ADSER

CCDE SERVICE PROVIDER PRACTICE SCENARIO

Author
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About the author

Mohammad Khalil is a 13 years' experience in service provider networks , Cisco courses trainer and holds two CCIE in routing & switching and Service Provider.

Technical Reviewer

Ronald Lopez (CCIE-SP #45257) from Nicaragua living in the US. Currently working as a Network Architect at a Human Capital Management Enterprise Company with 10 years' experience in service provider networks.

About this workbook

This workbook simulates a Cisco Certified Design Expert (CCDE) scenario that aim to test the technology knowledge from a high level perspective and evaluate the ability to optimize the given network topologies and choose the right features and exclude others based on outcomes of deployed technical features and the resulting behavior.

This workbook is a service provider scenario with remarkable number of questions that scan several technologies: routing protocols, MPLS VPNs, BGP, etc.

The number of questions that can be within a scenario from the lab exam is around 20 to 35 questions , the number of questions in this scenario is much more and was intended to cover more and more features , deployments and caveats.

The questions varies from multiple choice, filling comparison tables, choosing optimal design option based on the given information, etc.

The variation of questions order aims to increase the robustness of focus for readers.

The scenario is more into features from ability of deployment, adaptability and interaction.

Disclaimer

The opinions expressed in this publication are those of the author, they do not purport to reflect the opinions or views of Cisco Systems.

ADSER Background Information

ADSER is a Jordanian service provider which provides MPLS service to its customers due to the demand in providing VPN connectivity (banks, enterprises, etc.).

ADSER network mainly consists of 4 PoPs distributed over 4 major cities and dark fiber to interconnect in between these PoPs.

The main PoP which contains the Border Routers is located within the Capital city: Amman.

The rest of the PoPs are located in different cities to account for customer existence.

Currently, ADSER only provides MPLS L3VPN service to its customers due to the conviction by their network team that this service gives better control and visibility to the service provider.

The only PE-CE routing protocol allowed is BGP regardless of the number of customer nodes and received prefixes, as well, the choice was made due to previous bad experience with static routing which hardened the management for the customers.

The running IGP inside ADSER network is ISIS with flat Level-2 implementation as the previous network contained ATM switches and ISIS was the best to choose.

The current IP scheme used inside the network is 192.168.X.0/24 on all interconnection links inside the core and 10.10.X.0/24 on the customer's interconnection links. Loopback interfaces use the X.X.X.X for IPv4 addressing where X is the router # and this interface to be used as ID for any protocol to take place.

A variety of deployment for customers do exist from single-homed to dual-homed with Ethernet only as the physical media termination.

ADSER utilizes two routers as MPLS LSR which acts as well as route reflectors to the current MPLS core domain LERs but not to each other.

ADSER uses ASN:NN as the numbering convention for its MPLS L3VPN service defined VRFs.

One of the resigned network engineers connected a new PE router to another PE router in a cascaded fashion due to the lack of fiber connectivity in the city where it resides, but mistakenly configured the parent PE to be a route reflector to this new service PE (PE3).

Nothing has changed since it was connected as the served customer refused any downtime in its service.

Currently no Internet access is delivered to MPLS L3VPN customers.

ADSER deployed PIM Dense mode inside its network. The choice for PIM Dense mode was due to its usefulness in LAN environments and it is less sophisticated than PIM Sparse mode.

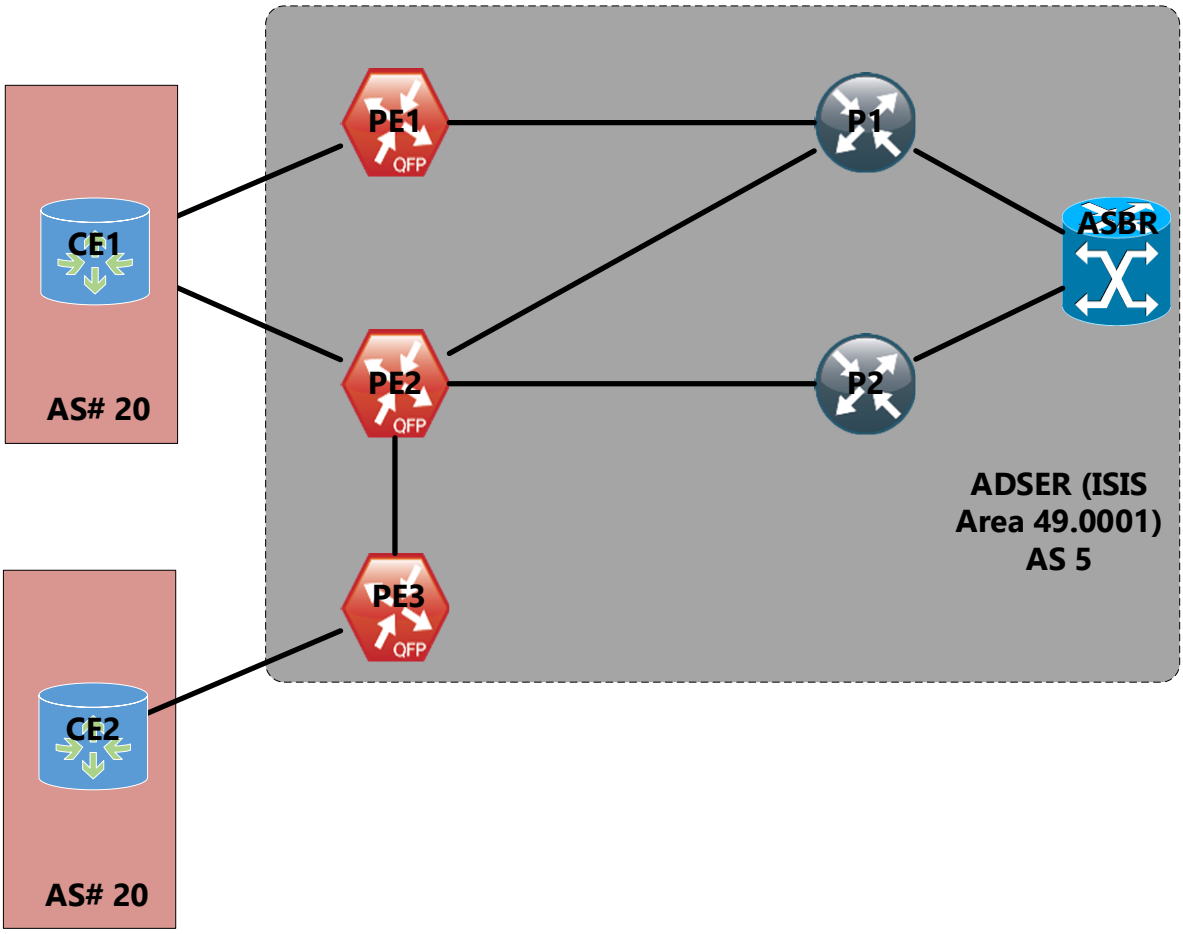


Figure: ADSER Network Diagram

BigSER Background Information

BigSER is another MPLS service provider that is located in Jordan as well with the main PoP co-exist in the same city but in a different region.

BigSER as well currently provides MPLS L3VPN services with the intention to provide L2VPN services in the coming future.

Below is a figure that illustrates the distribution of both providers PoPs among Jordan geographic map.

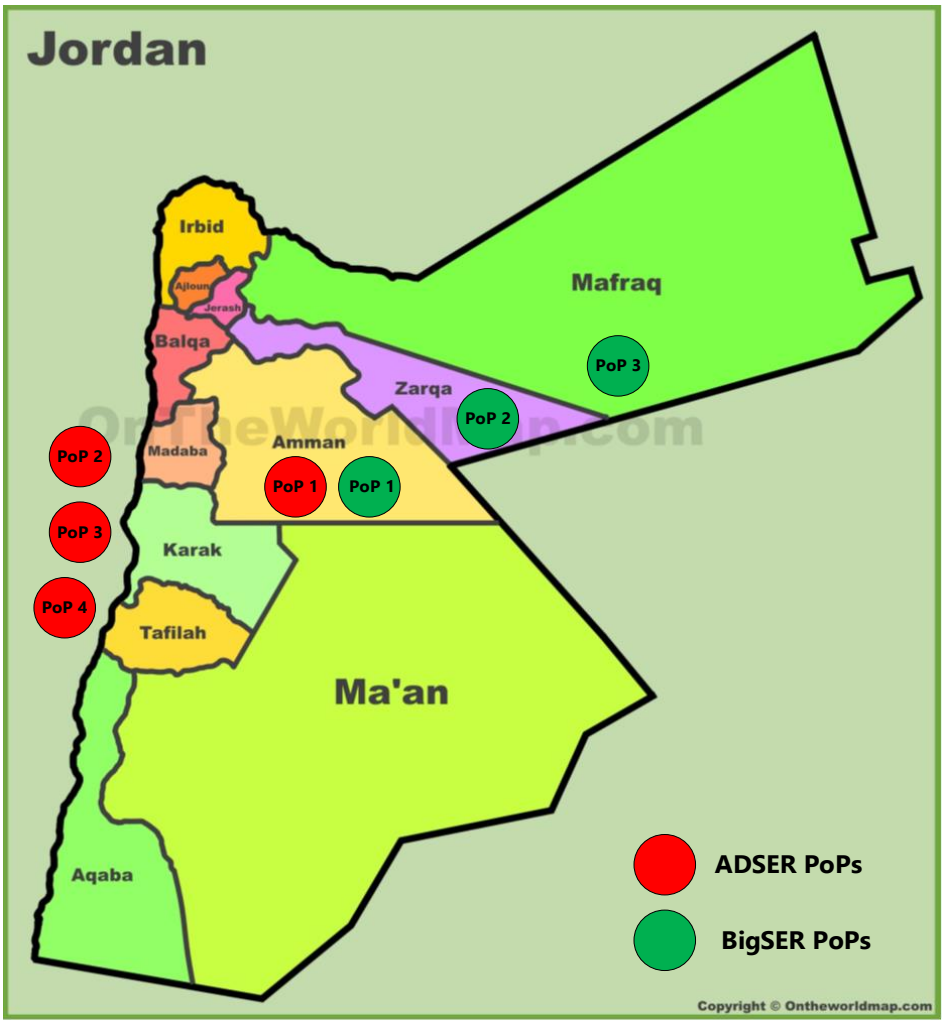


Figure: ADSER & BigSER Geo map

They also utilize P routers for route reflection role in the network for the serving PEs and they also use the same ASN:NN convention.

OSPF flat area 0 is in place for interconnection links and loopbacks prefixes advertisement.

The current IP scheme used inside the network is 192.168.X.0/24 on all interconnection links inside the core and 10.10.X.0/24 on the customer's interconnection links. Loopback interfaces use the X.X.X.X for IPv4 addressing where X is the router # and this interface to be used as ID for any protocol to take place.

BigSER deployed two ASBRs to handle Internet traffic with iBGP session in between for redundancy purposes.

Currently both ASBRs are connected to a single uplink provider single-homed to one router.

BigSER tried to purchase another circuit from another provider but due to financial issues they could not accomplish.

As well, the only available circuit from one of the ASBRs is FastEthernet in contrast to the second one which is GigEthernet.

BigSER deployed PIM Sparse mode due to its join behavior rather than the flood and prune behavior as the case with PIM Dense mode.

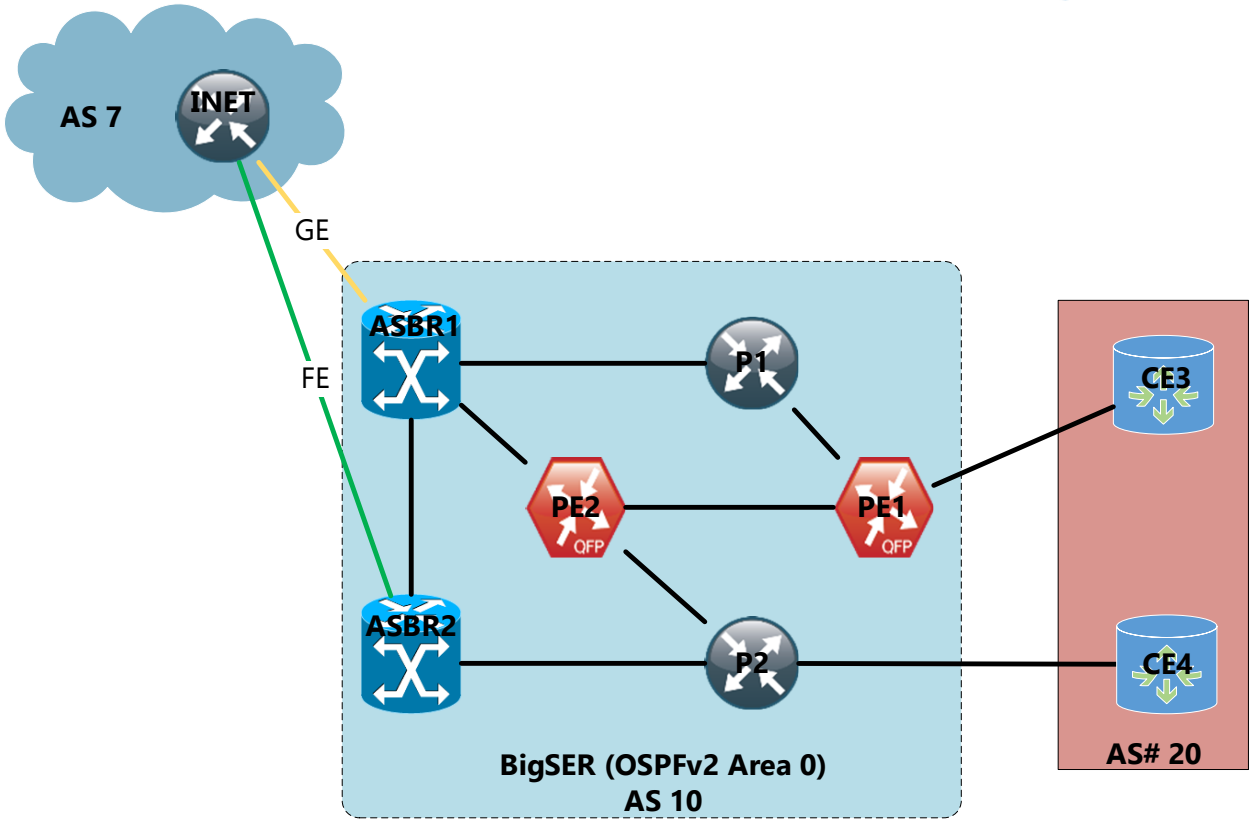


Figure: BigSER Network Diagram

MediaCORP Background Information

MediaCORP is a media broadcast station who is willing to connect their geographically distributed branches together.

Due to the sites separation, branches to be served are distributed between ADSER and BigSER which will force the two providers to cooperate to achieve and fulfil the needed for the new customer.

As the competition was high in between the two service providers in the market, lack of proper communication took place and the project timeline almost started.

As MediaCORP is concerned about their business to be smoothly implemented, they suggested to hire a freelancer network designer and optimizer who will propose the right model to follow.

This suggestion was met by approval from both service providers who are willing to get benefit from the expert to highlight some issues they are facing and develop some technologies they are considering to deploy as both providers have intermediate experienced engineers.

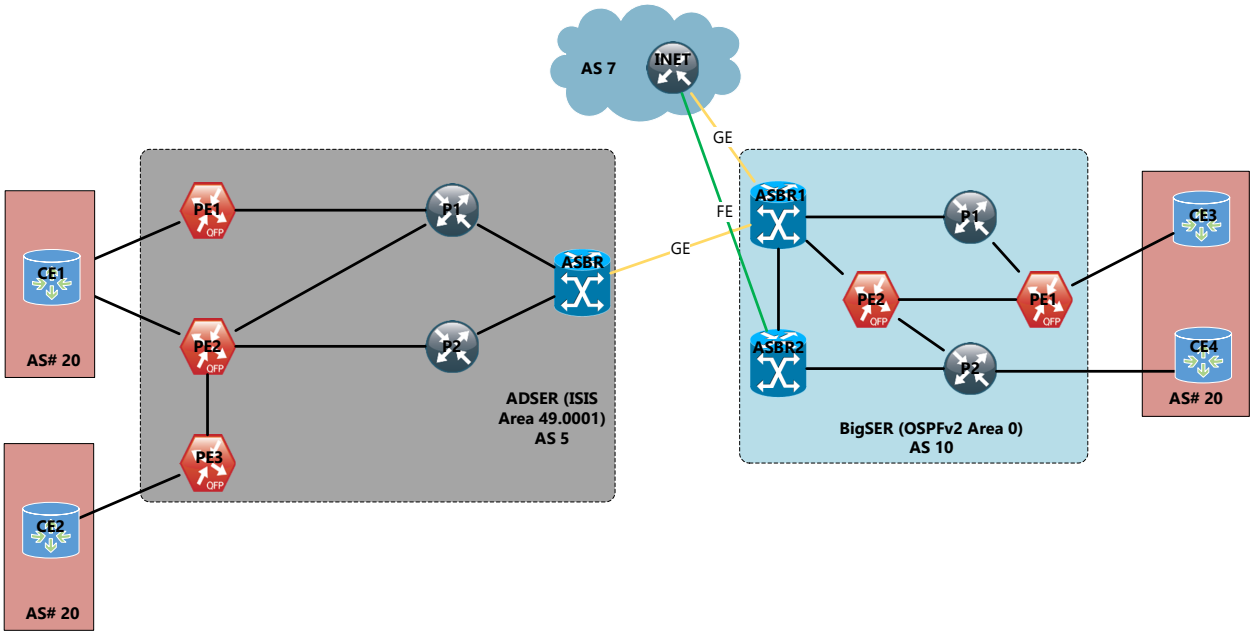


Figure: ADSER & BigSER Interconnection

E-Mail #1:

From: *network@mediacorp.com*
To: *KHALIL@godesign.com*
CC: *core@adser.com;core@bigser.com*
Subject: *Consultancy Services*

Dear KHALIL
Hope this mail finds you well

We are glad to inform you that your esteemed firm has been awarded the consultancy services for our network including all the applications and services running in it.

As well, with the agreement of our service providers, they are happy to have your experience spread among from the core walking down to the access layer.

In addition, some new services are running in the minds of their network engineers and they are willing to discuss it with you.

You are free to ask any piece of information you need in order to start the optimization process.

We expect from you after your analysis to provide us with:

- *Weaknesses points in both service providers*
- *Features/technologies that could enhance network performance*
- *Ability to hold new services*

Taking into account that both companies at the current time have limited budget as well as limited experience in certain areas of technologies.
After we are done with the service providers which will hold our traffic, you will be prompted to start with our applications and we will provide you with the needed at that time.

Thanks
Dani Shaw, CTO
MediaCORP

E-Mail #2:

From: *KHALIL@godesign.com*
To: *network@mediacorp.com*
CC: *core@adser.com;core@bigser.com*
Subject: *Re: Consultancy Services*

Dear Dani

Thanks for the generous chance you have provided and I will be looking forward to start the design and enhancement process.

BR,
KHALIL, Design Consultant
GoDesign

Q1) Based on the provided network topology and the associated information, what are the main issues with the current BGP design inside ADSER network? (Choose two)

a) Modularity
b) SPoF (Single Point of Failure)
c) Convergence
d) Scalability

Q2) In your opinion, what is the issue that could arise from having a PE connecting to another PE which is acting as a RR and already a pair of RRs already in place?

a) Management burden
b) Failure recovery
c) Scalability
d) Normal situation, nothing to worry about

E-Mail #3:

From: *core@adser.com*
To: *KHALIL@godesign.com*
Subject: *Single Point of Failures*

Dear KHALIL

We are glad you are here to assist us in some annoying caveats taking place in our infrastructure What is the most issue causing headache to us is the single point of failure either for nodes or interconnection links.
Can you please help us isolate this as we are trying to maintain a stable service to our customers?
And before I forget, MediaCORP is the customer illustrated in the network diagram we provided to you and we have it's headquarter dual-homed to one of our PEs.

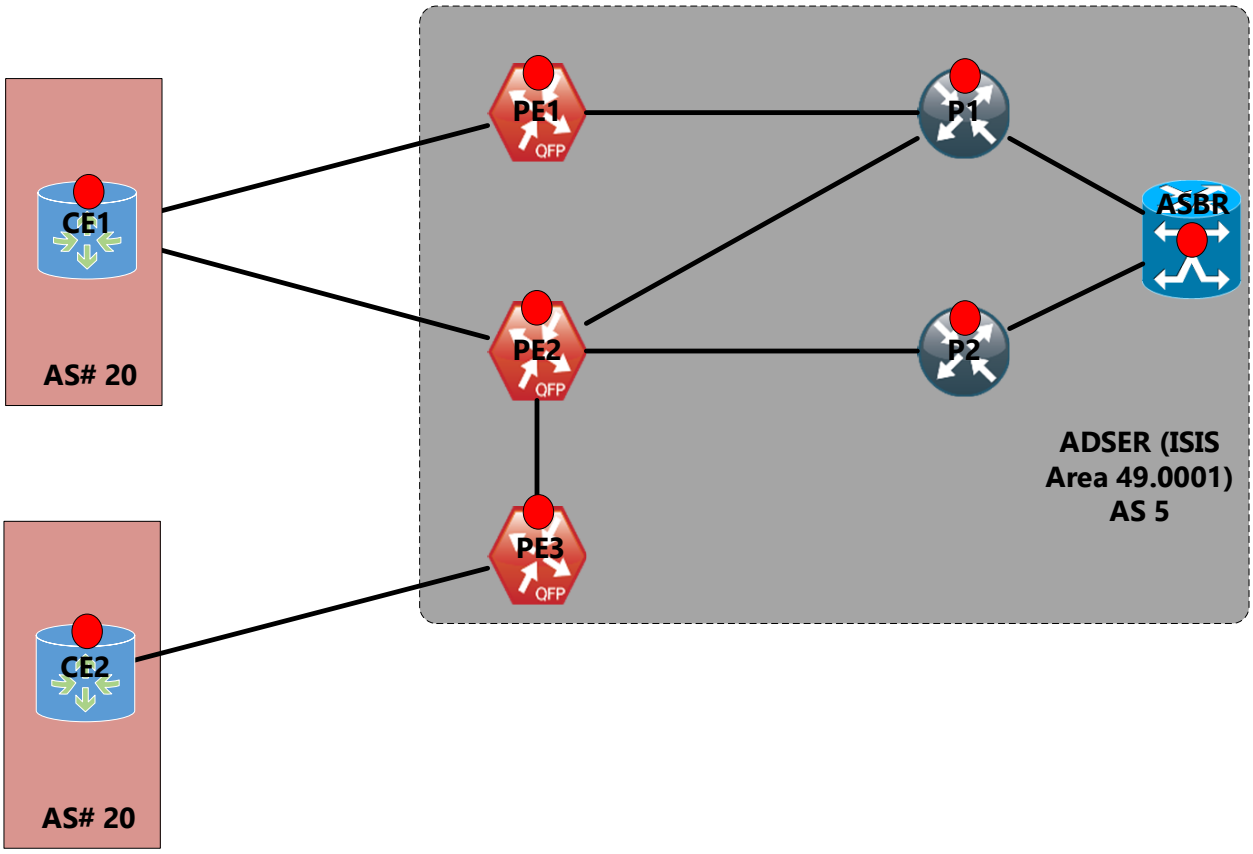
Thanks

Core Network Team
ADSER

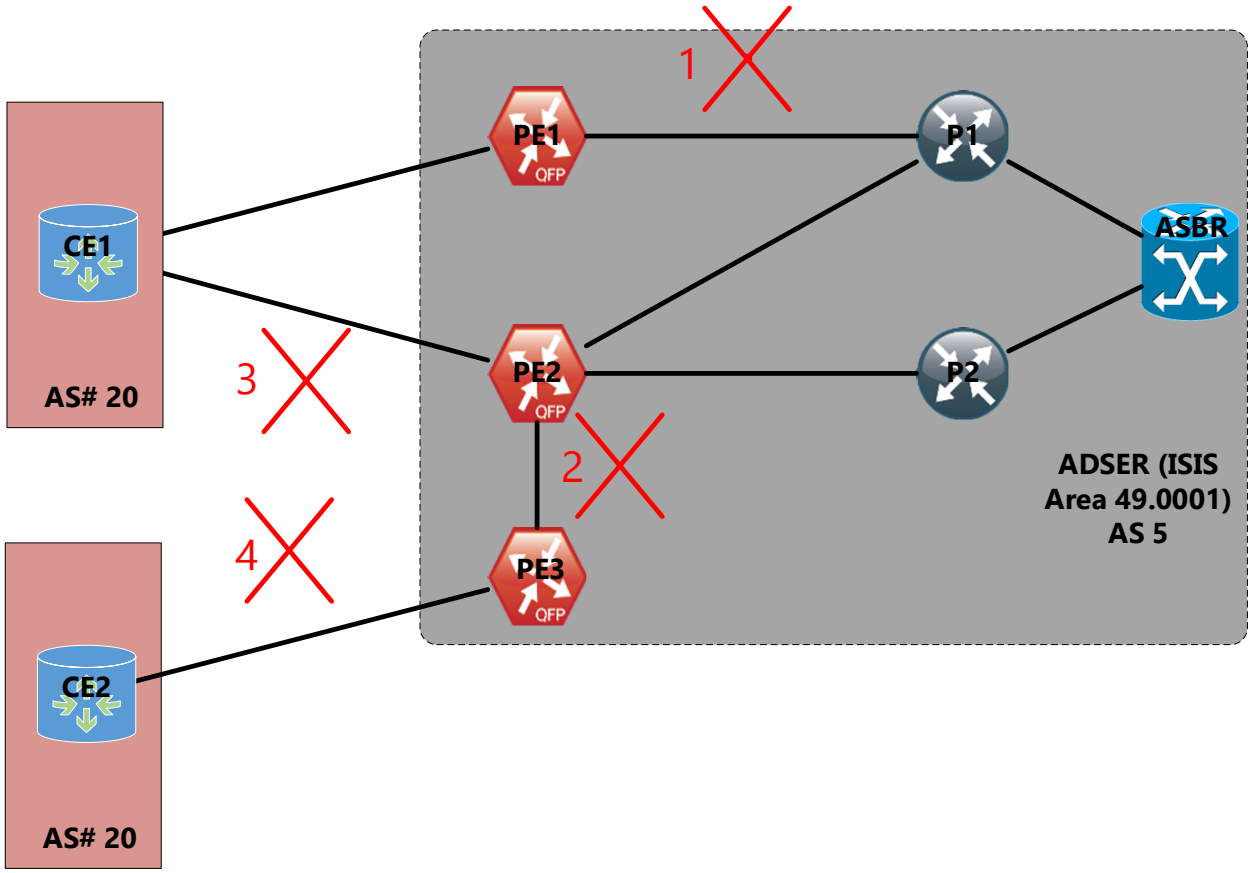
Q3) Based on the mail sent from ADSER core team, what is the parameter they are looking for?

a) Adaptability
b) Reliability
c) Expandability
d) Serviceability

Q4) Mark the most critical core devices that in case of failure will cause service interruption between MediaCORP entities (choose all that apply).

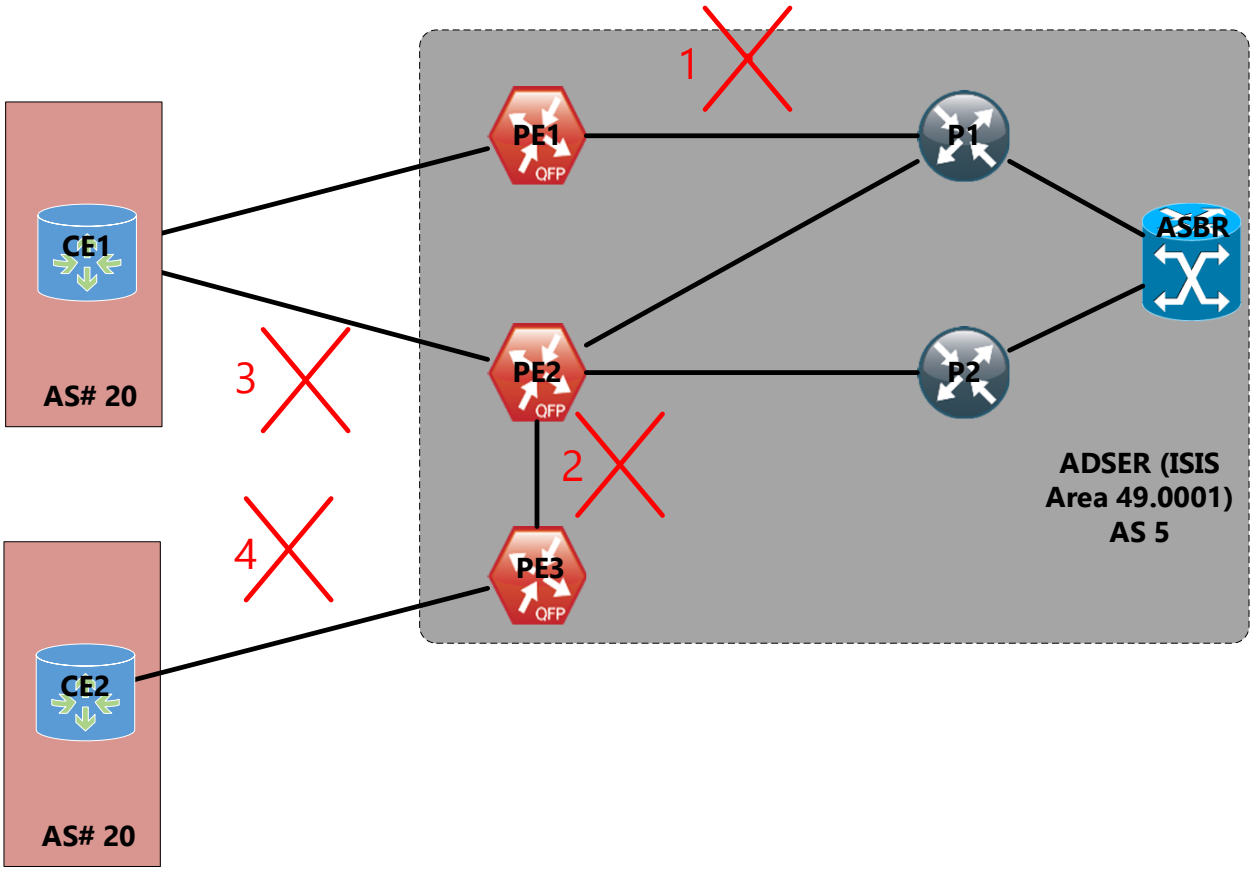


Q5) What is the access link that in case of failure will cause complete service disruption? (Refer to the below diagram).



