



Agenda Item 6: Assessment of operational requirements to define communication, navigation, and surveillance (CNS) improvements for en-route and terminal area operations

Follow-up to the implementation of the new REDDIG II digital network in the SAM Region

(Presented by the Secretariat)

SUMMARY	
This working paper presents information on the status of implementation of the new REDDIG II IP-based digital network.	
REFERENCES	
<ul style="list-style-type: none">• Sixteenth meeting of the REDDIG Coordination Committee (Lima, Peru, 18-20 March 2013);• Seventeenth meeting of the REDDIG Coordination Committee (Lima, Peru, 24-26 March 2014);• Third technical-operational meeting on the implementation of the new REDDIG II digital network (RTO/3, Bogota, Colombia, 28-29 July 2014); and• Summary of teleconferences for follow-up to the implementation of REDDIG II (1-2 October 2014).	
ICAO strategic objectives:	A – <i>Safety</i> ; and B – <i>Air navigation capacity and efficiency</i>

1. Background

1.1 The new REDDIG II digital network will be the first regional digital network for carrying aeronautical voice and data services worldwide on a mixed satellite-ground network fully based on the IP protocol. The main satellite equipment of the REDDIG II will be the CISCO 2900 routers, the SKYWAN IDU 7000 satellite modems that will act as masters (Manaus and Ezeiza), and the SKYWAN IDU 1070 modems in the other REDDIG II nodes, which will act as slaves. The block structure of a satellite network node is shown in *Figure 1* of **Appendix A** to this working paper.

1.2 The ground network will be a fibre optics network based on the MPLS protocol. Access to ground network services is through the CISCO 1921 router. Each node has an access capacity of 256k bits/sec. The configuration for accessing the MPLS network is shown in *Figure 2* of Appendix A. The ground network provider will be LEVEL 3 Peru.

1.3 Contract No. 22501200, signed between ICAO, on behalf of all REDDIG II member States, and the INEO & LEVEL 3 consortium for the implementation of REDDIG II includes, in addition to the installation and operation of satellite network equipment, the leasing of the MPLS service on the Level 3 fibre optics ground network for a period of 6 months, starting on final acceptance of REDDIG II. Following the initial six months, depending on the quality of the service during this initial period, the

REDDIG II member States will decide whether or not to renew the service for an additional period of 4 years and six months, renewable every year, maintaining the monthly costs established for the first 6 months of the service. **Appendix B** to this working paper contains a map with the location of the REDDIG II nodes (Figure 3) and the Level 3 ground network (Figure 4).

2. Discussion

2.1 In order to follow-up on REDDIG II implementation activities, the following aspects are described below:

- REDDIG II focal points
- Results of the factory course on REDDIG II
- Results of REDDIG II factory acceptance tests (FAT)
- Results of the Third technical-operational meeting for the implementation of REDDIG II (RTO/3)
- Results of the REDDIG II introductory course
- Results of the theoretical-practical course on REDDIG II
- Teleconferences for coordinating customs clearance of REDDIG II equipment.

Likewise, information will be provided on activities for the new MEVA REDDIG interconnection following the commissioning of the new MEVA III by the end of the first quarter of 2015 and the renewal of the INTELSAT leasing contract for an additional period of four years, starting in 2015.

REDDIG II focal points

2.2 The RTO/3 meeting updated the list of focal points, which is shown in **Appendix C** to this working paper. The Meeting should report on any changes to the list in order to keep it up to date.

Factory course on the REDDIG II

2.3 As scheduled, the factory course was held in Vélizy, France, on 21 April to 9 May 2014. The course was addressed to personnel of the Manaus and Ezeiza NCCs, and was attended by three delegates from Brazil, three delegates from Argentina, and the REDDIG Administrator. Course material has been posted on the REDDIG II website: www.lima1.icao.int/reddig.

2.4 The course took place uneventfully and all the topics of the Factory Training programme were covered, including theoretical classes and practical and laboratory exercises where applicable.

