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August 26, 2016

VIA HAND DELIVERY

Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, D.C. 20554

Re: *Consolidated Applications of XO Holdings and Verizon Communications Inc. for Consent to Transfer Control of Licenses and Authorizations*,
WC Docket No. 16-70

Dear Ms. Dortch:

Verizon Communications Inc. (“Verizon”) has submitted a whitepaper titled “The Effect of Verizon’s XO acquisition on Business Data Services” (the “Whitepaper”) in connection with the above-referenced transaction. The Whitepaper contained information that meets the requirements for treatment as “Highly Confidential,” and accordingly Verizon has filed an unredacted copy pursuant to the procedures established in the Protective Order.¹ Because the Whitepaper also contains information that is “Confidential,” Verizon is filing a CD containing a version of the Whitepaper that excludes material identified as “Highly Confidential” pursuant to the procedures established in the Protective Order. Verizon is also filing a version of the Whitepaper for public inspection that redacts the above materials. To avoid confusion, a copy of this cover letter, bearing the appropriate confidentiality legend, will accompany each submission.

Verizon has made diligent efforts to ensure that none of the material it is submitting is privileged under the attorney-client privilege or attorney work product doctrine. To the extent that any privileged materials may have been inadvertently produced, such production does not constitute a waiver of any applicable privilege. Verizon requests that any privileged materials

¹ *XO Holdings and Verizon Communications Inc., Consolidated Applications for Consent to Transfer Control of Domestic and International Authorizations Pursuant to Section 214 of the Communications Act of 1934, As Amended*, Protective Order, 31 FCC Rcd 5318 (WCB 2016) (“Protective Order”). Consistent with the Protective Order, *id.* at 5320 ¶ 3, Verizon obtained written approval from Commission staff to designate certain material as Highly Confidential.

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inadvertently produced be returned to Verizon as soon as such inadvertent production is discovered by any party, and reserves all rights to seek return of any such documents.

If any questions arise concerning this submission, please contact me.

Very truly yours,

A handwritten signature in black ink that reads "Katharine R. Saunders". The signature is written in a cursive style with a long horizontal flourish at the end.

Katharine R. Saunders

Enclosure

Verizon-XO Transaction

Whitepaper on the effect of Verizon's XO
acquisition on business data services

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August 1, 2017

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EFFECT OF VERIZON’S XO ACQUISITION ON BUSINESS DATA SERVICES

This White Paper addresses the effect of Verizon’s proposed acquisition of XO Communications on the marketplace for Business Data Services. It demonstrates that the transaction will not cause a substantial reduction in competition for these services.

The transaction is pro-competitive. XO primarily provides Business Data Services over fiber. Nearly 85% of XO’s fiber network covers area and locations that Verizon’s does not serve. Verizon will be able to use this complementary fiber presence to offer a broader and more robust set of services, and to compete more effectively against cable providers’ emerging services in Verizon’s own ILEC footprint and with other enterprise providers outside of its footprint. XO’s fiber will also provide Verizon Wireless with much-needed backhaul capacity to meet growing mobile data usage and to support 5G deployment. This will enhance service for mobile customers nationwide.

Following the transaction, there will continue to be extensive competition for Business Data Services where Verizon and XO are both present. Traditional CLECs, pure-play fiber providers, and even cable operators have deployed fiber networks in all of the metropolitan areas where XO provides service. This fiber deployment continues to grow, driven by rising demand for higher-bandwidth services and the deployment of next generation wireless networks.

Cable operators’ Hybrid-Fiber Coax (“HFC”) networks provide significant additional competition, which likewise is growing. Cable HFC networks already offer Business Data Services up to 10 Mbps, but following the rollout of DOCSIS 3.1 – expected to begin over the next 18 months – will have the capability to provide much greater speeds.

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Copper facilities are also used to provide Business Data Services. Most Business Data Services provided over copper are circuit-based services that use the TDM protocol, principally DS-1 and DS-3 services. It is also possible to provide packet-based Business Data Services over copper using the Ethernet protocol. Because they rely on the aging copper plant, however, Ethernet over Copper (“EoC”) and other Business Data Services over copper suffer from technical constraints that limit both their geographic availability and their technical capabilities. At the same time, these services are relatively inexpensive to provide, and therefore can be used by others to provide additional competition where there is demand for these services, to the same extent as XO is able to do so.

The transaction does not eliminate a unique supplier of Business Data Services.

XO is not a unique supplier for any of the Business Data Services it provides. In the areas where XO is present, there are other competitive providers of all the same services that XO offers. Indeed, there are only 691 on-net buildings that XO serves that Verizon also serves. All but one of those buildings is also served by at least one other competitive provider. And 99% of those buildings (684 out of 691) are served either by at least two other competitive providers, or by one provider with a second provider’s fiber within 0.1 mile of the building.

XO provides EoC services from 135 central offices in Verizon’s ILEC footprint. Verizon does not provide EoC services anywhere, but has no plans to discontinue XO’s EoC services following the transaction, either outside or within Verizon’s ILEC footprint. And XO’s EoC service is just one of several competitive Business Data Services offered. EoC competes with

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both other actual and potential EoC providers as well as Ethernet service provided over fiber and coaxial cable.

XO's EoC services will be of even less competitive significance going forward, as businesses and carrier customers consume and transmit growing amounts of data and demand higher bandwidth speeds and other capabilities that EoC cannot support. Indeed, over the past three years, XO has greatly reduced its capital expenditures on EoC services – from a peak of \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] in 2013 to \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] in 2016 – and XO's EoC sales have [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] over the last [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] months due in large part to EoC's limited bandwidth. Nonetheless, to the extent there is continued demand for EoC services, other providers can readily offer them to the same extent as XO. XO has no economic or technical advantages in providing these services, which rely solely on ILEC facilities available on non-discriminatory terms and off-the-shelf electronics.

Verizon plans to upgrade many of its central offices to fiber regardless of the XO transaction. Verizon's pre-merger [BEGIN CONFIDENTIAL] [END CONFIDENTIAL] copper retirement plan will eventually result in the elimination of EoC services in all but a few of the central offices where XO provides them today. These network upgrades will provide customers with better and more reliable service going forward and will significantly reduce Verizon's costs of supporting this aging copper infrastructure. Verizon's

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transition to fiber will occur regardless of this transaction. Nor will this transaction accelerate Verizon’s efforts to replace copper. If anything, Verizon may delay migrating central offices where XO collocates because Verizon will reap the benefit of XO’s EoC revenue and profits.

* * *

For all these reasons, Verizon’s acquisition of XO will not substantially reduce competition for Business Data Services. We encourage the Department to complete its review and terminate the HSR waiting period.

I. Combining Verizon’s and XO’s Complementary Networks and Services Is Procompetitive

“[A] primary benefit of mergers to the economy is their potential to generate significant efficiencies and thus enhance the merged firm’s ability and incentive to compete, which may result in lower prices, improved quality, enhanced service, or new products.”¹ As Verizon and XO explained more fully in their submissions to the FCC, the transaction will create efficiencies that benefit customers of Business Data Services.²

¹ DOJ Horizontal Merger Guidelines § 10.

² See Consolidated Applications to Transfer Control of Domestic and International Section 214 Authorizations, Exhibit 1, at 6-13, *XO Holdings and Verizon Communications, Inc.*, WC No. 16-70 (Mar. 4, 2016), <https://ecfsapi.fcc.gov/file/60001528257.pdf>; Response to Information and Document Request by Verizon Communications Inc., *XO Holdings and Verizon Communications*, WC No. 16-70 (July 7, 2016) (“Verizon Responses to FCC Interrogatories”), https://ecfsapi.fcc.gov/file/107072923912278/Verizon%20Response%20to%20RFI_PUBLIC.pdf; Joint Opposition of Verizon and XO Holdings To Petitions To Deny And Comments at 3-5, *XO Holdings and Verizon Communications, Inc.*, WC No. 16-70 (May 27, 2016), <https://ecfsapi.fcc.gov/file/60002078856.pdf>; Verizon/XO Supplemental Filing at 1-3, *XO Holdings and Verizon Communications*, WC No. 16-70 (Mar. 22, 2016), <https://ecfsapi.fcc.gov/file/60001548086.pdf>.

