Part 1.

1. Refer to the diagram. You are assisting with the design of an organization that has three geographically separated sites. Each site has multiple subnets that the logical diagram indicates. Each site uses part of the 10.0.0.0/8 network for data with the second octet indicating the site location. Amarillo (AMA) uses the 10.50.0.0/16 network block, Midland (MAF) uses the 10.100.0.0/16 network block, and Lufkin (LFK) uses the 10.150.0.0/16 network block. You will have to subnet one management network–for the inter-VLAN routing leg – at each site that will accommodate a minimum of 20 hosts. Amarillo has the 172.20.0.0/16 block for management networks, Midland has 172.21.0.0/16, and Lufkin has 172.22.0.0/16. Subnet the router to router connections using the 192.168.50.0/24 network block. Each site will use OSPF area 0 for routing between the interior routers. Networks cannot be duplicated across the organization. Routing to the exterior will be through a static route that OSPF propagates to other routers. Connection to the ISP will be through NAT. The server is assigned a static address and the remainder of the hosts share addresses.

2. The IT department has surveyed the organization and determined the current number of hosts needed for each subnet and has provided you with the following information. Each network must contain a minimum of 20% growth capacity over current needs.

Department	Current Number of Hosts
AMA Admin	167
AMA Server	804
AMA Cows	9246
AMA Bison	4450
MAF Admin	92
MAF Server	4890
MAF Oil Production	7653
MAF Gas Production	638
LFK Admin	132
LFK Server	501
LFK Logging	8108
LFK Mining	5794

Use the following table to identify VLANs at each site.

Location	VLAN	VLAN Name
Amarillo	101	Admin
	102	Cows
	103	Bison
	104	Management
	105	Parking_Lot
	109	Native
Midland	201	Admin
	202	Oil Production
	203	Gas Production

	204	Management
	205	Parking_Lot
	209	Native
Lufkin	301	Admin
	302	Logging
	303	Mining
	304	Management
	305	Parking_Lot
	309	Native

3. Your instructor will assign you one site to model but you must subnet all sites to receive full credit. Document your subnets in the following table.

#Hosts	Location/Link	Subnet Mask	Interval	Network	First Host	Last Host	Broadcast
11095.2	AMA Cows	255.255.192.0	64	10.50.0.0/18	10.50.0.1	10.50.63.254	10.50.63.255
5340	AMA Bison	255.255.224.0	32	10.50.64.0/19	10.50.64.1	10.50.95.254	10.50.95.255
964.8	AMA Server	255.255.252.0	4	10.50.96.0/22	10.50.96.1	10.50.99.254	10.50.99.255
200.4	AMA Admin	255.255.255.0	256	10.50.100.0/24	10.50.100.1	10.50.100.254	10.50.100.255
20	Management	255.255.255.224	32	172.20.0.0/27	172.20.0.1	172.20.0.30	172.20.0.31
2	Router to Router	255.255.255.252	4	192.168.50.0/30	192.168.50.1	192.168.50.2	192.168.50.3
MAF Oil Production	9183.6	255.255.192.0	64	10.100.0.0/18	10.100.0.1	10.100.63.254	10.100.63.255
MAF Server	5868	255.255.224.0	32	10.100.64.0/19	10.100.64.1	10.100.95.254	10.100.95.255
MAF Gas Production	765.6	255.255.252.0	4	10.100.96.0/22	10.100.96.1	10.100.99.254	10.100.99.255
MAF Admin	110.4	255.255.255.128	128	10.100.100.0/25	10.100.100.1	10.100.100.126	10.100.100.127
20	Management	255.255.255.224	32	172.21.0.0/27	172.21.0.1	172.21.0.30	172.21.0.31
2	Router to Router	255.255.255.252	4	192.168.50.4/30	192.168.50.5	192.168.50.6	192.168.50.6
LFK Logging	9729.6	255.255.192.0	64	10.150.0.0/18	10.150.0.1	10.150.63.254	10.150.63.255

LFK Mining	6952.8	255.255.224.0	32	10.150.64.0/19	10.150.64.1	10.150.95.254	10.150.95.255
LFK Server	601.2	255.255.252.0	4	10.150.96.0/22	10.150.96.1	10.150.99.254	10.150.99.255
LFK Admin	158.4	255.255.255.0	256	10.150.100.0/24	10.150.100.1	10.150.100.254	10.150.100.255
20	Management	255.255.255.224	32	172.22.0.0/27	172.22.0.1	172.22.0.30	172.22.0.31
2	Router to Router	255.255.255.252	4	192.168.50.8/30	192.168.50.9	192.168.50.10	192.168.50.11

4. Document Interfaces: You will be given one location to implement. Record the interface configurations for that location only. Your instructor will tell you which location to implement. Use the first host in the subnet for the router interface.

