



MALAYSIAN INSTITUTE OF INFORMATION TECHNOLOGY

**FINAL EXAMINATION
JANUARY 2016 SEMESTER**

SUBJECT CODE	:	IDB 20103
SUBJECT TITLE	:	COMPUTER NETWORKS
LEVEL	:	BACHELOR
TIME / DURATION	:	(2 HOURS) 2.00 pm – 4.00 pm
DATE	:	19 MAY 2016

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper **CAREFULLY**.
2. This question paper is printed on both sides of the paper.
3. This question paper consists of **ONE (1)** section only.
4. Answer **ALL** questions.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English.

THERE ARE 10 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 40 marks)**INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.**

A growing demand of internet related services and usage in education institution makes the infrastructure of computer networks crucial. A college in KL has decided to upgrade their computer network infrastructure in order to improve their internet access and provide better connectivity. The college building has 4 floors as shown in Appendix A. The requirements are:

1. To allow Wi-Fi access for 400 concurrent users for each floor. Total Wi-Fi access will be 1600 concurrent users
2. To make 2 classrooms in floor 2 to be computer lab with 60 pc in each lab. The lab access will be a wired fast Ethernet access

The college will subscribe an ultra-high speed broadband of 1000Mbps or 1Gbps broadband. Based on this background of the case study, please answer question 1 until 4.

Question 1

From the high level given requirement, propose to the college:

- A. The quantity of network device needed and the model.
 - a. Core switch
 - b. Wireless Access Point

(6 marks)

- B. The cabling type needed. Since it is a 4 floor building, a fiber optic backbone is required.

(2 marks)

[8 marks]

Question 2

Draw the high level network design that covers all the requirements.

The following element must be included:

1. The core switch
2. The switches
3. The router
4. The wireless access point
5. The PC/devices
6. The connection cable and type

(12 marks)

[12 marks]

Question 3

IP Subnetting. The requirement is to create a different VLAN for each floor Wi-Fi and the lab. The quantity of wireless access needed is 400 for each floor and 120 wired PC in the Labs. Given network address is **10.34.80.0/20**.

Propose the IP subnetting for each VLAN below in CIDR notation

- A. Wi-Fi floor1 VLAN network (400)
- B. Wi-Fi floor2 VLAN network (400)
- C. Wi-Fi floor3 VLAN network (400)
- D. Wi-Fi floor4 VLAN network (400)
- E. PC lab1 VLAN (60 PC)
- F. PC Lab2 VLAN (60 PC)

[10 marks]

Question 4

The application that will be running is a web server application. It is the college web portal and also student management system. It is running on the cloud services hosted at Microsoft Azure Cloud.

A. What will be the internet protocol used?

(2 marks)

B. Since you need to explain the IT technology to non-IT management:

a. Explain the term "Cloud" used in ICT?

(2 marks)

b. The internet broadband is 1Gbps, does it sufficient? What will be estimated speed per user if the ratio of 1 to 10 is used.

(2 marks)

c. Explain the term redundancy and suggest the upgrade to be done in order to achieve the redundancy in this project.

(4 marks)

[10 marks]