2.5 It was recommended that the next REDDIG coordination meeting (RCC/18) analyse the possibility of conducting a specialised course on management and operation of the WhatsUp Gold software within the context of the REDDIG II training plan.

REDDIG II factory acceptance tests (FAT)

2.6 REDDIG II factory acceptance tests were conducted on 12-16 May 2013 in Vélizy, Paris, at INEO facilities, with the participation of representatives of Project RLA/03/901 members of Argentina, Brazil, Paraguay, and Peru, and the REDDIG II Administration.

2.7 The following activities were conducted during the factory acceptance tests:

- Verification of cabling and equipment installation on each rack of REDDIG II
- Verification of models and serial numbers of all REDDIG II equipment
- Testing of communication links between sites, in a simulated environment
- Testing of outdoor equipment
- Testing of indoor equipment
- Testing of the REDDIG II monitoring system

2.8 For testing purposes, INEO installed in its laboratory all the equipment, cables, and connectors, in the respective racks of all REDDIG II nodes. For connections between nodes, coaxial cables were laid between satellite modems, using combiners and splitters.

2.9 Upon completion of the FAT, the group proceeded to accept the FAT with observations, which shall be fully resolved by the INEO & Level 3 consortium as a precondition for acceptance of provisional site acceptance tests (PSAT).

2.10 In this sense, REDDIG II focal points must be aware of all the observations made during the factory inspection (FAT), which are presented under this agenda item and described in detail in the REDDIG website: www1.lima.icao.int/reddig, making sure that the INEO & Level 3 consortium complies with them; otherwise, it should be reflected as a non-compliance in REDDIG II provisional acceptance tests (PSAT), which are the responsibility of each of the REDDIG II focal points.

Results of the Third technical-operational meeting for the implementation of REDDIG II (RTO/3)

2.11 The RTO/3 meeting was held in Bogota, Colombia, on 28-29 July 2014, with the participation of 9 member States (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Trinidad and Tobago, and Uruguay), totalling 19 attendees, including ICAO experts.

2.12 The meeting formulated important conclusions, mainly addressed to focal points, on actions required prior to REDDIG II implementation. A list of such conclusions appears in **Appendix D** to this working paper.

2.13 Main activities include the need for REDDIG II focal points to monitor the implementation of FAT observations by the contractor, the registration of the new frequencies for REDDIG II before the national entities responsible for the radio frequency spectrum, the installation of a redundant Ethernet switch and router for IP services to be carried on the REDDIG II, the installation of cabling for data and voice services to be carried on the REDDIG II, national coordination, as required, for customs clearance of equipment, and maintenance of antennae, since these will continue to operate with REDDIG II, except for the antenna of Paraguay, which will be new. Copy of the RTO/3 final report can be downloaded from the ICAO website: <http://www.icao.int/SAM/Pages/MeetingsDocumentation.aspx?m=2014-REDDIGII01>

Results of the REDDIG II introductory course

2.14 A course on CISCO routers and switches was held on 29 July to 1 August 2014 in Bogota, Colombia, to provide basic theoretical-practical knowledge on IP devices to those designated to participate in the theoretical-practical course on REDDIG II to be held in Rio, to be supplemented during the theoretical-practical course on the REDDIG II of Rio (11 August to 5 September 2014).

2.15 The course was given by a Colombian entity certified for providing the CISCO course, with the participation of 22 delegates from 9 REDDIG II member States. This event was possible thanks to the support provided by the Aeronautical Administration of Colombia.

2.16 During the course, the participants received theoretical classes on CISCO routers and switches, and did laboratory practice to supplement the theory. Taking into account the short duration of the course, an attempt was made to provide ample information.

Results of the theoretical-practical course on REDDIG II

2.17 The theoretical-practical course on the REDDIG was held as scheduled in Rio, Brazil, for two weeks. It comprised four sessions: three in Spanish and one in English. The four sessions were carried out in two sections: the first from 11 to 22 August and the second from 25 August to 5 September 2014.

