



**CONNECTIONS**  
A DIVISION OF JKM CONSULTING, INC.

*Project BEAR (Broadband for East Alabama Region)*

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# REQUEST FOR PROPOSAL

## Optical Networking Equipment



**BROADBANDUSA**  
CONNECTING AMERICA'S COMMUNITIES

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## I. INTRODUCTION

### ABOUT THE PROJECT

In the rural, economically distressed east-central Alabama region that includes Calhoun, Talladega, Clay, and Randolph Counties, many valuable community organizations rely on slower, copper-based service for their Internet access, and some have no broadband service at all. JKM Consulting's Project BEAR proposes to deploy a 176-mile fiber network that includes 88 miles of new fiber to provide high-speed, affordable broadband services and directly connect more than 40 community anchor institutions in the four-county region. The project also plans to deploy six wireless access points to facilitate last-mile consumer service in isolated rural areas like Fort McClellan in Anniston, Alabama, and the Talladega National Forest. The project intends to bring fiber to local Public Safety Access Points and other emergency agencies, and strengthen healthcare delivery by connecting rural hospitals such as Clay County and Wedowee Hospital to urban hospitals, enabling telemedicine services such as participation in the Alabama Pediatric Network. The project also expects to enhance local educational opportunities by connecting six community centers, increasing the quality of local after-school and homework programs.

*Project BEAR also proposes to:*

- Connect as many as 44 community anchor institutions with speeds between 100 Mbps and 1 Gbps, including 11 K-12 public schools, nine public safety entities, six libraries, two community colleges and three other institutes of higher learning, five healthcare facilities, and one government building.
- Facilitate more affordable and accessible broadband service for up to 52,800 households and 3,700 businesses by enabling local Internet service providers to utilize the project's open network.
- Connect two major military installations in Alabama, one of which is now decommissioned and functioning as Small Business Administration-designated Historically Underutilized Business HUBZone.
- Interconnect in Anniston and Delta with the BTOP-funded Appalachian Valley Fiber Network project.

### ORGANIZATION'S HISTORY

JKM Consulting, a woman-owned business, has been managing the deployment of advanced broadband networks since 1998, performing network process and project management services to fiber service providers throughout the southern United States. JKM's technology division, M<sup>2</sup> Connections, seeks to promote the growth of businesses, educational institutions, and nonprofit organizations with a focus on enhancements through technology.

## II. ADMINISTRATIVE

### 1. CONTACT

Any questions concerning technical specifications or proposal terms must be directed to:

<b>Name</b>	Joey Boyd
<b>Address</b>	(USPS) PO Box 3250 Oxford, AL 36203 (UPS/FEDEX) 1631 Hamric Drive East Oxford, AL 36203
<b>Phone</b>	256.405.0613
<b>FAX</b>	866.708.3062
<b>Email</b>	jboyd@projectbear.net

### 2. DUE DATES

All proposals are due by 3pm on 11/8/2011. Any proposal received at the designated location after the required date specified for receipt shall be considered late and non-responsive. Any late proposals will not be evaluated for award.

### 3. SCHEDULE

Event	Date
1. RFP Distribution to Vendors	10/12/2011
2. Proposal Due Date	11/8/2011
3. Review of Proposals	11/8 – 11/11
4. Vendor Selection Discussion(s)--	11/14/2011
5. Notice of Intent to Purchase	11/15/2011

### III. PROPOSAL REQUIREMENTS

#### 1. PROPOSAL SUBMISSION

Award resulting from this RFP will be based upon the most responsive Vendor whose offer will be the most beneficial to *M<sup>2</sup> Connections* in terms of cost, functionality, and other factors as specified elsewhere in this RFP.

*M<sup>2</sup> Connections* reserves the right to:

- Reject any or all offers and discontinue this RFP process without obligation or liability to any potential Vendor
- Accept other than the lowest priced offer
- Award on the basis of initial offers received, without discussions or requests for best and final offers.

The Vendor must submit sealed bid proposal by 3pm on 11/8/2011 to address referenced in Administrative section of RFP.

#### 2. TECHNICAL SPECIFICATIONS

1. *M<sup>2</sup> Connections* is looking an optical networking solution. We are considering three basic topographies and request proposals on each:
  - a. 10G Carrier Ethernet Hub and Spoke that utilizes WDM (See Visio Drawing Option 1)
  - b. 10G Carrier Ethernet Hub and Spoke without WDM (See Visio Drawing Option 2)
  - c. 10G Carrier Ethernet Ring (See Visio Drawing Option 3)
2. A bill of material will need to be created to accommodate each option. Each material list should be created on a separate spread sheet. The spread sheets should start with a totals tab. On the totals tab there should be a detailed description of the part, part number, quantities, price per part, line item total, and overall total at the bottom. After the totals tab there needs to be a tab to represent each of the core sites indicated on the network drawings and a customer premises tab to represent all of the edge devises shown as sub sites from the core. The core site tabs will need to contain the bill of materials for each site individually and should be laid out identically to the "totals tab." There needs to be a total for customer site equipment for each sub-site. It is not necessary to create a separate tab for each sub-site.
3. Cell site back haul is a part of our overall project. With this RFP we are requesting quotes for a hardened product to provide back haul for wireless carriers. Only 7 pole mountable hardened/self-contained devices are shown, but approximately 35 will be added to the network in the near future. It is not known at this time if the 35 additional hardened devices will need to be self-contained. This will be determined on a tower to tower basis. Please include the approximated 35 pieces of equipment in each spread sheet on an individual tab and propose them to be hardened, indoor, and

rack mountable. The 7 known devices will need to be listed in the tab for their respective core site. The cell site backhaul equipment will need to meet the Verizon Wireless specifications attached.

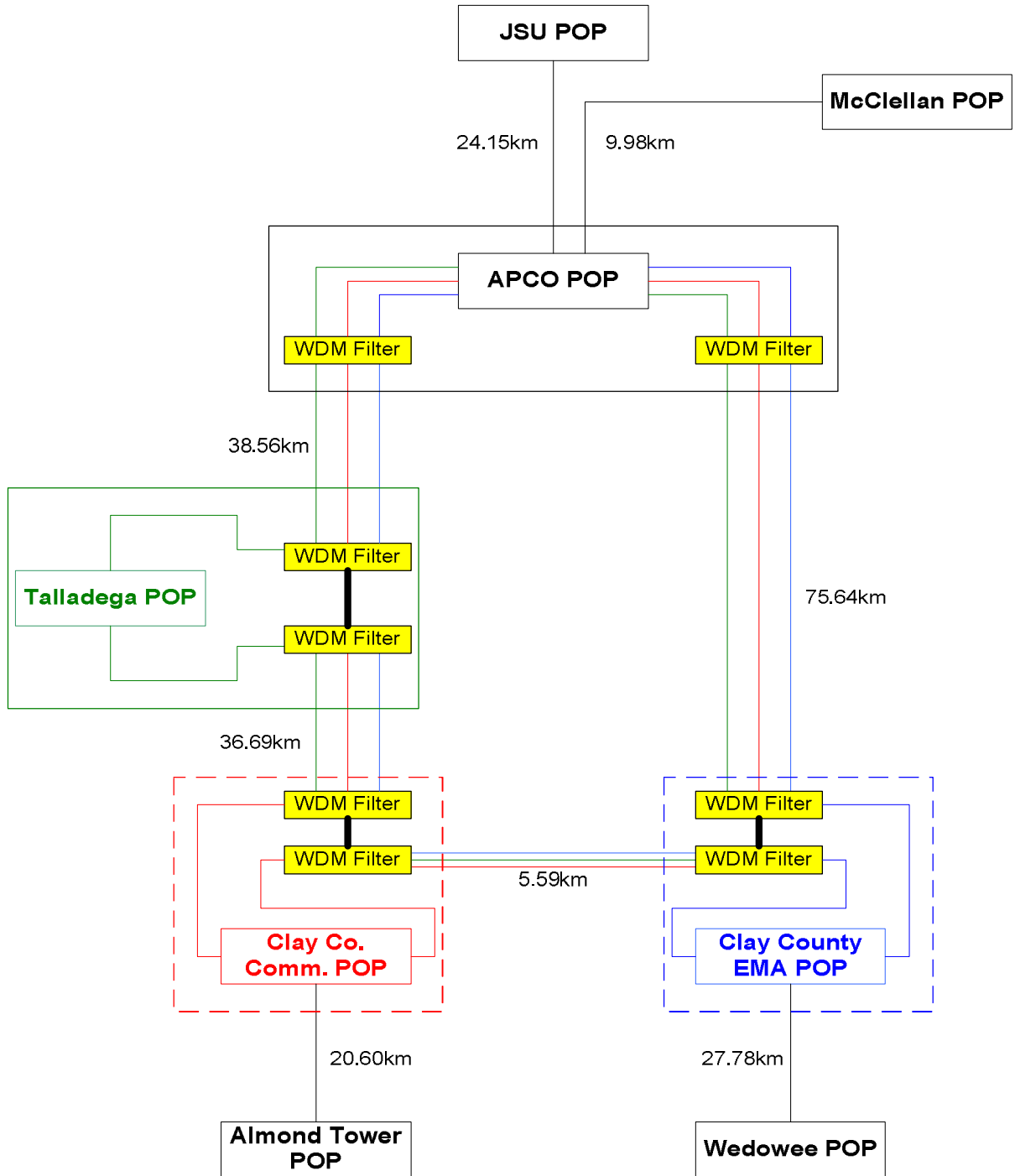
4. Each spread sheet should include a spares tab. A single spare should be included for each type of equipment excluding the chassis. A tunable optic should be listed as a spare for the WDM optics. The spares will need to be included in the totals tab.
5. All cellular backhaul equipment quoted will need to have the ability to transport a T1. This will not be part of the immediate plan, but this may be required in the future. Please include a statement of how this will be achieved using the proposed transport gear.
6. Included in the design is a core router. Please propose the best solution for providing the necessary routing for customer traffic. The primary use of the router will be to route customers to the Internet. The router does not have to be a standalone device. The router can sit at the core of the network and feed directly to the other core sites. Routing should reside on an individual tab and be included in the totals tab.
7. Future software upgrades to the equipment should be proposed on an individual tab if a charge is expected for future software releases. The charge should **NOT** be added to the totals.
8. All network devices proposed must have a way to rate shape and rate limit to 1Mb per second. Each customer sub-site is fed by a 1GigE link. The customer subscription will be less in most cases.
9. Network management software will need to be quoted on the totals tab of each sheet. This software should provide a unified view of the network and provide alarm monitoring. The network management system must have a customer portal as required by Verizon Wireless. A solution must be provided for the customer portal if it is not built into the software.
10. When indicating price on the management software please propose the software only. Individual request will be made for server hardware when and if we decide the hardware is required.
11. A proposal for technical support should be provided. Please describe the technical support system and how long technical support will be included. List technical support in the totals tab should an initial charge be required or list technical support as an option for renewal if complimentary support is include for a short term.
12. All equipment quoted must have a warranty. Please describe the warranty in detail. We are specifically looking for information regarding the length of the warranty, what failures it will cover, and the replacement time/plan for failed modules during the warranty period.
13. The WDM system design will be based on preliminary estimation of required equipment. These estimations will be made with the distances provided in the Technical Drawings. Fiber

characterization will be performed on the individual spans if needed to finalize the system. The characterization will take place after the plant construction is complete. This is estimated to be during the month of June 2012.

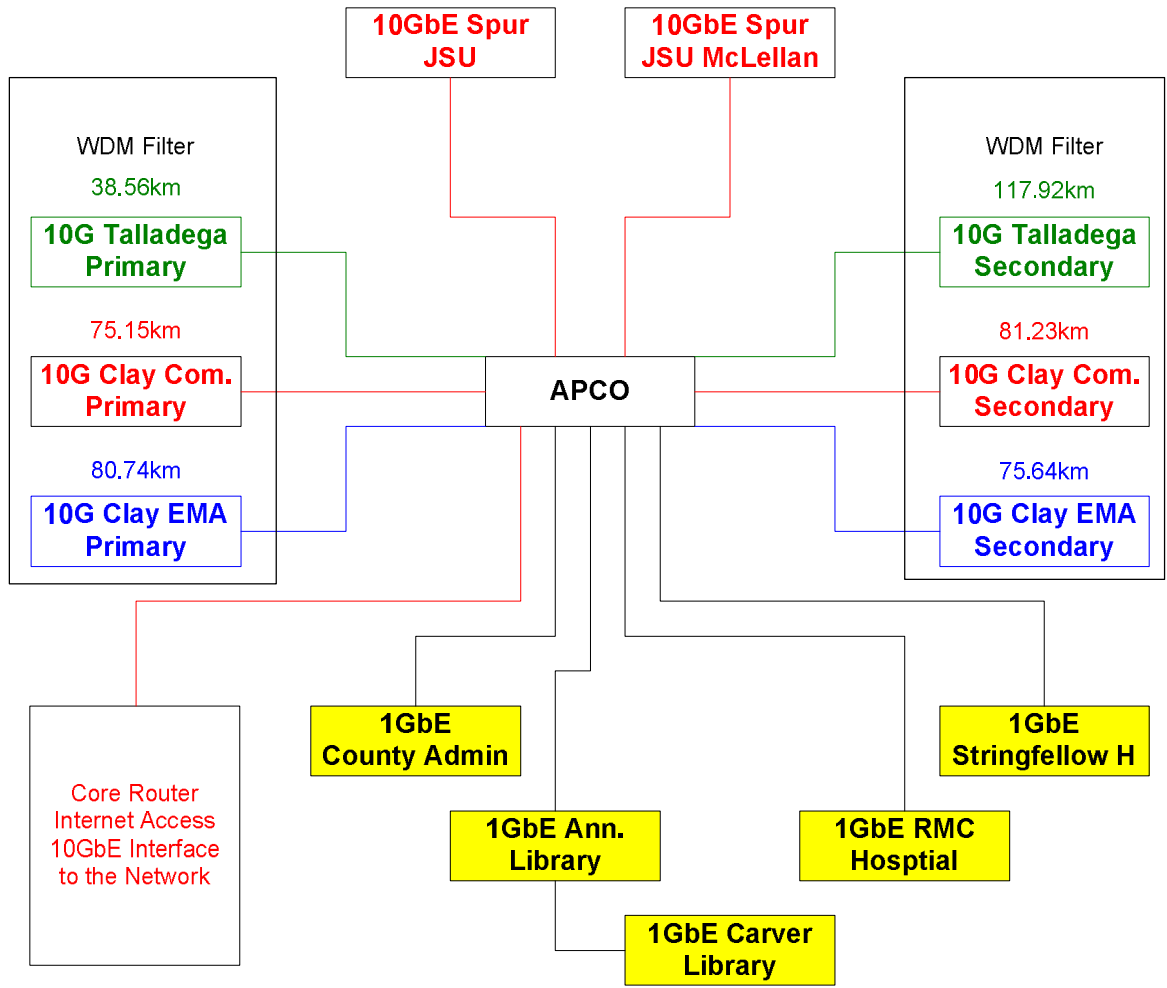
- 14.** Any equipment proposed should be MEF certified.
- 15.** Please provide information regarding the country in which the proposed equipment will be manufactured. It is accepted that 100% of the equipment will not be made in a single country. Instead, indicate the percentage of parts manufactured in the United States and the country in which the final product is assembled. Documentation of RUS certification for "Buy American" will suffice for this request.
- 16.** To be considered in the final deliberations an equipment demo will need to be performed with the Engineering Project Manager prior to the deadline for responses.

