

M2

NEVA – Network with Virtualization and Automation
USRS7L – Nouvelles architectures de réseaux

Introduction

Planning and details

Stefano Secci

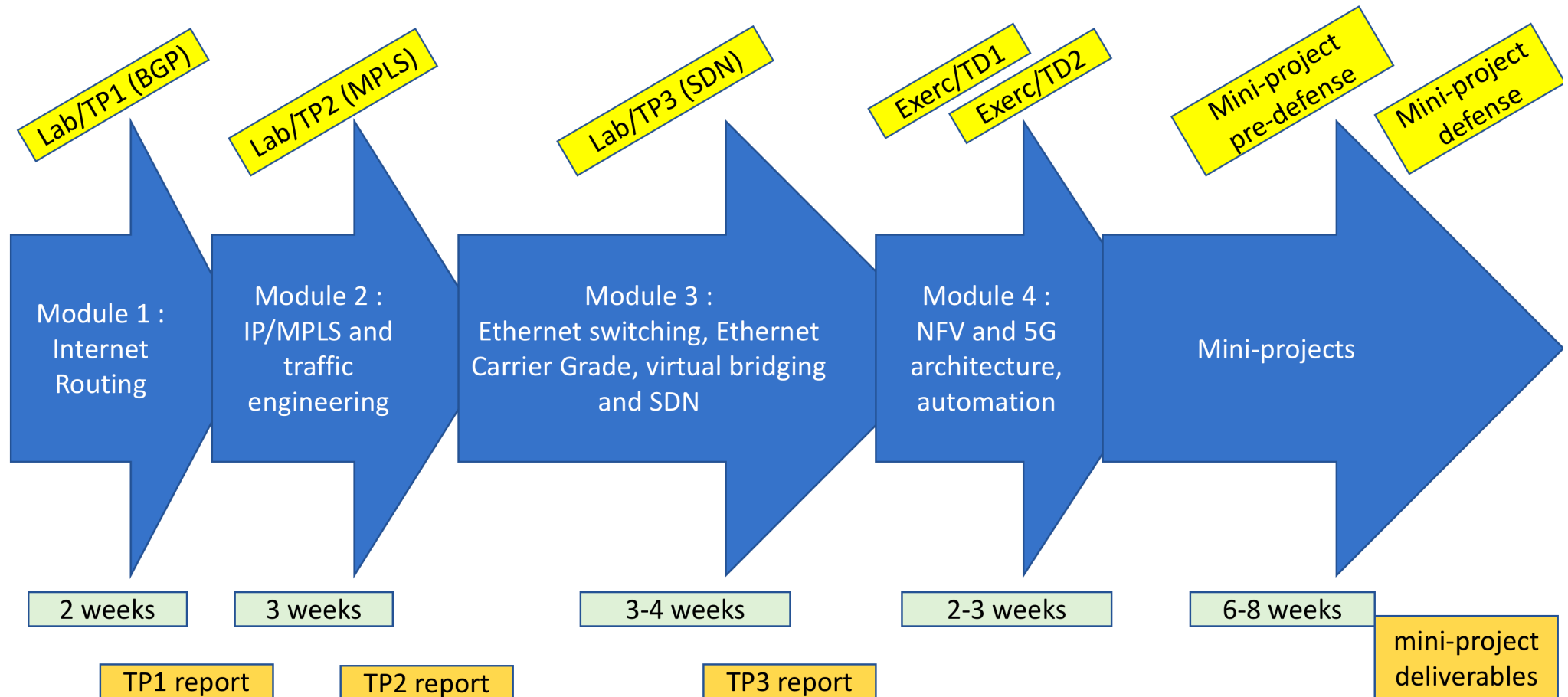
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Detailed programme - NEVA

