

# Network Upgrades Review

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# Network Upgrades – Why?

- Outdated Electronics
- Scalability
- Redundancy
- Lack of Equipment support / Warranties
- Equipment features / capabilities / limitations
- Bandwidth needs
- Port capacity
- IPv4 exhaustion
- Long term cost vs value

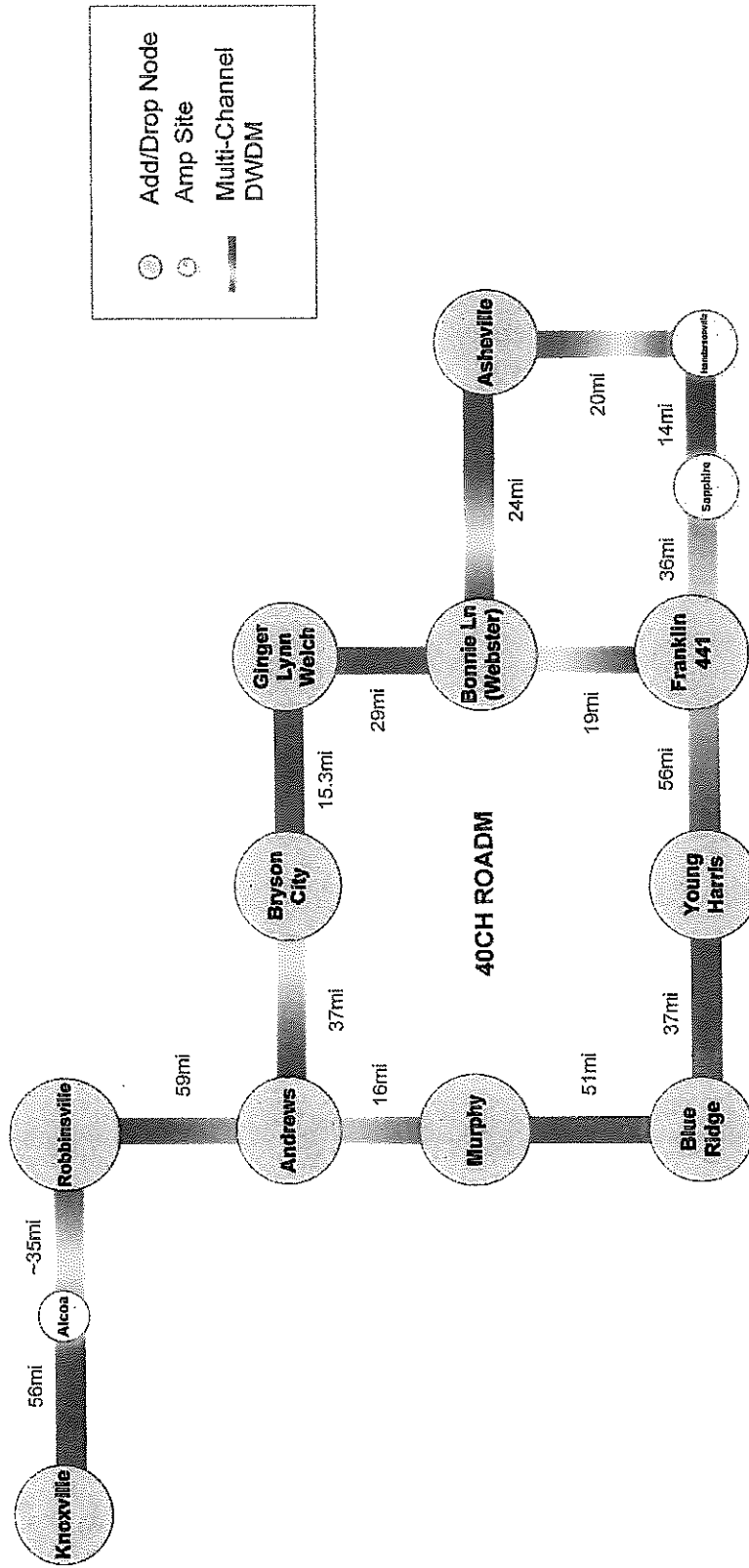
# Equipment Selection Criteria

- Cost – long term & upfront
- Carrier Grade
  - Scalability
  - Redundancy
- Equipment support & warranties
- Equipment features
  - IPv4/IPv6 Dual-stack
  - MC-LAG
  - Carrier Grade NAT
  - Virtual Chassis
  - High Availability
  - Vendor roadmap
  - Port capacity