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Verizon's and XO's network facilities are highly complementary. XO is heavily concentrated in areas where Verizon is not an ILEC. In particular, nearly 85% of XO's 5,000 metro fiber route miles and 4,500 on-net buildings are located outside of Verizon's ILEC footprint. Combining Verizon's and XO complementary fiber assets will benefit business and carrier customers by increasing, expanding, and improving Verizon's nationwide fiber facilities.³ This will allow Verizon to better serve business customers that have multiple locations and prefer to purchase services from a single provider.⁴ At the same time, the transaction will benefit XO's customers by expanding the fiber facilities serving them and by making additional capital available for network expansions, improvements, and maintenance, and also will give its customers access to Verizon's services.⁵

The transaction will also benefit wireless customers. XO's additional fiber assets will provide much-needed backhaul support for Verizon's cell sites.⁶ This is particularly critical given the ever-increasing demand for mobile data usage, and the need for much greater cell densification to support 5G wireless deployment.⁷ XO's fiber assets will allow Verizon quickly

³ See Verizon Responses to FCC Interrogatories at 37-39 ("When a carrier owns fiber instead of leasing it, the carrier gains a greater amount of knowledge and control about how the fiber is managed and maintained. This leads to specific and identifiable customer-facing benefits," such as expediting the ordering process and providing more responsive customer service, maintenance, and surveillance.).

⁴ See *id.* at 28-29, 39-40.

⁵ See *id.* at 39-40, 45.

⁶ See *id.* at 43.

⁷ See Transcript, Verizon Communications Inc. at JPMorgan Global Technology, Media and Telecom Conference (May 19, 2015) (Fran Shammo, EVP, CFO, Verizon) (explaining that Verizon is focused on densifying its wireless network first in the top 50 markets, with particular

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to deploy additional cell sites that are already connected to XO's fiber network without undertaking costly and time-intensive efforts to build out fiber.

Given that XO is concentrated where Verizon is not an ILEC, it is not surprising that Verizon's pre-merger documents indicate Verizon and XO rarely compete head-to-head in the marketplace. **[BEGIN HIGHLY CONFIDENTIAL]**

[END HIGHLY CONFIDENTIAL]⁹

emphasis on the top 10 markets), <http://www.verizon.com/about/investors/jp-morgan-global-technology-media-and-telecom-conference-2015>; Joey Jackson, *Dark Fiber Key to Future of Small Cells*, Backhaul, RCR Wireless News (Dec. 21, 2015) (explaining that Verizon is moving toward use of small cells with fiber backhaul to deliver to its customers on the promise of reliability) (quoting Brian Mecum, VP of Network for the West Area, Verizon), <http://www.rcrwireless.com/20151221/network-infrastructure/dark-fiber-key-to-future-of-small-cells-backhaul-tag20>; Kathleen Grillo, *5G Is the Driving Force at 2016 Mobile World Congress*, Verizon News (Feb. 22, 2016) (discussing Verizon 5G field trials, test results, and efforts to advance 5G technology for "rapid commercialization"), <http://www.verizon.com/about/news/5g-driving-force-2016-mobile-world-congress>; News Release, *Verizon 5G Trials Driving Ecosystem towards Rapid Commercialization* (Feb. 22, 2016) (outlining Verizon actions to accelerate innovation around 5G technology and bring new solutions to market for consumers), <http://www.verizon.com/about/news/verizon-5g-trials-driving-ecosystem-towards-rapid-commercialization>.

⁸ See Verizon's Partial Response to Specification 8 of the Second Request.

⁹ See Verizon's Partial Response to Request 12 (Reports on Competition).

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II. Following the Transaction There Will Continue to Be Extensive Competition for Business Data Services Where Verizon and XO Compete

Business Data Services “refer[] to the dedicated point-to-point transmission of data at certain guaranteed speeds and service levels using high-capacity connections.”¹⁰ These services may be either circuit-based or packet-based. Circuit-based Business Data Services – the most prominent of which are DS-1 and DS-3 services – use the TDM protocol, “which combines multiple individual communications between two locations over a single channel by dividing the channel into distinctly allocable time segments, i.e., capacity is reserved ‘in the form of dedicated time slots.’”¹¹ Packet-based Business Data Services often use the Ethernet protocol, which provides “secure, private Ethernet Virtual Connections across a Metropolitan Area, or even a Wide Area,” to connect points together or to connect to the Internet.¹² Other protocols used to provide packet-based Business Data Services include Multiprotocol Label Switching (MPLS), Frame Relay, Asynchronous Transfer Mode (ATM), Dense Wavelength Division Multiplexing (DWDM), and Synchronous Optical Networking (SONET).¹³

¹⁰ *Business Data Services in an Internet Protocol Environment et al.*, Tariff Investigation Order and Further Notice of Proposed Rulemaking, WC Docket No. 16-143 *et al.*, FCC 16-54, ¶ 12 (rel. May 2, 2016) (“BDS FNPRM”), https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-54A1.pdf.

¹¹ *Id.* ¶ 45 (quoting Memorandum Opinion and Order, *Petition of the Embarq Local Operating Companies for Forbearance Under 47 U.S.C. § 160(c) from Application of Computer Inquiry and Certain Title II Common - Carriage Requirements*, 22 FCC Rcd 19478, ¶ 1 n.5 (2007), *aff’d sub nom. Ad Hoc Telecommunications Users Committee v. FCC*, 572 F.3d 90 (D.D.C. 2009)).

¹² *Id.* ¶ 46 (internal quotation marks omitted).

¹³ *Id.* ¶ 48.

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Ethernet services, like other packet-based Business Data Services, can be provided over many different media, including the fiber-optic networks that both incumbent and competitive local exchange carriers have deployed, the HFC networks that cable operators have deployed, copper facilities, and fixed wireless connections.¹⁴ Each of these media has different characteristics that affect their availability as well as the range of Ethernet-based services they can provide. For example, fiber supports the greatest bandwidth speeds, but is not available at all locations and can be relatively costly to deploy.¹⁵ Copper supports relatively small bandwidth speeds and is widely available, although the copper plant is heavily worn and cannot support Ethernet services in many cases.¹⁶ Cable HFC networks are not available in all locations where demand for Business Data Services is heavily concentrated and currently support Ethernet services only up to 10 Mbps, although future upgrades will permit much higher speeds.¹⁷ Thus, while different media have various characteristics that affect their availability and desirability for each particular application, they all compete with each other to a significant extent.

In the geographic areas where Verizon and XO both provide services, there is extensive competition for all of the Business Data Services that Verizon and XO provide. And this facilities-based competition is continuing to grow, driven by rising demand for higher-bandwidth services and the deployment of next generation wireless networks.¹⁸

¹⁴ *Id.* ¶¶ 59-64, 189.

¹⁵ *Id.* ¶¶ 49, 211.

¹⁶ *Id.* ¶ 49.

¹⁷ *Id.* ¶¶ 64-65, 208.

¹⁸ *See, e.g., id.* ¶¶ 77-88.

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Fiber. Fiber has long been the primary technology used to provide high-bandwidth data services. As the FCC has recognized, fiber “provide[s] the greatest flexibility” because it “has exceptionally high bandwidth – that is, data carrying capacity – that does not vary significantly with the distance between the telephone company’s central office and a customer’s home.”¹⁹ Fiber is used to offer symmetrical data services up to 100 Gbps with high-quality service level agreements guaranteeing near 100 percent uptime.²⁰ According to Vertical Systems Group, the percentage of buildings with more than 20 employees with fiber increased from 10.9% in 2004 to 42.5% in 2014, and there has been considerable additional fiber deployment over the past 18 months as well.²¹ The FCC’s data collection in the Business Data Services proceeding shows that competitive fiber – often from multiple providers – has been deployed widely in the areas where there is concentrated demand for Business Data Services.²² Table 1 below – based on

¹⁹ *Id.* ¶ 49 & n.114 (quoting Jonathan Nuechterlein and Philip Weiser, *Digital Crossroads* 27 (2d ed. 2013)).

²⁰ *See id.* ¶¶ 47, 64

²¹ Vertical Systems Group Press Release, *Business Fiber Penetration hits 42.5% in U.S.* (Mar. 31, 2015), <http://www.verticalsystems.com/vsgpr/business-fiber-penetration-hits-42-5-in-u-s/>; Vertical Systems Group Press Release, *U.S. Business Fiber Gap Narrows in 2013* (Apr. 3, 2014), <http://www.verticalsystems.com/vsgpr/u-s-business-fiber-gap-narrows-in-2013/>.

²² *See* Reply Comments of the National Cable & Telecommunications Association, WC Docket No. 05-25; RM-10593, at 14 (FCC filed Feb. 19, 2016), <https://ecfsapi.fcc.gov/file/60001515259.pdf>; BDS NPRM ¶ 165 (FCC economic analysis concluding CLECs serve almost as many buildings with fiber as ILECs); *id.* at ¶ 211 n.551 (citing XO report that, “in major metropolitan areas where it operates, there often are competitive fiber facilities close (within 0.5 miles) to multiple large [multi-tenant environments] in close proximity”); *id.* ¶ 244 (noting only “limited complaints in the record about higher bandwidth services,” and recognizing “that supply of higher bandwidth services may often be more competitive than supply of lower bandwidth services”).