2.18 Two persons were trained for each REDDIG node. Some States had three candidates for each node, as was the case of Argentina, Brazil, Peru, and Bolivia. A total of 39 people were trained; per diems and travel expenditures for 36 people were covered by the contract. The content of the course in Rio is posted on the website of Project RLA/06/901 www.lima1.icao.int/reddig.

2.19 During the theoretical-practical course, it was noted that a significant number of participants had no experience with IP technology and that training in router programming was probably not fully taken advantage of, and many people had difficulties, despite being the most important component of REDDIG II. We feel this is mainly due to lack of basic knowledge of IP networks. Therefore, it is important that each person designated to be in charge of REDDIG II maintenance and operation, in addition to RF and satellite communication knowledge, should have basic knowledge of IP networks, CISCO routers, and switches. Although a course on the subject was conducted in Colombia and the course in Rio offered much information on the topic, we believe that the knowledge provided in these courses cannot be assimilated if the basics are lacking.

2.20 Basic courses on CISCO networks, routers, and switches are given in practically all REDDIG II member States. Aeronautical administrations should train all the technical staff in charge of communication system maintenance and operation through these basic courses, since, nowadays, there are IP networks and devices everywhere. If REDDIG members consider that this type of courses should be given with the support of Project RLA/03/901, this should be requested to the next meeting of the REDDIG II Coordination Committee (RCC/15) for its approval, and added to the courses scheduled under Project RLA/03/901 for the next three years. The Meeting could discuss this issue and submit the results to the RCC/15 meeting. **Appendix E** to this working paper contains information on a basic CISCO course that should be taken by every technician responsible for the operation and maintenance of REDDIG II.

Teleconferences to coordinate customs clearance of REDDIG II equipment

2.21 The RCC/16 meeting formulated Conclusion RCC/16/5 - *Customs clearance updatings*, requiring Project RLA/03/901 member States to update information concerning national customs clearance requirements and submit it to the ICAO SAM Office.

2.22 Each of the REDDIG II member States sent its requirements, as well as the address and name of the person to whom the REDDIG II provider should deliver the equipment.

2.23 The delivery of REDDIG II equipment by the contractor to member States, due in late July 2014, was delayed by almost two months due to problems encountered by the contractor in obtaining the export license from French customs. French customs wanted to make sure that REDDIG II equipment

was not to be used for military purposes. Accordingly, REDDIG member States sent a form signed by the focal point stating that the equipment was only to be used for civilian purposes.

2.24 In order to compensate for the delay, the contractor sent the equipment by air instead of by sea between mid-September to mid-October 2014.

2.25 In order to coordinate customs clearance of REDDIG II equipment with focal points, two teleconferences were held on 1 and 2 October 2014, to report on the date of delivery of the equipment and documents by the contractor for customs clearance by States, as specified in the contract.

2.26 It was agreed with the States that, although the timetable of activities of REDDIG II specified that States had 45 days to clear local customs, they would try to do it in a shorter period of time so that commissioning would not coincide with Christmas holidays. In this regard, each State noted how much time they would require for this process and it was estimated that it would not exceed one month. In the event a State took 45 days or more to clear customs, the States agreed during the teleconference that REDDIG II provisional acceptance tests (PSAT) should be conducted in January 2015 rather than on the scheduled date (see **Appendix E** to this working paper).

2.27 Information was also provided during the teleconferences on the status of implementation of last-mile links between REDDIG II nodes and the points of entry to the Level 3 fibre optics network. This activity is under the responsibility of Level 3. At the time of the teleconferences, no date had been set for the implementation of the last-mile link in French Guiana, Guyana, Suriname, and Venezuela. It is important to underline that all links must be implemented; if even one is missing, there can be no migration from REDDIG I to REDDIG II.

2.28 In summary, the two factors that might delay the operational implementation of REDDIG II are the time States take to clear customs, and the implementation by Level 3 of the last-mile links in the aforementioned sites. If States complete customs clearance in no more than one month, and the last-mile links in the remaining sites are completed by the end of October 2014, the commissioning and subsequent provisional acceptance of REDDIG II would take place during the first two weeks of December 2014.