Router	Interface/Sub-interface	VLAN	Description	IP Address	Mask
AMA Edge	S0/1/0	n/a	To ISP	66.94.189.62	255.255.255.252
	G0/0/0	n/a	To Interior	192.168.50.1	255.255.255.252
	G0/0/1	n/a	AMA Server	10.50.96.1	255.255.252.0
AMA Internal	G0/0/0	n/a	To Edge	192.168.50.2	255.255.255.252
	G0/0/1.101	101	AMA Admin	10.50.100.1	255.255.255.0
	G0/0/1.102	102	AMA Cows	10.50.0.1	255.255.192.0
	G0/0/1.103	103	AMA Bison	10.50.64.1	255.255.224.0
	G0/0/1.104	104	AMA MGT	172.20.0.1	255.255.255.224
	G0/0/1.109	109	AMA Native	n/a	n/a
MAF Edge	S0/1/0	n/a	To ISP	64.125.26.54	255.255.255.252
	G0/0/0	n/a	To Interior	192.168.50.5	255.255.255.252
	G0/0/1	n/a	MAF Server	10.100.64.1	255.255.224.0
MAF Interior	G0/0/0	n/a	To Edge	192.168.50.6	255.255.255.252

Device	Interface	VLAN	Description	IP Address	Mask
	G0/0/1.201	201	MAF Admin	10.100.100.1	255.255.255.128
	G0/0/1.202	202	MAF Oil	10.100.0.1	255.255.192.0
	G0/0/1.203	203	MAF Gas	10.100.96.1	255.255.252.0
	G0/0/1.204	204	MAF MGT	172.21.0.1	255.255.255.224
	G0/0/1.209	209	MAF Native	n/a	n/a
LFK Edge	S0/1/0	n/a	To ISP	184.105.64.214	255.255.255.252
	G0/0/0	n/a	To Interior	192.168.50.9	255.255.255.252
	G0/0/1	n/a	LFK Server	10.150.96.1	255.255.252.0
LFK Interior	G0/0/0	n/a	To Edge	192.168.50.10	255.255.255.252
	G0/0/1.301	301	LFK Admin	10.150.100.1	255.255.255.0
	G0/0/1.302	302	LFK Logging	10.150.0.1	255.255.192.0
	G0/0/1.303	303	LFK Mining	10.150.64.1	255.255.224.0
	G0/0/1.304	304	LFK MGT	172.22.0.1	255.255.255.224
	G0/0/1.309	309	LFK Native	n/a	n/a
ISP Server	202.202.202.22				

Device	Interface	IP Address	Mask	Default Gateway
AMA-S1	SVI	10.50.96.2	255.255.252.0	10.50.96.1
AMA-S2	SVI 104	172.20.0.2	255.255.255.224	172.20.0.1
AMA Server	n/a	10.50.96.100	255.255.252.0	10.50.96.1
AMA Admin	n/a	10.50.100.100	255.255.255.0	10.50.100.1

AMA Cows	n/a	10.50.0.100	255.255.192.0	10.50.0.1
AMA Bison	n/a	10.50.64.100	255.255.224.0	10.50.64.1
MAF-S1	SVI	10.100.64.2	255.255.224.0	10.100.64.1
MAF-S2	SVI 204	172.21.0.2	255.255.255.224	172.21.0.1
MAF Server	n/a	10.100.64.100	255.255.224.0	10.100.64.1
MAF Admin	n/a	10.100.100.100	255.255.255.128	10.100.100.1
MAF Oil	n/a	10.100.0.100	255.255.192.0	10.100.0.1
MAF Gas	n/a	10.100.96.100	255.255.252.0	10.100.96.1
LFK-S1	SVI	10.150.96.2	255.255.252.0	10.150.96.1
LFK-S2	SVI 304	172.22.0.2	255.255.255.224	172.22.0.1
LFK Server	n/a	10.150.96.100	255.255.252.0	10.150.96.1
LFK Admin	n/a	10.150.100.100	255.255.255.0	10.150.100.1
LFK Logging	n/a	10.150.0.100	255.255.192.0	10.150.0.1
LFK Mining	n/a	10.150.64.100	255.255.224.0	10.150.64.1

Part 2.

