ONF-Certified SDN Associate Exam (OCSA-2.0)

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Disclaimer

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1. Examination Details & Blueprint for ONF Certified SDN Associate Exam

Exam Title: ONF-Certified SDN Associate (OCSA-2.0)

Exam Details: 40 questions in 60 minutes and a pass score of 70%. Full credit given for each correct answer, no partial credit, as all questions return a binary response (correct/incorrect).

Exam Delivery: Delivered electronically via secure login, with attestation and affirmation of academic integrity by the candidate. This exam is delivered in English.

Credential Awarded: ONF Certified SDN Associate 2.0 (OCSA-2.0) upon successful completion of the exam.

Exam Purpose: This certification exam attests and formally certifies that the successful candidate has vendor-neutral conceptual knowledge of the major domains of networking practices that support the theory and practice of Software Defined Networking (SDN). It presupposes foundational knowledge in computer networking practices and will validate conceptual knowledge in how those computer networking foundations are affected in an SDN environment. It is an entry-level certification examination for technical professionals asserting concept-level mastery of the domain of SDN.

1.1 Intended Exam Audience

Job Position	Primary Job Responsibilities
SDN Sales Engineer	Create BOM's High Level Architecture and Design Product Comparisons/Capabilities RFP's/RFI's Product Line Updates
Business Development Manager	Value of Solution Identify Business Trends Develop Statements of Work
Product Manager	Feature Features/Roadmap Develop Go to Market Strategy Define Customer Requirements/Use Cases
Product Marketing/TME	Product Positioning and Differentiation Compare/Contrast Products (Both Internal and External Products) Sales Enablement Creation/Editing of Technical Documentation/White Papers/Collateral
Manager/Director for a Network/IT Group	Setting Strategy and Vision Career Development for Staff

	Assignment of Responsibilities Articulating Needs of Staff to Higher Technical and Management Leadership
Network Technician (Entry Level)	Installation/Migration (Entry Level, with Supervision) Monitoring (Entry Level, with Supervision) Trouble Tickets and Documenting/Communicating Issues via Wiki, Etc. (Entry Level, with Supervision)
IT Analyst (Entry Level)	Recommend IT Architectures/Products/Systems Test Plans (Product Certifications for ONF) Performance and Monitoring (see above in Network Technician) Business ROI Comparisons Education (if there is public material or could use high level examples of ROI savings)
System Administrator (Entry Level)	Manage IT Systems Operations Process Deploy Server/Storage Infrastructure (non-network) Hypervisors/Overlays/Virtual Switches
Consultant/Professional Services Engineer	Design/Implement Network Services ROI/CapEx/OpEx Analysis Business Proposals Recommendations for Network Architecture/Integration
Student/Researcher/EDU	Validate Course Level Knowledge for Online Course in SDN Foundations at a Concept Level Writing Research Projects Learning More Advanced Network Technologies Tech Evangelizing/White Papers/Speaking Fundamental Understanding from Academic/Theory Perspective
Sales Representatives	Sell SDN Products (assumes product knowledge about specific networking hardware/software) Price/Quote Product/Solutions Identify Opportunities and Sales Insertion Points
Project Manager (assumes knowledge, skills, abilities in project management domain)	Sets/Tracks Schedules Assign Resources Focus on Deliverables (SoW) Project Plans Communicate with Stakeholders
Program Manager (assumes knowledge, skills, abilities in program management domain)	Manage Budget/Resources (Financials) Business Case Development Procurement, Contract Management and Product Certification via Testing and Interoperability Governance/Control/Alignment of Operations
Help Desk/NOC Engineer	Trouble Tickets First Level Triage/Support Escalations (with experience) Bug Submission

1.2 Prerequisite Knowledge and Recommended Training Materials

In order to pass the ONF OCSA-2.0 Exam, a foundational knowledge of computer networking is assumed, with specific familiarity with various conceptual models of networking (OSI, Internet, etc.) and technologies also required. No job experience is mandated, but your familiarity with all the knowledge domains of this certification is essential to succeed. Resources that would be helpful include publications on networking, as well as foundational certifications in networking. Open source resources can also be found at https://www.opennetworking.org/skills-certification/

2. ONF Certified SDN Associate (OCSA) Examination Blueprint

Domain	% Weight of Exam (40 questions from random pool)
1. Networking Concepts	15%
2. SDN Concepts	25%
3. OpenFlow and P4	25%
4. SDN Architecture and Ecosystem	25%
5. SDN Open Source	10%

2.1 Domain 1: Networking Concepts

Identify and compare the layers of OSI and TCP/IP models and functionality of various fundamental elements of networking.

