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March 26, 2015

Dan P. Wolf  
Executive Secretary  
Minnesota Public Utilities Commission  
121 Seventh Place East, Suite 350  
St. Paul, MN 55101-2147

Via: E-File

Re: In the Matter of a Petition of Lake County Minnesota for Designation as an Eligible  
Telecommunications Carrier  
Docket No. M-15-65

Dear Mr. Wolf:

Enclosed for E-filing in the above-referenced matter please find Reply Comments of  
Lake County Minnesota and a Certificate of Service.

Sincerely,

/s/Gregory R. Merz

Gregory Merz

GRM/akm  
Enclosure  
cc: Service List

## **CERTIFICATE OF SERVICE**

I, Amy K. Milbradt, hereby certify that I have this day, served copies of the following document on the attached list of persons by electronic filing, email, or by depositing a true and correct copy thereof properly enveloped with postage paid in the United States Mail at Minneapolis, Minnesota.

**Reply Comments of Lake County Minnesota**

**Re: Docket No. M-15-65**

Dated this 26th day of March, 2015.

s/Amy K. Milbradt

Amy K. Milbradt

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Julia	Anderson	Julia.Anderson@ag.state.mn.us	Office of the Attorney General-DOC	1800 BRM Tower 445 Minnesota St St. Paul, MN 551012134	Electronic Service	No	OFF_SL_15-65_M-15-65
Scott	Bohler	scott.bohler@ftr.com	Frontier Communications Corporation	2378 Wilshire Blvd  Mound, MN 55364-1652	Electronic Service	No	OFF_SL_15-65_M-15-65
Thomas	Burns	tgburns@otcpas.com	OLSEN THIELEN & CO. LTD	2675 Long Lake Rd  St. Paul, MN 55113	Electronic Service	No	OFF_SL_15-65_M-15-65
Linda	Chavez	linda.chavez@state.mn.us	Department of Commerce	85 7th Place E Ste 500  Saint Paul, MN 55101-2198	Electronic Service	No	OFF_SL_15-65_M-15-65
Pete	Eggimann	PEGGIMANN@MN-MESB.ORG	Metropolitan Emergency Services Board	2099 University Ave W Ste 201  St. Paul, MN 551043431	Electronic Service	No	OFF_SL_15-65_M-15-65
Matthew	Huddleston	matthew.huddleston@co.lake.mn.us	Lake County Minnesota	601 3rd Ave  Two Harbors, MN 55616	Electronic Service	No	OFF_SL_15-65_M-15-65
John	Lindell	agorud.ecf@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012130	Electronic Service	No	OFF_SL_15-65_M-15-65
Gregory R.	Merz	gregory.merz@gpmlaw.com	Gray, Plant, Mooty	80 S 8th St Ste 500  Minneapolis, MN 55402-5383	Electronic Service	No	OFF_SL_15-65_M-15-65
Jeffrey	Roiland	jeff.s.roiland@gmail.com	Lake Communications	409 17th Ave  Two Harbors, Mn 55616	Electronic Service	No	OFF_SL_15-65_M-15-65
Kevin	Saville	kevin.saville@ftr.com	Citizens/Frontier Communications	2378 Wilshire Blvd.  Mound, MN 55364	Electronic Service	No	OFF_SL_15-65_M-15-65

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jason	Topp	jason.topp@centurylink.com	CenturyLink	200 S 5th St Ste 2200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_15-65_M-15-65
Dana	Wahlberg	dana.wahlberg@state.mn.us	Department of Public Safety	Town Square Ste 137 444 Cedar St St. Paul, MN 551015126	Electronic Service	No	OFF_SL_15-65_M-15-65
Daniel P	Wolf	dan.wolf@state.mn.us	Public Utilities Commission	121 7th Place East Suite 350 St. Paul, MN 551012147	Electronic Service	No	OFF_SL_15-65_M-15-65

STATE OF MINNESOTA

BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION

Beverly Jones Heydinger	Chair
Nancy Lange	Commissioner
Dan Lipschultz	Commissioner
John Tuma	Commissioner
Betsy Wergin	Vice Chair

In the Matter of a Petition of Lake County      Docket No. M-15-65  
Minnesota for Designation as an Eligible  
Telecommunications Carrier

**REPLY COMMENTS OF LAKE COUNTY MINNESOTA**

**INTRODUCTION**

Lake County Minnesota d/b/a Lake Connections (“Lake County”) respectfully submits these reply comments in response to comments filed by the Minnesota Department of Commerce (“DOC”), Citizens Telecommunications Company of Minnesota, LLC (“Citizens”), and Minnesota Telecom Alliance (“MTA”). Central to the comments of all of these parties is whether Lake County satisfies the requirement that it be a common carrier. Since Lake County filed its ETC petition, the Federal Communications Commission (“FCC”) released its *Open Internet Order*.<sup>1</sup> That order makes clear that the broadband Internet access service to be provided by Lake County is a telecommunications service for purposes of the common carrier provisions of the federal Communications Act and, accordingly, Lake County qualifies as a common carrier.

In these reply comments, Lake County will discuss how the *Open Internet Order* applies to the issues presented by Lake County’s ETC petition. In addition, Lake County will provide further detail regarding its business relationship with Lake Communications and also address certain miscellaneous issues raised by the commenting parties.

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<sup>1</sup> *In the Matter of Protecting and Promoting the Open Internet, Report and Order on Remand, Declaratory Ruling and Order*, GN Docket No. 14-28 (Rel. March 12, 2015) (“*Open Internet Order*”).

## DISCUSSION

### I. Lake County, As A Provider Of Broadband Internet Access Service, Is A Common Carrier For Purposes Of Designation As An ETC

In its *Open Internet Order*, the FCC reconsidered its previous holding that classified broadband Internet access service as an “information service” rather than a “telecommunications service.” *Open Internet Order* at ¶ 331. Noting the substantial changes in technology and the telecommunications market, the FCC determined that broadband Internet access service constitutes a “telecommunications service” under Title II, the common carrier provisions of the federal Communications Act. *Open Internet Order* at ¶¶ 361-64; *see also Open Internet Order* at ¶ 43. (“As the record reflects, times and usage patterns have changed and it is clear that broadband providers are offering both consumers and edge providers straightforward transmission capabilities that the Communications Act defines as a ‘telecommunications service.’”)

The FCC has defined “broadband Internet access service” as “a mass-market and retail service by wire or radio that provides the capability to transmit data to and receive data from all or substantially all Internet points, including any capabilities that are incidental to and enable the operation of the communications service, but excluding dial-up Internet access service.” *Open Internet Order* ¶ 336. Further, in its *Open Internet Order*, the FCC distinguished between the transmission capability of broadband Internet access service and the services delivered via that transmission capability:

[T]his Order concludes that the retail broadband Internet access service available today is best viewed as separately identifiable offers of (1) a broadband Internet access service that is a telecommunications service (including assorted functions and capabilities used for the management and control of that telecommunications service) and (2) various “add-ons”

applications, content, and services that generally are information services.

*Open Internet Order* at ¶ 47. The FCC also made clear that its characterization of broadband Internet access service as a telecommunications service is independent of the nature of the services that are provided over the broadband “pipes.” *Open Internet Order* ¶ 356. To that end, the FCC stated:

To the extent that broadband Internet access service is offered along with some capabilities that would otherwise fall within the information service definition, they do not turn broadband Internet access service into a functionally integrated information service. To the contrary, we find these capabilities either fall within the telecommunications systems management exception or are separate offerings that are not inextricably integrated with broadband Internet access service, or both.

*Open Internet Order* ¶ 365.

Finally, the FCC reconfirmed its “light touch” approach to regulation of the internet. To that end, the FCC exercised its authority to forbear from applying certain statutory and regulatory provisions to providers of broadband internet access service, in order to minimize the regulatory burden on broadband providers and promote deployment of broadband services. *See Open Internet Order*, ¶¶ 51-52. The FCC concluded that it would not forbear, however, from requirements “necessary to ensure consumers are protected, promote competition, and advance universal access,” including Communications Act sections 201 (duty to furnish communications service on reasonable request, on just and reasonable terms), 202 (prohibition on unjust and unreasonable discrimination), 208 (enforcement), 222 (consumer privacy), 225/255/251(a)(2) (disability access), 224 (infrastructure access), and 254 (universal service), and associated implementing regulations. *Open Internet Order* at ¶¶ 53-58.

Although the *Open Internet Order* has been released, it has not yet been published in the Federal Register and has not yet taken effect. However, Lake County is operating today as a common carrier and has interconnected with other carriers on a nondiscriminatory basis. Lake County has constructed a state of the art fiber optic network that provides high speed data transmission capability, through which Lake County's retail customers have access to a variety of services and applications. One such service is VoIP-based voice telephony service to be provided over Lake County's broadband network by Lake Communications. Because the transmission capability provided by Lake County's fiber optic network meets the FCC's definition of a broadband Internet access service, it is a telecommunications service, regardless of the regulatory treatment of the VoIP service provided using the Lake County broadband network. Thus, Lake County, as a provider of a telecommunications service, satisfies the common carrier requirement for ETC designation. For purposes of determining the issues presented by Lake County's ETC petition, the Commission need not reach the question of whether the VoIP service that will be provided by Lake Communications using the Lake County network is, itself, a telecommunications service. As a provider of broadband internet access, Lake County will be subject to the consumer protection provisions of the Communications Act.

## **II. Lake County Will Offer Its Customers Access To Voice Telephony Service Provided By Lake Communications**

Although Lake County will not, itself, provide voice telephony service, it will make voice telephony services available to its customers on a standalone basis, through a business relationship with Lake Communications, a Minnesota CLEC. As a CLEC authorized by this Commission to provide local exchange service, the voice telephony service to be provided over the Lake County broadband network will be subject to the same regulations and enforcement



authority as any other service offered by a CLEC. The terms and conditions applicable to that service are reflected in the tariff that Lake Communications has on file with the Commission.

The contract governing the relationship between Lake County and Lake Communications is not subject to approval of the Commission. However, because Lake County is a governmental agency, the contract, once it has been finalized, will be a public document.

Although the parties have not yet finalized the documentation of their business relationship, they have reached agreement in principle on the key elements of that relationship, which include:

- Lake County will provide its customers throughout its service territory with access to VOIP-based voice telephony service (“Voice Telephony”) provided by Lake Communications;
- Lake County and Lake Communications will establish network-to-network interconnection for the purpose of delivering Voice Telephony;
- Lake County will provide all transport from the network-to-network interconnection to end user premises;
- Lake Communications will be solely responsible for interactions with end users concerning Voice Telephony;
- Lake Communications may agree to purchase end user billing service from Lake County for the Voice Telephony provided to end users;
- Lake Communications agrees to comply, and will be solely responsible for compliance, with all applicable state and federal law and regulations as it relates to Voice Telephony provided to end users;
- Lake Communications agrees to perform any necessary regulatory requirements related to Voice Telephony;
- Lake Communications agrees to make Voice Telephony available to all customers in Lake County’s service areas on a non-discriminatory basis pursuant to the terms and conditions in Lake Communications’ tariff filed with the commission and/or as published on Lake Communications’ website.

### **III. Miscellaneous Issues**

#### **A. Pricing**

The DOC comments note some confusion regarding the pricing of the voice telephony service that will be provided to Lake County's customers. Pursuant to the contract between Lake County and Lake Communications, service will be made available to Lake County's customers on a nondiscriminatory basis at the rates set forth in Lake Communications' tariff. See Attachment A.

It has been brought to Lake County's attention that its website, which reflects that voice services are provided by Lake Communications, does not set forth the correct rate for standalone voice service. Lake County will be revising the content of its website to accurately reflect the correct rate for standalone voice service and also to reflect the availability of Lifeline service.

#### **B. Description of Facilities**

A copy of the documentation filed by Lake County with the FCC in support of its grant application accompanies these reply comments. See Attachment B.

#### **C. Service Area**

Citizens has raised an issue regarding the area that is intended to be covered by Lake County's ETC petition. Lake County has been conditionally approved for a grant under the Rural Broadband Experiment to provide service to specific census blocks and Lake County is seeking ETC designation only as to those census blocks.

Lake County has or will build facilities in *portions* of the following exchanges, if ETC designation is granted.

Aurora

Babbitt

Brimson

Duluth

Ely

Embarrass

Hoyt Lakes

Isabella

Palo

Silver Bay,

Two Harbors

The specific census blocks for which Lake County seeks ETC certification are reflected on the map accompanying these reply comments as Attachment C. As shown on Attachment C, there are portions of exchanges that Lake County will not serve and there are also areas where no incumbent LEC is assigned as the service provider.

Also, Citizens also raises the issue of how Lake County will serve customers in its requested service area where it has not yet completed construction of its network. As a threshold matter, Citizens obviously is not raising this issue because it is concerned that Lake County will not be able to effectively serve the customers throughout its designated service territory. The last thing that Citizens, as Lake County's chief competitor in the Citizens service territory, wants is for Lake County to extend the reach of its fiber network. Citizens true objective, in fact, is to derail Lake County's petition. Further, the purpose of Lake County's ETC petition is to meet the conditions of a federal grant to be used in building out its network. The FCC could not have intended that, in order to qualify for a grant to build out its network, Lake County must first have completed the construction of its network. Finally, Lake County's current schedule is that its

core network (i.e., the portion of the network exclusive of the drops necessary to connect individual customers to the network) will be substantially complete by the end of this summer.

The issue that Citizens raises is actually a non-issue.

**D. Advertising of Supported Services**

Lake Communications, as the provider of voice service, will be responsible for advertising its service, including the availability of Lifeline service. Lake County's website and other advertising will reflect that voice service is being provided by Lake Communications. To the extent that the Commission determines that Lake County should be required to separately advertise voice service, it will provide an advertising plan consistent with what the Commission has approved in similar cases.

**E. Compliance with Applicable Service Requirements**

As recommended by DOC, Lake County will provide a certification from an authorized county official that Lake County will comply with service requirements applicable to the support it receives.

**F. Functionality in Emergencies**

The network design information that was filed with the FCC and that is being provided with these reply comments reflects that Lake County's network employs a fiber ring design that is configured to assure survivability and the ability to re-route traffic as needed to respond to emergencies or technical failures.

**IV. Designation of Lake County as an ETC Will Advance the Public Interest**

Lake County has been conditionally approved to receive a \$3.5 million grant under the federal Rural Broadband Experiment program. Proceeds from the grant will be used to develop broadband infrastructure and service in areas of rural Minnesota that are currently unserved.