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publicly available data – demonstrates that a wide range of competitor providers are continuing to invest heavily in expanding their fiber networks.²³

²³ *See also* Verizon Ex Parte, App'x at 14-41, WC No. 05-25 (FCC filed Sept. 24, 2015), <https://ecfsapi.fcc.gov/file/60001325010.pdf> (cataloguing CLEC investments in fiber).

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Table 1		
Select Examples of Increased Fiber Deployment -- 2013 to 2016		
(based on publicly reported data)²⁴		
	<i>Fiber Route Miles²⁵</i>	<i>On-Net Buildings</i>
Time Warner Cable	+3,000 (147,000 to 150,000)	+22,000 (58,000 to 70,000+)
Cox Communications	+5,000 (25,000 to 30,000)	+N/A (N/A to 28,000+)
Spectrum (Charter)	+10,000 (55,000 to 65,000)	+6,500 (5,500+ to 12,000+)
Cablevision Lightpath	+1000 (5,400 to 6,400)	+2,000 (6,000+ to 8,000+)
Comcast	+4,000 (141,000 to 145,000)	Not available
Level 3	+31,000 (27,000 to 58,000)	+29,700 (<13,300 to 43,000)
Windstream	+7,000 (118,000 to 125,000)	Not available
Zayo Group	+1,186 (28,798 to 29,975)	+8,417 (14,196 to 22,613)
Lumos Networks	+1,000 (7,400 to 8,400)	+298 (1,344 to 1,642)
Edison Carrier Solutions	+1,000 (4,000 to 5,000)	+0 (140+ to 140+)
FiberLight	+350,000 (1.3m to 1.65m)	+700 (1,000 to 1,700)
Integra Telecom	+1,000 (3,000 to 4,000)	+1,000 (2,200 to 3,200+)
Lighttower Fiber Networks	+10,000 (20,000+ to 30,000+)	+7,500 (7,500+ to 15,000+)
Unite Private Networks	+2,200 (4,000 to 6,200)	+1,750 (2,000 to 3,750)

Cable HFC. Cable companies have also become “significant suppliers of BDS,” which the FCC has heralded as a “great entry success story.”²⁶ The enterprise-focused units of the

²⁴ Appendix B contains sources for this table. The sources generally are as of 2013 and 2016 where available or the nearest years if that data was unavailable.

²⁵ Fiber route miles are metro fiber route miles except for Windstream, which includes long haul fiber miles, and Fiberlight, which includes fiber strand miles.

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largest cable operators — Charter (formerly Time Warner Cable), Comcast, and Cox — have in just a few years become the fifth, sixth, and seventh largest providers of Ethernet services in the United States, respectively.²⁷ As Verizon internal documents note, “the looming threat [of cable] is no longer looming.”²⁸ The cable threat is here. Until recently, cable companies provided Business Data Services over fiber. But more recently, cable operators have upgraded their widely available HFC networks to offer Business Data Services.²⁹

Comcast, for example, reported in 2012 that “Business Services has become a \$2.4 billion unit” and “is the second-largest contributor to Cable revenue growth at Comcast behind high-speed Internet.”³⁰ And in September 2015, Comcast established a new “Enterprise Services” division to sell broadband, WiFi, Ethernet and other services to Fortune 1000 companies.³¹ In just the first nine months of 2015, Comcast signed up 25 to 30 enterprise

²⁶ See BDS NPRM ¶¶ 59, 236.

²⁷ See, e.g., Vertical Systems Group, *2015 U.S. Carrier Ethernet LEADERBOARD* (Feb. 25, 2016), <http://www.verticalsystems.com/vsglb/2015-u-s-carrier-ethernet-leaderboard/>.

²⁸ See Brendan Gunn, *VPS Ethernet/IP, Center of Excellence (COE) Update/Get Well* at slides 10-12 (describing the competition provided by cable carriers), attached as Exhibit 1. As of the submission of this White Paper, this document had yet to be produced, but Verizon intends to produce it.

²⁹ BDS NPRM ¶¶ 59-60.

³⁰ Comcast, *Business Services Tops \$2.4 Billion in Revenue at Comcast Cable*, <http://corporate.comcast.com/news-information/news-feed/business-services-tops-1-8-billion-at-comcast-cable>.

³¹ Comcast, *Comcast Business Announces New Unit Targeting Fortune 1000 Enterprises* (Sept. 16, 2015), <http://corporate.comcast.com/news-information/news-feed/comcast-business-announces-new-unit-targeting-fortune-1000-enterprises>.

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customers with \$45 million in contracts.³² Other major cable companies report a similar focus and success in providing high-capacity services to business customers.³³

Although cable HFC networks are not always found in downtown metropolitan areas where demand for Business Data Services is most heavily concentrated, they are still extremely widespread. According to the FCC’s National Broadband Map, cable HFC networks are available to approximately 89% of the population.³⁴ Analysts estimate that high-speed cable networks pass more than three quarters of small and medium business customers in the U.S.³⁵

³² CNBC, *Comcast Creates Enterprise Services Unit to Target Big Businesses* (Sept. 16, 2015), <http://www.cnbc.com/2015/09/16/comcast-creates-enterprise-services-unit-to-target-big-businesses.html>.

³³ See Verizon 9/24/2015 Ex Parte, App’x at 1-14, WC No. 05-25 (FCC filed Sept. 24, 2015), <https://ecfsapi.fcc.gov/file/60001325010.pdf> (cataloguing cable providers’ entry into the Business Data Services market); Matt Davis, IDC, *Market Analysis: U.S. SMB Telecom Voice and Data Services 2014-2018 Forecast*, IDC #248399, at 12-13 (May 2014) (“Cable operators have moved from broadband to single line VoIP offerings, but now they are making the move into SIP trunking, unified communications, and additional services like storage and security. . . . Cable operators are seeking new areas for growth and a way to leverage their increasing voice capabilities. The entry of this group will disrupt pricing and create a new focus on the SMB telecom voice and data services marketplace.”).

³⁴ NTIA, *Broadband Statistics Report* at 3 (Mar. 2015), [http://www.broadbandmap.gov/download/Technology by Speed.pdf](http://www.broadbandmap.gov/download/Technology%20by%20Speed.pdf) (national availability of cable broadband download speeds > 1.5 Mbps, as of June 2014); see also NCTA, *Industry Data*, <https://www.ncta.com/industry-data> (cable HFC available to 93% of U.S. households according to “NCTA analysis of SNL Kagan and Census Bureau estimates”).

³⁵ Alan Breznick, Heavy Reading, Presentation to The Future of Cable Business Services 2014 (Dec. 2, 2014) (“Cable industry’s HFC lines already passed more than three quarters of SMBs in U.S.”); see Ex Parte Letter from Patrick S. Brogan, USTelecom, to Marlene H. Dortch, FCC, WC Docket No. 05-25 & RM-10593, Attach., Arthur Menko, *Methodology for Identifying Local Competitive Commercial Infrastructure: Cable Modem High Capacity Services* at 1 (FCC filed Oct. 16, 2015), <https://ecfsapi.fcc.gov/file/60001329660.pdf> (study of Atlanta metro area finding cable broadband services were available to 80% of businesses); Letter from Maggie McCready, Verizon, to Marlene Dortch, FCC, WC Docket No. 05-25 & RM-10593, Attach. A, December 18, 2015 Declaration of Arthur Menko (FCC filed Jan. 14, 2016), <https://ecfsapi.fcc.gov/file/>

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And many, if not all, cable headends have been upgraded to be able to provide Ethernet services.³⁶

Cable HFC networks currently compete for lower bandwidth Business Data Services. Cable HFC networks currently use DOCSIS 3.0, which enables symmetrical service of 2 to 10 Mbps with service level guarantees.³⁷ Both Verizon’s and XO’s documents recognize cable as a significant and growing competitive threat. Verizon estimates that “MSO pricing is **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** % below [Verizon Global Wholesale’s] lowest (TITAN) rates and **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** % below VGW’s average rates.”³⁸ XO’s Director of Product Analytics acknowledged pre-merger that XO is “regularly competing” against cable companies for small- and mid-sized business accounts and has been “los[ing]” customers to those cable companies.³⁹ Likewise, Verizon’s sales team has noted “ **[BEGIN CONFIDENTIAL]**

60001404716.pdf (study of Albany, Boston, Philadelphia, Virginia Beach, and Washington, D.C. metro areas finding cable service was available to more than 75% of businesses).

