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Telecom Regulatory Authority of India

Consultation Paper on

Review of Tariff for Domestic Leased Circuits (DLCs)

New Delhi, India

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Written inputs/ comments on the Consultation Paper titled 'Review of Tariff for Domestic Leased Circuits (DLCs)' are invited from stakeholders by 22.02.2026. The inputs/ comments may be sent, preferably in electronic form, to Shri D Manoj, Principal Advisor (Financial & Economic Analysis), TRAI on the email ID at pradvfea@trai.gov.in, which will be posted on the TRAI's website (www.trai.gov.in).

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Chapter – I

Introduction and Background

A Overview of Domestic Leased Circuits (DLCs)

1.1. A domestic leased circuit (DLC) is a dedicated, private telecommunication link connecting two or more customer locations within the same country, provided on lease by a licensed operator. These circuits are leased by enterprises, institutions, and government bodies to ensure secure, high-speed, and uninterrupted data transmission. Besides, TSPs/ISPs lacking transmission infrastructure in specific regions also rely on leasing DLC to offer services like internet access and other telecommunication solutions to their customers.

1.2. DLCs are foundational to enterprise connectivity, enabling secure communication between data centers, branch offices, and operational hubs. They are widely used in sectors such as banking, Information Technology (IT)/ Information Technology Enabled Services (ITES), healthcare, education, and government services. Their reliability and performance make them indispensable for applications requiring low latency and high throughput.

1.3. The circuits can be provisioned using various technologies, including copper, optical fiber and wireless media. With the evolution of telecom infrastructure, fiber-based DLCs have become the norm due to their scalability and efficiency. The advent of satellite communication may also provide new avenues for provisioning of leased circuits. DLCs are mainly offered in bandwidths ranging from 2 Mbps to 10 Gbps, and even higher capacities in some cases.

1.4. DLCs are categorized into two main types: Point-to-Point DLCs (P2P-DLCs) and Virtual Private Networks (VPNs). While P2P-DLCs provide a direct link between two locations, VPNs use shared infrastructure to create logical circuits, often leveraging MPLS (Multiprotocol Label Switching) technology. VPNs have gained popularity due to their flexibility and cost-effectiveness.

1.5. The demand for DLCs has surged with the rise of cloud computing, video conferencing, and Enterprise Resource Planning (ERP) systems. Businesses require dedicated links to ensure seamless access to cloud services and real-time data exchange. DLCs provide the backbone for such connectivity, ensuring data security and performance.

1.6. In India, DLCs are currently offered by National Long-Distance Operators (NLDOs) and Access Service Providers (ASPs) under the Unified License regime. Major players in provisioning of DLCs include both Public Sector Undertakings (PSUs) and the private sector. PSUs such as Bharat Sanchar Nigam Limited (BSNL), RailTel and Power Grid Corporation of India Limited (PGCIL), as well as private players like Airtel, Reliance Jio, Tata Communications, Vodafone Idea and others offer DLC to clients. These service providers offer DLCs across urban, semi-urban, and rural areas. The quality of service and its pricing varies depending on the region, SLA agreements between the providers and clients etc.

1.7. Regarding provisioning of DLCs/ Virtual Private Networks (VPNs) under ISP authorisation, the Authority in September 2024[1] had held that the regulatory regime should be such that it facilitates the ISPs to fully exploit their network infrastructure and resources in providing the whole range of services. Further, it had noted that given the current scope of NLD services at pan-India level, and limited number of NLDOs, it is unlikely that such NLDOs would be able to cater to demand for leased circuits/ VPN services from non-enterprise class of users i.e. individual, SME, co-operatives etc. operating from Tier-2/ Tier-3 and rural habitations. Accordingly, the following had been recommended in September 2024[2]:

"*2.116 the scope of Internet Service authorisation under the Telecommunications Act, 2023 should also include the provision of Domestic*

[1] https://trai.gov.in/sites/default/files/2024-11/Recommendation_18092024.pdf
[2] https://trai.gov.in/sites/default/files/2024-11/Letter_to_Secy_18092024.pdf

Leased Circuits (DLCs)/ Virtual Private Networks (VPNs). In other words, an authorised entity, having an authorisation to provide Internet Service under the Telecommunications Act, 2023 should be permitted to also provide Domestic Leased Circuits (DLCs)/ Virtual Private Networks (VPNs)."

The Department of Telecommunications then formalized this in the Draft Telecommunications (Authorisation for Provision of Main Telecommunication Services) Rules, 2025, released on September 5, 2025[3], explicitly stating that Internet Service Providers (ISPs) would be authorised to provide domestic leased circuits.

Accordingly, with upcoming notification of new Rules, ISPs may be permitted to establish own infrastructure or lease/purchase dark fiber infrastructure from Infrastructure Provider (IP) or Digital Connectivity Infrastructure Provider (DCIP) entities and offer it as a managed DLC service. This expansion will allow ISPs to directly compete with NLD operators in the DLC market, enabling them to monetize the existing network infrastructure more efficiently, and enhance the vitality and competition in this sector.

1.8. Keeping in view the existing number of players in the DLC market, and the permission that may be granted to ISPs for provision of the same under the new Draft Telecom Rules, 2025, the following broad question is posed for inputs:

Issues for consultation:

Q1: What is expected to be the likely impact on competition and tariffs in the DLC sector, if the ISPs are permitted to provide DLCs in the future? Please provide your response with justification.

[3] https://dot.gov.in/sites/default/files/Gazette%20Notification%20of%20Draft%20Telecommunications%20%28Authorisation%20for%20Provision%20of%20Main%20Telecommunication%20S_0.pdf

1.9. The growth of Global Capability Centers (GCCs) in India has further fuelled the demand for DLCs. These centers, serving as offshore support hubs for multinational corporations, require high-capacity, low-latency links to connect with global centers/ offices. DLCs play a crucial role in enabling centralized operations and secure data exchange[4].

1.10. Technological advancements such as Software-Defined Wide Area Network (SD-WAN), Dense Wavelength Division Multiplexing (DWDM), and 5G are reshaping the DLC landscape. Enterprises now seek flexible, scalable, and burstable connectivity solutions. DLCs are evolving to meet these demands, integrating with modern network architectures and Service Level Agreements (SLAs).

1.11. In current market scenario, TSP/ISPs can acquire bandwidth capacities either by creation of own infrastructure or by leasing from other service providers. The IP-I registered companies can create, own and further lease, rent, or sell passive infrastructure to telecom licensees on mutually agreed terms, ensuring a non-discriminatory approach to service provision.[5] The IP-I category providers can also create and install active infrastructure, limited to antenna, feeder cable, Node B, Radio Access Network (RAN) and transmission system, *for and on behalf of* telecom licensees, but cannot own and share active infrastructure, as such elements should be owned by telecom licensees as per DoT Guidelines of 2009 and 2016.

1.12. The Authority recognizes the strategic importance of DLCs in India's digital transformation. DLCs form crucial building blocks for e-commerce, e-governance and high-speed connectivity for catering increased data requirements. Through periodic reviews and consultations, the Authority aims

[4] https://community.nasscom.in/communities/global-capability-centers/gcc-industry-brief-feb-2025-inductus

[5] https://eservices.dot.gov.in/ip1-registration

to ensure that DLCs remain fairly priced, competitive, and aligned with technological progress.

1.13. In order to review the tariff ceiling of DLCs, the Authority released Pre-Consultation Paper dated 29th April 2025[6] for seeking comments from industry players. Based on the comments received from various stakeholders, it is understood that in remote and hilly regions, tariffs remain high due to limited competition and infrastructure constraints.

1.14. As mentioned above, ISPs without adequate transmission infrastructure, which usually operate at LSA level (ISP B) or SSA level (ISP C), often rely on leasing DLC to offer their services, especially in remote or difficult regions. Thus, the DLC tariffs could likely have an impact on bandwidth charges incurred by ISP B&C operators. This is especially true for aforementioned small ISP players, who have not created their own active transmission infrastructure, nor are leasing dark fibre from IP-I or NLDOs to further install their own equipment and create an active data transmission path. It is learnt that most ISPs in B & C categories acquire wholesale bandwidth from larger operators, often from the ISP A category or Access Service providers, or from the bigger ISP B operators, along with leasing the optical fibre transmission links. Further, even in case of acquisition of bandwidth through peering with Internet Exchanges/ Content Delivery networks etc., the leasing of transmission links is a business cost, as the bandwidth is brought to the points of presence in the area of service. Keeping the above in mind, the following question is posed regarding the relationship between the tariffs for DLC and the bandwidth charges especially for the smaller ISP B & C players:

Issues for consultation:

Q2: What is the likely impact of tariffs for DLC on the bandwidth charges (including the transmission costs) or any other costs incurred

[6] https://trai.gov.in/pre-consultation-paper-review-tariff-domestic-leased-circuits-dlcs

by ISP operators, especially for ISP B & C operators who do not have their own transmission infrastructure? Further, what are the specific elements of DLC tariff which can be addressed in the regulation to make it more relevant for ISP B & C business? Please provide your response with justification.

B Overview of the existing tariff framework for DLCs in India

1.15. Section 11(2) of the Telecom Regulatory Authority of India Act, 1997 empowers the Authority to notify rates for various telecommunication services. In exercise of these powers, the Authority has been notifying tariff for telecommunication services including DLCs.

1.16. The Authority, while formulating the Telecommunication Tariff Order (TTO), 1999, specified distance–wise cost-based ceiling tariff for DLCs of 64 Kbps and 2 Mbps bandwidth capacities.

1.17. Subsequently, in 2004-05, the Authority reviewed the tariff for DLCs through a consultation process and restructured the tariff framework for DLC vide the TTO (36th Amendment), 2005. The ceiling tariffs for DLCs prescribed through the amended order were significantly lower than the ceiling tariffs of equivalent capacity prescribed in the year 1999. The ceiling tariffs of DLCs of 64 Kbps, 128 Kbps, 256 Kbps, 2 Mbps, DS3 (45 Mbps) and STM-1 (155 Mbps) capacities were prescribed through this TTO.

1.18. Furthermore, a significant revision came through the Telecommunication Tariff (57th & 58th Amendment) Orders issued in August 2014, which prescribed ceiling tariffs for various bandwidths for DLCs. These amendments marked a pivotal shift in the regulation of DLC tariffs by reducing the ceiling tariffs for equivalent capacities prescribed in 2005, regularising STM-4 capacity for the first time, and keeping capacities below 2 Mbps as well as VPN-based DLCs under forbearance. These changes reflected evolving market dynamics, technological advancements, and stakeholder feedback.

1.19. Under this framework, the Authority prescribed ceiling tariffs for DLCs of four key bandwidth capacities i.e. E1 (2 Mbps), DS-3 (45 Mbps), STM-1 (155 Mbps), and STM-4 (622 Mbps). These capacities were selected based on their widespread use in enterprise and telecom backhaul applications. Notably, this was the first time that STM-4 circuits, which were previously under tariff forbearance, were brought under defined ceiling tariffs.

1.20. The tariff structure remained distance-based under the 57th Amendment, 2014, consistent with earlier regulatory frameworks. The Authority provided detailed ready-reckoner tables for chargeable distances up to 500 Km, allowing service providers and customers to easily determine applicable tariffs. The ceiling tariffs for distance >500 Km were prescribed by rounding off the ceiling tariffs for 500 Km distance to the nearest thousand[7].

1.21. The chargeable distance for a DLC was defined as not exceeding 1.25 times the radial distance between the two ends of a domestic leased circuit. This provision provided fair approximation of the actual transmission path while accounting for practical network routing constraints. Further, for intermediate distances, not specified in the TTO, the Authority mandated computation of tariffs on a pro-rata basis, broadly for proportional pricing and fairness across distance bands.

1.22. The local leads, which connected customer premises to the nearest network node were also to be charged at the same ceiling tariffs as the main DLC link. In cases where leasing was not technically possible, tariff was to be on rent and guarantee basis/ special construction/ contribution or by mutual agreement. Such charging was to be cost-based, fair, transparent and reasonable. DLC providers were required to report the commercial and economic basis of these schemes to the Authority and communicate the terms and conditions to customers in a transparent manner.

[7] https://trai.gov.in/sites/default/files/2024-09/57Fifty_Seventh_Amendment_14_Jul_2014.pdf

1.23. DLCs were to be provided using spare capacity when available, and otherwise to be provided on Rent-Guarantee, special construction or Contribution basis. Service providers were required to report the commercial and economic rationale of such terms and conditions to the Authority in accordance with the Telecommunication Tariff Order, 1999.

1.24. Importantly, the DLC tariff framework, as per TTO amendments of 2005 & 2014, allowed service providers to offer discounts on the ceiling tariffs. However, such discounts were mandated to be transparent, non-discriminatory, based on defined criteria and duly reported to the Authority. This provision enabled competitive pricing while maintaining regulatory oversight. The revised tariffs reflected substantial reductions compared to the previous ceilings set in 2005.

