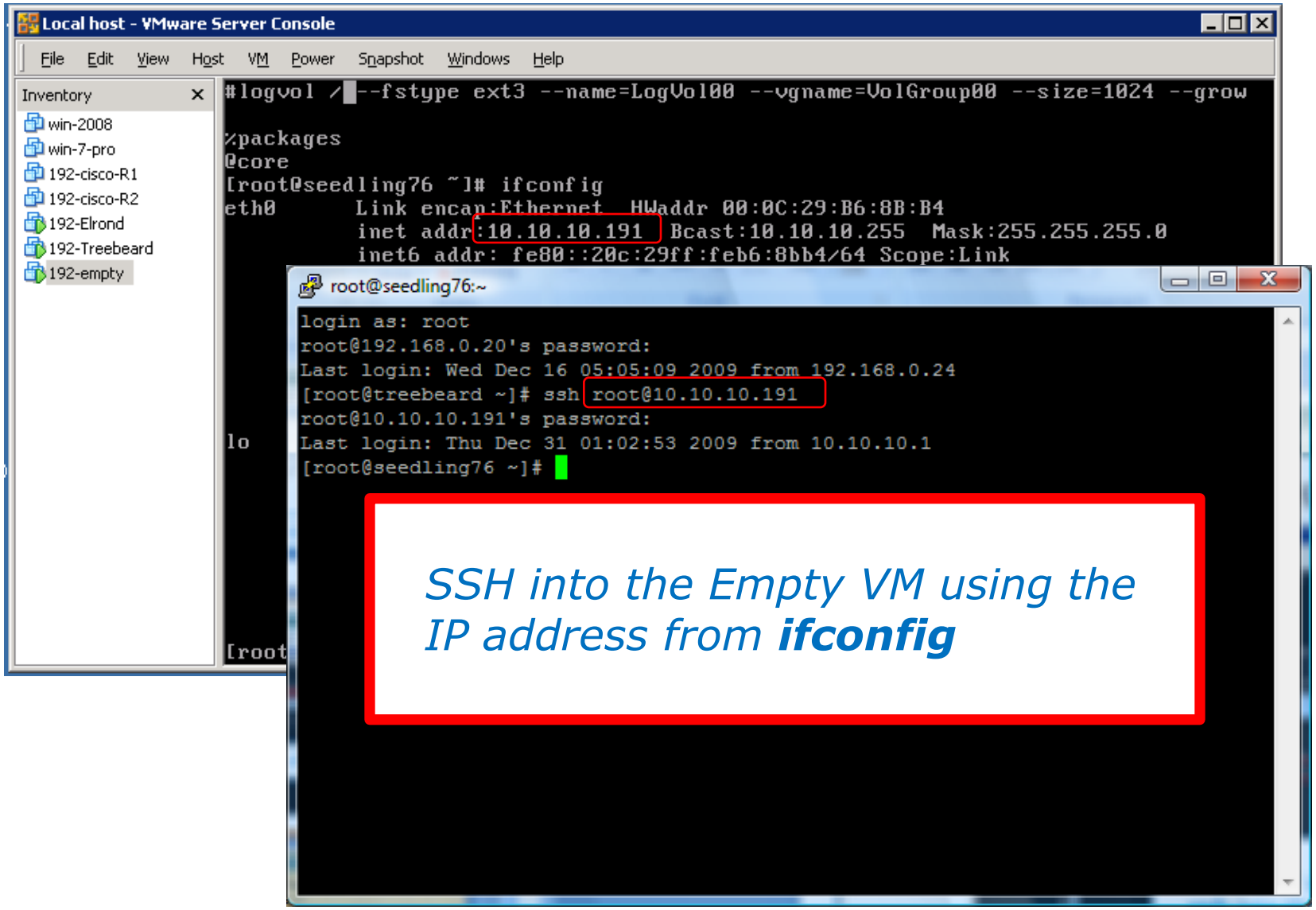
- SSH is a standard network protocol that lets data be exchanged securely (via authentication and encryption) by two computers on a network.
- On Linux and UNIX systems, SSH replaces Telnet for logging into remote system and issuing commands.
- SSH v2 is more secure than SSH v1. It is also incompatible.
- OpenSSH, found on most Linux distributions, is an open source implementation of SSH v2.
- On Linux, the **ssh** command is used to login and issue commands on another system. The **scp** command is used to securely copy files between systems.
- On Windows, the **Putty** software uses SSH. The Putty **pscp** command is the windows version of the Linux **scp** command.
- On Windows, **Filezilla** can copy files using SFTP which in turns uses SSH.

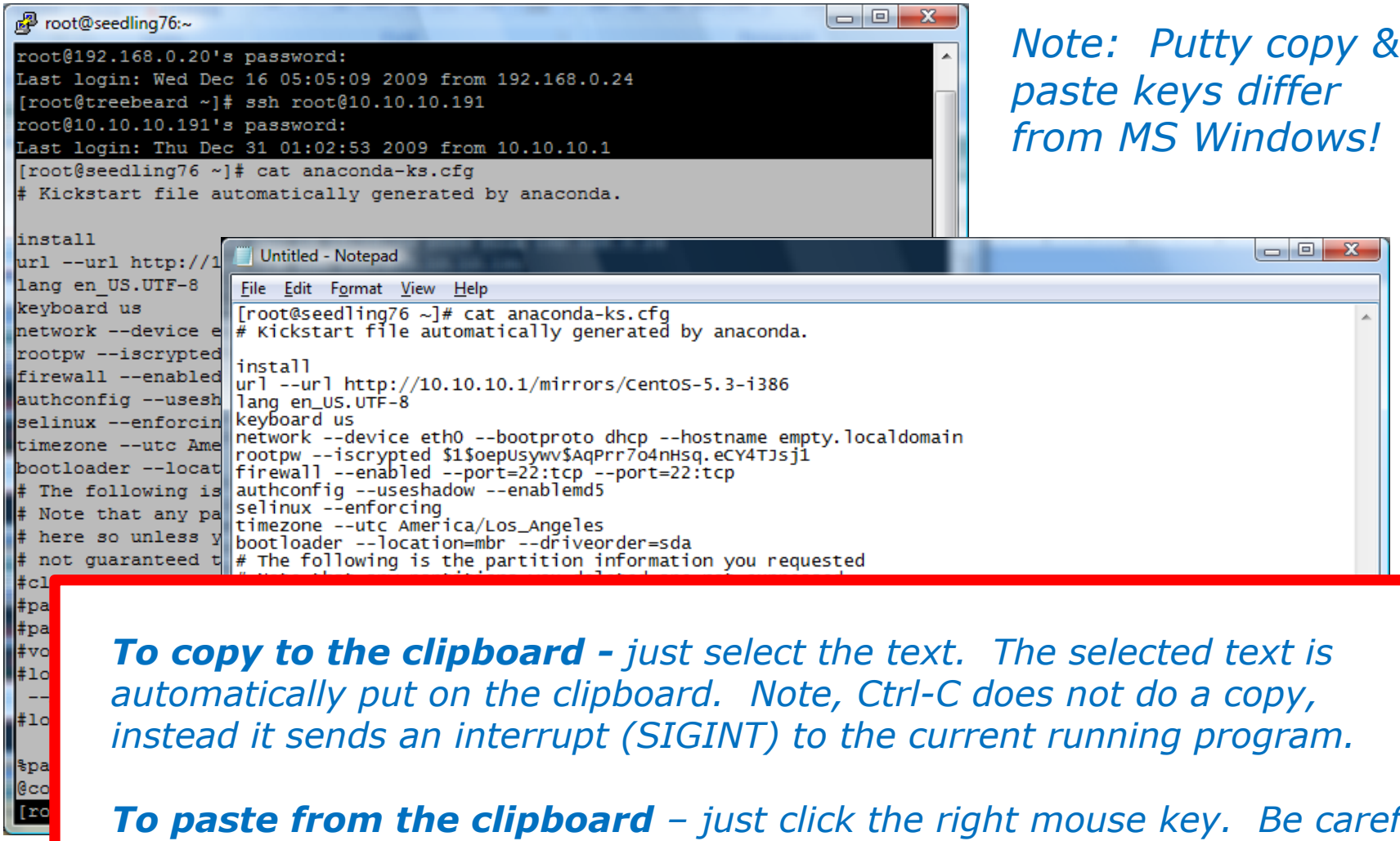
SSH Hopping – Putty into first system



*Putty into Treebeard using the IP address shown by **ifconfig***

SSH Hopping – ssh into next system





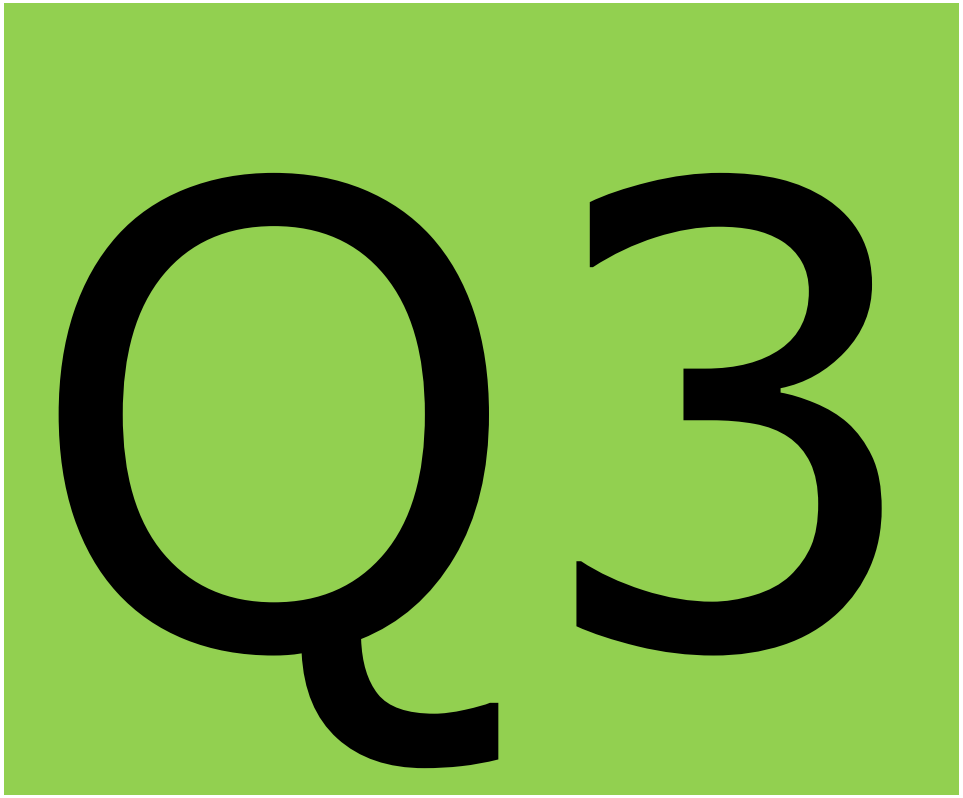
Note: Putty copy & paste keys differ from MS Windows!

To copy to the clipboard - *just select the text. The selected text is automatically put on the clipboard. Note, Ctrl-C does not do a copy, instead it sends an interrupt (SIGINT) to the current running program.*

To paste from the clipboard *– just click the right mouse key. Be careful as you may inadvertently paste unwanted clipboard contents into your Putty session!*

Class Activity
SSH Hopping

Live Demo

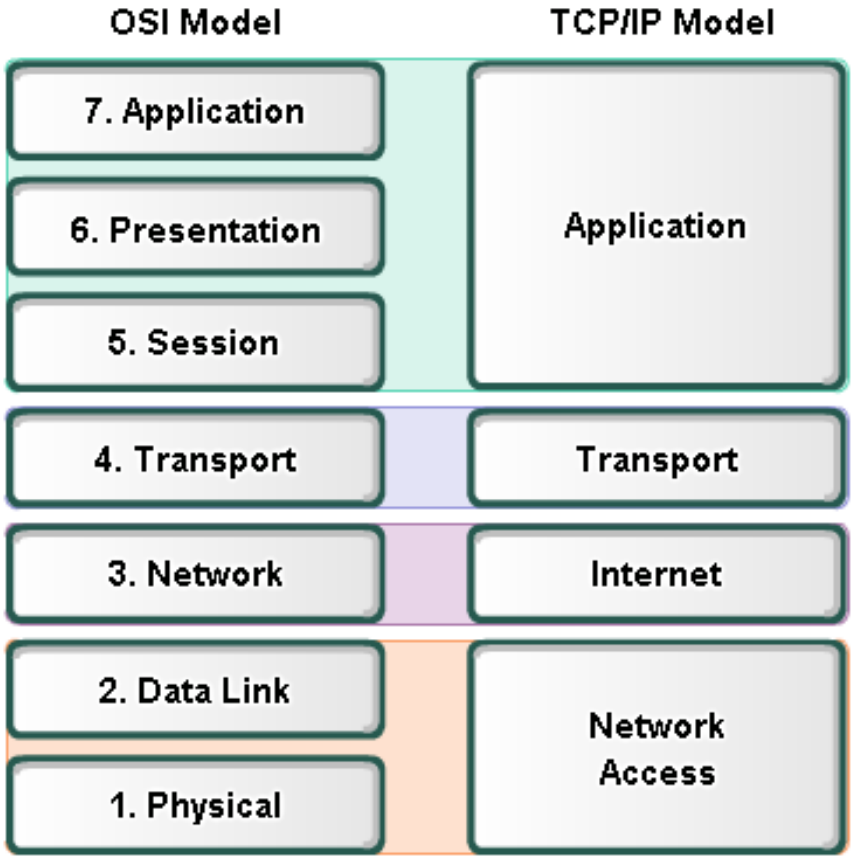


- Linux Review
- Network Review
- Standards
- NICs and drivers

Network Basics

Protocol Reference Models

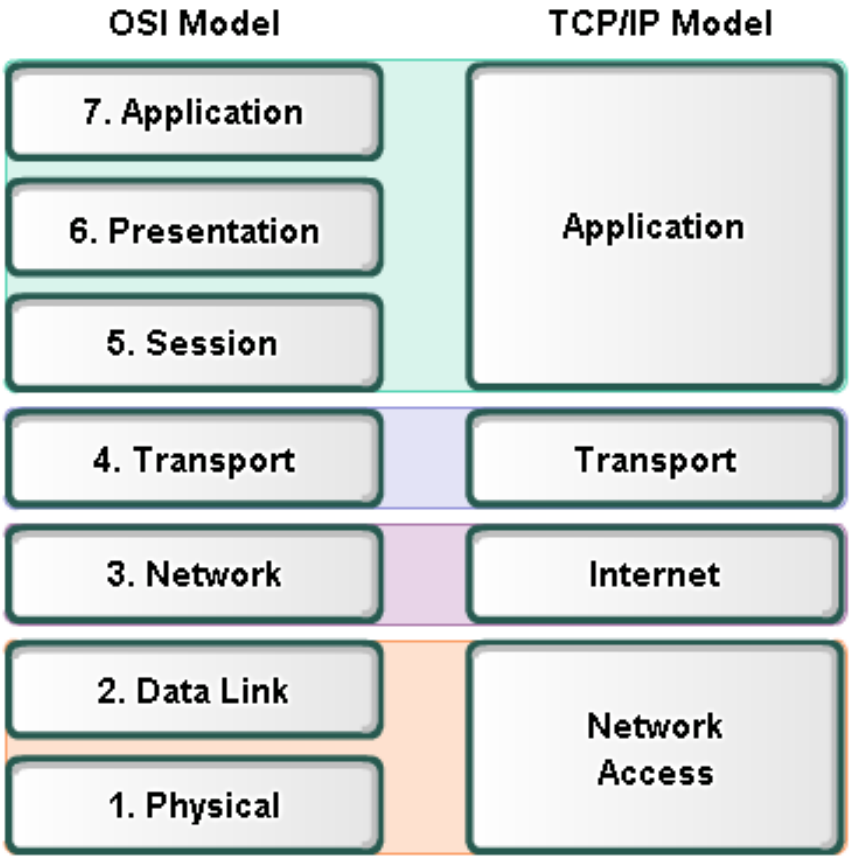
1977



1970's

The **OSI** (Open Systems Interconnection) and **TCP/IP** models are define various **abstraction layers.** Each layer serves a different role in the overall communication process.

Protocol Reference Models



Example Protocols

File Transfer Protocol (FTP), Simple Mail Transport Protocol (SMTP), Hyper Text Transfer Protocol (HTTP), etc.

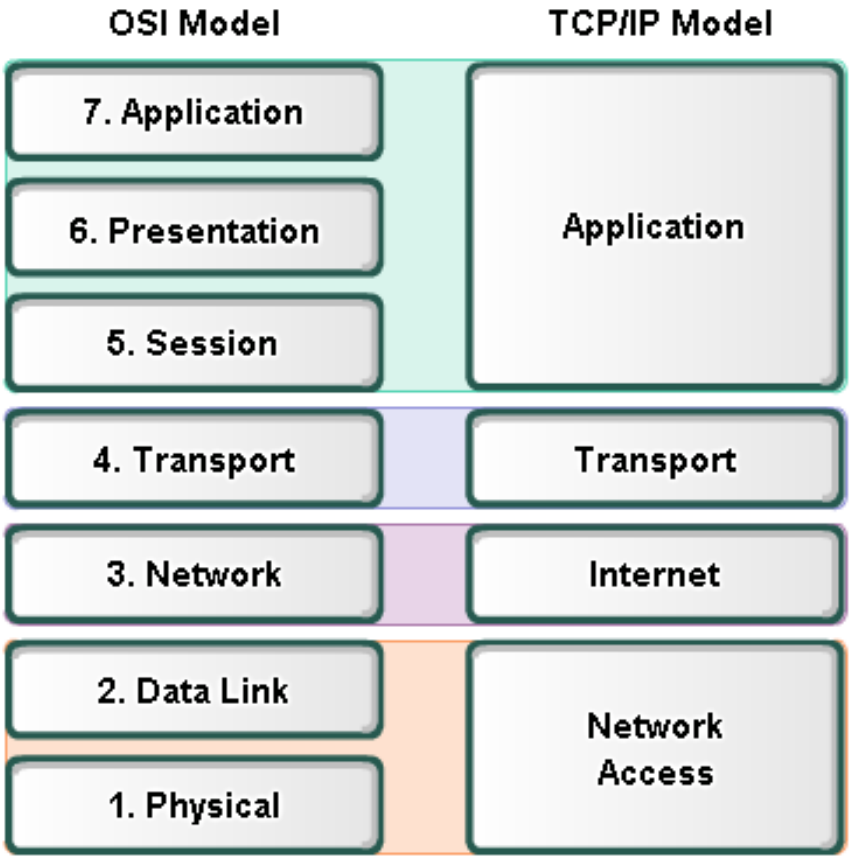
Transmission Control Protocol (TCP), User Datagram Protocol (UDP)

Internet Protocol (IP)

Ethernet, SLIP, PPP, X.25, Frame Relay, etc.

Showing how various **protocols** fit within the **OSI** and **TCP/IP** models. Each protocol is defined as a **standard** which enable multi-vendor solutions.

Protocol Reference Models



Example Products

Filezilla (FTP), Firefox (HTTP), Internet Explorer (HTTP), Exchange (SMTP), Sendmail (SMTP)

Network stacks

Routers, network stacks

Switches, NICs, network stacks

Hubs, NICs, cables

Each product must implement **standards** to enable multi-vendor **interoperability**.

Software implementations of network protocol layers are called **network stacks** and are built into OS's like Linux and Windows.

Reconciling the Layers

OSI	CIS 81	Nemeth Text	Wireshark	Source/ Destination	Unit	Devices
7 - Application	Application	Application	SSH, HTTP, DNS, RIP, Bootstrap (DHCP), SMB	An application program or service	Data	
6 - Presentation						
5 - Session						
4 - Transport	Transport	Transport	TCP/UDP	Port	Segment, Datagram	
3 - Network	Internet	Network	Internet Protocol	IP	Packet	Router
2 – Data link	Network Access	Link	Ethernet II	MAC	Ethernet Frame	Switch, NIC
1 - Physical		Physical	Frame	RJ-45 Jack	Bits	Hub, NIC, cables

The terminology for the different layers may change and blur a little depending on the textbook, product, or organization

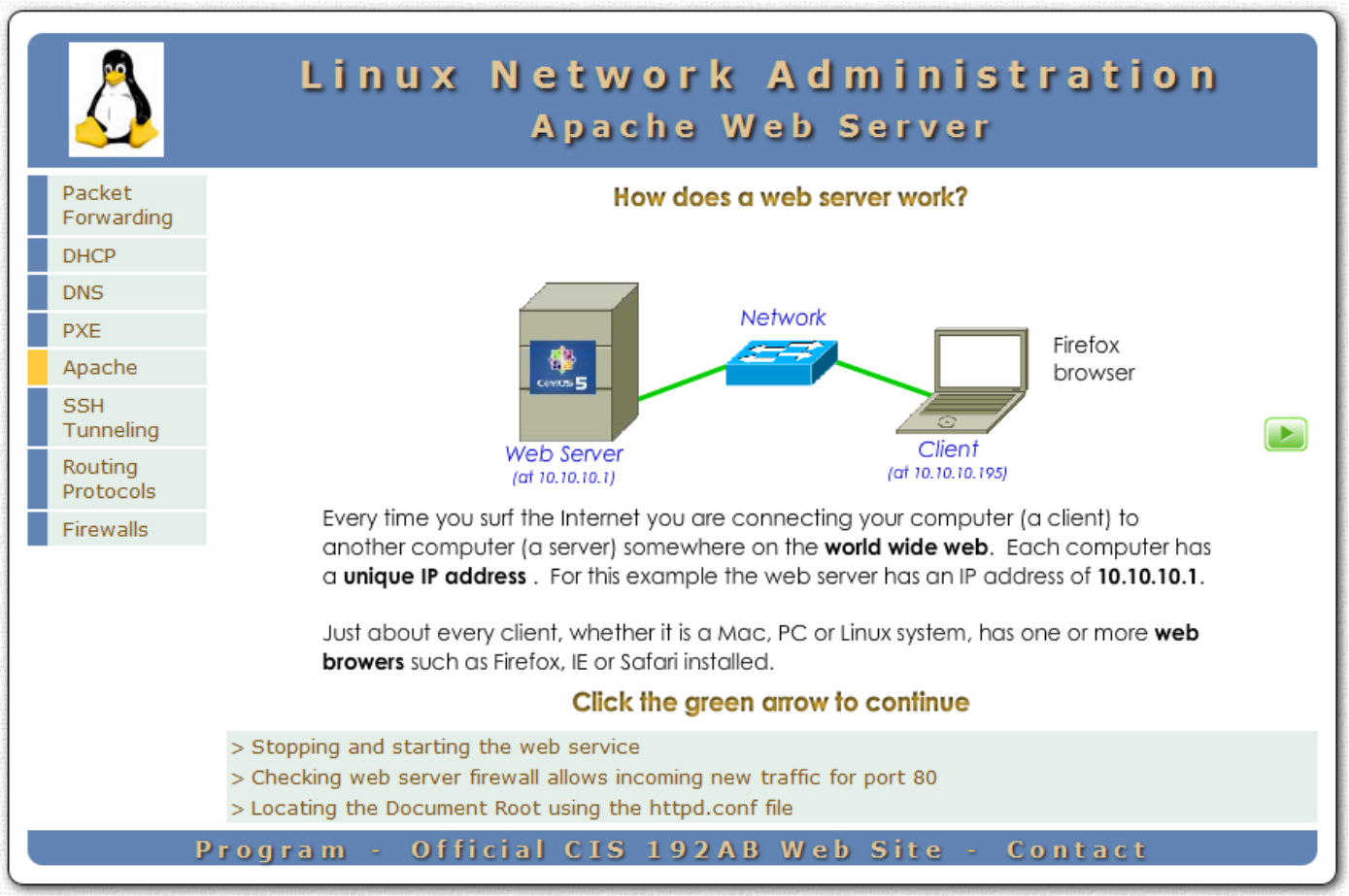
Deep dive into a single packet

*Now lets take a **deep dive** into a single network packet … an "HTTP Get" sent from a browser to a web server*

This example is based on using the Firefox browser on the Frodo VM at home to view a Wikipedia article on the Internet Protocol Suite

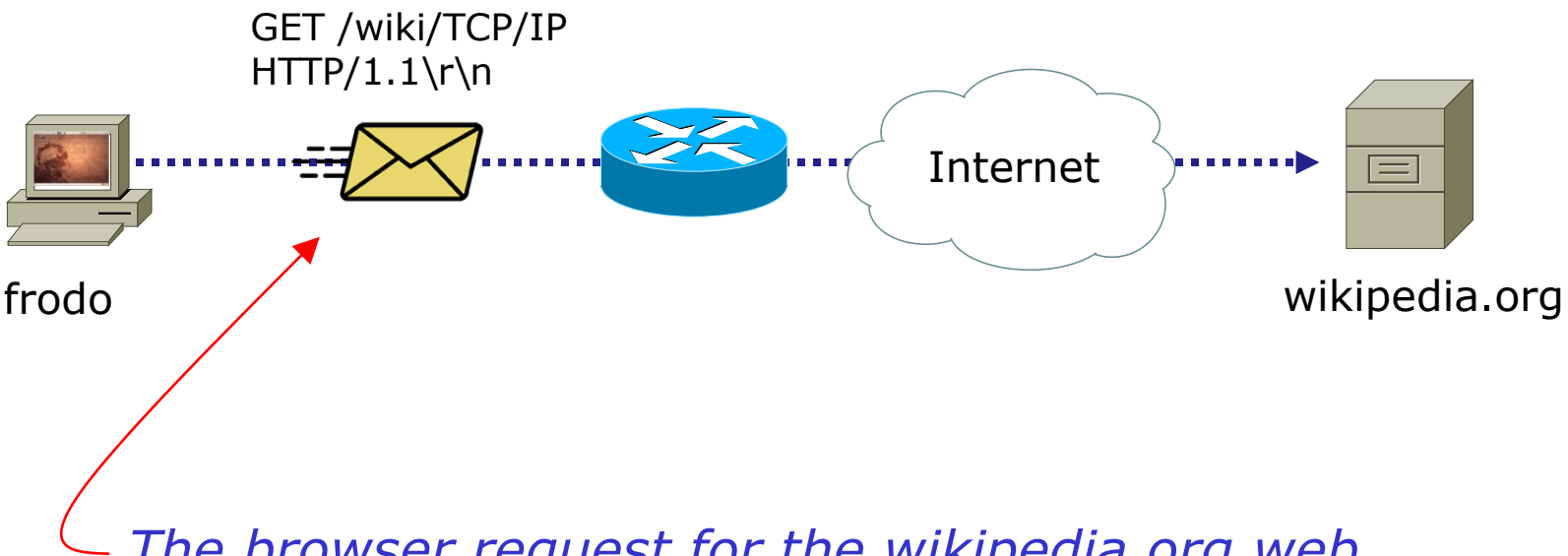
Putting it all together – web server example

http://simms-teach.com/animations/apache.html



Let's start with a web server example to see how the network is used

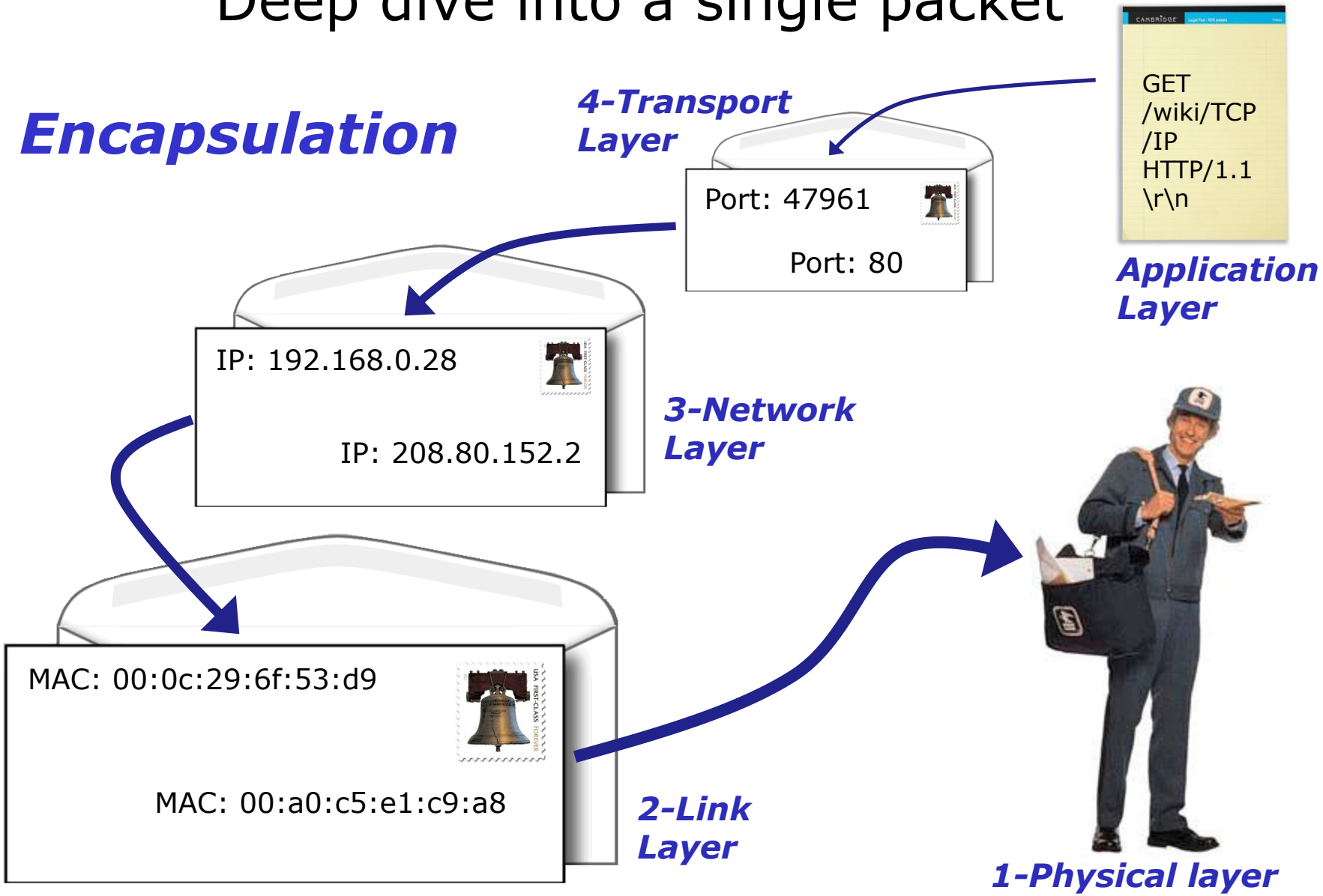
Deep dive into a single packet



*The browser request for the wikipedia.org web page is **encapsulated** into an Ethernet frame that is sent to the default gateway router.*

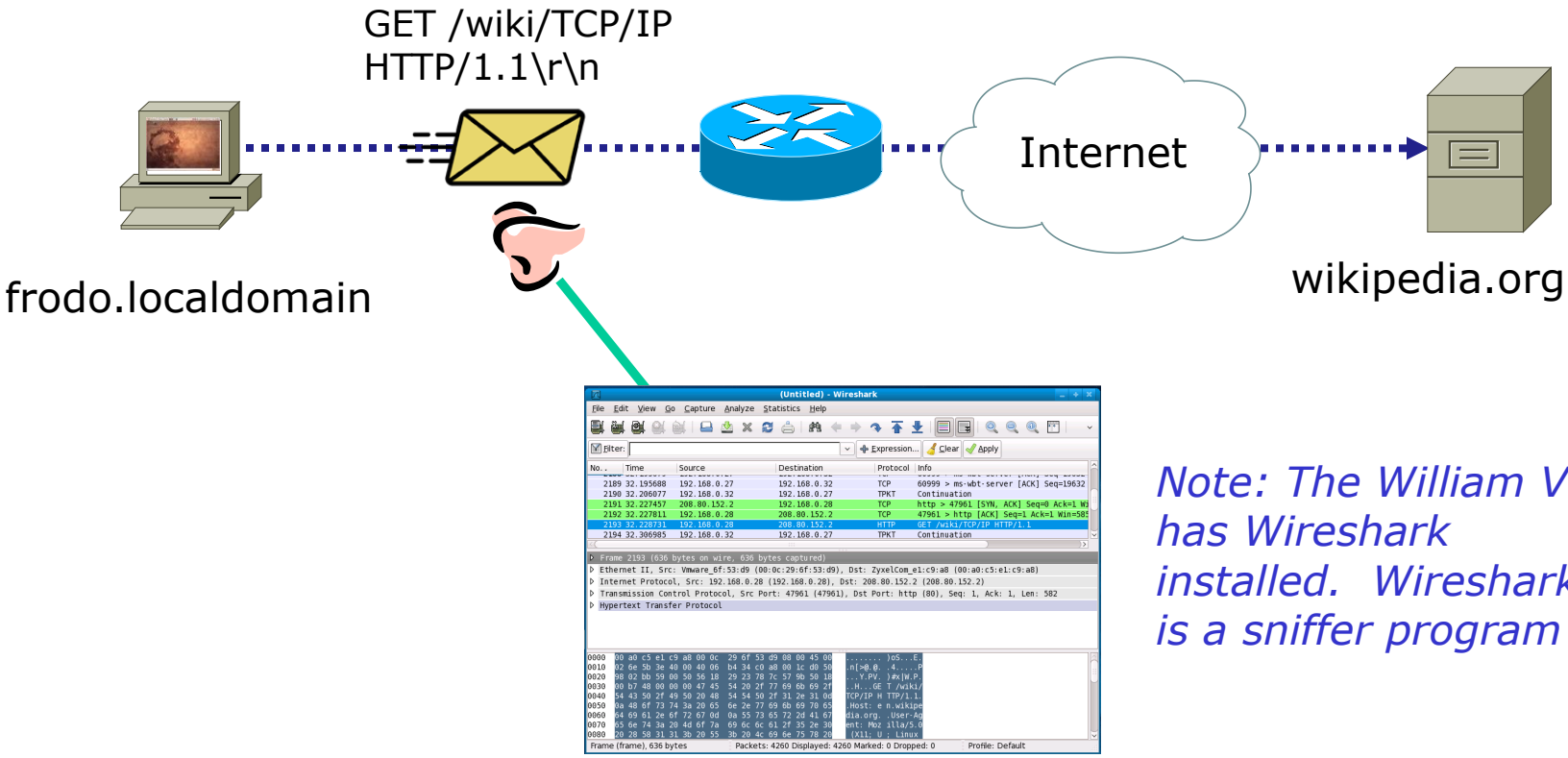
Deep dive into a single packet

Encapsulation



Deep dive into a single packet

We will use a sniffer to look at the "HTTP GET" packet sent out the NIC card on the Frodo VM to the home router (and from there it is forwarded out to the Internet)

