Faculty of Health, Science and Technology
Computer Science

Syllabus

Dataplane Programming

Course Code:	DVAD40
Course Title:	Dataplane Programming *Dataplansprogrammering*
Credits:	4.5
Degree Level:	Master's level
Progressive Specialisation:	Second cycle, has only first-cycle course/s as entry requirements (A1N)

Major Field of Study:
DVA (Computer Science)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2018-08-27, and is valid from the Spring semester 2019 at Karlstad University.

Prerequisites
Computer Science 30 ECTS credits or three years of work experience in the IT sector, or equivalent, plus upper secondary English 6 or B, or equivalent.

Learning Outcomes
Upon completion of the course, students should be able to:
- give an account of basic principles and concept of dataplane programmability and differences from software defined networking,
- identify key challenges and differences between software defined networking and dataplane programmability,
- demonstrate broad knowledge of the most common limitations and possibilities of the dataplane programming language P4,
- implement and test small-scale P4 programs (e.g. Switch),
- give an account of basic principles and concepts of data center networks,
- give an account of alternative approaches regarding load balancing and routing for data center networks,
- explain domain-specific concepts related to data plane programming regarding load balancing for data center networks,
- implement simple data-plane load balancing in P4,
- give an account of basic principles and concepts of network monitoring, In-band Network Telemetry (INT), In-network caching, and control,
- describe techniques for network monitoring, INT, in-network caching, and control, and
- explain how the INT framework can be programmed.

Content
The course comprises three modules:

Module 1 Introduction to Dataplane Programming, 1.5 ECTS cr
The module covers the definition and foundations of data plane programming, and the difference between Software Defined Networking and Dataplane programming. The primary focus of the course is on recent developments such as the programming language P4. Students are introduced to the P4 language and the workflow of implementing and testing simple P4 programs. The limitations of P4 are treated as well as the problems that need to be considered when implementing a use case for the P4 language.

Module 2 Load Balancing in Data Center Networks, 1.5 ECTS cr
The primary focus of the module is on recent developments that apply the concept of programmable data planes to the load-balancing problem. Data Center networks and their implications for the routing and load-balancing approaches are treated. Several load balancing strategies are studied in more detail such as Equal Cost Multipath Routing (ECMP), Conga and Hula. Finally, future usecases such as load balancing in data centre networks with cross-layer information are treated.

Module 3 Network Monitoring with Programmable Data Planes, 1.5 ECTS cr
The module treats the principles of software-based network monitoring techniques with INT and its use cases for monitoring network flows. In addition, network caching for programmable data planes and its use cases including caching for key-value tuple. Finally, future usecases such as network control for programmable sensor-actuator communication.

Reading List
See separate document.

Examination
Assessment is in the form of individual hand-in assignments and active participation in discussions.

Grades
One of the grades Distinction (VG), Pass (G), or Fail (U) is awarded in the examination of the course. Engineering students are awarded one of the grades Pass with Distinction (5), Pass with Some Distinction (4), Pass (3) or Fail (U) is awarded in the examination of the course.

Quality Assurance
Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate
A course certificate will be provided upon request.

Additional information
The courses DVAD41, DVAD42 and DVAD43 cannot be included in the same degree programme as DVAD40.

The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.