Bud Incorporated Network Design – CCDE Scenario

(Enterprise | Version 1.5)

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Purpose of this document:

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

Updates/Change log:		
Date	Version	Updates/Changes
2021.03.20	1.0	Initial Draft/Release of scenario.
2021.04.02	1.1	Fixed some language
2021.04.12	1.2	Updated title page. Fixed some language of questions
2021.05.01	1.3	Fixed document numbering, email addressing, some language in emails and wording of some questions.
2021.05.05	1.4	Fixed question numbering. Question 6 updates.
2021.05.15	1.5	Corrected question wording Q32.

Disclaimer: All of the Public/Private IP space, Public/Private ASNs, Designs, Naming Schemes, Site Locations, Scenarios, etc. that are in use in this topology were selected at random. If any of the information in this lab overlaps with or resembles that of a production network, it is purely coincidental and is not intentional. https://thenetworksdown.com

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Background Info:

You are a Design Consultant who has won an RFP to assist a small-time shop turned "big dog" manufacturing company, Bud Incorporated (Bud), with a network design and optimization project. Bud is an Enterprise that started producing custom cell phone cases and covers for various types of mobile phones back in 2007. Bud was originally started as a small "Mom and Pop" shop, with 3 employees. Bud now has grown to a multi-national 500-person operation encompassing a traveling sales staff, marketing department, web designers, back-office as well as warehouse workers and the IT support staff just to name a few departments.

Bud chose to retain their original small office of inception, located in Mississippi where the company's founder still resides. The largest office of Bud's, which is also a regional hub and headquarters, is in located in New York. In addition, Bud has an additional 9 locations (including 2 datacenters) and 1 warehouse between North America and Europe within Bud's Enterprise. Bud's WAN in North America is currently a mix of point-to-point connectivity, Direct IPSec Tunnels over the Internet and a very small (3 site) MPLS L3VPN deployment.

Bud's current internal corporate routing protocol is a single area of OSPF that spans all brick-and-mortar sites that are connected via their WAN. Their tech staff has working knowledge of both OSPF and EIGRP. The tech staff has an intermediate understanding of BGP, exclusively with regards to internet access.

Bud's European presence was a product of an acquisition of a startup company, Jukitis Saga WB, SL (Jukitis), which was founded and bases its operations in Valencia, Spain. Jukitis' office is mostly made up of a sales staff, and a small headcount of onsite IT support staff to assist with the "follow the sun model" of support the company subscribes to. The two companies were never fully merged together or standardized, so providing uniform support between the companies has proven to be a challenge. The North American network, although connected diversely, is fully reachable via New York.

The staff in Europe was recently migrated, to help unify the company's appearance internationally, to a utilize a single email domain worldwide. There were a lot of hiccups with this migration, so any future projects involving the European Branch sites need to have special attention in being planned out.

There are two other satellite offices of operations and financial staff, within Europe, located in Portugal and London. Due to the dispersity of the offices in Europe, the WAN connections are currently provided via IPSec VPN Tunnels over the Public Internet. Bud's European HQ (Jukitis' Spain Office) currently connected back to the North American HQ site via a Site-to-Site tunnel. Juiktis runs static routing, where needed, since their sites are very small. Inter-Office communication of the legacy Jukitis company is achieved with CryptoMap based IPSec tunnels to make up their WAN.

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Background Info (continued):

The New York Office also encompasses the New York DataCenter. The DataCenter has its own routing domain, which is the only place on Bud's network where EIGRP is present. EIGRP was implemented as a test, and was never removed as the DataCenter grew due to the traffic heading to the website and downtime is strongly scrutinized.

Bud runs BGP at the Internet Edge within both DataCenters using their own ASN assigned from ARIN, but their IP addressing has been provided by their ISPs. Since Bud's bread and butter comes from their e-commerce website, diverse providers are used within the same DataCenter and the appropriate LOAs are in place for their BGP Policy.

Bud's most critical system is their webpage. This website is currently hosted inhouse within the New York DataCenter and although there is no hard "five 9 requirements", the business has made it clear that IT should strive for minimal downtime as this is the main source of revenue and interaction between partners for the company. Alongside the website, other internal systems such as: File, HR, Payroll, and Infrastructure Monitoring Systems, as well as Application and Database servers are hosted within the New York DataCenter. Bud has the majority of their systems and applications inhouse (on-premise) but are not closed off to the thought of going to "The Cloud" for specific services or use cases.

The company is publicly traded, so investor reports, company performance and stock pricing drive the spend available for Bud Enterprise as a whole. Bud Enterprise, of North America, has much newer hardware than their Jukitis counterpart offices. As part of this RFPs pre-requisite, Bud has budgeted enough money to replace the critical parts of Jukitis infrastructure which is several years behind current technology's, especially for IPSec encryption and web traffic inspection functionality.

Bud has deployed out of band management via a separate ISP to manage their terminal servers which are available at critical sites.

Document 1 – Email 1

From: Alan Rickler <alan.rickler.21@bud.ccde>
To: CCDE Candidate <NetworkDesigner@scenario1.tnd.ccde>

Subject: Congrats and Welcome!

Hello Designer,

　　　Congratulations on winning our RFP to assist with our Network Design project. Welcome to our Enterprise, even though you are here on a consulting basis, please feel free to contact me with any questions regarding the job. The team and I look forward to working together, collaboratively, to improve our network.

　　　My name is Alan and I am the Manager of Infrastructure here at Bud Enterprises. We have 4 full time network engineers on staff, all with varying experience levels. We also have a "hybrid" engineer who resides in Europe to cover all Infrastructure projects and tickets during the early mornings for us. The European Engineer is about "mid-level" with regards to networking.

　　　Our current pain points are network reconvergence with dropped packets and reset sessions, due to rippling effects coming from link flaps in our WAN as well as long BGP Failover times in the DataCenter. We also have more of a split overarching network architecture within our company as we never fully integrated our European branches with our existing North American branches. The three European sites were treated more as additional entity, as opposed to an extension of our company. We would like to work on improving this integration as we have been awarded some capital to replace their legacy equipment. We will be looking for some help from you on this front as well.

　　　Another one of our open projects is evaluating cloud hosted providers for a handful of our applications. This project started about 6 months ago, however the Engineers and QA user group that I have assigned to this particular project have reported performance issues via connecting to these Cloud apps. We currently connect via VPN. Additionally, the performance of the applications "up there" has been subpar and we are looking to improve this as well.

　　　Again, please feel free to contact me with any questions.

Thank you,

Alan R.
Manager of Infrastructure
Bud Enterprises
alan.rickler.21@bud.ccde

Question 1. *(Choose 1)*
- From the Email above, what primary issue are you trying to solve?
  A. Unify the Engineer's varying experience levels.
  B. Network Reconvergence due to Link Flaps
  C. Migrating everything to the cloud and improving the VPN performance
  D. QoS for the European Connections
  E. BGP Failover Convergence
    o As mentioned in the background info the website is the bread and butter of this company; therefore this should be the first issue we look to resolve in this case.
  F. There is no issue, this RFP was a piece of cake. Let's go home.