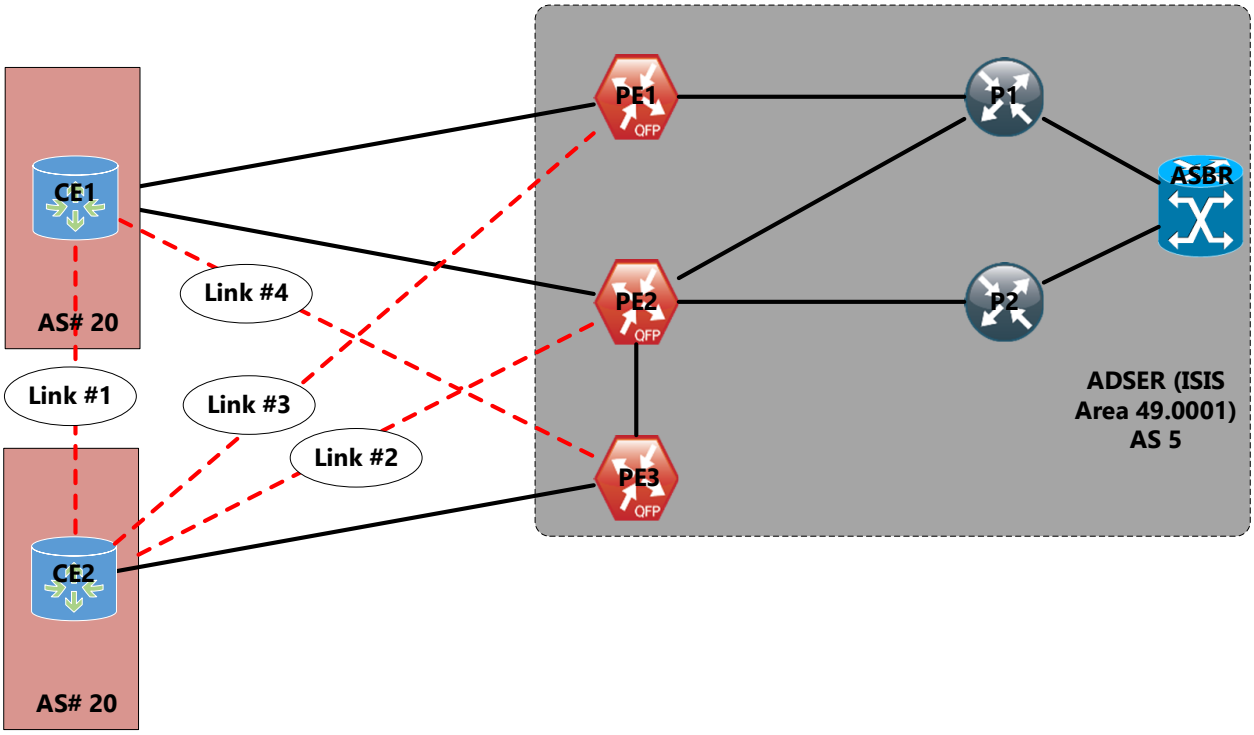
a) 1
b) 2
c) 3
d) 4

Q6) What is the core link that in case of failure will cause complete service disruption? (Refer to the below diagram).



a) 1
b) 2
c) 3
d) 4

Q7) Taking into consideration that MediaCORP do not participate in interconnection in-between entities , what last mile connection if available would you implement to achieve higher availability than the current situation? (Refer to the below diagram).



a) Link #1
b) Link #2
c) Link #3
d) Link #4

E-Mail #4:

From: *core@adser.com*
To: *KHALIL@godesign.com*
Subject: *BGP Design*

Dear KHALIL

Thanks for highlighting some points in our network in regard to single point of failures and we will try to account for the changes in the budget.
If you do not mind, let us move deeper into the core of our network.
As we are running flat Level-2 ISIS, we can see no changes to take place for now.
We are concerned about BGP design, and as you can see BGP is everywhere.
Currently we are only serving our customers with L3VPN but you do not know how things could change in the coming days.
We feel that redundancy level is not in the highest and we really care for that aspect to be raised as well as without affecting our routers resources as they are not that high end.
And by the way, do we really need route reflectors in our network?

Thanks

Core Network Team
ADSER

Q8) Fill the table below to compare between RR existence in the network and RR absence.

Aspect/Deployment	With RR	Without RR
iBGP Sessions	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐
Convergence time	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐
BGP Updates	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐
Adjacencies	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐
OPEX	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐
Path Diversity	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐

E-Mail #5:

From: *core@adser.com*
To: *KHALIL@godesign.com*
Subject: *RE: BGP Design*

Dear KHALIL

Based on your feedback, we will keep the route-reflection in place and we will establish iBGP session in-between the existing RRs.
We will solve the isolated PE issue later till we are done from our high valued customer
But still we need to perform the best deployment though.

Thanks

Core Network Team
ADSER

Q9) Would cluster-ID feature be of help to ADSER network?

a) Yes
b) No

Q10) BGP RR cluster implementation comes into two flavors: Same cluster-ID and different cluster-ID, which one will be the one that suites ADSER requirement?

a) Same Cluster-ID
b) Different Cluster-ID

Q11) If two additional physical links were available to you to account for single and double failures on the current core links, what is the best option to follow?

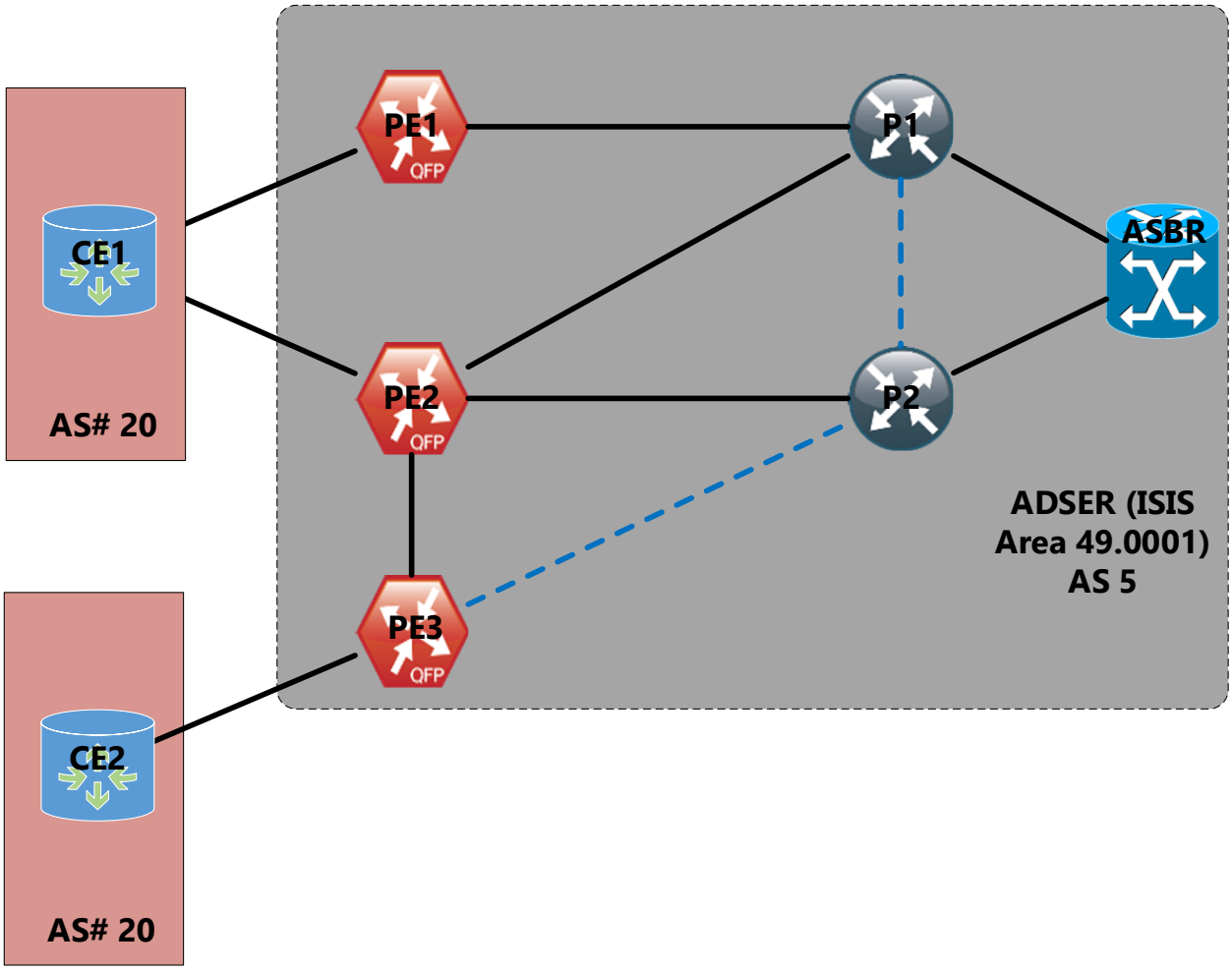


Figure: Option 1

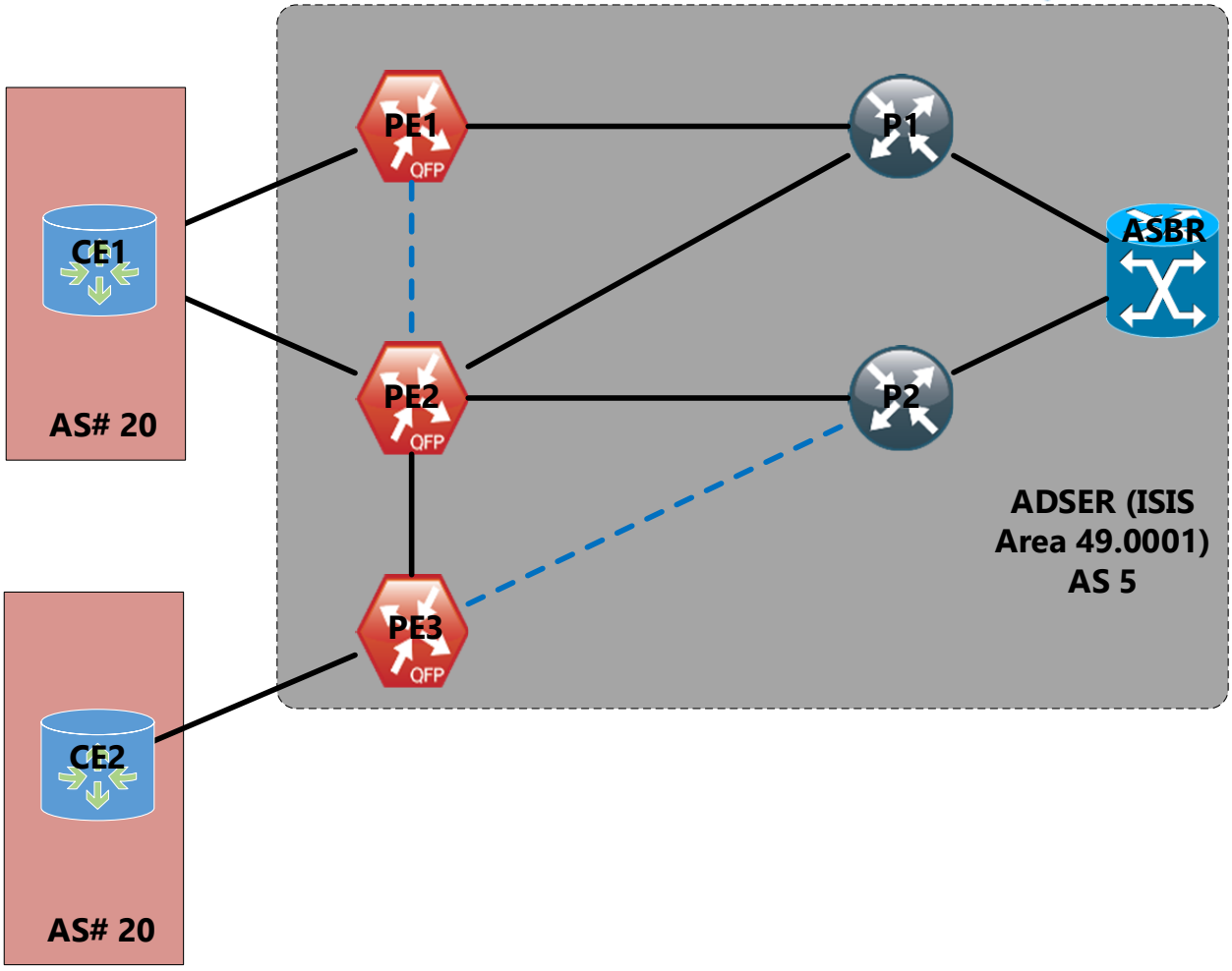


Figure: Option 2

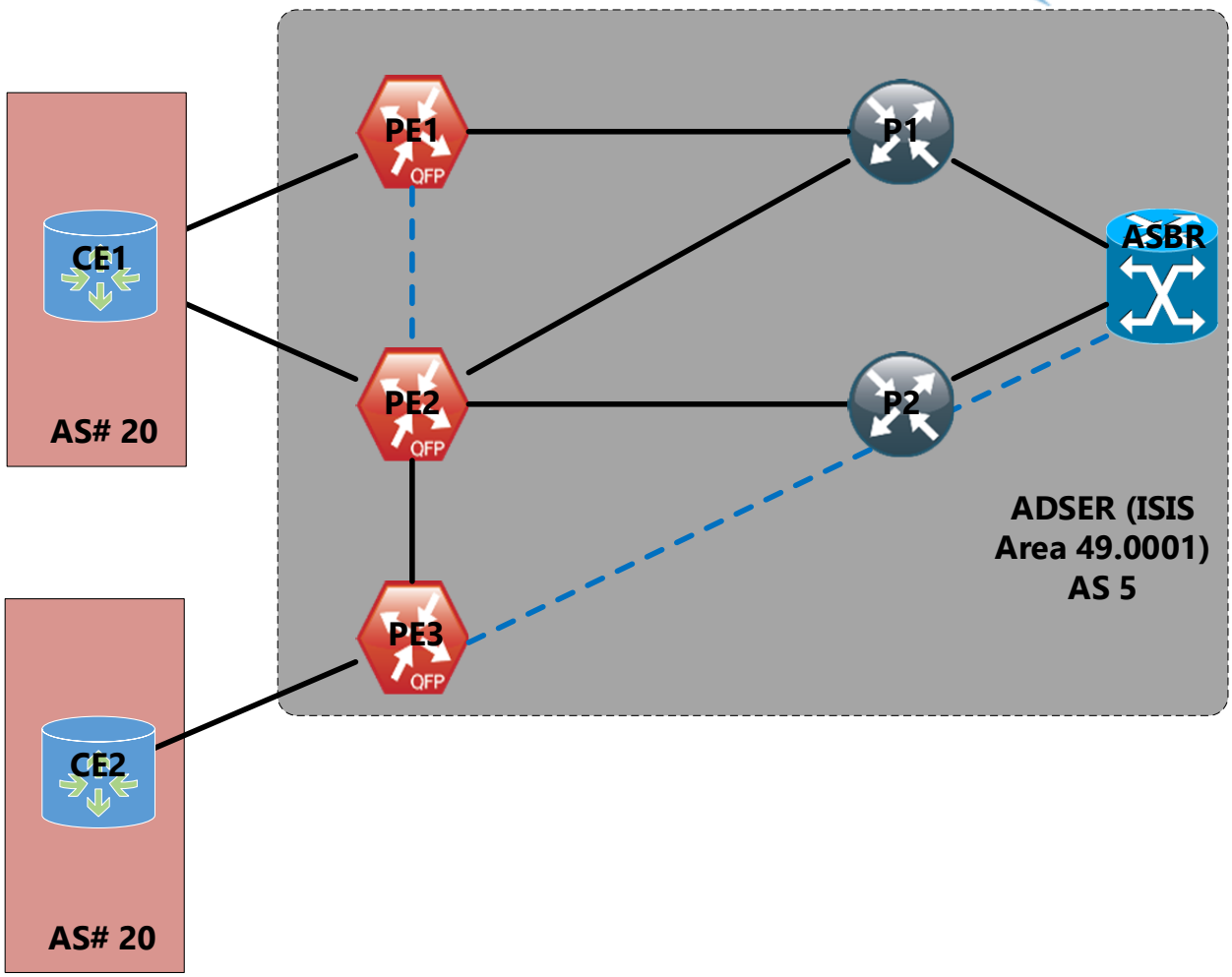


Figure: Option 3

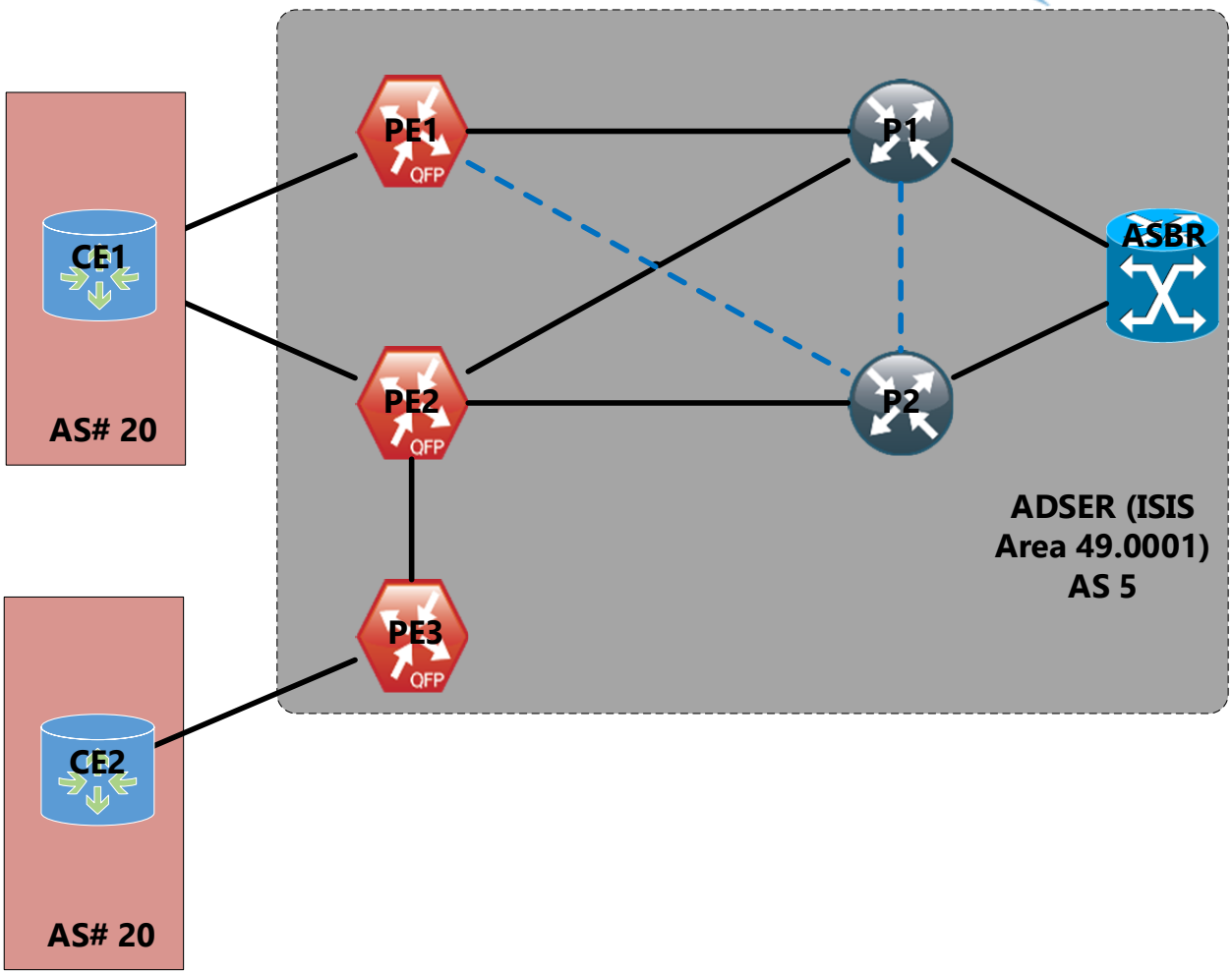


Figure: Option 4

a) Option 1
b) Option 2
c) Option 3
d) Option 4

E-Mail #6:

From: *core@adser.com*
To: *KHALIL@godesign.com*
Subject: *RE: BGP Design*

One of our engineers is enthusiastic about BGP and he read about a setup called: out-of-band route reflection, could you please highlight this and advise if we can get enhancement from this feature and if our network bear to support such.

Thanks

Core Network Team
ADSER

Q12) Is out-of-band route reflection model applicable in ADSER current network?

a) Yes
b) No

Q13) Why out-of-band route reflection model is not a good option for ADSER network?

a) Network topology
b) In-band is better serving IPv4 address-family
c) Current devices resources
d) It affects path diversity

E-Mail #7:

From: *core@adser.com*
To: *KHALIL@godesign.com*
Subject: *MPLS L3VPN Service*

We have configured the L3VPN service for our high valued customer with the arrangement with him and we can see prefixes installed but with lack of proper communication between the HQ and the branch.
We still inside our AS and we cannot guarantee the customer his paid service and the customer refuses any manipulation to be done from his side!
Any advice?

Core Network Team
ADSER

Q14) What feature should be implemented to allow for proper communication and for prefixes installment?

1) Add path
2) Next-hop-self
3) Allow-as in
4) As-override

E-Mail #8:

From: *core@adser.com*
To: *KHALIL@godesign.com*
Subject: *Network Convergence*

Dear KHALIL

Thanks for the previous action

Currently we are concerned about the convergence in our network due to the lack of full mesh connection model, we need a solution that can be applied to our core devices that will reduce the needed convergence time to msec value taking into account that we cannot do any sort of migrations, even though we are not satisfied about BW distribution.

Core Network Team
ADSER

Q15) What feature/technology do you recommend to ADSER to enhance their convergence time?

a) MPLS TE
b) OSPF IP LFA
c) ISIS IP LFA
d) OSPF Remote LFA

E-Mail #9:

From: *core@adser.com*
To: *KHALIL@godesign.com*
Subject: *Re: Network Convergence*

Dear KHALIL

We have decided to proceed with deploying IP LFA to achieve <50 msec convergence as per your recommendations.

At the same time (while doing the implementation), one of our senior engineers is proposing moving the link between PE2 to P1 to be connected to the PE1 instead.

Core Network Team
ADSER

Q16) Would the link moving be a good option?

a) Yes
b) No

Q17) What the impact of moving the mentioned interconnection will have on the network based on the current status?

a) Convergence time increase
b) Routing loops
c) Broken MPLS LSP
d) Lost attached bit sit on the PEs

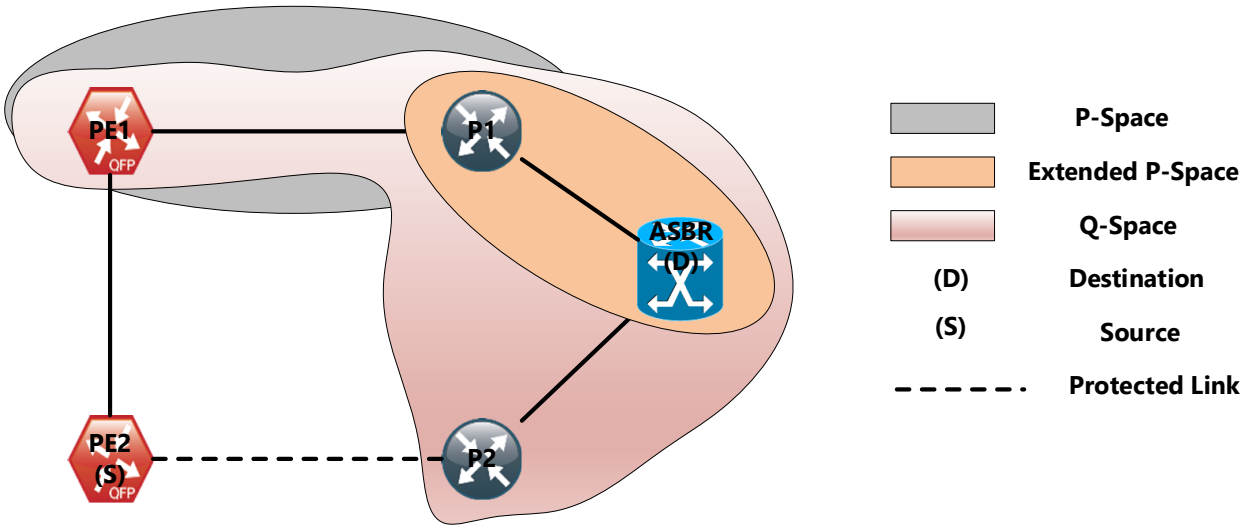
Q18) What would be the alternative in case the link has moved in order to get the convergence low again?

a) Remote LFA
b) Keep the current status

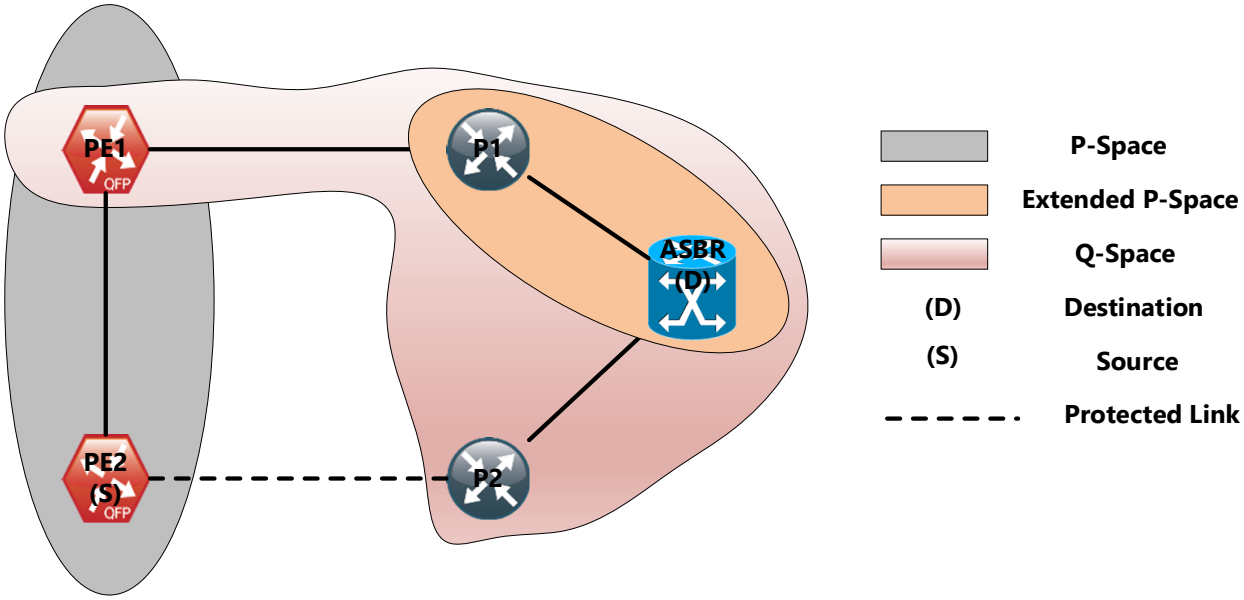
c) MPLS FRR
d) LDP FRR

Q19) Please pick the right illustration diagram from the below options that correctly describe the main domains associated with remote LFA feature based on ADSER topology and the proposed change?

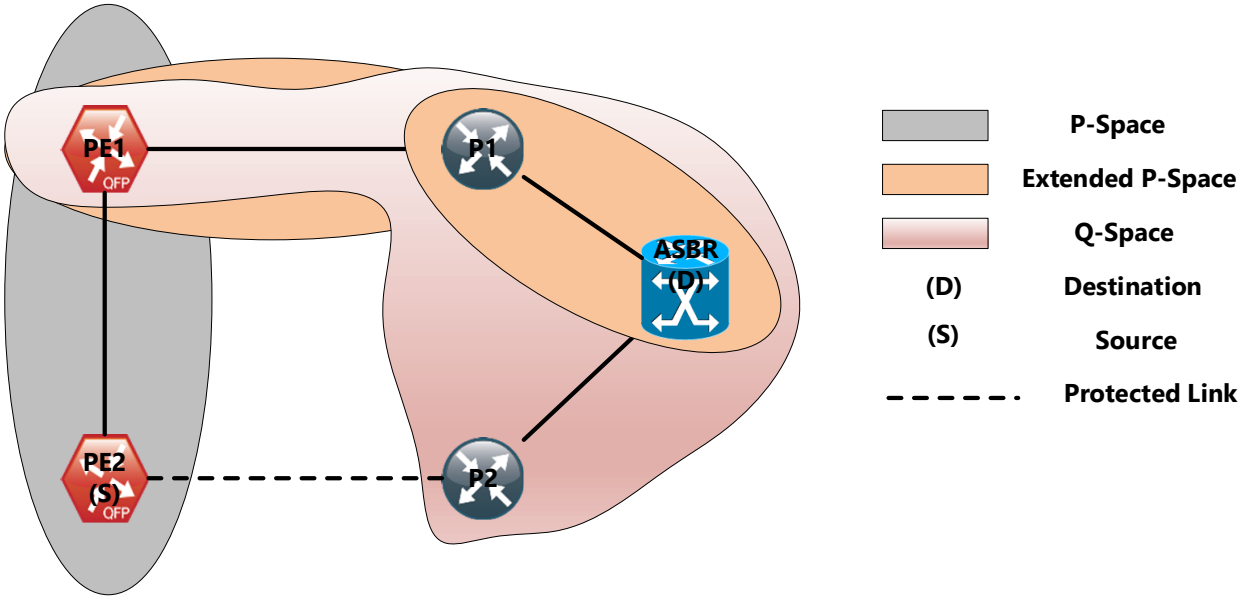
a)



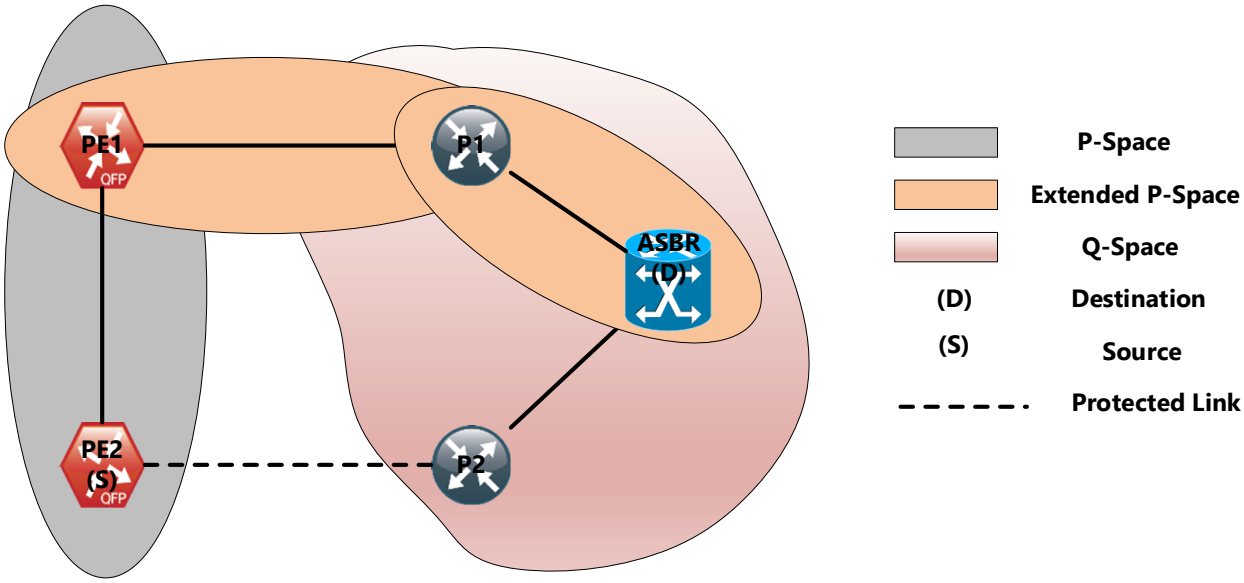
b)


PE1
QFP
P1
ASBR
(D)
PE2
(S)
QFP
P2
P-Space
Extended P-Space
Q-Space
(D) Destination
(S) Source
Protected Link

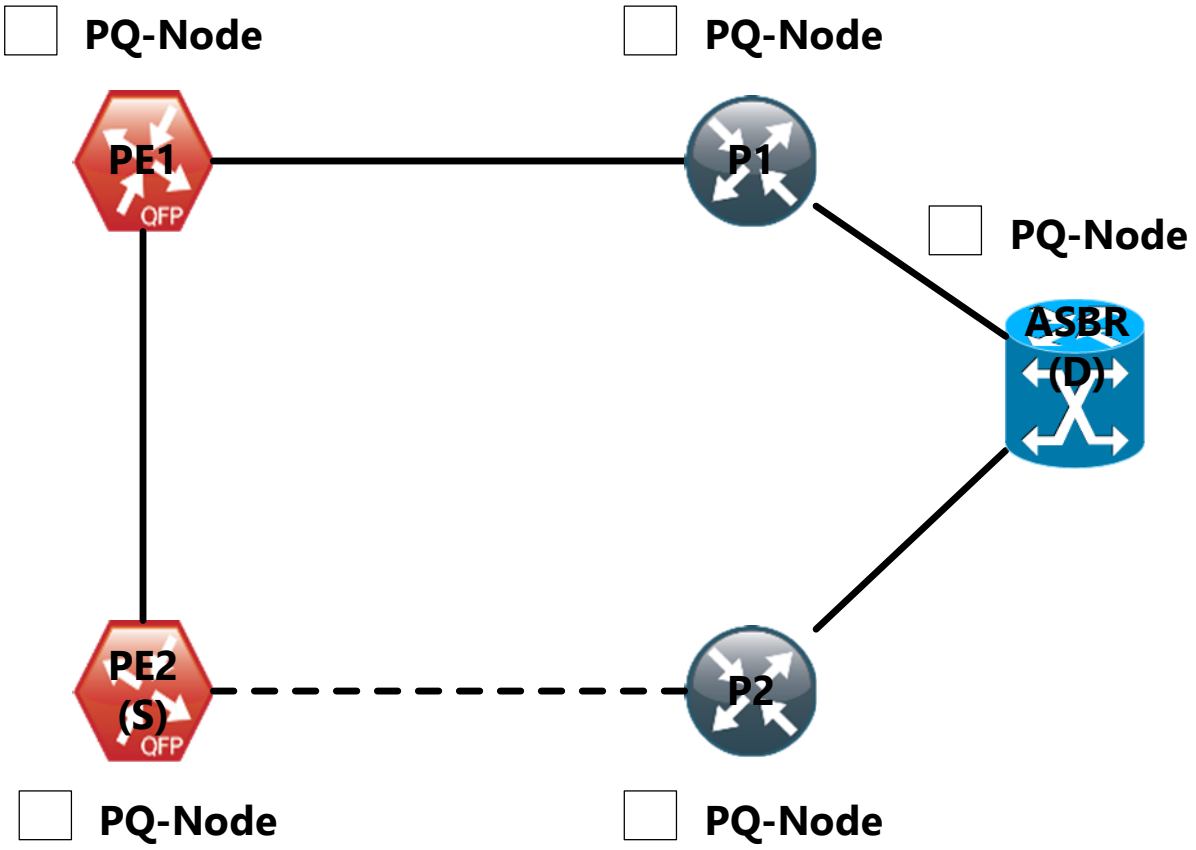
c)


PE1
QFP
P1
ASBR
(D)
PE2
(S)
QFP
P2
P-Space
Extended P-Space
Q-Space
(D) Destination
(S) Source
Protected Link

d)


PE1
QFP
P1
ASBR
(D)
PE2
(S)
QFP
P2
P-Space
Extended P-Space
Q-Space
(D)
Destination
(S)
Source
Protected Link

Q20) Based on the option you chose, mark the devices that will play the PQ-Node role in respect to the remote LFA solution discussed above.