1.25. In view of the developments in the technology and changes in market dynamics over the years, the Authority is presently examining the need for reviewing the existing ceiling tariffs for DLCs. Any proposed review will require a thorough analysis and a careful consideration of key aspects, including ensuring fair and affordable pricing, promoting healthy competition in the market, evolving technology and market dynamics and fair returns for service providers.

C Impact of emerging technologies on DLCs

1.26. Based on the comments received from various stakeholders in reply to the Pre-Consultation Paper released on 29th April 2025, it is understood that emerging technologies are reshaping the landscape of enterprise connectivity. DLCs, traditionally provisioned as point-to-point circuits, have been integrated with advanced networking solutions like Multiprotocol Label Switching (MPLS), Software-Defined Wide Area Network (SD-WAN), Dense Wavelength Division Multiplexing (DWDM) and cloud-based services. The MPLS, SD-WAN and cloud-based services are elaborated in the subsequent paragraphs.

1.27. Multiprotocol Label Switching (MPLS) has revolutionized DLC provisioning by enabling virtual private networks (VPNs) over shared infrastructure. MPLS-VPNs offer scalability, flexibility, and cost-efficiency, making them the preferred choice for enterprises.

1.28. Software-Defined Wide Area Network (SD-WAN) allows dynamic routing of traffic across multiple links, including DLCs, broadband, and LTE. It enhances performance, reduces costs, and supports cloud integration. SD-WAN enables centralized control and automation, making DLCs part of a programmable network fabric. These technologies demand flexible, usage-based pricing models.

1.29. Dense Wavelength Division Multiplexing (DWDM) is deployed on long-haul routes and is being extended to enterprise DLCs for high-capacity applications. This significantly increases the capacity of transmission network while optimizing fibre utilization and reducing transmission costs. It supports increasing data carrying capacity by increasing equipment capacity, which reduces the cost of data carrying.

1.30. Due to digital transformation and distributed application requirements, enterprises are increasingly relying on cloud services, which require high-capacity and low-latency links to connect their data centers/ edge nodes. In such scenarios, cloud based DLCs serve as the backbone for this connectivity, providing reliable and robust connections with guaranteed bandwidth capacity.

1.31. In the present scenario of increasing data demand in 5G networks and the requirements for ultra-low latency and massive device connectivity, DLCs will play an increasingly important role in backhauling 5G traffic and supporting IoT deployments in smart cities, factories and campuses. Further, application of AI driven management tools in DLCs has helped optimize the DLC network performance, predict faults and allocate network resources on a dynamic basis. These capabilities have reduced operational costs and improved service quality.

1.32. The emergence of VPNs and cloud-based services has changed the nature of enterprise connectivity. These services, though functionally similar to Point to Point - DLCs, are not covered under the existing tariff framework. The Authority intends to evolve its regulatory approach to support innovation, competition, and digital transformation while ensuring affordability and accessibility.

D Rationale for reviewing ceiling tariffs for DLCs

1.33. The rationale for reviewing ceiling tariffs for DLCs stems from multiple factors, including market evolution and technological progress. The same has also been mentioned in the stakeholder feedback on Pre-Consultation Paper dated 29th April 2025 on DLCs. It is felt that the existing framework, based on the 2014 TTO amendment, needs to be updated to be relevant to evolving dynamics of the DLC ecosystem.

1.34. The cost of bandwidth has declined significantly due to advancements in transmission technologies. Fiber optics, DWDM, and SD-WAN have reduced the unit cost of long-haul bandwidth. However, ceiling tariffs have not been revised to reflect these changes.

1.35. The market has become more competitive, especially in urban and industrial corridors. Service providers offer tariffs well below the prescribed ceiling in dense routes, indicating that the prescribed ceilings tariffs may not reflect prevailing tariffs in the market. In contrast, remote and hilly regions continue to face high tariffs due to limited competition.

1.36. The rapid technological advancement in DLCs ecosystem and provisioning of DLC services includes service-level agreements (SLAs), uptime guarantees, enterprise demand flexibility or scalability. The existing ceiling tariffs might not factor in these requirements into the tariff framework.

1.37. The digital transformation of India's economy demands robust and affordable connectivity. DLCs are critical to enterprises in healthcare, education, banking and IT/ITeS sector. High tariffs can impact the deployment and usage of DLCs and hence impede digital inclusion and economic growth.

1.38. The Authority's mandate includes promoting competition, protecting consumer interests, and ensuring fair pricing. A review of ceiling tariffs is essential to fulfil this mandate and align the regulatory framework with current market needs.

E Objective and Scope of the Consultation Paper

1.39. The primary objective of this Consultation Paper is to review the existing ceiling tariff framework for DLCs and to propose a revised model that reflects current market conditions and technological advancements. The review also takes into account stakeholder suggestions, including the assessment of the need for tariff ceilings for higher bandwidth capacities.

1.40. The present consultation seeks to assess the relevance of the 2014 tariff ceilings in today's context. It aims to determine whether these ceilings continue to serve their intended purpose or require recalibration based on technological evolution, cost trends and market dynamics.

1.41. During the pre-consultation process, the stakeholders suggested to explore alternative pricing models, such as cost-based model, dynamic pricing approaches (Long Run Incremental Cost - LRIC) and staggered pricing structures. These models could enhance transparency, promote efficient resource utilization, and ensure affordability across regions.

1.42. The consultation also aims to address the tariff framework for VPNs and other technology based DLCs. It will examine whether these services should be brought under the tariff framework and, if so, how they should be priced. The Pre-Consultation Paper dated 29th April 2025 on review of tariff for Domestic

Leased Circuits (DLCs) explicitly raised the issue of impact of new technological advancements on the evolving DLC ecosystem and associated tariff considerations[8].

1.43. The scope of present Consultation Paper includes evaluating the impact of technological innovations and market changes on DLC provisioning. This covers SD-WAN, Ethernet over fibre, DWDM, Cloud based DLCs, and evolving service delivery models including features such as SLA, uptime guarantees etc. The consultation will seek to assess the linkage between tariffs and service outcomes and value delivery.

1.44. Stakeholder feedback will be critical to shaping the recommendations. The consultation looks forward to inputs from TSPs/ ISPs, industry associations, consumer groups, academic institution and other stakeholders. Their views will form the design of a balanced and forward-looking tariff framework.

1.45. The consultation will also consider international best practices and regulatory models. It will analyse how other countries have addressed DLC pricing and whether those approaches can be adapted to the Indian context.

1.46. Through this consultation, Authority seeks to create a tariff framework that is fair and aligned with India's digital aspirations, with an overall objective of promoting transparency and competition in the DLC market and facilitating equitable and affordable access to DLCs across regions and categories of users. The revised model should promote innovation, competition, and consumer welfare while ensuring sustainable business models for service providers.

1.47. In this background, this Consultation Paper has been prepared to solicit comments from stakeholders on the 'Review of Tariff for Domestic Leased Circuits'. Chapter I provides background and introduction to the Consultation

[8] https://trai.gov.in/sites/default/files/2025-04/CP_29042025.pdf

paper. Chapter II deals with technological architecture of DLCs and the market and regulatory structure for DLCs in India. Chapter III deals with tariff structure and various models underpinning DLC tariffs. Chapter IV summarizes the issues for consultation.

Chapter – II

DLCs: Technology, Market & Regulation in India

A Approaches of provisioning DLCs

2.1. Domestic Leased Circuits (DLCs) can be provisioned using various models that cater to different enterprise needs. The most traditional model is the Point-to-Point (P2P) DLC, which provides a dedicated link between two fixed locations. The P2P-DLC connects two offices/ locations of a customer through a dedicated transmission bandwidth. It provides high level of security and reliability to the customer. The customer receives an end-to-end dedicated transmission bandwidth between its offices/ locations i.e. the bandwidth leased out to a customer is not shared with any other customer. Thus, the communication through P2P-DLC is fully secure and customer always gets a guaranteed bandwidth.

2.2. In case a customer places a request to a service provider to link its two offices (office-1 and office-2) through a DLC, the service provider would connect the office-1 and office-2 through two modes; (i) point-to-point DLC (P2P DLC); (ii) Virtual private networks. The two modes are explained in subsequent paras.

(i) P2P-DLC

2.3. Through P2P-DLC, the service provider would connect the office-1 and office-2 with its nearest point-of-presence (POP). The service provider would have to connect the middle segment between the two POPs using its core network. This may be explained with the help of the following diagrams:

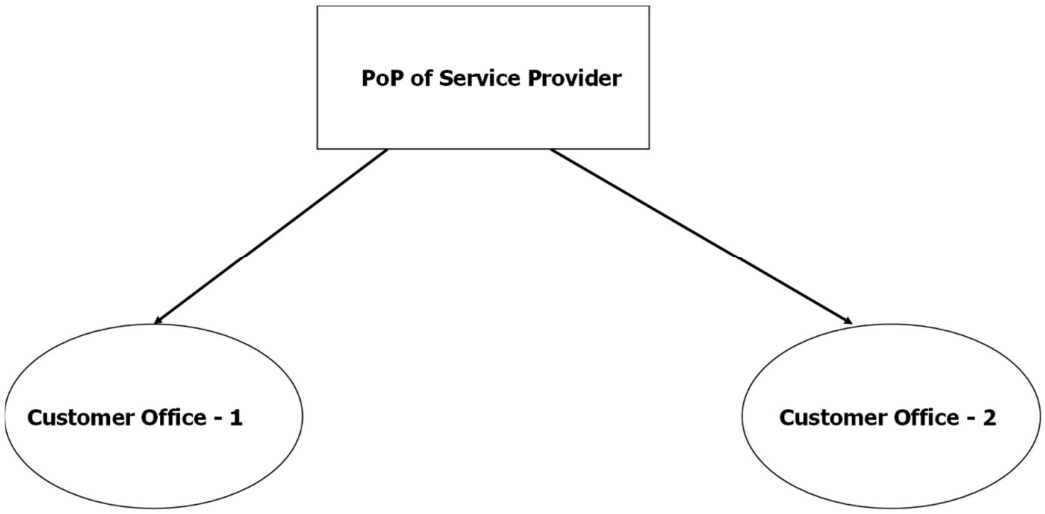

Figure-2.1: Connecting two offices through the same POP of the TSP

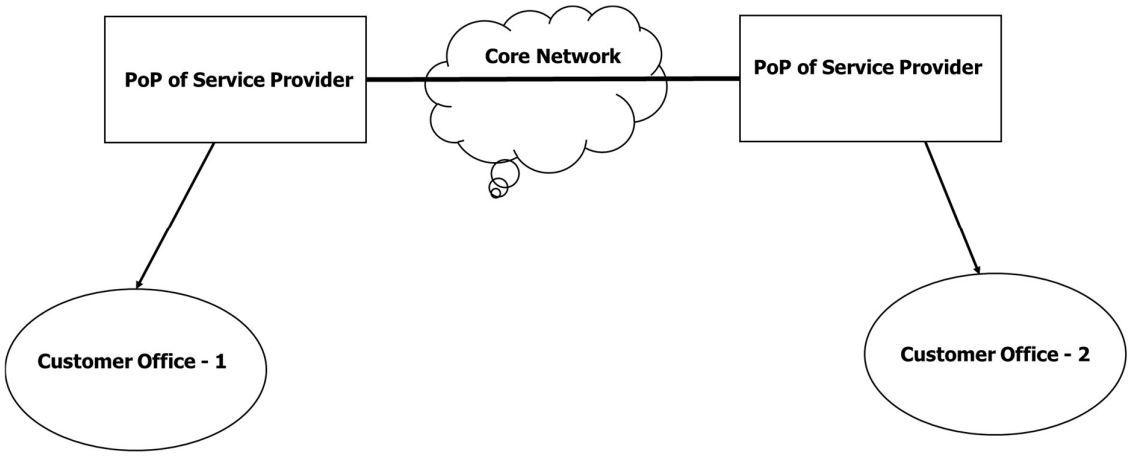

Figure-2.2: Connecting two offices through different POPs using Core Network of the TSP

2.4. In the above figures, the segment connecting the customer office with the POP of the service provider is termed as 'end-link' or 'local-lead' whereas the segment between the two POPs is called 'trunk segment'. Thus, a P2P-DLC generally comprises of one trunk segment and two local leads.

(ii) VPN

2.5. The VPN is a network technology that creates a secure network connection between two or multiple offices of a customer over a public network of a service provider. Though VPN is not a private leased circuit, it provides the functionality of a private leased circuit across a shared network. Typically, the enterprises subscribe for VPNs so that their remote offices can get a secure access to their organization's network resources (e.g. customer resource management data base).

2.6. There are a number of VPN protocols that secure the transport of customer's traffic over a public network infrastructure. By encrypting data at the sending end and decrypting it at the receiving end, these protocols send the data of a customer through a 'tunnel' that cannot be entered into by any other data.

