

# Todo Vale - Network Design – CCDE Scenario #2

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(APPLICATION SERVICE PROVIDER | VERSION 1.3)

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## Purpose of this document:

I tried to challenge myself to build a second CCDE Scenario to help fortify my knowledge of networking and practice a bit of Network Design. This scenario focuses on *Application Service Provider and Enterprise Connectivity Technologies*. I hope you enjoy reading about it and it makes you think a bit about Networking and Connectivity from both a Design and Business perspective.

It kind of goes without saying, but everything in this document (people, companies, designs, ISPs, etc.) is fictitious. Hence the footer below. So have fun while going through it.

<i>Updates/Change log:</i>		
<u>Date</u>	<u>Version</u>	<u>Updates/Changes</u>
2021.08.31	1.0	Rough Draft/Initial idea Scenario.
2021.09.04	1.1	Update Background Info. Added additional Questions, fixed some wording. Updated Exhibit 2.
2021.09.28	1.2	Fixed spelling errors. Format changed to one question per page.
2021.10.22	1.3	Minor updates. Fixed page numbering.

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## Background Info:

You are a Design Consultant who has been asked to assist with increasing the availability, optimizing the design, and scaling a growing Application Service Provider's (ASP) Network. Todo Vale Sociedad Limitada (TVSL), the company who has hired you for the job, is Head Quatered in Western Europe. TVSL began in Andalucía, Spain as a hobby/side-project between two Network Engineers looking to push the limits of technical knowledge by leveraging "Packet Switched Voice Communication", via their home internet. The idea was being able to accomplish that task without requiring any regular GSM cellular service enabled on their smart phones. This side project in its "testing phase", ended up turning out to be an alternative in a cellular-only world for an initial small group of people; including its founders, their families and some close friends/loved ones. However, once word got out, and after many bugs were fixed in the no-so-public beta, TVSL incorporated and started growing rapidly within continental Europe.

The application TVSL created, named "Ya-Ma Lo", was built to be both a very simple and lightweight application as it was exclusively leveraging the Public Internet for transport and connectivity. At the time of inception (Beta) and "soft launch" (Version 1.0), UDP was enough to do the job for the application. However, since the initial public rollout of the app, both the number of WiFi devices and users of the application have sky rocketed leading to more and more demand, and requiring more airtime fairness with regards to WiFi. On the flip side, WiFi transmission rates, ranges and reliability have all improved since the initial launch of the application several years ago. All of these changes have helped evolve the application to leverage both TCP and UDP. Presently, there is a TCP session built for the initial call setup (using port 7801) and then the multimedia payload is sent via a negotiated port at random (assigned by the call server) between the participants from the UDP range of ports between ports 60000 and 65535. Currently, Ya-Ma Lo is a peer-to-peer application, without support for more than two participants per session. However, the app does support multiple simultaneous sessions, or operations, while within the application. For example, while a user is on a call with the one user, that same user can be communicating with an additional user via the application's messaging service. This is accomplished within the program by an additional UDP port being signaled and negotiated between the end user sending the message and one of the central servers in the DataCenter "bridging the connection" between the two parties.

TVSL really started gaining traction one night while the founders were out and about after a technology conference in Granada, Spain. In a chance encounter, one of the founders was in an underground level (lower-level), of a multi floor bar. GSM signals were not able to penetrate the concrete ceiling above nor the surrounding building walls that far below ground. Since the bar provided free Wifi, one of the founders fired up their Ya-Ma Lo app on their smartphone and started a conversation with their significant other, who was at home. The few people that witnessed the VoIP call in this infamous "dead zone" were amazed. One of those people that evening happened to be a venture capitalist. After a brief face to face conversation following the Founder's initial call, and some follow up drinks, the TVSL founders flew to

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## Background Info (continued):

Madrid to perform a live demo. After pitching their company, application and future ideas for the 5 private initial angel investors, all 5 investors voted unanimously “Yes” to fund the project for expansion, and the rest is history.

Although the company was fully backed by these investors and is currently publicly traded, the company hasn't always been in the “positive”, with regards to their finances. The current board of directors and leadership teams are looking to continue the steady climb out of the plummet of the company's stock price 3 years ago after a vulnerability in the Ya-Ma Lo application that was exposed and unfortunately repeatedly exploited.

To make matters worse, this exploit had to do with user information being leaked via a “bug” the application. This bug gave TVSL a very bad stigma and many investors sold off their stock during this time. The userbase of the application also dropped about 35%. In response to this event, some internal TVSL organizational chart changes happened across multiple departments, as well as within the management staff. Even some C-level team changes happened as well, for various reasons. Aside from TVSLs internal changes, additional external pressures/changes started becoming present to the company. Such as regulations imposed by the European Union, consumer privacy laws, and of course enhancement requests from loyal users who stuck around with Ya-Ma Lo even after the exploit. All of these items contributed to the decision for the application to be completely rewritten internally, after take a long look at how the application was both performing and functioning.

Version 2.0 of the application launched roughly 6 months after the notorious “breach”, with a brand-new user-friendly HTML5 interface along with many bug and security fixes. Notably, the new version of the smartphone application connects consumers to the “Ya-Ma Lo” platform using an embedded SSL Session (within the app) to the closest COLO, based on the user's location. User authentication was also enhanced to allow Multi-Factor Authentication (MFA) for the user accessing the application. Also, within the security side of the house, all application data being transmitted between servers and their clients must be encrypted at a new AES standard (per government regulations). In some special cases, the encryption must be extended beyond the servers and be performed down on the actual storage devices housing the data.

Four months after the announcement of Version 2.0, TVSL surprised the world yet again, by opening up in the brand-new market of Asia. Launching in this new market was an attempt to increase revenue by having a more broad customer base, which would (hopefully) in turn help continue the stock prices upward trajectory. The expansion was facilitated by a strategic partnership with a relationship between TVSL's board of directors and a Seoul based company “In-Sa”. In-Sa, the South Korean based IXP/ASP brokerage company, is the only business partner providing exclusive access to the “Ya-Ma Lo” application in that region. This was

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## **Background Info (continued):**

marketed by In-Sa announcing themselves as “the fastest way for Asia’s subscribers to connect” to TVSLs application within the new region.