### 3. TECHNICAL DRAWINGS

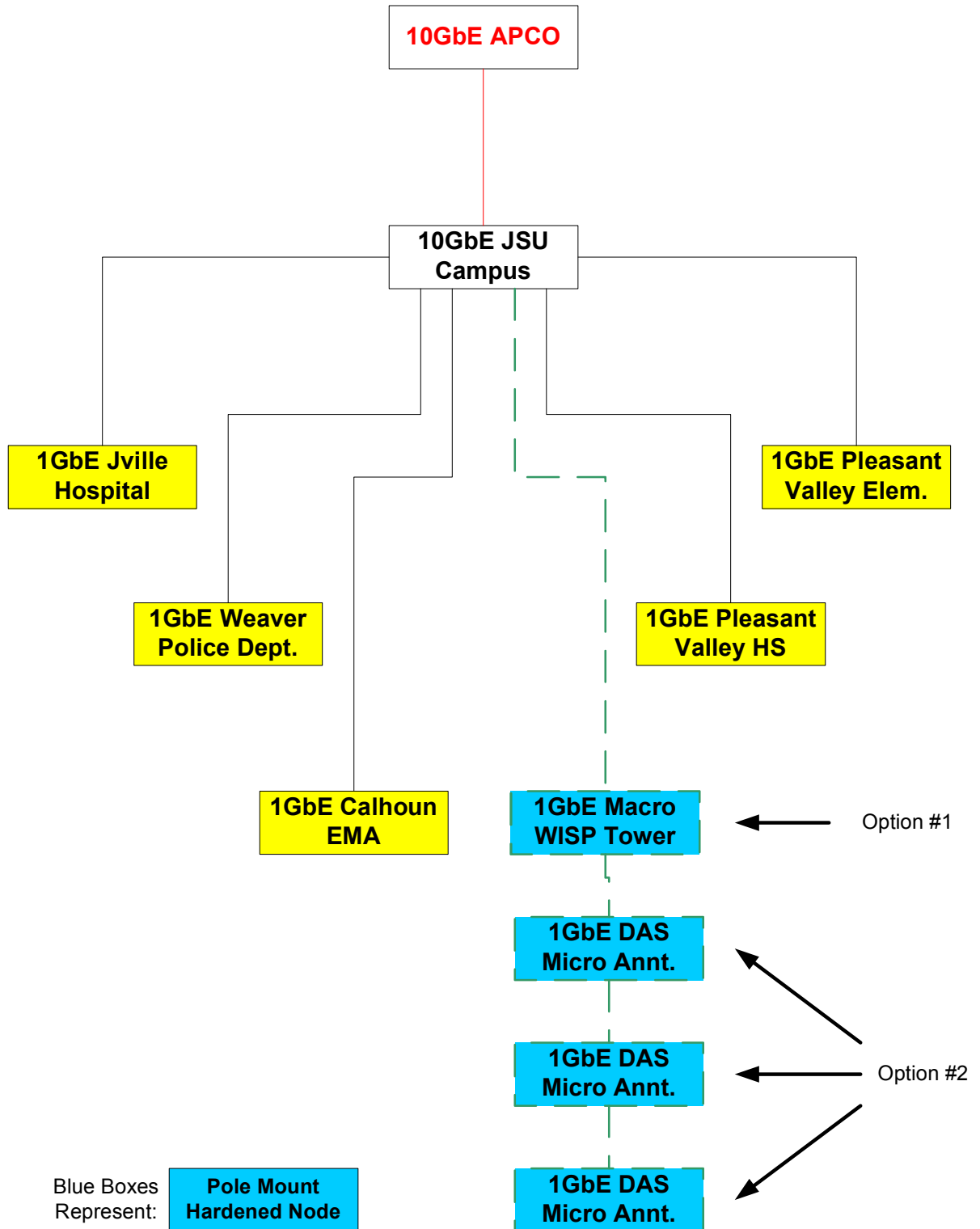
- Topology Option 1  
Network Overview:



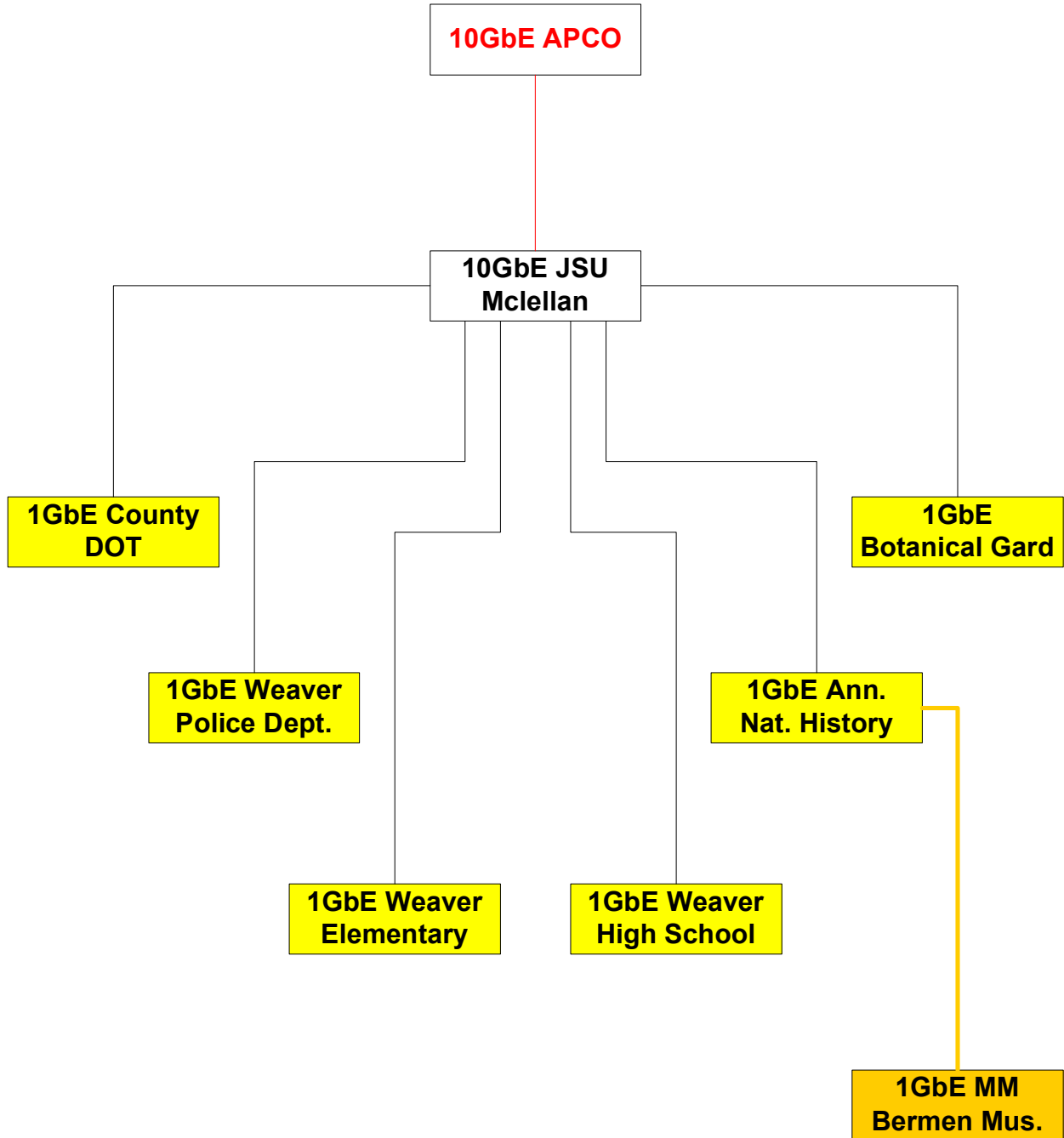
- **Topology Option 1**  
Primary Hub Site APCO:



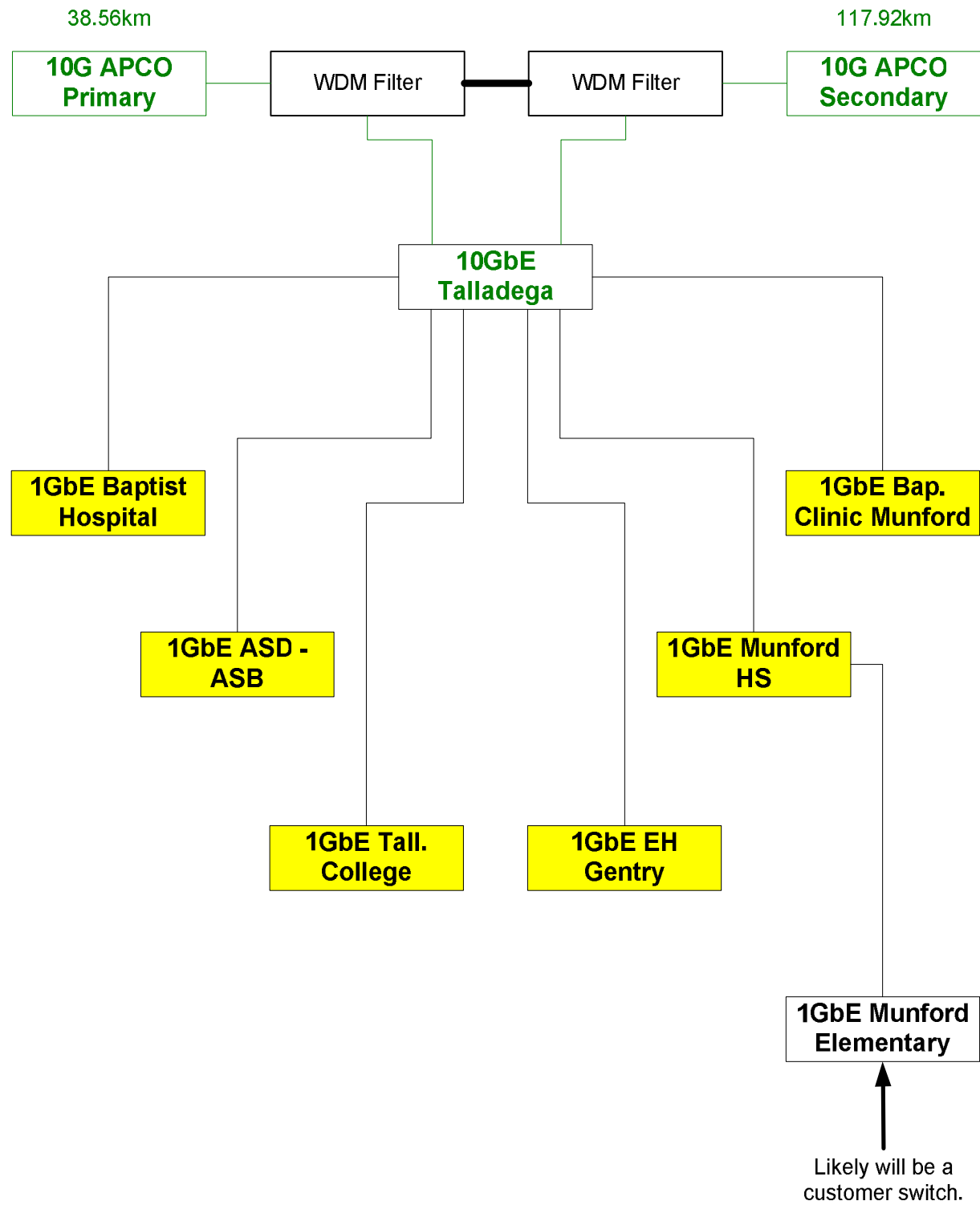
- Topology Option 1  
Core Site JSU (Spur from APCO):