New MEVA-REDDIG interconnection

2.29 At the RCC/17 meeting, information was provided on the activities for the implementation of the new MEVA III satellite network. In this regard, it was noted that MEVA III was expected to start operations at the end of the first quarter of 2015 and the new provider would be COMSOFT. Likewise, the RCC/17 meeting reviewed the offers submitted by COMSOFT for the implementation of the new MEVAIII/REDDIG II interconnection, and, in this regard, formulated conclusion RCC/17-1 *New MEVA III / REDDIG II interconnection*, whereby the equipment leasing option was chosen over equipment purchase with non-recurrent and recurrent expenditures.

2.30 In this regard, the REDDIG Administration, together with the technical cooperation section of ICAO in Montreal, went on to draft a new contract 22501528: for the provision of services between REDDIG II and MEVA III.

2.31 The new contract will initially be effective for five years. Costs are almost the same as for the current MEVA II REDDIG interconnection contract 22500187, which will be effective until March 2015.

Renewal of the INTELSAT spatial segment lease contract

2.32 REDDIG II continues to use the same spatial segment as REDDIG I. The leasing contract with INTELSAT ends in late 2014, and ICAO has renewed it for an additional period of 4 years, at the same annual cost as the current one.

3. **Suggested action**

3.1 The Meeting is invited to:

- a) take note of the information provided in this working paper;
- b) review the activities listed in section 2 and in the Appendices to this working paper;
and
- c) discuss any other related matter it may deem appropriate.

