

What Types of Regulatory and Pricing Strategies Work When Customers are Likely to Become Competitors?

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Abstract

Business Data Services (BDS), formerly called special access services, are dedicated broadband lines offered by network providers to business customers and network providers. In a packet-based broadband network, the distinction between customer and competitor is being blurred, and with it the meaning of the wholesale/retail distinction. A new approach to pricing and regulatory oversight is needed that moves away from treating any market segment as passive purchasers of BDS services. The authors propose a simple pricing structure that is cost-causative, reflects the opportunity cost of using the network, and controls opportunistic behavior. While the main focus of the paper is on BDS services, the recommendations also hold in other networks industries.

Introduction

The broadband revolution is shifting network intelligence from its core to its edges, and competition is following the move. Old line companies such as the United States Postal Service (USPS) face last mile competition from United Parcel Service, Federal Express, Amazon, and Uber. Verizon and AT&T face competition from cable TV companies (now called multichannel video service providers) such as Comcast, Cox, and Charter; and from wireless companies such as T-Mobile. Public Service Gas and Electricity (PSE&G) and other established electric utilities face competition from

emerging microgrids that can operate on their own but are still connected to the electric utility's macrogrid.

Customers can be potential competitors in this new environment. This paper explores the implications of this new and increasingly pervasive relationship. What types of contracts and tariffs will likely emerge between the old line companies and the new competitors? How should regulatory agencies react to the technological transformation underway?

By way of illustration, we focus on the Federal Communications Commission's (FCC) regulation of business data services (BDS)--sophisticated private line services offered in the telecommunications industries, examining basic regulatory issues:

- Does customer lock-in produce monopoly profits for some BDS providers at the expense of other providers and even perhaps foreclose competition?
- Does setting retail prices above wholesale prices lock-out competitors from winning the network provider's customers?
- How can the FCC measure market power? Is market power eroding?
- How does the FCC determine whether market power is being exercised by a large network provider? Are certain penalties charged to customers in long-term contracts an indicator? If so, should the FCC distinguish between *ex ante* and *ex post* losses when a market is in transition from one technology standard to another?
- Will a network provider exercise its market power now if its power is eroding? How will it affect repeat business if power is exercised? Does the answer change when customers are potential competitors?
- Does the regulator accommodate rent-seeking by companies that made bad decisions? If so, how will such accommodation affect future tariff-based contracts?
- How would price, services bundles, and penalties for non-performance be set in a competitive market? Are they in line with the FCC's decisions and wholesale price recommendations?

Although the FCC has repeatedly said that competition is the best regulator of markets, its 2016 BDS Order rescinded tariff terms and conditions to smooth the market transition from one where old line companies arguably had market power to one where they are a large-sized competitors. An Order issued in 2017 adopts a light-touch approach to regulation. Based on market trends, we also recommend light touch regulation is the proper policy in this new environment.

We will also suggest that tariffs will be cost-based, customized to fit the needs of customers, and will protect network providers from opportunistic behavior by customers.

Summaries of the FCC's 2016 and 2017 BDS Orders

The Federal Communications Commission (FCC) released an Order on May 2, 2016 that hardly caused a stir outside of the telecom industry and was barely covered by the media.¹ That Order, addressed complaints that large network providers were using their market power to unfairly lock-in large business customers and other network providers into long-term agreements that effectively prevented competition for BDS, formerly called special access service.² The FCC identified as anticompetitive two provisions of certain BDS tariffs that resemble long-term standardized contracts: requiring customers to purchase all services from one tariff plan (the all-or-nothing rule) that the FCC declared unlawful, and certain volume and term penalties that network providers were ordered to revise downwards.³

The Further Notice, released simultaneously as part of the 2016 BDS Order produced strong reactions from interested parties to a very important provision would have led to future regulatory battles: that wholesale rates should be below retail rates. Such a requirement may seem obvious if one draws comparisons from markets in which competition depends on the availability of wholesale inputs. The issue is whether this observation makes sense for networks where the customers are also potential competitors.

On March 30, 2017, the newly-appointed Chairman of the FCC, Ajit Pai, circulated a draft of a proposed Report and Order (adopted by the FCC by a 2-1 party-line vote on April 20 2017 and released on April 28, 2017) that relies primarily on market forces to control market behavior but does recognize that pockets of market power still exist.⁴ The essential features of the 2017 Order are to (1) continue the FCC's long-standing policy of not imposing *ex ante* pricing regulations on BDS services provisioned with newer technologies⁵ or on legacy BDS services⁶ in counties in metropolitan statistical areas (MSAs) for which the FCC had previously price-deregulated⁷ and (2) limit such regulations to DS-1 and DS-3 channel terminations (legacy services) in counties which are deemed to be non-competitive based on metrics on the extent of competition from competitive local exchange carriers and cable television providers in those counties.⁸ The 2017 BDS Order explained that competition for BDS has become very robust.⁹ In addition, the parties engaged in the proceeding assisted the commission "to develop an administrative approach to de-regulate in areas where competitive forces are able to ensure just and reasonable rates."¹⁰

Regulatory Issues

The regulatory debate centered on five key issues related to market power: customer lock-in, competitor lock-out, measures of market power, exercise of market power, and customer rent-seeking.