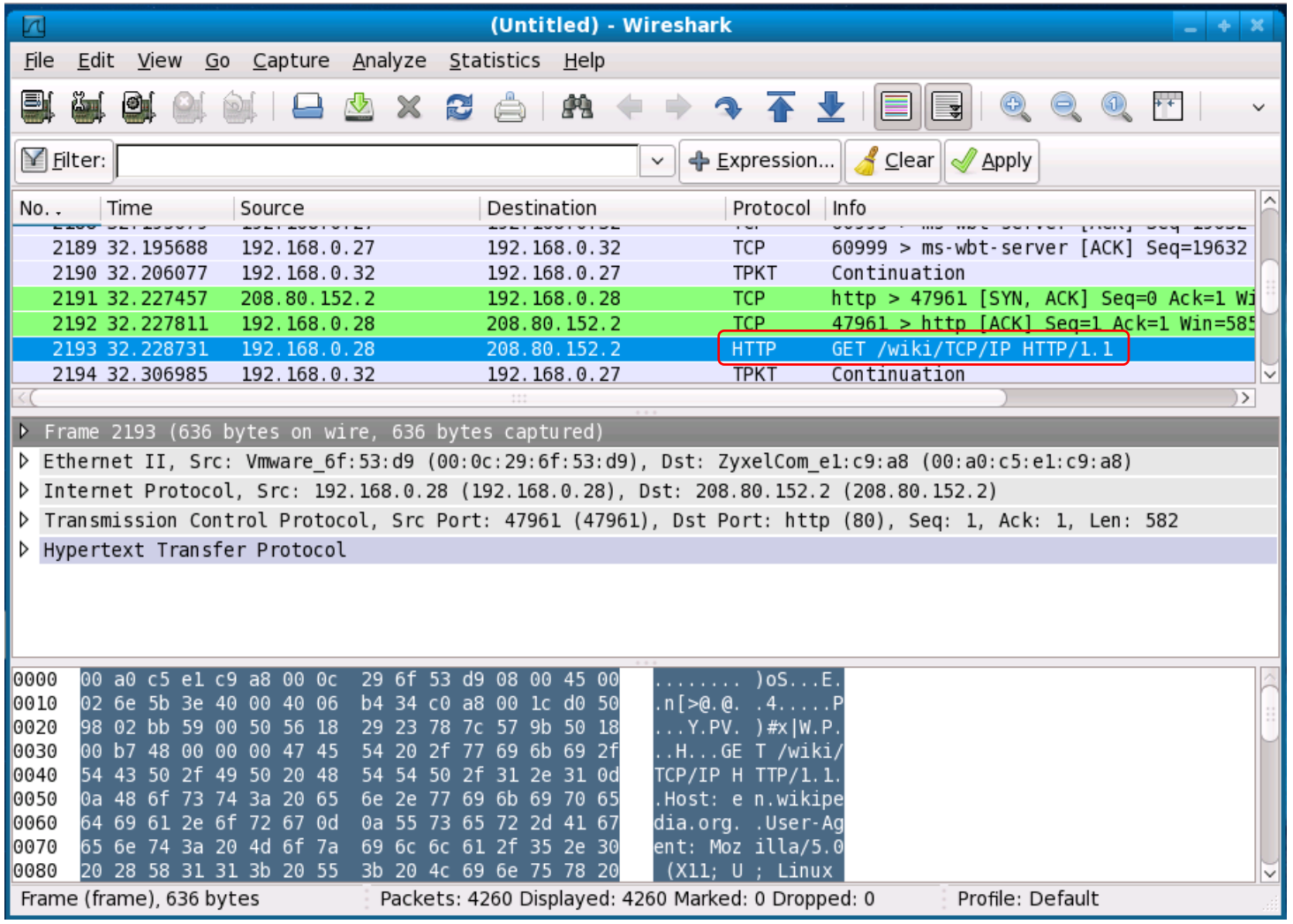


Note: The William VM has Wireshark installed. Wireshark is a sniffer program

Deep dive into a single packet

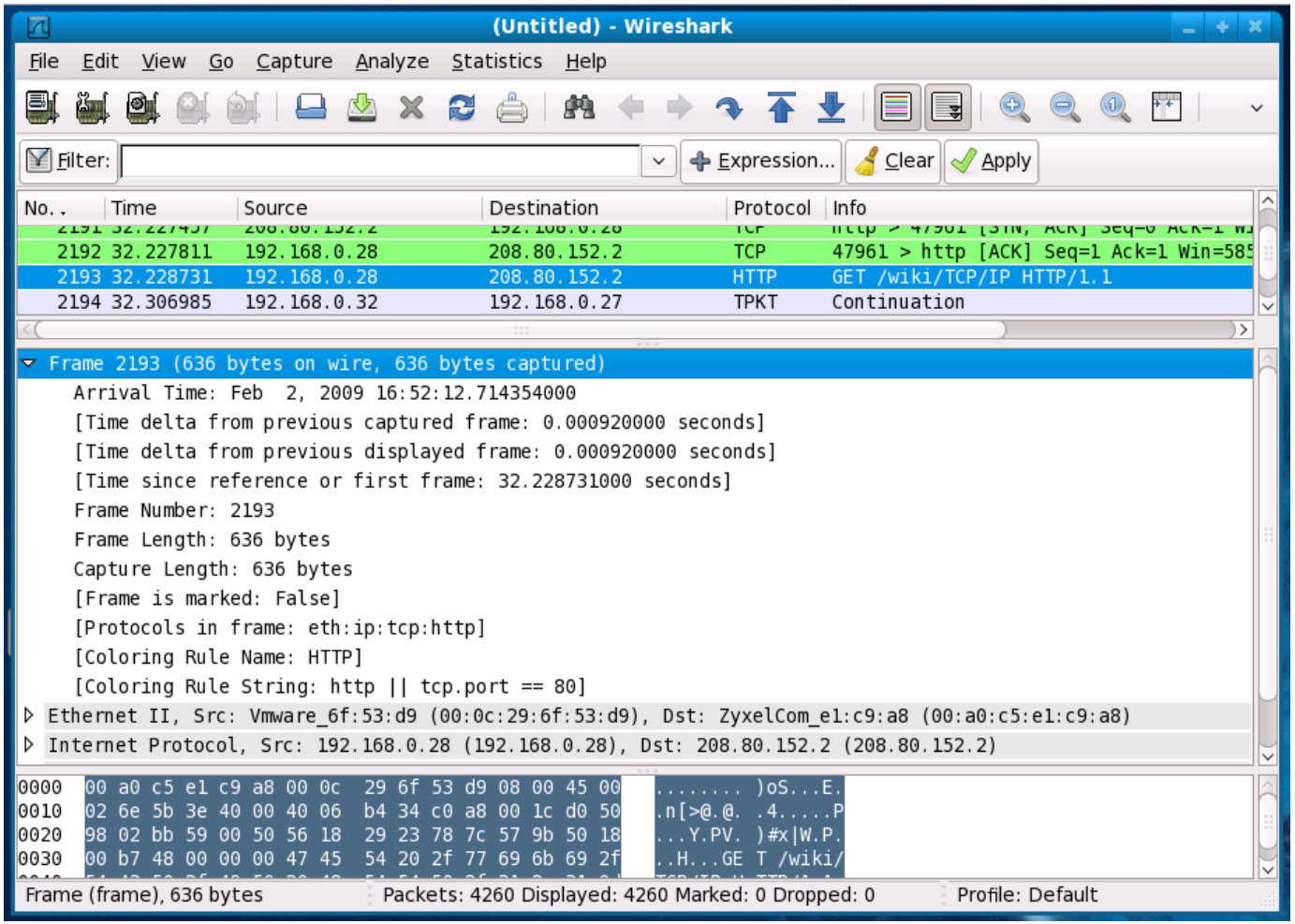
Note how Wireshark shows each layer for the selected HTTP GET packet

1-Physical
2-Link
3-Network
4-Transport
Application

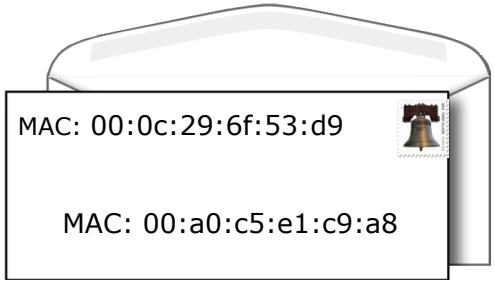


Deep dive into a single packet – Layer 1

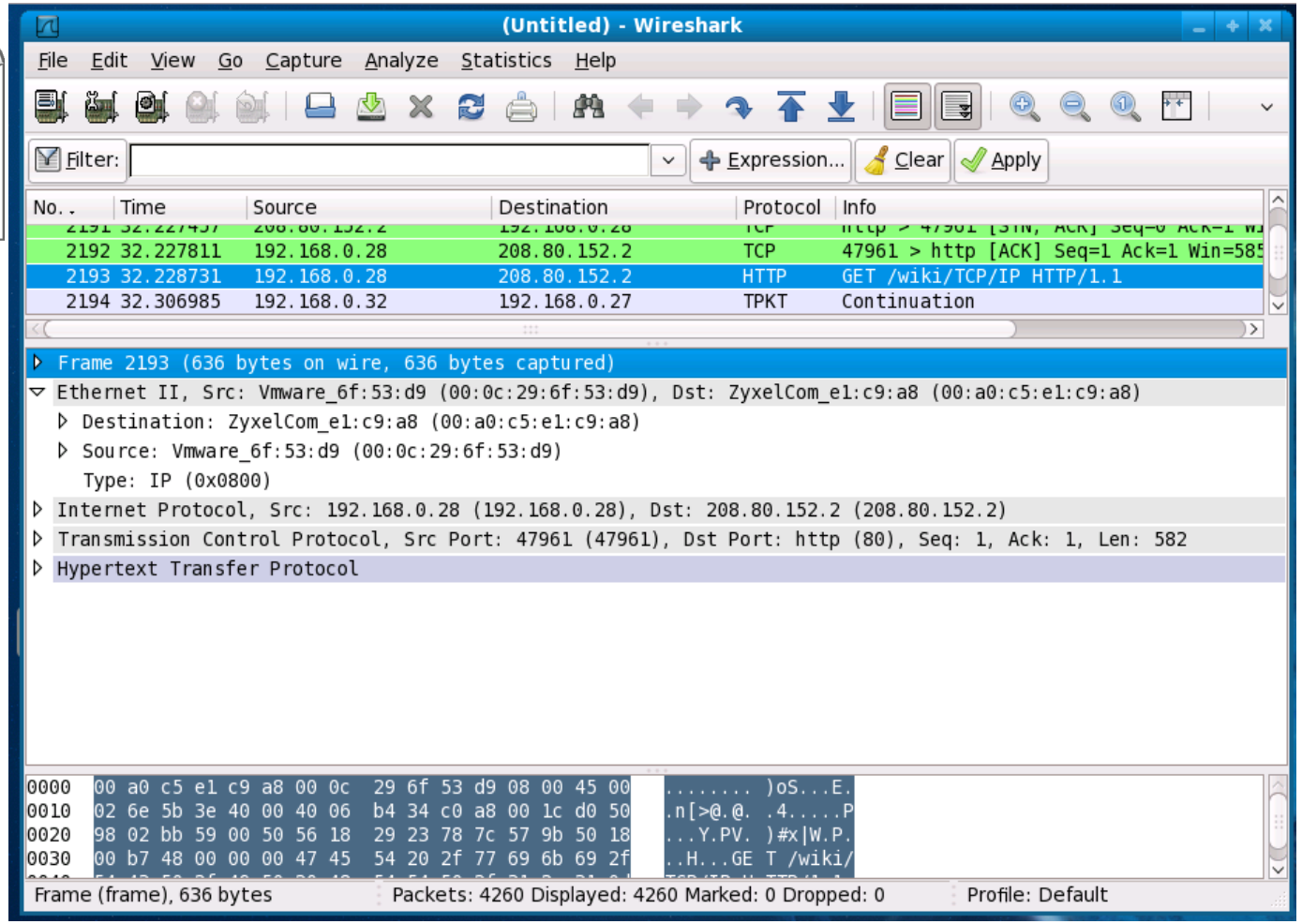
1-Physical layer expanded



Deep dive into a single packet – Layer 2

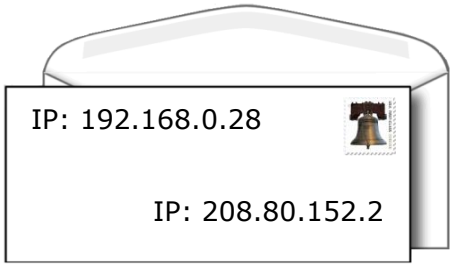


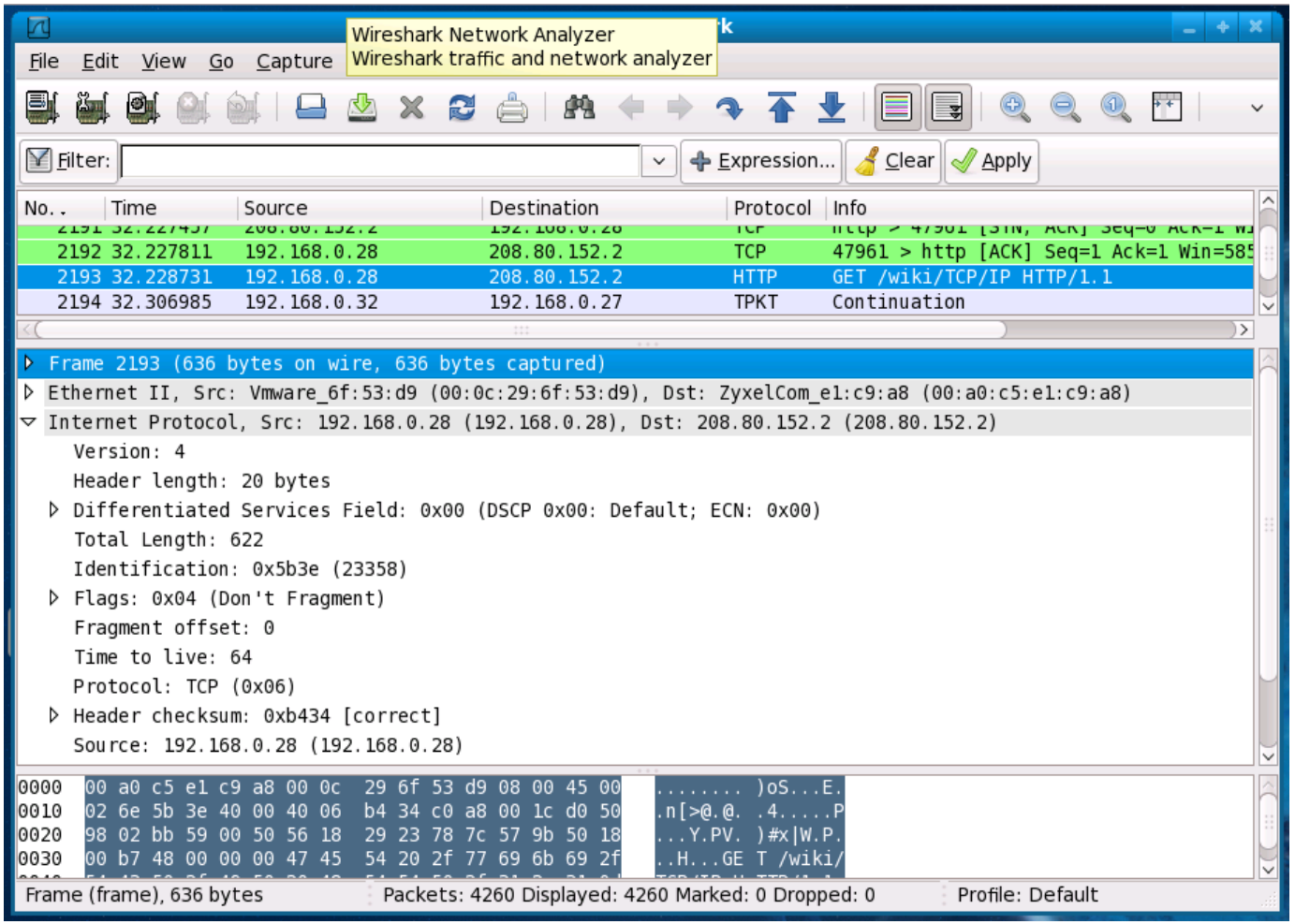
2-Link layer expanded



*Note the use of **MAC addresses** in this layer. The first half of the MAC address identifies the NIC vendor.*

Deep dive into a single packet – Layer 3

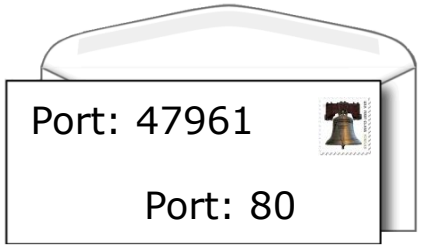




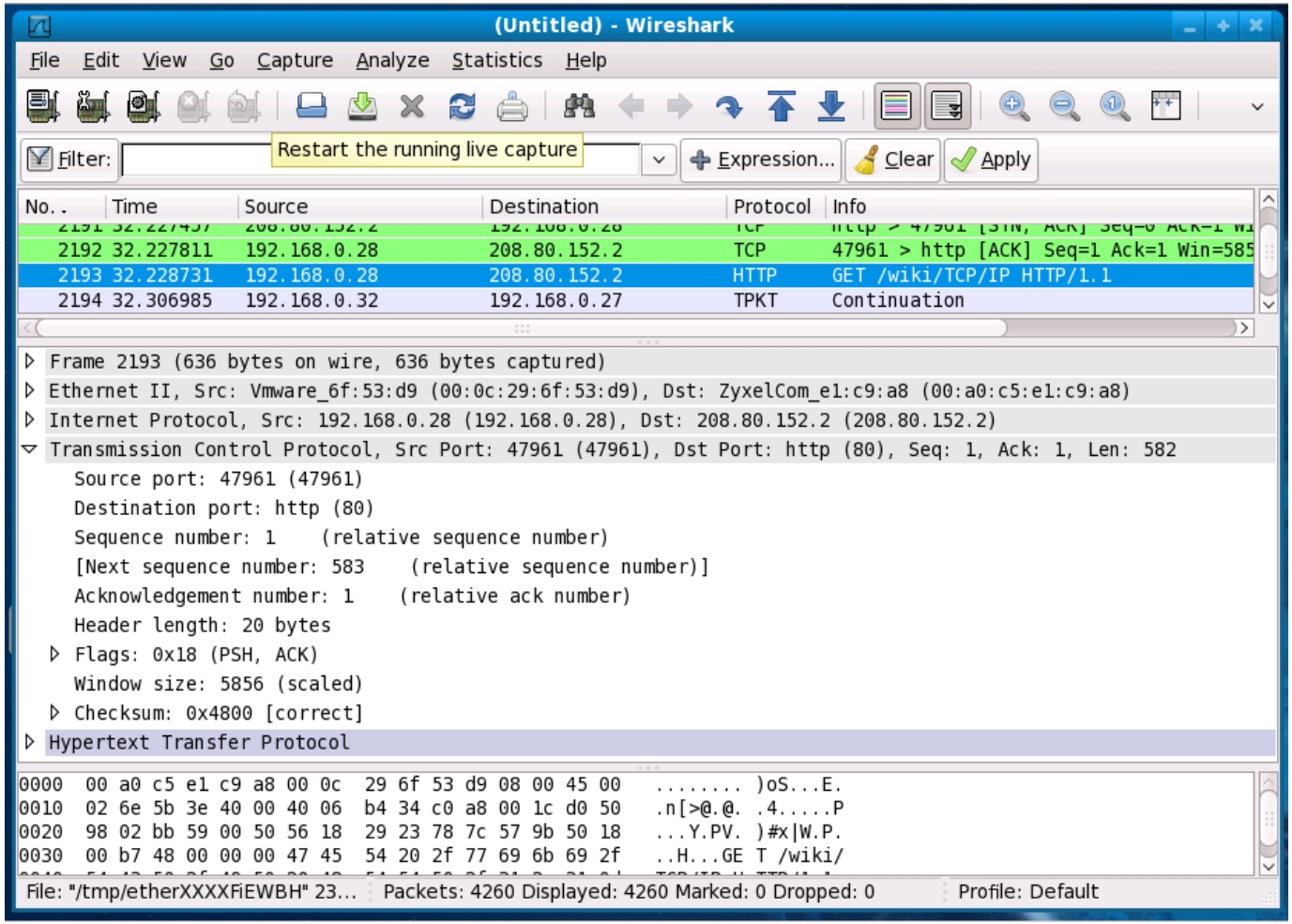
3-Network layer expanded

*Note the use of **IP addresses** in this layer.*

Deep dive into a single packet – Layer 4

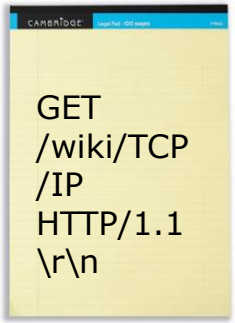


Transport layer expanded

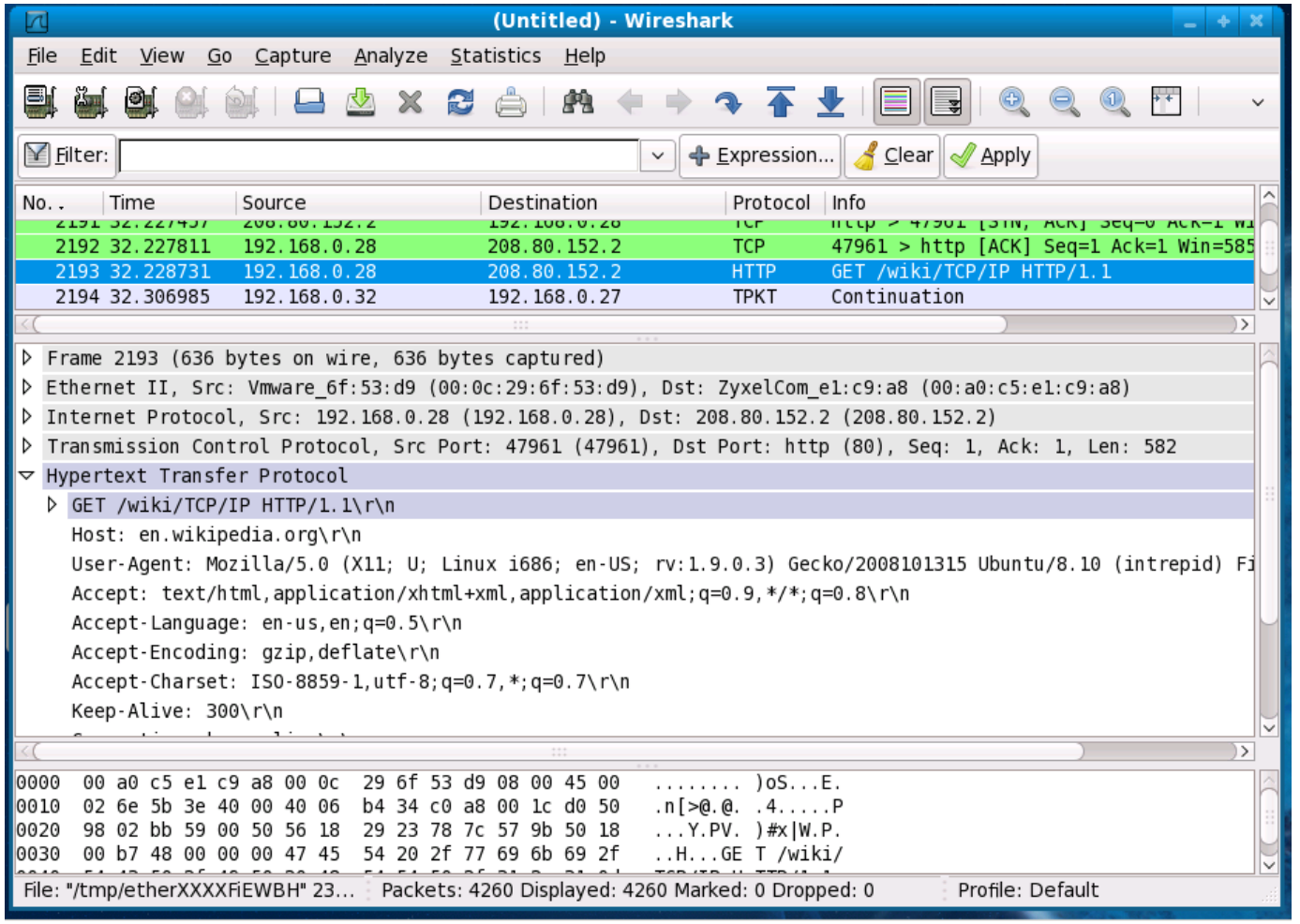


*Note the use of **ports** in this layer. Port 80 is for web servers.*

Deep dive into a single packet – Application layer

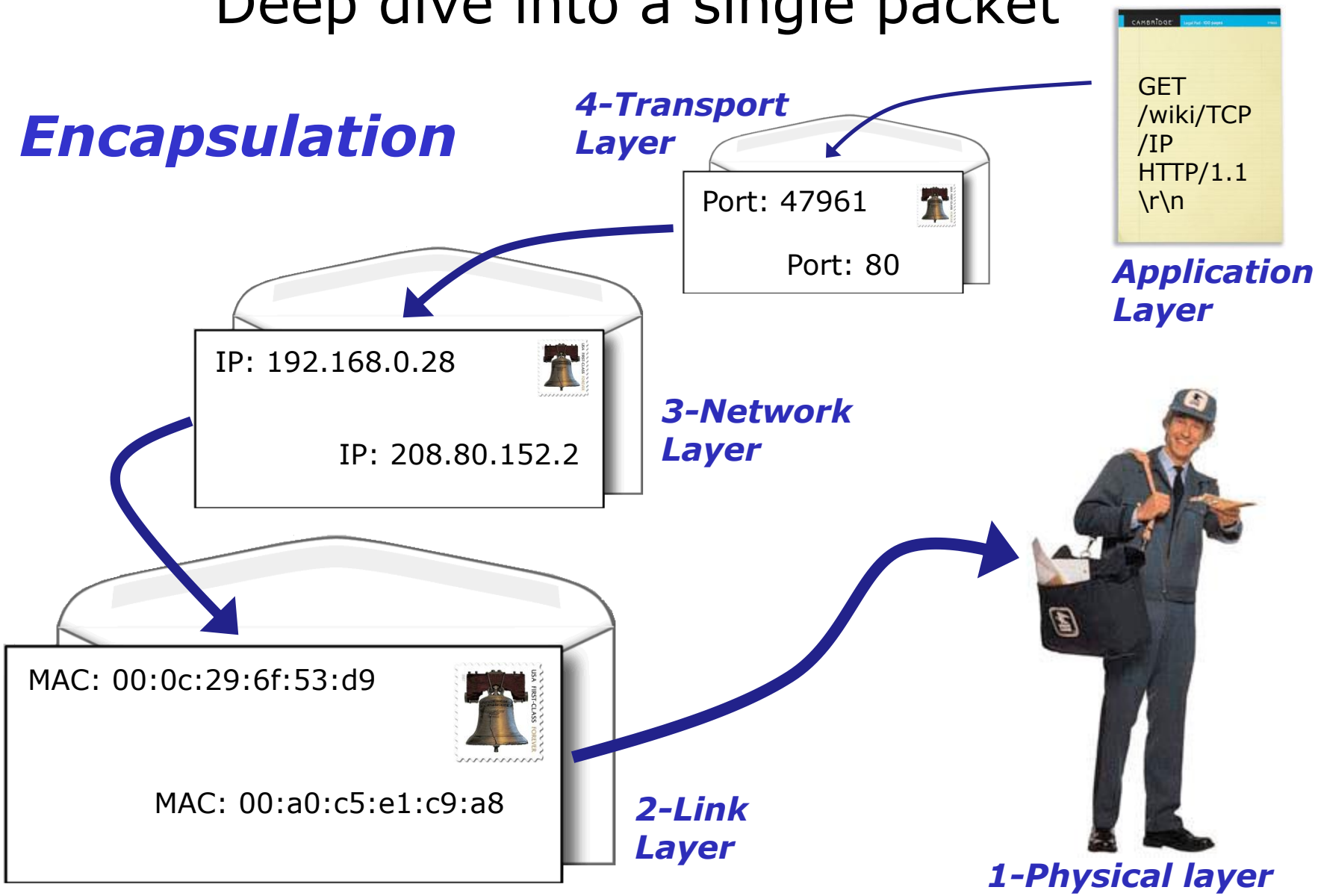


Application layer expanded



At last we get to the actual request being sent to the web server application

Deep dive into a single packet



Standards are needed

OSI	CIS 81	Nemeth Text	Wireshark	Source/ Destination	Unit	Devices
7 - Application	Application	Application	SSH, HTTP, DNS, RIP, Bootstrap (DHCP), SMB	An application program or service	Data	
6 - Presentation						
5 - Session						
4 - Transport	Transport	Transport	TCP/UDP	Port	Segment, Datagram	
3 - Network	Internet	Network	Internet Protocol	IP	Packet	Router
2 – Data link	Network Access	Link	Ethernet II	MAC	Ethernet Frame	Switch, NIC
1 - Physical		Physical	Frame	RJ-45 Jack	Bits	Hub, NIC, cables

- *For all this to work **standards** are essential.*
- *Each layer uses a protocol that follows a **standard**.*
- *Network equipment providers and software vendors build to **standards** so everything can interoperate.*

Standards

Standards

- How do we get all this stuff to work together?
- How can multiple vendors products interoperate?

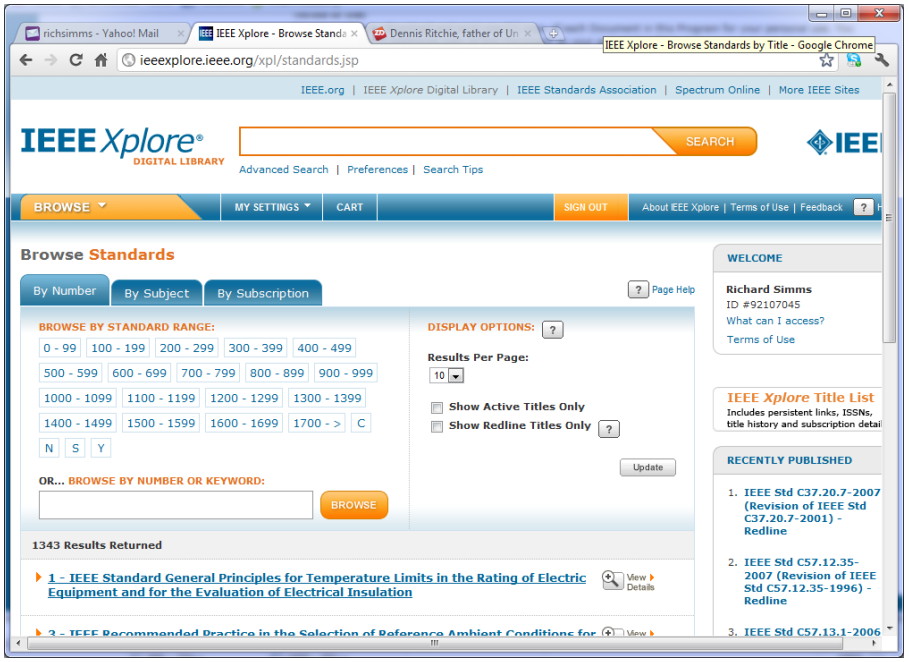
Answer: Standards

- IEEE – lower layer focus, e.g. Ethernet
- IETF – higher layer focus, e.g. HTTP protocol
- "Defacto" – vendor with market share sets, e.g. MS Word Doc, Adobe PDF

IEEE Standards

Institute of Electrical and Electronics Engineers

- Examples: 802.3 (Ethernet), 802.11 (WLAN)
- Search: **http://ieeexplore.ieee.org/xpl/standards.jsp**

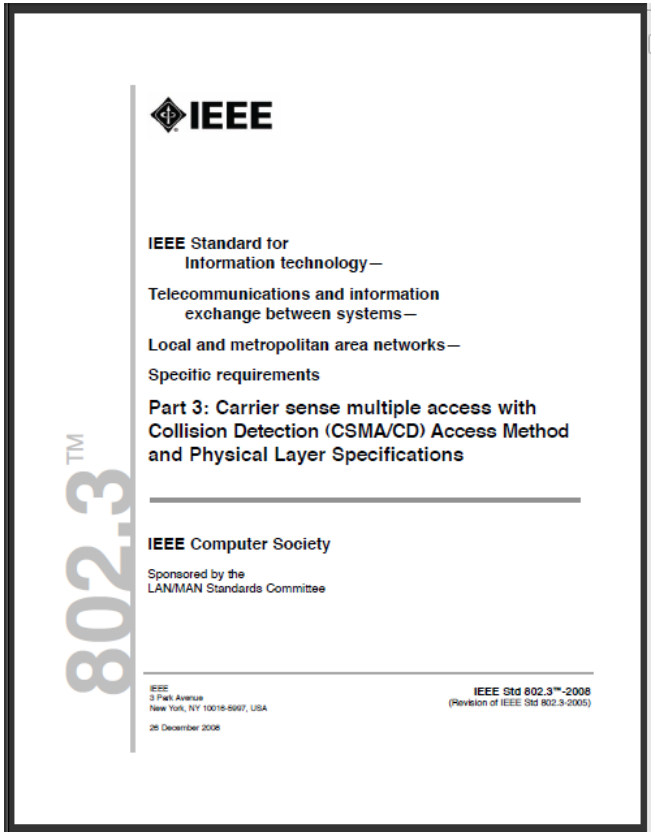


IEEE Standards

Institute of Electrical and Electronics Engineers

Example: Netgear Switch

IEEE 802.3i 10BASE-T Ethernet
IEEE 802.3u 100BASE-TX Fast Ethernet
IEEE 802.3z 1000BASE-T Gigabit Ethernet
IEEE 802.3x Full-duplex Flow Control
IEEE 801.p priority tags


IEEE

IEEE Standard for
Information technology—

Telecommunications and information
exchange between systems—

Local and metropolitan area networks—

Specific requirements

Part 3: Carrier sense multiple access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

