

Module Name: Next Generation Networks

Module Acronym: NGN

Module Manager: Dr Clive Poole

Course Summary:

Several forms of convergence are currently occurring within the telecommunications and IT industry, notably: IT and entertainment, fixed and mobile communications, and voice and data. This module examines the concepts, technology and architecture of next-generation networks (NGN). It also considers the drivers for moving to an NGN, namely: the convergence of services and the associated integration of networks, and in particular addresses the shift of telephony to Internet-based networks. In addition to examining voice over IP technology, we consider the requirements of an integrated IP-based network supporting a range of converged voice and data services.

Intended Learning Outcomes

On completion of this course, students should be able to:

- understand and explain the drivers of service conversion.
- define the term “Next Generation Network” and outline it’s main characteristics.
- outline the main architectural elements of a Next Generation Network and explain the logic behind it.
- understand the concept of Voice over IP (VoIP) and explain how full featured telephony can be provisioned over an IP network
- understand the portfolio of broadband access mechanisms in a fixed network and be able to explain the relative merits of each type.
- understand the principles of connection-orientated and connectionless packet switching and the protocols available to enable such networks.
- understand the principles of mobile networks and they relate to NGN.

Course Content

Convergence and Integration

- What is convergence and why is it now possible
- Service convergence
- Network integration
- The service stack model
- Drivers for network integration & Service convergence

MSc Communications Programmes

Next Generation Networks (NGN)

- Principles and definition of an NGN
- The NGN architecture
- Outline of technology choices
- Network and implementation issues with NGN
- Numbering & Addressing

Broadband Access

- Review of broadband access systems for
- Relative merits of the various systems and their enabling role in NGNs

Next Generation Core Network

- The role of the core network
- Enabling Control and Reconfigurability.

Packet Switching

- ATM
- IP
- MPLS
- Ethernet

IP Multi-Media System (IMS)

- Principles of control for IP networks
- Concept of IMS
- The architectural principles and the key components
- Service aspects

VoIP and SIP

- VoIP principles
- How telephony is provided over an IP network
- The various VoIP scenarios
- The principles of SIP
- Comparison of SIP with other signalling systems (e.g. SS7)
- SIP encapsulation in ISUP

NGN Service Aspects

- Services on an NGN
- Service compatibility with PSTN and IN
- Use of APIs and service provider interfaces

Mobile IP

- The concept of mobile IP
- Mobile IP application and limitations

Mobile Systems

- Brief review of the principles of mobile networks
- Relationship of mobile developments to NGN

Assessment:

Assessment is by undertaking a personal assignment

MSc Communications Programmes

Tutorials/Workshops:

Two-hour tutorial to address the principles of NGN as taught on the module and to help the students tackle the assignment question.

Guest Speakers:

Normally a speaker from an operator is invited to give the latest situation on their NGN.

Suggested Reading

Books

VALDAR, A R: 'Understanding Telecommunications Networks', IET Telecommunications Series 52, 2006.

Journals

Carugi, M.; Hirschman, B.; Narita, A.; , "Introduction to the ITU-T NGN focus group release 1: target environment, services, and capabilities," *Communications Magazine, IEEE* , vol.43, no.10, pp. 42- 48, Oct. 2005

doi: 10.1109/MCOM.2005.1522123

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1522123&isnumber=32552>

Chae-Sub Lee; Knight, D.; , "Realization of the next-generation network," *Communications Magazine, IEEE* , vol.43, no.10, pp. 34- 41, Oct. 2005

doi: 10.1109/MCOM.2005.1522122

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1522122&isnumber=32552>

MSc Communications Programmes

IET (UK-SPEC) Learning Outcome Codes

US1m: The module covers the key technical areas related to the technologies underpinning next generation networks. Building on the introductory modules and straying from the principles of connection-orientated and connectionless packet switching it demonstrates implementation of IP and other networking technologies to provide integrated networks and how these are deployed as VoIP services.

US1fl: The module covers the key technical areas related to the technologies underpinning next generation networks. Building on the introductory modules and straying from the principles of connection-orientated and connectionless packet switching it demonstrates implementation of IP and other networking technologies to provide integrated networks and how these are deployed as VoIP services.

US2m: The module considers a range of developing technologies including ASON, OTN, NG-SDH, GMPLS, FTTH, WiMAX, LTEAdvance.

US2fl: The module considers a range of developing technologies including ASON, OTN, NG-SDH, GMPLS, FTTH, WiMAX, LTEAdvance

US3fl: The course assignment requires the students to understand and integrate the technical content of the modules with an appreciation of the regulatory framework in which NGNs operate as well as the drivers for converged services and devices. Independent research is required to consolidate these ideas in the assignment.

US4m: The course assignment requires the students to understand and integrate the technical content of the modules with an appreciation of the regulatory framework in which NGNs operate as well as the drivers for converged services and devices. Independent research is required to consolidate these ideas in the assignment.

EA1m: The module requires the synthesis of technologies with basic network principles to demonstrate potential NGN implementations and the implications of network design. Students are required to demonstrate their knowledge and understanding of communications principles and apply them to the analysis of next generation networks, with a particular focus in this module on Network Architectures and protocols and the principles of mobile communications systems.

EA1fl: The module requires the synthesis of technologies with basic network principles to demonstrate potential NGN implementations and the implications of network design. Students are required to demonstrate their knowledge and understanding of communications principles and apply them to the analysis of next generation networks, with a particular focus in this module on Network Architectures and protocols and the principles of mobile communications systems.

EA3m: Students are expected to perform independent research into Next Generations Network and use this research to enable a systems orientated approach to the design of network solutions.

EA3fl: Students are expected to perform independent research into Next Generations Network and use this research to enable a systems orientated approach to the design of network solutions.

MSc Communications Programmes

D1fl: Consideration of innovative design in services enabled within NGNs is considered.

D2m: Consideration of innovative design in services enabled within NGNs is considered.

S1m: The interplay between technology, regulation and services is considered as part of this module.

S1fl: The interplay between technology, regulation and services is considered as part of this module.

P2m: The course places the theoretic study in the context of real world deployments through the use of industrial guest lectures. The lectures conclude the course demonstrate the application of the protocols, systems and technologies studies.

P2fl: The course places the theoretic study in the context of real world deployments through the use of industrial guest lectures. The lectures conclude the course demonstrate the application of the protocols, systems and technologies studies.

P3m: The course considers the impact of commercial and regulatory constraints on the development and deployment of next generation networks. Starting from the requirements for compatibility with legacy networks it outlines the trade-offs and restrictions that these place on designs.

P3fl: The course considers the impact of commercial and regulatory constraints on the development and deployment of next generation networks. Starting from the requirements for compatibility with legacy networks it outlines the trade-offs and restrictions that these place on designs.