The Lock-In Debate

The FCC's banning or modification of certain contract terms for legacy services (and its apparent consideration of extending similar restriction to BDS provisioned using newer technology) can be viewed as attempts to prevent customers from being locked into the BDS offerings of incumbent providers. The specific practices of concern to the FCC resemble loyalty discounts, an arrangement in which a customer receives a lower price when its purchases exceed a certain minimum threshold.¹¹ In evaluating such practices, Professor Joshua White, a former FTC Commissioner, observed the following:

Loyalty discounts are ubiquitous in today's marketplace and a common form of competitive rivalry among suppliers vying for more business. They are prevalent across a broad variety of industries including medical devices, pharmaceutical products, airlines, computers, and many consumer products. Loyalty discounts are common at both retail and wholesale levels, and are used in both highly competitive and highly concentrated industries...The primary competitive concerns with loyalty discounts are...that a monopolist might utilize such discounts as a strategy to protect its market position by excluding rivals, raising rivals' costs, and ultimately harming consumers.¹²

That is, the proper economic focus is to evaluate whether loyalty discounts harm competition and customers within relevant economic markets.¹³

Technological lock-in is also widespread in the digital age.¹⁴ It is a strategic tool for preventing customers from switching to another vendor. For example, a company that has invested in Microsoft products faces potentially large switching costs if it wants to migrate to Apple products.

Lock-in, by itself, does not have to translate into abnormal profits. Intense competition typically leads to generous introductory prices, promises of cheap upgrades, and other concessions that give both buyer and seller assurance that the network provider will provide services needed and not earn an abnormal rate of return. The length of the trading cycle is all that differs between competitive lock-in and the standard competitive model where trades occur immediately.¹⁵

On the other hand, lock-in can be abused. For example, Shapiro and Varian reported that AT&T sold 5ESS switches to Bell Atlantic and charged very high prices for upgraded features.¹⁶ Lack of number portability also impaired competition and so did non-equal access to the extent that

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customers had to dial extra digits to make long distance calls.^{17, 18} The TDM to Packet transition was questioned by the FCC, but evidence of abusive behavior did not materialize.¹⁹

Pricing plans that lock-in BDS raise some of the same issues encountered when the FCC established the total element long-run incremental cost method for determining rates for network elements, e.g., local loop, sold to the then new competitive local exchange carriers. In particular, telecommunications networks (1) often require investment in capital assets with relatively long lives, (2) some of these assets may be subject to technological improvement that results in lower equipment prices (and/or enhanced capabilities) over time, and (3) because of increasing competition and other factors, growing uncertainty over whether there will be sufficient demand for service after new investments are made.²⁰ Significantly, the FCC acknowledged that these considerations are economically valid and could be addressed through long-term contracts.

We agree ... that, as a theoretical matter, the combination of significant sunk investment, declining technology costs, and competitive entry may increase the depreciation costs and cost of capital of incumbent LECs... [W]e also agree that, as a matter of theory, an increase in risk due to entry into the market for local exchange service can increase a LEC's cost of capital. We believe that this increased risk can be partially mitigated, however, by offering term discounts, since long-term contracts can minimize the risk of stranded investment.²¹

In other words, to the extent that long-term contracts are not anticompetitively exclusionary, they are economically justifiable mechanism to managing the risks associated with investing in telecommunications networks.

The Lock-Out Debate: Wholesale Rates below Retail Rates

In its Further Notice, the FCC sought comment as to whether wholesale rates to other network providers should be lower than retail rates to account for avoided retail costs per unit of demand. This requirement is specified in the Telecommunications Act of 1996 when incumbent local exchange carriers resell retail services to competitors.²² The question is whether such a requirement is economically efficient when a customer is a competitor. The efficient component pricing literature's answer is no, it is not efficient. In a competitive market, a supplier's lease price for its facilities to a competitor would equal the cost of the network facilities plus the lost contribution the

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facilities would earn if sold to a retail customer.²³ The opportunity cost should include possible network configuration costs, according to Spulber and Yoo.²⁴ They claim that leasing facilities may make a network designed for one provider more costly when it is shared by two providers.²⁵

The broader issue is whether customers that are potential competitors in the network service provider's serving area should be classified as competing wholesalers. Wholesalers in the past were not a threat because they did not offer competing retail services. Traditionally, wholesale companies lowered a retailer's transport or product assembly costs by specializing in aggregating demand for particular products or services, or saved a retail company marketing costs by voluntarily farmed out its retail services to companies with local sales forces that could save the company money. BDS customers do not fall into either category. A better approach is to drop the wholesale label. The more accurate label is an enterprise customer, a sophisticated customer that wants customized bundles of services. An enterprise customer is at risk to become a competitor.

The term wholesale should be reserved for complementary network arrangements outside the network provider's service area.