- Ethernet networks
- Collision domains and broadcast domains
- Function of routers and switches
- Routing Protocols
- Optical network fundamentals
- IP Network Services
- Layer 2 addressing, including address resolution
- IPv4 and IPv6 fundamentals
- Layer 3 / IP addressing, including subnet masks
- Longest match routing
- Connection-oriented vs. connectionless protocols
- Packet Filtering with Match/Action Pairs
- Linux networking
- Fundamentals of Network Virtualization

2.2 Domain 2: SDN Concepts

Describe the fundamental characteristics of SDN, definitions, use cases, and history.

- History of SDN (Clean Slate, Ethane, OpenFlow, P4)
- What is SDN? (control and forwarding)
- SDN Value Proposition
- SDN Use Cases in the Data Center
- SDN Use Cases in Campus Networks
- SDN Use Cases in Service Providers
- SDN Use Cases in the Enterprise
- SDN Use Cases in Mobile Networks
- The six characteristics of an SDN Network (Plane Separation, Simplified Forwarding Element, Centralized Control, Network Automation, Virtualization, and Openness)
- SDN Devices (Controllers, Switches, Orchestration, API's, PISA)
- Overlay Networking Abstractions

2.3 Domain 3: OpenFlow™ and P4

Identify at a concept/definition level OpenFlow and P4 operations.

- OpenFlow™
    - TCP level secure channel/communication/session establishment between controller/switch
    - Message Types
    - Basic Operation/Packet Matching
        - (Pipeline Processing, Match Types/Actions, Flow Timers, Proactive vs Reactive Flows, etc.)
    - Differences between OpenFlow versions
    - OpenFlow Management and Configuration Protocol (OF-Config, NETCONF, etc.)
- P4
    - P4Runtime
    - Workflow and Architecture Model
    - Data Plane Tables
    - Programmable Match-Action Pipeline
    - Deploying P4 Programs

2.4 Domain 4: SDN Architecture and Ecosystem

Understand and Identify SDN architectural components, standards bodies, controller design, API's, and applications.

- SDN Layers
- SDN Architecture compared to Traditional Network Architectures
- Northbound APIs
- Security and Availability
- Packet and Optical Integration methods
- Migration Strategies
- Hybrid Mode Switches
- Organization in the SDN Ecosystem
    - Standards Bodies and Industry alliances
    - Network Operators and Enterprises
    - Network Equipment Manufacturers
    - Software vendors
    - Academic and Industry research institutions and labs
    - Open Source Initiatives
- Controller Placement and Redundancy
- SDN Applications (service chaining, virtualized network functions, analytics)

2.5 Domain 5: Open Source

Identify key open source projects in the SDN Ecosystem.

- SDN Controllers
    - Such as ONOS, ODL, Floodlight, RYU
- Utilities and Tools
    - Such as Mininet, Mininet Wifi, OpenFlow Manager, Wireshark
- Open vSwitch
- Orchestration Systems
- Open Source Initiatives

3. List of Abbreviations, Terms, and Acronyms

Please Note: terms and basic definitions are referenced to Wikipedia and TechTerms.com, reference texts, as well as other non-proprietary sources, including ONF publications posted at www.opennetworking.org

Table 3.1: List of Abbreviations, Terms, and Acronyms

Term, Abbreviations, or Acronym	Full Text Name
3GPP	third generation partnership project
Abstraction	a representation of an entity in terms of selected characteristics, while hiding or summarizing characteristics irrelevant to the selection criteria
ACL	access control list
A-CPI	application-controller plane interface
AES	advanced encryption standard
API	application program interface
ARP	address resolution protocol
ASIC	application-specific integrated circuit
BGP	border gateway protocol
Broadcast	broadcast or flooding is a simple routing algorithm in which every incoming packet is sent through every outgoing link except the one it arrived on.
CAPEX	capital expenditure
CHAP	challenge handshake redundancy protocol
CLI	command line interface
CO	central office
Controller	*see SDN Controller*
CPU	*central processing unit*
Data link layer	the second lowest layer of the seven-layer Open Systems Interconnection (OSI) model of computer networking
DDoS	distributed denial of service
DHCP	dynamic host configuration protocol
DPI	deep packet inspection
DNS	domain name system
East-West SDN Architecture	how entities within the same plane of the SDN architectures interrelate

