MEF SDN/NFV Certified Professional Examination Blueprint

MEF-SDN/NFV 202.1

Release Version A

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Disclaimer

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Contents

1 MEF SDN/NFV Certification Exam Description

1.1 Exam Title

MEF SDN/NFV Certified Professional Exam (MEF-SDN/NFV 202.1)

1.2 Exam Details

80 questions (70 scored and 10 unscored for research purposes) in 120 minutes and a pass score of 64% (validated and calibrated upon completion of the beta examination, June, 2018). Full credit given for each correct answer, no partial credit, as all questions return a binary response (correct/incorrect).

1.3 Exam Delivery

Delivered electronically via secure login, with attestation and affirmation of academic integrity by the candidate. May also be given by a MEF-certified proctor. Exam currently available in English only.

1.4 Credential Awarded

MEF SDN/NFV Certified Professional (MEF-SDN/NFV) upon successful completion of the exam. Beta recipients who pass the exam are awarded a certification that is equally valid. The term of the exam is three years of duration from the date the exam is passed.

1.5 Why Does MEF Require a Beta Examination?

Questions arise as to the purpose of a beta examination for an IT skills certification. The beta exam helps MEF to edit or correct any questions that are unclear. The exam also requires a certain level of statistical certainty so that the final released version of the exam is reliable. We can also identify any questions that may not be clear, especially for people who have something other than English for their primary language. MEF also identifies question items that are inappropriate for the target audience and calculates an acceptable passing score for the candidate through statistical evaluation. Finally, based on the feedback MEF receives from beta exam participants, MEF modifies exam questions, adjusts the time allotted to take an exam, and in general improves the final published exam.

1.6 Exam Purpose

This certification exam attests and formally certifies that the successful candidate has vendor-neutral knowledge, skills, and abilities in the major domains of software defined networking (SDN) and Network Functions Virtualization (NFV). This certification exam presupposes foundational knowledge in computer networking practices and technologies, which can be validated by the MEF Networking Foundations (MEF-NF) certification exam (note: the MEF Networking Foundations certification is a suggested, but not a mandatory prerequisite, for the

MEF-SDN/NFV certification exam. As regards the cognitive difficulty or intellectual rigor of the MEF-SDN/NFV certification exam, it is a professional-level (operator, engineer) level certification examination for technical professionals attesting to professional, practitioner-level mastery of the content domains. The content domains are structured about the major tasks in operating SDN and NFV—planning, deploying, and managing. For further details on the blueprint, please consult Section 3.

1.7 MEF Professional Certification Exam Architecture

MEF SDN/NFV is one of the professional level certifications in a "stack" of vendor-neutral certification skills certifications in networking called the **MEF Professional Certification Framework**. In time, a full suite of professional, practitioner-level certifications in addition to MEF Network Foundations, MEF Carrier Ethernet Certified Professional, and MEF SDN/NFV Certified Professional will be created, with LSO/Orchestration and Advanced Network Security being added in 2018-2019. Note: The MEF Professional Framework is subject to change, alteration, or addition based on industry input and requirements.

Figure 1: The MEF Professional Exam Framework (as of June 2018)

1.8 MEF Network Expert Certified Professional

With the introduction of the MEF Professional Exam Framework and the successful passing of the MEF Network Foundations exam, the MEF Carrier Ethernet Certified Professional certification, and this MEF SDN/NFV Certified Professional exam, the candidate earns a separate achievement and designation besides these three certifications. Earned without additional expense, it is a recognition by MEF of achieving a higher level of proficiency and knowledge in modern, software-centric networking. This designation is called the **MEF NETWORK EXPERT CERTIFIED PROFESSIONAL (NECP)**.

Figure 2. The MEF Network Expert. Awarded in recognition of broad skills and achievement in software-centric, vendor-neutral networking technologies.

1.9 Minimally Qualified Candidate (MQC)

The Minimally Qualified Candidate (MQC) determination is integral to a valid and reliable certification exam. This main character must be clearly-defined before starting the exam development project. From designing the blueprint, composing test questions to identifying the passing score, the MQC Profile provides subject matter experts (SMEs) with a mental picture to help them determine the point of separation between minimally-proficient and less-than-proficient qualifications. The MEF SDN/NFV MQC has the knowledge of foundational networking technology (as validated by the CompTIA Network+ certification, the MEF Network Foundations certification, or their equivalent), and has likely managed computer or telecom networks for 3-4 years. The MQC possesses vendor-neutral skills in software-centric networking technologies. The MQC will typically have experience in one or more of the areas of network operations, network design, network architecture, product management, and sales engineering.

The MQC is expected to complete these tasks without assistance:

- Create conceptual-level designs for SDN and /or NFV solutions (independent of technology)
- Explain how SDN and NFV complement and reinforce each other
- Explain the concept of a service chain
- Determine required SDN controller functionality
- Explain the interfaces and functionality of SDN and NFV components
- Identify the various components in an SDN/NFV system
- Select products for networking services based on the business requirements using SDN/NFV
- Explain the three levels of SDN as defined in the MEF Network Foundations examination blueprint
- Explain the various SDN frameworks
- Anticipate potential issues and determine how to prevent them
- Describe the steps when integrating a new network element/network function into an SDN/NFV domain

The MQC is expected to participate in these tasks with substantial guidance, mentoring, or instruction:

- Implement an SDN/NFV solution
- Implement a service chain
- Troubleshoot SDN/NFV technologies when they break or are misconfigured

- Choose and install an SDN controller
- Select an SDN and NFV ecosystem based on the functional requirements of the services each will carry
- Integrate a new network element/network function into an SDN/NFV domain
- Capacity planning/dimensioning/scale in and scale out of network functions and SDN controllers

The MQC is should be able to perform these tasks, or to define these terms, which are below the knowledge, skills, and abilities assessed on this exam:

- Definitions of SDN, characteristics of SDN solutions, evolution, benefits, challenges in deployment, scenario & implementation analysis, understanding the components involved in an SDN solution. This knowledge is concept-level only.
- Definitions of NFV, characteristics of NFV solutions, evolution, benefits, challenges in deployment, scenario & implementation analysis, security, understanding the components involved in an NFV solution. This knowledge is concept-level only.[1]

The MQC may be able to perform these tasks, but it is not expected at this level:

- Software development
- Hardware design
- Develop and program an SDN application or controller service
- Develop and program a network function
- Onboard a virtual network function
- Complete network design of an operator network

The MQC should be familiar with these tools:

- Packet analyzer
- Network simulator/emulator
- Desktop Hypervisor

The MQC should be comfortable working in these environments:

- Virtualization environments
- Production network environment
- Telecom industry

[1] Note: Concept-level understanding of software defined networking and network functions virtualization technologies and practices are two of the major 5 domains in the MEF Network Foundations certification exam. For more introduction on this introductory certification examination or to secure training, please visit http://www.mefprocert.com/mef-nf-overview

2 Certification Exam Development Process

One of the initial steps in test development is to outline the depth and breadth of the content area domains that will form the basis for the SDN/NFV certification examination. It is advised to rely on Subject Matter Experts (SMEs) to define the content area and the relative emphasis of each area of content on the final exam forms. MEF secured subject matter experts from a global audience of expertise to assure the highest quality of the examination.

The purpose of this report is to document the results of a blueprint weighting process conducted with Job Task Analysis (JTA) SMEs, the results of the blueprint survey completed by 73 respondents, and the final item allocation decisions made by MEF for the SDN/NFV examination. This report contains an approved test specification blueprint that includes the recommended weighting of each section and objectives for the exam. To every extent possible, references to areas address on the exam are also included, but these in no way are a guarantor that every question item was developed exclusively from this reference material.

