

T-110.5102 Laboratory Works in Networking and Security

Course Arrangements 13.1.2015 Otaniemi



- 1. Practical arrangements
- 2. Path A contents
- 3. Path B contents
- 4. OpenStack introduction
- 5. Practical demonstration of OpenStack usage



Course Personnel

Responsible teacher: Andrey Lukyanenko

Assistants:

Kimmo Ahokas Rasmus Eskola Markus Palonen Päivi Tynninen

Do not contact course staff directly, see next page for contact details!



Material and Contact Information

- Course material and news:
 - http://noppa.aalto.fi/noppa/kurssi/t-110.5102/
- Course personnel mailing list:
 - <u>T-110.5102@list.aalto.fi</u>
- Official IRC Channel
 - !dcslabcourse @ IRCNet
 - Ask questions directly on the channel
- Avoid contacting course staff directly, instead use mailing list and IRC channel!



Contents of the Course

- Get your hands dirty!
- Try the things that you've learned in practice
- Learn the basics of:
 - Configuring, monitoring and diagnosing computer networks and services
 - Configuration and inspection of network security
 - Linux networking and general administration tools
 - Learn to search for information and instructions from Internet
- Course material won't include everything you need!



What's new?

- Minor improvements in all assignments
- New virtualization environment using OpenStack
 - Take your own backups!
- If you have completed any of the former lab courses before or have completed some assignments from previous years, contact the course staff for arrangements



Prerequisites

- Highly recommended (one of these)
 - T-110.4100 Computer networks
 - CSE-C2400 Tietokoneverkot
 - S-38.2188 Communication networks
- Very useful
 - Basics of UNIX/Linux system administration
 - Command line
 - System commands
- Otherwise more work for you!
- Next lecture is a brief primer on UNIX basics
- During the course, we assume you can do UNIX!

Enrolment for the Course

- Registration in Oodi has already ended!
 - If you still want to enrol, send email to t-110.5102@list.aalto.fi as soon as possible.
 - There might be delays for granting access to course environment
- Ensure that you have working email address in Oodi (course news)



Material

- Google
- Various RFCs at the IETF
- Linux man pages (man –k keyword)
- O'Reilly's Safari books at http://nelliportaali.fi/
- Linux documentation page
- Debian and Ubuntu resources
 - http://debian-handbook.info
 - http://wiki.debian.org
 - http://www.debian-administration.org
 - http://wiki.ubuntu.com
- OpenStack documentation http://docs.openstack.org/user-guide/ content/



Assignments

- Path A
 - Network tools
 - Email server
 - IPv6
 - Encrypted filesystems
 - Firewall
 - Extra: LDAP

Path B

- Network tools
- Web server
- DNS
- Network filesystems
- VPN
- Extra: OpenFlow



Schedule

Week	Date(s)	Action	Path A	Path B
4	20.1.	Unix lecture		
5	26.1-30.1.	Round 1 demos	Network Tools	Network Tools
7	9.213.2.	Round 2 demos	Email server Web server	
9	23.227.2.	Round 3 demos	IPv6	DNS
11	9.313.3.	Round 4 demos	Encrypted FS	Network FS
13	23.327.3.	Round 5 demos	Firewall	VPN
15	7.410.4.	Extra demos	LDAP	OpenFlow

Before each demo week is a reception week to get help and discuss about the assignments

Details: https://noppa.aalto.fi/noppa/kurssi/t-110.5102/course_schedule



Environment for the assignments

- Course provides you with OpenStack account:
 - Three virtual Ubuntu servers
 - Three virtual networks
 - Course personnel will send you accounts by email
 - Details will follow later in these slides
- You are allowed to use your own virtual machines, but...
 - Bring your laptop to the sessions!
 - Course assistants are not required to help you with the problems with your own virtual machines



Passing the course 1 of 2

- T-110.5102 Laboratory Works in Networking and Security
- Path A: five (5) ECTS
- Path B: five (5) ECTS
- Path A+B: ten (10) ECTS
- 5cr: 1 intro + 4 mandatory assignments (+ 1 extra)
- 10cr: 1 intro + 8 mandatory assignments (+ 1 extra)

You have to demonstrate each assignment to an assistant to be graded



Passing the course 2 of 2

- First assignment shared between the paths
 - Completed only once (even if you take two paths)
- Optional extra assignment
 - Missed one of the mandatory assignments? Do the extra assignment to pass the course
 - Can be used to increase your total score
 - Extra assignment is mandatory if you're targeting for grade 5
 - If you take two paths (10 cr), choose only a single extra assignment
- Points published in Noppa
 - Each round is graded separately
 - To pass the assignment, you need to get 30% of the points
- See Noppa for the complete grading information and grade limits
- Course feedback in April is mandatory



Reception Sessions

- Reception session is face-to-face time with an assistant
- Troubleshoot difficult obstacles with an assistant
- The assistant will not do the exercise for you
- Ask your questions during the reception week, not during demo!
- Not mandatory!
- No reservation, first-come-first-serve
- Every even week
 - Wed 14-18 C106
 - Thu 8-12 A145
 - Thu 16-18 C106
 - Fri 8-10 A145



Demo Sessions

- Weekly schedule for demo sessions
- Reservation of session times to avoid overlap
- Session room at A145 at the CS building
- Reservation system will be announced in Noppa news
- Demonstrate your solution for the assignment face-to-face
- Do not ask help from the assistant, he asks the questions!
- 30 minutes per round
- Mandatory!
- It is your responsibility to prepare your answers to questions so that you can demonstrate the whole assignment in reserved time