Question 2. *(Choose 1)*
- Which issue would be seen as secondary?
  A. Nothing, we're now all good here.
  B. Unify the Engineer's varying experience levels.
  C. Network Reconvergence due to Link Flaps
    o Per the email from Alan, link flaps seem to be an issue as it is directly mentioned as a pain point.
  D. Migrating everything to the cloud and improving the VPN performance
  E. QoS for the European Connections
  F. BGP Failover Convergence

Question 3. *(Choose 1)*
- What additional information will you request to assist in solving Bud's primary issue?
  A. European WAN Diagram
  B. Current High Level BGP ISP Diagram
    o Requesting this will help frame out how BGP is setup in Bud's datacenter.
  C. Running configuration of the OSPF routing from the core
  D. Bandwidth report from the DataCenter ISPs
  E. ISP Carrier list for MPLS Sites
  F. Cable plant diagram
  G. IP Address Schema

Question 4. *(Choose 1)*
- What additional information will you request to assist in solving the second issue?
  A. European WAN Diagram
  B. Current High Level BGP ISP Diagram
  C. Running configuration of the OSPF routing from the core
    o Requesting this info will help see OSPFs overall setup and potentially identify any interface changes needed.
  D. Bandwidth report from the DataCenter ISPs
  E. ISP Carrier list for MPLS Sites

F.   Cable plant diagram
G.   IP Address Schema

Document 2 – Email 2

From: Alan Rickler <alan.rickler.21@bud.ccde>
To: CCDE Candidate <NetworkDesigner@scenario1.tnd.ccde>

Subject: Re: Additional Information Request

Hi Designer,

       Thank you for getting back to me so quickly. I have a good feeling about this engagement for the Network Design between us!

       Since we last spoke, our current board of directors has also sent me an inquiry about what it would take to "connect our entire network more formally" between North America and Europe.

       One of our open projects (collaborating with the Dev Team) was evaluating cloud hosted applications and their performance via VPN over the last 6 months. The performance has not been so great and we are looking to improve this as well. This may come up in the future as we are looking to grow our business and reduce our DataCenter costs in New York.

       Oh, I almost forgot, I am attaching the High-Level DataCenter BGP Diagram per your request.
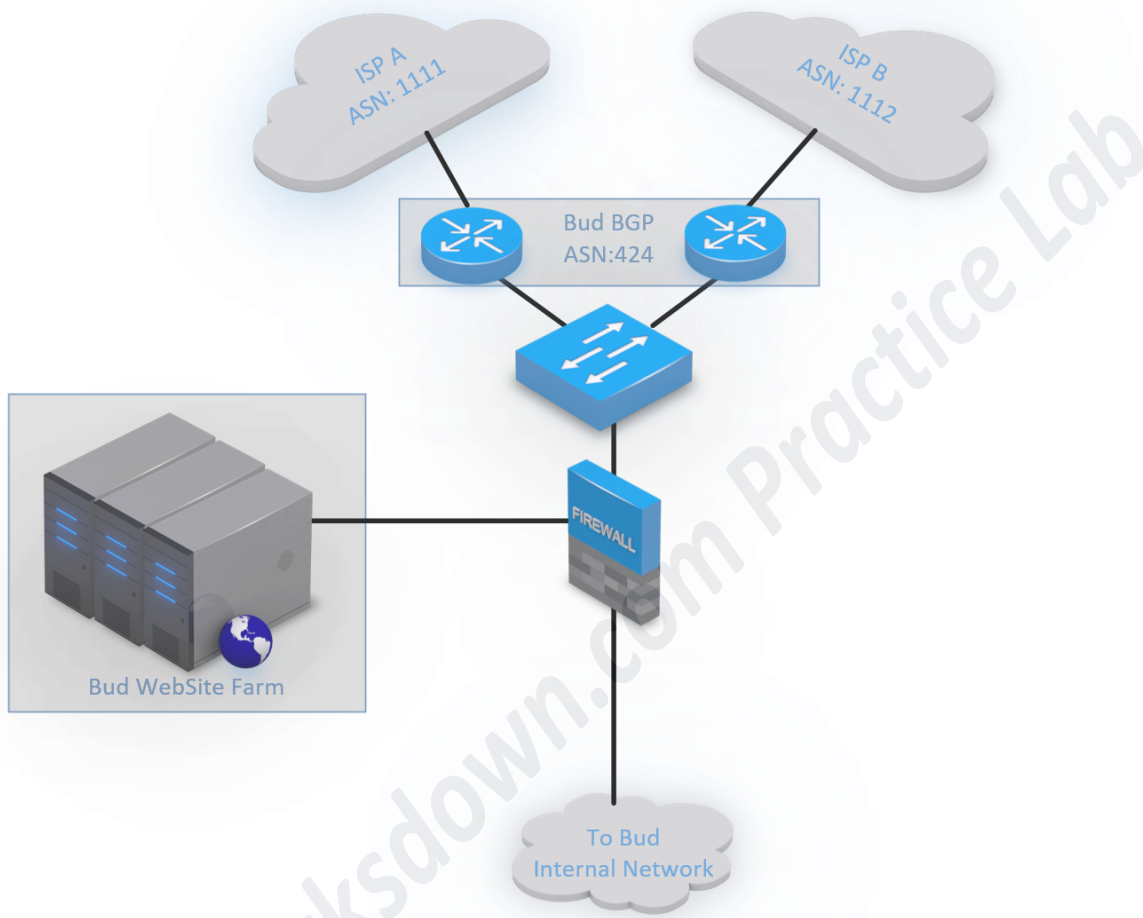
Thank you,
Alan R.

Document 3 – Email 2 - Attachment

Bud Enterprises – BGP DataCenter Current ISP Design

Question 5. *(Choose 3)*
- What other information would you request to assess the BGP Convergence issues?
  A. Bud's BGP Policy Breakdown
     o Identify how BGP is currently configured. Which ISP are we preferring? What attributes are we sending? Which router is our Ingress router into the DataCenter from the internet?
  B. ISP BGP Supported Attributes
     o Do the ISPs support communities? If so, which ones? Can we leverage these for faster failover?
  C. Speed of Internet Circuits
  D. Server Specifications hosting the Website
  E. FHRP configuration between iBGP Peers
     o Which router is our egresss router out of the DataCenter onto the Internet?
  F. Spanning-tree Topology
  G. Bud's DataCenter Internal Routing Configuration

Question 6. *(Choose 1)*
- What does requesting the ISPs Supported Attributes accomplish for this design?
  A. It shows how bad of a service provider the ISPs are.
  B. The ISPs support for Communities is a better way to control outbound Traffic
  C. The Supported Attributes can assist the network design with regards to bandwidth consumption
  D. The Supported Attributes will define whether or not the ISP supports BGP PIC
  E. The ISPs support for Communities is a better way to control inbound Traffic
     o Asking for Communities can help set your Local Preference within the ISPs environment, or manipulate the traffic as you would like/require that they are routing back to your DataCenter.
  F. The ISPs support for Communities is a better way influence traffic back into the Enterprise
  G. Supported attributes will assist with ASN assignment

Question 7. *(Choose 1)*
- Which device controls the website Sessions from a BGP perspective?
  A. The ISP NGFW.
  B. The Enterprise Firewall
     o The Firewall pictured seems to be the Gateway and potential NATTing device for this excursive. So it is the device that holds state or the Session to and from the web servers.
  C. The Enterprise's BGP Routers speaking eBGP
  D. The Enterprise's DMZ Server farm
  E. The Client connecting to the DMZ Server Farm

