



# NETWORK DESIGN PROPOSAL

---

PREPARED FOR ABC CORPORATION

Prepared by  
Crystal Technologies



# Network Design Proposal

PREPARED FOR ABC CORPORATION INC.

---

## ARTICLE I. OVERVIEW/HISTORY

---

In the January 2009 account review, Crystal presented to ABC Corporation a network design that included visios and recommendations focused on replacing ABC Corporation's existing back-up Frame Relay network with a back-up MPLS network that could be utilized for more than network failover in the event of an outage. This "secondary" network would be capable of offloading existing data requirements and also have the flexibility to accommodate future growth and changes.

In the May 2009 account review, Crystal highlighted the January network recommendations and also addressed more current needs, such as bandwidth saturation and expansion of video requirements, with additional recommendations. The fundamental of the basic recommended solution, however remained intact.

The purpose of this document is to define the requirements, considerations, and overall design specifications so that vendors can be selected to provide the appropriate solutions.

---

## ARTICLE II. BUSINESS REQUIREMENTS AND CONSIDERATIONS

---

1. MPLS secondary network that will back up the primary Qwest WAN at all locations that have five or more employees.
2. Utilize single router for both primary and secondary networks at remote locations.
3. Solution that will provide Internet access for guests, that is separate from ABC Corporation's production network(s).
4. Solution that will accommodate the bandwidth and priority required for data replication traffic between Pennsylvania and North Carolina that will not interrupt other production traffic.
5. Accommodate future growth in VoIP traffic on WAN.
6. Prioritization of Tier 1 and Tier 2 applications such as ERP, Email, and Time tracking.

CRSYTAL TECHNOLOGIES PROPRIETARY AND CONFIDENTIAL



7. Solution that will satisfy existing video requirements and be flexible enough to provide for future growth in use of video calls.
8. Provide flexibility to distribute secure access to the internet from more than the three existing locations (Pennsylvania, NY, North Carolina) without adding firewall hardware.
9. Support content filtering as a cloud computing application.
10. Support Distributed File System (DFS) initiative.

---

### **ARTICLE III. SOLUTION SUMMARY**

---

Crystal believes that the solution shared in this document will satisfy all of the business requirements and considerations of ABC Corporation, as well as provide necessary flexibility for today's rapidly changing business environment.

Crystal proposes the installation of a secondary MPLS network that will back up the primary Qwest Network. This secondary network will be capable of the following in addition to basic IP WAN connectivity and the ability to back up the Qwest WAN:

1. Capability to permit secure access to the internet from the carrier's cloud.
2. Capability to provide local dial-tone over IP.
3. Prioritization of any applications and traffic shaping through COS/QOS

Since a decision has been made that a back-up network is necessary, Crystal recommends that this network not sit idle waiting for a network failure, but also be used as a primary route for Internet browsing and video traffic. The two networks will essentially share the traffic loads according to traffic type and back each other up in case of a failure.



---

## ARTICLE IV. NETWORK SOLUTION DETAILS

---

### PRIMARY WAN NETWORK

The primary network will remain on Qwest with relevant changes to port size that are detailed in separate bandwidth analysis.

1. **Network gear** – all existing routers and switches will be able to be used
2. **Traffic types** – This network will be the primary path for :
  - a. Voice payloads – Interoffice Siemens Calls and Siemens VMail
  - b. Voice Call Control – Call set up for above payloads
  - c. Business Data applications- ERP, Time Tracking, DFS, file/print sharing, Active Directory traffic, etc. At this time we recommend that DFS traffic be routed on this network due to the complications that could be encountered trying to route, this traffic differently than other windows traffic.
3. **COS/QOS** – Qwest uses IPP for queuing. Class maps are needed to map DSCP values and/or specific applications to IPP values. Most of this is already in place on the router. The Queues will be prioritized as follows
  - a. Queue 1 - Voice Payloads
  - b. Queue 2 - Voice Call Control, Video
  - c. Queue 3 - Critical data applications such as ERP, Time Tracking, etc.
  - d. Queue 4 – All remaining traffic would be best effort

A specific location may or may not require all 4 Classes of Service.