Q21) Before making their decision , ADSER network team asked for a final comparison between IP LFA and MPLS FRR , can you please fill in the below table to clear the vision for them?

	MPLS FRR	IP LFA
Topology Dependent	☐	☐
Deployment Complexity	☐	☐
Full Coverage	☐	☐

E-Mail #10:

From: *core@adser.com*
To: *KHALIL@godesign.com*
Subject: *Security Concerns*

Dear KHALIL
Appreciate the optimization done so far, we have decided to keep the current setup as is in order to get the convergence value of interest by deploying IP LFA.
What we are concerned about is security, as you know, we are running eBGP as the PE to CE routing protocol with different deployments (single-homed and dual-homed). As well, Internet access to be implemented sooner or later, so we need a solution to help us prevent attacks.

Core Network Team
ADSER

Q22) What would you recommend to implement on CE1 to prevent attacks taking the destination address into account as well as validate the packets healthiness?

a) sRTBH
b) RTBH + Loose uRPF
c) Access lists
d) RTBH + Strict uRPF

Q23) What could be done from the service provider side to control the received prefixes from CE side?

a) Apply access-lists from the CE side
b) Apply maximum-prefix from the PE side
c) Apply maximum-prefix from the P side
d) Apply access-lists from the PE side

E-Mail #11:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *BigSER Network*

Dear Khalil

Hope this finds you well, as you have touched most of the issues that our cooperative service provider had, it is time to look for our issues as well in order to proceed with serving our mutual customers.
Just to brief you the current status, we have two ASBRs that are serving for Internet Access for our MPLS L3VPN customers with interconnection link in between, we have two P routers acting as route reflectors to the existing PE routers.
We have currently PE router (PE2) with no current customers and it was placed accounting for customers growth as we were informed by marketing department that the forecast is high and we have a bunch of customers joining in.
Another issue we have is that one of the customer branches got connected to a P router rather than a PE! I think this is something we should have a solution for in order to be able to serve him.

Thanks

Core Network Team
BigSER

Q24) In your opinion, what is the main issue in BigSER network that would affect business?

a) SPoF (Single Point of Failure)
b) In-band route reflection model
c) Cascaded PE connection
d) Customer branch connection to P router

E-Mail #12:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *Internet Access*

Dear KHALIL

We need a solution that can serve our MPLS L3VPN customer with Internet access smoothly and at the same time will not burden our resources as our ASBRs not that powerful and at the same time following our policy by not extending our customers VRFs to the border of our network.

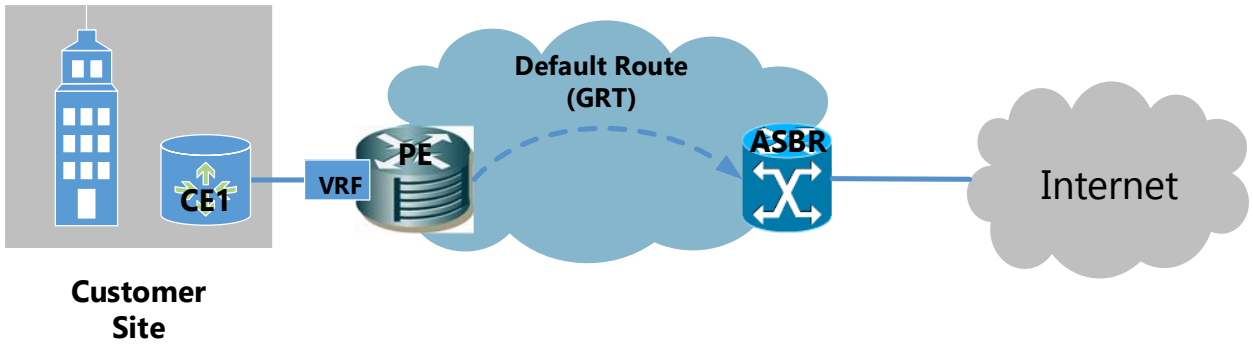
Please try your best not to touch our global RIB, we do trust you but for my staff experience sake try to avoid manipulating it!

Appreciated

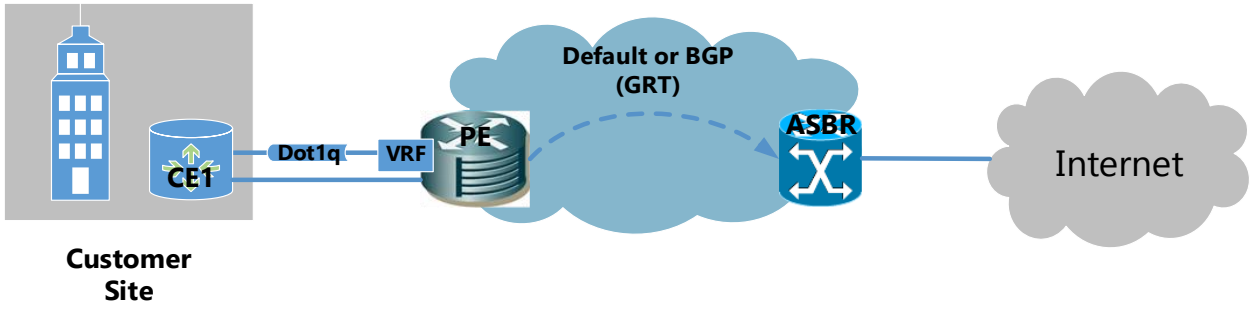
Core Network Team
BigSER

Q25) What MPLS L3VPN Internet access option from the below would you recommend for BigSER based on the above mail?

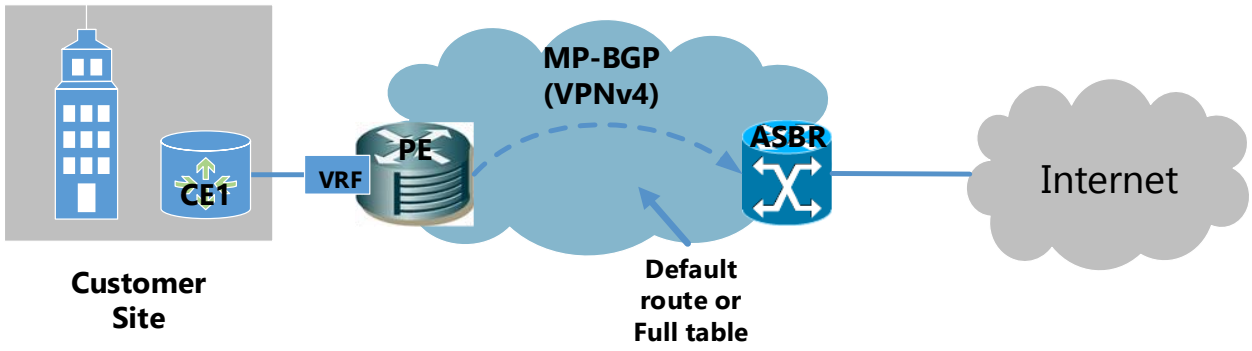
a)



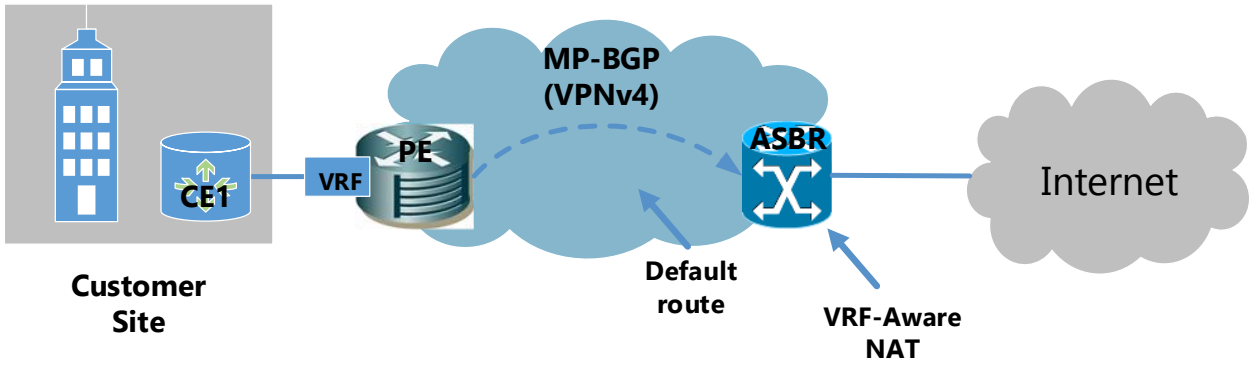
b)


Default or BGP
(GRT)
CE1
Dot1q
VRF
PE
ASBR
Internet
Customer
Site

c)


MP-BGP
(VPNv4)
CE1
VRF
PE
ASBR
Internet
Customer
Site
Default
route or
Full table

d)


MP-BGP
(VPNv4)
CE1
VRF
PE
ASBR
Internet
Customer
Site
Default
route
VRF-Aware
NAT

E-Mail #13:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *Re: Internet Access*

We have decided to proceed with Option 3 but we still feel we can enhance our convergence! Your input is highly appreciated.

Core Network Team
BigSER

Q26) If you to add a new BGP session to increase the convergence time and minimize the downtime for customers, what session will you add?

a) VPNv4 session between ASBRs
b) VPNv4 session between PEs and ASBRs
c) IPv4 session between Ps and PEs
d) IPv4 session between ASBRs

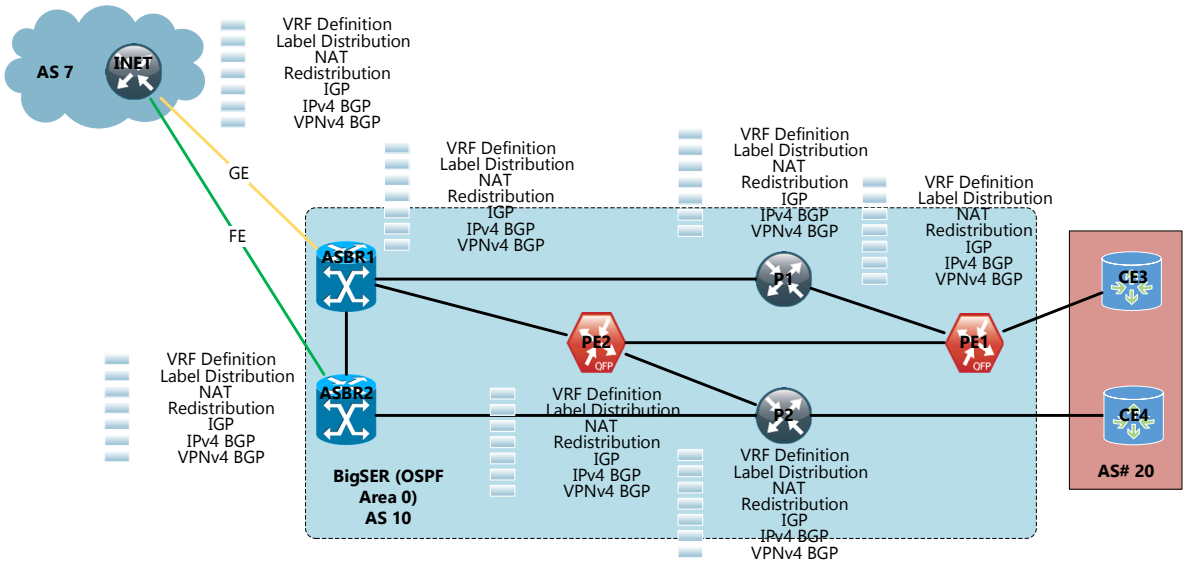
Q27) The service provider network engineers touched high utilization on the serving devices after deploying the Internet access model of choice, what could be the issue?

a) Label allocation mode
b) Sub-optimal routing
c) OSPF LSAs increment
d) Expected raise in the resources utilization, nothing to be done

Q28) What the action that could be done to enhance the processes utilization?

a) Change per allocation mode to per-prefix
b) Manipulate SPF throttling values
c) Adjust LSA pacing timers
d) Change per allocation mode to per-VRF
e) Nothing to be done

Q29) Please check the protocol/process that will take place on each device based on the chosen Internet access option.



Q30) If we faced a double failure scenario with which the link between the borders went down and the PE2 went down as depicted in the below figure.

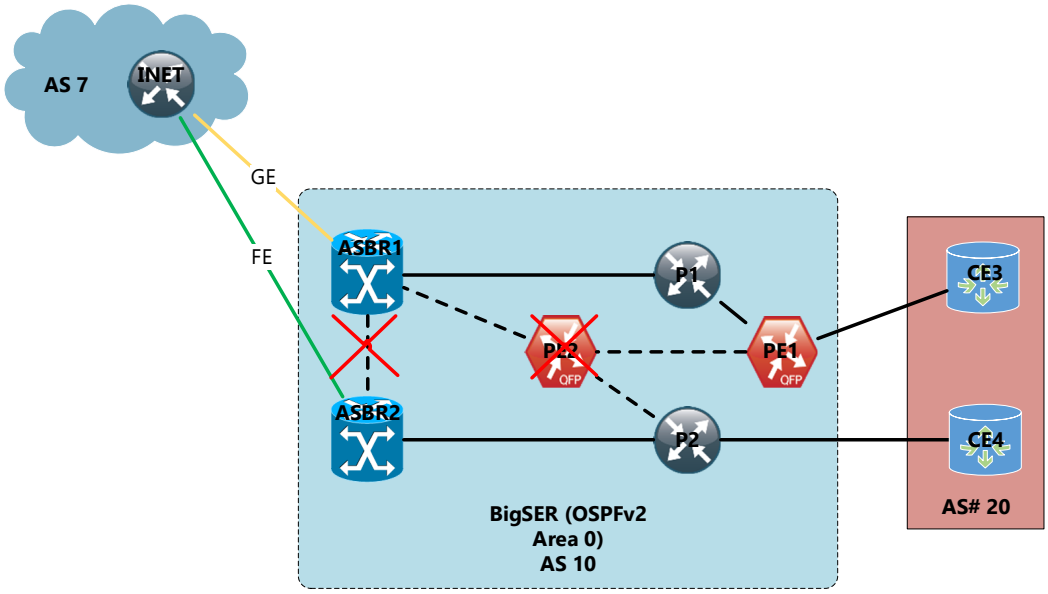
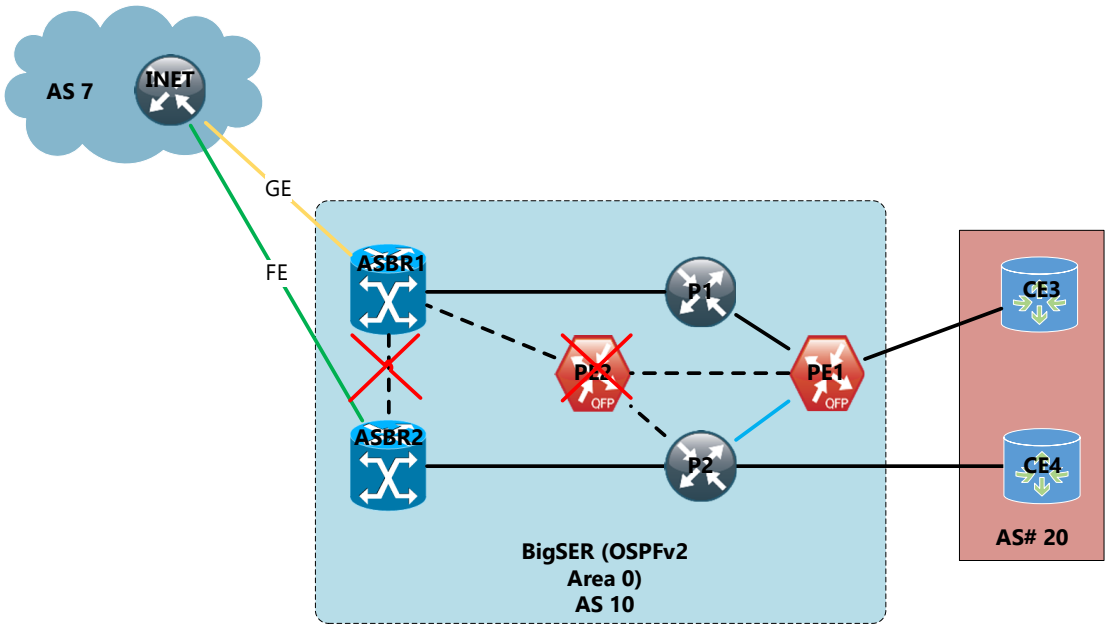


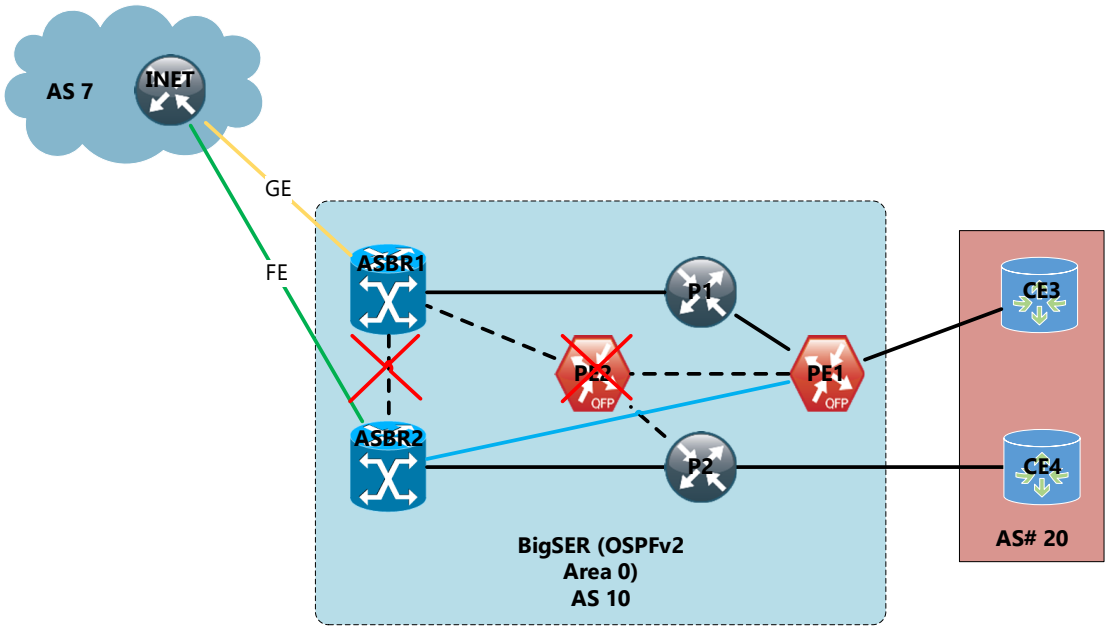
Figure: Double failure

What link if available will be the most effective in regard to convergence? (New link marked in blue).

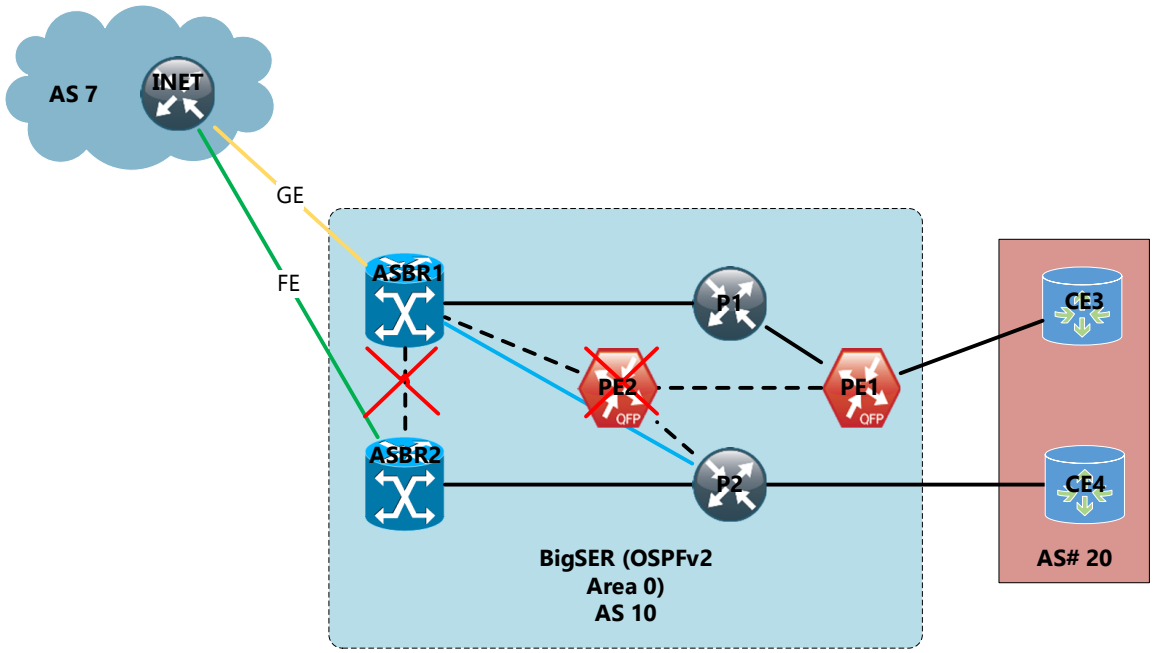
a)



b)



c)



Q31) Do you think the different uplinks speed will cause any issue?

a) Yes
b) No

Q32) Why do you think there is a problem?

a) Link congestion could take place if traffic distribution is not well designed
b) Traffic blackholing
c) Packet drops
d) There will be no issue

E-Mail #14:

From: *core@adser.com*
To: *KHALIL@godesign.com;core@bigser.com*
Subject: *Inter-AS Communication*

As the auditing and optimization process of both service providers has finished, let us try now achieve the necessary connectivity for our big customer in order to enable him to transport his traffic smoothly.

In regard to the customer, he is concerned about the marking of his packets and our network engineers are not that experienced in managing QoS and this is a big concern, in addition, we have two ASBRs in BigSER and we can use that to achieve fast convergence in case of failure with our knowledge that will work from one side as the other side contains only one ASBR with the hope to change the topology as merge rumor is flying in the horizon and our intervening customers are increasing.

We need label based solution to deploy ASAP to connect our customer geographically distributed entities and we need your opinion and please note that our core devices are mid-level.

Core Network Team
ADSER

Q33) What factor you think is the most determining one in choosing the solution to be used?

a) Security
b) Staff experience
c) QoS
d) Resource utilization

Q34) What option do you recommend for them to serve their customer?

a) MPLS Inter-AS option B

b) GRE+IPSEC
c) L2TPv3
d) MPLS Inter-AS option C

Q35) Why MPLS Inter-AS option A will not be a suitable option?

a) Scalability
b) Resource utilization
c) Complexity
d) Security

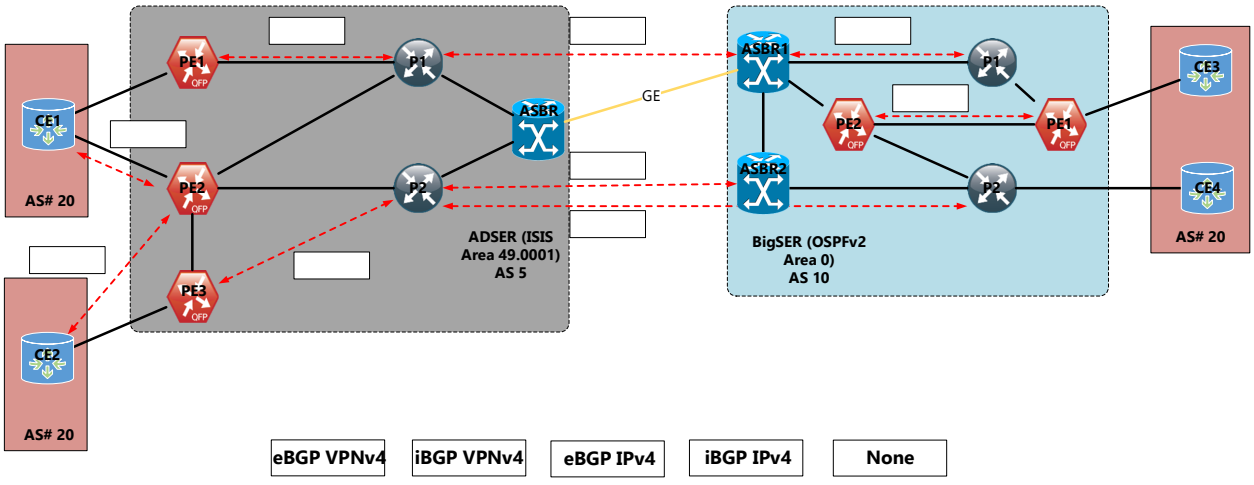
E-Mail #15:

From: *core@adser.com*
To: *KHALIL@godesign.com;core@bigser.com*
Subject: *BGP Sessions*

Dear KHALIL
We have chosen to implement MPLS Inter-AS Option C, but we got confused due to the several BGP sessions running inside our network!
Can you please clarify?

Core Network Team
ADSER

Q36) Drag from the listed options in the empty boxes the needed BGP relations needed for the MPLS Inter-AS Option C deployment



E-Mail #16:

From: *core@adser.com*
To: *KHALIL@godesign.com;core@bigser.com*
Subject: *MPLS Inter-AS Option C*

We have configured the needed for Option C and the LERs are holding the prefixes of concern but still the customer CEs are not getting the routes, what could be the issue?

Core Network Team
ADSER

Q37) What could be the issue that prevent the CEs from installing the routes?

a) Next-hop-self toward the PEs
b) Route-target-filter
c) Next-hop-unchanged toward the CEs
d) Missing redistributed route

Q38) BigSER engineers are wondering: PE2 is not configured with any VRF as there are no termination for customers till the moment, will that affect the end to end connectivity between the customer entities?

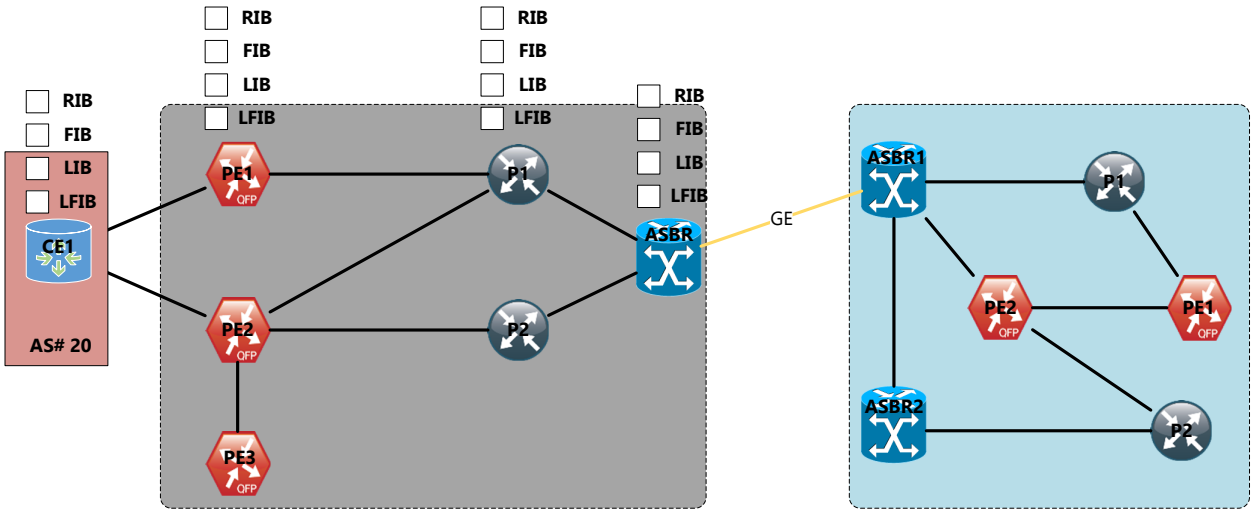
a) Yes
b) No

Q39) In regard to MPLS L3VPN Inter-AS Option C, check the right boxes that represent the active roles for protocols/features running on the core devices.

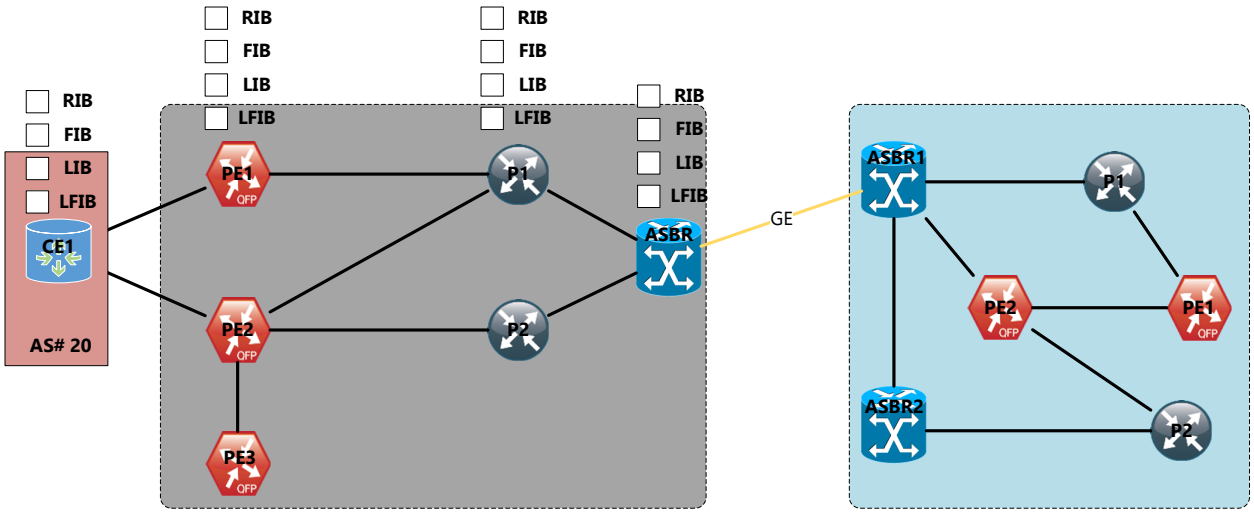
	ADSER					
	ASBR1	P1	P2	PE1	PE2	PE3
MP-eBGP	☐	☐	☐	☐	☐	☐
IGP (Global)	☐	☐	☐	☐	☐	☐
Route Target Filter	☐	☐	☐	☐	☐	☐
iBGP	☐	☐	☐	☐	☐	☐
iBGP RR	☐	☐	☐	☐	☐	☐
VPNv4 MP-iBGP	☐	☐	☐	☐	☐	☐
VPNv4 RR	☐	☐	☐	☐	☐	☐
VRF	☐	☐	☐	☐	☐	☐
Next-hop-self	☐	☐	☐	☐	☐	☐
LDP/RSVP	☐	☐	☐	☐	☐	☐
Next-hop-unchanged	☐	☐	☐	☐	☐	☐
Labeled Unicast	☐	☐	☐	☐	☐	☐
eBGP	☐	☐	☐	☐	☐	☐
BGP <--> IGP redistribution	☐	☐	☐	☐	☐	☐
VRF IGP	☐	☐	☐	☐	☐	☐

	BigSER					
	ASBR1	ASBR2	P1	P2	PE1	PE2
MP-eBGP	☐	☐	☐	☐	☐	☐
IGP (Global)	☐	☐	☐	☐	☐	☐
Route Target Filter	☐	☐	☐	☐	☐	☐
iBGP	☐	☐	☐	☐	☐	☐
iBGP RR	☐	☐	☐	☐	☐	☐
VPNv4 MP-iBGP	☐	☐	☐	☐	☐	☐
VPNv4 RR	☐	☐	☐	☐	☐	☐
VRF	☐	☐	☐	☐	☐	☐
Next-hop-self	☐	☐	☐	☐	☐	☐
LDP/RSVP	☐	☐	☐	☐	☐	☐
Next-hop-unchanged	☐	☐	☐	☐	☐	☐
Labeled Unicast	☐	☐	☐	☐	☐	☐
eBGP	☐	☐	☐	☐	☐	☐
BGP <--> IGP redistribution	☐	☐	☐	☐	☐	☐
VRF IGP	☐	☐	☐	☐	☐	☐

Q40) Assuming the link between the ASBRs (between the ASes) went down, please mark down the tables in the diagram below that will be affected accordingly.