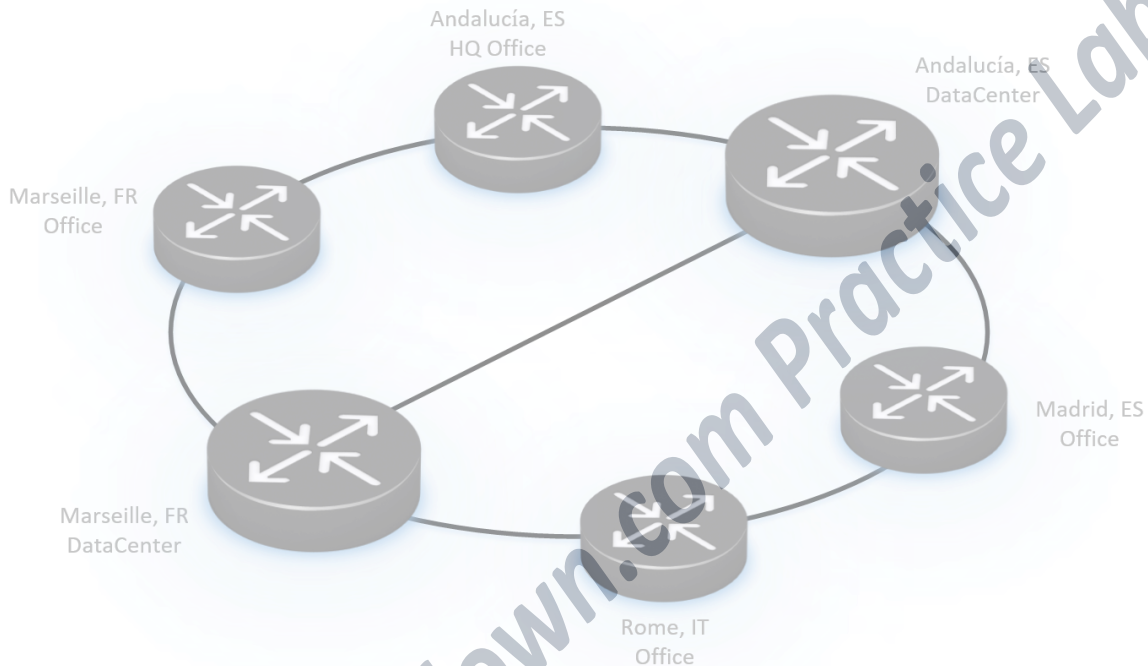
As part of the partnership agreement between TVSL and In-Sa (known to the public currently as “TVSL-Asia”), TVSL was able to procure some colocation rack space, at a severe discount, for their equipment in two of In-Sa’s already established Tier 2 DataCenters inside the APAC region. Tier 2 DataCenters provide only intra-country connectivity. Tier 1 DataCenters on the other hand provide both inter-country/inter-continental connections, as well as intra-country connectivity. An additional enhancement from this agreement, is that it also provides “local access” to TVSLs services to better serve new users of this market. Essentially, instead of backhauling all user traffic via the Internet at “best effort” to the existing DataCenters in Europe, there is a closer connection point for the users in the new market to connect to. This was aimed at increasing the user’s satisfaction, decreasing their wait times as well as reduce “lag”, all to provide a better experience for the user while within the application. TVSL has also opened up satellite offices in Seoul South Korea, Taipei Taiwan and in Manila in the Philippines. These brick-and-mortar offices are staffed with support a local sales staff and back-office staff as well.

TVSL leases their DWDM fiber connectivity within continental Europe. The DWDM agreement was signed for 30 a year term. TVSL is currently in year 11 of this contract. The 4 European offices are primarily connected via a single unprotected DWDM ring. The European DataCenters have connected legs within in the existing DWDM ring. In addition, there is an additional DCI between the European DataCenters via a separate DWDM connection. All corporate offices run a single link-state routing protocol for all Corporate and WAN connectivity to the DataCenters via the ring.