- New technologies designed for advanced operations of IP networks in the last twenty years
 - evolution of IP switching and routing architectures, with a particular focus in traffic engineering and quality-of-service architectures.
 - evolution of the Ethernet architecture and layer-2 protocols in general is presented, showing the extensions applied to let L2 protocols scale going from local area to metropolitan and data-center segments.
 - how IP and Ethernet evolutions recently converged in softwarized network environments, making use of data-plane programmability, network virtualization, cloud-native systems and automation frameworks.
- Topics:
 - High availability: infrastructure planning, redundant systems, computing standards for availability and reliability.
 - *Technologies* : CEI 61078, MTTF, MTBF.
 - Internet routing: advanced Internet routing and network mapping protocols.
 - *Technologies* : BGP, LISP.
 - *Label switching, MPLS*: history and principles of label switching, label distribution protocols, label stacking, and multi-layer generalizations.
 - *Technologies* : ATM, MPLS, LDP, MP-BGP, MPLS-VPN, GMPLS, T-MPLS.
 - *Traffic engineering*: traffic engineering in link-state routing protocols, IP/MPLS traffic engineering and inter-domain extensions, centralized control plane.
 - *Technologies* : OSPF/ISIS-TE, MPLS-TE, PCE, SDN.
 - *Ethernet carrier-grade* : Ethernet evolution from shared Ethernet to switched Ethernet and Ethernet routing, Ethernet carrier grade extensions for metropolitan area and data-center networks.
 - *Technologies* : IEEE 802.1 family, STP, RSTP, VLAN; PB, PBB, MSTP, LAG; PBB-TE, OpenFlow, TRILL, L2LSP, PWE3; VPLS.
 - *Network Virtualization*: virtual bridging, data-center architecture, reliability and node-path redundancy, virtualization of network functions, network operating systems, cloud network overlay protocols, cloud quality of experience.
 - *Technologies* : NFV, VMM, VXLAN, NVGRE, STT, OpenStack, Kubernetes.
 - *Orchestration and Automation* : NFV orchestration, 5G slicing, virtual machine mobility, differences between automation and orchestration, automation from script-based management to autonomous networks and zero-touch management. Review of recent advances in standardization bodies and open source communities.
 - *Technologies* : ZSM, ETI, ONAP.
 - *Network Optimization*: revisiting studied routing and traffic engineering problems (IP-TE, MPLS-TE, MSTP-TE, SDN, NFV) with mathematical programming, formulation and understanding of mixed integer linear programs.

Overall planning

Teachers: Stefano Secci (Cnam), Bruno Chatras (Orange),
Mario Patetta (Cnam), Francesca Fossati (SU), Chi-Dung Phung (Cnam)



Programme 2024/2025

TP = technical laboratories; TD = written exercise sessions

1.	Carrier grade networks, Internet routing	S. Secci	20/09
	1. TD1 MTTR, MTBF (except ROC-alt)	F. Fossati, Z. Braik	
	■ TP1 (3h) – BGP	M. Patetta, R.Aziz	
2.	Label-switching, Traffic Engineering	S. Secci	4/10
	■ TP2 (3h) – MPLS	M. Patetta, R.Aziz	
3.	Ethernet Carrier Grade, Virtual Switching	S. Secci	18/10
4.	NFV, SDN	S. Secci	8/11
	■ TP3 (3h) – SDN	M. Patetta, R.Aziz	
5.	ETSI NFV, automation	B. Chatras	29/11
	(start of mini-projects)		
6.	Mini-project pre-defenses	Phung, Patetta, Secci	13/12
7.	Network Optimization	F. Fossati	-
	1. TD2 network optimization (except ROC-alt)	F. Fossati, Z. Braik	
	2. TP4 network optimization (except ROC-alt)	F. Fossati, Z. Braik	
8.	Mini-project working sessions		
	1. Work on mini-projects		
9.	Exams correction		20/1
10.	Mini-project defense	Phung, Patetta, Secci	24/1
11.	Exam		7/2
	(final deliverables due for mini-projects : 14/2)		

Moodle and deliverables submission rules

- The moodle is organized in
 - 4 modules
 - 3 questionnaires for the first 3 modules
 - Answers to each questionnaire is required to
 - Access the corresponding TP/Lab submission form
 - Access the next module
 - TP/Lab submission forms for module 2 and 3
 - Not available if you have not submitted the previous TP/Lab report
 - Module 4
 - Not available if you have not submitted all the questionnaires and reports
 - Miniprojets
 - Presentations, final report and deliverables have to be submitted via its forms
 - Final report and final presentation
 - Cannot be submitted if you have not submitted the mid-term presentation
 - Final deliverables (files, videos)
 - Cannot be submitted if you have not submitted the final report and presentation
- **No exceptions, no favoritism : no deliverable, no mark**
 - Retards accepted only with medical justification sent to
 - CNAM: master-roc@cnam.fr, entreprise@lerebours.org
 - SU : alexandre.martin@sorbonne-universite.fr , Kim.Thai@lip6.fr, Stefano.Secci@Cnam.fr