³⁶ See Time Warner Ex Parte at 1, WC No. 05-25 (FCC filed May 12, 2016), <https://ecfsapi.fcc.gov/file/60001841630.pdf> (“[A]ll of TWC’s headends throughout its entire service footprint were Metro-Ethernet-capable by 2013.”); Motion to Strike at 9-13, CenturyLink, Inc. et al., WC No. 16-143 (FCC filed June 17, 2016), <https://ecfsapi.fcc.gov/file/60002367205.pdf> (“Based on Movants’ experience as in-region competitors to cable BDS and out-of-region purchasers of cable BDS, Movants would expect the new data to show that *all* the major cable operators have a ubiquitous or near-ubiquitous ability to provide Ethernet-based BDS.”).

³⁷ See BDS NPRM ¶¶ 61-64.

³⁸ VZXO-23-00000060 at 2.

³⁹ XO Comments, Anderson Decl. ¶ 33, WC 05-25 (FCC filed Jan. 27, 2016) (“XO Comments”), <https://ecfsapi.fcc.gov/file/60001420028.pdf>.

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[END CONFIDENTIAL] ,”⁴⁰ and Verizon’s carrier management group, responsible for purchasing access services nationwide for Verizon Enterprise (formerly MCI) has worked with cable providers to offer Ethernet services at low price points.⁴¹

Going forward, cable HFC networks will provide even greater speeds, further enhancing their competitive significance. Next generation DOCSIS 3.1 service will allow for asymmetrical speeds up to 10 Gbps downstream and 1 Gbps upstream, with an extension in development that would allow full symmetrical 10 Gbps.⁴² Comcast plans to start offering gigabit speed service using DOCSIS 3.1 by the end of 2016, with other cable operators planning deployment in 2017.⁴³

Copper. Copper facilities have long been used to provide circuit-based DS-1 and DS-3 services, and more recently have been used to provide packet-based Ethernet services. But there are challenges associated with EoC services for the provision of higher bandwidth speeds, flexibility, and security customers are demanding.⁴⁴ Over the last 18 months, each of XO’s EoC

⁴⁰ See VZXO-19-00000368.

⁴¹ See VZXO-18-00000967; see also VZXO-23-00000060 (describing the looming threat of HFC).

⁴² See BDS FNPRM ¶ 65; *Nokia Bell Labs Boasts 10Gbit/s Symmetrical Using DOCSIS 3.1*, LightReading (May 16, 2016), <http://www.lightreading.com/cable/docsis/nokia-bell-labs-boasts-10gbit-s-symmetrical-using-docsis-31/d/d-id/723413> (reporting that Nokia demonstrated a prototype technology that “can easily integrate into the CableLabs new Full Duplex DOCSIS® 3.1 concept”).

⁴³ See BDS FNPRM ¶ 65.

⁴⁴ See DOJ Horizontal Merger Guidelines § 5.2 (“[R]ecent or ongoing changes in market conditions may indicate that the current market share of a particular firm either understates or

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sales has been at [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] Mbps or below, and [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] % have been at [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] Mbps or below. Demand for Business Data Services at these low speeds (50 Mbps and below) is projected to continue to drop sharply (approximately 20% per year from 2014 to 2019), while demand for higher speeds is expected to grow significantly (29.1% growth rates for 1 to 100 Gbps from 2014 to 2019).⁴⁵ By 2019, only 3% of the Business Data Services market is projected to receive speeds less than 50 Mbps.⁴⁶ There are also low entry barriers to providing EoC services. Thus, while EoC services are of declining significance as demand for more robust Ethernet services grow, to the extent there is continued demand for EoC services competitive providers can readily offer them just as well as XO.

Due to the inherent limitations of providing digital services over copper loops, EoC services cannot be used to provide high-bandwidth services, and in some areas cannot be provided at all. As the FCC has explained, “using copper for the last-mile connection will greatly limit the capacity of the BDS service offering absent the deployment of additional lines to that location” because “[t]he bandwidth of copper wires is much more limited [than fiber]

overstates the firm’s future competitive significance. . . . For example, if a new technology that is important to long-term competitive viability is available to other firms in the market, but is not available to a particular firm, the Agencies may conclude that that firm’s historical market share overstates its future competitive significance.”).

⁴⁵ See Infonetics Research, *Ethernet and IP MPLS VPN Services Annual Worldwide and Regional Market Size and Forecasts: 2015*, at 13 (Sept. 15, 2015) (“Infonetics 2015 Forecasts”).

⁴⁶ See *id.*

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and varies inversely and dramatically with length.’”⁴⁷ Thus, while some CLECs offer EoC speeds as high as 220 Mbps to some customers (likely under ideal conditions),⁴⁸ speeds higher than 20 Mbps are “impossible in most locations due to the length of the copper loop and other factors.”⁴⁹ And “there are many locations where copper loops suitable for EoC cannot be obtained as UNEs.”⁵⁰ Indeed, as XO has had to explain to customers, although **[BEGIN HIGHLY CONFIDENTIAL]**

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EoC services also lack the flexibility of other media. As Windstream informed Verizon, “**[BEGIN HIGHLY CONFIDENTIAL]**

⁴⁷ BDS NPRM ¶ 49 & n.113 (quoting *Digital Crossroads* 27).

⁴⁸ Sean Buckley, *TelePacific introduces 220 Mbps EoC service*, FierceTelecom (Feb. 28, 2013) <http://www.fiercetelecom.com/story/telepacific-introduces-220-mbps-eoc-service/2013-02-28>.

⁴⁹ BDS NPRM ¶ 50 n.116 (quoting Level 3 Comments, McReynolds Declaration (App’x A) ¶ 13, WC No. 05-25 (Jan. 22, 2016) (“McReynolds Decl.”)); *see* XO Comments at 8-9, WC No. 05-25 (FCC filed Jan. 27, 2016), <https://ecfsapi.fcc.gov/file/60001420015.pdf> (noting speeds depend “upon the number of loops available, the length of the copper loops, and the quality of the copper pairs,” and further noting that “the end user location needs to be less than two miles from the closest Serving Wire Center” and “the copper pairs have to be clean end to end (i.e., no bridge taps)”).

⁵⁰ McReynolds Decl. ¶ 13; *see* XO Comments at 9 (“XO often cannot access sufficient numbers of copper DS0 loops that are short enough and of sufficient quality to provide EoC speeds necessary to meet a customer’s Ethernet requirements.”); *see* Declaration of Dan Deem, Douglas Derstine, Mike Kozlowski, Arthur Nichols, Joe Scattareggia, and Drew Smith, at ¶ 61, attached as Attach. A to Comments of Windstream Services LLC, WC Docket Nos. 05-25 (FCC filed Jan. 28, 2016), <https://ecfsapi.fcc.gov/file/60001416064.pdf> (explaining that Windstream typically offers Ethernet at Copper at speeds of 20 Mbps or lower).

⁵¹ *See* XOC-00116183, at 183-184 (email from D. Dunn dated 10/11/2013).

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CONFIDENTIAL]”⁵² And EoC also suffers from security disadvantages compared to other media. “Intercepting copper cable can be performed by connecting taps to a line to pick up the electronic signals,” but “[p]utting a tap on a fiber-optic internet cable to intercept data transmissions is incredibly difficult.”⁵³ For all of these reasons, EoC services do not comprise a significant portion of the Business Data Services marketplace.⁵⁴

Although EoC suffers from numerous technical challenges for higher speeds, it has the advantage of being relatively inexpensive to deploy.⁵⁵ As Global Capacity has explained, EoC “services are easy to install and manage because the technology uses . . . existing copper loop

⁵² VZXO-17-00001300.

⁵³ Tom Collins, *8 Advantages of Fiber-Optic Internet vs. Copper Cable*, Atlantech Online (Dec. 28, 2015), <https://www.atlantech.net/blog/8-advantages-of-fiber-optic-internet-over-copper-cable>.

⁵⁴ We note that EoC does have redundancy unlike certain other services, such that if some subset of the copper loops fail, the speed of the service will decrease but not necessarily be interrupted. However, that redundancy benefit is outweighed by the fact that EoC relies on aging copper infrastructure that is far more likely to fail than fiber. *See, e.g.*, XOC-00116183 (email chain describing two months of efforts to repair EoC service where there were problems with the copper infrastructure).

⁵⁵ *See* DOJ Horizontal Merger Guidelines § 9 (“A merger is not likely to enhance market power,” where “entry into the market is so easy that the merged firm and its remaining rivals in the market, either unilaterally or collectively, could not profitably raise price or otherwise reduce competition compared to the level that would prevail in the absence of the merger.”); *see also id.* § 5.1 (“Firms that are not current producers in a relevant market, but that would very likely provide rapid supply responses with direct competitive impact in the event of a [significant and non-transitory increase in price], without incurring significant sunk costs, are also considered market participants. These firms are termed ‘rapid entrants.’”).