In a networked world, no network has complete coverage. As a result, wholesale arrangements make sense. In a recent article touting the wholesale side of the business, the authors say, invariably [wholesale] means working with partners. Today it's no longer efficient for an operator to single-handedly invest in and develop its own set of services and infrastructure for every next generation service required. Establishing partnerships for innovation, growth and revenue sharing: that's the new order of the day and that means wholesale.²⁶

While the 2016 BDS Order entertained the possibility of regulating the wholesale-retail price relationship, the 2017 BDS Order does not impose such restrictions,²⁷ providing as reasons (1) the fact that complaining parties had provided "little concrete evidence that incumbent LECs charge their wholesale customers higher rates than they charge retail customers for like business data services,"²⁸ (2) that such a restriction "could have the unintended effect of preventing providers from reducing retail rates to competitive levels, as the provider would then have to reduce its wholesale rates to below those levels,"²⁹ and (3) the continued growth in competition and the FCC's complaint procedures provide sufficient safeguards against anticompetitive or discriminatory behavior.³⁰

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Measuring Market Power

Lock-in and lock-out presume that the large network providers have a stranglehold on the market. This is an empirical question. The market trends presented below suggest that barriers to entering this market have dropped substantially.

While incumbent local exchange carriers initially provided the bulk of business data services using legacy TDM technology, competitive telecommunications providers and, more recently, cable television providers have made substantial inroads using newer, much lower cost Ethernet (or packet switching) technology. As part of its evaluation of the regulatory regime for BDS, the FCC compiled extensive data on the volumes of BDS being provided in specific buildings in 2013. Professor Marc Rysman used these data to analyze the strength of competition for BDS.³¹ Professor Rysman's data showed that incumbents' competitors accounted for a substantial proportion of the \$45 billion BDS revenue in 2013. Table 1 is constructed from Professor Rysman's data.³²

Table 1. Estimated Revenue by Service Type

Service	Estimated Revenue (billion \$)
Incumbent DS1	\$ 10.6
Incumbent DS3	\$ 5.5
Incumbent Packet	\$ 5.6
Competitor Circuit	\$ 9.7
Competitor Packet	\$ 13.3
Total Revenue	\$ 44.7

The legacy (circuit) services are DS1 (with a capacity of 1.5 megabits per second (mbps) and DS3, with a capacity of 45 mbps. Total incumbent revenue was \$16.1 billion, with competitors providing services accounting for another \$9.7 billion. In contrast, competitors provided packet-based BDS accounting for \$13.3 billion, compared to \$5.6 billion of such services provided by incumbents.

There have been changes since 2013, as companies acquired all or parts of other companies' operations (Frontier acquired AT&T's Connecticut operations in 2014 and parts of Verizon's Florida, Texas, and California operations in 2016) and Charter cable acquired Time Warner cable in 2016. In addition, some providers experienced revenue increases, while others saw their revenues decrease. To illustrate these changes, we have updated information presented by Professor Rysman, which appears in Table 2.³³

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The general pattern is summarized by the four percent average annual decline in incumbent revenues, offset by a 10 percent annual increase in the revenues of non-incumbent providers.³⁴ Comcast's annual average growth, which unlike those of some of the other providers is not distorted by acquisitions or sales, was about twice that of the average for non-incumbent providers.³⁵

Table 2. Revenues by Company 2013-2016 (in million \$)

Company	2013	2014	2015	2016	Annual Change	Incumbent
AT&T	\$ 30,113	\$ 29,523	\$ 28,929	\$ 25,771	-5.1%	Yes
Verizon	\$ 20,716	\$ 19,839	\$ 18,922	\$ 16,624	-7.1%	Yes
CenturyLink	\$ 11,036	\$ 10,999	\$ 10,561	\$ 10,307	-2.3%	Yes
Level3	\$ 5,109	\$ 4,525	\$ 6,208	\$ 6,362	7.6%	No
Windstream	\$ 1,666	\$ 1,767	\$ 1,863	\$ 1,872	4.0%	Yes
Comcast	\$ 3,248	\$ 3,960	\$ 4,751	\$ 5,514	19.3%	No
Time Warner	\$ 2,312	\$ 2,838	\$ 3,284	-		No
Frontier	\$ 2,183	\$ 2,161	\$ 2,467	\$ 3,716	19.4%	Yes
Charter	\$ 812	\$ 993	\$ 1,127	\$ 3,909	68.9%	No
EarthLink	\$ 945	\$ 911	\$ 859	\$ 747	-7.6%	No
Total	\$ 78,143	\$ 77,515	\$ 78,971	\$ 74,822	-1.4%	
ILEC	\$ 65,716	\$ 64,289	\$ 62,742	\$ 58,290	-3.9%	
Other	\$ 12,427	\$ 13,227	\$ 16,229	\$ 16,532	10.0%	

In classic Schumpeterian style, the empirical evidence suggests the BDS market is opening up to competition because of a revolutionary change in technology. This observation is at odds with the view that large network providers have a stranglehold on last mile connections to customers. Low costs associated with Ethernet apparently have attracted many new network providers to offer broadband services. The legacy TDM technology required expensive equipment and universal clocks to time transmission across networks that are no longer necessary. The main issue is how competitive the BDS market is now and in the near-term while legacy technology is still widespread.