802.3™

IEEE Computer Society

Sponsored by the
LAN/MAN Standards Committee

IEEE
3 Park Avenue
New York, NY 10016-5997, USA

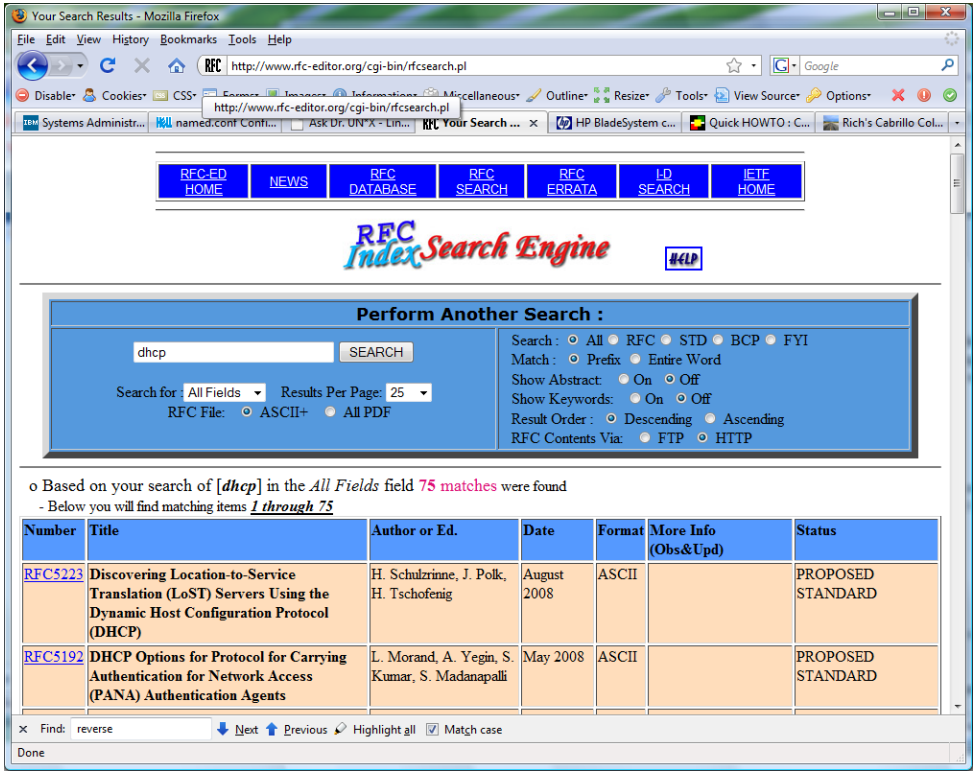
26 December 2008

IEEE Std 802.3™-2008
(Revision of IEEE Std 802.3-2005)

IETF Standards
Internet Engineering Task Force

- Published as RFCs (Request for Comments)
- Examples: TCP, IP, HTTP, FTP, DNS, DHCP, SSH
- Status
  - Informational (e.g. RFC 1983 "Glossary")
  - Experimental
  - Best Current Practice
  - Standards Track
    - Proposed Standard
    - Draft Standard
    - Internet Standard
  - Historic
- RFC Search Engine: **http://www.rfc-editor.org/rfcsearch.html**

Standards
IETF (Internet Engineering Task Force)

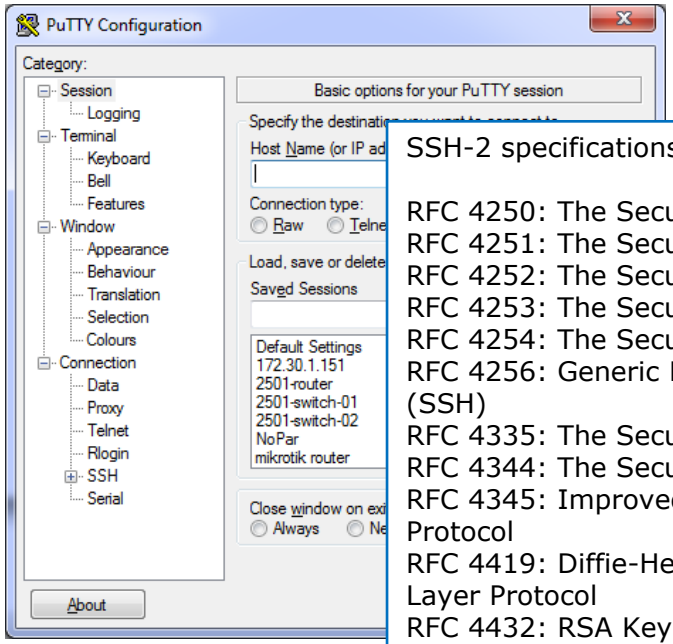


DHCP example

http://www.rfc-editor.org/rfcsearch.html

Standards
IETF (Internet Engineering Task Force)

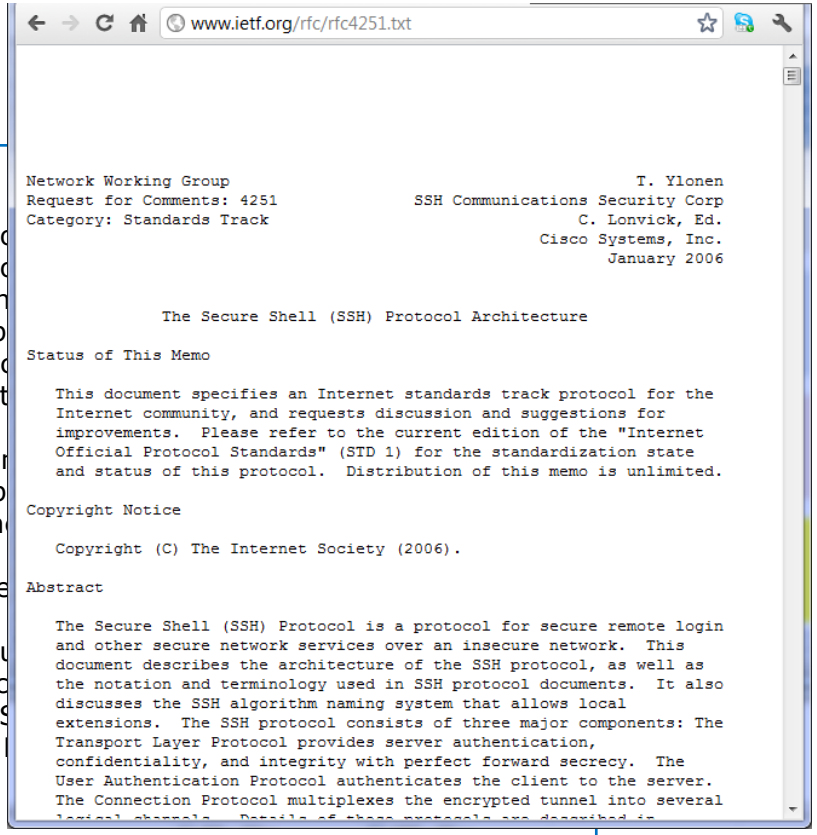
Example: PuTTY SSH software



SSH-2 specifications

RFC 4250: The Secure Shell (SSH) Protocol
RFC 4251: The Secure Shell (SSH) Protocol
RFC 4252: The Secure Shell (SSH) Authen
RFC 4253: The Secure Shell (SSH) Transp
RFC 4254: The Secure Shell (SSH) Connec
RFC 4256: Generic Message Exchange Aut
(SSH)
RFC 4335: The Secure Shell (SSH) Session
RFC 4344: The Secure Shell (SSH) Transp
RFC 4345: Improved Arcfour Modes for th
Protocol
RFC 4419: Diffie-Hellman Group Exchange
Layer Protocol
RFC 4432: RSA Key Exchange for the Secu
RFC 4462: Generic Security Service Applic
Authentication and Key Exchange for the S
RFC 4716: The Secure Shell (SSH) Public
IETF Secure Shell working group drafts:
filexfer
Independent drafts:
draft-miller-secsh-compression-delayed

RFC 4251 SSH Protocol Architecture



Joining the network

Connecting your Linux system to the Network

1. Identify the NIC in your system (vendor a)
2. Locate a driver for your NIC
   - may be already availab
   - may be available f
   - may be avai vendor
   - may h d build (compile) it
3. Load t smod or modprobe command)
4. Bring up and configure the interface (ifconfig)

We will go through each of these four steps

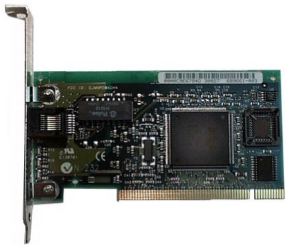
NIC

aka
Network Interface Card
Network Interface Controller
Network Adapter
Ethernet Device

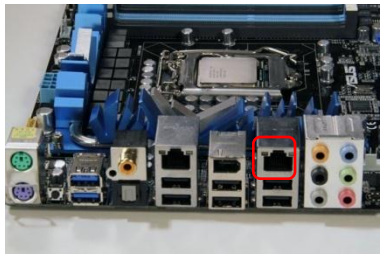
Connecting your Linux system to the Network

1. **Identify the NIC in your system (vendor and model)**
2. Locate a driver for your NIC
   - may be already available with your distro
   - may be available from NIC vendor
   - may be available from chipset vendor
   - may have get source and build (compile) it
3. Load the driver (**insmod** or **modprobe** command)
4. Bring up and configure the interface (ifconfig)

NIC (Network Interface Card/Controller)



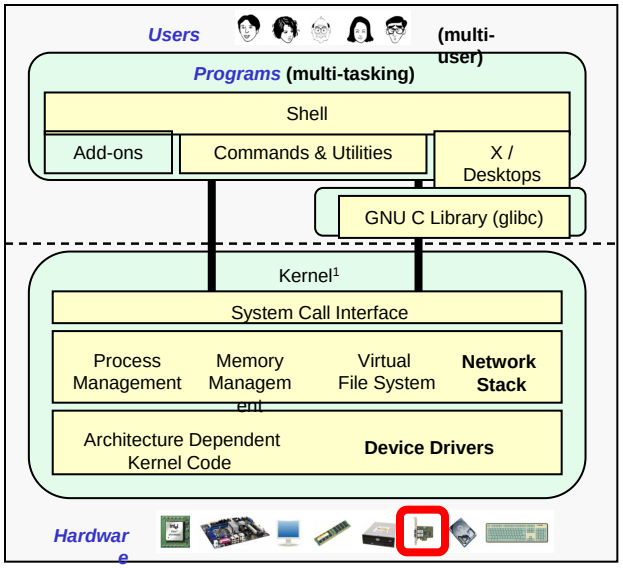
NIC card

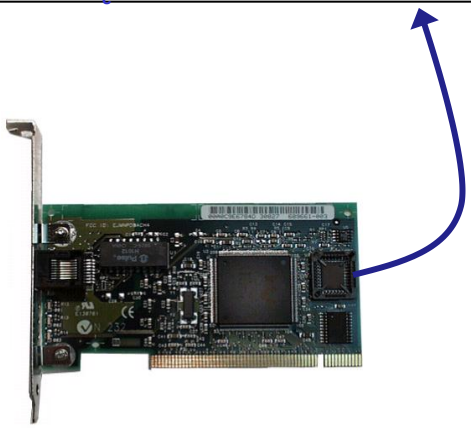


NIC on the motherboard

- The NIC is used by a computer to send and receive packets on the network.
- Most PC NICs are now part of the motherboard rather than a card.
- A NIC can operate at the level 2 (Link Layer) sending and receiving Ethernet frames based on MAC addresses.
- Multiple NICs allow a computer to be on multiple networks or they can be teamed for higher performance.
- On the Red Hat family, kudzu is used to probe for new hardware at boot time. If you install a second NIC after installation you will get prompted to configure it.

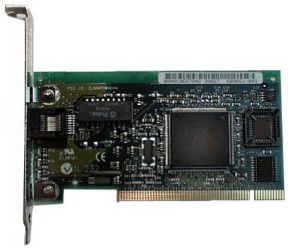
NIC Hardware Inventory





How to determine what NIC you have:

- Use **lspci** to show PCI hardware on the computer.
- Use **dmesg** and look for NIC and driver related information
- or use the web to check the technical specifications for your computer or mother board (assumes you have not made any NIC changes)



NIC Hardware Inventory

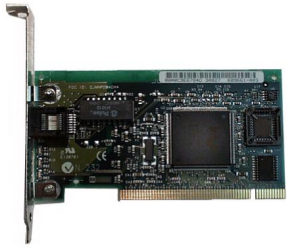
lspci command *... on a classroom VM*

```
[root@celebrian ~]# lspci
00:00.0 Host bridge: Intel Corporation 440BX/ZX/DX - 82443BX/ZX/DX Host bridge (rev 01)
00:01.0 PCI bridge: Intel Corporation 440BX/ZX/DX - 82443BX/ZX/DX AGP bridge (rev 01)
00:07.0 ISA bridge: Intel Corporation 82371AB/EB/MB PIIX4 ISA (rev 08)
00:07.1 IDE interface: Intel Corporation 82371AB/EB/MB PIIX4 IDE (rev 01)
00:07.3 Bridge: Intel Corporation 82371AB/EB/MB PIIX4 ACPI (rev 08)
00:07.7 System peripheral: VMware Virtual Machine Communication Interface (rev 10)
00:0f.0 VGA compatible controller: VMware SVGA II Adapter
00:10.0 SCSI storage controller: LSI Logic / Symbios Logic 53c1030 PCI-X Fusion-MPT Dual
  Ultra320 SCSI (rev 01)
00:11.0 PCI bridge: VMware PCI bridge (rev 02)
00:15.0 PCI bridge: VMware PCI Express Root Port (rev 01)
< snipped >
00:18.7 PCI bridge: VMware PCI Express Root Port (rev 01)
02:00.0 USB Controller: Intel Corporation 82371AB/EB/MB PIIX4 USB
02:01.0 Ethernet controller: Advanced Micro Devices [AMD] 79c970 [PCnet32 LANCE] (rev 10)
02:02.0 Ethernet controller: Advanced Micro Devices [AMD] 79c970 [PCnet32 LANCE] (rev 10)
02:03.0 Multimedia audio controller: Ensoniq ES1371 [AudioPCI-97] (rev 02)
02:04.0 USB Controller: VMware USB2 EHCI Controller
[root@celebrian ~]#
```

*Interpretation: The Celebrian VM on a **classroom PC** has two NICs installed.*

The NIC vendor is AMD and the model is 79c970.

NIC Hardware Inventory



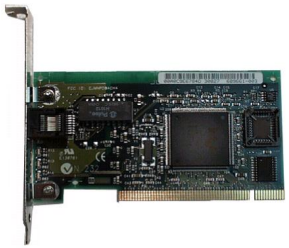
dmesg command *... on a classroom VM*

Use grep to search dmesg output for strings like net, eth, int etc.

```
[root@celebrian ~]# dmesg | grep net
Initializing cgroup subsys net_cls
audit: initializing netlink socket (disabled)
SELinux:  Registering netfilter hooks
Initializing XFRM netlink socket
Initalizing network drop monitor service
VMware vmxnet virtual NIC driver
vmxnet 0000:02:01.0: PCI INT A -> GSI 19 (level, low) -> IRQ 19
Found vmxnet/PCI at 0x2024, irq 19.
vmxnet 0000:02:02.0: PCI INT A -> GSI 16 (level, low) -> IRQ 16
Found vmxnet/PCI at 0x20a4, irq 16.
pcnet32.c:v1.35 21.Apr.2008 tsbogend@alpha.franken.de
[root@celebrian ~]#
```

dmesg *output may have useful messages regarding NIC and driver status during startup.*

Note the 02:01 and 02:02 match the NICs in the previous ***lspci*** *output.*



NIC Hardware Inventory

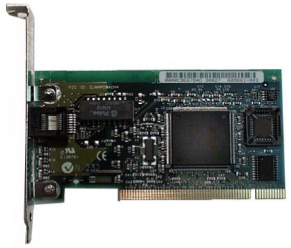
lspci command *... on VLab VM*

```
[root@celebrian ~]# lspci
00:00.0 Host bridge: Intel Corporation 440BX/ZX/DX - 82443BX/ZX/DX Host bridge (rev 01)
00:01.0 PCI bridge: Intel Corporation 440BX/ZX/DX - 82443BX/ZX/DX AGP bridge (rev 01)
00:07.0 ISA bridge: Intel Corporation 82371AB/EB/MB PIIX4 ISA (rev 08)
00:07.1 IDE interface: Intel Corporation 82371AB/EB/MB PIIX4 IDE (rev 01)
00:07.3 Bridge: Intel Corporation 82371AB/EB/MB PIIX4 ACPI (rev 08)
00:07.7 System peripheral: VMware Virtual Machine Communication Interface (rev 10)
00:0f.0 VGA compatible controller: VMware SVGA II Adapter
00:11.0 PCI bridge: VMware PCI bridge (rev 02)
00:15.0 PCI bridge: VMware PCI Express Root Port (rev 01)
< snipped>
00:18.7 PCI bridge: VMware PCI Express Root Port (rev 01)
02:00.0 Ethernet controller: Intel Corporation 82545EM Gigabit Ethernet Controller
  (Copper) (rev 01)
02:01.0 Ethernet controller: Intel Corporation 82545EM Gigabit Ethernet Controller
  (Copper) (rev 01)
03:00.0 Serial Attached SCSI controller: VMware PVSCSI SCSI Controller (rev
  02)[root@celebrian ~]#
```

Interpretation: The Celebrian VM on the VLab VMware ESXi server has two NICs installed.

The NIC vendor is Intel and the NIC model is 8254EM.

NIC Hardware Inventory



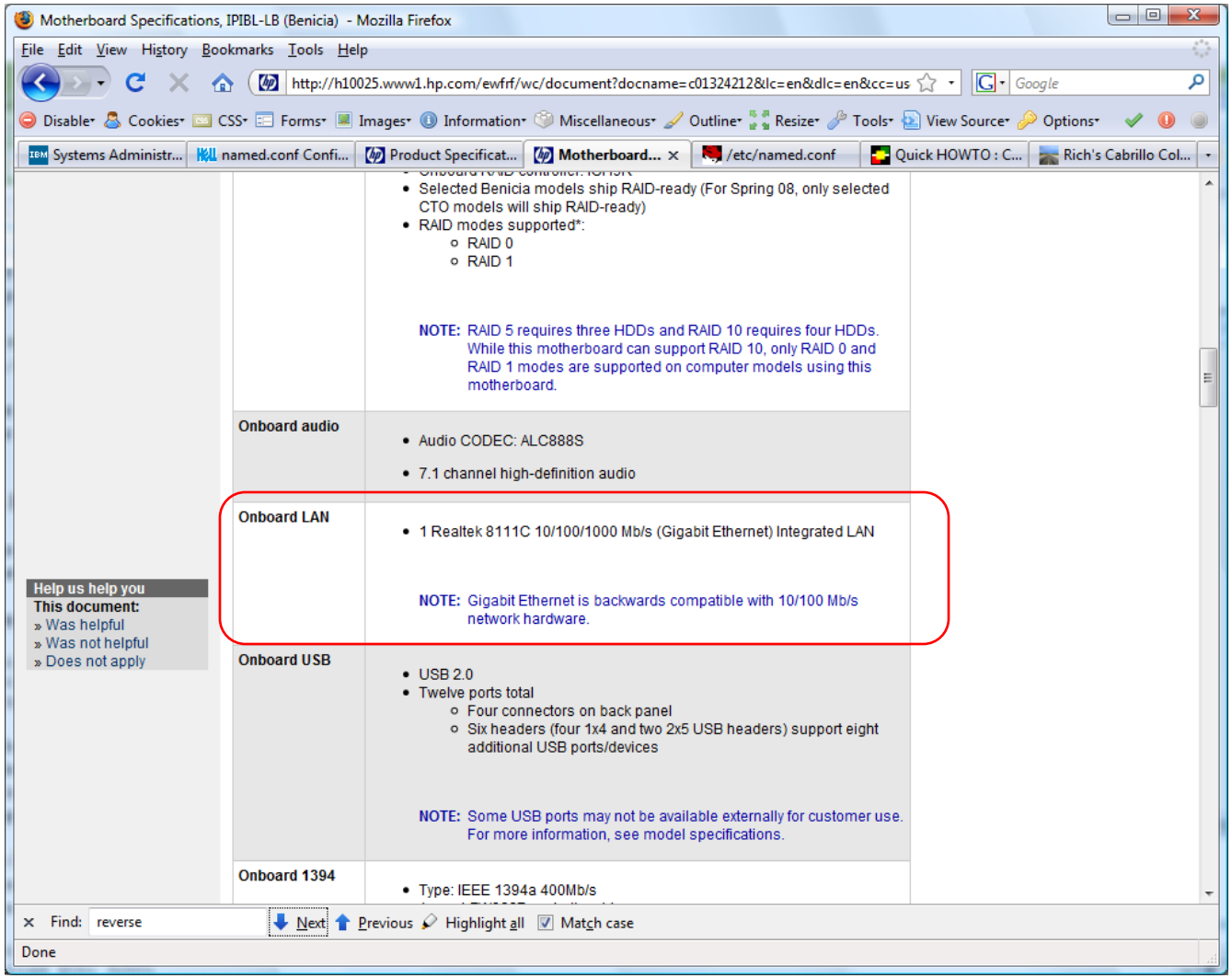
dmesg command *... on VLab VM*

Use grep to search dmesg output for strings like net, eth, int etc.

```
[root@celebrian ~]# dmesg | grep eth
e1000: eth0: e1000_probe: Intel(R) PRO/1000 Network Connection
e1000: eth1: e1000_probe: Intel(R) PRO/1000 Network Connection
e1000: eth0: e1000_set_tso: TSO is Enabled
e1000: eth1: e1000_set_tso: TSO is Enabled
e1000: eth0 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: None
eth0: no IPv6 routers present
[root@celebrian ~]#
```

dmesg *output may have useful messages regarding NIC and driver status during startup.*

NIC Hardware Inventory



Using the web to find NIC information

Example: An HP Pavilion a6750t uses a ASUS: IPIBL-LB (Benicia) motherboard which has a Realtek 8111C 10/100/1000 Mb/s (Gigabit Ethernet) Integrated LAN

Class Activity
NIC Inventory

1. Power on Frodo, login as cis192 then **sudo su –** to root.
2. Use the **lspci** command and locate the NIC hardware.
3. How many NICs does Frodo have?
4. What is the NIC vendor and model number?
5. Use the **dmesg | more** command browse through the kernel bootup messages.
6. Narrow down the output with

   dmesg | grep net

   or **dmesg | grep eth**

NIC Drivers

Connecting your Linux system to the Network

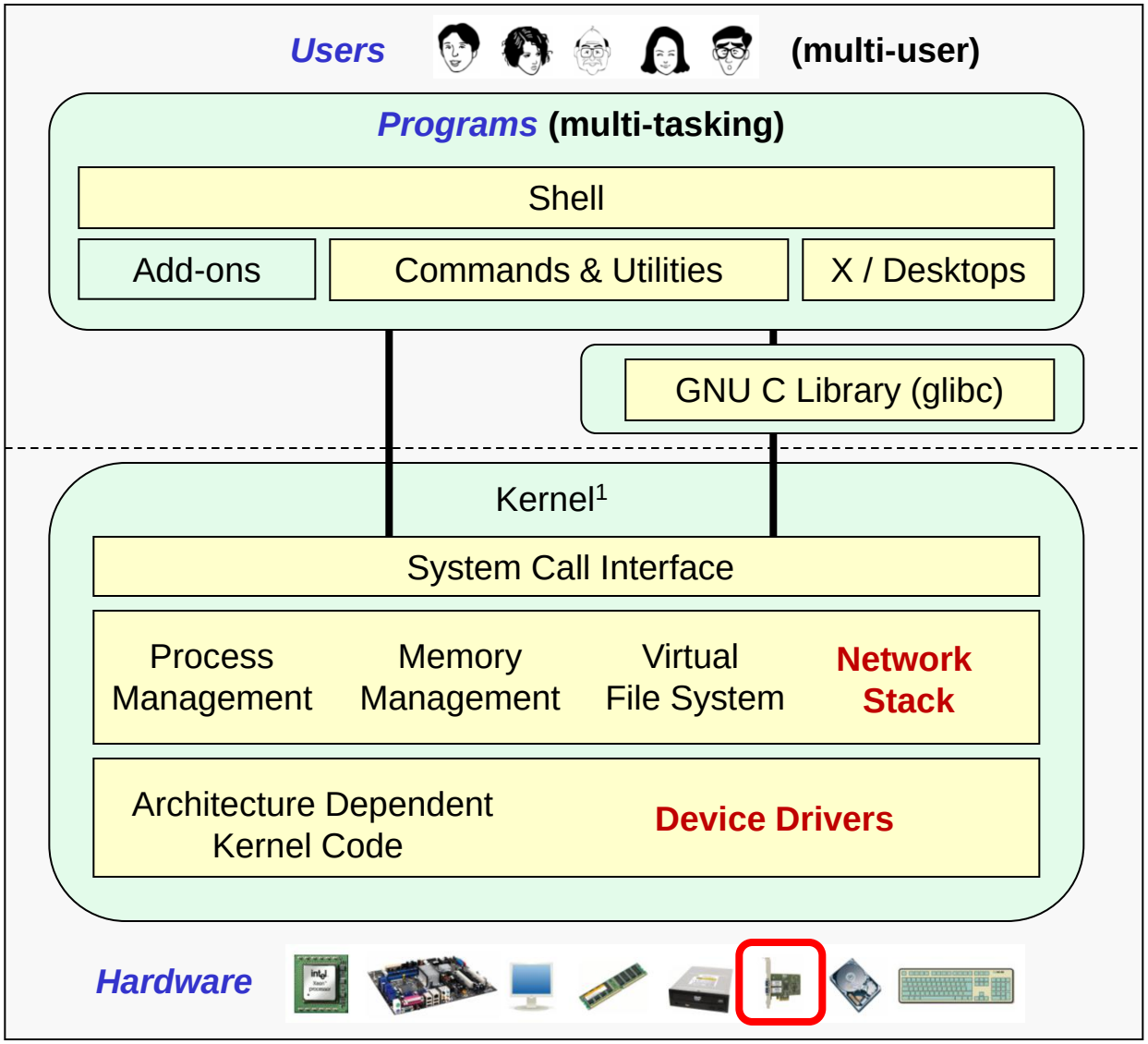
1. Identify the NIC in your system (vendor and model)

2. **Locate a driver for your NIC**
   - may be already available with your distro
   - may be available from NIC vendor
   - may be available from chipset vendor
   - may have get source and build (compile) it

3. Load the driver (**insmod** or **modprobe** command)

4. Bring up and configure the interface (ifconfig)

GNU/Linux Operating System Architecture

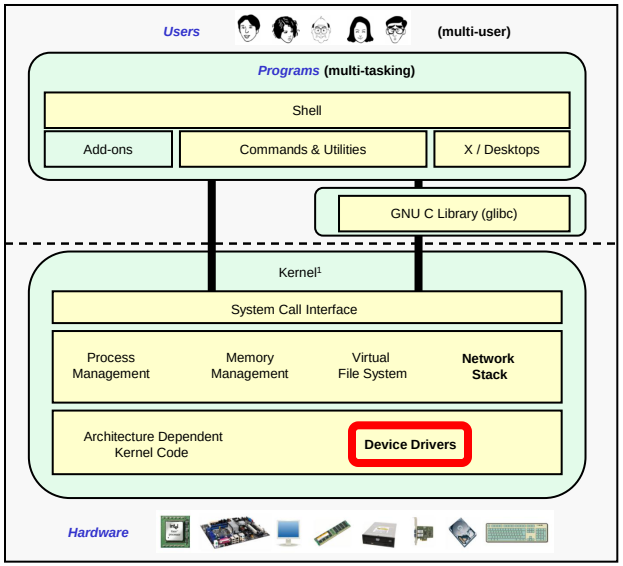


The network stack is implemented in the Linux kernel

NIC drivers are implemented as kernel modules than can be dynamically loaded and unloaded

[1]See "Anatomy of the Linux kernel" by M. Tim Jones at http://www-128.ibm.com/developerworks/linux/library/l-linux-kernel/

NIC Drivers



- The Linux kernel requires a specific driver to correctly use a specific vendors NIC hardware.
- Linux NIC drivers are implemented as **dynamic kernel modules**.
- Getting the right Linux NIC driver for your NIC can be **problematic**.
- ☺ Newer distributions are able to probe NIC hardware and automatically install the correct driver if they can recognize the NIC.
- ☹ An older distribution may not recognize a newer NIC and you will have to manually locate, sometimes compile and install the correct NIC driver.

While there are hundreds of different NICs there are relatively few NIC chipsets many of which have Linux support

Locating NIC Drivers

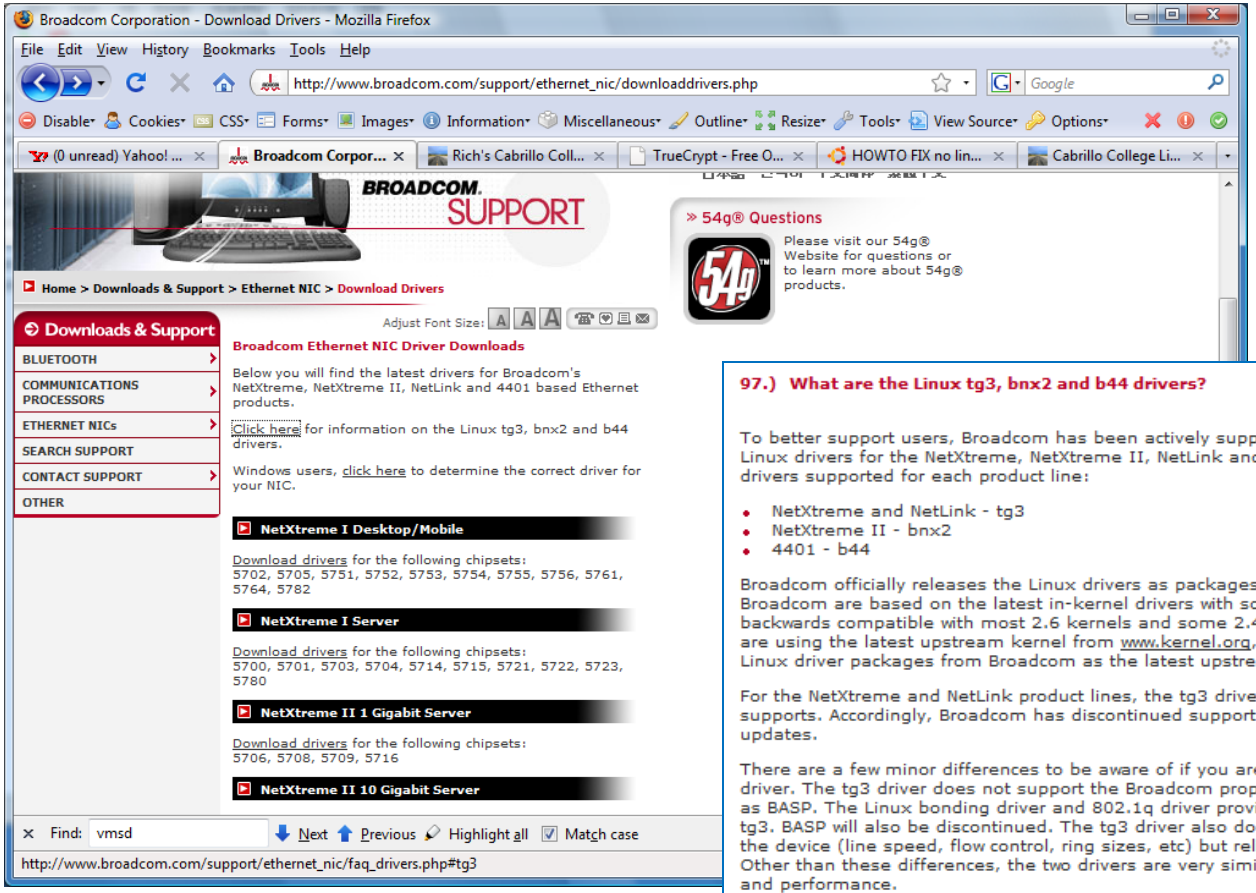
- To see the NIC drivers included with your distribution , look in the **/lib/modules/$(uname -r)/kernel/drivers/net** directory. This has all the NIC drivers that have been compiled for your kernel.

- Newer distribution, older NICs – no problem, correct NIC driver is chosen automatically during starup.

- Older distribution, newer NICs can be problematic:
  - You may have to manually load the NIC, refer to http://tldp.org/HOWTO/Ethernet-HOWTO.html for which driver to select for older equipment
  - Check the computer or NIC vendors web site for NIC drivers. For example, HP supplies Linux drivers for many of its servers (but few of its desktops)
  - Start googling, try **linux *nic-name* driver**. You may have to download source and compile a driver from the chipset vendor's site using their instructions.
  - If the preceding methods have not worked you can always install an older NIC in your computer and use that until you find the correct driver for the newer NIC.

NIC Drivers

Chipset vendor Downloads



97.) What are the Linux tg3, bnx2 and b44 drivers?

To better support users, Broadcom has been actively supporting, maintaining, and testing the in-kernel Linux drivers for the NetXtreme, NetXtreme II, NetLink and 4401 product lines. The following is list of drivers supported for each product line:

- NetXtreme and NetLink - tg3
- NetXtreme II - bnx2
- 4401 - b44

Broadcom officially releases the Linux drivers as packages. The Linux driver packages released by Broadcom are based on the latest in-kernel drivers with some added compatibility code to make it backwards compatible with most 2.6 kernels and some 2.4 kernels (generally newer than 2.4.24). If you are using the latest upstream kernel from www.kernel.org, you generally do not need to download the Linux driver packages from Broadcom as the latest upstream kernel has the latest Linux driver patches.

For the NetXtreme and NetLink product lines, the tg3 driver is now the only Linux driver that Broadcom supports. Accordingly, Broadcom has discontinued support for the bcm5700 driver and no longer provides updates.

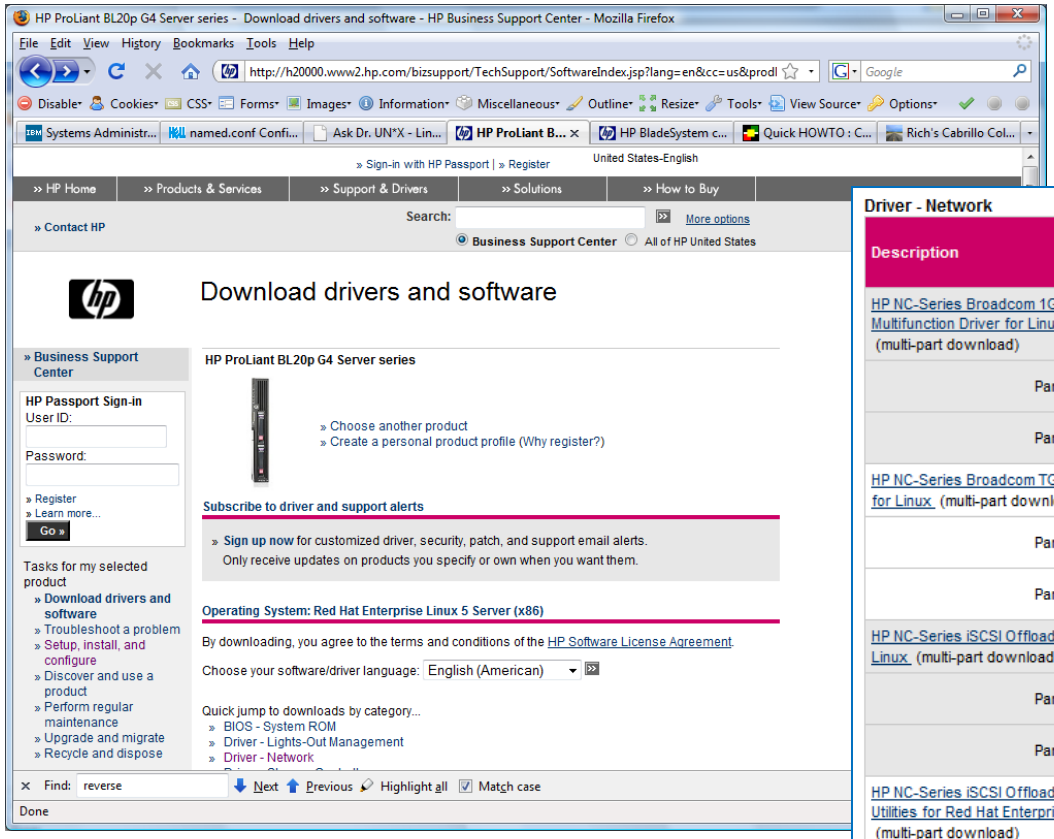
There are a few minor differences to be aware of if you are migrating from the bcm5700 driver to the tg3 driver. The tg3 driver does not support the Broadcom proprietary load balancing software module known as BASP. The Linux bonding driver and 802.1q driver provide similar functionalities and can be used with tg3. BASP will also be discontinued. The tg3 driver also does not support module parameters to configure the device (line speed, flow control, ring sizes, etc) but relies on standard Linux utilities such as ethtool. Other than these differences, the two drivers are very similar in terms of hardware support, robustness, and performance.

