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March 20, 2015

<u>VIA EFILING AND U.S. MAIL</u>

Public Utility Commission of Oregon
3930 Fairview Industrial Drive SE
PO Box 1088
Salem OR 97308-1088

      Re: Application of Douglas Services, Inc. d/b/a Douglas FastNet for designation as an
              eligible telecommunications carrier, designation as an eligible
              telecommunications provider and request for waiver

Dear Sir/Madam:

      Attached you will find the Application of Douglas Services, Inc. d/b/a Douglas FastNet
for designation as an eligible telecommunications carrier ("ETC"), designation as an eligible
telecommunications provider for OTAP purpose. Please note that the Application contains a
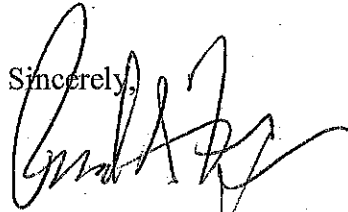request for waiver of certain requirements.

      This Application is a result of Douglas FastNet being tentatively awarded a Rural
Broadband Experiment by the Federal Communications Commission. One qualification on that
award is that Douglas FastNet must receive designation as an ETC by June 2, 2015.

      Please note that the area to be covered by the Rural Broadband Experiment does not
contain any tribal lands.

A copy of the application, exhibits and confidential material will be sent to the Commission via overnight mail.

Sincerely,

Richard A. Finnigan

RAF/cs

cc: Client (via email)

BEFORE THE PUBLIC UTILITY COMMISSION OF OREGON

In the Matter of

Application of Douglas Services, Inc. d/b/a
Douglas FastNet for Designation as an
Eligible Telecommunications Carrier in the
State of Oregon for the Limited Purpose of
Offering Lifeline Service to Qualified
Households and Request for Waiver.

DOCKET NO. _____

APPLICATION OF DOUGLAS SERVICES,
INC. D/B/A DOUGLAS FASTNET FOR
DESIGNATION AS AN ELIGIBLE
TELECOMMUNICATIONS CARRIER AND
REQUEST FOR WAIVER

Douglas Services, Inc. d/b/a Douglas FastNet ("DFN"), by its attorney, and pursuant to

Section 214(e)(2)[1] of the federal Communications Act of 1934, as amended (the "federal Act"),

Section 54.201[2] of the rules and regulations of the Federal Communications Commission ("FCC"),

and in accordance with this Commission's requirements as set forth in Order No. 06-292 in Docket

UM 1217,[3] hereby submits this Application for Designation as an Eligible Telecommunications

Carrier ("ETC") by the Public Utility Commission of Oregon (the "Commission") and request for a

waiver of certain requirements in the *ETC Order*. DFN also seeks designation as an Eligible

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[1] 47 U.S.C. § 214(e)(2).
[2] 47 C.F.R. § 54.201.
[3] *Public Utility Commission of Oregon Staff Investigation to Establish Requirements for Initial Designation and Recertification of Telecommunications Carriers Eligible to Receive Federal Universal Service Support*, Docket UM 1217, Order No. 06-292 (June 13, 2006) ("*ETC Order*").

APPLICATION FOR DESIGNATION AS AN
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Telecommunications Provider ("ETP") for the purpose of participating in the Oregon Telephone

Assistance Program ("OTAP"), which is the state's corollary of the federal Lifeline program.

DFN has been provisionally selected by the FCC as a winning bidder for a Rural Broadband

Experiment in Oregon. A copy of the Public Notice issued under DA 15-288 is attached as Exhibit

1. One of the requirements in order to finalize DFN's status and actually move the project forward

is that DFN must be designated as an ETC no later than Tuesday, June 2, 2015, at 11:59 p.m. EST.[4]

One of the aspects of the Rural Broadband Experiment proposed by DFN is to offer a Lifeline

service among its offerings. As a result, DFN seeks designation as an ETC for Lifeline purposes as

well. Thus, it would be appropriate to be designated as an ETP under the OTAP program.

This Application will demonstrate that DFN meets all of the statutory and regulatory

requirements for designation as an ETC and an ETP in the State of Oregon.

This Application is organized to respond to the federal requirements for ETC designation;

many of the responses to federal requirements also satisfy Oregon requirements, and this

Application includes footnotes referencing applicable Oregon ETC designation requirements.

DFN recognizes that the Commission will be examining the requirements for ETC

designation in Phase 2 of Docket UM 1648, Staff Investigation into Eligible Communications

Carriers' Requirements, and will amend this application to demonstrate compliance with any revised

requirements resulting from that proceeding or to request a waiver as applicable, if new

requirements take effect prior to June 2, 2105.

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[4] See, Exhibit 1 at p. 2. Note that the Public Notice states "EST." The correct designation should be "EDT."

APPLICATION FOR DESIGNATION AS AN
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Pleadings, orders, notices and other papers filed or serviced in this matter should be served upon:

Todd Way
Douglas FastNet
2350 NW Aviation Dr.
Roseburg, OR 97470
541-673-4242 Ext. 1002
tway@dfn.net

with copies to:

Richard A. Finnigan
2112 Black Lake Blvd. SW
Olympia, WA 98512
360-956-7001
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I.   OVERVIEW OF DFN

DFN is a wholly owned subsidiary of Douglas Electric Cooperative based in Roseburg, Oregon. DFN was formed in 2001 by the Douglas Electric Board of Directors out of necessity when the local incumbent local exchange carrier (ILEC) network had ongoing service quality issues and there were no plans by the ILEC to deploy DSL in Douglas County markets. Douglas Electric formed DFN with a mission of providing advanced communications to citizens of Douglas County.

DFN is the largest provider of broadband service to local school districts, serving twelve different school districts and the Douglas ESD. DFN provides broadband service to seven different city halls, the Douglas County courthouse, the State of Oregon and the local Indian tribe offices. DFN serves numerous fire departments, libraries, the local hospital and the majority of medical clinics in Douglas County.

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For the small business and residential customer base, DFN currently provides broadband service to over three thousand customers utilizing wireless, DSL and fiber to the home ("FTTH") technologies. DFN deployed voice services in 2011 and has recently surpassed one thousand voice subscribers.

As a subsidiary of Douglas Electric Cooperative, DFN is a locally owned, locally focused company that operates independently of its parent corporation. The back office systems and staff are in place providing voice and broadband service. DFN has an extensive fiber network in place connecting all of Douglas Electric's substations to a SCADA system. DFN also provides cellular backhaul for national cellular companies. As set forth below, DFN meets these requirements.

II. OVERVIEW OF THE RURAL BROADBAND EXPERIMENT

The Rural Broadband Experiment that DFN will offer is a FTTH project that will extend broadband throughout much of central and northern Douglas County. The FTTH project will utilize GPON technology to offer voice and broadband services capable of delivering up to 250 megabits per second download speed and 25 megabits per second upload speed. The project includes 2,495 locations. Of these, there are six anchor institutions. The project is in the remote foothills of the Cascade and Coastal mountain ranges of southwestern Oregon. Specifically, the project covers portions of the Drain, Glide, Oakland-Sutherlin, Roseburg, including the Winston wire center, and Yoncalla exchanges served by CenturyLink.

The service offerings will include a voice only service that will not exceed $34.99 per month.[5] It includes a 50 megabit per second download and 10 megabit per second upload speed

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[5] All prices are initial prices and can change over time.

APPLICATION FOR DESIGNATION AS AN
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1 broadband only offering that will not exceed $39.00 per month for 300 gigabits of usage and will

2 have less than 100 milliseconds of latency. There will be a bundled service offering of voice and

3 broadband including a 50 megabit per second download speed and 10 megabit per second upload

4 speed including basic telephone service for $59.99 per month. There will be a broadband plan of

5 100 megabits per second download speed and 25 megabits per second upload speed for $54.99 per

6 month which also includes 300 gigabits of usage. There will be a 250 megabit per second

7 download speed and a 25 megabit per second upload speed for $149.00 per month with 300 gigabits

8 of usage.

9 The Lifeline offering will be $34.99 per month for basic telephone service. There will be a

10 discounted broadband plan for low-income customers that will be in the 50 megabit per second

11 broadband download package. Qualifying Lifeline customers will be permitted to apply the

12 Lifeline discount to bundled voice and data packages.

13 A list of the effected census blocks is attached as Exhibit 2. DFN's Application for the Rural

14 Broadband Experiment is attached as Exhibit 3. Exhibit 3 includes both financial information

15 (confidential) and technical information about the project.

16 **III.   DFN IS A COMMON CARRIER**

17 DFN has been issued a certificate of authority to operate in Oregon as a Competitive

18 Provider, initially under Docket CP 962, Order No. 01-902, and subsequently under Docket CP

19 1457, Order No. 09-322. Copy attached as Exhibit 4. Therefore, DFN certifies that it is a common

20 carrier under 47 U.S.C § 214(e)(1) for purposes of ETC designation.[6]

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[6] See *ETC Order*, App. A, Initial Designation Requirement 1.1.

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IV. DFN's AUTHORIZED SERVICE

DFN is registered with the Oregon Secretary of State as a domestic corporation, and is authorized to do business in Oregon.[7] DFN's service area in Oregon is in Douglas County. DFN will offer supported services to any potential customer in the census blocks listed in its Rural Broadband Experiment Application (Exhibit 3).[8] DFN confirms that it will be subject to all applicable state and local regulatory fees, including, but not limited to, universal service fees, emergency services, and relay services.

V. DFN WILL OFFER THE SERVICE SUPPORTED BY FEDERAL UNIVERSAL SERVICE

Pursuant to Section 54.101(b) of the FCC's rules, as modified by the *Lifeline Reform Order*,[9] and the *ETC Order*, carriers seeking ETC designation must provide voice telephony services.[10] Specifically, eligible telephony services must provide voice grade access to the public switched telephone network ("PSTN") or its functional equivalent, minutes of use for local service provided at no additional charge, access to emergency 911 and enhanced 911 service in locations where implemented, and toll limitation at no charge (subject to certain requirements and limitations).[11] DFN certifies that its offering under the Rural Broadband Experiment includes its Lifeline service offering, satisfies the FCC's definition of voice telephony service, and it will therefore provide all services designated for support by the FCC. Certain services required by the Oregon ETC Initial

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[7] Oregon Secretary of State registration number 114281-90.
[8] See *ETC Order*, App. A, Initial Designation Requirement 3.2.
[9] *Lifeline and Link Up Reform and Modernization et al.*, WC Docket No. 11-42 *et al.*, *Report and Order and Further Notice of Proposed Rulemaking*, FCC 12-11 (rel. Feb. 6, 2012).
[10] 47 C.F.R. § 54.101(b); *Lifeline Reform Order* ¶ 48.
[11] 47 C.F.R. § 54.101(a); *Lifeline Reform Order* ¶ 48; see also *ETC Order*, App. A, Initial Designation Requirements 2.1, 2.2.

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Designation Requirement 2.1 are not longer required by the FCC.[12] However, DFN continues to provide dual tone multi-frequency signaling or its equivalent, single party service, and access to interexchange service.

DFN's offerings will provide voice grade access to the PSTN. DFN offers its customers access to operator services, the ability to make "long distance" telephone calls, and access to directory assistance services by dialing "411." In addition, DFN's service offering will provide consumers with access to 911 and enhanced 911 to the extent local governments have implemented such services.

The Commission requires a demonstration that an ETC applicant offers a local usage plan that is comparable to the basic local service offerings of the ILEC in the proposed designated service area.[13] The FCC has determined that carriers may satisfy the obligation to provide local usage via service offerings that bundle local and long distance minutes.[14] DFN's proposed service offerings meet the FCC's requirements, and Lifeline plans offered by DFN are comparable in value to the basic local service offerings of the ILEC in the proposed designated service area. DFN's service plans do not have a "minute" usage limitation for local voice telephony.

VI.   DFN SATISFIES THE FACILITIES REQUIREMENT

The federal Act, the FCC's rules, and the *ETC Order* require a carrier seeking ETC designation to offer the supported services using its own facilities or a combination of its own

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[12] In the *Connect America Fund Order*, the FCC revised the supported services definition to eliminate the requirement to offer dual tone multi-frequency signaling, single party service, access to interexchange service, and directory assistance. *Connect America Fund Order* ¶ 78. These services are included in the *ETC Order*, App. A, Initial Designation Requirement 2.1.

[13] *ETC Order*, App. A, Initial Designation Requirement 2.4.

[14] *Lifeline Reform Order* ¶ 49.

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facilities and resale of another carrier's services.[15]   DFN will use its own facilities. Therefore, DFN

certifies that it meets this requirement.

VII.   DFN WILL ADVERTISE THE AVAILABILITY OF THE SUPPORTED SERVICES AND THE RELEVANT CHARGES USING MEDIA OF GENERAL DISTRIBUTION

In accordance with FCC and Commission rules, DFN will publicize the availability of its

service offerings, including Lifeline and OTAP service offerings in the designated service area in a

manner reasonably designed to reach those likely to quality for the service.[16] DFN will utilize the

FCC's 2004 outreach guidelines for advertising Lifeline service offering.[17] Specifically, DFN will

utilize outreach materials and methods designed to reach households that currently do not have

telephone service, will develop advertising material for non-English speaking populations within its

service area, and will coordinate its outreach efforts with relevant government agencies.

DFN will coordinate with relevant state agencies, community outreach organizations, and

non-profit organizations to make information available regarding DFN's Lifeline and OTAP service

offerings in resource guides and other printed material produced by those organizations, as well as

in their offices or other locations visited by potential Lifeline-eligible subscribers. As a locally

based provider, DFN will build on the existing relationships with these organizations. As required

under the *Lifeline Reform Order*, DFN will ensure the FCC-required disclosures, and DBA names it

uses, and details of the Lifeline service offering are contained in all marketing materials.[18] DFN

commits to complying with the Commission rules regarding advertising and marketing Lifeline as

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[15] 47 U.S.C. § 214(e)(1); 47 C.F.R. § 54.201(d); see also *ETC Order*, App. A, Initial Designation Requirements 4.1, 4.3.
[16] 47 C.F.R. § 54.405(b); see also *ETC Order*, App. A, Initial Designation Requirements 6.1, 6.2, 7.1, 7.3.
[17] *Lifeline and Link Up*, 19 FCC Rcd 8302, ¶¶ 274-282.
[18] *Lifeline Reform Order* ¶¶ 274-282.

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1   set forth in OAR 860-033-0110.

VIII. DFN MEETS THE ADDITIONAL REQUIREMENTS FOR ETC DESIGNATION UNDER SECTION 54.202 OF THE FCC'S RULES AND OREGON RULES

Section 54.202 of the FCC's rules contains certain additional requirements for a common carrier to be designated as an ETC. As set for the below, DFN satisfies each of those requirements.

A. DFN Will Comply with the Service Requirements Applicable to Lifeline Support

Section 54.202(a)(1) of the FCC's rules requires a common carrier seeking ETC designation to (1) certify that it will comply with the service requirements applicable to the support that it receives and (2) submit a five-year plan for proposed improvements or upgrades to the applicant's network.[19] DFN hereby certifies that it will comply with the service requirements applicable to the support it receives. DFN, as set out below, requests waiver of the five-year plan requirement.

B. DFN Will Remain Functional in Emergency Situations

Pursuant to Section 54.202(a)(2) of the FCC's rules, and the *ETC Order*, a common carrier seeking ETC designation must demonstrate its ability to remain functional in emergency situations, including a demonstration that it has a reasonable amount of back-up power to ensure functionality without an external power source, is able to re-route traffic around damaged facilities, and is capable of managing traffic spikes resulting from emergency situations.[20] As a facilities based provider, DFN has access to a reasonable amount of back-up power to ensure functionality without an external power source, re-routing of traffic around damaged facilities, and the capability of managing traffic spikes resulting from emergency situations.

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[19] As will be discussed later, the FCC has waived the five-year plan requirements in 47 C.F.R. § 54.313(a)(1).
[20] 47 C.F.R. § 54.202(a)(2); see also *ETC Order*, App. A, Initial Designation Requirements 8.1.8.2.

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C. DFN Will Satisfy Applicable Consumer Protection and Service Quality Standards.

Section 54.202(a)(3) of the FCC's rules and the Commission rules,[21] require a common carrier seeking ETC designation to demonstrate that it will satisfy applicable consumer protection and service quality standards.[22] DFN will satisfy all applicable FCC and consumer protection and service quality standards. As a CLEC, DFN is currently subject to the consumer protection and service quality standards promulgated by the Commission. DFN will satisfy all consumer privacy protection standards as provided in 47 C.F.R. § 64, Subpart U as applicable and will protect Customer Proprietary Network Information ("CPNI") as required by state and federal law and will certify compliance with the same on an annual basis.

DFN commits to working with the Commission to resolve any complaints received by the Commission.

D. DFN is Financially and Technically Capable of Providing Lifeline Services in Accordance with the FCC's Rules

DFN has the financial and technical capability to provide Lifeline service. Section 54.202(a)(4)[23] of the FCC's rules requires a common carrier seeking ETC designation for Lifeline support to demonstrate it is financially and technically capable of providing Lifeline service in compliance with the FCC's rules.[24] Financial information was submitted to the FCC as part of the Rural Broadband Experiment Application. See Exhibit 3.

The management and ultimate owners of DFN are intimately familiar with the financial and

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[21] *ETC Order*, App. A, Initial Designation Requirements 9.1-9.2.
[22] 47 C.F.R. § 54.202(a)(3). Pursuant to FCC rules, DFN will annually certify that it is in compliance with applicable service quality standards and consumer protection rules. 47 C.F.R. § 54.422(B)(3).
[23] Technically, the requirements of 47 C.F.R. § 54.202(a)(4) and (5) apply only to those common carriers seeking Lifeline only certification. DFN is including this information out of an abundance of caution.
[24] 47 C.F.R. § 54.202(a)(4); see also *Lifeline Reform Order* ¶ 387.

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1   technical needs of a telecommunications company. DFN has been offering broadband and voice

2   services in Oregon. DFN currently serves over 1000 voice customers and 3000 broadband

3   customers.

4

E. DFN Will Provide Lifeline Service Plans to Eligible Consumers

5

6   Section 54.202(a)(5) of the FCC's rules and the *ETC Order* require a common carrier

7   seeking ETC designation for Lifeline support to submit information describing the terms and

8   conditions of the voice telephony plans offered to Lifeline subscribers, including details on the

9   number of minutes provided as part of the plan, additional charges for toll calls (if any), and rates

10   for each such plan.[25] The Lifeline plan offered by DFN is described in Section II, above. It

11   contains unlimited local voice calling.

12

IX.   DFN MEETS THE REQUIREMENTS FOR LIFELINE SERVICES UNDER

13   **SECTION 54.405 OF THE FCC'S RULES**

14   Under Section 54.405 of the FCC's rules, an ETC has certain obligations to offer Lifeline

15   service.[26] DFN understands these obligations and will meet them as described below.

16

A. DFN Will Make Lifeline Service Available as Defined under the FCC's Rules

17

18   Section 54.405(a) of the FCC's rules requires an ETC to make available Lifeline service, as

19   defined in Section 54.401 of the FCC's rules,[27] to qualifying low-income consumers.[28] DFN

20   certifies that its Lifeline service offering will conform to the definition of "Lifeline" in the FCC's

21   rules.

22

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23   [25] 47 C.F.R. § 54.202(a)(5); see also *ETC Order*, App. A, Initial Designation Requirement 2.3.

     [26] 47 C.F.R. § 54.405.

24   [27] 47 C.F.R. § 54.401.

     [28] 47 C.F.R. § 54.405(a).

25

26

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B. DFN Will Publicize the Availability of Lifeline Service

Section 54.405(b) of the FCC's rules requires an ETC to publicize the availability of Lifeline service in a manner reasonably designed to reach those likely to quality for the service.[29] As described above, DFN will publicize the availability of its Lifeline service offering in a manner reasonably designed to reach eligible consumers.

C. DFN Will Include Certain Disclosures on Materials Describing Its Lifeline Service, Including the Name of the ETC

Sections 54.405(c) and (d) of the FCC's rules require an ETC to make certain disclosures on all material describing the Lifeline service offering, including the name of the ETC.[30] As noted above, DFN will ensure that all material describing its Lifeline service offering use easily understood language to indicate that the service is a Lifeline service, that Lifeline is a government assistance program, that the service is non-transferable, that only eligible consumers may enroll in the program, and that the program is limited to one discount per household as required under the rules.[31] DFN will also ensure that all materials describing its Lifeline service offering utilize the DFN brand as the name of the ETC providing services.[32] DFN understands that the term "material describing the service" includes all print, audio, video, and web material used to describe or enroll in the Lifeline service offering, including applications and certification forms.[33]

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[29] 47 C.F.R. § 54.405(b).
[30] 47 C.F.R. § 54.405 (c), (d).
[31] 47 C.F.R. § 54.405(c).
[32] 47 C.F.R. § 54.405(d).
[33] 47 C.F.R. § 54.405(c).

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D. DFN Will Comply with the FCC's De-Enrollment Procedures

Section 54.405(e) of the FCC's rules requires an ETC to impose certain de-enrollment procedures for Lifeline services.[34] DFN will comply with the FCC's de-enrollment procedures. DFN will de-enroll Lifeline customers for duplicative support, for non-usage, and for failure to re-certify, and will have general de-enrollment procedures in place. DFN will comply with the de-enrollment procedures set forth in OAR 860-033-0030.

X.   DFN WILL COMPLY WITH THE FCC'S CONSUMER CERTIFICATION AND ANNUAL VERIFICATION REQUIREMENTS

DFN will offer its Lifeline and OTAP services to households receiving benefits from a qualifying state or federal assistance program or with an income at or below 135% of the Federal Poverty Guidelines.[35] DFN certifies that it will verify the eligibility of its Lifeline subscriber base after 2012[36] in accordance with Section 54.409 and 54.410 of the FCC's rules.[37] DFN has established processes for ensuring Lifeline services are provided only to eligible customers, re-certifying eligibility at regular intervals, and recordkeeping. In Oregon, DFN understands and agrees that the Commission's RSPF Staff will perform the eligibility verification functions for Lifeline pursuant to OAR 860-033-0030. The Commission has a dedicated team of staff who respond to public inquiries via inbound and outbound phone support in which the Commission Staff explains Lifeline rules, eligibility criteria, and the application and program processes, policies and procedures as well as available benefits.

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[34] 47 C.F.R. § 54.405(e).
[35] 47 C.F.R. § 54.409(a); OAR 860-033-0030(2).
[36] *Lifeline Reform Order* ¶ 133. As DFN did not have a Lifeline subscriber basis as of June 1, 2012, the FCC's January 31, 2013 recertification requirement is inapplicable. Id. ¶¶ 130, 132 ("[T]he rule we adopt today will apply to all Lifeline subscribers enrolled in the program as of June 1, 2012").
[37] 47 C.F.R. §§ 54.409, 54.410.

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DFN also confirms that it will comply with any future Commission, FCC, or USAC guidance, directives, or rule changes regarding the Lifeline program. DFN has designated an annual recertification process that fulfills the requirements set forth by Section 54.410(f) of the FCC's rules.[38] DFN recognizes that Commission Staff are currently investigating annual certification requirements--specifically, whether ETCs may file their annual FCC reports with the Commission in lieu of the annual recertification requirements described in the *ETC Order,* Appendix A.[39] Because review of the recertification requirements is pending at the time of filing this application,[40] DNF commits that it will comply with the annual recertification requirements that the Commission ultimately adopts, to the extent those reporting requirements are applicable to DFN's business model and except for those requirements for which DFN has specifically requested a waiver as described below.

XI. DESIGNATION OF DFN AS AN ETC IS IN THE PUBLIC INTEREST

Section 54.202(b) of the FCC's rules requires the Commission to make a public interest finding prior to making an ETC designation.[41] DFN's designation as an ETC will bring increased competitive choice and unique advantages to qualifying Oregon consumers, on the part of a carrier with demonstrated commitment to quality. The goals of universal service mandated by Congress

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[38] 47 C.F.R. § 54.410(f). To fulfill the Commission's annual reporting and certification requirements, DFN certifies that it will maintain records to document compliance with all FCC and Commission requirements pursuant to FCC rules. 47 C.F.R. § 54.417(a). DFN also certifies that it will comply with the FCC's annual reporting rules promulgated by 47 C.F.R. § 54.422.

[39] The Commission issued Order No. 13-228, approving a Stipulation between parties providing that ETCs file their 2013 FCC reports with the Commission, but reserving the issue of whether the annual recertification reporting requirements in the *ETC Order* should be modified for 2014 or any subsequent years. *In the Matter of Staff Investigation into Eligible Communications Carriers' Requirements,* Docket UM 1648, Order No. 13-228 (June 19, 2013).

[40] *In the Matter of Staff Investigation into Eligible Communications Carriers' Requirements,* Docket UM 1648.

[41] 47 C.F.R. § 54.202(b).

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are served by designation of DFN as an ETC.[42]

DFN's ETC designation will bring another competitive alternative to low-income consumers in Oregon, and will exert further competitive pressures on existing Lifeline providers operating in Oregon. This furthers the federal Act's goal of ensuring that quality communication services are available at "just, reasonable, and affordable rates."[43] As the FCC has observed, "an important goal of the [federal] Act is to open local telecommunications markets to competition. Designation of competitive ETCs promotes competition and benefits consumers in rural and high-cost areas by increasing customer choice, innovative services, and new technologies."[44]

As explained above, DFN seeks to offer a comprehensive communications solution to the qualifying consumer. DFN's ETC designation provides accessible, technologically advanced services to a portion of the public that may not otherwise be able to obtain telecommunications services.

Based on DFN's service offering under the Rural Broadband Experiment, DFN is required to serve 100 percent of the locations in the eligible census blocks. Therefore, a creamskimming analysis[45] is not applicable. DFN will not and cannot creamskim.

XII. DFN REQUEST WAIVER OF CERTAIN COMMISSION REQUIREMENTS THAT ARE INAPPLICABLE TO DFN'S ETC APPLICATION

DFN will meet all requirements of Order 06-292, as delineated in Appendix A of that decision, except as outlined in this Application.

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[42] 47 U.S.C. § 254.
[43] 47 U.S.C. § 254(b)(1).
[44] *Federal-State Joint Board on Universal Service*, 16 FCC Rcd 48, ¶ 17 (2000).
[45] *ETC Order*, Initial Designation Requirement 10.2.

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1. Comply with Appendix A, Initial Designation Requirement 3.1.1, to the extent it requires DFN to provide a map showing its licensed area boundaries and its requested designated service area boundaries overlaid on the boundaries of ILEC wire centers it proposes to include in its designated service area.

2. Comply with Appendix A, Initial Designation Requirement 4.2, to the extent it requires DFN to show a map of current network coverage.

3. Comply with Appendix A, Initial Designation Requirement 5.2, provide a copy of certification required by FCC rule 47 C.F.R. Subpart 54.809 to receive Interstate Access Support or pursuant to 47 C.F.R Subpart 54.904 to receive Interstate Common Line Support.

4. Comply with Appendix A, Initial Designation Requirement 5.3, to the extent it requires a formal network improvement plan and the corresponding requirements in 47 C.F.R § 54.202(a)(1).

The first two requirements do not make sense in the context of DFN's Rural Broadband Experiment proposal. The census blocks that are affected by this proposal have been identified (Exhibit 2). It does not make sense to try to overlay a map showing those census blocks compared to the service area of underlying ILECs. DFN respectfully requests a waiver of these requirements.

As to Item 3, above, DFN does not intend to seek this type of support at the present time. If this changes, DFN will provide the certification at the appropriate time.

In addition, DFN seeks a waiver of any requirement that its service area for ETC purposes be coexistent with any underlying ILEC exchange, wire center or study area. The census blocks that are included in DFN's proposal cover portions of the Roseburg and Oakland-Sutherlin

APPLICATION FOR DESIGNATION AS AN
ELIGIBLE TELECOMMUNICATIONS
CARRIER AND REQUEST FOR WAIVER - 16

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Richard A. Finnigan
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exchanges served by CenturyLink as legacy Qwest exchanges (including the Winston wire center in the Roseburg exchange) and the Drain, Glide and Yoncalla exchanges served by CenturyLink as legacy CenturyTel exchanges. Given the nature of the Rural Broadband Experiment, it can be expected that the service area need not conform strictly to the requirements of 47 C.F.R. § 54.207. For purposes of the Application, DFN respectfully requests that the Commission establish DFN's service area as the census blocks set forth in this Application.

As to item 4, above, DFN requests a waiver of the requirements related to a "network improvement plan." *The Rural Experiments Order*[46] contains build-out requirements for the Rural Broadband Experiment program:

> *Build-Out Requirements for all Recipients.* As we discuss above, all recipients of rural broadband support will receive support in 120 equal monthly disbursements over a 10-year support term, consistent with the support term we have adopted for the Phase II competitive bidding process. The support term will begin with the first disbursement of support after the entities have been notified that they are the winning bidders and that they have met the requirements outlined above. During this support term, the recipients will be required to meet interim build-out requirements consistent with the build-out requirements we have adopted generally for recipient of Connect America Phase II funding. By the end of the third year, the recipients must offer service meeting the public service obligations we adopted for the relevant experiment category to at least 85 percent of the number of required locations and submit the required certifications and evidence. By the end of the fifth year, the recipients must offer service meeting the public service obligations we adopted for the relevant experiment category to 100 percent of the number of required locations and submit the required certifications and evidence. Recipients must comply with the terms and condition of rural broadband experiment support for the full 10-year term.[47]

---

[46] *See Connect America Fund; ETC Annual Reports and Certifications*, WC Docket Nos. 10-90, 14-58, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 8769 (2014) ("*Rural Experiments Order*").
[47] *Rural Experiments Order*, 29 FCC Rcd 8769 at ¶ 74 (internal footnotes omitted).

APPLICATION FOR DESIGNATION AS AN
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Thus, the FCC concluded:

> We find there is good cause, however, to waive on our own motion section 54.313(a)(1) of the Commission's rules for recipients of rural broadband experiment support. Because we adopt other requirement for the rural broadband experiments recipients that will ensure that we will be kept apprised of their build-out progress, we find that it is unnecessary to require these entities to file a five year service quality plan.[48]

As a result, it appears to be appropriate to waive all aspects of five-year network improvement plans.

