

Arkansas Computer Science Standards for Grades 9-12

Advanced Networking

2016

Advanced Networking

Introduction

The Arkansas Advanced Networking course focuses on the skills necessary to design, develop, and maintain reliable and secure services, devices, and applications in various networked environments. Through these standards, students will explore, apply, and advance toward mastery of network analysis through troubleshooting, administration, and efficiency. Students will accomplish tasks and solve problems independently and collaboratively with the tools and skills needed to be successful in college and careers.

The Arkansas State Board of Education (SBE) does not place any pre-requisites on the Arkansas Computer Science High School Courses, but allows for schools to place students in any of the courses based on ability and desire. The Arkansas Department of Education (ADE) recommends that districts develop and formally adopt a written policy outlining placement protocols. Evaluation tools and placement criteria will be the responsibility of the local districts. Though there are no specific course prerequisites, students enrolling in Advanced Programming, Advanced Networking, or Advanced Information Security should understand and be able to apply the content/concepts found within the Arkansas Computer Science Courses Levels 1 - 4.

The SBE and ADE authorizes schools to enroll students across levels and emphases in the same sections of the master schedule (a.k.a. stacking) as long as the number of students does not exceed Standards of Accreditation maximums and/or ratios, and the school can reasonably assure a high-quality educational experience for all students within that section.

Implementation of the Arkansas Computer Science Standards for Grades 9-12 begins during the 2017-2018 school year.

Course Title: 465150 - Advanced Networking Level 1
465160 - Advanced Networking Level 2

Course/Unit Credit: 0.5 Credits per Course

Teacher Licensure: Please refer to the Course Code Management System (<https://adedata.arkansas.gov/ccms/>) for the most current licensure codes.
Grades: 9-12
Prerequisites: There are no ADE established course prerequisites for any of the Computer Science levels; it is up to the local district to determine placement based on student ability.

Computer Science Practices

Students will exhibit proficiency in computer science through:

Perseverance - Students expect and persist in overcoming the challenges that occur when completing tasks. They recognize that making and correcting mistakes will take place during the learning process and problem solving.

Collaboration - Students effectively work and communicate with others ensuring multiple voices are heard and considered. They understand that diverse thoughts may lead to creative solutions and that some problems may be best solved collaboratively.

Patterns - Students understand and utilize the logical structure of information through identifying patterns and creating conceptual models. They decompose complex problems into simpler modules and patterns.

Tools - Students evaluate and select tools to be used when completing tasks and solving problems. They understand that appropriate tools may include, but are not limited to, their mind, pencil and paper, manipulatives, software application programs, programming languages, or appropriate computing devices.

Communication - Students effectively communicate, using accurate and appropriate terminology, when explaining the task completion or problem solving strategies that were used. They recognize that good documentation is an ongoing part of the process, and when appropriate, provide accurate documentation of their work in a manner that is understandable to others.

Ethics and Impact - Students comprehend the ramifications of actions prior to taking them. They are aware of their own digital and cyber presence and its impact on other individuals and society.

Problem Solving - Students exhibit proficiency in Computer Science through identifying and systematically solving problems (e.g., engineering design process). They recognize problem solving as an ongoing process.

Advanced Networking

Strand	Content Cluster
Computational Thinking and Problem Solving	
	1. Students will analyze problem-solving strategies.
	2. Students will analyze connections between elements of mathematics and computer science.
	3. Students will solve problems cooperatively and collaboratively.
Data and Information	
	4. Students will analyze various ways in which data is accessed.
	5. Students will collect, interpret, and analyze data and information.
Computers and Communications	
	6. Students will analyze the utilization of network devices.
	7. Students will analyze various networking media types and topologies.
	8. Students will design and implement a local area network to host a network service.
Community, Global, and Ethical Impacts	
	9. Students will analyze appropriate uses of technology.

Notes for the Computer Science Standards for High School document:

1. The examples given (e.g.,) are suggestions to guide the instructor.
2. The course strands, content clusters, and the content standards are to be taught in an integrated manner, not in isolation.
3. The Practices are intended to be habits of mind for all students and were written broadly in order to apply to all grades. The Practices are not content standards and are not intended to be formally assessed but may be assessed formatively.
4. This Arkansas Department of Education curriculum standards document is intended to assist in district curriculum development, unit design, and to provide a uniform, comprehensive guide for instruction.
5. Notes found within the document are not approved by the Arkansas State Board of Education, but are provided for clarification of the standards by the Arkansas Department of Education and/or the standards drafting committee. The notes are subject to change as understandings of the standards evolve.