Back to Top

http://www.broadcom.com/support/ethernet_nic/downloaddrivers.php

NIC Drivers

Server vendor Downloads



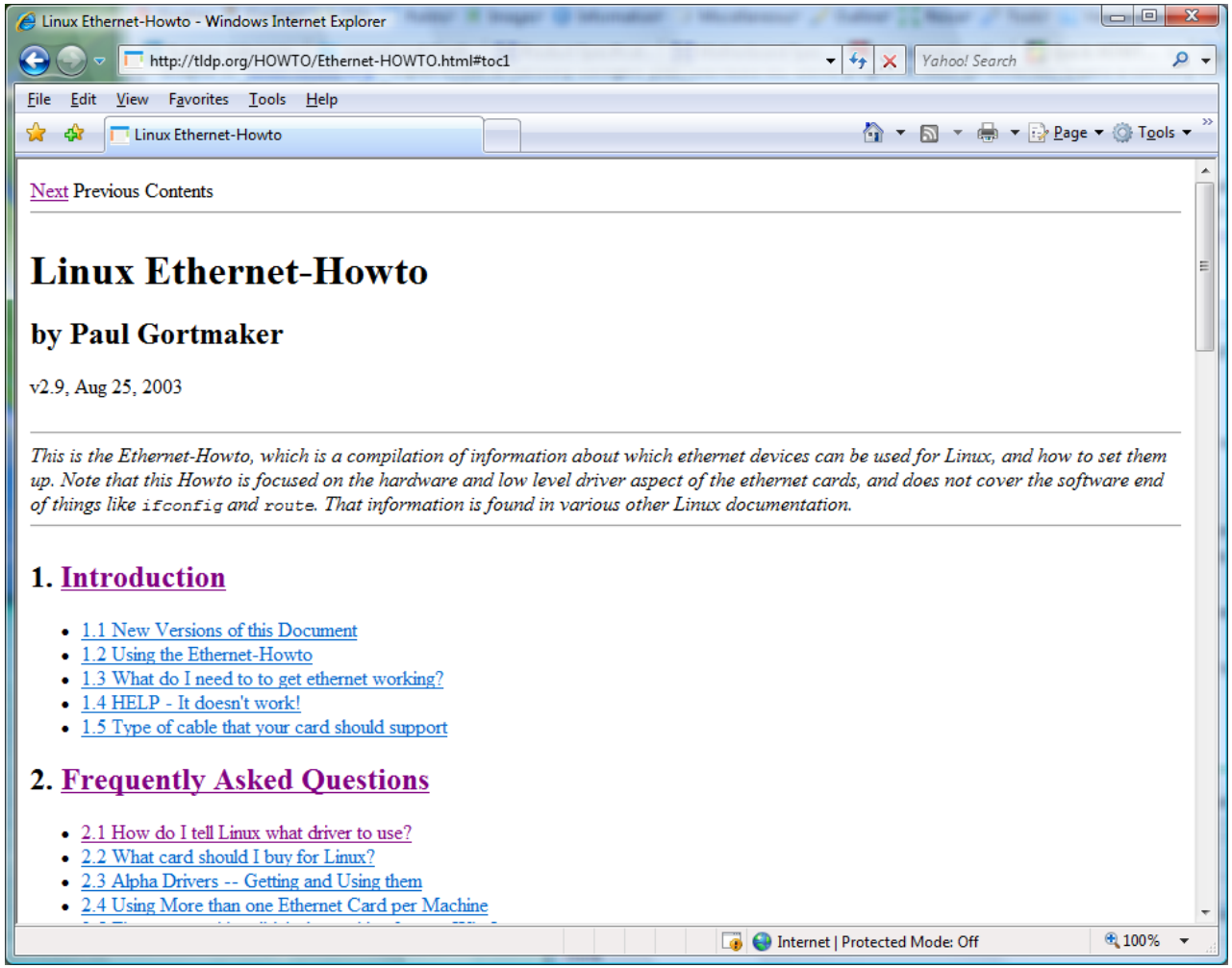
Driver - Network

Description	Current version	Size (MB)	Estimated download time	Previous version	
HP NC-Series Broadcom 1Gb Multifunction Driver for Linux (multi-part download)	1.8.1c-1 (B) 14 Nov 2008			1.8.1c-1 11 Nov 2008	
Part 1		0.31	56K: <1m 512K: <1m		Download »
Part 2		0.008	56K: <1m 512K: <1m		Download »
HP NC-Series Broadcom TG3 Driver for Linux (multi-part download)	3.92n-1 11 Nov 2008			3.92e-3 7 Aug 2008	
Part 1		0.14	56K: <1m 512K: <1m		Download »
Part 2		0.011	56K: <1m 512K: <1m		Download »
HP NC-Series iSCSI Offload Driver for Linux (multi-part download)	1.3.6-1 11 Nov 2008			1.2.14-1 8 Jul 2008	
Part 1		0.1	56K: <1m 512K: <1m		Download »
Part 2		0.011	56K: <1m 512K: <1m		Download »
HP NC-Series iSCSI Offload Initiator Utilities for Red Hat Enterprise Linux 5 (multi-part download)	6.2.0.868-0.7c 8 Jul 2008			6.2.0.742-0.6b 18 Dec 2007	
Part 1		0.26	56K: <1m 512K: <1m		Download »
Part 2		0.005	56K: <1m 512K: <1m		Download »
HP NC-Series open-iscsi Boot Package for Linux (multi-part download)	1.1.2-0 8 Jul 2008			1.1.0-6 18 Dec 2007	

http://www.hp.com/#Support

NIC Drivers

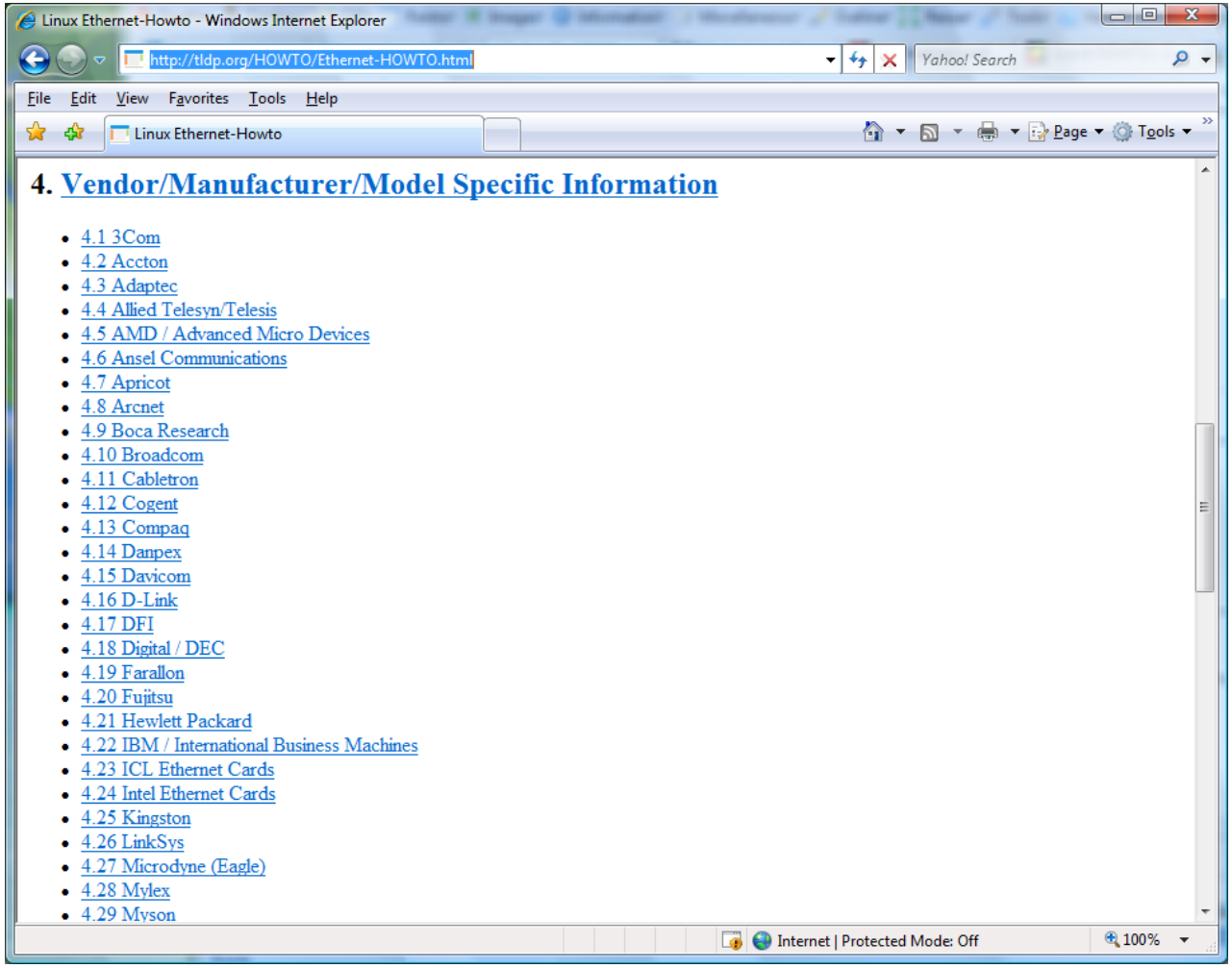
http://tldp.org/HOWTO/Ethernet-HOWTO.html



The TLDP web site has an Ethernet Howto that is extremely valuable when trying to find the correct NIC drivers for older NICs

NIC Drivers

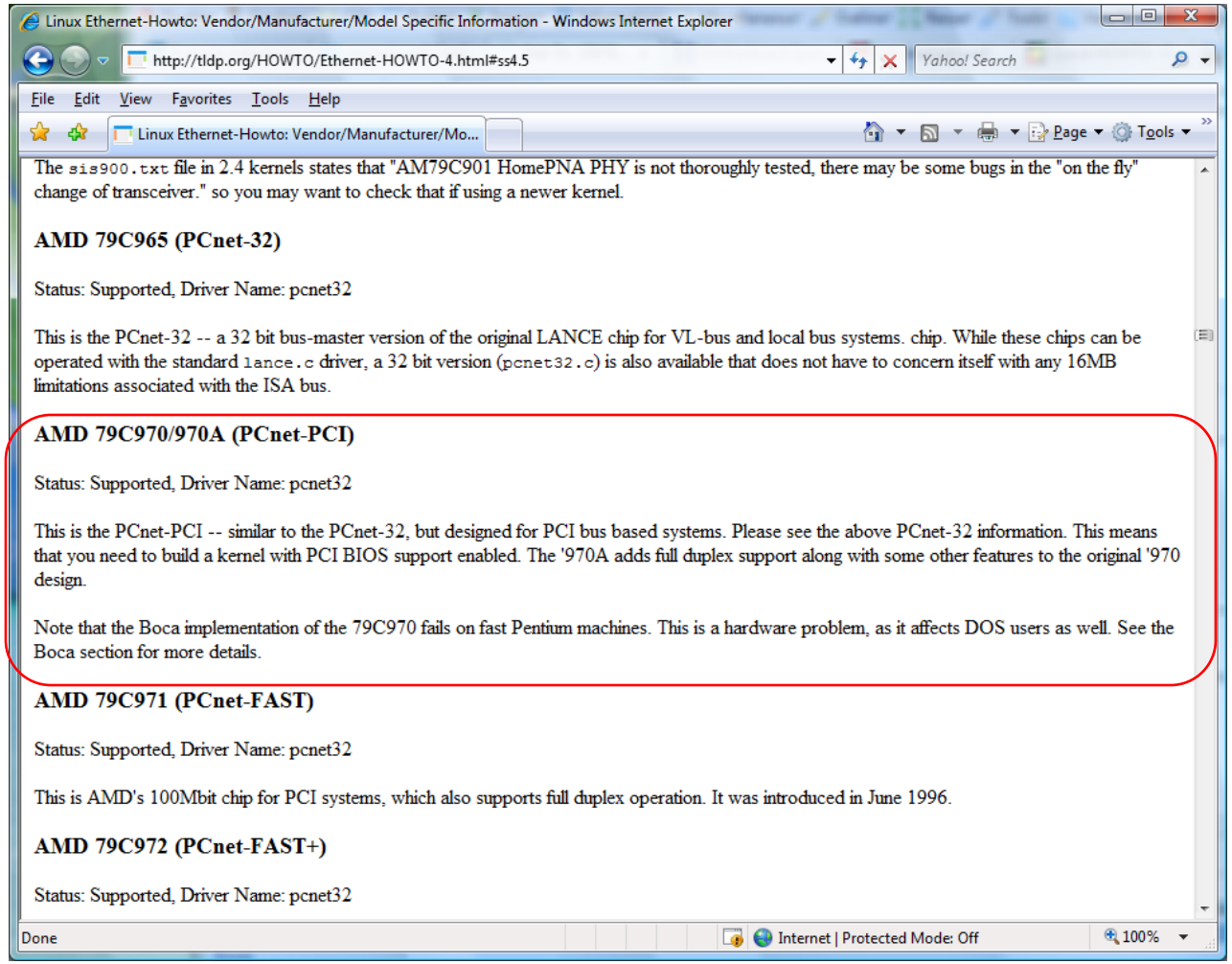
http://tldp.org/HOWTO/Ethernet-HOWTO.html



See section 4 for specific NICs

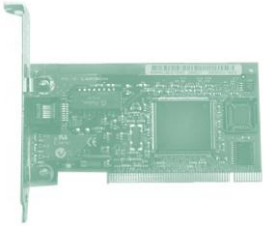
NIC Drivers

http://tldp.org/HOWTO/Ethernet-HOWTO.html



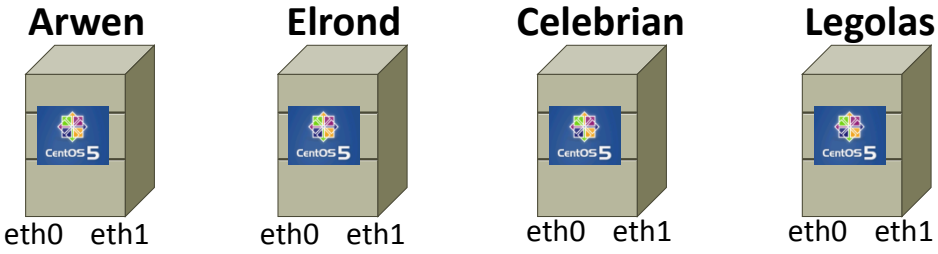
*The AMD 79C970 on the Celebrian VM uses the **pcnet32** driver*

CIS 192 VMs have Virtual NICs



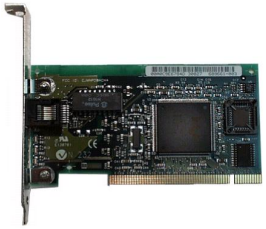
Fortunately , you will not need to locate and install NIC drivers for the CIS 192 VMs. The drivers are automatically selected and loaded at startup.

Servers



Clients

NIC Drivers

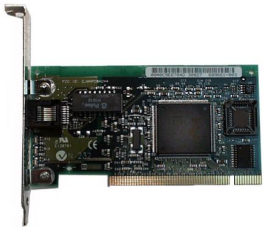


*Use the **lspci –k** command to see which driver was loaded for your NIC or NICs*

```
[root@celebrian ~]# lspci | grep -i Ethernet
02:00.0 Ethernet controller: Intel Corporation 82545EM Gigabit Ethernet
  Controller (Copper) (rev 01)
02:01.0 Ethernet controller: Intel Corporation 82545EM Gigabit Ethernet
  Controller (Copper) (rev 01)
[root@celebrian ~]#
```

```
[root@celebrian ~]# lspci -k
< snipped >
02:00.0 Ethernet controller: Intel Corporation 82545EM Gigabit Ethernet
  Controller (Copper) (rev 01)
        Subsystem: VMware PRO/1000 MT Single Port Adapter
        Kernel driver in use: e1000
        Kernel modules: e1000
02:01.0 Ethernet controller: Intel Corporation 82545EM Gigabit Ethernet
  Controller (Copper) (rev 01)
        Subsystem: VMware PRO/1000 MT Single Port Adapter
        Kernel driver in use: e1000
        Kernel modules: e1000
< snipped >
[root@celebrian ~]#
```

NIC Drivers



*NIC drivers are **kernel modules** and are kept is a specific directory so the kernel knows where to find them. They are kernel object files and named with a **.ko** suffix.*

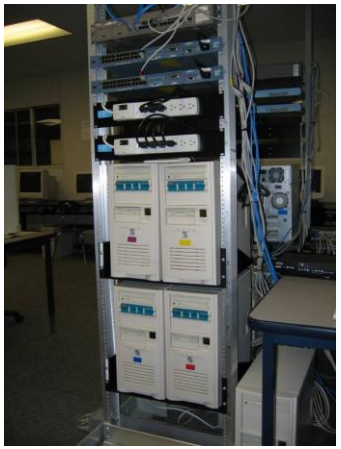
```
[root@celebrian ~]# ls /lib/modules/2.6.32-71.el6.i686/kernel/drivers/net/
3c509.ko        cxgb4           macvlan.ko      pppol2tp.ko     sungem_phy.ko
3c59x.ko        dl2k.ko         macvtap.ko      pppox.ko        sunhme.ko
8139cp.ko       dnet.ko         mdio.ko         ppp_synctty.ko  tehuti.ko
8139too.ko      dummy.ko        mii.ko          qla3xxx.ko      tg3.ko
8390.ko         e1000           mlx4            qlge            tlan.ko
8390p.ko        e1000e          myri10ge        r6040.ko        tulip
acenic.ko       e100.ko         natsemi.ko      r8169.ko        tun.ko
amd8111e.ko     enic            ne2k-pci.ko     s2io.ko         typhoon.ko
atl1c           epic100.ko      ne.ko           sc92031.ko      usb
atl1e           ethoc.ko        netconsole.ko   sfc             veth.ko
atlx            ewrk3.ko        netxen          sis190.ko       via-rhine.ko
b44.ko          fealnx.ko       niu.ko          sis900.ko       via-velocity.ko
benet           forcedeth.ko    ns83820.ko      skge.ko         virtio_net.ko
bnx2.ko         ifb.ko          pcmcia          sky2.ko         vmxnet3
bnx2x.ko        igb             pcnet32.ko      slhc.ko         vxge
bonding         igbvf           phy             slip.ko         wan
can             ipg.ko          ppp_async.ko    smc-ultra.ko    wimax
cassini.ko      ixgb            ppp_deflate.ko  smsc9420.ko     wireless
chelsio         ixgbe           ppp_generic.ko  starfire.ko     xen-netfront.ko
cnic.ko         ixgbevf         ppp_mppe.ko     sundance.ko
cxgb3           jme.ko          pppoe.ko        sungem.ko
[root@celebrian ~]#
```

The e1000.ko is in the e1000 directory

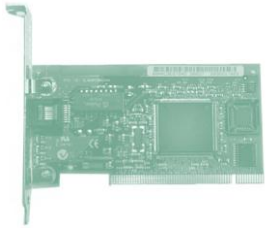
Note, in older distros, these show as .o files

Real NICs in old gear can be more challenging

System Pod



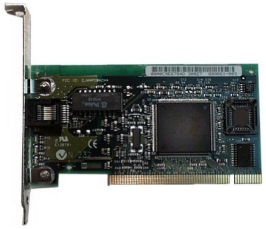
Press middle button to boot Linux



There are a variety on NICs on the older systems in the old CIS Lab system pods

NIC	Linux Driver
Intel PRO 100 NIC	e100
D-Link NICs with RealTek 8129/8139 chipsets	8139too
3Com 3c905x NICs	3c59x
Lite-on Communications LNE 100TX cards with DEC chipsets	tulip
AMD 79c970 NIC (used in VMware VMs)	pcnet32

Older Gear NIC Drivers



Some drivers that have been used with the PC's in the old CIS Lab

```
[root@celebrian ~]# ls /lib/modules/$(uname -r)/kernel/drivers/net
3c59x.ko        dummy.ko        natsemi.ko      ppp_synctty.ko  sunhme.ko
8139cp.ko       e1000           ne2k-pci.ko     qla3xxx.ko      tg3.ko
8139too.ko      e1000e          netconsole.ko   r8169.ko        tlan.ko
8390.ko         e100.ko         netxen          s2io.ko         tokenring
acenic.ko       epic100.ko      ns83820.ko      sis190.ko       tulip
amd8111e.ko     fealnx.ko       pcmcia          sis900.ko       tun.ko
b44.ko          forcedeth.ko    pcnet32.ko      skge.ko         typhoon.ko
bnx2.ko         ifb.ko          phy             sky2.ko         via-rhine.ko
bnx2x.ko        igb             ppp_async.ko    slhc.ko         via-velocity.ko
bonding         ixgb            ppp_deflate.ko  slip.ko         wireless
cassini.ko      ixgbe           ppp_generic.ko  starfire.ko
chelsio         mii.ko          ppp_mppe.ko     sundance.ko
cxgb3           mlx4            pppoe.ko        sungem.ko
dl2k.ko         myri10ge        pppox.ko        sungem_phy.ko
[root@celebrian ~]#
```

NIC	Linux Driver
Intel PRO 100 NIC	e100
D-Link NICs with RealTek 8129/8139 chipsets	8139too
3Com 3c905x NICs	3c59x
Lite-on Communications LNE 100TX cards with DEC chipsets	tulip
AMD 79c970 NIC (used in VMware VMs)	pcnet32

Managing Drivers

(showing, installing, removing)

Connecting your Linux system to the Network

1. Identify the NIC in your system (vendor and model)

2. Locate a driver for your NIC
   - may be already available with your distro
   - may be available from NIC vendor
   - may be available from chipset vendor
   - may have get source and build (compile) it

3. Load the driver (insmod or modprobe command)

4. Bring up and configure the interface (ifconfig)

Commands for handling NIC drivers (kernel modules)

- To show loaded kernel modules including NIC drivers
  lsmod
  example: **lsmod | grep pcnet32** (show NIC drivers used on VMs)

- To remove (unload) a NIC driver
  rmmod *driver*

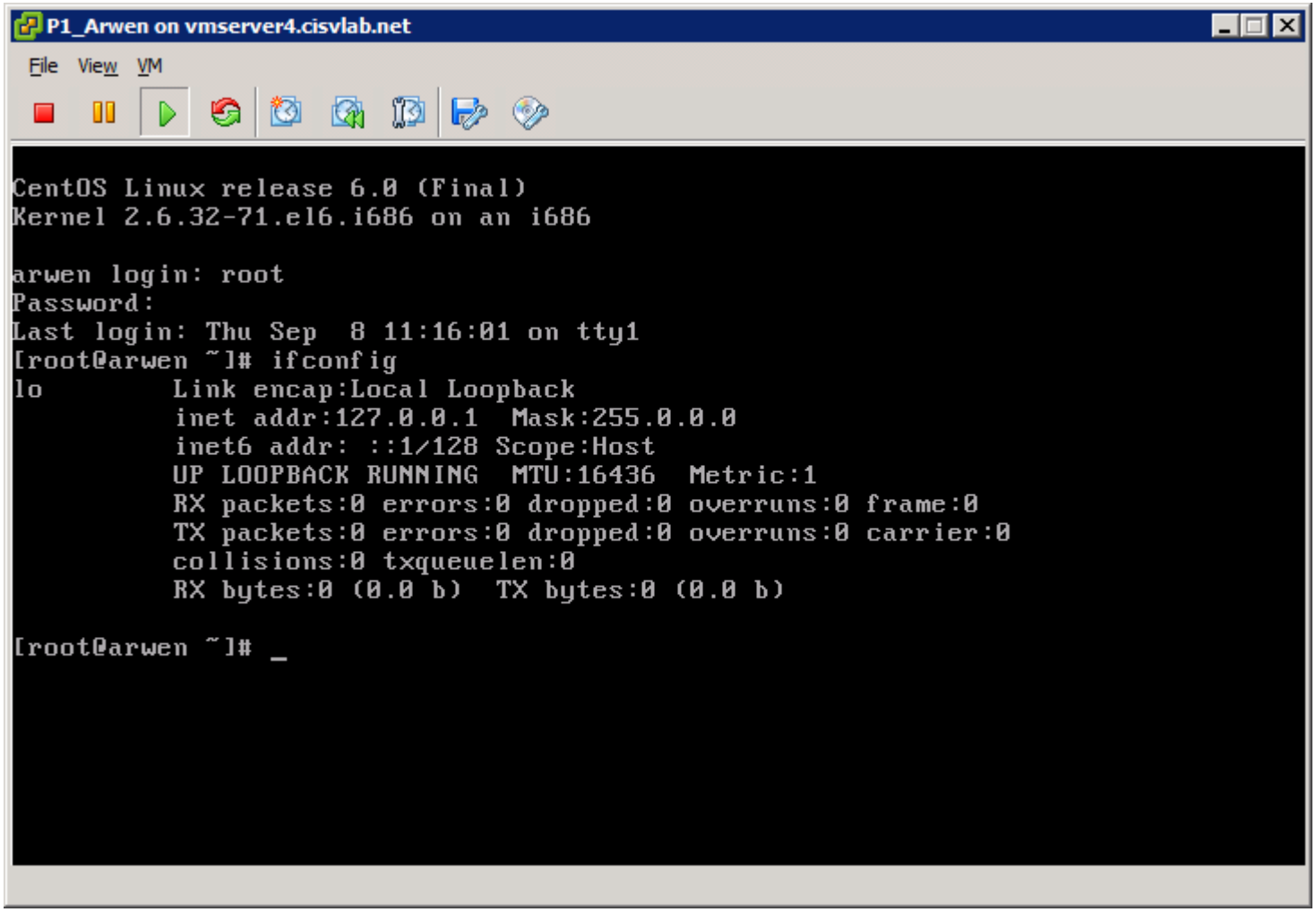
  example: **rmmod pcnet32** (removes pcnet32 VM NIC driver)
  Do not specify the path or suffix (.ko) for drivers

- To insert (load) a NIC driver
  insmod *driver*
  modprobe *driver*

  example: **modprobe pcnet32** (installs pcnet32 VM NIC driver)
  modprobe is more intelligent and recommended over insmod

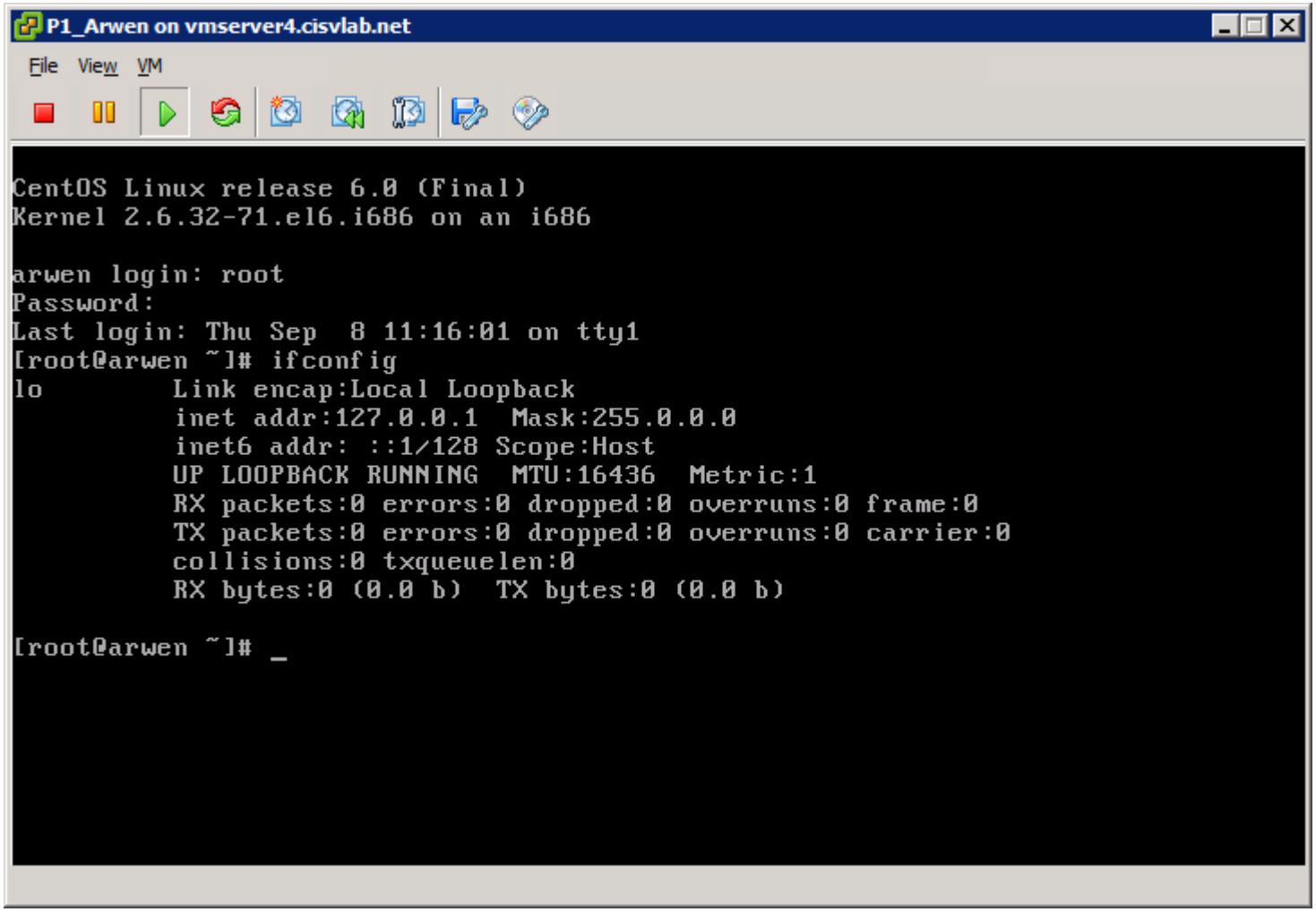
Driver Management Example

ifconfig



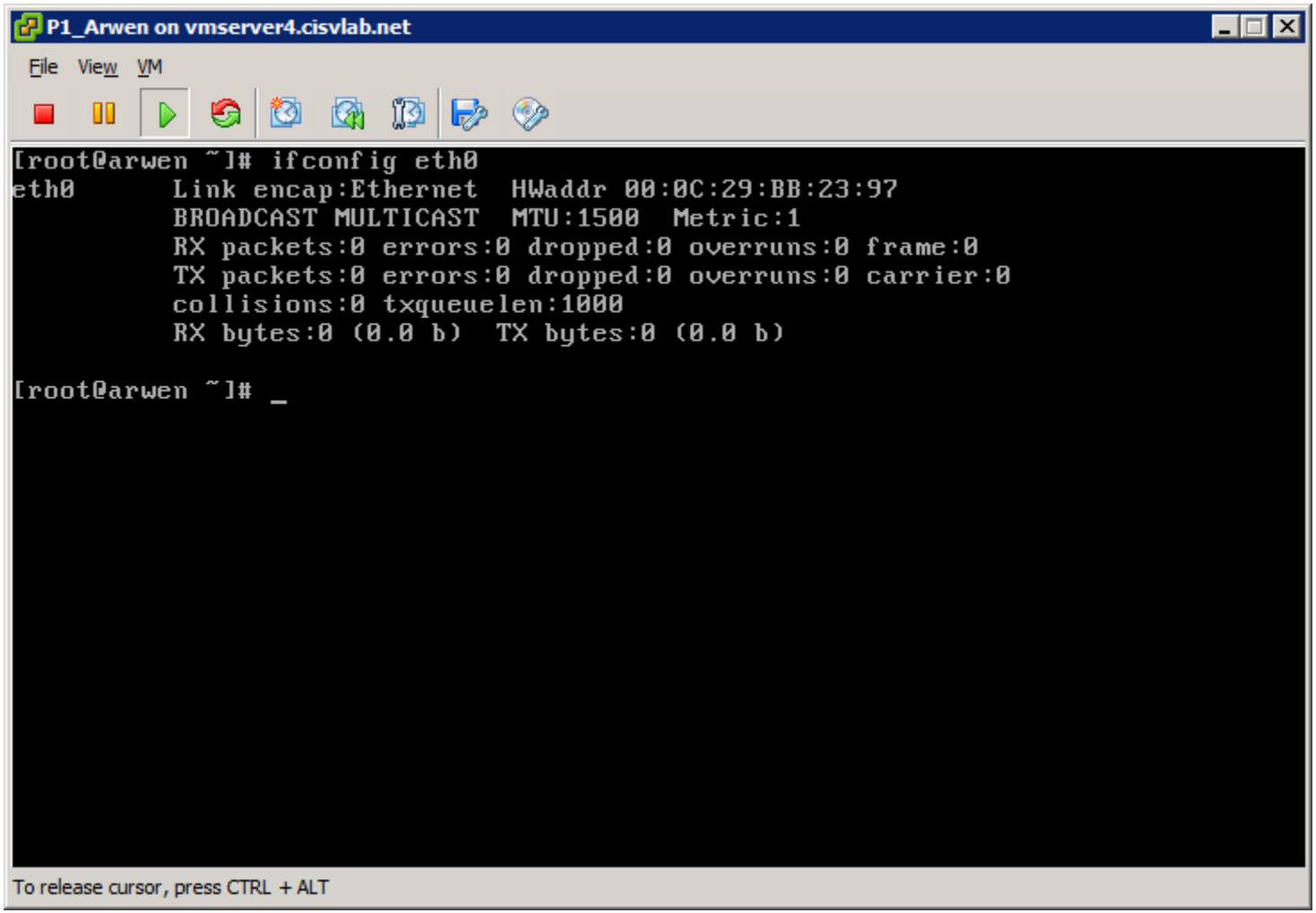
After Arwen boots up is there any network connectivity?