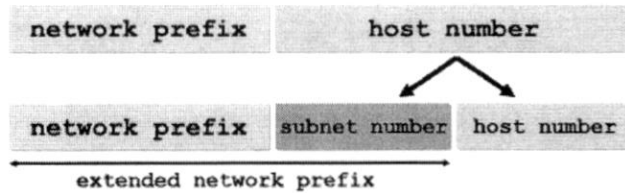
END OF EXAMINATION PAPER

Appendix B

IP Subnetting

Basic Idea of Subnetting

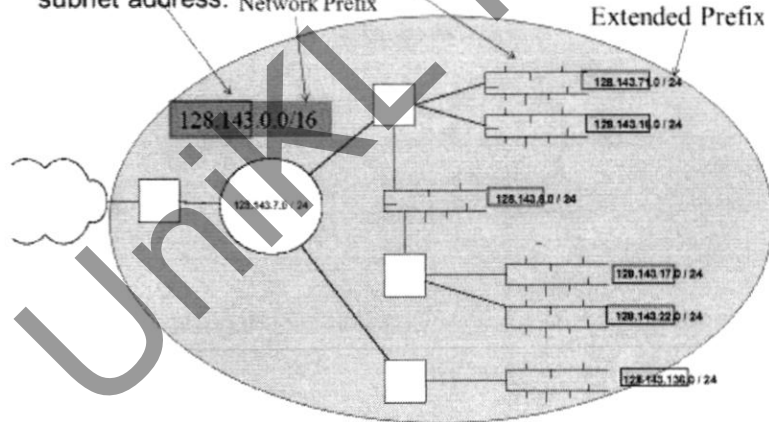
- Split the host number portion of an IP address into a subnet number and a (smaller) host number.
- Result is a 3-layer hierarchy



- Then:
 - Subnets can be freely assigned within the organization
 - Internally, subnets are treated as separate networks
 - Subnet structure is not visible outside the organization

Typical Addressing Plan for an Organization that uses subnetting

- In this IP domain, each Ethernet segment is allocated a subnet address. Network Prefix



Appendix C Data Sheet



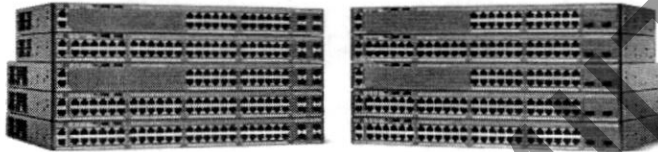
Data Sheet

Cisco Catalyst 2960-X Series Switches

Product Overview

Cisco® Catalyst® 2960-X Series Switches are fixed-configuration, stackable Gigabit Ethernet switches that provide enterprise-class access for campus and branch applications (Figure 1). Designed for operational simplicity to lower total cost of ownership, they enable scalable, secure and energy-efficient business operations with intelligent services and a range of advanced Cisco IOS® Software features.

Figure 1. A Cisco Catalyst 2960-X Series Switch Family



Product Highlights

Cisco Catalyst 2960-X switches feature:

- 24 or 48 Gigabit Ethernet ports with line-rate forwarding performance
- Gigabit Small Form-Factor Pluggable (SFP) or 10G SFP+ uplinks
- FlexStack Plus for stacking of up to 8 switches with 80 Gbps of stack throughput (optional)
- Power over Ethernet Plus (PoE+) support with up to 740W of PoE budget
- 24-port PoE fanless switch for deployment outside the wiring closet
- Reduced power consumption and advanced energy management features
- USB and Ethernet management interfaces for simplified operations
- Application visibility and capacity planning with integrated NetFlow-Lite
- LAN Base or LAN Lite Cisco IOS software features
- Enhanced limited lifetime warranty (E-LLW) offering next-business-day hardware replacement

Cisco Catalyst 2960-XR models also offer:

- Power resiliency with optional dual field-replaceable power supplies
- IP Lite Cisco IOS software with dynamic routing and Layer 3 features

Switch Models and Configurations

Catalyst 2960-X switches include a single fixed power supply and are available with either the Cisco IOS LAN Base or LAN Lite feature set. Catalyst 2960-XR switch models include a field-replaceable modular power supply and can accommodate a second power supply. Catalyst 2960-XR is available only with the Cisco IOS IP Lite feature set.