Strand: Computational Thinking and Problem Solving
 Content Cluster 1: Students will analyze problem-solving strategies.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS LEVELS	
Level 1	Level 2
ANL1.1.1 Interpret and follow graphically illustrated processes (e.g., flow charting, network map)	ANL2.1.1 Illustrate processes graphically (e.g., flow charting, network map)
ANL1.1.2 Define and identify network problems (e.g., test network cables/configuration)	ANL2.1.2 Identify and resolve networking problems (e.g., test network cables/configuration)
ANL1.1.3 Identify best method for problem solving various scenarios	ANL2.1.3 <i>Continuation of this standard is not specifically included or excluded</i>

Strand: Computational Thinking and Problem Solving
 Content Cluster 2: Students will analyze connections between elements of mathematics and computer science.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS LEVELS	
Level 1	Level 2
ANL1.2.1 Perform operations with base ₁₀ , base ₂ , base ₈ , and base ₁₆ numbers as they relate to networking concepts (e.g., packet transmission, subnet masking)	ANL2.2.1 Perform operations with base ₁₀ , base ₂ , base ₈ , and base ₁₆ numbers as they relate to networking concepts
ANL1.2.2 Describe limitations of addressing systems (e.g., IPv4 address scarcity vs. IPv6 limitations, 32 vs. 64 bit systems)	ANL2.2.2 <i>Continuation of this standard is not specifically included or excluded</i>

Strand: Computational Thinking and Problem Solving
 Content Cluster 3: Students will solve problems cooperatively and collaboratively.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS LEVELS	
Level 1	Level 2
ANL1.3.1 Analyze tradeoffs of collaborative and cooperative problem solving when performing various networking activities	ANL2.3.1 Design and complete a group-based networking project

Strand: Data and Information

Content Cluster 4: Students will analyze various ways in which data is accessed.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS LEVELS	
Level 1	Level 2
ANL1.4.1 Analyze various data storage methods (e.g., cloud, local, network)	ANL2.4.1 Design a multi-user storage solution
ANL1.4.2 Differentiate between types of access (e.g., internal/external accessibility)	ANL2.4.2 Select ideal access scheme for various situations (e.g., case studies)

Strand: Data and Information

Content Cluster 5: Students will collect, interpret, and analyze data and information.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS LEVELS	
Level 1	Level 2
ANL1.5.1 Analyze various tools used for network analysis (e.g., Ethereal, ping, traceroute)	ANL2.5.1 Collect and interpret data from a network using various tools
ANL1.5.2 Identify various data being represented in network analysis	ANL2.5.2 Describe network operations when provided with network traffic from live or simulated sources

Strand: Computers and Communications

Content Cluster 6: Students will analyze the utilization of network devices.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS LEVELS	
Level 1	Level 2
<p>ANL1.6.1</p> <p>Analyze the client-server relationship including, but not limited to:</p> <ul style="list-style-type: none"> • how the relationship of clients and server hierarchy extends both above and below the user level • how networks act as clients to an “upstream” network and as a server to “downstream” users, • how each layer of the OSI model supports the services below it and the layers above 	<p>ANL2.6.1</p> <p>Analyze the basics of load-balancing technologies</p>
<p>ANL1.6.2</p> <p>Describe differences among various network devices (e.g., hub, router, switch)</p>	<p>ANL2.6.2</p> <p>Select the most appropriate network device for a given role</p>

Strand: Computers and Communications

Content Cluster 7: Students will analyze various networking media types and topologies.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS LEVELS	
Level 1	Level 2
<p>ANL1.7.1</p> <p>Analyze various networking media (e.g., amateur radio, copper, fiber, infrared, Wi-Fi)</p>	<p>ANL2.7.1</p> <p>Analyze tradeoffs associated with various media (e.g., bandwidth, cost, distance, noise)</p>
<p>ANL1.7.2</p> <p>Identify common network topologies (e.g., contention, time slot, token)</p>	<p>ANL2.7.2</p> <p>Analyze tradeoffs of various network topologies</p>