Frequently asked questions

- Can I bring paper notes? Or can I use electronic notes?
 - Yes, but you should leave all material you brought to course personnel
- Can I script?
 - You can, but it is not often useful since you have to explain the script to the assistant
- Can I work with a pair?
 - Yes, but you will have to demo with your own virtual machines without your pair!
- Can I just reuse the work of some other student?
 - Zero tolerance; plagiarism will lead to failing of the whole course
 - The course personnel asks you additional questions to see you understand what you were doing and why
 - Plagiarism cases are always notified to the department



First Laboratory Assignment: Network tools

- Creating networks and virtual machines in OpenStack
- Basic UNIX-tools for networking
 - ip, netstat, dig, ping, traceroute...
- Configure network interfaces
- Simple client-server communication with netcat and telnet
- Learn the use of man pages!
- Learn to Google for information







A2: Email Server

- Setup an e-mail server
- Configure Postfix
- Fight against spam with procmail and spamassassin
- Procmail used also for non-spam filtering





- Build a small network with IPv6
- Routing with static or advertised routes
- Connect to global IPv6 using Teredo tunneling





A4: Encrypted Filesystems

- Simulation of encryption of an external memory (such as an USB memory stick)
- Two different schemes:
 - Encrypted loopback device with dm_crypt
 - Encryption layer for an existing filesystem with encFS
- Truecrypt also used to create a hidden volume inside another encrypted volume -> "plausible deniability"



A5: Firewall

- Firewalling basics
- Packet filtering with netfilter/iptables
- Squid as web proxy to control traffic



Extra A6: LDAP

- Lightweight Directory Access Protocol
- In this assignment LDAP is used for authentication
- LDAP is very versatile and can be used for many other things
- Configure an LDAP server
- Create a database
- Setup a client







B2: Web server

- Apache configurations
- A basic Node.js application
- Encryption using SSL/HTTPS
- Using nginx as a reverse proxy





- Create caching-only name server with BIND9
- Create own DNS domain .insec
- Configure subdomains
- Secure the server with DNSSEC



B4: Network Filesystems

- Setup and compare various network filesystems
- NFS
- Samba
- sshfs
- WebDAV



B5: VPN

- Introduction to Virtual Private Network (VPN) concept
- OpenVPN used to establish a host-to-net VPN scenario





Extra B6: OpenFlow

- Familiarize yourself with OpenFlow basics
- Build custom topologies with Mininet
- Control switches remotely using POX
- Create a Layer-2 firewall with Pyretic
- Requires basic knowledge of python programming



h1



Openstack™ CLOUD SOFTWARE



Motivation

- Work on this course is done using virtual machines
- Need to manage virtual machines somehow
- Self-service for students
- Resource usage limits
- OpenStack is a logical choice



OpenStack

- Popular open-source cloud operating system
- Similar to Amazon EC2 & Microsoft Azure
- Easy way to manage cloud resources
- Create virtual networks and routers
- Create virtual machines
- Manage storage resources
- Automatic scaling and failure handling
- And a lot more



OpenStack: The Open Source Cloud Operating System



Aalto University School of Science CSE DCS 13.1.15 34 / 42

OpenStack subprojects

- Keystone
 - Manage projects and users, authentication
- Nova
 - Manage virtual machines
- Neutron
 - Manage networks and routers
- Glance
 - Manage images and snapshots
- Horizon
 - Web user interface
- Cinder
 - Manage storage
- And lot more...



OpenStack command line interface

- Horrible mess at the moment
 - Unified OpenStack client on the way, but we won't use it yet
- Clients written in Python
- Commands categorized by project
- Syntax might seem complicated at first
 - But you will learn the logic soon \odot
- Documentation available at http://docs.openstack.org/userguide/content/ch_cli.html
- Each command has own help.
 - Type "nova help", "neutron help", "glance help" etc.



OpenStack Dashboard

- Graphical user interface for managing OpenStack resources
- Often the easiest way to do things
 - But not necessarily the fastest



OpenStack on this course



OpenStack on this course

- Everyone gets their own OpenStack project
- You create and manage your virtual machines
- If you break you virtual machine, you can always start new one
- No persistent storage available, so BACK UP YOUR WORK to some other place (e.g. niksula)
- Aalto has strict firewall, so accessing OpenStack requires some additional steps
 - We are sorry for this
- Usernames and passwords will be provided soon

Accessing OpenStack

- Gateway computer echo.niksula.hut.fi
 - Use ssh to access echo
 - generate ssh key pair, reduces need to write passwords
 - Separate username and password, will be emailed to you shortly
 - Accessible from public Internet
 - Command line clients installed to echo
- OpenStack dashboard at quebeck.niksula.hut.fi
 - Separate username and password
 - Access through echo
 - SSH tunnel and socks proxy
- More details in Noppa



Accessing virtual machines

- Accessible from echo using floating ip and ssh keys
- You will need to generate ssh keys
- Details in Noppa
- Only one floating ip per student ⊗
- You need (yet another) gateway machine
- Example
 - lab1 has ip 10.0.0.2, floating ip 130.233.42.66
 - Lab2 has ip 10.0.0.3
 - To access lab2: first open ssh to echo, then from echo open ssh to 130.233.42.66, from lab1 open ssh to 10.0.0.3
- We are truly sorry for the complicated setup, but we can not get enough ip addresses right now to make this easier.



Questions?

And demo...