# What needs upgraded?

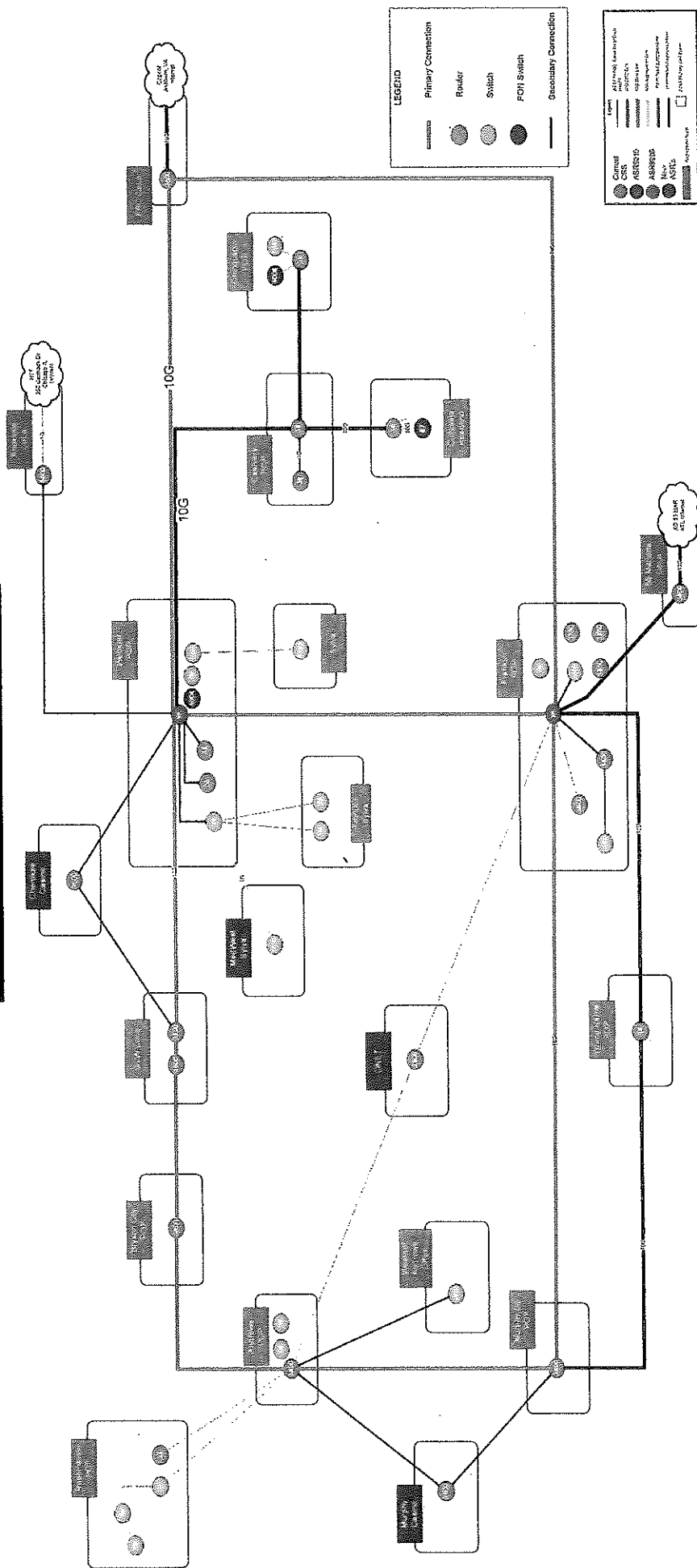
- Primary Networks
  - Optical Transport System - ROADM
  - Data Network (Internet & Ethernet Transport)
  - Management network
  - Migration off of SONET
- DDos & Threat Management
- Voice Single Points of Failure
- Tagua Replacement / Future of Softswitch
- Element Management & Reporting
- Facilities