2.7. In case an enterprise desires to connect 'n' number of its offices by connecting every other site using P2P-DLC of a service provider, it would require n*(n-1)/2 number of P2P-DLCs. On the other hand, it can subscribe a VPN by connecting each site with a single link to the public network (such as MPLS network) of a TSP which would require only 'n' number of links. This can be illustrated with the help of the following figures:

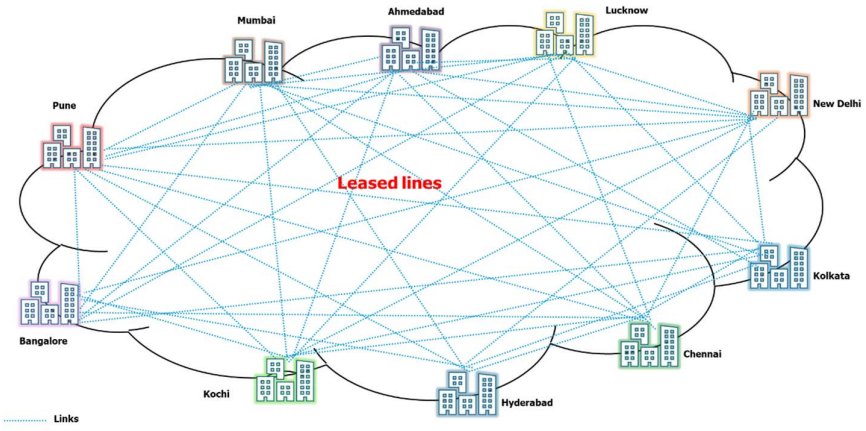

Figure 2.3: Connecting 'n' offices of a customer using P2P-DLCs

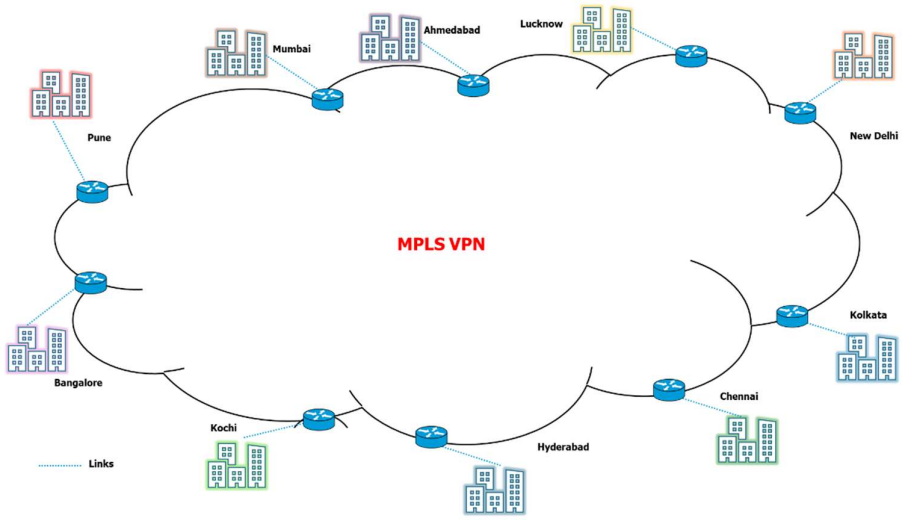

Figure 2.4: Connecting 'n' offices of a customer using VPN

2.8. Enterprise customers with many geographically dispersed offices across the country like to have end to end connectivity from its one office to another and based on its requirement seek P2P or VPN link. The service providers are offering DLCs through hybrid models that combine P2P and VPN features, providing bundled services with SLAs to meet specific enterprise requirements and optimize the cost-performance ratio.

Issues for consultation:

Q3: Should the MPLS-VPN DLCs be brought under the tariff regulation framework? Please provide your response with justification.

Q4: What are the key differences in cost structure and service delivery between traditional P2P-DLCs and MPLS-VPNs that should be reflected in tariff regulation? Please provide your response with justification.

Emerging technologies impacting provisioning of DLCs

2.9. With the evolving technological landscape across the country, Service Providers are increasingly adopting advanced methodologies for delivering DLCs. The technologies such as SD-WAN, Ethernet over Fibre and Dense Wavelength Division Multiplexing (DWDM) are being deployed to meet diverse connectivity needs. Each of these technologies offer distinct features & advantages and are being discussed in subsequent paragraphs. Service providers select the most appropriate solution based on specific customer requirements, ensuring optimal performance, scalability, and cost-efficiency. Service Providers are also charging tariffs based on burstable bandwidth requirements. In this case, they are offering flexible bandwidth allocation based on demand. Enterprise customers can scale their connectivity during peak hours without committing to higher fixed tariffs.

2.10. Today's network environment is a more complex mix of users, applications, devices and the cloud, all interacting with each other on a continuous basis. It connects multiple types of users (mobile network, broadband etc.) and devices across multiple networks and to add more customer locations easily. The data is carried by the trunk segment of a service provider as illustrated below:

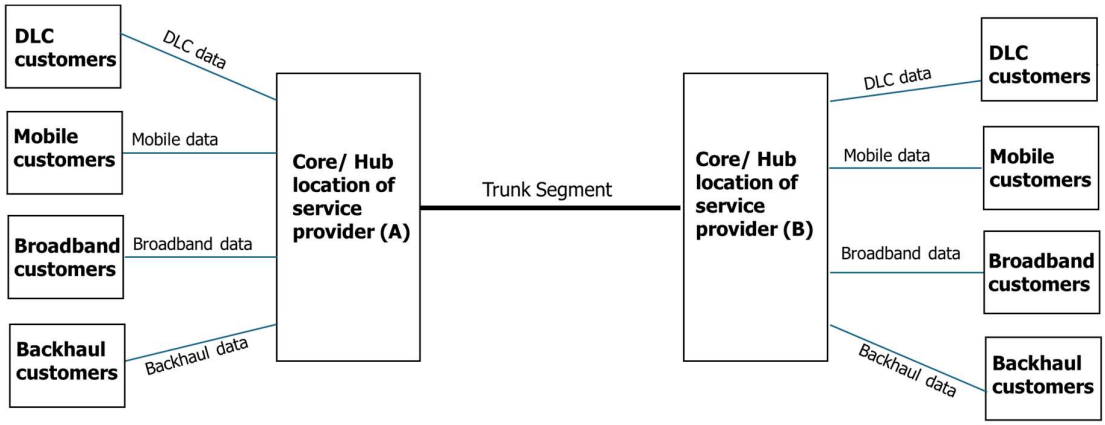

Figure 2.5: Suggestive diagram to reflect the complex scenarios of networks carrying the data of multiple type of users.

SD-WAN (Software-Defined Wide Area Network)

2.11. SD-WAN (Software-Defined Wide Area Network) is a modern networking technology that simplifies the management and operation of a wide area network by decoupling the networking hardware from its control mechanism. It enables businesses to securely connect users to applications across multiple locations using a combination of transport services like MPLS, broadband, and LTE. Based on Open Systems Interconnection (OSI) model, it operates between layer 2 and 3. It enables centralized network management, improved network visibility and increased network performance. It is suitable for large, mid and small size firms which are more cloud-native enterprises. It offers enhanced performance, agility, network resilience and reduced the operational cost of the network. Hence, the service providers are increasingly deploying SD-WAN overlays on DLC infrastructure to provide flexible, SLA-backed connectivity solutions.[9]

Ethernet over Fibre

2.12. Ethernet over Fibre is a provisioning model for enterprise businesses to connect their Local Area Networks (LANs) with the explicit public internet and reorganise their existing Wide Area Network (WAN) that delivers high-speed, dedicated connectivity using fibre-optic infrastructure. It supports symmetric bandwidths ranging from Mbps to Gbps and is widely deployed in urban and industrial zones between two offices of a customer. Based on Open Systems Interconnection (OSI) model, it operates on Layer 2 which is capable of transferring high throughput of data. This model ensures low latency, high reliability, and scalability, making it ideal for enterprises with high data throughput requirements. The service providers offer Ethernet-based DLCs as part of their managed connectivity portfolios.[10]

[9] https://www.astound.com/business/wp-content/uploads/2024/11/SD-WAN-White-Paper.pdf

[10] https://www.tccomm.com/Content/pdf/Literature/White-Paper-Network-Modernization-Leased-Lines.pdf

Dense Wavelength Division Multiplexing (DWDM)

2.13. Dense Wavelength Division Multiplexing (DWDM) is an optical transmission technology that enables multiple data streams to be transmitted simultaneously over a single fibre pair by using different wavelengths. DWDM uses single-mode fibre to carry multiple light waves of differing frequencies. It was first deployed on long-haul routes in a time of fiber scarcity. Then the equipment savings made it the solution of choice for new long-haul routes, even when ample fiber was available. This significantly increases the capacity of transmission network while optimizing fibre utilization and reducing transmission costs. DWDM is commonly used in backhaul connectivity and is being extended to enterprise DLCs for high-capacity applications.[11]

2.14. From both technical and economic perspectives, the ability to provide potentially unlimited transmission capacity is the most obvious advantage of DWDM technology. As demands change, more capacity can be added, either by simple equipment upgrades or by increasing the number of lambdas (λ) on the fiber, without expensive upgrades. Capacity can be obtained for the cost of the equipment, and existing fiber investment is retained.

2.15. DWDM's most compelling technical advantages are as below:

Transparency — DWDM is a physical layer architecture, it can transparently support different data formats and Fibre channel with open interfaces over a common physical layer.

Scalability — DWDM can leverage the abundance of dark fiber in many areas for long-haul network and enterprise networks to quickly meet demand for capacity on point-to-point links.

[11] https://www.cisco.com/c/dam/global/de_at/assets/docs/dwdm.pdf

Dynamic provisioning — Fast, simple, and dynamic provisioning of network connections give providers the ability to provide high-bandwidth services in short time.

2.16. Thus, over a period of time, especially in the last decade, the technology has changed for providing DLCs. Several study visits were undertaken by TRAI to gauge the impact of changing technologies in the provisioning of DLCs. From these visits, it has been gathered that currently, many DLCs are being provided or supported through MPLS networks as well as through SD-WAN, Ethernet on Fibre, DWDM, etc. Besides, most customers look for managed service partners instead of only network providers. Accordingly, the following questions are posed for inputs:

Issues for consultation:

Q5: What has been the impact of deployment of DWDM, SD-WAN and Ethernet over Fibre on provisioning of DLCs, in terms of operations, costs and tariffs? How should regulation incorporate these technological changes in the ceiling tariff framework? Please provide your response with justification.

Q6: Are there any other technological changes apart from the ones mentioned in above paragraphs in provisioning of DLCs in India? If yes, what has been the impact of deployment of such technologies on provisioning of DLCs, in terms of operations, costs and tariffs? How should regulation incorporate these technological changes in the ceiling tariff framework? Please provide your response with justification.

Q7: As an alternative to Q5 & Q6, should the Authority consider technology-neutral tariff models, focussing on bandwidth and service commitments rather than provisioning technologies? If yes,

what should be the criteria for the same? Please provide your response with justification.

B Evolution and growth of the DLC market in India

2.17. The demand for DLCs in India began to rise notably in the mid-1990s, coinciding with the liberalization of the telecom sector and the rapid growth of service industries such as financial services, IT, ITES, BPOs, and telecom. These sectors required reliable, high-speed, point-to-point connectivity for data transmission, which DLCs were well-suited to provide. At that time, the Department of Telecommunications (DoT) was the sole provider of DLCs, offering services primarily through its fixed-line infrastructure. The Telecommunication Tariff Order (TTO), 1999, issued by TRAI, formally recognized DLCs as a distinct service category and introduced tariff ceilings to regulate pricing and promote transparency.

2.18. During this period, the telecom access service segment was in its early stage of growth. Many new TSPs viz. cellular mobile telephony service providers basic service providers and ISPs were setting up telecommunication infrastructure in the country for providing services to their customers. While the incumbent service provider (erstwhile DoT now Bharat Sanchar Nigam Limited) had a nation- wide footprint, many of the new TSPs had a limited and scant presence in the country. In order to provide a full suite of services (e.g. local, STD, ISD), these new TSPs had to depend heavily on DoT for not only interconnection with its fixed-line network but also for long-haul and short-haul bandwidth capacities through DLCs.

2.19. The Authority, in the Consultation Paper dated 17th November 2006 on measures to enhance competition in Domestic Leased Circuits (DLC) market in India highlighted that this dependency created a bottleneck, as DoT's dominance in the DLC segment limited competition and innovation. The Authority observed that the lack of effective competition in the DLC market

was impeding the growth of downstream services and recommended measures to enhance infrastructure sharing and reduce entry barriers.[12]

C Regulatory milestones and tariff frameworks for DLCs

2.20. National Telecom Policy, 1994 emphasized the need to provide telecommunication services of world-class quality to support India's economic growth and improve competitiveness in the global market. The focus of the Telecom Policy was accessible and affordable telecom services for all. This meant ensuring the availability of telephone on demand as early as possible and to achieve universal service covering all villages as early as possible. The quality of telecom services was to be of world standard. The need to provide robust connectivity started from NTP 1994 which further fuelled the demand for DLCs in the country due to new economic policy adopted by the Government.[13] NTP 1994 also recognized that the required resources for achieving these targets would not be available only out of Government sources and concluded that private investment and involvement of the private sector was required to bridge the resource gap.