Q41) If MPLS Inter-AS Option B was the solution in play for connecting the customer branches, what tables will be impacted? Fill in the table below.



E-Mail #17:

From: *core@adser.com*
To: *KHALIL@godesign.com*
Subject: *Isolated PE*

Finally, we could convince our customer to reserve a maintenance window in order to move the BGP VPNv4 session to be optimally directed to the existing route reflectors.
We need to perform the migration smoothly with minimal downtime.
What is the best procedure to follow?

Core Network Team
ADSER

Q42) Arrange the below steps for minimal downtime operation that will maintain the connectivity for our customer entities.

a) Establish VPNv4 session between PE3 and P2
b) Check loopback availability
c) Deactivate BGP VPNv4 session between PE3 and PE2
d) Establish VPNv4 session between PE3 and P1

Q43) Why the route is preferred from PE3 and not from PE2?

a) Oldest route
b) BGP Next-hop
c) Origin code
d) Local preference

Q44) Will there be actual packet loss following the above procedure?

a) Yes
b) No

E-Mail #18:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *BW Concerns*

Dear Khalil
We are concerned about the BW utilization inside our network, we noticed that the link between PE2 and ASBR1 is getting more and more utilized, so we observed that the interconnection link between the ASBRs is almost idle except for what seems to be some control traffic.
We want to be able to control our traffic within our AS in order to better serve our customers and maintain our existing interconnections, we still have some time.

Appreciated

Core Network Team
BigSER

Q45) What is your recommendation for BigSER to achieve their requirement?

a) Deploy MPLS TE
b) Policy-Based Routing
c) Diffserv QoS
d) Manipulate OSPF metric among specific links

Q46) What impact will implementing MPLS TE has on BigSER network? (Choose two)

a) Control-Plane overhead
b) RIB size increment
c) IGP database increment
d) FIB size increment

E-Mail #19:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *Re: BW Concerns*

Dear Khalil
We will proceed upon your recommendation and deploy MPLS TE, but we like to know how the actual traffic pattern looks like.
As well, I do not trust BGP attributes and would like a permanent solution to avoid the traffic passing through P routers and maintain its actual role.

Appreciated

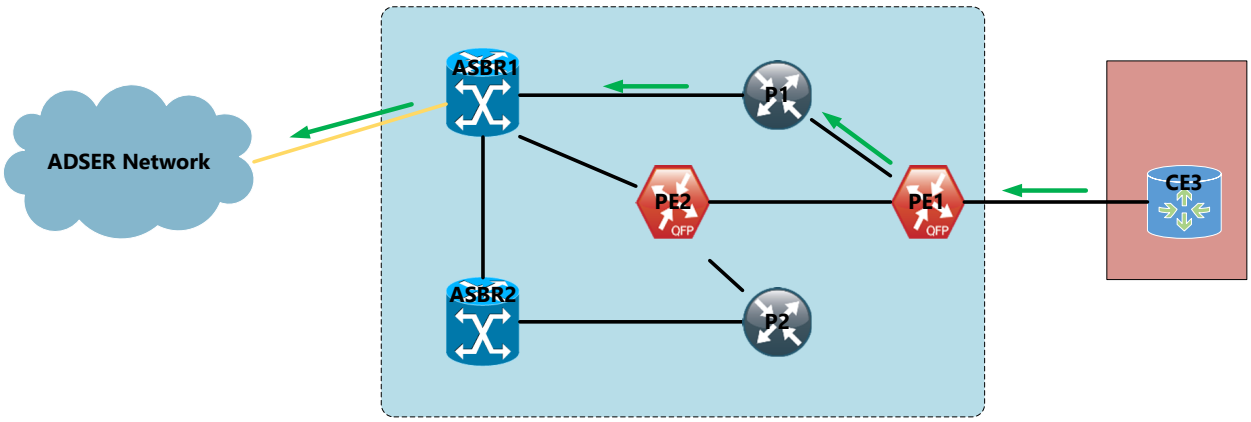
Core Network Team
BigSER

Q47) What model of MPLS TE will you advise them to deploy?

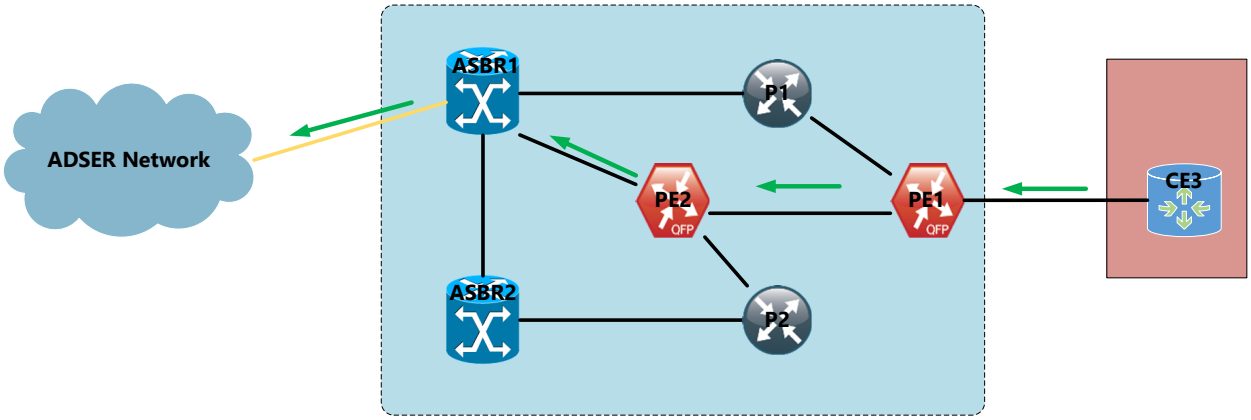
a) Tactical MPLS TE
b) Strategic MPLS TE

Q48) Based on the information provided so far, choose from the below diagrams how the packet travels between the CEs (within BigSER network)

a)



b)



Q49) should we care about the customer request regarding the traffic flow going through the P routers?

a) Yes
b) No

Q50) What can be done on the core devices in order to fulfil the customer request without extra change on the current design?

a) Increase LP on PE1 BGP sessions for all received prefixes
b) Enable max-metric router-lsa on the LERs
c) Enable max-metric router-lsa on the LSRs
d) Change the area between P and PEs to a new area other than backbone

Q51) If the provider deployed the max-metric router-lsa feature on the P devices, what actually has been done?

a) In-band route-reflection model is in play
b) Out-of-band route reflection model is in play
c) Optimal route reflection is in play
d) DR/BDR election will not take place on the target devices

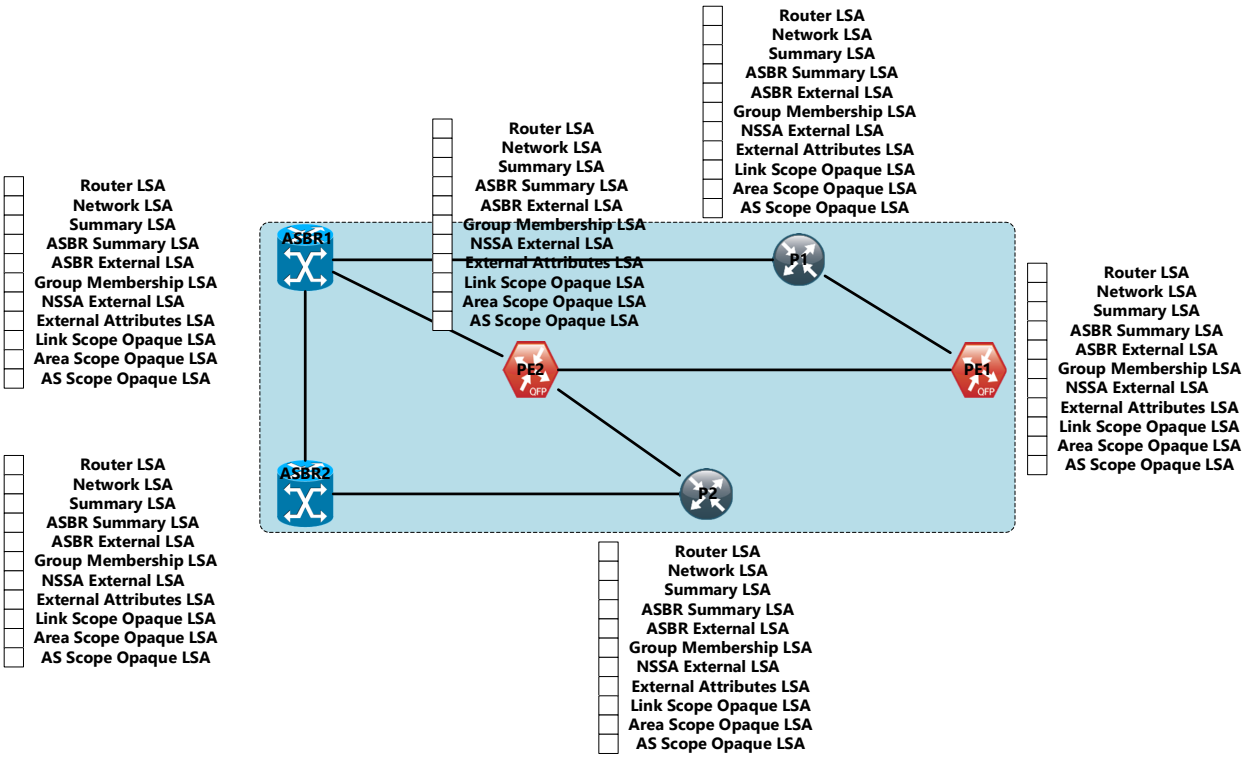
E-Mail #20:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *OSPF LSAs*

As per our discussion, we are convinced now with the power of BGP attributes and will not change any attribute regarding OSPF.
What we are looking for now is understanding the OSPF LSAs running inside our network after the changes took place.

Core Network Team
BigSER

Q52) Mark the appropriate LSA running per device



E-Mail #21:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *MPLS TE*

Dear KHALIL
We have implemented RSVP on all the core physical interfaces and established our first tunnel (with dynamic path option as a start), the tunnel is from PE1 toward ASBR1.
Once we deployed the above mentioned configuration, customer branches lost connectivity in between and we had to shut down the interfaces!
Can you please assist?

Core Network Team
BigSER

Q53) What is the cause of the above mentioned behavior?

a) LDP and RSVP cannot co-exist in the same network
b) End to end tunnel is broken

Q54) What quick action do you recommend for them to do in order to activate traffic forwarding down the tunnel?

a) Enable LDP on the overlay MPLS TE tunnel
b) Disable LDP inside the network
c) Manipulate the MPLS LDP advertisement
d) MPLS TE is not a valid option for BigSER network

Q55) Please fill in the table below to help the customer understand the main aspects for LDP and RSVP.

Aspect/Protocol	LDP	RSVP
OPEX	High ☐ Low ☐	High ☐ Low ☐
State	Hard ☐ Soft ☐	Hard ☐ Soft ☐
Scalability	High ☐ Low ☐	High ☐ Low ☐
LSPs Topology	PP ☐ P2MP ☐	PP ☐ P2MP ☐
LSP Initiator	Ingress ☐ Egress ☐	Ingress ☐ Egress ☐

E-Mail #22:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *Re: MPLS TE*

Thanks, the issue is resolved after we implemented MPLS LDP on the configured tunnel.
We feel some weakness in respect to MPLS TE and the team is not well experienced, can you please highlight some aspects regarding the MPLS TE operation?
As well, we are considering keeping only RSVP running inside our network, what do you think?

Core Network Team
BigSER

Q56) Mark the options (responsible protocol) listed to the correct MPLS TE operation.

MPLS TE Operation	Protocols	Options
Link Information Distribution		
		CBTS
Path Calculation		RSVP
		CSPF
Path Setup		OSPF
		PBR
Traffic Forwarding		ISIS

Q57) What impact will disabling LDP will have on the network in regard to BigSER core?

a) Better traffic control
b) Service interruption

E-Mail #23:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *Re: MPLS TE*

Due to financial issues, we cannot invest this year with extra physical links and we noticed that availability is not in its best status with respect to serving our customers.
Can you propose something that can raise availability?

Core Network Team
BigSER

Q58) What is the link you classify the most critical one in regard to serving the customer?

a) CE3 to PE1 link
b) PE1 to PE2 link
c) PE1 to P1 link
d) P1 to ASBR link

Q59) What feature do you recommend for them to enhance their infrastructure availability per the new design?

a) MPLS FRR
b) IP LFA
c) BGP PIC
d) BGP fall-over

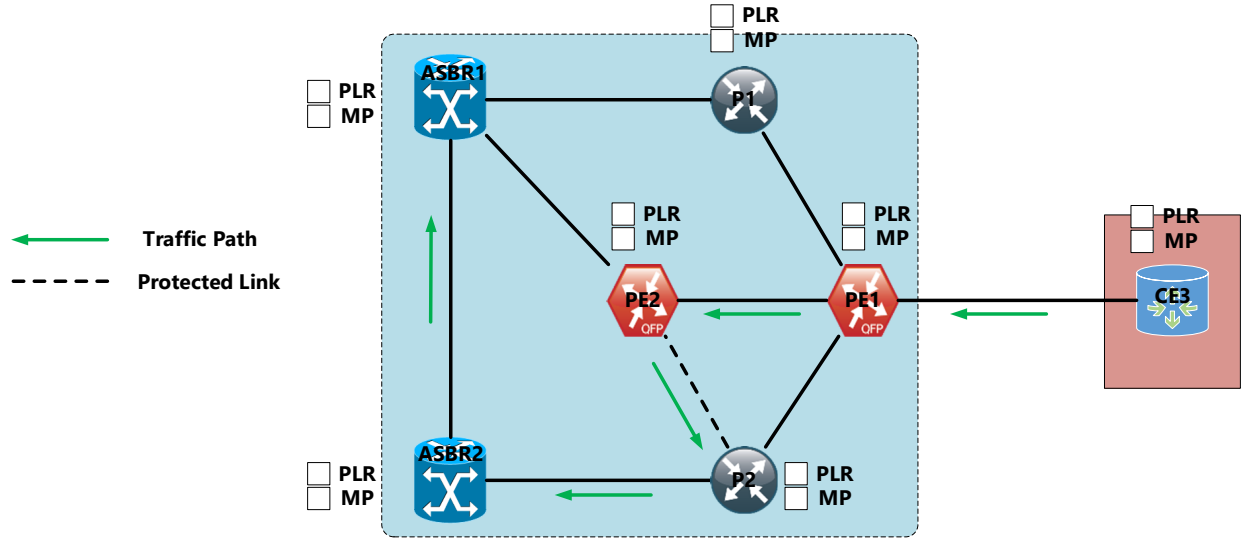
E-Mail #24:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *MPLS FRR*

Dear KHALIL
We have read some documents about MPLS FRR and we think it can be doable within our network as RSVP is already running.
Can you please explain more?

Core Network Team
BigSER

Q60) In regard to MPLS FRR link protection and taking into consideration the protected link in the dashed line and the traffic path illustrated by the green arrows , please assign the MPLS FRR respective terms on the below diagram.

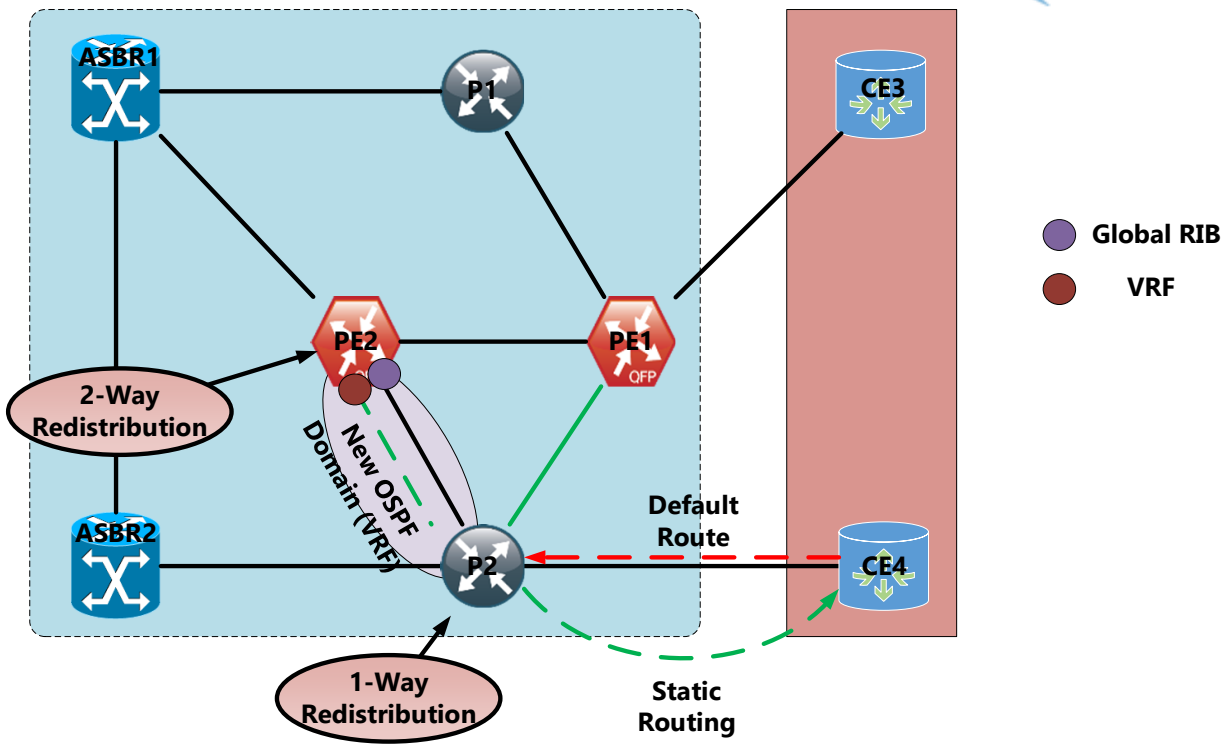


E-Mail #25:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *New Branch*

Dear KHALIL
As you know, we have unserved customer branch who is connected unluckily to one of our P routers due to lack of physical termination media to our PEs.
We need to serve our customer branch to maintain his connectivity among his entities
The customer is hiring people for this new branch, so I think we have some time to prepare the proper design.
As per our policies, no VRFs to be configured on LSRs following best practices.
One of our network engineers proposed the below design, please check out and feed us back.

Core Network Team
BigSER



Q61) What drawbacks will this design have on BigSER ASBRs?

a) OSPF LSDB increase
b) Flapping routes
c) SPoF (Single Point of Failure)
d) Routing Loops

Q62) From business perspective, what is the effect of this proposed design will have on the network? (Check the respective boxes).

Aspect	Effect
Scalability	↑ ☐ ↓ ☐
Manageability	↑ ☐ ↓ ☐
Serviceability	↑ ☐ ↓ ☐
Modularity	↑ ☐ ↓ ☐
OPEX	↑ ☐ ↓ ☐

E-Mail #26:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *Re: New Branch*

Dear KHALIL
We need an optimized and well-managed solution to deploy even on the expense of reduced resiliency.

Core Network Team
BigSER

Q63) What solution will you follow in order to achieve the serviceability in an optimized manner?

a) Make the termination P a PE and modify the respective BGP sessions
b) Move the customer connection to the nearest PE
c) Ask the customer to connect a link between his branches
d) The proposed solution is scalable and will work fine per the requirements

E-Mail #27:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *Network Convergence*

Dear KHALIL
Thanks for the massive help so far.
As you know, we are running OSPF as our IGP to maintain prefixes transport.
But we are worried about the recovery from failures that could take place within our infrastructure.
Please note that customer is advertising additional prefixes, will that affect our network?

Thanks

Core Network Team
BigSER

Q64) What the effect of the customer advertising new prefixes?

a) Down convergence will increase
b) Up convergence will increase
c) Customers' prefixes have nothing to do with the SP core network
d) Overall network convergence will be affected

Q65) In case of core link failure, arrange the actions that will take place after that assuming a backup link do already exists.

a) Routing protocols rebuild the IP routing table and forwarding table
b) Respective entries are removed from LIB, LFIB and FIB
c) LFIB and labeling information in the FIB are rebuilt immediately after the routing protocol convergence
d) Routing protocols and labels distribution protocols neighbors are lost

Q66) BigSER network team is asking about a lot of tools that can enhance convergence but needs help in choosing the correct tool according to the convergence action, please help filling in the table below.

MPLS TE Operation	Tool	Options
Event Detection		Carrier Delay
		LSA Throttle Timers
		Interface Event Dampening
Event Propagation		BFD
		MinLSArrival Timer
		Hello/Dead Timers
Event Processing		LSA Packet Pacing
		iSPF

E-Mail #28:

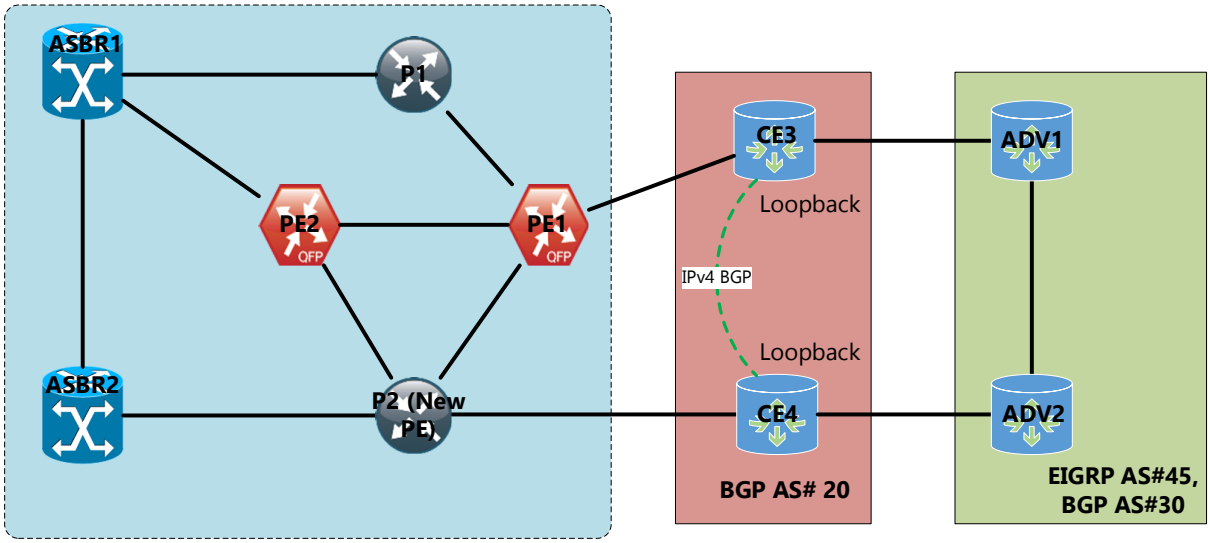
From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *New Customer (ADV)*

Dear KHALIL
Our valued customer (MediaCORP) has acquired a new small advertisement agency, this company currently has two branches connected to different branches belonging to MediaCORP CEs which are served by BigSER network.
BigSER per the experience they had with BGP and following your continuous consultancy became convinced that BGP is the best protocol to use, so they managed the new advertisement agency routers.
We need your insight to confirm the setup which briefly consist of eBGP peerings toward MediaCORP and EIGRP inside the new company PoP with one-way redistribution inside EIGRP domain.
What might be of concern in the coming future is that we could need to fulfill connectivity between this agency and the HQ of MediaCORP for prototypes exchange.

Thanks

Core Network Team
BigSER

Q67) iBGP IPv4 session has been established between MediaCORP routers to maintain connectivity between Advertisement Agency routers, is connectivity in place?



a) Yes
b) No

Q68) Why do you think there is an issue?

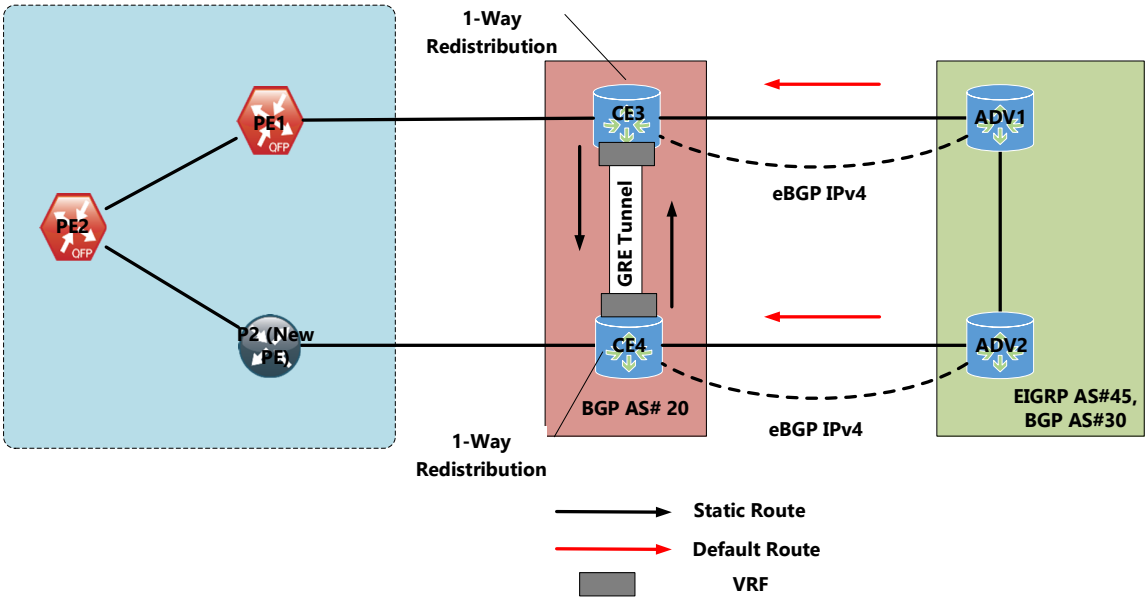
a) FIB Recursion issue
b) Route reflection deployment should be in place
c) AS-Override feature should be enabled
d) There is no issue and connectivity is in place

Q69) The senior network engineer suggested to configure a GRE tunnel and build the iBGP session between the MediaCORP routers to serve Advertisement Agency, what would be your opinion in regards?

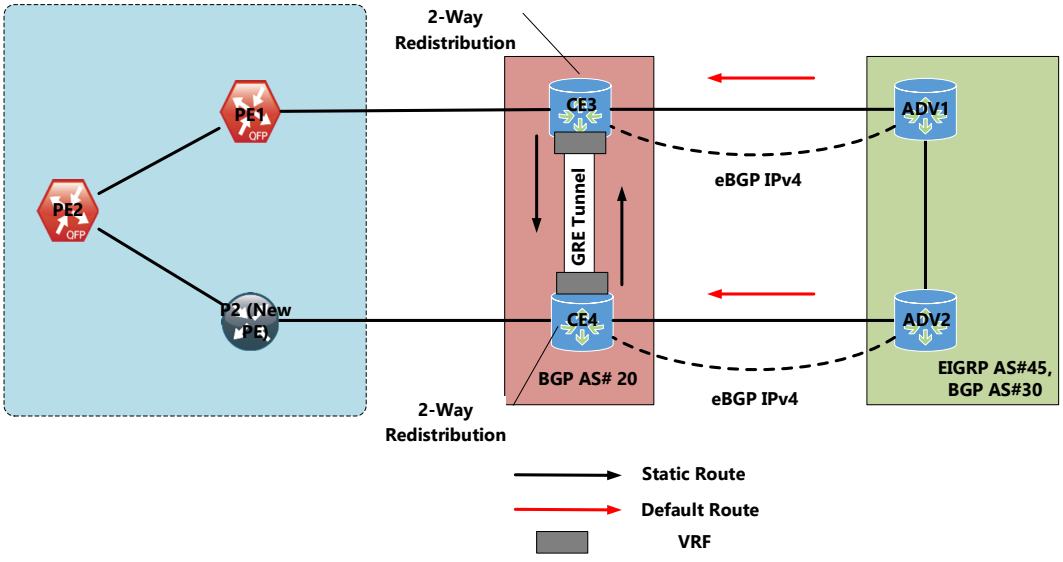
a) Recursive lookup behavior will take place and the BGP session will not come up
b) The BGP session will come up bit with extra MTU modification under the created tunnel to take place
c) BGP session will come up but extra send-label under the IPv4 AF will be needed
d) The tunnel mode of GRE will not work and should be modified
e) The BGP session will come up but the GRE tunnel should be sourced from the physical interface

Q70) Choose one of the below options that will fulfil the connectivity needed between Advertisement Agency entities.