FEC	forward error correction
Flood	flooding is a simple routing algorithm in which every incoming packet is sent through every outgoing link except the one it arrived on.
Frame	a unit of data transferred over a L2 network
FTP	file transfer protocol
FOSS	free and open source software
HTTP	hypertext transfer protocol
HTTPS	hypertext transfer protocol secure
iBGP	interior border gateway protocol
ICMP	internet control message protocol
IDS	intrusion detection system
Information model	a set of entities, together with their attributes and the operations that can be performed on the entities. An instance of an information model is visible at an interface.
IPS	intrusion prevention system
IP	Internet Protocol
IP address	the unique value assigned to each host on a computer network that is employing the Internet Protocol for addressing
IPsec	internet protocol security
IPv4	internet protocol version 4, using a 32-bit integer value for host addressing
IPv6	internet protocol version 6, using a 128-bit integer value for host addressing
IS-IS	intermediate system to intermediate system protocol
Layer	a stratum in a framework that is used to describe recursion within the data plane. Adjacent layers have a client-server relationship.
Layer 1 or Layer One or L1	*see Physical layer in the OSI model*
Layer 2 or Layer Two or L2	*see Data Link layer in the OSI model*
Layer 3 or Layer Three or L3	*see Network layer in the OSI model*
Layer 4 or Layer Four or L4	*see Transport layer in the OSI model*
Layer 5 or Layer Five or L5	*see Session layer in the OSI model*
Layer 6 or Layer Six or L6	*see Presentation layer in the OSI model*
Layer 7 or Layer Seven or L7	*see Application layer in the OSI model*
Level	a stratum of hierarchical SDN or networking abstraction
LAN	local area network
LIFO	last in/first out

LLDP	link layer discovery protocol
MAC	media access control
MAN	metropolitan area network
MPLS	multiprotocol label switching protocol
Network layer	provides the functions and processes that allow data to be transmitted from sender to receiver across multiple intermedia networks
NFV	network function virtualization
NOC	network operations center
NOS	network operating system
NV-GRE	network virtualization using generic routing encapsulation
OFA	OpenFlow© agent
OFC	OpenFlow© controller
OPEX	operational expense
OS	operating system
OSPF	open shortest path first
Overlay architecture	an overlay network is a computer network that is built on top of another network
OVSDB	Open vSwitch database management protocol
Packet	a unit of data transferred over an L3 network
Packet switch	a packet switch is a node in a network, which uses the packet switching paradigm for data communication. Packet switches can operate at a number of different levels in a protocol suite; although the exact technical details differ, fundamentally they all perform the same function: they store and forward packets.
Physical layer	lowest layer of the seven layer Open Systems Interconnection (OSI) model of computer networking
Pipeline Processing	a chain of data-processes or other software entities
PKI	public key infrastructure
Port	a virtual data connection between computer programs connected through a computer network
RDP	remote desktop protocol
ROI	return on investment
Router	A router is a networking device that forwards data packets between computer networks. A router is connected to two or more data lines from different networks (as opposed to a network switch, which connects data lines from one single network). When a data packet comes in on one of the lines, the router reads the address information in the packet to determine its ultimate destination. Then, using

	information in its routing table or routing policy, it directs the packet to the next network on its journey.
RSVP	resource reservation protocol
SDN	software defined networking
SDN Architecture	the SDN architecture is: • Directly programmable: network control is directly programmable because it is decoupled from forwarding functions. • Agile: abstracting control from forwarding lets administrators dynamically adjust network-wide traffic flow to meeting changing needs. • Centrally managed: network intelligence is (logically) centralized in software-based SDN controllers that maintain a global view of the network, which appears to applications and policy engines as a single, logical switch. • Programmatically configured: SDN lets network managers configure, manage, secure, and optimize network resources very quickly via dynamic, automated SDN programs, which they can write themselves because the programs do not depend on proprietary software. • Open standards-based and vendor-neutral: when implemented through open standards, SDN simplifies network design and operation because instructions are provided by SDN controllers instead of multiple, vendor-specific devices and protocols.
SDN Controller	a software entity that has exclusive control over an abstract set of data plane resources. An SDN controller may also offer an abstracted information model instance to at least one client.
SLA	service level agreement
SNMP	simple network management protocol
Stateless v. Stateful pack flow classification	connection information details
Switch	a network switch (also called switching hub, bridging hub, officially MAC bridge) is a computer networking device that connects devices together on a computer network, by using packet switching to receive, process and forward data to the destination device. A network switch forwards data only to one or multiple devices that need to receive it, rather than broadcasting the same data out of each of its ports.
TCP	transmission control protocol
TLS	transport layer security
UDP	user datagram protocol
Virtualization	an abstraction whose selection criterion is dedication of resources to a particular client or application. When the context is general, for example when speaking of virtual network elements (VNEs), the term

	virtual may be used even when abstract might suffice. Virtual is also sometimes used colloquially to mean non-physical.
VM	virtual machine
VXLAN	virtual extensible LAN
WAN	wide area network
WLAN	wireless local area network
XML	extensible markup language