2.21. **In New Telecom Policy 1999,** National Long Distance (NLD) service beyond service area to the private operators was opened for competition with effect from January 1, 2000. To promote setting up of long-distance bandwidth capacity in the country, provide a choice to consumers and promote competition, all NLDOs were to be able to access subscribers. With a view to achieve the above, all access providers were mandatorily required to provide interconnection to the NLDOs resulting in choice for subscribers to make long distance calls through any operator. [14]

2.22. The Telecommunication Tariff Order (TTO), 1999, issued by the Authority on 9th March 1999, marked a significant milestone in the regulation of telecom

[12] https://trai.gov.in/sites/default/files/2024-09/consultationpaper17nov06.pdf
[13] https://dot.gov.in/national-telecom-policy-1994
[14] https://dot.gov.in/new-telecom-policy-1999#

services in India. For the first time, DLCs were formally recognized as a distinct service category under the regulatory framework. This inclusion was critical in ensuring transparency, non-discrimination, and affordability in the pricing of leased line services, which were increasingly being used by enterprises, ISPs, and telecom operators for dedicated point-to-point connectivity.

2.23. Under the TTO, 1999, the Authority prescribed tariff ceilings for various bandwidth capacities of DLCs, including 64 kbps and 2 Mbps. The order mandated that service providers adhere to these ceilings while offering DLCs to customers, thereby curbing arbitrary pricing and promoting fair competition. The tariff structure was designed to be technology-neutral and service-agnostic, allowing DLCs to be used across different transmission media such as copper, fiber and microwave. Additionally, the order introduced the principles of forbearance and reporting, requiring service providers to notify TRAI of any tariff changes and to publish standard packages for consumer awareness.

2.24. The regulation of DLC tariffs through TTO, 1999, laid the foundation for subsequent reforms in the leased circuit market. It enabled new telecom service providers to access bandwidth at regulated rates, facilitating interconnection and network expansion. The move also addressed concerns raised by industry stakeholders regarding high leased line costs and lack of competition. By bringing DLCs under tariff regulation, the Authority ensured that these essential services could support the growth of IT, BPO, and digital services in India's liberalized telecom environment.[15]

2.25. Department of Telecommunications (DoT) announced on 13th Aug 2000 the guidelines for entry of private sector in the NLD services without any restriction on the number of operators. As a result, apart from the incumbent operator viz. Bharat Sanchar Nigam Limited (erstwhile DoT), three new operators entered NLD segment viz. Bharti Airtel Limited (BAL), Reliance Communication

[15] https://trai.gov.in/sites/default/files/2024-09/Main_Regulations_09_Mar_1999_0.pdf

Limited (RCL) and Videsh Sanchar Nigam Limited (VSNL) (now TATA Communications Limited).

2.26. Between 2001 and 2004, India witnessed a transformative phase in its telecommunications infrastructure, driven by the emergence of a new set of National Long Distance Operators (NLDOs). These operators made substantial investments in expanding the country's long-distance bandwidth capacity, marking a significant shift in the telecom landscape. Their efforts led to the laying of several thousand kilometers of optical fibre cables (OFC) across the nation, covering both urban and rural regions. This massive deployment of OFC created a robust backbone for data transmission, enabling high-speed connectivity between major cities and towns. The demand for other applications like tele-banking, tele-medicine, tele-education, tele-trading, e-commerce was also increasing in the country which further created demand for high bandwidth capacity requirements.

2.27. As the supply of bandwidth surged, particularly in inter-city routes, the DLC segment began to experience competition for the first time. Previously dominated by a few players, the DLC market opened up, allowing enterprises and service providers to choose from multiple bandwidth suppliers. This competitive environment led to improved service quality, reduced tariffs, and greater innovation in bandwidth offerings. The increased availability of long-distance capacity also supported the growth of internet services, enterprise connectivity, and digital applications across sectors. Overall, the investments made by NLDOs during this period laid the foundation for a more open, efficient, and competitive telecom ecosystem in India.[16]

2.28. This was also the time when Business Process Outsourcing (BPO) business in India was entering into its growth phase backed with the emergence of third party BPOs and entry of IT majors into the business. These BPOs required

[16] https://cms.trai.gov.in/sites/default/files/2024-11/20140428042531189622 5ISPAI%20%28Internet%20Service%20Providers%20Association%20of%20India%29.pdf

reliable, scalable and affordable bandwidth capacities to connect to their domestic and international customers. While bandwidth capacities built on OFC by the new NLDOs were highly reliable and easily scalable, the emerging competition in DLC segment helped BPOs in getting much cheaper tariff for DLCs. This contributed to the growth of BPOs in the country in a big way.[17]

2.29. The tariff framework applicable to DLCs underwent a significant revision through the Telecommunication Tariff Order (TTO), 36th Amendment, issued in 2005. This amendment replaced the earlier Schedule IV of the TTO and introduced a major restructuring of DLC tariffs. The revised framework introduced distance-based ceiling tariffs for a wider range of bandwidth capacities, including 64 kbps, 128 kbps, 256 kbps, E1 (2 Mbps), DS-3 (45 Mbps), and STM-1 (155 Mbps). The tariffs were specified as ceilings, allowing service providers the flexibility to offer lower rates. Discounts, if offered, were mandated to be transparent and non-discriminatory, subject to reporting requirements.

2.30. The 36th amendment, 2005[18] mandated that DLCs be provided using spare capacity when available, and when not, on Rent and Guarantee Terms or Special Construction/Contribution basis. Service providers were required to report the commercial and economic basis of such terms to the Authority. Tariffs for local leads or end links were also regulated under the ceiling structure, with provisions for alternative arrangements if technical constraints existed. Additionally, the amendment included specific provisions for E1 links for ISPs, detailing port charges and tariffs for leased lines and local leads.

2.31. The ceiling tariffs were determined using a bottom-up cost model based on network element costs provided by operators. The Authority chose not to adopt the Forward Looking Long Run Incremental Cost model to avoid market disruption and ensure a smooth transition. The Authority emphasized that the

[17] https://trai.gov.in/sites/default/files/2024-09/CP_on_Review_of_Tariff_for_DLC_24.03.2014_Final_0.pdf

[18] https://trai.gov.in/sites/default/files/2024-09/36Thirty_Sixth_Amendment_21_Apr_2005.pdf

revised tariffs would stimulate demand, improve utilization of network capacity, and foster a competitive environment. It was noted that the DLC market lacked effective competition, and further measures to enhance competition were to be considered in subsequent consultations. The Authority also highlighted the potential for explosive market growth, drawing parallels with the mobile sector, and reiterated the importance of affordable bandwidth for broadband expansion, especially in rural and remote areas. The 38th amendment to the TTO, notified on 2nd June 2005, was introduced to address the provisioning of 64 kbps, 128 kbps, and 256 kbps circuits using Managed Leased Line Network (MLLN) technology[19].

2.32. The Authority in the Consultation Paper dated 17th November 2006 recommended further liberalization of the National Long Distance (NLD) license framework to promote competition and improve enterprise connectivity. The key regulatory shift was the permission granted to NLD operators to directly access subscribers for providing leased circuits and data services to Closed User Groups (CUGs), which was previously restricted. This change enabled NLD licensees to offer end-to-end connectivity, including last-mile access, thereby enhancing service delivery for enterprise customers. The recommendations also aimed to simplify licensing norms and encourage infrastructure investment by making the NLD license more commercially viable. These reforms laid the groundwork for a more competitive bandwidth market and supported the growing demand for reliable leased line services.

2.33. The Authority notified the DLC regulations on 14th September 2007 to address the persistent issue of limited competition in the segment. These regulations were designed to ensure that DLCs and associated local leads were made available to all eligible service providers in a fair, transparent, and non-discriminatory manner. The framework mandated that any service provider licensed to offer DLCs must provide access to other service providers upon request. It laid down a clear procedural mechanism for making such requests,

[19] https://trai.gov.in/sites/default/files/2024-09/38Thirty_Eighth_Amendment_02_Jun_2005.pdf

including defined timelines for provisioning and obligations for responding to feasibility queries. This was a significant step toward improving inter-operator access and fostering competition in the enterprise connectivity space[20].

2.34. Further, the regulations specified the commercial arrangements under which DLCs and local leads could be provided. These included standard provisioning, Rent and Guarantee Terms, and Special Construction/Contribution Basis, depending on the feasibility and availability of infrastructure. The regulations also required service providers to maintain records of non-feasibility responses and report them to the Authority, thereby enhancing accountability. By formalizing these provisions, the Authority aimed to improve the availability and affordability of DLCs, especially for smaller operators and enterprise customers, and to promote a more competitive and efficient bandwidth market across the country. Through these regulations, an obligation was imposed on all service providers who had the capacity of copper, fibre or wireless, and who were allowed under the license to provide DLC.

2.35. Due to liberalized licensing regime for NLD services, new players entered the NLD market. As the NLDOs could now access the subscribers directly for provision of leased circuits/ closed user groups, many NLDOs built not only long distance (trunk) transmission infrastructure but also the local area networks in order to serve their customer directly. As a result, a significant competitive activity was witnessed in the retail market of the DLCs which drove the prices further downwards. The new breed of players started offering MPLS-VPN and a host of customized services viz. provision of Service Level Agreements (SLAs), class of service (CoS), bandwidth on demand, managed services etc. as per the requirement of the customers. The increase in customer focus of the TSPs and reduction in tariffs for DLCs owing to increased

[20] https://trai.gov.in/sites/default/files/2024-10/20120618051335912541 3regulation14sep07%5B1%5D.pdf

competition fuelled the demand of DLCs in the country particularly amongst the enterprises in the field of IT, ITES and financial services.

2.36. As per National Telecom Policy (NTP) 2012, notwithstanding the economic progress over the last decade, the digital divide in the country continued to be significant. On the one hand, expansion of telecommunications in the rural areas had been slower than urban areas. On the other, the ability of the poorer sections of the society, both in rural and urban areas, to benefit from technology needed to be enhanced. Hence, the country required robust digital infrastructure to realize the vision of "Broadband on Demand." This vision involved leveraging telecom infrastructure to enable all citizens and businesses—across both rural and urban areas—to participate in the internet and digital economy, thereby promoting equitable and inclusive development nationwide. Telecommunications was no longer limited to voice services. The evolution from analog to digital technology had facilitated the conversion of voice, data and video to the digital form. Increasingly, these were now being rendered through single networks bringing about a convergence in networks, services and also devices. Hence, it was now imperative to move towards convergence between telecom, broadcast and IT services, networks, platforms, technologies and overcome the existing segregation of licensing, registration and regulatory mechanisms in these areas to enhance affordability, increase access, delivery of multiple services and reduce cost[21].

2.37. The TTO (57th Amendment), 2014 and TTO (58th Amendment), 2014 were issued by the Authority on 14 July 2014 and 1st August 2014 respectively to revise the ceiling tariffs applicable to DLCs.

The TTO (57th Amendment), 2014 aimed to rationalize tariffs for higher bandwidths and longer distances, ensuring transparency and competitiveness. The amendment applied to DLCs with bandwidths of E1 (2 Mbps), DS3 (45 Mbps), STM-1 (155 Mbps), and STM-4 (622 Mbps). Tariffs were specified as

[21] https://dot.gov.in/sites/default/files/NTP-06.06.2012-final_0.pdf

ceiling rates, allowing service providers to offer lower prices. The amendment retained the distance-based slab structure, with intervals from 5 km up to >500 km. Tariffs for bandwidths below 2 Mbps were forborne, reflecting their declining relevance. Tariffs were determined using a bottom-up cost (BU-FAC) model, based on network element costs submitted by operators. The amendment emphasized cost recovery, service sustainability, and fair pricing, especially in difficult terrain and rural areas[22]. The other provisions of the TTO (57th Amendment), 2014 are discussed in Chapter I.

The TTO (58th Amendment), 2014 was issued to rectify the typographical errors under the column 'Ceiling tariff for DS-3 (45 Mbps)' in the Table-II in the Annexure to the Schedule IV of the Telecommunication Tariff Order, 1999.

D Present structure of the DLC market in India

2.38. Based on the progress evolving around revised license terms, since 1999 when the first TTO for DLC services was introduced, the market has transformed from being a monopolistic, nascent and growing one to a competitive and mature market. Post liberalization in Dec 2005, the NLD operators were allowed to access the customers directly for the provision of leased circuits. In 2014, there were 7 to 10 ASPs in different LSAs and 31 NLDs operators in the telecom market who could provide the DLC connectivity to the end user. As on date, multiple NLDOs and ASPs under Unified license (UL) and UL-VNOs are providing DLCs services across the country. The list of the NLD license holders is attached as **Annexure-II**.

Table 2.1: Details of NLDs and ASPs holders in India.