Identifying the Exercise of Market Power

A network provider that still has market power may exercise it through the use of contract terms that extract rents from customers. The contracts, themselves would specify penalties that bear little resemblance to the incumbent's costs and would likely place market risks mainly on the customer. The FCC focused on three types of tariff arrangements to build the case that large network providers still have substantial market power: all-or-

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nothing contracts, excessive term and volume penalties, and large penalties exacted from customers.

Term and Volume Penalties

Basic economic theory, which assumes perfectly competitive markets, doesn't consider legal contracts because there are no penalties for renegeing on a purchase. The neglect of legal contracts is understandable because in a perfectly competitive market, where goods are divisible and transferred immediately, renegeing does not impose penalties.³⁶ In contrast, for BDS services, there are large sunk costs and no alternative source of customers. Large financial risks can translate into large transaction costs if the customer breaches the agreement. Therefore, a formal legal contract can mitigate such risks.

Such legal protection makes sense when a network provider has to install fiber optics and electronic equipment to meet the needs of the customer. Potentially large losses hold even for installed legacy equipment that must be maintained. Besides the difficulty of obtaining replacement parts and maintaining old equipment, a network provider will have to buy hybrid routing equipment to keep legacy service operating. Moreover, the requirement to continue offering legacy services also prevents broader network reconfigurations needed for an all-fiber/Ethernet network.

A BDS pricing plan, like a standard contract, will specify penalties for breaches of the agreement.³⁷ Generally, the law awards damages to restore the innocent party to the position as if the contract was performed.³⁸ However, Ayres and Gertner suggest a penalty default rule may improve market performance when one side in the contract may not disclose important information to get a better deal.³⁹

Typically, the buyer (rather than the seller) is more likely not to disclose important information.⁴⁰ Such non-disclosure is likely to be the case in the broadband market, where a wireless company, for example, may decide to build its own transmission facilities instead of leasing them from the network provider. A penalty liability could be set to assure the network provider that a customer will honor the agreement by making it costly for the customer to renege.

A reasonable BDS pricing plan would provide the network provider the expectation that it will recover its costs and earn a fair rate of return on investment. Such a plan will likely have a few basic features: a discounted price in exchange for a lock-in, minimum volume targets, a fixed term to the contract, and penalties for breaches of performance.

Penalties based on minimum volume and term targets are a means of limiting network provider losses. They may alternatively be viewed as an

alternative method of controlling revenue forecasts. During negotiations, network providers may use penalties as a means of shielding the network provider's assumptions about the customer's use of the network. Penalties may also shield the network provider's general pricing strategy.

A penalty that increases return above expected revenue can help identify good customers, and so can lengthening the term of a contract.

- A customer that accepts a longer term contract is likely not to renege. It is a signal of being a reliable customer.
- Similarly, a customer that accepts a high penalty without much of a price break displays commitment (adverse selection issue in insurance).

Fixed-price contracts have little value if one party renegotiates when prices are not favorable to it.⁴¹ Such circumstances may encourage opportunistic behavior when sunk costs are involved as they are in the broadband market. Once the network provider has invested in plant and equipment, a customer could press for lower prices thinking that the network provider would prefer to recover some of its investment instead of none.⁴² In this case, it is a zero sum game where penalty reductions translate into network provider losses.

To limit gaming, *ex ante* losses (not *ex post* losses) should be the basis for judging whether actual penalties are pro- or anti-competitive. *Ex post* losses are likely to be large in the BDS market because of the difficulties predicting *ex ante* the timing of the technology transition from TDM to Ethernet technology. As indicated in the Order, mobile providers paid the largest penalties for non-performance. They chose to lock-in discounted TDM rates instead of paying full price for month-to-month service because they were afraid to commit to Ethernet in the early 2000s, but started to demand Ethernet services after 2010. As a result, they could not make their commitments. In hindsight, the mobile providers made a mistake. The FCC, however, used realized losses to justify reducing the penalties.

All-or-nothing

A network provider that offers a menu of prices, minimum volumes, term commitments, and penalties will both prevent adverse selection and, more positively, will likely match a customer's needs.⁴³ This may be especially true in the BDS market where some customers are network providers and others operate in other industries. Yet large network providers offered BDS customers tariffs with an all-or-nothing provision, which states that a customer must commit all relevant purchases to a single pricing plan, even though the network provider offers several others.⁴⁴ This arrangement prevents customers from shifting some of their demand to month-to-month

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plans in anticipation of shifting demand to another provider.⁴⁵ The FCC was concerned that this particular lock-in is an anticompetitive manifestation of market power for legacy TDM services.

Customer Rent-Seeking through Regulation

Between 2000 and 2010, wireless carriers were reluctant to commit to Ethernet/Packet technology.⁴⁶ They continued to enter into term and volume discount plans for legacy DS1 and DS3 services. As Ethernet/Packet standards were adopted and the newer technology became widely available at attractive rates, the wireless carriers sought relief from the FCC, and it was granted to some extent, by limiting penalties to minimum commitment levels and allowing wireless carriers to opt out of an all-or-nothing service contract. In effect, the FCC was sending a market signal that bad forecasts don't matter. Seeking regulatory relief and having it granted is well documented.