Designation as an ETC is one of the conditions that Lake County must satisfy in order to qualify for the grant. Approving Lake County's petition for designation as an ETC, by helping to qualify Lake County to receive funds that it will use to build out its broadband network, will advance the public policy interest in improving broadband availability and speed in rural Minnesota.

### **CONCLUSION**

For the foregoing reasons, Lake County respectfully requests that its petition for ETC designation be granted. Lake County's application meets all statutory requirements and granting the petition is in the public interest. Concerns about Lake County's status as a common carrier are fully addressed by the FCC's determination, as set forth in the *Open Internet Order*, that broadband internet access service is a telecommunications service subject to the common carrier provisions of the Communications Act.

The issues raised by the commenting parties: 1) are legal, rather than factual, issues; 2) have been adequately addressed, either in these reply comments or Lake County's initial petition; or 3) are not material to resolution of Lake County's petition. To refer this matter to a contested case proceeding, as urged by Citizens, will only result in significant delay that may jeopardize Lake County's eligibility for federal funding, which is the very purpose of Lake County's ETC petition. Although such a result be very much in the interests of Citizens, as one of Lake County's competitors, it would be contrary to the public interest.

Dated: March 26, 2015

**GRAY, PLANT, MOOTY,  
MOOTY & BENNETT, P.A.**

By \_\_\_\_\_s/Gregory R. Merz  
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STATE OF MINNESOTA

BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION

Beverly Jones Heydinger  
Nancy Lange  
Dan Lipschultz  
John Tuma  
Betsy Wergin

Chair  
Commissioner  
Commissioner  
Commissioner  
Vice Chair

In the Matter of a Petition of Lake County  
Minnesota for Designation as an Eligible  
Telecommunications Carrier

Docket No. M-15-65

**ATTACHMENT A TO**

**REPLY COMMENTS OF LAKE COUNTY MINNESOTA**

**March 26, 2015**

Exchange	ILEC	ILEC 1FR	ILEC 1FB	LCI Authority	Residential			Business		
					Flat Rate	EAS Rate	NRC	Flat Rate	EAS Rate	NRC
Alborn	Citizens	23.01	45.03	X	\$13.60	\$3.60	\$40.00	\$27.10	\$7.15	\$40.00
Aurora	Citizens	23.01	45.03	X	\$13.60	\$3.45	\$40.00	\$27.10	\$6.75	\$40.00
Babbitt	Citizens	23.01	45.03	X	\$13.60	\$0.00	\$40.00	\$27.10	\$0.00	\$40.00
Biwabik	Qwest	15.96	34.61	X	\$14.25	\$2.15	\$25.00	\$33.00	\$5.35	\$50.00
Brimson	Citizens	23.01	45.03	X	\$13.60	\$3.60	\$40.00	\$27.10	\$7.15	\$40.00
Brookston	Citizens	23.01	45.03	X	\$13.60	\$3.60	\$40.00	\$27.10	\$7.15	\$40.00
Buhl	Qwest	15.96	34.61	X	\$14.25	\$3.85	\$25.00	\$33.00	\$9.65	\$50.00
Chisholm	Qwest	15.96	34.61	X	\$14.25	\$0.85	\$25.00	\$33.00	\$2.05	\$50.00
Cloquet	Qwest	15.96	34.61	X	\$14.25	\$1.80	\$25.00	\$33.00	\$4.40	\$50.00
Cook	Qwest	15.96	34.61	X	\$14.25	\$4.35	\$25.00	\$33.00	\$10.50	\$50.00
Crane Lake	Citizens	23.01	45.03	X	\$13.60	\$0.36	\$40.00	\$27.10	\$0.73	\$40.00
Duluth	Qwest	15.96	34.61	X	\$14.25	\$0.95	\$25.00	\$33.00	\$2.35	\$50.00
Ely	Citizens	23.01	45.03	X	\$13.60	\$0.00	\$40.00	\$27.10	\$0.00	\$40.00
Embarrass	Citizens	23.01	45.03	X	\$13.60	\$2.30	\$40.00	\$27.10	\$4.55	\$40.00
Floodwood	Citizens	23.01	45.03	X	\$13.60	\$4.00	\$40.00	\$27.10	\$7.95	\$40.00
Greaney	Citizens	23.01	45.03	X	\$13.60	\$3.60	\$40.00	\$27.10	\$7.15	\$40.00
Hibbing	Qwest	15.96	34.61	X	\$14.25	\$0.65	\$25.00	\$33.00	\$1.50	\$50.00
Hoyt Lakes	Citizens	23.01	45.03	X	\$13.60	\$3.60	\$40.00	\$27.10	\$7.15	\$40.00
Isabella	Citizens	23.01	45.03	X	\$13.60	\$0.00	\$40.00	\$27.10	\$0.00	\$40.00
Kabetogama	Citizens	23.01	45.03	X	\$13.60	\$3.80	\$40.00	\$27.10	\$7.65	\$40.00
Meadowland	Citizens	23.01	45.03	X	\$13.60	\$3.60	\$40.00	\$27.10	\$7.15	\$40.00
Palo	Citizens	23.01	45.03	X	\$13.60	\$3.60	\$40.00	\$27.10	\$7.15	\$40.00
Silver Bay	Qwest	15.96	34.61	X	\$14.25	\$0.00	\$25.00	\$33.00	\$0.00	\$50.00
Tower	Citizens	23.01	45.03	X	\$13.60	\$1.50	\$40.00	\$27.10	\$3.05	\$40.00
Two Harbors	Citizens	23.01	45.03	X	\$13.60	\$3.65	\$40.00	\$27.10	\$7.55	\$40.00
Virginia (including Eveleth)	Qwest	15.96	34.61	X	\$14.25	\$1.30	\$25.00	\$33.00	\$3.30	\$50.00



STATE OF MINNESOTA

BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION

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In the Matter of a Petition of Lake County  
Minnesota for Designation as an Eligible  
Telecommunications Carrier

Docket No. M-15-65

**ATTACHMENT B TO**

**REPLY COMMENTS OF LAKE COUNTY MINNESOTA**

**March 26, 2015**

**Lake County – FCC Rural Broadband Experiment Project**  
**Technology Description**  
**FCC Form 5620**  
**December 17, 2014**

This project involves only last mile subscriber location connections which encompasses fiber drops, premises equipment (such as ONT, UPS, and miscellaneous wiring and accessories), and additional cards for central office or remote access equipment. All mainline is either completed or is scheduled to be completed soon as part of the RUS BIP project.

This document contains:

- Technical description of the subscriber connections and equipment
- Example staking sheets used to layout/design subscriber drop locations
- Data sheets describing the access equipment and the ONT's
- Google maps showing the eligible areas and locations of the mainline network
- Diagrams and descriptions of the mainline network and equipment

**Technical description of subscriber connections and equipment**

The Lake County network consists of a GPON design utilizing Calix E7 access equipment. This access equipment is already in place and in operation as part of the RUS BIP project. Shelf space is already sufficient and available to add the number of additional access cards necessary for this FCC Experiment project. The premises equipment consists of Calix 836GE and 844G (GigaCenter) ONT's.

All access equipment and ONT equipment meet/exceed the speed requirements for this project. Product data sheets follow this technical description.

I have reviewed the technical description, example staking sheets, and equipment list and data sheets and agree that this subscriber connection project meets/exceeds the scalable speed requirements and general design requirements for a GPON project of this type. Build-out of the mainline network is not part of this project and is either already in place and in operation, or is scheduled to be completed soon.



Mark J. Mrla, P.E., PMP  
MN PE License #48227  
December 17, 2014

SAMPLE  
STAKING  
SHEETS

USE INSTEAD FROM C. ROAD  
SEE NOTATION



STAKING SHEET & PLANT RECORD

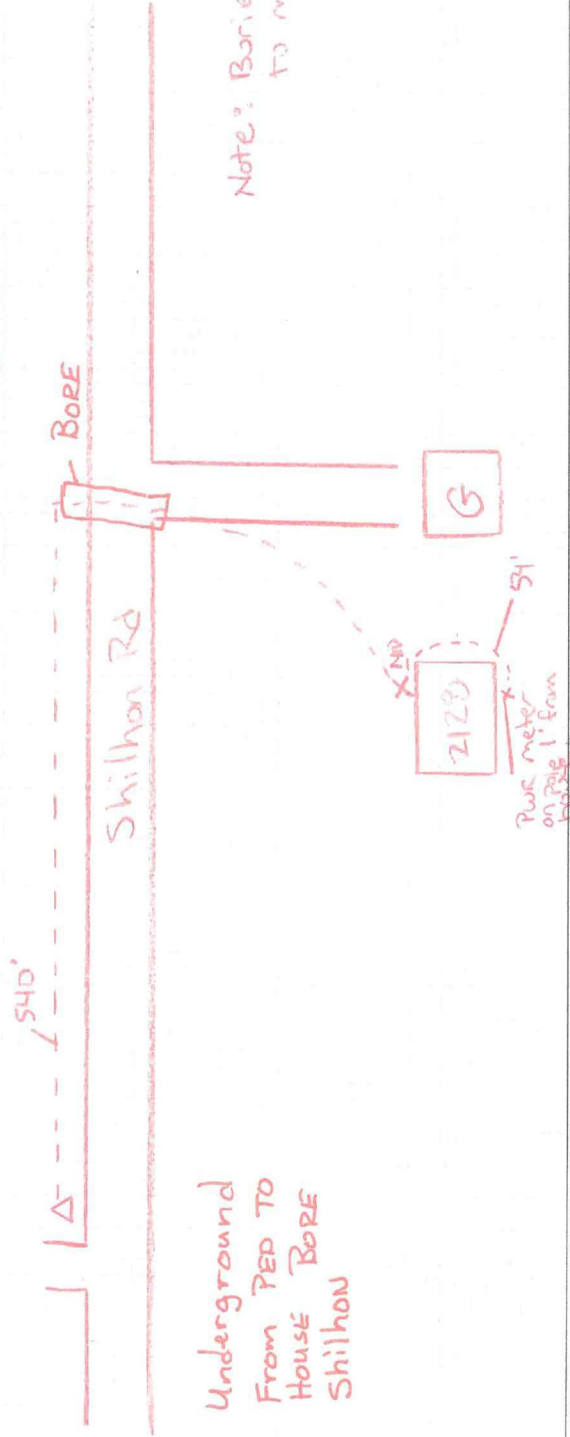
DATE  
REV. DATE  
AS BUILT ENT. BY DATE

COMPANY  
PROJECT  
EXCHANGE

SEC  
TWP  
RANGE  
CO.

SHEET  
RANGE  
ROUTE  
MAP REFERENCE

OF



Underground From PED TO HOUSE BORE Shilhon

Note: Buried Power to meter

G

2120

54' PWR meter on pole 1' from 2120'

540'

BORE

Shilhon Rd

X.M.P.

PED.	....	BA	BD	BFC	SUB. SEB NO.	BM	HC





DISTANCE FROM G. ROAD  
SEE NOTATION

STAKING SHEET & PLANT RECORD

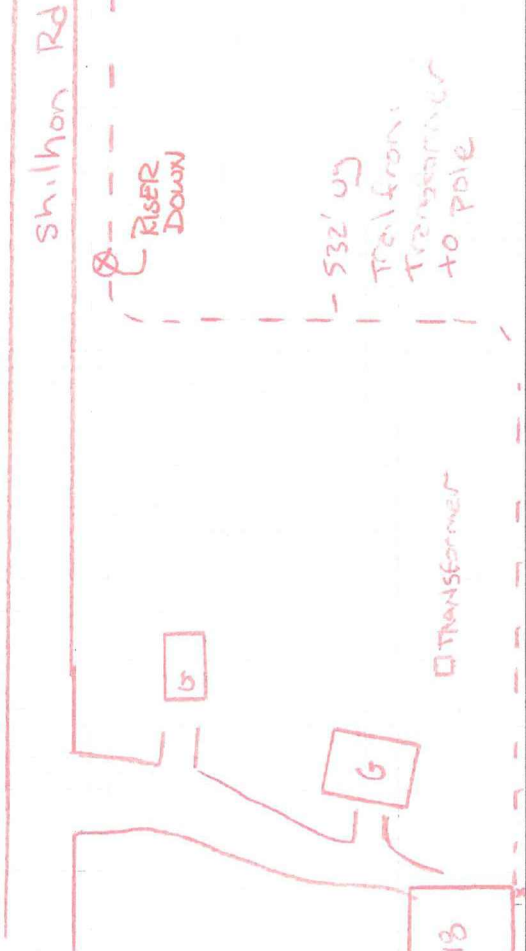
STAKED BY [ ] DATE [ ]  
 REV. [ ]  
 AS BUILT BY [ ] DATE [ ]

SEC [ ]  
 TWP [ ]  
 RANGE [ ]  
 CO. [ ]

SHEET [ ] OF [ ]

ROUTE [ ]

MAP REFERENCE [ ]



Combination - Aerial & UG.

PED.	....	BA	BD	BFC	SUB. NO.	SEB	BM	HC

ACCESS  
EQUIPMENT &  
ONT's  
Data Sheets

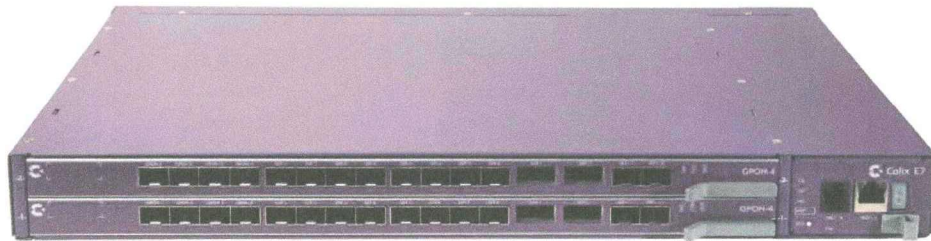
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## PRODUCT DATASHEET

# Calix E7 Ethernet Service Access Platform

### PRODUCT OVERVIEW

The Calix E7 Ethernet Service Access Platform integrates IP service delivery and Ethernet transport into a compact, high availability, carrier-class modular system that delivers high-performance, scalable network solutions for service providers. The 1RU E7 platform delivers Gigabit Passive Optical Network (GPON) and point-to-point Gigabit Ethernet (GE) services with redundant 10-Gigabit Ethernet (10GE) transport and aggregation within a single integrated 2-slot chassis. The E7 enables service providers to deliver differentiated triple play services, advanced business services, and mobile backhaul from a single converged network that revolutionizes the economics of networking by enabling new services and market expansion with a flexible, scalable, pay-as-you-grow solution.