Question 8. *(Choose 1)*
- What role does FHRP play within Bud's BGP design?
  A. FHRP convergence can effect inbound (from the internet) traffic flows.
  B. FHRP adds gateway redundancy for session owners.
  C. FHRP helps mitigate traffic pinning (polarization) to a specific ISP.
  D. FHRP helps determine the egress ISP toward the internet.
     o FHRP will determine which router is ARPing and would be potentially set as the Gateway for the Firewall

Question 9. *(Choose 1)*
- How can you improve the eBGP convergence?
  A. Speak with the ISP regarding BFD.
  B. Speak with the ISP about tuning BGP Timers.
  C. Review the ISPs Supported attributes to control inbound toward Bud's DataCenter.
     o Reviewing the ISPs supported attributes/communities will allow for more granular control of routing your prefix

Document 4 – Email 3

From: Alan Rickler <alan.rickler.21@bud.ccde>
To: CCDE Candidate <NetworkDesigner@scenario1.tnd.ccde>

Subject: Re: BGP & DataCenter Suggestion

Hey Designer,

Thank you for your advice with regards to getting the correct communities in place with our current ISPs. After hearing from the ISP, doing some research on my own and being here when we had an ISP outage, I really understand now why Prepending isn't exactly "the silver bullet." The failover test we performed last Sunday morning worked like a charm!

We are looking to implement the FHRP information you provided as well during our next maintenance window in a couple of weeks, so thank you for that as well.

Now onto the second thorn in my side. Our OSPF instances in North America running across our point-to-point lines are putting a lot of strain on our core switches. I'm attaching our Point-to-Point Diagram to this email so you can see our current design.

Since the BGP stuff is out of our way, for now, what recommendations can you send my way with regards to improving our WAN connectivity via our point-to-point lines? We have additional funding for equipment if needed.

Our New York DataCenter sits in the same building as the rest of us at HQ, but it is located in the basement of our building, not on one of our 4 floors. We only have a MPLS connectivity down to there to connect it to the rest of the Corporate Network. Moving that DataCenter is not an option at the moment. ISP internet handoffs are done directly within our DataCenter Space.

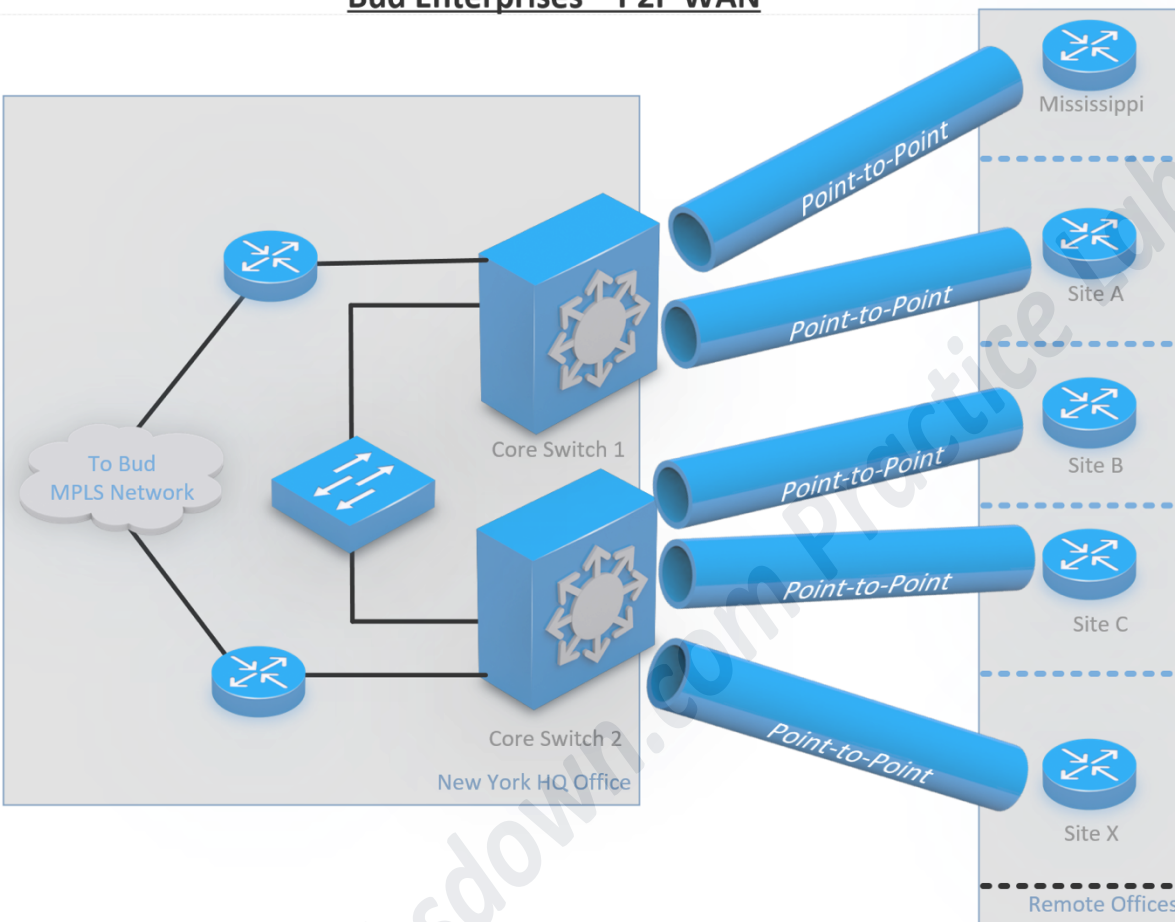I'm also attaching our MPLS diagram for you to reference.

Thank you,
Alan R.

Document 5 – Email 3 - Attachment

Bud Enterprises – P2P WAN

Document 6 – Email 3 – Attachment #2

Bud Enterprises – MPLS L3VPN Design

Question 10. *(Choose 1)*
- What is the largest risk to the business with the information provided above?
    A. MPLS is not encrypted in transport.
    B. Fate sharing since the HQ office and the DataCenter reside within the same building.
    C. Lack of Redundancy connecting the DataCenters to the rest of the Corporate Network.
    D. Oversubscription of the MPLS line as it's the single point of entry between the DataCenter and Corporate Network.
    E. The New York Office is performing Transit for Corporate Traffic.
        o Although most of the other answers here are true; The New York Office's network now becomes the most important as it is the only way into the DataCenter's network; aside from the other MPLS sites.
    F. The Risks mentioned above are valid, but the website is safe behind a firewall.

Question 11. *(Choose 1)*
- Why is having the New York Office performing Transit an issue in this design?
    A. New York is too far in distance from the DataCenter.
    B. Traversing an office is not an ideal setup, it adds extra complexity.
        o There is complexity in the setup of transiting a corporate "enterprise" network in order to access the DataCenter's resources
    C. A fiber cut between the 4 corporate floors would result in a total outage.
    D. New York's circuit size is too small to support the traffic load.

Question 12. *(Choose 2)*
- Which of the options below can help solve the "rippling effects" of point-to-point flaps?
    A. Convert the networks to EIGRP point to point links.
    B. Implement static routing with tracking.
    C. Purchase new hardware and migrate the point-to-point lines onto an aggregation switch, removing them off of the core switches.
        o This is a good option as moving the inter-office routing off of the current cores will allow for summarization and route optimization where possible. Also in the last email, Alan had said they have funding available.
    D. Create GRE tunnels over EIGRP to leverage virtual links for full connectivity.
    E. Create a new stub area in OSPF and assign all remote sites to this area.
        o Migrating the remote sites to another area would also stop the SPF propagation from flapping links between offices. This would decrease the resources used for every flap. Although, ABRs require more resources to keep the info of each area they are attached to.