## DWDM ROADM ARCHITECTURE

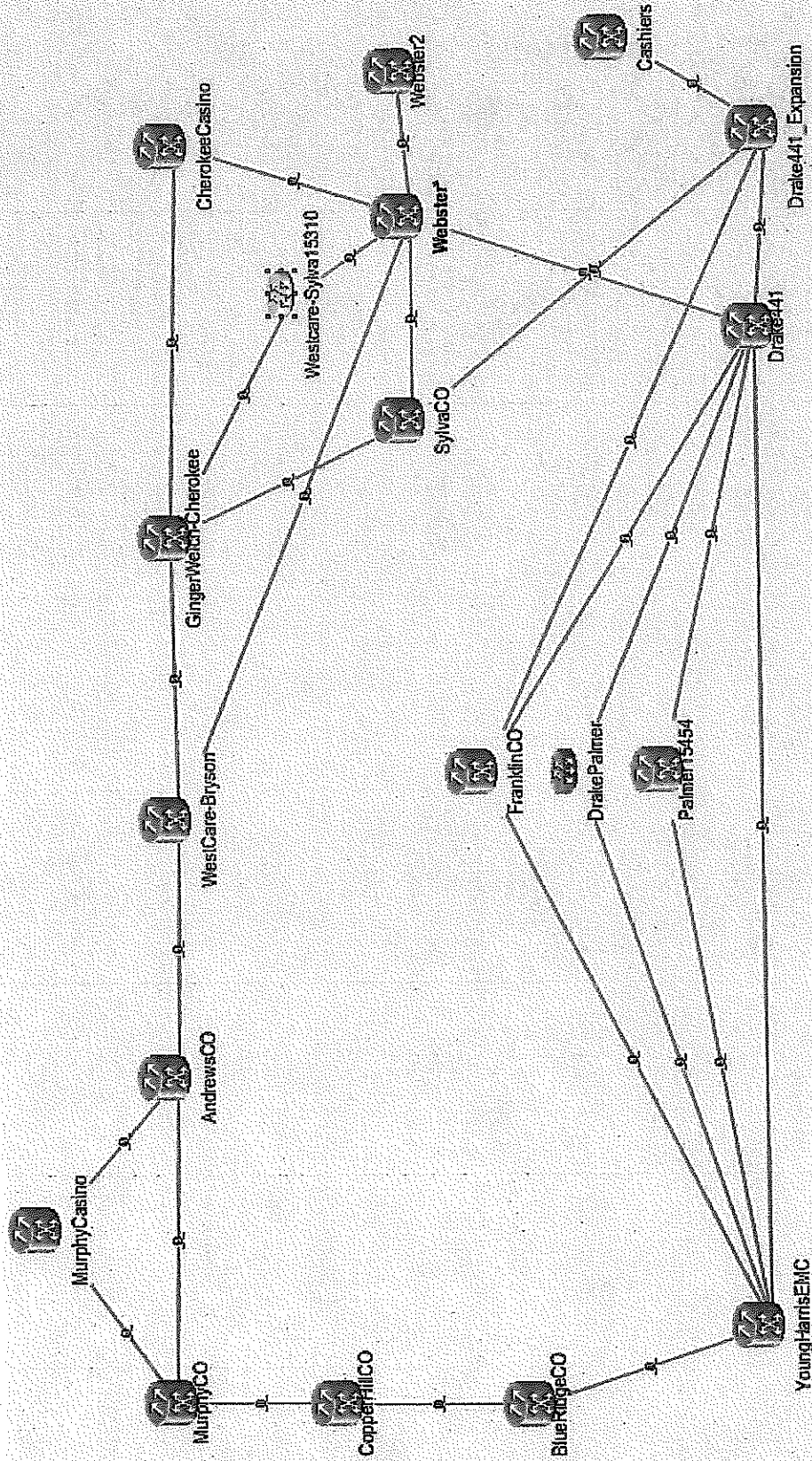


• Cisco 40ch ROADM (Inventory: M6, SMR, SMR2, and EDFAs)