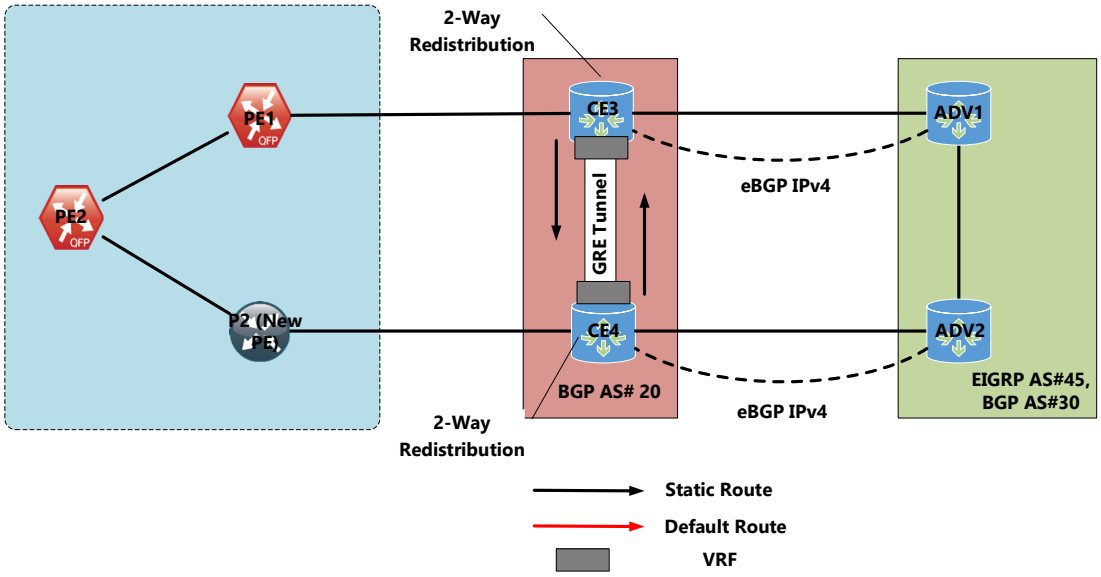
a)



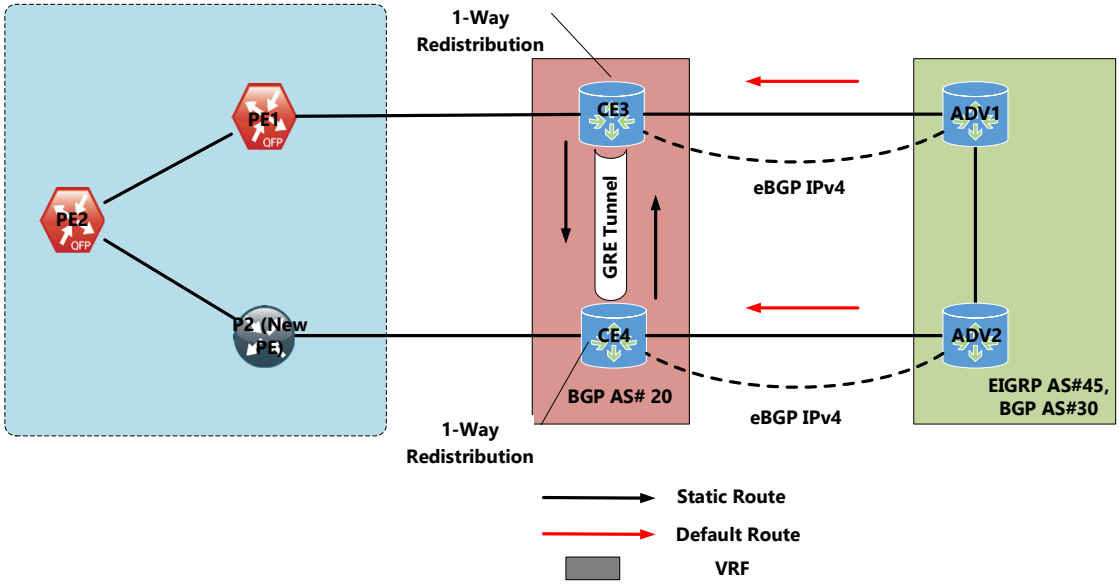
b)



c)


2-Way
Redistribution
PE1
QFP
PE2
QFP
P2 (New
PE)
CE3
GRE Tunnel
CE4
BGP AS# 20
ADV1
ADV2
eBGP IPv4
eBGP IPv4
EIGRP AS#45,
BGP AS#30
2-Way
Redistribution
Static Route
Default Route
VRF

d)


1-Way
Redistribution
PE1
QFP
PE2
QFP
P2 (New
PE)
CE3
GRE Tunnel
CE4
BGP AS# 20
ADV1
ADV2
eBGP IPv4
eBGP IPv4
EIGRP AS#45,
BGP AS#30
1-Way
Redistribution
Static Route
Default Route
VRF

E-Mail #29:

From: *core@bigser.com*
To: *KHALIL@godesign.com*
Subject: *Re: New Customer (ADV)*

We have noticed something weird, our internal network prefixes are learned through our uplink devices through BGP, is this normal?

Thanks

Core Network Team
BigSER

Q71) What is happening inside the network that best describes the issue mentioned above?

a) Administrative distance is the tie breaker and this is normal
b) This is not normal and the link between the Advertisement Company routers should be shutdown

Q72) What should be done to avoid this behavior?

a) Enable BGP SoO on the PE toward the CE in the outbound direction
b) Enable BGP SoO on the CE toward the PE in the outbound direction
c) Enable BGP SoO on the PE toward the CE in the inbound direction
d) Enable BGP SoO on the CE toward the PE in the inbound direction

E-Mail #30:

From: *network@mediacorp.com*
To: *KHALIL@godesign.com*
CC: *core@adser.com;core@bigser.com*
Subject: *Our Network*

Dear KHALIL
Appreciate the help done so far from your side, now it is our turn to consult you with several aspects and we are enthusiastic about new technologies to intervene our network.
As a start, one of our network engineers was checking the configuration and figured out that BGP PIC edge was configured, will this feature work for us?!

Thanks

Q73) Which statement from the below options is correct regarding the feature enabled above? (Choose two).

a) The feature will work under the IPv4 AF
b) FIB database size increase
c) BGP table size increase
d) RIB size decrease
e) MPLS LFIB table entries decrease

Q74) The customer is asking about another feature called BGP local-convergence and he thinks that the feature will work better than BGP PIC edge in regards to backup restoration time, is he right?

a) Yes
b) No

Q75) Please fill in the table below to highlight the differences between BGP local convergence and BGP PIC edge.

Aspect/Feature	BGP Local Convergence	BGP PIC Edge
Simplicity	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐
Backup paths location	RIB ☐ FIB ☐	RIB ☐ FIB ☐
Failure detection time	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐
Backup restoration time	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐

E-Mail #31:

From: *core@adser.com*
To: *KHALIL@godesign.com*
Subject: *Load sharing*

Dear KHALIL
We need to provide our customer HQ with load balancing/sharing functionality as he is concerned about his links utilization, can you assist in regards?

Core Network Team
ADSER

Q76) What deployment will you suggest to achieve the above?

a) Different RD per VRF per PE
b) ECMP
c) PBR
d) Change the routing protocol to EIGRP as it supports equal/unequal load sharing

Q77) What feature would you recommend for ADSER network team to deploy in order to decrease convergence time when a PE router fails?

a) BGP PIC Core
b) BGP PIC Edge
c) BGP NHT
d) BGP AS-Path Prepend

E-Mail #32:

From: *core@adser.com*
To: *KHALIL@godesign.com*
CC:*core@bigser.com*
Subject: *Re: Load sharing*

Dear KHALIL
We have took your advice into consideration and will implement BGP advertise-best-external feature in conjunction with manipulating RD values to be different on the serving PEs.

Core Network Team
ADSER

E-Mail #33:

From: *network@mediacorp.com*
To: *KHALIL@godesign.com*
Subject: *Inter-AS Communication*

Dear KHALIL
We already deployed MPLS Inter-AS Option C to achieve communication between our distributed branches.
ADSER network engineer contacted us privately claiming that the merge project is not confirmed yet and he is worried about infrastructure information leakage in between the ASes even though he is aware about the forecast of the coming customers.
Please advise the impact of his concern.

Q78) What do you think ADSER network engineer is thinking about?

a) Change the Inter-AS Option C to Option A
b) Change the Inter-AS Option C to Option B
c) Change the Inter-AS Option C to Option AB

Q79) What will be the impact of changing the current Inter-AS communication model to Option B?

a) BigSER BGP convergence time will increase
b) Just small downtime will be introduced due to some changes which will take place
c) Inter-AS option B will be better as it is more scalable
d) Service interruption

Q80) Based on the Internet option chosen and your recommendation to change the label allocation mode, will moving to Option B make any difference?

a) Per-VRF label allocation mode will not work and we have to change to Per-CE label allocation mode

b) We do not have to change anything, Per-VRF will continue to work with possibility of loops
c) We have to revert back to Per-Prefix label allocation mode and upgrade our devices to account for high resources utilization
d) Change the Internet option model to something else in order to avoid changing label allocation modes

E-Mail #34:

From: *core@adser.com*
To: *KHALIL@godesign.com; core@bigser.com*
Subject: *Inter-AS TE*

The rumor of merge is eating our minds, and we are thinking of deploying constrained path among both ASes between the main devices.
So BigSER network engineers are thinking of extending MPLS TE into our network.

Your suggestions please.

Q81) Which statement from the below is correct regarding extending MPLS TE to ADSER network? (Choose two).

a) Protection will increase as LFA is running and FRR might not be available
b) LFA will not interact with RSVP and will be disabled
c) IP LFA coverage might not be 100%
d) We cannot deploy Inter-AS MPLS TE in our case

Q82) What could be the alternative to consider for Inter-domain MPLS TEs issue not processing full network topology information?

a) Full mesh MPLS TEs
b) Merge service provider's networks with unified IGP
c) Path Computation Element
d) LDP is point to multi-point and it will fulfil the necessary

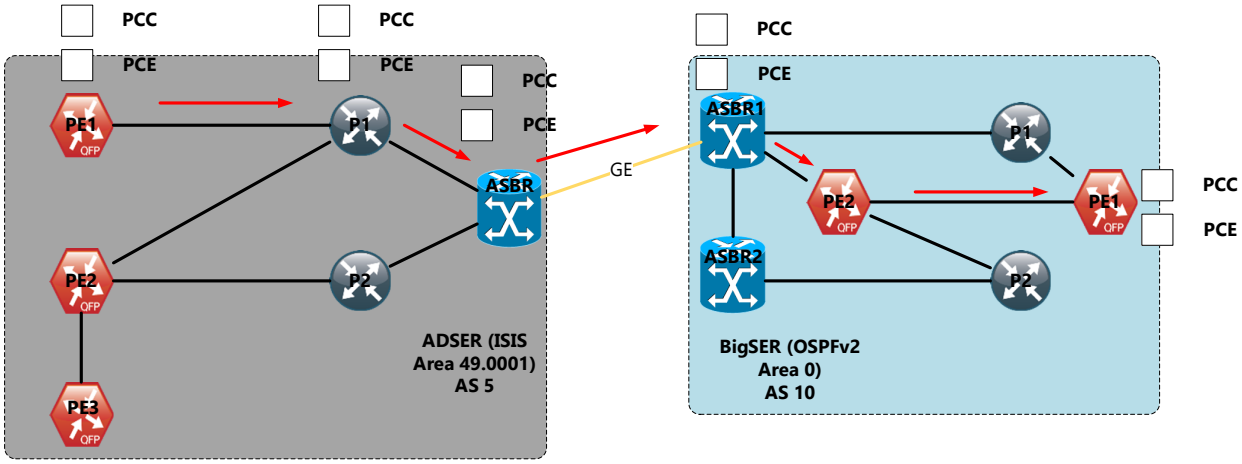
Q83) Implementing RSVP on all LFA enabled devices as illustrated earlier will cause customer service interruption, is this correct?

a) Yes
b) No

Q84) Why do you think there is an issue?

a) PE3 is not LFA enabled and implementing RSVP TE will need metric style manipulation
b) No service interruption will take place as LDP is already running
c) Attached bit is lost from PE3 and default route to be redistributed from upper routers
d) A new tunnel to be configured from PE3 to the nearest PE

Q85) With respect to PCE technology, can you please mark the component to the relative device assuming the red arrow represent the established Inter-AS TE tunnel?



E-Mail #35:

From: *core@adser.com*
To: *KHALIL@godesign.com*
CC: *core@bigser.com*
Subject: *Quality of Service*

Dear KHALIL
Our customer is asking for QoS support.
We need to determine the best QoS model which will preserve customer markings and should not influence our PE egress queuing taking into account that we can remark traffic.

Thanks

Q86) What QoS tunneling mode would you choose based on the above mail?

a) Uniform mode
b) Shot pipe mode
c) Pipe mode

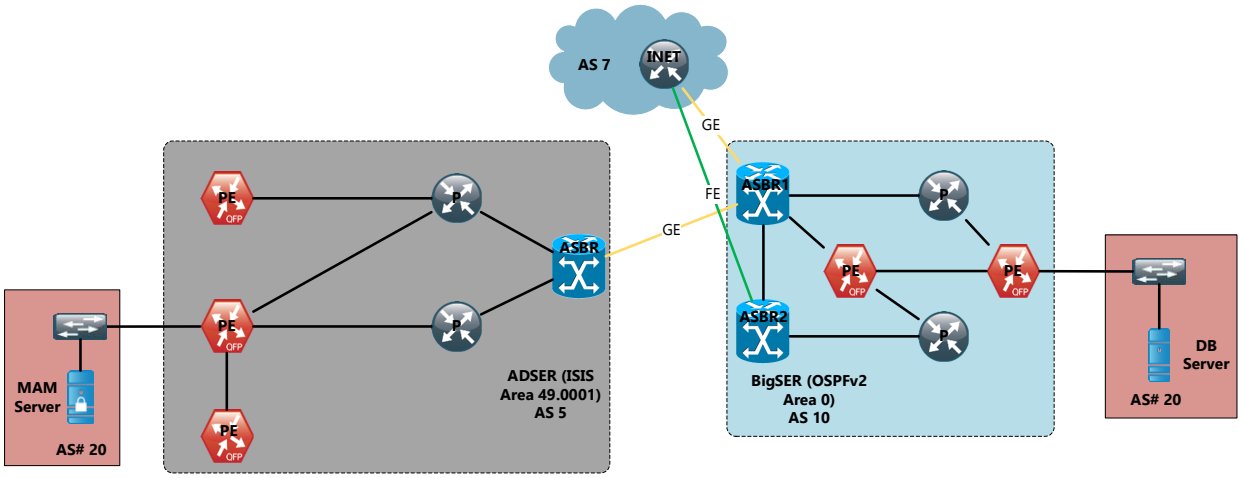
Q87) The customer is concerned about the QoS model chosen (pipe mode), and the team is not that experienced in such implementations and he needs you to highlight MPLS actions with respect to the model.
Pick the needed action to the correct link/connection per the below table.

(Link/Connection)/MPLS Operation	Push	Swap	PoP	Options
IPv4 --> MPLS				Copies the IP Precedence into the EXP
				Copies the received EXP into the newly imposed EXP.
MPLS --> MPLS				Copies the removed EXP into the newly revealed EXP.
				Doesn't modify DSCP; selects the PHB based on the EXP.
MPLS --> IPv4				NA

E-Mail #36:

From: *core@adser.com*
To: *KHALIL@godesign.com*
CC: *core@bigser.com*
Subject: *Media Asset Management (ADNEWS)*

Dear KHALIL
We have an urgent issue connecting one of MAM (Media Asset Management) servers which belongs to one of our co-partners (ADNEWS).
The Server is located in ADSER network and the DB server to which it needs to communicate with is located in BigSER network.
We already know that L3 connectivity is in place for MediaCORP HQ and branches, but this is a critical connection for our co-partner and we need to isolate both providers from participating in it and please try to minimize states overhead as possible.



Please advice

Thanks

Q88) What option from the below options do you recommend for ADNEWS?

a) EoMPLS
b) VPLS
c) L2TPv3
d) Frame Relay

Q89) One of ADSER network engineers claim that EoMPLS will not work per the current setup due to broken LSP and the current LSP serves only L3 traffic, is he right?

a) Yes
b) No

E-Mail #37:

From: *network@mediacorp.com*
To: *KHALIL@godesign.com*
Subject: *Security*

Dear KHALIL
We are concerned about out traffic flowing down through the service provider networks unprotected and we need a VPN solution that can secure our traffic taking into consideration overhead to be minimized.

Thanks

Q90) Based on the information you have about MediaCORP and the current service in place, what VPN technology would you recommend for them?

a) DMVPN
b) GETVPN
c) IPSEC + GRE
d) mGRE

E-Mail #38:

From: *core@adser.com*
To: *KHALIL@godesign.com*
Subject: *New Customer*

Dear KHALIL
We have made a new deal with a bank with several branches.
The same issue in place is that branches are distributed between us and BigSER networks.
The HQ is located within our premises with some branches and the rest is within BigSER network.
We need a scalable solution that will assist us serving the new customer taking into consideration that the customer do not want us to participate from our side in routing neighborships establishment.
We have his HQ dual-homed to the terminating PE and he is asking for load balancing, as well, our terminating devices might need software upgrade to account for new features and we accounted for that in the next year budget.

Thanks

Core Network Team
ADSER

Q91) what technology could assist in connecting the new customer branches as explained in the above mail?

a) VPLS
b) AToM
c) EVPN
d) MPLS L3VPN

Q92) Why VPLS is not the best optimal choice in this case?

a) It is Ethernet based L2 Multi-point technology and should be considered
b) It does not support load balancing as requested

c) We cannot wait for the router to be upgraded to support EVPN, so we have to serve him ASAP and deploy VPLS
d) VPLS introduces extra control-plane overhead compared to EVPN

Q93) Fill in the below table to compare between VPLS and EVPN in respect to the mentioned aspects.

Aspect/Protocol	VPLS	EPVN
Signaling Protocols	BGP ☐ LDP ☐	BGP ☐ LDP ☐
CE Multihoming	1 Active ☐ All Active ☐	1 Active ☐ All Active ☐
MAC Learning	Data Plane ☐ Control Plane ☐	Data Plane ☐ Control Plane ☐
Control Plane Overhead	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐
Service Labels	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐
Scalability	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐
Manageability	↑ ☐ ↓ ☐	↑ ☐ ↓ ☐

E-Mail #39:

From: *network@mediacorp.com*
To: *KHALIL@godesign.com*
Subject: *IPv6*

Dear KHALIL
We have reserved our IPv6 space and we need to maintain IPv6 connectivity among our devices. AS per our discussion BigSER will do the needful to serve us , meanwhile ADSER network engineers are afraid from the load that deploying IPv6 in their core network will have on their mid-sized devices , we need your help please.

Thanks

Q94) Do you think ADSER are right regarding their concerns?

a) Yes
b) No

Q95) Why do you think that they are not right?

a) We do not need to enable Dual Stack IP addressing to serve the customers
b) Enabling Dual stack on the core devices will not increase resource utilization

Q96) Based on the information provided in the mail, what option from the below will you to choose taking into consideration Inter-AS communication to be maintained?

a) MPLS 6PE
b) MPLS 6VPE

Q97) Please fill in the table below to highlight the main differences between 6PE and 6VPE.

Aspect/Deployment	6PE	6VPE
IPv6 Information location	GRT ☐ VRF ☐	GRT ☐ VRF ☐
Information Exchange	Label ☐ Community ☐	Label ☐ Community ☐

Note: GRT (Global Routing Table).

E-Mail #40:

From: *network@mediacorp.com*
To: *KHALIL@godesign.com*
Subject: *Re: IPv6*

BigSER deployed the necessary 6VPE sessions inside his network and the CEs within its AS can communicate, now we have to account for the other side: ADSER.

We could convinced them with the importance of this issue to us and they agreed to have only one PE device IPv6 enabled.

Thanks

Q98) Do we need to configure any extra information leaking to serve the customer end to end?

a) Yes
b) No

Q99) What is the impact of running different IGPs for both IPv4 and IPv6?

a) Nothing, both AF share the same DB
b) Nothing, Exclusive impact
c) Double path calculation in case of failure

Q100) If you were to advice ADSER to implement IPv6 in their network and to unify the routing protocol for address families, will you need any extra modification?

a) Yes
b) No

Q101) If you were to advice BigSER to implement IPv6 in their network and to unify the routing protocol for address families, will you need any extra modification?

a) Yes
b) No

E-Mail #41:

From: *network@mediacorp.com*
To: *KHALIL@godesign.com*
Subject: *Re: IPv6*

We went through some readings and we found that other techniques such as tunneling could serve us, but we need more explanations.

Thanks

Q102) Match the tunneling method mentioned below to its respective usage.

Tunneling Method		Usage
Manual		Used to provide a point-to-multipoint IPv6 link over an existing IPv4 network; sites can use IPv6 addresses from any range
GRE		Used to provide a point-to-point IPv6 link over an existing IPv4 network; only supports IPv6 traffic.
6to4		Used to provide point-to-multipoint IPv6 links over an existing IPv4 network. Designed to be used between devices inside the same site.
6RD		Used to provide a point-to-point IPv6 link over an existing IPV4 network; supports multiple protocols, including IPv6.
ISATAP		Used to provide a point-to-multipoint IPv6 link over an existing IPv4 network; sites must use IPv6 addresses from the 2002::/16 range

E-Mail #42:

From: *network@mediacorp.com*
To: *KHALIL@godesign.com*
Subject: *Streaming Traffic*

Dear KHALIL
As the communication between our branches is in place, it is time for us to activate our streaming application.
This application will be from the HQ toward the branches.
As per our knowledge, ADSER is multicast enabled and PIM DM is the running flavor, at the meantime, BigSER is utilizing PIM SM.
Can you please help us in the deployment process?

Appreciated

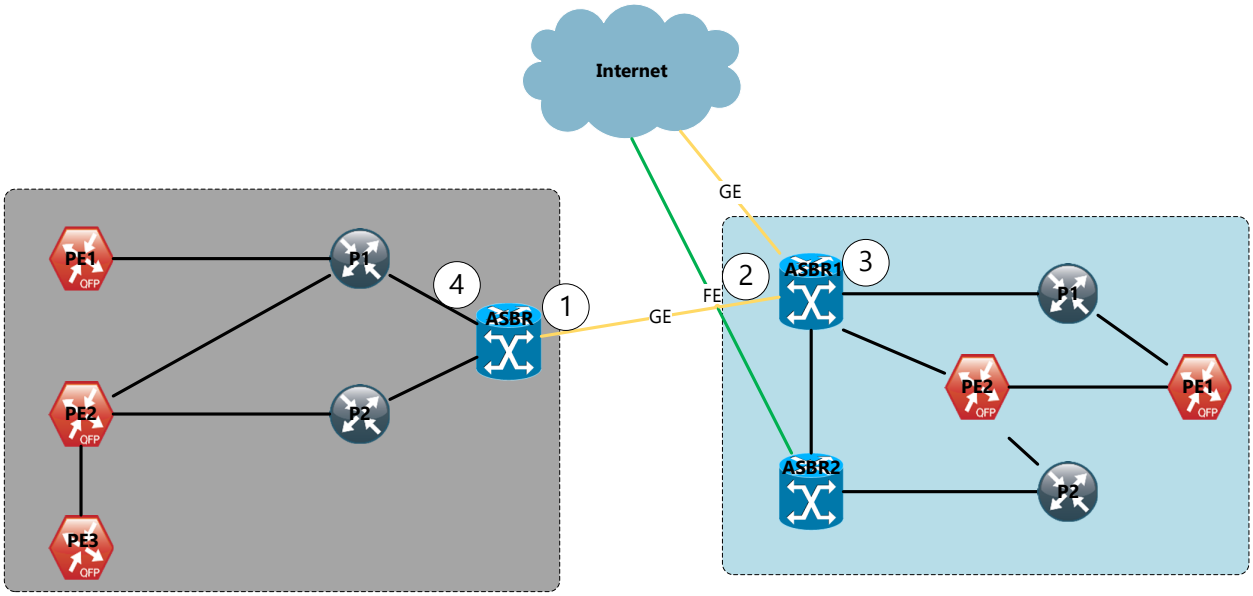
Q103) Will choosing MSDP be a good option?

a) Yes
b) No

Q104) What can be done on service providers side in order to accept Multicast traffic from the customer HQ source application?

a) ADSER should change their PIM DM to PIM SM and enable MSDP between the ASes
b) BigSER should change their PIM SM to PIM DM and enable MSDP between the ASes
c) Proxy-register feature should be enabled to accept PIM DM packets
d) Proxy-register feature should be enabled to accept PIM SP packets

Q105) Pick from the below diagram where the proxy-register should be applied.



a) 1
b) 2
c) 3
d) 4

E-Mail #43:

From: *core@adser.com*
To: *KHALIL@godesign.com*
CC:*core@bigser.com*
Subject: *Acquisition*

Dear KHALIL

The decision was made due to financial issues. Both Providers now need to account for that change and keep serving their customers with the same level of resiliency. We need your advice in order to place the proper design that will ensure continuity and integrity.

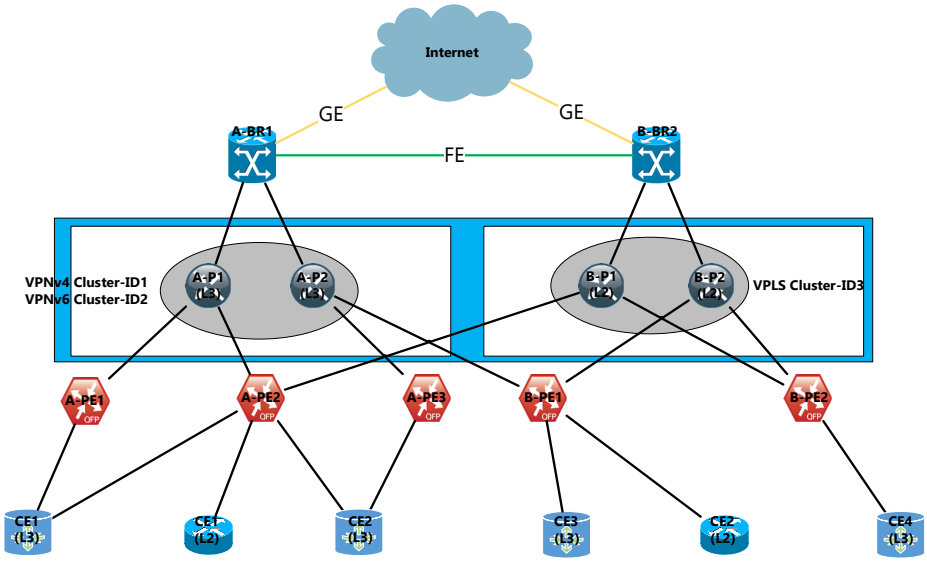
Thanks

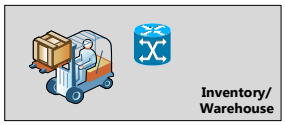
Q106) As per the current services running in-between the two providers, what two options are true regarding the migration process?

a) We are running MPLS Inter-AS Option C so a lot of information is leaked and this will ease the migration process
b) If MPLS Inter-AS Option B was in play the migration could be easier
c) The migration is not possible due to the services running between the providers
d) The migration is possible with little downtime to take place

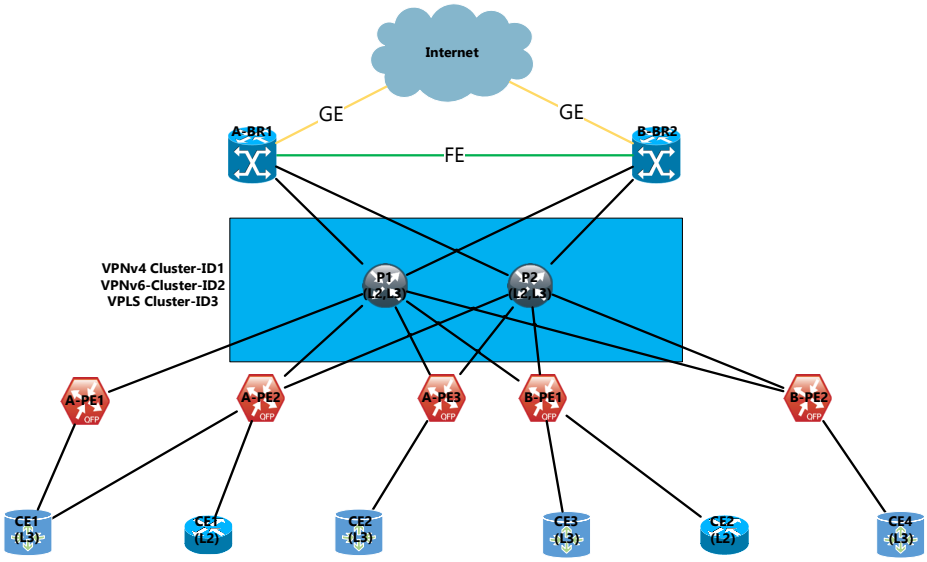
Q107) Assuming that both providers networks got merged regardless of the IGP in use and taking into consideration the services running in the network, as well, assuming that both access and core links are interchangeable (total of 20 links), what option from the below options should be chosen for an optimal traffic flow, enhanced design and redundancy level that will assure business continuity?
Please try your best to balance between resources consumption and operation complexity!

a) Design 1

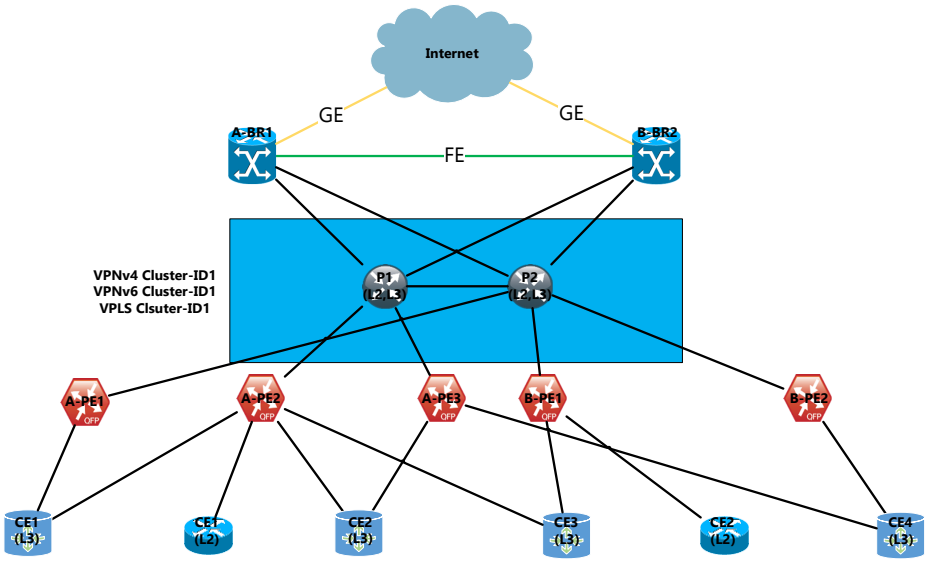




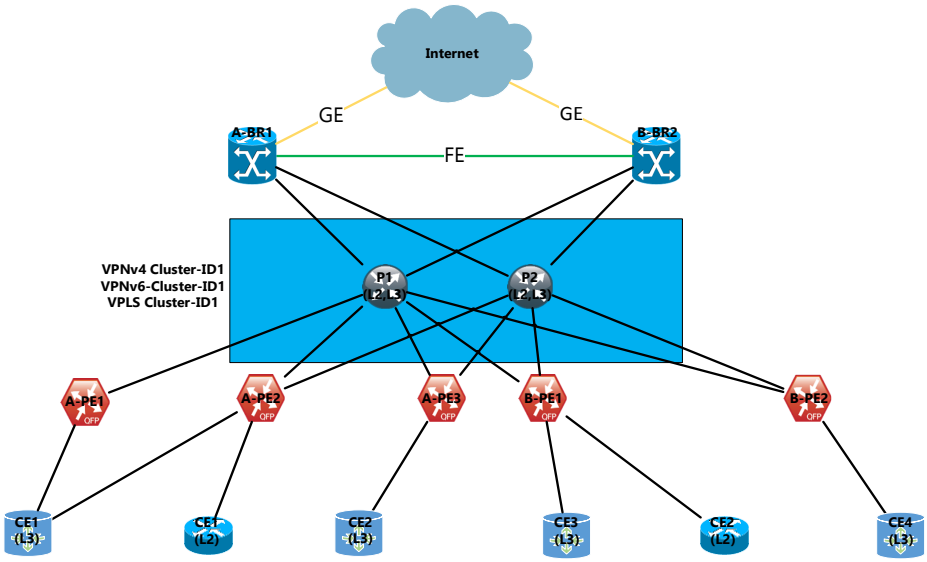
b) Design 2



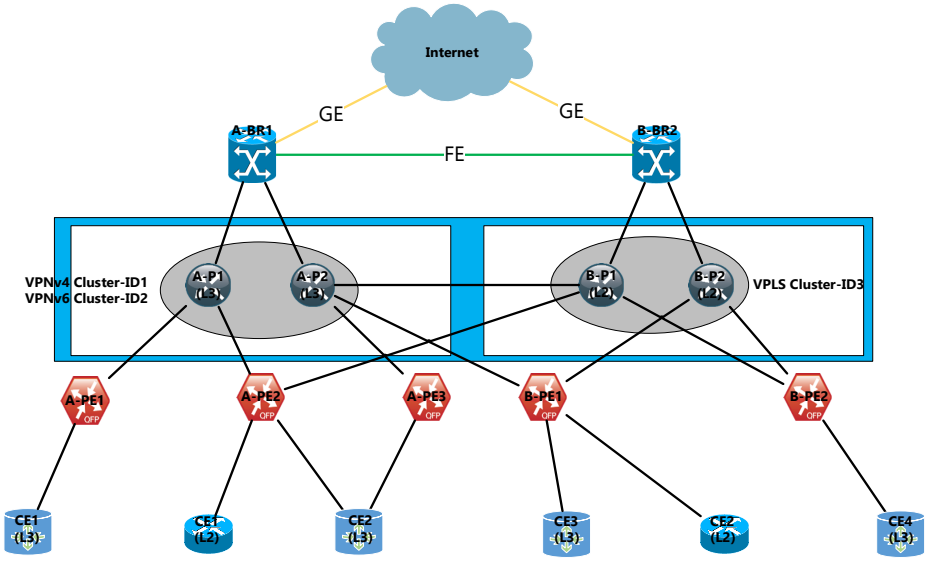
c) Design 3



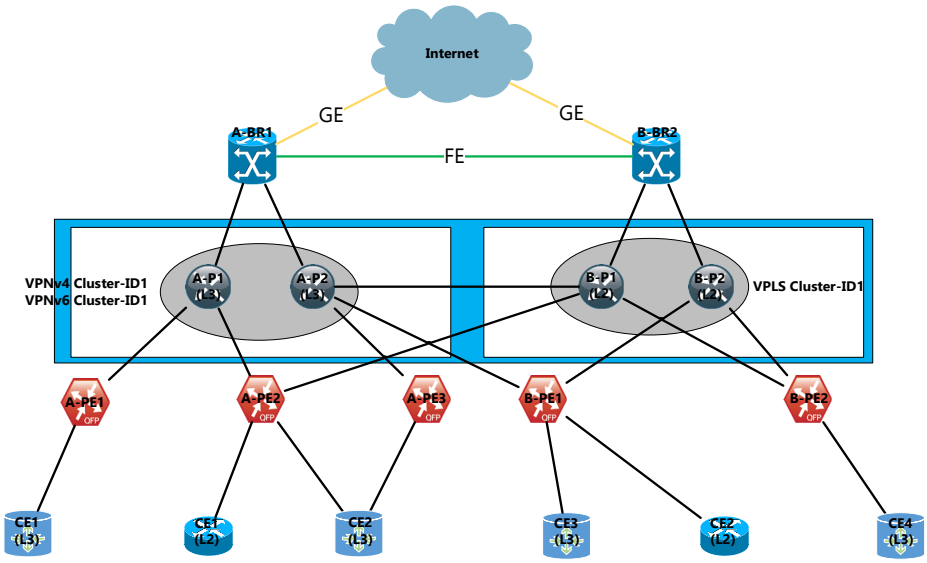
d) Design 4



e) Design 5



f) Design 6



Note: Correct answers will be bolded

Question 1:

a) **Modularity**
b) **SPoF (Single Point of Failure)**
c) Convergence
d) Scalability

a) **Having PE3 connected to PE2 and PE2 is acting as a BGP route reflector will make modularity for the network lower.**
b) **ADSER deploys only one ASBR which in case of failure will cause interruption in the provided services.**
c) Convergence is an issue as well, but we can serve and provide customer with the needed even with high convergence.
d) Scalability is not in its best status, but ADSER network setup needs to be enhanced in order to serve the current customers.

