

Knight Foundation School of Computing and Information Sciences

Course Title: Enterprise IT Troubleshooting

Date: 11/28/2018

Course Number: CTS 4743

Number of Credits: 3

Subject Area: Systems	Subject Area Coordinator: Kianoush Gholamiboroujeni email: kgholami@fiu.edu
Catalog Description: This course covers advanced topics in troubleshooting from the perspective of an infrastructure engineer focusing on diagnosing & resolving issues found in common application architectures patterns.	
Textbook: None – Public information reading suggestions plus instructor created content	
References: “Patterns of Enterprise Application Architecture”, Martin Fowler. ISBN-10: 0321127420. ISBN-13: 978-0321127426. Addison-Wesley. "Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions", Gregor Hohpe, Bobby Woolf. ISBN-10: 0133065103. ISBN-13: 978-0133065107. Addison-Wesley.	
Prerequisites Courses: COP 4703 and (CNT 4403 or EEL 4806)	
Corequisites Courses:	

Type: Elective (CY, IT)

Prerequisites Topics:

- Basic Programming Knowledge
- Basic Networking & Security Knowledge
- Basic Operating System Knowledge (Linux & Windows)
- Basic Database Knowledge

Course Outcomes:

1. Understand and execute enterprise IT troubleshooting best practices
2. Demonstrate mastery of fundamental IT troubleshooting tools
3. Define enterprise IT organization & disciplines
4. Classify and describe enterprise IT infrastructure components
5. Identify and explain application architecture patterns
6. Recognize and explain infrastructure component dependencies for each application architecture pattern
7. List and state ITIL and ITSM concepts
8. Understand and use cloud computing and infrastructure automation

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Outline

Topic	Lecture Hours	Outcome
<ul style="list-style-type: none"> • Enterprise IT Overview <ul style="list-style-type: none"> • Enterprise IT organization & disciplines • ITIL & ITSM Overview • IT Troubleshooting best practices 	3	1,3,7
<ul style="list-style-type: none"> • Brief Review of Core Infrastructure Components <ul style="list-style-type: none"> • Networking (firewalls, routing, VPN, etc.) • Compute (virtualization, OS types) • Storage (SAN, NAS) • Database (clustering, replication) • Security (IPS, content filtering, WAF, etc.) • Desktop (packaging, automated deployment) 	3	4
<ul style="list-style-type: none"> • Introduction to Support Tools <ul style="list-style-type: none"> • Networking (nslookup, Wireshark, etc.) • Compute (netstat, perfmon/top, etc.) • Databases (catalog queries) • Enterprise monitoring 	3	1,2,4
<ul style="list-style-type: none"> • Deploying Infrastructure to the Cloud <ul style="list-style-type: none"> • Cloud computing fundamentals • Infrastructure as code fundamentals • Utilizing automation scripts to deploy infrastructure to the cloud 	8	8
<ul style="list-style-type: none"> • Legacy Application Architecture Patterns <ul style="list-style-type: none"> • For each - use support tools to review, step through infrastructure components used, security implications, etc. <ul style="list-style-type: none"> ◦ Terminal emulation ◦ Batch ◦ Client-server (2-tier) 	8	1,2,4,5,6
<ul style="list-style-type: none"> • Modern Application Architecture Patterns <ul style="list-style-type: none"> • For each - use support tools to review, step through infrastructure components used, security implications, etc. <ul style="list-style-type: none"> ◦ Web-based (3-tier) ◦ N-tier (SOA, micro services, message queuing, rules engine) ◦ Business to business integration ◦ Cloud Native 	15	1,2,4,5,6

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Learning Outcomes: (Familiarity → Usage → Assessment)

Pervasive Themes in IT:

1. Explain how the components of an IT system interrelate. [Assessment]
2. Explain how and why complexity occurs in IT. [Familiarity]
3. Solve for complexity in an information technology environment by applying best practices and using appropriate technologies and methodologies. [Familiarity]