## Background Info (continued):

### Exhibit 1 – DWDM Diagram

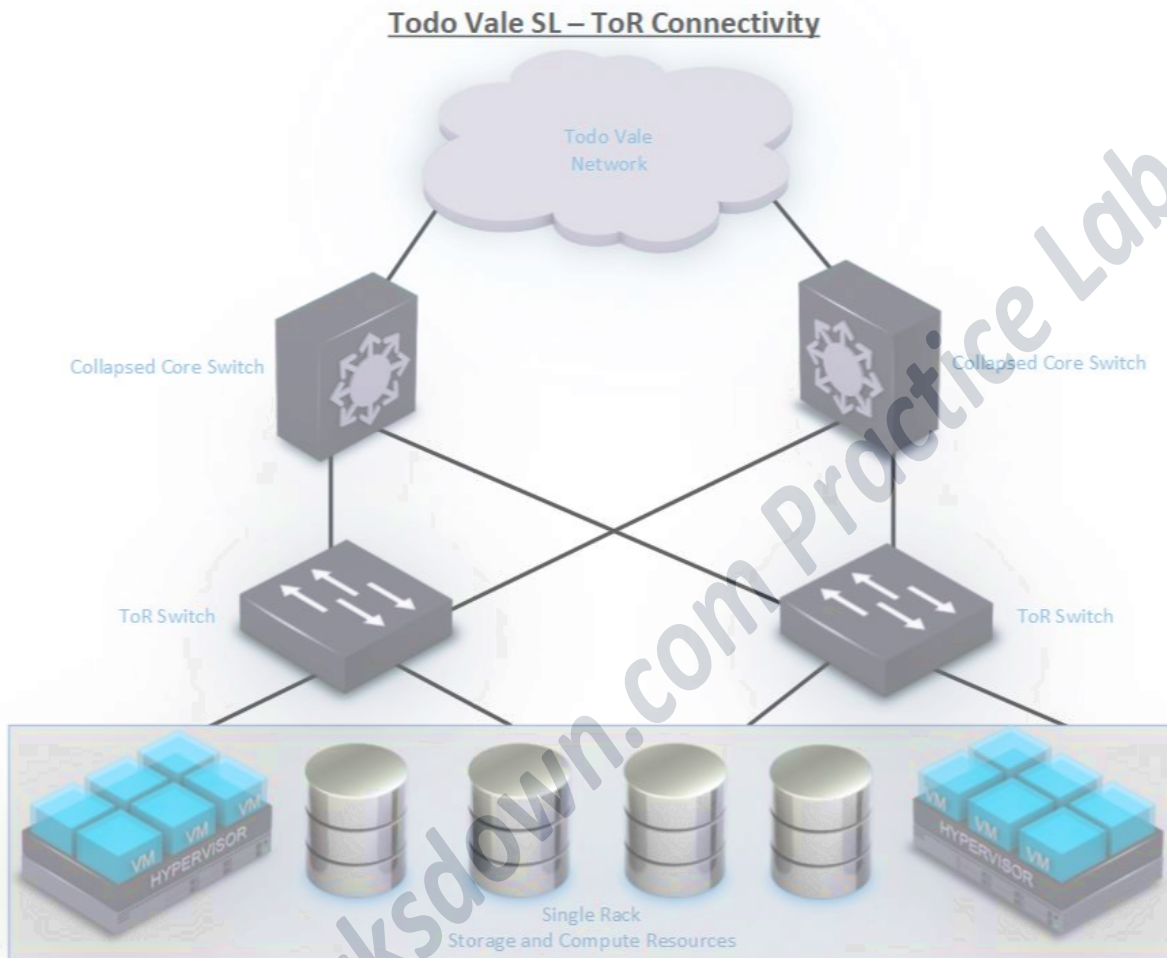
#### Todo Vale SL – DWDM Connectivity



TVSLs DataCenters run eBGP out to the Internet in a multi-homed dual ISP setup. BGP is also run toward External-Partner and other European IXP networks. The current internal routing table within the DataCenter has approximately 20,000 routes between the Corporate, The DataCenter, Partner, VPN and Transit Networks. TVSL's DataCenter setup is mostly ToR switching, leveraging 10GB connectivity. WAN connectivity is provided by multi-purposed routers. All but one external vendor within the European DataCenters use OSPF as the Dynamic routing protocol to exchange routes with TVSL. The OSPF "holdout" company is contracted to assist with physical security of the DataCenter (IP Cameras, Badge Readers, Temperature Sensors) is still running RIPv2. TVSL has repeatedly asked this vendor to change routing protocols, but so far, their requests have not been met as of yet. All TVSL's vendors have a presence in both DataCenters for redundancy.

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Exhibit 2 – TVSL ToR Diagram



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## The Network's Down – CCDE Scenario 002

Question 1. (Choose 2)

What information would you request from TVSL before your first meeting regarding the European DataCenters?

- A. ToR Diagrams
- B. Model and Capacity of Hypervisor Hosts
- C. Utilization and Performance Metrics of the Core Devices
- D. Physical connectivity diagram
- E. DWDM lease length
- F. Speed of the Internet Handoffs
- G. Community list supported by BGP Providers

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Question 2. (Choose 3)

What information would you request from TVSL-Asia before your first meeting with TVSL when it comes to the DataCenters owned by In-Sa?

- A. Cooling and environmental information.
- B. Major IXP/ISP handoffs within the Datacenter's
- C. Connectivity provided between different Tier DataCenters
- D. Average annual network availability for Tier 3 DataCenters
- E. QoS Support
- F. SRLG considerations between Tier 2 and Tier 1 DataCenters
- G. OSPF Process ID

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Question 3. (Choose 2)

Which two items will be critically important to monitor and manage between TVSL and TVSL-Asia with regards to application support?

- A. One way Jitter
- B. Round trip Jitter
- C. Round trip Delay
- D. One way Delay
- E. Bandwidth Utilization
- F. Ensuring End-to-End QoS
- G. Core router topology tables

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## The Network's Down – CCDE Scenario 002

Document 1 – Email 1

From: Maria Lucia de Cote <luciam.05@tvsl.ccde>  
To: NetworkDesigner@scenario2.tnd.ccde  
CC: Rubén Castillo <castillor.82@tvsl.ccde>

Subject: Bienvenido and Hello!

Hi Designer,

I'm Maria and I am the CTO and Co-head of Infrastructure Technology here at Todo Vale. On behalf of the staff, we are excited that you have joined our team as a consultant to help us with a few issues we have been experiencing with our network. The team and I look forward to meeting with you next week via our web conferencing platform.

Here is some information that you have requested, as well as some that you will probably need going forward. We run a single IS-IS routing domain as our IGP in Europe, throughout our Corporate Office, WAN and DataCenters. We recently started having issues when we redistribute within the DataCenters into our Routing Domain. A couple of our Senior Engineers took a look and verified that the prefix filters seem to be matching the traffic correctly. Any ideas? Our Core Routers resource utilization and critical links hover around 45-65%, and we do not currently implement QoS as we haven't had the need to yet. We leverage our COLO providers "blended" Tier 1 Internet that is handed off to us via dual 3Gbps circuits, policed per handoff. This service is delivered over a 10Gigabit Ethernet handoff. We do not own our own IP Block; it has been allocated from our Upstream COLO ISP. We have seen some spikes on certain routers, not in the core of the network, after there are network events as well.

Shifting gears to our TVSL-Asia business, this should be looked at as its own entity and segmented from our corporate network. Our current WAN router utilization has doubled since launching TVSL-Asia. Our WAN connection to TVSL-Asia is 10Gbps and is terminated only in our France DataCenter.

Please feel free to reach out with any questions you may have as we work through our process of improving our Network Architecture and Design. If I am not available, you can always contact the other Co-head of Infrastructure Rubén (CCed here as well). I am attaching the TVSL-Asia data you have requested.