- END -

APPENDIX A

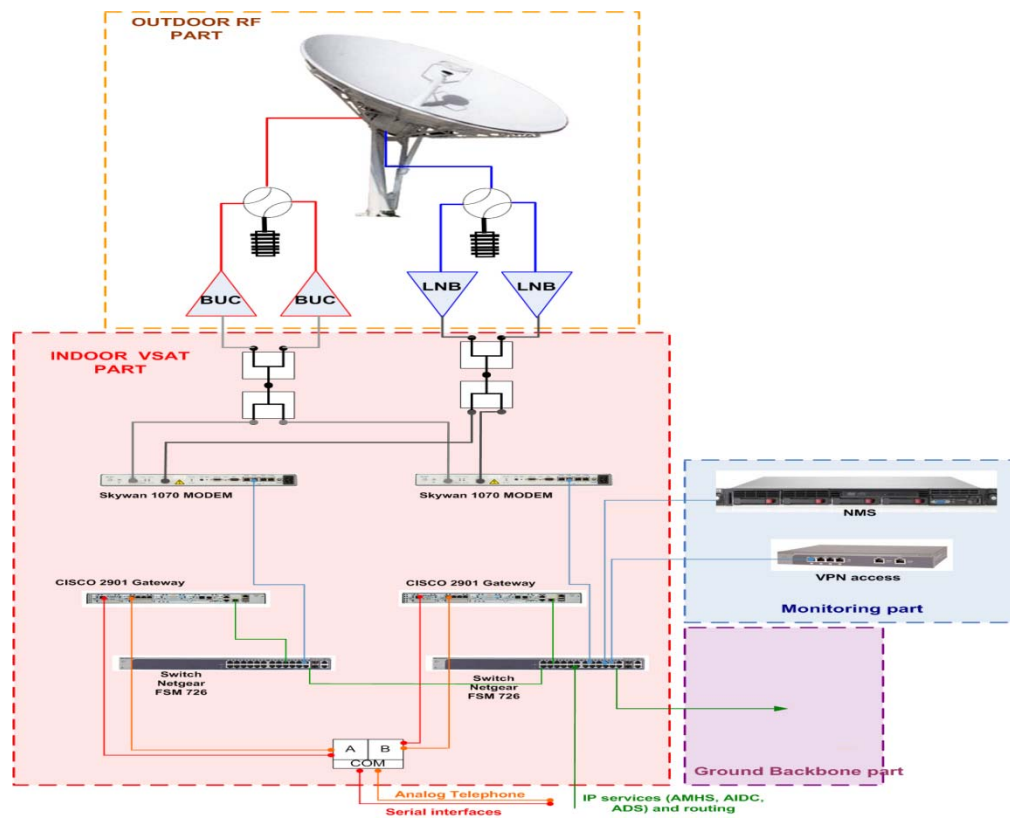


Figure 1: Configuration of REDDIG II satellite node

DIAGRAM 1

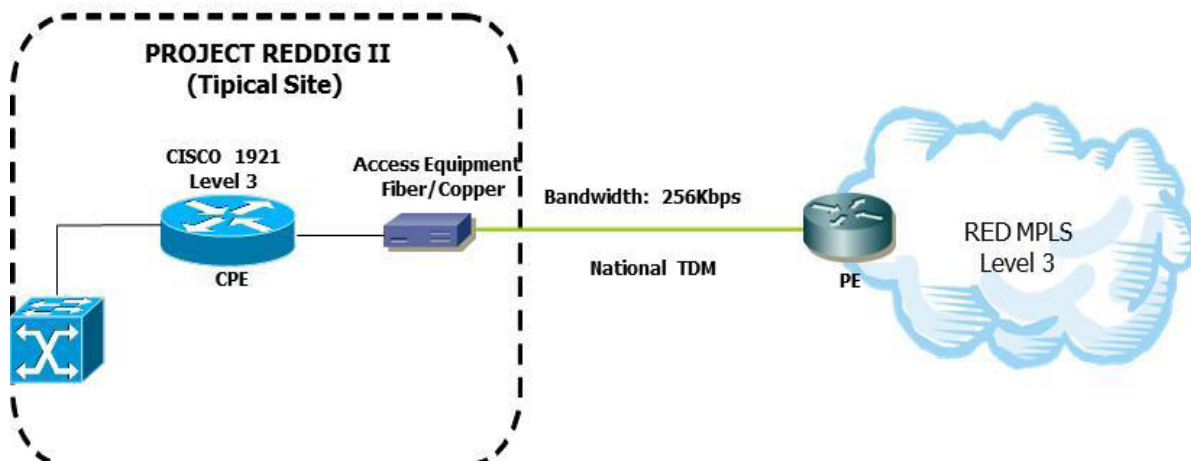


Figure 2: Configuration of MPLS ground network connection in a REDDIG II node

Appendix B

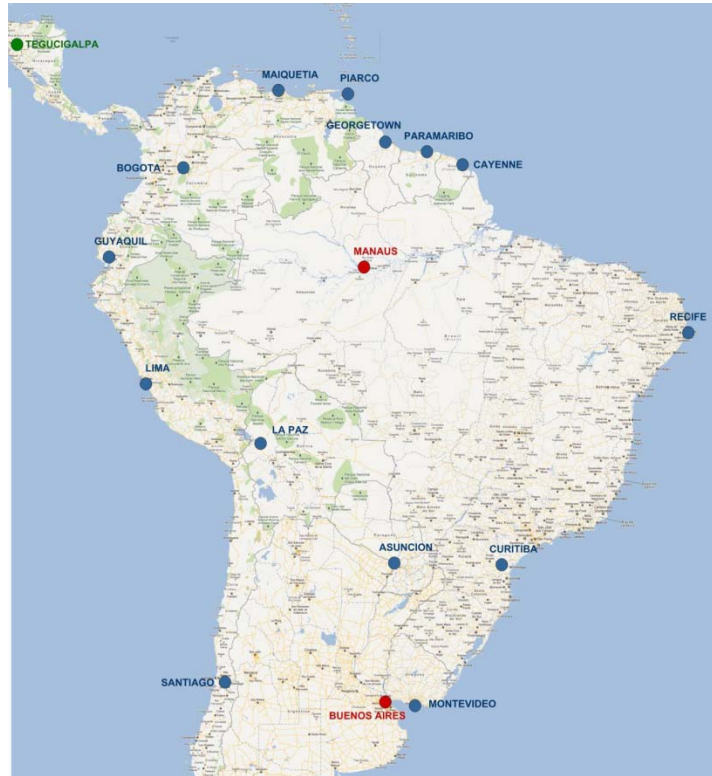


Figure 3: Location of REDDIG II nodes



Figure 4: Optic fiber ground network of LEVEL 3

APPENDIX C / APENDICE C

REDDIG II FOCAL POINTS / PUNTOS FOCALES REDDIG II

STATE / ESTADO	Name / Nombre	Title / Cargo	E-Mail / Correo-e	Telephone / Teléfono	Address / Dirección
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STATE / ESTADO	Name / Nombre	Title / Cargo	E-Mail / Correo-e	Telephone / Teléfono	Address / Dirección
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STATE / ESTADO	Name / Nombre	Title / Cargo	E-Mail / Correo-e	Telephone / Teléfono	Address / Dirección
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APPENDIX D

List of Conclusions adopted in RTO/3

Conclusion RTO/3-1 Proposal to conduct a course on the WhatsUp Gold application

That the Eighteenth Meeting of the Coordination Committee of Project RLA/03/901 (RCC/18) to be carried out at the end of the first trimester of 2015 in Lima, Peru, consider the possibility to develop, as part of the training program, a complete course on the application of WhatsUp Gold at the end of the first semester of 2015.

Conclusion RTO/3-2 Implementation of the observations made in the FAT

That the REDDIG II focal points:

- take note of all the observations made during the factory inspection (FAT) presented in this agenda item and are detailed on the REDDIG website www1.lima.icao.int/reddig;
- verify that the INEO & Level 3 Consortium has implemented them during the provisional acceptance tests in the sites (PSAT); and
- consider the non-compliance of the observations as part of the provisional acceptance in the site (PSAT).

Conclusion RTO/3-3 Registration of new REDDIG II frequencies

That the REDDIG II focal points proceed to update the information recorded in the national entities that manage the radio frequency spectrum with the new frequencies allocated to REDDIG II by INTELSAT, presented as **Appendix F** of this agenda day.