Year	No. of Players in DLC Market	Remarks
1999	BSNL	Single public sector operator

[22] https://trai.gov.in/sites/default/files/2024-09/58Fifty_Eight_Amendment_01_Aug_2014.pdf

Year	No. of Players in DLC Market	Remarks
2005	BSNL/MTNL, TATA, Reliance, Airtel, TTSL, HFCL and IP-II (GAIL, Power Grid, RailTel, Shyam Telelink)[23]	Entry of private operators and infrastructure providers
2014	7 to 10 ASPs in different LSAs and 31 NLDOs	Market expansion with multiple service providers
2025	71 operators for NLDs (16 NLDOs through Standalone NLD license, 38 NLDOs through UL-NLD license & 17 NLDOs through UL-NLD-VNO license)[24] and multiple ASPs under UL[25] and UL-VNO[26] licenses	Unified License regime with broader participation

2.39. In response to the Pre-Consultation Paper released by the Authority for review of the tariff for Domestic Leased Circuit (DLC), the stakeholders stated that the DLC market in India has undergone a significant transformation since the last tariff review with the shift from voice to data. The immense rise in data traffic has led to more extensive and evolved customer requirements in the provisioning of DLC viz. stringent SLA conditions, strict uptime/ downtime rules, advanced analytics etc. This has been supported by rapid advancements in transmission technology, which warrants a careful examination/ review of all the aspects. In terms of technological shifts, there are next generation multi-gigabit supporting transport/ transmission equipment up to 800GB

[23] https://trai.gov.in/sites/default/files/2024-11/20140428043039574831 1Reliance%20Communications%20Ltd.pdf

[24] https://dot.gov.in/sites/default/files/List%20of%20NLD%20Licensees_0.pdf?download=1

[25] https://dot.gov.in/sites/default/files/List%20of%20Unified%20Licenses%20issued%20by%20AS%20Wing%20as%20on%2030th%20June%202025.pdf?download=1

[26] https://dot.gov.in/sites/default/files/List%20of%20UL%20VNO%20licenses%20issued%20by%20AS%20Wing%20as%20on%2015th%20July%202025.pdf?download=1

catering to customer demands. The market is notably influenced by the rising demand for data centres and cloud services, particularly from Cloud Service Providers (CSPs) and the Banking, Financial Services, and Insurance (BFSI) sector. With AI at the core of these sectors, they are undergoing massive technological, market and consumer driven needs.

2.40. The stakeholders also highlighted that enterprise customers now demand high-speed, secure, scalable, and flexible connectivity solutions. Traditional static, distance-based DLC models are being replaced by dynamic, on-demand offerings. Additionally, customers expect integrated SLAs, seamless cloud integration, and advanced analytics. For instance, customers in sectors like BFSI, IT/ITES, healthcare, manufacturing, and government, are demanding higher bandwidth, low-latency, and highly reliable connectivity to support data-intensive applications, cloud adoption, and remote work. Further, the fiber-based solutions have become the norm due to their superior speed, uptime, and scalability. Enterprises increasingly expect managed leased line services that include network monitoring, security, support, and simplified management, rather than just raw connectivity. Customers look for end-to-end solutions that can be tailored to their specific business needs, including SLAs for uptime and performance. Moreover, enterprises also require flexible contracts and scalable bandwidth options to accommodate fluctuating needs, seasonal spikes, or rapid expansion.

2.41. The stakeholders mentioned that ongoing investment in fibre networks coupled with data center expansion and network modernisation, reflected strong commercial incentives among service providers to meet growing enterprise demand. It is understood that the service providers keep upgrading their transmission networks on a regular basis in order to meet the demand of their customers. As per stakeholders' inputs, the pricing of DLCs is determined through commercial negotiations, with rates varying by diversity (path, route and service redundancy), location, bandwidth, SLA terms and bundled configurations. It is also understood that multiple providers, including Pan-

India operators, regional players and IP-1s, offer DLCs and alternative connectivity services. With the new Draft Authorisation Rules, ISPs may also enter this sector. This has driven sustained price competition, innovation in service offerings and customer-centric contractual models.

2.42. Accordingly, the following questions regarding evolution of DLCs as a managed service, and its linkage with tariffs, are posed below:

Issues for Consultation:

Q8: What are the various service commitments (such as bandwidth, SLA requirements such as uptime, latency, packet loss, response time etc.) bundled as part of managed DLC service, for both P2P & VPN based DLC? How are the service commitments, offered as part of managed DLC services, linked with tariffs? Please provide your response with justification.

Q9: Should the proposed regulation include staggered tariffs in line with service commitments, possibly further staggered for different regions, for both VPN & P2P based DLC? If yes, what are the service commitments, mentioned as reply to Q8, which should be considered for tariff regulation?

2.43. TRAI conducted visits in the North region, North-Eastern Region (NER) specifically Shillong and the Southern region, with the objective of assessing the existing infrastructure, technological developments, and evolving cost components associated with the deployment of DLCs. The team aimed to collect relevant data to support ongoing regulatory reviews and policy development. Interactions with service providers and a review of pricing and tariff-related records were useful in developing a grounded perspective on service delivery in the area.

2.44. From the visit to the NER, the team observed that a limited number of ISPs currently offer leased line services in the region. Cost structures, infrastructure deployment choices, and bandwidth procurement practices directly influence service delivery and pricing. Smaller ISPs and VNOs face significant cost disadvantages due to unfavourable market dynamics in bandwidth pricing.

2.45. Currently, the existing DLC market is growing year-on-year due to rising demand across various sectors in the country. Based on data received from major service providers, approximately 4.3% of their total Adjusted Gross Revenue (AGR) in FY 2023-24 comes from DLC services, which is 0.6% higher than in FY 2012-13. The total revenue earned by service providers from DLCs in FY 2023–24 is around INR 13,300 crores, which is approximately 60% higher than the revenue earned in FY 2012–13.

2.46. Based on the data submitted by the service providers, it is understood that DLCs are being provided through both Point-to-Point (P2P) and Virtual Private Network (VPN) technologies. In FY 2023–24, P2P DLCs accounted for 53% of the total DLC market revenue, while the remaining 47% came from VPN-based DLCs. In comparison, in 2014, P2P DLCs held a 70% market share, and VPN-based DLCs only 30%. This indicates a clear trend toward VPN-based DLCs. The market share distribution between P2P and VPN-based DLCs is illustrated below:

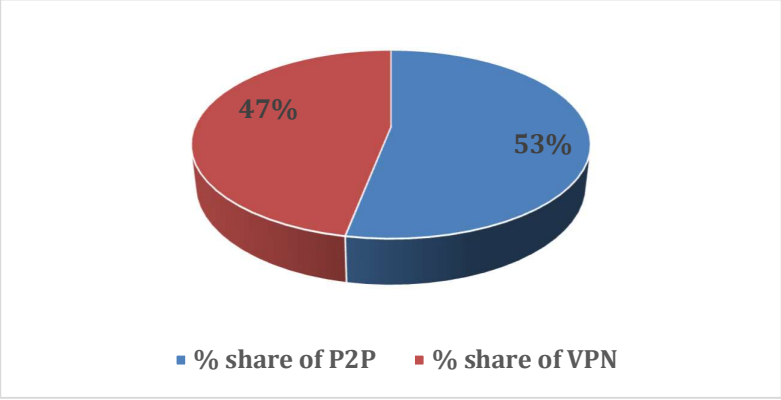

Figure 2.6: Current market share of P2P and VPN based DLCs.

E Prevailing tariff of DLCs in Indian market

2.47. The Authority requested information regarding tariffs across various capacities for DLCs (both P2P and VPN-based) from all service providers. In response, some service providers shared their current tariff details with the Authority. Based on the data received, it is understood that service providers offer significant discounts to customers depending on factors such as bandwidth, distance, location, volume of business, and duration of commitment. These price discounts are generally much higher on densely trafficked routes. The table below provides details of the maximum discounts offered by major service providers on their base tariffs for select routes:

Table 2.2: Maximum discounts offered by major Service Providers for P2P-DLCs of <50 Km distance on their base tariffs on select routes

S. No.	Capacity of DLC (P2P)	Maximum discount (in %) on their base tariff for P2P-DLC of <50 Km			
		SP-1	SP-2	SP-3	SP-4
1	> 2 Mbps	74%	74%	--	40%
2	10 Mbps	94%	--	--	40%
3	45 Mbps (DS-3)	97%	74%	64%	44%
4	155 Mbps (STM-1)	95%	90%	79%	45%
5	622 Mbps (STM-2)	--	90%	82%	41%
6	1 Gbps	96%	--	97%	38%
7	2.5 Gbps (STM-16)	--	90%	93%	43%
8	10 Gbps (STM-64)	--	90%	94%	55%
9	40 Gbps	--	--	74%	--
10	100 Gbps	--	--	53%	--

S. No.	Capacity of DLC (P2P)	Maximum discount (in %) on their base tariff for P2P-DLC of <50 Km			
		SP-1	SP-2	SP-3	SP-4
11	200 Gbps	--	--	88%	--
12	300 Gbps	--	--	88%	--
13	400 Gbps	--	--	--	--
14	500 Gbps	--	--	27%	--
15	600 Gbps	--	--	47%	--
16	700 Gbps	--	--	--	--
17	800 Gbps & above	--	--	88%	--

Table 2.3: Maximum discounts offered by major Service Providers for P2P-DLCs of >500 Km distance on their base tariffs on select routes

S. No.	Capacity of DLC (P2P)	Maximum discount (in %) on their base tariff for P2P-DLC of >500 Km			
		SP-1	SP-2	SP-3	SP-4
1	> 2 Mbps	93%	97%	30%	50%
2	10 Mbps	98%	--	--	50%
3	45 Mbps (DS-3)	96%	50%	76%	56%
4	155 Mbps (STM-1)	99%	95%	81%	55%
5	622 Mbps (STM-2)	--	--	86%	47%
6	1 Gbps	99%	--	97%	56%
7	2.5 Gbps (STM-16)	--	90%	79%	43%
8	10 Gbps (STM-64)	--	90%	74%	44%
9	40 Gbps	--	--	92%	--
10	100 Gbps	--	--	69%	--
11	200 Gbps	--	--	48%	--
12	300 Gbps	--	--	71%	--
13	400 Gbps	--	--	66%	--

S. No.	Capacity of DLC (P2P)	Maximum discount (in %) on their base tariff for P2P-DLC of >500 Km			
		SP-1	SP-2	SP-3	SP-4
14	500 Gbps	--	--	65%	--
15	600 Gbps	--	--	--	--
16	700 Gbps	--	--	76%	--
17	800 Gbps & above	--	--	78%	--

2.48. Based on the information received from service providers, it is observed that discounts in the range of 30% to 99% in case of P2P-DLCs are being provided.

2.49. It can be seen that market share of VPN based DLCs has increased significantly in the last decade and as suggested by major industry players, the VPN based DLCs is likely to be the norm in future. The current TTO (57th & 58th Amendment), 2014 has kept VPN based DLCs under forbearance. It can be seen from the data received from major service providers that wide range of discounts are being provided on base tariffs to customers. The table below provides details of the maximum discounts offered by major service providers on their base tariffs for select routes:

Table 2.4: Maximum discounts offered by major Service Providers for VPN based DLCs on their base tariffs on select routes.

S. No.	Capacity of DLC (VPN)	Maximum discount (in %) on their base tariff for VPN based DLCs			
		SP-1	SP-2	SP-3	SP-4
1	> 2 Mbps		59%	20%	98%
2	10 Mbps		72%	20%	96%
3	45 Mbps (DS-3)			20%	94%
4	155 Mbps (STM-1)			20%	89%
5	622 Mbps (STM-2)			20%	81%

S. No.	Capacity of DLC (VPN)	Maximum discount (in %) on their base tariff for VPN based DLCs			
		SP-1	SP-2	SP-3	SP-4
6	1 Gbps		76%	20%	78.20%
7	2.5 Gbps (STM-16)			20%	60%
8	10 Gbps (STM-64)			20%	
9	40 Gbps & above	--	--	--	--

2.50. Based on the information received from service providers, it is observed that discounts in the range of 20% to 98% in case of VPN based DLCs are being provided.

2.51. The role of discounts had been acknowledged by TRAI in its previous regulations as well. To ensure transparency, non-discrimination and fairness in discounts being offered, the Authority had mandated reporting requirements in the 57th Amendment to TTO in 2014. It is sought to further define the reporting requirements so as to facilitate the aforementioned principles in DLC tariffs. Accordingly, the following questions are posed for inputs by stakeholders:

Issues for Consultation:

Q10: What reporting mechanisms should be mandated to ensure transparency in discounts and service bundling for DLCs? Please provide your response with justification.

Q11: Should the Authority mandate standardized tariff disclosure formats for all DLC service providers? Please provide your response with justification.