Thank you,

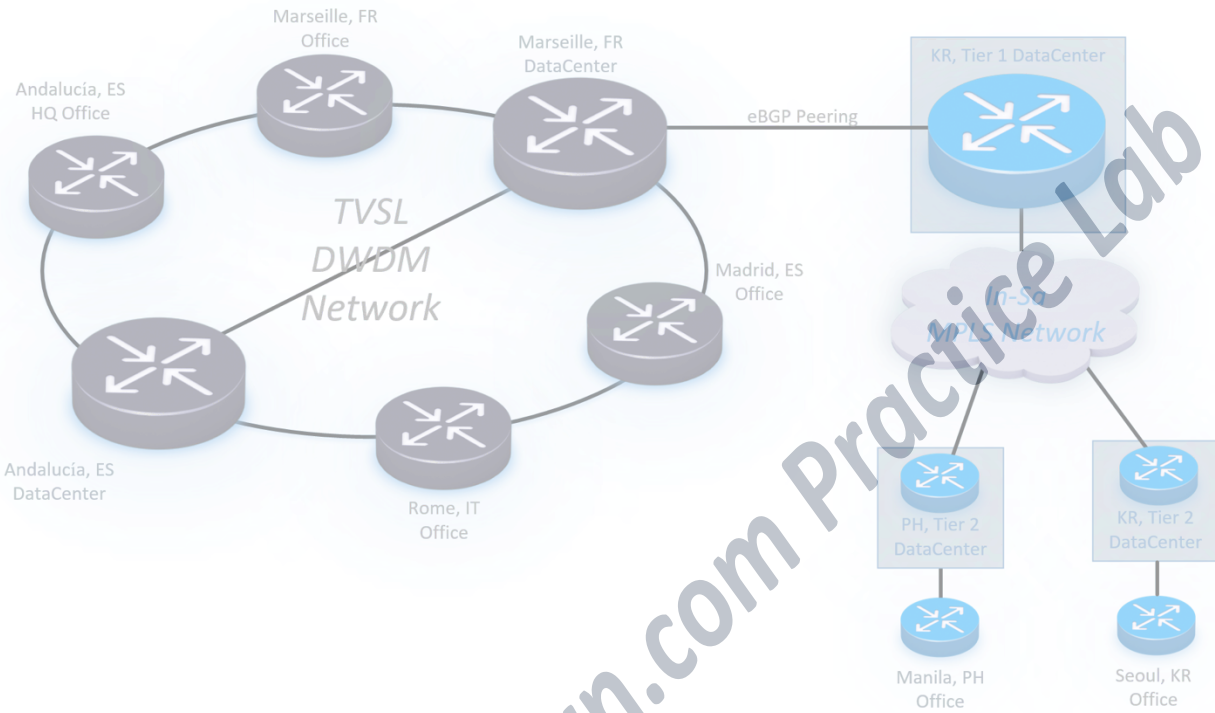
Maria Lucia de Cote  
CTO / Co-Head of Technology  
Todo Vale Sociedad Limitada

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# The Network's Down – CCDE Scenario 002

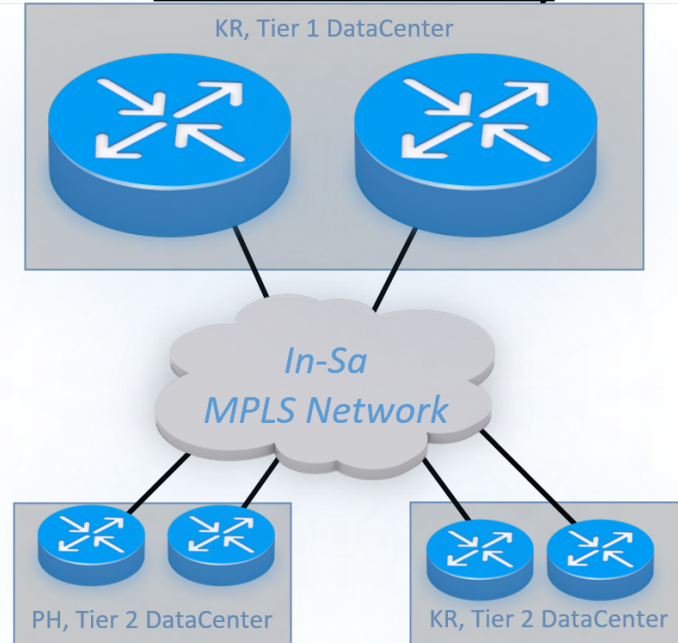
Document 2 – Attachment 1

## Todo Vale SL – In-SA (TVSL-Asia)



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Document 3 – Attachment 2  
**In-SA – DC Connectivity**



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## The Network's Down – CCDE Scenario 002

Question 4. (Choose 1)

What is the best option to explain the root cause for the redistribution issues that Maria has mentioned?

- A. There is a configuration issue with the prefix-lists
- B. IS-IS requires Wide Metrics in this scenario
- C. OSPFs metric cannot be converted into IS-IS via redistribution
- D. The OSPF Area's IP Addressing conflicts with TVSLs DataCenter IP Addressing Schema
- E. IS-IS needs to be enabled on the transit link between the Vendor and TVSL

## The Network's Down – CCDE Scenario 002

Question 5. (Choose 1)

What item(s) would you review as part of your investigation for the spikes on routers?

- A. Point to Point subnet suppression
- B. Ensure all routers are running in Level2 only domain
- C. Tuning of timers for faster convergence
- D. Ensure all routers are running in Level1 only domain

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## The Network's Down – CCDE Scenario 002

Question 6. (Choose 1)

What is the biggest concern with the internet handoff, at this point?

- A. In order to help avoid traffic drops, shaping should be put in place on the routers
- B. In order to help avoid traffic drops, policing should be put in place on the routers
- C. Auto negotiation is difficult at sub-line rate for most routers
- D. Multi-homing to the COLO will cause sub-optimal routing

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## The Network's Down – CCDE Scenario 002

Question 7. (Choose 1)

Where is the biggest risk so far between TVSL and TVSL-Asia?

- A. The offices are single homed
- B. In-Sa only has a single MPLS Network for Transport
- C. The configuration between Marseille and the Tier 1 DataCenter in Korea
- D. Multipathing Inter-DataCenter Communication between Andalucia and Marseille
- E. The Tier2 to Tier1 SRLG configuration
- F. The physical connectivity between Marseille and the Tier 1 DataCenter in Korea

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## The Network's Down – CCDE Scenario 002

Question 8. (Choose 2)

Which two areas overall are the riskiest connectivity points, so far?

- A. TVSLs DWDM unprotected ring
- B. A-B PDU assignments within the TVSL-Asia DataCenters
- C. TVSL-Asia's line to TVSL
- D. TVSLs HQ connectivity to the TVSL DataCenters
- E. TVSLs DataCenter Internet
- F. TVSL-Asia's MPLS Provider Redundancy
- G. TVSL-Asia's lack of cabinet redundancy within the Colocation DataCenter

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## The Network's Down – CCDE Scenario 002

Document 4 – Email 2

From: Maria Lucia de Cote <luciam.05@tvsl.ccde>  
To: NetworkDesigner@scenario2.tnd.ccde  
CC: Rubén Castillo <castillor.82@tvsl.ccde>

Subject: Re: Bienvenido and Hello!

Hello Designer,

Thank you for helping us pin-point and resolve the IS-IS redistribution Wide-Metric issue, we are all set now. Our Engineers have also have modified the few routers that were spiking, per your recommendation, to only run in IS-IS in L2 and it seems like the resource consumption has gone back to normal on them. Thanks again! Hopefully we can replace these routers soon with newer more powerful ones.