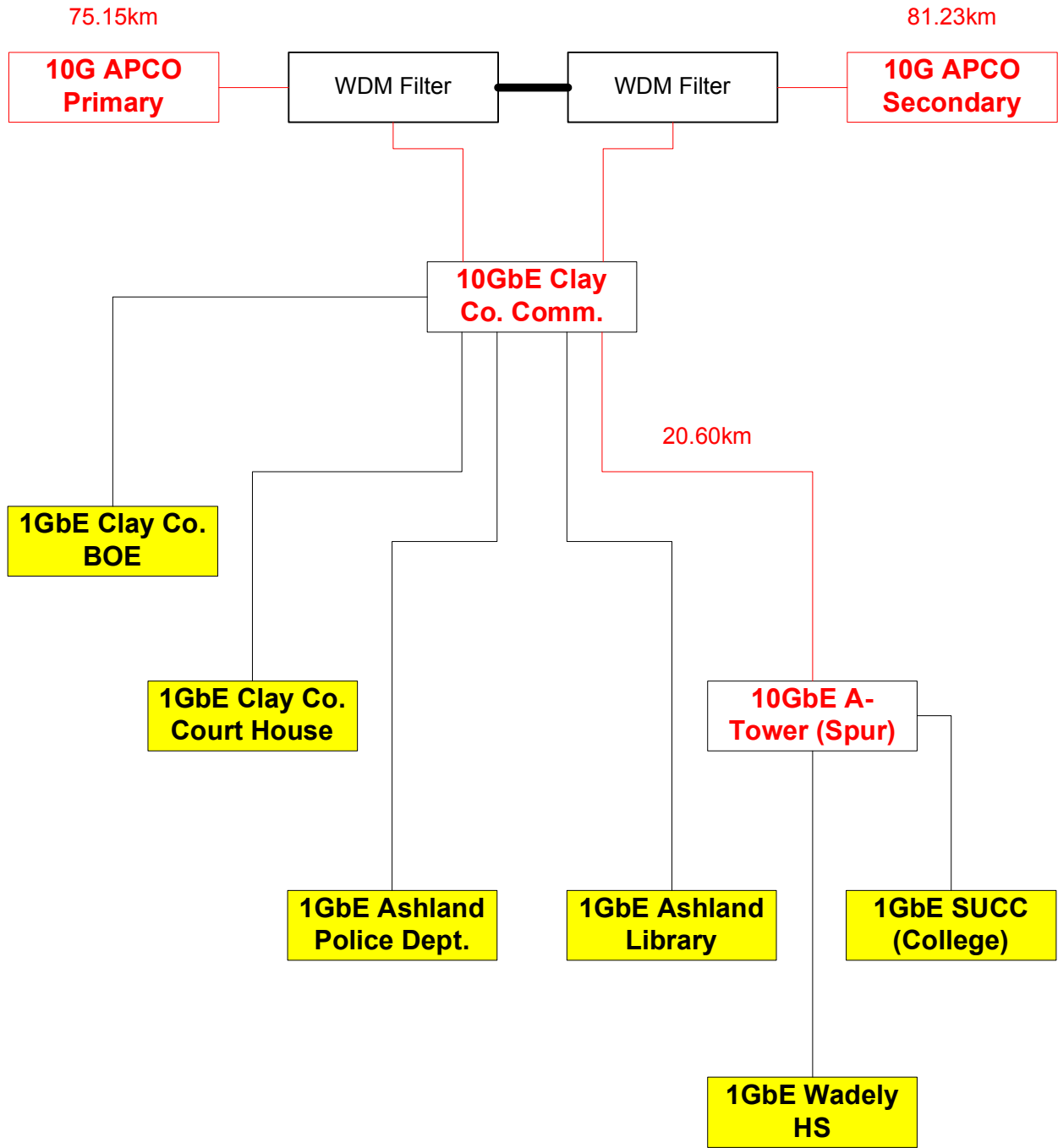
- **Topology Option 1**  
Core Site JSU McClellan (Spur from APCO):



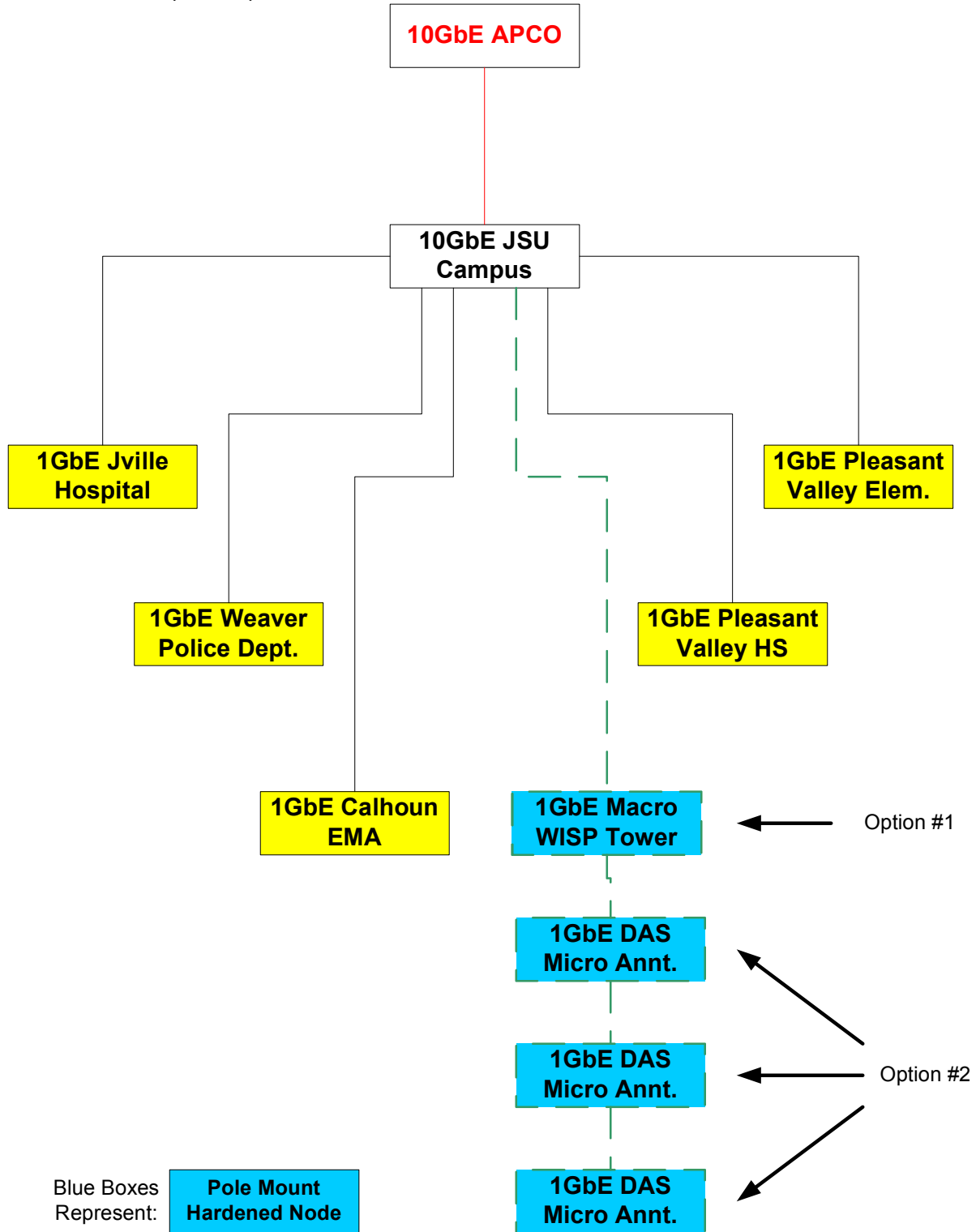
- Topology Option 1  
Core Site Talladega:



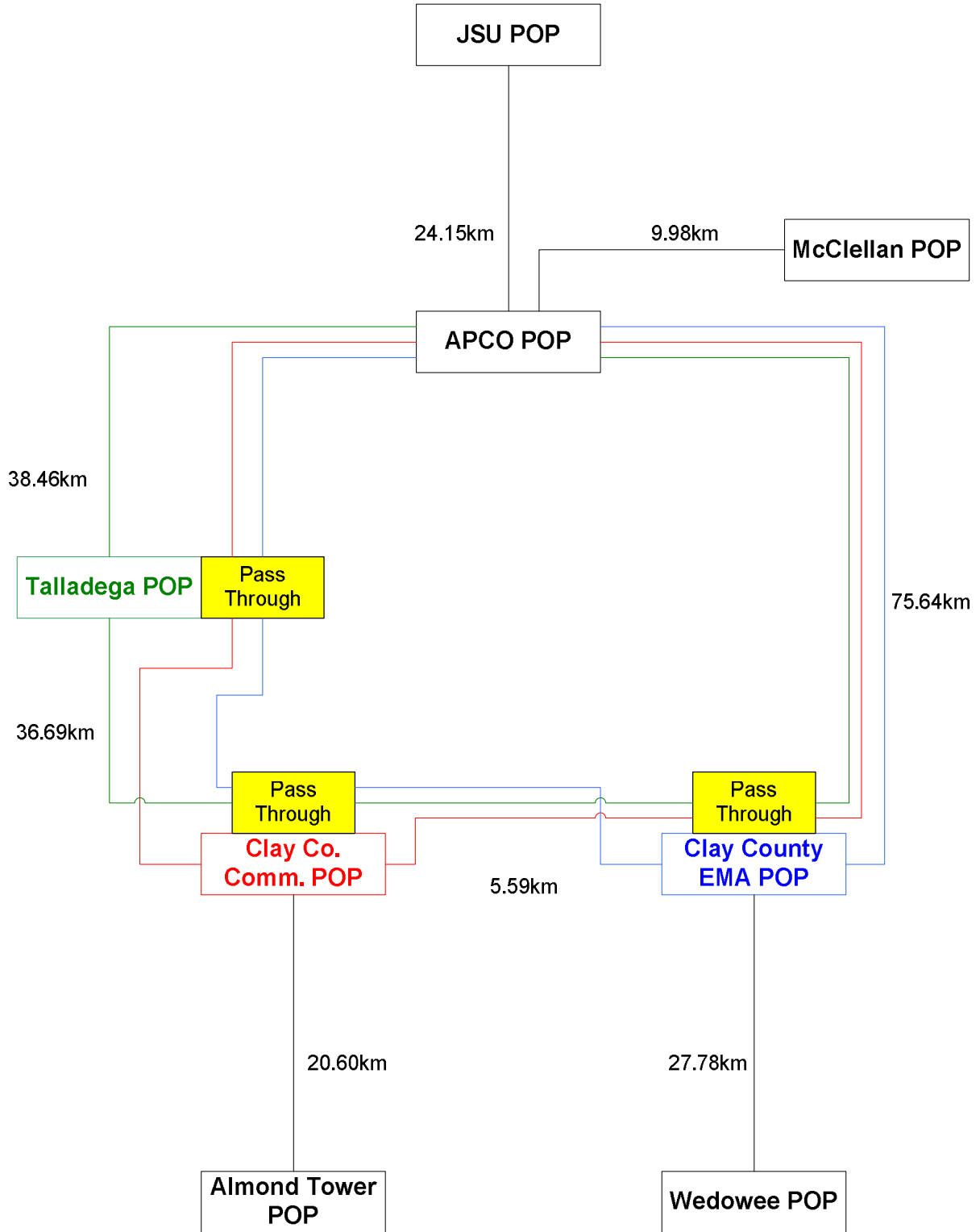
- **Topology Option 1**  
Core Site Clay County Commission:



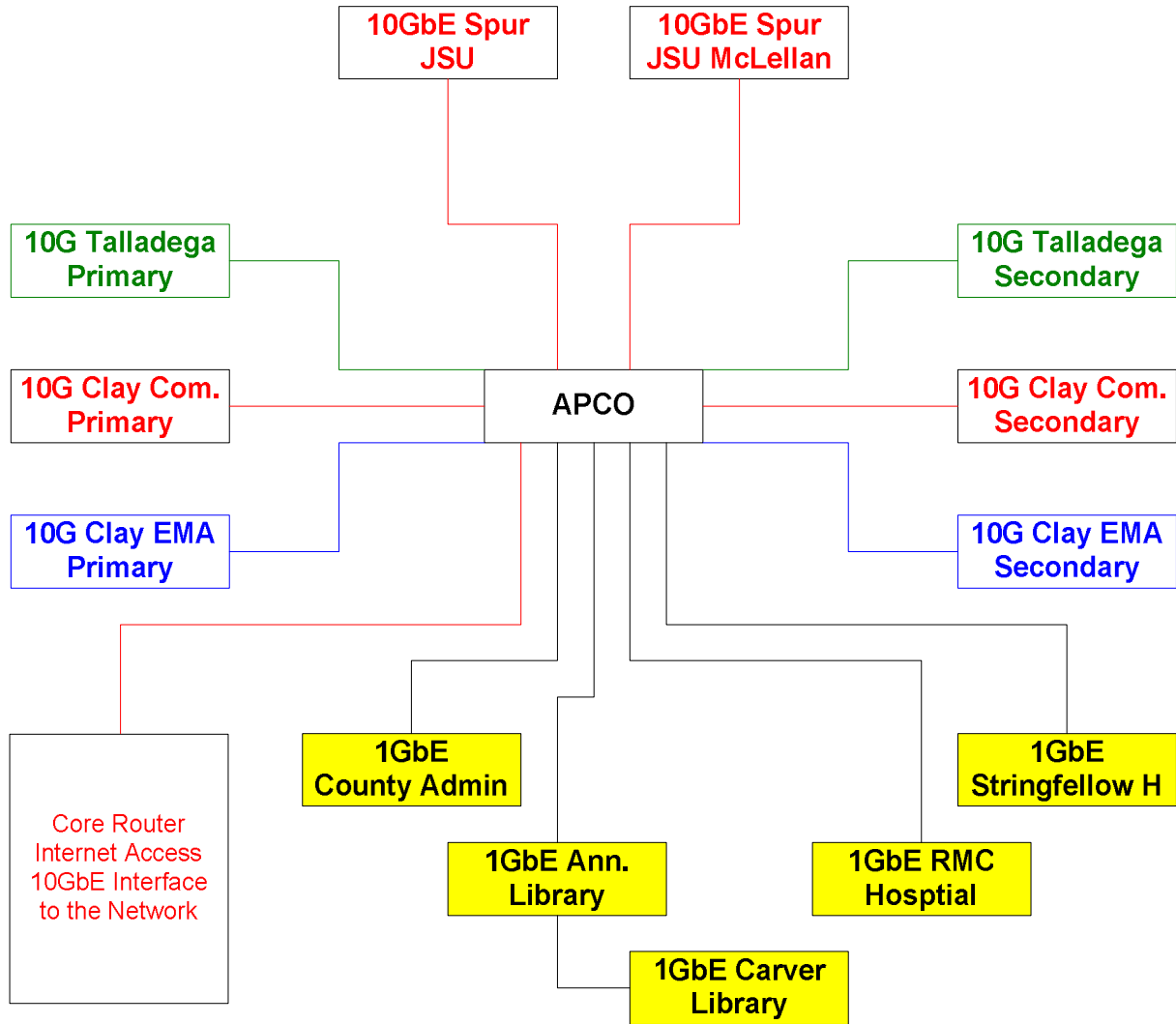
- Topology Option 1  
Core Site Clay County EMA:



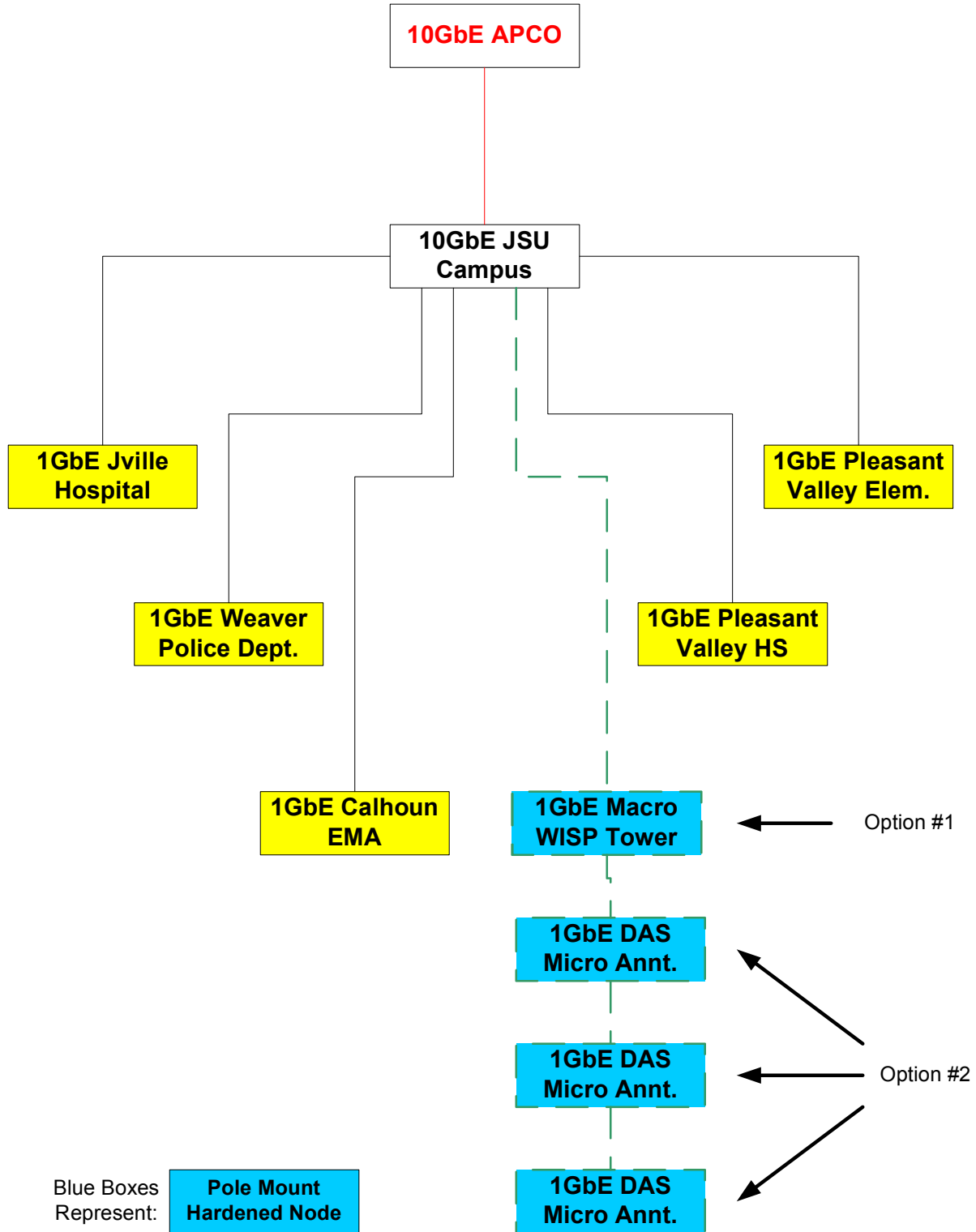
- **Topology Option 2**  
Network Overview:



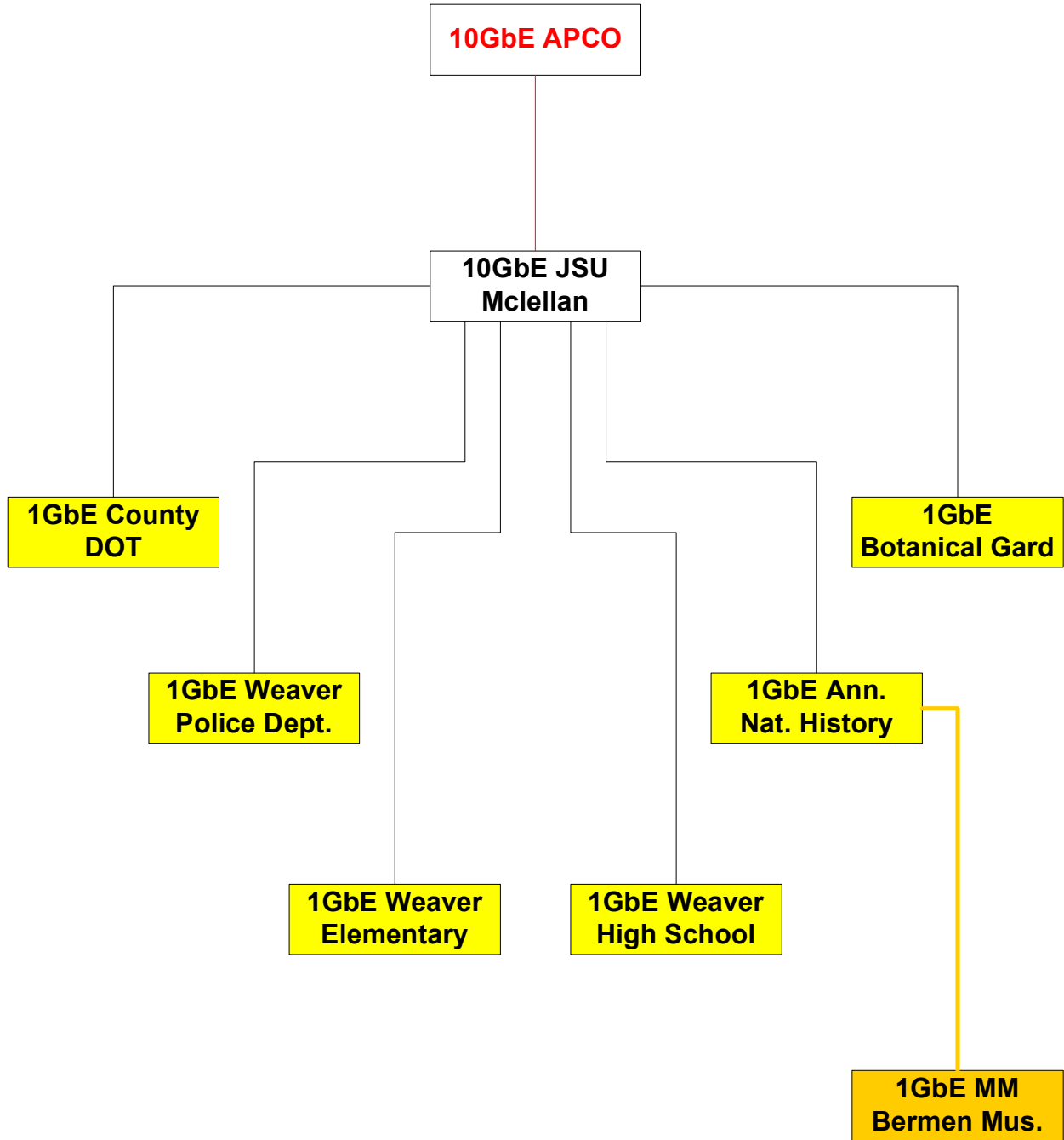
- Topology Option 2  
Primary Hub Site APCO:



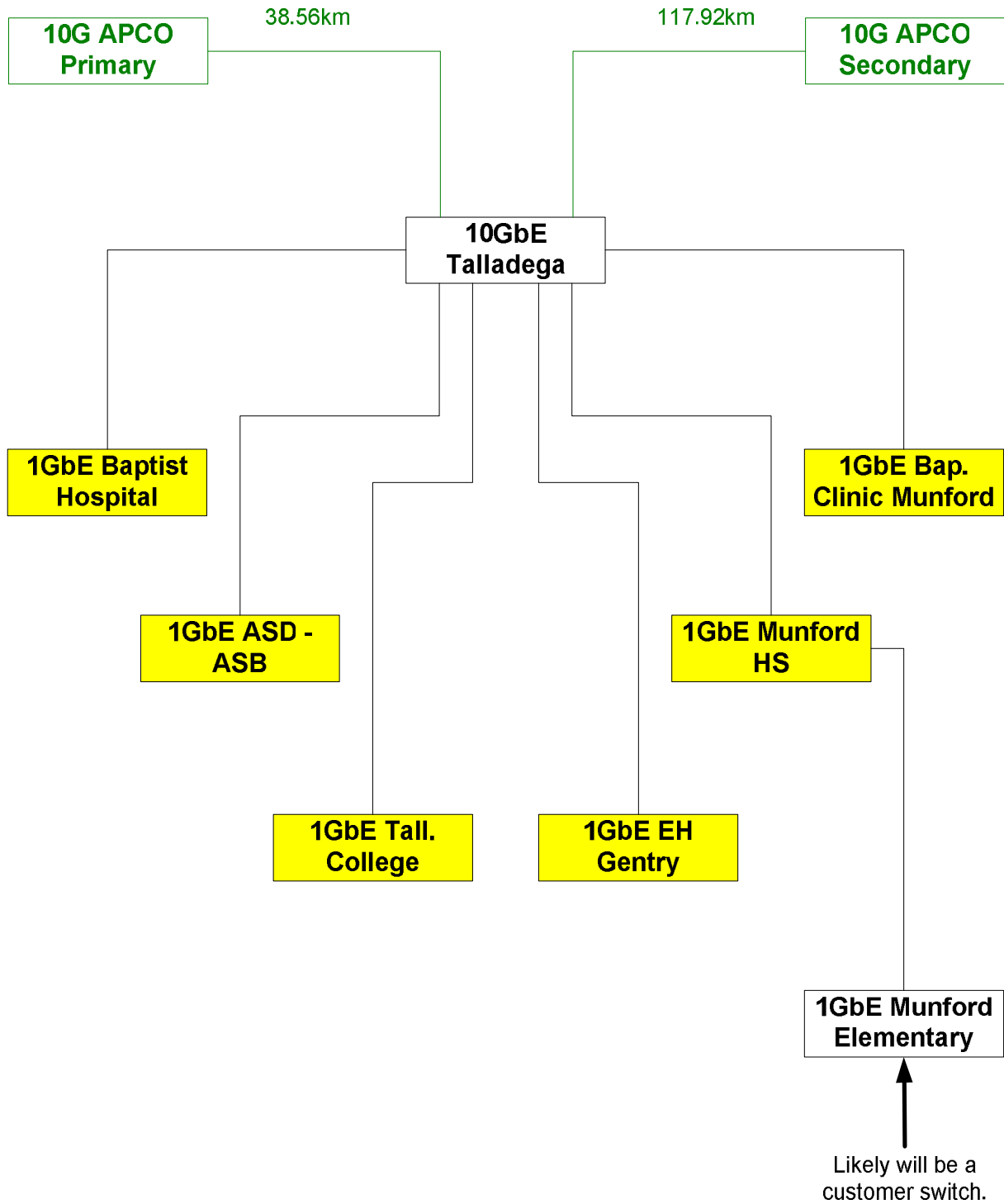
- Topology Option 2  
Core Site JSU:



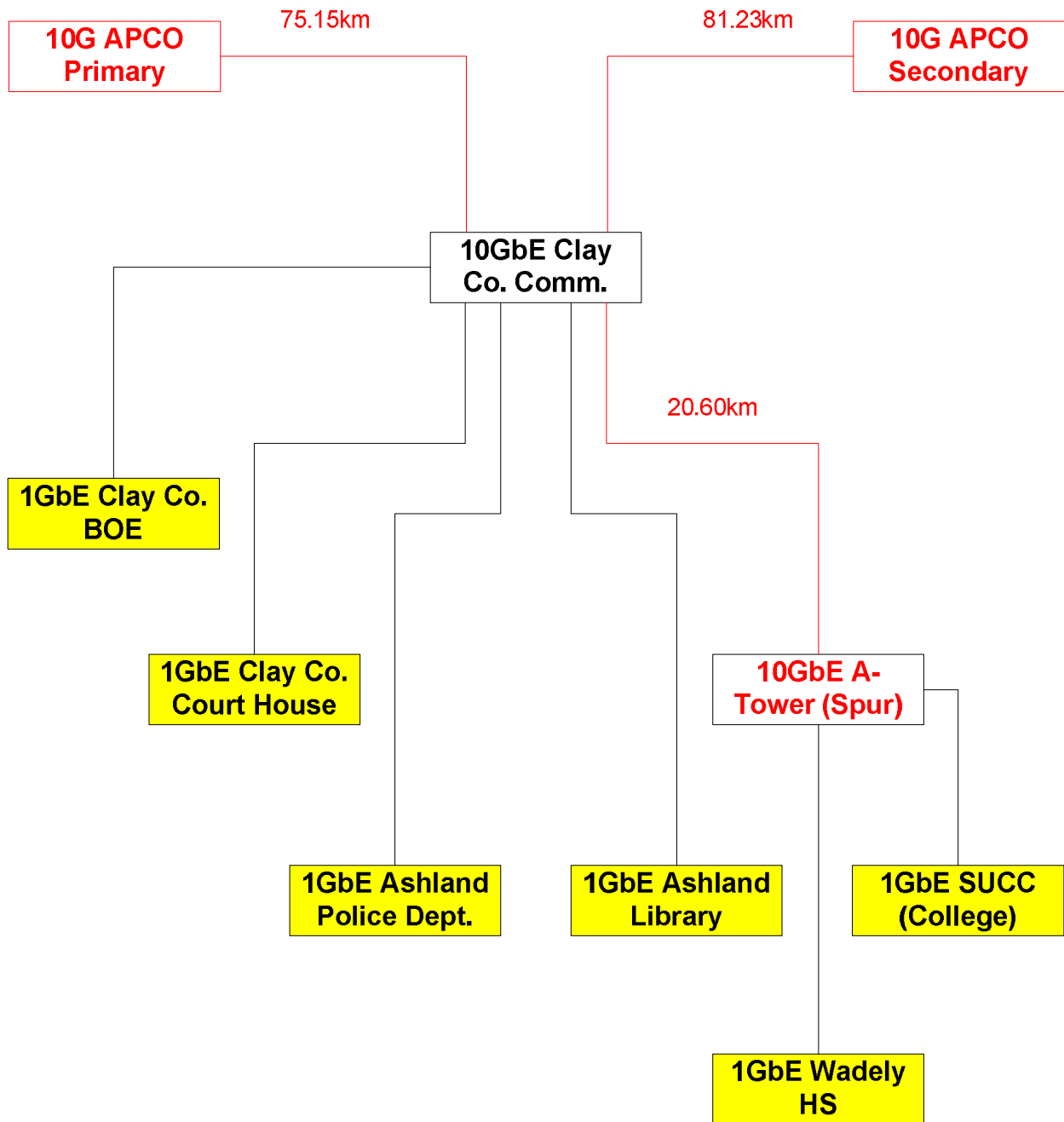
- Topology Option 2  
Core Site JSU McClellan:



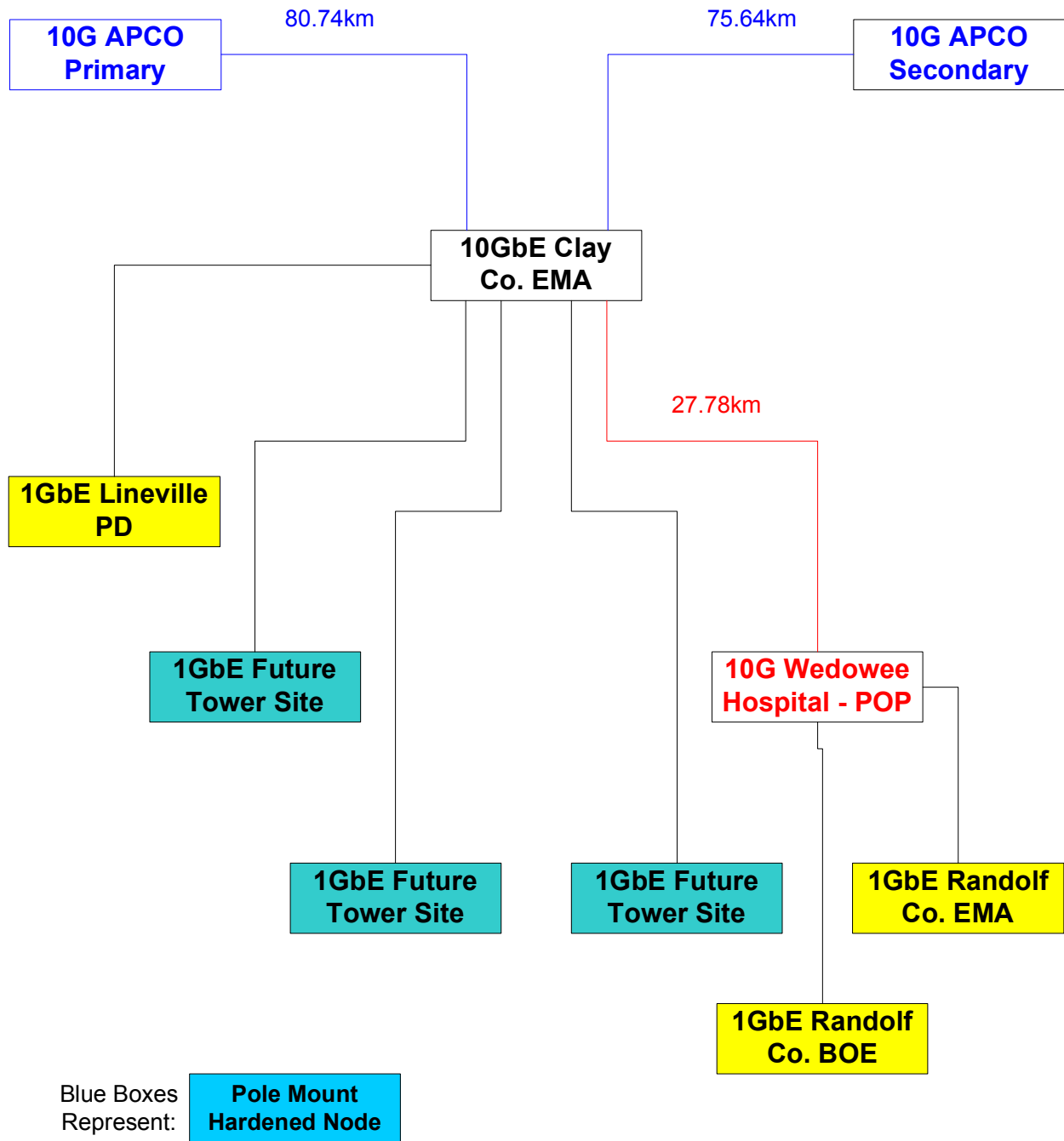
- Topology Option 2  
Core Site Talladega:



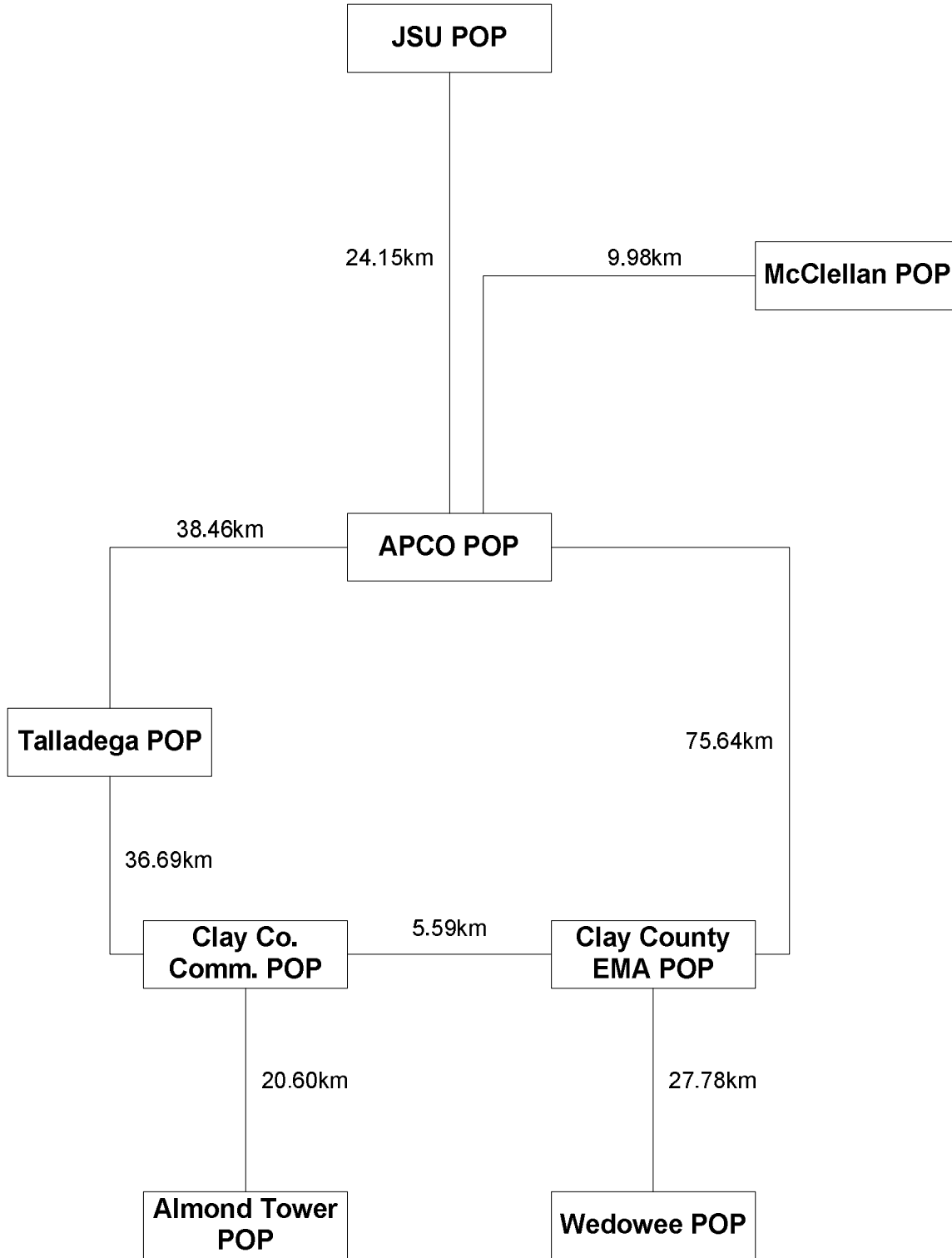
- Topology Option 2  
Core Site Clay County Commission:



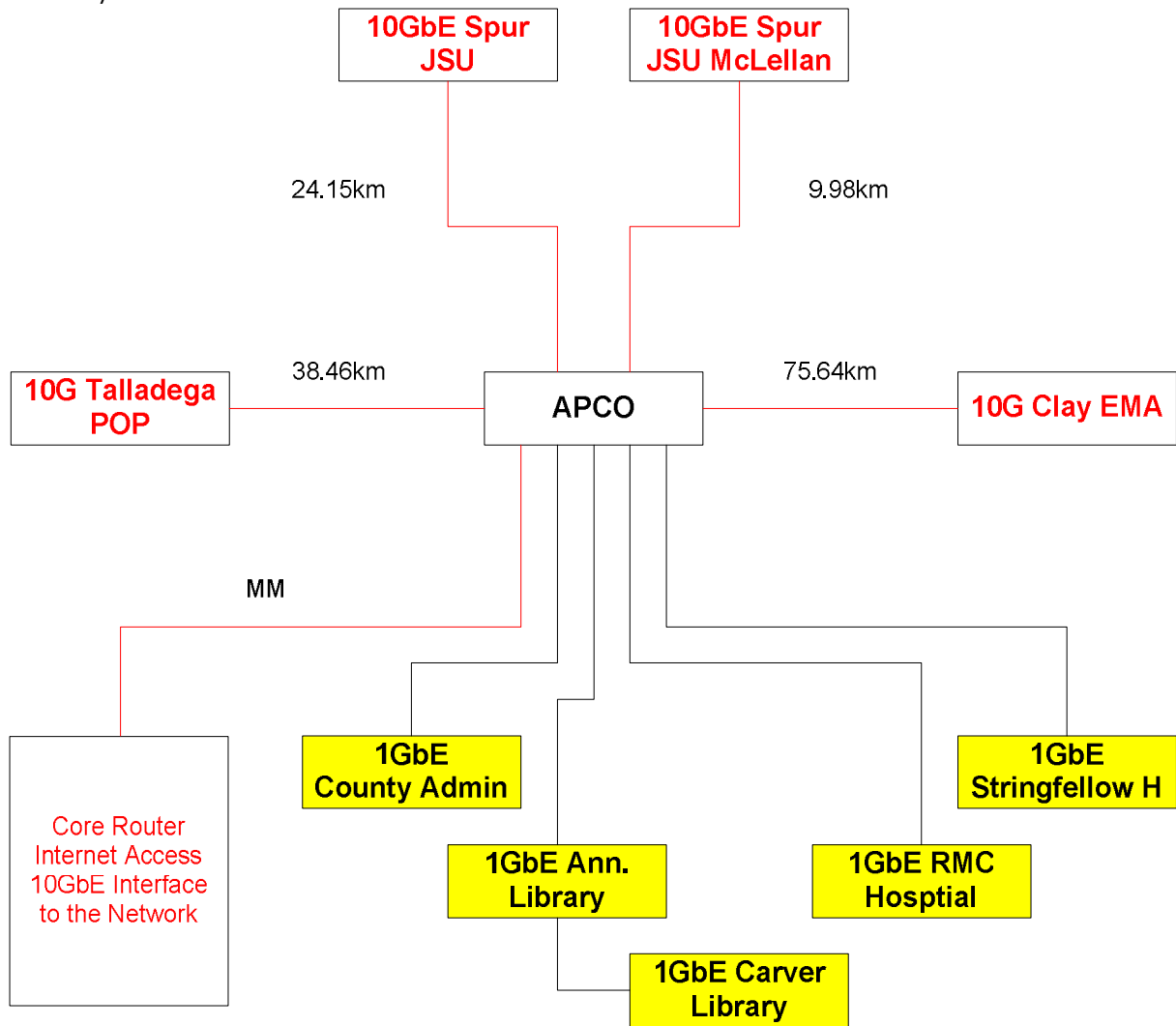
- Topology Option 2  
Core Site Clay County EMA:



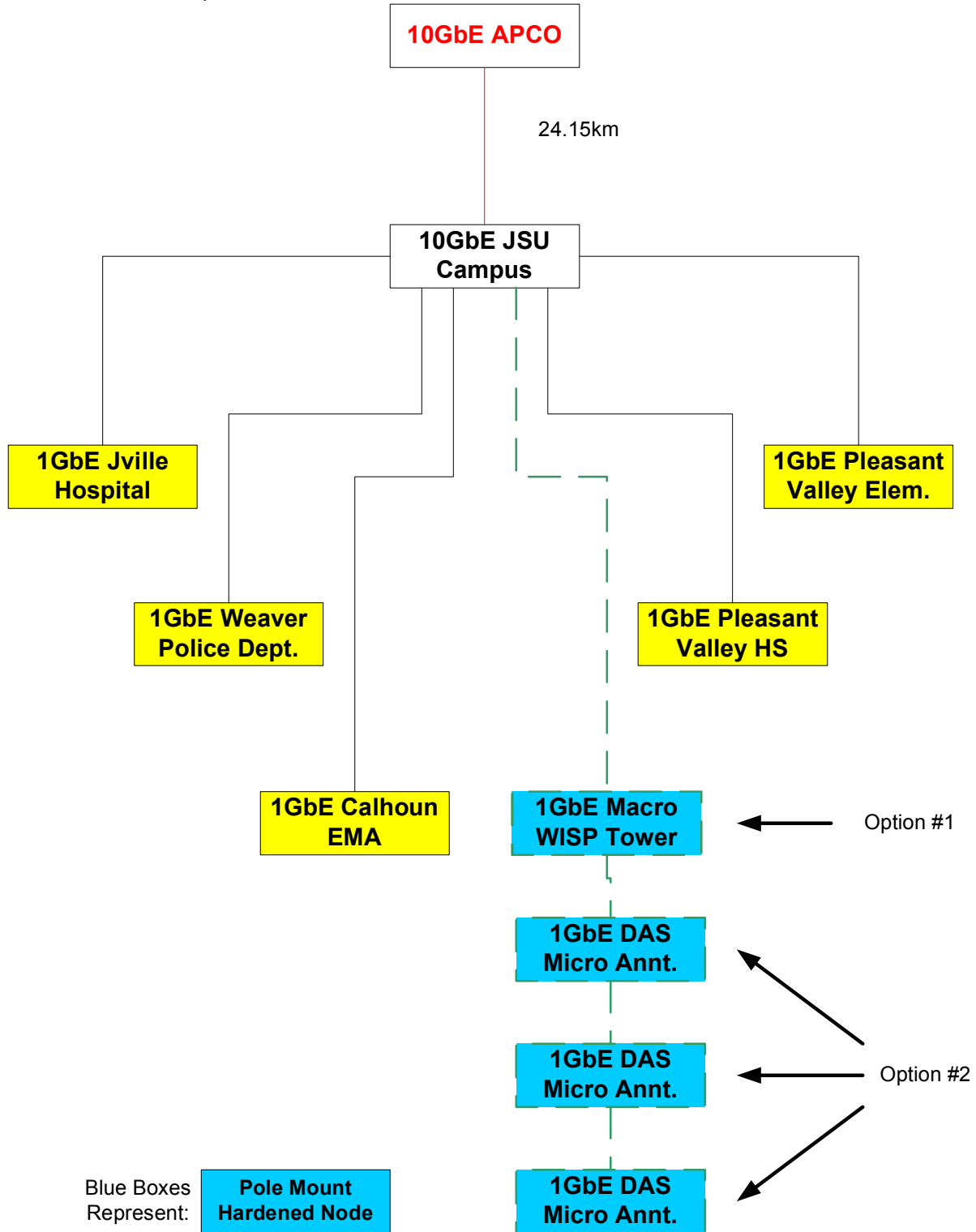
- Topology Option 3  
Network Overview:



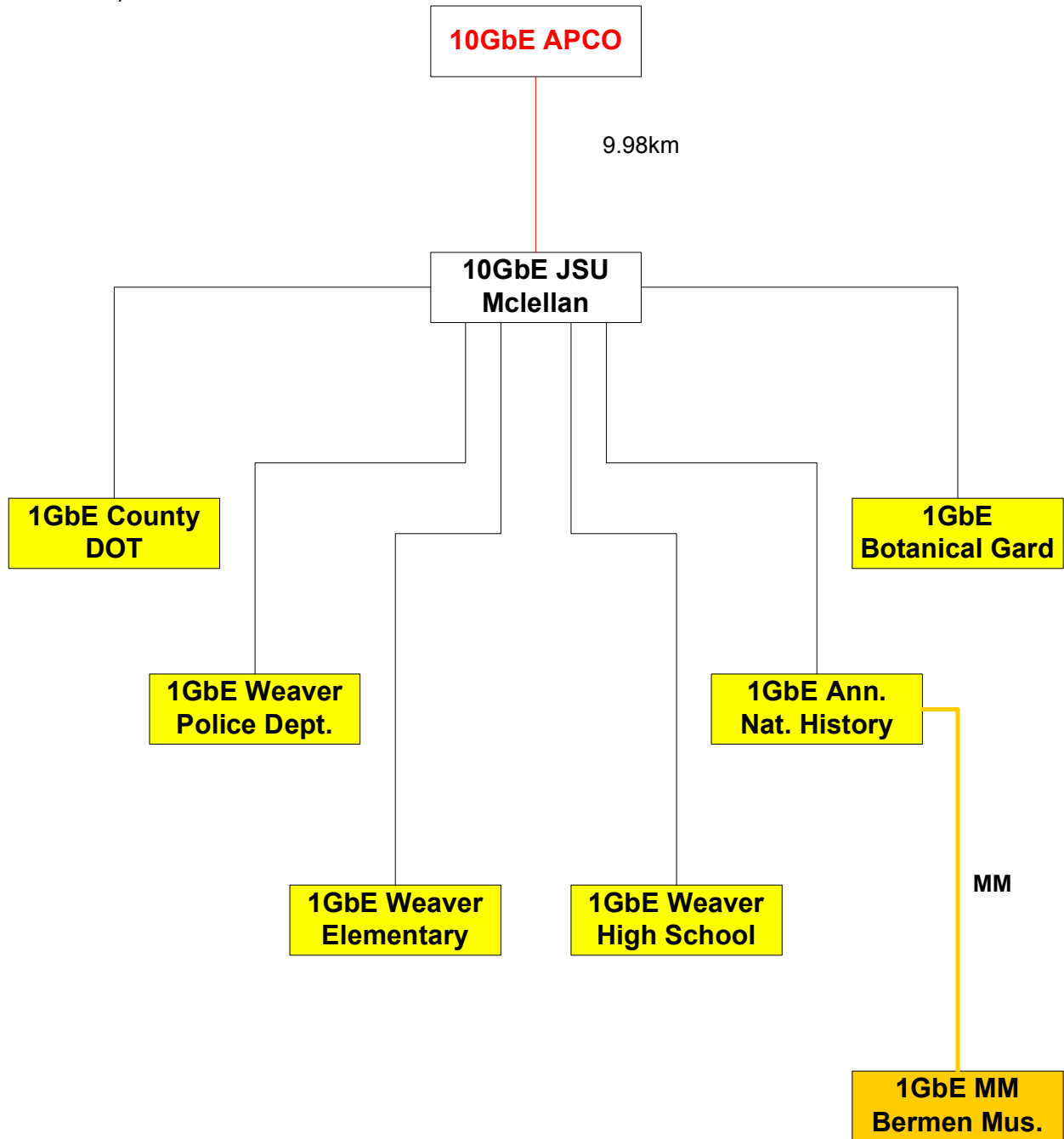
- **Topology Option 3**  
Primary Hub APCO:



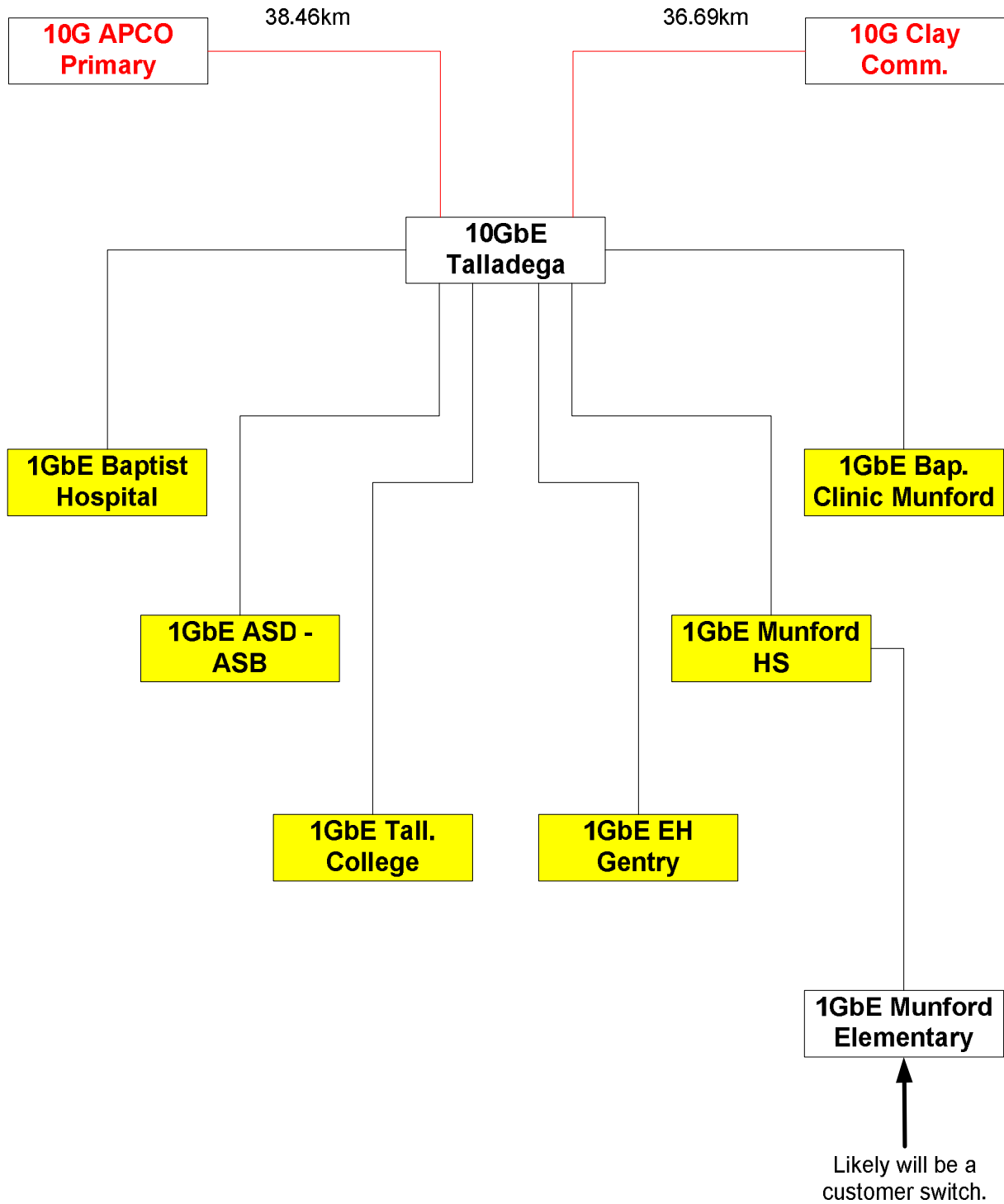
- Topology Option 3  
Core Site JSU (Spur from APCO):



- Topology Option 3  
Primary Site JSU McClellan:

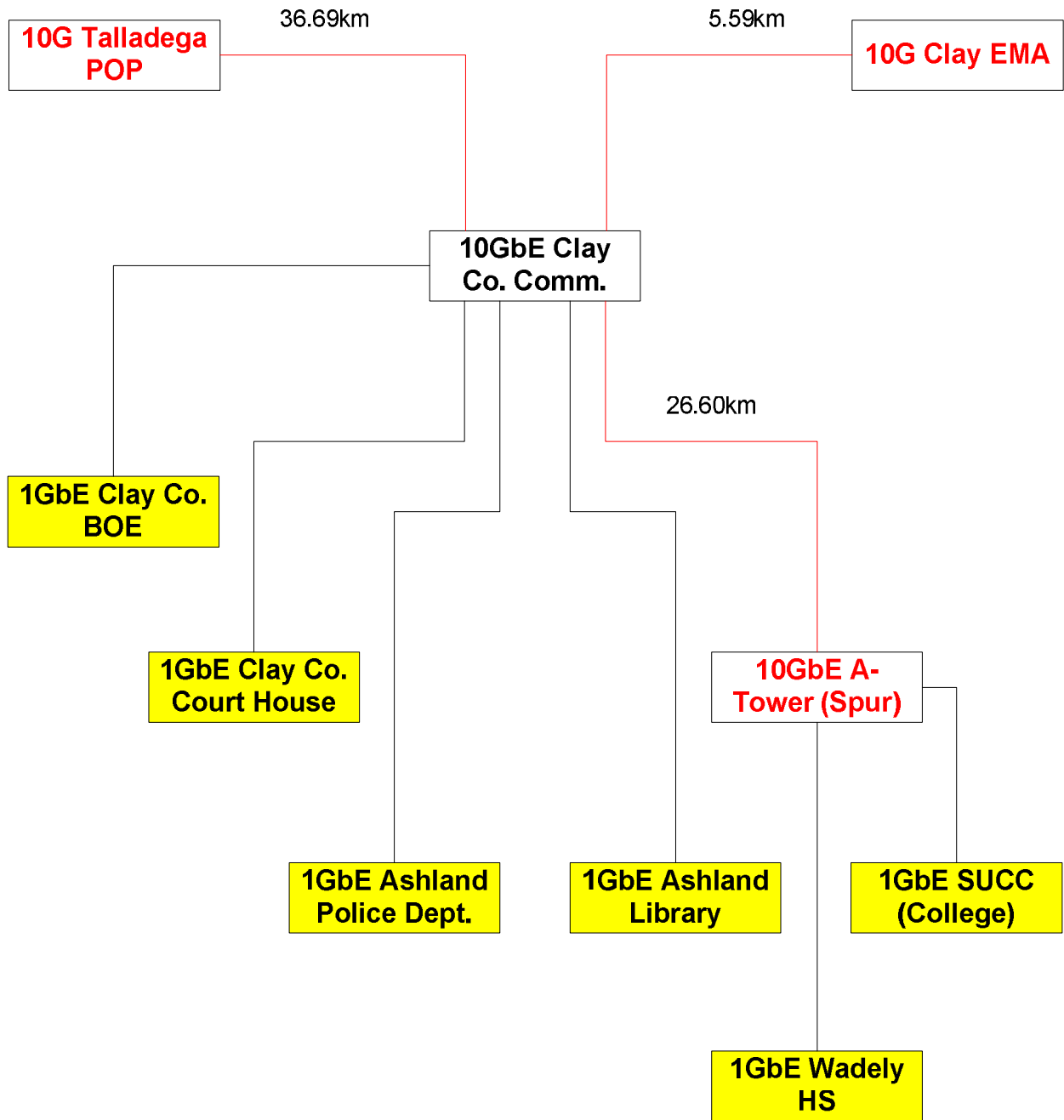


- Topology Option 3  
Core Site Talladega:



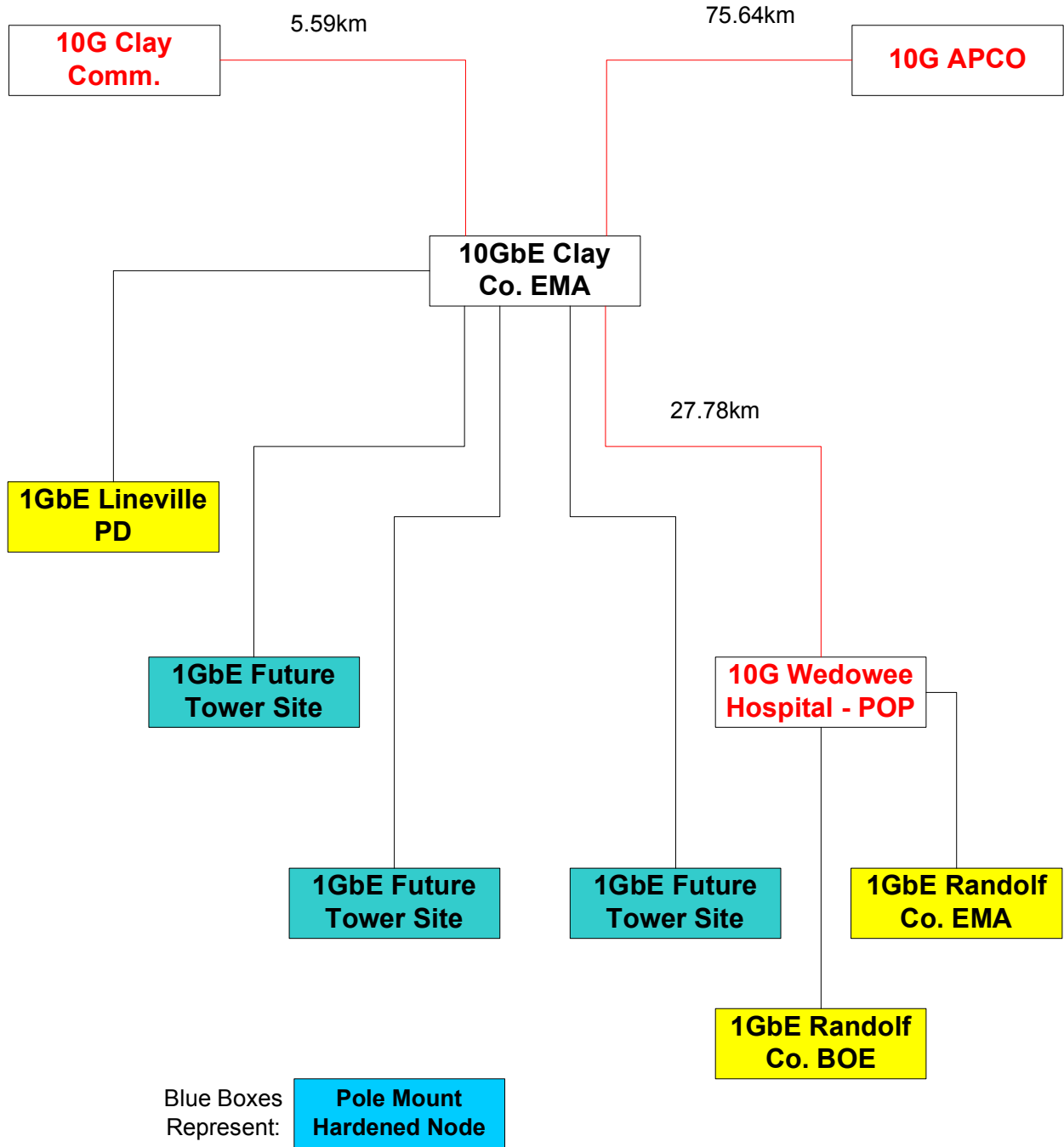
**Topology Option 3:**

Core Site Clay County Commission:



**Topology Option 3:**

Core Site Clay County EMA:



## **IV. DETAILED RESPONSE DETAILS**

### **1. SUMMARY**

Present a high-level synopsis of the Vendor's responses to the RFP. The Summary should be a brief overview of product, pricing and delivery.

### **2. DETAILED AND ITEMIZED PRICING**

Present a detailed and itemized pricing of equipment and/or material listed in the Technical Specifications section of RFP.

### **3. DETAILED AND ITEMIZED DELIVERY DATES**

Present a detailed and itemized schedule of delivery for all equipment and/or material listed in the Technical Specification section of RFP.

### **4. COMPANY OVERVIEW**

- Official registered name (Corporate, D.B.A., Partnership, etc.), address, main telephone number, toll-free numbers, and fax numbers.
- Key contact name, title, address (if different from above address), direct telephone and fax numbers.
- Person authorized to contractually bind the organization for any agreement against this RFP.
- Brief history, including year established and past performance history in relation to ordering, delivery, problem solving and meeting proposal needs.

## V. EVALUATION FACTORS

### 1. CRITERIA

Any award to be made in accordance to this RFP will be based upon the proposal with appropriate consideration given to technical, cost and management requirements. Evaluation of offers will be based upon the Vendor's responsiveness to the RFP and the total price quoted for all items covered by the RFP. The following elements will be the primary considerations in evaluating all submitted proposals and in the selection of a Vendor:

- Buy American – Section 1605 of the American Recovery and Reinvestment Act that specifies no funds appropriated by the Act may be used for public buildings/works project unless “all iron, steel and manufactured goods uses are produced in the U.S”. Exceptions are allowed for cases where the head of the Federal agency concerned determines adherence would be “inconsistent with the public interest”, where iron/steel/manufactured goods are not produced in the U.S. in sufficient and available quantities, or inclusion of U.S. products would increase overall project cost by 25 percent.
- Product(s) – Must meet specified technical specification requirements
- Cost – Lowest cost and competitive analysis
- Availability – Product(s) must meet anticipated delivery date
- Performance – Past performance history in relation to equipment and/or material ordering, delivery, problem solving and meeting schedule demands.

*M<sup>2</sup> Connections* may, at their discretion and without explanation to the prospective Vendors, at any time choose to discontinue this RFP without obligation to such prospective Vendors.

# APPENDIX 1

Verizon EBH Specifications



# Verizon Wireless Network Architecture Document

Project Name: Ethernet Backhaul (EBH)  
Product Line: Infrastructure and Transport  
Tracking Number: V2.07

This document is releasable to potential suppliers under NDA terms.

These requirements are subject to change by Verizon Wireless.

A Revision History is included at the end of the document.

**This document is divided into three sections:**

- 1. INTERFACE REQUIREMENTS**
- 2. SLA REQUIREMENTS AND SLA MONITORING**
- 3. PROTOCOL REQUIREMENTS**

**Note to Transport Provider: Briefly describe the Transport System you will be using to transport VZW Traffic:**

**Topology Type (SONET, Packet, Hybrid, other):** \_\_\_\_\_

**Interface at the MSC: (SONET or Ethernet):** \_\_\_\_\_

**Short Description:**

ETHERNET SERVICE  
INTERFACE REQUIREMENTS

**All items in this section are Required unless specifically stated otherwise or a written exception is made.**

<p><b>Demarcation</b></p>	<p>Two interface options are available depending on the number of cell sites to be delivered at the MSC:</p> <p>1000BASE (GigE Fiber) 10000BASE (10GE Fiber)</p> <p>Multiple GigE's or 10GE's may be needed if traffic warrants. Minimum two circuits required to allow for protection with either circuit being able to carry the full load.</p> <p>MM or SM fiber will be determined during site engineering. Suggest the use of SFPs for flexibility. If the Ethernet is delivered as a SONET payload, the VZW MSPP will provide the SONET to Ethernet conversion.</p> <p>The links will pass through a VZW owned MSPP (test access) and terminate on two independent Routers (L3).</p>	<p>The following interface will be used at the cell site.</p> <p>Two 1000BASE-SX (GigE Multimode fiber)</p> <p>Initial installations may use only a single interface, It is required that these have the capability to be configured as Link Agg or configured as separate circuits. It is desirable, but not required, to have these feeds from separate cards on the Transport Providers ADM. Suggest the use of SFPs for flexibility.</p> <p>The links shall terminate on a VZW owned Cell Site Router (CSR). In some cases the links shall pass through a VZW owned NID placed between the Transport Provider and the CSR.</p>
<p><b>Site Scaling</b></p>	<p>Ability to support from 1 to multiple wireless switches at a MSC location.</p> <p>Each switching location will typically have one or two wireless switches.</p>	<p>Ability to support from 10 to 1000 cell sites for each wireless switch.</p> <p>Each wireless switch will typically support from 250-500 cell sites.</p>
<p><b>Bandwidth Scaling</b></p>	<p>Ability to scale bandwidth from a single pair of GigE links to 10GigE link pairs or more as 4G equipment is rolled out.</p> <p>Initial deployments likely to be a single pair of 10GigE links or a transition plan to migrate to 10GigE links must be available.</p>	<p>Ability to scale bandwidth from 10Mbps to the full link speed of GigE.</p> <p>Initial deployments are likely to be in the 50-150Mbps range.</p>
<p><b>Primary Power</b></p>	<p>-48VDC, A/B feeds Transport provider to detail current needed, fuse sizes, etc</p>	<p>One of the following will be available depending on what voltage is presently in use at the cell site:</p> <p>+24VDC -48VDC</p> <p>Power available at cell site to be detailed during the engineering phase. Separate A</p>

		<p>and B power feeds for cell site hardware desirable.</p> <p>Battery Plants:          Lucent Cell Sites: usually +24VDC          Nortel Cell Sites: mixed +24VDC/-48VDC          Motorola Cell Sites: usually +24VDC</p>
<b>Back-up Power</b>	8 hr battery plus generator VZW will provide power at the MSC	8 hr battery and typically generator  VZW will provide DC power if located in or attached to the building. Since batteries are considered hazardous material, transport equipment should not contain additional batteries unless coordinated with VZW.
<b>Mounting</b>	Floor or rack space will be provided	Rack space will be provided if inside the building.  If unit is to be attached to the outside of the building, further discussion required.
<b>Environmental (General)</b>	Controlled environment	<ol style="list-style-type: none"> <li>1. If VZW full shelter, controlled environment</li> <li>2. If VZW PCS cabinet, uncontrolled environment</li> <li>3. If attached to outside of the VZW building, semi controlled environment</li> </ol> <p>Note that the unit may have to function in environmental extremes for options 2 and 3.</p>
<b>Temperature Range</b>	-40C (-40F) to +55C (+131F)	-40C (-40F) to +55C (+131F)  This range is required in the event shelter loses power for an extended period of time and the device must restart.
<b>NEBS</b>	NEBS Level 3 Certified	<p>Cell Site: NEBS Level 2 Certified          Hub Site: NEBS Level 3 Certified</p> <p>Certifications per Maint Engr Ntwk Directive 431 modified 2/7/08.</p> <p>Applicable documents:          GR-63-CORE Physical Criteria          GR-1089-CORE Electrical Criteria</p>

<p><b>Interface Isolation</b></p>	<p>Fiber interface into the MSC.</p> <p><b>NO METALLIC MEMBERS OR METALLIC SHEATH CAN BE PRESENT IN THE FIBER CABLE</b></p> <p>The fiber optic cable between the Transport Providers demarc device (mounted in or on the VZW cell site or MSC) and the OSP system must not have metallic members. The cell site or MSC must be electrically isolated from the outside world to prevent transients from entering (or leaving) the cell site or MSC.</p>	<p>Same requirement as MSC</p>
<p><b>Path Diversity</b></p>	<p>There shall be separate East/West fiber paths into the MSC. There shall be no common portions of path between the VZW MSC and the Transport providers Hubs.</p>	<p>There is no requirement for cell site path diversity, i.e. the "lateral" from the cell site to the provider's first hub. However, path diversity is required in the core network of the provider starting from the first hub or node to the hub or node connecting to VZW's MSPP.</p> <p>There shall be no single point of failure for circuits carrying 5 cell sites or more.</p>
<p><b>Hardware Redundancy</b></p>	<p>Hardware redundancy at all levels except at shelf level is required at the MSC and in the transport core.</p>	<p>There shall be no single point of failure for circuits carrying 5 cell sites or more.</p>

**ETHERNET SERVICE  
SLA REQUIREMENTS AND SLA MONITORING**

All items in this section are Required unless specifically stated otherwise or a written exception is made.