Table 1. Cisco Catalyst 2960-X Configurations

Model	10/100/1000 Ethernet Ports	Uplink Interfaces	Cisco IOS Software Image	Available PoE Power	FlexStack-Plus Capability
Cisco Catalyst 2960X-48FPD-L	48	2 SFP+	LAN Base	740W	Y
Cisco Catalyst 2960X-48LPD-L	48	2 SFP+	LAN Base	370W	Y
Cisco Catalyst 2960X-24PD-L	24	2 SFP+	LAN Base	370W	Y
Cisco Catalyst 2960X-48TD-L	48	2 SFP+	LAN Base	-	Y
Cisco Catalyst 2960X-24TD-L	24	2 SFP+	LAN Base	-	Y
Cisco Catalyst 2960X-48FPS-L	48	4 SFP	LAN Base	740W	Y
Cisco Catalyst 2960X-48LPS-L	48	4 SFP	LAN Base	370W	Y
Cisco Catalyst 2960X-24PS-L	24	4 SFP	LAN Base	370W	Y
Cisco Catalyst 2960X-24PSQ-L	24 (8PoE)	2 SFP, 2 10/100/1000BT	LAN Base	110W	-
Cisco Catalyst 2960X-48TS-L	48	4 SFP	LAN Base	-	Y
Cisco Catalyst 2960X-24TS-L	24	4 SFP	LAN Base	-	Y
Cisco Catalyst 2960X-48TS-LL	48	2 SFP	LAN Lite	-	-
Cisco Catalyst 2960X-24TS-LL	24	2 SFP	LAN Lite	-	-

Table 2. Cisco Catalyst 2960-XR Configurations

Model	10/100/1000 Ethernet Ports	Uplink Interfaces	Cisco IOS Software Image	Available PoE Power	Power Supply
Cisco Catalyst 2960XR-48FPD-I	48	2 SFP+	IP Lite	740W	1025WAC
Cisco Catalyst 2960XR-48LPD-I	48	2 SFP+	IP Lite	370W	640WAC
Cisco Catalyst 2960XR-24PD-I	24	2 SFP+	IP Lite	370W	640WAC
Cisco Catalyst 2960XR-48TD-I	48	2 SFP+	IP Lite	-	250WAC
Cisco Catalyst 2960XR-24TD-I	24	2 SFP+	IP Lite	-	250WAC
Cisco Catalyst 2960XR-48FPS-I	48	4 SFP	IP Lite	740W	1025WAC
Cisco Catalyst 2960XR-48LPS-I	48	4 SFP	IP Lite	370W	640WAC
Cisco Catalyst 2960XR-24PS-I	24	4 SFP	IP Lite	370W	640WAC
Cisco Catalyst 2960XR-48TS-I	48	4 SFP	IP Lite	-	250WAC
Cisco Catalyst 2960XR-24TS-I	24	4 SFP	IP Lite	-	250WAC

Catalyst 2960-X series Software Features

All Catalyst 2960-X Series Switches use a single Universal Cisco IOS Software Image for all SKUs. Depending on the switch model, the Cisco IOS image automatically configures the LAN Lite, LAN Base, or IP Lite feature set.

LAN Lite models have reduced functionality and scalability for small deployments with basic requirements. Cisco Catalyst 2960-X Family of Switches are available with the LAN Base and LAN Lite feature sets and Catalyst 2960-XR Family of switches are available IP Lite feature sets.

Note: - Small form-factor pluggable (SFP) is a specification for a new generation of optical modular transceivers.

Appendix D
Wireless AP Data sheet

ZoneFlex™ R710

DUAL-BAND 4X4:4 802.11AC
SMART WI-FI AP

Patented BeamFlex+ technology extends signal range, improves stability of client connections

The ZoneFlex R710 integrates patented software-controlled adaptive antennas that delivers additional signal gain per radio chain. As BeamFlex+ adapts to client locations and antenna polarity, the smart antenna technology optimizes the RF energy toward client on a per packet basis. This allows for substantial performance improvement and a reduction in packet loss from the ability to automatically mitigate interference and obstacles. BeamFlex+ with PD-MRC or polarization diversity ensures the R710 listens in all polarizations simultaneously. This results in significant receive signal gain from mobile devices with weak transmitters.

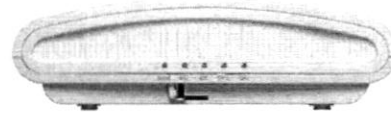
Multi-User MIMO (MU-MIMO)

802.11ac MU-MIMO allows the ZoneFlex R710 to transmit multiple spatial streams to multiple client devices simultaneously, increasing the total throughput and capacity of the wireless network. The ZoneFlex R710 is able to provide up to three clients each their own dedicated full-bandwidth channel using an MU-MIMO technique known as spatial reuse. This capability enables several benefits.