Question 2:

a) **Management burden**
b) Failure recovery
c) Scalability
d) Normal situation , nothing to worry about

a) **Extra BGP sessions will take place.**
b) In case the parent PE went down, there is no other RR to serve this child PE, as well it is connected only via one physical link.

c) Connecting a child PE to a parent PE will not be scalable, but optimality is the key as per the current status.
d) The setup will work, but for sure it is not an optimal or common design.

Question 3:

a) Adaptability
b) Reliability
c) Expandability
d) Serviceability

a) Nothing was mentioned regarding issues related to adaptability, so this is not a valid solution.
b) They assured that the headache right now is the single point of failures in links and nodes.
c) They are not seeking to expand their network or services at the mean time.
d) They can serve their customers per the current setup.

Question 4:

CE1: This device when failure will cause communication interruption with CE2, but this is not a core device, so it will be out the correct answers.

CE2: This device when failure will cause communication interruption with CE2, but this is not a core device, so it will be out the correct answers.

PE1: CE is connected dual-homed to different MPLS PEs, so in case this device failed, the other MPLS PE (PE2) will serve the communication to the branch.

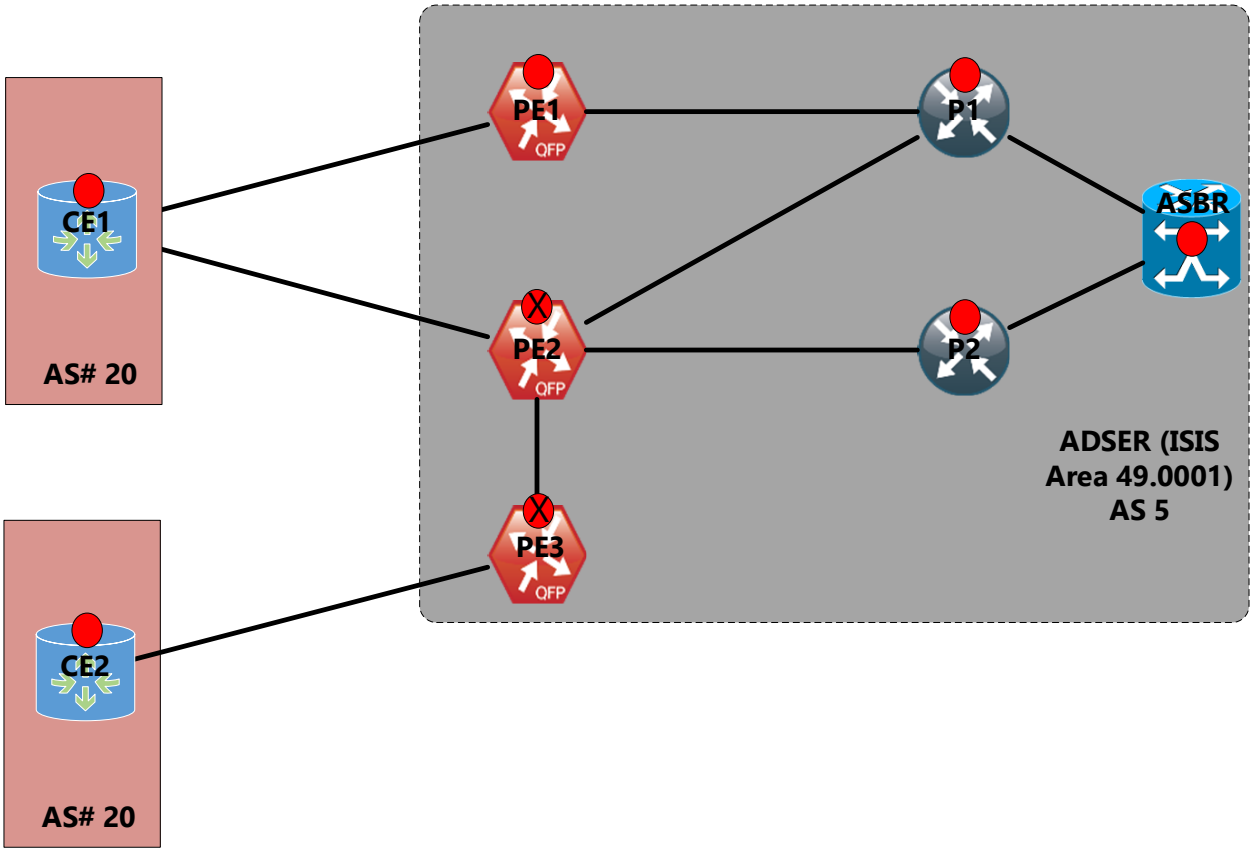
PE2: When this device fail, the connection to the cascaded PE will be idle (one physical link with no redundancy), so this device when fail cause communication failure between MediaCORP entities.

PE3: It is obvious that failure of this link will isolate CE2 completely from the network.

P1: Currently, PE1 and PE2 are acting as route reflector clients for both P1 and P2 per the background information, so failure of this device will not cause any failure in the communication between CE1 and CE2.

P2: Currently, PE1 and PE2 are acting as route reflector clients for both P1 and P2 per the background information, so failure of this device will not cause any failure in the communication between CE1 and CE2.

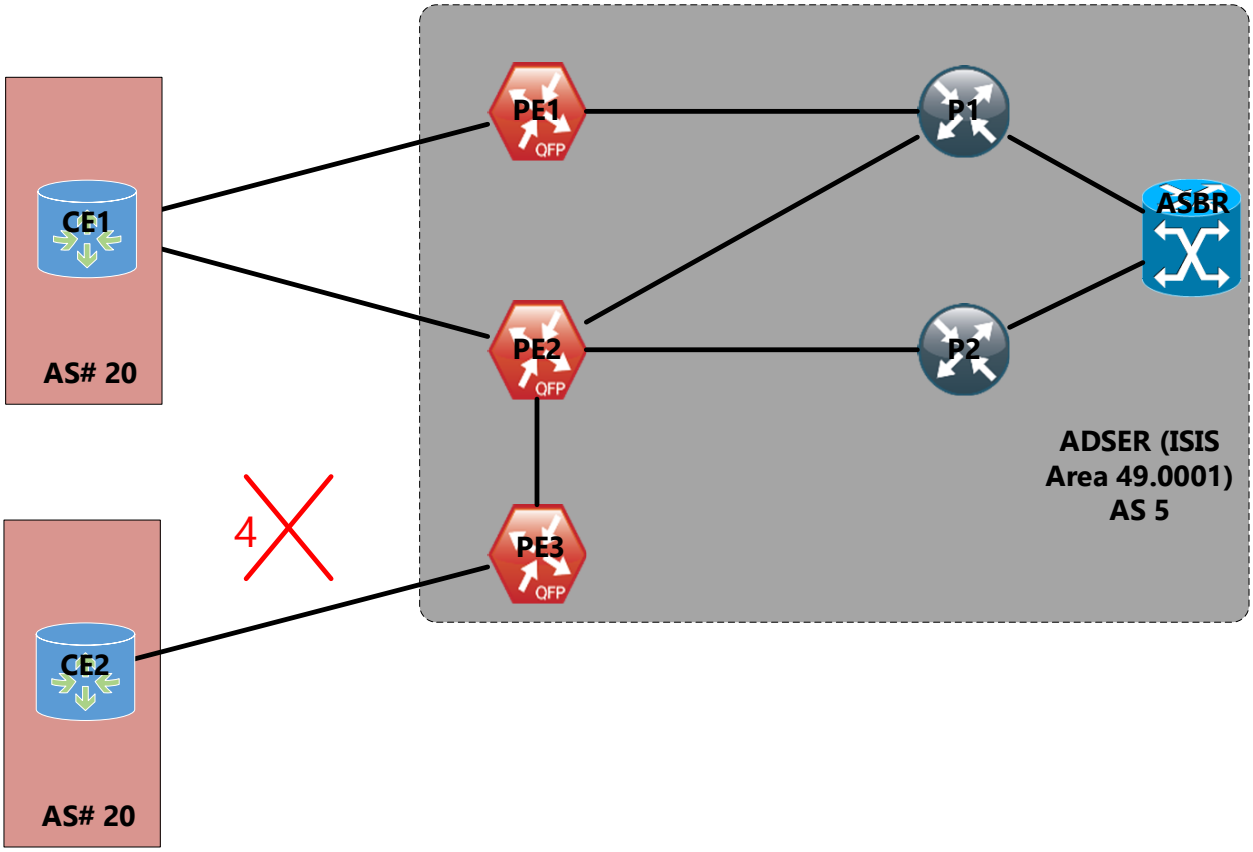
ASBR: We are still inside ADSER network, so what we care for is the communication between the customer entities indie the same network.



Question 5:

a) 1
b) 2
c) 3
d) 4

a) This is a core link and not to be evaluated per the question.
b) This is a core link and not to be evaluated per the question.
c) CE1 is dual-homed and if one link failed, the other link will handle the communication regardless of the convergence.
d) CE2 has only one link and when it failed the communication will be broken between CE1 and CE2.



Question 6:

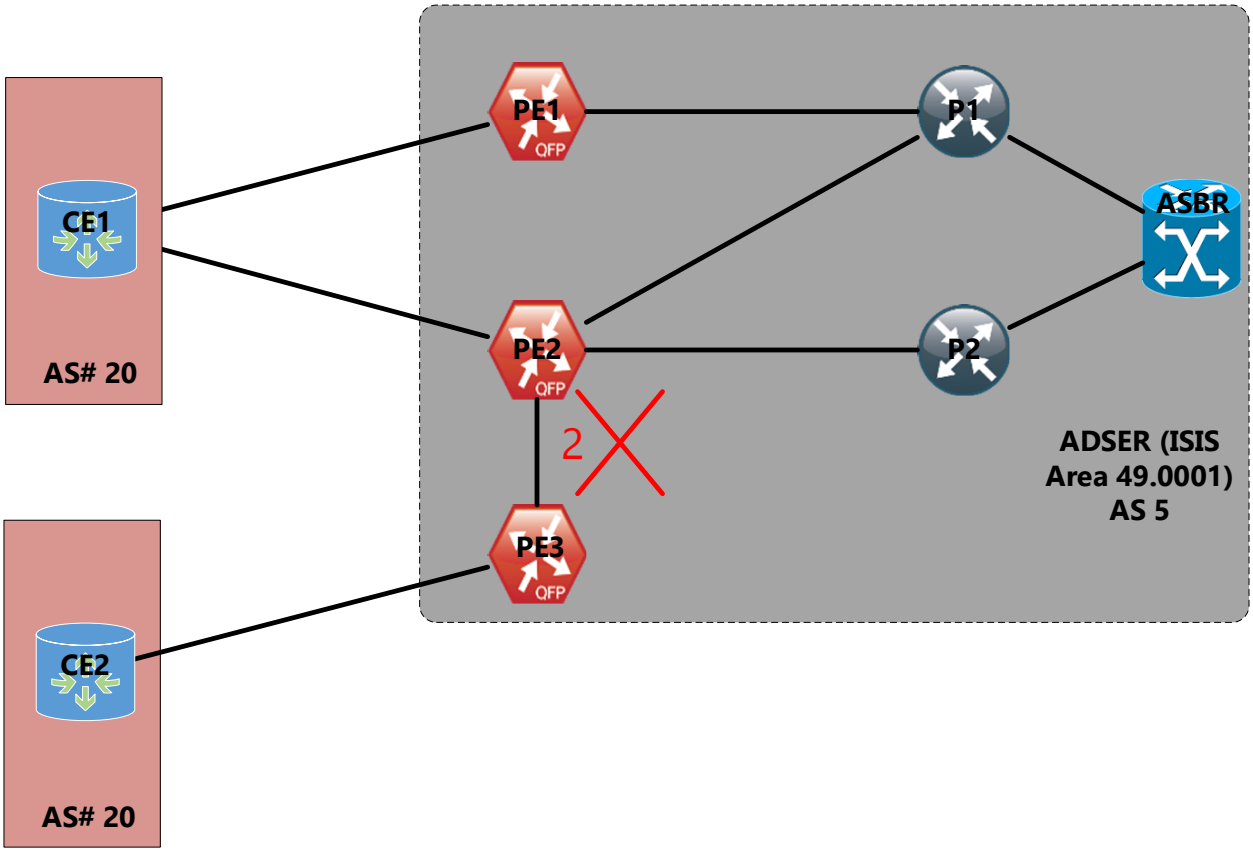
a) 1
b) 2
c) 3
d) 4

a) This link if failed will cause IGP neighborship to go down but even though the BGP VPNv4 session will remain up as the link will be reachable through another path and the service will be maintained.

b) It is obvious that this is one of the issues ADSER network suffer from which is the single point of failure and if the mentioned core link went down , IGP, LDP and BGP VPNv4 sessions will go down and the CE will be totally isolated.

c) This is an access link and not to be evaluated per the question.

d) This is an access link and not to be evaluated per the question.



Question 7:

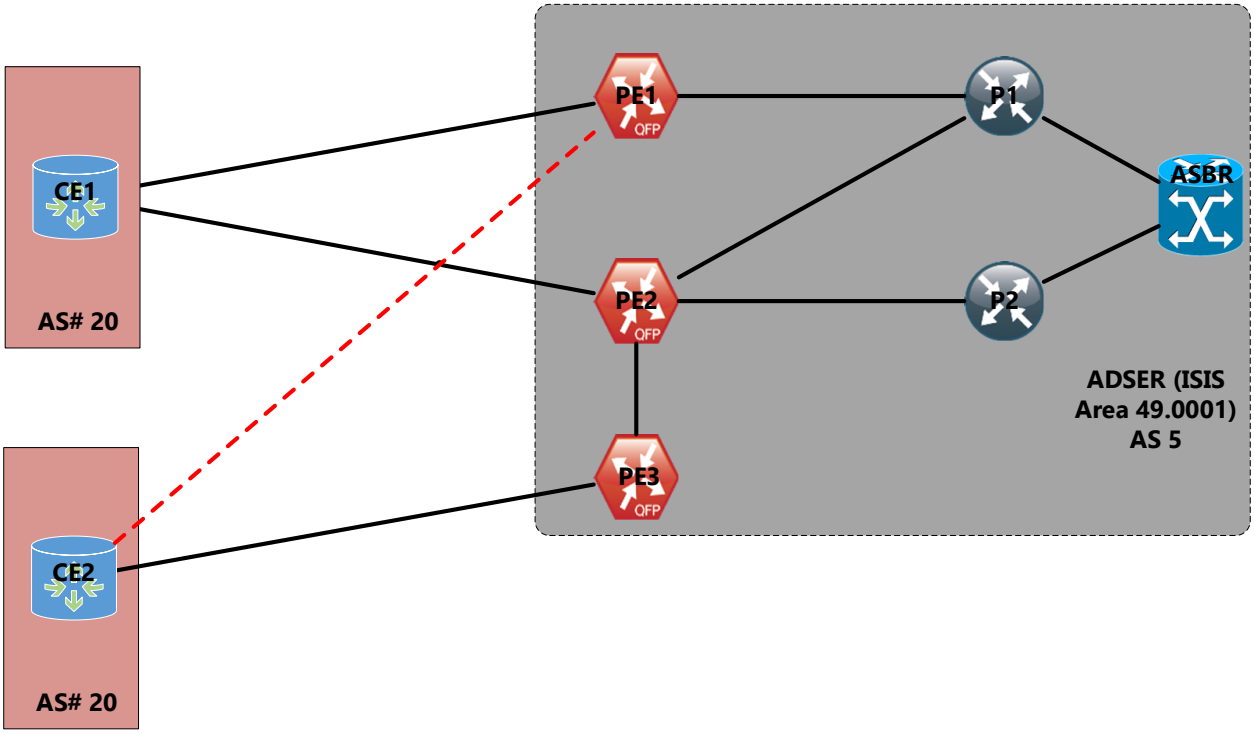
a) Link #1

b) Link #2

c) Link #3

d) Link #4

a) It is mentioned that MediaCORP will not participate in interconnection between its entities, as well, this link is not considered a last mile.
b) Adding new link between CE2 and PE2 will add extra availability, but the concern will be if the PE2 went down again, we will lose connectivity as there is no interconnection link between the CEs.
c) Adding a new link between CE2 and PE1 will be more flexible as our main issue resides in the child PE, so PE1 failure will not cause service interruption and VPN will continue working through PE2.
d) Adding a new link from CE1 to the child PE will add extra redundancy as it is well known: two is good, three is crowded. Keeping CE2 connected only via one link still add resiliency issues.



Question 8:

Aspect/Deployment	With RR	Without RR
iBGP Sessions	↑ ☐ ↓ ☑	↑ ☑ ↓ ☐
Convergence time	↑ ☐ ↓ ☑	↑ ☑ ↓ ☐
BGP Updates	↑ ☐ ↓ ☑	↑ ☑ ↓ ☐
Adjacencies	↑ ☐ ↓ ☑	↑ ☑ ↓ ☐
OPEX	↑ ☐ ↓ ☑	↑ ☑ ↓ ☐
Path Diversity	↑ ☐ ↓ ☑	↑ ☑ ↓ ☐

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Question 9:

a) **Yes**
b) No

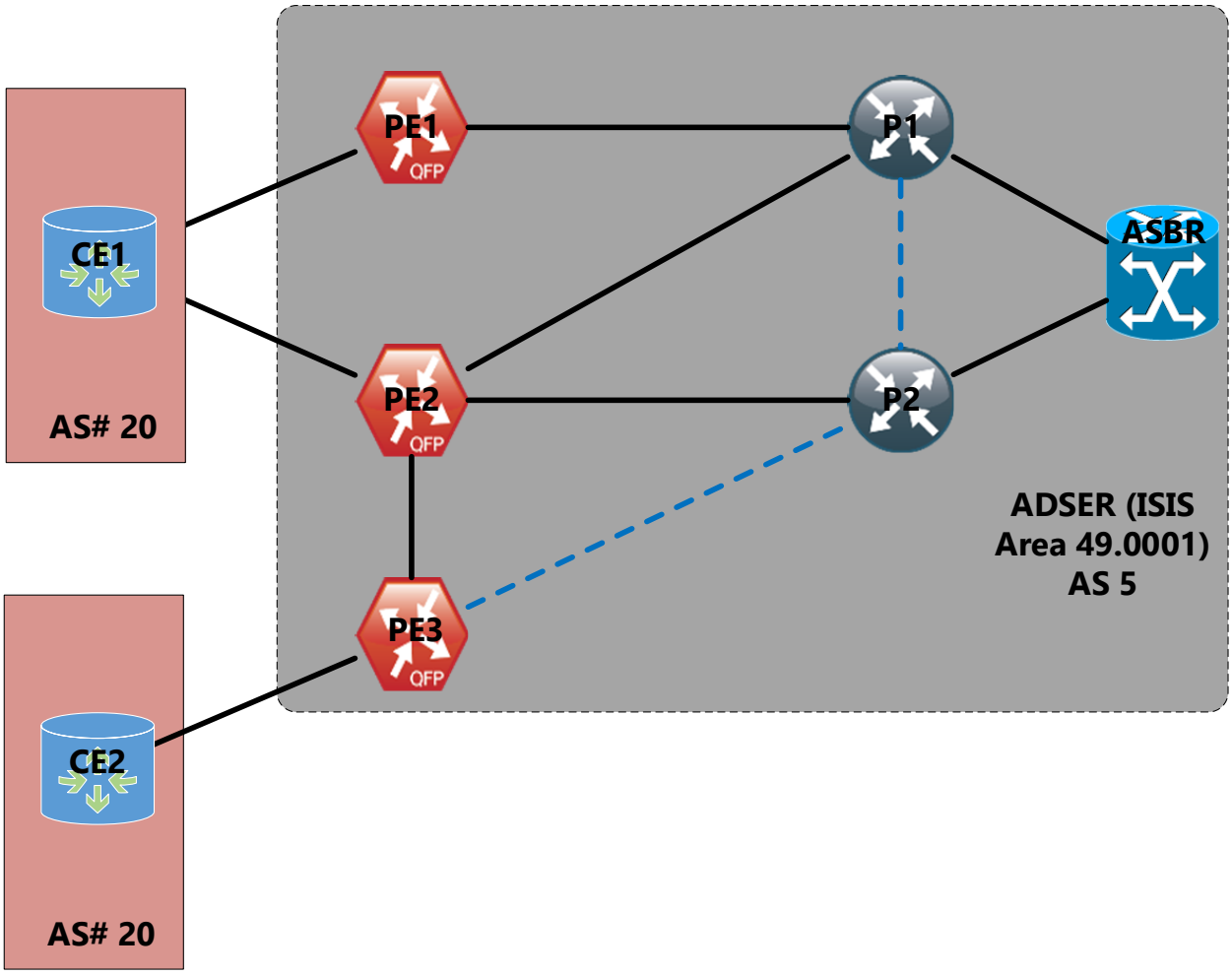
Same cluster-ID will reserve resource utilization and different cluster-ID will add flexibility. The main goal of this feature regardless of the deployment is the loop prevention behavior it adds to the network.

Question 10:

a) **Same Cluster-ID**
b) Different Cluster-ID

In normal cases and with multiple address-families in place, it is better to use different cluster-ID which will gives flexibility. But taking into consideration the devices resources within ADSER network, it is better for resources utilization to use same cluster-ID.

Question 11:



a) **Option 1**
b) Option 2
c) Option 3
d) Option 4

Looking closely at the network diagram for ADSER yield to the conclusion that the focal point to care for is PE3 which is currently isolated and connected to a parent PE only via one single link. Even though that option 2 is valid , but it is better to connect the link in between the route reflectors (MPLS P routers) to account for any failure taking into consideration that per the design so far , the two routers are acting as a cluster.

Question 12:

a) Yes
b) No

Question 13:

a) Network topology
b) In-band is better from convergence perspective
c) Current devices resources
d) It affects path diversity

a) The current network topology for ADSER has the route reflectors physically in the traffic path and there are no available links that can be used around.
b) This is not true as we are not using BGP IPv4 (Global Routing Table).
c) Out-of-band route reflection requires a lot memory for directing packets and it was mentioned that the devices resources are to be considered, but although we are trapped with the topology.
d) Route reflection in general has the issue of path diversity.

Question 14:

a) Add path
b) Next-hop-self
c) Allow-as in
d) As-override

a) Add path is a fast convergence and recovery mechanism.
b) We are still inside the same AS and no external routes are to be considered.
c) This feature could be implemented if the control is from the customer side.
d) This is the feature to be deployed as looking into the previous diagrams , the customer nodes are in the same AS which will prevent the routes from being installed as a loop prevention mechanism.

Question 15:

a) MPLS FRR
b) OSPF IP LFA
c) ISIS IP LFA

d) OSPF Remote LFA

a) It was mentioned that the customer is not satisfied with BW distribution, but at the same time they cannot do any sort of migrations which will prevent them from using MPLS FRR which requires RSVP to be deployed.
b) The IGP running inside ADSER network is ISIS L2.
c) This is the feature based on the collected information that can enhance the convergence time inside ADSER network.
d) The IGP running inside ADSER network is ISIS L2.

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Question 16:

a) Yes
b) No

No, it will not be a good option per the deployment of IP LFA to enhance the convergence time, moving the link will make IP LFA useless and we should enable remote IP LFA instead.

Question 17:

a) Convergence time increase
b) Routing loops
c) Broken MPLS LSP
d) Lost attached bit sit on the PEs

a) The convergence time will increase as we disabled the IP LFA feature which should enhanced the convergence time compared to the flat ISIS Level-2 setup.
b) No routing loop will take place in normal circumstance as it is a ring topology with nothing extra to worry about.
c) MPLS will still be enabled and loopback reachability is still maintained and VPNv4 session is operation, though MPLS LSP is maintained end to end (regardless of the end points).
d) We are deploying flat ISIS Level-2 and there are currently no L1 routers to worry about.

Question 18:

a) Remote LFA

b) Keep the current status
c) MPLS FRR
d) LDP FRR

a) As the link will be moved, the new topology is ring topology. IP LFA is topology dependent and will not achieve the needed when working in ring topologies, remote LFA will the needed from convergence perspective.
b) As the concern of the customer is to enhance the convergence time, keeping the current situation will not fulfil the needed.
c) MPLS FRR needs RSVP to be enabled within the network and currently we are deploying LDP, so making these changes at the mean time is not required nor desired.
d) LDP FRR is the same as IP FRR.

Question 19:

Before we select the right topology, let us highlight some terms related to IP FRR in order for us to be able to choose:

The P-Space of a router with respect to a protected link is the set of routers reachable from that specific router with the use of the pre-convergence shortest paths, without any of those paths, that transits that protected link.
The extended P-Space of the protecting router with respect to the protected link is the union of the P-Space of the neighbors in that set of neighbor, with respect to the protected link, which makes it the union of the P-Spaces of the neighbors in that set of neighbors with respect to the protected link.
Q-Space of a router with respect to a protected link is the set of routers from which that specific router that can be reached without any path (that includes ECMP splits) and transits that protected link.

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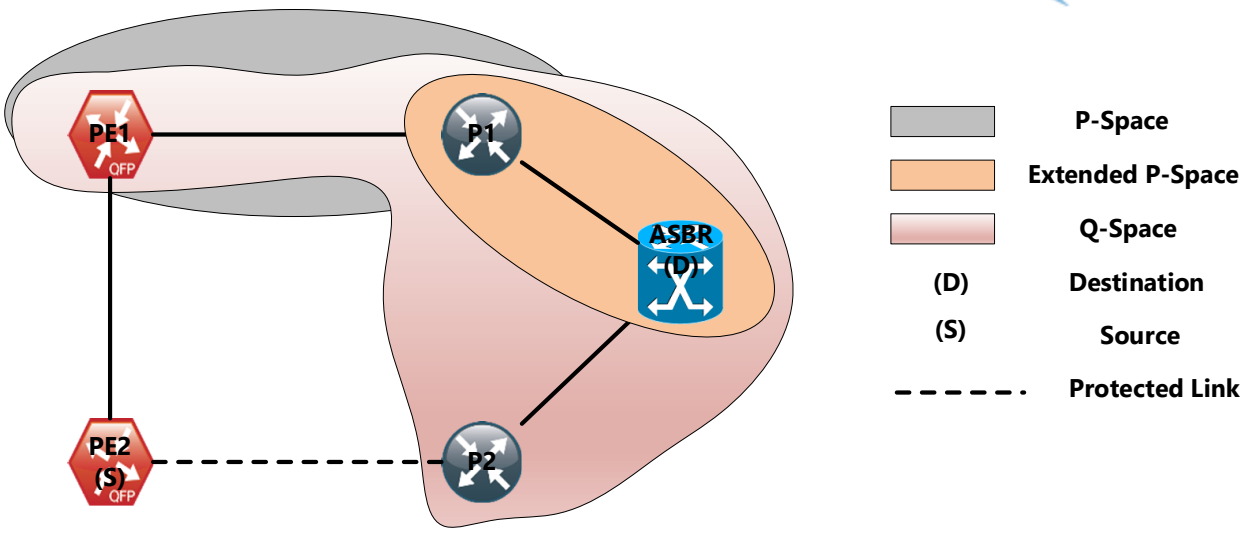
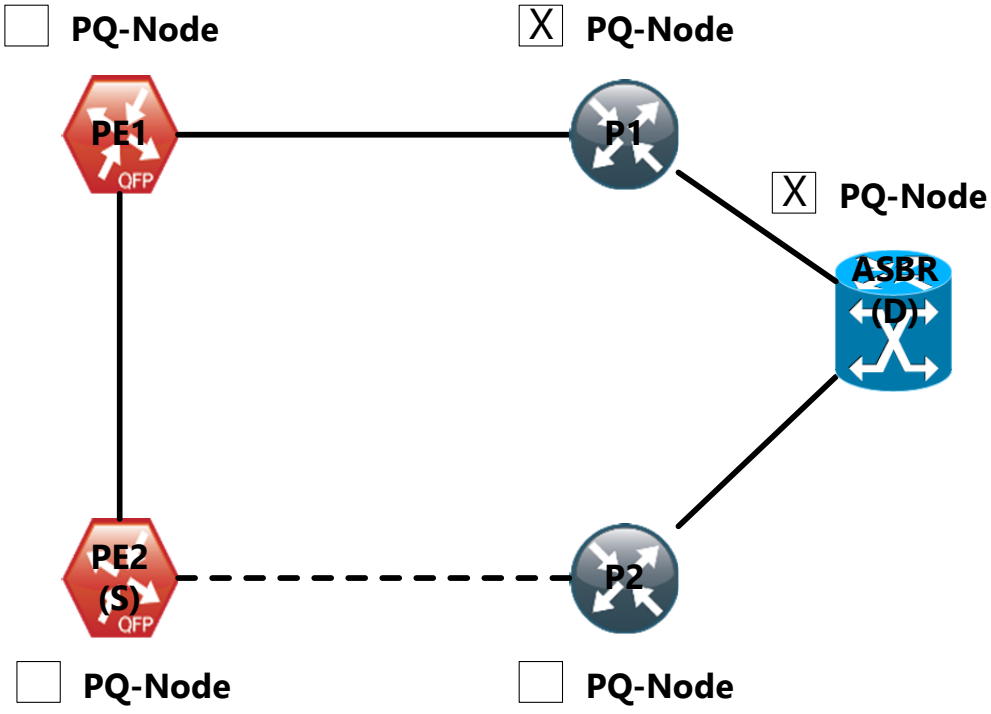
Thus the answer will be figure number 1 (option a).