ifconfig



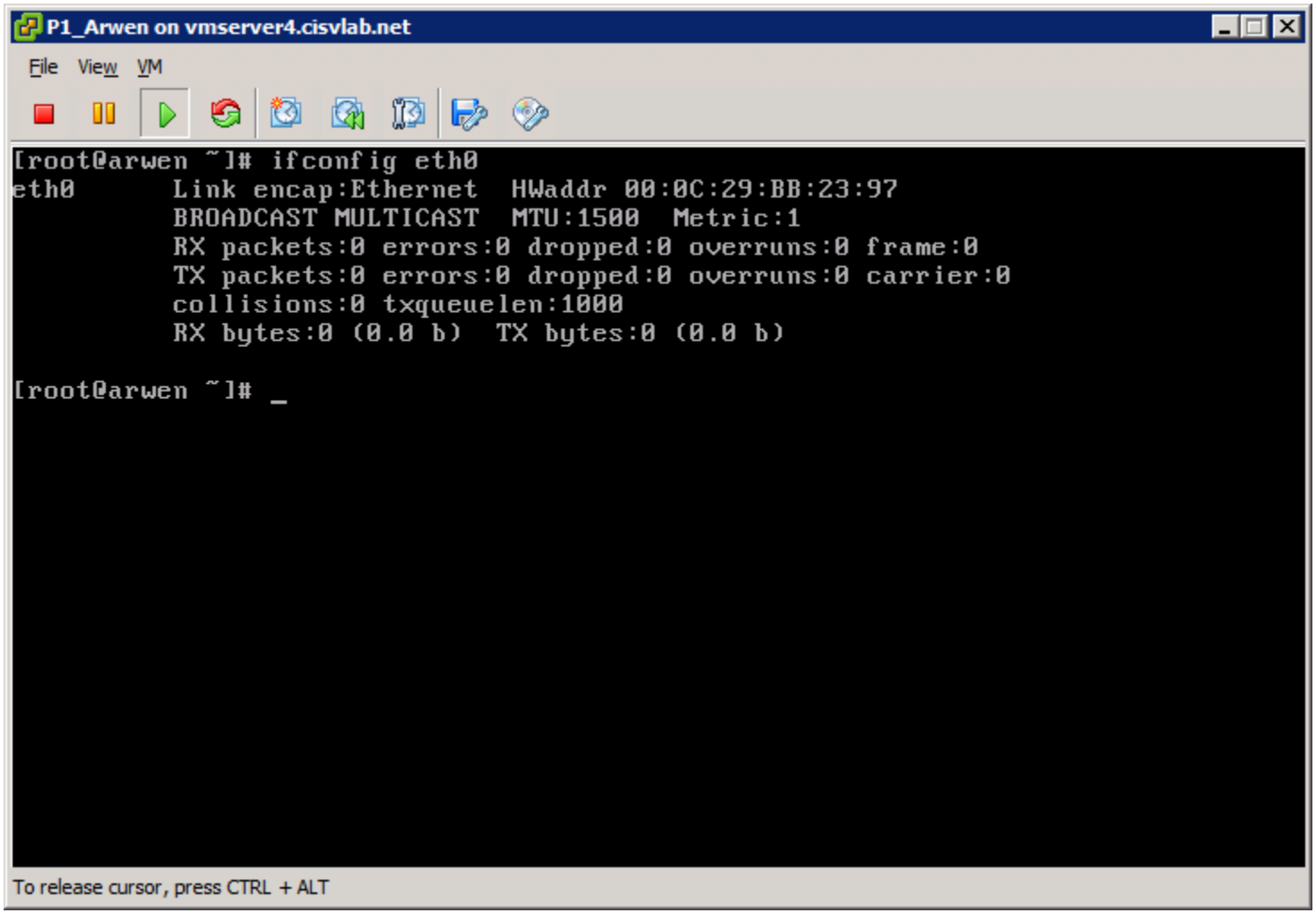
After Arwen boots up is there any network connectivity? ***NO***

ifconfig eth0



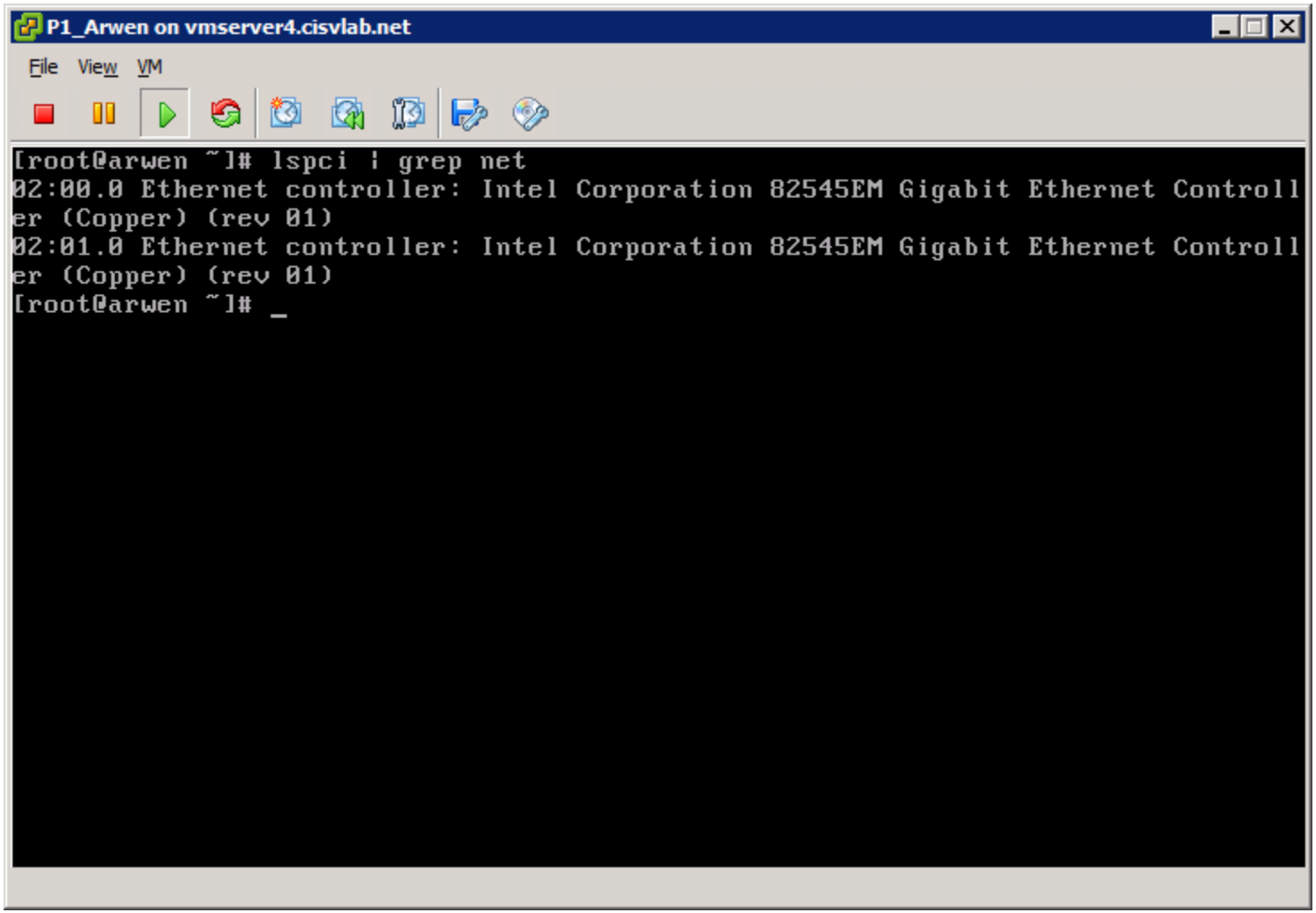
Is the eth0 interface up or down?

ifconfig eth0



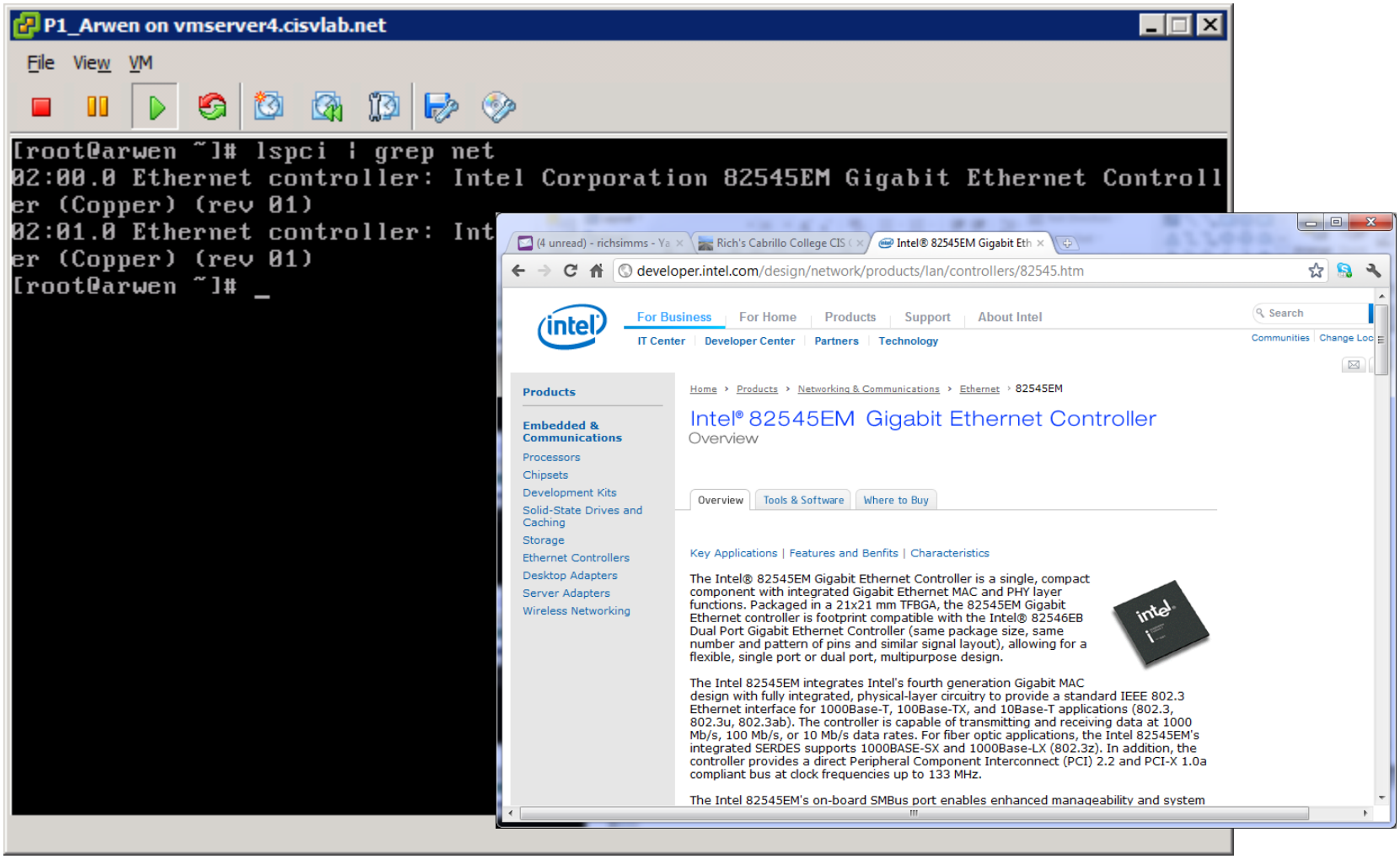
Is the eth0 interface up or down? ***It's down***

lspci | grep net



How many NICs are on Arwen?
What is the vendor and model number of the NICs?

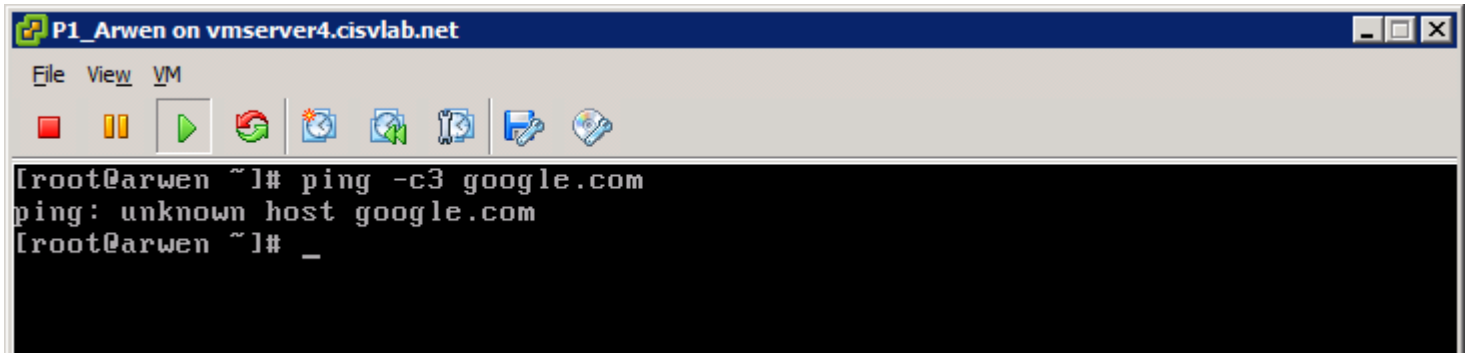
lspci | grep net



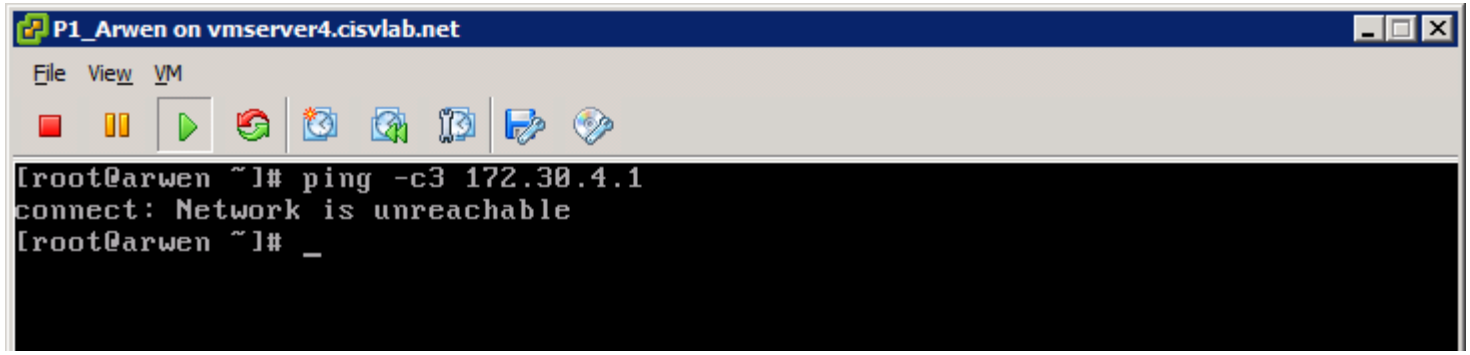
How many NICs are on Arwen? ***2***

What is the vendor and model number of the NICs? ***Intel, 82545EM***

ping –c3 google.com



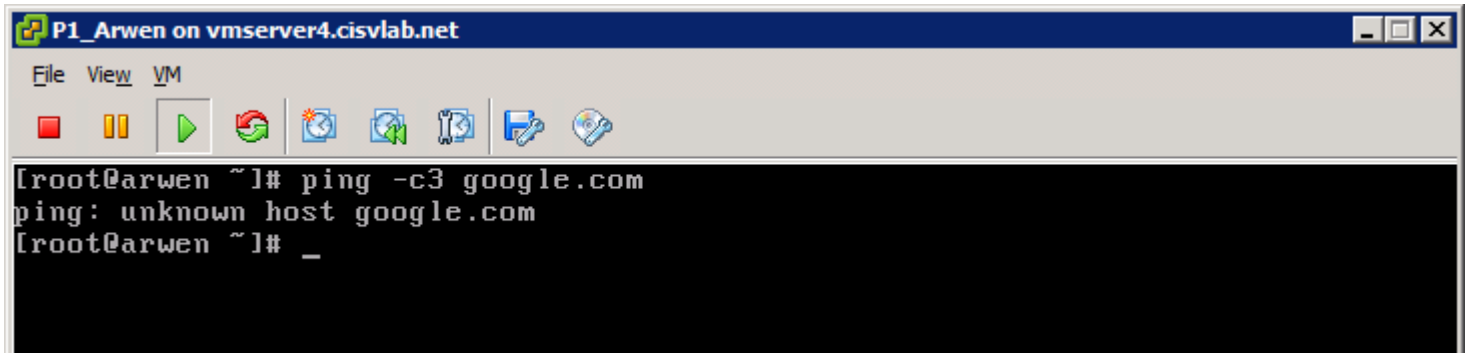
ping –c3 172.30.4.1



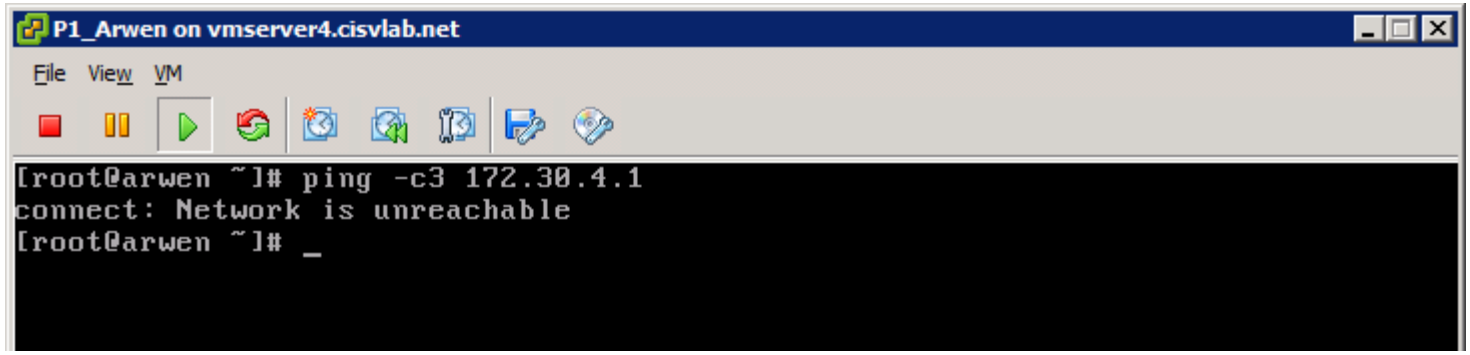
With no network connectivity can we ping a hostname on the Internet?

Can we ping a local IP address on the LAN?

ping –c3 google.com



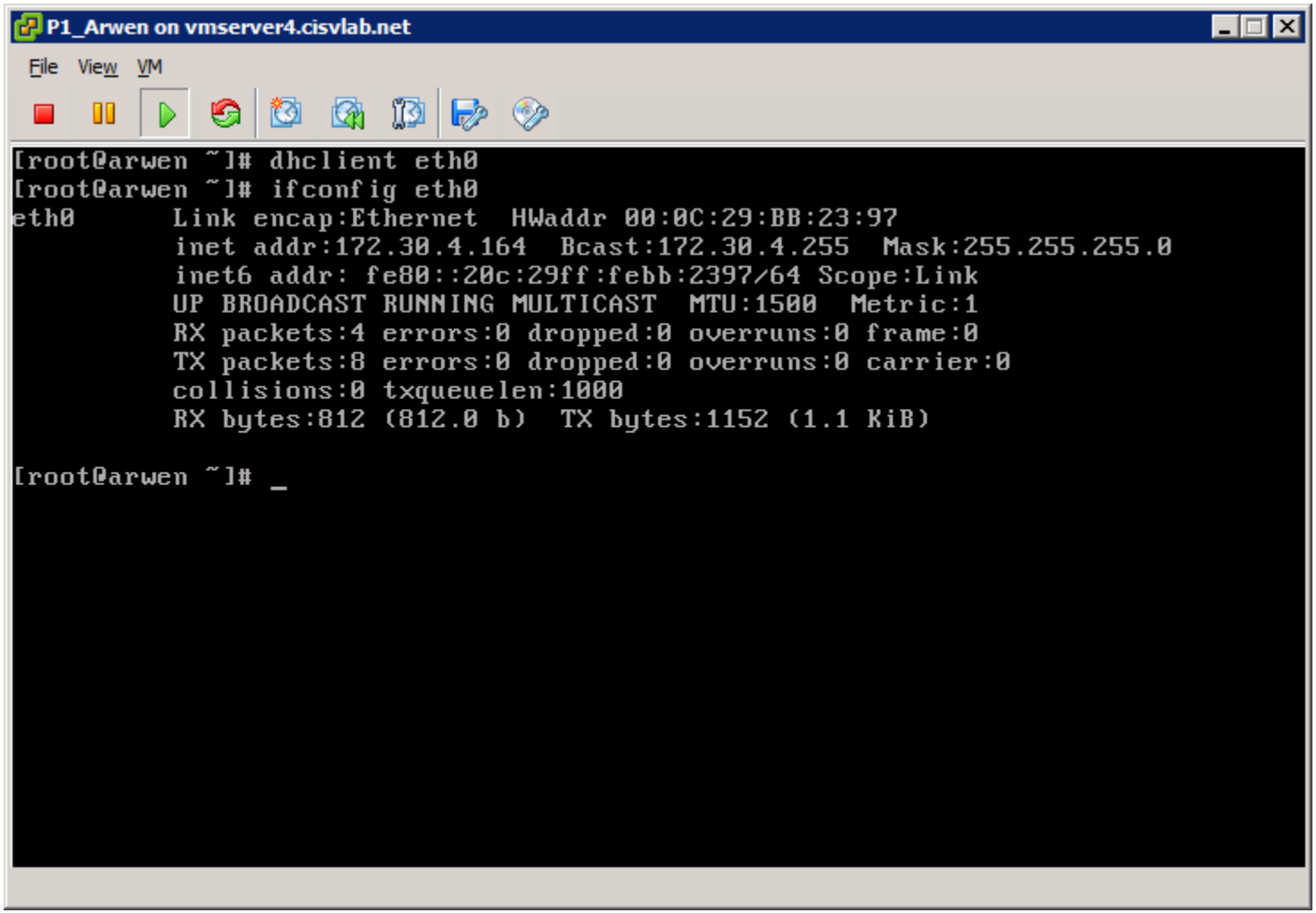
ping –c3 172.30.4.1



With no network connectivity can we ping a hostname on the Internet? ***No***

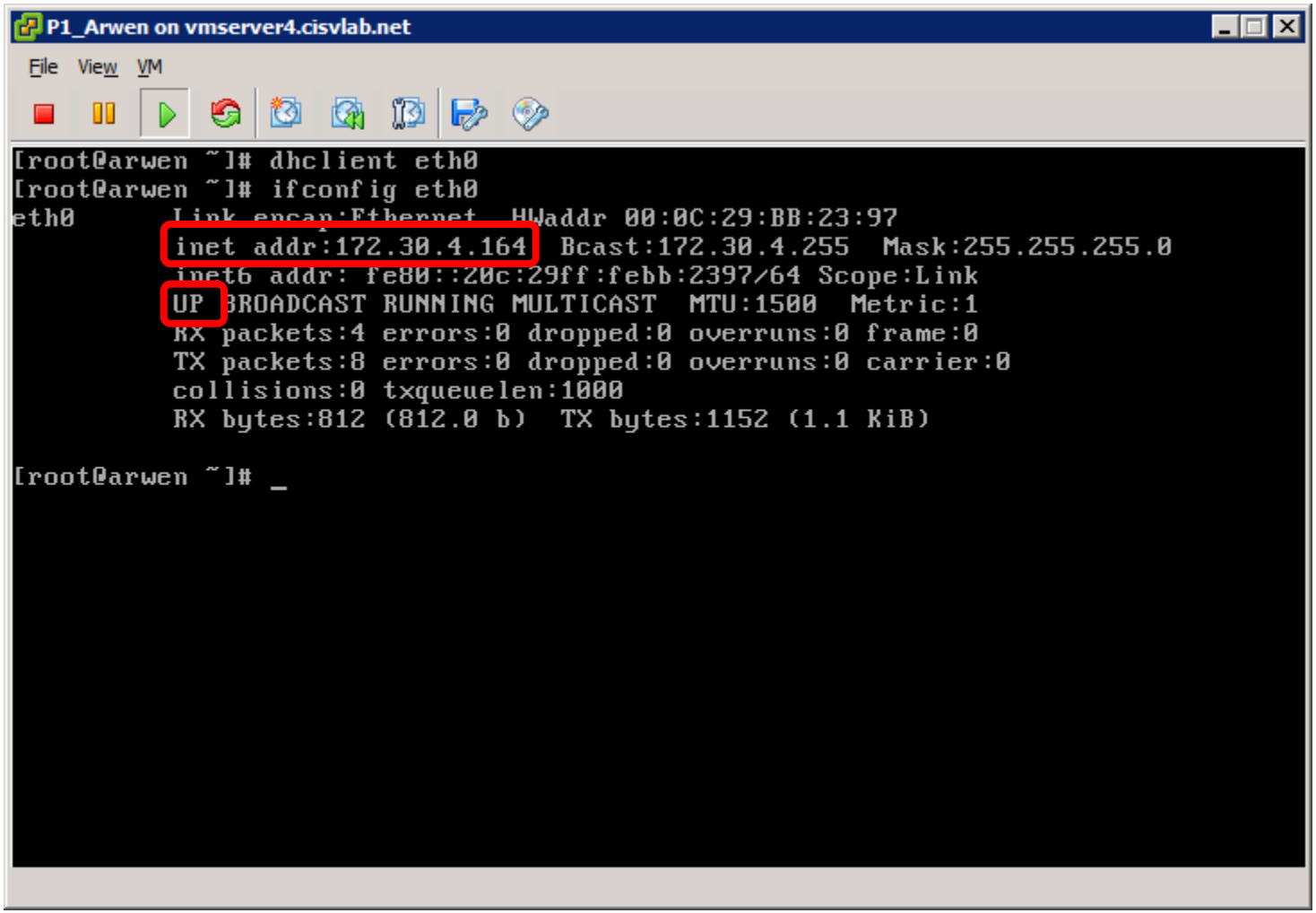
Can we ping a local IP address on the LAN? ***No***

dhclient eth0



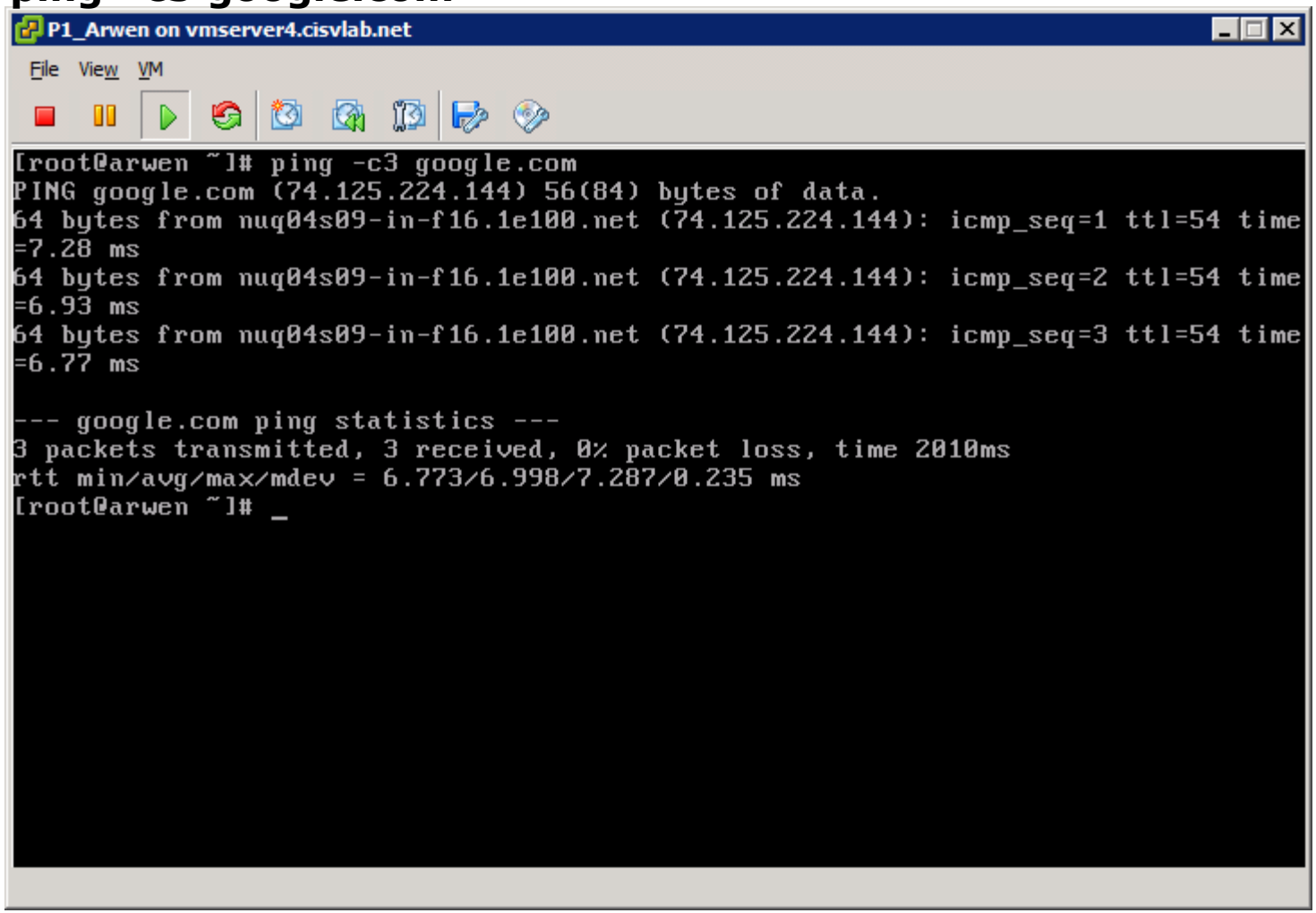
After requesting an IP address from a DHCP server for eth0 what IP address was assigned? Is the eth0 interface up or down?

dhclient eth0



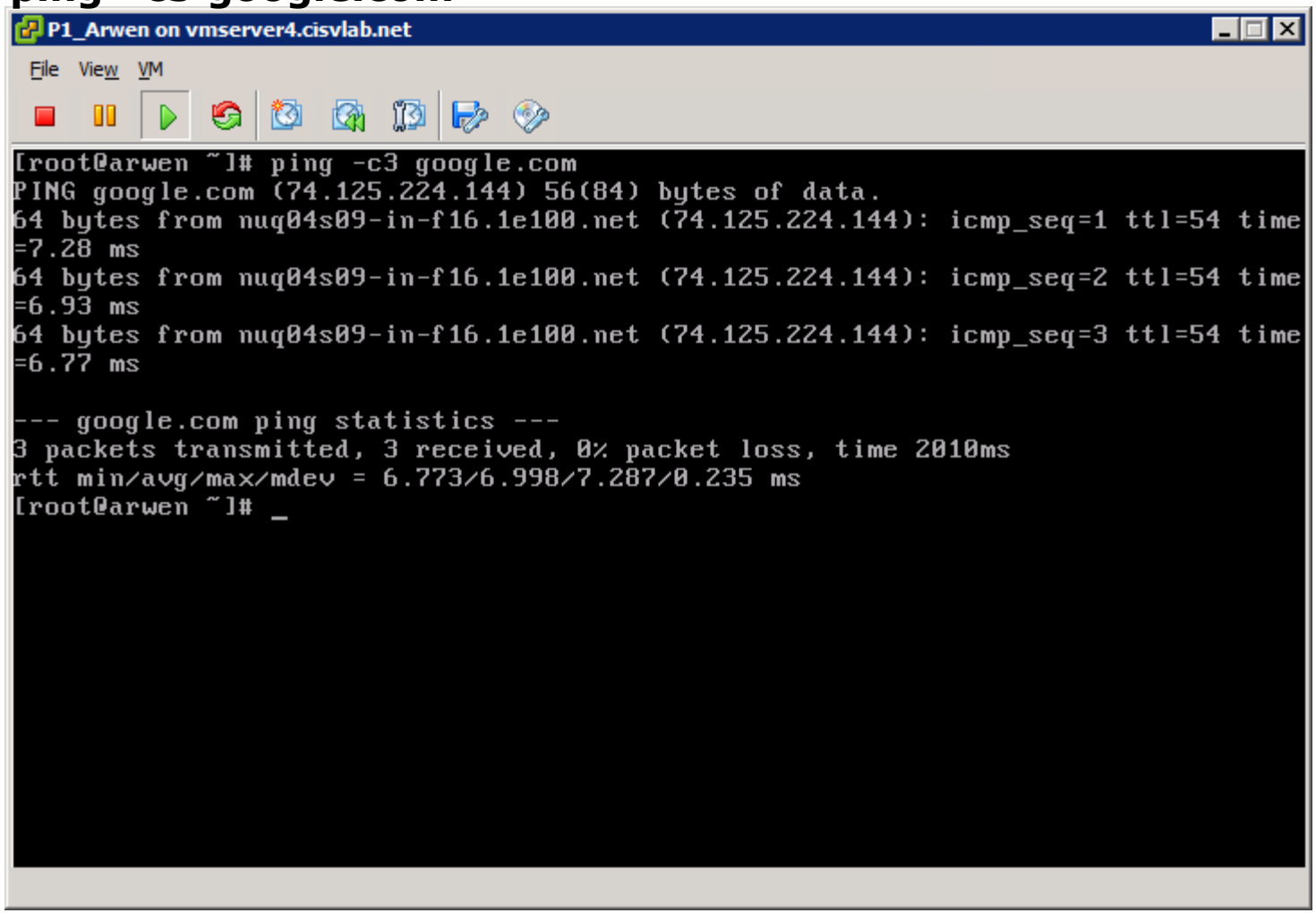
After requesting an IP address from a DHCP server for eth0 what IP address was assigned? ***172.30.4.164*** *Is the eth0 interface up or down?* ***Up***

ping –c3 google.com



Now that the eth0 interface is up and has an IP address can we ping a hostname on the Internet?
What did the –c3 option do on the ping command?