Question 13. *(Choose 1)*
- Most of the remote sites are very small with regards to complexity. What other OSPF tuning would you suggest to improve convergence?
  A. Address Summarization.
    o Applying Address summarization would allow for a single route entry to be injected/withdrawn when a line recovers/flaps, which will also decrease the amount of entries in the DataBase.
  B. Tune OSPF timers.
  C. Passive non-OSPF participating interfaces.

Question 14. *(Place in order)*
- Place the following steps in order to migrate from single area OSPF to Multi-Area.
  A. Add additional Area to Stub Site
  B. Add additional Area to DataCenter
  C. Configure additional Area as Stub
  D. Summarize Subnets from DataCenter down to Stub Site
  E. Summarize Subnets from Stub Site up to DataCenter
  F. Compare LSDB entries

  1. (A) Add additional Area to Stub Site
  2. (C) Configure additional Area as Stub
  3. (B) Add additional Area to DataCenter
  4. (E) Summarize Subnets from Stub Site up to DataCenter
  5. (D) Summarize Subnets from DataCenter down to Stub Site
  6. (F) Compare LSDB entries

Document 7 – Email 4

From: Alan Rickler <alan.rickler.21@bud.ccde>
To: CCDE Candidate <NetworkDesigner@scenario1.tnd.ccde>

Subject: What a week! – Infrastructure Upgrades!

Hi there,

We were just awarded a large contract from a distributer in South Florida. With this huge win with a lot of potential for increased revenue! With this, the business has decided to invest into our infrastructure and purchase a brand-new Voice over IP based telephone system. In speaking with the rest of the Business Partners we would really like to take advantage of the internal dialing feature between all of our offices to help leverage our network and help cut our overseas phone costs.

The business has also expressed interest in a cloud-based inventory control system, so long as we work through our original woes of connectivity to the cloud provider, we were testing in. More on that front once we get this phone system in.
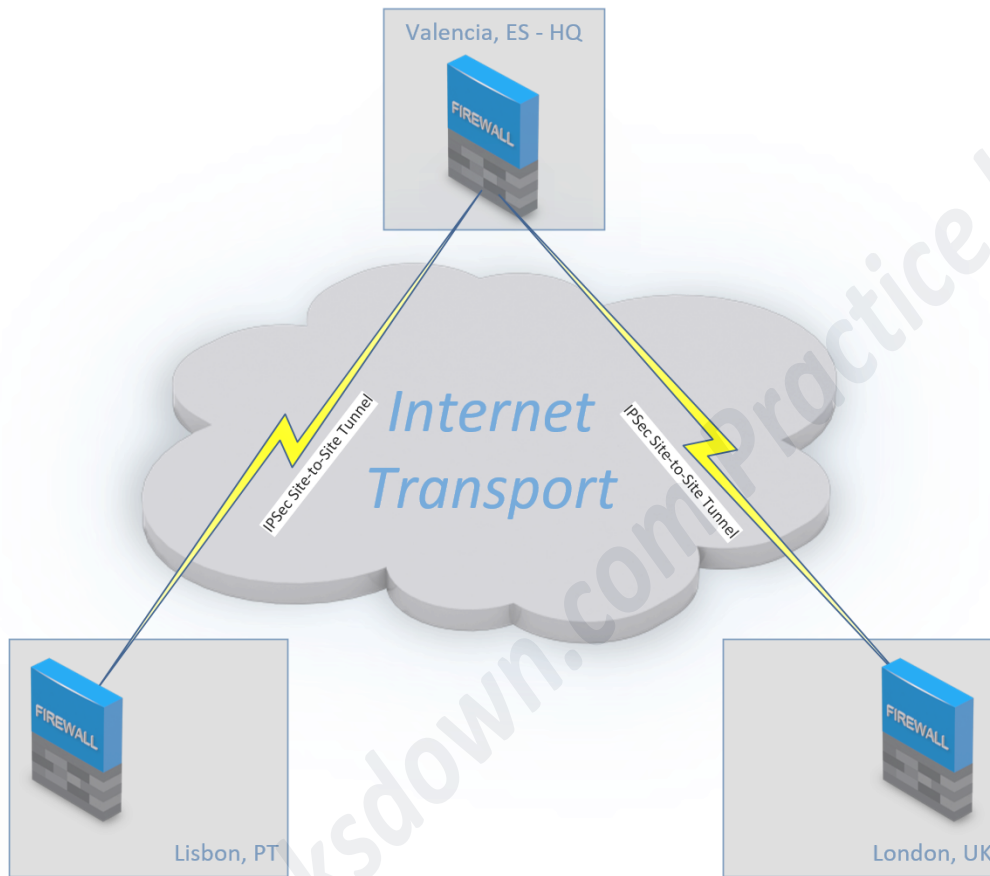
I'm attaching the current WAN setup for the Jukitis sites. Please feel free to reach out with any questions.

Thank you,
Alan R.

Document 8 – Email 4 – Attachment

Jukitis Saga SL – European WAN (IPSec)

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Question 15. *(Place in order)*
- In which order would you place the following steps to roll out the new VoIP System connectivity?
    - A. Test music on hold
    - B. Build new Layer 2 VLANs at each site.
    - C. Test end to end latency between each site.
    - D. Build new Layer 3 interfaces at each site.
    - E. Update the OSPF routing table to advertise the new subnets at each site.
    - F. Convert the CryptoMap VPNs into GRE over IPSec.
    - G. Replace European legacy equipment with new equipment.
    - H. Pick up the phone and 4-digit dial between offices.
    - I. Confirm unicast routing is functional between VoIP Subnets.
    - J. Configure QoS policies on required links.
    - K. Confirm multicast transport is functional.

    1. (C) Test end to end latency between each site.
    2. (G) Replace European legacy equipment with new equipment.
    3. (B) Build new Layer 2 VLANs at each site.
    4. (D) Build new Layer 3 interfaces at each site.
    5. (F) Convert the CryptoMap VPNs into GRE over IPSec.
    6. (E) Update the OSPF routing table to advertise the new subnets at each site.
    7. (I) Confirm unicast routing is functional between VoIP Subnets.
    8. (J) Configure QoS policies on required links.
    9. (H) Pick up the phone and 4-digit dial between offices.
    10. (K) Confirm multicast transport is functional.
    11. (A) Test music on hold

Question 16. *(Choose 2)*
- What is the primary concern with regards on the VoIP system?
    - A. The round-trip latency time needs to be within 300ms.
    - B. Jitter is less of a concern when you have sufficient bandwidth
    - C. Classifying TCP and UDP within the same QoS class increases its effectiveness
    - D. The internet, as it is a best effort transport.
        - o Although latency is a concern, running a production VoIP system over the internet does not guarantee you quality, nor latency timing.

