Liverpool John Moores University

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Title:	NETWORK ALGORITHMICS
Status:	Definitive
Code:	**6115COMP** (121279)
Version Start Date:	01-08-2018
Owning School/Faculty:	Computer Science
Teaching School/Faculty:	Computer Science

Team	Leader
Angelos Marnerides	Y

Academic Level:	FHEQ6	**Credit Value:**	20	**Total Delivered Hours:**	55
Total Learning Hours:	200	**Private Study:**	145		

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Lecture	22
Practical	20
Tutorial	11

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	AS1	Design & Analysis of a fast and memory-efficient algorithm for detecting network bottlenecks	50	
Exam	AS2	Examination	50	2

Aims

To develop an understanding on fundamental networking implementation bottlenecks and the general principles of addressing them algorithmically.

To design, implement and evaluate techniques for specific bottlenecks as derived from the general principles.

Learning Outcomes

After completing the module the student should be able to:

1	Identify and analyse specific network bottleneck problems caused by hardware failures, wrong network configurations, or network attacks
2	Demonstrate network algorithmics to support the efficient management of a networking problem
3	Compare a variety of bottleneck types that could exist in a network
4	Apply appropriate mechanisms derived by network algorithmics for solving problems caused by network bottlenecks

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Algorithm Design and Analysis	1	2
Exam	3	4

Outline Syllabus

Introduction to Network Algorithmics
- Network bottlenecks
- Network Implementation Models
- Network Implementation Principles

Memory & Data Copying
- Reducing Data Copying via Local Restructuring
- Copying vs. Remote
- File systems

Control Overhead
- Scheduling Overhead
- Switching Overhead
- Context-Switching Overhead
- System Calls
- Fast Select
- Interrupts

Prefix-Match Lookup
- Threaded Indices & Tag Switching
- Flow Switching
- Non-algorithmic techniques for prefix matching
- Unibit tries
- Multibit tries

- Binary Search on Ranges & Prefix Lengths
- Memory Allocation in Compressed Schemes
- Lookup Chip Model

Packet Classification
- Packet Classification problem
- Requirements and Metrics for Classification
- Two-dimensional packet classification schemes
- Divide and Conquer classification
- Bit Vector Linear Search
- Decision tree classification

Switching
- Shared-memory switches
- Head-of-line Blocking
- Network scaling to larger switches
- Network scaling to faster switches

Learning Activities

Include attending lectures, practicals and tutorials, as well as reading books and handouts.

Notes

Computer networks have become an integral part of society. However, for networks to take their place as part of the fundamental infrastructure of society, they must provide performance guarantees. While there are many factors that go into performance, one major issue is that of current and future network bottlenecks. Such bottlenecks need to be confronted by network engineers, network architects and network protocol implementers. In response to this challenge and the need for understanding how such bottlenecks are created and how they can be handled or prevented. This interdisciplinary module introduces fundamental network algorithmic methods that facilitate the basis for developing efficient network protocols and solutions that address network bottlenecks.