2.1 Job Task Analysis (JTA) and Test Specification (Blueprint) Development

2.1.1 Job Task Analysis

Through a Job Task Analysis workshop, which involved the determination by a group of subject experts in both SDN and NFV, representing not only themselves, but their companies and several industry standards bodies worldwide that develop SDN and NFV standards, specific key responsibilities and competencies required for effective performance in SDN and NFV (as well as their intersection) are identified. Subject matter experts (SMEs) are assembled who then participate in a focus group which MEF facilitates. The focus group evaluates the necessary knowledge, skills and abilities (KSA's) necessary to measure the desired level of competency in a given technology specialization, including establishment of tasks and subtasks that are required to earn the certification.

2.1.2 Test Specification (Blueprint) Development

The development of a test specification (blueprint) document[2] for the MEF-SDN/NFV certification exam follows the Job Task Analysis and ensures that each section and objective is appropriately represented on the test. Ratings are solicited from the SMEs during the Job Analysis in order to ensure that the weightings of each objective are appropriate.

2.1.3 Question Item Writing Workshop

A group of selected SMEs is recruited and is trained to write test items/questions. They are all trained in a Question Item Writing Workshop. During the workshop, a professional educational facilitator conducts item writing training and directs the item writing process. MEF staff assist in

[2] The test specification documents for each MEF professional certification are listed on the **MEF Reference Website** (https://wiki.mef.net) and can be reached by searching for the specific examination. To keep the content up-to-date and reflecting the current state and practice of a specific technology area, these blueprints are updated, corrected, and elaborated as technologies mature. The address for the current state of the MEF-SDN/NFV certification blueprint is https://wiki.mef.net/pages/viewpage.action?pageId=75990347

the process. The SMEs then author questions on their own time and submit them for editing and review. Each item is designed to be an accurate measure of knowledge and relevancy to the goals of the testing program, as well as psychometrically[3] sound and legally defensible.

2.2 Blueprint Weighting Process

The final step for the SMEs who participated in the JTA workshop was to weight and rate the blueprint sections and objectives, respectively. Note, there was not time to complete this exercise during the in-person JTA workshop held October 22-23, 2017. A virtual 2-hour call was held on December 5, 2017 with JTA SMEs to complete the blueprint weighting exercise. Rick Bauer of the MEF defined the rating scales for both frequency and criticality based on examples provided by Alpine (MEF's contract psychometrician). The scales are provided below.

The definition of the numerical markers for the frequency scale was established in terms of how frequently the MQC would use the knowledge, skill, or competency presented in the task objective:

5 = Daily (at least one time per day)
4 = Weekly (one to four times per week)
3 = Monthly (one to three times per month)
2 = Quarterly (two to four times per year)
1 = Yearly (one or fewer times per year)

The definition of the numerical markers for the criticality scale was established according to the ramifications of a minimally qualified candidate's (MQC) failure to master the knowledge, skill, or competency presented in the objective:

5 = Complete failure, ALL networks are stopped (all systems down)
4 = Critical failure, significant network disruption (some systems down)
3 = Substantial risk of network disruption (all systems up, poor performance)
2 = Moderate risk of network disruption (all systems up, possible poor performance)
1 = Networks not disrupted but there is an administration/communications inconvenience

2.3 MEF SDN/NFV Likely Job Descriptions

Job Position	Primary Job Responsibilities
Manager/Director for a Network/IT Group	Career Development for Staff Assignment of responsibilities Articulating needs of staff to higher technical and management leadership
Network Technician (Operator Level)	Installation/Migration (practitioner level) Monitoring (practitioner level)

[3] **Psychometrics** is the field of study concerned with the theory and technique of psychological measurement. As defined by the National Council on Measurement in Education (NCME), psychometrics refers to psychological measurement. Generally, it refers to the field in psychology and education that is devoted to testing, measurement, assessment, and related activities. The field is concerned with the objective measurement of skills and knowledge, abilities, attitudes, competencies in various fields of practice, and educational achievement. Some psychometric researchers focus on the construction and validation of assessment instruments such as questionnaires, tests, and skills certifications. Practitioners are described as psychometricians. Psychometricians usually possess a specific qualification, and most are psychologists with advanced graduate training.

Job Position	Primary Job Responsibilities
IT Analyst (Operator Level)	Recommend IT Architectures/Products/Systems Performance & Monitoring (see above in Network Technician) Business ROI Comparisons
System Administrator (Operator Level)	Manage Networks and IT Systems Operations Process Deploy Server/Network/Storage Infrastructure Hypervisors/Overlays/Virtual Switches
Consultant/Professional Services Engineer	Design/Implement Network Services ROI/CapEx/OpEx Analysis Business Proposals Recommendations for Network Architecture/Integration
Student/Faculty	Learning more advanced networking technologies Looking for Future Job/Career Fundamental Understanding from Practitioner Level
Sales Representatives	Sell SDN/NFV/Advanced Networking Solutions or Services (assumes product knowledge about specific networking hardware/software) Identify Opportunities and Sales Insertion Points Can carry on an intelligent and informed conversation with every individual in a sales cycle process
IT Project Manager (assumes knowledge, skills, abilities in a project management domain)	Sets/Manages schedules for IT projects Assign resources based on project estimates and deliverables Creates and updates project plans Capable of discussions with IT subject matter experts in various networking domains Communications with stakeholders
IT Program Manager (assumes knowledge, skills, abilities in a program management domain)	Manage Budget/Resources (financials) Business Case Development (technical and financial) Procurement & Contract Management & Product Certification via Testing and Interoperability via published recommendations Governance/Control/Alignment of Operations
Help Desk/NOC Engineer	Network support Network outage escalations (with experience)

The major focus of this certification is the IT professional currently working in network operations (server, network, storage administrators) who is seeking greater responsibility in their current job or seeking to validate new skills to gain a better job, are interested in modern network technologies. Additionally, the marketing, support, product management, and practitioner-level technical training needs of companies that make or utilize these technologies would also benefit by training and certification with this credential.

The breadth of skills necessary to address all the facets of advanced networking is daunting and growing daily. The growing body of vendor-neutral information that an IT technical professional needs to know (networking, virtualization—in many forms, as well as the knowledge to plan, install, and operate advanced SDN and NFV networks) is no longer found in any one domain, but must be acquired intentionally across a larger variety of previously separated disciplines. The migration from a single-role network administrator, responsible for only one function of the network, to a multi-skilled and multivendor set of professionals managing a complex set of technologies, has already begun. For those network engineers who are practitioners with standard networking equipment and want to make the move to more software-driven topologies and technologies, this certification could validate their operational competence in the world of advanced, virtualized networking featuring SDN and NFV.

2.4 Prerequisite Knowledge and Recommended Validation Certification

In order to pass the MEF SDN/NFV certification 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. Such knowledge is formally validated by the CompTIA Network+™ certification examination. Additionally, the MEF Network Foundations certification training and exam is a thorough introduction to SDN and NFV. At least two years' familiarity with the technologies of SDN/NFV are recommended. Resources that would be helpful include publications on networking, as well as foundational certifications in networking from Cisco, Citrix, CompTIA, Juniper, or Microsoft, and materials freely available from MEF, Open Networking Foundation, ETSI-NFV, and SDN/NFV projects from The Linux Foundation.