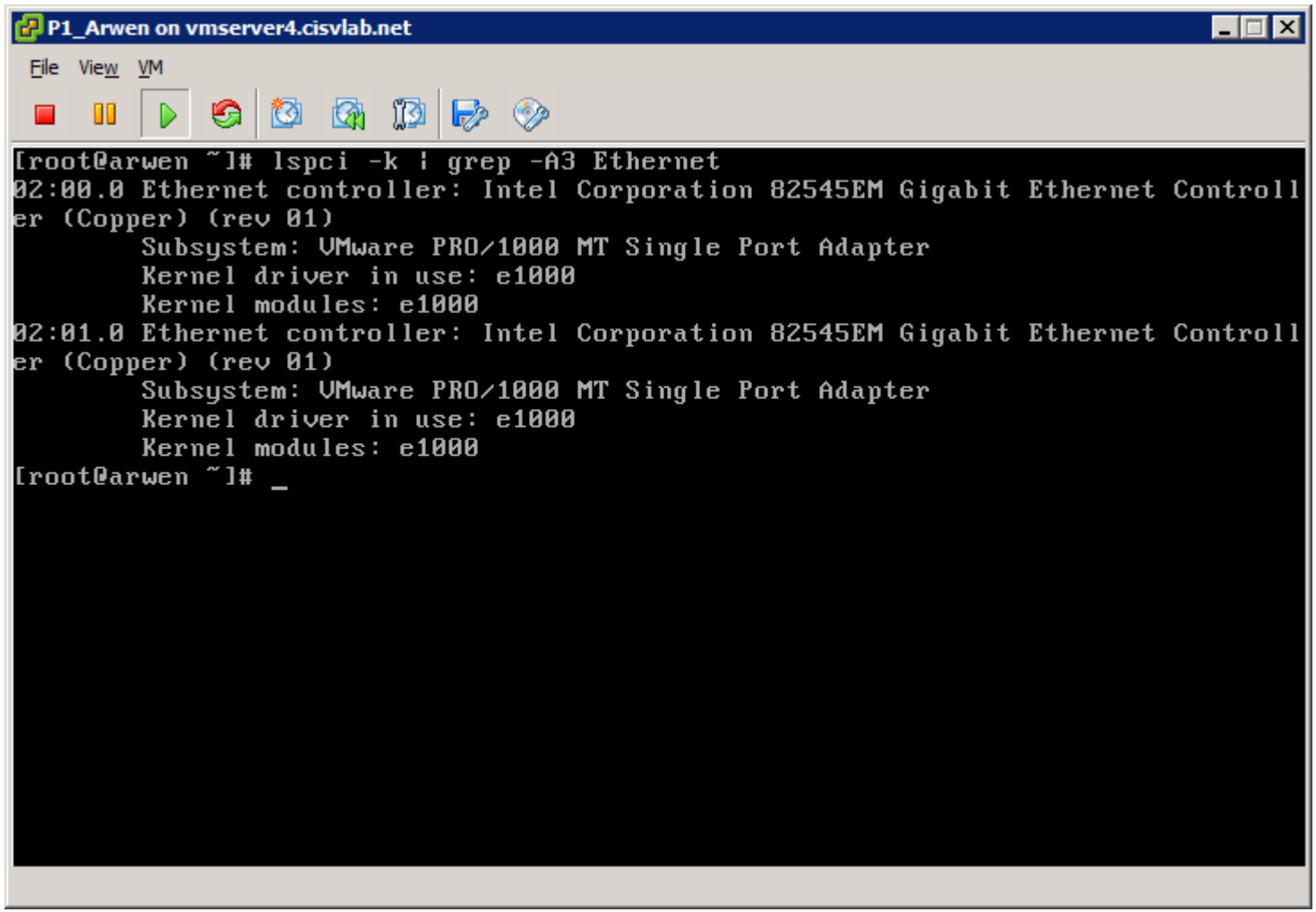
ping –c3 google.com



Now that the eth0 interface is up and has an IP address can we ping a hostname on the Internet? ***Yes***

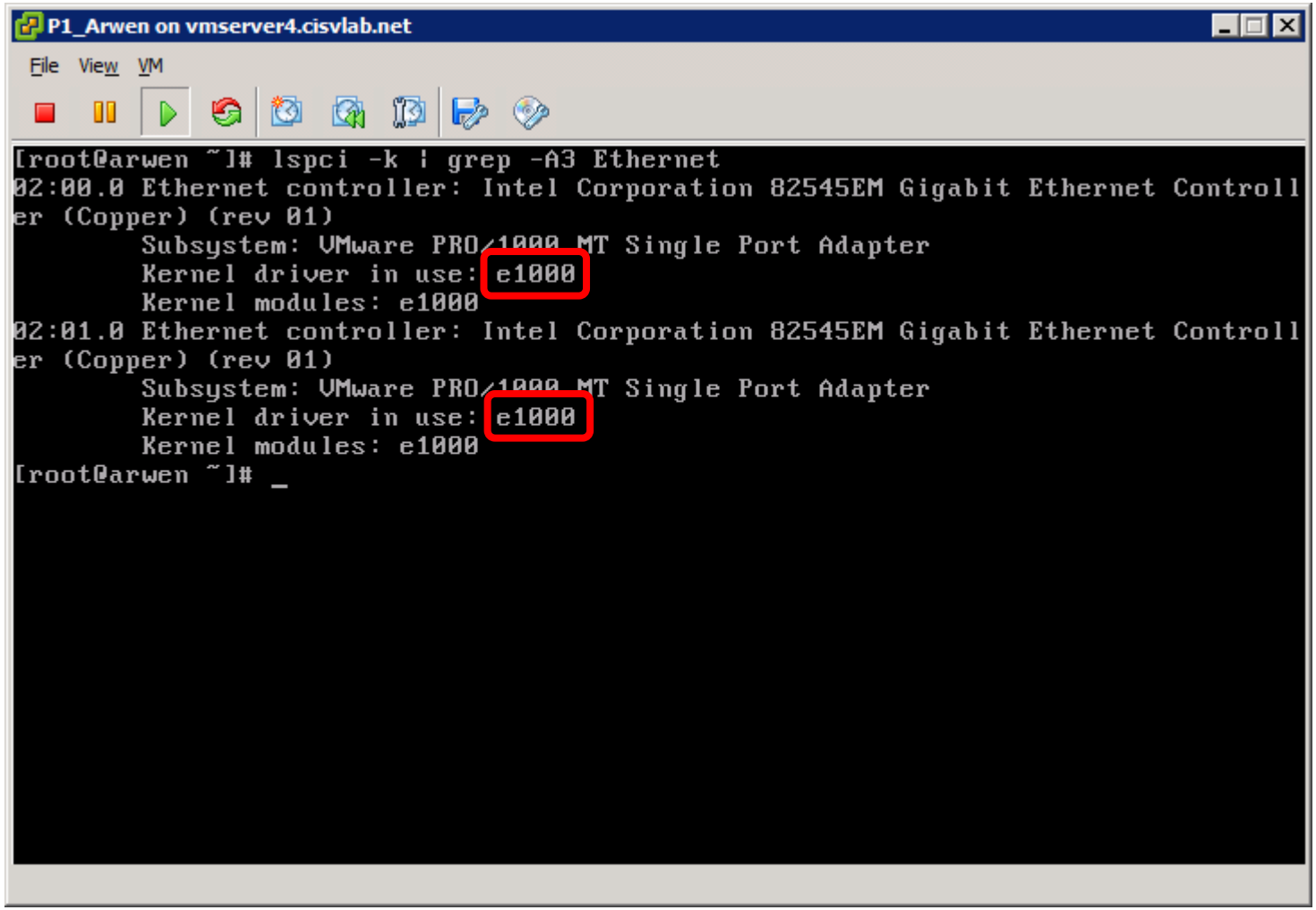
What did the –c3 option do on the ping command? ***3 pings only***

lspci –k | grep –A3 Ethernet



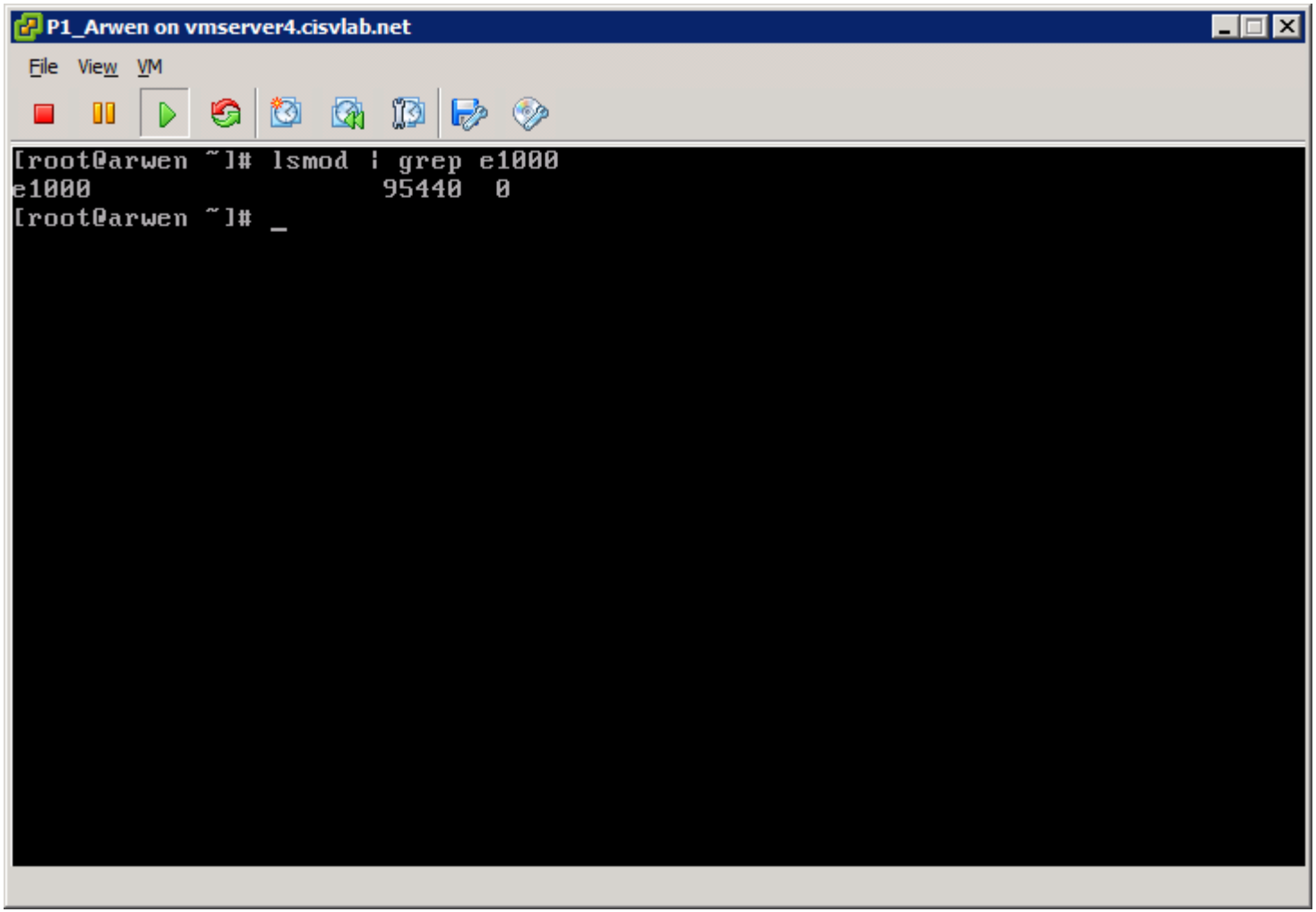
What driver is used for the Intel NICs?
What did the –A3 option do on the grep command?

lspci –k | grep –A3 Ethernet



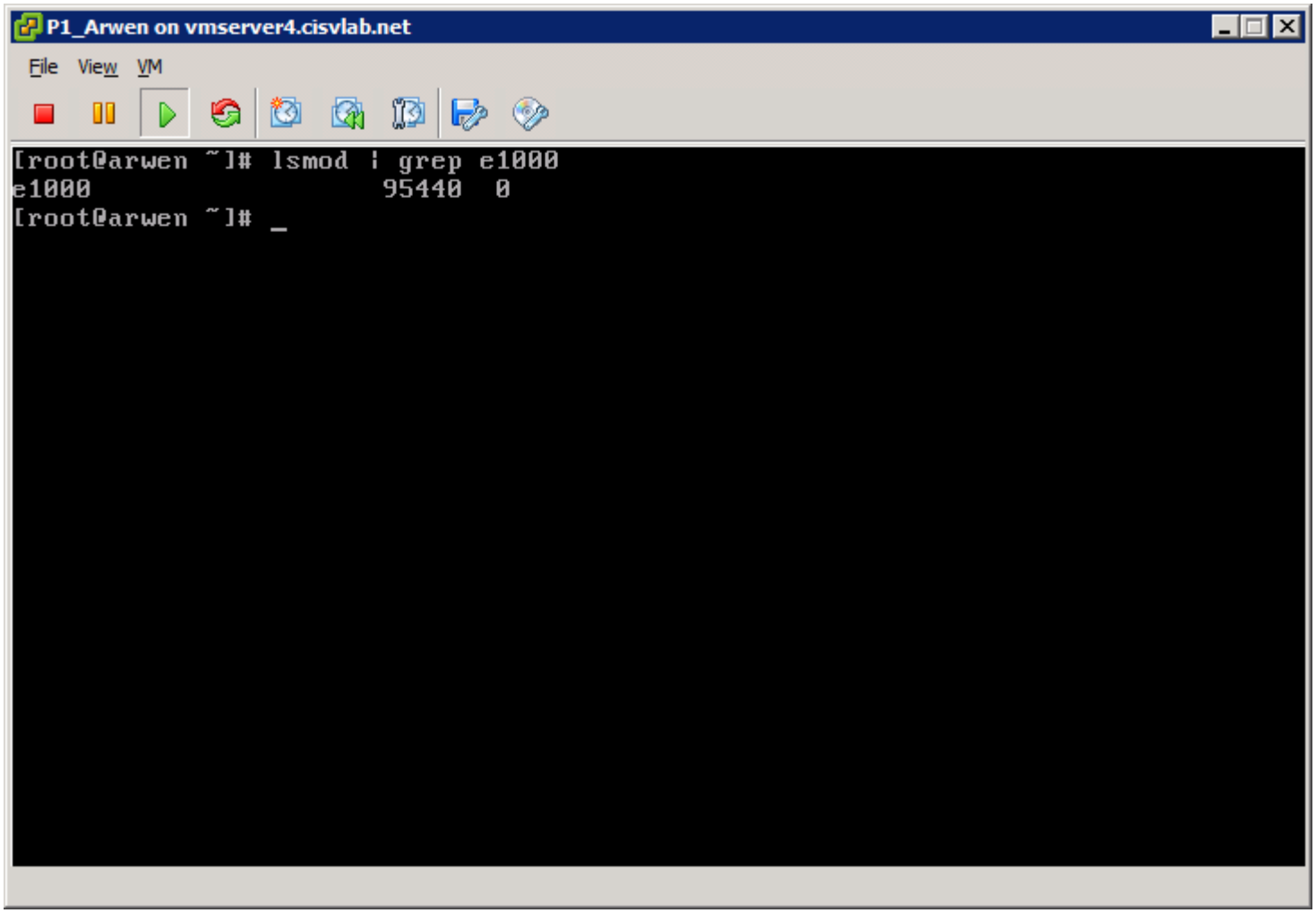
What driver is used for the Intel NICs? ***e1000***
What did the –A3 option do on the grep command? ***prints the matching line and the 3 lines after the matching line***

lsmod | grep e1000



Is the e1000 kernel module loaded and running?

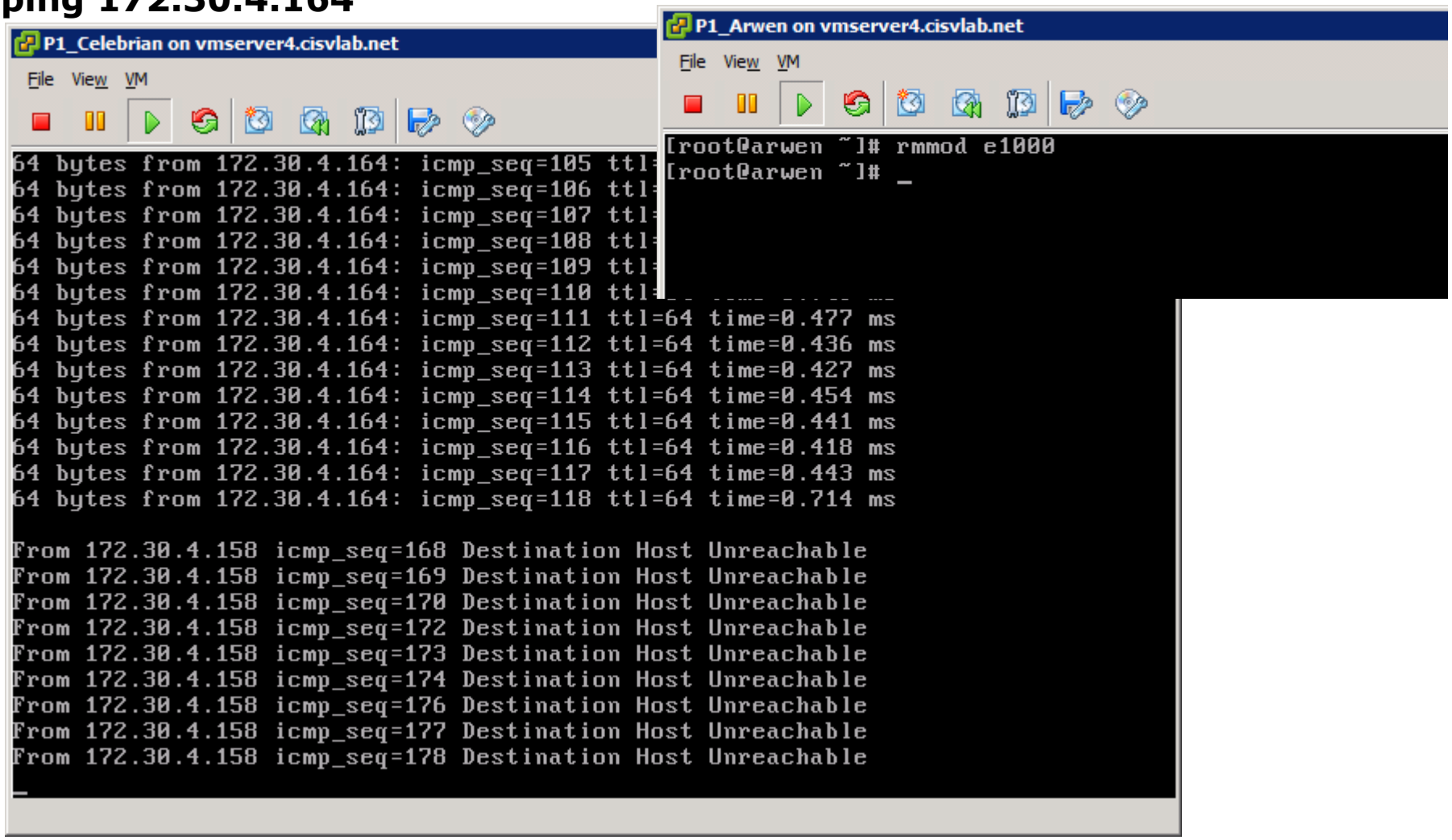
lsmod | grep e1000



Is the e1000 kernel module loaded and running? ***Yes***

On Celebrian
ping 172.30.4.164

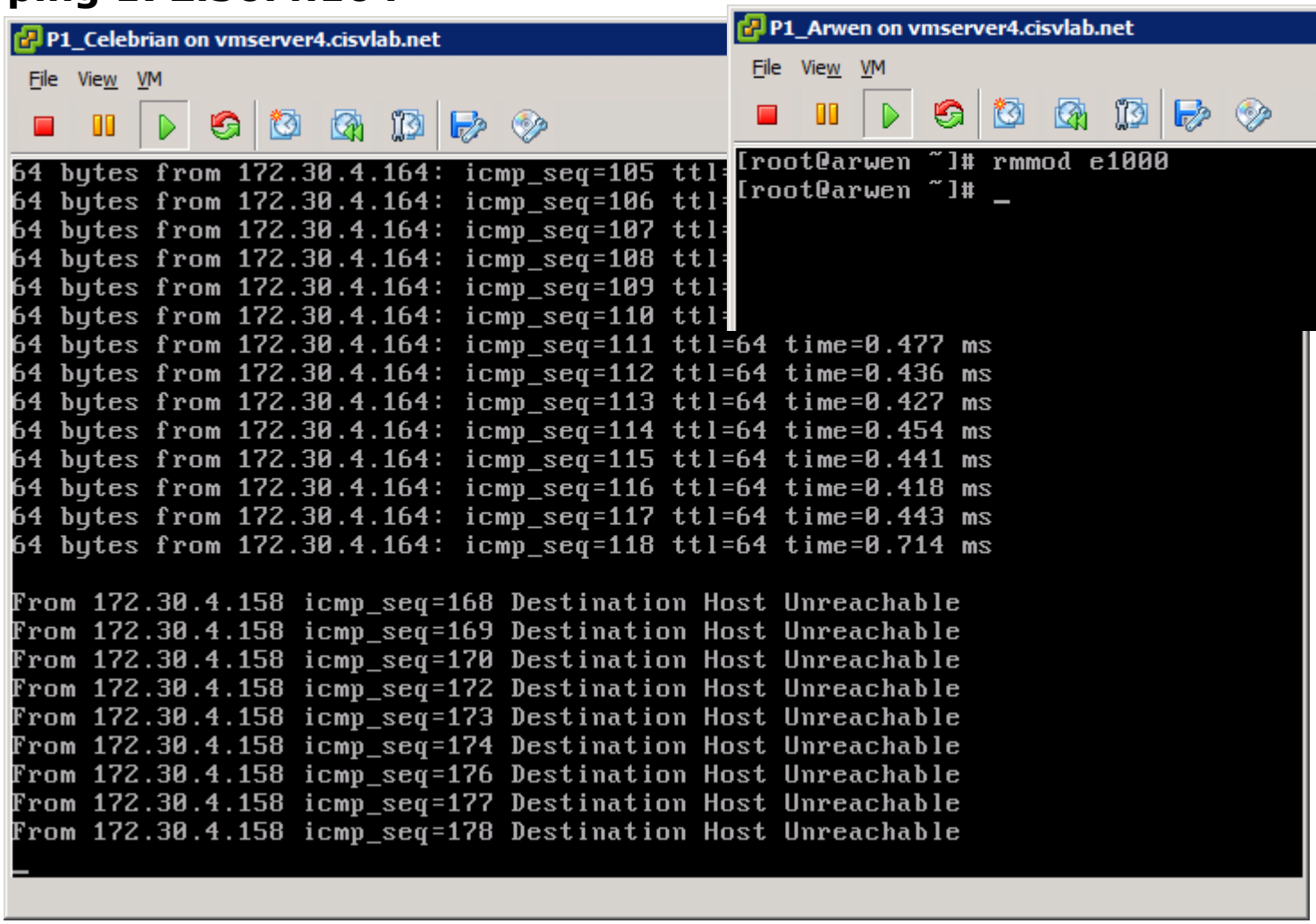
On Arwen
rmmod e1000



What happened when the e1000 driver was unloaded on Arwen?

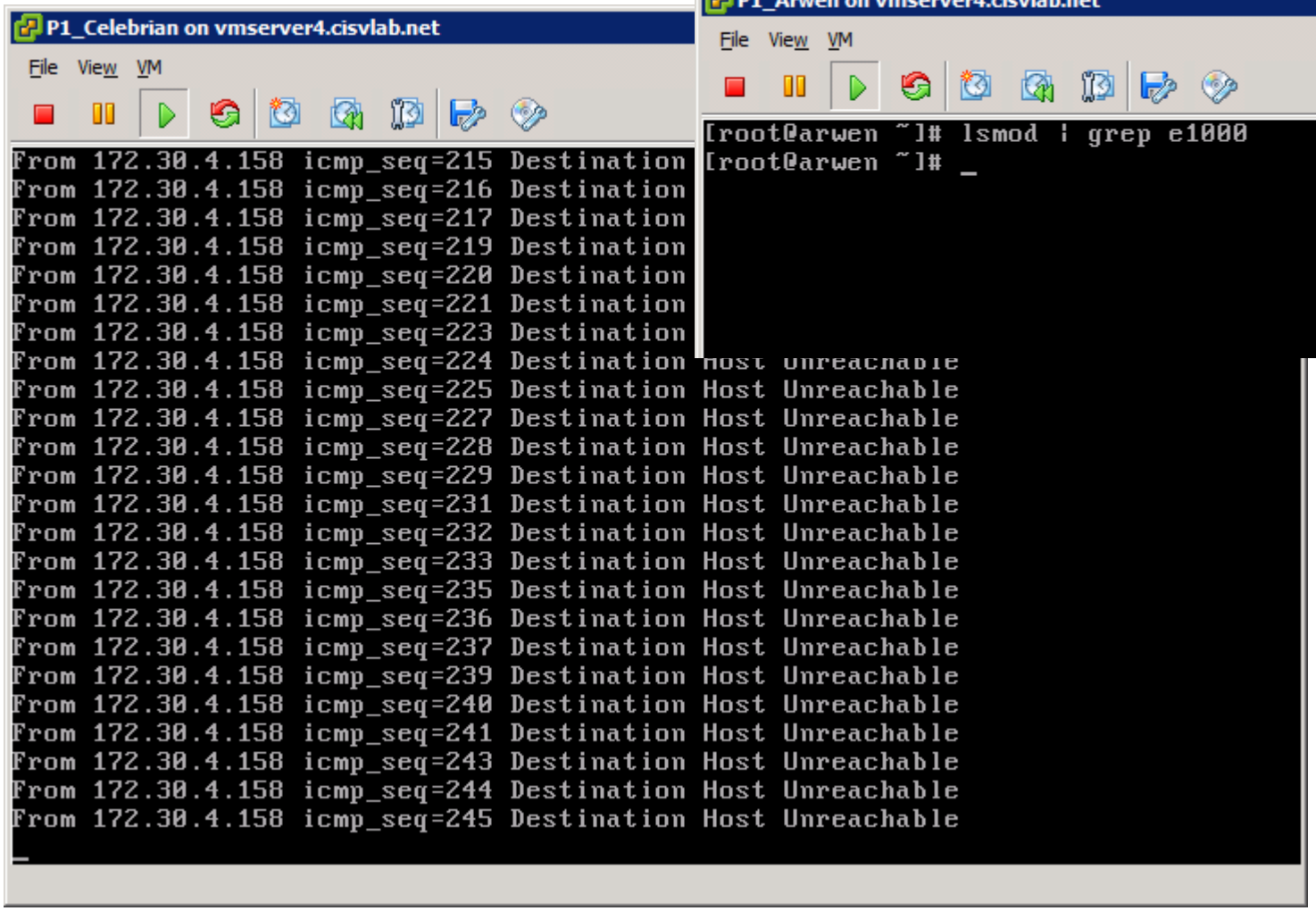
On Celebrian
ping 172.30.4.164

On Arwen
rmmod e1000



What happened when the e1000 driver was unloaded on Arwen? ***Arwen lost network connectivity and stopped responding to ping requests***

On Celebrian
ping 172.30.4.164

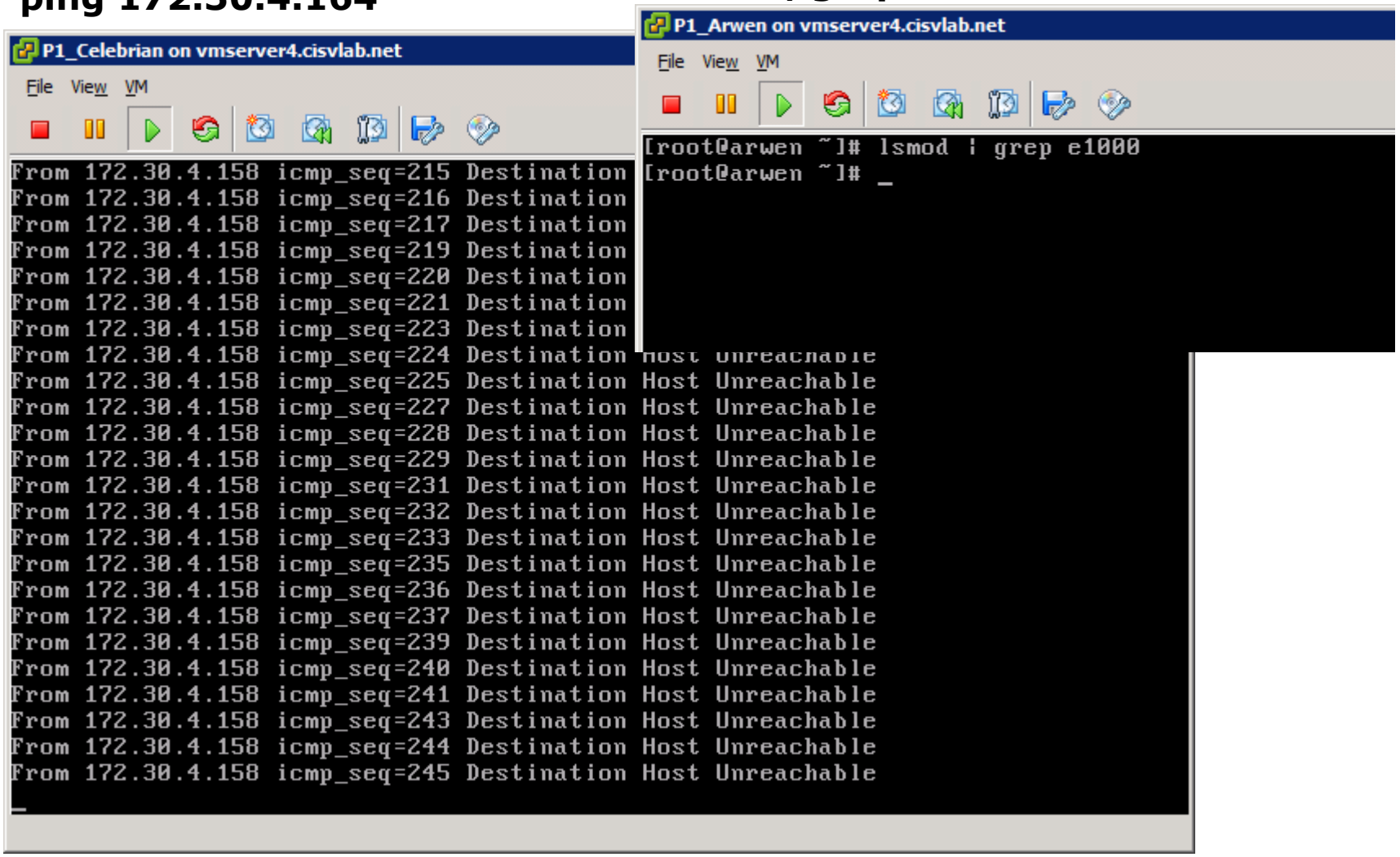


On Arwen
lsmod | grep e1000

Is the e1000 driver (a kernel module) loaded on Arwen?

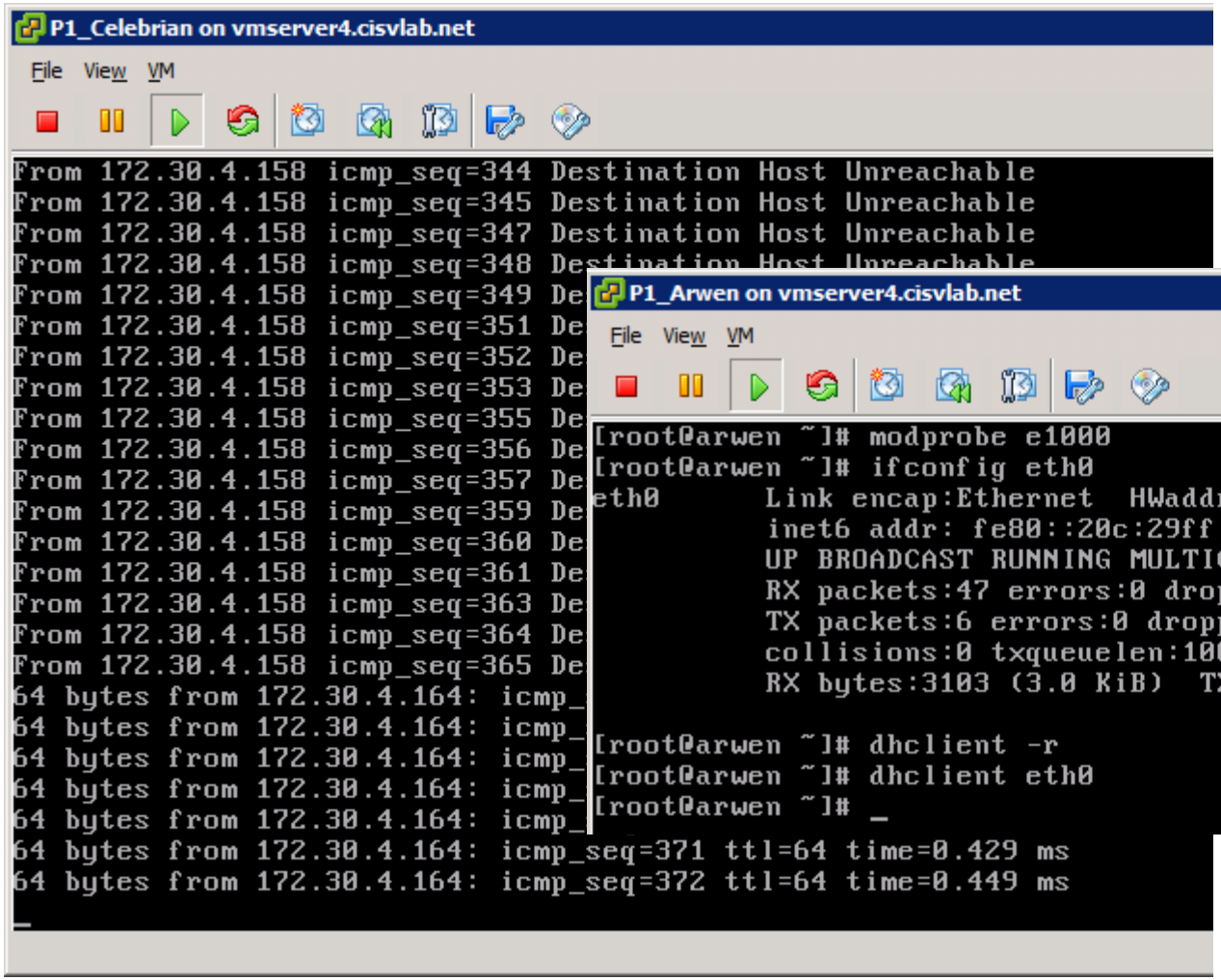
On Celebrian
ping 172.30.4.164

On Arwen
lsmod | grep e1000



Is the e1000 driver (a kernel module) loaded on Arwen? ***No***

On Celebrian
ping 172.30.4.164



On Arwen:
modprobe e1000
ifconfig eth0
dhclient –r
dhclient eth0

What happened here?