Chapter – III

Methodologies for determining DLC Tariffs

A Costing methodologies for tariff determination

3.1. In year 2000, the World Bank released telecommunication regulation handbook[27] which provided detailed cost methodologies for telecommunication networks. The World Bank stated that *"determining or verifying the costs for telecommunications services are among the most difficult challenges facing regulators. Nevertheless, cost analysis can be of crucial importance. In particular, regulators use cost analysis in setting or approving prices, including "retail" prices for consumers and "wholesale" prices for competitors (e.g. interconnection and unbundled network elements, etc.), and in enforcing competition policy".*

3.2. The handbook explained in detail about cost methods such as:

(i) LRIC (Long Run Incremental Cost): it measures the cost of producing an additional unit of output over the long run, it excludes fixed and common costs.

(ii) TSLRIC / LRAIC (Total Service Long Run Incremental Cost / Long Run Average Incremental Cost): it includes service-specific fixed costs in addition to LRIC, it is more comprehensive than LRIC.

(iii) TELRIC (Total Element Long Run Incremental Cost): it is used in the U.S. for interconnection pricings, it is similar to TSLRIC but applied to network elements.

(iv) FDC / FAC (Fully Distributed/ Allocated Cost): it allocates all costs (including joint and common) to services using formulas often used in traditional accounting.

[27] https://documents1.worldbank.org/curated/en/390451468780890888/pdf/multi0page.pdf

(v) Stand-Alone Costs: it assumes the cost of providing a service independently and includes all fixed, joint, and shared costs[28].

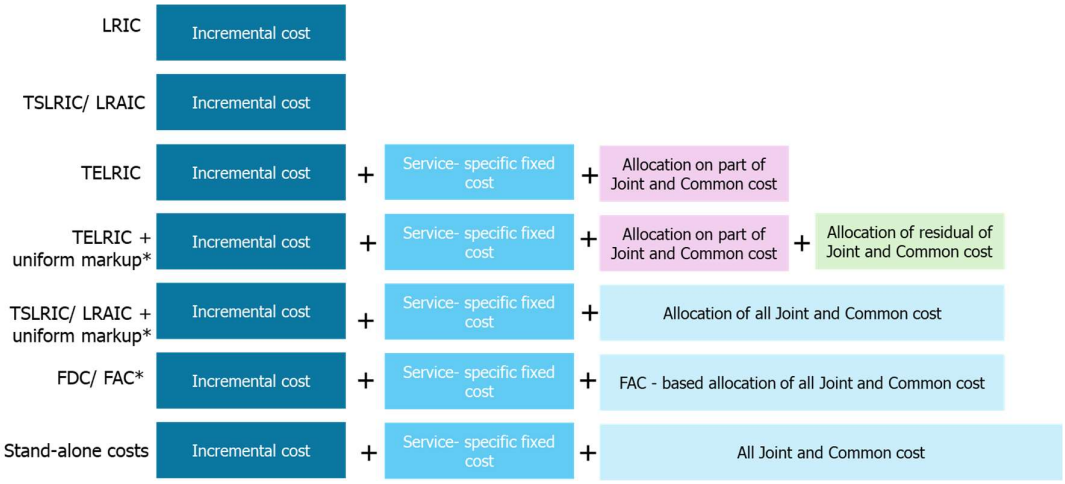

Figure 3.1: Relationship between cost, costing methods and allocations

Notes:

1. For TSLRIC/ LRAIC, the increment is defined as the total service
2. FDC/ FAC is assumed to be based on forward looking economic cost
3. Total cost of the three concepts identified by an asterisk (*) does not necessarily have to be equal as shown in the diagram

B Costing methodologies for tariff determination used in India:

3.3. In 2014, the Authority had carried out the estimation of ceiling tariff of DLC on the basis of bottom-up methodology using fully-allocated-cost (BU-FAC method) of setting up a new OFC system. The salient features of the costing exercise conducted for TTO (57th & 58th Amendment), 2014 are as below:

(i) The Authority used Bottom-up methodology using Fully Allocated Cost (BU-FAC) for computation of ceiling tariffs for DLCs of E1, DS-3 and STM-1 capacity.

[28] https://www.worldbank.org/en/research

(ii) The cost of underlying Optical Fibre Cable (OFC) system to be made up of three cost categories:

(a) Fixed cost [i.e. present capital cost of terminal equipment (including accessories and associated powering and housing infrastructure) and annual operating cost thereof]

(b) Semi-variable cost [i.e. present capital cost of repeater (including accessories and associated powering and housing infrastructure) which would be incurred after a distance interval of 50 Km and annual operating cost thereof]

(c) Variable cost [i.e. present capital cost of OFC, high density polyethylene (HDPE) pipe, trenching and cable laying, project management, accessories and other related costs per Km and annual operating cost thereof]

(iii) Fixed costs were independent of distance while variable costs were directly linked to the distance covered.

(iv) OFC per Km cost was calculated basis of proportion between bituminous and non-bituminous soil.

(v) The cost of only those NLDOs had been considered who possess their own transmission infrastructure in the country. The average of the costs submitted by NLDOs had been considered to better reflect average NLDO cost.

(vi) The cost of repeaters (including accessories and associated powering and housing infrastructure) was taken the same as for terminal equipment cost. NLDOs submitted the cost data for STM-1, STM-4 and STM-16 capacities.

(vii) The Return on Capital Employed (ROCE) had been taken 15% for computation of annual costs. The useful life of transmission equipment and OFC was considered eight (8) years and eighteen (18) years respectively. Hence, the annual depreciation was used 12.5% and 5.56% for transmission equipment and OFC respectively. The annual cost for terminal equipment and OFC was computed as per below mentioned formula:

- Annual cost of terminal equipment = {(15% + 12.5%) * Average present cost per terminal equipment} + Average annual operating cost per terminal equipment

- Annual cost of OFC per Km = {15% + 5.56%) * Average present cost of OFC per Km} + Average annual operating cost of OFC per Km

(viii) The average no. of lit fibre pairs (i.e. amortization factor of variable cost) in the local lead and trunk segment as 4 and 3 respectively.

(ix) The benchmark capacity of underlying OFC system for computation of ceiling tariffs for DLCs of various capacities was taken as per the table below:

Capacity of DLC	**Benchmark capacity of underlying OFC system**	
	For distance up to 100 Kms (50 Kms at each end)	**For distance >100 Kms**
E1 (2 Mbps)	STM – 1	STM – 4
DS – 3 (45 Mbps)	STM – 4	STM – 16
STM – 1 (155 Mbps)	STM – 4	STM – 16

(x) For computation of ceiling tariffs for E1, DS-3 and STM-1 capacities the percent capacity utilization of 50%, 35% and 40% respectively of the underlying OFC system was considered.

(xi) The factor of use (i.e. number of circuits in the underlying OFC system) for computation of ceiling tariffs for DLCs of E1 capacity was taken as 63 in local lead (where underlying OFC system was STM-1) and 63*4 = 252 in trunk segment (where underlying OFC system in STM-4). In the same way, the factor of use for DS-3 and STM-1 was taken as 12 and 4 in local lead respectively.

(xii) The Annual fixed cost and annual semi-variable cost per unit in trunk segment and local lead was computed on the basis of percentage capacity utilization adding the factor of use of the underlying OFC system. Further, Annual Variable Cost per Km in trunk segment and local lead was computed on the basis of the percentage capacity utilization and factor of use of the underlying OFC system apart from the amortization factor of Variable Cost. The computation of the above costs was carried out in the following manner:

(a) Annual fixed cost per unit = Annual cost of terminal equipment/ (percent capacity utilization * factor of use)

(b) Annual variable cost per Km = Annual cost of OFC per Km / (Amortization factor of variable cost * percent capacity utilization * factor of use)

(xiii) Distance based (starting at 5 Kms for E1 and <50 Kms for DS-3, STM-1 & STM-4, with varying distance intervals) ceiling tariff of E1, DS-3, STM-1 and STM-4 capacities for various distances was computed after making provision for expenses on License Fee (8% of Adjusted Gross Revenue).

(xiv) The multiplicative factor of 2.6 was applied on the ceiling tariffs prescribed for DLCs of STM-1 capacity to determine the ceiling tariffs for DLCs of STM-4 capacity.

(xv) The ceiling tariffs for DLCs of DS-3, STM-1 and STM-4 capacities for <50 Km distance was obtained by way of rounding down the ceiling tariff for DLCs of respective capacities for 50 Km distance to the nearest thousands and for >500 Km was obtained by way of rounding up the ceiling tariffs for 500 Km distance to the nearest thousands.

3.4. On the basis of afore-mentioned cost model, ceiling tariff for DLC of E1, DS-3, STM-1 and STM-4 capacities for various distances was provided vide TTO (57th & 58th Amendment), 2014. The ceiling tariffs prescribed for DLC were made applicable for end-links also.

3.5. In response to the Pre-consultation Paper released on 29th April 2025 for Review of Tariff for Domestic Leased Circuits (DLCs), the Authority received the responses from stakeholders in which they have suggested to adopt various cost estimation methodologies such as bottom-up methodology with Fixed Allocated Cost (BU-FAC), Long Run Incremental Cost (LRIC), benchmarking etc.

C Global practices in DLC tariff framework

3.6. The regulation of DLC tariffs plays a critical role in ensuring fair competition, efficient cost recovery, and affordable access to high-capacity connectivity services. Globally, regulatory authorities have adopted diverse approaches to tariff design, balancing the need for incentivising investment with consumer protection and market development. This section highlights how regulators in mature markets have structured price controls, cost models, and compliance mechanisms for leased line services.

(i) United Kingdom (UK)

3.7. Tariff framework in the United Kingdom was revised on 18th March 2021. This shall be effective till 202629. The base year considered was 2019/ 2020 for leased line cost calculation30. The Regulatory Authority implemented CPI–CPI price caps on active leased line services at 1 Gbit/s and below in areas where competition was limited. This decision was based on the objective of promoting pricing stability and encouraging investment in fibre networks. The regulator considered that maintaining prices at current levels would better support investor confidence and long-term infrastructure development, rather than aligning prices strictly to cost models over a short review period.

3.8. For inter-exchange dark fibre services, the Regulatory Authority adopted a cost-based pricing approach using fully allocated costs (FAC) prepared on a current cost accounting (CCA) basis. The cost structure was divided into three elements: passive infrastructure costs, shared operational costs, and dark fibre-specific costs. These components were derived from regulatory financial statements and adjusted to reflect efficient cost recovery, excluding non-relevant items such as restructuring charges and integration costs.

3.9. Due to uncertainty in demand for dark fibre services, the regulator opted not to use a basket control. Instead, it set fixed maximum charges for each service over the review period. This approach was supported by stakeholders who emphasized the importance of price certainty during the early adoption phase.

[29] https://www.ofcom.org.uk/siteassets/resources/documents/consultations/category-1-10-weeks/185028-promoting-investment-and-competition-in-fibre-networks--wholesale-fixed-telecoms-market-review-2021-26/associated-documents/wftmr-statement-volume-4-pricing-remedies.pdf?v=326141

[30] https://www.ofcom.org.uk/phones-and-broadband/telecoms-infrastructure/2021-26-wholesale-fixed-telecoms-market-review

The pricing structure mirrored that of existing Ethernet services, comprising a connection charge, annual rental, and a distance-based main link charge[31].

(a) Guernsey

3.10. Incidentally, Guernsey, one of the Channel Islands and a part of the United Kingdom (UK), has a separate regulator. The regulatory authority named Guernsey Competition & Regulatory Authority (GCRA) adopted a cost-oriented pricing model using a Discounted Cash Flow (DCF) approach to determine the regulated prices for wholesale on-island leased lines[32].

(ii) Australia

3.11. Australian Competition and Consumer Commission (ACCC) provided its final report on Domestic Transmission Capacity Service (DTCS) in June 202533. The ACCC has used a benchmarking approach on the basis that competitive market prices can provide a proxy to the cost of providing the services, and as such, are a useful reference to guide the determination of the regulated price. The discussion paper sought input on potential benchmarking options that the ACCC should consider in the current inquiry, including:

- adjusting the current model derived from a dataset of commercial prices across both regulated and unregulated areas.
- developing a new regression model
- benchmarking to industry-wide prices, and

[31] https://www.ofcom.org.uk/siteassets/resources/documents/consultations/category-1-10-weeks/148271-review-of-physical-infrastructure-and-business-connectivity-markets/associated-documents/volume-3-llcc-final-statement.pdf?v=324046
[32] https://www.gcra.gg/sites/default/files/case-document/t1621g-final-decision-wholesale-leased-line-pricing-non-confidential-version.pdf
[33] https://www.accc.gov.au/system/files/dtcs-fad-final-report-instrument-combined.pdf?ref=0&download=y

- benchmarking to prices for services to the points of interconnect

3.12. Hence, ACCC updated its old regression model based on current market requirements. The ACCC said that *"the existing non-price terms and conditions continue to provide a useful framework for commercial negotiation for the remaining DTCS access seekers and access providers. The existing non-price terms and conditions will promote competition by ensuring a regulatory fallback option for those matters that could be the subject of competition concerns or disputes between access providers and access seekers*". DTCS final access determination prices are effective for the period 1st December 2025 to 31st March 2029[34].