2.5 Summary Diagram of Process Workflow in MEF Professional Exam Development Certification

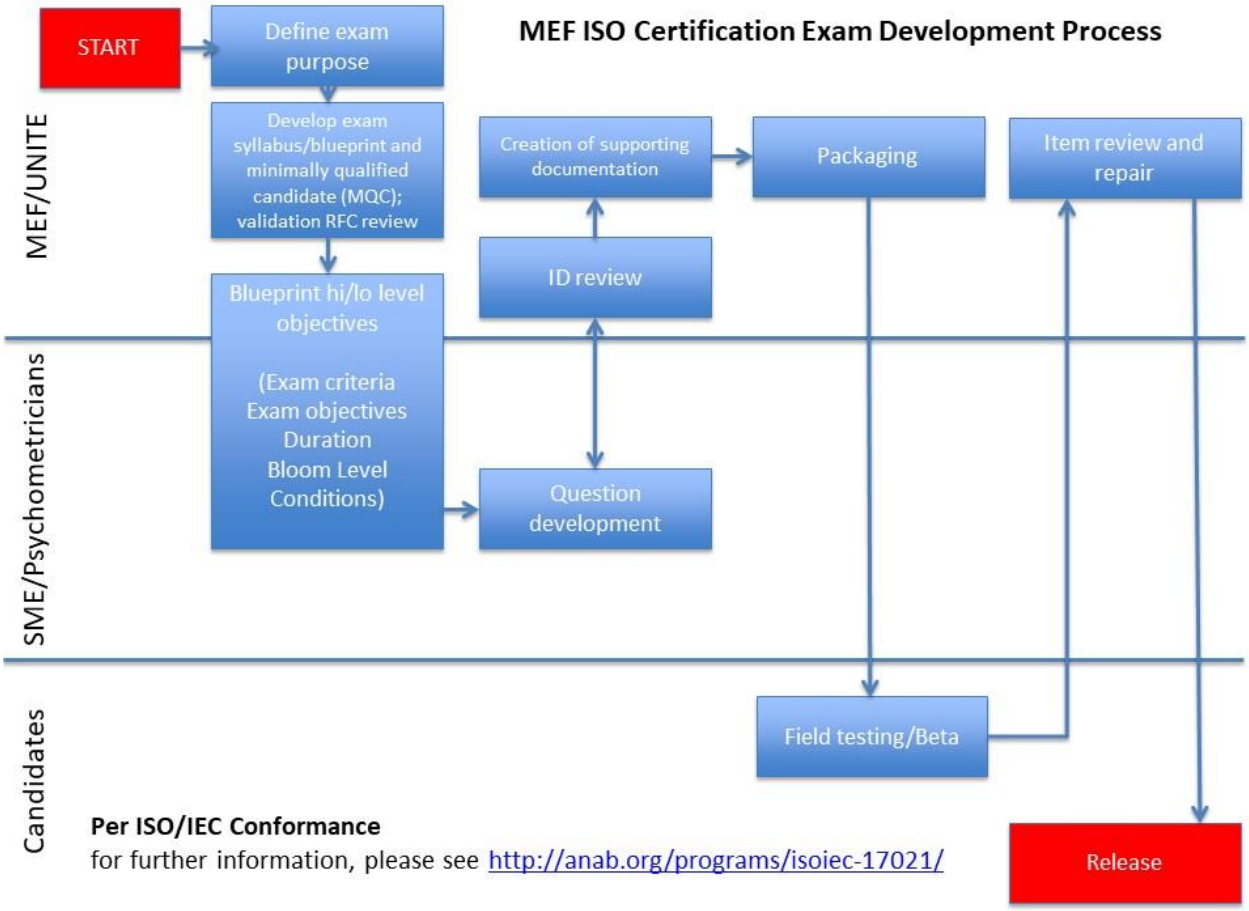

Figure 2: The MEF Professional Exam Development Process (per ISO/IEC Specification 17024)

3 MEF SDN/NFV Certified Professional: Certification Examination Blueprint & References (v1.0 June 2018; Release Candidate Exam)

Domain & Item #	Blueprint Requirement	Reference(s)	Cognitive Complexity[4]	Weighting	Items/ Form
1	**Plan**			**35.71%**	**25**
1.01	Validate conceptual architecture	*Network Functions Virtualization with a Touch of SDN* (Chayapathi, Hassan, Shah), Addison-Wesley 2017 Chapter 3: Designing NFV Networks; *Network Function Virtualization* (Nadeau, Gray), Morgan Kaufmann, 2016, Chapter 1: Network Function (sic) Virtualization; *Software Defined Networks, 2nd Edition* (Goransson, Black, Culver), Morgan Kaufmann, 2016, Chapter 5	A/E	7.14%	5
1.02	Specify service requirements and characteristics	"On the controller placement for designing a distributed SDN control layer" (IEEE); http://www.etsi.org/deliver/etsi_gs/NFV-IFA/001_099/010/02.01.01_60/gs_nfv-ifa010v020101p.pdf ; http://innovation.verizon.com/content/dam/vic/PDF/Verizon_SDN-NFV_Reference_Architecture.pdf ; *Software Defined Networks, 2nd Edition* (Goransson, Black, Culver), Morgan Kaufmann, 2016, Chapter 12;	U/A	5.71%	4
1.03	Determine high level test plans for validating new SDN and NFV components	ETSI GS NFV-TST 001 V1.1.1: Network Functions Virtualisation (NFV); Pre-deployment Testing; Report on Validation of NFV Environments and Services Section 7.1.3 http://www.etsi.org/deliver/etsi_gs/NFV-TST/001_099/001/01.01.01_60/gs_nfv-tst001v010101p.pdf ; ETSI GS NFV 001, Network Functions Virtualisation (NFV); Use Cases; ETSI GS NFV 003, Network Functions Virtualisation (NFV); Terminology for Main Concepts; ETSI NFV GS NFV 004, Network Functions Virtualisation (NFV); Virtualisation Requirements; ETSI GS NFV-PER 001, Network Functions Virtualisation (NFV); NFV Performance & Portability	A/E	4.29%	3
1.04	Determine which service elements need to be obtained	ETSI GS NFV-TST 001 V1.1.1: Network Functions Virtualisation (NFV); Pre-deployment Testing; Report on Validation of NFV Environments and Services; https://searchsdn.techtarget.com/tip/What-do-we-need-from-NFV-orchestration : MEF White Paper: Understanding SD-WAN Managed Services, Section 4	A/E	7.14%	5
1.05	Evaluate a network service leveraging SDN and NFV technologies	http://searchsdn.techtarget.com/tip/The-future-of-SDN-in-2018-moves-toward-increased-automation ; http://searchsdn.techtarget.com/essentialguide/SDN-use-cases-emerge-across-the-LAN-WAN-and-data-	A/E	5.71%	4

[4] Cognitive Complexity is a psychological characteristic or psychological variable that indicates how complex or simple is the frame and perceptual skill of a person. A person who is measured high on cognitive complexity tends to perceive nuances and subtle differences which a person with a lower measure, indicating a less complex cognitive structure for the task or activity, does not (adapted from Wikipedia). The abbreviations and comparative weightings of cognitive complexity on the MEF-SDN/NFV exam are illustrated in figure 3, page 15, following.

Domain & Item #	Blueprint Requirement	Reference(s)	Cognitive Complexity[4]	Weighting	Items/ Form
		center ; http://www.etsi.org/deliver/etsi_gs/NFV-INF/001_099/010/01.01.01_60/gs_NFV-INF010v010101p.pdf ;			
1.06	Evaluate an SDN Controller (and potentially other SDN/NFV components)	*Software Defined Networks, 2nd Edition* (Goransson, Black, Culver), Morgan Kaufmann, 2016, Chapter 12; https://onosproject.org/features/ ; https://www.opendaylight.org/what-we-do/odl-platform-overview ;	A/E	5.71%	4
2	**Build**			**35.71%**	**25**
2.01	Identify the steps to integrate a new network element/network function into an SDN/NFV domain	ETSI GS NFV 002; OpenFlow Specification (https://www.opennetworking.org/wp-content/uploads/2014/10/openflow-switch-v1.5.1.pdf); ETSI GS NFV-MAN 001; *Software Defined Networks, 2nd Edition* (Goransson, Black, Culver), Morgan Kaufmann, 2016, Chapter 10;	U/A	5.71%	4
2.02	Define service chain instantiation parameters	*Software Defined Networks, 2nd Edition* (Goransson, Black, Culver), Morgan Kaufmann, 2016, Chapter 10;	U/A	5.71%	4
2.03	Identify resource limitations and provision resources	http://docs.oasis-open.org/tosca/tosca-nfv/v1.0/csd04/tosca-nfv-v1.0-csd04.html#_Toc482896050 ; *Network Functions Virtualization with a Touch of SDN* (Chayapathi, Hassan, Shah), Addison-Wesley 2017 Chapter 3: Designing NFV Networks; http://innovation.verizon.com/content/dam/vic/PDF/Verizon_SDN-NFV_Reference_Architecture.pdf	U/A	5.71%	4
2.04	Select an implementation based on constraints	*Software Defined Networks, 2nd Edition* (Goransson, Black, Culver), Morgan Kaufmann, 2016, Chapters 12, 14; ETSI GS NFV 001;	U/A	4.29%	3
2.05	Apply procedures to implement QoS	OpenFlow 1.3 Specification; http://www.etsi.org/deliver/etsi_gs/NFV-INF/001_099/010/01.01.01_60/gs_NFV-INF010v010101p.pdf ;	U/A	4.29%	3
2.06	Select the appropriate method to make an SDN/NFV network and the services secure	Towards Secure and Dependable Software-Defined Networks (public domain), (Kreutz, Ramos, Verissimo), https://dl.acm.org/citation.cfm?id=2491199 ; *Building the Network of the Future* (Donovan, Prabhu), 2017, CRC Press, Chapter 9; *Software Defined Networks, 2nd Edition* (Goransson, Black, Culver), Morgan Kaufmann, 2016, Chapters 7, 10; OpenFlow 1.3 Specification; https://www.networkworld.com/article/2840273/sdn/sdn-security-attack-vectors-and-sdn-hardening.html ;	U/A	4.29%	3