XIII. DESIGNATION OF DFN AS AN ETP

DFN also seeks designation as an ETP, authorizing it to provide OTAP benefits to low-income customers in Oregon. Consistent with OAR 860-033-0035(1), DFN's Oregon Lifeline plans are designed to provide both the federal Lifeline benefit and the State of Oregon support of $3.50. DFN certifies that it will meet all RSPF and OTAP requirement in Commission rules (i.e. OAR 860-033-0001 through 860-033-0110). On this basis, DFN requests ETP designation to provide OTAP services.

IX. OUSF PARTICIPATION
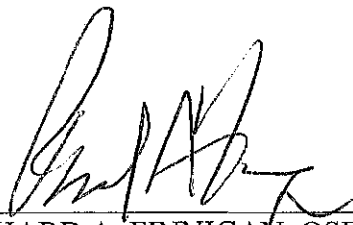
DFN is not requesting eligibility to participate in the OUSF at this time. DFN reserves the right to apply for OUSF participation at a later date.

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[48] *Rural Experiments Order*, 29 FCC Rcd 8769 at ¶ 77 (internal footnotes omitted).

APPLICATION FOR DESIGNATION AS AN
ELIGIBLE TELECOMMUNICATIONS
CARRIER AND REQUEST FOR WAIVER - 18

CONCLUSION

WHEREFORE, for the foregoing reasons, DFN respectfully requests that the Commission expeditiously: (1) designate it as an ETC for the provision of service in the State of Oregon in the service area consisting of the census blocks set out in Exhibit 2, including Lifeline services in the State of Oregon; and (2) designate it as an ETP for the purpose of participation in the OTAP.
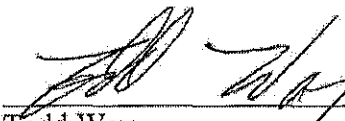
DATED: March 20, 2015.

RICHARD A. FINNIGAN, OSB No. 965357
Attorney for Douglas Services, Inc. d/b/a Douglas FastNet

APPLICATION FOR DESIGNATION AS AN
ELIGIBLE TELECOMMUNICATIONS
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AFFIDAVIT/CERTIFICATION

I, Todd Way, Manager of DFN, hereby certify that I have read the foregoing Application and am authorized to make the certifications contained therein on behalf of DFN.

Pursuant to the requirements set out in Order No. 06-292, Appendix A, Part 5.1, as an officer of DFN, I hereby attest, swear and certify that support funds received pursuant to 47 C.F.R. Part 54, Subpart D and Part 36, Subpart F, if any, will be used only for the intended purposes.

_____
Todd Way
Manager

APPLICATION FOR DESIGNATION AS AN
ELIGIBLE TELECOMMUNICATIONS
CARRIER AND REQUEST FOR WAIVER - 20

Law Office of
Richard A. Finnigan
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EXHIBIT 1

PUBLIC NOTICE

Federal Communications Commission
445 12th St., S.W.
Washington, D.C. 20554

News Media Information 202 / 418-0500
Internet: http://www.fcc.gov
TTY: 1-888-835-5322

Released: March 10, 2015

ERRATUM

WIRELINE COMPETITION BUREAU ANNOUNCES ADDITIONAL PROVISIONALLY SELECTED BIDDERS FOR RURAL BROADBAND EXPERIMENTS AND SETS DEADLINES FOR SUBMISSION OF ADDITIONAL INFORMATION

WC Docket No. 10-90
WC Docket No. 14-259

On March 4, 2015, the Wireline Competition Bureau released a *Public Notice*, DA 15-288, in the above captioned proceeding. This Erratum amends the Attachment of the *Public Notice* as indicated below:

In the table, fourth column third row, replace "$163,460.79" with "$875,000.00" and in the last row, replace "$26,920,536.50" with "$27,632,075.71".

-- FCC --

PUBLIC NOTICE

DA 15-288

Released: March 4, 2015

WIRELINE COMPETITION BUREAU ANNOUNCES ADDITIONAL PROVISIONALLY SELECTED BIDDERS FOR RURAL BROADBAND EXPERIMENTS AND SETS DEADLINES FOR SUBMISSION OF ADDITIONAL INFORMATION

WC Docket No. 10-90
WC Docket No. 14-259

On December 18, 2014, the Federal Communications Commission (Commission) established a process to enable the provisional selection of additional bidders for rural broadband experiments support in the event any of the initial provisionally selected bidders defaulted before the Wireline Competition Bureau (Bureau) finalized the list of census blocks that will be offered to the price cap carriers for Phase II of the Connect America Fund.[1] Specifically, rural broadband experiments bidders interested in being considered for any newly available support were required to file certain financial and technical information by Tuesday, January 6, 2015.[2]

Today, the Bureau announces additional bidders have been provisionally selected for rural broadband experiments funding in category one, subject to the post-selection review process.[3] The Attachment provides summary information concerning these new provisionally selected bidders, including the number of project bids, the states in which these proposed projects are located, the total amount of support requested for these projects, and the total number of census blocks covered by these projects. The Bureau plans to issue a Public Notice in the near future identifying all of the specific census blocks that have been provisionally selected for rural broadband experiment funding that will be removed from the offer of model-based support to price cap carriers.[4]

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[1] *See Connect America Fund; ETC Annual Reports and Certifications; Petition of USTelecom for Forbearance Pursuant to 47 U.S.C. § 160(c) from Obsolete ILEC Regulatory Obligations that Inhibit Deployment of Next-Generation Networks,* WC Docket Nos. 10-90, 14-58, 14-192, Report and Order, 29 FCC Rcd 15644, 15674-75, para. 83 (2014).

[2] *See Wireline Competition Bureau Announces Deadline for Bidders Interested in Remaining Under Consideration for Rural Broadband Experiments Support to File Additional Information,* WC Docket Nos. 10-90, 14-259, Public Notice, 29 FCC Rcd 15132 (Wireline Comp. Bur. 2014).

[3] *See Connect America Fund; Rural Broadband Experiments,* WC Docket Nos. 10-90, 14-259, Order, DA 15-139 (Wireline Comp. Bur. rel. Jan 30, 2015).

[4] A number of the census blocks that provisionally selected bidders seek to serve are the subject of a pending challenge in the Phase II challenge process. *See Wireline Competition Bureau Announces Application Process for Entities Interested in Participating in the Rural Broadband Experiments,* WC Docket No. 10-90, Public Notice, 29 FCC Rcd 10016, 10035-36, paras. 64-66 (Wireline Comp. Bur. 2014). The Bureau is currently reviewing the challenges and responses received in the Phase II challenge process. In the event that census blocks are deemed served and therefore ineligible for rural broadband experiment funding, support for any project selected for funding that includes such census blocks will be adjusted proportionally. *See Connect America Fund; ETC Annual Reports and Certifications,* WC Docket Nos. 10-90, 14-58, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 8769, 8786-87, para. 51 (2014) (*Rural Broadband Experiments Order*).

With the release of this Public Notice, we establish additional deadlines for the post-selection review process for these new provisionally selected bidders. These bidders already have filed their technical and financial information on January 6, 2015.[5] Therefore, within 60 days of this Public Notice, the bidders identified in the Attachment are required to submit a letter from an acceptable bank committing to provide the bidder with a letter of credit (LOC) in the amount of the support the bidder will receive for each of its projects.[6] These letters must be uploaded to the FCC Form 5620 by **Monday, May 4, 2015 at 11:59p.m. EST.**[7] Failure to submit the requested materials by this deadline will constitute a default, and the bidder will no longer be considered for rural broadband experiments support. Within 90 days of this Public Notice, by **Tuesday, June 2, 2015, at 11:59p.m. EST**, the bidders identified in the Attachment are required to upload to the FCC Form 5620 appropriate documentation of their designation as an eligible telecommunications carrier (ETC) in all areas for which they will receive support.[8]

For additional information on this proceeding, contact Ian Forbes (Ian.Forbes@fcc.gov) of the Wireline Competition Bureau, Telecommunications Access Policy Division, (202) 418-7400.

– FCC –

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[5] *Rural Broadband Experiments Order*, 29 FCC Rcd at 8787, para. 52.

[6] The Bureau previously has released information regarding the LOCs that new provisionally selected bidders may find helpful in obtaining their commitment letters. *See Wireline Competition Bureau Reminds Provisionally Selected Rural Broadband Experiments Bidders of Letter of Credit Requirements*, WC Docket Nos. 10-90, 14-259, Public Notice, DA 15-99 (Wireline Comp. Bur. rel. Jan. 23, 2015).

[7] The Bureau previously has released instructions for provisionally selected bidders regarding how to complete FCC Form 5620. *See Wireline Competition Bureau Announces Entities Provisionally Selected for Rural Broadband Experiments; Sets Deadlines for Submission of Additional Information*, WC Docket No. 10-90, 29 FCC Rcd 14684, 14690-94 (Wireline Comp. Bur. 2014).

[8] The Commission expects provisionally selected bidders to submit their ETC applications to the relevant jurisdiction as soon as possible and has indicated that it will presume an entity is acting in good faith to complete the requirements necessary for it to be authorized for funding if the entity files its ETC application within 15 days of release of the public notice. *Rural Broadband Experiments Order*, 29 FCC Rcd at 8778, para. 22 n.52. We recognize that several of the bidders listed on Attachment A previously were provisionally selected for other projects and may wish to amend an existing ETC petition to include the newly identified projects.

DA 15-288

ATTACHMENT
Additional Provisionally Selected Bidders

Bidder Name	State(s)	Selected Bids	Support Requested for Selected Bids	Census Blocks Covered by Selected Bids	Selected Bid Project IDs
BARC Electric Cooperative	VA	1	$239,918.00	64	1
City of Chanute, Kansas	KS	1	$508,467.00	37	1
Daktel Communications LLC	ND	1	$163,460.79	109	1
Douglas Services, Inc.	OR	1	$2,375,000.00	325	1
EPB	TN	1	$710,147.00	128	1
Federated Telephone Cooperative	MN	1	$1,455,961.71	95	2
Lake Region Technology & Communications, LLC	OK	2	$591,987.00	68	1, 2
Midwest Energy Cooperative d/b/a Midwest Connections	MI	1	$211,532.00	31	1
Northeast Rural Services, Inc.*	OK	6	$7,415,062.00	588	2, 3, 5, 7, 9, 11
Paul Bunyan Rural Telephone Cooperative	MN	2	$1,962,000.00	134	1, 3
Skybeam, LLC*	IA, MN, TX	4	$11,012,274.00	1,771	1, 5, 6, 9
West Central Telephone Association	MN	1	$274,727.00	15	1
	Totals	22	$26,920,536.50	3,365	

* Denotes previous provisionally selected bidder that is now being provisionally selected for additional projects.

EXHIBIT 2

Project ID	Entity FRN	Category Type	CBFIPS	Total Support Requested	Total Eligible Locations	Total Extremely High Cost Locations	Contingent Bid Project IDs
1	0001566306	1	410190700002343	2375000	1784	62	
			410191000002055				
			410190400003036				
			410191700002285				
			410191700002193				
			410190600001074				
			410191700002170				
			410191700002178				
			410190400003054				
			410190400001028				
			410191700002165				
			410190300002444				
			410191700002137				
			410191000001057				
			410190600001028				
			410190300003450				
			410190600001130				
			410190300002036				
			410191700002192				
			410190600001206				
			410190600001092				
			410190400001041				
			410190600001069				
			410190700002146				
			410190400001161				
			410191100001011				
			410191100001067				
			410190600001205				
			410190600001093				
			410190500012062				
			410190500012004				
			410190600001155				
			410190600001076				
			410190400001197				

410190700001020
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410190500012086

EXHIBIT 3

EXHIBIT 3
REDACTED

DFN

DOUGLAS FAST NET

December 31, 2014

Douglas Services Inc.,
2350 NW Aviation Dr.
Roseburg, OR 97470
(541) 673-4242

Commission's Secretary, Office of the Secretary,
Federal Communications Commission.
445 12th Street, SW,
Washington, DC 20554

DOUGLAS SERVICES, INC.

AUDIT REPORT

Years Ended December 31, 2011, and 2010

KENNETH KUHNS & CO.
Certified Public Accountants
570 Liberty Street S.E., Suite 210
Salem, Oregon 97301-3594

Telephone: (503) 585-2550

TABLE OF CONTENTS

DOUGLAS SERVICES, INC.

December 31, 2011

Directors	
Terry Nelson	President
Robert Poage	Vice President
Shirley Cairns	Secretary
Dick McHaffie	Treasurer
Roy Ellis	Director
Larry Shipley	Director
Carey Weatherly	Director

KENNETH KUHNS & CO.
CERTIFIED PUBLIC ACCOUNTANTS
570 LIBERTY STREET S.E., SUITE 210
SALEM OREGON 97301-3594

TELEPHONE (503) 585-2550

INDEPENDENT AUDITOR'S REPORT

March 13, 2012

Board of Directors
Douglas Services, Inc.

EXHIBIT 3
REDACTED

DOUGLAS SERVICES, INC.

Balance Sheet

Assets

Current assets:
    Cash (Note 1)
    Accounts receivable (less provision for doubtful
        accounts of $988 in 2011 and $5,264 in 2010)
    Prepayments
    Inventory (Note 1)

        Total current assets

Other assets:
    Investments in associated organizations (Note 2)
    Investment in Eastern Oregon Telecomm
    Organization costs

        Total other assets

Utility plant: (Note 1)
    In service
    Construction in progress

        Total utility plant

    Less: accumulated provision for depreciation

        Net utility plant

        Total assets

Liabilities and Equity

Current liabilities:
    Current maturities of note payable
    Accounts payable
    Accrued paid time off
    Deferred tax liability (Note 4)
    Other current liabilities - 2.19,805

        Total current liabilities

Long-term liabilities:
    Note payable, less current maturities
    Deferred tax liability (Note 4)

        Total long-term liabilities

        Total liabilities

Equity:
    Retained earnings-(deficit)

        Total liabilities and equity

The accompanying notes are an integral part of this statement.

-3-

EXHIBIT 3

REDACTED

DOUGLAS SERVICES, INC.

Statement of Revenue and Retained Earnings

Operating revenues:
    Sales

Operating expenses:
    Cost of sales
    Labor and benefits
    Materials and services
    Depreciation

        Total operating expenses

        Net income from operations

Other income-(expenses):
    Investment income
    Loss on disposal of plant
    Interest expense

        Net income before provision for income taxes

Provision for income taxes

        Net income

Retained earnings-(deficit) - beginning of year

Retained earnings-(deficit) - end of year

The accompanying notes are an integral part of this statement.

EXHIBIT 3

REDACTED

DOUGLAS SERVICES, INC.

Statement of Cash Flows

Cash flows from operating activities:
    Cash received from customers
    Cash received from interest
    Cash payments to employees and other suppliers of goods and services
    Cash payments for interest
    Cash payments for income taxes

        Net cash provided by operating activities

Cash flows from investing activities:
    Capital expenditures
    Proceeds from sale of plant
    Payment received for capital credits

        Net cash used in investing activities

Cash flows from financing activities:
    Decrease in line of credit payable
    Principal payments on note payable

        Net cash used in financing activities

Net increase-(decrease) in cash and cash equivalents for year

Cash - beginning of year

Cash - end of year

Reconciliation of net income to net cash provided by operating activities:
    Net income
    Adjustments to reconcile net income to net cash provided by
        operating activities:
    Depreciation
    Loss on disposal of plant
    Noncash investment income
    Decrease-(increase) in:
     Accounts receivable
     Prepayments
     Inventory
    Increase-(decrease) in:
     Accounts payable
     Accrued paid time off
     Accrued interest
     Deferred tax liability
     Other current liabilities

    Total adjustments

    Net cash provided by operating activities

The accompanying notes are an integral part of this statement.

DOUGLAS SERVICES, INC.

Notes to Financial Statements
December 31, 2011 and 2010

DOUGLAS SERVICES, INC.

Notes to Financial Statements
December 31, 2011 and 2010

DOUGLAS SERVICES, INC.

AUDIT REPORT

Years Ended December 31, 2012, and 2011

KENNETH KUHNS & CO.
Certified Public Accountants
570 Liberty Street S.E., Suite 210
Salem, Oregon 97301-3594

Telephone: (503) 585-2550

EXHIBIT 3

TABLE OF CONTENTS

DOUGLAS SERVICES, INC.

December 31, 2012

Directors

Terry Nelson	President
Robert Poage	Vice President
Shirley Cairns	Secretary
Dick McHaffie	Treasurer
Roy Ellis	Director
Larry Shipley	Director
Carey Weatherly	Director

EXHIBIT 3

REDACTED

KENNETH KUHNS & CO.
CERTIFIED PUBLIC ACCOUNTANTS
570 LIBERTY STREET S.E., SUITE 210
SALEM OREGON 97301-3594

TELEPHONE (503) 585-2550

INDEPENDENT AUDITOR'S REPORT

April 2, 2013

Board of Directors
Douglas Services, Inc.

EXHIBIT 3

Opinion

DOUGLAS SERVICES, INC.

Balance Sheet

Assets

Current assets:
    Cash (Note 1)
    Accounts receivable (less provision for doubtful
        accounts of $320 in 2012 and $988 in 2011)
    Prepayments
    Inventory (Note 1)

        Total current assets

Other assets:
    Investments in associated organizations (Note 2)
    Investment in Eastern Oregon Telecomm
    Organization costs

        Total other assets

Utility plant: (Note 1)
    In service
    Construction in progress

        Total utility plant

  Less: accumulated provision for depreciation

        Net utility plant

        Total assets

Liabilities and Equity

Current liabilities:
    Current maturities of note payable
    Line of credit payable (Note 5)
    Accounts payable
    Accrued paid time off
    Deferred tax liability (Note 4)
    Other current liabilities

        Total current liabilities

Long-term liabilities:
    Note payable, less current maturities (Note 3)
    Deferred tax liability (Note 4)

        Total long-term liabilities

        Total liabilities

Equity:
    Retained earnings

        Total liabilities and equity

The accompanying notes are an integral part of this statement.

-4-

EXHIBIT 3

REDACTED

DOUGLAS SERVICES, INC.

Statement of Revenue and Retained Earnings

Operating revenues:
  Sales

Operating expenses:
  Cost of sales
  Administration and operations
  Depreciation

    Total operating expenses

    Net income from operations

Other income-(expenses):
  Investment income
  Loss on disposal of plant
  Interest expense

    Net income before provision for income taxes

Provision for income taxes

    Net income

Retained earnings-(deficit) - beginning of year

Retained earnings - end of year

The accompanying notes are an integral part of this statement.

EXHIBIT 3

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DOUGLAS SERVICES, INC.

Statement of Cash Flows

Cash flows from operating activities:
    Cash received from customers
    Cash received from interest
    Cash payments to employees and other suppliers of goods and services
    Cash payments for interest
    Cash payments for income taxes

        Net cash provided by operating activities

Cash flows from investing activities:
    Capital expenditures
    Proceeds from sale of plant
    Payment received for capital credits

        Net cash used in investing activities

Cash flows from financing activities:
    Line of credit advances
    Principal payments on note payable

        Net cash used in financing activities

Net decrease in cash and cash equivalents for year

Cash - beginning of year

Cash - end of year

Reconciliation of net income to net cash provided by operating activities:
    Net income
    Adjustments to reconcile net income to net cash provided by
            operating activities:
    Depreciation
    Loss on disposal of plant
    Noncash investment income
    Decrease-(increase) in:
      Accounts receivable
      Prepayments
      Inventory
    Increase-(decrease) in:
      Accounts payable
      Accrued paid time off
      Deferred tax liability
      Other current liabilities

        Total adjustments

        Net cash provided by operating activities

The accompanying notes are an integral part of this statement.

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EXHIBIT 3

REDACTED

DOUGLAS SERVICES, INC.

Notes to Financial Statements
December 31, 2012 and 2011

EXHIBIT 3

REDACTED

DOUGLAS SERVICES, INC.

Notes to Financial Statements
December 31, 2012 and 2011

EXHIBIT 3

DOUGLAS SERVICES, INC.

Notes to Financial Statements
December 31, 2012 and 2011

DOUGLAS SERVICES, INC.

AUDIT REPORT

Years Ended December 31, 2013, and 2012

KENNETH KUHNS & CO.
Certified Public Accountants
570 Liberty Street S.E., Suite 210
Salem, Oregon 97301-3594

Telephone: (503) 585-2550

TABLE OF CONTENTS

DOUGLAS SERVICES, INC.

December 31, 2013

Directors	
Terry Nelson	President
Robert Poage	Vice President
Shirley Cairns	Secretary
Dick McHaffie	Treasurer
Evan Barnes	Director
Larry Shipley	Director
Carey Weatherly	Director

EXHIBIT 3
REDACTED

KENNETH KUHNS & CO.
CERTIFIED PUBLIC ACCOUNTANTS
570 LIBERTY STREET S.E., SUITE 210
SALEM OREGON 97301-3594

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INDEPENDENT AUDITOR'S REPORT

March 12, 2014

Board of Directors
Douglas Services, Inc.

EXHIBIT 3

REDACTED

EXHIBIT 3

REDACTED

DOUGLAS SERVICES, INC.

Balance Sheet

Assets

Current assets:
    Cash (Note 1)
    Accounts receivable (less provision for doubtful
        accounts of $1,500 in 2013 and $320 in 2012)
    Prepayments
    Inventory (Note 1)

        Total current assets

Other assets:
    Investments in associated organizations (Note 2)
    Organization costs

        Total other assets

Utility plant: (Note 1)
    In service
    Construction in progress

        Total utility plant

    Less: accumulated provision for depreciation

        Net utility plant

        Total assets

Liabilities and Equity

Current liabilities:
    Current maturities of loans and note payable
    Line of credit payable (Note 5)
    Accounts payable
    Accrued paid time off
    Deferred tax liability (Note 4)
    Other current liabilities

        Total current liabilities

Long-term liabilities:
    Loans payable, less current maturities (Note 6)
    Note payable, less current maturities (Note 3)
    Deferred tax liability (Note 4)

        Total long-term liabilities

        Total liabilities

Equity:
    Retained earnings

        Total liabilities and equity

The accompanying notes are an integral part of this statement.

EXHIBIT 3

REDACTED

DOUGLAS SERVICES, INC.

Statement of Revenue and Retained Earnings

Operating revenues:
  Sales

Operating expenses:
  Administration and operations
  Depreciation

    Total operating expenses

    Net income from operations

Other income-(expenses):
  Investment income
  Loss on disposal of plant
  Interest expense

    Net income before provision for income taxes

Provision for income taxes

    Net income

Retained earnings - beginning of year

Retained earnings - end of year

The accompanying notes are an integral part of this statement.

EXHIBIT 3
REDACTED

DOUGLAS SERVICES, INC.

Statement of Cash Flows

Cash flows from operating activities:
    Cash received from customers
    Cash received from interest
    Cash payments to employees and other suppliers of goods and services
    Cash payments for interest
    Cash payments for income taxes

        Net cash provided by operating activities

Cash flows from investing activities:
    Capital expenditures
    Proceeds from sale of plant
    Payment received for capital credits

        Net cash used in investing activities

Cash flows from financing activities:
    Loans payable advances
    Line of credit advances
    Principal payments on loans and note payable
    Principal payments on line of credit

        Net cash provided by-(used in) financing activities

Net increase-(decrease) in cash and cash equivalents for year

Cash - beginning of year

Cash - end of year

Reconciliation of net income to net cash provided by operating activities:
    Net income
    Adjustments to reconcile net income to net cash provided by
        operating activities:
    Depreciation
    Loss on disposal of plant
    Noncash investment income
    Decrease-(increase) in:
      Accounts receivable
      Prepayments
      Inventory
    Increase-(decrease) in:
      Accounts payable
      Accrued paid time off
      Deferred tax liability
      Other current liabilities

    Total adjustments

    Net cash provided by operating activities

The accompanying notes are an integral part of this statement.

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EXHIBIT 3

REDACTED

DOUGLAS SERVICES, INC.

Notes to Financial Statements
December 31, 2013 and 2012

EXHIBIT 3

DOUGLAS SERVICES, INC.

Notes to Financial Statements
December 31, 2013 and 2012

EXHIBIT 3

DOUGLAS SERVICES, INC.

REDACTED

Notes to Financial Statements
December 31, 2013 and 2012

EXHIBIT 3

DOUGLAS SERVICES, INC.

Notes to Financial Statements
December 31, 2013 and 2012

EXHIBIT 3

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DOUGLAS FAST NET

Income Statement for December 2014

RUS Form 479

		Year to Date	Current Month
Item			
1. Local Network Services Revenue			
0 5000.01	Local Services - Transport (Ethernet)		
0 5000.02	Local Services - DSL		
0 5000.03	Local Services - Voice		
0 5000.05	Local Services - Co-Location		
	Total for Line 1:		
2. Network Access Services Revenue			
0 5080.0	Network Access Revenue		
	Total for Line 2:		
3. Long Distance Network Services Revenues			
0 5000.04	Local Services – Voice Long Distance		
	Total for Line 3:		
5. Miscellaneous Revenues			
0 5010.0	LAN Services (Local Area Network)		
0 5200.01	NRR Installation		
0 5250.00	Other / Misc. Income		
	Total for Line 5:		
7. Net Operating Revenues (1 thru 5 less 6)			
8. Plant Specific Operations Expense			
0 6112.0	Motor Vehicle Expense		
0 6121.0	Land and Building Expense		
	Total for Line 8:		
9. Plant Nonspecific Operations Expense			
0 6530.0	Network Operation - Electronic Plant		
0 6531.0	Power Expense		
0 6534.0	Plant Operations – Outside Plant		
0 6540.0	Access Expense		
	Total for Line 9:		
10. Depreciation Expense			
0 6561.0	Depreciation Expense - Plant in Service		
	Total for Line 10:		
12. Customer Operations Expense			
0 6612.0	Sales		
0 6613.0	Product Advertising		
0 6623.0	Customer Service		
	Total for Line 12:		

EXHIBIT 3

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13. Corporate Operations Expense

0 6711.0	Executive	
0 6720.0	General and Administrative	
0 6721.0	Accounting and Finance	
0 6723.0	Human Resources	
0 6725.0	Legal	
0 6726.0	Procurement	
0 6728.0	Other General and Administrative	

Total for Line 13:

14. Total Operating Expenses (8 thru 13)

15. Operating Income or Margins (7 less 14)

16. Other Operating Income and Expenses

0 7300	Interest Expense	
0 7400.0	Gain/Loss – Disposal of Assets	
0 7500.0	Interest Income	

Total for Line 16:

17. State and Local Taxes / Other

0 6750.01	Taxes – Federal	
0 6750.02	Taxes – State	
0 6750.03	Taxes – Other	

Total for Line 17:

∞

20. Total Operating Taxes (17 + 18 + 19)

21. Net Operating Income or Margins

EXHIBIT 3

DOUGLAS FAST NET

Balance Sheet for December 2014

RUS Form 479

Year to Date

ASSETS

Current Assets

1. Cash and Equivalents

0 1120.01	Cash - Checking Account	
0 1120.03	Petty Cash	
0 1120.04	Cash Drawer	
0 1120.05	Cash - Checking - Umpqua Bank	
0 1120.051	Cash - Money Market - Umpqua Bank	

Total for Line 1:

3. Affiliates:

a. Telecom, Accounts Receivable

0 1180.01	Accounts Receivable - Customers	
0 1180.02	Allowance for Bad Debt - Customers	
0 1181.01	Accounts Receivable - Prof. Services	

Total for Line 3A:

b. Other Accounts Receivable

0 1182.01	Accounts Receivable - Other Receivable	
0 1182.02	Allowance for Bad Debt - Other Rec.	