As for our connectivity between TVSL and TVSL-Asia, the business had originally accepted the “single line risk” at the time we had set this partnership up. However, due to the user increase and the criticality of this line, we are looking into getting a second line put in between Europe and Asia since we are seeing substantial growth and demand of subscribers from our new Market of Asia.

Thank you,

Maria Lucia de Cote  
CTO / Co-Head of Technology  
Todo Vale Sociedad Limitada

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## The Network's Down – CCDE Scenario 002

Question 9. (Choose 1)

What is the ideal plan to implement the 2<sup>nd</sup> line between TVSL and TVSL-Asia?

- A. Use the current routers in place, turning up a new interface for connectivity
- B. Install an aggregation switch to terminate both lines on and trunk up to the routers
- C. Request a bandwidth increase on the existing line between France and Korea
- D. Request funding to procure new routers, transceivers and cabling for both DataCenters
- E. Setup QoS on the existing line between France and Korea

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## The Network's Down – CCDE Scenario 002

Question 10. (Choose 1)

What is the most diverse way to plan for the 2<sup>nd</sup> line between France and Korea?

- A. Use the current routers in place, turning up a new interface for connectivity
- B. Request funding to procure new routers, transceivers and cabling for both The Andalucia and Korean Tier 2 DataCenters
- C. Request funding to procure new routers, transceivers and cabling for both The Marseille and Korean Tier 1 DataCenters
- D. Request funding to procure new routers, transceivers and cabling for both The Marseille and Korean Tier 2 DataCenters
- E. Request funding to procure new routers, transceivers and cabling for both The Andalucia and Korean Tier 1 DataCenters

## The Network's Down – CCDE Scenario 002

Question 11. (Choose 1)

What is the quickest way to plan for the 2<sup>nd</sup> line between France and Korea?

- A. Use the current routers in place, turning up a new interface for connectivity
- B. Install an aggregation switch to terminate both lines on and trunk up to the routers
- C. Request funding to procure new routers, transceivers and cabling for both The Andalucia and Korean Tier 2 DataCenters
- D. Request funding to procure new routers, transceivers and cabling for both The Marseille and Korean Tier 2 DataCenters
- E. Request funding to procure new routers, transceivers and cabling for both The Marseille and Korean Tier 1 DataCenters
- F. Request funding to procure new routers, transceivers and cabling for both The Andalucia and Korean Tier 1 DataCenters

## The Network's Down – CCDE Scenario 002

Question 12. (Choose 1)

Which is an item to keep in mind with regards to the Application's V2 launch?

- A. The Geo-Load Balancing setup for DNS may not work correctly since data is encrypted in flight
- B. The new version of software requires encryption for communication, so we need to take into account the MTU with any additional headers
- C. Version 2 of the application has a new GUI, which will require more bandwidth due to user preferences and the HD screens presented
- D. The DWDM DCI between the European DataCenters will require modification for the usage of Version 2 of the app.

## The Network's Down – CCDE Scenario 002

### Document 5 – Email 3

From: Rubén Castillo <castillor.82@tvsl.ccde>  
To: NetworkDesigner@scenario2.tnd.ccde  
CC: Maria Lucia de Cote <luciam.05@tvsl.ccde>, Alba de la Concha <jefa.alba@lcc.ccde>

Subject: TVSL Expansion and Merger with LCC!

Hola Designer,

I hope you are well. We need your help again! Due to our subscriber increase and a few good quarters of revenue from our TVSL-Asia venture, and a blessing from our board; TVSL has purchased an Argentinian based company La Culpa Comunicaciones (LCC). LCC has a much more robust application than “Ya-Ma Lo” so in the longer term, we will be folding both applications into one. LCC had been on our radar for a while due their application enhancements and their application being more mature as well as further integrated into the user’s experience. LCC also offers video streaming & chatting as part of their messaging application.

Since TVSL had no presence in South America, this is a great time for us to expand (yet again) to get new clients! We are looking to setup shop ASAP! We have a similar business agreement with LCC, for now, that we have with “In-SA” in Korea. Short term, we want to just integrate the networks so we can piggy back their physical infrastructure and offer “Ya-Ma Lo” off of the existing two DataCenter’s that LCC has an existing presence in. This will give us local points of presence on yet another continent and hopefully increase subscriber base and provide an additional revenue stream in the South American region over the next few months.

Prior to our acquisition, LCC had signed an exclusive 10-year deal with Alma (a local ISP in Argentina) to utilize Alma’s Colocation DataCenters and internet connectivity to conduct their business. This signing was 3 years ago. As part of that agreement, LCC has a burstable 5 Gigabit internet line delivered over dual 10 Gigabit circuits in an active/passive setup.

Thank you,

Rubén Castillo  
CIO / Co-Head of Technology  
Todo Vale Sociedad Limitada

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## The Network's Down – CCDE Scenario 002

Question 13. (Choose 2)

Which two items would you request to help start the process of establishing a point of presence in South America, from LCC?

- A. Number of subscribers to plan for future capacity within the European DataCenters
- B. Alma's WAN Connectivity options to Europe
- C. Alma's Internet Connectivity options to Europe
- D. Amount of Rack Space available to TVSL to establish a physical point of presence
- E. What routing protocol is LCC using to route client traffic

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## The Network's Down – CCDE Scenario 002

Question 14. (Choose 1)

Which factor should be considered when establishing the point of presence for TVSL in Alma's COLO?

- A. The amount of available bandwidth on the internet for clients to connect with
- B. Designation of which team will be responsible for the TVSL point of presence, since the companies are not fully merged yet
- C. Which Codec LCC is using for VoIP
- D. How to enroll TVSLs application onto the LCCs Certificate Authority to offer encrypted communication

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## The Network's Down – CCDE Scenario 002

Question 15. (Choose 2)

Which two items would you request to become more familiar with LCC's Network?

- A. LCCs Network HLD Topology
- B. LCCs IP Addressing Scheme
- C. Alma's QoS offerings between their points of presence
- D. Alma's Internet Upgrade options for LCC and TVSL

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**The Network's Down – CCDE Scenario 002**

Question 16. (Choose 2)

For the longer-term project of full integration between companies, which information would be useful for planning your design?

