

Network Design Project

Specification Information

- Specification Number: 5.9
- Class A internal network address: 70.144.0.0/20
- Class B NAT pool public address: 150.9.0.0/21
- Class C ISP network connection address: 214.5.9.0/30
- Class B ISP Internet Web Server address: 150.24.5.0/30
- Wireless Deployment Site: Tallinn
- Management VLAN number: 111
- Percentage Growth (VLSM): 35

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Phase 2 – IP Addressing & VLSM Design

Subnetting is essential to IP Addressing and it can be utilised to split a corporate network into smaller subnets. Subnetting is also important to reducing wasteful use of addressing and saving addresses. By splitting the network and creating logical subnets creates boundaries and departments which allows the organisation to gain control and limit access according to departmental access layout.

The following subnetting table shows all the required subnets. in case of Electric Vehicles, subnetting will provide improved network performance, much greater control and better security. The future 35% growth was taken in consideration when designing the VLSM

Table A: VLSM Design

#	Number of host addresses required	Subnet Network Address	Subnet Mask	Subnet Prefix	Max Number of Hosts Possible	Future Use Y/N	VLAN Number	Site Location
1	270	70.144.0.0	255.255.254.0	/23	510	Y	VLAN 300	Minsk
2	243	70.144.2.0	255.255.255.0	/24	254	Y	VLAN 200	Minsk
3	189	70.144.3.0	255.255.255.0	/24	254	Y	VLAN 150	Tallinn
4	169	70.144.4.0	255.255.255.0	/24	254	Y	VLAN 100	Minsk
5	169	70.144.5.0	255.255.255.0	/24	254	Y	VLAN 150	Riga
6	108	70.144.6.0	255.255.255.128	/25	126	Y		Minsk
7	108	70.144.6.128	255.255.255.128	/25	126	Y	VLAN 100	Kaunas
8	14	70.144.7.0	255.255.255.240	/28	14	Y	VLAN 111	Minsk
9	14	70.144.7.16	255.255.255.240	/28	14	Y	VLAN 111	Kaunas
10	14	70.144.7.32	255.255.255.240	/28	14	Y	VLAN 111	Tallinn
11	14	70.144.7.48	255.255.255.240	/28	14	Y	VLAN 111	Riga
12	7	70.144.7.64	255.255.255.240	/28	14	Y	VLAN 10	Minsk
13	7	70.144.7.80	255.255.255.240	/28	14	Y	VLAN 20	Minsk
14	7	70.144.7.96	255.255.255.240	/28	14	Y	VLAN 30	Minsk
15	7	70.144.7.112	255.255.255.240	/28	14	Y	VLAN 10	Kaunas
16	7	70.144.7.128	255.255.255.240	/28	14	Y	VLAN 20	Kaunas
17	7	70.144.7.144	255.255.255.240	/28	14	Y	VLAN 30	Kaunas
18	7	70.144.7.160	255.255.255.240	/28	14	Y	VLAN 10	Tallinn
19	7	70.144.7.176	255.255.255.240	/28	14	Y	VLAN 20	Tallinn
20	7	70.144.7.192	255.255.255.240	/28	14	Y	VLAN 30	Tallinn
21	7	70.144.7.208	255.255.255.240	/28	14	Y	VLAN 10	Riga
22	7	70.144.7.224	255.255.255.240	/28	14	Y	VLAN 20	Riga
23	7	70.144.7.240	255.255.255.240	/28	14	Y	VLAN 30	Riga
24	5	70.144.8.0	255.255.255.248	/29	6	Y		Minsk
25	5	70.144.8.8	255.255.255.248	/29	6	Y		Kaunas
26	5	70.144.8.16	255.255.255.248	/29	6	Y		Tallinn
27	5	70.144.8.24	255.255.255.248	/29	6	Y		Riga

28	4	70.144.8.32	255.255.255.248	/29	6	N		Frame Relay
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Phase 3 – Routing Protocol Planning

EIGRP routing protocol is a distance vector protocol and is used throughout the company and at each site to advertise networks and allow all the routers to learn their adjacent neighbours.

The Minsk router has been configured for SSH accessibility for Technical Support group.

The user and password for Technical group is username: techuser, password: techuser.

Phase 4 Switch and VLAN Planning

All the VLANs has been identified for each site, vlan printer has only been configured at Kaunas for purpose of demonstration. At Riga one distribution switch and two access switches are configured for the purpose of path redundancy. Furthermore, Tallinn site switches are configured with redundant paths and Etherchannel which are combined into logical paths.