Total for Line 3B:

5. Interest and Dividends Receivable

0 1210.00	Interest / Dividends Receivable	

Total for Line 5:

6. Material-Regulated

0 1220.01	Materials and Supplies/Inventory	

Total for Line 6:

8. Prepayments

0 1280.01	Pre-Paid - Rent / Lease	
0 1280.02	Pre-Paid - Taxes	
0 1280.03	Pre-Paid - Insurance	
0 1280.04	Pre-Paid - Regulatory Charges	
0 1280.05	Pre-Paid - Other	

Total for Line 8:

---

10. Total Current Assets (1 thru 9)

9

EXHIBIT 3

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Noncurrent Assets

11. Investments in Affiliated Companies

    b. Nonrural Development

        0 1401.0   Investments - Affiliated Companies

                                            Total for Line 11B:

---

17. Total Noncurrent Assets (11 thru 16)

Plant, Property, and Equipment

18. Telecom, Plant-in-Service

        0 2112.0   Motor Vehicles

        0 2116.0   Tools and Equipment

        0 2121.0   Building

        0 2122.0   Furniture and Fixtures

        0 2124.0   General Purpose - Computers / Software

        0 2402.0   Outside Plant

        0 2403.0   Electronic Plant

                                            Total for Line 18:

20. Plant Under Construction

        0 2002.01   Construction in Progress - Plant

        0 2002.02   Construction in Progress - Billable

                                            Total for Line 20

22. Less Accumulated Depreciation

        0 3112.0   Accum. Depr. - Motor Vehicles

        0 3116.0   Accum. Depr. - Tools and Equipment

        0 3116.0   Accum. Depr. - Building

        0 3122.0   Accum. Depr. - Furniture and Fixtures

        0 3124.0   Accum. Depr. - General Purpose

        0 3402.0   Accum. Depr. - Outside Plant

        0 3403.0   Accum. Depr. - Electronic Plant

                                          Total for Line 2

---

23. Net Plant (18 thru 21 less 22)

---

24. Total Assets (10 + 17 + 23)

LIABILITIES AND STOCKHOLDERS' EQUITY

Current Liabilities

25. Accounts Payable

        0 4010.01   Accounts Payable

        0 4010.02   Accounts Payable - Other

        0 4020.01   Employee Deduction - Medical

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0 4020.02	Employee Deduction - Dental	
0 4020.03	Employee Deduction - Vision	
0 4020.04	Employee Deduction - 401(k)	
0 4020.05	Employee Deduction - Life	
0 4020.06	Employee Deduction - Child Support	
0 4020.07	Employee Deduction - Section 125	
0 4020.08	Employee Deduction - Other	
0 4020.1	Employee Deduction - Garnishment	
0 4025.04	Employer 401(k) Match	
0 4030.01	Federal Payroll Taxes Payable	
0 4030.02	FUTA Tax Payable	
0 4030.03	State Payroll Taxes Payable	
0 4030.04	SUTA Payable	
0 4030.05	Worker's Comp. - State	

Total for Line 25:

29. Current Maturity - L/T Debt

0 4155.00	Current Portion - Long Term Debt

Total for Line 29:

32. Income Taxes Accrued

0 4070.00	Accrued Income Taxes
0 4190.00	Deferred Income Taxes

Total for Line 32:

33. Other Taxes Accrued

0 4100.01	Franchise Fees - Myrtle Creek
0 4100.02	Franchise Fees - Riddle
0 4100.03	Franchise Fees - Winston
0 4100.04	Franchise Fees - Canyonville
0 4100.05	Franchise Fees - Eugene
0 4100.06	Franchise Fees - Sutherlin
0 4100.07	Franchise Fees - Roseburg
0 4100.08	Franchise Fees - Oakland
0 4100.09	Franchise Fees - Drain
0 4100.10	Franchise Fees - Glendale
0 4100.11	Franchise Fees - Yoncalla
0 4160.01	Federal Universal Service Fee
0 4160.02	Oregon Universal Service Fee
0 4160.03	PUC Fees

Total for Line 33:

34. Other Current Liabilities

0 4040.00	Accrued Paid Time Off
0 4050.00	Accrued Payroll

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EXHIBIT 3

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4130.00	Other Current Liability
4150.01	Line of Credit - NCSC
4220.01	Accrued Interest - N/P - Restructure
4220.02	Accrued Interest - N/P - Capital Needs
0 4220.03	Accrued Interest - N/P - Aviation Drive

Total for Line 34:

---

35. Total Current Liabilities (25 thru 34)

Long-Term Debt

39. Funded Debt - Other

0 4215.01	Notes Payable - NCSC - Debt Restructure
0 4215.02	Notes Payable - NCSC - Capital Needs
0 4215.03	Notes Payable - NCSC - Aviation Drive

Total for Line 39:

---

46. Total Long-Term Debt (36 thru 45)

Other Liability and Deferred Credits

57. Retained Earnings or Margins

| 0 4560.00 | Retained Earnings |
| | Current Fiscal Margins |

Total for Line 57:

---

58. Total Equity (51 thru 57)

---

59. Total Liabilities and Equity (35 + 46 + 50 + 58)

12

EXHIBIT 3

DOUGLAS FAST NET

Cash Flow for December 2014

OPERATING ACTIVITIES
Net Income
Depreciation Expense
Amortization Expense
Loss/Gain from Disposal of Assets
Total Funds from Operations

Accounts Receivable
Materials and Supplies
Prepayments and Deferred Charges
(Increase)/Decrease in Operating Assets

Accounts Payable
Other Current Liabilities
Increase/(Decrease) in Operating Liabilities

CASH FROM OPERATING ACTIVITIES

INVESTMENT ACTIVITIES
Net Capital Expenditures
Other Long-Term Investments
CASH FROM INVESTMENT ACTIVITIES

FINANCING ACTIVITIES
Long-Term Debt
Other Liabilities and Deferred Credits
CASH FROM FINANCING ACTIVITIES

CASH FROM ALL ACTIVITIES

TOTAL CASH BEGINNING OF PERIOD

TOTAL CASH END OF PERIOD

structured
bridging people, business & technology™

December 31, 2014

Douglas Services (dba Douglas Fast Net)
Jon Vradenburg, Director of Network Operations
2350 NW Aviation Drive
Roseburg, Oregon 97470

RE: Certification of Network Diagram

Dear Mr. Vradenburg,

As requested, members of the Structured Communication Systems, Inc. ("Structured") network engineering team have reviewed the attached network diagram (Exhibit A) and associated technology descriptions for purposes of determining whether the network is capable of delivering voice and broadband service up to 100 Mbps.

Based upon our review of the information provided, Structured certifies that the Douglas Services (dba Douglas Fast Net) network drawing contained in Exhibit A demonstrates a network design capable of delivering voice and broadband services up to 100 Mbps.

Structured is a leading information technology consultancy and systems integrator that has partnered with hundreds of clients throughout the U.S. to maximize the value of IT. For two decades, Structured consultants have collaborated with CIOs and IT departments to develop and implement technology strategies that drive measureable improvements throughout the organization.

Founded in 1992 and headquartered in Portland Oregon, Structured has offices throughout the US and represents a global clientele. For more information, visit http://www.structured.com.

Regards,

Casey Richmond, General Counsel
Structured Communication Systems, Inc.
12901 S.E. 97th Avenue, Suite 400
Clackamas, Oregon 97015

EXHIBIT 3
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SIX Peering Exchange 1 Gpbs

NWAX Peering Exchange / OHN Peering 1 Gbps

Upstream Provider 1 Gpbs

DFN DOUGLAS FAST NET

Portland Switch Juniper EX-4200

Portland Border Router Juniper M7i

MPLS Backbone

Seattle Switch Juniper EX-4200

Upstream Provider 1 Gbps

Roseburg QC57 Router Juniper MX-480

Roseburg Metaswitch Voice Switch

Roseburg DECO Switch Juniper EX-4550 Stack

Roseburg Juniper EX-4550 Switch Stack

Roseburg QC57 Switch Juniper EX-4550 Stack

Roseburg Adtran TA5000 - GPON OLT

Roseburg QC57 TA5000 GPON OLT

Sample Customer ONT Adtran TA 311 – Up to 1 Gbps 1 Voice Port

Sample Customer ONT Adtran TA 324 Up to 1 Gbps 2 Voice Ports

Sample Business ONT Adtran TA 371 Up to 1 Gbps 8 Voice Ports

Douglas Fast Net		
	12/31/2014	

Legend:
———— 1GbE
———— 10GbE
———— 2x 10GbE

MX240, MX480 and MX960 3D Universal Edge Routers
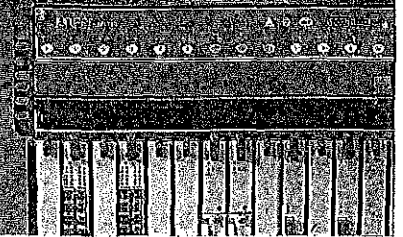
Product Overview

Businesses and cloud builders of all types—from telecom service providers to enterprises—are under pressure to increase network scale, performance, and reliability while containing capital spending and streamlining operations. Achieving these goals is difficult due to double-digit growth rates, driven mainly by cloud adoption, online video, and mass adoption of mobile devices.

Powered by the Junos operating system and Junos Trio chipset, the SDN-ready MX Series Universal Edge Router portfolio helps enterprises, cloud operators, service providers, and cable operators increase network scale, performance, and reliability. The MX Series delivers the capital efficiency, service agility, and operational scale needed for next-generation carrier, cloud and enterprise applications.

METAFABRIC: ARCHITECTURE FOR CLOUD SUCCESS. Watch the MetaFabric webinar and learn more.

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Product Description

Juniper Networks® MX Series 3D Universal Edge Routers are a portfolio of high-performance, software-centric physical and virtual routers that support a broad set of applications in service provider, enterprise and cloud networks. With powerful routing, switching, and services capabilities, the MX Series delivers unmatched flexibility and investment protection.

Powered by Juniper Networks Junos® operating system, the MX Series streamlines network operations and improves the availability, performance, and security of all types of services. It offers the most complete, advanced features in the industry, including traffic segmentation and virtualization with MPLS, subscriber management, sophisticated virtualization techniques such as Virtual Chassis technology and virtual CPE, low-latency multicast, as well as comprehensive security and QoS implementations that ensure the quality delivery of time-sensitive applications and services.

With the MX Series, all major components are field replaceable, increasing system availability and decreasing mean time to repair (MTTR). Carrier-class reliability and high availability features on the MX Series include graceful restart, nonstop active routing (NSR), MPLS fast reroute, unified in-service software upgrade (unified ISSU), a comprehensive OAM toolkit, and service-level resiliency with features such as virtual private LAN service (VPLS) multihoming.

MX Series 3D Universal Edge Routers provide the 3D scale, bandwidth, services, and subscribers that cloud builders, enterprises and service providers need to command a competitive advantage in today's rapidly changing environment. The MX Series portfolio offers a broad range of physical and virtual platforms that deliver routing capacity from 1 Gbps through 80 Tbps. The MX Series portfolio includes the vMX virtual router; highly compact routers such as the MX5, MX10, MX40, and MX80; an aggregation optimized router, the MX104; modular edge routers including the MX240, MX480, and MX960; and ultra-high capacity edge and converged edge/core platforms such as the MX2010 and MX2020. This datasheet specifically addresses the Juniper Networks MX240, MX480, and MX960 3D Universal Edge Routers.

- The MX240 offers high-interface density and performance in a space-efficient package that is practical for enterprise WAN, data center, and campus deployments as well as several service provider applications in small and medium points of presence (POPs).
- The MX480 provides a dense, highly redundant platform primarily targeted for medium to large enterprise campuses and data centers, and service provider edge applications in medium and large PoPs.
- The MX960 is a high-density, high-capacity platform designed for the service provider edge and data center cores.

Architecture and Key Components

Table 1: MX Series Key Components

Description	MX240	MX480	MX960
System capacity[1]	1.92 Tbps	5.12 Tbps	9.92 Tbps
Switch fabric capacity per slot[2]	480 Gbps	480 Gbps	480 Gbps
MPCs and DPCs per chassis	3	6	12
Chassis per rack	9	6	3

Switch Control Board (SCB)

The SCB powers on and powers off cards, controls clocking, resets, boots, monitors and controls system functions, including fan speed, board power status, inline power distribution module (PDM) status and control, and the system front panel. The switch fabric is integrated into the SCB, providing a non-blocking architecture that connects to all within the chassis, and the Routing Engine installs directly into the SCB. Three SCBs are available for the MX960, MX480, and MX240 routers—the SCB, the SCBE, and the SCBE2.

Table 2: SCB Comparison

Model Number	Description	Switch Fabric Capacity (Tbps)		
		MX240	MX480	MX960
SCBE2-MX-BB	Enhanced MX Switch Control Board (SCBE2)	1.92	5.12	9.92
SCBE-MX-BB	Enhanced Switch Control Board (SCBE)	.96	2.72	5.12
SCB-MX960-BB	Switch Control Board (SCB)	.48	1.44	2.64

Routing Engine (RE)

The Routing Engine handles all routing protocol processes, the software processes that control the router's interfaces, the chassis components, system management, and user access to the router. These routing and software processes run on top of a kernel that interacts with the Packet Forwarding Engine (PFE). The Routing Engine also provides control plane functions and runs Junos OS. Software processes that run on the Routing Engine maintain the routing tables, manage the routing protocols used on the router, control the router interfaces, control some chassis components, and provide the interface for system management and user access to the router. Routing Engines communicate with DPCs and MPCs via dedicated out-of-band management channels, providing a clear distinction between the control and forwarding planes.

Modular Port Concentrator (MPC)

MPCs leverage the Junos Trio chipset to deliver high density 1, 10, 40 and 100 Gigabit Ethernet, as well as ATM/SONET and inline services across the entire MX Series portfolio. These advanced capabilities allow you to flexibly mix and match interfaces to create service-specific and "pay-as-you-grow" configurations. The MPC houses the PFEs to deliver comprehensive Layer 3 routing (IPv4 and IPv6), MPLS, and Layer 2 switching and advanced Hierarchical quality-of-service (HQoS).

For more details on MPCs, please visit www.juniper.net/us/en/local/pdf/datasheets/1000294-en.pdf.

Dense Port Concentrator (DPC)

DPCs provide multiple physical interfaces and PFEs on a single board that installs in a slot in the MX Series routers. A DPC receives incoming packets from the network and sends outgoing packets to the network. The PFEs on a DPC are equipped with purpose-built ASICs that perform packet processing and forwarding. Each PFE consists of one I-Chip for Layer 3 processing and one Layer 2 network processor.

For more details on the DPC, please visit www.juniper.net/us/en/local/pdf/datasheets/1000209-en.pdf.

Junos OS

Junos OS is a single, modular OS with a single release cycle that is supported across all Juniper Networks routers, switches, and security devices in a unique approach that extends significant operational and economic benefits. Junos OS streamlines network operations and improves the availability, performance, and security of all types of services supported by the MX Series 3D Universal Edge Routers, including L2/L3 VPNs, traffic segmentation, low-latency multicast, and comprehensive QoS features that accelerate the delivery of time-sensitive applications.

Junos OS also offers advanced virtualized network services such as Virtual Chassis technology, cloud-based CPE, and network edge services such as network address translation (NAT) and carrier-grade NAT (CGNAT), IPsec, flow monitoring, and stateful firewall—allowing the seamless and operationally efficient integration of these advanced service capabilities directly on the MX Series. Unlike other network operating systems that are fragmented into many different release images joined under a common "brand," our unified approach to OS development and deployment reduces the cost, complexity, and time to implement and maintain network infrastructure.

MX Series Features and Benefits

Unmatched Network Availability

The MX Series 3D is a true carrier-grade platform that ensures nonstop network availability with layered physical, logical, and protocol-level resiliency options. Chassis redundancy is based on advanced Virtual Chassis technology. Link aggregation group (LAG) technology supports stateful card and port redundancy, as well as subscriber and session persistence in the case of switchover.

On the software side, Junos OS has a modular architecture that runs each program independently with its own memory space to ensure that processes do not interfere with one another. A full set of high availability (HA) features, including unified in-service software upgrade (ISSU); a comprehensive OAM toolkit, Junos XML management protocol commit script capabilities and service-level resiliency with features such as virtual private LAN service (VPLS) multihoming.

Advanced Virtualized Network Services

Junos OS-based virtualized network services enable cost-effective router integrated service scale without impacting forwarding performance or requiring operators to use third-party appliances. The MX Series can efficiently support services that include the following:

- Junos Video Focus for proactive video quality assurance
- Junos Address Aware, which helps you conserve your IPv4 address pool, ensure IPv4/IPv6 coexistence, and transition to IPv6
- Junos Network Secure, which provides stateful firewall services for network protection and managed security offers
- Junos VPN Site Secure, which uses standard encryption modes to secure communication between the customer premises and the network edge, and for added security over L3 VPNs
- Junos Traffic Vision, which monitors traffic flows and generates detailed flow records

The Service Control Gateway, an open platform that enables the creation and delivery of subscriber- and application-aware services and service chaining.

Comprehensive Broadband Edge Capabilities

The MX Series provides a powerful broadband network gateway (BNG) that lets operators provision broadband services for today and tomorrow with support for Point-to-Point Protocol (PPP) subscriber termination, Dynamic Host Configuration Protocol (DHCP), IPv4/IPv6 local server, and relay proxy for subscribers' migration to DHCP access models. Juniper's solution also supports RADIUS and Diameter back-end servers to facilitate authentication, policy control, and accounting, and it offers flexible L2/L3 wholesale models. The MX Series BNG also delivers advanced features such as hierarchical queuing, granular QoS, and dynamic multilayer service activation.

Broad Business Edge Capabilities

The MX Series provides a comprehensive VPN toolkit that enables feature-rich, standards-based, secure interworking and streamlined operations needed to help you reduce expenses and enable innovative business services. In addition to basic L3 VPN, L2 VPN, and VPLS, enhanced VPN service support includes QoS prioritized VPN traffic for voice and video, VPN-aware multicast and firewall services that leverage technologies such as LDP-BGP VPLS interworking, point-to-multipoint label-switched paths (P2MP LSPs), BGP-based multicast L3VPN, L2 VPN interworking to connect dissimilar L2 access networks, MPLS plug-and-play, and IPsec/GRE VPNs.

Metro Ethernet Capabilities

The MX Series is Carrier Ethernet 2.0 certified and supports metro Ethernet and aggregation solutions with a full suite of routing and switching features, allowing you to choose the deployment model that best fits your business and technical needs. The MX Series can be flexibly deployed as an IP/IP VPN edge router, VPLS provider edge router (VPLS-PE), MPLS label-switching router (LSR), L2 switch, or L3 router in mobile, fixed, and cable networks.

Universal SDN Gateway Capabilities

Supporting a wide range of SDN and encapsulation protocols, the MX Series is ideal as an SDN universal gateway to bridge between physical and virtual networks—even networks running different encapsulation or overlay technologies. Examples of supported protocols include Multiprotocol BGP (MBGP), dynamic tunnels using MPLS-over-GRE or VXLAN encapsulation, virtual routing tables and forwarding (VRF) and EVI (E-VPNs), mechanisms to send traffic between VRF and global routing table based on configuration and policy, and support for NETCONF.
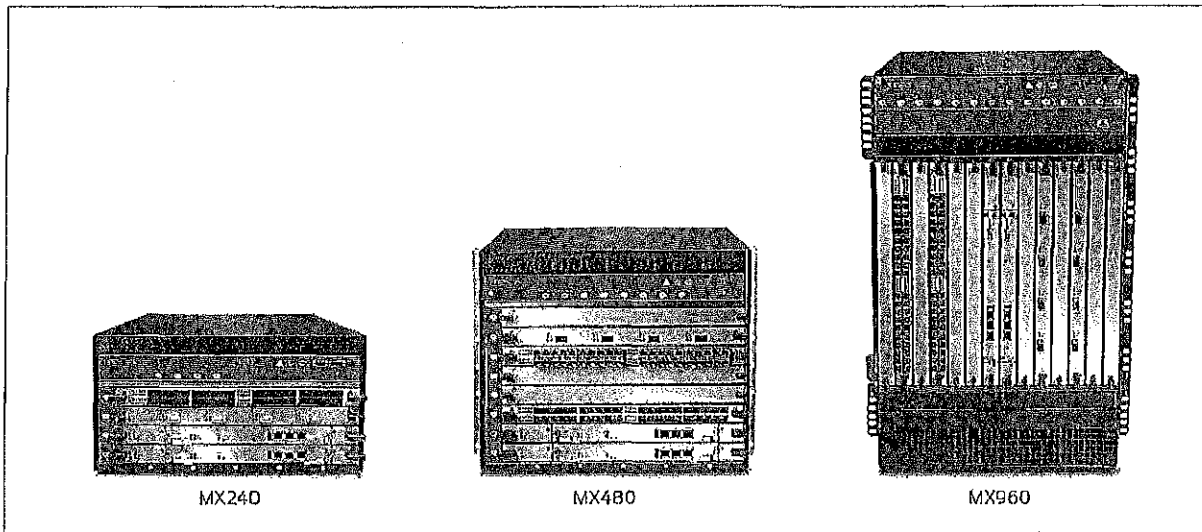
MX240　　　　　　　MX480　　　　　　　MX960

Specifications and Approvals

This section lists basic specifications by platform. For further details, please refer to the hardware Installation manuals at www.juniper.net/techpubs/hardware.

Specification	MX240	MX480	MX960
Dimensions and Power			
Physical dimensions (W x H x D)	17.5 x 8.7 x 23.8 In (44.5 x 22.1 x 60.5 cm)	17.5 x 14 x 23.8 In (44.5 x 35.6 x 60.5 cm)	17.5 x 27.8 x 23.5 In (44.5 x 70.5 (16 RU) x 59.7 cm)
Weight (lb/kg) fully configured	130 lb/59 kg	180 lb/81.7 kg	334 lb/151.6 kg
Mounting	Front or center	Front or center	Front or center
Power (DC/AC)	–40 to –72 V DC 100 to 240 V AC	–40 to –72 V DC 100 to 240 V AC	–40 to –72 V DC 200 to 240 V AC

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit www.juniper.net/us/en/products-services.

Ordering Information

Model Number	Description		
Base Unit	**MX240**	**MX480**	**MX960**
DC Chassis	MX240BASE-DC, MX240BASE3-DC	MX480BASE-DC, MX480BASE3-DC	MX960BASE3-DC; MX960BASE-DC
AC Chassis	MX240BASE-AC, MX240BASE3-ACH, MX240BASE3-ACL	MX480BASE-AC, MX480BASE3-AC	MX960BASE3-AC; MX960BASE-AC

MPC	
MX-MPC1-3D	1xTrio Chipset MPC, port queuing; includes full scale L2/L2.5 and reduced scale L3 features
MX-MPC1-3D-Q	1xTrio Chipset MPC, per-IFL HQoS, 128,000 queues (maximum 64000 egress); includes full scale L2/L2.5 and reduced scale L3 features
MX-MPC1-3D-Q-R-B	MX-MPC1-3D-Q line card bundle; includes full scale L3, L2, and L2.5 features
MX-MPC1-3D-R-B	MX-MPC1-3D line card bundle; includes full scale L3, L2, and L2.5 features
MX-MPC1E-3D	1xTrio Chipset Enhanced MPC, port queuing; includes full scale L2/L2.5 and reduced scale L3 features
MX-MPC1E-3D-Q	1xTrio Chipset Enhanced MPC, per-IFL HQoS, 128,000 queues (max 64,000 egress); includes full scale L2/L2.5 and reduced scale L3 features
MX-MPC1E-3D-Q-R-B	MX-MPC1E-3D-Q line card bundle; includes full scale L3, L2, and L2.5 features
MX-MPC1E-3D-R-B	MX-MPC1E-3D line card bundle;includes full scale L3, L2, and L2.5 features
MX-MPC2-3D	2xTrio Chipset MPC, port queuing; includes full scale L2/L2.5 and reduced scale L3 features
MX-MPC2-3D-EQ	2xTrio Chipset MPC, per-IFL HQoS, 512,000 queues; includes full scale L2/L2.5 and reduced scale L3 features
MX-MPC2-3D-EQ-R-B	MX-MPC2-3D-EQ line card bundle, includes full scale L3, L2 and L2.5 features
MX-MPC2-3D-Q	2xTrio Chipset MPC, per-IFL HQoS, 256,000 queues (max 128,000 egress); includes full scale L2/L2.5 and reduced scale L3 features
MX-MPC2-3D-Q-R-B	MX-MPC2-3D-Q line card bundle; includes full scale L3, L2, and L2.5 features
MX-MPC2-3D-R-B	MX-MPC2-3D line card bundle; includes full scale L3, L2, and L2.5 features
MX-MPC2E-3D	2xTrio Chipset Enhanced MPC, port queuing; includes full scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-EQ	2xTrio Chipset Enhanced MPC, per-IFL HQoS, 512,000 queues; includes full scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-EQ-R-B	MX-MPC2E-3D-EQ line card bundle; includes full scale L3, L2, and L2.5 features
MX-MPC2E-3D-P	2xTrio Chipset Enhanced MPC, 1588v2, port queuing; includes full scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-P-Q-B	MX-MPC2E-3D-P line card bundle; includes 1588v2, per-IFL HQoS, 256,000 queues (maximum 128,000 egress), full scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-P-Q-R-B	MX-MPC2E-3D-P line card bundle; includes 1588v2, per-IFL HQoS, 256,000 queues (maximum 128,000 egress), full scale L3, L2, and L2.5 features
MX-MPC2E-3D-P-R-B	MX-MPC2E-3D-P line card bundle; includes 1588v2, full scale L3, L2, and L2.5 features
MX-MPC2E-3D-Q	2xTrio Chipset Enhanced MPC, per-IFL HQoS, 256,000 queues (maximum 128,000 egress); includes full scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-Q-R-B	MX-MPC2E-3D-Q line card bundle; includes full scale L3, L2, and L2.5 features
MX-MPC2E-3D-R-B	MX-MPC2E-3D line card bundle; includes full scale L3, L2, and L2.5 features
MX-MPC3E-3D	MPC3 with support for 100GbE, 40GbE, and 10GbE interfaces, L2.5 features, optics sold separately
MX-MPC3E-3D-R-B	MPC3E with support for 100GbE, 40GbE, and 10GbE interfaces, includes full scale L2, L3, L3VPN features, optics sold separately
MPC-3D-16XGE-SFPP	16x10GbE ports with L2.5 features, optics sold separately
MPC-3D-16XGE-SFPP-R-B	16x10GbE ports with full scale L3, L2, and L2.5 features, optics sold separately
MPC4E-3D-2CGE	2x100GbE and 8x10GbE ports; full scale L2/L2.5 and reduced scale L3 features
MPC4E-3D-32XGE-SFPP	32x10GbE, full scale L2/L2.5 and reduced scale L3 features
MPC4E-3D-2CGE-8XGE-IRB	2x100GbE and 8x10GbE ports, full scale L2/L2.5, L3 features, up to 16 L3VPNs per MPC

Model Number	Description
MPC4E-3D-32XGE-IRB	32x10GbE SFPP ports, full scale L2/L2.5, L3 features, up to 16 L3VPNs per MPC
MPC4E-3D-2CGE8XGE-RB	2x100GbE and 8x10GbE ports, full scale L2/L2.5, L3 and L3VPN features
MPC4E-3D-32XGE-RB	32XGbE SFPP ports, full scale L2/L2.5, L3 and L3VPN features
MPC5E-100G10G	2-port 100GbE and 4-port 10GbE; Includes full scale L2/L2.5 and reduced scale L3 features, optional license permits up to 32,000 queues with HQoS.
MPC5E-100G10G-IRB	2-port 100GbE and 4-port 10GbE; Includes full scale L2/L2.5, L3 features and up to 16 L3VPN Instances, optional license permits up to 32,000 queues with HQoS.
MPC5E-100G10G-RB	2-port 100GbE and 4-port 10GbE; Includes full scale L2/L2.5, L3 and L3VPN features, optional license permits up to 32,000 queues with HQoS.
MPC5E-40G10G	6-port 40GbE or 24-port 10GbE; Includes full scale L2/L2.5 and reduced scale L3 features, optional license permits up to 32,000 queues with HQoS.
MPC5E-40G10G-IRB	6-port 40GbE or 24-port 10GbE; Includes full scale L2/L2.5, L3 features and up to 16 L3VPN instances, optional license permits up to 32,000 queues with HQoS.
MPC5E-40G10G-RB	6-port 40GbE or 24-port 10GbE; includes full scale L2/L2.5, L3 and L3VPN features, optional license permits up to 32,000 queues with HQoS.
MPC5EQ-100G10G	2-port 100GbE and 4-port 10GbE with HQoS; supports 1 million queues and 128,000 sessions; Includes full scale L2/L2.5 and reduced scale L3 features.
MPC5EQ-100G10G-IRB	2-port 100GbE and 4-port 10GbE with HQoS; supports 1 million queues and 128,000 sessions; Includes full scale L2/L2.5, L3 features and up to 16 L3VPN instances.
MPC5EQ-100G10G-RB	2-port 100GbE and 4-port 10GbE with HQoS; supports 1 million queues and 128,000 sessions; includes full scale L2/L2.5, L3 and L3VPN features.
MPC5EQ-40G10G	6-port 40GbE or 24-port 10GbE with HQoS; supports 1 million queues and 128,000 sessions; Includes full scale L2/L2.5 and reduced scale L3 features.
MPC5EQ-40G10G-IRB	6-port 40GbE or 24-port 10GbE with HQoS; supports 1 million queues and 128,000 sessions, includes full scale L2/L2.5, L3 features and up to 16 L3VPN instances.
MPC5EQ-40G10G-RB	6-port 40GbE or 24-port 10GbE with HQoS; supports 1 million queues and 128,000 sessions, includes full scale L2/L2.5, L3 and L3VPN features.
MS-MPC-128	Multiservices MPC supports a variety of licensed applications Including Stateful firewall, Carrier-Grade NAT (CGN), and deep-packet Inspection (DPI); each purchased separately. MS-MPC occupies a single slot in MX2020, MX2010, MX960, MX480, and MX240.

MIC

MIC3-3D-10XGE-SFPP	MIC with 10x10GbE SFP+ Interface
MIC-3D-20GE-SFP	20 ports of 10/100/1000 Ethernet with small form-factor pluggable transceiver (SFP) interfaces
MIC-3D-20GE-SFP-E	20 ports of 10/100/1000 Ethernet with enhanced small form-factor pluggable transceiver (SFP) Interfaces
MIC-3D-20GE-SFP-EH	20 ports of 10/100/1000 Ethernet with enhanced and temperature hardened small form-factor pluggable transceiver (SFP) Interfaces
MIC-3D-2XGE-XFP	2 10GbE modular Interface cards with XFP Interfaces
MIC-3D-4XGE-XFP	4 10GbE modular Interface cards with XFP Interfaces
MIC-3D-40GE-TX	40 ports of 10/100/1000 Ethernet with TX Interfaces
MIC3-3D-1X100GE-CFP	MIC with 1x100GbE C form-factor pluggable transceiver (CFP) Interface
MIC3-3D-1X100GE-CXP	MIC with 1x100GbE CXP Interface
MIC3-3D-2X40GE-QSFPP	MIC with 2x40GbE QSFP+ interfaces
MS-MIC-16	Multiservices MIC supports a variety of licensed applications Including Stateful firewall, Carrier-Grade NAT (CGN), and deep-packet Inspection (DPI); each purchased separately.

