<table>
<thead>
<tr>
<th><strong>Module Code</strong></th>
<th>CS4031</th>
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<tbody>
<tr>
<td><strong>Module Name</strong></td>
<td>Next generation networks</td>
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<tr>
<td><strong>ECTS weighting</strong></td>
<td>5</td>
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<tr>
<td><strong>Term</strong></td>
<td>MT</td>
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<tr>
<td><strong>Contact Hours</strong></td>
<td>3 lecture hours per week</td>
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<tr>
<td><strong>Module Personnel</strong></td>
<td>Assistant Professor Marco Ruffini and Dr. Tim Forde</td>
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**Learning Outcomes**

On successful completion of this module a student will be able to:

- **NS3LO1** Describe the basic characteristics, structure and operation of wired and wireless networks.
- **NS3LO2** Identify appropriate architectural models, systems strategies and use cases for a range of modern network concepts.
- **NS3LO3** Reason about the challenges and impediments that new, disruptive networking paradigms encounter, as well as their appropriate application.
- **NS3LO4** Implement solutions to key challenges in modern network architecture, e.g., scalability, cost effectiveness and energy efficiency.
- **NS3LO5** Implement solutions to key challenges in the wireless space e.g. mobility, interference, energy consumption.
- **NS3LO6** Assess the operation of medium access protocols in contemporary wireless standards for local and wide area networks, and Internet of Things, and discuss co-existence between different types of systems.

**Module Learning Aims**

This module aims to provide both a theoretical and practical understanding of modern and next generation networking and systems concepts, principles, practices and technologies. Contemporary and emerging wired and wireless network systems are targeted. Students will be exposed to a variety of system platforms, architectures, protocols, and algorithms, with a strong focus on key design principles and practices e.g. performance, scalability, mobility, virtualization. The module also aims to highlight some of the relevant ongoing research and innovation in the space taking place within Ireland and internationally.

**Module Content**

Specific topics addressed in this module include:

- **Contemporary and emerging fixed telecommunication network architecture and systems:**
  - Fixed telecom operator network architectures
  - Optical networking and transmission technology
  - Next generation fixed access network technologies (latest copper and fibre access technologies)
- Contemporary and emerging wireless network architecture and systems:
  - Wireless channel impairments and mitigation techniques, overview of wireless networks
  - Mobile architectures: LTE, LTE-A, LTE-A-PRO
  - Wireless local area networks: IEEE 802.11, HetNet and small cell deployments, mmWave
- Convergence of mobile and fixed architectures: backhaul, fronthaul, midhaul and protocol convergence
- Multi-service networks and quality of service assurance
- Centralised network control plane and protocols: Path Computation Element (PCE), Q-in-Q, MAC-in-MAC, MPLS
- Next generation software-defined network (SDN) controlled systems
- Recent trends in wireless networking
  - Cognitive radio self-organising networks and spectrum sharing
  - 5G and Internet of Things

| Assessment Details | Exam: 70%  
| Coursework: 30% |