In general, regulators are unlikely to commit to an original agreement when there is an ex post appearance of excess profits (or financial distress). This has been a fatal flaw in price cap regulation according to Crew and Kleindorfer.⁴⁷ In this case, the timing of the transition from TDM to Ethernet was unclear. Industry associations such as Metro Ethernet Forum (MEF) were trying to develop quality of service standards for Ethernet, a technology originally designed for data transmission, not voice. It is not surprising that mobile company customers would experience large losses and complain to the regulator about them.

Besides trying to limit assessed penalties, the FCC sought to roll back prices for the legacy broadband services that the wireless carriers had bet on. The fact that DS_n equipment is no longer being manufactured⁴⁸ did not stop the FCC from imposing an industry-wide productivity gain factor to justify its price reductions for these legacy services.⁴⁹

Pricing in a Schumpeterian Market where Customers may be Competitors

The main conclusion so far is that the FCC's attempts to manage the BDS market to make it more competitive may be counterproductive. Market trends point towards increasing competition in this market. Economic theory suggests that contract terms will lock in customers to assure the network provider recovers its costs.

The question now is what types of pricing methods and tariff plans would work effectively in an increasingly competitive BDS market, and how can regulation help make the transition smoother. To answer these questions, we will assume the distinction between customer and competitor is being blurred, and with it the meaning of the wholesale/retail distinction. Product

differentiation is built largely from end-user controlled applications. Entry barriers are being lowered by low-cost Ethernet technology.

Another basic assumption is that large network providers want repeating customers, even among mobile service providers that are potential competitors and could eventually build their own networks. The large network provider will calculate the expected present value of repeated agreements for the foreseeable future. Exploiting temporary market power will likely have a lower present value than setting prices at competitive levels.⁵⁰ A reasonable prediction is that network providers will not raise rates to benefit from temporary market power.

The new pricing strategy begins with the premise that pricing arbitrage is a high risk factor in a packet world. Arbitrage is not a new problem. Resellers bought services from the old AT&T at deeply discounted rates and then used those discounted services to undercut AT&T's retail service prices.⁵¹

While network arbitrage is not new, the potential scale and extent of potential arbitrage has increased significantly. Cheap routers, servers, and applications lower the barrier for providing service. A customer could resell underpriced services, lease facilities until they build their own, and introduce new bandwidth intensive services without notice to the network provider.

An effective pricing strategy would anticipate the long run cost of service, recognizing that some of these costs are fixed, while others vary by volume. That is, prices would account for use of facilities and potential network redesigns needed to accommodate a customer. The strategy would also account for the arbitrage risk and attempt to mitigate opportunistic behavior on the part of the customer. The pricing methodology and related terms and conditions would be consistent across similarly-situated customers and anticipate the need for justification if the FCC opened an inquiry as to whether prices and contract terms are reasonable. In general, effective pricing of telecommunications services in a packet-world also has implications for other networked industries that are introducing packet technology to monitor and control their systems. In sum, effective pricing should aim at simplicity, transparency, customer neutrality, and economic sustainability.

Here is an example of a pricing strategy that could work for BDS services. The proposed rate elements mirror network costs and tariff arrangements to recognize non-performance risks.⁵²

Network-Related Last Mile Customer Link and Port Charges. Link charges recover the costs of connecting a customer to the network provider's switching office. Link equipment includes last mile outside

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plant and electronics needed to ship traffic to the nearest end office where major re-routing and transport of traffic occurs.

Ports are the gateways to network services. Port charges could include quality-of-service features, encryption services, and virtual private network services as examples (many require cooperation among network providers). In general, feature charges could be derived from Open System Interconnection (OSI) elements – network, transport, session, and application layers – which identify the key cost elements of a broadband network.

Link and port charges may be nodal. Competition is likely to induce a network provider to have location-specific prices that are based on construction and maintenance costs.

Network-Related Middle Mile Charges. These rates recover costs associated with transporting traffic from the local switching office to the next network provider's facilities. Traffic from many customers are transported over the same fiber optic facilities. Fiber optics have potentially unlimited capacities; therefore, cost allocation to a particular customer group could be based on the relative costs of local ports that enable a link to access the features of the Middle Mile network.

Network Related Busy Hour Charges. Usage charges may be necessary to limit network congestion caused by heavy use of the network during busy hours. Usage charge will fund network redesign costs. Storage should be considered now that Content Delivery Networks (CDNs), which store content close to customers to minimize transportation and switching costs, are widespread. Fill factors (perhaps levelized) would account for excess capacity needs designed for long-term growth and unexpected fluctuations in demand.

Fungibility Considerations on Charges. Up-front fees and term commitments may be necessary when network facilities used to serve a BDS customer are not easily reused. For example, a network provider may require special construction cost payments and long-term commitments (e.g., from a wireless carrier seeking a connection between a cell tower and its mobile switching office), because the network provider runs the risk of stranded investment if such a customer decides to drop the service. Volume commitments assure the network provider that the present value of the expected revenue stream from the BDS service equals the present value of the network provider's costs.