Model Number	Description
DPC	
DPCE-R-20GE-2XGE	20-port GbE + 2-port 10GbE DPC with L2+L3 features
DPCE-R-Q-20GE-2XGE	20-port GbE + 2-port 10GbE enhanced queuing DPC with L2+L3 features
DPCE-R-Q-20GE-SFP	20x1GbE L2/L3 capable with enhanced queuing
DPCE-R-2XGE-XFP	2x10GbE Enhanced DPC for MX Series
DPCE-R-40GE-SFP	40x1GbE L2/L3 capable
DPCE-R-Q-40GE-SFP	40x1GbE enhanced queuing DPC for MX Series with L2/L3 features and VLAN-HQoS
DPCE-R-40GE-TX	40-port 10/100/1000 RJ-45 DPC with L2+L3 features
DPCE-X-40GE-SFP	40x1GbE L2+ capable
DPCE-X-Q-40GE-SFP	40x10/100/1000 Ethernet L2/L3 capable with RJ45
DPCE-X-4XGE-XFP	4x10GbE L2+ capable
DPCE-R-4XGE-XFP	4x10GbE Enhanced DPC with L2+L3 features
DPCE-R-Q-4XGE-XFP	4x10GbE queuing DPC with L2/L3 features and VLAN-HQoS
DPCE-X-Q-4XGE-XFP	4x10GbE L2+ capable board with enhanced queuing
MX-FPC2	DPC with 2 slots for type 2 PICs
MS-DPC	Multiservices DPC provides 20 Gbps of service throughput
Routing Engines	
RE-S-1300-2048-BB	1.3 GHz CPU and 2 GB memory, base bundle
RE-S-2000-4096-UPG-BB	2 GHz CPU and 4 GB memory, base bundle
RE-S-1300-2048-R	1.3 GHz CPU and 2 GB memory, redundant
RE-S-2000-4096-R	2 GHz CPU and 4 GB memory, redundant
RE-S-1800X2-8G-R	Dual-core 1.8 GHz CPU and 8 GB memory, redundant
RE-S-1800X2-16G-R	Dual-core 1.8 GHz CPU and 16 GB memory, redundant
RE-S-1800X4-8G-R	Quad-core 1.8 GHz CPU and 8 GB memory, redundant
RE-S-1800X4-16G-R	Quad-core 1.8 GHz CPU and 16 GB memory, redundant
RE-S-1800X2-8G-UPG-BB	Dual-core 1.8 GHz CPU and 8 GB memory, upgrade for base bundle
RE-S-1800X2-16G-UPG-BB	Dual-core 1.8 GHz CPU and 16 GB memory, upgrade for base bundle
RE-S-1800X4-8G-UPG-BB	Quad-core 1.8 GHz CPU and 8 GB memory, upgrade for base bundle
RE-S-1800X4-16G-UPG-BB	Quad-core 1.8 GHz CPU and 16 GB memory, upgrade for base bundle
RE-S-1800X4-32G-BB	Quad Core 1.8GHz CPU with 32 GB memory, base bundle
RE-S-1800X4-32G-R	Quad Core 1.8GHz CPU with 32 GB memory, redundant
RE-S-1800X4-32G-S	Quad Core 1.8GHz CPU with 32 GB memory, spare
RE-S-1800X4-32G-UB	Quad Core 1.8GHz CPU with 32 GB memory, upgrade for base bundle
RE-S-1800X4-32G-WS	Quad Core 1.8GHz CPU with 32 GB memory, worldwide version
Switch Board Control	
SCB-MX960-BB	SCB for MX240, MX480, and MX960
SCBE-MX-BB	Enhanced Switch Control Board for MX240, MX480, and MX960
SCBE2-MX-BB	Enhanced MX Switch Control Board for MX240, MX480, and MX960
Junos OS	
USA	Junos OS
Worldwide	Junos-WW

About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.

JUNIPEr
NETWORKS

Data Sheet

EX4500 Ethernet Switch
with Virtual Chassis Technology

Product Overview

The Juniper Networks EX4500 line of Ethernet switches delivers a scalable, high-performance platform for supporting high-density 1 gigabit per second (Gpbs) and 10 Gbps data center top-of-rack as well as data center, campus, and service provider aggregation deployments.

Product Description

Featuring up to 48 wire-speed 10-Gigabit Ethernet (10GbE) ports In a two rack unit (2U) platform, the Juniper Networks® EX4500 Ethernet Switch delivers Layer 2 and Layer 3 connectivity to networked devices such as servers and other switches. The EX4500 base switch provides 40 fixed 10GbE pluggable ports that can also support GbE connectors for added flexibility. Two optional high-speed uplink modules offer four additional 10GbE small form-factor pluggable transceiver (SFP+) ports each for connecting to upstream devices.

By targeting high-density 10GbE top-of-rack and aggregation deployments In the data center, campus, and service provider environments, EX4500 switches perfectly complement the Juniper Networks EX Series Ethernet Switch product family: the Juniper Networks EX2200 line and EX3200 line designed for low-density access deployments; the EX4200 line designed for data center and campus GbE access and aggregation deployments; and the EX8200 line of Ethernet switches designed for data center and campus core and aggregation environments.

Virtual Chassis Technology

The EX4500 supports Juniper Networks' unique Virtual Chassis technology, which enables up to 10 interconnected switches to operate as a single, logical device with a single IP address. When deployed in a Virtual Chassis configuration, the EX4500 switches are connected over a 128 Gbps backplane using Virtual Chassis interconnect cables. EX4500 switches can also be interconnected using a link aggregation (LAG) of up to eight SFP+ 10 GbE line-rate links, allowing switches to reside In different locations. Interconnected switches are monitored and managed as a single device, enabling enterprises to separate physical topology from logical groupings of endpoints and allowing more efficient resource utilization.

In the data center, using Virtual Chassis technology at the top of rack or end of row to aggregate servers provides flexibility In the deployment of uplinks. Rather than requiring redundant links for each physical switch to ensure high availability, redundant links are only needed for each Virtual Chassis group. EX4500 and EX4200 switches may be combined within a single Virtual Chassis configuration to support environments where both GbE and 10GbE servers are present.
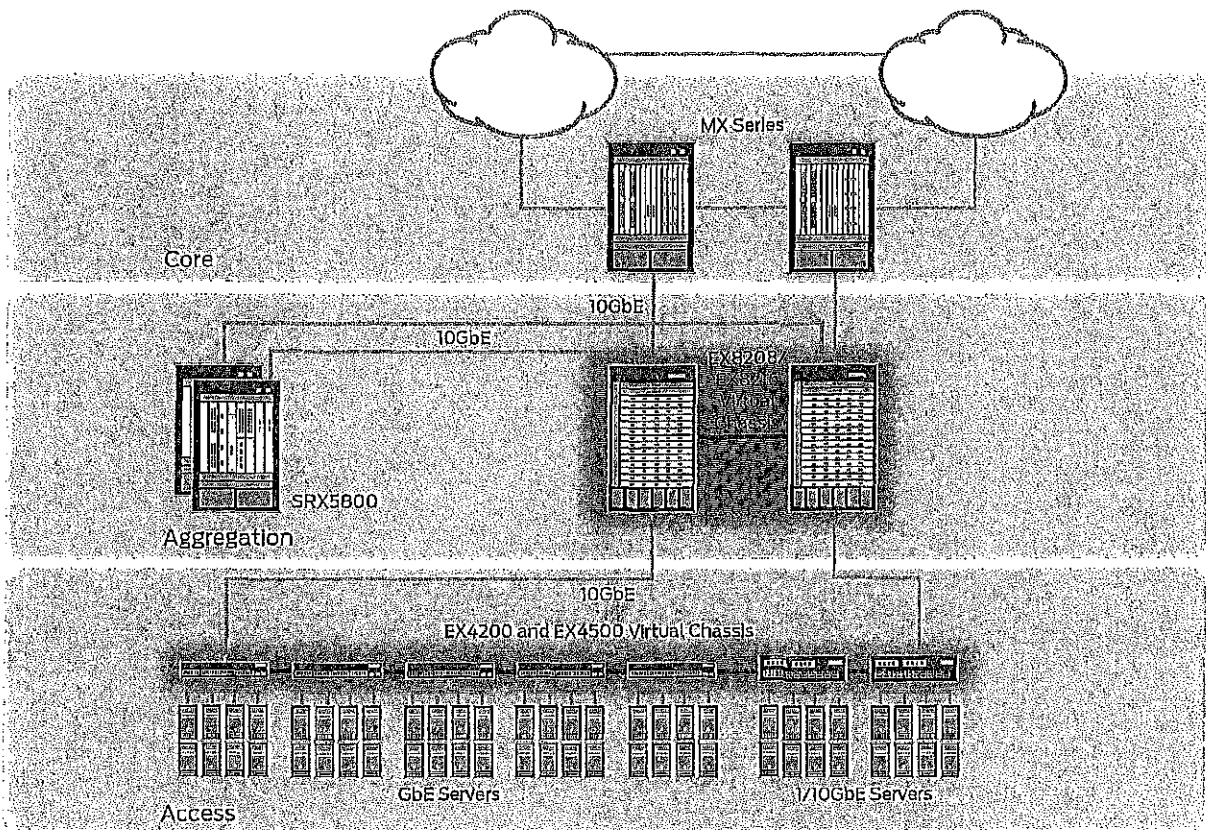
Figure 1: The EX4500 provides 10GbE server access in the data center.

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit www.juniper.net/us/en/products-services.
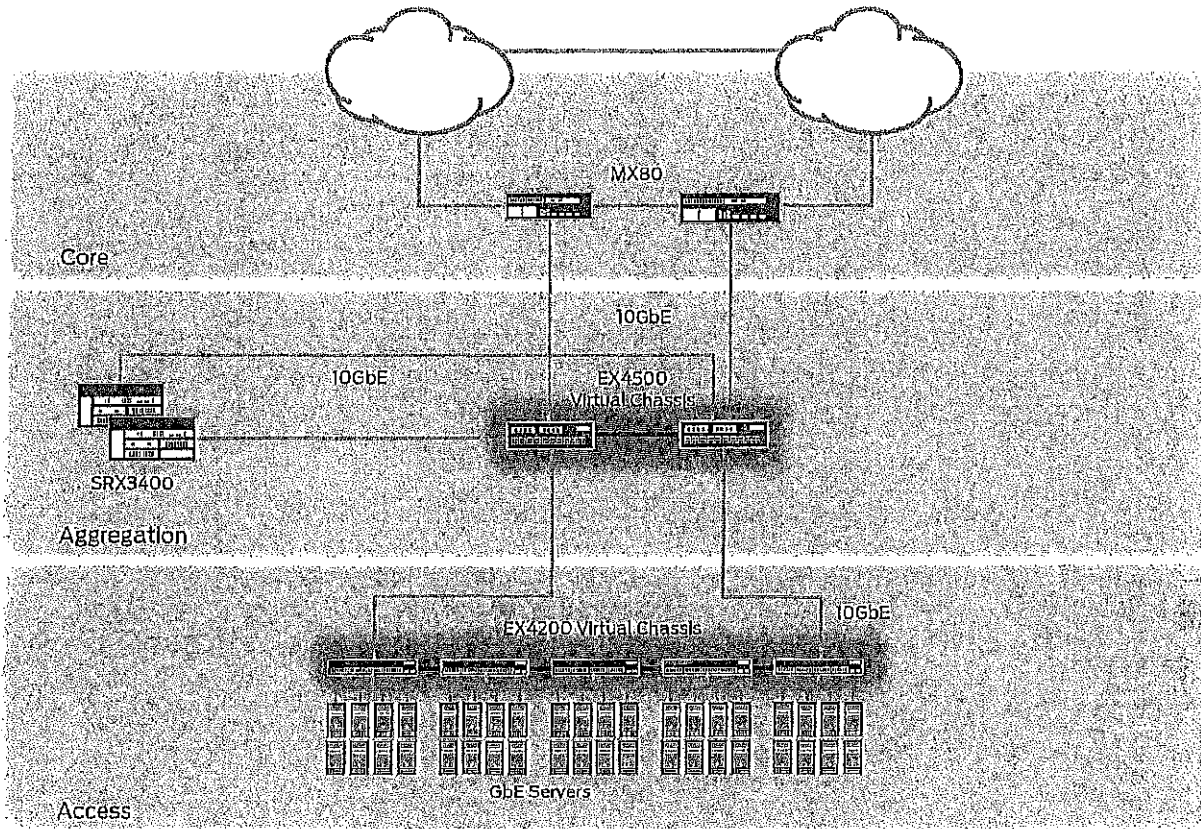
Figure 2: The EX4500 10GbE switch is ideal for small data center core deployments.
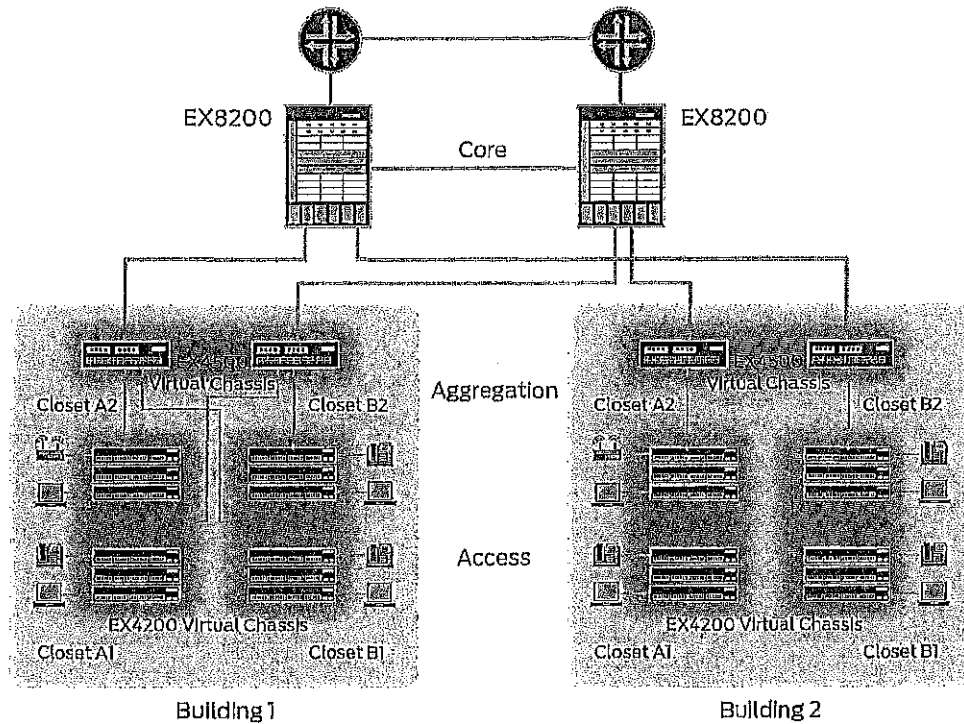
Figure 3: The EX4500 switch offers an economical, power-efficient, compact solution for campus aggregation deployments.

Campus Deployments

The EX4500 also offers an economical, power efficient and compact solution for aggregating 10GbE uplinks from access devices in building and campus deployments (see Figure 3). The switch's dual-speed interfaces also support environments transitioning from GbE to 10GbE.

The EX4500 easily meets enterprise core switch requirements, delivering wire-speed performance on every port, full device redundancy, support for Layer 3 dynamic routing protocols such as RIP and OSPF, and a comprehensive security and quality-of-service (QoS) feature set.

Data Center Deployments

The EX4500 Ethernet Switch is designed for demanding data center applications where high performance, high availability, and energy efficiency are key requirements (see Figure 1). Operating at wire speed, the EX4500 switches deliver 714 Mpps throughput and a data rate of 960 Gbps (full duplex) for both Layer 2 and Layer 3 protocols. An industry first and only, EX4500s can be interconnected in a Virtual Chassis configuration that also includes EX4200s, creating a single logical switch that offers a variety of port and density options for mixed server environments.

Flexible deployment options enable the EX4500 to support back-to-front and front-to-back cooling, which ensures consistency with server designs for hot and cold aisle deployments. Front- and rear-facing configuration options ensure closer proximity to server ports, optimizing performance and keeping cable lengths short and manageable. The EX4500 is also very environmentally conscious, drawing less than eight watts per port under maximum load.

For small data centers, the EX4500, in a Virtual Chassis configuration, is ideally deployed as the aggregation/core switch, aggregating 10GbE uplinks from EX4200 Virtual Chassis configurations in the access layer (see Figure 2).

Customers introducing 10GbE into their racks will be able to use the EX4500 to add 10GbE-attached servers, iSCSI, and network-attached storage (NAS) with minimal impact to the current switching infrastructure.

The EX4500 also includes hardware support for the Data Center Bridging (DCB) feature set, also referred to as Converged Enhanced Ethernet (CEE). DCB is a collection of individual IEEE standards that allow for Ethernet-based I/O and network convergence, including support for FCoE.

10GbE DCB and I/O Convergence Deployments

The EX4500 is a full IEEE DCB- and T11 FC-BB-5-based FCoE Transit Switch, delivering a high-performance solution for converged server edge access environments. As an FCoE Transit Switch, the EX4500 provides a pure IEEE DCB-converged access layer between FCoE-enabled servers and an FCoE-enabled Fibre Channel SAN (see Figure 4).

The EX4500 also supports FC Initiation Protocol (FIP) snooping, which provides perimeter protection to ensure that the presence of an Ethernet layer does not impact existing SAN security policies. The FCoE Transit Switch functionality, along with Priority-based Flow Control (PFC) and Data Center Bridging Exchange (DCBX), are included as part of the default software; no additional licenses are required.
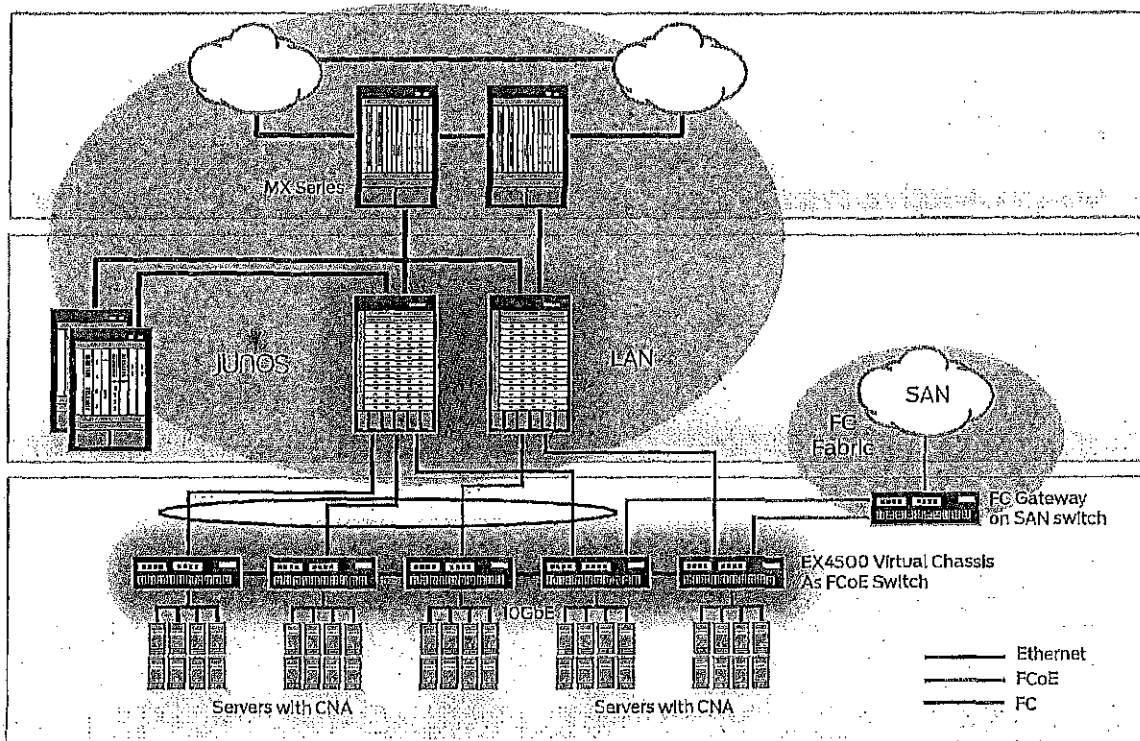
Figure 4: The EX4500 deployed as a data center FCoE Transit Switch in a top-of-rack Virtual Chassis configuration.

Junos Operating System

The EX4500 runs the same Juniper Networks Junos operating system that is used by other EX Series Ethernet Switches, as well as all Juniper Networks routers and Juniper Networks SRX Series Services Gateways. By utilizing a common operating system, Juniper Networks delivers a consistent implementation and operation of control plane features across all products. To maintain that consistency, Junos OS adheres to a highly disciplined development process that uses a single source code, follows a single quarterly release train, and employs a highly available modular architecture that prevents isolated failures from bringing down an entire system.

These attributes are fundamental to the core value of the software, enabling all Junos OS-powered products to be updated simultaneously with the same software release. All features are fully regression tested, making each new release a true superset of the previous version; customers can deploy the software with complete confidence that all existing capabilities will be maintained and operate in the same way.

Management Options

Up to four different system management options are available for the EX4500 Ethernet switches.

The standard Junos OS command-line interface (CLI) offers the same granular management capabilities and scripting parameters found in any router powered by the Junos OS.

1. The EX4500 also includes the Integrated Juniper Networks J-Web Software, an embedded web-based device manager that allows users to configure, monitor, troubleshoot, and perform system maintenance on individual switches via a browser-based graphical interface.

2. EX4500 performance, configuration, and fault data can also be exported to leading third-party management systems such as HP OpenView, IBM Tivoli, and Computer Associates Unicenter software, providing a complete, consolidated view of network operations.

3. The EX4500 is also supported by Juniper Networks Junos® Space*, an open, programmable application platform for hosting a comprehensive suite of network operational application tools that provide a smart, simple, and open approach for automating the deployment and operation of a Juniper infrastructure.

4. Explicitly designed to allow partners and customers to build and deploy smart, simple, and easy-to-use applications, Junos Space provides multiple management and infrastructure applications for managing Juniper resources and assets, including inventory management, device and interface configuration, automated software management and deployment, and event-driven fault management. These Junos Space applications offer predefined automation schemes and best practice templates to enable rapid and accurate deployments.

*Roadmap

Features and Benefits

The EX4500 Ethernet switches include the following key features and benefits.

High Performance

Each EX4500 supports 480 Gbps of bandwidth with 48 line-rate 10 Gbps ports at all packet sizes or 14.88 Mpps per port at the minimum Ethernet frame size.

High Availability

The EX4500 switches offer dual internal load sharing AC power supplies, and redundant variable-speed fans as standard features, protecting the switch from a single power supply or fan failure. DC power options will be available in the future.

Energy Efficient

Consuming less than eight watts per 10GbE interface, the EX4500 offers a low power solution for 10GbE top-of-rack, end-of-row, and aggregation deployments. The EX4500 switches also improve cooling efficiency with redundant variable-speed fans that automatically adjust their speed based on existing conditions to reduce power consumption.

Small Footprint

The EX4500 supports up to 48 wire-speed 10GbE ports in a single 2U platform.

Additional Features

- System status LEDs
- LCD status display
- Versatile two- and four-post rack mounting options
- Front-to-back and back-to-front airflow options
- AC and DC power supply options
- Support for Jumbo frames (9,000)
- Quality of service (IEEE 802.1p marking)
- Multicast (IGMP v1/v2/v3 snooping)
- Layer 2 features including support for 4,096 VLAN IDs, Spanning Tree (802.1s and 802.1w), bridge protocol data unit (BPDU) guard, 802.3as Link Aggregation
- Management features including Telnet and SSH v1/v2, SNMP v1-v3, RADIUS, TACACS+, and RMON

Table 1: EX4500 Power Consumption

Configuration	Power Consumption
No uplinks installed; 40 USR ports in base, all ports forwarding (line rate)	328 W
One uplink module (4 x 10GbE SFP+ ports) installed; 40 USR ports in base, all ports forwarding (line rate)	346 W
Two uplink modules (8 x 10GbE SFP+ ports) installed; 40 USR ports in base, all ports forwarding (line rate)	364 W

EX4500 with two uplink modules
(4 x 10GbE SFP+ ports)

EX4500 with Virtual Chassis module and
dual redundant power supplies
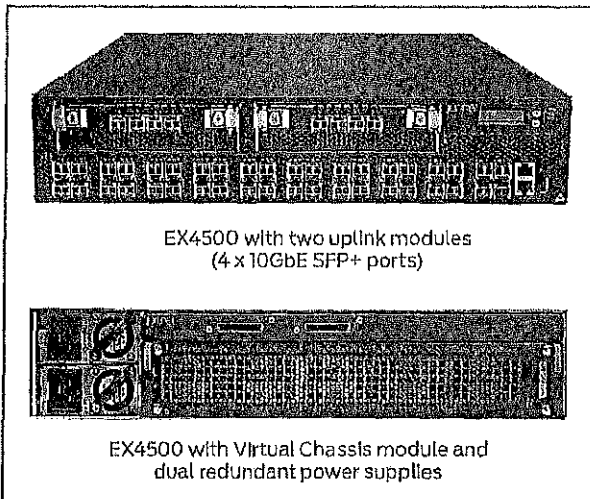
EX4500 10GbE Ethernet Switch Specifications

Hardware

Interface Options

- 40 GbE/10GbE small form-factor pluggable transceiver (SFP/SFP+) fiber connectors
- Eight 10GbE SFP+ uplink ports (via two optional four-port uplink modules)
- 1 x 10/100/1000 Ethernet RJ-45 ports for management
- Console port for management
- 128 Gbps Virtual Chassis module with 2 x 64 Gbps ports

Supported Optics

- 10GbE SFP+ LC connector type: short reach (SR) (multimode), long reach (LR) (single mode), ultra short reach (USR) (multimode), extended reach (ER) (single mode)
- 10GbE SFP+ copper: Direct-attached copper (1/3/5/7 m)
- 1 GbE SFP LC connector type: LX (single mode), SX (multi mode), 1000BASE-T (only 1,000 M supported)

Dimensions

- Height: 3.5 in (8.9 cm); 2U
- Width: 17.25 in (43.8 cm)
- Depth: 21.1 in (53.6 cm)
- Weight: 37 lb (17 kg) with one AC and DC power supply

Rack Installation Kit

- Versatile two- and four-post mounting options for 19-in server rack or datacom rack

LEDs

- System LEDs that indicate status

Airflow

- Front-to-back or back-to-front cooling
- Redundant variable-speed fans reduce power draw

CPU

- 1.5 GHz PowerPC

Memory

- DRAM: 1 GB
- Flash: 2 GB

Power

- Dual hot-swappable load sharing AC and DC power supplies

Software

Security

- RADIUS
- TACACS+
- Access control lists (ACLs): Allow and deny
- SSH v1, v2
- Secure interface login and password
- Local proxy Address Resolution Protocol (ARP)
- Static ARP support

Layer 2 Switching

- Maximum number of MAC addresses in hardware: 32,000*
- Jumbo frames: 9,216 bytes
- Number of VLANs: 4,096
- Port-based VLAN
- 4,096 VLAN IDs supported
- Routed VLAN Interface (RVI)

Link Aggregation

- 802.3ad support
  - Number of Link Aggregation Groups (LAGs) supported: 64
  - Maximum number of ports per LAG: 8
- LAG load-sharing algorithm—bridged or routed (unicast or multicast) traffic:
  - IP: S/D IP
  - TCP/UDP: S/D IP, S/D Port
  - Non-IP: S/D MAC
  - Tagged ports support in LAG

Spanning Tree

- RSTP and VSTP running concurrently
- Spanning Tree Protocol (802.1D)
- Multiple Spanning Tree Protocol (MSTP) (802.1s)
- Rapid Spanning Tree Protocol (RSTP) (802.1w)
- VSTP - VLAN Spanning Tree
- BPDU protect
- Loop protect
- Root protect

Quality of Service (QoS)

- EZQoS
- CoS on L3 VLAN
- Per interface rewrite
- Per interface classification
- Policer mark down action
- Remarking of bridged packets
- Layer 2 QoS
- Layer 3 QoS
- Rate Limiting

* MAC address table uses a hash-based scheme to program entries; therefore, some entries may not be programmed due to hash index collision.