(iii) Singapore

3.13. Infocom Development Authority of Singapore (IDA, Singapore) released Consultation Paper on 30th May 2003 for designation of Singapore Telecommunications Limited Local Leased Circuits as Mandatory Wholesale Service[35]. The IDA recognised that Local Leased Circuits (LLCs) were key telecommunication products for businesses, and that effective competition within this sector could make a positive contribution to the competitiveness of the overall economy[36]. Hence, IDA decided that SingTel was required to offer the full-circuit connections at 30% below retail prices and tail-circuit connections at 50% below retail prices. These "retail-minus" prices were to be available for up to two years, after which cost-based pricing would apply[37].

3.14. IDA on 28th October 2005, issued an information paper which had detailed costing methodology for LLCs (Tail Circuits) as an interconnection related

[34] https://www.accc.gov.au/system/files/2024-dtcs-final-access-determination-inquiry-discussion-paper.pdf
[35] https://www.imda.gov.sg/-/media/imda/files/inner/archive/policies-and-regulation/policies_and_regulation_level2/designation_mandatory_wholesale_service/llcsconsultationpaper30may03.pdf
[36] https://www.imda.gov.sg/regulations-and-licensing-listing/information-papers/costing-methodology-for-local-leased-circuits-tail-circuits
[37] https://www.nas.gov.sg/archivesonline/data/pdfdoc/2004070298.htm

service. "*IDA views that Forward Looking Economic Costs (FLEC) using Long-Run Average Incremental Costs (LRAIC) would be the most appropriate and reasonable costing methodology to adopt as it*

(i) creates the right balance between investment incentives for facilities based entry by new entrants since, in a fully competitive environment "build vs buy" decisions will be made on the basis of competitive offerings priced on the basis of FLEC; and

(ii) *sends the right signals to incumbents as it retains the investment incentives for incumbents to upgrade or extend their existing facilities when new technologies are available and/or their current practices are inefficient* [38]."

(iv) United States

3.15. On 8th August 2025, the Federal Communications Commission (FCC) issued a "*Notice of Proposed Rule Making and Order, third further notice of proposed rulemaking and order"* in the matter of Price Cap Business Data Services and the Regulation of Business Data Services for Rate-of-Return Local Exchange Carriers[39]. In this notice FCC mentioned that "Business data services" (BDS) refers to the dedicated point-to-point transmission of data at certain guaranteed speeds and service levels using high-capacity connections to support applications that require symmetrical bandwidth, substantial reliability, security, and connected service to more than one location.

3.16. Further FCC has mentioned that BDS fall into two technology categories: circuit-based and packet-based. Circuit-based BDS utilizes the Time Division Multiplexing (TDM) protocol, which sends communications over a single circuit-switched channel by dividing the channel into dedicated time slots. TDM is

[38] https://www.imda.gov.sg/-/media/imda/files/regulation-licensing-and-consultations/frameworks-and-policies/information-papers/costing-methodology-for-local-leased-circuits/02-infopaper-_llc_cost_methdolodgy.pdf

[39] https://docs.fcc.gov/public/attachments/FCC-25-44A1.pdf

considered a legacy technology, and TDM-based services consist primarily of DS1 and DS3 circuits with symmetrical capacities of 1.5 Mbps and 45 Mbps, respectively. Packet-based BDS, on the other hand, relies on the modern IP in which data are sent using packets, and can generally offer much higher capacities. The Commission generally has historically imposed dominant carrier regulation on carriers' legacy TDM based BDS and abstained from regulating packet-based BDS[40].

3.17. FCC in the said notice dated 8th August 2025 inter-alia stated the following:

"37. To effectuate these proposed deregulatory actions, we propose to grant forbearance under section 10 of the Act from the application of section 203 tariffing requirements for price cap and rate-of return carriers in their provision of end user channel termination services nationwide and for rate-of return carriers in their provision of transport services nationwide. We seek comment on this proposal."

"38. Specifically, we propose to detariff price cap carriers' TDM-based lower-capacity (DS1 and DS3) end user channel termination services in the remaining regulated counties by granting forbearance from section 203 tariffing obligations. We propose to detariff electing rate-of-return carriers' TDM-based lower-capacity (DS1 and DS3) end user channel termination and transport services by granting forbearance from section 203 tariffing obligations. We also propose to grant rate-of-return carriers forbearance from section 203 tariffing requirements in the provision of end user channel termination services and transport services and other BDS on a nationwide basis. Our proposed forbearance applies to rate-of-return carriers that did not elect, or were ineligible to elect, incentive regulation, including rate-of-return carriers receiving legacy universal service support. We seek comment on this proposal. The Commission granted electing rate-of-return carriers forbearance from tariffing obligations with respect to packet-based and higher-capacity TDM

[40] https://www.fcc.gov/general/special-access-data-collection-overview-1

BDS and lower-capacity TDM-based end user channel termination services in study areas deemed competitive……."

3.18. Subsequently, the FCC vide its "*Statement of Chairman Brenden Carr"* stated that "*we propose further deregulating business data services currently subject to ex-ante pricing regulation. We will also commence the first comprehensive review of this market in over half a decade with the goal of identifying additional areas for regulatory relief. Our goal is to make sure carriers have the right incentives to invest in the technologies of the future, not the past*[41]".

3.19. Keeping in view the cost methodologies used in India as well as international jurisdictions, the following questions are posed for inputs:

Issues for consultation:

Q12: Should TRAI use the same cost methodology i.e. BU-FAC for computing cost-based ceiling tariffs for P2P DLCs in the present exercise, as was used in 2014? Please provide your response with justification.

Q13: In case response to the above question is affirmative, what values of the following items could be used for estimation of ceiling tariffs for DLCs:

(i) Return of Capital Employed (ROCE)

(ii) Useful lives of transmission equipment and Optical Fibre Cable separately

(iii) Average no. of fibre pairs lit in OFC in trunk segment and local lead segment separately

[41] https://www.fcc.gov/document/addressing-business-data-services-pricing-regulations-0

(iv) Utilization factor of OFC system in trunk segment and local lead segment separately

(v) % of use for the transmission equipments used at local lead junction points and in trunk segment for DLCs

(vi) If the repeaters are still being used in the trunk segment, what is the average distance between two repeater sites?

(vii) What is the factor of use (no. of circuits in underlying OFC system) to be taken into consideration at local lead and trunk segment for computation of ceiling tariffs?

Q14: As an alternative to the BU-FAC methodology, or in addition to it, should LRIC or any other methodology be considered for computing ceiling tariffs for P2P DLCs? Please support your view with detailed justification along with data and assumptions.

Q15: What should the bandwidth capacities be, including the minimum and maximum bandwidth capacity, of P2P DLC for which ceiling tariffs need to be prescribed? In case of bandwidth capacities not regulated in the 2014 TTO, what could be the concomitant value of the relevant factors mentioned at Q.13? Please provide your response with justification.

Q16: Should the Authority consider the cost methodologies used in other countries for determining tariffs for P2P-DLCs? If so, which methodologies would be appropriate for the present exercise? Please provide your response with justification along with data and assumptions.

Q17: Is there a need for prescribing separate ceiling tariffs for local lead and trunk segment? Should the Authority adopt different cost

methodology for local lead and trunk segment for provisioning of DLCs? If yes, please provide your response with justification.

3.20. As can be seen, the above questions deal with the provision of only P2P DLCs. As has been mentioned before, the tariff for MPLS-VPN DLCs was kept under forbearance in the TTO (57th Amendment), 2014. However, within the ambit of this Consultation Paper, the Authority is exploring the need and feasibility of including MPLS-VPNs under the ceiling tariff framework. The questions related to need for the same are placed at Chapter II. Here, the following questions related to appropriate cost methodology for VPN are posed for inputs:

Q18: Should the Authority adopt BU-FAC, LRIC or any other methodology for computing ceiling tariffs for VPN DLCs? Please support your view with a detailed justification along with data and assumptions.

Q19: What should the bandwidth capacities be, including the minimum and maximum bandwidth capacity, of VPN DLC for which ceiling tariffs need to be prescribed? Please provide your response with justification.

Q20: Should the Authority consider the cost methodologies used in other countries for determining tariffs for VPN DLCs? If so, which methodologies would be appropriate for the present exercise? Please provide your response with justification along with data and assumptions.

3.21. On 10th December 2025, the Authority had issued Recommendations on assignment of the Microwave Spectrum in 6 GHz (lower), 7 GHz, 13 GHz, 15 GHz, 18 GHz, 21 GHz Bands, E-Band, and V-Band for radio backhaul, in which the Authority recommended the spectrum charges for radio backhaul by telecom service providers as well as captive users. The Authority recommended

spectrum charges of Rs 75,000 per carrier per annum for each point-to-point link assignment in 6 GHz (lower)/ 7 GHz band.

3.22. It is noted that radio spectrum, as a transmission media, suffers from multiple disadvantages related to bandwidth, latency etc. in comparison to optical fibre, while offering advantages such as lower cost, easier operationalisation etc. In areas of application with high-capacity requirements, radio spectrum cannot be seen as replacement for optical fibre. However, considering that within limited capacity & coverage requirements, spectrum could possibly be used as part of DLC, the charges recommended for radio links can be taken as a possible reference for DLC costing. Keeping the above in mind, the following questions are posed regarding the ceiling tariffs for DLC:

Issues for consultation

Q21: Should the spectrum charges recommended for a point-to-point link of 28 MHz paired bandwidth in the 6 GHz(lower) band, be taken as reference for DLC ceiling tariff? If yes, what could be the approximate order of multiple between the backhaul link charges and DLC ceiling tariff? Should the reference be considered for local lead or trunk segment or on overall basis? Please provide your response with justification.

3.23. In the pre consultation process, the stakeholders also stated that service providers offer various tariffs for DLCs across different technologies, bandwidths, and distances. The customers are being offered with solutions connecting multiple locations with multiple connectivity options. With the growing prevalence of IP-based networks, tariff structures have become largely independent of distance and technology, as services are mostly delivered over IP backbones. Generally, the tariffs are inclusive of the bandwidth bundled with Service Level Agreements (SLAs), security, and managed services. The adoption of new technologies and IP backbones has led to standardised uniform

bandwidth-based tariff simplifying offering for customers, irrespective of distance or technology.

3.24. Keeping the above in mind, it appears that tariffs should be largely dependent on bandwidth along with other elements of SLA, which have positioned DLC as a managed service rather than provision of only network infra. The questions exploring the link between bandwidth/ SLA commitments and tariffs have been posed at Q10 & Q11 in Chapter II. Further, since the role of distance seems to be significantly reduced in costing and tariffs, the closely spaced distance-based slabs in the 57th TTO Amendment of 2014, as mentioned at Para 3.3 above need a review. For instance, the tariffs can be fixed based on slabs of greater distances, such as intracity (within 50 Kms), intercity (within 200 Kms), intra circle (within 500 Kms) and inter circle (more than 500 Kms) for Point to point (P2P). Accordingly, the following question is posed for inputs:

Issues for consultation:

Q22: Is the distance-based pricing, based on distance slabs contained in the 2014 TTO (57th Amendment), still relevant for prescribing ceiling tariffs for P2P DLCs? Should the Authority consider new distance slabs, separately for both the local lead and trunk segments, for prescribing ceiling tariffs for P2P DLC? Please provide your response with justification.

3.25. The stakeholders mentioned that disparities in tariffs across different routes and geographical regions is a relevant consideration and cases can be found where the local geography or other issues may lead to difficulty in providing the last mile connectivity. This may, in turn, affect the CAPEX requirements leading to a deviation from standard tariff. Further, specific requirements of the customer may also have an impact on the tariff. In such exceptional circumstances, the customer is offered a tariff structure that is the combination of One Time Charges (OTC) and Annual Recurring Charges (ARC). The stakeholders also mentioned that in DLC segment, the buyers are mostly

enterprises and have a high degree of bargaining power in this market due to availability of number of service providers. The buyers generally resort to tender process citing their requirement and SLAs and select a service provider offering them the lowest prices.

Issues for consultation:

Q23: Is there a need for prescribing separate ceiling tariffs for remote and hilly areas? What criteria should be used to define such regions? Please provide your response with justification.

Q24: How can the Authority ensure affordability in low-competition areas, such as remote and hilly areas, without distorting market incentives? Please provide your response with justification.

Q25: Are there any other relevant issues related to revision of tariff framework for DLCs which the Authority should keep in mind, while carrying out the present review exercise, to further the broad objectives as espoused in this Consultation Paper? Please provide full details and justification for consideration of the same.

Chapter – IV

Issues for Consultations

Q1: What is expected to be the likely impact on competition and tariffs in the DLC sector, if the ISPs are permitted to provide DLCs in the future? Please provide your response with justification.

Q2: What is the likely impact of tariffs for DLC on the bandwidth charges (including the transmission costs) or any other costs incurred by ISP operators, especially for ISP B & C operators who do not have their own transmission infrastructure? Further, what are the specific elements of DLC tariff which can be addressed in the regulation to make it more relevant for ISP B & C business? Please provide your response with justification.

Q3: Should the MPLS-VPN DLCs be brought under the tariff regulation framework? Please provide your response with justification.