Penalties. A network provider could include contract penalties for customer non-performance. In general, they should be based on the network provider's expected losses, because penalties above expected losses would hurt the network provider's reputation.

Sustainable price levels would recover at minimum long-run average cost of the service. Direct assignment of costs to services should be done where possible. Shared service costs can be allocated based on relative port costs for blades placed into routers. In this case, port costs serve as proxies for relative cost of transporting voice, data, and video traffic over the same fiber optic network.

In order for investments to be economic, prices would reflect the direct and joint investment costs, based on the cost of capital for companies operating as network providers. Similarly, in competitive markets, demand conditions determine the extent to which prices recover common costs – such as general administration expenses such as the cost of an accounting department. Any price higher than average long run incremental costs of offering the service will contribute to the recovery of common costs, which the network provider will have to recover from all its services. Contributions could be based on Faulhaber's idea that all combinations of services must cover average incremental costs, including the full bundle of services.⁵³ Overall, this basic strategy applies to all services: it will simplify the price-setting mechanism, and serve as a basis to justify a price level when the FCC investigates a complaint.

Both competitive trends and the FCC's latest thinking anticipate that network providers will increasingly opt for commercial contracts over tariff plans for BDS customers.⁵⁴ Negotiated terms make sense for three reasons: BDS customers may have unique requirements, there are location-specific costs, and listed rates may lead to market coordination or undercutting by competing network providers. However, they should base negotiated terms on a menu of plans, including month-to-month plans. This tariff-like set of standard plans has two benefits. First, they serve as a consistent basis for negotiating plans with customers. Second, they can be used as evidence before the FCC that demonstrates customers are being treated fairly. For example, the "list" prices will be highest in month-to-month arrangements, because the risk of stranded investment will fall completely on the network provider. Term rates will be offered at a discount below the month-to-month rate.

If these types of pricing arrangements emerge, how should the FCC's rules accommodate them? The all-or-nothing rule may have been used to temporarily lock-in customers when big network providers were the main

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providers of legacy DSn service. It is possible that eager staff could have adopted this strategy to keep customers tied to their companies. If that was the strategy, it was faulty. The FCC's ruling may have helped the large network providers in the long-term by signaling customers that this won't happen again.

The FCC's penalty strategy of limiting it to a minimum volume commitment may induce network providers to raise the minimum and perhaps raise month-to-month rates. Term commitment penalties should be left to the network provider because they depend on whether the circuit is fungible.

Conclusion

The FCC's 2016 BDS Order may not have improved the efficiency of the BDS market with the possible exception of eliminating the all-or-nothing tariff provision. In contrast, the 2017 BDS Order is more closely aligned with the principle that regulation should defer to competition in shaping the market when the latter is sufficient. The resulting pricing plans will likely resemble long-term contracts in other industries. Lock-ins, which are likely in the BDS market because of large sunk costs, will lead to pricing plans or contracts with term and volume discounts as well as non-performance penalties. Fungibility will be an important consideration for setting the terms of an agreement. Stranded investment is more likely when customers are network providers themselves. Less rigid contracts may be likely for other BDS customers operating in densely populated business districts.

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Endnotes

1. The "2016 BDS Order" refers to the following: FCC Report on Business Data Services. Federal Communications Commission. (2016). *Tariff investigation order and further notice of proposed rule making* (FCC Report, 16-148).
2. The FCC defines BDS as "a telecommunications service that: transports data between two or more designated points at a rate of at least 1.5 Mbps in both directions (upstream/downstream) with prescribed performance requirements that typically include bandwidth, reliability, latency, jitter, and/or packet loss. BDS does not include "best effort" services, e.g., mass market BIAS such as DSL and cable modem broadband access" (2016 BDS Order, par. 279)
3. 2016 BDS Order, par. 11
4. Chairman Pai was joined by Republican Commissioner Michael O'Rielly in the majority. Commissioner Mignon Clyburn vigorously dissented. At the time of the vote, two of the positions on the five-member commission were vacant, including the one formerly occupied by the previous chairman Tom Wheeler.
5. The "2017 BDS Order" refers to the following: FCC Report and Order. Federal Communications Commission. (2017). *Business Services in an Internet Protocol Environment, Technology Transitions, Special Access for Price Cap Local Exchange Carriers, AT&T Corporation Petition for Rulemaking to Reform Regulation of Local Incumbent Local Exchange Carrier Rates for Interstate Special Access Services* (FCC Report and Order, 17-43, par. 87-88). While the FCC had previously chosen not to extend price regulation to services provisioned over newer technologies, the investigation that produced the 2016 BDS Order sought comments on whether price regulation should be extended to such services, whether offered by incumbent telecommunications providers or newer entrants. Earlier orders from this proceeding are discussed in: Glass, V., & Tardif, T. (2017). Re-regulation of business data services. *Rutgers Business Review*, 2(1), 81-82.
6. In particular, legacy BDS is provisioned with Time Division Multiplexing (TDM) technology— a circuit-switch technology that has widely been supplanted by Internet Protocol (IP) packet switching technology used in the newer technology BDS.
7. 2017 BDS Order, par. 131 and 160.