### E7 PRODUCT DESCRIPTION

#### **ETHERNET SERVICES ACCESS NETWORK:**

Residential and business services are converging as more subscribers work from home offices, and internet “over the top” video services consume an increasing percentage of both enterprise and service provider network capacity. IP and Ethernet are the dominant network and transport protocols, and all services – voice, data, and video – are rapidly migrating to a packet-based architecture. High performance applications demand high performance solutions; the Calix E7 Ethernet Service Access Platform meets the demanding requirements of Ethernet services access networks.

The Calix E7 delivers a wide array of high performance applications, including 10GE Ethernet transport, delivery of high density residential triple play services over GPON and point-to-point Ethernet, Metro Ethernet Forum (MEF) compliant business services, mobile backhaul, and protected GE aggregation of Calix E7, C7 and E5 platforms.

**HIGH DENSITY SUBSCRIBER ACCESS:** With two cards per system, the E7 provides flexible, high density subscriber access options in a 1RU shelf:

- 8 GPON and 16 GE ports (528 ONTs)
- 24 point-to-point GE ports (24 ONTs)

With Multi-dwelling unit (MDU) ONTs, the subscribers per 1RU system can exceed several thousand.

#### **CHASSIS FEATURES IN A STACKABLE FORMAT:**

The Calix E7 combines the most advantageous attributes of a small form factor product with a large chassis-based system, while eliminating the disadvantages of each.

- 1RU design can expand with an extra slot for very low first install cost – additional chassis are added with subscriber growth yielding a near linear cost curve
- Line cards are managed as a single chassis for operational efficiency
- Mix and match line cards in a common chassis – no common control equipment required
- Line cards can be added or replaced without uninstalling/installing power, alarms, or cables – reducing MTR from hours to minutes
- Subscribers are easily aggregated and network resources efficiently shared across protected trunk facilities
- Hardened 1RU system delivers GPON and Ethernet with 10GE transport from CO, cabinet or pole mount
- Resilient, hot-swappable line cards and fan tray

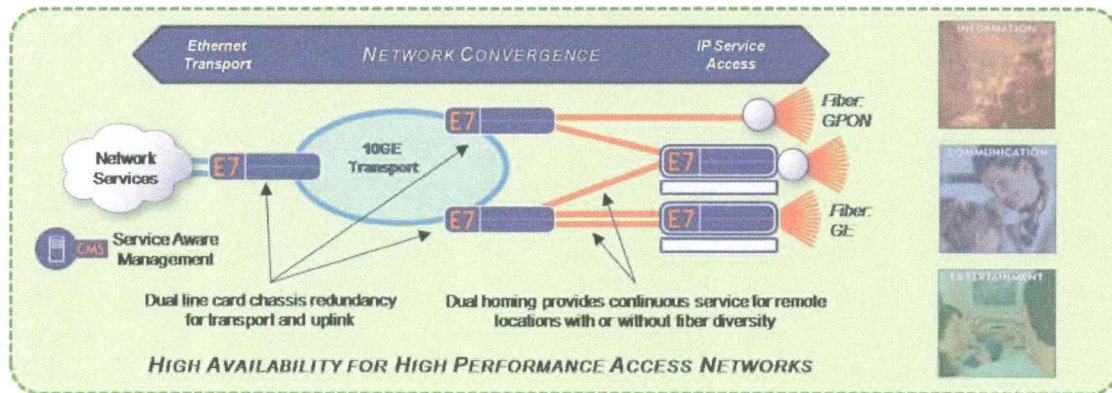
With the Calix E7, service providers no longer need to decide between a single service product and a high growth chassis solution. E7 provides low first install cost, operational efficiency and near linear incremental cost per subscriber, enabling Calix customers to maximize their business return.



## PRODUCT DATASHEET

# Calix E7 Ethernet Service Access Platform

## ARCHITECTURE AND KEY ATTRIBUTES



**FULL SPECTRUM OF SERVICES:** The E7 delivers a full spectrum of access services over GPON and Point-to-Point Ethernet using the family of Calix 700 ONTs, including Single Family Unit (SFU), Small Business Unit (SBU), Multi-Dwelling Unit (MDU), and rack-mount models.

- IPTV – broadcast and Video on Demand (VoD)
- MEF compliant business services
- High-Speed Internet (HSI) access
- Voice – Native SIP/VoIP and TDM Gateway support
- TI services
- CATV video: RF video overlay with RF return

Calix 700GX ONTs support auto sensing GPON and GE network interfaces, allowing service providers to manage service changes without subscriber onsite technical support.

**DELIVERING "QUALITY OF EXPERIENCE":** The E7 provides per-subscriber and per-service hierarchical QoS to deliver uncompromised triple play and business services. A powerful collection of classification, policing, queuing and scheduling algorithms let operators manage per-subscriber and per-service traffic flows to maintain priority/delay/loss service differentiation within the E7 network.

**SCALABLE IPTV SUPPORT:** IPTV services are by far the most demanding in terms of quality, and user expectations are very high. The E7 supports industry standard IGMP snooping to identify and replicate multicast video sent between the set-top box and the video distribution network, providing efficient, scalable, high-quality IPTV distribution on both GPON and Ethernet interfaces

### **INTEGRATED HIGH-CAPACITY AGGREGATION:**

The E7 is built on a core Layer 2 and Layer 3 switch capable of full-duplex, line rate forwarding at all frame sizes and traffic types across all interfaces. This capacity makes the E7 ideal for aggregation and transport of IP/Ethernet services across the access network. The E7 platform supports industry standard pluggable modules for all service and network interfaces, including ITU G.984 compliant GPON, Small Form-Factor Pluggable (SFP) Gigabit Ethernet, XFP 10GE ports, and SFP+ 10GE ports.

**NETWORK RESILIENCY:** The Calix E7 supports a flexible set of standards-based network topology protocols for use in aggregation, ring-based transport, and uplink applications.

- ITU G.8032 Ethernet Ring Protection Switching (ERPS)
- IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
- IEEE 802.3ad/802.1AX Link Aggregation

**SERVICE AWARE MANAGEMENT:** The E7, along with the Calix Management System (CMS), allows operators to manage services while understanding their relationship to the network infrastructure. Service-oriented management includes rapid service provisioning, service templates and policies, and service assurance. Comprehensive network management tools let operators create physical and logical topology maps, engineer traffic flows, and manage network commissioning and software upgrades. Network inventory, alarm surveillance and PM collection are enabled by the E7 system. The E7 provides locally hosted Web GUI, CLI, and SNMP interfaces.



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## SPECIFICATIONS

# Calix E7 Ethernet Service Access Platform

### SUBSCRIBER AND NETWORK PORTS

Subscriber and network port count is determined by the line cards placed in the E7's two universal card slots.

E7 Card	GPON Ports	GE SFP Ports	10GE XFP Ports	10GE SFP+ Ports
10GE-4	0	12	2	2
GPON-4	4	8	2	2
GE-12	0	12	0	2

### BACKPLANE BANDWIDTH

100 Gbps between slots

### SLOTS

2 universal line card slots  
1 FTA slot

### DIMENSIONS (W x H x D)

17.5 x 1.7 x 11.45 inches  
44.5 x 4.3 x 29.1 cm  
Height is 1 RU

### WEIGHT

5.9 lb (2.7 kg) E7 shelf  
7.4 lb (3.4 kg) shelf with Fan Tray

### OPERATING ENVIRONMENT

Temperature: -40 to +65° C  
(-40° F to +149° F)  
Humidity: 10 to 95%  
(non-condensing)  
Operating altitude: 10,000 ft  
(3,049 m)

### STORAGE ENVIRONMENT

Temperature: -40 to +85° C  
(-40° F to +185° F)  
Humidity: 5 to 95%

### MANAGEMENT SUPPORT

Calix CMS network management  
Calix CLI and Web GUI for local  
management interface  
SNMP v2c AND v3 performance and  
fault monitoring

### MANAGEMENT INTERFACES

Ethernet 10/100 (RJ-45 connector on  
Calix E7 Fan Tray)  
Ethernet 10/100 (RJ-45 connector on  
back of Calix E7)  
RS-232 (RJ-11 connector on Calix E7  
Fan Tray)

### SYNCHRONIZATION

Synchronization is enabled by the E7  
line cards as required.  
External reference timing  
Built-in Stratum-3 clock  
Hardware-ready to support IEEE  
1588v2 and Synchronous Ethernet

### ALARM I/O INTERFACES

Wire wrap pin access on E7 back  
User definable alarm  
inputs: 7; outputs: 1

### FIBER INTERFACES

All optical ports use pluggable optics  
(SFP, XFP, SFP+)  
LC or SC connectors on modules

### ANALOG/METALLIC INTERFACES

Two standard 25-pair RJ-21  
connectors per slot

### TIMING I/O INTERFACES

Access through wire wrap pins on the  
back of the Calix E7  
BITS clock (sink and source)

### STANDARDS COMPLIANCE

NEBS Level 3 compliance  
(GR-63-CORE, GR-1089-CORE,  
GR-3028)  
UL 60950  
FCC Part 15 Class A

### POWER FEEDS

Integrated power management on  
Calix E7 line cards  
Redundant -48/60 VDC battery  
feeds (A and B)  
Input Range: -42.5VDC to -72VDC  
Fuse: 7.5 Amps (A and B)



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## SPECIFICATIONS

# Calix E7 Ethernet Service Access Platform

## FAN TRAY ASSEMBLY

### FANS

4 fans housed in fan tray  
Resilient design maintains system cooling with one fan failure

### MANAGEMENT INTERFACES

Ethernet 10/100 (RJ-45 connector)  
RS-232 (RJ-11 connector)

### SYSTEM INFORMATION

7-segment LCD display  
System Controller (MGT) – GREEN

### SHELF ALARM INDICATOR

Critical (CR) - RED  
Major (MJ) - RED  
Minor (MN) - AMBER  
Alarm Cut-Off (ACO) button

### POWER SPECIFICATIONS

Typical CO Environment  
Power: 22 Watts  
Heat dissipation: 6 Watts  
RT Environment  
Power: 65 Watts  
Heat dissipation: 18 Watts

### MAINTENANCE

Field-replaceable air filter  
(not used in RT locations)  
Hot-swappable fan tray assembly



## ORDERING INFORMATION

### CALIX E7 ETHERNET SERVICE ACCESS PLATFORM

000-00372..... E7 Chassis with Fan Tray Assembly and Installation Kit

### CALIX E7 LINE CARDS

100-01771..... E7 10GE-4 (2x10GE XFP, 2x10GE SFP+, 12xGE SFP)  
100-01772..... E7 GE-12 (12xGE SFP, 2x10GE SFP+)  
100-01773..... E7 GPON-4 (4xGPON OIM, 8xGE SFP, 2x10GE XFP, 2x10GE SFP+)

### CALIX E7 FAN TRAY ASSEMBLY

100-01451..... E7 Fan Tray Assembly  
000-00228..... E7 Fan Tray Assembly Filter, Package of 10 units

### CALIX OPTICAL AND COPPER PLUGGABLE MODULES

Calix offers a full suite of optical and copper modules for E7 line cards.

SFP ..... 1 GE optical and copper 10 Gigabit Small Form-factor Pluggable (SFP) modules  
SFP+ ..... 10GE optical and copper Small Form-factor Pluggable (SFP+) modules  
GE SFP modules may also be used in SFP+ ports at a 1Gbps rate  
XFP ..... 10GE optical 10 Gigabit Small Form-factor Pluggable (XFP) modules  
GPON OIM ..... 2.5Gbps GPON (Class B+ ODN with minimum 28dB link budget, up to 1:64 splits)  
ER-GPON OIM..... 2.5Gbps Extended Reach GPON (up to 40 km with 1:8 split)



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## 836GE Residential Services Gateway



### DESCRIPTION

The Calix 836GE Residential Services Gateway (RSG) is a next generation service delivery device that supports broadband connections into the home and manages subscriber voice, data and video services. This high-performance services gateway integrates an auto-detect 2.5 GPON or 1 Gbps Active Ethernet (AE) optical WAN interface with switching and routing functions that manage premises network traffic at speeds up to 1 Gbps. Gateway interfaces include: four Gigabit Ethernet (GE) ports for IPTV video and data services, two integrated voice lines supporting carrier grade VoIP and network-based TDM voice circuits, wireless networking with 802.11n Wi-Fi, and a USB port for future home interconnect services.

**ADVANCED SERVICES MANAGEMENT:** The 836GE Residential Services Gateway uses advanced service management features to rapidly deliver premium services throughout a subscriber's home. The RSG terminates a GPON or a point-to-point AE fiber optic link at the subscriber's location and provides industry-standard interfaces for the customer premises equipment. The 836GE RSG enables subscribers to receive broadband data, IP video, and VOIP or TDM based voice on a single fiber. Inside the subscriber home, the optical signal is converted to the appropriate electrical format for transmission over the residence's in-home network including Wi-Fi. The 836GE RSG is designed to the latest 802.11n standard, which supports selectable dual-band 2.4MHz and 5MHz operation, MIMO spatial diversity antenna technology and 40MHz bandwidth support. The internal wireless antennas are optimized for residential coverage and single- or dual-polarity connections. A USB port is also available for networking with other Ethernet appliances.

**EASY TO INSTALL, ACTIVATE, AND MAINTAIN:** With the 836GE RSG, Calix has redefined how a services gateway is installed and activated at a subscriber's location. Using the RSG's Smart Activate feature and a phone or laptop, a field technician can install and apply the subscriber's services without special equipment or assistance from the central office. Calix also provides innovative software management tools that allow the service provider to configure, activate and upgrade the RSG quickly from a remote location using in-band management or TR-069. Extensive troubleshooting capabilities, remote software downloads, and easy-to-use service-profile menus ensure that services are delivered and maintained without needless truck rolls and hardware upgrades. Employing an 836GE RSG allows service providers to reduce their operational expenses while providing future proof management of the in-home network.

**NEW STANDARD FOR PERFORMANCE AND RELIABILITY:** The 836GE RSG is a network-managed, intelligent service gateway that features Calix Home Gateway software. This sophisticated software allows the RSG to support multiple high-bandwidth applications such as 1 Gbps high-speed data, HDTV-based IPTV video; routing and bridging features to support Whole-Home DVR, and the transfer/exchange of media from digital storage devices. Home Gateway support includes: administrating Internet traffic, Quality of Service features, parental controls, and port forwarding rules for traffic management of on-line gaming, music, video and children's entertainment.

**TRUE CARRIER CLASS SOLUTION:** The 836GE RSG offers a variety of power options including: a basic 100-240 VAC, 50-60 Hz to 15 VDC converter, and a carrier grade 120-240 VAC, 50-60 Hz AC to 12 VDC Uninterruptible Power Supply (UPS). The UPS provides battery backup of lifeline voice in the event of local AC power loss; it also monitors battery status, battery charge and battery life, and reports results through the Calix Management System (CMS).