Domain & Item #	Blueprint Requirement	Reference(s)	Cognitive Complexity[4]	Weighting	Items/ Form
2.07	Apply procedures to compose a network service leveraging SDN and NFV technologies	*Building the Network of the Future* (Donovan, Prabhu), 2017, CRC Press, Chapter 9;	U/A	5.71%	4
3	**Operate**			**28.57%**	**20**
3.01	Identify essential health metrics and most common points of failure for SDN and NFV components	https://www.nctatechnicalpapers.com/Paper/2016/2016-assessing-network-and-equipment-failures-in-the-new-sdn-nfv-architectures/download ; *Software Defined Networks, 2nd Edition* (Goransson, Black, Culver), Morgan Kaufmann, 2016, Chapter 5; OpenFlow Switch Specification Version 1.X ONF TS-002;	U/A	5.71%	4
3.02	Apply procedures to update a service based on events and manage alerts and remediation	http://innovation.verizon.com/content/dam/vic/PDF/Verizon_SDN-NFV_Reference_Architecture.pdf ; ETSI GS NFV-SWA 001 V1.1.1; https://www.opennetworking.org/wp-content/uploads/2013/02/TR_SDN_ARCH_1.0_06062014.pdf ;	U/A	5.71%	4
3.03	Identify the interaction point with an SDN/NFV system (for a particular task)	NFV and SDN architecture specifications; OpenFlow Architecture Specification; ETSI GS NFV-MAN 001; *Software Defined Networks, 2nd Edition* (Goransson, Black, Culver), Morgan Kaufmann, 2016, Chapter 4; http://www.etsi.org/deliver/etsi_gs/NFV-MAN/001_099/001/01.01.01_60/gs_NFV-MAN001v010101p.pdf	U/A	5.71%	4
3.04	Identify the components of SDN and NFV technologies that contribute to an overall disaster recovery plan	*Network Functions Virtualization with a Touch of SDN* (Chayapathi, Hassan, Shah), Addison-Wesley 2017 Chapter 3: Designing NFV Networks	U/A	5.71%	4
3.05	Apply procedures to upgrade network software	Considerations, Best Practices and Requirements for a Virtualised Mobile Network https://www.gsma.com/futurenetworks/wp-content/uploads/2017/05/Virtualisation.pdf ; https://www.cisco.com/c/dam/en_us/training-events/product-training/prime-infrastructure-31/ja-swim/PI31-UpgradingDeviceSoftwareImages-JobAid.pdf ;	U/A	5.71%	4
	Total			**100%**	**70**

3.1 Cognitive Complexity Map for the MEF-SDN/NFV Examination Blueprint

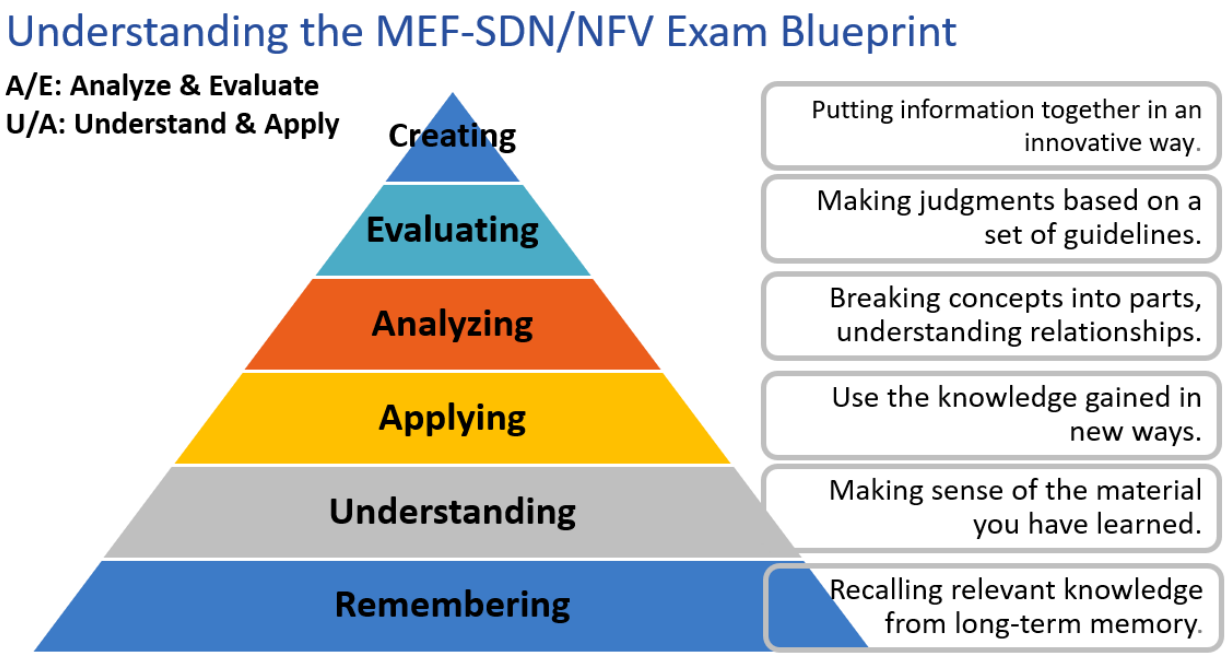

Figure 3: The Cognitive Complexity Map for the MEF-SDN/NFV Certification Examination Blueprint

4 List of Abbreviations, Acronyms, and Defined Terms

Please *note: terms and basic definitions are referenced to Wikipedia and TechTerms.com, reference texts, as well as other non-proprietary sources, including MEF[5] and other SDO publications as referenced in Section 5: References. Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV (ETSI GS NFV v1.2.1 (2014-12) Group Specification, used by permission of ETSI Industry Specification Group. All terms reproduced by permission of their respective copyright owners, unmodified.*

4.1 Expansive Defined Terms Dictionary and Acronym of SDN/NFV

Note: not all of these items are used on the exams, but these terms are curated by various standards organizations for a broader level of understanding.

Term, Abbreviation, or Acronym	Full Text Name/Definition
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.