Question 20:

A PQ node is a router that is both in the Extended P-Space and the Q-Space
Based on the previous question in which we have determined these spaces, we can answer the question as below:



Question 21:

	MPLS FRR	IP LFA
Topology Dependent	☐	☑
Deployment Complexity	☑	☐
Full Coverage	☑	☐

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Question 22:

a) sRTBH
b) RTBH + Loose uRPF
c) Access lists
d) RTBH + Strict uRPF

a) It was mentioned in the mail that the destination address to be taken into account, so this option is excluded.
b) RTBH is used to filter attacks based on destination address. In loose mode, if the incoming packet source address is reachable via any interface, the packet is forwarded. For dual-homed connections, uRPF mechanism is relaxed by using loose mode.
c) Access-list is not a scalable not a flexible solution even though it can be used to filter.
d) RTBH is used to filter attacks based on destination address. In strict mode, the packet must enter via the exact interface through which the source address would be reached. Strict mode is intended to be used at the edge of the network.

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Question 23:

a) Apply access-lists from the CE side
b) Apply maximum-prefix from the PE side
c) Apply maximum-prefix from the P side
d) Apply access-lists from the PE side

a) It is mentioned that the solution should be from the service provider side.
b) This is the correct option as we can use the BGP maximum-prefix feature to control the number of prefixes received from a neighbor.
c) The MPLS P router does not have VPNv4 routes for the customers, it is main function is label switching.
d) This option can be considered but will increase the management headache.

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Question 24:

a) SPoF (Single Point of Failure)
b) In-band route reflection model
c) Cascaded PE connection
d) Customer branch connection to P router

a) We still can provide service to customers even with Single Point of Failures inside the network.
b) Irrelevant.
c) Still we can provide business to customers.
d) This is the option to be considered as connecting a customer to non-PE device could affect the business as serving him could be an issue and could involve making some changing either related to CAPEX or OPEX.

Question 25:

Internet access for MPLS L3VPN comes mainly into two main categories:

- Non MP-BGP
- MP-BGP

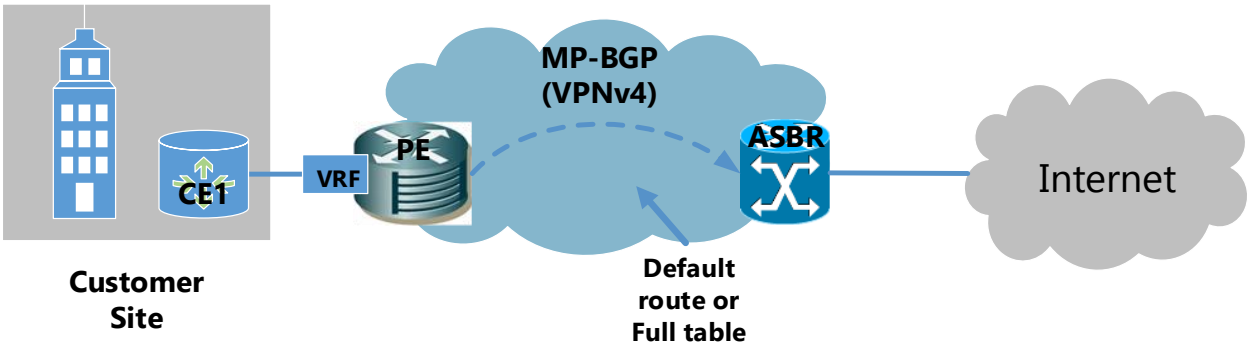
For the first category, the access is provided with the help of the global routing table (GRT).

For the second one, the access is provided with the help of establishing VPNv4 session between the ASBR and the serving device (PE).

Reading through the mail, we can see that the customer is requesting not to touch the global routing table, so we can exclude options a and b.

We are left with two options: c and d.

The customer asked to respect the policy they had by not extending their customers defined VRFs to the border of the network , i.e. to the ASBRs , which mean that we have implement something similar to shared service VRF and avoid deploying VRF-aware NAT which will require defining the customers VRFs on the border device.



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https://bit.ly/2MgiE4g
https://bit.ly/2Dd6Mxb
https://bit.ly/2HgNVFH

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Question 26:

a) **VPNv4 session between ASBRs**
b) VPNv4 session between PEs and ASBRs
c) IPv4 session between Ps and PEs
d) IPv4 session between ASBRs

a) **This session will for sure add extra redundancy to the current setup.**
b) This session already exist to transport the customers prefixes (which needs Internet access) and bring the Internet routes (either default or full table) inside the respective VRF.

c) We are deploying MP-BGP based solution, therefor no need for IPv4 sessions to take place.
d) We are deploying MP-BGP based solution, therefore no need for IPv4 sessions to take place.

Question 27:

a) Label allocation mode
b) Sub-optimal routing
c) OSPF LSAs increment
d) Expected raise in the resources utilization, nothing to be done

a) The default label allocation mode is per-prefix allocation which means that for every prefix a label is generated, imagine that a customer seeks a full routing table!
b) Irrelevant as we did not perform any redistribution or similar action that could generate a routing loop.
c) OSPF DB has nothing to do with what have been performed as it relates directly to the IGP and we are within the MP-BGP address families.
d) It is expected per the default label allocation mode, but there is something that we can do which is to change the default label allocation mode to something that can reserve our resources.

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https://bit.ly/2Dd6Mxb

Question 28:

a) Change per allocation mode to per-prefix
b) Manipulate SPF throttling values
c) Adjust LSA pacing timers
d) Change per allocation mode to per-VRF
e) Nothing to be done

a) The default label allocation mode is per-prefix and this is what cause the resource utilization when deploying MPLS L3VPN Internet access option 3.

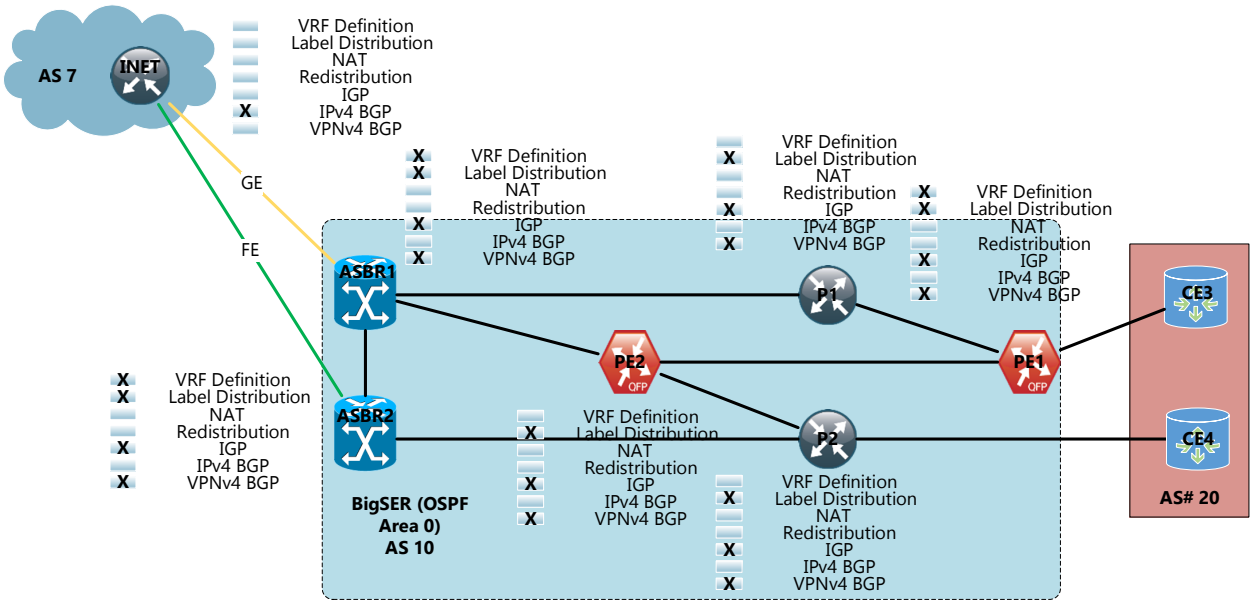
b) Modifying SPF throttling is one of the fast convergence tools used when OSPF is used as the IGP inside a network, but currently OSPF is out of the picture as we are suffering from resource utilization issue.

c) LSA pacing timer's modification also falls into the fast convergence categorization and this is not the correct answer.

d) This is the correct answer as whatever the number of prefixes is, one label will be assigned per the VRF.

e) This is not the correct answer as changing the label allocation mode will solve the issue as mentioned in option d.

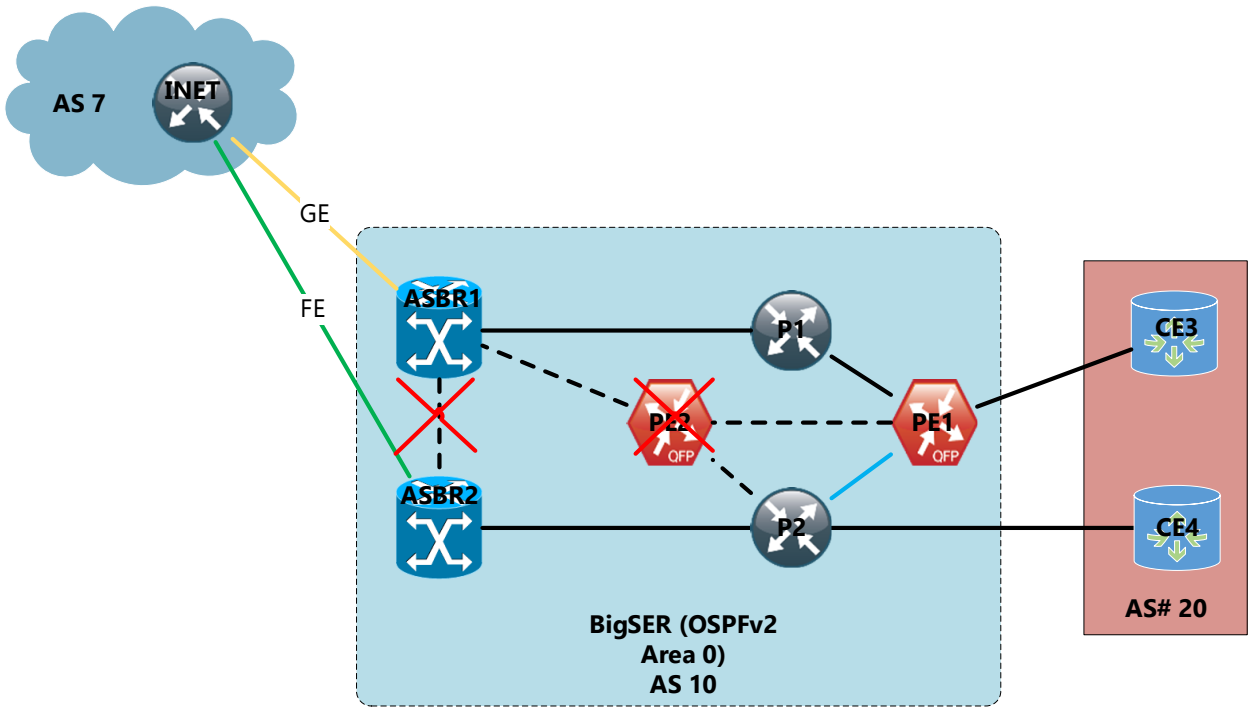
Question 29:



Note: When deploying MPLS L3VPN Internet access option 3, a VRF to be configured on the ASBR that will transport the prefixes of concern to the respective PEs.

This will be don't through manipulating the route-target import/export values to allow proper installment.

Question 30:



Question 31:

a) **Yes**
b) No

As nothing was mentioned regarding traffic manipulation, different uplinks speed could cause traffic congestion.

Question 32:

a) **Link congestion could take place if traffic distribution is not well designed**
b) Traffic blackholing
c) Packet drops
d) There will be no issue

a) **This is the option to consider as difference in uplinks speed could affect performance if proper distribution of traffic is not in place.**
b) This is not true as the concern is related to physical media.

c) This option could be true in certain circumstances, but congestion includes all outputs that could be produced (packet drops, jitter, delay, etc.).
d) This is obviously not true.

Question 33:

a) Security
b) Staff experience
c) QoS
d) Resource utilization

a) Nothing was mentioned regarding security (for now).
b) It was mentioned that the staff is not that experience in managing QoS policies, so we need a solution that will ease the issue for them.
c) The customer is concerned about QoS markings to be preserved and this is the most critical factor.
d) The devices are mid-level but we still have no idea about the solution to be deployed.

Question 34:

a) MPLS Inter-AS option B
b) GRE+IPSEC
c) L2TPv3
d) MPLS Inter-AS option C

a) This is a label based solution and it deals with QoS almost in the same way, but as merge rumor is in place, option C will be better.
b) Security currently is not mentioned as the ultimate goal to achieve connectivity, as well, this is not a label based solution.
c) Again, we need a label based solution and this option is IP based.
d) This is the solution to be considered as it is a label based and fits when merge is to take place.

Question 35:

a) Scalability
b) Resource utilization
c) Complexity
d) Security

a) **MPLS Inter-AS option A is the less scalable among all the available options as it needs a back-to-back VRF per each customer to serve. It was mentioned that many customers will connect their geographically distributed entities, so this is the correct option.**
b) It is the most resource intensive as the ASBR will handle VRFs, VPN and BGP tables.
c) From complexity perspective, it is the less complex one compared to the other available options.
d) Option A is the most secure option to deploy as there are no much information to be leaked between the participating ASes.

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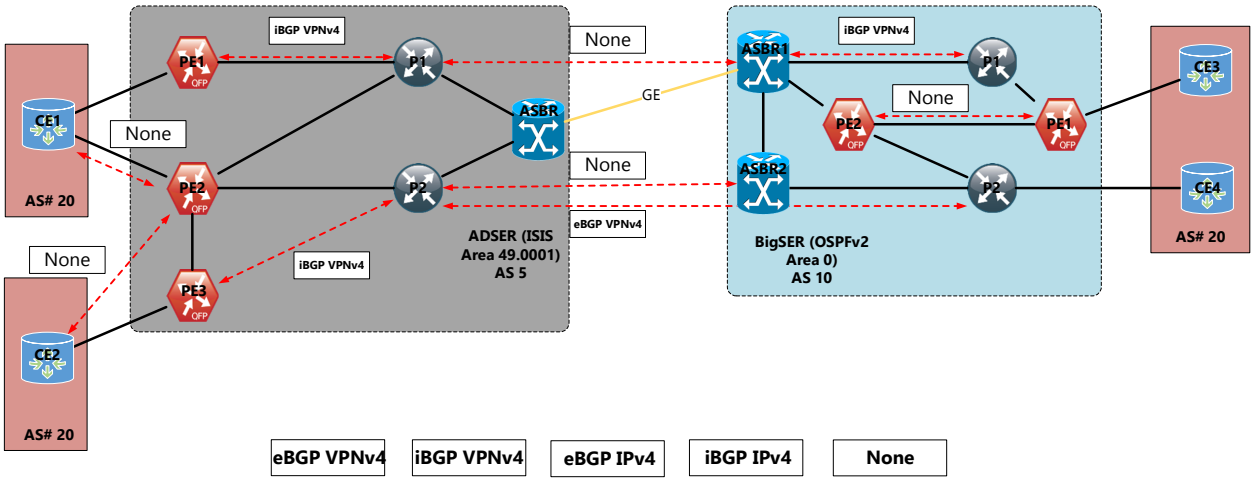
Question 36:



Question 37:

a) Next-hop-self toward the PEs
b) Route-target-filter
c) Next-hop-unchanged toward the CEs
d) Missing redistributed route

a) Irrelevant.
b) It was mentioned that definition for the VRFs use the convention of ASN:NN which will prevent the routes from being installed as the route-target import does not allow outside AS prefixes from being installed.

c) This feature is configured between the route reflectors in between the ASes not toward the CEs.
d) We are not performing any redistribution.

Question 38:

a) Yes
b) No

PE2 is not configured for any VRF, that is correct, but it is not configured with any BGP VPNv4 session as well, so it will not participate at all in the prefix advertisement.

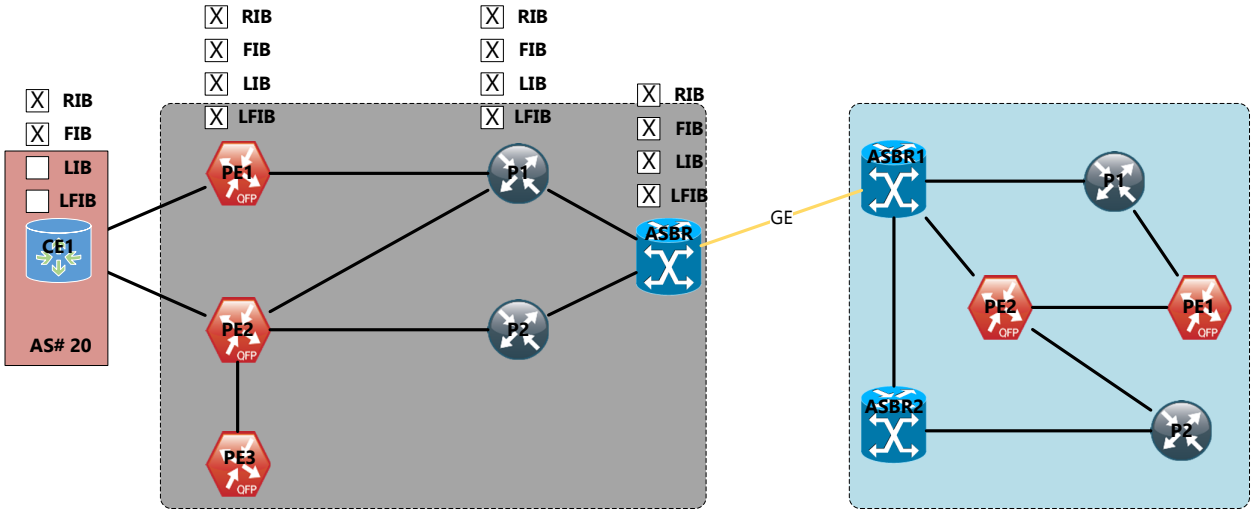
Question 39:

	ADSER					
	ASBR1	P1	P2	PE1	PE2	PE3
MP-eBGP	☐	☑	☑	☐	☐	☐
IGP (Global)	☑	☑	☑	☑	☑	☑
Route Target Filter	☐	☐	☐	☐	☐	☐
iBGP	☐	☐	☐	☐	☐	☐
iBGP RR	☐	☐	☐	☐	☐	☐
VPNv4 MP-iBGP	☐	☑	☑	☑	☑	☑
VPNv4 RR	☐	☑	☑	☐	☑	☐
VRF	☐	☐	☐	☑	☑	☑
Next-hop-self	☐	☐	☐	☐	☐	☐
LDP/RSVP	☑	☑	☑	☑	☑	☑
Next-hop-unchanged	☐	☑	☑	☐	☐	☐
Labeled Unicast	☑	☐	☐	☐	☐	☐
eBGP	☑	☐	☐	☐	☐	☐
BGP <--> IGP redistribution	☐	☐	☐	☐	☐	☐
VRF IGP	☐	☐	☐	☐	☐	☐

Note: It was mentioned in the background information that the new service PE (PE3) was mistakenly connected to PE2 which is currently acting as a route reflector for PE3, so we have to check the PE2 VPNv4 RR.

	BigSER					
	ASBR1	ASBR2	P1	P2	PE1	PE2
MP-eBGP	☐	☐	☑	☑	☐	☐
IGP (Global)	☑	☑	☑	☑	☑	☑
Route Target Filter	☐	☐	☐	☐	☐	☐
iBGP	☑	☑	☐	☐	☐	☐
iBGP RR	☐	☐	☐	☐	☐	☐
VPNv4 MP-iBGP	☐	☐	☑	☑	☑	☑
VPNv4 RR	☐	☐	☑	☑	☐	☐
VRF	☐	☐	☐	☐	☑	☐
Next-hop-self	☐	☐	☑	☑	☐	☐
LDP/RSVP	☑	☑	☑	☑	☑	☑
Next-hop-unchanged	☐	☐	☑	☑	☐	☐
Labeled Unicast	☑	☑	☐	☐	☐	☐
eBGP	☑	☑	☐	☐	☐	☐
BGP <---> IGP redistribution	☐	☐	☐	☐	☐	☐
VRF IGP	☐	☐	☐	☐	☐	☐

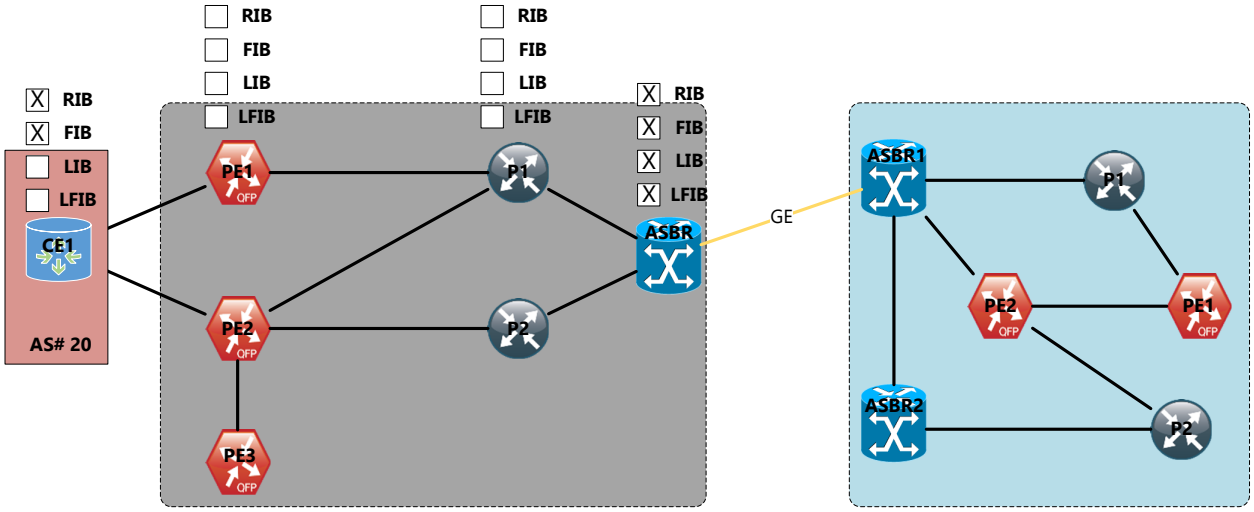
Question 40:



Note: As MPLS L3VPN Inter-AS Option C is deployed, information leakage is in place which means that the loopback interfaces for the MPLS PEs are leaked inside each of the operating AS.

If the interconnection between the ASBRs went down that means the loopback interfaces are lost which will make the respective tables to converge looking for a backup path.

Question 41:



Note: In MPLS L3VPN Inter-AS Option B ,the eBGP VPNv4 session is established between the ASBRs to carry traffic belong to different VRFs not like Option C in which the eBGP VPNv4 session is established between the route reflectors.

Question 42:

a) Check loopback availability.
b) Establish VPNv4 session between PE3 and P1.
c) Establish VPNv4 session between PE3 and P2.
d) Deactivate BGP VPNv4 session between PE3 and PE2.

Question 43:

a) Oldest route
b) BGP Next-hop
c) Origin code
d) Local preference

a) As nothing was mentioned about BGP attributes manipulation , BGP selection criteria will continue down the list till a tie breaker is found which is in this particular case is the oldest route as nothing has changed.
b) BGP next-hop is the same for both.
c) Origin code is the same for both.
d) Local preference value is the same for both.

Question 44:

a) Yes
b) No

No actual traffic loss will be present as the needed BGP VPNv4 sessions will be established prior to bringing down the previously operational BGP VPNv4 session.

Question 45:

a) Deploy MPLS TE
b) Policy-Based Routing
c) Diffserv QoS
d) Manipulate OSPF metric among specific links

a) This is the correct answer as it gives the administrator the ability to steer the traffic taking the BW into consideration.
b) Not a scalable option and complex from configuration point of view.
c) Bandwidth reservation mechanism.
d) IGP is used to discover remote destinations.

CCDE in Depth (P 418).

Question 46:

a) Control-Plane overhead
b) RIB size increment
c) IGP database increment
d) FIB size increment

a) Implementing RSVP will add more states on the devices which will increase the control-plane overhead.
b) No additional routes to be installed in the routing table (RIB).
c) Implementing RSVP TE will add extra entries in the respective protocol database (which is OSPF in BigSER network) due to the needed IGP extensions to support the new protocol.
d) No additional entries to be installed in the CEF table (FIB).

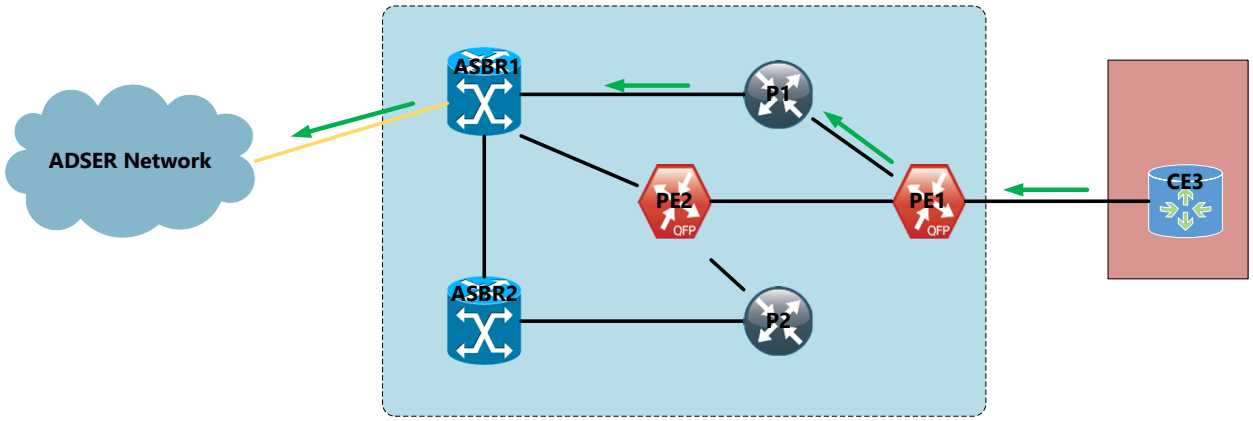
Question 47:

a) Tactical MPLS TE
b) Strategic MPLS TE

a) Tactical MPLS TE tunnels are built as needed to work around congestion or failures.
b) Strategic MPLS TE relies on building full mesh of tunnels or partial mesh in some part of the network , it was mentioned in the mail that the customer still have some time, so we can manage to design the needed.

https://bit.ly/2SSSY0h

Question 48:



P1 is the route reflector for MPLS PEs running inside BigSER network.

The packet travels from CE3 going toward ADSER network will pass through the serving P as nothing was mentioned related to IGP metric manipulation.
The normal behavior currently for the packet is to go through the route reflector representing the in-band route reflection model.

Question 49:

a) Yes
b) No

The main goal is to serve the customer and care for his concerns.

Question 50:

a) Increase LP on PE1 BGP sessions for all received prefixes
b) Enable max-metric router-lsa on the LERs
c) Enable max-metric router-lsa on the LSRs
d) Change the area between P and PEs to a new area other than backbone

a) Manipulating the Local Preference will not prevent the packets from traverse the MPLS Ps.
b) Enabling the mentioned feature on MPLS PEs will not necessarily prevent the packets from traversing the MPLS Ps.
c) This will prevent the packets from traversing the MPLS Ps.
d) Irrelevant and not doable, we need to fulfil the customer request with minimum changes and without big changes to the current network.

https://bit.ly/2HttMvZ

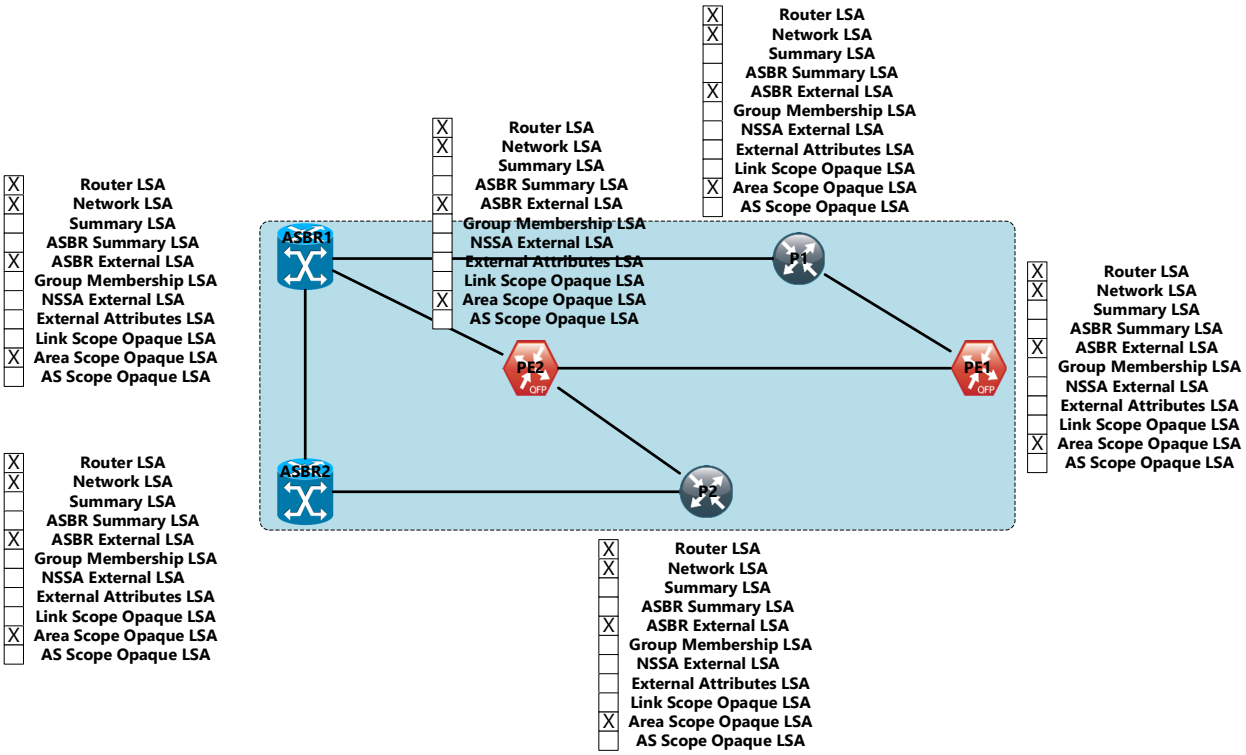
Question 51:

a) In-band route-reflection model is in play
b) Out-of-band route reflection model is in play
c) Optimal route reflection is in play
d) DR/BDR election will not take place on the target devices

a) In-band route-reflection is already in place and decided by the IGP metrics.
b) This is true as deploying the max-metric router-lsa feature will exclude the devices of concern from the traffic path.
c) Irrelevant.
d) Irrelevant, DR/BDR election is not affected by modifying the link metrics.

https://bit.ly/2HttMvZ

Question 52:



Question 53:

a) LDP and RSVP cannot co-exist in the same network

b) End to end tunnel is broken

LDP and RSVP can coexist as service providers need sometimes to steer certain traffic to better utilize links speeds and control bandwidth utilization.

Question 54:

a) **Enable LDP on the overlay MPLS TE tunnel to allow LDP packets to be routed hop by hop. This routing allows to use simplex (one way) TE LSP and the traffic in the opposite direction to flow through the LDP established LSP that follow the unicast routing.**
b) Disable LDP inside the network
c) Manipulate the MPLS LDP advertisement
d) MPLS TE is not a valid option for BigSER network

a) **This will solve the issue caused.**
b) Not an option to consider as RSVP will not be scalable as LDP and this action will require extra modifications to take place.
c) Our issue in not related to LDP advertisements.
d) We are already recommend the option to resolve the issue they are facing regarding the utilized link.

Question 55:

Aspect/Protocol	LDP	RSVP
OPEX	High ☐ Low ☑	High ☑ Low ☐
State	Hard ☑ Soft ☐	Hard ☐ Soft ☑
Scalability	High ☑ Low ☐	High ☐ Low ☑
LSPs Topology	PP ☐ P2MP ☑	PP ☑ P2MP ☐
LSP Initiator	Ingress ☐ Egress ☑	Ingress ☑ Egress ☐

Question 56:

MPLS TE Operation	Protocols
Link Information Distribution	ISIS
	OSPF
Path Calculation	CSPF
Path Setup	RSVP
Traffic Forwarding	PBR
	CBTS

Question 57:

a) Better traffic control
b) Service interruption

a) RSVP is the protocol which will give traffic control.
b) This is the correct option to consider.