4. **Routing** – The BGP routing protocol is needed and is already in place to maintain appropriate routing tables. Video and Voice need to be in a separate VLAN and Subnet. Cisco 4500 switches in NY, Pennsylvania, will also need to support BGP; these switches will become the core routers at their respective locations. North Carolina will need to have a Layer 3 switch that can support BGP.



VoIP traffic and user-server data traffic will have this network configured as the preferred route, and the Carrier X network will be weighted as the less-preferred route.

The Qwest network cloud will continue to route traffic to Pennsylvania as the default route.

## **SECONDARY WAN NETWORK**

Carrier X will be selected to provide the secondary MPLS network. This MPLS network must be capable of providing secure internet access from the carrier cloud as well as providing local dial-tone using SIP trunks..

1. **Network gear** – This WAN will terminate into existing routers at the remote locations and into their own routers at the host locations that have a layer 3 switch (NY, Pennsylvania, and North Carolina)
  - a. Remote Locations - The routers at these locations will need an additional WIC card(s) added to support the T1s for the secondary WAN.. The existing routers will be able to support 4 T1's total between the primary and secondary networks. Additional bandwidth requirements at an individual location that are in excess of these 4 T1's will require replacing the existing router or adding a new router and layer 3 switch.
  - b. Remote locations with integrated Voice – For locations that require an integrated voice solution, these routers may require additional hardware depending upon the capabilities and SIP hand-off qualifications of the existing PBX systems.
    - 1) PBX system qualified for SIP trunks with Carrier X – an existing unused Ethernet port on the router can be used to hand the SIP trunks to the PBX. The PBX must be pre-qualified with Carrier X for this functionality
  - c. Host Locations – New 2845 or 3825 routers will be required at these locations to support the bandwidth requirements of the new secondary network.
2. **Traffic types** – This network will be the primary path for :
  - a. Video – All Video Conferencing Calls



- b. Internet browsing traffic.
- 3. **COS/QOS** – The COS configuration on this network will mirror the primary network at an appropriate scale. Router configurations will be required to treat and/or map traffic to the appropriate queue according to Carrier X's Queuing method.
- 4. **Routing** – Carrier X will need to support both BGP and Static routing to support automatic failover and fail-back between the two networks.

The Video subnets will have the Carrier X networks configured as the preferred route. The Qwest network will be weighted as a less preferred route for video. We recommend that company policy dictate that video conferencing not be used during an outage situation. If it becomes necessary, the COS configuration will be in place to support video.

The preferred default route for internet browsing will be the Carrier X network. The Qwest network will be weighted as the less preferred route of last choice, sending internet traffic to Pennsylvania if the local Carrier X MPLS network fails.

#### **GUEST INTERNET ACCESS**

All sites that require guest internet access should have a broadband DSL, cable, or FIOS product. This will be a completely separate physical network that is not connected to the production subnets. A SOHO router/firewall appliance such as the Linksys R082 should be deployed.

#### **DISASTER RECOVERY DATA REPLICATION**

ABC Corporation is currently using a Data Replication application to replicate critical data and application servers from Pennsylvania to North Carolina. North Carolina will serve as a DR site.

Crystal recommends that this traffic be placed on its own dedicated circuit path using Carrier Y, per best practices for DR considerations. The cost of a private line would be prohibitive compared to a separate IP network that will be more than sufficient. COS will not be required. This accomplishes the following:

- 1. Maintains an N+1 ratio of network circuit paths to sites for the 2 host locations.
- 2. Eliminates any contention for bandwidth on the two existing network paths
- 3. Reduces possibility for contention with prioritization of packets within a specified QOS queues.



This design would include new routers at Pennsylvania and North Carolina for this separate IP Network..

In addition to a separate WAN for this replication process Crystal also recommends that a separate LAN be considered for this as well. The participating servers and SAN systems should be multi-homed for both the production LAN and the replication LAN. This solution will take a considerable amount of load off of the existing production LAN.

Note:

As an alternative to the Carrier Y solution for this requirement, Crystal also recommends that separate PVCS – CUGS be defined on the Qwest enhanced DS3 ports at North Carolina and Pennsylvania. This accomplishes all of the same objectives including N+1 circuit paths, however without N+ 1 carriers.