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Term, Abbreviation, or Acronym	Full Text Name/Definition
Access Provider	A wide area network service provider that delivers connectivity between an ENNI and one of more UNIs
ACL	Access Control List
A-CPI	Application-controller plane interface
AES	Advanced Encryption Standard
Agile	Relating to a Service Provider's ability to rapidly introduce new, on demand services using new technologies without disrupting their top-to-bottom operational environment. Agility can be achieved via proper product / service / resource abstractions using APIs and orchestration.
API	Application Program Interface. In the context of LSO, API describes one of the Management Interface Reference Points based on the requirements specified in an Interface Profile, along with a data model, the protocol that defines operations on the data and the encoding format used to encode data according to the data model.
ARP	Address Resolution Protocol
ASIC	Application-Specific Integrated Circuit
Assured	Relating to the Customer's expectations that a network Connectivity Service will provide consistent performance and security assurances to meet the needs of their applications.
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.
BSS	Business Support System
Business Process Flow	Graphically represents the behavior of Process Elements in an "end-to-end" or "through" Process view across the business (i.e., Enterprise).
CAPEX	CAPital EXpenditure. Money spent by a business or organization on acquiring or maintaining fixed assets, such as land, buildings, and equipment.
CE 2.0	Carrier Ethernet 2.0 generation
CHAP	Challenge Handshake Redundancy Protocol
CLI	Command Line Interface
CO	Central Office. A CO contains at least one Class-5 telephone switch, which is a telephone switch or telephone exchange in the public switched telephone network located at the local telephone company's central office, directly serving subscribers. Class-5 switch services include basic dial-tone, calling features, and additional digital and data services to subscribers connected to a local loop.
Compute Domain	Domain within the NFVI that includes servers and storage
Compute Note	Abstract definition of a server

Term, Abbreviation, or Acronym	Full Text Name/Definition
Controller	see *SDN Controller*
Connectivity Service	A service delivering network connectivity (i.e. traffic) among service access points described by a set of both static and/or dynamic service attributes.
CPU	Central Processing Unit; device in the compute node that provides the primary container interface
Customer	A Customer is the organization purchasing, managing, and/or using Connectivity Services from a Service Provider. This may be an end user business organization, mobile operator, or a partner network operator.
DC	Data Center
Data link layer	The second lowest layer of the seven-layer Open Systems Interconnection (OSI) model of computer networking.
Data Model	Models managed objects based on an Information Model at a more detailed level using a specific data modeling language. Data modeling languages include XSD, IDL, and YANG.
DDoS	Distributed Denial of Service. In computing, a denial-of-service attack (DDoS attack) is a cyber-attack where the perpetrator seeks to make a machine or network resource unavailable to its intended users by temporarily or indefinitely disrupting services of a host connected to the Internet. Denial of service is typically accomplished by flooding the targeted machine or resource with superfluous requests in an attempt to overload systems and prevent some or all legitimate requests from being fulfilled.
DHCP	Dynamic Host Configuration Protocol
DPI	Deep Packet Inspection
DNS	Domain Name System
EMS	Element Management System. A management system used to manage the individual network elements as well as the networks that connect them. One or more EMSs may be deployed within a Service Provider management domain depending on the different supplier products and geographic distribution of the network elements in the network.
ENNI	External Network-to-Network Interface. A reference point representing the boundary between two Operator networks that are operated as separate administrative domains.
EPL	Ethernet Private Line
EVC	Ethernet Virtual Connection. An association of two or more Ethernet UNIs.
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.

Term, Abbreviation, or Acronym	Full Text Name/Definition
Frame	A unit of data transferred over a L2 network
FTP	File Transfer Protocol
FOSS	Free and Open Source Software
Forwarding Construct (FC)	Enabled forwarding between two or more LTPs which supports any transport protocol including all circuit and packet forms.
Forwarding Domain (FD)	The topological component which represents the opportunity to enable forwarding between points represented by LTPs.
Functional Management Entity	A set of specific management layer functionality within the LSO Reference Architecture.
HTTP	Hypertext Transfer Protocol. A stateless application-level protocol for distributed, collaborative, hypertext information systems.
HTTPS	Hypertext Transfer Protocol Secure
IaaS	Infrastructure as a Service. (IaaS) refers to online services that provide high-level APIs used to de-reference various low-level details of underlying network infrastructure like physical computing resources, location, data partitioning, scaling, security, backup etc. A hypervisor runs the virtual machines as guests. Pools of hypervisors within the cloud operational system can support large numbers of virtual machines and the ability to scale services up and down according to customers' varying requirements. IaaS clouds often offer additional resources such as a virtual-machine disk-image library, raw block storage, file or object storage, firewalls, load balancers, IP addresses, virtual local area networks (VLANs), and software bundles
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. Models managed objects at a conceptual level, independent of any specific implementations or protocols used to transport the data. Information models may be described using UML class diagrams.
INNI	Internal Network-to-Network Interface. A reference point representing the boundary between two networks or network elements that are operated within the same administrative domain.
Interface Profile	Defines the structure, behavior, and semantics supporting a specific Management Interface Reference Point identified in the LSO Reference Architecture. The Interface Profile specification contains all the necessary information to implement the related API, including objects, attributes, operations, notifications, and parameters.
iSCSI	Internet Small Computer Systems Interface

Term, Abbreviation, or Acronym	Full Text Name/Definition
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
JavaScript Object Notation (JSON)	A text format that facilitates structured data interchange between all programming languages.
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 the network layer in the OSI model
Layer 4 or Layer Four or L4	See the transport layer in the OSI model
Layer 5 or Layer Five or L5	See the session layer in the OSI model
Layer 6 or Layer Six or L6	See the presentation layer in the OSI model
Layer 7 or Layer Seven or L7	See the 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
Lifecycle Service Orchestration (LSO)	Open and interoperable automation of management operations over the entire lifecycle of Layer 2 and Layer 3 Connectivity Services. This includes fulfillment, control, performance, assurance, usage, security, analytics and policy capabilities, over all the network domains that require coordinated management and control in order to deliver the service. LSO is an agile approach to streamlining and automating the service lifecycle in a sustainable fashion for coordinated management and control across all network domains responsible for delivering an

Term, Abbreviation, or Acronym	Full Text Name/Definition
	end-to-end Connectivity Service (e.g., Carrier Ethernet, IP VPN, MPLS, etc.).
LSO Reference Architecture	A layered abstraction architecture that characterizes the management and control domains and entities, and the interfaces among them, to enable cooperative orchestration of Connectivity Services.
Logical Termination Point (LTP)	Termination point that encapsulates the termination, adaptation and OAM functions of one or more transport layers.
MAC	Media Access Control
MAN	Metropolitan Area Network
MANO	Management and Orchestration (see also NFV MANO)
Management Abstraction	A management view of information categories and high-level information classes that hides the details of the underlying complexity. LSO identifies Management Abstractions for the Product, Service, and Resource views.
Management Interface Reference Point	The logical point of interaction between specific management entities
MPLS	Multiprotocol Label Switching Protocol
NaaS	Network-as-a-Service
NAT	Network Address Translation
Network Control Domain	Manages the subnetwork boundary edge to subnetwork boundary edge aspects of the network connectivity along with the resources and infrastructure under its control within a specific subnetwork domain.
Network controller	Functional block that centralizes some or all of the control and management functionality of a network domain and may provide an abstract view of its domain to other functional blocks via well-defined interfaces (ETSI)
Network forwarding path	Ordered list of connection points forming a chain of NFs, along with policies associated to the list (ETSI)
Network Function (NF)	Functional block within a network infrastructure that has well-defined external interfaces and well-defined functional behavior. In practical terms, a Network Function is today often a network node or physical appliance. (ETSI)
NF set	A collection of NFs with unspecified connectivity between them (ETSI)
Network forwarding graph	The graph of logical links connecting NF nodes for the purpose of describing traffic flow between these network functions (ETSI)
Network layer	Provides the functions and processes that allow data to be transmitted from sender to receiver across multiple intermedia networks.
Network operator	Defined as an operator of an electronics communications network or part thereof. An association or organization of such network operators also falls within this category (ETSI)
NFV	Network Functions Virtualization. The principle of separating network functions