Conclusion RTO/3-4 Installation of an Ethernet redundant router and switch for the native IP services

Que los Estados miembros de la REDDIG que van a tener el servicio IP nativos en la REDDIG II (AMHS, radar, AIDC, VoIP), procedan a la instalación de un router y switch Ethernet redundante para poder soportar todas las “VLANs” de todos los servicios en IP, tanto actuales como futuros que entrarán por el puerto único del nodo de la REDDIG II.

CCNA Routing and Switching

At-A-Glance



The Cisco Networking Academy® CCNA Routing and Switching curriculum is designed for students who are seeking entry-level ICT jobs or plan to pursue more specialized ICT skills.

CCNA Routing and Switching provides comprehensive coverage of networking topics, from fundamentals to advanced applications and services, with opportunities for hands-on practical experience and career skills development.

Cisco Certifications

Students will be prepared to take the Cisco CCENT® certification exam after completing a set of two courses and the CCNA® Routing and Switching certification exam after completing a set of four courses.

Features and Benefits

The CCNA Routing and Switching curriculum offers the following features and benefits:

- Students learn the basics of routing, switching, and advanced technologies to prepare for the CCENT and CCNA certification exams, networking related degree programs, and entry-level careers.
- The language used to describe networking concepts is designed to be easily understood by

learners at all levels and embedded interactive activities help reinforce comprehension.

- Courses emphasize critical thinking, problem solving, collaboration, and the practical application of skills.
- Multimedia learning tools, including videos, games, and quizzes, address a variety of learning styles and promote increased knowledge retention.
- Hands-on labs and Cisco® Packet Tracer simulation-based learning activities help students develop critical thinking and complex problem solving skills.
- Embedded assessments provide immediate feedback to support the evaluation of knowledge and acquired skills.