## **VOIP GROWTH**

This design fully accounts for future growth with the existing VoIP applications as well as future considerations of alternative and/or complimentary solutions.

1. Existing VoIP applications – The Siemens solution is currently using VoIP for interoffice calls and vmail between LA, California, Pittsburgh, and Philadelphia.
  - a. Solution provides for flexibility to grow Siemens or an alternative network on existing Qwest WAN through adding bandwidth and QOS, when and where it is needed..
  - b. Design calls for mapping all voice payloads to the top priority Queue in both the Qwest primary network and Carrier X back-up network in case of failure.
2. Future VoIP applications
  - a. Introduction of one or more additional IP PBX solutions can be fully supported through the Qwest and/or Carrier X WAN.
  - b. Carrier X will fully be able to support SIP trunks to provide local and LD calling over the MPLS connection. Qwest also now has this functionality for LD and is road mapped for local availability. SIP trunks do require a pre-qualification process for each PBX
  - c. Both Qwest and some Carrier X candidates offer hosted PBX solutions. These solutions are only supported on their native networks, however 3<sup>rd</sup>



Party PBX Hosting Services are available that are carrier independent, and could be supported successfully on this design.

### **PRIORITIZATION OF CRITICAL BUSINESS APPLICATIONS**

Both Qwest and Carrier X will support COS for critical business applications in a 2<sup>nd</sup>, 3<sup>rd</sup>, or 4<sup>th</sup> Queue as needed. Some of the Carrier X candidates support more than 4 Queues, however we believe that ABC Corporation only needs 4, especially with the design to move replication to another network.

We recommend setting both the primary and secondary network up with mirrored COS/QOS configurations that are scaled to the appropriate bandwidth. This design will ensure maximum quality assurance of data prioritization in event of a network failure that causes a re-route of traffic.

### **SUPPORT EXISTING VIDEO REQUIREMENTS AND PROMOTE FUTURE GROWTH**

This design calls for the placing of Video into the 2<sup>nd</sup> Queue on the Carrier X network. This will provide video calls top priority over internet traffic, and will only be trumped by VoIP calls if applicable.

The Qwest network can be configured with a mirrored QOS configuration for Video in case of a Carrier X failure, but at this time we recommend that corporate policy dictate that no video calls are permitted during an outage.

Additional growth will only require appropriate bandwidth and setting QOS parameters.

### **Secure Distributed Local Internet**

The current configuration has NY, Pennsylvania and North Carolina with direct local internet access secured by premise based firewalls. All remote sites access the internet through the Pennsylvania internet connection, and are secured through that firewall.

This design proposes that each site access the internet locally. This will accomplish the following:





1. Reduce internet latency for roundtrips across the country
2. Alleviate periodic congestion at Pennsylvania Qwest WAN port that is partly caused by Internet traffic to and from remotes.

The specifics of this design are as follows:

1. NY, Pennsylvania, and North Carolina will continue to access the internet from their local internet connection and be secured by the local firewall. These locations will handle all inbound traffic for all application server that need to receive traffic from the public domain such as mail, web servers, employee and client VPN connections, etc.
2. Remote sites will access the internet locally using their Carrier X MPLS trunk that will have a gateway to the internet that is secured by a network-based firewall in the cloud. This internet access will only be used for web based traffic such as internet browsing or web based applications hosted in the public domain. No traffic originated in the public domain will be permitted through the network based firewall. There is no need for an IOS firewall.
3. Carrier X's cloud base Internet access will be geographically diverse with 2-5 gateways configured. This reduces latency and also provides redundancy within the Carrier network.
4. NY, Pennsylvania, and North Carolina also require local DIA backup. Crystal recommends that additional Carrier X DIA ports be added at these locations and has incorporated this into the design. This solution was chosen over increasing the bandwidth on both the Qwest Wan and DIA ports at NY AND Pennsylvania to rerouting of local DIA traffic in the vent of a DIA failure at one of these 3 locations.

### **Cloud-Based Content Filtering**

Crystal recommends a 3<sup>rd</sup> party hosted content filtering solution. This solution is flexible and carrier independent and will permit filtering from any carrier network. There are a few very reputable solutions available that will provide the protections and reporting necessary for ABC Corporation. They also offer authentication methods that can be integrated with AD structure. This may require the installation of a Radius server depending on the specific product.