Term, Abbreviation, or Acronym	Full Text Name/Definition
	from the hardware they run on by using virtual hardware abstraction (ETSI). Network functions virtualization (NFV) is an initiative to virtualize the network services that are now being carried out by proprietary, dedicated hardware. If successful, NFV will decrease the amount of proprietary hardware that's needed to launch and operate network services.
NFVI	Network Functions Virtualisation Infrastructure (NFVI): totality of all hardware and software components that build up the environment in which VNFs are deployed. The NFV-Infrastructure can span across several locations, e.g. places where data centers are operated. The network providing connectivity between these locations is regarded to be part of the NFV- Infrastructure. NFV-Infrastructure and VNF are the top-level conceptual entities in the scope of Network Function Virtualization. All other components are sub-entities of these two main entities. (ETSI)
NFVI Components	Network Functions Virtualisation Infrastructure (NFVI) components: NFVI hardware resources that are not field replaceable, but are distinguishable as COTS components at manufacturing time (ETSI)
NFV component	NFVI hardware resource that is not field replaceable, but is distinguishable as a COTS component at manufacturing time (ETSI)
NFV framework	The totality of all entities, reference points, information models and other constructs defined by the specifications published by the ETSI ISG NFV
NFVI Node	Network Functions Virtualisation Infrastructure Node (NFVI-Node): physical device[s] deployed and managed as a single entity, providing the NFVI Functions required to support the execution environment for VNFs (ETSI)
NFV Orchestrator (NFVO)	The functionality that coordinates the management of the connectivity lifecycle, Virtualized Network Functions (VNF) lifecycle, and Network Functions Virtualization Infrastructure (NFVI) resources to ensure an optimized allocation of the necessary supporting resources and connectivity. The functional block that manages the Network Service (NS) lifecycle and coordinates the management of NS lifecycle, VNF lifecycle (supported by the VNFM) and NFVI resources (supported by the VIM) to ensure an optimized allocation of the necessary resources and connectivity (ETSI)
NFVI-PoP	Network Function Virtualisation Infrastructure Point of Presence (NFVI-PoP): N-PoP where a Network Function is or could be deployed as Virtual Network Function (VNF) (ETSI)
NFV-MANO	Network Functions Virtualisation Management and Orchestration (NFV-MANO): functions collectively provided by NFVO, VNFM, and VIM (ETSI)
NFV-MANO Architectural Framework	Network Functions Virtualisation Management and Orchestration Architectural Framework (NFV-MANO Architectural Framework): collection of all functional blocks (including those in NFV-MANO category as well as others that interwork with NFV-MANO), data repositories used by these functional blocks, and reference points and interfaces through which these functional blocks exchange information for the purpose of managing and orchestrating NFV (ETSI)
Network Service	A template that describes the deployment of a Network Service including service

Term, Abbreviation, or Acronym	Full Text Name/Definition
Descriptor	topology (constituent VNFs and the relationships between them, Virtual Links, VNF Forwarding Graphs) as well as Network Service characteristics such as SLAs and any other artefacts necessary for the Network Service on-boarding and lifecycle management of its instances (ETSI)
Network Service Orchestration	The subset of NFV Orchestrator functions that are responsible for Network Service lifecycle management (ETSI)
Network Stability	The ability of the NFV framework to maintain steadfastness while providing its function and resume its designated behavior as soon as possible under difficult conditions, which can be excessive load or other anomalies not exceeding the design limits.
Network Service Provider	A type of Service Provider implementing the Network Service
NIC	Network Interface Controller (NIC): device in a compute node that provides a physical interface with the infrastructure network (ETSI)
NOC	Network Operations Center
NBI	North Bound Interface (see SDN Architecture). In a software-defined network (SDN) architecture, the northbound application program interfaces (APIs) are used to communicate between the SDN Controller and the services and applications running over the network. The northbound APIs can be used to facilitate innovation and enable efficient orchestration and automation of the network to align with the needs of different applications via SDN network programmability.
NFaaS	Network Functions-as-a-Service
NOS	Network Operating System
NV-GRE	Network Virtualization Using Generic Routing Encapsulation
OAM	Operations, Administration, and Maintenance
Object Class	Used to convey the representation of an entity, including behavior, properties, and attributes. An instance of an Object Class may be referred to as an Object.
OC	Optical Carrier
OFA	OpenFlow agent
OFC	OpenFlow controller
OPEX	OPerational EXpense. An operating expense, operating expenditure, operational expense, operational expenditure or OPEX is an ongoing cost for running a product, business, or system. Its counterpart, a capital expenditure (CAPEX), is the cost of developing or providing non-consumable parts for the product or system. For example, the purchase of a photocopier involves CAPEX, and the annual paper, toner, power and maintenance costs represents OPEX. For larger systems like businesses, OPEX may also include the cost of workers and facility expenses such as rent and utilities.
Operator Service Endpoint	The demarcation points between network operators

Term, Abbreviation, or Acronym	Full Text Name/Definition
OSS	Operational Support System
Operator Virtual Connection (OVC)	An association of “external interfaces” within the same Operator network.
Orchestrated	Relating to automated service management across potentially multiple operator networks which includes fulfillment, control, performance, assurance, usage, security, analytics, and policy capabilities, which are achieved programmatically through APIs that provide abstraction from the particular network technology used to deliver the service.
OS	Operating System
OSPF	Open Shortest Path First
OTN	Optical Transport Network
OTT	Over the Top
OTU	Optical Channel Transport Unit
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.
Partner	An organization providing Products and Services to the Service Provider in order to allow the Service Provider to instantiate and manage Service Components external to the Service Provider domain.
Physical layer	lowest layer of the seven-layer Open Systems Interconnection (OSI) model of computer networking
Physical Network Function (PNF)	The implementation of a NF via a tightly coupled software and hardware system (ETSI)
Pipeline Processing	A chain of data-processing processes or other software entities
PaaS	Platform-as-a-Service
PNF	Physical Network Function
Public Key Infrastructure (PKI)	A public key infrastructure (PKI) is a set of roles, policies, and procedures needed to create, manage, distribute, use, store, and revoke digital certificates and manage public-key encryption. The purpose of a PKI is to facilitate the secure electronic transfer of information for a range of network activities such as e-commerce, internet banking and confidential email. It is required for activities where simple passwords are an inadequate authentication method and more

Term, Abbreviation, or Acronym	Full Text Name/Definition
	rigorous proof is required to confirm the identity of the parties involved in the communication and to validate the information being transferred. In cryptography, a PKI is an arrangement that binds public keys with respective identities of entities (like people and organizations). The binding is established through a process of registration and issuance of certificates at and by a certificate authority (CA). Depending on the assurance level of the binding, this may be carried out by an automated process or under human supervision.
Port	A virtual data connection between computer programs connected through a computer network
Process	A systematic, sequenced set of functional activities that deliver a specified result. In other words, a Process is a sequence of related activities or tasks required to deliver results or outputs.
Product Lifecycle	The sequence of phases in the life of a Product Offering, including definition, planning, design and implementation of new Product Offerings, changes for existing Product Offerings, and the withdrawal and retirement of Product Offerings.
P-SDN	Packet-Software Defined Networking
PSTN	Public Switched Telephone Network
QOS	Quality of Service
RDP	Remote Desktop Protocol
Resilience	In an NFV network, the ability of the NFV framework to limit disruption and return to normal or at a minimum acceptable service delivery level in the face of a fault, failure, or an event that disrupts the normal operation (ETSI)
Resource	A physical or non-physical component (or some combination of these) within a Service Provider's infrastructure or inventory.
Return on Investment (ROI)	Return on Investment (ROI) is the benefit to an investor resulting from an investment of some resource. A high ROI means the investment's gains compare favorably to its cost. As a performance measure, ROI is used to evaluate the efficiency of an investment or to compare the efficiencies of several different investments. In purely economic terms, it is one way of relating profits to capital invested.
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
SaaS	Software-as-a-Service