R1 Minsk (head office-two floors):

Leasing	VLAN 100
Marketing	VLAN 200
Business	VLAN 300
Security	VLAN 10
Technical	VLAN 20
5Vehicle Servicing	VLAN 30
Management VLAN	VLAN 111
Server Farm	VLAN 99

R2 Kaunas (single level):

Leasing	VLAN 100
Security	VLAN 10
Technical	VLAN 20
Vehicle Servicing	VLAN 30
Management VLAN	VLAN 111

Printer VLAN VLAN 5

R3 Tallinn (single level) + (Ether Channel):

Sales VLAN 150

Security VLAN 10

Technical VLAN 20

Vehicle Servicing VLAN 30

Management VLAN VLAN 111

R4 Riga (single level) + (ISP):

Sales VLAN 150

Security VLAN 10

Technical VLAN 20

Vehicle Servicing VLAN 30

Management VLAN VLAN 111

Phase 5 Configuring Switches and VLANs

Table B: Switch Details

Name	Model	# of Ports	Location	Management VLAN IP Address	Default Gateway IP Address	Management VLAN	VTP Mode	VTP Domain
M-Dist-S1	2960-24TT		Minsk	70.144.7.34/28	70.144.7.33	VLAN 111		
M-Access-S2	2960-24TT		Minsk	70.144.7.35/28	70.144.7.33	VLAN 111		
M-Access-S3	2960-24TT		Minsk	70.144.7.36/28	70.144.7.33	VLAN 111		
K-Dist-S1	2960-24TT		Kaunas	70.144.7.50/28	70.144.7.49/28	VLAN 111		
K-Access-S2	2960-24TT		Kaunas	70.144.7.51/28	70.144.7.49/28	VLAN 111		
K-Access-S3	2960-24TT		Kaunas	70.144.7.52/28	70.144.7.49/28	VLAN 111		

R-Dist-S1	2960-24TT		Riga	70.144.7.18/28	70.144.7.17/28	VLAN 111		
R-Access-S1	2960-24TT		Riga	70.144.7.19/28	70.144.7.17/28	VLAN 111		
R-Access-S2	2960-24TT		Riga	70.144.7.20/28	70.144.7.17/28	VLAN 111		
T-Dist-S1	2960-24TT		Tallinn	70.144.7.2/28	70.144.7.1/28	VLAN 111		
T-Access-S2	2960-24TT		Tallinn	70.144.7.3/28	70.144.7.1/28	VLAN 111		
T-Access-S3	2960-24TT		Tallinn	70.144.7.4/28	70.144.7.1/28	VLAN 111		

Phase 7 Configure Routers and Routing Protocol

The Web Server is configured as Loopback 0 on ISP to represent the internet.

Table C: Routers Details

Site: Minsk

Router Name: R1-Minsk

Interface/Sub Interface Type/Number	Description and Purpose	Network/VLAN Name	Network Address	Interface IP Address	Subnet Mask/Value
Go/0/0.10	Connection to VLAN 10	Security	70.144.7.64	70.144.7.65	255.255.255.240
Go/0/0.20	Connection to VLAN 20	Technical	70.144.7.80	70.144.7.81	255.255.255.240
Go/0/0.30	Connection to VLAN 30	Vehicle-Servicing	70.144.7.96	70.144.7.97	255.255.255.240
Go/0/0.99	Connection to VLAN 99	Server Farm	70.144.6.0	70.144.6.1	255.255.255.128
Go/0/0.100	Connection to VLAN100	Leasing	70.144.4.0	70.144.4.1	255.255.255.0
Go/0/0.111	Connection to VLAN 111	Management	70.144.7.32	70.144.7.33	255.255.255.240
Go/0/0.200	Connection to VLAN 200	Marketing	70.144.2.0	70.144.2.1	255.255.255.0
Go/0/0.300	Connection to VLAN 300	Business	70.144.0.0	70.144.0.1	255.255.254.0