- Ingress policing: 1 rate 2 color
- Egress shaping: per-queue, per-port
- Eight hardware queues per port
- Scheduling methods (egress): Strict priority (SP), shaped deficit weighted round-robin (SDWRR)
- 802.1p remarking
- Layer 2-4 classification criteria: Interface, MAC address, Ethertype, 802.1p, VLAN, IP address, DSCP/IP precedence, TCP/UDP port numbers, etc.
- Congestion avoidance capabilities: Weighted tail drop eight queues

Layer 3 Features: IPv4
- VRF-lite (ISIS, RIP, OSPF, BGP, BGP, ISIS)
- IP directed broadcast traffic forwarding
- Routing protocols: RIPv1/v2, OSPF, BGP, ISIS
- Max number of IPv4 unicast routes in hardware: 14,000**
- Max number of IPv4 multicast routes in hardware: 4,000
- Static routing
- Routing policy
- Virtual Router Redundancy Protocol (VRRP)
- Bidirectional Forwarding Detection (BFD) protocol

Layer 3 Features: IPv6
- Max number of Neighbor Discovery (ND) entries: 1,000
- Max number of IPv6 unicast routes in hardware: 3,400**
- Max number of IPv6 multicast routes in hardware: 1,000
- Routing protocols: RIPng, OSPFv3, IPv6, BGP, MLDv2
- Static routing

Multicast
- VRF-lite (PIM, IGMP)
- IGMP static
- Internet Group Management Protocol (IGMP): v1, v2, v3
- IGMP snooping
- PIM-SM, PIM-SSM
- Multicast Source Directory Protocol (MSDP)

Access Control Lists (ACLs) (Junos OS firewall filters)
- Port-based ACL (PACL)—ingress and egress
- VLAN-based ACL (VACL)—ingress and egress
- Router-based ACL (RACL)—ingress and egress
- ACL entries (ACE) in hardware per system: 1,500
- ACL counter for denied packets
- ACL counter for permitted packets
- Ability to add/remove/change ACL entries in middle of list (ACL editing)
- Layer 2-L4 ACL
- Trusted Network Connect (TNC) certified
- MAC authentication (RADIUS)
- Control plane denial-of-service (DoS) protection

** Uni-dimensional scale (shared table between v4 and v6)

Virtual Chassis Capabilities
- Maximum number of members: 10
- Virtual Chassis Ports (VCPs):
  - Two dedicated 64 Gbps ports with 128 Gbps Virtual Chassis module
  - Any base or uplink port can act as VCPs
- Maximum Virtual Chassis interconnect capacity:
  - 128 Gbps with Virtual Chassis module
  - Up to 48 x 10 Gbps using base or uplink ports (subject to a maximum of 8 members per LAG group per destination, 64 LAG groups per system)
- Maximum Virtual Chassis distance:
  - Virtual Chassis module ports: Up to 5m with VCP cable
  - Base or uplink ports: Up to maximum distance supported by optics

Data Center Bridging (DCB)
- Priority-based Flow Control (PFC) — IEEE 802.1Qbb
- Data Center Bridging Exchange Protocol (DCBX)

Fibre Channel over Ethernet (FCoE)
- FCoE Transit Switch (FIP snooping)
- ISCSI SAN
- ISCSI TLV support

High Availability
- Non-Stop Routing (NSR): OSPF v2, RIP v1/v2, BGP, ISIS, IGMP v1, v2, v3
- Redundant, hot-swappable power supplies
- Redundant, field-replaceable, hot-swappable fans
- Graceful Route Engine Switchover (GRES) for Layer 2 hitless forwarding and Layer 3 protocols on Routing Engine failover
- Graceful Protocol Restart: OSPF, BGP, IGMP v1/v2/v3 snooping
- Non-stop Bridging (NSB) for xSTP, LACP, LLDP/LLDP-MED
- Non-stop Switch Upgrade (NSSU) for EX4500-VC or EX4200-EX4500-VC
- Virtual Chassis Fast Convergence (as low as sub-50ms)

Supported RFCs
- RFC 2925 MIB for Remote Ping, Trace
- RFC 1122 Host Requirements
- RFC 768 UDP
- RFC 791 IP
- RFC 783 Trivial File Transfer Protocol (TFTP)
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 894 IP over Ethernet
- RFC 903 RARP
- RFC 906 TFTP Bootstrap
- RFC 1027 Proxy ARP
- RFC 2068 HTTP server

- RFC 1812 Requirements for IP Version 4 Routers
- RFC 1519 Classless Interdomain Routing (CIDR)
- RFC 1256 IPv4 ICMP Router Discovery (IRDP)
- RFC 1058 RIP v1
- RFC 2453 RIP v2
- RFC 1112 IGMP v1
- RFC 2236 IGMP v2
- RFC 3618 MSDP
- RFC 4915 MT-OSPF
- RFC 3376 IGMP v3
- RFC 1492 TACACS+
- RFC 2138 RADIUS Authentication
- RFC 2139 RADIUS Accounting
- RFC 3579 RADIUS EAP support for 802.1x
- RFC 5176 Dynamic Authorization Extensions to RADIUS
- RFC 2267 Network Ingress Filtering
- RFC 2030 SNTP, Simple Network Time Protocol
- RFC 854 Telnet client and server
- RFC 951, 1542 BootP
- RFC 2131 BOOTP/DHCP relay agent and Dynamic Host Configuration Protocol (DHCP) server
- RFC 1591 Domain Name System (DNS)
- RFC 2338 VRRP
- RFC 2328 OSPF v2 (edge mode)
- RFC 1587 OSPF not-so-stubby area (NSSA) Option
- RFC 2154 OSPF w/Digital Signatures (Password, MD-5)
- RFC 2370 OSPF Opaque link-state advertisement (LSA) Option
- RFC 3623 OSPF Graceful Restart
- RFC 2362 PIM-SM (edge mode)
- RFC 3569 draft-ietf-ssm-arch-06.txt PIM-SSM PIM Source Specific Multicast
- RFC 2474 DiffServ Precedence, including 8 queues/port
- RFC 2598 DiffServ Expedited Forwarding (EF)
- RFC 2597 DiffServ Assured Forwarding (AF)
- RFC 2475 DiffServ Core and Edge Router Functions
- LLDP Media Endpoint Discovery (LLDP-MED), ANSI/TIA-1057, draft 08
- PIM-DM Draft IETF PIM Dense Mode draft-ietf-idmr-pim-dm-05.txt, draft-ietf-pim-dm-new-v2-04.txt
- Draft-ietf-bfd-base-05.txt Bidirectional Forwarding Detection

Supported MIBs*

- RFC 1155 SMI
- RFC 1157 SNMPv1
- RFC 1905 RFC 1907 SNMP v2c, SMIv2 and Revised MIB-II
- RFC 2570 – 2575 SNMPv3, user based security, encryption and authentication
- RFC 2576 Coexistence between SNMP Version 1, Version 2, and Version 3

*Unless explicitly specified for any particular MIB table or variables, Junos OS does not support SNMP set operations.

- RFC 1212, RFC 1213, RFC 1215 MIB-II, Ethernet-Like MIB and TRAPs
- RFC 2578 SNMP Structure of Management Information MIB
- RFC 2579 SNMP Textual Conventions for SMIv2
- RFC 2925 Ping/Traceroute MIB
- RFC 2665 Ethernet-like Interface MIB
- RFC 1643 Ethernet MIB
- RFC 1493 Bridge MIB
- RFC 2096 IPv4 Forwarding Table MIB
- RFC 2011 SNMPv2 for Internet protocol using SMIv2
- RFC 2012 SNMPv2 for transmission control protocol using SMIv2
- RFC 2013 SNMPv2 for user datagram protocol using SMIv2
- RFC 2863 Interface MIB
- RFC 3413 SNMP Application MIB
- RFC 3414 User-based Security Model for SNMPv3
- RFC 3415 View-based Access Control Model for SNMP
- RFC 1724 RIPv2 MIB
- RFC 2863 Interface Group MIB
- RFC 2932 IPv4 Multicast MIB
- RFC 2787 VRRP MIB
- RFC 1850 OSPFv2 MIB
- RFC 2819 RMON MIB
- RFC 2287 System Application Packages MIB
- RFC 4188 STP and Extensions MIB
- RFC 4363 Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering, and VLAN extensions
- RFC 2922 LLDP MIB
- Draft – blumenthal – aes – usm – 08
- Draft – reeder – snmpv3 – usm – 3desede -00
- Draft – ietf-idmr-igmp-mib-13
- Draft – ietf-idmr-pim-mib-09
- Draft – ietf-bfd-mib-02.txt

Troubleshooting

- Debugging: CLI via console, Telnet, or SSH
- Diagnostics: Show and debug command, statistics
- Traffic monitoring/mirroring (port, VLAN)
- IP tools: Extended ping and trace
- Junos OS commit and rollback

Traffic Mirroring

- Port-based
- VLAN-based
- ACL-based mirroring
- Mirroring destination ports per system: 1
- LAG port monitoring
- Multiple destination ports monitored to 1 mirror (N:1)
- Maximum number of mirroring sessions: 1
- Mirroring to remote destination (over L2): 1 destination VLAN

Safety and Compliance

Safety Certifications
- UL-UL60950-1 (First Edition)
- C-UL to CAN/CSA 22.2 No.60950-1 (First Edition)
- TUV/GS to EN 60950-1, Amendment A1-A4, A11
- CB-IEC60950-1, all country deviations

Electromagnetic Compatibility Certifications
- FCC 47CFR Part 15 Class A
- EN 55022 Class A
- ICES-003 Class A
- VCCI Class A
- AS/NZS CISPR 22 Class A
- CISPR 22 Class A
- EN 55024
- EN 300386
- CE

Environmental
- Reduction of Hazardous Substances (ROHS) 5
- Telco
- CLEI code
- Environmental Ranges
- Operating temperature: 32° to 113° F (0° to 45° C)
- Storage temperature: -40° to 158° F (-40° to 70° C)
- Operating altitude: up to 10,000 ft (3,048 m)
- Non-operating altitude: up to 16,000 ft (4,877 m)
- Relative humidity operating: 10% to 85% (noncondensing)
- Relative humidity non-operating: 0% to 95% (noncondensing)

Telecom Quality Management
- TL9000

Mean Time Between Failures (MTBF)

Part Number	Description	Predicted MTBF (khrs)	FIT Rate
EX4500-40F-BF/FB-C	EX4500 40-port GbE/10GbE SFP/SFP+ with back-to-front/front-to-back airflow	110	9,094
EX4500-40F-VC1-BF/FB	EX4500 40-port GbE/10GbE SFP/SFP+ with back-to-front/front-to-back airflow and 128 Gbps Virtual Chassis Interconnect module	96	10,389
EX4500-UM-4XSFP	EX4500 four-port 10GbE SFP+ uplink module	626	1,598

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit www.juniper.net/us/en/products-services.

Ordering Information

Model Number	Description
Base Unit*	
EX4500-40F-FB-C	40-port GbE/10GbE SFP/SFP+ front-to-back airflow, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues
EX4500-40F-BF-C	40-port GbE/10GbE SFP/SFP+ back-to-front airflow, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues
EX4500-40F-DC-C	40-port GbE/10GbE SPF/SFP+ front-to-back airflow, 1200W DC, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues
EX4500-40F-VC1-BF	40-port GbE/10GbE SFP/SFP+ back-to-front airflow, 128 Gbps Virtual Chassis Interconnect module, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues
EX4500-40F-VC1-FB	40-port GbE/10GbE SFP/SFP+ front-to-back airflow, 128 Gbps Virtual Chassis Interconnect module, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues
EX4500-40F-VC1-DC	40-port GbE/10GbE SFP/SFP+ front-to-back airflow, 128 Gbps Virtual Chassis Interconnect module, 1200W DC power supply, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues
Advanced Feature Licenses	
EX-48-AFL	Advanced Feature License for IS-IS, BGP, MPLS and IPv6 routing
Accessories	
EX4500-PWR1-AC-FB	EX4500 1200 W AC (1000 W at 110 V) power supply – front-to-back airflow
EX4500-PWR1-AC-BF	EX4500 1200 W AC (1000 W at 110 V) power supply – back-to-front airflow
EX4500-UM-4XSFP	EX4500 4-Port 10GbE SFP+ uplink module (optics sold separately)
EX4500-PWR1-DC	EX4500 1200 W DC power supply – front to back airflow (power cord needs to be ordered separately)
EX4500-VC1-128G	128 Gbps Virtual Chassis module
EX-CBL-VCP-50CM	Virtual Chassis Port cable 0.5 M length
EX-CBL-VCP-1M	Virtual Chassis Port cable 1 M length
EX-CBL-VCP-3M	Virtual Chassis Port cable 3 M length
EX-CBL-VCP-5M	Virtual Chassis Port cable 5 M length

* EX4500 base unit includes chassis, fan tray, intraconnect module, AC power supply, power cord, power supply cover panel, and two uplink module cover panels

Model Number	Description
Pluggable Optics	
EX-SFP-1GE-T	SFP 1000BASE-T copper; RJ-45 connector; 100 m reach on UTP
EX-SFP-1GE-SX	SFP 1000BASE-SX; LC connector; 850 nm; 550 m reach on multimode fiber
EX-SFP-1GE-LX	SFP 1000BASE-LX; LC connector; 1310 nm; 10 km reach on single mode fiber
EX-SFP-10GE-SR	SFP+ 10GBASE-SR; LC connector; 850 nm; 300 m reach on 50 microns multimode fiber; 33 m on 62.5 microns multimode fiber
EX-SFP-10GE-LR	SFP+ 10GBASE-LR; LC connector; 1310 nm; 10 km reach on single mode fiber
EX-SFP-10GE-LRM	SFP+ 10GBASE-LRM; LC connector; 1310 nm; 220 m reach on multimode fiber
EX-SFP-10GE-ER	SFP+ 10GBASE-ER 10 Gigabit Ethernet Optics, 1550 nm for 40 km transmission on single-mode fiber
EX-SFP-10GE-DAC-1M	SFP+ 10GbE Direct Attach Copper (twinax copper cable) 1 m
EX-SFP-10GE-DAC-3M	SFP+ 10GbE Direct Attach Copper (twinax copper cable) 3 m
EX-SFP-10GE-DAC-5M	SFP+ 10GbE Direct Attach Copper (twinax copper cable) 5 m
EX-SFP-10GE-DAC-7M	SFP+ 10GbE (twinax copper cable) 7 m
EX-SFP-10GE-USR	10GbE Ultra Short Reach; 850 nm; 10 m on OM1, 30 m on OM2, 100 m on OM3 multimode fiber

About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.

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EX4200 ETHERNET SWITCHES With Virtual Chassis Technology

Product Overview

High-performance businesses demand high-performance networking solutions. These solutions include a new class of secure, scalable and always-on enterprise switch that advances the economics of networking by enabling businesses to deploy innovative new technologies that increase revenue and improve productivity. The Juniper Networks EX4200 line of Ethernet switches with Virtual Chassis technology combine the compact, pay-as-you-grow economics and low power and cooling requirements of stackable switches with the performance, availability, operational ease and port densities of chassis-based platforms to meet the demands of today's high-performance enterprises.

Product Description

The Juniper Networks® EX4200 line of Ethernet switches with Virtual Chassis technology combine the high availability (HA) and carrier-class reliability of modular systems with the economics and flexibility of stackable platforms, delivering a high-performance, scalable solution for data center, campus and branch office environments.

Offering a full suite of Layer 2 and Layer 3 switching capabilities as part of the base software, the EX4200 satisfies a variety of high-performance applications, including branch, campus and data center access deployments as well as Gigabit Ethernet (GbE) aggregation deployments. A single 24-port or 48-port switch can be deployed initially; as requirements grow, Juniper Networks Virtual Chassis technology allows up to 10 EX4200 switches to be interconnected over a 128 gigabit-per-second (Gbps) backplane and managed as a single device, delivering a scalable, pay-as-you-grow solution for expanding network environments. Flexible Gigabit Ethernet (GbE) and 10-Gigabit Ethernet (10GbE) uplink options enable high-speed connectivity to aggregation- or core-layer switches which connect multiple floors or buildings.

All EX4200 switches include HA features such as redundant, hot-swappable internal power supplies and field-replaceable, multi-blower fan trays to ensure maximum uptime. In addition, the base EX4200 partial PoE switch models offer Class 3 Power over Ethernet (PoE), delivering up to 18.6 watts on the first eight ports to support networked devices such as telephones, video cameras and wireless LAN (WLAN) access points for low-density converged networks. Full PoE options delivering up to 18.6 watts on all 24 or 48 ports are also available, making them ideal for high-density IP telephony deployments. Furthermore, PoE+ models deliver up to 30 watts of standards-based 802.3at PoE+ on 24 or 48 ports making them ideal for all PoE applications including campus deployments with 802.11n wireless access points.

Juniper Networks Virtual Chassis Technology: Chassis-like Switch Features in a Stackable Form Factor

- Redundant, internal hot-swappable power supplies
- Hot-swappable fan tray with redundant blowers
- Consistent modular Juniper Networks Junos® operating system control plane feature implementation
- Dual Route Engines with Graceful Routing Engine Switchover (GRES)
- Single management interface
- Easy, centralized software upgrades
- Scales from 24 to 480 ports with up to 20 10GbE uplinks
- Limited lifetime switch hardware warranty

Each EX4200 switch includes an integrated application-specific integrated circuit (ASIC)-based Packet Forwarding Engine, the EX-PFE, while an integrated Routing Engine (RE) delivers all control plane functionality. Based on field-proven Juniper Networks technology, the Route Engine brings the same level of carrier-class performance and reliability to the EX4200 line of Ethernet switches that Juniper Networks routers bring to the world's largest service provider networks.

The EX4200 also leverages the same modular Juniper Networks Junos OS as Juniper Networks router products, ensuring a consistent implementation and operation of each control plane feature across an entire Juniper Networks infrastructure.

Architecture and Key Components

The EX4200 switches are single rack-unit devices that deliver a compact solution for crowded wiring closets and access switch locations where space and power are at a premium. Each EX4200 supports optional front-panel uplink modules offering either four GbE ports or two 10GbE ports for high-speed backbone or link-aggregation connections between wiring closets and upstream aggregation switches. Uplink modules can be installed without powering down the switch, enabling users to add high-speed connectivity at any time or migrate from one uplink type to the other to deliver the ultimate in flexible, high-performance interconnectivity.

The EX4200 also features a front-panel LCD that offers a flexible interface for performing device bring-up and configuration rollbacks, reporting switch alarm and LED status, or restoring the switch to its default settings. The LCD also displays a Virtual Chassis member switch's chassis "slot number" and Route Engine status for rapid identification and problem resolution.

Dual rear-panel Virtual Chassis ports enable EX4200 switches to be interconnected over the 128 Gbps virtual backplane. Switches deployed in close proximity, such as wiring closets or top-of-rack data center applications, can be securely connected using a Virtual Chassis cable and cable lock supplied by Juniper Networks.

In addition, a dedicated rear-panel RJ-45 port is available for out-of-band management, while a rear-panel USB port can be used to easily upload Junos OS and configuration files.
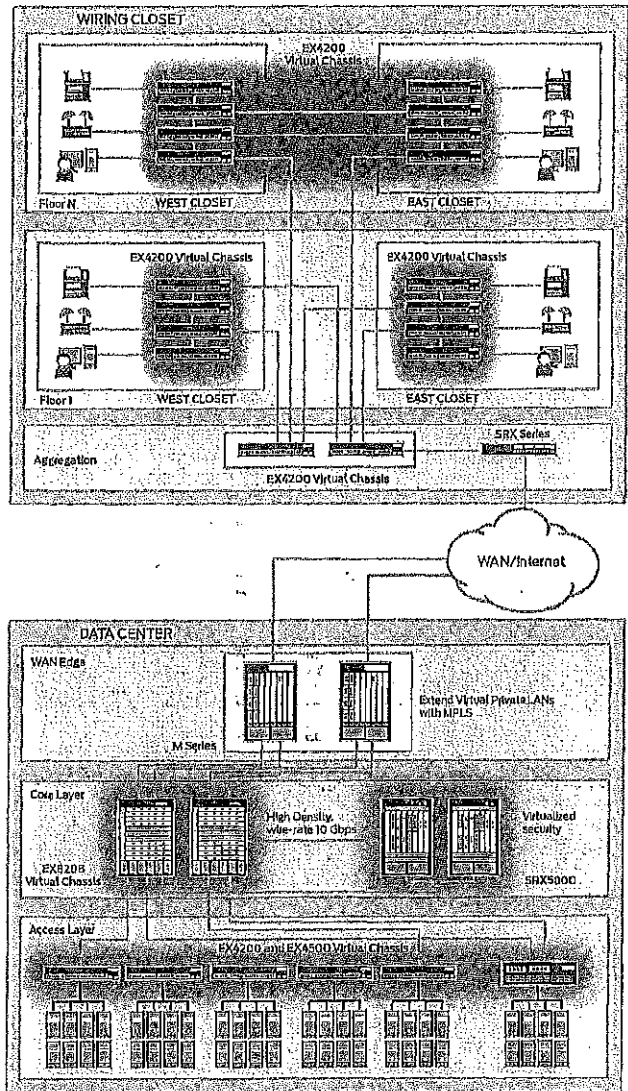
Figure 1: The EX4200 Ethernet switch with Virtual Chassis technology delivers a high-performance, scalable and highly reliable solution for data center, branch and campus environments.

Virtual Chassis Technology

Up to 10 EX4200 switches can be interconnected using Virtual Chassis technology to create a single logical device supporting up to 480 10/100/1000BASE-T ports or 240 100/1000BASE-X ports, plus an additional 40 GbE or 20 10GbE uplink ports. Additionally, EX4200s can be interconnected in a Virtual Chassis configuration that also includes EX4500s, creating a single logical switch that offers a variety of port and density options for mixed server environments.

In a Virtual Chassis configuration, all switches are monitored and managed as a single device, enabling enterprises to separate physical topology from logical groupings of endpoints and allowing more efficient resource utilization. Highly resilient topologies can also be created using the GbE or 10GbE uplink ports to extend the Virtual Chassis configuration across long distances spanning multiple wiring closets, floors or even buildings.
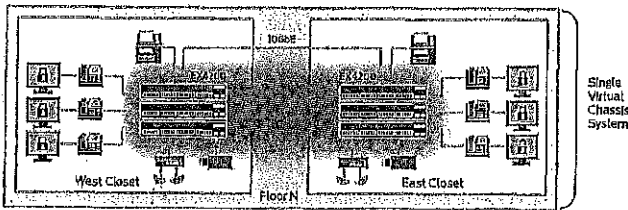
Figure 2: Using Virtual Chassis technology, up to 10 EX4200 switches can be interconnected to create a single logical device spanning multiple wiring closets, floors or even buildings.

Features and Benefits

Chassis-Class Availability

The EX4200 line of Ethernet switches deliver the same HA functionality and support many of the same failover capabilities as other Juniper chassis-based systems.

Each EX4200 switch is capable of functioning as a Route Engine. When two or more EX4200 switches are interconnected, they share a single control plane among all Virtual Chassis member switches. When two EX4200 switches are interconnected, Junos OS automatically initiates an election process to assign a master (active) and backup (hot-standby) Route Engine. An integrated Layer 2 and Layer 3 Graceful Route Engine Switchover (GRES) feature maintains uninterrupted access to applications, services and IP communications in the unlikely event of a primary RE failure.
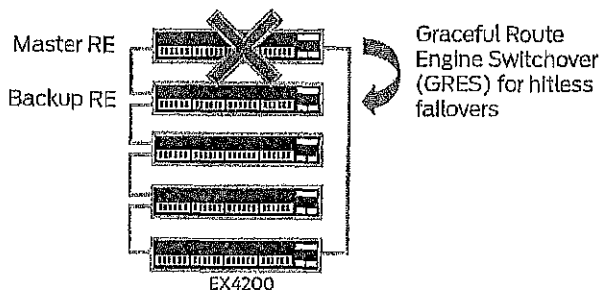
Figure 3: Support for Graceful Route Engine Switchover (GRES) ensures a smooth and seamless transfer of control plane functions following a master Route Engine failure.

When more than two switches are interconnected in a Virtual Chassis configuration, the remaining switch elements act as line cards and are available to assume the backup RE position should the designated master fail. Master, backup and line card priority status can be assigned by the network operations team to dictate the order of ascension; this N+1 RE redundancy, coupled with the GRES, nonstop routing (NSR) and nonstop bridging (NSB) capabilities of the Junos OS, assures a smooth transfer of control plane functions following unexpected failures.

The EX4200 implements the same slot/module/port numbering schema as other Juniper Networks chassis-based products when numbering Virtual Chassis ports, providing true chassis-like operations. By utilizing a consistent operating system and a single configuration file, all switches in a Virtual Chassis configuration are treated as a single device, simplifying overall system maintenance and management.

Individually, the EX4200 offers a number of HA features that are typically associated with modular chassis-based switches. When combined with the field-proven Junos OS and L2/L3 failover capabilities, these features provide the EX4200 with true carrier-class reliability.

- Redundant power supplies: The EX4200 line of Ethernet switches support internal redundant, load-sharing, hot-swappable and field-replaceable AC and DC power supplies to maintain uninterrupted operations. Thanks to their compact footprint, the EX4200 requires significantly less power than chassis-based switches delivering equivalent port densities.

- Hot-swappable fan tray with multiple blowers: The EX4200 includes a hot-swappable, field-replaceable fan tray with three blowers, providing sufficient cooling even if one of the blowers were to fail.

- Redundant Trunk Group (RTG): To avoid the complexities of the Spanning Tree Protocol (STP) without sacrificing network resiliency, the EX4200 employs redundant trunk groups to provide the necessary port redundancy and simplify switch configuration.

- Cross-member link aggregation: Cross-member link aggregation allows redundant link aggregation connections between devices in a single Virtual Chassis configuration, providing an additional level of reliability and availability.

- Carrier-class hardware: The EX4200 leverages a purpose-built packet forwarding engine ASIC, the EX-PFE, which integrates much of the same intellectual property used in Juniper Networks carrier routers. As a result, the EX4200 delivers the same predictable, scalable functionality found in the world's largest networks.

- Non-Stop Bridging (NSB) and Non-Stop Routing (NSR): NSB and NSR on the EX4200 ensure control plane protocols, states and tables are synchronized between Master and Standby REs to prevent protocol flaps or convergence issues following a Routing Engine failover.

- Non-Stop Software Upgrade (NSSU): With NSSU, all members of a Virtual Chassis system can be upgraded with a single command. Mission-critical traffic can be configured as a link aggregate across multiple Virtual Chassis switch members, ensuring minimal disruption during the upgrade process.

- IPv4 and IPv6 routing support: IPv4 and IPv6 Layer 3 routing (OSPF and PIM) is available in the base license, enabling highly resilient networks.
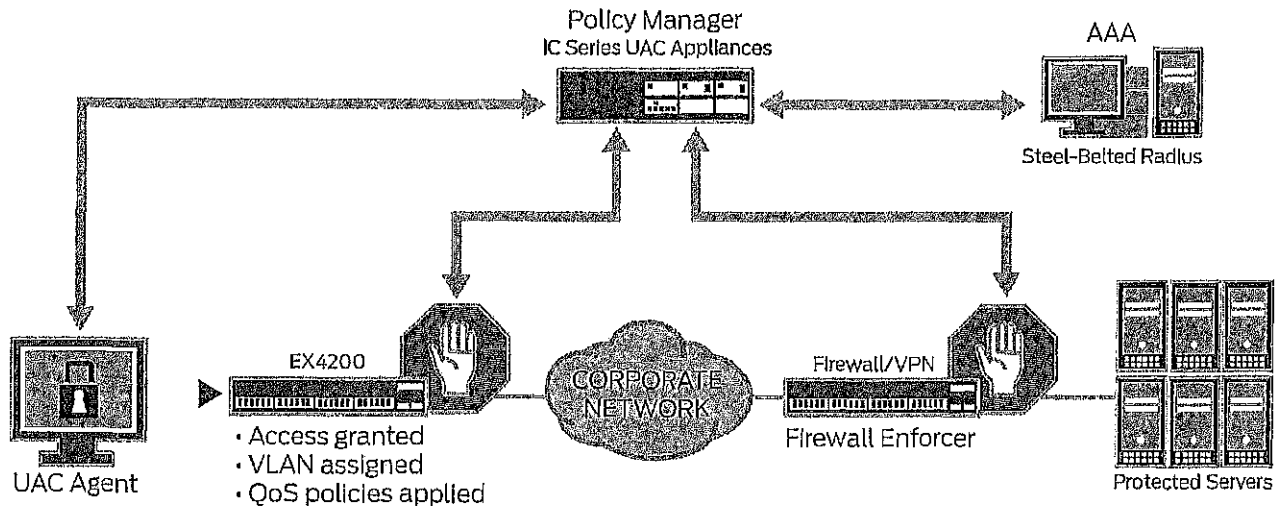
Figure 4: The EX4200 works with the Juniper Networks UAC to enforce access control
down to the individual port level.

Carrier-Class Operating System

The EX4200 runs on Junos OS, the same operating system software used by Juniper Networks routers to power the world's largest and most complex networks.

By utilizing a common operating system, Juniper delivers a consistent implementation and operation of control-plane features across all products. To maintain that consistency, Junos OS adheres to a highly disciplined development process that utilizes a single source code, follows a single quarterly release train, and employs a highly available modular architecture that prevents isolated failures from bringing an entire system down.

These attributes are fundamental to the core value of the software, enabling all products powered by Junos OS to be updated simultaneously with the same software release. All features are fully regression-tested, making each new release a true superset of the previous version; customers can deploy the software with complete confidence that all existing capabilities will be maintained and operate in the same way.

Converged Networks

The EX4200 line of Ethernet switches provide the highest levels of availability for the most demanding converged data, voice and video environments, delivering the most reliable platform for unifying enterprise communications.

By providing Class 3 PoE with 15.4 watts on some or all ports to power voice over IP (VoIP) telephones, closed-circuit security cameras, wireless access points, and other IP-enabled devices, the EX4200 delivers a future-proofed solution for converging disparate networks onto a single IP infrastructure. Furthermore, any PoE port can provide up to 18.6 watts to power wireless access points and other PoE powered devices requiring more than Class 3, 15.4 watts of PoE. EX4200 PoE+ switches also support 802.3at standards-based PoE+ for powering networked devices like multiple radio IEEE 802.11n wireless access points, and video phones that may require more power than available with IEEE 802.3af.

LLDP-MED-based granular PoE management allows the EX4200 to negotiate PoE usage down to a fraction of a watt on powered devices, enabling more efficient PoE utilization across the switch.

To ease deployment, the EX4200 supports the industry-standard Link Layer Discovery Protocol (LLDP) and LLDP-Media Endpoint Discovery (LLDP-MED), which enable the switches to automatically discover Ethernet-enabled devices, determine their power requirements and assign virtual LAN (VLAN) parameters.

In addition, the EX4200 supports rich quality of service (QoS) functionality for prioritizing data, voice and video traffic. The switches support eight QoS queues on every port, enabling them to maintain multi-level, end-to-end traffic prioritizations. The EX4200 also supports a wide range of policy options, including priority and shaped deficit weighted round-robin (SDWRR) queuing.

Security

The EX4200 line of Ethernet switches fully integrate with the Juniper Networks Unified Access Control (UAC), which consolidates all aspects of a user's identity, device and location, enabling administrators to enforce access control and security down to the individual port or user levels.

Policy orchestration, enabled via Juniper UAC Enhancement Protocol (JUEP), enables the EX4200 to construct dynamic ACLs on a port-by-port basis by associating role/resource access policies with authorization table entries. This allows the switch to dynamically create thousands of ACLs or role-based access policies in a scaled environment.

Additionally, a captive portal redirection feature redirects URLs from the EX4200 to the Infranet Controller (IC) for user authentication and authorization, making the IC a "single source of truth" for user and device authentication and for enforcing role-based security policies.

Working as an enforcement point within the UAC, the EX4200 provides both standards-based 802.1X port-level access control as well as Layer 2–4 policy enforcement based on user identity, location and/or device. A user's identity, device type, machine posture check and location can be used to determine whether access should be granted and for how long. If access is granted, the switch assigns the user to a specific VLAN based on authorization levels. The switch can also apply QoS policies or mirror user traffic to a central location for logging, monitoring or threat detection by intrusion prevention systems.

The EX4200 also provides a full complement of port security features including DHCP (Dynamic Host Configuration Protocol) snooping, DAI (dynamic ARP inspection) and MAC limiting (per port and per VLAN) to defend against internal and external spoofing, man-in-the-middle and denial-of-service (DoS) attacks.