Course Description

CCNA Routing and Switching teaches comprehensive networking concepts, from network applications to the protocols and services provided to those applications by the lower layers of the network. Students will progress from basic networking to more complex enterprise and theoretical networking models later in the curriculum.

There are four courses in the recommended sequence:

- Introduction to Networks
- Routing and Switching Essentials
- Scaling Networks
- Connecting Networks

In each course, Networking Academy™ students will learn technology concepts with the support of interactive media and apply and practice this knowledge through a series of hands-on and simulated activities that reinforce their learning.

Course	Description
Introduction to Networks	Introduces the architecture, structure, functions, components, and models of the Internet and computer networks. The principles of IP addressing and fundamentals of Ethernet concepts, media, and operations are introduced to provide a foundation for the curriculum. By the end of the course, students will be able to build simple LANs, perform basic configurations for routers and switches, and implement IP addressing schemes.
Routing and Switching Essentials	Describes the architecture, components, and operations of routers and switches in a small network. Students learn how to configure a router and a switch for basic functionality. By the end of this course, students will be able to configure and troubleshoot routers and switches and resolve common issues with RIPv1, RIPv2, single-area and multi-area OSPF, virtual LANs, and inter-VLAN routing in both IPv4 and IPv6 networks.
Scaling Networks	Describes the architecture, components, and operations of routers and switches in a large and complex network. Students learn how to configure routers and switches for advanced functionality. By the end of this course, students will be able to configure and troubleshoot routers and switches and resolve common issues with OSPF, EIGRP, STP, and VTP in both IPv4 and IPv6 networks. Students will also develop the knowledge and skills needed to implement DHCP and DNS operations in a network.
Connecting Networks	Discusses the WAN technologies and network services required by converged applications in a complex network. The course enables students to understand the selection criteria of network devices and WAN technologies to meet network requirements. Students learn how to configure and troubleshoot network devices and resolve common issues with data link protocols. Students also develop the knowledge and skills needed to implement IPSec and virtual private network (VPN) operations in a complex network.



Skills and Competencies

Here are some examples of tasks students will be able to perform after completing each course.

Introduction to Networks	Routing and Switching Essentials
Describe the devices and services used to support communications in data networks and the Internet	Describe enhanced switching technologies such as VLANs, VLAN Trunking Protocol, Rapid Spanning Tree Protocol, and 802.1q
Describe the role of protocol layers in data networks	Describe basic switching concepts and the operation of Cisco switches
Describe the importance of addressing and naming schemes at various layers of data networks in IPv4 and IPv6 environments	Configure and troubleshoot basic operations of a small switched network
Design, calculate, and apply subnet masks and addresses to fulfill given requirements in IPv4 and IPv6 network	Configure and troubleshoot basic operations of routers in a small routed network
Build a simple Ethernet network using routers and switches	Configure and troubleshoot VLANs and inter-VLAN routing
Use Cisco command-line interface (CLI) commands to perform basic router and switch configurations	Describe the operations of Dynamic Host Configuration Protocol and Domain Name System for IPv4 and IPv6

Scaling Networks	Connecting Networks
Configure and troubleshoot DHCP and DNS operations for IPv4 and IPv6	Describe the operations and benefits of virtual private networks (VPNs) and tunneling
Describe the operations and benefits of the Spanning Tree Protocol (STP)	describe different WAN technologies and their benefits
Configure and troubleshoot STP operations	Configure and troubleshoot serial connections
Describe the operations and benefits of link aggregation and Cisco VLAN Trunk Protocol (VTP)	Configure and troubleshoot broadband connections
Configure and troubleshoot basic operations of routers in a complex routed network for IPv4 and IPv6	Configure and troubleshoot IPSec tunneling operations
Configure and troubleshoot advanced operations of routers and implement RIP, OSPF, and EIGRP routing protocols for IPv4 and IPv6	Monitor and troubleshoot network operations using syslog, SNMP, and NetFlow
Manage Cisco IOS® Software licensing and configuration files	Design network architectures for borderless networks, data centers, and collaboration

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