Question 17. *(Choose 1)*
- How can you overcome the internet's best effort transport?
    - A. Purchase a dedicated link.
    - B. Build a packet accelerated network.
    - C. Build an overlay tunnel.
    - D. Assign QoS marking on egress from your network towards the internet

Question 18. *(Choose 1)*
- During the Jukitis equipment refresh what other optimization would you consider in light of the VoIP system rollout?
  A. Purchasing stacked switches for ease of management.
  B. Purchasing Power over Ethernet enabled switches for simplified management.
  C. Purchasing stacked switches for routing purposes at each location.
  D. Purchasing Power over Ethernet enable switches for Phone power at users' desks.
     o This will allow for less clutter and adapters at the desk, and the network then becomes the central point of power management for these devices

Question 19. *(Choose 1)*
- When would changing the VoIP system's codec come into the picture with this project?
  A. If the phones require a special codec for international audio translation.
  B. If the distance between offices is too far for one way audio.
  C. If the bandwidth along the path of the call is not sufficient.
     o Changing the codec can compress the audio to overcome any bandwidth chokepoints

Document 9 – Email 5

From: Alan Rickler <alan.rickler.21@bud.ccde>
To: CCDE Candidate <NetworkDesigner@scenario1.tnd.ccde>

Subject: Mo' Money, Mo Networks!

Hello Designer,

Thank you again for all of your help with the VoIP implementation. It's working exactly how the business expected it to.

I hope you enjoyed your vacation and are well rested, you're going to need it! We've got some more work for you. Our South Florida distribution deal that we had spoken about earlier went over so well that we actually ended up surpassing our investors targets and our stock price sky rocketed.

Due to the success on the Miami Business deal, Corporate had enough capital to purchase one of our European competitors to gain more ground within Europe. The company that we have purchased is being rebranded as "Bud Europa", and will contain the existing 3 site footprint we had in Europe (Jukitis Sites) as well as 4 more brick and mortar locations. Bud Europa also came with 1 DataCenter as part of the purchase. This brings our European location count to 7! Well, 8 with the German DataCenter.

Word of our acquisition spread really fast within our company, especially since our CEO announced an initiative to "Work from Anywhere" to the staff. This will allow any employee to float between our offices around the world. In the long term, we are looking to provide the same experience to all of our employees (Video Conferencing, Single Corporate email domain Wireless Networks, Phone System, Authentication Systems, etc.) so the employees can travel freely between the North American and European sites. On our shorter radar, we are looking to fast track getting our roots planted on the network out in the new offices throughout Europe. Valencia will still remain our European HQ. How much of a pain is it going to be to get us IP Phones as well as basic corporate 802.1x Wireless connectivity to the European Offices?

By the way, get your head out of "the cloud" for now, this takes priority over the inventory system we were speaking of earlier! Those Dev guys can wait.
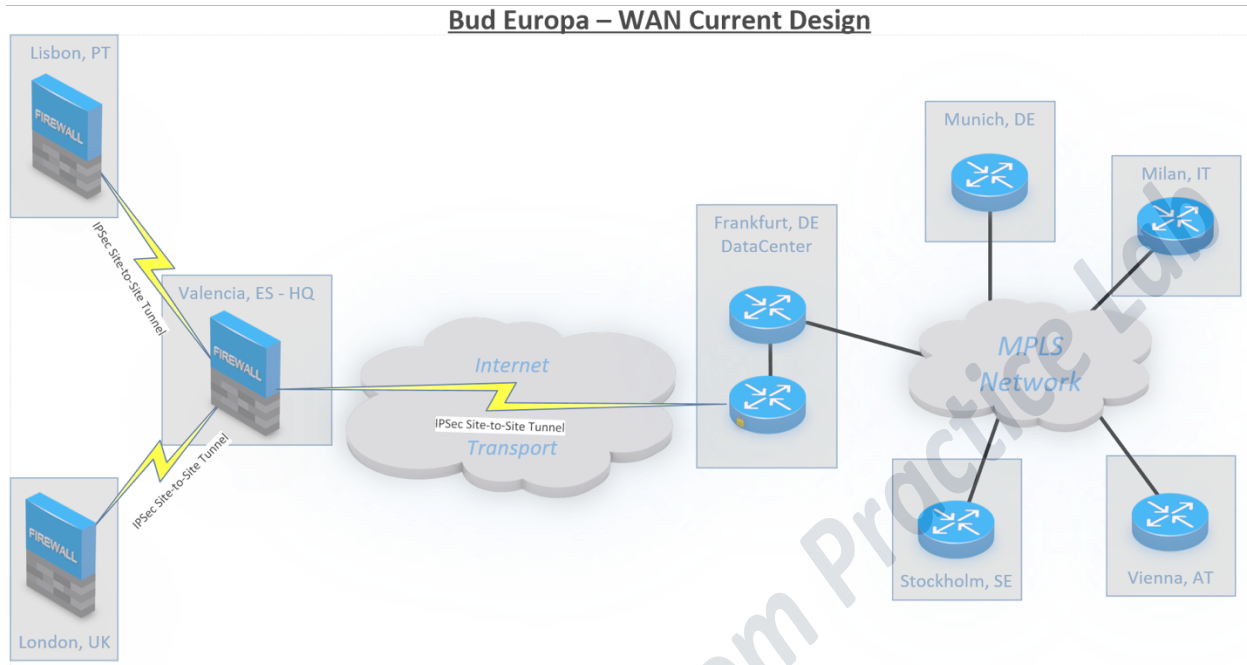
Keep up the good work! Here is the current WAN design of Bud Europa as an attachment.

Thank you,
Alan R.

Document 10 – Email 5 - Attachment

Bud Europa – WAN Current Design

Question 20. *(Choose 3)*
- For the long-term goal, which options below would provide the best user experience between offices?
    A. Run BGP as the IGP across all of the sites to improve scalability and performance.
    B. Setup a new EVPN Layer 2 network and convert all of the offices over
    C. Connect all three of the DataCenters via MPLS L3VPN
    D. Migrate all the current North American point-to-point links onto the MPLS L3VPN network.
    E. Extend the current Bud Europa MPLS L3VPN Network to the legacy Jukitis sites.
    F. Enable fast hellos on the PE to CE equipment running MPLS L3VPN

Question 21. *(Choose 5)*
- For the short-term goal, which options below would provide the quickest connectivity requirements?
    A. Deploy a Wireless LAN Controller within the German DataCenter.
    B. Deploy a local VoIP Server within the German DataCenter and add it to the existing Cluster in North America.
    C. Deploy SSL VPN Phones to the new Bud Europa offices and backhaul the calling to the North American DataCenters
    D. Establish a VPN connection between the New York and Germany DataCenters.
    E. Deploy wireless access points inside of the Bud Europa Offices.
    F. Establish connectivity from legacy Jukitis sites back to the German DataCenter.
    G. Register Bud Europa's Wireless Access Points to the existing Wireless Controllers

Question 22. *(Choose 5)*
- For the short-term goal, with sufficient funding, which options below would provide the quickest connectivity requirements?
    A. Deploy a Wireless LAN Controller within the German DataCenter.
    B. Deploy a local VoIP Server within the German DataCenter and add it to the existing Cluster in North America.
    C. Deploy SSL VPN Phones to the new Bud Europa offices and backhaul the calling to the North American DataCenters
    D. Establish a VPN connection between the New York and Germany DataCenters.
    E. Deploy wireless access points inside of the Bud Europa Offices.
    F. Establish connectivity from legacy Jukitis sites back to the German DataCenter.
    G. Register Bud Europa's Wireless Access Points to the existing Wireless Controllers

Document 11 – Email 6

From: Alan Rickler <alan.rickler.21@bud.ccde>
To: CCDE Candidate <NetworkDesigner@scenario1.tnd.ccde>

Subject: Re: Quick Wireless and Phone Rollout Recommendations

Designer,

Your solution took a little convincing, but I was able to get the hardware you requested put into our budget code. What sold them was your track record with design decisions in the past, so KEEP IT UP! We have deployed a new VoIP Server and Wireless controller within the Germany DataCenter, however the larger WAN project was tabled for now as "the cost seemed to outweigh the benefits" according to our leadership committee. So for Inter-Continental DataCenter and office Connectivity we are stuck with site to site VPN tunnels, which are now setup. However, we are now using GRE over IPSec thanks to you.