MACsec on the EX4200

A MACsec software license enables the EX4200 to provide near line-rate hardware-based encryption of user traffic on a dual-speed 2x10GbE or 4x1GbE SFP+ MACsec uplink module.

Defined by IEEE 802.1AE, MACsec provides secure, encrypted communication at the link layer that is capable of identifying and preventing threats from denial of service (DoS) and intrusion attacks, as well as man-in-the-middle, masquerading, passive wiretapping and playback attacks launched from behind the firewall. When MACsec is deployed on switch ports, all traffic is encrypted on the wire but traffic inside the switch is not. This allows the switch to apply all network policies such as Quality of Service (QoS), deep packet inspection and sFlow to each packet without compromising the security of packets on the wire.

Hop-by-hop encryption enables MACsec to secure communications while maintaining network intelligence. In addition, Ethernet-based WAN networks can use MACsec to provide link security over long-haul connections. MACsec is transparent to Layer 3 and higher-layer protocols and is not limited to IP traffic; it works with any type of traffic carried over Ethernet links.

Simplified Management and Operations

When employing Virtual Chassis technology, the EX4200 dramatically simplifies network management. Up to 10 interconnected EX4200 switches can be managed as a single device. Each Virtual Chassis group utilizes a single Junos OS image file and a single configuration file, reducing the overall number of units to monitor and manage. When Junos OS is upgraded on the master switch in a Virtual Chassis configuration, the software is automatically upgraded on all other member switches at the same time.

The EX4200 also includes port profiles that allow network administrators to automatically configure ports with security, QoS and other parameters based on the type of device connected to the port. Six preconfigured profiles are available, including default, desktop, desktop plus IP phone, wireless access point, routed uplink and Layer 2 uplink. Users can select from the existing profiles or create their own and apply them through the command line interface (CLI), Junos Web Interface or management system.

An EZ touchless provisioning feature allows a DHCP server to push configuration details and software images to multiple switches at bootup.

Four system management options are available for the EX4200. The standard Junos OS CLI management interface offers the same granular capabilities and scripting parameters found in any device powered by Junos OS. The EX4200 also includes the integrated Junos Web management tool, an embedded device manager that allows users to configure, monitor, troubleshoot and perform system maintenance on individual switches via a browser-based graphical interface.

When managing a group of EX4200 switches, the Juniper Networks Network and Security Manager (NSM) provides system-level management across all Juniper switches in the network, from a single console.

Finally, the EX4200 switch system, performance and fault data can be exported to leading third-party management systems such as HP OpenView, IBM Tivoli and Computer Associates Unicenter software, to provide a complete, consolidated view of network operations.
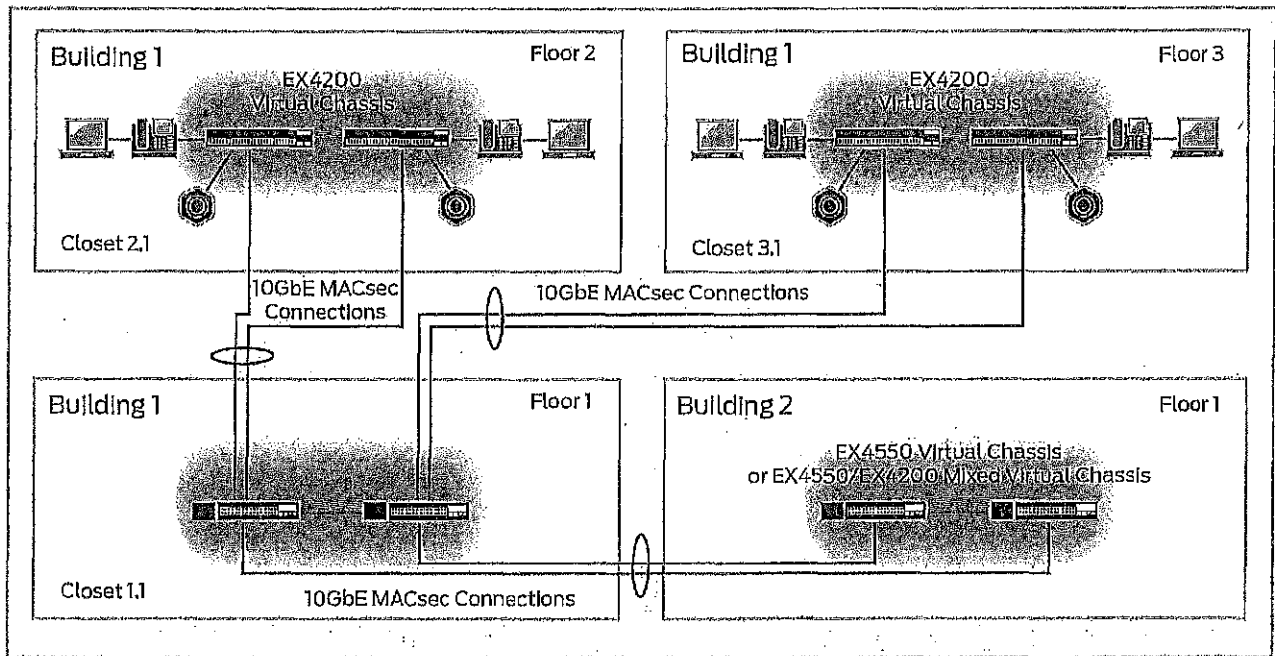
Figure 5: MACsec deployment with EX4200 and EX4550 switches.

Limited Lifetime Warranty

The EX4200 includes a limited lifetime hardware warranty that provides return-to-factory switch replacement for as long as the original purchaser owns the product. The warranty includes lifetime software updates, advanced shipping of spares within one business day, and 24x7 JTAC support for 90 days after the purchase date. Power supplies and fan trays are covered for a period of five years. For complete details please visit www.juniper. net/support/warranty.

Junos SDK

Juniper offers a Junos Software Developer's Kit (SDK) that enables users to create, deploy and validate innovative custom applications that run on top of the Junos operating system on EX Series switches, confirming the company's commitment to software innovation through network programmability. Junos SDK simplifies the development and reuse of components for collaboration while the underlying Junos OS provides security, robustness and resiliency, creating a widespread platform for running network applications.

Product Options

Eight EX4200 switch models are available (see Table 1 below).

Table 1: EX4200 Line of Ethernet Switches

Model	Access Port Configuration	PoE Ports*	Height	POE Budget	Power Supply Rating
EX4200-24T**	24-port 10/100/1000BASE-T	8 PoE	1 RU	130 W	320 W AC
EX4200-24PX	24-port 10/100/1000BASE-T	24 PoE+	1 RU	740 W	930 W AC
EX4200-48T**	48-port 10/100/1000BASE-T	8 PoE	1 RU	130 W	320 W AC
EX4200-48PX	48-port 10/100/1000BASE-T	48 PoE+	1 RU	740 W	930 W AC
EX4200-24F**	24-port 100/1000BASE-X (SFP)	N/A	1 RU	N/A	320 W AC
EX4200-24T-DC**	24-port 10/100/1000BASE-T	0	1 RU	N/A	190 W DC
EX4200-48T-DC**	48-port 10/100/1000BASE-T	0	1 RU	N/A	190 W DC
EX4200-24F-DC**	24-port 100/1000BASE-X (SFP)	N/A	1 RU	N/A	190 W DC

*All PoE ports 802.3af-compliant @ 15.4W. All PoE+ ports on EX4200-24PX/48PX models 802.3at compliant @ 30 W subject to maximum PoE budget.
** NEBS certified

EX4200-24F

EX4200-24P/24PX

EX4200-24T

EX4200-48T

EX4200-48P/48PX
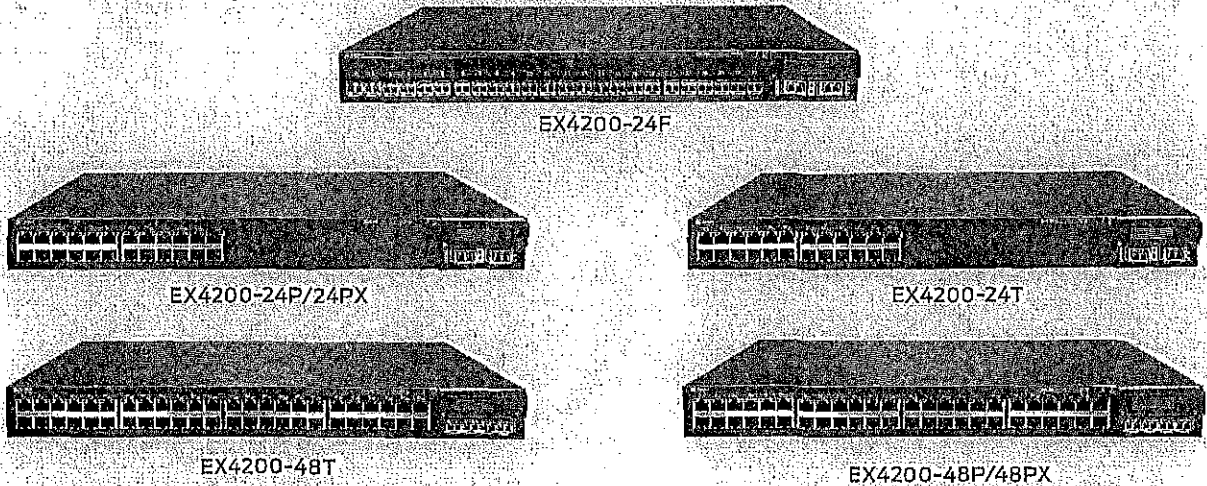
EX4200 Specifications

Physical Specifications

- Backplane: 128 Gbps Virtual Chassis interconnect to combine up to 10 units as a single logical device
- Uplink module options:
  - 4-port GbE module with pluggable SFP optics
  - 2-port 10GbE module with pluggable XFP optics
  - Dual-mode 2-port 10GbE SFP+ / 4-port GbE SFP module with pluggable SFP+/SFP optics
  - Dual-mode 2-port 10GbE SFP+ / 4-port GbE SFP module with pluggable SFP+/SFP optics and MACsec support

Power Options

- Power supplies: Autosensing; 100-120 V / 200-240 V; AC 320 W, 600 W and 930 W dual load-sharing hot-swappable internal redundant power supplies
- Maximum current inrush: 50 amps
- DC power supply: 190 W DC, input voltage range 36 V – 72 V, dual input feed, dual load-sharing hot-swappable internal redundant power supplies
- Minimum number of PSUs required for fully loaded chassis: 1 per switch

Dimensions (W x H x D)

- 17.41 x 1.72 x 16.43 in (44.21 x 4.32 x 41.73 cm)
- [1]Desktop installation width noted above, rack-mount width is 17.5 in (44.5 cm)
- [2]Height: 1 RU
- [3]Depth with 320 W AC PSU and 190 W DC PSU noted above, 18.8 in (47.8 cm) with 600/930 W AC PSU

System Weight

- EX4200-24T with 320 W AC PSU: 16.5 lb (7.5 kg)
- EX4200-24P with 600 W AC PSU: 17.2 lb (7.8 kg)
- EX4200-24PX with 930 W AC PSU: 18 lb (8.16 kg)
- EX4200-48T with 320 W AC PSU: 17.1 lb (7.8 kg)
- EX4200-48P with 930 W AC PSU: 18.2 lb (8.3 kg)
- EX4200-48PX with 930 W AC PSU: 19 lb (8.61 kg)
- EX4200-24F with 320 W AC PSU: 16.1 lb (7.3 kg)
- EX4200-24T-DC with 190 W DC PSU: 16.5 lb (7.5 kg)
- EX4200-48T-DC with 190 W DC PSU: 17.1 lb (7.8 kg)
- EX4200-24F-DC with 190 W DC PSU: 16.1 lb (7.3 kg)

Environmental Ranges

- Operating temperature: 32° to 113° F (0° to 45° C)
- Storage temperature: -40° to 158° F (-40° to 70° C)
- Operating altitude: up to 10,000 ft (3,049 m)
- Non-operating altitude: up to 16,000 ft (4,877 m)
- Relative humidity operating: 10% to 85% (noncondensing)
- Relative humidity non-operating: 0% to 95% (noncondensing)

Cooling

- Field-replaceable fan tray with multiple blowers (3)
- Switch remains operational even if one blower fails
- Airflow: 20.3 cfm

Hardware Specifications

- Switching Engine Model: Store and forward
- DRAM – 1 GB with ECC
- Flash – 1 GB
- CPU – 1 GHz PowerPC CPU
- GbE port density per system:
  - 24P/24T/24F: 28 (24 host ports + four-port GbE uplink module)
  - 48P/48T: 52 (48 host ports + four-port GbE uplink module)
- 10GbE port density per system (all models): 2 (uplink module)

Optics

- 100 Mbps optic/connector type: LC SFP fiber supporting 100BASE-FX SFP (multimode), LX (single-mode) and BX (single-strand)
- 10/100/1000BASE-T connector type: RJ-45
- GbE SFP optic/connector type: RJ-45 or LC SFP fiber supporting 1000BASE-T SFP, SX (multimode), LX (single-mode), LH/ZX (single-mode) and BX (single strand)
- 10GbE XFP optic/connector type: 10GE XFP LC connector, SR (multimode), LR (single-mode), ER (single-mode) or ZR (single-mode)
- 10GbE SFP+ optic/connector type: 10GE SFP+ LC connector, SR (multimode), USR (multimode), LR (single-mode), ER (single-mode), LRM (multimode) and DAC (direct-attach copper)

Physical Layer

- Time Domain Reflectometry (TDR) for detecting cable breaks and shorts: 24P/24T and 48P/48T only
- Auto MDI/MDIX support: 24P/24T and 48P/48T only (all ports)
- Port speed downshift/setting max advertised speed on 10/100/1000BASE-T ports: 24P/24T and 48P/48T only; on all ports
- Digital optical monitoring for optical ports

Packet Switching Capacities (Maximum with 64 Byte Packets)

- 24P/24T: 88 Gbps
- 48P/48T: 136 Gbps
- 24F: 88 Gbps

Aggregate Switch Capacities (Maximum with 64 Byte Packets)

- 24P/24T/24F: 216 Gbps
- 48P/48T: 264 Gbps

Layer 2/Layer 3 Throughput (Mpps) (Maximum with 64 Byte Packets)

- 24P/24T: 65 Mpps (wire speed)
- 48P/48T: 101 Mpps (wire speed)
- 24F: 65 Mpps (wire speed)

Layer 2 Switching

- Max MAC addresses per system: 32,000
- Jumbo frames: 9216 Bytes
- Number of VLANs: 4,096
- VST instances: 253
- Port-based VLAN
- MAC-based VLAN
- GVRP
- Voice VLAN

EX4200 Specifications (continued)

Layer 2 Switching (continued)
- Physical port redundancy: Redundant trunk group (RTG)
- Compatible with PVST+
- RVI (Routed VLAN Interface)
- IEEE 802.1AB: Link Layer Discovery Protocol (LLDP)
- LLDP-MED with VoIP integration
- IEEE 802.1D: Spanning Tree Protocol
- IEEE 802.1p: CoS prioritization
- IEEE 802.1Q: VLAN tagging
- IEEE 802.1s: Multiple Instances of Spanning Tree Protocol (MSTP)
- Number of MST Instances supported: 64
- Number of VSTP Instances supported: 253
- IEEE 802.1w: Rapid reconfiguration of Spanning Tree Protocol
- IEEE 802.1X: Port Access Control
- IEEE 802.1ak: Multiple Registration Protocol
- IEEE 802.3: 10BASE-T
- IEEE 802.3u: 100BASE-T
- IEEE 802.3ab: 1000BASE-T
- IEEE 802.3z: 1000BASE-X
- IEEE 802.3ae: 10 Gigabit Ethernet
- IEEE 802.3af: Power over Ethernet
- IEEE 802.3x: Pause Frames/Flow Control
- IEEE 802.3ad: Link Aggregation Control Protocol
- IEEE 802.3ah: Ethernet in the First Mile
- Metro
  - PVLAN support
  - IEEE 802.1ag connectivity fault management
  - ITU-T G803.2
  - ITU-T Y.1731
  - IEEE 802.1ad Q-in-Q
  - Multicast VLAN routing

Layer 3 Features: IPv4
- Max number of ARP entries: 16,000
- Max number of IPv4 unicast routes in hardware: 16,000
- Max number of IPv4 multicast routes in hardware: 8,000
- Routing protocols: RIPv1/v2, OSPF, BGP, IS-IS
- Static routing
- Routing policy
- Bidirectional Forwarding Detection
- Layer 3 redundancy: VRRP
- IPv4/v6 GRE tunneling

Layer 3 Features: IPv6
- Max number of Neighbor Discovery (ND) entries: 16,000 (shared with IPv4)
- Max number of IPv6 unicast routes in hardware: 4,000
- Max number of IPv6 multicast routes in hardware: 2,000
- Routing protocols: RIPng, OSPFv3, IPv6, ISIS, BGP4+, PIM, MLD, MLDv2
- Static routing

MPLS
- Circuit Cross Connect (CCC)
- Multicast snooping MLD v1/v2
- VRF-Lite

Supported RFCs
- RFC 768 UDP
- RFC 783 TFTP
- RFC 791 IP
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 854 Telnet client and server
- RFC 894 IP over Ethernet
- RFC 903 RARP
- RFC 906 TFTP Bootstrap
- RFC 951, 1542 BootP
- RFC 1027 Proxy ARP
- RFC 1058 RIP v1
- RFC 1112 IGMP v1
- RFC 1122 Host Requirements
- RFC 1195 Use of OSI IS-IS for Routing in TCP/IP and Dual Environments (TCP/IP transport only)
- RFC 1256 IPv4 ICMP Router Discovery (IRDP)
- RFC 1492 TACACS+
- RFC 1519 CIDR
- RFC 1587 OSPF NSSA Option
- RFC 1591 DNS
- RFC 1745 BGP4/IDRP for IP-OSPF interaction
- RFC 1771 Border Gateway Protocol 4
- RFC 1812 Requirements for IP Version 4 Routers
- RFC 1965 Autonomous System Confederations for BGP
- RFC 1981 Path MTU Discovery for IPv6
- RFC 1997 BGP Communities Attribute
- RFC 2030 SNTP, Simple Network Time Protocol
- RFC 2068 HTTP server
- RFC 2080 RIPng for IPv6
- RFC 2131 BOOTP/DHCP relay agent and DHCP server
- RFC 2138 RADIUS Authentication
- RFC 2139 RADIUS Accounting
- RFC 2154 OSPF w/Digital Signatures (Password, MD-5)
- RFC 2236 IGMP v2
- RFC 2267 Network Ingress Filtering
- RFC 2283 Multiprotocol Extensions for BGP-4
- RFC 2328 OSPF v2 (Edge-mode)
- RFC 2338 VRRP
- RFC 2362 PIM-SM (Edge-mode)
- RFC 2370 OSPF Opaque LSA Option
- RFC 2385 TCP MD5 Authentication for BGPv4
- RFC 2439 BGP Route Flap Damping
- RFC 2453 RIP v2
- RFC 2460 Internet Protocol, Version 6 (IPv6) Specification
- RFC 2461 Neighbor Discovery for IP Version 6 (IPv6)
- RFC 2463 Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification
- RFC 2464 Transmission of IPv6 Packets over Ethernet Networks
- RFC 2474 DiffServ Precedence, including 8 queues/port
- RFC 2475 DiffServ Core and Edge Router Functions
- RFC 2526 Reserved IPv6 Subnet Anycast Addresses
- RFC 2545 Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing

EX4200 Specifications (continued)

Supported RFCs (continued)

- RFC 2597 DiffServ Assured Forwarding (AF)
- RFC 2598 DiffServ Expedited Forwarding (EF)
- RFC 2740 OSPF for IPv6
- RFC 2784 Generic Routing Encapsulation (GRE)
- RFC 2796 BGP Route Reflection (supersedes RFC 1966)
- RFC 2796 Route Reflection
- RFC 2918 Route Refresh Capability for BGP-4
- RFC 2925 MIB for Remote Ping, Trace
- RFC 3176 sFlow
- RFC 3376 IGMP v3
- RFC 3392 Capabilities Advertisement with BGP-4
- RFC 3484 Default Address Selection for Internet Protocol Version 6 (IPv6)
- RFC 3513 Internet Protocol Version 6 (IPv6) Addressing Architecture
- RFC 3569 draft-ietf-ssm-arch-06.txt PIM-SSM PIM Source Specific Multicast
- RFC 3579 RADIUS EAP support for 802.1x
- RFC 3618 MSDP
- RFC 3623 OSPF Graceful Restart
- RFC 4213 Basic Transition Mechanisms for IPv6 Hosts and Routers
- RFC 4291 IP Version 6 Addressing Architecture
- RFC 4360 BGP Extended Communities Attribute
- RFC 4443 ICMPv6 for the IPv6 Specification
- RFC 4486 Subcodes for BGP Cease Notification message
- RFC 4541 IBMP and MLD snooping services
- RFC 4861 Neighbor Discovery for IPv6
- RFC 4862 IPv6 Stateless Address Autoconfiguration
- RFC 4915 MT-OSPF
- RFC 5176 Dynamic Authorization Extensions to RADIUS
- RFC 5798 VRRPv3 for IPv6
- Draft-ietf-bfd-base-05.txt Bidirectional Forwarding Detection
- Draft-ietf-idr-restart-10.txt Graceful Restart Mechanism for BGP
- Draft-ietf-isis-restart-02 Restart Signaling for IS-IS
- Draft-ietf-isis-wg-multi-topology-11 Multi Topology (MT) Routing in IS-IS
- Internet draft-ietf-isis-ipv6-06.txt, Routing IPv6 with IS-IS
- ITU-T Y.1731
- LLDP Media Endpoint Discovery (LLDP-MED), ANSI/TIA-1057, draft 08
- PIM-DM Draft IETF PIM Dense Mode draft-ietf-idmr-pim-dm-05.txt, draft-ietf-pim-dm-new-v2-04.txt

Security

- MAC limiting (per port and per VLAN)
- Allowed MAC addresses – configurable per port
- Dynamic ARP Inspection (DAI)
- IP source guard
- Local proxy ARP
- Static ARP support
- DHCP snooping
- Captive Portal
- Persistent MAC address configurations
- DDoS protection (CPU control path flooding protection)

Access Control Lists (ACLs) (Junos OS firewall filters)

- Port-based ACL (PACL) – Ingress and Egress
- VLAN-based ACL (VACL) – Ingress and Egress
- Router-based ACL (RACL) – Ingress and Egress
- ACL entries (ACE) in hardware per system: 7,000
- ACL counter for denied packets
- ACL counter for permitted packets
- Ability to add/remove/change ACL entries in middle of list (ACL editing)
- Layer 2 – L4 ACL
- 802.1X port-based
- 802.1X multiple supplicants
- 802.1X with VLAN assignment
- 802.1X with authentication bypass access (based on host MAC address)
- 802.1X with VoIP VLAN support
- 802.1X dynamic ACL based on RADIUS attributes
- 802.1X Supported EAP types: MD5, TLS, TTLS, PEAP
- TNC certified
- MAC Authentication (RADIUS)
- Control-Plane DoS protection

High Availability

- Non-Stop Routing (NSR) - PIM, OSPF v2 and v3, RIP v2, RIPnG, BGP, BGPv6, ISIS, IGMP v1, v2, v3
- Non-Stop Software Upgrade (NSSU)
- Redundant, hot-swappable power supplies
- Redundant, field-replaceable, hot-swappable fans
- Graceful Route Engine Switchover (GRES) for Layer 2 hitless forwarding and Layer 3 protocols on RE failover
- Graceful protocol restart – OSPF, BGP
- Layer 2 hitless forwarding on RE failover
- Online insertion and removal (OIR) uplink module
- Non-Stop Bridging (NSB) - LACP

Link Aggregation

- 802.3ad (LACP) support
- Number of LAGs supported: 64
- Max number of ports per LAG: 8
- LAG load-sharing algorithm – Bridged or Routed (Unicast or Multicast) Traffic:
- IP: S/D IP
- TCP/UDP: S/D IP, S/D Port
- Non-IP: S/D MAC
- Tagged ports support in LAG

QoS

- Layer 2 QoS
- Layer 3 QoS
- Ingress policing: 1 rate 2 color
- Hardware queues per port: 8
- Scheduling methods (egress): Strict priority (SP), Shaped Deficit Weighted Round-Robin (SDWRR)
- 802.1p, DSCP/IP Precedence trust and marking
- Layer 2-4 classification criteria: Interface, MAC address, Ethertype, 802.1p, VLAN, IP address, DSCP/IP Precedence, TCP/UDP port numbers, etc.
- Congestion avoidance capabilities: Tail Drop

*Unless explicitly specified for any particular MIB table or variables, Junos OS does not support SNMP set operations.

EX4200 Specifications (continued)

Multicast
- IGMP: v1, v2, v3
- IGMP snooping
- PIM-SM, PIM-SSM, PIM-DM

Services and Manageability
- Junos OS CLI
- Web Interface
- Out-of-band management: Serial; 10/100/1000BASE-T Ethernet
- ASCII configuration
- Rescue configuration
- Configuration rollback
- Image rollback
- LCD management
- Element management tools: Network and Security Manager (NSM)
- Remote performance monitoring
- Junos SDK
- Proactive services support via Advanced Insight Solutions (AIS)
- SNMP: v1, v2c, v3
- RMON (RFC 2819) Groups 1, 2, 3, 9
- NTP
- DHCP server
- DHCP client and DHCP proxy
- DHCP relay and helper
- DHCP local server support
- RADIUS
- Service Now for automated fault detection, simplified trouble ticket management and streamlined operations
- TACACS+
- SSHv2
- Secure copy
- HTTP/HTTPs
- DNS resolver
- Syslog logging
- Temperature sensor
- Config-backup via FTP / secure copy
- Interface range specification
- Port profile associations

Supported MIBs*
- RFC 1155 SMI
- RFC 1157 SNMPv1
- RFC 1212, RFC 1213, RFC 1215 MIB-II, Ethernet-Like MIB & TRAPs
- RFC 1493 Bridge MIB
- RFC 1643 Ethernet MIB
- RFC 1657 BGP-4 MIB
- RFC 1724 RIPv2 MIB
- RFC 1850 OSPFv2 MIB
- RFC 1905 RFC 1907 SNMP v2c, SMIv2 and Revised MIB-II
- RFC 2011 SNMPv2 for Internet protocol using SMIv2
- RFC 2012 SNMPv2 for transmission control protocol using SMIv2
- RFC 2013 SNMPv2 for user datagram protocol suing SMIv2
- RFC 2096 IPv4 Forwarding Table MIB
- RFC 2287 System Application Packages MIB
- RFC 2570 – 2575 SNMPv3, user based security, encryption and authentication
- RFC 2576 Coexistence between SNMP Version 1, Version 2 and Version 3
- RFC 2578 SNMP Structure of Management Information MIB

- RFC 2579 SNMP Textual Conventions for SMIv2
- RFC 2665 Ethernet-like Interface MIB
- RFC 2787 VRRP MIB
- RFC 2819 RMON MIB
- RFC 2863 Interface Group MIB
- RFC 2863 Interface MIB
- RFC 2922 LLDP MIB
- RFC 2925 Ping/Traceroute MIB
- RFC 2932 IPv4 Multicast MIB
- RFC 3413 SNMP Application MIB
- RFC 3414 User-based Security model for SNMPv3
- RFC 3415 View-based Access Control Model for SNMP
- RFC 3621 PoE-MIB (PoE switches only)
- RFC 4188 STP & Extensions MIB
- RFC 4363 Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering and VLAN extensions
- RFC 5643 OSPF v3 MIB support
- Draft – blumenthal – aes – usm – 08
- Draft – reeder - snmpv3 – usm – 3desede -00
- Draft-ietf-bfd-mib-02.txt
- Draft-ietf-idmr-igmp-mib-13
- Draft-ietf-idmr-pim-mib-09
- Draft-ietf-idr-bgp4-mibv2-02.txt – Enhanced BGP-4 MIB
- Draft-ietf-isis-wg-mib-07

Troubleshooting
- Debugging: CLI via console, Telnet or SSH
- Diagnostics: Show and debug cmd, statistics
- Traffic mirroring (port)
- Traffic mirroring (VLAN)
- ACL-based mirroring
- Mirroring destination ports per system: 1
- LAG port monitoring
- Multiple destination ports monitored to 1 mirror (N:1)
- Max number of mirroring sessions: 1
- Mirroring to remote destination (over L2): 1 destination VLAN
- IP tools: Extended ping & trace
- Juniper Networks commit and rollback

Warranty
- Limited lifetime switch hardware warranty

Safety and Compliance

Safety Certifications
- UL-UL60950-1(First Edition)
- C-UL to CAN/CSA 22.2 No. 60950-1 (First Edition)
- TUV/GS to EN 60950-1, Amendment A1-A4, A11
- CB-IEC60950-1, all country deviations

Electromagnetic Compatibility Certifications
- FCC 47CFR Part 15 Class A
- EN 55022 Class A
- ICES-003 Class A
- VCCI Class A
- AS/NZS CISPR 22 Class A
- CISPR 22 Class A
- EN 55024
- EN 300386
- CE

NEBS
- GR-63-Core: NEBS, Physical Protection
- GR-1089-Core: EMC and Electrical Safety for Network Telecommunications Equipment
- All models except EX4200-24P and EX4200-48P

Environmental
- Reduction of Hazardous Substances (ROHS) 5

Telco
- CLEI code

Joint Interoperability Test Command (JITC)
- Department of Defense (DoD) Unified Capabilities (UC) Approved Products List (APL)

Common Criteria
- CC-EAL3

Metro Ethernet Forum
- MEF 9

Telecom Quality Management
- TL9000

Trusted Network Connect
- TNC IF-PEP

FIPS
- FIPS 140-2 Level 1

Noise Specifications
Noise measurements based on operational tests taken from bystander position (front) and performed at 23° C in compliance with ISO 7779.

