



Module name: MPLS Networks

Academic year: 2014/2015 Code: IET-1-707-s ECTS credits: 3

Faculty of: Computer Science, Electronics and Telecommunications

Field of study: Electronics and Telecommunications Specialty: —

Study level: First-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 7

Course homepage: —

Responsible teacher: dr inż. Kantor Mirosław (kantor@kt.agh.edu.pl)

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Module summary

Within the subject, the student has the opportunity to gain knowledge of MPLS-based network services as well as the ability to configure them.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence			
M_K001	Student is able to cooperate with people in the group, understands the necessity for improving his competence	ET1A_K01	Case study
Skills			
M_U001	Student is able to work in group aiming at configuring MPLS network devices	ET1A_U23	Case study
M_U002	Student is able to configure MPLS network devices for applying traffic engineering mechanisms	ET1A_U23	Test
M_U003	Student is able to find documentation required for configuring network devices	ET1A_U01	Case study
Knowledge			
M_W001	Student has ordered knowledge about organizing and managing MPLS networks	ET1A_W10, ET1A_W09	Test

M_W002	Student has knowledge about MPLS traffic engineering mechanisms as well as quality and resilience ones.	ET1A_W10, ET1A_W09	Test
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FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Others	E-learning
Social competence												
M_K001	Student is able to cooperate with people in the group, understands the necessity for improving his competence	-	-	+	-	-	-	-	-	-	-	-
Skills												
M_U001	Student is able to work in group aiming at configuring MPLS network devices	-	-	+	-	-	-	-	-	-	-	-
M_U002	Student is able to configure MPLS network devices for applying traffic engineering mechanisms	-	-	+	-	-	-	-	-	-	-	-
M_U003	Student is able to find documentation required for configuring network devices	-	-	+	-	-	-	-	-	-	-	-
Knowledge												
M_W001	Student has ordered knowledge about organizing and managing MPLS networks	+	-	-	-	-	-	-	-	-	-	-
M_W002	Student has knowledge about MPLS traffic engineering mechanisms as well as quality and resilience ones.	+	-	+	-	-	-	-	-	-	-	-

Module content

Lectures

1.Introduction. MPLS architecture. (2h)

Introducing basic MPLS concepts. Frame-mode and cell-mode MPLS. Introducing MPLS labels and label stack. Identifying MPLS applications.

2.Forwarding Labeled Packets. (2h)

Introducing CEF switching. Load balancing in CEF. MPLS MTU. Path MTU discovery.

3.Label Distribution Protocol. (2h)

LDP overview and operation. Introducing MPLS label allocation, distribution, and retention modes. Discovering LDP neighbors. Targeted LDP session.

4.MPLS traffic engineering. (3h)

The need for MPLS TE. RSVP-TE. Distribution of TE information. Dual TE metrics. PCALC. Link Manager. Forwarding traffic onto MPLS TE tunnels.

5.MPLS-based recovery mechanisms. (2h)

Path protection. Link protection. Node protection. Fast ReRoute.

6.MPLS and Quality of Service. (2h)

DiffServ with IP packets. DiffServ tunneling models. MQC commands for MPLS QoS. Voice over MPLS.

7.Advances of MPLS (2h)

GMPLS. MPLS-TP. New MPLS applications. Work at IETF.

Laboratory classes

1.MPLS architecture. (3h)

Basic MPLS configuration. Configuring OSPF and IS-IS for MPLS TE. Analysis of MPLS labels and label stack. Observing TTL behavior of labeled packets.

2.Label Distribution Protocol. (6h)

Configure Label Distribution Protocol (LDP) on routers. Analysis of the process of LDP neighbor discovery. Configuring targeted LDP sessions. Troubleshoot MPLS and LDP.

3.MPLS traffic engineering. (6h)

Establishing the core MPLS TE environment. Configuring MPLS Traffic Engineering paths. Forwarding traffic onto MPLS TE tunnels. Class-based tunnel selection with MPLS TE. Troubleshoot MPLS-TE.

4.MPLS-based recovery mechanisms. (6h)

Configuring resilience methods in MPLS. Configuring FHRP (including HSRP, VRRP, and GLBP) on available routers.

5.MPLS and Quality of Service. (6h)

Configuration of DiffServ with IP packets. Configuration of DiffServ tunneling models. Usage of MQC commands for configuring MPLS QoS. Configuration of Voice over MPLS transmission.

6.Troubleshooting MPLS Networks. (3h)

Method of calculating the final grade

Final grade will be issued after successful assessment of laboratory class. The final grade will be based on activity during the laboratories.

Prerequisites and additional requirements

Knowledge of IP networks, routing protocols and their configuration on network devices.

Recommended literature and teaching resources

1.L. De Ghein, MPLS Fundamentals. Cisco Press, Inc. Indianapolis 2007.

2.Dokumenty IETF RFC związane z omawianymi protokołami; <http://www.rfc-editor.org>

3.Dokumenty IEEE związane z omawianymi protokołami; <http://standards.ieee.org>

Scientific publications of module course instructors related to the topic of the module

1. Optimized protection schemes for resilient interdomain traffic distribution / Mirosław KANTOR, Piotr CHOŁDA, Andrzej JAJSZCZYK // W: IEEE GLOBECOM 2009 [Dokument elektroniczny] : Global Communications Conference, Exhibition & Industry Forum : riding the way wave to global connectivity : Honolulu, Hawaii, USA, 30 November - 4 December 2009.

2. Inter-ALTO communication protocol draft-dulinski-alto-inter-alto-protocol-00 / Z. Dulinski, R. STANKIEWICZ, P. CHOŁDA, P. WYDRYCH, B. Stiller, Marcin NIEMIEC, Mirosław KANTOR. — S.l. : IETF Trust, cop. 2010.
3. LCR solution for performance and cost-efficient inter-domain traffic distribution / Mirosław KANTOR, Piotr CHOŁDA, Andrzej JAJSZCZYK // W: NETWORKS 2010 : proceedings of 2010 14th international telecommunications network strategy and planning symposium : September 27-30, 2010, Warsaw, Poland.
4. Cost-driven peer rating algorithm / Zbigniew Duliński, Rafał STANKIEWICZ, Piotr WYDRYCH, Mirosław KANTOR, Piotr CHOŁDA // W: ICC 2011 : 2011 IEEE International Conference on Communications : source of innovation: back to the origin : 5-9 June, 2011, Kyoto, Japan.
5. Least Cost Routing (LCR) solution for inter-domain traffic distribution / Mirosław KANTOR, Piotr CHOŁDA, Andrzej JAJSZCZYK // Telecommunication Systems ; ISSN 1018-4864. — 2013 vol. 52 iss. 2, s. 979-991.

Additional information

None

Student workload (ECTS credits balance)

Student activity form	Student workload
Participation in lectures	15 h
Participation in laboratory classes	30 h
Preparation for classes	10 h
Realization of independently performed tasks	20 h
Summary student workload	75 h
Module ECTS credits	3 ECTS