Security Mechanisms (Countermeasures):

1. Explain the three key factors involved in authentication and how they are used to verify identity and. [Assessment]
2. Explain the differences between symmetric and asymmetric cryptosystems, e.g., number of keys required, the types of algorithms used, etc. [Assessment]
3. Explain how public key infrastructure (PKI) works. [Familiarity]

Managing the Database Environment:

1. Explain the concept of database security. [Familiarity]
2. Describe client-server database architecture. [Assessment]
3. Describe n-tier database architecture. [Assessment]
4. Explain the role of ODBC, JDBC and XML in the implementation of an n-tier database architecture. [Familiarity]
5. Describe the concept of web services and the role of SOAP. [Assessment]

Intersystem Communications:

1. Describe and contrast the different types of architectures for integrating systems. [Assessment]
2. Describe the role of socket programming in communicating between systems and contrast the protocols and uses of TCP/IP sockets and Datagram sockets. [Assessment]
3. Describe the purpose of message and queuing services and how they work and list the protocol used by one messaging service (e.g. JMS) [Familiarity]

Foundations of Networking:

1. Compare and contrast the OSI and Internet models as they apply to contemporary communication protocols. [Assessment]
2. Analyze and compare the characteristics of various communication protocols and how they support application requirements. [Usage]
3. Demonstrate the ability to solve basic problems and perform basic troubleshooting operations on LANs and connected devices. [Usage]

Operating Systems:

1. Distinguish between server and client services. [Usage]
2. Identify situations in which a support organization needs to be consulted in resolving operating system issues. [Usage]

Administrative Domains:

1. Describe the responsibilities common to the various administrative domains. [Assessment]
2. Describe the responsibilities unique to each of the various administrative

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- domains. [Assessment]
- Identify responsibilities in each domain that support activities in other domains. [Familiarity]

Organizational Context:

- Outline the basic parts of a typical IT environment. [Assessment]

Course Outcomes Emphasized in Laboratory Projects / Assignments

	Outcome	Number of Weeks
1	Deploy infrastructure in cloud (Azure or AWS) Outcomes: 4	2
2	Deploy applications onto infrastructure Outcomes: 2,4,5,6	2
3	Diagnose/remedy generated application issues (4 assignments – mostly group assignments) Outcomes: 2,4,5,6	6

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.	Authentication/authorization methods
3.	Application architecture patterns
4.	Troubleshooting best practices (goals, principles, steps, constraint detection)
5.	Cryptography

Problem Analysis Experiences

1.	Troubleshoot different types of applications issues across various technologies (4 assignments – mostly group assignments)
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Solution Design Experiences

1.	Build cloud infrastructure (1 assignment)
2.	Deploy applications on cloud infrastructure (4 assignments)

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**The Coverage of Knowledge Units within the Information Technology
 Body of Knowledge¹**

Knowledge Unit	Topic	Lecture Hours
ITF1	IT systems model; Management of complexity; Information and communication technologies	5
IAS2	Cryptography; Authentication; Redundancy	6
IM5	Client-server databases; n-tier architectures; Database administration-Concurrency	5
IPT1	Architectures for integrating systems; Web services and middleware; Message and queuing services	7
NET1	OSI model; Internet model; Components and architectures; Routing and switching (bridging); Communication protocols	7
SA1	Server services (print, file, DHCP, DNS, FTP, HTTP, mail, SNMP, telnet); Client services; Support	7
SA4	Web domain; Network domain; Database domain; OS domain; Support domain	2
SP1	IT environment	1

Assessment Plan for the Course & how Data in the Course are used to assess Program 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.cs.fiu.edu/csassessment/>

¹See *Information Technology 2008 - Curriculum Guidelines for Undergraduate Degree Programs in Information Technology*; by Association for Computing Machinery (ACM), IEEE Computer Society; cf. The Information Technology Body of Knowledge, page 27. Available at: https://www.acm.org/binaries/content/assets/education/cs2013_web_final.pdf