Efficient use of available spectrum effectively multiplies the total capacity of a network, allowing it to meet the increasing data demand driven by the proliferation of mobile Wi-Fi clients and data-hungry applications and uses such as high-definition video streaming. Additionally, MU-MIMO does not require client devices to time-share connections with other clients on the network as in legacy Wi-Fi, which means each device experiences less wait time and makes the network more responsive overall. Even legacy clients benefit from MU-MIMO on the wireless network, because substantially increased efficiency for MU clients leaves the network with more free time and capacity by supporting multiple users.

Advanced WLAN applications

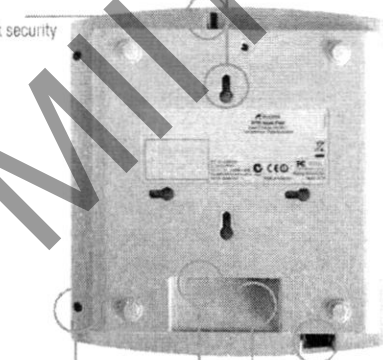
When used with the Ruckus Smart WLAN management systems, the ZoneFlex R710 supports a wide range of value-added applications such as guest networking, Dynamic PSK, hotspot authentication, wireless intrusion prevention and many more. WLANs can also be grouped and shared by specific APs. In a centrally managed configuration, the ZoneFlex R710 works with various authentication servers including AD, LDAP, and RADIUS.



Front View

Integrated key holes for wall or ceiling mount
(adjustable acoustic drop ceiling bracket included)

Pad-lock security latch

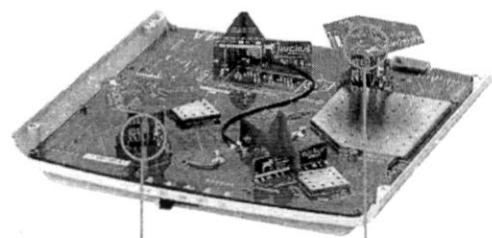


Kensington Lock Eye

Hidden Cables

USB Port for BLE

Two 10/100/1000 Ethernet ports, one with 802.3af/at PoE



BeamFlex+ Adaptive Antenna Technology

ZoneFlex R710 Specifications

PHYSICAL CHARACTERISTICS	
POWER	<ul style="list-style-type: none"> DC Input: 12 VDC 2A PoE: 802.3af/at 802.3af mode feature: <ul style="list-style-type: none"> Limits 2.4GHz to 2x4 (2-chain transmit at 22dBm aggregate power, 4-chain receive) Turns off USB port Turns off Ethernet 1 port
PHYSICAL SIZE	• 22 cm (L), 22 cm (W), 6 cm (H)
WEIGHT	• 1.1kg / 2.3 lbs.
RF	<ul style="list-style-type: none"> Adaptive antenna array: 4,000+ unique antenna patterns, polarization diversity Maximum Transmit Power: 28 dBm on 2.4 GHz; 28 dBm on 5 GHz Physical antenna gain: 3 dBi (2.4 and 5GHz) BeamFlex SINR Tx gain: up to 6 dB BeamFlex SINR Rx gain: up to 3-5 dB Interference mitigation: up to 15 dB Minimum Rx sensitivity: -104 dBm
ETHERNET PORTS	<ul style="list-style-type: none"> 2 ports, auto MDX, auto-sensing 10/100/1000 Mbps, RJ-45 Power over Ethernet (802.3af/at) with Category 5/5e/6 cable Link Aggregation (LACP)
ENVIRONMENTAL CONDITIONS	<ul style="list-style-type: none"> Operating Temperature: -4°F (-20°C) to 140°F (60°C) Operating Humidity: up to 95% non-condensing
POWER CONSUMPTION	<ul style="list-style-type: none"> 5.5W (minimum) 9.4W (typical) 18.5W peak, no USB 25W peak, including USB loading and 100m cable 12.95W (peak in 802.3af mode)