On Celebrian
ping 172.30.4.164

On Arwen:
modprobe e1000
ifconfig eth0
dhclient –r
dhclient eth0

P1_Celebrian on vmserver4.cisvlab.net

File View VM

```
From 172.30.4.158 icmp_seq=344 Destination Host Unreachable
From 172.30.4.158 icmp_seq=345 Destination Host Unreachable
From 172.30.4.158 icmp_seq=347 De
From 172.30.4.158 icmp_seq=348 De
From 172.30.4.158 icmp_seq=349 De
From 172.30.4.158 icmp_seq=351 De
From 172.30.4.158 icmp_seq=352 De
From 172.30.4.158 icmp_seq=353 De
From 172.30.4.158 icmp_seq=355 De
From 172.30.4.158 icmp_seq=356 De
From 172.30.4.158 icmp_seq=357 De
From 172.30.4.158 icmp_seq=359 De
From 172.30.4.158 icmp_seq=360 De
From 172.30.4.158 icmp_seq=361 De
From 172.30.4.158 icmp_seq=363 De
From 172.30.4.158 icmp_seq=364 De
From 172.30.4.158 icmp_seq=365 De
64 bytes from 172.30.4.164: icmp_
64 bytes from 172.30.4.164: icmp_
64 bytes from 172.30.4.164: icmp_
64 bytes from 172.30.4.164: icmp_seq=369 ttl=64 time=0.531 ms
64 bytes from 172.30.4.164: icmp_seq=370 ttl=64 time=0.473 ms
64 bytes from 172.30.4.164: icmp_seq=371 ttl=64 time=0.429 ms
64 bytes from 172.30.4.164: icmp_seq=372 ttl=64 time=0.449 ms
_
```

P1_Arwen on vmserver4.cisvlab.net

File View VM

```
[root@arwen ~]# modprobe e1000
[root@arwen ~]# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:0C:29:BB:23:97
          inet6 addr: fe80::20c:29ff:febb:2397/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:47 errors:0 dropped:0 overruns:0 frame:0
          TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:3103 (3.0 KiB)  TX bytes:468 (468.0 b)

[root@arwen ~]# dhclient -r
[root@arwen ~]# dhclient eth0
[root@arwen ~]# _
```

What happened here? ***Loaded the e1000 driver, then obtained an IP address and Arwen started to replying to ping requests again***

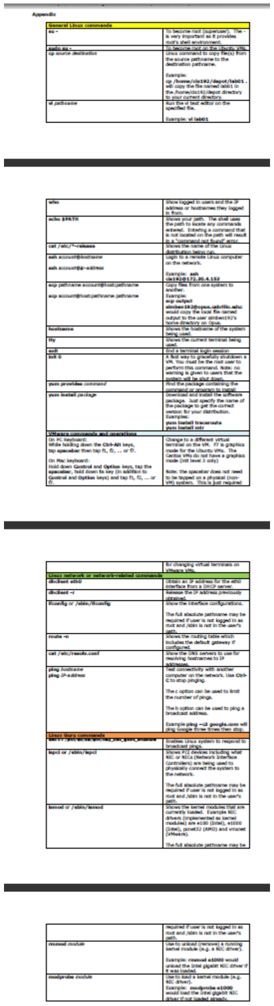
Class Activity - Managing NIC Drivers

Live Demo

Remove a driver and add it back in

UNIX/Linux Commands

http://simms-teach.com/docs/cis192/cis192lab01.pdf



The Appendix at the end of Lab 01 has a list of basic UNIX/Linux commands.

This is a good list to review if you are feeling a little rusty since you took your last UNIX/Linux course.

> *filename*	*filename* is created if it does not exist and emptied. Example: **> output** would empty the file named output or create it if it did not exist already.
command **>** *filename*	*filename* is emptied, then the output of the command is redirected into *filename.* Example: **ifconfig > output** would save the output of the ifconfig command in a file named output.
command **>>** *filename*	Output of the command is appended to the end of *filename.* Example: **route –n >> output** would append the routing table to the end of the file named output.

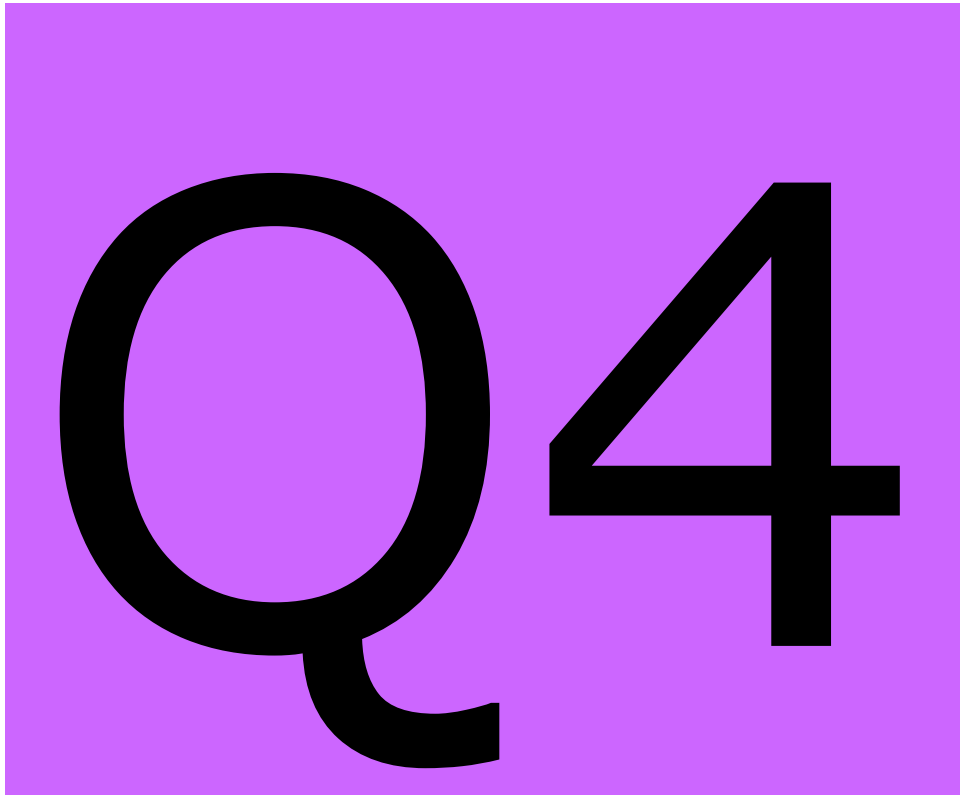
General Linux commands	
su -	To become root (superuser). The - is very important as it provides root's shell environment.
sudo su -	To become root on the Ubuntu VMs.

In CIS 90 you never logged in as root ... the all-powerful, super user!

ssh *account@hostname* **ssh** *account@ip-address*	Login to a remote Linux computer on the network. Example: **ssh cis192@172.30.4.153**
ssh *account@hostname 'command'*	Run a command on a remote system. Example: **ssh root@172.30.4.164 'ifconfig'** would run the ifconfig command on the remote system and show the output of the command on the local system.
scp *pathname account@host:pathname* **scp** *account@host:pathname pathname*	Copy files from one system to another. Example: **scp output simben192@opus.cabrillo.edu:** (above all on one line) would copy the local file named output to the user simben192's home directory on Opus.

init 0	A fast way to gracefully shutdown a VM. You must be the root user to perform this command. Note: no warning is given to users that the system will be shut down.

yum provides *command*	Find the package containing the command or program to install
yum install *package*	Download and install the software package. Just specify the name of the package to get the correct version for your distribution. Examples: **yum install traceroute** **yum install mtr**


Q4

Joining the network continued ...

Connecting your Linux system to the Network

1. Identify the NIC in your system (vendor and model)

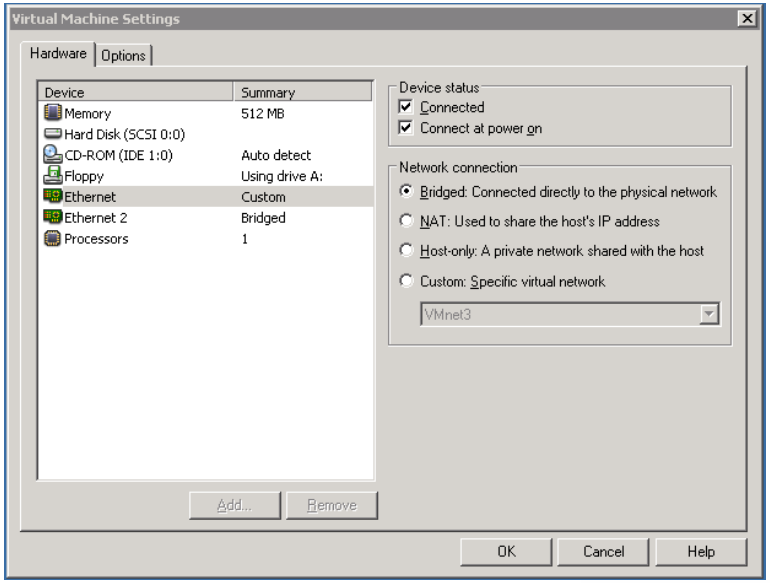
2. Locate a driver for your NIC
   - may be already available with your distro
   - may be available from NIC vendor
   - may be available from chipset vendor
   - may have get source and build (compile) it

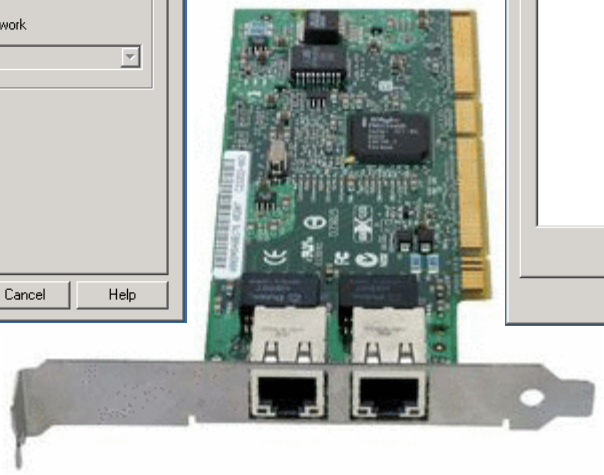
3. Load the driver (insmod or modprobe command)

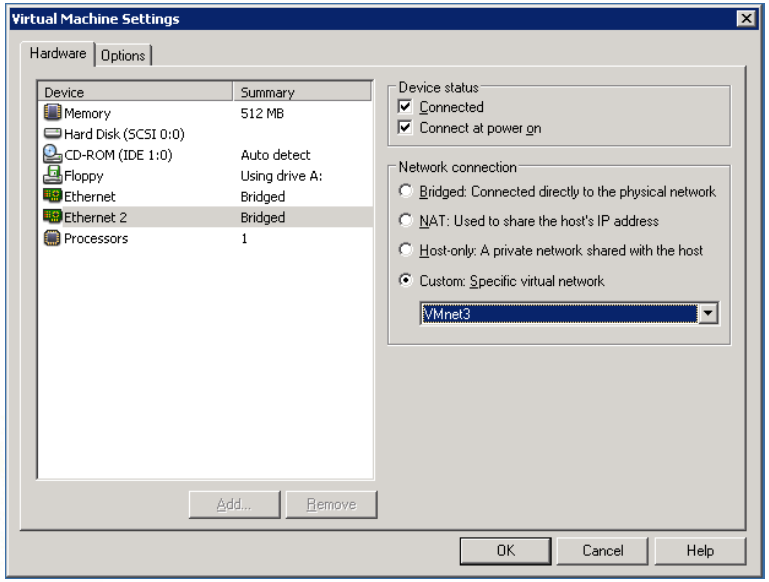
4. **Bring up and configure the interface (ifconfig)**

Configuring a static IP address with ifconfig

Having two Ethernet adapters in your VM is the same as having two real adapters in a real physical computer







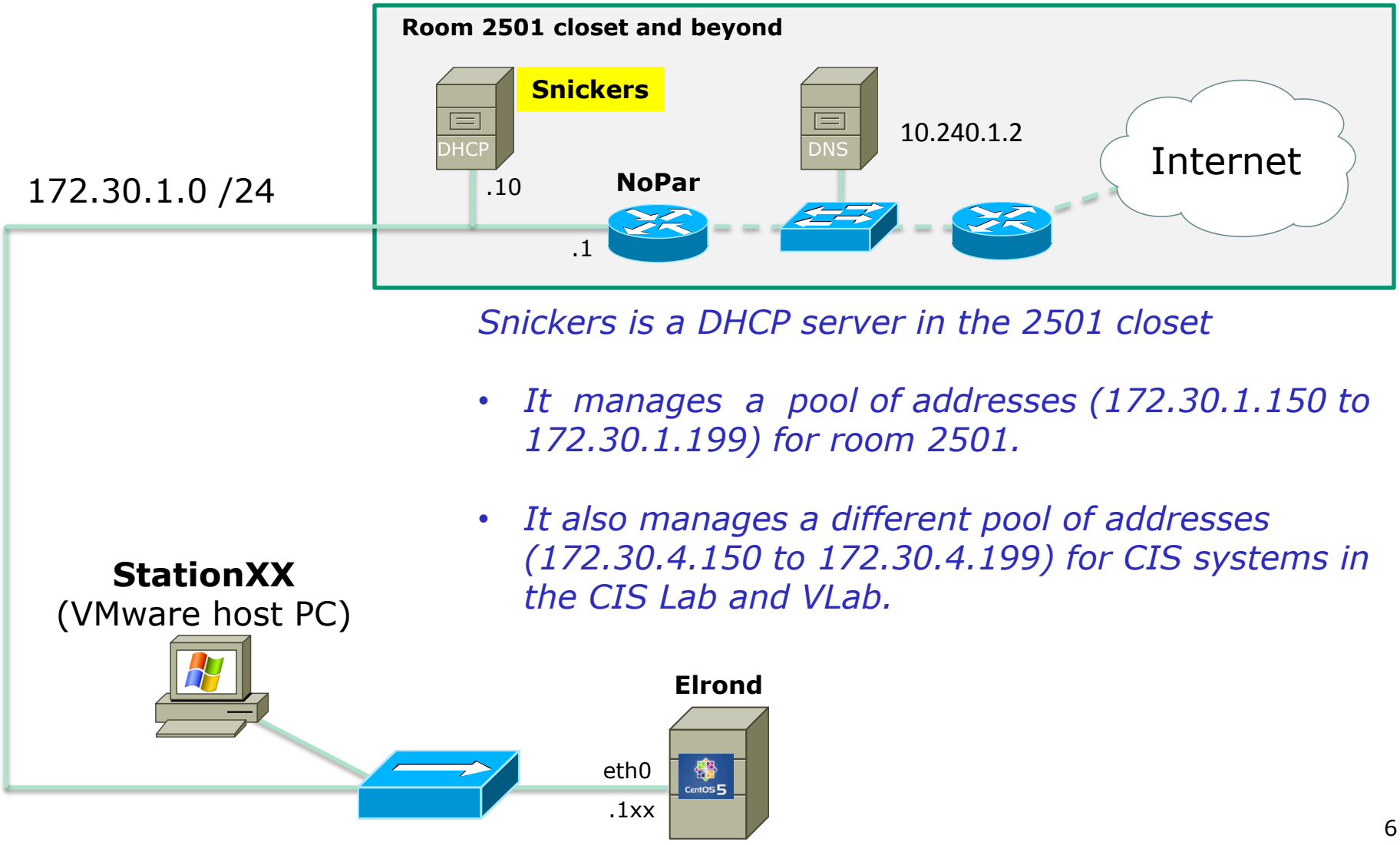
Ethernet = eth0

Ethernet2 = eth1

*Linux will refer to the first adapter as **eth0** and the second as **eth1***

Configuring dynamic IP address (dhcp)

Configuring dynamic IP addresses



Snickers is a DHCP server in the 2501 closet

- *It manages a pool of addresses (172.30.1.150 to 172.30.1.199) for room 2501.*
- *It also manages a different pool of addresses (172.30.4.150 to 172.30.4.199) for CIS systems in the CIS Lab and VLab.*

Configuring dynamic IP addresses

- To request a dynamic IP address for eth0:
  dhclient eth0

- To release a dynamic IP address:
  dhclient –r eth0

- To see what happened:
  tail /var/log/messages

Note: Specifying eth0 is not necessary for systems with a single NIC. However, all the CentOS systems used for this course have 2 NICs making it necessary to designate the specific interface

Initial state – system is not connected to network

ifconfig eth0

eth0 interface is down

```
[root@legolas ~]# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:0C:29:90:77:B4
          BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)
```

route -n

No default gateway

```
[root@legolas ~]# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
[root@legolas ~]#
```

cat /etc/resolv.conf

No DNS server configured

```
[root@legolas ~]# cat /etc/resolv.conf
[root@legolas ~]# _
```

Obtain IP address from DHCP server

dhclient eth0 *Request an IP address*

```
[root@legolas ~]# dhclient eth0
[root@legolas ~]#
[root@legolas ~]#
```

tail -6 /var/log/messages *Check the log to see what happened*

```
[root@legolas ~]# tail -6 /var/log/messages
Oct 20 09:27:31 legolas dhclient: DHCPDISCOVER on eth0 to 255.255.255.255 port 6
7 interval 6
Oct 20 09:27:31 legolas dhclient: DHCPOFFER from 172.30.4.1
Oct 20 09:27:31 legolas dhclient: DHCPREQUEST on eth0 to 255.255.255.255 port 67
Oct 20 09:27:31 legolas dhclient: DHCPACK from 172.30.4.1
Oct 20 09:27:31 legolas NET[1454]: /sbin/dhclient-script : updated /etc/resolv.c
onf
Oct 20 09:27:32 legolas dhclient: bound to 172.30.4.150 -- renewal in 10951 seco
nds.
[root@legolas ~]#
```

ifconfig eth0 *eth0 interface is up and has IP address*

```
[root@legolas ~]# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:0C:29:90:77:B4
          inet addr:172.30.4.150  Bcast:172.30.4.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fe90:77b4/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:131 errors:0 dropped:0 overruns:0 frame:0
          TX packets:18 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:9187 (8.9 KiB)  TX bytes:2688 (2.6 KiB)

[root@legolas ~]# _
```

More than IP address is obtained

route -n

Default gateway set to 172.30.4.1

```
[root@legolas ~]# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
172.30.4.0      0.0.0.0         255.255.255.0   U     0      0        0 eth0
0.0.0.0         172.30.4.1      0.0.0.0         UG    0      0        0 eth0
```

cat /etc/resolv.conf

```
[root@legolas ~]# cat /etc/resolv.conf
; generated by /sbin/dhclient-script
search cisvlab.net
nameserver 192.168.0.8
nameserver 10.240.1.2
[root@legolas ~]#
```

Primary DNS server set to 192.168.0.8 and secondary DNS server set to 10.240.1.2

Release the IP address

dhclient –r eth0

```
[root@legolas ~]# dhclient -r eth0
[root@legolas ~]#
```

Release the IP address

tail -2 /var/log/messages

Check the log to see what happened

```
[root@legolas ~]# tail -2 /var/log/messages
Oct 20 09:29:42 legolas dhclient: DHCPRELEASE on eth0 to 172.30.1.10 port 67
Oct 20 09:29:42 legolas NET[1484]: /sbin/dhclient-script : updated /etc/resolv.c
onf
[root@legolas ~]# _
```

ifconfig eth0

eth0 interface is down

```
[root@legolas ~]# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:0C:29:90:77:B4
          BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:114 errors:0 dropped:0 overruns:0 frame:0
          TX packets:10 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:7595 (7.4 KiB)  TX bytes:1536 (1.5 KiB)
```

Release the IP address

route -n

No default gateway

```
[root@legolas ~]# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
[root@legolas ~]#
```

cat /etc/resolv.conf

No DNS servers

```
[root@legolas ~]# cat /etc/resolv.conf

[root@legolas ~]#
```

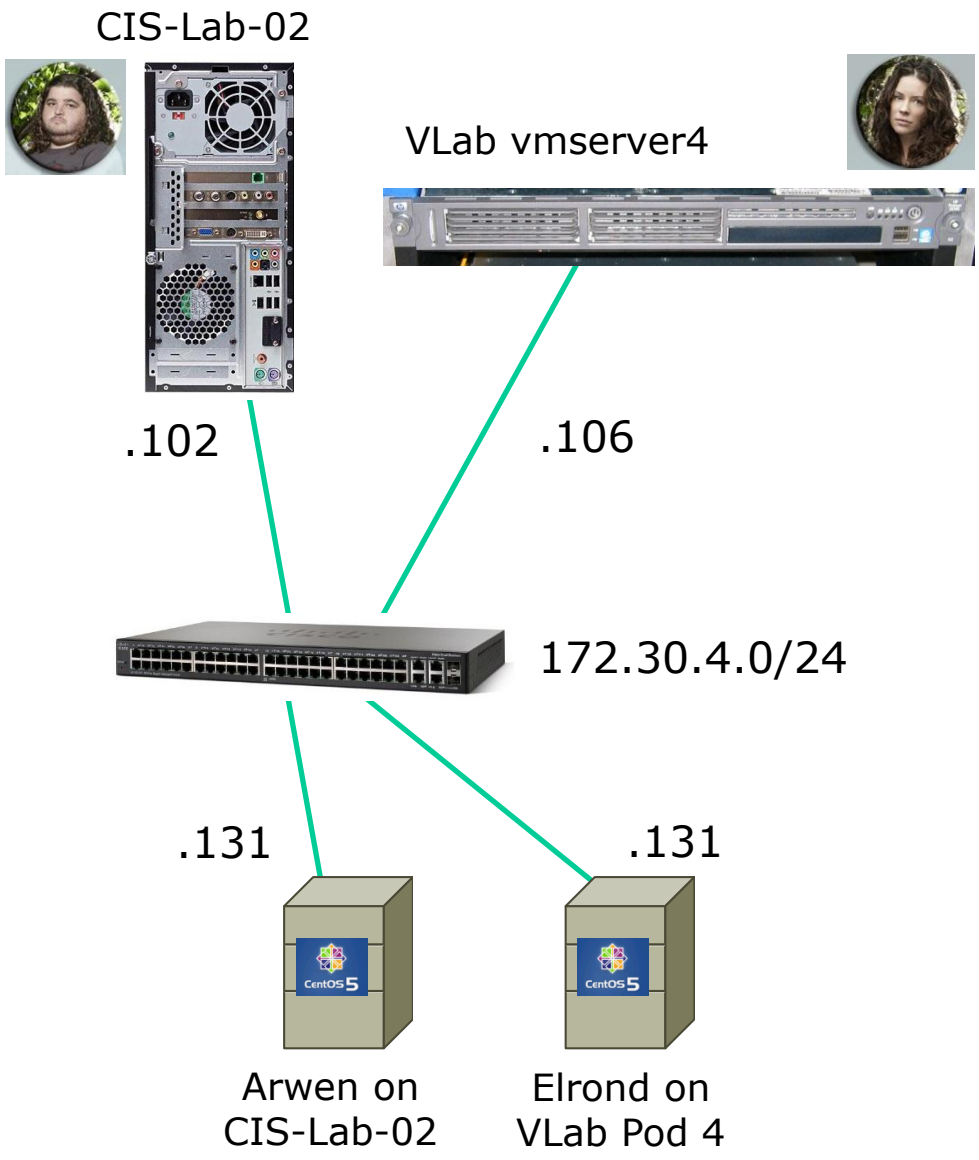
Class Activity

Obtain and release an IP address

Live Demo

Dup IPs

The classroom 172.30.1.0/24 and CIS Lab 172.30.4.0/24 networks have a limited number of IP addresses!

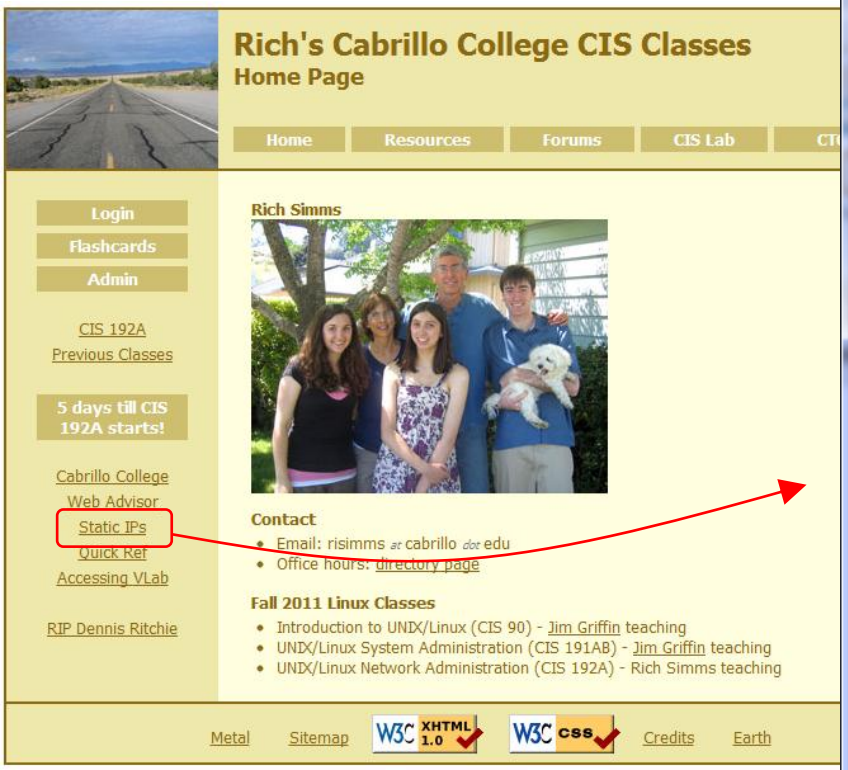


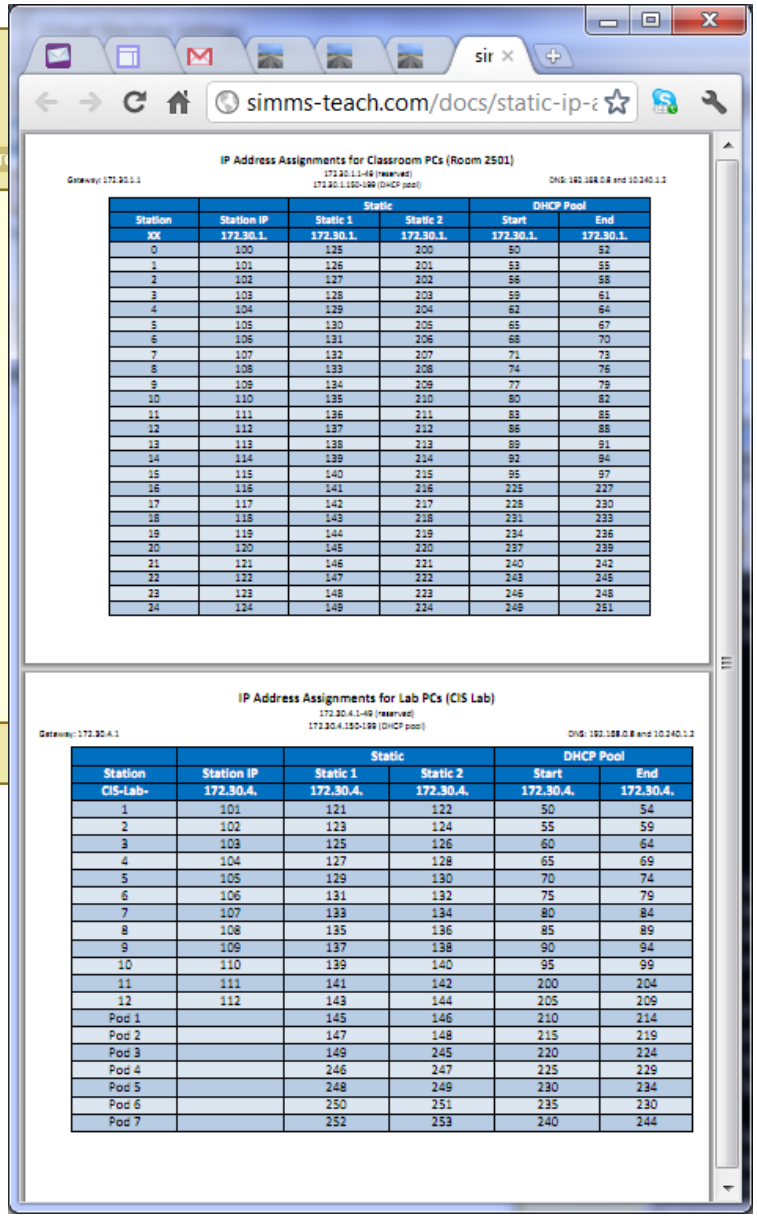
Duplicate IP addresses = TROUBLE !!

Hugo is using local VMs on a CIS Lab workstation. He configures his Arwen VM eth0 interface to 172.30.4.131 and connects it to the Lab network.

Kate is remotely accessing Pod 4 in VLab from home. She configures her Elrond VM eth0 interface to 172.30.4.131 and connects it to the Lab network.

What will happen when Ben pings 172.30.4.131 on the Lab network?





Station	Station IP	Static		DHCP Pool	
		Static 1	Static 2	Start	End
XX	172.30.1.	172.30.1.	172.30.1.	172.30.1.	172.30.1.
0	100	125	200	50	52
1	101	126	201	53	55
2	102	127	202	56	58
3	103	128	203	59	61
4	104	129	204	62	64
5	105	130	205	65	67
6	106	131	206	68	70
7	107	132	207	71	73
8	108	133	208	74	76
9	109	134	209	77	79
10	110	135	210	80	82
11	111	136	211	83	85
12	112	137	212	86	88
13	113	138	213	89	91
14	114	139	214	92	94
15	115	140	215	95	97
16	116	141	216	225	227
17	117	142	217	228	230
18	118	143	218	231	233
19	119	144	219	234	236
20	120	145	220	237	239
21	121	146	221	240	242
22	122	147	222	243	245
23	123	148	223	246	248
24	124	149	224	248	251

Station	Station IP	Static		DHCP Pool	
		Static 1	Static 2	Start	End
CIS-Lab-	172.30.4.	172.30.4.	172.30.4.	172.30.4.	172.30.4.
1	101	121	122	50	54
2	102	123	124	55	59
3	103	125	126	60	64
4	104	127	128	65	69
5	105	129	130	70	74
6	106	131	132	75	79
7	107	133	134	80	84
8	108	135	136	85	89
9	109	137	138	90	94
10	110	139	140	95	99
11	111	141	142	200	204
12	112	143	144	205	209
Pod 1		145	146	210	214
Pod 2		147	148	215	219
Pod 3		149	245	220	224
Pod 4		246	247	225	229
Pod 5		248	249	230	234
Pod 6		250	251	235	230
Pod 7		252	253	240	244

To avoid **TROUBLE**, use the Static IPs link on the web site to select IP addresses.

Only use static IPs assigned to the station you are using in the classroom or the lab!

IP Address Assignments for Classroom PCs (Room 2501)

Gateway: 172.30.1.1

172.30.1.1-49 (reserved)
172.30.1.150-199 (DHCP pool)

DNS: 192.168.0.8 and 10.240.1.2

		Static		DHCP Pool	
Station	Station IP	Static 1	Static 2	Start	End
XX	172.30.1.	172.30.1.	172.30.1.	172.30.1.	172.30.1.
0	100	125	200	50	52
1	101	126	201	53	55
2	102	127	202	56	58
3	103	128	203	59	61
4	104	129	204	62	64
5	105	130	205	65	67
6	106	131	206	68	70
7	107	132	207	71	73
8	108	133	208	74	76
9	109	134	209	77	79
10	110	135	210	80	82
11	111	136	211	83	85
12	112	137	212	86	88
13	113	138	213	89	91
14	114	139	214	92	94
15	115	140	215	95	97
16	116	141	216	225	227
17	117	142	217	228	230
18	118	143	218	231	233
19	119	144	219	234	236
20	120	145	220	237	239
21	121	146	221	240	242
22	122	147	222	243	245
23	123	148	223	246	248
24	124	149	224	249	251

What static IP addresses can be used by the student sitting at station 10 in the classroom?

IP Address Assignments for Classroom PCs (Room 2501)

Gateway: 172.30.1.1

172.30.1.1-49 (reserved)
172.30.1.150-199 (DHCP pool)

DNS: 192.168.0.8 and 10.240.1.2

		Static		DHCP Pool	
Station	Station IP	Static 1	Static 2	Start	End
XX	172.30.1.	172.30.1.	172.30.1.	172.30.1.	172.30.1.
0	100	125	200	50	52
1	101	126	201	53	55
2	102	127	202	56	58
3	103	128	203	59	61
4	104	129	204	62	64
5	105	130	205	65	67
6	106	131	206	68	70
7	107	132	207	71	73
8	108	133	208	74	76
9	109	134	209	77	79
10	110	135	210	80	82
11	111	136	211	83	85
12	112	137	212	86	88
13	113	138	213	89	91
14	114	139	214	92	94
15	115	140	215	95	97
16	116	141	216	225	227
17	117	142	217	228	230
18	118	143	218	231	233
19	119	144	219	234	236
20	120	145	220	237	239
21	121	146	221	240	242
22	122	147	222	243	245
23	123	148	223	246	248
24	124	149	224	249	251

What static IP addresses can be used by the student sitting at station 10 in the classroom?

172.30.1.135 or 172.30.1.210

IP Address Assignments for Lab PCs (CIS Lab)

172.30.4.1-49 (reserved)
172.30.4.150-199 (DHCP pool)

Gateway: 172.30.4.1

DNS: 192.168.0.8 and 10.240.1.2

		Static		DHCP Pool	
Station	Station IP	Static 1	Static 2	Start	End
CIS-Lab-	172.30.4.	172.30.4.	172.30.4.	172.30.4.	172.30.4.
1	101	121	122	50	54
2	102	123	124	55	59
3	103	125	126	60	64
4	104	127	128	65	69
5	105	129	130	70	74
6	106	131	132	75	79
7	107	133	134	80	84
8	108	135	136	85	89
9	109	137	138	90	94
10	110	139	140	95	99
11	111	141	142	200	204
12	112	143	144	205	209
Pod 1		145	146	210	214
Pod 2		147	148	215	219
Pod 3		149	245	220	224
Pod 4		246	247	225	229
Pod 5		248	249	230	234
Pod 6		250	251	235	230
Pod 7		252	253	240	244

What static IP addresses can be used by the student sitting at station CIS-Lab-06 in the CIS Lab?

IP Address Assignments for Lab PCs (CIS Lab)

172.30.4.1-49 (reserved)
172.30.4.150-199 (DHCP pool)

Gateway: 172.30.4.1

DNS: 192.168.0.8 and 10.240.1.2

		Static		DHCP Pool	
Station	Station IP	Static 1	Static 2	Start	End
CIS-Lab-	172.30.4.	172.30.4.	172.30.4.	172.30.4.	172.30.4.
1	101	121	122	50	54
2	102	123	124	55	59
3	103	125	126	60	64
4	104	127	128	65	69
5	105	129	130	70	74
6	106	131	132	75	79
7	107	133	134	80	84
8	108	135	136	85	89
9	109	137	138	90	94
10	110	139	140	95	99
11	111	141	142	200	204
12	112	143	144	205	209
Pod 1		145	146	210	214
Pod 2		147	148	215	219
Pod 3		149	245	220	224
Pod 4		246	247	225	229
Pod 5		248	249	230	234
Pod 6		250	251	235	230
Pod 7		252	253	240	244

What static IP addresses can be used by the student sitting at station CIS-Lab-06 in the CIS Lab?

172.30.4.131 or 172.30.4.132

IP Address Assignments for Lab PCs (CIS Lab)

172.30.4.1-49 (reserved)
172.30.4.150-199 (DHCP pool)

Gateway: 172.30.4.1

DNS: 192.168.0.8 and 10.240.1.2

		Static		DHCP Pool	
Station	Station IP	Static 1	Static 2	Start	End
CIS-Lab-	172.30.4.	172.30.4.	172.30.4.	172.30.4.	172.30.4.
1	101	121	122	50	54
2	102	123	124	55	59
3	103	125	126	60	64
4	104	127	128	65	69
5	105	129	130	70	74
6	106	131	132	75	79
7	107	133	134	80	84
8	108	135	136	85	89
9	109	137	138	90	94
10	110	139	140	95	99
11	111	141	142	200	204
12	112	143	144	205	209
Pod 1		145	146	210	214
Pod 2		147	148	215	219
Pod 3		149	245	220	224
Pod 4		246	247	225	229
Pod 5		248	249	230	234
Pod 6		250	251	235	230
Pod 7		252	253	240	244

What static IP addresses can be used by the student using Pod 2 in the CIS VLab?