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PRODUCT DATASHEET

# 836GE Residential Services Gateway

## KEY ATTRIBUTES

- Standards-based Full Service Access Network (FSAN), ITU-T GPON and IEEE AE compliant
- Supports multiple networking standards including 2.5 Gbps GPON and 1.0 Gbps AE, with auto-detect optics enabling a seamless transition between WAN interfaces
- Home Gateway:
  - Layer 2 and 3 switching and routing
  - DHCP server options
  - DHCP (IPoE) and PPPoE network connections
  - Network Access Translation (NAT), public to private IP addressing
  - Configurable IP address schemes, subnets, static-IP addresses
  - DNS server
  - Bridge port assignment and data traffic mappings
  - Port forwarding
  - Firewall and security
  - Application and website filtering
  - Selectable forwarding and blocking policies
  - DMZ hosting
  - Parental controls, time of day usage
  - Denial of service
  - MAC filtering
  - Time/Zone support
  - Universal Plug-and-Play (UPnP)
- Wireless:
  - 2.4GHz and 5GHz, selectable dual-band
  - 802.11n certified, 802.11a/b/g compatible
  - WPA/WPA2
  - WPS push-button
  - WEP 64/128 bit encryption
  - Four SSID support with factory default SSID
  - MAC filtering
- Two voice lines:
  - FXS ports, ANSI and ETSI
  - Carrier grade SIP, H.248, MGCP VoIP
  - TDM GR-303/TR-08 mode II/GR-57, GR-08 (TR-08 Mode I) voice services
- Four Gigabit Ethernet (GE) interfaces:
  - Symmetrical 1 Gbps bandwidth for IPTV and data services
  - Multi-rate 10/100/1000 BaseT Ethernet, auto-negotiating
- USB port:
  - Type A configured as a host controller device
- Supports multiple data service profiles
- Traffic management and Quality of Service (QOS):
  - 802.1Q VLANs
  - 802.1p service prioritization
  - Q-in-Q tagging
  - Multiple VLANs
  - Rate limiting
  - DiffServ
  - Pre-defined QOS on service type
- IPTV, IGMPv2, future support of IGMPv3:
  - IGMP Snooping and Proxy
  - IGMP Fast Leaves
- Complete OAM&P support via Calix Management System (CMS)
- Gateway Management:
  - TR-069
  - Local Home Gateway GUI, access provisionable
  - Remote WAN side GUI access
  - Default username/password
  - Set-up persistence, factory reboot option
- Indoor mounting options:
  - Wall mount
  - Structured Wiring Enclosure (SWE) mount
  - Desktop mount: horizontal or vertical
  - Optional fiber management assembly
- AC to 15 VDC wall transformer available
- Optional carrier-grade lifeline-service power source with in-home battery backup and alarm monitoring



## SPECIFICATIONS

# 836GE Residential Services Gateway

### DIMENSIONS

Height: 6.8 in (17.3 cm)  
Width: 6.8 in (17.3 cm)  
Depth: 1.5 in (3.8 cm)  
Weight: 14 oz. (.4 kg)

### PON CHARACTERISTICS

Max. split: 64 GPON  
Max. reach: 40 km (25 miles)  
Maximum Attenuation:  
GPON Class B+, 28 dB  
1490 ± 10 nm optical receiver:  
-27.0 to -8.0 dBm  
1310 ± 20 nm optical transmitter:  
0.5 to 5.0 dBm

### POINT-TO-POINT (AE) CHARACTERISTICS

Max. reach: 50 km (31 miles)  
1490 nm optical receiver:  
-22.0 to -3.0 dBm  
1310 optical transmitter:  
-5.5 to 0.0 dBm

### INTERFACES

Wireless: 802.11n Wi-Fi  
Telephony: RJ-11  
Data/IPTV: 10/100/1000 BaseT  
Ethernet ports, RJ-45 connectors  
USB: Type A  
AE/PON: Single 9/125 μm (single mode) fiber, SC/APC connector, minimum 50 dB return loss  
Power: 9-pin DIN jack

### TELEPHONY

General: POTS via SIP, H.248, MGCP or TDM gateway, TR-08 Mode I & II  
Number of lines: 2  
RENs per line: 5 maximum  
RENs per unit: 10 maximum  
CPE—physical connection: RJ-11 jack (one per line)  
Drop length: Maximum 1000 feet (305 m)  
DS0 Output: 25 mA  
Ring Voltage: 56–84 VAC

### DATA

Drop length: 328 feet (100 m) maximum using CAT5 cable  
Auto MDI/MDIX crossover for 1000BASE-TX, 100BASE-TX, and 10BASE-T ports  
Traffic Management and QOS: 802.11nQ VLAN; 802.11np voice, video, data and management priorities; Q-in-Q tagging; Rate limiting

### WIRELESS

802.11 a/b/g/n  
2x2 MIMO antenna  
2.4 GHz and 5 GHz, selectable  
Multiple SSID  
Auto channel select  
WPS, WPS push button  
Wireless Security: Wi-Fi protected access (WPA/WPA2), WEP, MAC address filtering  
Wi-Fi multimedia (WMM)

### REMOTE MANAGEMENT

OAM&P via Calix Management System (CMS)  
TR-069 remote management  
TR-064 local management  
TR-98 Internet gateway device data model

### ENVIRONMENTAL

Operating temperature: Indoor ambient temperature, 0° to 40°C  
Operating/storage relative humidity: 0 to 95 % non-condensing  
Altitude: -200 to 10,000 feet (-61 to 3,048 m) above sea level

### CERTIFICATION AND COMPLIANCE

Emissions: FCC Part 15 Class B, IC ICES-003 Class B, CISPR-22  
Safety: UL 60950 and UL 1697 approved, CE Mark  
Telcordia: GR-1089  
IEEE: 802.3, 802.3AB, 802.3U, 802.11np, 802.11nQ



### POWER AND ALARMS

9-pin DIN connector with 7-conductor power and alarm cable

### POWERING

Input voltage: 12 VDC (nominal), 10 VDC (min.), 16 VDC (max)  
Input current: 900 mA (nominal)  
Residential battery backup source: UPS mounted at subscriber's residence  
Battery backup time rated capacity: 8 hours based on Telcordia GR-909 calculation methods using recommended UPS. Contact Calix for recommended UPS



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ORDERING INFORMATION

# 836GE Residential Services Gateway

## Calix 836GE Residential Services Gateway

836GE RSG (100-03158)..... RSG, 2 POTS, 4 Gigabit Ethernet, 1 USB, Wi-Fi

## Calix 836GE Residential Services Gateway Power Supplies

PS 15V 9DIN-A (100-02042) ..... Power Supply 700GE Indoor 100-240 VAC 50/60 Hz to 12 VDC,  
9-pin DIN, AM Type A

PS 15V 9DIN-C (100-03238) ..... Power Supply 700GE Indoor 100-240 VAC 50/60 Hz to 15 VDC,  
9-pin DIN, EU/BR Type C

PS 15V 9DIN-G (100-03239) ..... Power Supply 700GE Indoor 100-240 VAC 50/60 Hz to 15 VDC,  
9-pin DIN, UK Type G

PS 15V 9DIN-I (100-03240)..... Power Supply 700GE Indoor 100-240 VAC 50/60 Hz to 15 VDC,  
9-pin DIN, AU/NZ Type I

## Calix 836GE Residential Services Gateway UPSs and UPS Cords

Indoor UPS 24W B (100-02062)..... Indoor UPS, Wall Mount or Desktop, 12V 7.2AH 24W, Black - AM Type A

Indoor UPS 24W B-C (100-03278) ..... Indoor UPS, Wall Mount or Desktop, 12V 7.2AH 24W, Black - EU Type C

Indoor UPS 24W B-G (100-03279) ..... Indoor UPS, Wall Mount or Desktop, 12V 7.2AH 24W, Black - UK Type G

Indoor UPS 24W B-I (100-03280)..... Indoor UPS, Wall Mount or Desktop, 12V 7.2AH 24W, Black - AU/NZ Type I

Indoor PWR Cord 4B (100-02063)..... Indoor UPS Power Cord, 7-pin Connector to 9-pin DIN Male, 4' Black

Indoor PWR Cord 10B (100-02064)..... Indoor UPS Power Cord, 7-pin Connector to 9-pin DIN Male, 10' Black

Indoor PWR NT Cord 20B (100-03296) ..... Indoor UPS Power Cord, Un-terminated to 9-pin DIN Male, 20' Black

## Calix 836GE Residential Services Gateway Fiber Management Assembly

Indoor ONT FMA QTY 20 (100-03448) ..... Indoor ONT Fiber Mgmt Assembly - Quantity 20



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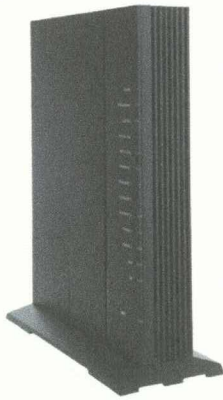
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## PRODUCT DATASHEET

# 844G and 854G GigaCenters | ANSI



### DESCRIPTION

The Calix 844G and 854G GigaCenters are next generation residential premises service delivery platforms that extend the access network into the home and act as a strategic location for control of the gigabit experience. Supporting broadband connectivity within the home and managing subscriber voice, data and video services, this intelligent, high-performance service platform integrates a 2.5 GPON optical interface with switching and routing functions that manage premises network traffic at speeds up to 1 Gbps. The GigaCenter service interfaces include: carrier class wireless networking with 802.11ac Wi-Fi and four Gigabit Ethernet (GE) ports for IPTV video and data services, two integrated voice lines supporting carrier grade VoIP and network-based TDM voice circuits, a USB port for home networking services, and an option for RF video.

**GIGABIT SUBSCRIBER EXPERIENCE:** The 844G and 854G GigaCenters are integrated access and gateway solutions that deliver advanced network management and software features to unleash the gigabit experience throughout a subscriber's home. The GigaCenter service delivery platform terminates a GPON fiber optic link at the subscriber's premises and provides carrier class Wi-Fi and Gigabit Ethernet interfaces for customer multi-media devices. The 844G and 854G GigaCenters enable residential subscribers to receive gigabit broadband data, IP video, and VoIP or TDM based voice on a single fiber. Using the latest 802.11ac 5GHz technology incorporating 4x4 multi-user multiple-input and multiple-output (MU-MIMO) and beamforming, the 844G and 854G GigaCenters allow service providers to extend the access network inside the home and establish a strategic location for the delivery and control of broadband services. A USB port is available for home networking with other Ethernet appliances. The GigaCenter family also includes the option of RF signaling for broadcast video services over existing Hybrid Fiber Coax (HFC) networks.

Calix engineered the 844G and 854G GigaCenters for optimal whole-home coverage with simultaneous dual-band 2.4GHz and 5GHz operation and dynamic beamforming at 5GHz. For maximum performance, the GigaCenter supports high-power 2x2 MIMO spatial diversity at 2.4GHz and 4x4 MU-MIMO at 5GHz. The 844G and 854G GigaCenters support the entire 5GHz band including DFS channels and can be provisioned to support 80MHz bandwidth at 5GHz. The GigaCenter solution delivers HD video and data throughout a subscriber's home with control and management of an increasingly video-rich and mobile broadband environment.

**EASY TO INSTALL, ACTIVATE, AND MAINTAIN:** With the 844G and 854G GigaCenters, Calix has redefined how to install and activate residential services at a subscriber's premises. Using the Calix Smart Activate feature and a phone or laptop, a field technician can install and apply the subscriber's service profile without special equipment or assistance from the central office. Calix also provides the innovative Compass software portfolio, including Consumer Connect, which allows the service provider to configure, activate and upgrade the GigaCenter quickly from a remote location using in-band management or TR-069. Extensive troubleshooting capabilities, remote software downloads, and easy-to-use service activation ensure that services are delivered and maintained without needless truck rolls and hardware upgrades. Employing GigaCenters allows service providers to reduce their operational expenses while effectively delivering the gigabit experience to their subscribers.

**TRUE CARRIER GRADE VOICE SOLUTION:** The 844G and 854G GigaCenters deliver a truly agile and responsive service platform with lifeline voice in the event of local AC power loss. A carrier grade 120-240 VAC, 50-60 Hz AC to 12 VDC Uninterruptible Power Supply (UPS) provides battery backup of voice services compliant to Telcordia GR-909. The 844G and 854G GigaCenters can monitor battery status, battery charge and battery life, and report results through the Calix Management System (CMS).





## 844G and 854G GigaCenters | ANSI

### KEY ATTRIBUTES

- Standards-based Full Service Access Network (FSAN), ITU-T GPON compliant
- Home Gateway:
  - Layer 2 bridge and Layer 3 routing for High Speed Internet (HSI) data and IPTV video services
  - DHCP server options
  - DHCP (IPoE) and PPPoE network connections
  - Network Access Translation (NAT), public to private IP addressing
  - Configurable IP address schemes, subnets, static-IP addresses
  - DNS server
  - Bridge port assignment and data traffic mappings
  - Port forwarding
  - Firewall and security
  - Application and website filtering
  - Selectable forwarding and blocking policies
  - DMZ hosting
  - Parental controls, time of day usage
  - Denial of service
  - MAC filtering
  - Time/Zone support
  - Universal Plug-and-Play (UPnP)
- Wireless:
  - 2.4GHz and 5GHz, simultaneous dual-band
  - 5GHz 802.11ac certified, 802.11a/g/n compatible
  - 2.4GHz 802.11n certified, 802.11b/g compatible
  - WPA/WPA2
  - WPS push-button
  - WEP 64/128 bit encryption
  - Eight SSIDs per band with factory default SSIDs
  - MAC filtering
- Two voice lines:
  - FXS ports, ANSI
  - Carrier grade SIP, H.248, MGCP VoIP
  - TDM GR-303/TR-08 Mode II/GR-57, GR-08 (TR-08 Mode I) voice services
- Four Gigabit Ethernet (GE) interfaces:
  - Symmetrical 1 Gbps bandwidth for residential IPTV and data services
  - Multi-rate 10/100/1000 BaseT Ethernet, auto-negotiating
- USB port:
  - USB 2.0 - Type A configured as a host interface
- RF video bandwidth to 1 GHz for extended digital programming
- Supports multiple data service profiles
- Traffic management and Quality of Service (QoS):
  - 802.1Q VLANs
  - 802.1p service prioritization
  - Q-in-Q tagging
  - Multiple VLANs
  - Rate limiting
  - DiffServ
  - Pre-defined QoS on service type
- IPTV, IGMPv2, future support of IGMPv3:
  - IGMP Snooping and Proxy
  - IGMP Fast Leaves
- Complete OAM&P support via Calix Management System (CMS)
- Gateway Management:
  - TR-069
  - Local Home Gateway GUI, access provisionable
  - Remote WAN side GUI access
  - Default username/password
  - Set-up persistence, factory reboot support
- Indoor mounting:
  - Wall and Structured Wiring Enclosure (SWE) mount with fiber management
  - Desktop mounting stand
- Optional voice lifeline service power source with in-home battery backup and alarm monitoring
- AC to 12 VDC power adapter available for non-lifeline services.