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8. 2017 BDS Order, p. 138. In particular, legacy BDS services would be subject to ex- ante price regulation if (1) fewer than 50 percent of business locations demanding BDS are within 0.5 miles from a competitive provider and (2) cable companies offer broadband in fewer than 75 percent of the county's census blocks. Chairman Pai's predecessor had proposed to impose ex ante price regulation on all of the incumbent's legacy services. The 2017 BDS Order replaces the previous BDS pricing regime, which had price deregulated legacy BDS in metropolitan statistical areas (MSAs) accounting for 28 percent of the US population, granted downward and contract pricing flexibility in MSAs accounting for 43 percent of the US population, and had frozen BDS prices (with no flexibility) in areas accounting for the remaining 29 percent of the US population. Glass and Tardiff, 81, adjusted for MSAs accounting for 85 percent of the US population. The 2017 BDS Order imposes a price cap index (apparently designed to approximately maintain the current freeze), but extends downward and contract price flexibility to non-competitive counties. (In contrast, Chairman's Pai's predecessor proposed to roll back prices by 11 percent and impose a price cap expected to reduce future prices). Commissioner Clyburn's dissent criticized these provisions, stating (among other things) that the tests to determine whether there was sufficient competition in a county would maintain price controls for less than 10 percent of buildings with BDS demand and that current price controls have been insufficient to constrain market power. 2017 BDS Order, p. 191. In fact, the FCC subsequently released the list of counties determined to be competitive and non-competitive (available at <https://www.fcc.gov/bds-county-lists>). Counties deemed to be competitive account for 91 percent of US population (with 2 percentage points of this amount attributable to "grandfathered" counties that had been price-deregulated under the previous regime). Counties deemed to be non-competitive (and therefore subject to price caps) account for the remaining 9 percent of the US population.
9. 2017 BDS Order, par. 2 and 4
10. Ibid., par. 5
11. Wright, J. D. (2013). Simple but wrong or complex but more accurate? The case of an exclusive-dealing based approach to evaluating loyalty discounts. *Remarks of Federal Trade Commissioner at the Bates White 10th Annual Antitrust Conference*.
12. Ibid., pp. 4 and 6
13. While the overall growth in competitors' volumes and concomitant decline in incumbents' volumes (as we will show below) demonstrates that long-term contracts have not generally excluded competitors, perhaps the proper focus could be on geographic markets of more limited scope. For example, some (including Commissioner Clyburn) have argued that a single building is the proper geographic market for BDS services (2017 BDS Order, p. 191.) While the geographic scope of economic markets for BDS is hotly contested, Professor Rysman's analyses, which were, in fact, based on treating single buildings as economic markets, can be interpreted to show that any lack of competition within individual buildings has had relatively modest, if not inconclusive impacts on the prices paid for BDS services (see Endnote 5 for Glass and Tardiff, 2017, p. 81-82). Tim Brennan provides an economic assessment of whether a single building is a proper market for evaluating BDS competition in Brennan, T. (2016). Can a single building really be its own BDS market? *Perspectives from FSF Scholars*, 11(29), 1-3.
14. For example: Shapiro, C. & Varian, H.R. (1999). *Information rules: A strategic guide to the network economy*. Boston, MA: Harvard Business School Press.
15. Ibid., p. 145
16. Ibid., pp.105-106
17. Number portability. (n.d.). In *Wikipedia*.

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18. Feature group. (n.d.). In *Wikipedia*.
19. Shapiro & Varian, 1999, p. 105-106
20. The combination of these features not only increases investment risks, generally making sales without long-term commitments problematic, but in the case of declining asset prices, suggests rates that are relatively high at the beginning, which decline over the life of an asset. For example: Tardiff, T. J. (2015). Prices based on current costs or historical costs – how different are they? *Journal of Regulatory Economics*, 47(2), 201-217. The real options literature identifies another feature affecting the risk—the timing of the investment in order to mitigate the effects of demand and technological uncertainty. This perspective includes an additional cost component associated with an investment—the economic value of an option to defer the investment until more information is available. For example: Hausman, J.A. (2003). Regulated costs and prices in telecommunications. In G. Madden (Ed.), *International Handbook on Telecommunications Economics* (pp.199-233). Cheltenham: Edward Elgar Publishers. Another example: Pindyck, R. S. (2004). *Mandatory unbundling and irreversible investment in telecom networks* (Working Paper 10287). National Bureau of Economic Research.
21. Federal Communications Commission. (1996). Implementation of the local competition provisions of the Telecommunications Act of 1996/Interconnection between Local Exchange Carriers and Commercial Mobile Radio Service Providers (FCC First Report and Order, 96-325, par. 686-687). Federal Communications Commission.
22. 47 C.F.R., Section 252(d)(3)
23. Baumol, W. & Sidak, J. G. (1994). *Toward competition in local telephony*. Cambridge, MA: MIT Press, Cambridge.
24. Spulber, D., & Yoo, C. (2009). *Networks in telecommunications: Economics and law*. Cambridge, UK: Cambridge University Press.
25. *Ibid.*, pp. 50-52
26. Wholesale Systems: What they are and why they are important to telecom's future, Interview with Daniel ÖIvebrink (2014, September). *Telexchange.org*.
27. Commissioner Clyburn also took issue with this determination (2017 BDS Order, p. 193).
28. 2017 BDS Order, par. 262
29. *Ibid.*, par. 263
30. *Ibid.*, par. 264
31. The "Rysman White Paper" refers to the following: Rysman, M. (2016). Empirics of Business Data Services (White Paper). Federal Communications Commission.
32. Rysman White Paper, 2016, Tables 1 and 12
33. We added 2016 results to Professor Rysman's Table 3. In the process, we were not always able to duplicate the results for 2013 to 2015 listed in Professor Rysman's table.
34. Vertical Systems Group's "Ethernet LEADERBOARD" ranking of the top carriers (measured by retail ports) provides additional information about the relative magnitudes of BDS providers. The 2013 ranking (starting with the largest provider) was AT&T, Verizon, tw telecom (acquired later by Level3), Century Link, Time Warner Cable, Cox, XO, Comcast, and Level3 as referenced in: 2013 U.S. Carrier Ethernet Leaderboard (2014, February 12). *Vertical Systems Group*. The 2016 ranking has changed to AT&T, Level3, Spectrum Enterprise (which includes services provided by Charter, Time Warner Cable, and Bright House cable), Verizon, Century Link, Comcast, XO, Windstream, and Cox as referenced in: 2016 U.S. Carrier Ethernet Leaderboard (2017, February 23). *Vertical Systems Group*.