- A. LCCs Routing Protocol
- B. LCCs staff experience
- C. LCCs financial situation
- D. LCCs subscriber count

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## The Network's Down – CCDE Scenario 002

### Document 6 – Email 4

From: Alba de la Concha <jefa.alba@lcc.ccde>  
To: NetworkDesigner@scenario2.tnd.ccde  
CC: Maria Lucia de Cote <luciam.05@tvsl.ccde>, Rubén Castillo <castillor.82@tvsl.ccde>  
Subject: LCC additional information

Hello Designer,

My name is Alba, and I am the Network Infrastructure Manager of La Culpa Comm. Maria and Rubén have told me you have helped them out with their design and architecture in the past, so my team at LCC and I are looking to getting some assistance from you.

I spoke with our local ISP in Argentina and we have two options for connecting to the European DataCenters. There is an MPLS L3VPN option via one of our Tier 1 ISPs using Inter-AS and a PseudoWire offering through another Tier 1 ISP. The Pseudowire will take between 30-60 days to bring up, and the MPLS L3VPN will be between 60-90 days. Which do you suggest we request more information for and go forward with?

We should be able to secure a half of a rack in our Buenos Aires DataCenter and an additional half of a rack in our other Puerto Madryn DataCenter in Argentina. Alma provides us a single gigabit handoff between the datacenters and preserves all of our QoS markings as part of our agreement. We have requested an increase on that line since we are already approaching 80% utilization of that 1GB line prior to the acquisition. Once we review the cost, we will let you know which speed we will have between the Argentina DataCenters going forward.

We are running Multi Area OSPF within our entire network (both Corporate and DataCenters). We have about 300 employees who work from home that VPN in utilizing SSL or site to site tunnels (at VIPs residences). We have an additional 200 employees at our HQ office in Buenos Aires and we had recently purchased a UI startup company (E ai) of 20 employees in Sao Paulo, Brazil. Their workload is primarily based “in the cloud,” so they are just considered our Brazil office.

Thank you,

Alba de la Concha  
Network Infrastructure Manager  
La Culpa Comunicaciones (A TVSL Company)

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## The Network's Down – CCDE Scenario 002

Question 17. (Choose 1)

Considering the customer requirements, which option should you suggest for connecting LCC to TVSL in Europe?

- A. Pseudowire
- B. Static GRE Tunnels with IPSec
- C. MPLS L3VPN

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## The Network's Down – CCDE Scenario 002

Question 18. (Choose 1)

Why is Pseudowire the optimal choice in this scenario?

- A. Layer 2 Connectivity will provide more DCI options than Layer 3
- B. Pseudowire allows for Dynamic Routing with Multiple tenants
- C. The deployment timeline fits the needs of the Business better than L3VPN

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## The Network's Down – CCDE Scenario 002

Question 19. (Choose 1)

How can we establish TVSL Point-to-Point connectivity over the Pseudowire?

- A. Setup a GRE tunnel and establish an IS-IS adjacency
- B. Run BGP over the Pseudowire
- C. Enable MPLS and use CEF

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## The Network's Down – CCDE Scenario 002

Document 7 – Email 5

From: Alba de la Concha <jefa.alba@lcc.ccde>  
To: NetworkDesigner@scenario2.tnd.ccde  
CC: Maria Lucia de Cote <luciam.05@tvsl.ccde>, Rubén Castillo <castillor.82@tvsl.ccde>  
Subject: Re:LCC additional information

Hola Designer,

We have decided to go with the MPLS L3VPN option. Even though it will take longer to deploy, our staff is much more comfortable with this model of connectivity.

So, Alma got back to me and since we signed the original contract and have been good customers, we were able to upgrade our inter-datacenter connectivity to dual Active/Active 4GB circuits so hopefully this will allow us to co-exist inside the racks without competing for bandwidth.

Speaking of which, we run a CBWFQ setup internally since we offer so many services to our clients at LCC via our App. We also have 2 LLQs, one for Voice and one for Realtime Video (exclusively used for our chat app function). Since TVSL is going to be seen as a tenant within our environment, please mark your voice traffic with EF so Alma picks up and preserves those markings for you across the DCI they provide.

Unfortunately, we do not have the correct licensing to run MPLS on our WAN routers that connect our DataCenters together. So, you will have to figure out how to setup a multi-tenant environment to include TVSLs traffic along with our own traffic; while maintaining full separation and individual QoS markings, since our contracts are still being review by legal.

I'm attaching a WAN diagram that we will be our future state, after we get the MPLS Connectivity up between Argentina and Europe. Also, I have added in our second Alma provided line for completeness to the diagram.