## SPECIFICATIONS

# 844G and 854G GigaCenters | ANSI

### DIMENSIONS

Height: 10.6 in (26.9 cm)  
Width: 7.9 in (20.0 cm)  
Depth: 1.8 in (4.6 cm)  
Weight: 28 oz. (.8 kg)

### PON CHARACTERISTICS

Max. split: 64 GPON  
Max. reach: 58 km (36 miles) with C+/FEC  
Maximum Optical Distribution Network (ODN) Attenuation:  
GPON Class B+, 28 dB  
GPON Class C+, 32 dB  
1490 ± 10 nm optical receiver:  
-27.0 to -8.0 dBm  
1310 ± 20 nm optical transmitter:  
0.5 to 5.0 dBm

### INTERFACES

Wireless: 2.4GHz 2x2 and 5Hz 4x4 internal antennas  
Telephony: Two RJ-11 connectors  
Data/IPTV: Four 10/100/1000 BaseT Ethernet ports, RJ-45 connectors  
USB: USB 2.0 Type A  
RF Video: F-connector, 75 Ohms  
PON: Single 9/125 μm (single mode) fiber, SC/APC connector, minimum 50 dB return loss  
Power: 8-pin connector

### TELEPHONY

General: SIP, H.248, MGCP or TDM Gateway (GR-303, GR-57, TR-08 Mode I, TR-08 Mode II)  
Number of lines: 2  
RENs per line: 5 maximum  
RENs per unit: 10 maximum  
Drop length: Maximum 500 feet (152.4 m)  
DS0 Output: 23.5 mA

### DATA

Drop length: 328 feet (100 m) maximum using CAT5 cable  
Auto MDI/MDIX crossover for 1000BASE-TX, 100BASE-TX, and 10BASE-T ports  
Traffic Management and QOS:  
802.11nQ VLAN; 802.11np voice, video, data and management priorities; Q-in-Q tagging;  
Rate limiting

### WIRELESS

2.4GHz 802.11 b/g/n  
2x2 MIMO, high-power  
5GHz 802.11 a/g/n/ac  
4x4 MU-MIMO, implicit/explicit dynamic beamforming  
2.4GHz and 5GHz simultaneous  
8 SSIDs per band (2 SSID subscriber default)  
Auto channel selecting and interference detection  
WPS, WPS push button  
Wireless Security: Wi-Fi protected access (WPA/WPA2) WEP, MAC address filtering  
Wi-Fi multimedia (WMM)

### VIDEO-ANALOG RF OUTPUT

Bandwidth: 54 to 550 MHz  
Return loss: 10 dB minimum  
Signal strength (with AGC range):  
18 ± 2 dBmV  
Flatness: ± 1.0 dB  
Tilt: 1.0 dB ± 1.0 dB from 54 to 550 MHz

### VIDEO-DIGITAL RF OUTPUT

Bandwidth: 550 to 1003 MHz  
Return loss: 8 dB minimum  
Signal strength (within AGC range):  
12 ± 2 dBmV  
Flatness: ± 1.5 dB  
Tilt: 4.0 dB ± 1.0 dB from 550 to 1003 MHz  
Modulation error ratio (MER): 33 dB

### REMOTE MANAGEMENT

OAM&P via Calix Management System (CMS)  
TR-069 remote management  
TR-064 CPE management  
TR-098 Internet Gateway Device Data Model

### ENVIRONMENTAL

Operating temperature: Indoor ambient temperature, 0° to 40°C  
Operating/storage relative humidity: 8 to 95 % non-condensing  
Altitude: -200 to 10,000 feet (-61 to 3,048 m) above sea level

### CERTIFICATION AND COMPLIANCE

Emissions:  
FCC Part 15 Class B  
IC ICES-003 Class B  
CISPR-22  
Safety:  
UL 60950 and UL 1697 approved  
IEEE: 802.3, 802.3AB, 802.3U, 802.11np, 802.11nQ  
Wi-Fi Alliance Certified  
802.11ac and 802.11n



USB-IF Compliance  
USB 2.0



### POWERING AND ALARMS

8-pin connector with 7-conductor power and alarm cable  
Input voltage: 12 VDC (nominal), 10 VDC (min.), 15 VDC (max)  
External Power Adapter: 12 VDC, 2.5 A  
Residential battery backup source: UPS mounted **at subscriber's residence**  
Battery backup time rated capacity:  
8 hours based on Telcordia GR-909 calculation methods using recommended UPS. Contact Calix for recommended UPS

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ORDERING INFORMATION

## 844G and 854G GigaCenters | ANSI

### Calix 844G and 854G GigaCenters

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100-04011 .....844G-1 GigaCenter, 2 POTS, 4 GE, Dual Wi-Fi, 1 USB -UPS Power Interface  
100-04013 .....854G-1 GigaCenter, 2 POTS, 4 GE, Dual Wi-Fi, 1 USB, 1 RF -UPS Power Interface

### Calix 844G and 854G UPS and UPS Cords

---

100-04068 .....Indoor UPS, 12V 7.2AH 36W, Black - AM Type B Grounded  
100-03893 .....Indoor UPS Power Cord, 7 pin UPS to 8 pin ONT Male, 1M Black  
100-03894 .....Indoor UPS Power Cord, 7 pin UPS to 8 pin ONT Male, 3M Black  
100-03895 .....Indoor UPS Power Cord, Un-terminated to 8 pin ONT Male, 6M Black