This solution should be implemented company wide to simplify administration and management. If necessary however this could become a staged deployment with the remote sites being rolled out as Carrier X is installed.

### Distributed File System

This design will accommodate ABC Corporation’s DFS initiative. This traffic will be routed on the primary Qwest network. The bandwidth will have to be sized to accommodate the additional traffic at the locations that are involved in this replication.

Current research indicates that this traffic uses typical Windows NetBIOS ports. This will negate the ability to treat this traffic with QOS or create special routing rules.

### NETWORK REDUNDANCY SUMMARY

Traffic Description	Primary Network Route	COS Queue	Secondary Network Route	COS Queue
<b>Remotes</b>				
Siemens VoIP	Qwest MPLS	1	Carrier X MPLS	1
Integrated VoIP (if elected)	Carrier X MPLS	1	POTS back-up	NA
Video	Carrier X MPLS	2	Not permitted by company policy	2
Preferred data applications (ERP, etc.)	Qwest MPLS	3	Carrier X MPLS	3
Normal business applications including DFS	Qwest MPLS	4	Carrier X MPLS	4



Internet	Carrier X MPLS	4	Pennsylvania DIA via Qwest MPLS	4
<b>Pennsylvania</b>				
Siemens VoIP	NA		NA	
<b>Traffic Description</b>	<b>Primary Network Route</b>	<b>COS Queue</b>	<b>Secondary Network Route</b>	<b>COS Queue</b>
Integrated VoIP	NA		NA	
Video	Carrier X MPLS	2	Not permitted by company policy	2
Preferred data apps (ERP, etc.)	Qwest MPLS	3	Carrier X MPLS	3
Normal business applications, including DFS	Qwest MPLS	4	Carrier X MPLS	4
Internet	Qwest local DIA	NA	Carrier X local DIA	4
Double-Take	Qwest ATM	NA	Qwest MPLS	2
<b>North Carolina</b>				
Siemens VoIP	NA		NA	
Integrated VoIP (if elected)	Carrier X MPLS	1	POTS back-up	NA
Video	Carrier X MPLS	2	Not permitted by company policy)	2
Preferred data applications (ERP, etc.)	Qwest MPLS	3	Carrier X MPLS	3



Best effort (Normal business applications)	Qwest MPLS	4	Carrier X MPLS	4
--	------------	---	----------------	---



Internet	Qwest local DIA	NA	Carrier X local DIA	4
Double-Take	Qwest ATM Port	NA	Qwest MPLS	2
<b>New York</b>				
Siemens VoIP	NA		NA	
Integrated VoIP (if elected)	NA		NA	
<b>Traffic Description</b>	<b>Primary Network Route</b>	<b>COS Queue</b>	<b>Secondary Network Route</b>	<b>COS Queue</b>
Video	Carrier X MPLS	2	Qwest (or not permitted by company policy)	2
Preferred data applications (ERP, etc.)	Qwest MPLS	3	Carrier X MPLS	3
Best effort (Normal business applications)	Qwest MPLS	4	Carrier X MPLS	4
Internet	Qwest local DIA	NA	Carrier X local DIA	4

**ADDITIONAL CONSIDERATIONS**

1. The network configuration can be simplified and made more efficient by separating the Qwest internet port from the enhanced DS3 ports in Pennsylvania, NY, and North Carolina. This current configuration creates routing complexities with the Firewall being physically behind the WAN connection.



Crystal recommends that ABC Corporation consider separating the DIA port from the enhanced DS3 port. The enhanced DS3 port could be used for the primary WAN and a separate PVC for the Data replication network.(Carrier Y)

2. The continued requirement for ISA should be explored. The proposed configuration will not require it, however there may be other reasons for continued use of this that are not evident at this point in time.
3. Once a network concept and design are approved a thorough examination of current and future bandwidth utilization should be conducted to properly size both networks and create desired COS/QOS plans.

#### ATTACHMENTS

1. Bandwidth Analysis



N:\CUSTOMERS M -  
Z\STV Inc\STV Inc. - 4

2. Network Design Document (Visio required)



N:\CUSTOMERS M -  
Z\STV Inc\STV Inc. - 1