Model	Power Supply Rating	Acoustic Noise in dBA
EX4200-24T	320 W AC	51.6
EX4200-24P	600 W AC	53.2
EX4200-24PX	930 W AC	39.9
EX4200-24F	320 W AC	50.8
EX4200-48T	320 W AC	51.6
EX4200-48P	930 W AC	54.0
EX4200-48PX	930 W AC	45.6
EX4200-24T-DC	190 W DC	48.0
EX4200-48T-DC	190 W DC	48.3
EX4200-24F-DC	190 W DC	46.7

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit www.juniper.net/us/en/products-services.

Ordering Information

Model Number	Description
Switches*	
EX4200-24T	24-port 10/100/1000BASE-T (8 PoE ports) + 320 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24P	24-port 10/100/1000BASE-T (24 PoE ports) + 600 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24PX	24-port 10/100/1000BASE-T (24 PoE+ ports) + 930 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48T	48-port 10/100/1000BASE-T (8 PoE ports) + 320 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48P	48-port 10/100/1000BASE-T (48 PoE ports) + 930 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48PX	48-port 10/100/1000BASE-T (48 PoE+ ports) + 930 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24F	24-port 100/1000BASE-X SFP + 320 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24T-DC	24-port 10/100/1000BASE-T + 190 W DC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48T-DC	48-port 10/100/1000BASE-T + 190 W DC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24F-DC	24-port 100/1000BASE-X SFP + 190 W DC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24T-TAA	Trade Agreement Act-compliant 24-port 10/100/1000BASE-T (8 PoE ports) + 320 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24P-TAA	Trade Agreement Act-compliant 24-port 10/100/1000BASE-T (24 PoE ports) + 600 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48T-TAA	Trade Agreement Act-compliant 48-port 10/100/1000BASE-T (8 PoE ports) + 320 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48P-TAA	Trade Agreement Act-compliant 48-port 10/100/1000BASE-T (48 PoE ports) + 930 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24F-TAA	Trade Agreement Act-compliant 24-port 100BASE-FX/1000BASE-X SFP + 320 W AC PSU. Includes 50cm Virtual Chassis cable.
Accessories	
EX-CBL-VCP-50CM	Virtual Chassis Port cable 0.5 M length
EX-CBL-VCP-1M	Virtual Chassis Port cable 1 M length
EX-CBL-VCP-3M	Virtual Chassis Port cable 3 M length
EX-CBL-VCP-5M	Virtual Chassis Port cable 5 M length
Mounting Options	
EX-4PST-RMK	Adjustable 4-post rack-mount kit for EX4200 and EX3200
EX-RMK	Rack-mount kit for EX2200, EX3200, EX4200 and EX4550
EX-WMK	EX4200 and EX3200 wall-mount kit
EX4200 Feature Licenses**	
EX-24-AFL	Advanced Feature License for EX4200-24T, EX4200-24T-DC, EX4200-24P, EX4200-24F and EX4200-24F-DC switches
EX-48-AFL	Advanced Feature License for EX4200-48T, EX4200-48T-DC and EX4200-48P switches
EX-QFX-MACSEC-ACC†	MACsec Software License for EX4200 access switches

* Each switch comes with one power supply, RJ-45 cable, RJ-45-to-DB-9 serial port adapter, 19" rack-mount kit, and Virtual Chassis cable and connector retainer. Each system also ships with a power cord for the country to which it is being shipped. The EX4200-24F also comes with fiber port dust covers.

** AFL includes licenses for IS-IS, BGP and MPLS.

† Not available in Russia and CIS countries.

Ordering Information (continued)

Model Number	Description
Uplink Modules	
EX-UM-2XFP	2-port 10GbE XFP Uplink Module
EX-UM-4SFP	4-port GbE SFP Uplink Module
EX-UM-2X4SFP	2-port 10GbE SFP+ / 4-port GbE SFP Uplink Module
EX-UM-2X4SFP-M*	2-port 10GbE SFP+ / 4-port GbE SFP Uplink Module with MACsec Support
Power Supplies	
EX-PWR-320-AC	320 W AC Power Supply Unit (PSU)
EX-PWR-600-AC	600 W AC Power Supply Unit (PSU)
EX-PWR3-930-AC	930 W PoE+ AC Power Supply Unit (PSU)
EX-PWR-190-DC	190 W DC Power Supply Unit (PSU)
Pluggable Optics	
EX-SFP-1FE-FX	SFP 100BASE-FX; LC connector; 1310nm; 2km reach on multimode fiber
EX-SFP-1FE-LX	SFP 100BASE-LX; LC connector; 1310nm; 10km reach on single-mode fiber
EX-SFP-1FE-LX40K	SFP 100BASE-LX; LC connector; 1310nm; 40km reach on single-mode fiber
EX-SFP-1FE-LH	SFP 100BASE-LX; LC connector; 1310nm; 80km reach on single-mode fiber
EX-SFP-FE20KT13R15	SFP 100BASE-BX; LC connector; TX 1310nm/RX 1550nm; 20km reach on single-strand, single-mode fiber
EX-SFP-FE20KT15R13	SFP 100BASE-BX; LC connector; TX 1550nm/RX 1310nm; 20km reach on single-strand, single-mode fiber
EX-SFP-1GE-T	SFP 10/100/1000BASE-T copper; RJ-45 connector; 100m reach on UTP
EX-SFP-1GE-SX	SFP 1000BASE-SX; LC connector; 850nm; 550m reach on multimode fiber
EX-SFP-1GE-LX	SFP 1000BASE-LX; LC connector; 1310nm; 10km reach on single-mode fiber
EX-SFP-GE10KT13R14	SFP 1000BASE-BX; Tx 1310nm/Rx 1490nm for 10km transmission on single-strand, single-mode fiber
EX-SFP-GE10KT13R15	SFP 1000BASE-BX; Tx 1310nm/Rx 1550nm for 10km transmission on single-strand, single-mode fiber
EX-SFP-GE10KT14R13	SFP 1000BASE-BX; Tx 1490nm/Rx 1310nm for 10km transmission on single-strand, single-mode fiber
EX-SFP-GE10KT15R13	SFP 1000BASE-BX; Tx 1550nm/Rx 1310nm for 10km transmission on single-strand, single-mode fiber
EX-SFP-1GE-LX40K	SFP 1000BASE-LX; LC connector; 1310nm; 40km reach on single-mode fiber

Model Number	Description
EX-SFP-GE40KT13R15	SFP 1000BASE-BX; Tx 1310nm/Rx 1550nm for 40km transmission on single-strand, single-mode fiber
EX-SFP-GE40KT15R13	SFP 1000BASE-BX; Tx 1550nm/Rx 1310nm for 40km transmission on single-strand, single-mode fiber
EX-SFP-1GE-LH	SFP 1000BASE-LH; LC connector; 1550nm; 70km reach on single-mode fiber
EX-XFP-10GE-SR	XFP 10GBASE-SR; LC connector; 850nm; 300m reach on 50 microns multimode fiber; 33m on 62.5 microns multimode fiber
EX-XFP-10GE-LR	XFP 10GBASE-LR; LC connector; 1310nm; 10km reach on single-mode fiber
EX-XFP-10GE-ER	XFP 10GBASE-ER; LC connector; 1550nm; 40km reach on single-mode fiber
EX-XFP-10GE-ZR	XFP 10GBASE-ZR; LC connector; 1550nm; 80km reach on single-mode fiber
EX-SFP-10GE-SR	SFP+ 10GBASE-SR; LC connector; 850nm; 300m reach on 50 microns multimode fiber; 33m on 62.5 microns multimode fiber
EX-SFP-10GE-LRM	SFP+ 10GBASE-LRM; LC connector; 1310nm; 220m reach on multimode fiber
EX-SFP-10GE-LR	SFP+ 10GBASE-LR; LC connector; 1310nm; 10km reach on single-mode fiber
EX-SFP-10GE-DAC-xM	SFP+ 10 Gigabit Ethernet Direct Attach Copper (twinax copper cable), where "x" denotes 1, 3, 5 or 7 meter lengths
EX-SFP-10GE-ER	SFP+ 10GBASE-ER 10 Gigabit Ethernet Optics, 1550nm for 40km transmission on single-mode fiber
EX-SFP-10GE-USR	SFP+ 10 Gigabit Ethernet Ultra Short Reach Optics, 850 nm for 10m on OM1, 20m on OM2, 100m on OM3 multimode fiber
EX-XFP-10GE80KDWDM	XFP 10GBASE DWDM; LC connector, tunable across C-band 50 GHz channel spacing (compliant with ITU-T G.698.1); 80km reach on single-mode fiber
EX-SFP-GE80KCWxxxx	SFP Gigabit Ethernet CWDM, LC connector; xxxx nm where xxxx represents 1470, 1490, 1510, 1530, 1550, 1570, 1590 or 1610; 80km reach on single-mode fiber

About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.

*Not available in Russia and CIS countries.

Corporate and Sales Headquarters	**APAC and EMEA Headquarters**	To purchase Juniper Networks solutions, please contact your Juniper Networks representative at 1-866-298-6428 or authorized reseller.
Juniper Networks, Inc.	Juniper Networks International B.V.	
1194 North Mathilda Avenue	Boeing Avenue 240	
Sunnyvale, CA 94089 USA	1119 PZ Schiphol-Rijk	
Phone: 888.JUNIPER (888.586.4737)	Amsterdam, The Netherlands	
or 408.745.2000	Phone: 31.0.207.125.700	
Fax: 408.745.2100	Fax: 31.0.207.125.701	
www.juniper.net		

Total Access 5000 Octal OLT
8-port GPON Optical Line Terminal Access Module

Product Features

- Supports Gigabit and Committed Information Rate (CIR) services
- Supports an extensive and growing family of ONTs
- Supports both IPTV and RF overlay video service
- Supports Dynamic Bandwidth Allocation (DBA) enabling committed rate business services
- Supports service-aware provisioning and troubleshooting
- Allows both CO and RT deployments
- Scalable to 64 ONTs per GPON
- Supports native Ethernet transport over GPON

Today, carriers are dealing with increasing competition, operating costs and demand for bandwidth. As a result, many are turning to fiber deployment as a solution. For many carriers, GPON is the means to compete in an environment where high bandwidth is required. GPON provides the flexibility, reliability, and bandwidth to give carriers a competitive advantage in today's Fiber-to-the-Home (FTTH) market.

ADTRAN* provides an ultra-flexible, high-capacity, deep fiber solution allowing over 8,700 subscribers to be served from a single FTTH platform. The Total Access* 5000 is a carrier class Multi-service Access and Aggregation platform (MSAP) that bridges the gap between existing and the nextgeneration networks—like GPON. With a pure Ethernet core, the Total Access 5000 system supports services over copper and fiber, easily scaling to support even the most bandwidth-intensive applications. As a GPON Optical Line Terminal (OLT), the Total Access 5000 provides the bandwidth and Ethernet switching capabilities needed to deliver a highly profitable service offering and meet a variety of legacy and emerging service requirements.

The SFP-based GPON OLT allows operators to increase their serving area by utilizing optical capabilities to reach up to 60 km on a single PON.

The ADTRAN GPON solution utilizes GPON Encapsulation Mode (GEM) to exclusively carry Ethernet traffic. ADTRAN has made a complete commitment to Ethernet in the access network with the Total Access 5000, and the GPON OLT Access Module is furthering this commitment.

With the ADTRAN solution, data traffic is carried natively as Ethernet, which is a very efficient means of transporting high bandwidth data connections.

Video options with the Total Access 5000 GPON OLT include both IPTV and RF video. IPTV functions in the Total Access 5000 and the GPON OLT Access Module provide Internet Group Management Protocol (IGMP) signaling and multicast replication functions. RF video overlay at 54–1,004 MHz is supported on GPON as a third wavelength at 1550 nm using outboard amplifiers and wavelength combiners.

Environmentally hardened, the Total Access 5000 GPON OLT Access Module can be installed in both Central Office (CO) and Remote Terminal (RT) environments. This allows carriers to deploy GPON from whatever infrastructure is available or desired rather than limiting GPON to just CO deployments.

ADTRAN®

Total Access 5000 Octal OLT
8-port GPON Optical Line Terminal Access Module
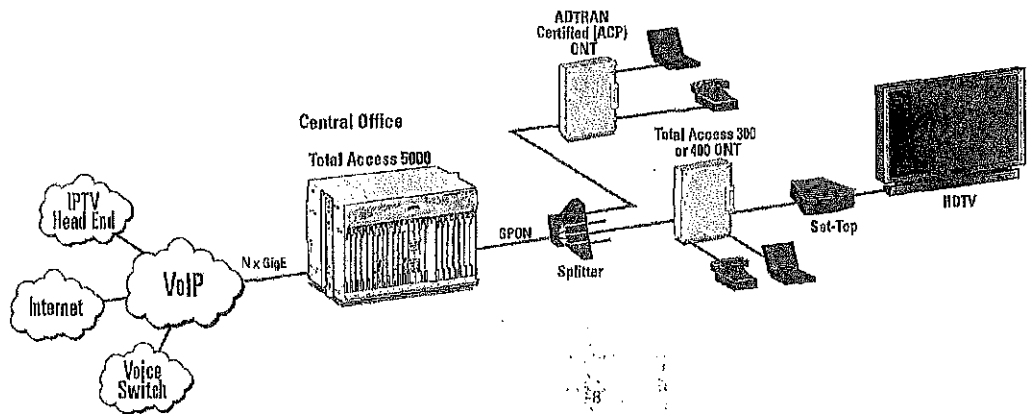
Product Specifications

Mechanical
- Dimensions: 9.25 in. x 0.8 in. x 9.25 in. (235 mm x 20 mm x 235 mm) (H x W x D)

Interfaces
- 8-SFP Single-mode fiber Interfaces on Faceplate

Capacities
- Capable of up to 64 ONTs per GPON Interface
- 21 GPON OLT Access Modules per 23-Inch Total Access 5000 chassis
- 10752 Subscribers per 23-Inch Total Access 5000 Chassis utilizing 1:64 Split

Regulatory Standards
- ETSI EN 300 019
- ETS 300 753
- ETSI EN 300 386
- ETS ES 201 468
- ETSI EN 60950
- ITU-T K.20/21/27/31/35/45

Management
- AOE
- Remote Management Through SNMP and TL1
- Ethernet Interface on SCM for Web, SNMP and Telnet Access
- Craft Interface on SCM
- OMCI to ONTs

Environmental
- Operating Temperature: -40° F to 158° F (-40° C to +65° C)
- Storage Temperature: -40° F to 185° F (-40° C to +85° C)
- Relative Humidity: Up to 95%, at 122° F (50° C), Non-condensing

Optics
- Class B+ Compliant as Specified in G.984.2 Amendment 1
- 20 km Reach with 64x Split
- 30 km Reach with 32x Split
- 37 km Reach with 16x Split

Ordering Information

Equipment	Part No.
Total Access 5000 GPON Octal OLT	1187503F1
SFP GPON 2.5G, 1.25G 30km	1442530G1

Total Access 311
SFU GPON Indoor ONT

Product Features

- Cost-effective delivery of triple-play services
- Supports symmetric gigabit services
- G.984 compliant 2.5 Gbps downstream and 1.25 Gbps upstream
- Small form factor packaging designed for indoor deployments
- Auto-negotiating/sensing 10/100/1000Base-T Ethernet port
- Built-in layer-2 switch
- Native Ethernet transport over the GPON (GEM Based)
- VoIP using SIP or MGCP
- Native POTS RJ-11 port with full suite of voice quality features
- IPTV video support including IGMP snooping feature set
- Traffic management through priority queuing, scheduling, policing and traffic shaping
- VLAN Stacking (Q-in-Q), VLAN tagging/untagging
- QoS with four traffic classes as per IEEE 802.1p
- Full IEEE 802.1Q VLAN ID processing per port
- Full OMCI integration

Carriers today are dealing with increasing competition, operational costs, and demand for bandwidth. To address these concerns, ADTRAN® offers a complete suite of fiber access solutions that are enabling carriers to compete more cost-effectively while expanding broadband services to un-served and underserved areas, like those targeted by national broadband initiatives.

With fiber access solutions like Gigabit Passive Optical Networking (GPON) carriers have a new means to compete in an environment where bandwidth is king. GPON provides the flexibility, reliability, and bandwidth to give carriers a competitive advantage in today's market. As part of the ADTRAN FTTx strategy, ADTRAN offers a range of differentiated GPON Optical Network Terminal (ONT) solutions to address residential, business, and cell site applications.

The Total Access® 300 and 400 ONTs are designed to address the market with industry leading voice, data, and video capabilities. These ONTs include both indoor and outdoor models for residential and business applications. With Total Access GPON ONTs, carriers can benefit from high data rates of fiber optic transmission and the flexibility offered by ADTRAN's portfolio of Ethernet-based systems that can be easily configured for new, customized service offerings.

Total Access 300 and 400 ONTs work seamlessly with ADTRAN's widely deployed Total Access 5000 Series Multiservice Access and Aggregation Platform. Functioning as a highly capable GPON OLT

and flexible carrier class access platform, the Total Access 5000 bridges the gap between existing and next-generation network architectures like GPON. It makes a carrier's access network capable of meeting a variety of legacy and emerging system requirements. Its Ethernet architecture allows carriers to increase bandwidth while offering differentiated capabilities. Coupled with Total Access 300 and 400 ONTs, this provides an end-to-end GPON deployment strategy that is supported by a common management solution.

The Total Access 300 and 400 ONTs leverage the industry-leading converged voice and data functionality widely deployed in ADTRAN integrated access, IP gateway, and Voice over IP (VoIP) platforms, with millions of ports currently deployed. Based on the ADTRAN Operating System (AOS), each ONT provides unmatched SIP and MGCP interoperability with a host of major softswitch vendors, as well as integrated statistics and tools that allow carriers to quickly and easily troubleshoot network configuration issues, as well as monitor performance.

Features of the Total Access 300 and 400 outdoor ONTs include box-in-box, weatherproof and access controlled construction with entry ports for fiber, power, ground, Ethernet, telephone, RFoG (specific models), and HPNA (specific models). Each device supports 2.5 Gbps GPON applications per the ITU-T G.984.2 specification. Data services are delivered over 10/100/1000Base-T Ethernet interfaces.

ADTRAN®

ADTRAN

TL9000

Total Access 311
SFU GPON Indoor ONT

Product Specifications

Ethernet Interfaces
- 10/100/1000Base-T Interface with RJ-45 connectors
- Ethernet port auto negotiation or manual configuration
- MDI/MDIX automatically sense
- Hardware priority queues on the downstream direction in support of CoS

Ethernet Services
- Committed symmetric 1Gbps throughput
- 802.1D bridging
- 802.1x Authentication
- Virtual switch based on 802.1q VLAN
- VLAN tagging/detagging per Ethernet port
- VLAN stacking (Q-in-Q) and VLAN translation
- IP ToS/DSCP to 802.1p mapping
- Class of Service based on VLAN-ID, 802.1p bit, ToS/DSCP
- Marking/remarking of 802.1p
- IGMP v2/v3 snooping
- Broadcast/multicast rate limiting

POTS Interface
- RJ-11 interface
- 3-REN, 55V RMS
- VoIP Voice: Both SIP and MGCP
- TDM Voice: Both GR.303 and TR-08
- Full CLASS feature set
- Both ANSI and ETSI POTS
- T.38 Facsimile
- Configurable dial plan
- Configurable country specific ring-back tones (frequency and cadence)
- DHCP Client or static IP configuration
- Optionally Metallic Loop Testing

Dimensions
- 1.4 in. x 3.9 in. x 5.5 in. (35 mm x 100 mm x 140 mm) (H x W x D)

Power Supply
- +12V (feed via external AC/DC adapter)
- Dying Gasp support
- Power switch
- Power Consumption: Less than 4W

Working Environment
- Temperature: 32° F – 104° F (0° C – 40° C)
- Humidity: 5% – 95% relative humidity

Safety and EMI
- CE certificate
- FCC/UL compliant

Environmental Directive
- RoHS 6 of 6

Installation
- Wall mounting & desktop mounting

GPON Interface
- Compliant with ITU-T G.984 GPON standards
- Compliant with ITU-T G.984.2 Amd1, Class B+
- Support G.984.5 blocking filter
- Multiple T-CONTs per device
- Multiple GEM Ports per device
- DBA reporting by piggyback reports in the DBRu (mode 0 and mode 1)
- 802.1p mapper service profile on U/S
- Mapping of GEM Ports into a T-CONT with priority queues based scheduling
- Support multicast GEM port and incidental broadcast GEM port

LEDs
- Power
- GPON
- Optical
- LAN
- VoIP

OAM
- Standard compliant OMCI (the embedded operations channel) interface as defined by ITU-T G.988
- Provisioning all kinds of services including Ethernet, VoIP etc.
- Alarming and performance monitoring
- Remote software image download over OMCI, as well as activation and rebooting
- Hold two software sets with software image integrity checking and automatic rollback

Ordering Information

Equipment	Part No.
Total Access 311 SFU GPON Indoor ONT	1287565G1

Total Access 300 Series

Total Access 300 Series GPON SFU ONTs
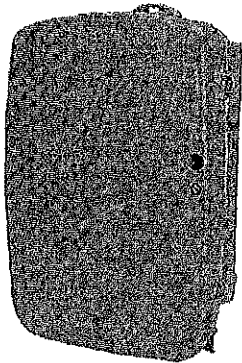
Product Features

- ▣ G.984 compliant
- ▣ Environmentally hardened for indoor and outdoor deployments
- ▣ Full Class B+ Optics, capable of 30 km reach
- ▣ Optional Internal Opti-Fit mounting
- ▣ 10/100/1000 Base-T Ethernet Port(s)
- ▣ RF Over Glass Support (ONT specific)
- ▣ HPNA Support (ONT specific)
- ▣ Fiber cable management
- ▣ Native Ethernet transport over the GPON (GEMBased)
- ▣ VoIP using SIP or MGCP
- ▣ Traditional voice using GR-303, TR-008, or TR-57
- ▣ IPTV video support
- ▣ Traffic management through priority queuing, scheduling, policing and traffic shaping
- ▣ VLAN Stacking (Q-in-Q), VLAN tagging/untagging
- ▣ QoS with four traffic classes as per IEEE 802.1p
- ▣ Full IEEE 802.1Q VLAN ID processing per port
- ▣ Full OMCI integration

Carriers today are dealing with increasing competition, operational costs, and demand for bandwidth. To address these concerns, ADTRAN® offers a complete suite of fiber access solutions that are enabling carriers to compete more cost-effectively while expanding broadband services to un-served and underserved areas, like those targeted by the American Recovery and Reinvestment Act and Connect American Fund.

With fiber access solutions like Gigabit Passive Optical Networking (GPON) carriers have a new means to compete in an environment where bandwidth is king. GPON provides the flexibility, reliability, and bandwidth to give carriers a competitive advantage in today's market. As part of the ADTRAN FTTx strategy, ADTRAN offers a range of differentiated GPON Optical Network Terminal (ONT) solutions to address residential, business, and cell site applications.

The Total Access® 300 Series is a line of GPON ONTs designed to address the residential market with industry-leading voice, data, and video capabilities. This series includes the Total Access 351, 352, 352H, 361, 362, 362H, 362R Outdoor ONTs and Total Access 324 and 334 Indoor ONTs. With Total Access GPON ONTs, carriers can benefit from high data rates of fiber optic transmission and the flexibility offered by ADTRAN's portfolio of Ethernet-based systems that can be easily configured for new, customized service offerings.

Total Access 300 Series ONTs work seamlessly with ADTRAN's widely deployed Total Access 5000 Series Multiservice Access and Aggregation Platform. Functioning as a highly capable GPON OLT and flexible carrier-class access platform, the Total Access 5000 bridges the gap between existing and next-generation network architectures like GPON. It makes a carrier's access network capable of meeting a variety of legacy and emerging system requirements. Its Ethernet architecture allows carriers to increase bandwidth while offering differentiated capabilities. Coupled with Total Access 300 Series ONTs, this provides an end-to-end GPON deployment strategy that is supported by a common management solution.

The Total Access 300 series ONTs leverage the industry-leading converged voice and data functionality widely deployed in ADTRAN

integrated access, IP gateway, and Voice over IP (VoIP) platforms, with millions of ports currently deployed. Based on the ADTRAN Operating System (AOS), each ONT provides unmatched SIP and MGCP interoperability with a host of major softswitch vendors, as well as integrated statistics and tools that allow carriers to quickly and easily troubleshoot network configuration issues, as well as monitor performance.

Features of the Total Access 300 Series Outdoor ONTs include box-in-box, weatherproof and access controlled construction with entry ports for fiber, power, ground, Ethernet, telephone, RPoG (specific models), and HPNA (specific models). Each device supports 2.5 Gbps GPON applications per the ITU-T G.984.2 specification. Data services are delivered over 10/100/1000Base-T Ethernet interfaces. Telephone service is supported by POTS interfaces.

The POTS ports use in-band signaling tones and currents to determine call status. GPON Encapsulation Mode (GEM) is used to carry Ethernet traffic. SIP, MGCP, GR-303, TR-008, and TR-57 are all available to support a wide variety of network models. Voice traffic is carried as VoIP packets to either the Total Access 5000 integrated Voice Gateway Module for access to legacy TDM interfaces, or as SIP or MGCP to an external soft-switch to support voice services. A full suite of Quality of Service (QoS) features are available with support for 802.1Q VLANs and 802.1p for prioritization.

The Total Access 300 Series Outdoor ONTs are powered by an external UPS. The AC-powered UPS provides a nominal 12 VDC to the ONT. Total Access 300 Series Indoor ONTs are optionally powered by an external UPS or directly connected to a 120 VAC power source. Management of the Total Access 300 Series ONTs is performed over OMCI as specified in G.984.4. The Total Access 300 Series Outdoor ONTs are environmentally hardened for installation inside or outside a residence as a particular installation demands. The ONTs are accepted by Rural Utilities Service (RUS) and provide a wealth of benefits for carriers of all types, deploying broadband solutions including voice, data, video, and HDTV. An industry-leading warranty and best-in-class technical support make ADTRAN Total Access GPON solutions the best value on the market today.

Total Access® System

Smart Solutions for a Connected World.

ADTRAN®

ADTRAN

Total Access 300 Series

Total Access 300 Series GPON SFU ONTs

Product Specifications

Voice Support
VoIP Protocol
- SIP
- MGCP

Traditional Voice
- GR-303
- TR-008
- TR-57

LEDs
- Power
- Network Status
- POTS
- ETH

Mechanical Outdoor Units
- 9.75" W x 12" H x 4" D
- 3 lbs., 0.5 oz. weight

Mechanical Indoor Units
- 9.3" W x 2.1" H x 6.7" D
- 1.25 lbs. weight

Compliance
- FCC PART 15 Class B
- UL/CSA 60950
- RoHS 5 of 6 Compliant

Interfaces
Voice Interfaces
- 2 POTS lines
- RJ-11 and screw-down terminals
- 5 REN per line
- 10 REN per unit
- 1,000 ft. drop length

Data Interfaces
- RJ-45 10/100/1000Base-T Ethernet ports
- Auto-sensing
- Auto MDI/MDIX

RF Video Interfaces (ONT specific)
- F-Type connector
- 1610nm RF return path

Video PON Optical Output (ONT specific)
- Output wavelength 1610+ 10nm
- Optical output Power 1 dBm min.