**BalsamWest  
Data Network  
High Level Drawing**



# SONET



# ROADM Upgrades

Recommended system – Ciena 6500 Flex

- Industry leader
- Willing to provide better pricing & bigger discounts to win our business
- Dispersion Compensated Less
- Features and System Roadmap offer Future proofing
- Excellent Integration with 40G & Juniper Upgrades
- Lower costs to expand or upgrade in the future
- System is not license limited
- Reduced Maintenance & Support costs vs Cisco

# SONET MIGRATION

- Why Migrate off of SONET?
  - Technology is considered obsolete
  - Was designed for TDM consolidation not data
  - Bandwidth limitations
  - Hardware has been EOL for more than 5 years
  - Hardware is beginning to fail
  - Spare parts
    - Are becoming hard to obtain
    - Used parts only with no warranties
    - No longer supported by manufacture
    - Costs are rising

# SONET MIGRATION

## What to Consider?

- Two traffic types
  - Voice / TDM
  - Ethernet
- Proposed Changes
  - Voice will moved to a dedicated network via Circuit Emulation
    - Ciena 3928 Platform
    - Same network can be used to create a new Management network
    - Guarantee bandwidth and performance for PSTN traffic
    - Easier integration with L2/L3 Network in future
  - Ethernet traffic will be migrated to new L3/MPLS network (Juniper)
    - Native transport
    - Simplifies troubleshooting
    - Adds scalability
    - Better able to evaluate our utilization
    - Reduces number of technologies and platforms

# Additional Upgrades

- Facilities
  - Updates identified in the audits
  - Additions & modifications to support Network Upgrades
  - Alerts, notifications, and security
- DDos Threat Management
- Voice Network
  - Single Points of Failure
  - Taqua replacement
  - Long term plans for Softswitch
- EMS / Network OAM
  - Equipment Management
  - Provisioning
  - Fault Management
  - Capacity Management
  - SLA Assurance
  - Troubleshooting

# ROADM UPGRADE

## COSTS COMPARISON

- CIENA ROADM – 10X10G: \$1.66M
- CISCO ROADM – 10x10G: \$1.81M

### Cisco ROADM Costs

|                                      |                        |
|--------------------------------------|------------------------|
| <b>Modernize Only - No Upgrades</b>  | <b>\$ 880,000.00</b>   |
| <b>Next 10G around ring</b>          | <b>\$ 1,176,010.00</b> |
| <b>20G ring instead of 40G</b>       | <b>\$ 1,217,410.00</b> |
| <b>40G ring for Juniper</b>          | <b>\$ 1,548,035.00</b> |
| <b>10x10G/100G</b>                   | <b>\$ 1,809,729.00</b> |
| <b>Enable Next 10 Channels</b>       | <b>\$ 121,000.00</b>   |
| <b>Cost to enable channels 11-40</b> | <b>\$ 363,000.00</b>   |