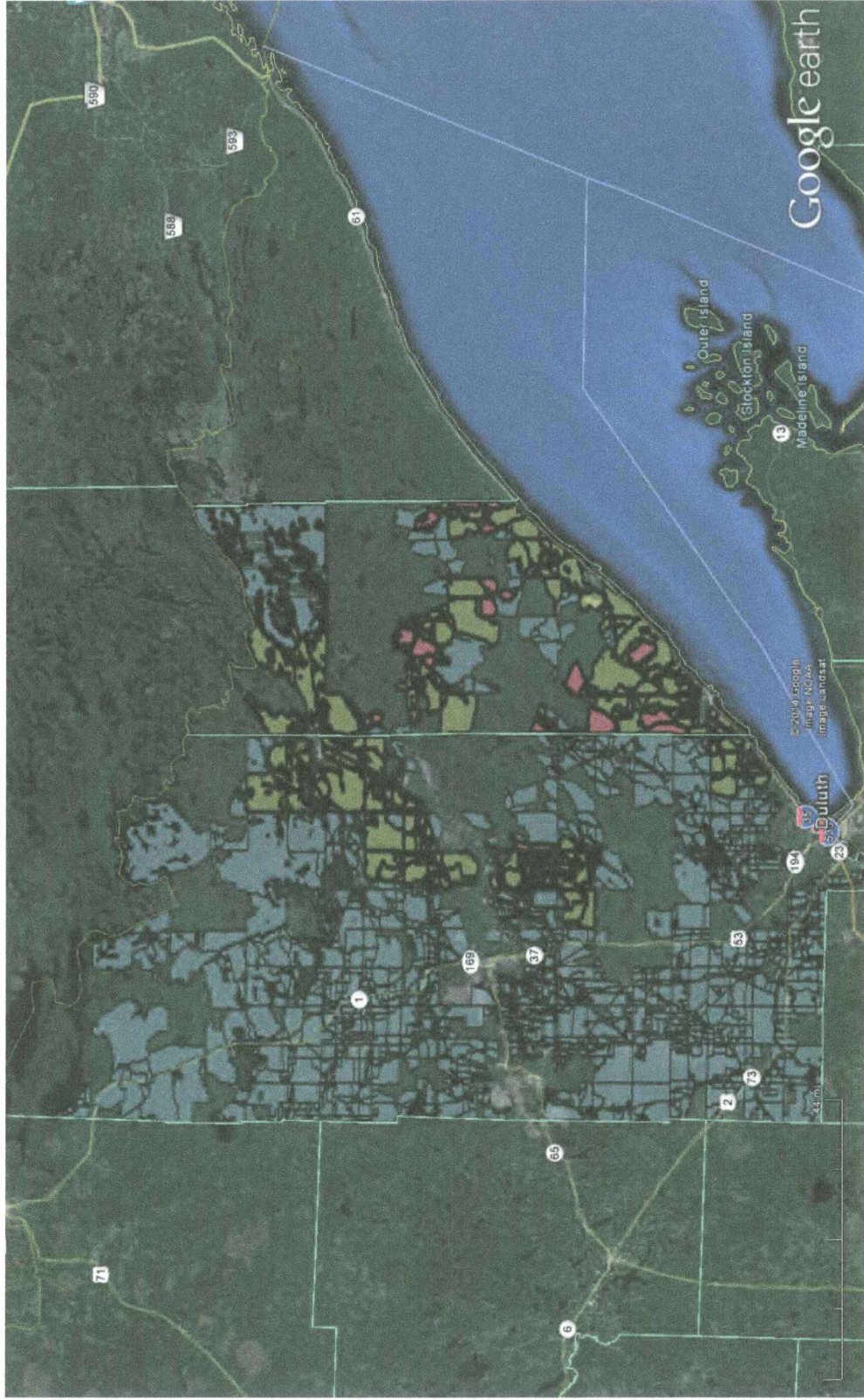


1035 N. McDowell Blvd., Petaluma CA 94954  
TEL: 877.766.3500 [www.calix.com](http://www.calix.com)

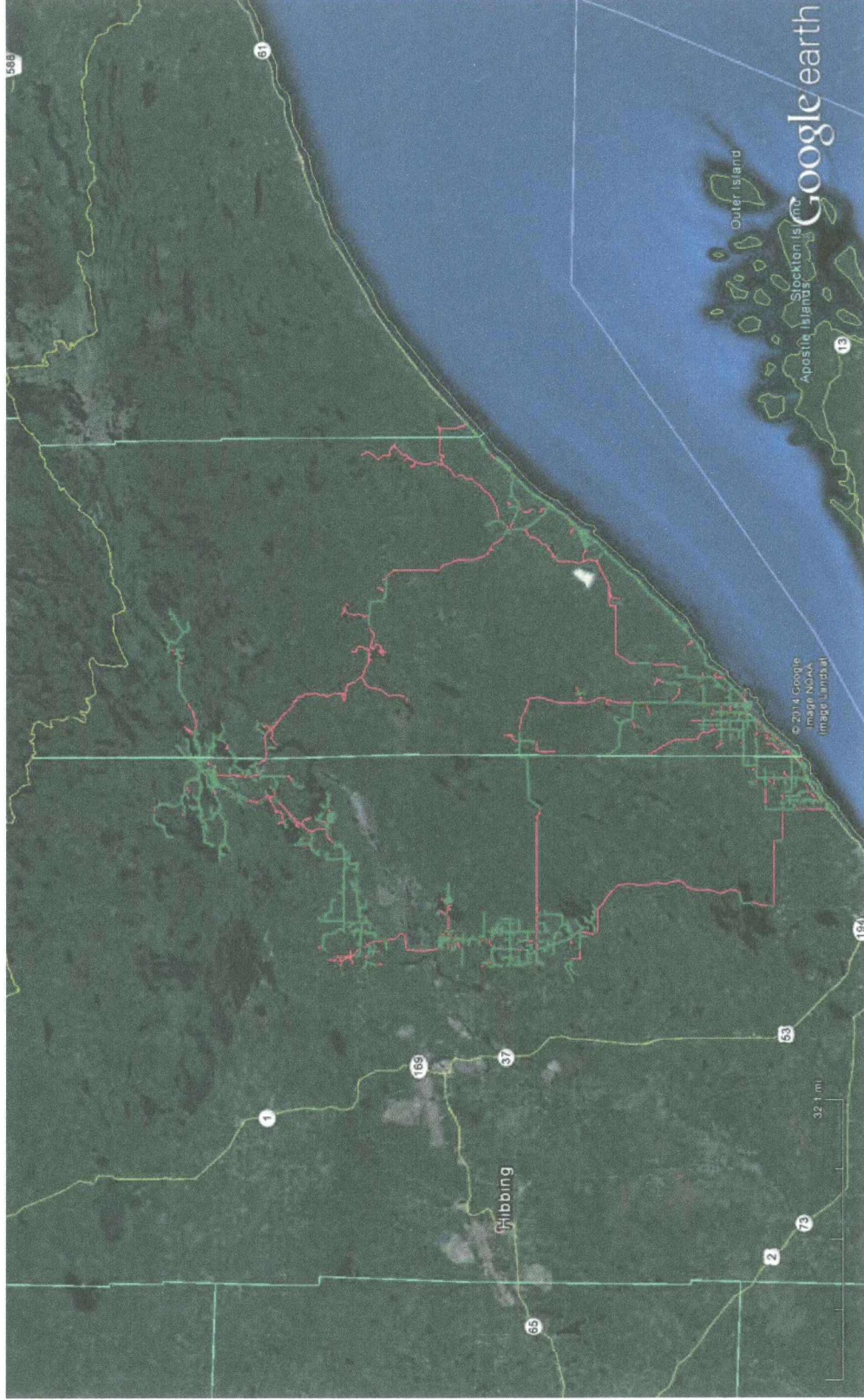
250-00287, Rev.10

GOOGLE  
MAPS  
ELIGIBLE AREAS  
&  
MAINLINE  
NETWORK

Lake Communications  
FCC Eligible Census Blocks



Lake Communications  
Mainline Fiber Network

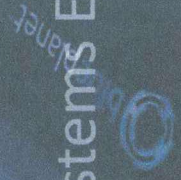


MAINLINE  
NETWORK  
&  
EQUIPMENT



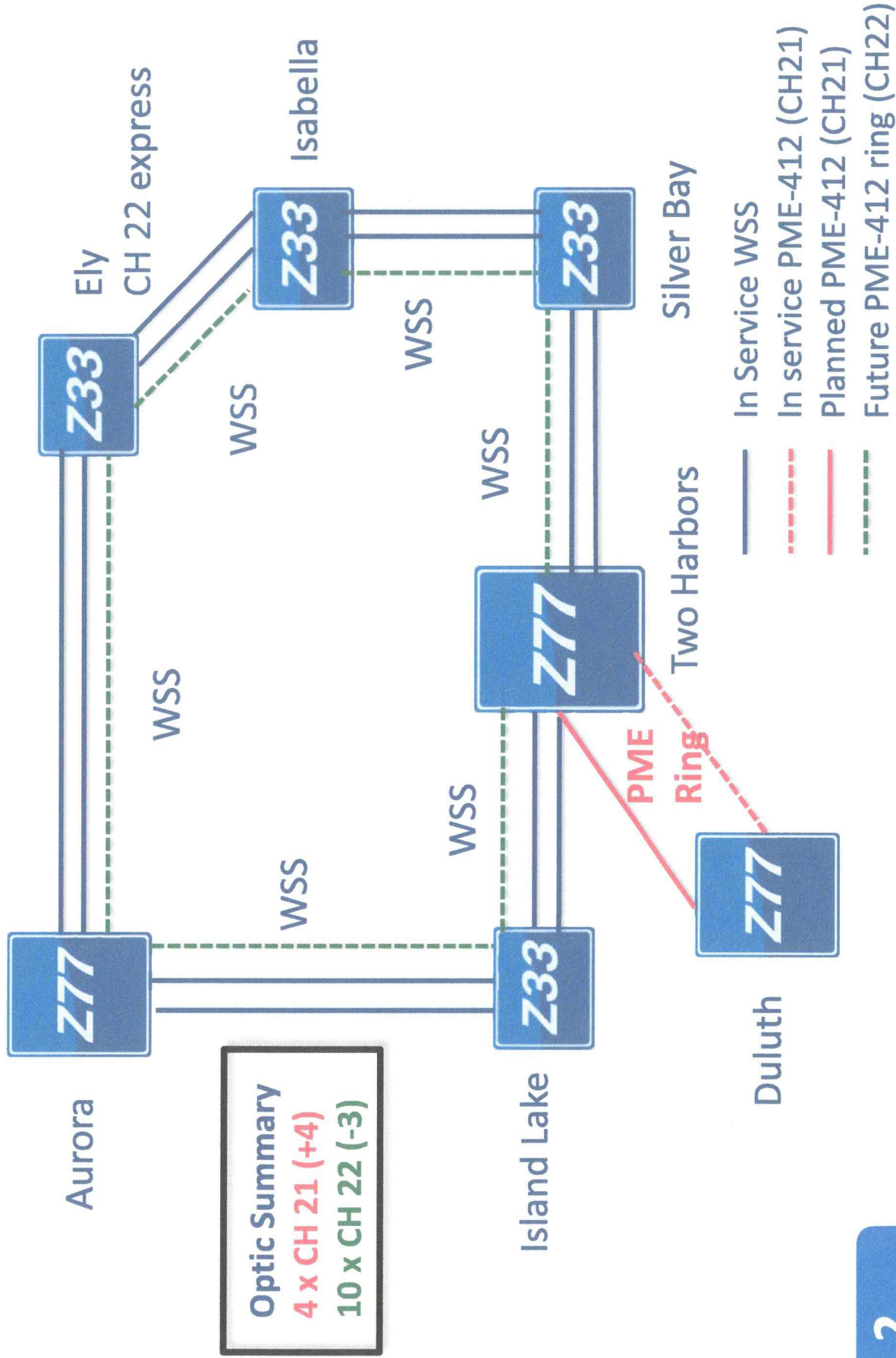
# Lake County DWDM Network Review June 18<sup>th</sup>, 2014

Jim Pizzirusso, Systems Engineer

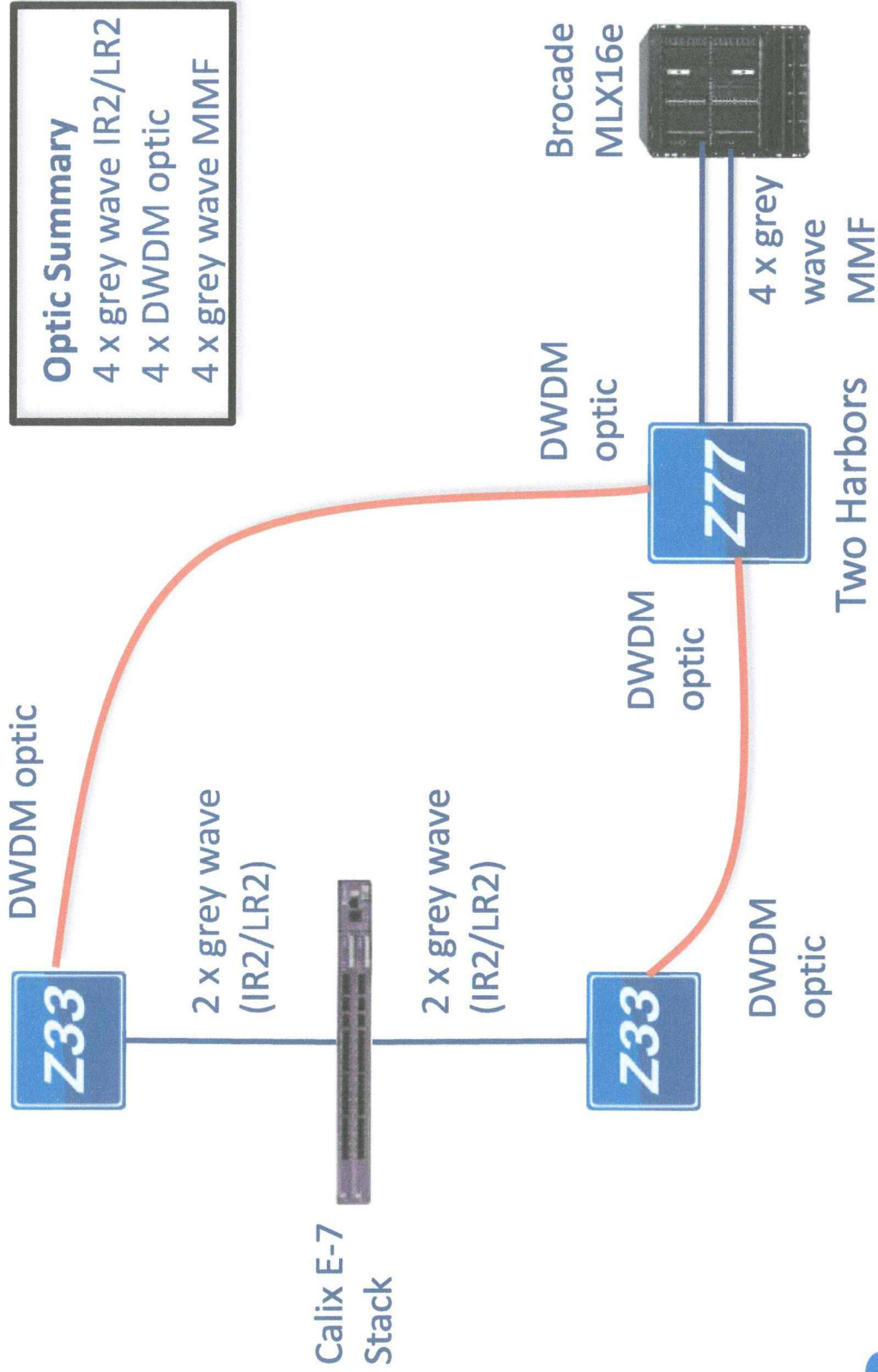




# Proposed - High level Cyan network



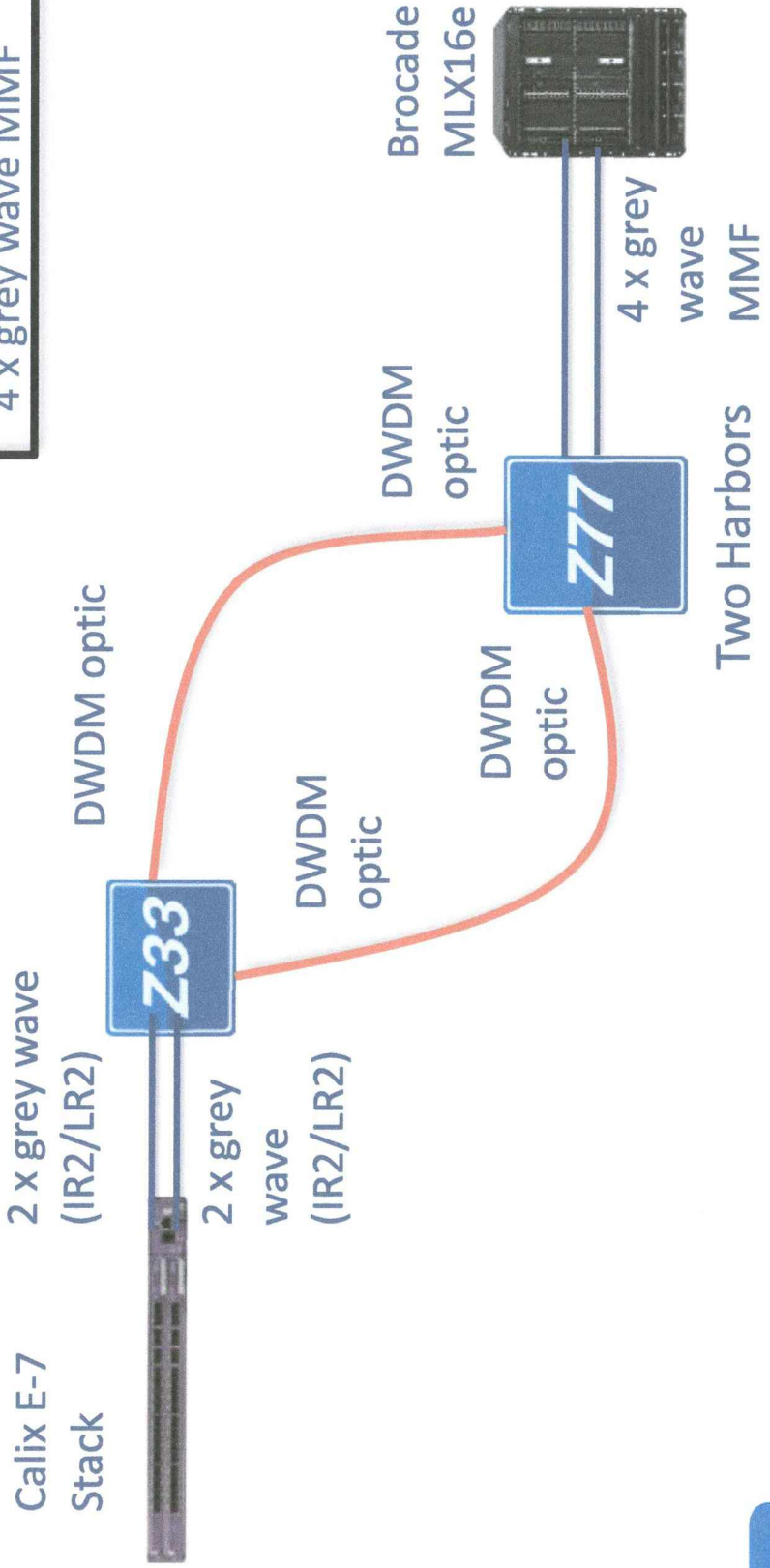
# Diverse Cyan node homed Calix E-7 (majority of sites)



# Single node homed Calix E-7 (i.e. Hoyt Lakes)



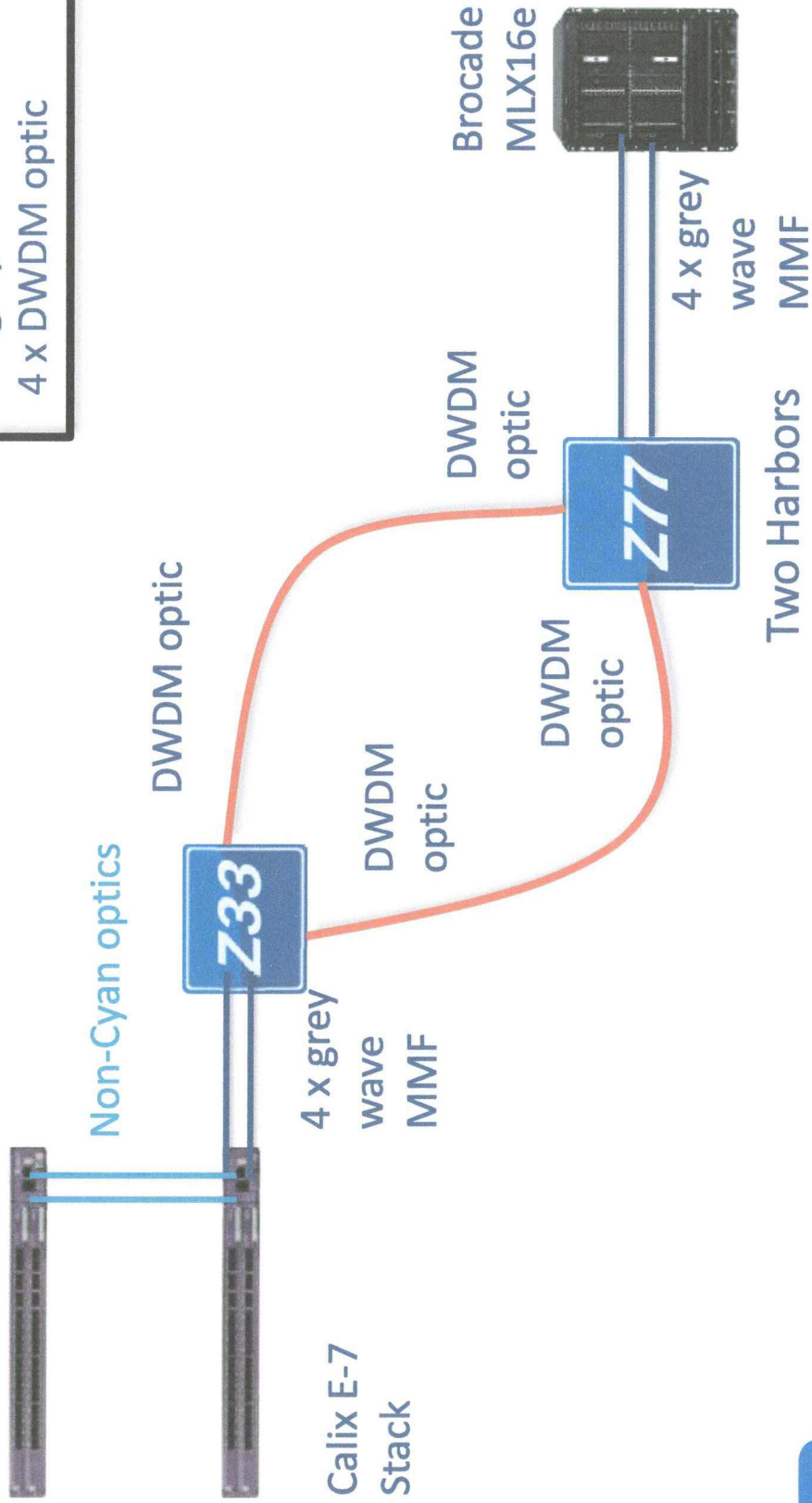
**Optic Summary**  
 4 x grey wave IR2/LR2  
 4 x DWDM optic  
 4 x grey wave MMF