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infrastructure, an Ethernet bridge, a router, and a standard, familiar 10/100 Ethernet interface.”⁵⁶

To provide EoC services, providers like XO collocate in an ILEC central office, and attach electronics to unbundled loops that terminate in that office. However, carriers do not necessarily need to rent significant amounts of dedicated space in a central office, but can instead use less costly options such as interconnecting to Verizon services or UNEs without physical access to a central office by installing equipment commingled with the ILEC’s own network equipment (virtual collocation), placing equipment in as little as one equipment bay (secured collocation open physical environment), placing equipment in Verizon conditioned space (cageless collocation open environment), or sharing a single collocation node with another CLEC (shared collocation).⁵⁷ These underlying copper facilities are available to all competitive carriers on non-discriminatory terms.⁵⁸ Moreover, the central office and customer premises equipment is available off the shelf from telecommunications equipment manufacturers such as Adtran, Hatteras, and Actelis.⁵⁹ XO’s average cost for such current generation equipment (including

⁵⁶ Global Capacity, *Choosing Ethernet Services*, at 2 (rev. Oct. 12, 2015), https://globalcapacity.com/documents/Global_Capacity_WP_Choosing-Ethernet-Services.pdf.

⁵⁷ All collocations provide a carrier physical space within a central office. Various types of collocations dictate whether the carrier is collocating in a cage or cage-less environment, in an open space, or with a section of the central office used for Verizon’s own network equipment. For example, is a Secure Cage-less Open Physical Environment (SCOPE), carriers install their equipment on racks with a cage. They secure the equipment as they like. Carriers’ employees are given ID badges that grant them access to the CO and their equipment. *See* Verizon East, Types of Collocation Arrangements, <http://www22.verizon.com/wholesale/local/collocation/portal/types-of-collocation-arrangements-east.html>.

⁵⁸ *See* BDS NPRM ¶ 56.

⁵⁹ Global Capacity and XO use Adtran, while Windstream relies on Actelist. *See* XO Ex Parte Presentation at slide 4, GN No. 13-5 (FCC filed June 9, 2015), <https://ecfsapi.fcc.gov/file/60001077430.pdf>; Global Capacity, *Wholesale Ethernet over Copper (EoC)*, at 1 (rev. Jan. 26,

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installation) is approximately \$ [BEGIN HIGHLY CONFIDENTIAL] [END
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EoC connections at 10 Mbps, and that equipment can be scaled to support 640 copper loops that
can provide approximately 100 EoC connections at 10 Mbps. The customer premises equipment
("CPE") costs approximately \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY
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In addition to the competition that already exists for Business Data Services, the FCC's
regulation of this area further reduces any harm that could befall consumers. The FCC currently
imposes price-cap regulations on ILECs' TDM-based DS1 and DS3 services that compete with
EoC.⁶⁰ Although the FCC has granted forbearance from price regulation to ILEC packet-based
Business Data Services, it has recently proposed to revamp this regulatory regime to impose rate
regulation in geographic markets that are not competitive.⁶¹ The FCC's guiding principle for
these rules is that "where competition does not exist," its regulations should "ensure that non-
competitive market conditions do not disadvantage business customers and their ability to

2016), https://globalcapacity.com/documents/Global_Capacity_DS_EoC_012616.pdf ("The
Global Capacity EoC network is built on the Adtran TA5000 platform."); Cindy Whelan,
Current Analysis, *Windstream – Business Services US*, at 6 (Apr. 5, 2016) (reporting that
Windstream delivers Ethernet over Copper over Actelis ML1300 and ML600); *see also* Adtran,
Carrier Ethernet: A New Era in Business Access, [http://portal.adtran.com/pub/Library/Product_
Brochures/Default/CN034_Carrier%20Ethernet%20BR.pdf](http://portal.adtran.com/pub/Library/Product_Brochures/Default/CN034_Carrier%20Ethernet%20BR.pdf); Actelis, *Profitably Get High Speed,
Reliable CE 2.0 Services Out to Small and Medium Business Using EFM over Copper*,
<http://actelis.com/wp-content/uploads/2015/09/SMB-services-application-note-v5.pdf>.

⁶⁰ Certain ILECs have been granted forbearance from these regulations for some of their
services, and, until 2012, were able to receive relief from the price caps by showing potential
competition in a geographic area. *See* BDS FNPRM ¶¶ 16-18, 24-25.

⁶¹ *See id.* ¶ 11.

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compete and innovate in downstream markets.”⁶² As the Supreme Court has explained, where, as here, there exists “a regulatory structure designed to deter and remedy anticompetitive harm,” “the additional benefit to competition provided by antitrust enforcement will tend to be small.”⁶³ Moreover, Verizon has supported these efforts at regulatory reform and believes that, properly calibrated, they can benefit consumers. Together with INCOMPAS, a trade association made up of various CLECs, wireless companies, and others, Verizon has proposed a framework for regulation of packet-based business data services.

III. The Transaction Does Not Eliminate a Unique Supplier of Business Data Services

The transaction will not substantially reduce competition for Business Data Services where Verizon and XO both provide services because there is a wide range of actual and potential competitors for these services today. In addition, the transaction will not remove XO as a unique supplier of Business Data Services in any area.

XO primarily provides Business Data Services over fiber. Approximately **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** % of XO’s revenues for Business Data Services are generated from services that XO provides over its own fiber facilities or over fiber it leases from a third-party, or a combination of both. As discussed in Section I, XO’s fiber facilities complement Verizon’s network, with more than 85% of XO’s metro route miles and on-net buildings located outside of Verizon’s ILEC footprint. Where there is overlap, however, other competitive fiber is also available. Within Verizon’s ILEC footprint,

⁶² *See id.* ¶ 5.

⁶³ *Verizon Communications Inc. v. Law Offices of Curtis V. Trinko, LLP*, 540 U.S. 398 (2004).

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XO has 691 on-net buildings. All but one of those buildings is also on-net for at least one other provider, and 99% of those buildings (684 out of 691) are either on-net for at least two additional providers, or are on-net for one additional provider with a second provider's fiber within 0.1 mile of the building.⁶⁴ In addition, six of the remaining seven buildings may be served by Windstream or cable providers based on the service areas described on their web sites.

XO also provides Ethernet services over copper. EoC services account for approximately **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** % of XO's revenues for Business Data Services. But due to the limitations of EoC and waning customer demand for the service, XO has sharply curtailed its investment in EoC over the past three years. As the figure below demonstrates, XO's annual capital expenditures on EoC have declined from a peak of \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** million in 2013 to just \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** million in the first half of 2016 **[BEGIN HIGHLY CONFIDENTIAL]**

⁶⁴ See 2016-06-16 Verizon-XO Transaction – UPDATED On-Net Building Analysis – CONFIDENTIAL.

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[END HIGHLY CONFIDENTIAL] Over the last 18 months, XO’s EoC service has continued to wane, with installations of EoC services declining from approximately **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** per month in early 2015 to fewer than **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** per month in mid 2016. **[BEGIN HIGHLY CONFIDENTIAL]**

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The transaction will not affect XO’s EoC services in any geographic area and thus will not reduce competition resulting from those services.⁶⁵ Verizon has no plans to discontinue XO’s EoC service. And within Verizon’s ILEC footprint, Verizon does not provide EoC service and pre-merger had no plans to do so. Prior to and completely unrelated to the transaction, Verizon studied the feasibility of offering Ethernet services over its copper plant, but ultimately

⁶⁵ See DOJ Merger Guidelines § 2.1.4 (noting that it is relevant whether merging firms are “substantial head-to-head competitors”).

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concluded the service did not make business sense for Verizon given its focus on enterprise customers and other services, particularly its fiber-based service.⁶⁶

In any event, there is extensive competition for Business Data Services where XO provides EoC services. First, as set forth above, competitive fiber now reaches many buildings and is continuing to expand. This expansion is likely to continue because 1 to 100 Gbps Business Data Services are expected to be the largest growth area in the coming years, and fiber is currently best situated to provide that service.⁶⁷

Second, cable HFC competes with XO's EoC services. Although cable HFC currently supports Business Data Services up to 10 Mbps, the vast majority of the EoC services that XO provides are at or below this threshold. Approximately **[BEGIN HIGHLY CONFIDENTIAL]**

[END HIGHLY CONFIDENTIAL] % of XO's EoC sales (by unit) are provided at 10 Mbps or below. Ethernet over HFC is also more cost effective than EoC. For example, Comcast's 10 Mbps Ethernet over HFC costs as little as \$200 per month,⁶⁸ compared to approximately \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY**

⁶⁶ Verizon's analysis concluded that customer demand did not support the requisite investment in network technologies needed to offer Ethernet services over its copper plant, which Verizon's documents refer to as Ethernet over TDM or EoTDM.

