

# Knight Foundation School of Computing and Information Sciences

**Course Title:** Net-centric Computing

**Date:** 12/20/2022

**Course Number:** CNT 4713

**Number of Credits:** 3

<b>Subject Area:</b>	<b>Subject Area Coordinator:</b> Dong Chen <b>email:</b> dochen@cs.fiu.edu
<b>Catalog Description:</b> This course covers networking fundamentals, network security, network applications, mobile and wireless computing. The course focuses on network programming, including sockets and web programming concepts.	
<b>Textbook:</b> "UNIX Network Programming: The sockets networking API, 3/e", by W. Richard Stevens, Bill Fenner, and Andrew M. Rudoff. ISBN-10: 0131411551. ISBN-13: 978-0131411555. Addison-Wesley.	
<b>References:</b> "Computer Networks, 5/e", by Andrew S. Tanenbaum, and David J. Wetherall. ISBN-10: 0132126958. ISBN-13: 9780132126953. Prentice Hall.	
<b>Prerequisites Courses:</b> <a href="#">COP 4338</a>	
<b>Corequisites Courses:</b>	

Type: Required for BS-in-CS

Prerequisites Topics:

- C programming on UNIX

Course Outcomes:

1. Master socket programming and transport layer services
2. Master web programming concepts
3. Be familiar with network architecture and OSI network model
4. Be familiar with internetworking, routing, and congestion control
5. Be familiar with applied cryptography and other network security concepts
6. Be exposed to wireless and mobile networking, multimedia networking, network management, and distributed computing

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**Association between Student Outcomes and Course Outcomes**

<b>BS in Computing: Student Outcomes</b>	<b>Course Outcomes</b>
1) Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	3, 4
2) Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	1, 2
3) Communicate effectively in a variety of professional contexts.	
4) Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.	
5) Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.	
<b>Program Specific Student Outcomes</b>	
6) Apply computer science theory and software development fundamentals to produce computing-based solutions. [CS]	5, 6
6) Apply security principles and practices to maintain operations in the presence of risks and threats. [CY]	
6) Use systemic approaches to select, develop, apply, integrate, and administer secure computing technologies to accomplish user goals. [IT]	

**Assessment Plan for the Course and how Data in the Course are used to assess Student Outcomes**

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan:  
<https://abet.cis.fiu.edu/>

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**Outline**

Topic	Lecture Hours	Outcome
<ul style="list-style-type: none"> <li>• Introduction to net-centric computing               <ul style="list-style-type: none"> <li>• Background and history of networking and the Internet</li> <li>• Network architectures and stacks (OSI, TCP/IP models)</li> <li>• Network protocols</li> <li>• Network application models: client/server, publish-subscribe, peer-to-peer</li> <li>• Web programming</li> <li>• Network security</li> <li>• Distributed computing</li> </ul> </li> </ul>	2.5	3
<ul style="list-style-type: none"> <li>• Transport layer services and socket programming               <ul style="list-style-type: none"> <li>• Transport layer protocols and services</li> <li>• TCP protocol and congestion control</li> <li>• Other transport layer protocols</li> <li>• TCP and UDP socket programming</li> </ul> </li> </ul>	10	1, 4
<ul style="list-style-type: none"> <li>• Network layer, wireless and mobile networking               <ul style="list-style-type: none"> <li>• IPv4 and IPv6 network protocols</li> <li>• Routing algorithms, protocols, and internetworking</li> <li>• Introduction to wireless and mobile networks</li> </ul> </li> </ul>	7.5	4, 5, 7
<ul style="list-style-type: none"> <li>• Network applications and web programming               <ul style="list-style-type: none"> <li>• HTTP, Email, DNS</li> <li>• Multimedia (VoIP, RTP, MPEG-DASH) and peer-to-peer applications</li> <li>• Web technologies and programming: backend (CGI, PHP), frontend (Javascript, typescript, AJAX)</li> <li>• Web application APIs: RPCs (SOAP, REST), pub/sub (message queues, brokers)</li> <li>• Cloud-based distributed computing (Google Cloud, AWS) and web application deployment</li> </ul> </li> </ul>	11	2, 7
<ul style="list-style-type: none"> <li>• Introduction to network security               <ul style="list-style-type: none"> <li>• Principles of cryptography</li> <li>• Symmetric cryptography (AES): encryption/decryption, HMAC signatures</li> <li>• Asymmetric (public-key) cryptography (RSA, ECDSA): encryption/decryption, digital signatures, digital certificates</li> <li>• Network attacks and defenses (Firewalls, IPSec, VPNs, TLS, HTTPS)</li> </ul> </li> </ul>	7	6

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**Course Outcomes Emphasized in Laboratory Projects / Assignments**

	<b>Outcome</b>	<b>Number of Weeks</b>
1	Multithreaded web server (socket programming) Outcomes: 1	2
2	Overlay multi-hop routing Outcomes: 1,4,6	4
3	Collaborative white board Outcomes: 2	3
4	Cryptography Outcomes: 5	4

**Oral and Written Communication**

No significant coverage

**Social and Ethical Implications of Computing Topics**

No significant coverage

**Theoretical Contents**

1.	Network architecture and network design
2.	Transport layer, reliable data transfer, congestion control
3.	Routing algorithms
4.	Web application and distributed computing concepts
5.	Cryptography

**Problem Analysis Experiences**

1.	Network programming (4 assignments)
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**Solution Design Experiences**

1.	Design and implementation of an overlay multi-hop routing algorithm
2.	Design and implementation of a collaborative whiteboard program

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**The Coverage of Knowledge Units within Computer Science Body of Knowledge<sup>1</sup>**

<b>Knowledge Unit</b>	<b>Topic</b>	<b>Lecture Hours</b>
AL9	Cryptographic algorithms; symmetric-key algorithms, public-key algorithms, authentication	3
NC1	Introduction to net-centric computing; internet history, network architecture, network protocols, networked applications	3
NC2	Communication and networks; OSI and TCP/IP reference model, internetworking and routing	18
NC3	Network security; network attacks and defenses	4
NC4	The web as an example of client-server computing; socket programming, HTTP	4
NC5	Building web applications; web programming	5
NC9	Wireless and mobile computing	3

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<sup>1</sup>See *Computing Curricula 2001 Computer Science*, by the Joint Task Force on Computing Curricula IEEE Computer Society Association for Computing Machinery; cf. Computer Science Body of Knowledge, page 17. Available at:  
[https://www.acm.org/binaries/content/assets/education/cs2013\\_web\\_final.pdf](https://www.acm.org/binaries/content/assets/education/cs2013_web_final.pdf)