The tech departments have also gotten an influx of tickets regarding poor live video quality between North America and Europe. The business wanted me to run the following by you. What if we started hosting some of our services out of our Arizona DR site instead of New York? They are wondering if the load is too much for New York, given our new 800-person headcount, VoIP, Wireless and Video Conferencing Setup. What do you think?

We can't thank you enough for helping us this far!

Thank you,
Alan R.

Question 23. *(Choose 1)*
- What is the most likely cause for poor video quality?
  A. Insufficient Bandwidth between sites.
  B. Incorrect configuration on the routers.
  C. GRE over IPSec is an improvement, but it's still leveraging the Internet.
     o Internet is a best effort transport and not guarunteed
  D. New York's capacity is saturated and dropping packets.

Question 24. *(Choose 1)*
- In your opinion, would moving the suggested services to the Arizona DataCenter Help?
  A. Yes, this will reduce the transitive traffic in New York.
  B. No, the Internet is still best effort.
  C. Yes, this will allow for load balancing across more BGP Circuits.
  D. No, Arizona is physically further away from Europe.
     o While B is also true, the item to discuss here is physical locations Arizona is further West from Europe than New York is.

Question 25. *(Place in order)*
- Removing budgetary constraints, place the following options in order (first being the most effective) to help with the poor video quality.
  A. Ensure QoS models encompass Voice, Video and Call setup parameters.
  B. Confirm inter-cluster Call Servers (VoIP and Video) traffic is marking DSCP properly.
  C. Verify QoS placement throughout the enterprise.
  D. Upgrade bandwidth between New York and Germany DataCenters.
  E. Provide leased lined connectivity (Point-to-Point or MPLS L3VPN) between New York and Germany
  F. Shape traffic facing WAN providers.
  G. Ensure Wireless endpoints are participating in Wireless QoS policy.
  H. Install larger screens and cameras in common areas to allow large groups to gather and participate in companywide conferences.

  1. (E) Provide leased lined connectivity (Point-to-Point or MPLS L3VPN) between New York and Germany
  2. (F) Shape traffic facing WAN providers.
  3. (B) Confirm inter-cluster Call Servers (VoIP and Video) traffic is marking DSCP properly.
  4. (C) Verify QoS placement throughout the enterprise.
  5. (A) Ensure QoS models encompass Voice, Video and Call setup parameters.
  6. (H) Install larger screens and cameras in common areas to allow large groups to gather and participate in companywide conferences.

Document 12 – Email 7

From: Alan Rickler <alan.rickler.21@bud.ccde>
To: CCDE Candidate <NetworkDesigner@scenario1.tnd.ccde>

Subject: NYC doesn't sleep, but it sure slowed down!

Hi there,

I hope you enjoyed the weekend I have forwarded your suggestions up the chain for management approval to see how we can help with the Video issues we are experiencing. I supposed this would be chalked up as part of our growing pains to a single international enterprise.

So, we had a strange event happen within the New York network, we had someone accidentally loop one of our new IP Phones between two ports on one of our access switches 3 floors down and everything within the New York Office came to a very-very-VERY slow crawl. It took us about 4 hours to find the offending phone and remove it. Quite some time passed before we were able to stabilize. What's up with that? Can you take a look with our Engineers to see how we can prevent this in the future? Luckily, our website was not affected by this issue.

On a possibly unrelated note, we did receive reports, companywide, of phones rebooting during that time saying "TFTP timeout" on their screens. A few random remote offices, but not all, also reported spotty and non-existent wireless coverage during this Phone issue. The reported cleared up shortly (30-60 minutes) after the phone removal took place. I dug through our Purchase Orders from our equipment purchases for HQ, and it looks like all switches, with the exception of our office cores, can only run at layer 2. Way to go on the budget pinching, I know…

Can you give us some suggestions on what may have gone wrong and how to prevent this in the future? Other than putting a policy in place for employees to not touch their phones during the day!

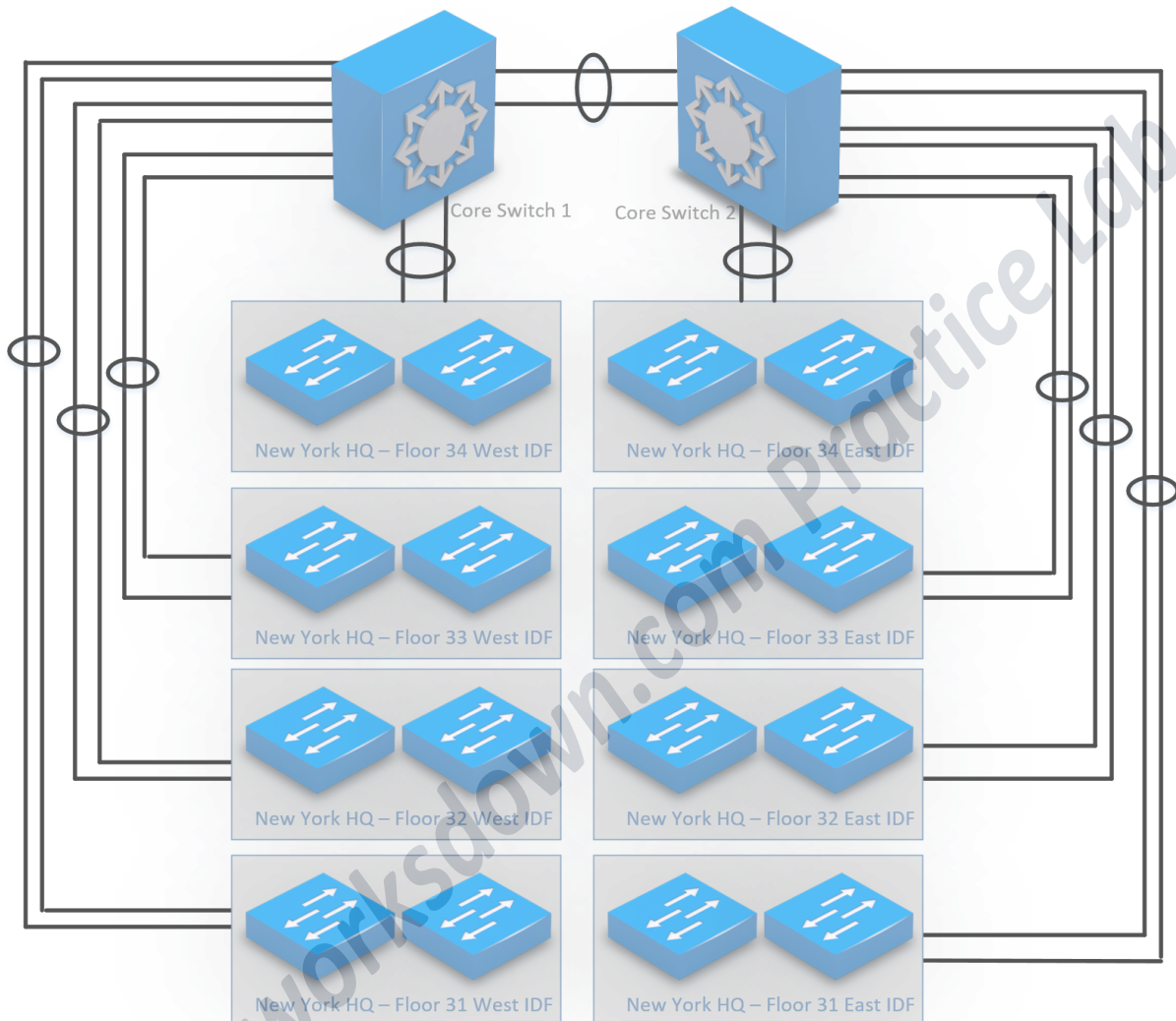I'm attaching some diagrams for our NYC Office. As always, feel free to reach back out to me with any questions.