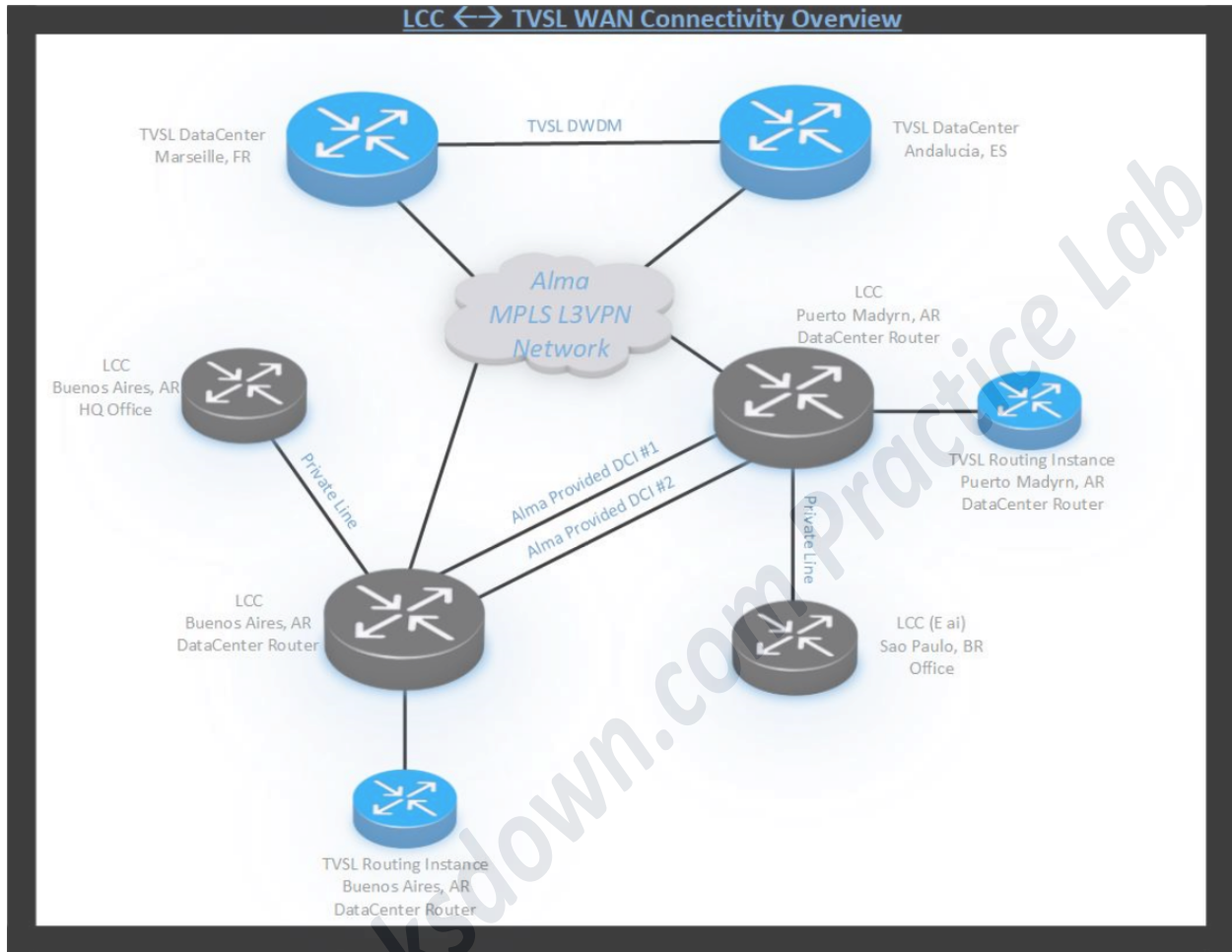
Thank you,

Alba de la Concha  
Network Infrastructure Manager  
La Culpa Comunicaciones (A TVSL Company)

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## The Network's Down – CCDE Scenario 002

### Document 8 – Attachment 3



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## The Network's Down – CCDE Scenario 002

Question 20. *(Choose all that apply)*

Given the requirements, which options can be used to connect LCC and TVSL while maintaining full separation across the DCIs?

- A. Q-in-Q Tunneling
- B. MPLS L3VPN
- C. MPLS L3VPN with Distinct RDs
- D. Using one DCI per company
- E. Unique VLANs
- F. Routed Sub-interfaces
- G. Routed Sub-interfaces and firewalls
- H. Routed Sub-interfaces and VRFs

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## The Network's Down – CCDE Scenario 002

Question 21. (Choose 3)

The network team at LCC has chosen to have TVSL leverage VRFs with routed sub-interfaces. Which three items will be required to configure this?

- A. Unique Routed Sub-interface tags per company
- B. VRFs for both companies with the Address-Family IPv6 Command activated
- C. VRFs for both companies with the Address-Family IPv4 Command activated
- D. A VRF for LCC with the Address-Family IPv4 Command activated
- E. A VRF for TVSL with the Address-Family IPv4 Command activated
- F. A separate Spanning-Tree instance for the Sub-Interface configuration
- G. A separate VRF Aware Routing Instance for TVSL

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## The Network's Down – CCDE Scenario 002

Question 22. *(Ordered list)*

Given the steps below, place in order the steps to turn up the new 4GB Circuits and add TVSL to the lines.

- A. Define dot1q tag for LCCs routing instance
- B. Build out the layer 3 sub-interface on LCCs router
- C. Test end to end connectivity between South American DataCenters via VRF Aware Ping
- D. Activate the IPv4 Address family
- E. Configure IS-IS to be VRF Aware and setup routing
- F. Convert the existing Router Interface into a sub-interface to support Trunking
- G. Add the layer 3 sub-interface to TVSLs VRF
- H. Build out a layer 2 transit network between the Argentinian Infrastructures for TVSL
- I. Define the TVSL VRF

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## The Network's Down – CCDE Scenario 002

Document 9 – Email 6

From: Maria Lucia de Cote <luciam.05@tvsl.ccde>  
To: NetworkDesigner@scenario2.tnd.ccde  
CC: Alba de la Concha <jefa.alba@lcc.ccde>, Rubén Castillo <castillor.82@tvsl.ccde>

Subject: Ya-Ma Lo Issues

Hola Designer,

Since going live in our Argentinan DataCenters, we have had issues in Eastern Europe and Asia start complaining about having poor experiences when making phone calls. I tasked our Top Network Engineers to look into the issue. They have performed and analyzed packet captures at all of our DataCenter locations as well as performed some basic connectivity testing. Certain sessions time out, and other ones connect but there was a delay in the payload being delivered. Can you help us out again?

We are looking to integrate the Video Chat Feature into our new merged app (*a hybrid of Ya-Ma Lo and LCCs application*) to offer a single unified experience for our users in Europe, Asia and South America across one app. Before we do this, we wanted to make sure our network was ready.

One last thing, we now need to put in Firewalls between our continental boundaries, so please keep that in consideration when designing our solutions going forward. Thank you again for your help with everything you have done so far. We look forward to you assisting us with this, as well as in the future.

I am attaching our DataCenter WAN Connectivity to this email as well for you to have as a reference.