Term, Abbreviation, or Acronym	Full Text Name/Definition
Scaling	The ability to dynamically extend/reduce resources granted to the Virtual Network Function (VNF) as needed. NOTE: This includes scaling up/down and scaling out/in. Scaling out/in: ability to scale by add/remove resource instances (e.g. VM) (ETSI)
SDN	Software Defined Networking. (SDN) technology is an approach to computer networking that allows network administrators to programmatically initialize, control, change, and manage network behavior dynamically via open interfaces and provide abstraction of lower-level functionality. SDN is meant to address the fact that the static architecture of traditional networks doesn't support the dynamic, scalable computing and storage needs of more modern computing environments such as data centers. This is done by decoupling or disassociating the system that makes decisions about where traffic is sent (the SDN controller, or control plane) from the underlying systems that forward traffic to the selected destination (the data plane). SDN was commonly associated with the OpenFlow protocol (for remote communication with network plane elements for the purpose of determining the path of network packets across network switches) since the latter's emergence in 2011. Since 2012, however, many companies have moved away from OpenFlow, and have embraced different techniques. These include Cisco Systems' Open Network Environment and Nicira's network virtualization platform.
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 meet 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. An SDN Controller Translates SDN applications' requirements and exerts more granular control over network elements, while providing relevant information up to SDN applications.
SDO	Standards Development Organization
SD-WAN	An SD-WAN is a Wide Area Network (WAN) managed using the principles of

Term, Abbreviation, or Acronym	Full Text Name/Definition
	software-defined networking. The main driver of SD-WAN is to lower WAN costs using more affordable and commercially available leased lines, as an alternative or partial replacement of more expensive MPLS lines. Control and management is administered separately from the hardware with central controllers allowing for easier configuration and administration.
Service	Represents the Customer experience of a Product Instance that has been realized within the Service Provider's and / or Partners' infrastructure. (TMF GB922)
Service Component	A segment or element of a Service that is managed independently by the Service Provider.
Service Continuity	The continuous delivery of service in conformance with service's functional and behavioral specification and SLA requirements, both in the control and data planes, for any initiated transaction or session till its full completion even in the events of intervening exceptions or anomalies, whether scheduled or unscheduled, malicious, intentional or unintentional. (ETSI)
Service Access Point	The endpoint of a specific Connectivity Service at an Service Interface (e.g., UNI, ENNI).
Service Level Agreement (SLA)	The contract between the Customer and Service Provider or Operator specifying the agreed to service level commitments and related business agreements.
Service Level Specification (SLS)	The technical specification of the service level being offered by the Service Provider to the Customer.
Service Operations, Administration, and Maintenance (SOAM)	Mechanisms for monitoring connectivity and performance for entities (links, services, etc.) within the Carrier Ethernet Network.
SLA	A service-level agreement is an agreement between two or more parties, where one is the customer and the others are service providers. This can be a legally binding formal or an informal "contract" (for example, internal department relationships). The agreement may involve separate organizations, or different teams within one organization. Contracts between the service provider and other third parties are often (incorrectly) called SLAs – because the level of service has been set by the (principal) customer, there can be no "agreement" between third parties; these agreements are simply "contracts." Operational-level agreements or OLAs, however, may be used by internal groups to support SLAs. If some aspect of a service has not been agreed with the customer, it is not an "SLA"
Service Provider	The seller of network services. Defined as a company or organization, making use of an electronics communications network or part thereof to provide a service or services on a commercial basis to third parties (ETSI).
Service Specification	The detailed description of the characteristics and behavior of a Service.
SNMP	Simple Network Management Protocol
Synchronous Optical Networking (SONET)	Synchronous optical networking (SONET) and synchronous digital hierarchy (SDH) are standardized protocols that transfer multiple digital bit streams synchronously over optical fiber using lasers or highly coherent light from light-emitting diodes

Term, Abbreviation, or Acronym	Full Text Name/Definition
	(LEDs). At low transmission rates data can also be transferred via an electrical interface. The method was developed to replace the plesiochronous digital hierarchy (PDH) system for transporting large amounts of telephone calls and data traffic over the same fiber without synchronization problems.
Stateless v. Stateful packet flow classification	A stateless protocol is a communications protocol in which no information is retained by either sender or receiver. The sender transmits a packet to the receiver and does not expect an acknowledgment of receipt. A UDP connection-oriented session is a stateless connection because the system doesn't maintain information about the session during its life. A stateless protocol does not require the server to retain session information or status about each communications partner for the duration of multiple requests. In contrast, a protocol that requires keeping of the internal state on the server is known as a stateful protocol. A TCP connection-oriented session is a 'stateful' connection because both systems maintain information about the session itself during its life. Examples of stateless protocols include the Internet Protocol (IP), which is the foundation for the Internet, and the Hypertext Transfer Protocol (HTTP), which is the foundation of data communication for the World Wide Web.
STM	Synchronous Optical Networking
Subscriber	The buyer of network services
Subscriber Service Endpoint	The demarcation points for the beginning or end of a NaaS
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
TDM	Time Division Multiplexing
Tenant Domain	The domain that provides VNFs, and combinations of VNFs into Network Services, and is responsible for their management and orchestration, including their functional configuration and maintenance at application level
Transaction Language 1 (TL1)	Transaction Language 1 (TL1) is a widely used management protocol in telecommunications. It is a cross-vendor, cross-technology man-machine language, and is widely used to manage optical (SONET) and broadband access infrastructure in North America. TL1 is used in the input and output messages that pass between Operations Support Systems (OSSs) and Network Elements (NEs). Operations domains such as surveillance, memory administration, and access and testing define and use TL1 messages to accomplish specific functions between the OS and the NE. TL1 is defined in Telcordia Technologies (formerly Bellcore) Generic Requirements document GR-831-CORE.
TLS	Transport-Layer Security

Term, Abbreviation, or Acronym	Full Text Name/Definition
UDP	User Datagram Protocol
Unified Markup Language (UML)	A general-purpose, developmental, modeling language in the field of software engineering that is intended to provide a standard way to visualize the design of a system. (OMG UML)
Use Case	In UML, a Use Case represents one particular type of a system's behavior based on stimuli from an external source (i.e., an actor). A system may have several Use Cases that define all its behavior. (OMG UML)
User Network Interface (UNI)	The physical demarcation point between the responsibility of the Service Provider and the responsibility of the Customer.
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.
Virtual Application (VA)	The more general term for a piece of software which can be loaded into a Virtual Machine. NOTE: A VNF is one type of VA. (ETSI)
Virtualized CPU (vCPU)	A virtualized CPU created for a VM by a hypervisor. NOTE: In practice, a vCPU may be a time sharing of a real CPU and/or in the case of multi-core CPUs, it may be an allocation of one or more cores to a VM. It is also possible that the hypervisor may emulate a CPU instruction set such that the vCPU instruction set is different to the native CPU instruction set (emulation will significantly impact performance). (ETSI)
Virtualized Deployment Unit (VDU)	A construct that can be used in an information model, supporting the description of the deployment and operational behavior of a subset of a VNF, or the entire VNF if it was not componentized in subsets. NOTE: In the presence of a hypervisor, the main characteristic of a VDU is that a single VNF or VNF subset instance created based on the construct can be mapped to a single VM. A VNF may be modelled using one or multiple such constructs, as applicable. (ETSI)
Virtualized Infrastructure Manager (VIM)	A functional block that is responsible for controlling and managing the NFVI compute, storage and network resources, usually within one operator's Infrastructure Domain (e.g. NFVI-PoP) (ETSI)
Virtual Link	A set of connection points along with the connectivity relationship between them and any associated target performance metrics (e.g. bandwidth, latency, QoS). NOTE: The Virtual Link can interconnect two or more entities (VNF components, VNFs, or PNFs) and it is supported by a Virtual Network (VN) of the NFVI. (ETSI)
VM	Virtual Machine. A virtualized computation environment that behaves very much like a physical computer/server. A VM has all its ingredients (processor, memory/storage, interfaces/ports) of a physical computer/server, and is generated by a Hypervisor, which partitions the underlying physical resources and allocates them to VMs. Virtual Machines are capable of hosting a VNF Component (VNFC). (ETSI)
Virtual network	A virtual network routes information among the network interfaces of VM instances and physical network interfaces, providing the necessary connectivity.