1. Configure the Routers NOTE: It is best to save frequently.
   a. Configure interfaces and sub interfaces
      i. Set the IPv4 address as the 1st address in the network
      ii. Edge router is assigned the first address in the network attached to the interior router
      iii. Activate the interface
   b. Configure OSPF
      i. Manually configure router IDs so that the edge routers are the designated routers
      ii. Configure a network statement for each locally attached network using a wild card mask that matches each network's subnet mask. Do not include the ISP network in OSPF (will break NAT).
   c. Configure the default route
      i. Set a gateway of last resort on the edge router

        ii.   Propagate to the other router using OSPF

   d.   Configure network address translation. Your local ISP is leasing the following network blocks to your organization to service each location as follows:

Location	Public Address Space
Amarillo	104.245.79.112/29 (Amarillo Wireless)
Midland	24.155.123.24/29 (Net3 ISP)
Lufkin	204.154.23.40/29 (East Texas Broadband)

        i.   Statically assign the first public address to the server

        ii.   Create an access control list that allows host networks but not management or point-to-point networks to participate in NAT.

        iii.   Create a pool with the remaining public address(es)

        iv.   Create a binding statement that allows port address translation

2. Configure the switch
   a. Activate VLANs
   b. Name VLANs
   c. Set connections to routers as trunks
   d. Set all other connections as access
   e. Assign interfaces to appropriate VLANs
3. Configure hosts
   a. Statically assign addresses to PCs
   b. Statically assign IPv4 address to the server
4. Test the configuration
   a. Ensure pings and http are successful between PCs and ISP server and http is successful from ISP server to local server. Take screen shots of successes.

Part 3. NOTE: it is best to check connectivity after each of the following to ensure you have a functional network when you turn it in.

1. Fine tune OSPF
   a. Configure all interfaces not directly connected to an OSPF neighbor as passive
   b. Adjust the reference bandwidth to 1 GB

      c. Tune the hello timer for 30 seconds

      d. Adjust the dead interval to 4 times the hello timer

2. Enforce the following policies using access control lists

      a. Servers are assessable from outside the local network only with http and https. All other access and pings are blocked.

      b. Hosts can ping outside the local network, but hosts cannot be pinged from outside the local network.

      c. Only hosts in the local Admin network can manage routers.

3. Test the configuration

      a. Verify OSPF settings.

            i. Use the protocols command output on both routers.

            ii. Show the OSPF specific settings on the interface

      b. Verify policies

            i. Test the a. policy with ping and http

            ii. Test the b. policy with ping

            iii. Test the c. policy with SSH

Part 4. Basic configuration

1. Basic configuration on the router. Complete only on the Edge router.

      a. Disable DNS resolution

      b. Configure router name that matches the logical name

      c. Configure domain name <your_last_name>.edu

      d. Set interface descriptions to match the connected network

      e. Encrypt all passwords

      f. Minimum password length of 10 characters

      g. Encrypted privileged EXEC password of ciscoENSApass

      h. Create an administrative user in the local database with an encrypted password. User = 1stinitialLastname Password =admin1pass

      i. Set console lines to use the password ciscoconpass

      j. Set login on VTY lines to use local database

      k. Set VTY lines to accept SSH connections only

      l. Configure an MOTD banner

            i. Unauthorized access is prohibited

      m. Generate an RSA crypto key with a 1024-bit modulus

2. Basic configuration on the switch. Complete only on switch 2 (interior).
   a. Disable DNS resolution
   b. Configure the switch name that matches the logical name
   c. Configure domain name <your_last_name>.edu
   d. Activate a parking lot VLAN
   e. Assign all unused interfaces to the parking lot VLAN
   f. Deactivate all unused interfaces
   g. Limit trunks to data, management, and native VLANs only
   h. Activate port security on all access ports
   i. Encrypt all passwords
   j. Encrypted privileged EXEC password of ciscoENSApass
   k. Create an administrative user in the local database with an encrypted password. User = 1stinitialLastname Password =admin1pass
   l. Set console lines to use the password ciscoconpass
   m. Set login on VTY lines to use local database
   n. Set VTY lines to accept SSH connections only
   o. Configure an MOTD banner
      i. Unauthorized access is prohibited
   p. Generate an RSA crypto key with a 1024-bit modulus

Part 5. Turn in documents

1. Subnetting calculations
2. Interface table
3. Running configuration
4. Successful pings and http from Part 2 item 4.
5. Verification from Part 3 item 3.
6. Routing tables
7. VLAN tables
8. Trunk status
9. IP Protocol status