Thank you,
Alan R.

Document 13 – Email 7 – Attachment 1

Bud Enterprises – Office Layer 1 Connectivity

Document 14 – Email 7 – Attachment 3

Bud Enterprises – Office/DC Layer 1 Connectivity

DataCenter
Core Switch 1

DataCenter
Core Switch 2

Bud MPLS L3VPN
Network

HQ Office
Core Switch 1

HQ Office
Core Switch 2

New York HQ – Floor 3X West IDF

New York HQ – Floor 3X East IDF

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Question 26. *(Choose 1)*
- Given the reported outage and the provided documentation, can you definitively determine what the underlying issue was?
    - A. Yes, I do not need any further information.
    - B. Yes, the issue has to do with how the IP phone handles TFTP traffic.
    - C. No. I need some more information to confirm.
    - D. No, the issue is there are too many switches.

Question 27. *(Choose 2)*
- If you require more information, which two items would you request from the options below?
    - A. Ask for the IP Address of the TFTP Server and a routing diagram.
    - B. Ask for the current Spanning-tree mode and edge port configurations.
    - C. Ask for the current Spanning-tree mode and root switch.
    - D. Ask for a diagnostic to be run on both the phone and IDF Switch(es) that reported the problem.

Question 28. *(Choose 2)*
- What recommendation would you provide to the team without requesting any additional information?
    - A. Reconfigure the IP Phones to disable their extra pass-through port.
    - B. Confirm which Switch is the spanning-tree root for the Phone VLANs.
    - C. Shutdown unused ports to prevent unintended loops.
    - D. Deploy Spanning-Tree BPDU-Filter configurations on edge ports.
    - E. Deploy Spanning-Tree BPDU-Guard configurations on edge ports.
    - F. Enable port security on all access ports with a low maximum value for MAC entries.

Document 15 – Email 8

From: Alan Rickler <alan.rickler.21@bud.ccde>
To: CCDE Candidate <NetworkDesigner@scenario1.tnd.ccde>

Subject: Re: Spanning-Tree Info Request

Designer,

Per your request, I had the guys confirm the root bridges for everything in HQ. Apparently Core Switch 2 is the root bridge for all Voice VLANs and Core Switch 1 is the root bridge for all Data VLANs. Is that, ok?

As far as we are aware, we do not run BPDU-Guard on our ports. Although we are running Rapid Spanning-Tree. I will fast track that in our upcoming maintenance window this week. You're a lifesaver!

Are there any other Spanning-Tree optimizations we should throw in in this Change Control Window for this coming Friday Evening? Anything a little further long term to help optimize our setup?
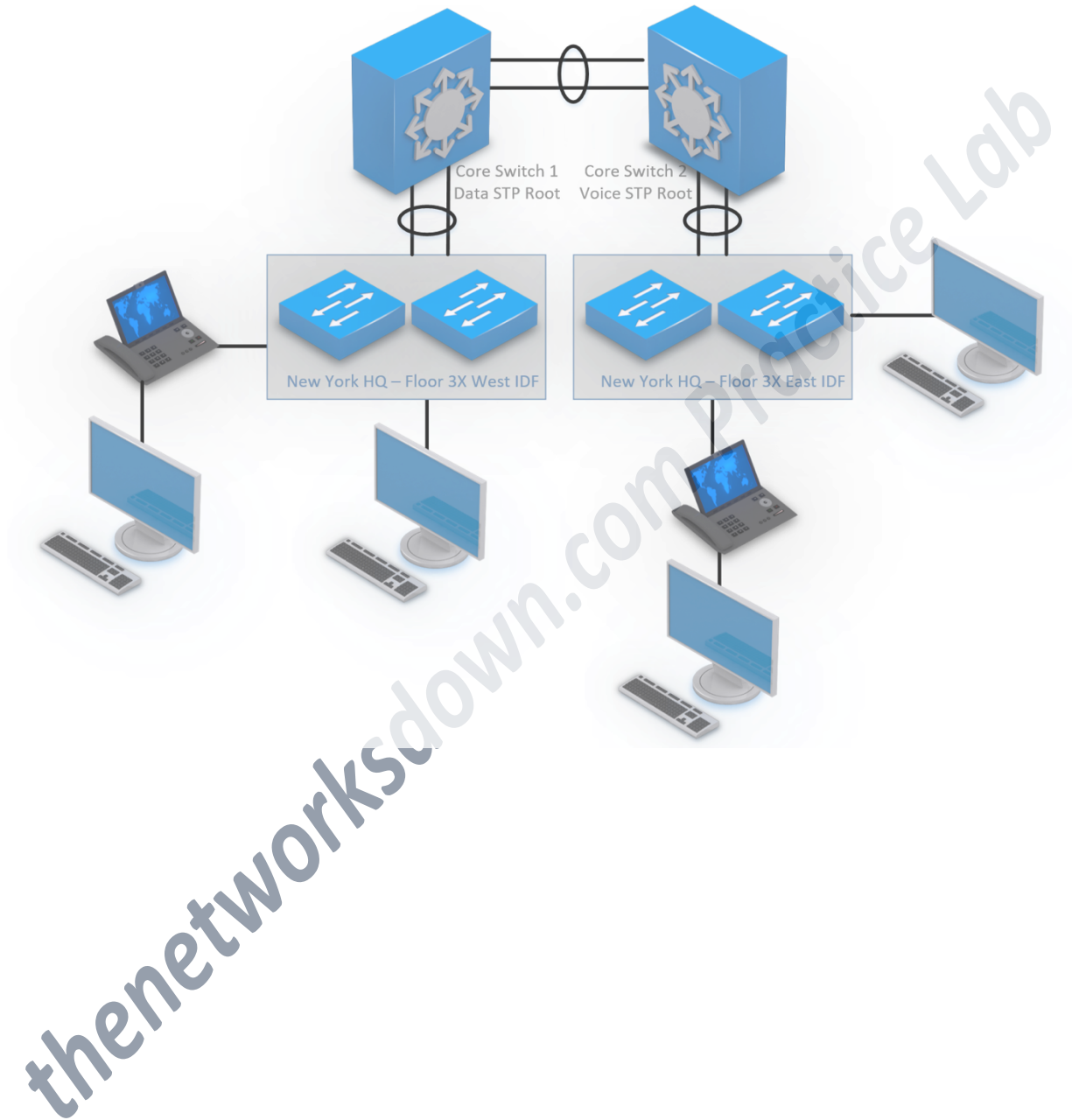
I will report back later this week with our progress of BPDU Guard. Attached please find our spanning-tree overview diagram for HQ.