TP/Labs - NEVA

- Groups of maximum 4 persons per report
- Moodle used for TP/Lab report submission
 - account to join the NEVA moodle in <https://lecnam.net> before the first TP/Lab
- A linux Virtual Machine (VM) linux is made available with all the software for the three TPs preinstalled
 - C-BGP, GNS-3, Wireshark, ONOS, ODL, OVS, Java
 - VM can be executed locally in your laptop/PC but you need at least 8GB RAM
- VM usage:
 - A remote access to the VM, one per student, run in the research platform <https://roc.cnam.fr> will be assigned to each student
 - VM image and remote access to be sent mid october
 - Recommendation to work on the local VM only if problems with the remote VM
 - During the TP/Lab slot in the assigned room at Jussieu : it will have the same VM running with name "TPNEVA_2023".
 - After login, launch the VM from terminal with "Vbox TPNEVA_2023".
- **Contact in case of technical problems with the VM: chi-dung.phung@lecnam.net**

Mini-projects - NEVA

- Based on the TP SDN
- Project list distributed on **Nov. 25**
- Choice to take on **Dec. 2**; assignments on **Dec. 4**.
- **Can be done in groups up to 4 persons max, no exceptions**
- Working time planned in December/January (free room)
- Pre-defense of each mini-project on **Dec. 13**
 - 5' per project, 3 slides, every person must present part of the presentation
 - Environment preparation
 - Difficulties
 - Planning ahead
 - !!!! Upload the slides before the pre-defense day, otherwise not evaluated
- Final defense on **Jan. 24**
 - 5' per project, 1 slide with all important details, 1 demo video of 2', every person must present part of the presentation
 - Remaining difficulties
 - !!!! Upload the slides before the defense day, otherwise not evaluated
- Final report, code files, demo video files to upload before **Feb. 14**
- **Contact in case of BIG problems : chi-dung.phung@lecnam.net, mario.patetta@lecnam.net**

Rules for TP and mini-projects deliverables

- Deliverables are: TP reports, and mini-project presentation slides, files, demo videos, final report
- Every student should submit each deliverable by the deadline
 - If you do not submit it, the deliverable mark will be 0, even if your team mates have submitted one with your name.
- Penalties apply on the marks
 - If submitted files are corrupted deliverable marked 0/20 : check it opening within the moodle environment after submission
 - Deliverable submitted after the deadline by only some students marked with a penalty only for the student having submitted it late, not the others
 - If report is correct from a technical standpoint but it is badly written, it will undergo a penalty
- No response to any message on this matter will be given
- **Reports submitted by email will not be evaluated**

Logistics - NEVA

- Teachers:
 - Lessons: Stefano Secci, Bruno Chatras, F. Fossati
 - TD/Exercices & TP/Lab & miniprojects : F. Fossati, M. Patetta, L. Linguaglossa
- Evaluation
 - Labs mark (40%)
 - Based on the TP/lab & mini-project reports
 - Reports & miniproject slides+files to upload in the moodle by the given deadlines
 - Final exam (60%)
 - 1 A4 paper hand-written on both pages : no other support allowed
 - Typical exam:
 - One practical exercise on network protocol understanding
 - One analytical exercise on network optimization or on network reliability modeling
 - No external book required, slides and provided exercices are enough
- Slides + annals
 - Available in the moodle

Some books (optional)

- ATM, MPLS, carrier networks
 - « Connection-oriented networks : SONET/SDH, ATM, MPLS, and optical networks » -- Harry G. Perros
 - Les Réseaux -- G. Pujolle. Edition Eyrolles, 2011.
- Carrier Ethernet
 - « Delivering Carrier Ethernet » -- A. Kasim. Edition McGraw-Hill. (chap. 1,2,4,13,14)
- Network optimization
 - « Routing, Flow, and Capacity Design in Communication and Computer Networks » -- Michal Pioro, Deep Medhi, Elsevier Science&Tech. Books. 2004.
- Availability and Reliability
 - Téléinformatique: transport et traitement de l'information dans les réseaux et systèmes téléinformatiques et télématiques - chapitre »Sécurité des systèmes téléinformatiques" -- C. Macchi, J.-F. Guilbert. Dunot, 1987/91.
- IP Networking
 - O. Bonaventure, Computer Networking: Principles, Protocols and Practice <https://scm.info.ucl.ac.be/release/cnp3/Book/0.0/>