Strand: Computers and Communications

Content Cluster 8: Students will design and implement a local area network to host a network service.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN A PROJECT BASED TASK OF BOTH ADMINISTRATION AND NETWORK SERVICES	
Level 1	Level 2
<p>ANL1.8.1 Install, configure, and administer a server including the following tasks:</p> <ul style="list-style-type: none"> • Research server software requirements (e.g., email, filer, game, virtual services, web) • Install and configure server operating system (virtual or physical) • Apply appropriate server security • Install and configure server software (e.g., Apache, Exchange, Internet Information Services, Openfiler, Samba, Sendmail, Virtualbox, VMware,) • Install and configure supporting services (e.g., Dynamic Host Configuration Protocol [DHCP], Domain Name System [DNS]) • Explain domain name registration process • Describe propagation of DNS authoritative records • Ensure and maintain availability of services 	<p>ANL2.8.1 Install, configure, and administer a server including the following tasks:</p> <ul style="list-style-type: none"> • Research server software requirements (e.g., email, filer, game, virtual services, web) • Install and configure server operating system (virtual or physical) • Apply appropriate server security • Install and configure server software (e.g., Apache, Exchange, Internet Information Services, Openfiler, Samba, Sendmail, Virtualbox, VMware,) • Install and configure supporting services (e.g., Dynamic Host Configuration Protocol [DHCP], Domain Name System [DNS]) • Explain domain name registration process • Describe propagation of DNS authoritative records • Ensure and maintain availability of services
<p>NOTE for ANL1.8.1 and ANL2.8.1: Students who install, configure, and administer a server as part of their Level 1 work may be allowed to continue expanding their Level 2 knowledge by using that server installation. The intent is to provide students the opportunity to select a network service(s) to provide to multiple users. Servers need not be externally available, but should provide adequate challenge and opportunity for learning.</p>	
<p>ANL1.8.2 Install, configure, and administer a network addressing the following:</p> <ul style="list-style-type: none"> • Explain concepts of Voice over Internet Protocol (VoIP) networks implementation (e.g., Power-over-Ethernet [PoE], Private Branch Exchange [PBX] configuration, Quality of Service [QoS], Virtual LAN [VLAN], video) • Analyze VLAN configuration (e.g., network segmentation, reasons) • Discuss considerations for QoS configuration • Identify uses for PoE to power network devices, including but not limited to the necessity of power injector and operation • Analyze common cable standard for cat5/cat6 cables (e.g., crossover, patch, straight through) • Demonstrate process of cable punch down for patch panels, wall jacks • Describe proper cable placement and cable management best practices • Explain operation of Network Address Translation (NAT) • Describe internal/external access as it related to Firewall operation • Discuss various Routing Types (e.g., distance, reliability, bandwidth) • Explain fundamentals of switch management 	<p>ANL2.8.2 Install, configure, and administer a network addressing the following:</p> <ul style="list-style-type: none"> • Explain concepts of Voice over Internet Protocol (VoIP) networks implementation (e.g., Power-over-Ethernet [PoE], Private Branch Exchange [PBX] configuration, Quality of Service [QoS], Virtual LAN [VLAN], video) • Analyze VLAN configuration (e.g., network segmentation, reasons) • Discuss considerations for QoS configuration • Identify uses for PoE to power network devices, including but not limited to the necessity of power injector and operation • Analyze common cable standard for cat5/cat6 cables (e.g., crossover, patch, straight through) • Demonstrate process of cable punch down for patch panels, wall jacks • Describe proper cable placement and cable management best practices • Explain operation of Network Address Translation (NAT) • Describe internal/external access as it related to Firewall operation • Discuss various Routing Types (e.g., distance, reliability, bandwidth) • Explain fundamentals of switch management

Strand: Community, Global, and Ethical Impacts
 Content Cluster 9: Students will analyze appropriate uses of technology.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS LEVELS	
Level 1	Level 2
ANL1.9.1 Recognize social impact of software piracy, plagiarism, and intellectual property theft	ANL2.9.1 <i>Continuation of this standard is not specifically included or excluded</i>
ANL1.9.2 Compare values of open-source and closed-source software development models	ANL2.9.2 <i>Continuation of this standard is not specifically included or excluded</i>
ANL1.9.3 Explore legitimate and illegitimate uses of file sharing networks (e.g., BitTorrent, CDNs)	ANL2.9.2 <i>Continuation of this standard is not specifically included or excluded</i>

Contributors

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