Thank you,
Alan R.

Document 16 – Email 8 – Attachment 1

Bud Enterprises – Office Spanning-Tree Connectivity

Question 29. *(Choose 2)*
- After reviewing the provided diagram, what is the overall issue with this design?
    A. Some phones are used as passthrough devices for PC connectivity.
    B. Each IDF is connected to one core switch which will may cause a suboptimal forwarding path.
    C. The design is ok, since it's already in use for the company.
    D. The VLANs are spanned between IDF closets.
    E. The VLANs are spanned between Core Switches.
    F. Some phones are used as passthrough devices for PC connectivity, which causes forwarding path issues.

Question 30. *(Choose 2)*
- What are two options to correct the overall design issues?
    A. The IDFs should be cross connected (eg West IDF to East IDF) for redundancy.
    B. The VLANs should be contained per IDF.
    C. Phones should be contained to one side of the floor to provide an optimal forwarding path.
    D. Multihoming the IDF closets to both cores for redundancy.

Question 31. *(Choose 1)*
- What should be enabled on the access ports facing user devices to help optimize the spanning-tree domain?
    A. Portfast only.
    B. Portfast and BPDU Guard.
    C. Portfast and BPDU Filter.
    D. Portfast, BPDU Guard and BPDU Filter.
    E. Portfast, BPDU Guard, BPDU Filter and Root Guard.
    F. Portfast, BPDU Guard and Root Guard.
    G. Portfast and Port Security.
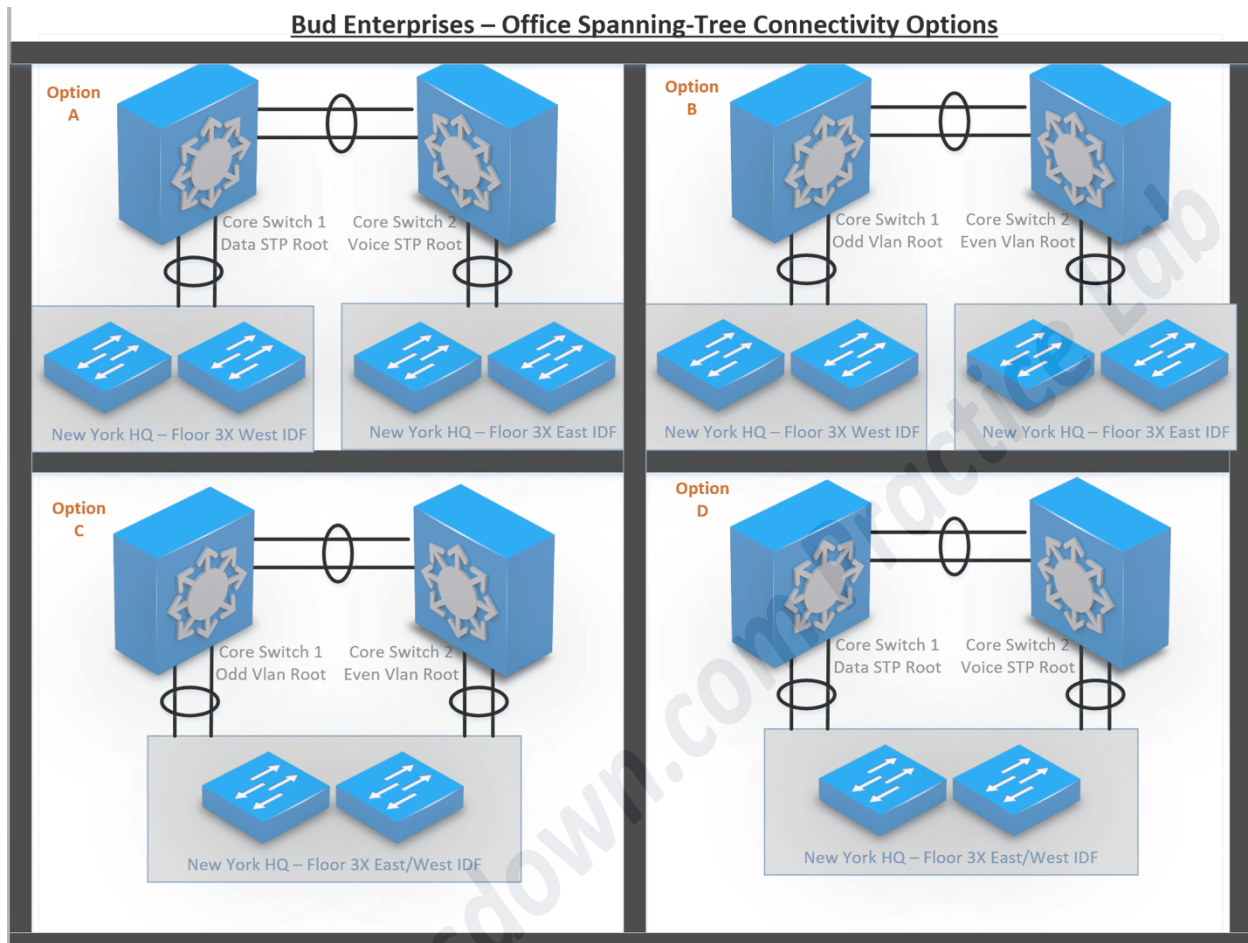   H. Portfast, BPDU Guard, Root Guard and Port Security.

Question 32. *(Choose 2)*
- How do these optimizations (from Question 31) help?
    A. Portfast disables the sending of TCNs on access ports within the Spanning-Tree Domain.
    B. BPDU Guard disables the sending and receiving of BPDUs from looped ports.
    C. Port Security enforces 802.1x on access ports.
    D. Root Guard is used when you want to control which ports participate in the Spanning-Tree Election
    E. BPDU Filter works at layer 1 which is below spanning-tree.
    F. Using Portfast and BPDU guard are more effective in Multi-Spanning-Tree.

Document 17 – Proposed STP Topology Diagram

Bud Enterprises – Office Spanning-Tree Connectivity Options

Option A — Core Switch 1 Data STP Root, Core Switch 2 Voice STP Root — New York HQ – Floor 3X West IDF, New York HQ – Floor 3X East IDF

Option B — Core Switch 1 Odd Vlan Root, Core Switch 2 Even Vlan Root — New York HQ – Floor 3X West IDF, New York HQ – Floor 3X East IDF

Option C — Core Switch 1 Odd Vlan Root, Core Switch 2 Even Vlan Root — New York HQ – Floor 3X East/West IDF

Option D — Core Switch 1 Data STP Root, Core Switch 2 Voice STP Root — New York HQ – Floor 3X East/West IDF

Question 33. *(Choose 1)*
- Which Proposed solution above provides the most efficient use of load balancing without significant changes?
    A. Option A
    B. Option B
    C. Option C
    D. Option D

Question 34. *(Choose 1)*
- Why does this solution work for the proposed scenario in Question 32?
    A. It optimizes the traffic flow between IDF rooms
    B. It optimizes the traffic flow between the Core Switches
    C. It optimizes the Load on both Core Switches
    D. It optimizes the Load on both Core Switches while simplifying Management.
    E. It optimizes the Load on both Core Switches while adding redundancy.