<b>CIR</b>	Committed Information Rate	<b>Cell Site:</b>  Support for the following data rates (Mbps) on the GigE link: 10, 20, 30, 50, 100, 150, 200, 300, 500, 1000  Bandwidth guaranteed to Verizon Wireless, no exceptions.	Most probable data rates: 2G/3G Cell: 10, 20, 30 Mbps 4G Cell: 50, <b>100</b> , 150, 200, 300, 500, GigE (hub site)
		<b>MSC:</b> Support for a CIR equal to the full bandwidth of the link.	Most probable data rates: GigE, 10GigE, and a transition plan to 40G and 100G as those become available.
<b>EIR</b>	Excess Information Rate (Burst BW)	At the present time, EIR will not be used. VZW requires a guaranteed BW.	Bandwidth above the CIR, but available only if capacity on the Transport Providers network is available.
<b>Latency</b>	Demarc to Demarc one way latency	Maximum 5ms  Applies to both the primary and alternate paths of the circuit.	
<b>Jitter</b>	Variation of packet arrivals	+/- 1ms	Total variation of 2ms  A frame delivered outside the jitter window shall be considered an errored frame.
<b>FER</b>	Frame Error Rate or Frame Loss	Better than 1E10-6	One errored or lost frame in one million (5 minute measurement interval)
<b>CoS/QoS</b>	Class of Service/ Quality of Service	Prioritize traffic based on L2 802.1p markings (7=highest, 0=lowest).  Frames shall be delivered in the sequence presented	L3 DiffServ bits shall be passed through unaltered.  Exception: If the circuit is SONET EPL without the ability to examine 802.1p markings, the packets shall be passed

		unless the priority bits indicate otherwise.	through in the order received.
<b>IPv4/IPv6</b>	IPv4 and IPv6 support	Both IPv4 and v6 shall be supported	Since the Transport Provider is delivering a layer 2 service to VZW, support for v6, i.e. Layer 3, should have minimal impact.
<b>Circuit Acceptance</b>	RFC 2544	Pass RFC 2544 during circuit turn-up, bandwidth upgrades, and on-demand.	Typical frame sizes of 64, 128, 256, 512, 1024, 1280, 1518, and up to 2000 shall be tested. RFC 2544 must be passed with zero frame loss.
<b>Circuit Monitoring</b>	Y.1731/802.1ag	Pass Y.1731/802.1ag  VZW will monitor the SLA parameters with Y.1731 or a similar protocol.	Typical measurement interval will be 5 minutes
<b>Circuit Test Points</b>	NIDs	There shall be the establishment of Even/Odd VLAN test point at the MSC end of the path. This test point will aid both VZW and the Transport Provider in resolving issues quickly.	If the Transport system demarcs to VZW at the MSC with Ethernet, the vendor shall establish a NID that shall allow VZW to test from the VZW MSPP/Test device through the interconnect facility and then through the first device on the Providers network. This NID will provide a termination point for an even/odd VLAN set similar to an actual cell site. The NID must support both RFC 2544 and Y.1731 and respond to a 2544 loop-up command. The NID will not be in the main transport path, but will “hang” off a port on the provider’s first node. Failover testing of even/odd VLAN traffic in the transport path shall be conducted with the aid of the NID.
<b>Availability</b>		MSC and Transport Providers Core: .9999+ (Five 9’s Plus)  Paths with more than 5 Cell Sites riding on them must be protected.	The objective is zero down time. The MSC and Transport Provider Core should be made as robust as possible. The MSC demark and the Transport Providers core must be protected.
		Cell Site: .99995 (Four 9’s and a 5)  Cell sites would typically be on an unprotected lateral and therefore have a lower reliability than the MSC.	26.3 minutes downtime per year  (excludes approved Maintenance Window downtime)

		Hub Cell Site: .99999 (Five 9's)	Five 9's is 5.25 minutes downtime per year. Any hubbing site serving multiple cell sites must be five nines, Five nines usually requires diverse path.  (This parameter excludes approved Maintenance Window downtime)
<b>Redundancy</b>	MSC	If the primary connectivity into the MSC fails, the secondary becomes active.	VZW uses a dual router/MLS pair at the entrance into the MSC. The transport provider must use a design that provides connectivity to both. Dual homing to two Central Offices or a robust L1 ring design is required.
	Cell Site	Although a redundant path into the cell site is not required, it may be necessary in order to meet Availability requirements	If the tail circuit into the cell site is a long run, consider a L1 ring. This could be a full ring or a partially collapsed ring depending on the risk factor for each segment. A cost vs. reward evaluation may be needed.
<b>Fail-Over</b>		Worse case failover times, from interruption of traffic to restoral of traffic: L1: 50ms (SONET) L2: 100-500ms (typically MPLS)	The objective for failover times shall be SONET-like, i.e. 50 ms or better. However, at L2, intervals tend to be longer, but shall not be more than 500ms.
<b>TTR</b>	Time to Repair	Not greater than 4 Hrs (this is not average TTR, it is per case)  Target TTR of 2 hours average	Expedited repair time if the failure is for more than one cell site or resulting in an outage to our customers.
<b>Reporting</b>	Real-time (5 min intervals)	Full circuit performance monitoring ability in real-time to include: Availability Throughput (Mbps) Delay Jitter Packet Loss Other parameters as appropriate	This reporting is to be available to VZW via a customer accessible, read only web page.  Refer to RFC2544, RFC1242, Y1731  Both real-time and historic values should be viewable via the web page.
	Off-line	Full circuit performance reporting ability, weekly and monthly, of the parameters	This reporting is to be available to VZW via a customer accessible, read only web page.

		listed above.	
	Executive	Automated performance reporting with an executive summary section.	Executive summary allows interpretation of system performance without sifting through volumes of information.
<b>Alerting</b>		SLA real-time alerting of out of specification parameters or of circuit degradation.	
<b>Tracking</b>	Trouble Ticket Tracking	Detailed Trouble Ticket tracking via a web interface.	Ability for Trouble Ticket: Initiation Tracking Post mortem data  All via a web interface.
<b>Loopback</b>	Intrusive or non intrusive loopbacks	Ability to troubleshoot circuit using selective or hard loopbacks.	The type of loopback available will be dependent on the type of hardware deployed. 802.3ah is one option the provider may select.
<b>Circuit Modifications</b>	Real-time	Ability to modify and upgrade circuit parameters in real time via a user web page.	These changes would be implemented in real-time if adequate infrastructure (ex: bandwidth) was available. These changes would automatically flow through to the billing systems. An example would be increasing cell site BW from 10 to 20Mbps.  Supplier will use commercially reasonable efforts to commence providing the forgoing ability to modify and upgrade circuit parameters via a user web page as promptly as such ability becomes generally available with respect to the applicable services offered by Supplier to its other customers.
	On-line	On line ordering of upgrades for circuits that were not available for upgrade in real-time.	The elapsed time for the new parameter to become active should be hours or days, not weeks.

**<sup>1</sup> Exception for Ethernet over SONET Transport with SONET Hand-Off at the MSC**

For transport systems deploying an Ethernet over SONET (EoS) architecture AND handing off pure SONET at the MSC (rather than Ethernet), access to the raw Ethernet signal at the MSC may not be practical. For this architecture, Ethernet Performance Requirements must still be met, but the requirement for the Supplier to continuously measure circuit parameters like latency and jitter on a real-time basis may be eliminated upon concurrence of VZW. Measurement of SONET circuit parameters would be at circuit turn-up and on an "on-demand" basis when Verizon Wireless detects circuit performance issues. A visit to the cell site by the Supplier may be required, but circuit performance (latency, jitter, etc) issues with SONET transport are expected to be rare issues. This procedure will parallel what is currently done on SONET T1 circuits today. The Supplier will still be required to measure SONET type circuit parameters like availability in real-time and make those available to Verizon Wireless. As SONET systems migrate to Ethernet hand-off at the MSC, real-time circuit monitoring of Ethernet stats will be required.

## ETHERNET SERVICE PROTOCOL REQUIREMENTS

R = Required

NR= Not Required at this time

L2	802.1D	STP	Spanning Tree Protocol	NR	
L2	802.1p	CoS	Class of Service Prioritization	R	Forward tagged traffic based on L2 marking
L2	802.1Q	.1q Q in Q	VLAN Encapsulation 802.1q in 802.1q tagging	R	VZW currently uses just a "C-tag". Stacked tags (C-tag+S-tag) are not currently used.
L2	802.1s	mSTP	Merged into 802.1Q Multiple instances of STP	Merged	
L2	802.1v	VLAN Class	Merged into 802.1Q VLAN classification by Protocol or port	Merged	
L2	802.1w	RSTP	Merged into 802.1D Rapid Spanning Tree Protocol	Merged	
L2	802.1x	Authentication	Port based network access control	NR	
L2	802.1ae	MAC sec	MAC Security	NR	
L2	802.1ag	Flt Mgmt	Connectivity Fault Mgmt	R	
L2	802.1ah	PBB	Provider Backbone Bridge, PBB (Mac in Mac)	NR	
L2	802.1aj	TPMR	Two Port MAC Relay	NR	
L2	802.3-2008	Ethernet Framing	Support for the IEEE standard for Ethernet Frames	R	
L2	802.3u	FE	Fast Ethernet, 100BASE-TX (copper). Fast Ethernet, 100BASE-FX (MM fiber)	NR	
L2	802.3x	MAC Pause	Flow Control	R	
L2	802.3z	GigE	1000BASE-X	R	Cell Site: 1000BASE-SX, 850nm MM fiber MSC: GigE/10GigE, typically SM fiber
L2	802.3ab	GigE	1000BASE-TX (copper)	NR	

L2	802.3 ac	VLAN Tagging	VZW traffic will contain a VLAN tag that reflects the cell site.  Support for 4096 VLANs. Up to 4 VLAN tags per cell site	R	VZW uses up to 4 VLAN tags per cell site. The more typical number is two VLANs per cell site.
L2	802.3 ad	LACP	Link Aggregation Control Protocol	R	Protection
L2	802.3 ae	10GigE	10 Gbps over SM fiber	R	MSC
L2	802.3 af	PoE	Power over Ethernet	NR	
L2	802.3 ah	EFM	Ethernet in the first mile	R	
L2	802.3 an	10GigE UTP	10 GigE over unshielded twisted pair (UTP)	NR	
L2	802.3 aq	10G MM	10Gbps over MM fiber	R	MSC
L2		Auto Negotiation	Auto negotiation, but the ability to force speed and duplex settings	R	VZW Maint. Engr Requirement for 10/100/1000 link speeds.
L2		Large Frames	Support for Ethernet frames from 1518 bytes up to 2000 Bytes.  This parameter is sometimes referred to as Transport MTU.	R	VZW will have frames in excess of 1518 Bytes. VZW requirement is for vendors to support frames of 2000 Bytes or larger on all equipment in the transport path. VZW requires support for at least 1546 Bytes to support VLAN tags and MPLS tags.
L2		Jumbo Frames	Support for frames from 1601 Bytes to 9600 Bytes.	R	Jumbo frame support from 1601 Bytes to 2000 Bytes is required. Jumbo frame support from 2001 Bytes through 9600 Bytes is desired.
L2		Security	MAC Filtering	NR	
L2		L2F	Layer 2 Forwarding Protocol Tunneling of PPP over IP, virtual extension of dial-up link	NR	
L2		L2TP	Layer 2 Tunneling Protocol, Encapsulating one Ethernet packet in another (1500+18+50=1568 Bytes)	NR	
L2		PPTP	Point to point Tunneling	NR	

			Protocol		
L2	Cisco	DTP	Dynamic Trunking Protocol	NR	
L2	Cisco	VTP	VLAN Trunking Protocol	NR	
L2	Cisco	PAgP	Port Aggregation across Cisco Etherchannel. Similar to 802.3ad	NR	
L2	Cisco	UDLD	Unidirectional Link Detection Detects one way fiber links. Similar to 802.3ah.	NR	
L2	Nortel	SMLT	Split Multi Link Trunking Nortel's enhancement to LACP	NR	
					V2.07

## Requirements Template Revision History

Author	Date	Version	Revision Comments
Jeff Stuparits	10/15/07	1.00	Initial Draft
Jeff Stuparits	01/03/08	1.02	Minor revision to Appendix D
Jeff Stuparits	04/22/08	1.04	Appendices A-E are now separate from the main document to allow them to be updated more easily.
Jeff Stuparits	06/24/08	1.09	Modify cell site NEBS requirements to reflect latest Maint Engr Ntwk Directive 431, NEBS Level 3 Certified at Hub sites (i.e. not just Compliant). For inside shelter deployments.
Jeff Stuparits	10/06/08	1.10	Delete App D - L2A Requirements (the L2A functionality will be provided by a VZW supplied Cell Site Router). Minor updates to text and requirements.
Jeff Stuparits	11/10/08	1.11	Specified measurement interval of 5min in SLA section. VZW eHealth system uses 5 min today.
Jeff Stuparits	04/14/09	1.12	Minor formatting revisions
Jeff Stuparits	04/15/09	1.13	Deletion of 100BASE-FX fiber interface at cell site. GigE fiber is the preferred interface at this end as rates are likely to eventually surpass 100Mbps.
Jeff Stuparits	06/26/09	1.14	Clarify frame size requirements of 1536 Bytes.
Jeff Stuparits	8/25/09	1.15c	Delete Bit Error Rate (BER) as T1 delivery is no longer included. FER remains.
Jeff Stuparits	11/11/09	1.15d	Revise Protocol Table 802.3ac to show pseudowire tag and expected frame size of 1530 rather than 1526. Required support for Baby Giant frames (up to 1600 Bytes) remains unchanged.
Jeff Stuparits	12/21/09	1.15e	Clarify Baby Giant frame length wording >1518 and <1600.
Jeff Stuparits	02/09/10	2.01	Merge Ethernet Appendices into a single document to support easier attachment to contract MSAs. Clarify multiple topics; frame size of 1536, support for IPv6, circuit acceptance using RFC 2544, reliability.
Jeff Stuparits	02/11/10	2.02	Add detail on VLAN use, 2 or 4 tags.
Jeff Stuparits	03/09/10	2.04	Clarify 5 cell site redundancy requirement.
Jeff Stuparits	04/19/10	2.05	Add requirement for a NID test point at the MSC end of the path.
Jeff Stuparits	05/03/10	2.06	Protocol Table: Required support for Baby Giant frames up to 1600B remains unchanged but clarify expected frame size, increase from 1536 to 1546.
Thomas Tan	08/12/10	2.07	Amendments to Path Diversity and Hardware Redundancy Sections in Ethernet Service Interface Requirements. Amendments to Circuit Acceptance and Circuit Test Points Sections in SLA Requirements – Data Parameters. Amendments to Fail-Over Section in SLA Requirements – Availability. Protocol Table: Corrected “Baby Giant” frames to “Large” frames; required support for large frames is amended to 2000 Bytes, and support for Jumbo frames up to 2000 Bytes is now required; support for Jumbo frames up to 9600 Bytes is desired.