

**Module Details**

<b>Title:</b>	Network Performance <b>PENDING APPROVAL</b>
<b>Long Title:</b>	Network Performance
<b>Language of Instruction:</b>	English

<b>Module Code:</b>	EE500
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<b>Credits:</b>	7.5
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<b>NFQ Level:</b>	9
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<b>Field of Study:</b>	Electronic Engineering
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<b>Valid From:</b>	2017/18 (Sep 2017)
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<b>Module Delivered In</b>	1 programme(s)
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<b>Administrator:</b>	Noel Murphy
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<b>Module Coordinator:</b>	Gabriel-Miro Muntean
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<b>Module Department:</b>	20 - ELECTRONIC ENGINEERING
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<b>Module Description:</b>	<p>The aim of the module is to introduce the students to advanced network performance concepts. The students will be reminded of the OSI and the TCP/IP models and basic network-related protocol aspects. They will be introduced to Quality of Service and Network Performance metrics as well as to Quality of Experience and Quality of Perception as metrics to assess the quality of data delivery. Various novel and existing network protocols at network and transport network layers will be introduced and their performance-related characteristics will be discussed. These protocols will be classified based on the layers of the OSI stack they operate at and include: IPv4, IPv6, TCP, SCTP, DCCP, RTP, RTCP, etc. At application layer, multimedia and gaming applications will be discussed in details in the context of real-time content delivery, but other application types will also be presented. Adaptive and non-adaptive content delivery solutions will be presented along with significant issues such as end-user perceived quality. Modeling and simulation with the goal of assessing network performance will be introduced with focus on the application layer. Java development with focus on performance of transport and application layer network protocols will be performed. Novel performance-related issues in the context of mobility, power consumption and security will be discussed.</p>
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**Learning Outcomes**

*On successful completion of this module the learner will be able to:*

LO1	demonstrate advanced knowledge of networking in general and network performance in particular
LO2	define network performance metrics, quality of service and quality of experience
LO3	present different performance-aware communications solutions at network, transport and application network layers
LO4	present solutions for power saving, mobility and security
LO5	demonstrate knowledge of modeling, simulations and prototyping

**Pre-requisite learning**
**Module Recommendations**

*This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.*

No recommendations listed

**Co-requisite Modules**

No Co-requisite modules listed

**Pre-Requisite**

*This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.*

No Pre-Requisites listed

**Module Content & Assessment**
**Indicative Content and Learning Activities**
**1) Introduction**

Review of Layered Network Architectures; Introduction to Data Network Performance; Quality of Service (QoS), Quality of Experience (QoE) and Network Performance Metrics – definitions, relationship and mapping between them.

**2) Quality of Service Metrics**

Availability, Delivery, Latency, Bandwidth, MTBF (Mean Time Between Failure), MTRS (Mean Time to Restore Service), Power consumption, Mobility, Quality of Service - Cause and Effect; Solutions for Improving Quality of Service levels.

**3) Network Performance Metrics**

Availability (Connectivity, Functionality), Loss (One way loss, round trip loss), Delay (One way delay, Round trip time, Delay variance), and Utilization (Capacity, bandwidth, Throughput), Power consumption (Power per Mbps).

**4) Network Modeling and Simulations**

Introduction to using NS-3; Measuring performance metrics – focus on performance at the application layer.

**5) User Perceived Quality**

Type of services (Multimedia delivery, Real-time and interactive applications, Web applications, e-commerce, gaming) Quality of Experience and Quality of Perception.

**6-7) Performance-aware Java Network Development**

Sockets; TCP and UDP Client-Server; Multi-threaded communication; Protocol Implementation: ICMP, SMTP, POP3, FTP and HTTP

**8) Performance at Application Layer**

Multimedia delivery, Web applications, gaming, etc. Quality of Experience and Quality of Perception; Quality-aware application solutions: QOAS, LDA+, DOAS, iPAS

**9) Performance at Network and Transport Layers**

Protocols: IPv4, IPv6, RTP, RTCP, SCTP, DCCP, MPTCP, TCP-SNOOP, Indirect-TCP, TCP-W

**10) Mobility Aspects**

Mobility Management, network selection, handover, protocols to support mobility: Mobile IP, mDCCP, mSCTP, IEEE 802.21

**11) Power Management**

Network power consumption; Energy savings solutions (e.g. IEEE 802.11 PSM);

**12) Network Security Issues**

Authentication and authorisation, Cryptography, Security solutions (e.g. IEEE 802.11i )

Assessment Breakdown	%
Continuous Assessment	25.00%
End of Academic Session	75.00%

**Continuous Assessment**

Assessment Type	Assessment Description	Outcome Addressed	% of total	Assessment Date
Assignment	n/a	1,3,5	25.00	n/a

**End of Module Formal Examination**

Assessment Type	Assessment Description	Outcome Addressed	% of total	Assessment Date
Formal Examination	n/a	1,2,3,4,5	75.00	End-of-Semester

DCU reserves the right to alter the nature and timings of assessment



## EE500: Network Performance

### Module Workload

This module has no Full Time workload.

This module has no Part Time workload.

## Module Resources

### *Essential Book Resources*

**Andrew S. Tanenbaum and David J. Wetherall 2013, *Computer Networks*, 5 Ed., Pearson [ISBN: 978-129202422]**

**Douglas E. Comer 2014, *Computer Networks and Internets*, 6 Ed., Pearson [ISBN: 978-013358793]**

**Douglas E. Comer 2013, *Internetworking with TCP/IP*, 2013 Ed., Pearson [ISBN: 978-013608530]**

**Aff Osseiran, Jose F. Monserrat and Patrick Marsch 2016, *5G Mobile and Wireless Communications Technology*, Cambridge University Press [ISBN: 978-110713009]**

**Erik Dahlman, Stefan Parkvall and Johan Skold 2016, *4G, LTE-Advanced Pro and The Road to 5G*, 3 Ed., Academic Press [ISBN: 978-012804575]**

*This module does not have any article/paper resources*

*This module does not have any other resources*

## Module Delivered In

Programme Code	<i>Programme Title</i>
	MEng in Electronic & Computer Engineering (Draft)

## Module Managers & Teachers

<b>Module Managers</b>		
<i>Semester</i>	<i>Staff Member</i>	<i>Staff Number</i>
Semester 1	Gabriel-Miro Muntean	80020216
Semester 2	Gabriel-Miro Muntean	80020216
Autumn	Gabriel-Miro Muntean	80020216

  

<b>Module Teachers</b>	
<i>Staff Member</i>	<i>Staff Email</i>
No Teacher Staff Assigned	