Question 58:

a) CE3 to PE1 link
b) PE1 to PE2 link
c) PE1 to P1 link
d) P1 to ASBR link

a) This branch is single-homed and when failed it will cause complete service interruption.
b) If this core link failed, we have an alternative physical link to hold the traffic.
c) If this core link failed, we have an alternative physical link to hold the traffic.
d) If this core link failed, we have an alternative physical link to hold the traffic.

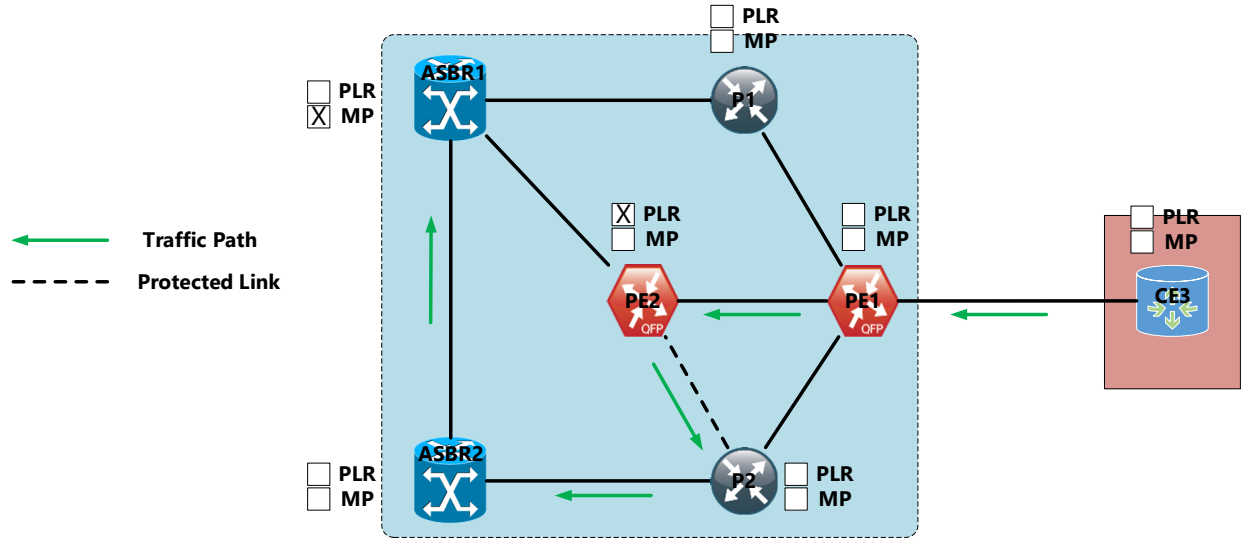
Question 59:

a) **MPLS FRR**
b) IP LFA
c) BGP PIC
d) BGP fall-over

a) **This is the option to consider as we already implemented RSVP.**
b) We implemented RSVP and IP LFA will work with LDP.
c) BGP PIC will be of good use, but we are looking for infrastructure.
d) The command will monitor the RIB and if route to a peer is not present, it will deactivate the peer session without waiting for the hold-down timer.

https://bit.ly/2sQal6y

Question 60:



In MPLS FRR deployment, a unidirectional tunnel is created from the head-end router to the tail-end router to establish the LSP.
FRR (Fast Reroute) aims to reroute the traffic quickly around a failure.

PLR (Point of Local Repair) is here the protection tunnel originates, where MP (Merge Point) is where the protection tunnel terminates and merges into the original protected LSP.

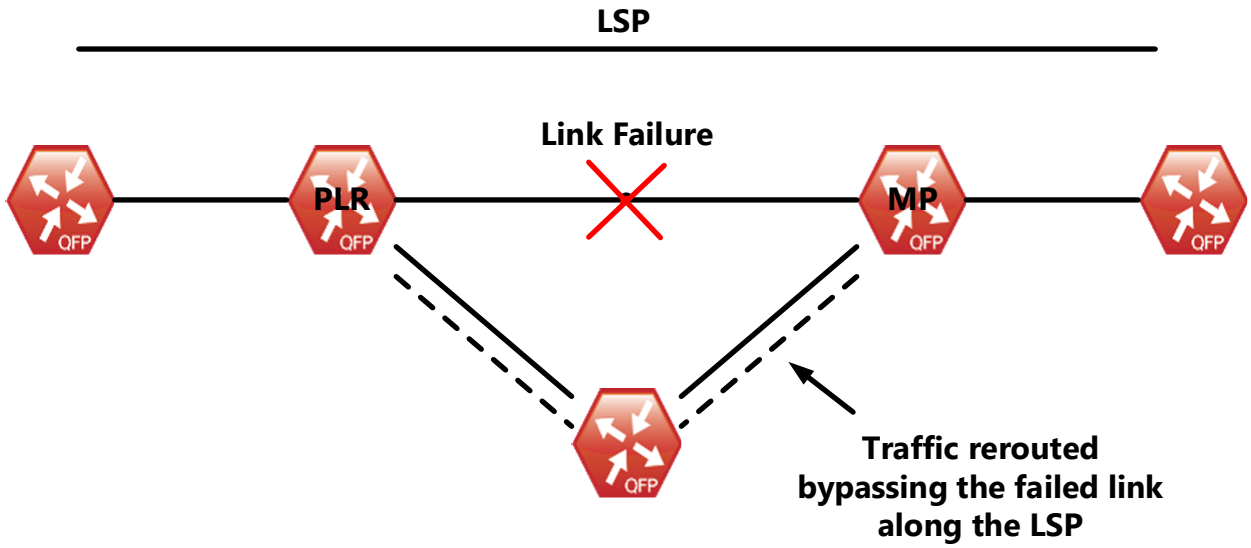


Figure: FRR Link Protection

https://bit.ly/2UpfEpj
https://bit.ly/2RlkKkr

Question 61:

a) OSPF LSDB increase
b) Flapping routes
c) SPoF (Single Point of Failure)
d) Routing Loops

a) Creating a new OSPF process inside a VRF from one side and GRT (Global Routing Table) will not increase the OSPF database.
b) Creating a new OSPF process inside a particular VRF with no information available regarding leakage will not cause routes flapping
c) If the link between PE2 and P2 (The original link for which CE4 traffic will use to reach target destinations), for sure this will be considered Single Point of Failure and that is why this is the correct answer.
d) We are performing 2-way redistribution on one router (between BGP and OSPF inside the respective VRF) with no leakage inside the GRT (Global Routing Table), so no routing loops to take place.

Question 62:

Aspect	Effect
Scalability	↑ ☐ ↓ ☑
Manageability	↑ ☑ ↓ ☐
Serviceability	↑ ☑ ↓ ☐
Modularity	↑ ☐ ↓ ☑
OPEX	↑ ☑ ↓ ☐

Scalability: Creating a new OSPF process to serve the customer of concern and only that customer will reduce scalability, as well, resources are affected per the increase in IGP database.

Manageability: The proposed solution requires implementation steps to take place which are not following the known guidelines to serve customers.

Serviceability: The ability to serve the customer whatever the way is will fir sure increase the serviceability level.

Modularity: The proposed solution will not divide the network into replicated segments neither per function nor policy, the boundaries got complicated.

OPEX: As mentioned, the deployment efforts to take place will increase the operation level.

Question 63:

a) **Make the termination P a PE and modify the respective BGP sessions**
b) Move the customer connection to the nearest PE
c) Ask the customer to connect a link between his branches
d) The proposed solution is scalable and will work fine per the requirements

a) **The customer chose serviceability on the expense of resiliency, so this is the most ideal solution in this particular case.**
b) It was mentioned that new physical links installation is not an option.

c) It is the service provider responsibility to handle the customer request. Relaying the solution to the customer side is not an option.
d) The solution is not scalable as it will add extra control-plane overhead and increase resources utilization.

Question 64:

a) Down convergence will increase
b) Up convergence will increase
c) Customers' prefixes have nothing to do with the SP core network
d) Overall network convergence will be affected

a) Convergence in MPLS VPN networks is the time it takes for the data traffic from the remote CE to reach the local CE after a topology change has occurred.
b) Up convergence in L3VPN environment can be defined as the time it takes for traffic to be restored between VPN sites when:

- **A new prefix is advertised and propagated from a local CE to the remote CE**
- **A new site comes up**

c) This is not true as customers' prefix will pass by through the service provider network by entering through the ingress PE.
d) Network convergence (directly related to customer) will be affected, down convergence is more accurate to consider.


https://bit.ly/2Co9EG4

Question 65:

a) Routing protocols and labels distribution protocols neighbors are lost.
b) Respective entries are removed from LIB, LFIB and FIB.
c) Routing protocols rebuild the IP routing table and forwarding table.
d) LFIB and labeling information in the FIB are rebuilt immediately after the routing protocol convergence.

https://bit.ly/2VcEeuU

Question 66:

MPLS TE Operation	Tools
Event Detection	Carrier Delay
	BFD
	Hello/Dead Timers
Event Propagation	LSA Packet Pacing
	Interface Event Dampening
Event Processing	MinLSArrival Timer
	LSA Throttle Timers
	iSPF

Question 67:

a) Yes
b) No

Question 68:

a) FIB Recursion issue
b) Route reflection deployment should be in place
c) AS-Override feature should be enabled
d) There is no issue and connectivity is in place

a) The loopback interfaces for MediaCORP routers (which now are acting as PEs to the new company) are learned through BGP which will cause the BGP peering session not to be established.
b) Irrelevant, route reflection has nothing to do with proper session establishment and correct prefix advertisement.
c) The main BGP session is not place in the first manner and we can take this into account later.
d) Not correct.

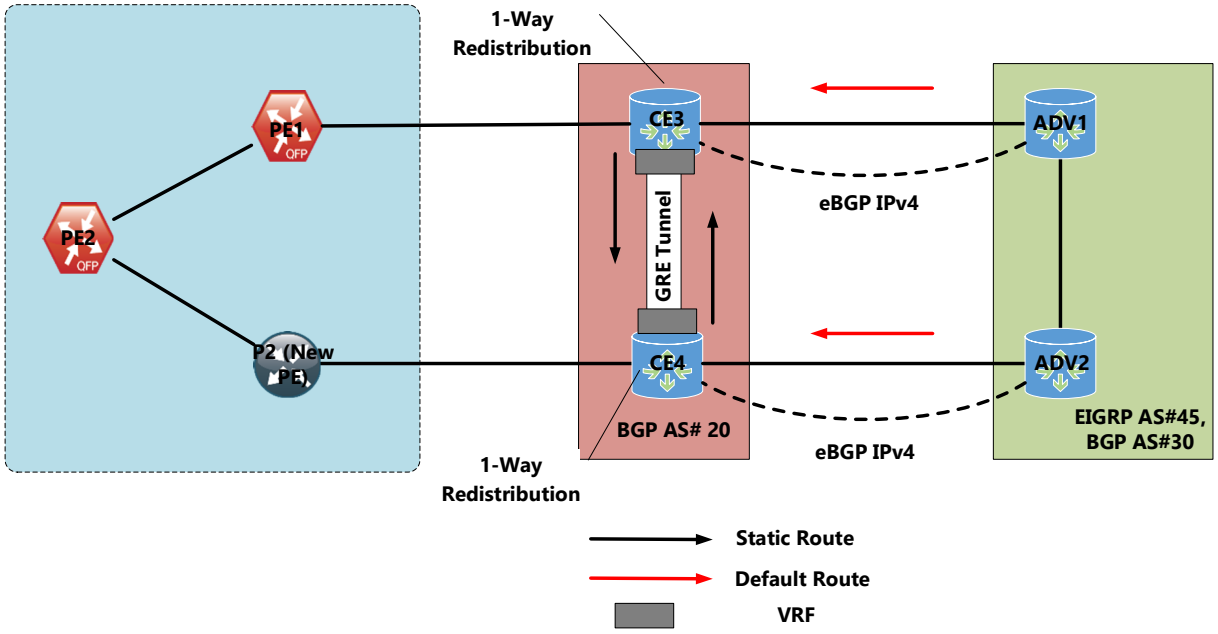
Question 69:

a) **Recursive lookup behavior will take place and the BGP session will not come up**
b) The BGP session will come up bit with extra MTU modification under the created tunnel to take place
c) BGP session will come up but extra send-label under the IPv4 AF will be needed
d) The tunnel mode of GRE will not work and should be modified
e) The BGP session will come up but the GRE tunnel should be sourced from the physical interface

a) **Using the loopback interfaces which are already learned via BGP and use them as sources for the GRE tunnels will cause recursive lookups which will cause the tunnel to come up.**
b) The session will not come up.
c) The session will not come up.
d) Irrelevant.
e) The session will not come up.

https://bit.ly/2MxlAd0

Question 70:



The static routes are configured to change the way both routers are learning the tunnel sources (as mentioned earlier, they were learned via BGP).

Question 71:

a) **Administrative distance is the tie breaker and this is normal**
b) This is not normal and the link between the Advertisement Company routers should be shutdown

Question 72:

a) Enable BGP SoO on the PE toward the CE in the outbound direction
b) Enable BGP SoO on the CE toward the PE in the outbound direction
c) Enable BGP SoO on the PE toward the CE in the inbound direction
d) Enable BGP SoO on the CE toward the PE in the inbound direction

https://bit.ly/2MExZfu

Question 73:

a) **The feature will work under the IPv4 AF**
b) **FIB database size increase**
c) BGP table size increase
d) RIB size decrease
e) MPLS LFIB table entries decrease

a) **The feature will work for both IPv4 and VPNv4 address-families.**
b) **The goal of this feature is to add extra entry in the FIB (CEF) to enhance the convergence time.**
c) The BGP table size will not increase, the change to take place is to mark the non-best routes as backup (b).
d) The routing table will not be affected.
e) The customer is not running MPLS inside his network.

Question 74:

a) Yes
b) **No**

https://bit.ly/2STmWB7

Question 75:

Aspect/Feature	BGP Local Convergence	BGP PIC Edge
Simplicity	↑ ☑ ↓ ☐	↑ ☐ ↓ ☑
Backup paths location	RIB ☑ FIB ☐	RIB ☐ FIB ☑
Failure detection time	↑ ☐ ↓ ☑	↑ ☑ ↓ ☐
Backup restoration time	↑ ☑ ↓ ☐	↑ ☐ ↓ ☑

https://bit.ly/2STmWB7

Question 76:

a) **Different RDs per VRF per PE**
b) ECMP
c) PBR
d) Change the routing protocol to EIGRP as it supports equal/unequal load sharing

a) **This is the correct option to be done from the service provider side.**
b) This option can be done from the customer side.
c) Not a scalable solution and you cannot ensure load balancing/sharing, it can be for traffic distribution regardless of the utilization value but it is a management burden.
d) Not doable per the service providers policies.

https://bit.ly/2Uhl71h

Question 77:

a) BGP PIC Core
b) BGP PIC Edge
c) BGP NHT
d) BGP AS-Path Prepend

a) BGP PIC Core decreases convergence time when a core router fails and the IGP has to find a new best path to the PE.
b) BGP PIC Edge decreases convergence time when a PE router fails and BGP has to switch to a different PE router.
c) Next hop Tracking is an optimization feature that reduces the processing time involved in the BGP best path algorithm by monitoring changes to the routing table.
d) BGP AS-Path Prepend is not a convergence mechanism, it is a traffic manipulation mechanism.

Question 78:

a) Change the Inter-AS option C to option A
b) Change the Inter-AS option C to option B
c) Change the Inter-AS option C to option AB

a) ADSER network engineer is worried about security as by deploying MPLS Inter-AS Option C as there are a lot of information leaked between the participating ASes to achieve the necessary sessions establishment, however, this option is be considered event though the forecast is expected to be high because the main concern is security.
b) MPLS Inter-AS Option B compared to A from scalability perspective is better, as well, the size of leaked information is smaller compared to Option C ,but still the amount of leaked information is higher compared to Option A.
c) MPLS Inter-AS option AB AKA as Option D combines the characteristics of Options A and B which means we are still suffering from Option A scalability with leakage information from Option B.

https://bit.ly/2Fu5U9Z

Question 79:

a) BigSER BGP convergence time will increase
b) Just small downtime will be introduced due to some changes which will take place
c) Inter-AS option B will be better as it is more scalable
d) Service interruption

a) We already implemented BGP PIC as a fast convergence tool for enhancing our recovery process, but deploying BGP PIC with MPLS Inter-AS Option B will produce compatibility issues which means that the feature will be disabled and we will have our convergence time increased again.
b) Migration from the current Option C to Option B will introduce some downtime, but this is what the issue is all about.
c) From scalability perspective, Option C is more scalable among all the other available options.
d) The service will be interrupted as the MPLS Inter-AS Option B will not be compatible with BGP PIC Edge and the associated changes of RD values on the respective PEs.

Cisco Live Session: BRKIPM-2265 (Deploying BGP Fast Convergence / BGP PIC)

Question 80:

a) Per-VRF label allocation mode will not work and we have to change to Per-CE label allocation mode
b) We do not have to change anything, Per-VRF will continue to work with possibility of loops
c) We have to revert back to Per-Prefix label allocation mode and upgrade our devices to account for high resources utilization
d) Change the Internet option model to something else in order to avoid changing label allocation modes

a) Per-CE label allocation mode will not work with BGP PIC Edge.
b) Per-VRF will continue to work with the possibility of loops in active/standby deployments due to needed additional lookup to find the final destination.
c) It was mentioned limited budget and we cannot cause the resources to get high again by reverting back to per-prefix label allocation mode.

d) Not an option to consider since Internet Option 3 was chosen based on the customer requirements.

 **Cisco Live Session**: BRKIPM-2265(Deploying BGP Fast Convergence / BGP PIC)

Question 81:

a) Protection will increase as LFA is running and FRR might not be available
b) LFA will not interact with RSVP and will be disabled
c) IP LFA coverage might not be 100%
d) We cannot deploy Inter-AS MPLS TE in our case

 https://bit.ly/2CLkbv3

Question 82:

a) Full mesh MPLS TEs
b) Merge service provider's networks with unified IGP
c) Path Computation Element
d) LDP is point to multi-point and it will fulfil the necessary

a) Full mesh MPLS TEs will require full network topology information processing.
b) Not a scalable solution till the moment for our particular case and might cause downtime.
c) This is the new technology that can fulfil what needed.
d) It is true that LDP is a point to multi-point, but it is designed to work inside an AS. As well, new technologies that assist in label distribution relies on BGP to do so.

 https://bit.ly/2RjREBS

Question 83:

a) Yes
b) No

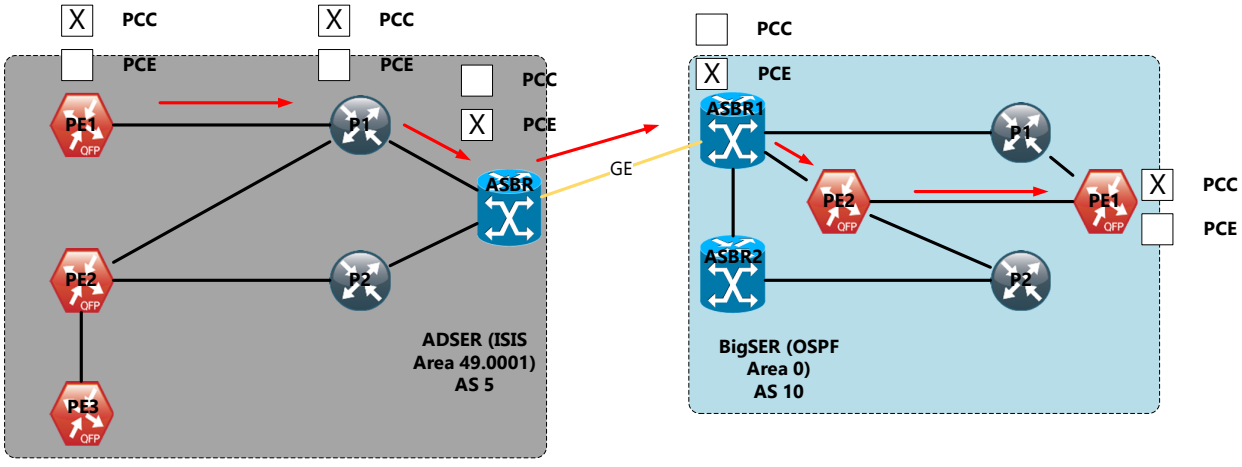
PE3 is not included in the diagram, so changing the metric-style on all devices except for PE3 will tore down the IGP relations which will cause service interruption.

Question 84:

a) **PE3 is not LFA enabled and implementing RSVP TE will need metric style manipulation**
b) No service interruption will take place as LDP is already running
c) Attached bit is lost from PE3 and default route to be redistributed from upper routers
d) A new tunnel to be configured from PE3 to the nearest PE

a) **PE3 is not included in the diagram, so changing the metric-style on all devices except for PE3 will tore down the IGP relations which will cause service interruption.**
b) Not correct as explained in the first answer.
c) We are running flat Level-2 implementation, so no default routes nor attached bit in play.
d) The question is asking about the reason and not a solution.

Question 85:



Question 86:

a) Uniform mode
b) Shot pipe mode

c) Pipe mode

a) Uniform mode is generally used when the customer and the service provider share the same Diffserv domain, as in the case of an enterprise deploying its own MPLS VPN core.

b) Short Pipe Mode is used when the customer and SP are in different DiffServ domains. (The SP's DiffServ domain begins at the ingress PE's ingress interface and terminates on the egress PE's ingress interface.) This mode is useful when the SP wants to enforce its own DiffServ policy and the customer requests that its DiffServ information be preserved through the MPLS VPN cloud. Short Pipe Mode provides DiffServ transparency through the SP network.
For enterprise customers who prefer transparency and maximum control over their traffic, choose Short Pipe Mode MPLS DiffServ tunneling.

c) Pipe Mode will preserve customer packet markings, but these will not influence PE egress queuing policies.

End-to-End QoS Network Design (P782)

Question 87:

(Link/Connection)/MPLS Operation	Push	Swap	PoP
IPv4 --> MPLS	Copies the IP Precedence into the EXP	NA	NA
MPLS --> MPLS	Copies the received EXP into the newly imposed EXP.	Copies the received EXP into the newly imposed EXP.	Copies the removed EXP into the newly revealed EXP.
MPLS --> IPv4	NA	NA	Doesn't modify DSCP; selects the PHB based on the EXP.

https://bit.ly/2SoKYnt

Question 88:

a) EoMPLS

b) VPLS

c) L2TPv3

d) Frame Relay

a) We have two servers that needs to communicate to each other, i.e. this is a point to point connection, labels are already exchanged between the two service providers and states overhead is low, so this is the best option to follow.

b) VPLS is a point to multipoint technology and can serve the needed but on the expense of extra states.
c) We already have MPLS LSP established, so it's better to carry the needed L2 frames inside MPLS packets rather than IPv4 packets.
d) Frame-relay is one of the obsolete VPN technologies, as well it was mentioned that media is Ethernet.

Question 89:

a) Yes
b) No

Labels are already exchanged between the two service providers and this can enable both L2 and L3 MPLS VPN services

Question 90:

a) DMVPN
b) GETVPN
c) IPSEC + GRE
d) mGRE

a) DMVPN is a multi-point solution, it is actually mGRE+IPSEC for encryption. This solution can work but with extra overhead which were pointed to in the mail.
b) GETVPN is the best solution to fit for MediaCORP as it runs over private network (which is currently the case), less overhead and centralized solution.
c) The combination is a point to point solution.
d) mGRE is a multi-point solution but does not provide encryption.

https://bit.ly/2DDzHeh

Question 91:

a) VPLS
b) AToM
c) EVPN

d) MPLS L3VPN

a) It is mentioned in the E-mail body that the customer is seeking a solution to its dual-homed HQ that can gives him the ability of load sharing. VPLS does not support load sharing and that is why this options excluded.
b) This option will be excluded as well as it was mentioned in the E-mail body that the solution should be scalable and AToM is a point to point solution and less scalable when compared to other available options that are point to multipoint.
c) This is the correct option to consider as EVPN is a point to multipoint technology, supports load sharing and not necessarily require software upgrade and not to forget scalability.
d) It is obvious that this option not to be considered as the customer do not want any intervention from the provider side in routing neighborship establishment.

Question 92:

a) It is Ethernet based L2 Multi-point technology and should be considered
b) It does not support load sharing as requested
c) We cannot wait for the router to be upgraded to support EVPN, so we have to serve him ASAP and deploy VPLS
d) VPLS introduces extra control-plane overhead compared to EVPN

a) This is correct, but our concern is not the physical media nor the connectivity mechanism and we already know that all media are Ethernet based.
b) This is the correct answer, because we care for the customer request regarding load sharing and VPLS do not support load sharing.
c) It is not necessary that the devices need upgrade, do not assume.
d) This is incorrect as EVPN introduces extra control-plane overhead compared to VPLS.

Question 93:

Aspect/Protocol	VPLS	EPVN
Signaling Protocols	BGP ☑ LDP ☑	BGP ☑ LDP ☐
CE Multihoming	1 Active ☑ All Active ☐	1 Active ☑ All Active ☑
MAC Learning	Data Plane ☑ Control Plane ☐	Data Plane ☐ Control Plane ☑
Control Plane Overhead	↑ ☐ ↓ ☑	↑ ☑ ↓ ☐
Service Labels	↑ ☑ ↓ ☐	↑ ☐ ↓ ☑
Scalability	↑ ☐ ↓ ☑	↑ ☑ ↓ ☐
Manageability	↑ ☑ ↓ ☐	↑ ☐ ↓ ☑

Note**:**

Outer Label (Transport Label) is the label that only P routers are use. In other words, this label is used in the swap process of P routers. Think about this label as the package of your delivery. This package changes on every P router.

Inner Label (Service Label / VC Label) is the label that carries the original customer VPLS information. At P routers, it remains unchanged. But in PE routers this labels stripped and according to VPLS information inside, VPLS process is done. Think this label as a Secret Key of the customer. It is only belong to him.

Question 94:

a) Yes
b) No

Question 95:

a) We do not need to enable Dual Stack IP addressing to serve the customers

b) Enabling Dual stack on the core devices will not increase resource utilization

a) We do not have to enable Dual-Stack inside a network to serve pour existing MPLS L3VPN customer.

b) Enabling dual stack inside the network will add a new process to handle this address-family which will add more control plane overhead.

Question 96:

a) MPLS 6PE

b) MPLS 6VPE

6PE is for transporting IPv6 natively while 6VPE is for IPv6 MPLS VPN which is the required in our particular case.

Question 97:

Aspect/Deployment	6PE	6VPE
IPv6 Information location	GRT ☑ VRF ☐	GRT ☐ VRF ☑
Information Exchange	Label ☑ Community ☐	Label ☐ Community ☑

Question 98:

a) Yes

b) No

We already running MPLS Inter-AS Option C and the information is leaked.

Question 99:

a) Nothing, both AF share the same DB

b) Nothing, Exclusive impact

c) Double path calculation in case of failure

a) Not correct, each protocol has independent database.

b) Correct, each protocol has independent database.

c) Not correct, the affected AF will perform path calculation.

 https://bit.ly/2Rjonrg

Question 100:

a) Yes
b) No

ISIS does not require a new process, it will handle the extra AF (IPv6) through TLVs.

Question 101:

a) Yes
b) No

OSPF do need a new process to be activated to handle IPv6 AF (OSPFv3).

Question 102:

Tunneling Method	Usage
Manual	Used to provide a point-to-point IPv6 link over an existing IPv4 network; only supports IPv6 traffic.
GRE	Used to provide a point-to-point IPv6 link over an existing IPV4 network; supports multiple protocols, including IPv6.
6to4	Used to provide a point-to-multipoint IPv6 link over an existing IPv4 network; sites must use IPv6 addresses from the 2002::/16 range
6RD	Used to provide a point-to-multipoint IPv6 link over an existing IPv4 network; sites can use IPv6 addresses from any range.
ISATAP	Used to provide point-to-multipoint IPv6 links over an existing IPv4 network. Designed to be used between devices inside the same site.

 https://bit.ly/2F8HmUg

Question 103:

a) Yes
b) No

MSDP (Multicast Source Discovery Protocol) is used to exchange multicast source information between multiple BGP-enabled Protocol Independent Multicast (PIM) sparse-mode domains.

https://bit.ly/2FUmuiy

Question 104:

a) ADSER should change their PIM DM to PIM SM and enable MSDP between the ASes
b) BigSER should change their PIM SM to PIM DM and enable MSDP between the ASes
c) Proxy-register feature should be enabled to accept PIM DM packets
d) Proxy-register feature should be enabled to accept PIM SP packets

Manipulating the PIM operational modes can be a solution but it will need extra implementation, thus using a feature such as proxy-register will do the necessary to ease the interaction between the two autonomous systems.

Selecting MPLS VPN Service, (P195)

Question 105:

a) 1
b) 2
c) 3
d) 4

In order to accept PIM Desne mode, we have to enable proxy-register on the bordering ASBR interface with Dense mode domain.

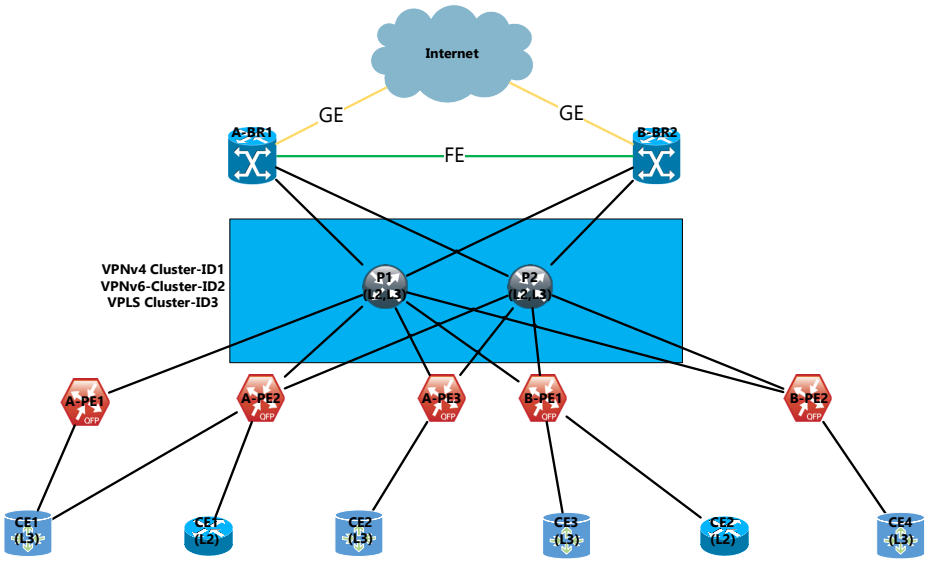
Question 106:

a) **We are running MPLS Inter-AS Option C so a lot of information is leaked and this will ease the migration process**
b) If MPLS Inter-AS Option B was in play the migration could be easier
c) The migration is not possible due to the services running between the providers
d) **The migration is possible with little downtime to take place**

a) **This is correct as deploying MPLS Inter-AS Option C will leak infrastructure information between the autonomous systems and that why it is considered the least secure option among all available Inter-AS MPLS VPN options and it is the preferred option in the cases of acquisitions.**
b) It will not be easier in terms of the leaked information. Leaking more information will require extra work to take place.
c) That is not correct because whatever work is needed, migration is possible.
d) **That is correct as some services might go down regardless of the period.**

Question 107:

a) Design 1
b) **Design 2**
c) Design 3
d) Design 4
e) Design 5
f) Design 6



It is already known that we are deploying MPLS L2VPN and L3VPN services, as well VPNv6 address-family is deployed.
Deploying two pair of route reflectors will increase the complexity and will require extra physical connections to be installed.
As well, we enhanced our warehouse inventory in case of devices failure which in return increased our CAPEX and this will account for any network expansion with reduced cost.
Using the same cluster-ID for different address-families will reduce the management burden, but from flexibility point of view, different cluster-IDs is better.
Making the redundant connections from the service provider side is better to serve the customers.