PERFORMANCE AND CAPACITY	
PHY DATA RATES	<ul style="list-style-type: none"> Up to 800 Mbps (2.4GHz) Up to 1733 Mbps (5GHz)
CONCURRENT STATIONS	• Up to 512
NETWORK ARCHITECTURE	
IP	• IPv4, IPv6, dual-stack
VLANs	<ul style="list-style-type: none"> 802.1Q (1 per BSSID or dynamic, per user based on RADIUS) Port-based
802.1X FOR WIRED PORTS	<ul style="list-style-type: none"> Authenticator Supplicant
TUNNELING	• L2TP, PPPoE
MULTIMEDIA AND QUALITY OF SERVICE	
802.11e/WMM	• Supported
SOFTWARE QUEUES	• Per WLAN priority (2), Per traffic type (4), per client
TRAFFIC CLASSIFICATION	• Automatic, heuristics and TOS based or VLAN-defined
RATE LIMITING	• Dynamic per-user or per-WLAN

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MANAGEMENT	
DEPLOYMENT OPTIONS	<ul style="list-style-type: none"> Standalone (individually managed) Centrally managed
WI-FI	
STANDARDS	• IEEE 802.11a/b/g/n/v/ac
SUPPORTED DATA RATES	<ul style="list-style-type: none"> 802.11ac: 29.3 Mbps – 1733 Mbps (80MHz) 802.11n: 6.5 Mbps – 216.7 Mbps(20MHz) 13.5 Mbps – 800 Mbps (40MHz) 802.11a: 54, 48, 36, 24, 18, 12, 9 and 6 Mbps 802.11b: 11, 5.5, 2 and 1 Mbps 802.11g: 54, 48, 36, 24, 18, 12, 9 and 6 Mbps
RADIO CHAINS/ STREAMS	• 4x4:4
MIMO	<ul style="list-style-type: none"> SU-MIMO — Up to 4 streams MU-MIMO — Up to 3 streams
CHANNELIZATION	• 20 MHz, 40 MHz, and/or 80 MHz
FREQUENCY BAND	<ul style="list-style-type: none"> IEEE 802.11ac: 5.15 – 5.85 GHz IEEE 802.11a/n: 5.15 – 5.85 GHz IEEE 802.11b: 2.4 – 2.484 GHz
BSSIDs	<ul style="list-style-type: none"> Up to 16 (2.4 GHz) Up to 16 (5 GHz)
POWER SAVE	• Supported
CERTIFICATIONS	<ul style="list-style-type: none"> WEEE/ROHS compliance EN 60601-1-2 Medical Wi-Fi Alliance certified UL 2043 plenum rated
SUBWAY AND RAILROAD CERTIFICATIONS	<ul style="list-style-type: none"> EN50121-1 EMC EN50121-4 Immunity IEC 61373 Shock & Vibration

1. Max power varies by country setting, band, and MCS rate
 2. BeamFlex gain is a statistical system-level effects (including Tx/Rx) trade-off to enhanced SINR here, and based on observations over time in real-world conditions with multiple APs and many clients
 3. Rx sensitivity varies by band, channel width, and MCS rate
 4. Refer to price list for current country certifications

Product Ordering Information

MODEL	DESCRIPTION
ZoneFlex R710 Dual Band 802.11ac Access Point	
901-R710-XX00	ZoneFlex dual-band (5 GHz and 2.4 GHz concurrent) Wave 2 802.11ac wireless access point. 4x4:4 streams, adaptive antennas, dual ports, PoE support. Includes adjustable acoustic drop ceiling bracket. Does not include power adapter.
Optional Accessories	
902-0162-XX00	PoE injector (50 – 264 VAC 47-63 Hz)
902-1169-XX00	Power supply (80 – 264 VAC 47-63 Hz)
902-0120-0000	Secure Mounting Bracket

PLEASE NOTE: When ordering ZoneFlex Indoor APs, you must specify the destination region by indicating -US, or -WW instead of XX. When ordering PoE injectors or power supplies, you must specify the destination region by indicating -US, -EU, -AU, -BR, -CN, -IN, -JP, -KR, -SA, -UK, or -UN instead of -XX.

WARRANTY: Sold with a limited lifetime warranty. For details see: <http://support.ruckuswireless.com/warranty>



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