IP Address Assignments for Lab PCs (CIS Lab)

172.30.4.1-49 (reserved)
172.30.4.150-199 (DHCP pool)

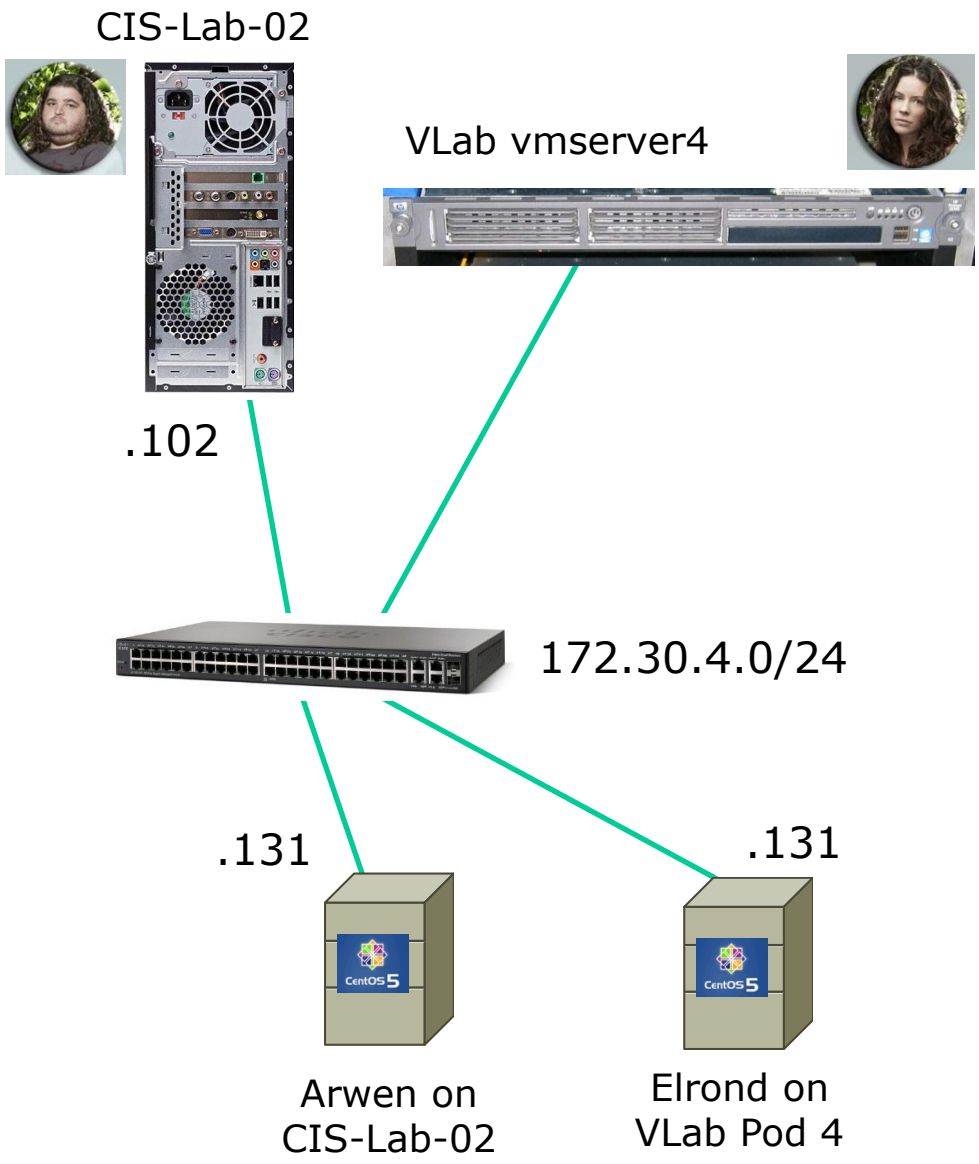
Gateway: 172.30.4.1

DNS: 192.168.0.8 and 10.240.1.2

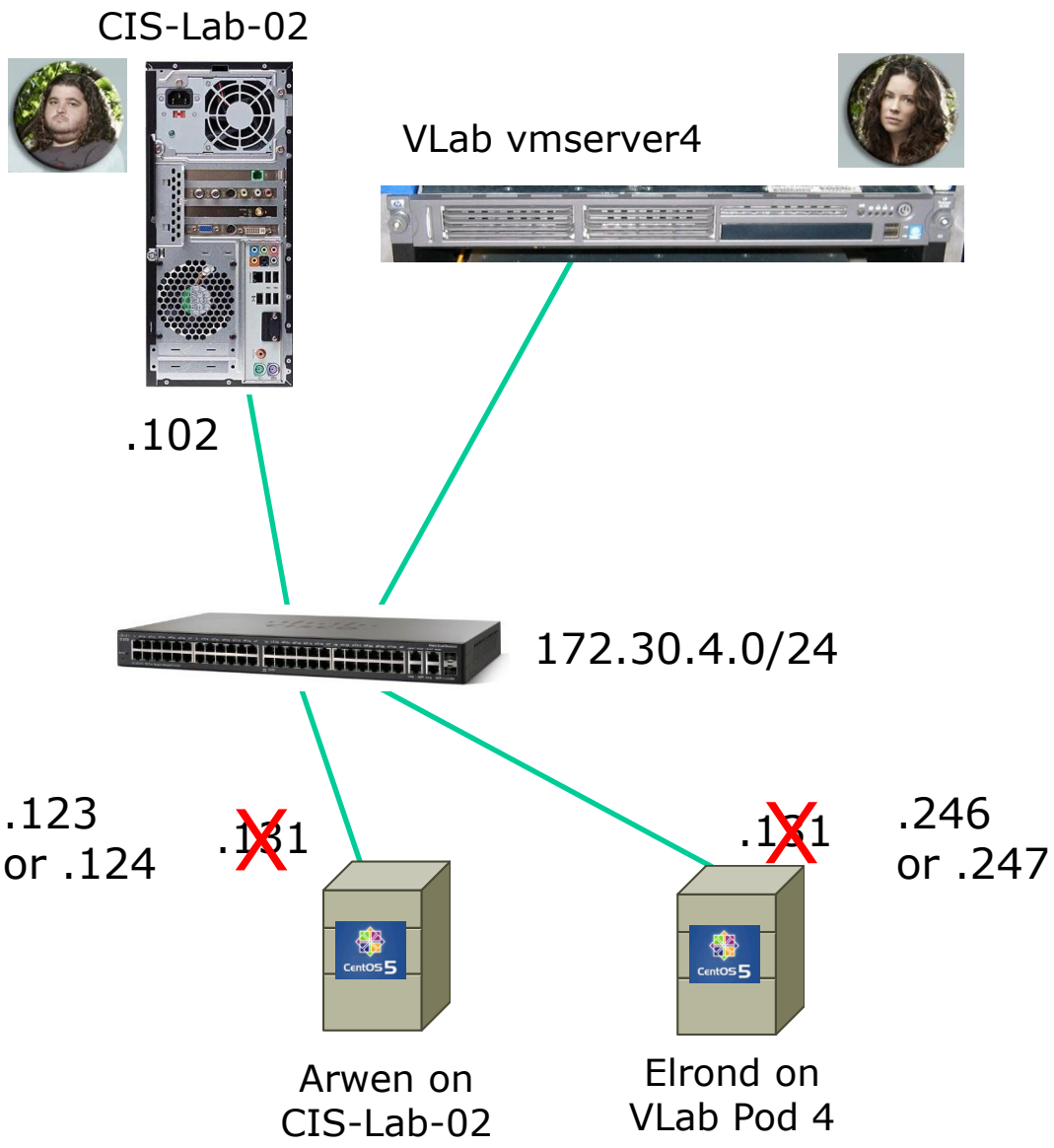
		Static		DHCP Pool	
Station	Station IP	Static 1	Static 2	Start	End
CIS-Lab-	172.30.4.	172.30.4.	172.30.4.	172.30.4.	172.30.4.
1	101	121	122	50	54
2	102	123	124	55	59
3	103	125	126	60	64
4	104	127	128	65	69
5	105	129	130	70	74
6	106	131	132	75	79
7	107	133	134	80	84
8	108	135	136	85	89
9	109	137	138	90	94
10	110	139	140	95	99
11	111	141	142	200	204
12	112	143	144	205	209
Pod 1		145	146	210	214
Pod 2		147	148	215	219
Pod 3		149	245	220	224
Pod 4		246	247	225	229
Pod 5		248	249	230	234
Pod 6		250	251	235	230
Pod 7		252	253	240	244

What static IP addresses can be used by the student using Pod 2 in the CIS VLab?

172.30.4.147 or 172.30.4.148



What IP addresses should Hugo and Kate have used?



Hugo should have used:
172.30.4.123 or
172.30.4.124

and Kate should have used:
172.30.4.246 or
172.30.4.247

Configuring static IP address

Configuring a static IP address with ifconfig

- To show all interfaces (and to show your IP address):
  ifconfig

- To show the eth0 interface:
  ifconfig eth0

- To set ip address and subnet mask:
  ifconfig ethx xxx.xxx.xxx.xxx **netmask** xxx.xxx.xxx.xxx
  or **ifconfig eth**x xxx.xxx.xxx.xxx**/**nn *(where nn=prefix)*

- To shut down an interface:
  ifconfig ethx **down**

- To bring up an interface:
  ifconfig ethx **up**

*Note: Configuring an IP address with **ifconfig** is temporary. It will last until the system is rebooted or the network service is restarted.*

Configuring a static IP address with ifconfig

The **ifconfig** command, with no arguments, will list all "up" interfaces

ifconfig

```
[root@elrond ~]# ifconfig
lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:8 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:560 (560.0 b)  TX bytes:560 (560.0 b)

[root@elrond ~]# _
```

Network settings have been disabled on the CentOS VMs so you can practice setting them up. When you first power them on only the loopback "lo" interface is active.

Configuring a static IP address with ifconfig

To set an IP address and subnet mask on Station 05 in the classroom:

ifconfig eth0 172.30.4.130 netmask 255.255.255.0

MAC address

IPv4 address

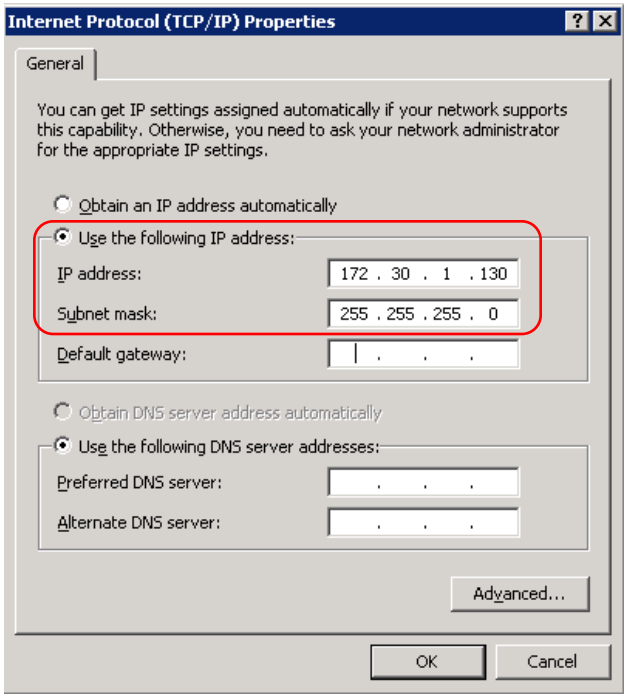
```
[root@elrond ~]# ifconfig eth0 172.30.1.130 netmask 255.255.255.0
[root@elrond ~]# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:0C:29:68:36:87
          inet addr:172.30.1.130  Bcast:172.30.1.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fe68:3687/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:31 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 b)  TX bytes:7726 (7.5 KiB)
          Interrupt:177 Base address:0x1400
```

IPv6 address

Remember that 172.30.1.130 is only to be used on Station 5 in the classroom.

If every student configures their VM with the same static IP address there will be duplicate IP issues with the classroom network = TROUBLE

Configuring static IP and mask on other planets



Lan Area Connection on Windows XP

One standard …. many implementations!

fa 0/0 on Cisco 2811 router

```
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ip add 172.30.1.130 255.255.255.0
Router(config-if)#
```

Caveat: Root's environment has /sbin in path

To show all interfaces (and to show your IP address):
ifconfig

As root, your path includes /sbin

```
[root@benji ~]# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0C:29:E6:2C:03
          inet addr:192.168.0.34  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fee6:2c03/64 Scope:Link
<snipped>
```

As non-root user your path does not include /sbin

```
[cis192@benji ~]$ ifconfig
-bash: ifconfig: command not found


[cis192@benji ~]$ /sbin/ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0C:29:E6:2C:03
          inet addr:192.168.0.34  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fee6:2c03/64 Scope:Link
<snipped>
```

Configuring Gateway DNS

Configuring the gateway and DNS

- To show the routing table (including gateway)
  route -n

- To set the gateway
  route add default gw xxx.xxx.xxx.xxx

- To delete the gateway
  route del default gw xxx.xxx.xxx.xxx

Configuring the gateway and DNS

To set the default gateway

route add default gw xxx.xxx.xxx.xxx

```
[root@elrond ~]# route add default gw 172.30.1.1
[root@elrond ~]# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
172.30.1.0      0.0.0.0         255.255.255.0   U     0      0        0 eth0
0.0.0.0         172.30.1.1      0.0.0.0         UG    0      0        0 eth0
[root@elrond ~]#
```

*After setting a new route it's a good idea to verify it using **route –n***

The routing table above has two entries:

- *Packets destined for 172.30.1.0/24 are sent out the eth0 interface to the connected subnet*
- *All other packets are sent to the default gateway at 172.30.1.1*

Configuring the gateway and DNS

To delete the default gateway

route del default gw xxx.xxx.xxx.xxx

```
[root@elrond ~]# route del default gw 172.30.1.1
[root@elrond ~]# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
172.30.1.0      0.0.0.0         255.255.255.0   U     0      0        0 eth0
[root@elrond ~]#
```

*After changing a route it's a good idea to verify it using **route -n***

Configuring the gateway and DNS

- To set the DNS server
  edit **/etc/resolv.conf** and add:
  nameserver xxx.xxx.xxx.xxx

Configuring the gateway and DNS

To set the DNS server edit **/etc/resolv.conf** and add:

nameserver xxx.xxx.xxx.xxx

```
[root@elrond ~]# cat /etc/resolv.conf
cat: /etc/resolv.conf: No such file or directory
[root@elrond ~]# echo nameserver 207.62.187.53 > /etc/resolv.conf
[root@elrond ~]# cat /etc/resolv.conf
nameserver 207.62.187.53
[root@elrond ~]# _
```

Testing

Testing Interface Settings

- Check IP address by pinging router or neighbor
  ping xxx.xxx.xxx.xxx

At school, the nosmo router is at:
- *172.30.1.1 in the classroom*
- *172.30.4.1 in the lab*

- Check DNS by pinging hostname
  ping google.com

Use Ctrl-C to stop pinging which will go on forever if you don't.

Commands for testing interfaces

Check settings by pinging the classroom router

ping 172.30.1.1

```
[root@elrond ~]# ping 172.30.1.1
PING 172.30.1.1 (172.30.1.1) 56(84) bytes of data.
64 bytes from 172.30.1.1: icmp_seq=1 ttl=64 time=5.81 ms
64 bytes from 172.30.1.1: icmp_seq=2 ttl=64 time=1.20 ms
64 bytes from 172.30.1.1: icmp_seq=3 ttl=64 time=1.31 ms
64 bytes from 172.30.1.1: icmp_seq=4 ttl=64 time=0.956 ms

--- 172.30.1.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3003ms
rtt min/avg/max/mdev = 0.956/2.322/5.813/2.019 ms
[root@elrond ~]#
```

Use Ctrl-C to stop pinging which will go on forever if you don't.

Commands for testing interfaces

Check settings by pinging the classroom router

ping 172.30.1.1

```
[root@elrond ~]# ping 172.30.1.1
connect: Network is unreachable
```

The interface has not been configured with an IP address or a default route has not been set.

Commands for testing interfaces

Check DNS settings by pinging hostname

ping google.com

```
[root@elrond ~]# ping google.com
PING google.com (74.125.45.100) 56(84) bytes of data.
64 bytes from yx-in-f100.google.com (74.125.45.100): icmp_seq=1 ttl=235 time=48.
4 ms
64 bytes from yx-in-f100.google.com (74.125.45.100): icmp_seq=2 ttl=235 time=44.
4 ms
64 bytes from yx-in-f100.google.com (74.125.45.100): icmp_seq=3 ttl=235 time=44.
9 ms
64 bytes from yx-in-f100.google.com (74.125.45.100): icmp_seq=4 ttl=235 time=44.
4 ms

--- google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3002ms
rtt min/avg/max/mdev = 44.478/45.605/48.464/1.676 ms
[root@elrond ~]# _
```

Use Ctrl-C to stop pinging which will go on forever if you don't.

Commands for testing interfaces

Check DNS settings by pinging hostname

ping google.com

```
[root@elrond ~]# ping google.com
ping: unknown host google.com
```

The DNS name server has not been configured

Class Activity

Configuring Interface, default gateway and DNS

1. Power on **Celebrian** if it is not already on.
2. Configure eth0 with ***your*** static IP address (based on **your** station number)
   ifconfig eth0 172.30.1.xxx netmask 255.255.255.0
3. Check it with **ifconfig eth0**
4. Configure your default gateway with:
   route add default gw 172.30.1.1
5. Set up your DNS with:
   echo nameserver 10.240.1.2 > /etc/resolv.conf
6. Test by pinging the router 172.30.1.1, google.com and your Windows station.

ipv6

Using IPv6 addresses in Linux

- IPv6 is a layer 3 protocol designed to replace IPv4
- The CentOS VMs for this course have the IPv6 module loaded into the kernel (**use lsmod | grep ipv6** to see it)
- IPv6 uses 128 bits to form an IP address as opposed to 32 bits in IPv4
- IPv4 IP address and mask do not need to be configured in order to use IPv6
- The loopback address for IPv6 is **::1**, for IPv4 it is **127.0.0.1**
- To ping yourself use **ping6 ::1**

Using IPv6 addresses in Linux – ping6

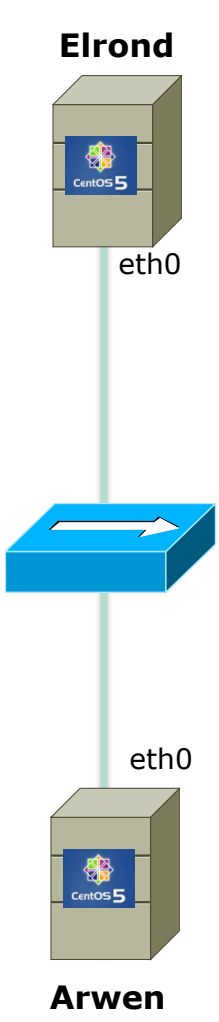

```
root@elrond ~]# ping6 ::1
ING ::1(::1) 56 data bytes
4 bytes from ::1: icmp_seq=0 ttl=64 time=0.330 ms
4 bytes from ::1: icmp_seq=1 ttl=64 time=0.265 ms

-- ::1 ping statistics ---
 packets transmitted, 2 received, 0% packet loss, time 1001ms
tt min/avg/max/mdev = 0.265/0.297/0.330/0.036 ms, pipe 2
root@elrond ~]# ping 127.0.0.1
ING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
4 bytes from 127.0.0.1: icmp_seq=1 ttl=64 time=0.980 ms
4 bytes from 127.0.0.1: icmp_seq=2 ttl=64 time=0.095 ms

-- 127.0.0.1 ping statistics ---
 packets transmitted, 2 received, 0% packet loss, time 1000ms
tt min/avg/max/mdev = 0.095/0.537/0.980/0.443 ms
root@elrond ~]#
```

The first ping uses an IPv6 loopback address.

The second ping uses the traditional IPv4 loopback address.

Loopback address are used to make network connections to local services. Packets stay local and are not sent out the NIC to the network.

Using IPv6 addresses in Linux – ping6



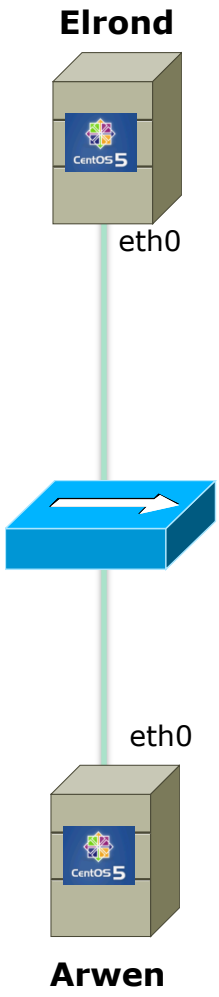

```
[root@elrond ~]# ping6 -I eth0 fe80::20c:29ff:fe4b:f5ce
PING fe80::20c:29ff:fe4b:f5ce(fe80::20c:29ff:fe4b:f5ce) from fe80::20c:29ff:fe68
:3687 eth0: 56 data bytes
64 bytes from fe80::20c:29ff:fe4b:f5ce: icmp_seq=0 ttl=64 time=2.30 ms
64 bytes from fe80::20c:29ff:fe4b:f5ce: icmp_seq=1 ttl=64 time=2.14 ms

--- fe80::20c:29ff:fe4b:f5ce ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1000ms
rtt min/avg/max/mdev = 2.141/2.223/2.306/0.095 ms, pipe 2
[root@elrond ~]# _
```

Note: the interface must be specified on the ping6 command

```
eth0      Link encap:Ethernet  HWaddr 00:0C:29:4B:F5:CE
          inet6 addr: fe80::20c:29ff:fe4b:f5ce/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:713 errors:0 dropped:0 overruns:0 frame:0
          TX packets:605 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:557922 (544.8 KiB)  TX bytes:61674 (60.2 KiB)
          Interrupt:177 Base address:0x1400

[root@arwen ~]# _
```

*Use the **ifconfig** command to see what the ipV6 address is*

Using IPv6 addresses in Linux - ssh




```
[root@elrond ~]# ssh fe80::20c:29ff:fe4b:f5ce%eth0
root@fe80::20c:29ff:fe4b:f5ce%eth0's password:
Last login: Mon Jan 25 23:30:16 2010 from fe80::20c:29ff:fe68:3687%eth0
[root@arwen ~]# _
```

Note: the interface must be specified on the ssh command

```
eth0      Link encap:Ethernet  HWaddr 00:0C:29:4B:F5:CE
          inet6 addr: fe80::20c:29ff:fe4b:f5ce/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:713 errors:0 dropped:0 overruns:0 frame:0
          TX packets:605 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:557922 (544.8 KiB)  TX bytes:61674 (60.2 KiB)
          Interrupt:177 Base address:0x1400

[root@arwen ~]# _
```

*Use the **ifconfig** command to see what the ipV6 address is*

Class Activity
IPv6

1. Power on **Frodo** and **Celebrian** if they are not on already using two different VMware consoles.

2. Their eth0 NICs should both be connected as **bridged**.

3. On Frodo, ping yourself using the loopback address with **ping6 ::1**

4. On Frodo, discover your IPv6 address using **ifconfig**

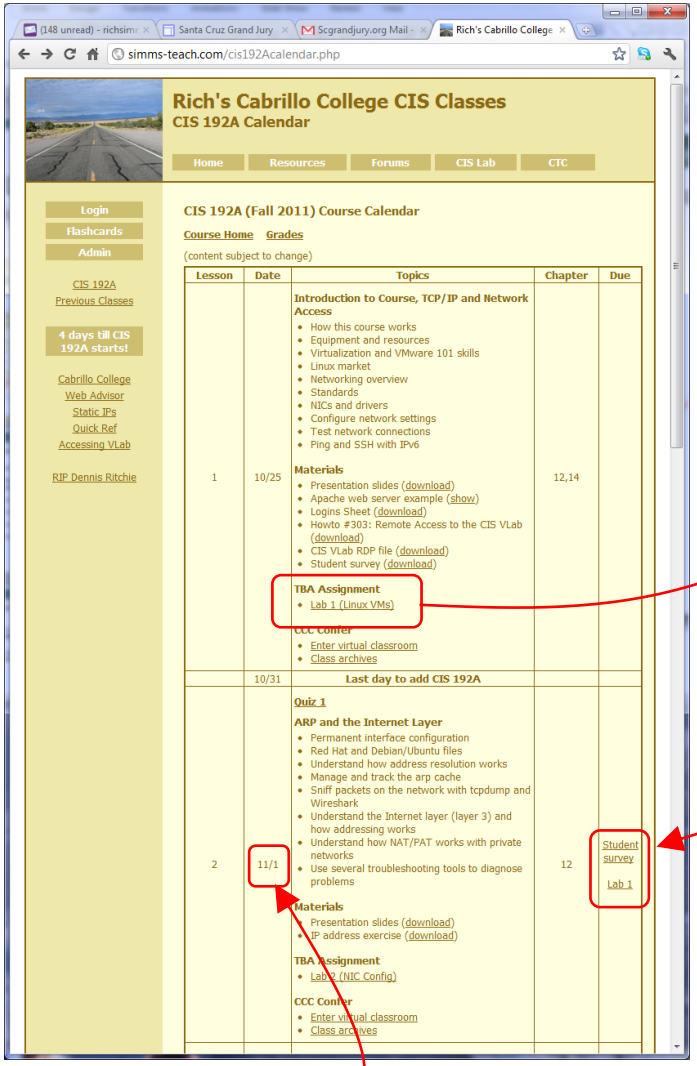
5. Position the smaller Celebrian console on top of the Frodo console so you can see Frodo's IPv6 address.

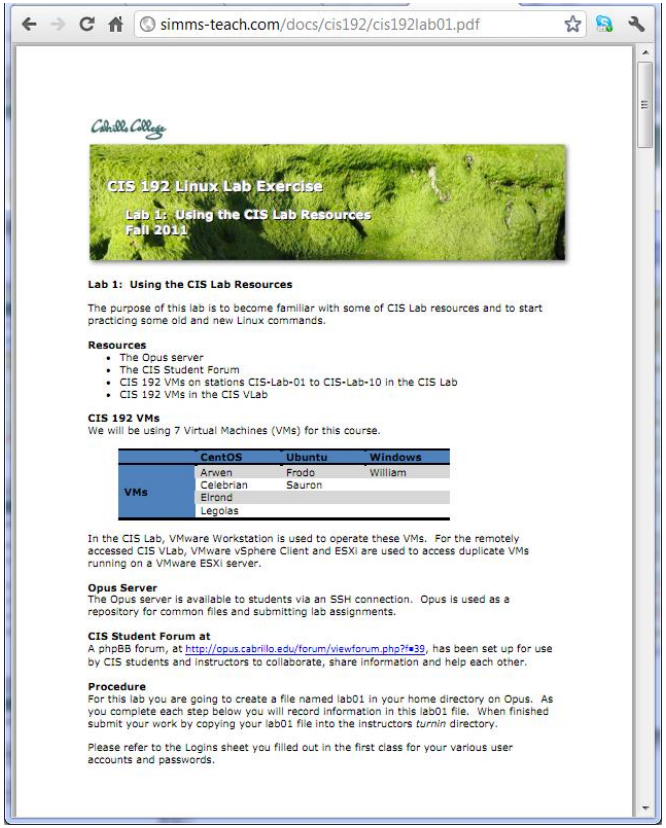
6. On Celebrian use **ping6 –I eth0** <*insert Frodo's IPv6 address*> to ping Frodo using IPv6.

7. On Celebrian use **ssh cis192@**<*insert Frodo's IPv6 address*>**%eth0** and login to Frodo.

Lab Assignment

Use the class calendar to see all assignments and due dates





What is due by midnight (and not one minute later) on that date (Opus time)

The Date

How to submit your work for grading

- For each lab you will create a text file on Opus that gets submitted for grading.
- To submit, copy that text file to the /home/rsimms/turnin directory on Opus and name your file lab*xx*.$LOGNAME (where *xx* = the number of the lab).
- It's a good idea to verify your copy worked!
- Labs must get turned in by midnight (Opus time) on the due date to get credit.
- Submit as many times as you wish up till the deadline.
- No points for late work. It's better to make a partial submittal before the deadline for partial credit.

How to submit your work for grading

Examples:

- Submit using cp command on Opus:

  [simben192@opus ~]$ **cp lab01 /home/rsimms/turnin/lab01.$LOGNAME**

  [simben192@opus ~]$

- Check your submittal from Opus:

  [simben192@opus ~]$ **ls /home/rsimms/turnin**

  lab01.simben192

  [simben192@opus ~]$

Some troubleshooting tips for doing labs

The "I've tried everything and it still won't work" problem

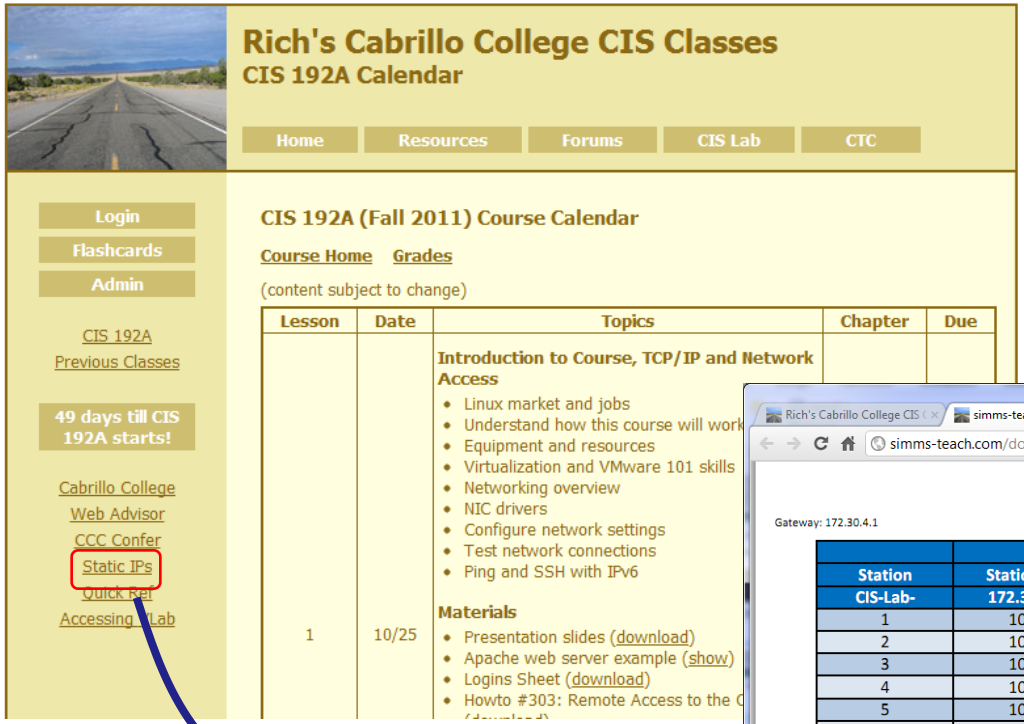
- Use the forum to ask questions and to clarify things.
- Review Lesson Powerpoints which usually have examples aimed at doing the lab assignments.
- Make a network diagram with all interfaces labeled. Confirm your configuration matches the diagram.
- Go back and methodically verify each step was completed. For example, if you modified /etc/hosts then cat it out and review your changes. If you set the default gateway, use route –n command to verify. If you configured an IP address, use **ifconfig** to verify.
- Google unknown error messages you observe.
- Google any problems you are observing.

Some organization tips for doing labs

Some Tips

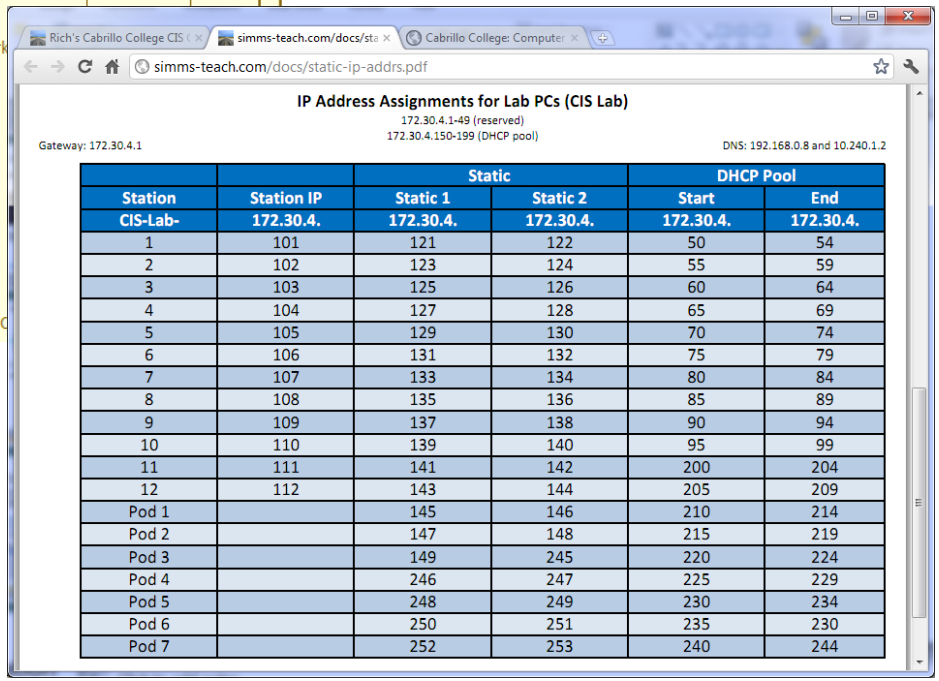
- Start early, doing labs at the last minute adds unnecessary time pressure and there may be no available equipment to use.
- It's best if you fully understand each step as you do it. Use Google or refer back to Lesson slides to understand the commands you are using.
- Keep a growing cheat sheet of commands and examples.
- Partner with another student – "two heads are better than one" (at least most of the time!)
- Use the forum to share specific tips you learned while doing a lab.

Static IP addresses are one click away:



Don't forget!

Don't ruin your day with duplicate IP addresses!



		Static		DHCP Pool	
Station	Station IP	Static 1	Static 2	Start	End
CIS-Lab-	172.30.4.	172.30.4.	172.30.4.	172.30.4.	172.30.4.
1	101	121	122	50	54
2	102	123	124	55	59
3	103	125	126	60	64
4	104	127	128	65	69
5	105	129	130	70	74
6	106	131	132	75	79
7	107	133	134	80	84
8	108	135	136	85	89
9	109	137	138	90	94
10	110	139	140	95	99
11	111	141	142	200	204
12	112	143	144	205	209
Pod 1		145	146	210	214
Pod 2		147	148	215	219
Pod 3		149	245	220	224
Pod 4		246	247	225	229
Pod 5		248	249	230	234
Pod 6		250	251	235	230
Pod 7		252	253	240	244

Always use the Static IP tables to find a unique IP address based on the station or pod you are using

Wrap

New commands:

- dmesg
- ifconfig
- insmod
- lsmod
- lspci
- modprobe
- ping
- ping6
- rmmod
- route
- scp
- ssh
- su

New Files and Directories:

- /etc/resolv.conf
- /lib/modules/2.6.18-164.e15/kernel/drivers.net

Next Class

Assignment: Check Calendar Page on web site to see what is due next week.

Quiz questions for next class:

- What command would you use to remove (unload) the e1000 NIC driver?
- What command would you use to add 172.30.4.1 as the default gateway.
- What command would you use to show the MAC address on eth1?

Backup