10. OSPF neighbors
11. NAT translations showing active translations
12. ACL statistics
13. Packet Tracer file

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Rubric

Worksheet

	Item	Possible points
Subnet	Descending Order	3
	Correct block	9
	Correct mask	18
	Correct network	18
	Correct 1st Host	18
	Correct last host	18
	Correct broadcast	18
Interfaces		
Edge	G/0 IP	1
	G/0 Mask	1
	G/1 IP	1
	G/1 Mask	1
Interior	G/0 IP	1
	G/0 Mask	1
	G/1.1 IP	1
	G/1.1 Mask	1
	G/1.2 IP	1
	G/1.2 Mask	1
	G/1.3 IP	1
	G/1.3 Mask	1
	G/1.4 IP	1
	G/1.4 Mask	1
Devices	S1	3
	S2	3

	Server	3
	PC-A	3
	PC-B	3
	PC-C	3
Total		134

Configuration

	Item	Possible points
Edge Router	Encrypt password	1
	Minimum pass length	1
	Name	1
	Secret enable	1
	Local User	1
	Local secret	1
	Disable DNS	1
	Domain	1
	G0/0/0 Desc	1
	G0/0/0 IP	1
	G0/0/0 Mask	1
	G0/0/0 Hello intv	10
	G0/0/0 Dead int	10
	G0/0/0 NAT direction	10
	G0/0/1 Desc	1
	G0/0/1 IP	1
	G0/0/1 Mask	1
	G0/0/0 NAT direction	10
	S0/1/0 Description	1
	S0/1/0 IP	1

S0/1/0 Mask	1
S0/1/0 Policy	10
S0/1/0 Policy direct	10
S0/1/0 NAT direction	10
OSPF Instance	10
OSPF Router ID	10
OSPF Passive	10
OSPF Ref bandwidth	10
OSPF Network	20
OSPF route prop	10
NAT pool range	10
NAT pool mask	10
NAT pool binding	10
NAT static	10
Default route	1
NAT ACL	10
Policy A&B ACL	30
Policy C ACL	10
Banner	1
Console pas	1
Console Login	1
VTY policy	10
Login local	1
Transport	1

Total	263

Interior Router		
	G0/0/0 Description	1
	G0/0/0 IP	1
	G0/0/0 Mask	1
	G0/0/0 Hello	10
	G0/0/0 Dead	10
	G0/0/1 enable	1
	G0/0/1.1 Description	1
	G0/0/1.1 Encapsulate	1
	G0/0/1.1 IP	1
	G0/0/1.1 Mask	1
	G0/0/1.2 Description	1
	G0/0/1.2 Encapsulate	1
	G0/0/1.2 IP	1
	G0/0/1.2 Mask	1
	G0/0/1.3 Description	1
	G0/0/1.3 Encapsulate	1
	G0/0/1.3 IP	1
	G0/0/1.3 Mask	1
	G0/0/1.4 Description	1
	G0/0/1.4 Encapsulation	1
	G0/0/1.4 IP	1
	G0/0/1.4 Mask	1
	G0/0/1.9 Description	1
	G0/0/1.9 Encapsulation	1
	G0/0/1.9 Native	1
	OSPF instance	10
	OSPF router ID	10
	OSPF passive interfaces	40
	OSPF reference band	10

	OSPF networks	50
Total		163
Interior Switch	Encrypt password	1
	Name	1
	Enable	1
	Disable DNS	1
	Domain	1
	Local user	1
	F0/5 Native VLAN	1
	F0/5 limit VLANs	1
	F0/5 trunk	1
	F0/6, 10, 18 VLAN	3
	F0/6, 10, 18 access	3
	F0/6, 10, 18 port security	3
	Unused in parking lot	1
	Unused disabled	1
	Banner	1
	Console password	1
	Console login	1
	VTY login local	1
	VTY transport	1
Total		25
Reports		
	Worksheet	1
	Running configuration	4
Pre ACL	Ping from host to ISP Server	10

Post ACL	HTTP from ISP Server to Server	10
	Ping from ISP Server to Server	20
	SSH from Admin	10
	SSH not from Admin	20
	Routing table	2
	VLAN table	1
	Trunk	1
	IP Protocol	20
	OSPF neighbors	20
	NAT translations	50
	ACL statistics	100
	PT file	1
Total		270
Grand Total		855