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35. Windstream operates as an incumbent in some locations and as a competitive telecommunications carrier in others. It is classified as an incumbent in Table 2 because most of its BDS revenue appears to be from its incumbent operations.
36. For example: Veljanovski, C. (2007). *Economic Principles of Law*. Cambridge, UK: Cambridge University Press.
37. Ibid., pp. 113
38. Ibid., pp. 158
39. Ayres, I. & Gertner, R. (1989). Filling the gaps in incomplete contracts: An economic theory of default rules. *The Yale Law Journal*, 99(1), 87-130.
40. Ibid., pp. 98
41. Veljanovski, C. (2007). *Economic Principles of Law*. Cambridge, UK: Cambridge University Press.
42. Ibid., pp. 138-139
43. For example: Hermalin, B. E., & Katz, M. L. (1993). Judicial modification of contracts between sophisticated parties: A more complete view of incomplete contracts and their breach. *Journal of Law, Economics, and Organization*, 9(2), 230-255. Also, Verizon's Commitment Discount Plans and National Discount Plans illustrate such a menu (2016 BDS Order, par. 98).
44. 2016 BDS Order, par. 95
45. Ibid., par. 96
46. Loughridge, J. (2011). The case for IP backhaul. *The Internet Protocol Journal*, 14(3).
47. For example: Crew, M., & Kleindorfer, P. (2006). Regulation, pricing, and social welfare. In M. Crew, & D. Parker (Eds.), *International Handbook on Economic Regulation*, Edward Elgar Publishers. Another example: Sappington, D. E.M., & Weisman, D. L. (2010). Price cap regulation: What have we learned from 25 years of experience in telecommunications. *Journal of Regulatory Economics*, 38(3) 227-257. Sappington and Weisman (2010) explain, "When this political pressure is so intense as to preclude substantial earnings for the firm, the potential gains from PCR [price cap regulation] will be limited, and so PCR may not be implemented" (p. 245). They also note (p. 249) that once certain retail prices are capped and no longer reflect an specific earnings expectation (rate of return), regulators may be less concerned about the firm's earnings, providing as an example that fact that unbundled network element rates, which would facilitate entry and a concomitant erosion of the incumbent's volumes, tended to be lower in states with price cap regulation.
48. Bernier, P. (2015, September 22). Alcatel-Lucent urges power companies to plan transitions as TDM networks sunset [Blog post]. *TMCNet*.
49. The 2017 BDS Order does not roll back prices for legacy services subject to price cap regulation. As some commentators on the 2016 BDS Order observed, the earlier-proposed price roll-back would inhibit the transition to superior technology, and in the process, would seem to be inconsistent with the FCC's concern that certain contract terms inhibit a purchaser from transitioning to Ethernet services (2016 BDS Order, par. 117). For example: Glass, V., & Tardif, T. (2017). Re-regulation of business data services. *Rutgers Business Review*, 2(1), 84.
50. For example see repeated games: Varian, H. (Ed.). (1992). *Microeconomic Analysis Third Edition*. New York: W. W. Norton and Co., p. 269-270.
51. For example: Rohde, D. (1995). Tariff 12 ruling may save users money. *Network World*, 12(24), 17.
52. Similar tariff elements are listed in Tariff 5 - Internet Access Services (Section 16). (2011). *National Exchange Carrier Association*. p. 979.

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53. Faulhaber, G. (1975). Cross-subsidization: Pricing in public enterprises. *American Economic Review*, 65(5), 966-977.
54. In fact, the 2017 BDS Order removes BDS services not subject to price cap regulation from tariffs and further extends the availability of contracts in areas still subject to price regulation. See 2017 BDS Order, par. 155 and 157.