Thank you,

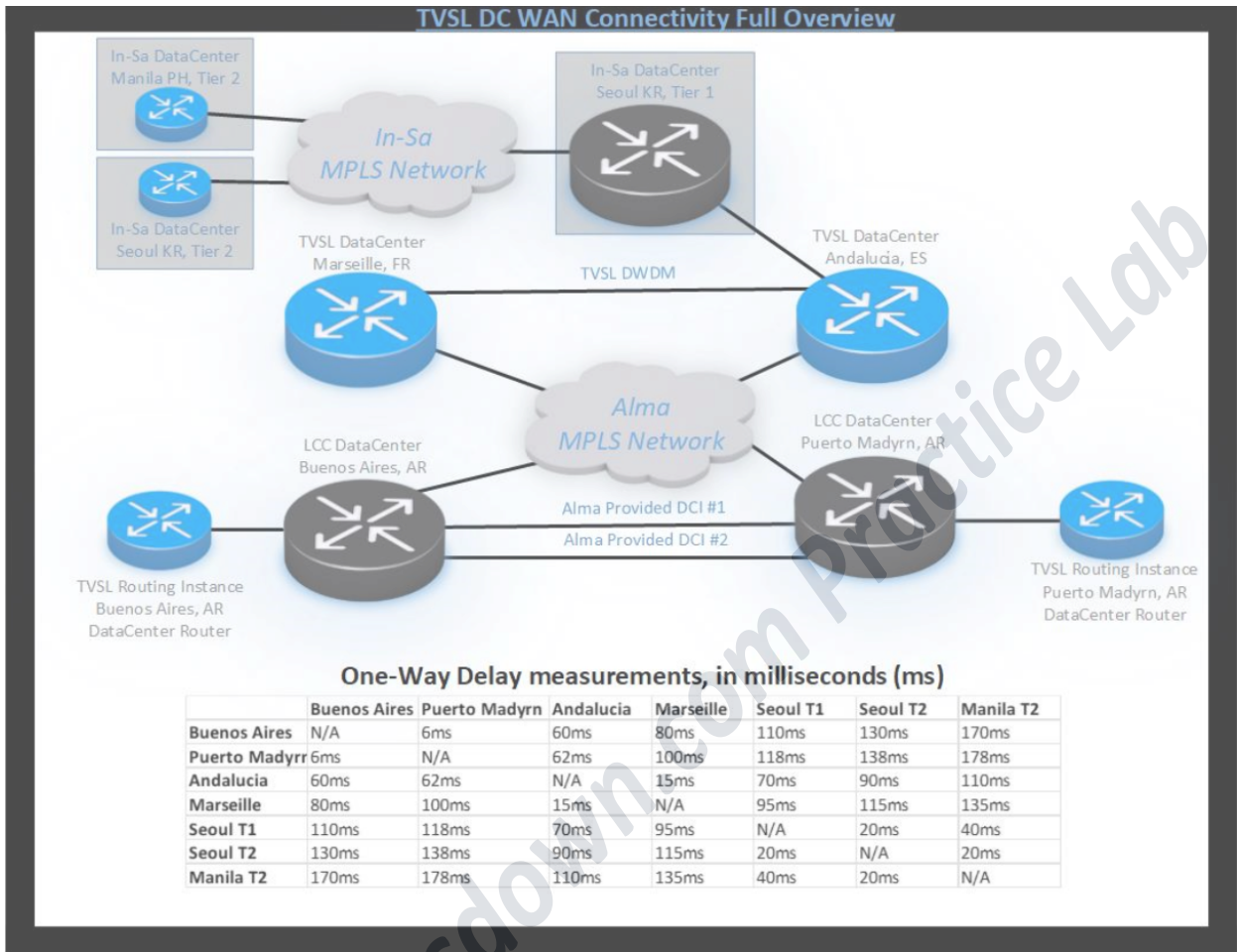
Maria Lucia de Cote  
CTO / Co-Head of Technology  
Todo Vale Sociedad Limitada (Una compañía Global de Comunicaciones)

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**The Network's Down – CCDE Scenario 002**

Document 10 – Attachment 4

TVSL DC WAN Connectivity Full Overview



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## The Network's Down – CCDE Scenario 002

Question 23. (Choose 1)

With regards to the engineer's findings, what is the best explanation for the "delay in the payload" Maria has described?

- A. International Voice requires a specific codec for compression
- B. The Jitter is too high
- C. The Bandwidth is not enough
- D. The QoS the company is running is not compatible with the ISPs transit routers
- E. The Round-Trip delay exceeds the recommended time

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## The Network's Down – CCDE Scenario 002

Question 24. (Choose 2)

Where would the delay be most notable within the TVSL WAN network?

- A. Between Buenos Aires and Seoul's Tier 1 DataCenter
- B. Between Buenos Aires and Manila
- C. Between Seoul's Tier 2 DataCenter and Puerto Madyrn
- D. Between Manila and Seoul's Tier 2 DataCenter
- E. Between Marseille and Andalucia
- F. Between Manila and Puerto Madyrn
- G. Between Andalucia and Manila

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**The Network's Down – CCDE Scenario 002**

Question 25. (Choose 1)

Is there any concern for the delay between the TVSL-Asia network?

- A. Yes
- B. No

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**The Network's Down – CCDE Scenario 002**

Question 26. (Choose 1)

Where is the delay?

- A. Between Marseille and Seoul's T1 DataCenter
- B. Between Manila and Seoul's T2 DataCenter
- C. Between Seoul's DataCenters

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## The Network's Down – CCDE Scenario 002

Question 27. (Choose 1)

Who should TVSL contact in order to address the Delay issues found in Seoul?

- A. LCC's ISP
- B. TVSLs Networking Staff
- C. In-Sa's DWDM Provider
- D. In-Sa's COLO Provider
- E. Alma's Networking Staff

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## The Network's Down – CCDE Scenario 002

Question 28. (Choose 2)

What should be taken into account with regards to the new Unified app with Video Chatting?

- A. Video chatting should be given Precedence over Voice Traffic
- B. The delay reported in the document should be used to compare against the ISPs requirements
- C. The delay reported in the document should be used to compare against the new Applications requirements
- D. The number of datacenter hops for the overall TVSL network, the less latency is introduced
- E. The demand of users will either increase or decrease the delay sensitivity in the DataCenters.
- F. Realtime Video traffic can be bursty, so special considerations for QoS should be communicated

**The Network's Down – CCDE Scenario 002**

Question 29. (Choose 1)

Do the firewalls introduce any other potential issues within the TVSL application design and deployment?

- A. Yes
- B. No

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Question 30. (Choose 3)

What potential issues can be caused with these firewalls within the TVSL network?

- A. Connectivity Loss
- B. NAT-T for Realtime Applications
- C. Deploying them in Transparent mode will require extra routing configuration
- D. Deploying them in Routed mode will not affect traffic flow
- E. Special care should be taken if the firewalls support fixup protocols
- F. QoS traversing a firewall must be defined via IPP Values
- G. QoS traversing a firewall must be define via DSCP Values
- H. If we are not using IPSec than NAT-T is not relevant for our situation.

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## The Network's Down – CCDE Scenario 002

Question 31. (Choose 3)

Users in the Brazil office are having problems getting to the new UAT/DEV environment that is hosted in the TVSL European DataCenter in Spain. What information would you require in order to troubleshoot this?

- A. Cloud information
- B. Office IP Addressing
- C. UAT Firewall Permissions
- D. DEV server VM Host information
- E. DEV Server IP Addressing
- F. UAT LDAP information
- G. Web Server configuration

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