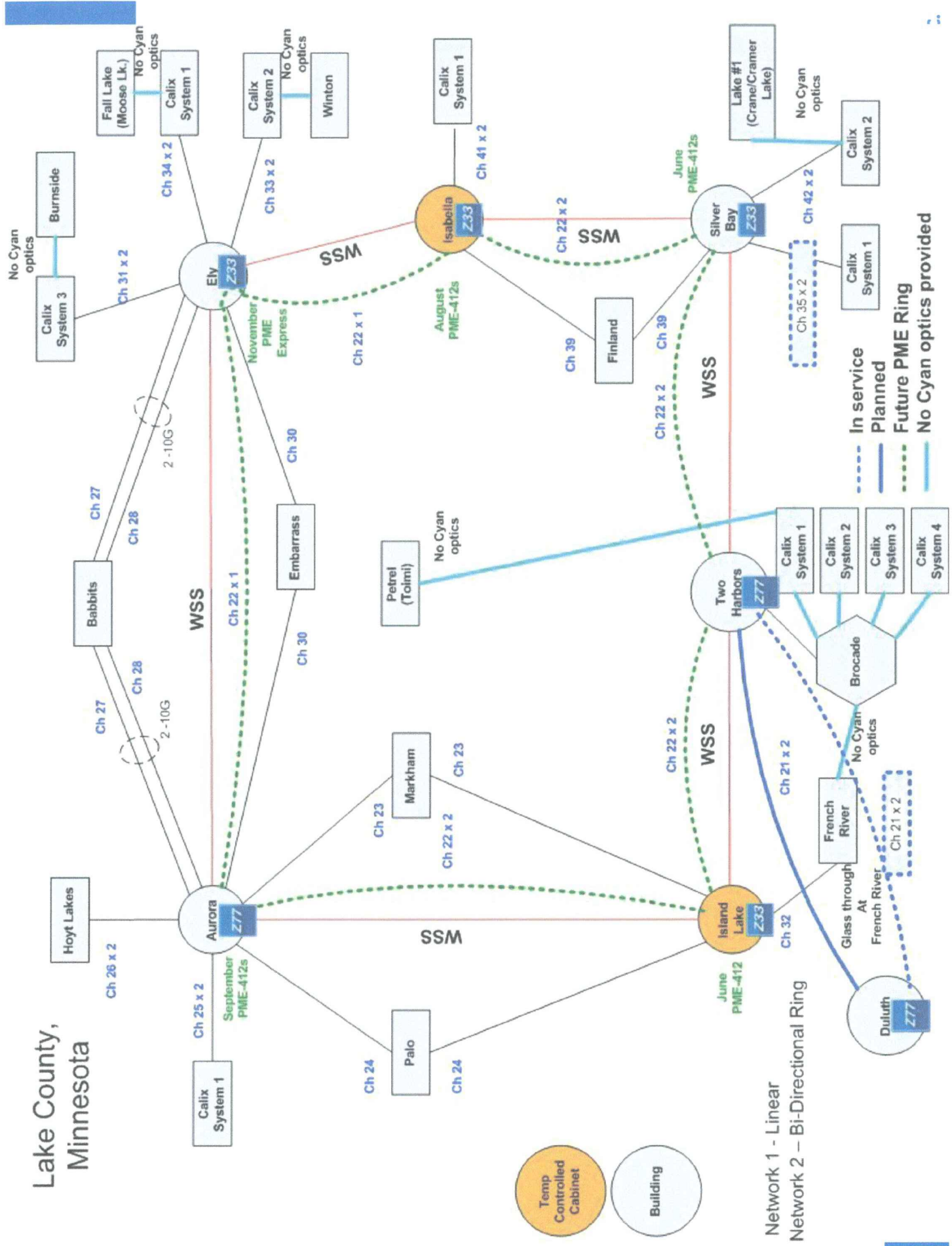
# Calix E-7 Remote Calix Systems



**Optic Summary**  
8 x grey wave MMF  
4 x DWDM optic



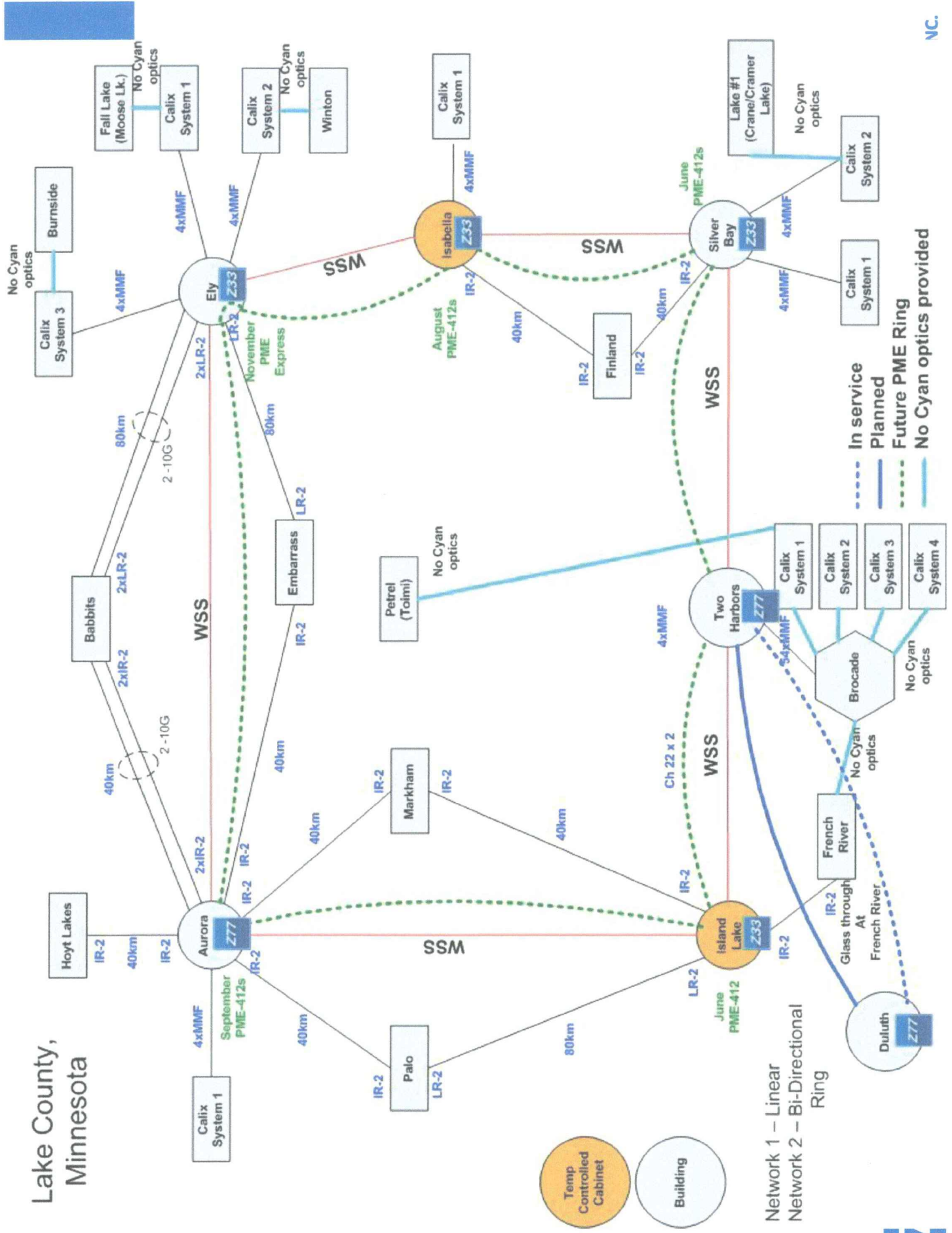
# Lake County, Minnesota

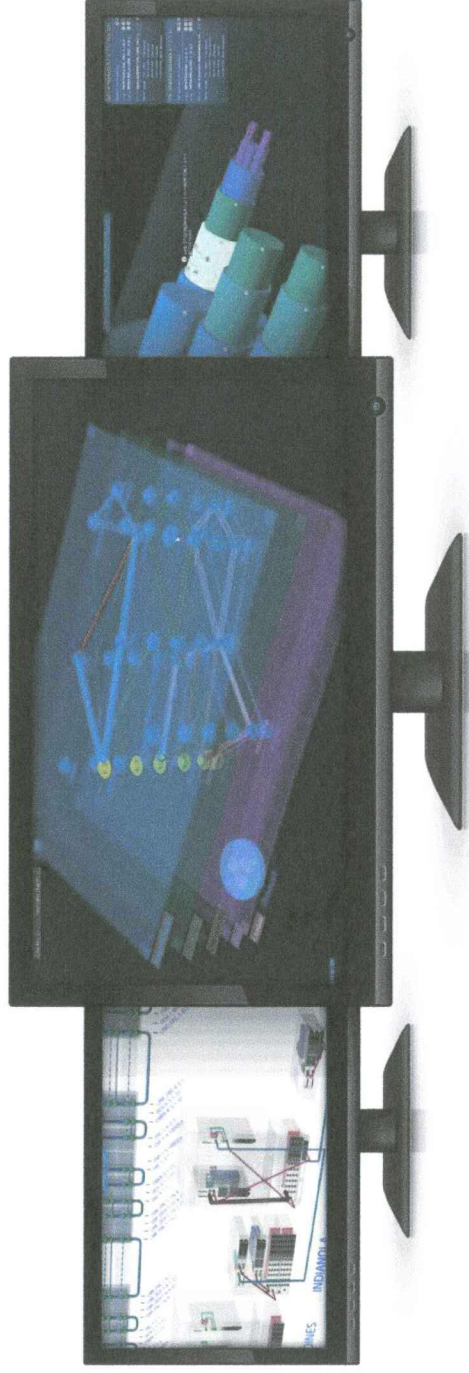


Network 1 - Linear  
Network 2 - Bi-Directional Ring

--- In service  
--- Planned  
... Future PME Ring  
— No Cyan optics provided

# Lake County, Minnesota





Software makes the difference.

# Cyan Z33 Platform

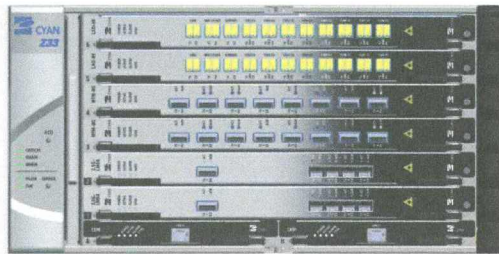
## Edge- and Aggregation-Optimized P-OTP

### Introduction

The Z33 is Cyan's environmentally hardened packet-optical transport platform (P-OTP) optimized for edge and aggregation deployments. Cyan Z-Series systems, combined with the **Blue Planet™ Software-Defined Network (SDN) Platform**, provide a compelling and economically efficient solution for network transformation.

The mid-size Z33 system balances flexibility with low costs to efficiently scale network capacity at the edge. The modular six slot shelf supports the full range of Z-Series Ethernet, wavelength, OTN, and SONET/SDH modules to enable plug-and-pay switching, aggregation, grooming, and transport for any mix of services. Service modules also support pluggable SFPs/XFPs for media and reach flexibility.

At just 5RU in height, the Z33 complements the Z22 and Z77 for a complete solution from the edge to the metro core. With a holistic approach to the transport network, the Cyan Z-Series enables scalable, service rich networks with operational simplicity and capital efficiency.



### Benefits

#### *Scalable, cost-effective operation*

Flexible platform architecture supports scalability for investment protection, common sparing and inventory, operational consistency, and pay-as-you-grow capacity and functionality

#### *Software-defined networking*

**Supported by Cyan's Blue Planet Software-Defined Network (SDN) Platform** to simplify multi-layer network design, operations, SLA assurance, and service orchestration

#### *Flexible, multi-layer transport*

Advanced technology modules support a range of applications and seamless transport and networking integration enables unprecedented multi-layer network efficiencies with single-layer simplicity

#### *Energy efficiency*

Integrated approach reduces power consumption and truck rolls, saving energy and the environment

#### *Environmentally hardened chassis*

Extends service delivery into outside plant cabinets

#### *Compact footprint*

Compact 5RU chassis houses six multiservice slots, plus two common control modules





## Flexibility and Scalability

With support for a wide variety of powerful Ethernet aggregation switching, SDH/SONET, as well as DWDM muxponding, transponding, and regeneration modules, the Z33 delivers a full range of packet, TDM, and wavelength services. All service modules support pluggable SFP/SFP+/XFP/CFPs for pay-as-you-grow economics.

Optional ROADMs further enable the Z33 to support full optical level (OOO) add/drop multiplexing with scalability up to ninety-six 10G and/or 100G channels per fiber.

Rounding out support for wholesale, wavelength services and the need to muxpond and transpond certain services, the Z33 supports a complete range of transport requirements, with integrated Optical Transport Network (OTN) encapsulation.

Driven by IPTV, VOD, 2/3/4G wireless backhaul, Carrier Ethernet 2.0, and rapidly scaling Internet services, the Cyan Z33 grooms services into discrete high-capacity 10G/100G wavelengths. As services scale, the Z33 provides the option to transport multiple 10G/100G wavelengths per fiber using DWDM.

## Applications

Understanding and embracing the multi-layer aspect of evolving networks, the Cyan Z33 introduces multiple functions in one fully integrated system:

- MEF Carrier Ethernet 2.0 (CE2.0) certified services with 1, 10, and 100 GbE aggregation, switching and COE transport
- SONET/SDH multiplexing and cross-connect functionality with scalability up to OC-192/STM-64
- OTN digital wrapper functionality
- 10G/100G DWDM transport

In addition, the Z33 is supported by Cyan's Blue Planet, an SDN platform that provides network virtualization and service-enabling capabilities.