⁶⁷ See Infonetics 2015 Forecasts at 13.

⁶⁸ See BDS NPRM ¶ 64 n.159.

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CONFIDENTIAL] per month for XO’s 10 Mbps EoC.⁶⁹ And fiber, where available, can be even cheaper than EoC.⁷⁰

Third, XO is not the only competitive provider that provides or is readily capable of providing EoC services, and XO has no unique advantages in providing these services. EoC primarily relies on leased ILEC facilities (collocation and unbundled network elements, or “UNEs”) that are available on non-discriminatory terms. The rates for UNEs are set by state commission following federal guidelines, while collocation rates are tariffed.⁷¹ Thus, any cost advantages of XO’s service are not only artificial, but also easily replicable by other competitive providers who have access to the same ILEC facilities at the same regulated rates. Indeed, the FCC has explained that this practice of purchasing an ILEC’s facilities at wholesale and selling them at retail is of little relevance in competition analysis because, while the practice “can be a cost effective means for a competitive LEC to expand its reach,” it “cannot place competitive

⁶⁹ XO Ex Parte Presentation at slide 4, GN No. 13-5 (June 9, 2015), <https://ecfsapi.fcc.gov/file/60001077430.pdf>.

⁷⁰ See VZXO-18-00015112 (showing XO charges between \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** to \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** per month for 10 Mbps fiber service and \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** to \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** per month for 10 Mbps EoC service).

⁷¹ See BDS NPRM ¶ 56 (“UNE rates, as determined by the state public utility commissions, are based on forward-looking costs and not on the incumbent LECs’ historic costs.”); 47 C.F.R. § 51.501 *et seq.* (setting forth the UNE pricing rules); *id.* §§ 51.321, 51.323 (setting forth collocation rules); Verizon FCC Tariff 1, § 19 (interstate collocation tariff).

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pressure on supply of the underlying facility.”⁷² Moreover, XO has no technical advantages in supplying EoC services, but rather uses off-the-shelf electronics.⁷³

Other competitors in Verizon’s region already offer EoC services according to these companies’ public statements and marketing, including:

- **Global Capacity/MegaPath** markets itself as “a nationwide leader in EoC,” offering EoC service at 2.2 million business addresses.⁷⁴ Its Ethernet offerings are available in 2,007 central offices in all 50 major metropolitan areas, with 230,000 new commercial addresses across 58 metro markets in 28 states added in 2015 alone.⁷⁵
- **Broadview Networks** offers EoC service throughout much of the Northeast and Mid-Atlantic – regions that coincide with Verizon’s ILEC footprint. As of 2013, it offered EoC from 100 Local Serving Offices (over 38% of all LSOs where Broadview is collocated) and provided EoC service to nearly 10,000 customers.⁷⁶

⁷² BDS NPRM ¶ 230.

⁷³ In addition to EoC equipment, customer premise equipment, collocation, and UNEs, a CLEC that seeks to offer EoC services also needs transport from the ILEC’s central office to the CLEC’s own central office. In many central offices, there are CLECs already using their own fiber to provide competitive transport, which can also be made available to other CLECs. CLECs can connect their fiber to the central office through a competitive alternate transport terminal (CATT). There is at least one CLEC using CATT collocation in at least 162 of the 297 Verizon central offices where XO is collocating. Verizon provides CATT collocation, like types of collocation, under tariff.

⁷⁴ Global Capacity, *Wholesale Ethernet over Copper (EoC)*, at 1 (rev. Jan. 26, 2016), https://globalcapacity.com/documents/Global_Capacity_DS_EoC_012616.pdf; Global Capacity Press Release, *Global Capacity Increases Availability of Ethernet Services Across Nationwide Footprint* (Jan. 27, 2016), http://globalcapacity.com/pr-files/PR_Global_Capacity_Ethernet_expansion_012716_Publish_FINAL.pdf.

⁷⁵ Global Capacity Press Release, *Global Capacity Increases Availability of Ethernet Services Across Nationwide Footprint; Choosing Ethernet Services*, at 1, 5 (Oct. 12, 2015), https://globalcapacity.com/documents/Global_Capacity_WP_Choosing-Ethernet-Services.pdf.

⁷⁶ Declaration of Rebecca Sommi ¶¶ 3-4, *attached to* Comments of XO Communications, LLC and Broadview Networks, Inc., *AT&T Petition To Launch a Proceeding Concerning the TDM-to-IP Transition*, GN Docket No. 12-353 (FCC filed Mar. 5, 2013), <https://ecfsapi.fcc.gov/file/7022127914.pdf>.

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- **Earthlink** identifies EoC as one of its “Core Product[s].”⁷⁷
- **Windstream** offers EoC in both its ILEC territory and where it acts as a CLEC.⁷⁸ As of 2013, it provided Ethernet over Copper service from 435 LSOs nationwide.⁷⁹

Although Verizon has no way to determine where competitors are offering EoC services (or even all of its competitors that offer EoC services), it can determine where they have obtained collocation, which indicates the areas where CLECs may be offering EoC. XO has obtained collocation in 297 Verizon central offices and is providing EoC services in 135 of those. As shown in Table 2, of the 297 central offices where XO has obtained collocation, there is at least one other competitive provider in all but one, two or more competitors in 93% of those central offices, and three or more competitors in 82% of those central office.

Table 2				
Percentage of 297 Verizon Central Offices with XO Collocation in which Other Competitors also have Obtained Collocation				
<i>No. of other Providers</i>	<i>1 or more</i>	<i>2 or more</i>	<i>3 or more</i>	<i>4 or more</i>
	99.7%	93%	82%	65%

Moreover, as shown in Table 2, in the 135 Verizon central offices in which XO collocates and offers EoC service, at least one (and often several) of the aforementioned known and current competitive providers of EoC service also collocates in that central office (either

⁷⁷ See Comments of EarthLink, Integra, and tw telecom at 4-5, *Petitions for Rulemaking and Clarification Regarding the Commission’s Rules Applicable to Retirement of Copper Loops and Copper Subloops*, RM-11358 & GN Docket No. 12-353 (FCC filed Mar. 5, 2013), <https://ecfsapi.fcc.gov/file/7022127905.pdf>.

⁷⁸ *Windstream Sees EoC as a Time-To-Market Play*, FierceTelecom (Feb. 7, 2012), <http://www.fiercetelecom.com/special-reports/stepping-eoc-plate-incumbent-telcos-take-swing/windstream-sees-eoc-time-market-play>.

⁷⁹ *Chart: Ethernet Over Copper Providers*, FierceTelecom (Mar. 11, 2013), <http://www.fiercetelecom.com/special-reports/chart-ethernet-over-copper-providers>.

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Global Capacity/MegaPath, Broadview Networks, Earthlink, and Windstream). Thus, in the locations where XO offers EoC, there are likely already competitive EoC offerings, or, at the very least, known providers of EoC could easily begin to offer that service.

Table 3				
Percentage of 135 Verizon Central Offices with XO EoC Service in which Other Competitors also have Obtained Collocation				
<i>No. of other Providers</i>	<i>1 or more</i>	<i>2 or more</i>	<i>3 or more</i>	<i>4 or more</i>
	99%	88%	50%	7%

A number of the competitors that provide EoC services in Verizon’s ILEC region have obtained collocation in an even greater number of central offices than XO, demonstrating their ability to match or exceed XO’s EoC offering. As shown in Table 4 below, Global Capacity/MegaPath, Earthlink, AT&T, and Windstream each collocate in more Verizon central offices than XO, thus giving them broader bases from which to offer EoC services. And Broadview Networks collocates in nearly as many Verizon central offices as XO. **[BEGIN CONFIDENTIAL]**

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[END CONFIDENTIAL] Verizon also provides more copper loop UNEs to [BEGIN
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For a CLEC already collocated in a wire center, the cost of installing the necessary equipment to provide EoC service is low, and there are very modest economies of scale, so that any of the CLECs already collocated in these central offices could profitably enter at very small

⁸⁰ See Verizon's Response to Specific 3 of Second Request. In terms of total monthly revenue, Verizon receives [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] from XO, [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] from Windstream, [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] from Earthlink, and [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] from Broadview Networks. See Verizon's Supplemental Response to Specification 3a of Second Request at Tab 2015 Booked Rev by Month & Acct.

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scale to satisfy very modest levels of demand, even if they were not currently providing EoC services in these central offices.

Appendix A to this whitepaper analyzes the profitability of offering EoC service for a CLEC that is already collocated in a central office but does not currently offer EoC out of that central office. Based on information provided by XO, we estimate the investment cost, the monthly recurring revenue, the monthly recurring cost, and, ultimately, the payback period for the investment for the CLEC to provide EoC service out of a central office for different levels of demand.⁸¹ The payback period is calculated as a function of the number of 10 Mbps circuits that the CLEC is able to sell.