Site: Kaunas

Router Name: R2-Kaunas

Interface/Sub Interface Type/Number	Description and Purpose	Network/VLAN Name	Network Address	Interface IP Address	Subnet Mask/Value
Go/0/0.5	Connection to VLAN 5	Printer	70.144.8.8	70.144.8.9	255.255.255.248
Go/0/0.10	Connection to VLAN 10	Security	70.144.7.112	70.144.7.113	255.255.255.240
Go/0/0.20	Connection to VLAN 20	Technical	70.144.7.128	70.144.7.129	255.255.255.240
Go/0/0.30	Connection to VLAN 30	Vehicle-Servicing	70.144.7.144	70.144.7.145	255.255.255.240
Go/0/0.100	Connection to VLAN100	Leasing	70.144.6.128	70.144.6.129	255.255.255.128
Go/0/0.111	Connection to VLAN 111	Management	70.144.7.48	70.144.7.49	255.255.255.240

Site: Tallinn

Router Name: R3-Tallinn

Interface/Sub Interface Type/Number	Description and Purpose	Network/VLAN Name	Network Address	Interface IP Address	Subnet Mask/Value
Go/0/0.10	Connection to VLAN 10	Security	70.144.7.160	70.144.7.161	255.255.255.240
Go/0/0.20	Connection to VLAN 20	Technical	70.144.7.176	70.144.7.177	255.255.255.240
Go/0/0.30	Connection to VLAN 30	Vehicle-Servicing	70.144.7.192	70.144.7.193	255.255.255.240
Go/0/0.111	Connection to VLAN 111	Management	70.144.7.0	70.144.7.1	255.255.255.240
Go/0/0.150	Connection to VLAN 150	Sales	70.144.3.0	70.144.3.1	255.255.255.0

Site: Riga

Router Name: R4-Riga

Interface/Sub Interface Type/Number	Description and Purpose	Network/VLAN Name	Network Address	Interface IP Address	Subnet Mask/Value
Go/0/0.10	Connection to VLAN 10	Security	70.144.7.208	70.144.7.209	255.255.255.240

Go/0/0.20	Connection to VLAN 20	Technical	70.144.7.224	70.144.7.225	255.255.255.240
Go/0/0.30	Connection to VLAN 30	Vehicle-Servicing	70.144.7.240	70.144.7.241	255.255.255.240
Go/0/0.111	Connection to VLAN 111	Management	70.144.7.16	70.144.7.17	255.255.255.240
Go/0/0.150	Connection to VLAN 150	Sales	70.144.5.0	70.144.5.1	255.255.255.0

Phase 8 Configuring IP Addresses

DHCP – Kaunas Site

Table D: Kaunas DHCP Server Pool IP Host Addresses

VLAN Name	IP Address Pool Range	Subnet Mask /value	Default Gateway IP Address
5 Printer	70.144.8.10-14	255.255.255.248	70.144.8.9
10 Security	70.144.7.117-126	255.255.255.240	70.144.7.113
20 Technical	70.144.7.134-142	255.255.255.240	70.144.7.129
30 Vehicle-Servicing	70.144.7.150-158	255.255.255.240	70.144.7.145
100 Leasing	70.144.6.134-254	255.255.255.128	70.144.6.129

Due to Packet Tracer's limitations, it was not possible to reserve a specific host address for Printer1, therefore, a separate printing vlan/pool was created only for Kaunas to demonstrate DHCP's feature of manually assigning IP. All the addresses were excluded except one address to avoid DHCP giving a different ip address.

Table E: Statistically assigned IP Host Addresses – Servers, Printers etc

Server/Printer Etc	In Which VLAN	IP Address	Subnet Mask/Value	Default Gateway IP	Service/s Provided
Printer 1	VLAN 5	70.144.8.14	255.255.255.248	70.144.8.9	Printing

Phase 9 Configuring Frame Relay and PPP

Phase 10 Wireless LAN Deployment Tallinn

Table F: Wireless Access Point Details

At Tallinn site, in the prototype design, a wireless access point is connected to Switch-Access 3 to provide wireless connection to Technical group.

Name	Model	SSID	Channel	
Security WAP	AP-PT	Security Wifi	2.4GHz	

Phase 11 NAT Configuration

Network Address Translation (NAT) plays an important role as organisations grow, more devices need IP addresses NAT provides the process of reducing the number of public IP addresses used by an organisation. In case of Electric Vehicles Ltd, a static address is configured to all the three servers demonstrated in the prototype.

Phase 12 Access Control at Minsk Site

As previously mentioned, the benefits of subnetting, Access Control Lists is another tool which effectively take advantage of a departmental company design. VLSM allows ACLs to control traffic subnet by subnet.

At Minsk site, ACL is configured on g0/0 to control the traffic. For example, a PC host from their respective has been denied access to specified VLANs. PC host in Vehicle Servicing is denied access to Server Farm.