Term, Abbreviation, or Acronym	Full Text Name/Definition
	NOTE: The virtual network is bounded by its set of permissible network interfaces. (ETSI)
Virtual Network Element (VNE)	An abstraction representing a set of network functions providing network element capabilities implemented in a virtualized environment.
Virtualized Network Function (VNF)	The implementation of an NF that can be deployed on a Network Function Virtualisation Infrastructure (NFVI)
Virtualized Network Function Instance (VNF Instance)	A run-time instantiation of the VNF software, resulting from completing the instantiation of its components and of the connectivity between them, using the VNF deployment and operational information captured in the VNFD, as well as additional run-time instance-specific information and constraints (ETSI)
Virtualized Network Function Component (VNFC)	An internal component of a VNF, providing a VNF Provider a defined sub-set of that VNF's functionality, with the main characteristic that a single instance of this component maps 1:1 against a single Virtualisation Container (ETSI)
Virtualized Network Function Component (VNFC) Instance:	The instance of a VNFC deployed in a specific Virtualisation Container instance. It has a lifecycle dependency with its parent VNF instance (ETSI)
Virtualized Network Function Descriptor (VNFD)	A configuration template that describes a VNF in terms of its deployment and operational behavior, and is used in the process of VNF on-boarding and managing the lifecycle of a VNF instance (ETSI)
Virtualized Network Function Manager (VNFM)	A functional block that is responsible for the lifecycle management of VNF (ETSI)
Virtualized NIC (vNIC)	Virtualized NIC created for a VM by a hypervisor (ETSI)
VoIP	Voice over IP
Virtual Private LAN Service (VPLS)	Virtual Private LAN Service (VPLS) is a way to provide Ethernet-based multipoint to multipoint communication over IP or MPLS networks. It allows geographically dispersed sites to share an Ethernet broadcast domain by connecting sites through pseudowires. The term 'sites' includes multiplicities of both servers and clients. The technologies that can be used as pseudo-wire can be Ethernet over MPLS, L2TPv3 or even GRE. There are two IETF standards track RFCs (RFC 4761 and RFC 4762) describing VPLS establishment.
VXLAN	Virtual Extensible LAN
WAN	Wide Area Network
WLAN	Wireless Local Area Network
XML	Extensible Markup Language. A markup language that defines a set of rules for encoding documents in a format which is both human-readable and machine-readable.

4.2 Acronyms and Abbreviations for Form A of MEF-SDN/NFV Exam

Revision 2, March 26, 2017

4.2.1 Acronyms that all candidates should know

The acronyms and abbreviations in this list are commonly used and all candidates are expected to know both the meaning of the acronym and the expansion (i.e., what the letters stand for). These acronyms will normally appear in the exam without expansion.

Acronym	Expansion ("stands for")
API	Application Programming Interface
CORD	Central Office Re-Architected as Datacenter Customer Premises Equipment
CEP	Deep Packet Inspection
DPI	European Telecommunications Standards Institute
ETSI	Fault Management
FM	File Transfer Protocol
FTP	Internet Protocol
IP	Intrusion Detection System
IDS	Intrusion Prevention System
MANO	Management and Orchestration
MPLS	Multi-Protocol Label Switching
NAT	Network Address Translation
NFVO	Network Functions Virtualization Orchestrator
NFV	Network Functions Virtualization
NIC	Network Interface Card
NFVI	NFV Infrastructure
ONAP	Open Network Automation Platform Performance Monitoring
PM	Quality of Service
QoS	Random Access Memory
RAM	Service Level Agreement
SLA	Software Defined Networking
SD-WAN	Software-Defined Wide Area Network
vCPE	Virtual CPE
vCPU	Virtual CPU
VLAN	Virtual LAN
VM	Virtual Machine
VNF	Virtual Network Function
VNFM	VNF Manager
VPN	Virtual Private Network
VIM	Virtual Infrastructure Manager
VoLTE	Voice over LTE

4.2.2 Acronyms that all candidates should know without expansion

List 4.2.2 is similar to List 4.2.1 in that the acronyms and abbreviations in this list are commonly used. But in the case of List 4.2.2 all candidates are expected to know the meaning of the acronym but not necessarily the expansion (for example, the candidate should know that BGP is an IP routing protocol but not necessarily that it

stands for Border Gateway Protocol). These acronyms will normally appear in the exam without expansion.

Acronym	Expansion ("stands for")
BGP	Border Gateway Protocol
CDN	Content Delivery Network
CPU	Processor/Central Processing Unit
DSCP	Differentiated Service Code Point
E-CORD	Enterprise CORD
EMS	Element Management System
M-CORD	Mobile CORD
NETCONF	Network Configuration (Protocol)
NMS	Network Management System
OSPF	Open Shortest Path First
OSS	Operations Support System
OLT	Optical Line Terminal
R-CORD	Residential CORD
SSH	Secure Shell
SNMP	Simple Network Management Protocol
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
vNAT	Virtual NAT
YANG	Yet Another Next Generation (Protocol)

4.2.3 Acronyms that candidates are not expected to know without expansion

All acronyms that are not on List 4.2.1 or List 4.2.2 fall into this category. This list is provided because the acronyms are relatively common and therefore the expectation might not be obvious. These acronyms should never appear on the exam without expansion.

Acronym	Expansion ("stands for")
ADC	Application Delivery Controller
BNG	Broadband Network Gateway
BSS	Business Support System
ISG	Industry Specification Group
ODL	Open Daylight
ONOS	Open Network Operating System
PCI	Payment Card Industry
PGW	Packet Data Network Gateway
SAT	Service Activation Testing
SFC	Service Function Chaining
SG	Service Gateway
VDU	Virtual Deployment Unit
VTEP	Virtual Tunnel End Point

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5.2 Standards Development Organizations and Open Source Projects

	ETSI-NFV
Founded in November 2012 by seven of the world's leading telecoms network operators ISG NFV became the home of the Industry Specification Group for NFV. Five years and over 100 publications later, the ISG NFV community has evolved through several phases, its publications have moved from pre-standardization studies to detailed specifications. This large community (300+ companies including 38 of the world's major service providers) is still working intensely to develop the required standards for NFV as well as sharing their experiences of NFV implementation and testing.	
	Open Source Networking: The Linux Foundation
Includes open source networking projects CORD, DPDK, IOVISOR, ONAP, ONOS, Open Daylight, OPNFV, OvS, and PNDA. On January 1, 2018, The LF Networking Fund (LFN) was formed, a new entity that increases collaboration and operational excellence across networking projects. LFN integrates the governance of participating projects in order to improve operational excellence and simplify member engagement. Each technical project retains its technical independence and project roadmaps.	
	MEF (formerly Metro Ethernet Forum)
MEF is an industry association of 200+ member companies, MEF is the driving force enabling agile, assured, and orchestrated communication services that empower users with the dynamic performance and security required to thrive in the digital economy. MEF is working with many of the world's leading service and technology providers, open source projects, standards associations, enterprises, and universities to realize a shared vision of orchestrating dynamic services across multiple providers and network technology domains. MEF works with leading standards bodies, industry groups, and academic institution to create and manage the MEF Professional Certification Program.	
	Open Networking Foundation
The Open Networking Foundation (ONF) is a non-profit operator led consortium driving transformation of network infrastructure and carrier business models. We are an open, collaborative, community of communities. The ONF serves as the umbrella for a number of projects building solutions by leveraging network disaggregation, white box economics, open source	

TM Forum

software and software defined standards to revolutionize the carrier industry.
TM Forum is the global industry association that drives collaboration and collective problem-solving to maximize the business success of communication and digital service providers and their ecosystem of suppliers. Our vision is to help communications service providers (CSPs) and their suppliers to digitally transform and thrive in the digital era. A neutral, non-profit member organization, TM Forum represents over 850 member companies generating US$2 trillion in revenue and serving five billion customers across 180 countries.