The smallest capacity EoC equipment available is capable of providing approximately 20 EoC circuits per month. Assuming that this equipment is utilized at **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** % capacity (14 circuits), the payback period is **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** months. But even if the CLEC is able to sell only **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** EoC circuits per month, the payback period is still less than **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]**. Higher levels of demand generate additional economies of scale up until about **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** EoC circuits per month, at which point the payback period is **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** months. These

⁸¹ The analysis assumes that the CLEC provides 10 Mbps EoC service, which is the most common service capacity for EoC services sold by XO.

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results suggest that, even in cases where XO is currently the only CLEC in a central office providing EoC service, there is always at least one additional CLEC and typically at least 2 or 3 additional CLECs already collocated in that central office (and that provide EoC service elsewhere) that could profitably enter and begin providing EoC service even for very modest levels of demand.⁸²

IV. Verizon Plans To Upgrade Many Of Its Central Offices To Fiber Regardless Of The XO Transaction

The already-slight competitive pressure provided by XO's EoC service will necessarily dwindle even further in the future. Separate and apart from the XO transaction, Verizon has long planned to invest approximately \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] to migrate [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] of its [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] central offices to fiber.⁸³ This plan will eventually eliminate EoC services in all but a few of the central offices where XO provides them today. XO has thus described EoC has [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL]⁸⁴

⁸² See *supra* Table 3.

⁸³ The [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] planned transformations include eight central offices in Alexandria and Baltimore where Verizon may consider fiber deployment in the future. In the event Verizon does not deploy fiber in those locations, it would not transform those central offices under its current plan. See Verizon's Response to Specification 17 of the Second Request.

⁸⁴ See XOC-00116183 at 184 (email from D. Dunn dated 10/11/2013).

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This pre-merger plan began in 2014 and is currently being targeted for completion in

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[END HIGHLY CONFIDENTIAL] Throughout this process, Verizon strives to provide like-for-like services to customers when feasible. After transformation, however, copper-based products, including EoC, will no longer be available in these areas.⁸⁶

Verizon has invested in upgrading its infrastructure because its existing copper infrastructure cannot meet growing bandwidth demands and is fragile and costly to maintain.⁸⁷ Verizon's ongoing network upgrade is overwhelmingly pro-competitive because it replaces Verizon's legacy copper infrastructure with far more efficient and superior fiber technology that can meet future data demands and will drastically reduce costs. Primarily due to these cost savings, Verizon projects \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** in additional EBITDA over the course of the project.⁸⁸

⁸⁵ See Verizon's Response to Specification 17 of the Second Request (GENBAND Verizon Network Transformation Final 160502.pdf at slide 4) (showing number of transformations in progress).

⁸⁶ The FCC has established rules governing the retirement of copper infrastructure relied upon by competitive carriers. See Report and Order, Order on Reconsideration, and Further Notice of Proposed Rulemaking, *Technology Transitions; Policies and Rules Governing Retirement of Copper Loops by ILECs*, 30 FCC Rcd 9372 (2015).

⁸⁷ See Verizon's Response to Specification 17 of the Second Request (Network Evolution.pdf); VZXO-13-00001824.

⁸⁸ See VZXO-15-00000035, at slide 3.

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Indeed, as the FCC has recognized, “[c]ommunications networks are rapidly transitioning away from the historic provision of time-division multiplexed (TDM) services running on copper to new, all-Internet Protocol (IP) multimedia networks using copper, co-axial cable, wireless, and fiber as physical infrastructure.”⁸⁹ Today, “almost 75 percent of U.S. residential customers (approximately 88 million households) no longer receive telephone service over traditional copper facilities.”⁹⁰ And, “[a]s consumer demand for faster service speeds continues,” customers of all types will find it “even more critical” to migrate to alternative facilities for Ethernet service, “which is more easily scalable to increasing user demands compared to copper.”⁹¹ The FCC thus has stated “[o]ur society is clearly in the midst of a series of technology transitions, and the question in many cases is ‘when’ and not ‘if’ providers will wish to cease to provide TDM services.”⁹² It cited Verizon’s copper retirement plan as an example of that transition.⁹³

Under Verizon’s planned network upgrades, **[BEGIN CONFIDENTIAL]**
[END CONFIDENTIAL] of the central offices in which XO collocates **[BEGIN CONFIDENTIAL]**
[END CONFIDENTIAL] will be migrated to fiber,
including **[BEGIN CONFIDENTIAL]** **[END CONFIDENTIAL]** central
offices from which XO offers EoC. To date, Verizon has only migrated one of the central

⁸⁹ Technology Transitions *et al.*, Report and Order, Order on Reconsideration, and Further Notice of Proposed Rulemaking, GN Docket No. 13-15 *et al.*, FCC 15-97, ¶ 1 (rel. Aug. 7, 2015), https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-97A1.pdf.

⁹⁰ *Id.* ¶ 9.

⁹¹ *Id.*

⁹² BDS NPRM ¶ 84.

⁹³ *See id.*

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offices in which XO is collocating, and that migration was not part of Verizon's network transformation plan but was forced after hurricane Sandy destroyed significant portions of Verizon's copper plant in the Northeast. Under Verizon's pre-merger plans, it also **[BEGIN HIGHLY CONFIDENTIAL]**

[END HIGHLY

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Verizon's acquisition of XO will not accelerate the network transformation nor the demise of EoC service. Rather, approval of the transaction may prolong the availability of XO's EoC service, and at the very least, would have no additional effect on Verizon's transformation plans. To maintain flexibility to respond to changing market conditions and needs to unexpectedly repair or replace degrading copper plant, Verizon has not yet determined the order in which central offices will be migrated in 2017 and beyond. That determination is based on several practical and economic factors, including for example (but not limited to), **[BEGIN HIGHLY CONFIDENTIAL]**

[END

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Upgrading to fiber is a capital-intensive process with **[BEGIN HIGHLY CONFIDENTIAL]**

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the extent XO's EoC service is profitable, at best that would be a consideration weighing against near-term migration of a central office. To the extent XO's EoC service provides little material incremental revenue to Verizon, Verizon would not have any greater incentive to migrate the facility any sooner than it does today, pre-acquisition.

Some may argue that Verizon has an incentive to migrate facilities sooner so as to remove EoC, a lower revenue generating product, from its portfolio in favor of higher revenue generating fiber-based services. Such an argument misconstrues the competitive environment pre- and post-acquisition. Pre-acquisition, as discussed above, Verizon faces competition from fiber providers, cable providers, and other CLECs offering copper-based services such as EoC. Thus, the elimination of XO's EoC service does not leave Verizon competitively unconstrained to shift to higher revenue services. Put simply, if XO's EoC service fills demand and is profitable, it will remain that way even after the transaction, and where those potential profits exist, Verizon will have added incentive to delay upgrading those central offices to fiber.

Finally, because XO's EoC service will erode away over the next decade regardless of the transaction, the transaction itself cannot make consumers worse off.⁹⁴ Rather, consumers will be better off because the transaction will expand Verizon's fiber network for the benefit of businesses across Verizon's ILEC footprint and for the benefit of Verizon Wireless's mobile customers.

⁹⁴ See DOJ Horizontal Merger Guidelines § 11 ("If the relevant assets would otherwise exit the market, customers are not worse off after the merger than they would have been had the merger been enjoined.").

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CONCLUSION

For the foregoing reasons, the transaction does not threaten a substantial reduction competition for Business Data Services. Following the transaction there will continue to be extensive competition for these services provided over fiber, cable, and copper by a wide range of providers. In the limited areas where Verizon and XO compete, XO is not a unique supplier, and all of these competitive alternatives are available.

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Appendix A (EoC Profitability Analysis)

This appendix estimates the investment cost (I), the monthly recurring revenue (MRR), and the monthly recurring cost (MRC) for a CLEC to begin providing EoC service out of a central office in which it already collocates. This analysis is based on data provided by XO regarding its own EoC service.¹ Based on these estimates, this appendix calculates the payback period (M) for different levels of demand for EoC service, which is the number of months of operation required to repay the initial investment cost.²

The formula for calculating the monthly payback period (M) is as follows. *First*, define the monthly recurring profit (MRP) to be monthly recurring revenue (MRR) minus monthly recurring cost (MRC).

$$\text{MRP} = \text{MRR} - \text{MRC} \tag{1}$$

Second, calculate the payback period in months (M) as the investment cost (I) divided by the monthly recurring profit (MRP).³

$$M = I/\text{MRP} = I/(\text{MRR} - \text{MRC}) \tag{2}$$

¹ See Incremental EoC Allocated Capital Estimate.xls (“Capital Estimate Spreadsheet”), enclosed as a native spreadsheet.