## Compact, Scalable Design

The Cyan Z33 provides six multi-service slots, plus two common control modules to support multi-layer add/drop multiplexing and transport in a compact, 19-in. (483 mm) wide chassis.

With support for 100 Gbps of protected packet throughput per slot, this design sets new industry benchmarks for functionality and scalability in just 5RU of rack space with amazing economics.

## Key Features

- Scalability for investment protection, common sparing and inventory, operational consistency, and pay-as-you-go capacity and functionality
  - Get started at a low cost
  - Add cards as needed
  - Pair switch cards to increase switch capacity
  - Add SFP/SFP+/XFP/CFPs as needed
- Option to add DWDM and up to four degrees of WSS for scale-efficient ROADM functionality
  - Up to 8- or 40-channel terminal DWDM for OEO flexibility
  - Up to 96 channels of DWDM with ROADM for OOO efficiencies as traffic scales



- Advanced technology modules that support a range of applications
  - Scalable Ethernet capacity with advanced COE for resilient, carrier-grade packet transport
  - Seamless TDM-to-packet transition for flexible and efficient phased migration of networks from TDM to packet
  - SDH/SONET upgrade alternative, providing grooming and 10G transport of sub-rate services for less than the cost of adding an OC-192/STM-64 port to legacy systems
  - Multi-layer wholesale transport flexibility with OTN support for improved performance and management with transparency
  - Fiber relief options ranging from aggregation and transport at 10G/100G or the combination of multiple 10G/100G transports per fiber with DWDM
  - OTN on all trunk connections for enhanced performance and management on all services
- 100 Gbps per-slot capacity
- Flexibility to redeploy Z33 cards in larger-capacity Z77 for further expansion of capacity and functionality
- Unprecedented multi-layer network efficiencies with single-layer simplicity through multi-layer transport and networking integration
- Greater utilization of network resources and lower operational costs via Blue Planet
- Integrated approach for reduced power consumption and truck rolls, saving energy and lowering environmental impact

## Technical Specifications

### System Overview

- Modules
  - Service module slots: 6
  - Common control module slots: 2
  - Hot-swap capabilities on all modules
  - Front access for all modules and connection interfaces
- Chassis capacity
  - Packet: up to 600 Gbps of packet services
    - 400 Gbps full-mesh (slots 1-4)
    - 200 Gbps (paired slots 5,6)
  - SDH/SONET: up to 60 Gbps of services
  - Optical: 8, 40, or 96 channels @ 10 Gbps/100 Gbps, C-band terminal mux and ROADMs
  - Future support of higher-capacity modules
- Physical interfaces
  - Pluggable optical modules, fixed and tunable
  - Maximum port densities:

Interface Type	Ports/Chassis
FE/GbE	108
10GbE	60
100GbE	6
OC-3/12, STM-1/4	96
OC-48/STM-16	48
OC-192/STM-64	60
2.5/OTU1	48
10G/OTU2	60
100G	6



## Technical Specifications (cont.)

### System Overview (cont.)

- Redundancy and protection
  - Redundant fans
  - Redundant power connections
  - 1:1 equipment protection for all common cards and service modules
  - Carrier Ethernet protection
    - IEEE 802.3 ad Link Aggregation
    - IEEE 802.3Qay and G.8031 Path Protection
    - G.8032v2 Ring Protection
  - SDH/SONET protection
    - 1+1 APS/MSP
    - UPSR/SNCP
- Synchronization
  - Stratum 3-compliant timing subsystem
  - Redundant DS1 and 2MHz timing inputs
  - Derived DS1 timing outputs
  - Line-timed SDH/SONET and Sync-E Ethernet support
- Power connectors: dual-feed quick-connect terminal block
- Alarm connectors: quick-connect terminal block

### Management

- 4x10/100/1000Base-T DCN interfaces
- System alarm outputs: CRITICAL, MAJOR, MINOR, AUDIBLE, FAILSAFE
- System alarm inputs: ACO
- Provisionable environmental alarm outputs: 2
- Provisionable environmental alarm inputs: 5
- SNMP v2, CLI, TL1

### Physical

- Shelf dimensions
  - Depth: 12" (305 mm) from rack mount (14.85" or 377 mm total)
  - Width: 19" (483 mm)
  - Height: 8.75" (222 mm)
- Weight: 27 lbs (12.25 kg); includes 2 CEMs and fan tray

### Power

- Dual -48 VDC nominal (-40 VDC to -60 VDC)
- Optional 1RU AC/DC solution supporting 120/240 VAC inputs
- Maximum power consumption: 1000 watts (typical < 500 watts)



## Technical Specifications (cont.)

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### Environmental

- -40° to +65° C operating temperature (industrial temperature)\*
- 5% to 85% operating relative humidity (non-condensing)
- 13,000 ft (4,000 m) altitude

### Compliance / Safety

- NEBS 3 Certified (GR-63 CORE, GR-1089)
- UL/CSA Listed
- UE/CE-Marked: EN 60950, EN 55022, EN 61000, ETSI EN 300 386 V1.3.3
- CB Scheme Certified 60950
- FCC, Subpart B, Part 15, Class A
- RoHS compliant

\* While the Z33 chassis is environmentally hardened, not all supported interface modules meet these specifications. Environmentally hardened interface modules include the following:

- LAD-8i terminal multiplexer
- FLX-216i OTN muxponder
- PME-216i Ethernet switching and transport module

# Cyan Z77 Platform

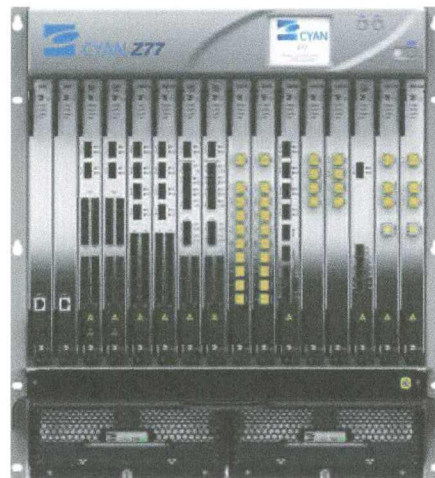
## Aggregation- and Core-Optimized P-OTP

### Introduction

The Z77 is Cyan's flagship packet-optical transport platform (P-OTP), optimized for high-capacity aggregation and metro/regional core network deployments. Cyan Z-Series systems, combined with the Blue Planet™ Software-Defined Network (SDN) Platform, provide a compelling and economically efficient solution for network transformation.

The Z77 is a fully integrated P-OTP that provides transformational scale by supporting up to 200 Gbps of capacity per slot and 2.8 Tbps per chassis. The modular, carrier-grade Z77 architecture supports the full suite of Z-Series Ethernet, wavelength, OTN, and SONET/SDH modules, plus an optional unified packet and Optical Transport Network (OTN) switch-fabric.

At just 13RU in height, the Z77 combines massive capacity with modular functionality at a fraction of the cost of prior-generation systems. It complements the Z22 and Z33 for a complete solution from the edge to the regional core.



### Benefits

#### *Scalable, cost-effective operation*

Flexible platform architecture supports scalability for investment protection, common sparing and inventory, operational consistency, and pay-as-you-grow capacity and functionality

#### *Software-defined networking*

Supported by Cyan's Blue Planet Software-Defined Network (SDN) Platform to simplify multi-layer network design, operations, SLA assurance, and service orchestration

#### *Flexible, multi-layer transport*

Advanced technology modules support a range of applications and services

#### *Energy efficiency*

Integrated approach reduces power consumption and truck rolls, saving energy and the environment



## Flexible, Multi-Layer Transport

The Z77 integrates a wide range of optional packet and optical capabilities to meet transport requirements across aggregation, transit, and hub locations.

Cyan's Z-Series family was among the first products to achieve Carrier Ethernet 2.0 (CE2.0) certification from the Metro Ethernet Forum (MEF), ensuring that the platform enables cost-effective Ethernet service delivery with carrier-grade capabilities such as QoS, scalability, reliability, and service management. Beyond CE2.0, the Z-Series also implements connection-oriented Ethernet (COE) to provide more resilient and predictable Ethernet transport for E-Line, E-LAN, E-Tree, and E-Access services at interface rates up to 100 GbE.

A multi-layer transport solution, the Z-Series provides simultaneous support for native transponding and muxponding of G.709 OTN and SONET/SDH, in addition to SONET/SDH multiplexing and cross-connect functionality. Rounding out support for wholesale wavelength services, the Z77 also supports a complete range of dense wave division multiplexing (DWDM) options.

**The Z77 provides the option to transport 8, 40, or 96 DWDM channels per fiber (10G and/or 100G) to scale traffic aggregates.** Optional WSS-based optical switching further expands functionality and scale with 2- and 4-degree ROADMs supporting highly automated network configuration.

## Applications

The Z77 introduces packet-optical transport functions in one fully integrated system capable of supporting a diverse mix of applications:

- MEF Carrier Ethernet 2.0 (CE2.0) service aggregation and transport to reduce the need for expensive and complex switch/router platforms
- SONET/SDH multiplexing and cross-connect functionality to cap and transition from legacy MSPPs
- OTN multiplexing, transponding, and framing to efficiently converge multiple service types over a single wavelength
- 10G and/or 100G wavelength multiplexing and switching to scale service transport capacity

## Massively Scalable, Modular Architecture

The 13RU-high Cyan Z77 chassis provides remarkable scale in a compact footprint. All 14 service slots are available to support either optical or electrical modules, reducing slot restrictions and engineering rules.

When equipped with the optional multi-technology XC-2800 switching fabric, the Z77 architecture supports more than 200 Gbps of non-blocking packet switch capacity per slot and up to 2.8 Tbps per chassis. The Z77 XC-2800 ensures unprecedented packet services performance by delivering any-to-any connectivity between a new generation of interface modules with full line-rate switching across all ports concurrently. The scalability provided by the Z77 XC-2800 enables a simple and cost-effective migration to high-density 1/10 Gigabit Ethernet (GbE) as well as 100 GbE and ODU-4 services.



## Key Features

- Scalability for investment protection, common sparing and inventory, operational consistency, and pay-as-you-go capacity and functionality
  - Get started at a low cost
  - Add cards as needed
  - Add SFP/SFP+/XFP/CFPs as needed
- Option to add multi-technology switch fabric and compatible cards as needed – supporting switching across all card slots
  - 200 Gbps per slot capacity
  - Up to 2.8 Tbps packet capacity, with any-to-any packet cross-connect (switching) for point-to-multipoint services, grooming, and transport efficiency
- Option to add up to 4 degrees of WSS optical switching, supporting fully dynamic optical grooming with automatic optical tuning and adjustment
  - Fixed wavelength 8- or 40-channel DWDM for economic efficiency
  - 2- and 4-degree (future 8-degree), 96-channel ROADMs for simplified operations and maximum operational efficiency
- Multi-layer transport integration
  - OTN on all trunk connections for enhanced performance and management on all services
  - Integration across Ethernet, SDH/SONET, COE, OTN, and DWDM for true multi-layer network visibility
  - Integrated approach reduces power consumption and truck rolls, saves energy and expense, and lessens environmental impact

## Technical Specifications

### System Overview

- Chassis (front)
  - Service module slots: 14
  - Common control module slots: 2
  - All modules are hot-swappable
- Chassis (rear)
  - XC-2800 multi-technology switch fabric modules: 4 per chassis
- Chassis capacity
  - Up to 2.8 Tbps of packet services
  - Up to 2.8 Tbps of OTN services
  - Up to 140 Gbps of SDH/SONET
- Optical
  - 2- and 4-degree 96-channel ROADMs
  - Integrated pre-amp and booster amplifiers and OSC
  - 8- or 40-channel, C-band terminal mux
  - Tunable or fixed-wavelength transceivers
- Physical interfaces
  - A wide-range of pluggable optical modules (with different reach) with the choice to match the desired application
  - Maximum port densities:

Interface Type	Ports/Chassis
FE/GbE	252
10GbE	140
100GbE	14
OC-3/12, STM-1/4	224
OC-48/STM-16	112
OC-192/STM-64	140
2.5G/OTU1	112
10G/OTU2	140
100G/OTU4	14



## Technical Specifications (cont.)

### System Overview (cont.)

- Redundancy and protection
  - Redundant fans
  - Redundant power connections
  - Equipment protection
    - 1:1 for all common cards and service modules
    - 1:3 for multi-technology switch fabric modules
  - Carrier Ethernet protection
    - IEEE 802.3 ad Link Aggregation
    - IEEE 802.3Qay Path Protection
  - SDH/SONET protection
    - 1+1 APS/MSP
    - UPSR/SNCP
- Synchronization
  - Stratum 3 compliant timing subsystem
  - Redundant DS1 and 2MHz timing inputs
  - Derived DS1 timing outputs
  - Line-timed SDH/SONET and Sync-E Ethernet support
- Power connectors: quad-feed quick-connect terminal block
- Alarm connectors: quick-connect terminal block

### Management

- LED panel for local monitoring and provisioning
- 4x10/100/1000Base-T DCN interfaces
- System alarm outputs: CRITICAL MAJOR, MINOR, AUDIBLE, FAILSAFE

- System alarm inputs: ACO
- Provisionable environmental alarm outputs: 2
- Provisionable environmental alarm inputs: 5
- SNMP v2, CLI, TL1

### Physical

- Shelf dimensions
  - Width: 21" (534 mm)
  - Depth: 21" (534 mm)
  - Height: 22.75" (578 mm)
  - Compatible with 21" and 23" racks
- Weight: 98 lbs (44.5 kg); includes fan tray

### Power

- Dual -48 VDC nominal (-40 VDC to -60 VDC)
- Maximum power consumption – 4000 watts (typically < 1500 watts)

### Environmental

- 0° to 50° C operating temperature
- 5% to 85% operating relative humidity (non-condensing)
- 13,000 ft (4,000 m) altitude

### Compliance / Safety

- NEBS 3 Certified (GR-63 CORE, GR-1089)
- UL/CSA Listed
- UE/CE-Marked: EN 60950, EN 55022, EN 61000, ETSI EN 300 386 V.1.3.3
- CB Scheme Certified 60950
- FCC, Part 15, Subpart B, Class A
- RoHS compliant



STATE OF MINNESOTA

BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION

Beverly Jones Heydinger  
Nancy Lange  
Dan Lipschultz  
John Tuma  
Betsy Wergin

Chair  
Commissioner  
Commissioner  
Commissioner  
Vice Chair

In the Matter of a Petition of Lake County  
Minnesota for Designation as an Eligible  
Telecommunications Carrier

Docket No. M-15-65

ATTACHMENT C TO

REPLY COMMENTS OF LAKE COUNTY MINNESOTA

March 26, 2015