# All Upgrade Costs

| Network Project                           | Cost            | Timeframe (days) | Contingencies | Comments                                                                                                                                                                                                               |
|-------------------------------------------|-----------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>Facility Amends</u>                    | \$ 296,965      | 60               | none          | facilities updates and changes identified from the audit                                                                                                                                                               |
| <u>Facility Upgrades</u>                  | \$ 98,168       | 30               | 2             | \$57,000 of Facility Amendments from audit required to complete Network Upgrades                                                                                                                                       |
| <u>New ROADM</u>                          | \$ 1,663,582    | 180              | 1, 2, 3       | Greenfield deployment - includes cost to migrate TDM off of SONET Migration. Cisco Cost comparison                                                                                                                     |
| <u>ROADM for Juniper</u>                  | \$ 236,578      | 60               | 1, 2, 3       | Additional cards and transceivers to bring up 40G ring                                                                                                                                                                 |
| <u>SONET Migration</u>                    | \$ 27,725       | 30               | 1, 2          | cost is for T3 to T1 and EoS migration where data network upgrades were not slotted. 3928 represents about \$50k capex included in ROADM quote. Assumes new routing/switching hardware exists to migrate ethernet gear |
| <u>Data Core Upgrades</u>                 | \$ 775,500      | 120              | 1, 2, 3       | New Juniper Core & Aggregation Layer                                                                                                                                                                                   |
| <u>TMS Firewalls</u>                      | \$ 262,000      | 30               | none          | Requires Upgrades of Colos in ATL, ASH, & KNX                                                                                                                                                                          |
| <u>Element Management &amp; Reporting</u> | TBD             | 30               | 1             | includes additional tools to troubleshoot voice issues, report on network performance, and expand alarm monitoring                                                                                                     |
| <u>Voice SPOF</u>                         | \$ 20,820       | 30               | 2             | Replaces 3560, Cat 3750 & ME3400 switches                                                                                                                                                                              |
| <u>Tagua Replacements</u>                 | \$ 475,000      | 30               | 1, 3, 4       | includes geo-redundancy                                                                                                                                                                                                |
| <u>Circuit Grooming</u>                   | \$ 300,000      | 180              | 5             | Opportunity to replace media converters with new CPE. Cost includes new optics as well as new CPE                                                                                                                      |
| <b>Total</b>                              | \$ 4,156,338.15 | 780              |               |                                                                                                                                                                                                                        |

|                               |
|-------------------------------|
| Contingencies                 |
| 1. Upgrade Management Network |
| 2. facility updates           |
| 3. facility upgrades          |
| 4. Voice SPOF                 |
| 5. Data Core Upgrades         |

# Ciena Upgrade Costs

| Location                   | Hardware Per POP | Expense        |
|----------------------------|------------------|----------------|
| Aloca                      | \$ 13,588.71     | One-time       |
| Andrews CO                 | \$ 131,805.83    | One-time       |
| Asheville                  | \$ 88,710.24     | One-time       |
| Blueridge                  | \$ 89,124.74     | One-time       |
| Bonnie Lane                | \$ 154,099.23    | One-time       |
| Bryson City                | \$ 88,710.24     | One-time       |
| Franklin 441               | \$ 155,816.45    | One-time       |
| Ginger Lynn Welch          | \$ 88,710.24     | One-time       |
| Hendersonville             | \$ 46,563.70     | One-time       |
| Knoxville                  | \$ 65,388.99     | One-time       |
| Murphy CO                  | \$ 88,710.24     | One-time       |
| Robbinsville               | \$ 88,710.24     | One-time       |
| Sylva CO                   | \$ 6,340.84      | One-time       |
| Young Harris               | \$ 108,484.58    | One-time       |
| Spares / Lab               | \$ 51,443.80     | One-time       |
| Hardware Subtotal          | \$ 1,266,208.07  |                |
| Hardware                   | \$ 1,266,208.07  | One-time       |
| Software                   | \$ 20,229.10     | Annual License |
| Consulting/Software Config | \$ 36,746.01     | One-time       |
| Installation Services      | \$ 194,891.05    | One-time       |
| Training Classes           | \$ 28,448.28     | One-time       |
| Technical Support          | \$ 78,260.93     | 3 year term*   |
| Hardware Replacement       | \$ 38,798.86     | 3 year term*   |
| Project Total              | \$ 1,663,582.30  |                |

\*Annual after 3 years