² The Capital Estimate Spreadsheet presents the analysis in a slightly different format than this appendix. Instead of calculating a payback period for the investment, the spreadsheet allocates investment costs per period to calculate fully allocated accounting unit costs per circuit per month. The spreadsheet also allocates shares of investment costs to the EoC project that are not incremental to the project. That is, it allocates certain shares of investment costs to EoC service that a CLEC already collocated in a central office would have already undertaken even if it did not currently provide EoC service, in accordance with its standard cost allocation practices.

³ Because the payback periods are so short (less than a year and often much less than a year), discounting cash flows makes no significant difference to the analysis.

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This payback period is a function of the number of 10 Mbps EoC circuits that the CLEC will be able to sell. This analysis assumes that the CLEC provides 10 Mbps EoC circuits, which is the most common EoC circuit capacity sold by XO.

The costs of providing EoC service are as follows. *First*, the CLEC must purchase an EoC chassis for the central office, which is the most significant piece of equipment. The EoC chassis holds “cards” that can each support 32 copper loops. The chassis comes with a minimum of four cards capable of supporting 128 copper loops, which can be expanded to 20 cards capable of supporting 640 copper loops. The current price for an EoC chassis (the Adtran Total Access 5000) is \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] plus the number of cards multiplied by \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL].⁴ Thus, a chassis with the minimum number of cards (four) costs \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL], and a chassis with the maximum number of cards (20) costs \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL]. The installation cost (“EFI”) for the EoC chassis is \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL], and that cost does not vary significantly with the number of cards.⁵

⁴ See Capital Estimate Spreadsheet, cells G48 to J66.

⁵ See Capital Estimate Spreadsheet, cell I17. EFI stands for “Engineer, Furnish, and Install.” The EFI costs include various installation costs directly related to the chassis that are allowed to be capitalized under GAAP.

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On average, a single 10 Mbps EoC circuit requires 6.4 copper loops. Therefore, a chassis with four cards would be capable of supporting a maximum of 20 EoC circuits, and a chassis with 20 cards would be capable of supporting a maximum of 100 EoC circuits. In XO's planning, it generally assumes that it will operate a chassis at **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** % of its total capacity, which is the same assumption used here. This means that, in normal usage, a chassis with four cards would be expected to provide **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** EoC circuits, and a chassis with 20 cards would be expected to provide **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** circuits.⁶ This indicates that most economies of scale are exhausted at a production level of **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** circuits (when a chassis with 4 cards is fully utilized), but that some economies of scale continue up to a production level of **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** circuits (when a chassis with 20 cards is fully utilized).

Second, the CLEC must invest in DS0 termination blocks. Each block costs \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** and has an EFI cost of \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** for a total

⁶ This is reflected in the cost allocations for the EoC chassis in the Capital Estimate Spreadsheet. The spreadsheet allocates the total cost of a chassis that is fully loaded with 20 cards by assuming that only 70 circuits are provided and therefore allocates 1/70 of the cost to each circuit. The total cost for the EoC chassis is \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** (which is the equipment and EFI costs). *See id.* at Cell J17. The cost allocated to one circuit of \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]**. *See id.* at Cell L17.

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cost of \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL]

after rounding.⁷ These blocks are each capable of supporting 50 DS0 circuits.⁸

Third, the CLEC must install CPE for each customer. The Adtran Netvanta NV818 is typically used as CPE. It costs \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] and has an EFI cost of \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL], for a total cost of \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL].⁹

Fourth, installation of CPE, sale, set-up, and activation of a new EoC Circuit involves what XO refers to as “one time variable costs.” These costs cannot be capitalized under GAAP and are recorded separately from the EFI costs for the CPE. These costs are estimated to be \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] per circuit.¹⁰

⁷ See Capital Estimate Spreadsheet, cells G16 to J16. The spreadsheet lists two other pieces of equipment collocated in the ILEC central office, necessary to provide EoC service: the fiber distribution panel and the Ciena (DWDM). The costs of these items are not included in the analysis because a CLEC already collocated in a central office would already have purchased this equipment to provide other services. Thus, it is unlikely that a CLEC would need to purchase this equipment to offer EoC service.

⁸ See Capital Estimate Spreadsheet, cell G16; *see also id.* cells N21 to O25 (details on how the termination block cost is allocated to circuits).

⁹ See Capital Estimate Spreadsheet, cells H14 to J14. A single Adtran Netvanta818 can service EoC circuits using up to eight DS0s. *See id.* at cell G14. Because a 10 Mbps EoC circuit requires on average 6.4 DS0s, a single Adtran Netvanta818 will generally be sufficient for each circuit.

¹⁰ See Capital Estimate Spreadsheet. Cell L34 indicates that a per period accounting allocation for one time variable costs is \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] per circuit per month. Cell E30 reports that this allocation is calculated by allocating the total one time variable cost over [BEGIN HIGHLY CONFIDENTIAL]

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Table A1 presents the calculations for the payback period for demand levels between 1 and [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] circuits and for [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] circuits. The “Circuits Sold” column is the number of EoC circuits the CLEC expects to sell. The “I (WC)” column is the investment costs for equipment located in the central office (the EoC chassis and the DS0 termination block). The “I (WC) per circuit” column is the investment cost of equipment in the central office per EoC circuit. The “I (CPE) per circuit” column is the cost of customer premises equipment per EoC circuit. The “I (one-time install) per circuit” column is the one time variable cost per EoC circuit. And the “I (total) per circuit” is the total investment cost per EoC circuit, which is the sum of the “I (WC) per circuit,” “I (CPE) per circuit,” and “I (one-time install) per circuit” columns.¹¹

The monthly recurring revenue generated by EoC service (MRR) per circuit is the average price that the CLEC is able to charge for a circuit. XO’s average price for a 10 Mbps EoC circuit is \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] per month, which is the amount used in the “MRR per circuit” column.¹²

The primary monthly recurring cost for a CLEC is the cost of the UNE DS0s that the CLEC must

[END HIGHLY CONFIDENTIAL] months. Therefore, the total one time variable cost is \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] ([BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL] multiplied by \$ [BEGIN HIGHLY CONFIDENTIAL] [END HIGHLY CONFIDENTIAL]).

¹¹ While the Capital Estimate Spreadsheet also lists three additional pieces of equipment that need to be located in the CLEC central office in order for the CLEC to be able to provide EoC service, *see* cells E21 through L23, the CLEC would very likely already have purchased this equipment to provide other services.

¹² *See* Capital Estimate Spreadsheet, cell L29.

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purchase from the ILEC to provide EoC service. XO's average UNE price for one DS0 is \$

[BEGIN HIGHLY CONFIDENTIAL] **[END HIGHLY CONFIDENTIAL]** .

Because an average of 6.4 DS0s are needed to provide one 10 Mbps circuit, the monthly UNE

cost is \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]**

(6.4 multiplied by \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY**

CONFIDENTIAL]).¹³ XO reports that the sum of all other elements of MRC other than UNE

costs is equal to \$ **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY**

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CONFIDENTIAL] **[END HIGHLY CONFIDENTIAL]** , which is the amount used in

“MRC per circuit” column. The difference between “MRR per circuit” and “MRC per circuit” is

the monthly recurring profits (MRP) per circuit. That amount is \$ **[BEGIN HIGHLY**

CONFIDENTIAL] **[END HIGHLY CONFIDENTIAL]** , and is the amount that

appears in the “MRP per circuit” column.

The final column in Table A1, “Payback Period in Months” represents the time needed to break even for a CLEC that begins to offer EoC service. The payback period is equal to “I (total per circuit” divided by “MRP per circuit.”

Table A1 shows that the payback period is **[BEGIN HIGHLY CONFIDENTIAL]**

[END HIGHLY CONFIDENTIAL] so long as the CLEC expects to sell **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** or more EoC circuits.

¹³ See Capital Estimate Spreadsheet cells G41 to I44.

¹⁴ See Capital Estimate Spreadsheet, cell L35.

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The payback period shrinks even further for higher but still very modest levels of demand. The smallest capacity EoC chassis that can be purchased is capable of producing **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** circuits per month when operating at normal capacity usage. At this level of demand, the payback period is **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** months. Some economies of scale continue up until a production level of **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** circuits, at which point the payback period is **[BEGIN HIGHLY CONFIDENTIAL]** **[END HIGHLY CONFIDENTIAL]** months.

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Table A1

[BEGIN HIGHLY CONFIDENTIAL]

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Appendix B (Sources for Table 1)

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Exhibit 1

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Exhibit 2

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