Video—RF Output (ONT specific)
- Impedence: 75-ohms
- Connector Type: F-Type
- Bandwidth: 54MHz to 1GHz
- RF Output Power: 15dBmV/ch to 24.5dBmV/ch
- RF Output Tilt: 2dB to 7dB from 54 to 870MHz
- Channel Loading: up to 82 (Analog), up to 200 (Digital)
- CNR: 46dB min
- CSO: -56dBc max
- CTB: -56dBc max

HPNA Interface (ONT specific)
- HPNA 3.1 compliant

Power Connections Battery Backup
- 12 VDC (nominal) from external battery backup/power supply
- 5-wire battery backup/power supply status signals
- Screw-down terminal

Power Connections Indoor AC
- 12 VDC external power supply connects to 120 VAC source
- External power supply provided with appropriate Indoor ONT models

Management
- Remote management through SNMP and TL1 to Total Access 5000 GPON OLT
- Ethernet interface on Total Access 5000 for IP management access
- Craft interface on Total Access 5000 for VT100 management access
- OMCI between ONT and OLT
- AOS statistics and debug capabilities

Environmental Outdoor
- Operating Temperature: -40°C to +65°C
- Storage Temperature: -40°C to +85°C
- Relative Humidity: Up to 95%, non-condensing

Environmental Indoor
- Operating Temperature: 0°C to 40°C
- Storage Temperature: -20°C to +70°C
- Relative Humidity: Up to 95%, non-condensing

Optics
- Class B+ compliant as specified in G.984.2
- Up to 30km reach with 32x split
- SC/APC for GPON uplink

ADTRAN®

Enclosures for Outdoor Units
- Corning OptiTap™ mounting for pre-terminated fiber cable
- Slack storage tray
- Wind-driven rain protection

Packet-based Voice Resources
- CODECs
  - G.711-64k PCM
  - G.729a-8k CS-ACELP
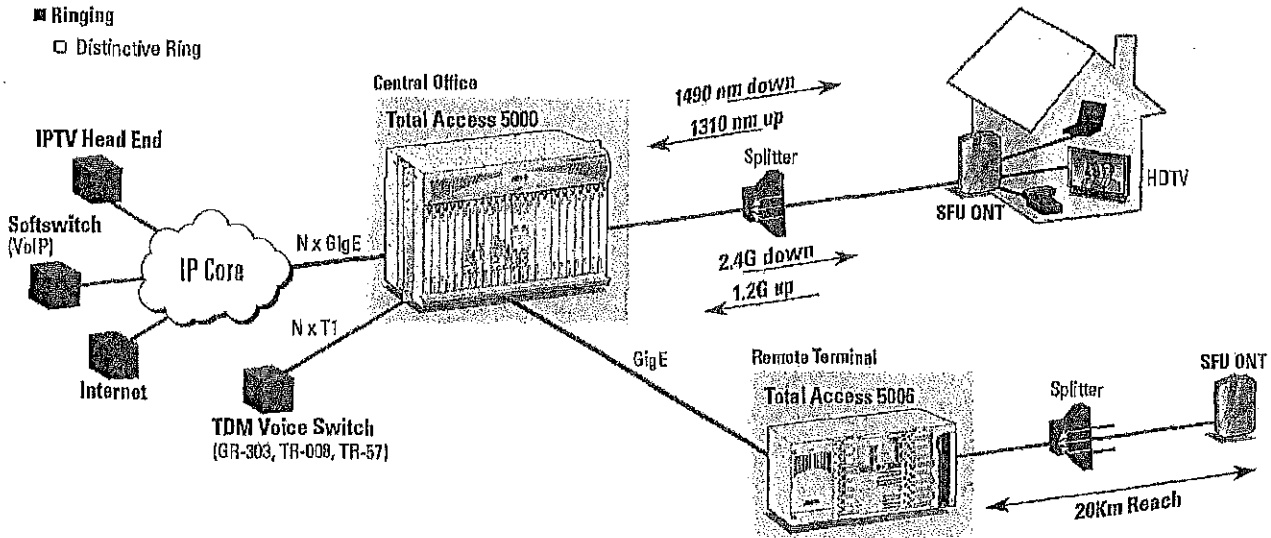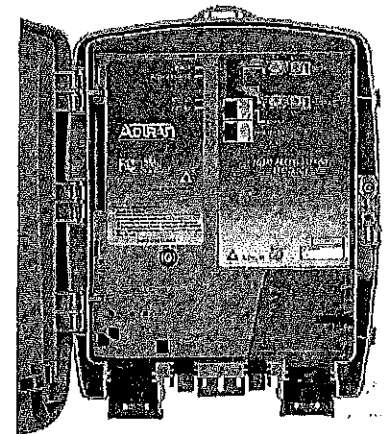- G.168 Echo Cancellation

Media Stream
- RTP/UDP/IP (RFC 3550)
- RTP payload for DTMF digits (RFC 2833)
- SDP (RFC 2327)

Tone Services
- Local DTMF Detection
- Local Tone Generation
  - Dialtone
  - Busy
  - Call Waiting
  - Alternate Call Waiting
  - Receiver Off Hook
- Ringing
  - Distinctive Ring

Calling Feature Support
(varies with feature server/gateway)
- Caller ID
  - Name and Number (MDMF, SDMF)
  - Call Waiting IAD
- Voice Mail
  - Stutter dialtone
  - Visual Message Waiting Indicator (VMWI)
- Call Hold
- Call Forward
  - Busy Line
  - No Answer
- Call Transfer
  - Blind, Attended
- Call Waiting
- Distinctive Ring
- Do Not Disturb
- Three-way Calling
- Call Return
- Speed Dial
- 3-way Conferencing (3WC)

IPTV Head End

Softswitch (VoIP)

IP Core

N x GigE

N x T1

Internet

TDM Voice Switch (GR-303, TR-008, TR-57)

Central Office

Total Access 5000

1490 nm down
1310 nm up

Splitter

SFU ONT

HDTV

2.4G down
1.2G up

GigE

Remote Terminal

Total Access 5006

Splitter

SFU ONT

20Km Reach

Fiber To The Premises (FTTP)

ADTRAN Total Access 5000 Multiservice Access and Aggregation Platform enables multiplay service delivery over an all Ethernet access platform capable of delivering FSAN-compliant GPON. OLT modules can be installed in any access slot in the Total Access 5000 enabling FTTP service delivery. Services are delivered over a single fiber up to 30km from a central office or remote terminal, providing 2.4Gb of bandwidth over the PON. The ADTRAN OLT is completely ITU-T G.984 standards-compliant and offers unprecedented bandwidth per subscriber.

The Total Access Series ONTs work seamlessly with ADTRAN Total Access 5000 Series Multiservice Access and Aggregation Platform. With its Ethernet architecture, the Total Access 5000 allows carriers to increase bandwidth while offering differentiated capabilities. Coupled with Total Access Series ONTs, this provides an end-to-end GPON deployment strategy that is supported by a common management solution.

Total Access 300 Series

Total Access 300 Series GPON SFU ONTs

Splice Tray Enclosure   Corning OptiTap™ Enclosure
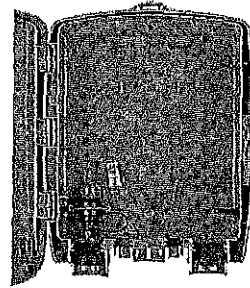
Ordering Information

Indoor ONTs

ONT Model	Part number	Application	POTS	GigE Ports	HPNA	RF Video	Battery Backup/UPS
Total Access 324	1287735G1	SFU/Indoor	2	4	—	—	No, AC only
Total Access 324 w/UPS Connector	1287735G2	SFU/Indoor	2	4	—	—	Yes
Total Access 334	1287736G1	SFU/Indoor	2	4	—	1	No, AC only
Total Access 334 w/UPS Connector	1287736G2	SFU/Indoor	2	4	—	1	Yes

Outdoor ONTs

ONT Model	Housing	Part number	Application	POTS	GigE Ports	HPNA	RF Video
Total Access 351	Splice	4287701G2	SFU	2	1	—	—
Total Access 352	Splice	4287702G2	SFU	2	2	—	—
Total Access 352	Opti-tap	4287702G3	SFU	2	2	—	—
Total Access 352H	Splice	4287702G4	SFU	2	4	1	—
Total Access 362	Splice	4287712G12	SFU	2	2	—	1
Total Access 362	Opti-tap	4287712G13	SFU	2	2	—	1
Total Access 362H	Splice	4287712G14	SFU	2	4	1	1
Total Access 362R	Splice	4287715G12	SFU	2	2	—	1 (w/RF return)

ONT Cartridge Only (No Housing)

Total Access 351, 2ND GEN	1287701G1
Total Access 352, 2ND GEN	1287702G1
Total Access 352H, 2ND GEN	1287702G3
Total Access 362, 2ND GEN	1287712G1
Total Access 362H, 2ND GEN	1287712G3
Total Access 362R 2ND GEN	1287715G1
Total Access 324	1287735G1
Total Access 324 W/UPS CONN	1287735G2
Total Access 334	1287736G1
Total Access 334 W/UPS CONN	1287736G2

SFU Housing and Spare Kits

Total Access 350 ONT NID HSG SPLICE	1187770G1
Total Access 350 ONT NID HSG OPTITAP	1187771G1
Total Access 350 ONT Slack Storage Unit	1187772G1
Total Access 300 SFU Spares Kit, Qty 5	1187700G1
ONT UPS, GPON	1187731G1
GPON UPS Cable, 50 FT	1187732G1

MDU Housing Details

MDU UPS, GPON	1187733G1
GPON MDU SPLITTER	1187734G1
ONT INSTALLATION ACC KIT	1187736G1
Total Access 380 MDU, SPLICE	1187773G1

Total Access 372 GPON SBU Series

GPON SBU Optical Network Terminal (ONT)

Product Features

- 8 POTS and 4 DS1/E1 for PWE Transport through Total Access 5000
- 10/100/1000 Base-T Ethernet Port(s)
- G.984 compliant
- Environmentally hardened for indoor and outdoor deployments
- Full Class B+ Optics, capable of 30 km reach
- Optional Internal Opti-Fit mounting
- RF over Glass (RFoG) Support (ONT specific)
- Fiber cable management
- Native Ethernet transport over the GPON (GEMBased)
- VoIP using SIP or MGCP
- Traditional voice using GR-303, TR-008, or TR-57
- IPTV video support
- Traffic management through priority queuing, scheduling, policing and traffic shaping
- VLAN Stacking (Q-in-Q), VLAN tagging/untagging
- QoS with four traffic classes as per IEEE 802.1p
- Full IEEE 802.1Q VLAN ID processing per port
- Full OMCI integration

Carriers today are dealing with increasing competition, operational costs, and demand for bandwidth. To address these concerns, ADTRAN® offers a complete suite of fiber access solutions that are enabling carriers to compete more cost-effectively while expanding broadband services to unserved and underserved areas, like those targeted by the American Recovery and Reinvestment Act and Connect American Fund.

With fiber access solutions like Gigabit Passive Optical Networking (GPON) carriers have a new means to compete in an environment where bandwidth is king. GPON provides the flexibility, reliability, and bandwidth to give carriers a competitive advantage in today's market. As part of the ADTRAN FTTx strategy, ADTRAN offers a range of differentiated GPON ONT solutions to address residential, business, and cell site applications.

The Total Access® 300 Series Small Business Units (SBU) GPON ONTs are designed to address the small business market with industry-leading voice, data, and video capabilities. This series includes the Total Access 372 and 372R. With Total Access GPON SBU ONTs, carriers can benefit from high data rates of fiber optic transmission, multiple DS1 hand-offs, and the flexibility offered by ADTRAN's portfolio of Ethernet-based systems that can be easily configured for new, customized service offerings.

Total Access 300 Series SBU ONTs work seamlessly with ADTRAN's widely deployed Total Access 5000 Series Multiservice Access and Aggregation Platform. Functioning as a highly capable GPON OLT and flexible carrier-class access platform, the Total Access 5000 bridges the gap between existing and next-generation network architectures like GPON. It makes a carrier's access network capable of meeting a variety of legacy and emerging system requirements. Its Ethernet architecture allows carriers to increase bandwidth while offering differentiated capabilities. Coupled with Total Access 300 Series SBU ONTs, it provides an end-to-end GPON deployment strategy that is supported by a common management solution.

The Total Access 300 Series SBU ONTs leverage the industry-leading converged voice and data functionality widely deployed in ADTRAN integrated access, IP gateway, and Voice over IP

(VoIP) platforms, with millions of ports currently deployed. Based on the ADTRAN Operating System (AOS), each ONT provides unmatched SIP and MGCP interoperability with a host of major soft-switch vendors, as well as integrated statistics and tools that allow carriers to quickly and easily troubleshoot network configuration issues, as well as monitor performance.

Features of the Total Access 300 Series Outdoor ONTs include box-in-box, weatherproof and access controlled construction with entry ports for fiber, power, ground, Ethernet, telephone, RFoG (specific models), and DS1 (pseudowire) business circuits. Each device supports 2.5 Gbps GPON applications per the ITU-T G.984.2 specification. Data services are delivered over 10/100/1000Base-T Ethernet interfaces. Telephone service is supported by POTS interfaces and DS1 delivery is achieved by leveraging SAToP PWE3 services through the Total Access 5000 platform.

The POTS ports use in-band signaling tones and currents to determine call status. GPON Encapsulation Mode (GEM) is used to carry Ethernet traffic. SIP, MGCP, GR-303, TR-008, and TR-57 are all available to support a wide variety of network models. Voice traffic is carried as VoIP packets to either the Total Access 5000 integrated Voice Gateway Module for access to legacy TDM interfaces, or as SIP or MGCP to an external soft-switch to support voice services. A full suite of Quality of Service (QoS) features are available with support for 802.1Q VLANs and 802.1p for prioritization.

The Total Access 300 Series SBU ONTs are powered by an external UPS. The AC-powered UPS provides a nominal 12 VDC to the ONT. Management of the Total Access 300 Series SBU ONTs is performed over OMCI as specified in G.984.4. The Total Access 300 Series SBU ONTs are environmentally hardened for installation inside or outside a residence as such a particular installation demands. The ONTs are accepted by Rural Utilities Service (RUS) and provide a wealth of benefits for carriers of all types, deploying broadband solutions including voice, data, video, and HDTV. An industry-leading warranty and best-in-class technical support make ADTRAN Total Access GPON solutions the best value on the market today.

Total Access® System

Smart Solutions for a Connected World.

ADTRAN®

ADTRAN®

Total Access 372 GPON SBU Series

GPON SBU ONT

Product Specifications

Voice Support
VoIP Protocol
- SIP
- MGCP

Traditional Voice
- GR-303
- TR-008
- TR-57

LEDs
- Power
- Network Status
- Voice
- ETH
- DS1

Mechanical
- 9.75" W x 12" H x 4" D
- 3 lbs., 0.5 oz. weight

Compliance
- FCC PART 15 Class B
- UL/CSA 60950

Interfaces
Voice
- 8 POTS Lines
- RJ-11

Data
- RJ-45 10/100/1000Base-T Ethernet ports
- Auto-sensing
- Auto MDI/MDIX

RF Video Interfaces (ONT specific)
- F-Type connector
- 1610nm RF return path

DS1/E1, PWE
- RJ-45
- SAToP structured in conjunction with PWE Modules in Total Access 5000

Video PON Optical Output (ONT specific)
- Output Wavelength: 1610+ 10nm
- Optical Output Power: 1 dBm min.

Video—RF Output (ONT specific)
- Impedance: 75-ohms
- Connector Type: F-Type
- Bandwidth: 54MHz to 1GHz
- RF Output Power: 15dBmV/ch to 24.5dBmV/ch
- RF Output Tilt: 2dB to 6dB from 54 to 870MHz
- Channel Loading: up to 82 (Analog), up to 200 (Digital)
- CNR: 46dB min
- CSO: -56dBc max
- CTB: -56dBc max

Power Connections Battery Backup
- 12 VDC (nominal) from external battery backup/power supply
- 5-wire battery backup/power supply status signals

Management
- Remote management through SNMP and TL1 to Total Access 5000 GPON OLT
- Ethernet interface on Total Access 5000 for IP management access
- Craft interface on Total Access 5000 for VT100 management access
- OMCI between ONT and OLT
- AOS statistics and debug capabilities

Environmental Outdoor
- Operating Temperature: -40°C to +65°C
- Storage Temperature: -40°C to +85°C
- Relative Humidity: Up to 95%, non-condensing

Optics
- Class B+ compliant as specified in G.984.2
- 30 km reach with 32x split
- SC/APC for GPON uplink

ONT Model	Application	POTS	GigE Ports	T1/E1	RF Video
Total Access 372	SBU	8	2	4	—
Total Access 372R	SBU	8	2	4	1

ADTRAN

TL9000

TL19.1270

Total Access 372 GPON SBU Series

GPON SBU ONT

Ordering Information

ONT Model	Housing	Part number	Application	POTS	GigE Ports	T1/E1	RF Video
Total Access 372	Splice	4287722G2	SBU	8	2	4	—
Total Access 372R	Splice	4287722G4	SBU	8	2	4	1

Equipment	Part #
ONT Cartridge Only (No Housing)	
Total Access 372 SBU, 2ND GEN	1287722G1
Total Access 372R SBU, 2ND GEN	1287722G2
Housings and Spare Kits	
NID, SBU STND	1187774G1
NID, SBU OPTITAP	1187775G1
Total Access 300 SBU Spares Kit, Qty 5	1187700G2
GPON UPS CABLE, 50 FT	1187732G1
SBU UPS, GPON	1187735G1

ADTRAN

Enclosures for Outdoor Units
- Corning OptiTap™ mounting for pre-terminated fiber cable
- Slack storage tray
- Wind-driven rain protection

Packet-based Voice Resources
- CODECs
  - G.711-64k PCM
  - G.729a-8k CS-ACELP
- G.168 Echo Cancellation

Media Stream
- RTP/UDP/IP (RFC 3550)
- RTP payload for DTMF digits (RFC 2833)
- SDP (RFC 2327)

Tone Services
- Local DTMF Detection
- Local Tone Generation
  - Dialtone
  - Busy
  - Call Waiting
  - Alternate Call Waiting
  - Receiver Off Hook
  - Ringing
  - Distinctive Ring

Calling Feature Support
(varies with feature server/gateway)
- Caller ID
  - Name and Number (MDMF, SDMF)
  - Call Waiting IAD
- Voice Mail
  - Stutter dialtone
  - Visual Message Waiting Indicator (VMWI)
- Call Hold
- Call Forward
  - Busy Line
  - No Answer
- Call Transfer
  - Blind, Attended
- Call Waiting
- Distinctive Ring
- Do Not Disturb
- Three-way Calling
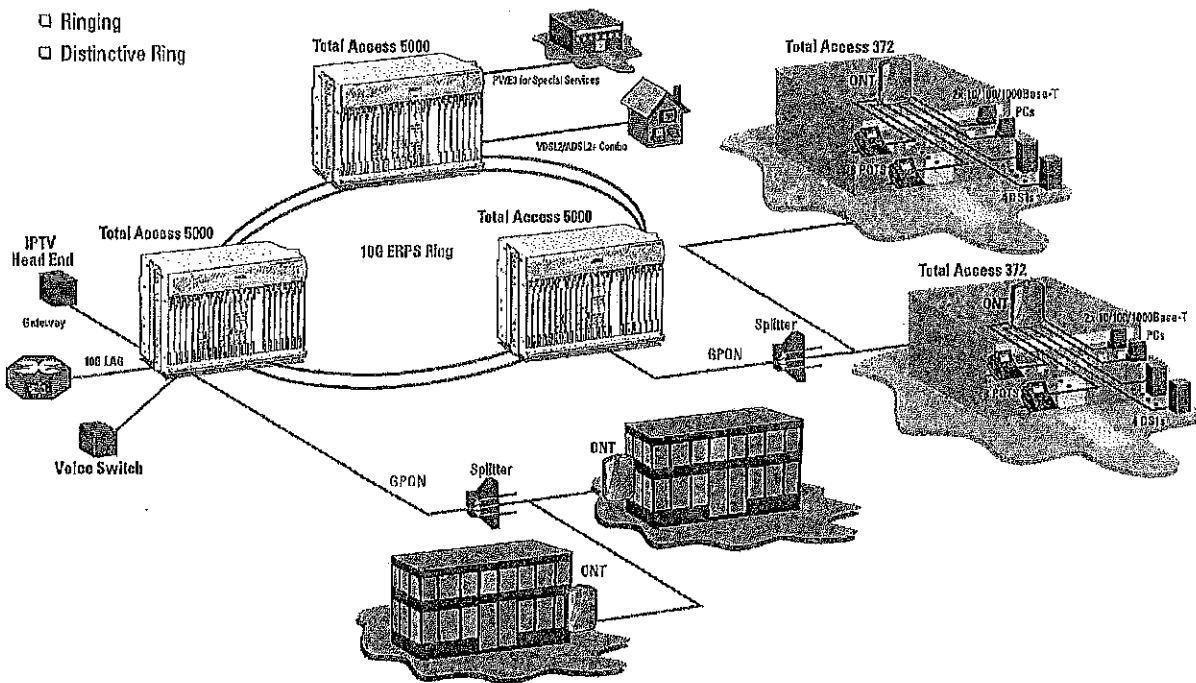- Call Return
- Speed Dial
- 3-way Conferencing (3WC)

Total Access® System

EXHIBIT 4

ORDER NO. 09-322
ENTERED 08/20/09

BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

CP 1452
CP 962

In the Matter of)
)
DOUGLAS SERVICES, INC. dba) ORDER
DOUGLAS FAST NET)
)
Application for a Certificate of Authority to)
Provide Telecommunications Service in Oregon)
and Classification as a Competitive Provider.)

DISPOSITION: DOCKET CP 1452, APPLICATION GRANTED;
DOCKET CP 962, ORDER NO. 01-902,
CERTIFICATE OF AUTHORITY CANCELED.

Note: By issuing this certificate, the Commission makes no endorsement or certification regarding the certificate holder's rates or service.

The Application

On July 8, 2009, Douglas Services, Inc., dba Douglas Fast Net (Applicant) filed an application for certification to provide telecommunications service in Oregon as a competitive provider. Applicant currently has a certificate to provide telecommunications service in Oregon. *See* Order No. 01-902, docket CP 962. This application before us now requests the same authority plus authority to provide additional service. Therefore, this certificate of authority replaces the current one, and the Commission will cancel the authority granted by Order No. 01-902.

Applicant proposes to provide intraexchange (local exchange) switched service (i.e., local dial tone) and non-switched, private line service (dedicated transmission service) within all exchanges of the telecommunications utilities and cooperative corporations listed in Appendices A and B to this order.

Applicant also proposes to provide interexchange switched service (toll) and non-switched, private line service (dedicated transmission service) statewide in Oregon. Applicant indicates that it intends to construct facilities and operate as a facilities-based provider, and operate as a reseller, for intraexchange and interexchange service. Applicant may purchase network elements and finished services for resale only from other certified carriers.

Applicant will not directly provide operator services as defined in OAR 860-032-0001 nor be an 'operator service provider' as defined in ORS 759.690(1)(d).

Applicant indicates an affiliated interest with Eastern Oregon Telecom LLC as simply a 5% voting power. Eastern Oregon Telecom LLC has a Certificate of Authority to do business in Oregon as a competitive provider.

The Commission served notice of the application on July 22, 2009. No protests or requests to be made parties of the proceeding were filed.

Based on the record in this matter, the Commission makes the following:

FINDINGS AND CONCLUSIONS

Applicable Law

Two statutory provisions apply to this application. First, ORS 759.020 governs Applicant's request to provide telecommunications as a competitive provider. Under ORS 759.020(5), the Commission shall classify Applicant as a competitive provider if Applicant demonstrates that its services are subject to competition, or that its customers or those proposed to become customers have reasonably available alternatives. In making this determination, the Commission must consider the extent to which services are available from alternative providers that are functionally equivalent or substitutable at comparable rates, terms and conditions, existing economic or regulatory barriers to entry, and any other factors deemed relevant.

Second, ORS 759.050 governs Applicant's request to provide local exchange telecommunications service. Under ORS 759.050(2)(a), the Commission may authorize Applicant to provide local exchange service within the local exchange of a telecommunications utility if the Commission determines such authorization would be in the public interest. In making this determination, the Commission must consider the extent to which services are available from alternative providers, the effect on rates for local exchange service customers, the effect on competition and availability of innovative telecommunications service in the requested service area, and any other facts the Commission considers relevant. *See* Order No. 96-021.

Designation as a Competitive Provider

Applicant has met the requirements for classification as a competitive telecommunications service provider. Applicant's customers or those proposed to become customers have reasonably available alternatives. The incumbent telecommunications utilities and cooperative corporations listed in the appendices provide the same or similar local exchange services in the local service area requested by Applicant. AT&T, MCI, Sprint Communications, Qwest Corporation, Verizon Northwest Inc., and others provide

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interexchange telecommunications service in the service area requested by Applicant. Subscribers to Applicant's services can buy comparable services at comparable rates from other vendors. Economic and regulatory barriers to entry are relatively low.

Public Interest

With regard to the general factual conclusions relevant to this proceeding, the Commission adopts the Commission's findings in Order No. 93-1850 and Order No. 96-021. Based on a review of those findings, as well as information contained in the application, the Commission concludes that it is in the public interest to grant the application of Douglas Services, Inc., dba Douglas Fast Net to provide local exchange telecommunications service as a competitive telecommunications provider in exchanges of the telecommunications utilities and cooperative corporations listed in the appendices, as described in the application. Further, it is in the public interest to grant statewide interexchange authority as described in the application. This finding will have no bearing on any determination the Commission may be called upon to make under sections 251 or 252 of the Telecommunications Act of 1996 (47 USC § 251, 252) with regard to the telecommunications utilities and cooperative corporations in this docket.

Conditions of the Certificate

In Order No. 96-021, the Commission interpreted ORS 759.050 and established conditions applicable to competitive local exchange carriers. Also, other conditions are listed in administrative rules, including among others OAR 860-032-0007. Applicant, as a competitive provider, shall comply with the conditions adopted in Order No. 96-021, as well as all applicable laws, Commission rules, and orders related to provision of telecommunications service in Oregon.

Per ORS 759.050(2)(c) and Order No. 96-021, Applicant shall comply with the following conditions.

1. Applicant shall terminate all intrastate traffic originating on the networks of other telecommunications providers that have been issued a certificate of authority by the Commission.

2. Applicant shall make quarterly contributions to the Oregon Universal Service fund based on a Commission approved schedule and surcharge percentage assessed on all retail intrastate telecommunications services sold in Oregon, pursuant to ORS 759.425. If Applicant bills the surcharge to its end-users, Applicant shall show the charges as a separate line item on the bill with the words "Oregon Universal Service Surcharge ___%".

3. Applicant shall offer E-911 service. Applicant has primary responsibility to work with the E-911 agencies to ensure that all users

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of its services have access to the emergency system. Applicant will deliver or arrange to have delivered to the correct 911 Controlling Office its customers' Automatic Number Identification telephone numbers so the lead 911 telecommunications service provider can deliver the 911 call to the correct Public Safety Answering Point. Applicant shall work with each 911 district and lead 911 telecommunications service provider to develop procedures to match Applicant's customer addresses to the 911 district's Master Street Address Guide in order to obtain the correct Emergency Service Number (ESN) for each address. Applicant shall provide the lead 911 telecommunications service provider with daily updates of new customers, moves, and changes with the correct ESN for each.

4. For purposes of distinguishing between local and toll calling, Applicant shall adhere to local exchange boundaries and Extended Area Service (EAS) routes established by the Commission. Applicant shall not establish an EAS route from a given local exchange beyond the EAS area for that exchange.

5. When Applicant is assigned one or more NXX codes, Applicant shall limit each of its NXX codes to a single local exchange or rate center, whichever is larger, and shall establish a toll rate center in each exchange or rate center proximate to that established by the telecommunications utility or cooperative corporation serving the exchange or rate center.

6. Applicant shall pay an annual fee to the Commission pursuant to ORS 756.310 and 756.320 and OAR 860-032-0095. The minimum annual fee is $100. Applicant is required to pay the fee for the preceding calendar year by April 1.

7. Pursuant to Oregon Laws 1987, chapter 290, sections 2-8, and to OAR chapter 860, division 033, Applicant shall ensure that the Residential Service Protection Fund surcharge is remitted to the Commission. This surcharge is assessed against each retail subscriber at a rate that is set annually by the Commission.

Competitive Zones

All exchanges of the telecommunications utilities and cooperative corporations listed in the appendices to this order are designated competitive zones pursuant to ORS 759.050(2)(b).

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Pricing Flexibility

Dedicated Transmission Service

The telecommunications utilities listed in Appendix A are granted pricing flexibility for dedicated transmission service in their respective exchanges by this order. *See* Order No. 93-1850, docket UM 381.

Local Exchange Switched Service

Cooperative telephone companies are generally not regulated by the Commission for local exchange services, and therefore already have pricing flexibility. Any telecommunications utility exempt under ORS 759.040, listed in Appendix A, has pricing flexibility for local exchange service. By Order No. 96-021, at page 82, pursuant to ORS 759.050(5), the Commission established procedures whereby telecommunications utilities would be granted pricing flexibility for local exchange switched services. Qwest has complied with those procedural requirements for all of its exchanges. Verizon has complied with those procedural requirements for forty-three of its forty-four exchanges.

ORDER

IT IS ORDERED that:

1. The application of Douglas Services, Inc., dba Douglas Fast Net is granted with conditions described in this order.

2. Applicant is designated as a competitive telecommunications provider for intraexchange service in the local exchanges of the telecommunications utilities and cooperative corporations listed in Appendices A and B. In addition, Applicant is designated as a competitive telecommunications provider for interexchange service statewide in Oregon.

3. The local exchanges of the telecommunications utilities and cooperative corporations listed in Appendices A and B are designated as competitive zones.

4. Any obligation regarding interconnection between Applicant and the telecommunications utilities and cooperative corporations listed in Appendices A and B shall be governed by the provisions of the Telecommunications Act of 1996 (the Act). Commission Order No. 96-021 will govern the interconnection obligations between such parties for the provision of switched local services, unless otherwise addressed by an interconnection agreement or subsequent Commission order.

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5.   No finding contained in this order shall have any bearing on any determination the Commission may be called upon to make under sections 251 or 252 of the Act with regard to the telecommunications utilities and cooperative corporations listed in the appendices to this order.

6.   The telecommunications utilities listed in Appendix A shall receive pricing flexibility on an exchange-by-exchange basis as set forth in this order.

7.   The authority granted to Douglas Services, Inc., by Order No. 01-902, docket CP 962, is canceled.

Made, entered, and effective _____ AUG 2 0 2009 _____ .

Lee Sparling
Director
Utility Program

A party may request rehearing or reconsideration of this order pursuant to ORS 756.561. A request for rehearing or reconsideration must be filed with the Commission within 60 days of the date of service of this order. The request must comply with the requirements in OAR 860-014-0095. A copy of any such request must also be served on each party to the proceeding as provided by OAR 860-013-0070(2). A party may appeal this order by filing a petition for review with the Court of Appeals in compliance with ORS 183.480-183.484.

ORDER NO. 09-322

APPENDIX A

CP 1452

EXCHANGES ENCOMPASSED BY THE APPLICATION:

ALL EXCHANGES OF THE TELECOMMUNICATIONS
UTILITIES LISTED BELOW

Telecommunications Utilities Not Exempt Pursuant to ORS 759.040

CenturyTel of Eastern Oregon, Inc.
CenturyTel of Oregon, Inc.
Qwest Corporation
United Telephone Company of the Northwest/Embarq
Verizon Northwest Inc.

Telecommunications Utilities Exempt Pursuant to ORS 759.040

Asotin Telephone Company
Cascade Utilities, Inc.
Citizens Telecommunications Company of Oregon
Eagle Telephone System, Inc.
Helix Telephone Company
Home Telephone Company
Malheur Home Telephone Company
Midvale Telephone Exchange
Monroe Telephone Company
Mt. Angel Telephone Company
Nehalem Telecommunications, Inc.
North-State Telephone Company
Oregon Telephone Corporation
Oregon-Idaho Utilities, Inc.
People's Telephone Company
Pine Telephone System, Inc.
Roome Telecommunications, Inc.
Trans-Cascades Telephone Company

APPENDIX A
PAGE 1 OF 1

APPENDIX B

CP 1452

EXCHANGES ENCOMPASSED BY THE APPLICATION:

ALL EXCHANGES OF THE COOPERATIVE
CORPORATIONS LISTED BELOW

Beaver Creek Cooperative Telephone Company
Canby Telephone Association
Clear Creek Mutual Telephone
Colton Telephone Company
Gervais Telephone Company
Molalla Telephone Company
Monitor Cooperative Telephone Co.
Pioneer Telephone Cooperative
Scio Mutual Telephone Association
St. Paul Cooperative Telephone Association
Stayton Cooperative Telephone Co.