Q4: What are the key differences in cost structure and service delivery between traditional P2P-DLCs and MPLS-VPNs that should be reflected in tariff regulation? Please provide your response with justification.

Q5: What has been the impact of deployment of DWDM, SD-WAN and Ethernet over Fibre on provisioning of DLCs, in terms of operations, costs and tariffs? Should the regulation incorporate these technological changes in the ceiling tariff framework? Please provide your response with justification.

Q6: Are there any other technological changes apart from the ones mentioned in above paragraphs in provisioning of DLCs in India? If yes, what has been the impact of deployment of such technologies on provisioning of DLCs, in terms of operations, costs and tariffs? Should the regulation incorporate these technological changes in the ceiling tariff framework? Please provide your response with justification.

Q7: As an alternative to Q5 & Q6, should the Authority consider technology-neutral tariff models, focussing on bandwidth and service commitments rather than provisioning technologies? If yes, what should be the criteria for the same? Please provide your response with justification.

Q8: What are the various service commitments (such as bandwidth, SLA requirements such as uptime, latency, packet loss, response time etc.) bundled as part of managed DLC service, for both P2P & VPN based DLC? How are the service commitments offered as part of managed DLC services linked with the tariffs? Please provide your response with justification.

Q9: Should the proposed regulation include staggered tariffs in line with service commitments, possibly further staggered for different regions, for both VPN & P2P based DLC? If yes, what are the service commitments, mentioned as reply to Q8, which should be considered for tariff regulation?

Q10: What reporting mechanisms should be mandated to ensure transparency in discounts and service bundling for DLCs? Please provide your response with justification.

Q11: Should the Authority mandate standardized tariff disclosure formats for all DLC service providers? Please provide your response with justification.

Q12: Should TRAI use the same cost methodology i.e. BU-FAC for computing cost-based ceiling tariffs for P2P DLCs as was used in 2014? Please provide your response with justification.

Q13: In case response to the above question is affirmative, what values of the following items should be used for estimation of ceiling tariffs for DLCs:

(i) Return of Capital Employed (ROCE)

(ii) Useful lives of transmission equipment and Optical Fibre Cable separately

(iii) Average no. of fibre pairs lit in OFC in trunk segment and local lead segment separately

(iv) Utilization factor of OFC system in trunk segment and local lead segment separately

(v) % of use for the transmission equipments used at local lead junction points and in trunk segment for DLCs

(vi) If the repeaters are still being used in the trunk segment, what is the average distance between two repeater sites?

(vii) What is the factor of use (no. of circuits in underlying OFC system) to be taken into consideration at local lead and trunk segment for computation of ceiling tariffs?

Q14: As an alternative to the BU-FAC methodology, or in addition to it, should LRIC or any other methodology be considered for computing ceiling tariffs for P2P DLCs? Please support your view with detailed justification along with data and assumptions

Q15: What should the bandwidth capacities be, including the minimum and maximum bandwidth capacity, of P2P DLC for which ceiling tariffs need to be prescribed? In case of bandwidth capacities not regulated in the 2014 TTO, what should be the concomitant value of the relevant factors mentioned at Q13? Please provide your response with justification.

Q16: Should the Authority consider the cost methodologies used in other countries for determining tariffs for P2P-DLCs? If so, which methodologies would be appropriate for the present exercise? Please provide your response with justification along with data and assumptions.

Q17: Is there a need for prescribing separate ceiling tariffs for local lead and trunk segment? Should the Authority adopt different cost methodology for local lead and trunk segment for provisioning of DLCs? If yes, please provide your response with justification.

Q18: Should the Authority adopt BU-FAC, LRIC or any other methodology for computing ceiling tariffs for VPN DLCs? Please support your view with a detailed justification along with data and assumptions.

Q19: What should the bandwidth capacities, including the minimum and maximum bandwidth capacity, of VPN DLC for which ceiling tariffs need to be prescribed? Please provide your response with justification.

Q20: Should the Authority consider the cost methodologies used in other countries for determining tariffs for VPN-DLCs? If so, which methodologies would be appropriate for the present exercise? Please provide your response with justification along with data and assumptions.

Q21: Should the spectrum charges recommended for a point-to-point link of 28 MHz paired bandwidth in the 6 GHz(lower) band, be taken as reference for DLC ceiling tariff? If yes, what could be the approximate order of multiple between the backhaul link charges and DLC ceiling tariff? Should the reference be considered for local lead or trunk segment or on overall basis? Please provide your response with justification.

Q22: Is the distance-based pricing, based on distance slabs contained in the 2014 TTO (57th Amendment), still relevant for prescribing ceiling tariffs for P2P DLCs? Should the Authority consider new distance slabs, separately for both the local lead and trunk segments, for prescribing ceiling tariffs for P2P DLC? Please provide your response with justification.

Q23: Is there a need for prescribing separate ceiling tariffs for remote and hilly areas? What criteria should be used to define such regions? Please provide your response with justification.

Q24: How can the Authority ensure affordability in low-competition areas, such as remote and hilly areas, without distorting market incentives? Please provide your response with justification.

Q25: Are there any other relevant issues related to revision of tariff framework for DLCs which the Authority should keep in mind, while carrying out the present review exercise, to further the broad objectives as espoused in this Consultation Paper? Please provide full details and justification for consideration of the same.

Annexure-I

List of abbreviations

S. No.	Abbreviations	Expansion
1	AGR	Adjusted Gross Revenue
2	ASP	Access Service Provider
3	BFSI	Banking, Financial Services, and Insurance
4	BPO	Business Process Outsourcing
5	BSNL	Bharat Sanchar Nigam Limited
6	BU-FAC	Bottom-up methodology using Fully Allocated Cost
7	CSP	Cloud Service Provider
8	DLC	Domestic Leased Circuit
9	DoT	Department of Telecommunications
10	DWDM	Dense Wavelength Division Multiplexing
11	FDC / FAC	Fully Distributed/ Allocated Cost
12	Gbps	Gigabits Per Second
13	GCC	Global Capability Center
14	IP	Internet Protocol
15	IP-I	Infrastructure Provider Category - I
16	IP-II	Infrastructure Provider Category - II
17	IT	Information Technology
18	ITES	Information Technology Enabled Service
19	Kbps	Kilobits Per Second
20	LRIC	Long Run Incremental Cost
21	Mbps	Megabytes Per Second
22	MLLN	Managed Leased Line Network
23	MPLS	Multi Protocol Label Switching
24	NLD	National Long Distance
25	NLDO	National Long Distance Operator
26	NTP	New Telecom Policy
27	OFC	Optical Fibre Cable
28	P2P-DLC	Point to Point – Domestic Leased Circuit
29	PGCIL	Power Grid Corporation of India Limited
30	POP	Point of Presence
31	PSU	Public Sector Undertaking
32	SD-WAN	Software-Defined Wide Area Network
33	SLA	Service Level Agreement
34	TELRIC	Total Element Long Run Incremental Cost

S. No.	Abbreviations	Expansion
35	TSP	Telecom Service Provider
36	TSLRIC	Total Service Long Run Incremental Cost
37	TTO	Telecommunication Tariff Order
38	VPN	Virtual Private Network
39	VNO	Virtual Network Operator

Annexures

Annexure-II

List of the NLD license holders

List of NLD Licensees as on 31.12.2024 | 1

SUMMARY

S. No.	Type of License	No. of licensee
1	Standalone NLD	16
2	UL(NLD) authorization	38
3	**Total No of NLD**	**54**
4	**UL(NLD) VNO authorization**	17

1. List of Companies having NLD Service License before UL regime.

Sr. No.	Name of Company	License No.	Effective Dateof License
1	M/s Reliance Communications Limited	10-21/2001-BS-1(NLD-02)	28.01.2002
2	M/s Mahanagar Telephone Nigam Ltd.	10-14/2006-BS-I(NLD-04)	10.05.2006
3	M/s Railtel Corporation of India Ltd.	10-10/2006-BS-I	07.07.2006
4	M/s Tikona Infinet Private Ltd. (Formerly HCL Infinet Ltd.)	10-05/2006-BS-I (NLD-07)	11.07.2006
5	BT Global Communications India Pvt. Ltd (M/s i2i Enterprises Ltd.)	10-16/2006-BS-I(NLD-08)	11.07.2006
6	M/s AT&T Global Network Services India Pvt. Ltd.	10-42/2006-BS-I (NLD-11)	09.10.2006
7	M/s Vodafone Idea Limited (Subsequent to amalgamation of M/s Spice Communications Ltd.with M/s Idea Cellular Limited, NLD license in the name of M/s Spice Communications Limited has been transferred)	10-40/2006 (BS-I) (NLD-14)	23.11.2006
8	M/s Dishnet Wireless Ltd.	10-03/2006-BS-I (NLD-15)	13.12.2006
9	M/s Oil India Limited	10-25/2006-BS-I (NLD-19)	27.12.2007
10	M/s Verizon Communications India Private Limited	10-44/2007-CS-III(NLD-20)	03.01.2008
11	M/s Orange Business Services India Network Pvt Ltd (Formerly Equant Network Services India Private Limited)	10-77/2007-CS-III(NLD-22)	20.06.2008
12	M/s Shyam Spectra Private Limited (ErstwhileM/s Citycom Networks Pvt. Ltd.)	10-64/2008-CS-III (NLD-24)	03.10.2008
13	M/s SingTel Global (India) Private Limited	10-89/2008-CS-III(NLD-26)	05.03.2009
14	M/s Videocon Telecommunications Ltd (formerly M/s Datacom Solutions Private Limited)	10-32/2008-CS-III(NLD-27)	18.03.2009
15	M/s Telstra Telecommunications Pvt. Limited	10-67/2010-CS-III (NLD-31)	11.10.2011
16	M/s Bharat Broadband Network Limited	10-46/2012-CS-III (NLD-33)	01.04.2013

Carrier Services Wing, DoT HQ

2. List of Companies having NLD Service authorization under UL regime.

Sr. No.	Name of Company	License No.	Effective Date of Authorization
1	M/s Reliance Jio Infocomm Limited	20-401/2013 (AS-I)	21.10.2013
2	M/s Sprint Telecom India Private Limited	20-419/2014-AS-I	29.08.2014
3	M/s Sify Technologies Limited	20-408/2013-AS-I	27.06.2014 (Migrated to UL)
4	M/s Hughes Communications India Ltd	20-413/2013-AS-I	01.08.2014 (Additional authorization on 02.09.2014)
5	M/s NTT Communications India Network Services Private Limited	10-77/2015-CS-III	02.12.2015
6	M/s Andhra Pradesh State FIbre Net Pvt. Ltd.	20-491/2015-AS-I	08.03.2016
7	M/s Microscan Infocommtech Pvt. Ltd. (formerlyM/s Microscan Computers Pvt. Ltd.)	10-81/2015-CS-III	29.03.2016
8	M/s Ishan Netsol Pvt. Ltd.	821-22/2013-DS	22.06.2015 (Additional authorization on 14.02.2017)
9	M/s Lightstorm Telecom connectivity Pvt. Ltd.	20-1212/2020-AS-I	28.08.2020
10	M/s Bharat Sanchar Nigam Ltd.	20-1206/2020-AS-I	29.02.2020 Date of signing10.12.2020
11	M/s V-CON Mobile & Infra Private Limited	DS-11/250/2018-DS-III	03.12.2018 (Additional authorization on 19.01.2021)
12	M/s Assam Electronics Development CorporationLtd.	20-579/2018-AS-I	30.12.2017 (Additional authorization on 29.07.2021)
13	M/s Oneweb India Communications Pvt. Ltd.	20-1254/2021-AS-I	24.08.2021
14	M/s Ringcentral India Pvt. Ltd.	20-1244/2021-AS-I	31.08.2021
15	M/s Nelco Limited	10-29/2021-CS-III	01.11.2021
16	M/s Bharti Airtel Ltd	20-430/2014-AS-I	03.03.2014 (Additional authorization on 29.11.2021) Date of signing 24.08.2021
17	M/s Tata Communications Ltd.	821-78/2014-DS	Effective date-25.01.2014 (Additional authorization on 01.01.2022) Date of signing-08.12.2021
18	M/s Yotta Network Services Pvt. Ltd.	DS-11/243/2019-DS-III	16.10.2020 (Additional authorization on 29.11.2021)
19	CTRL S Connectivity Solutions Private Limited (erstwhile M/s CTRL S NLD SERVICES PRIVATE LIMITED)	10-86/2020-CS-III	28.12.2021
20	M/s Jio Satellite Communications Ltd.	20-1286/2021-AS-I	09.03.2022
21	M/s Powergrid Teleservices Limited	20-1302/2022-AS-I	11.05.2022
22	M/s OneOTT Intertainment Limited	821-52/2013-DS	27.05.2014 (additional authorization on 23.05.2022)
23	M/s Extreme Infocom Pvt. Ltd.	20-1320/2022-AS-I	17.06.2022

24	M/s Adani Data Networks Limited	20-1327/2022-AS-I	26.08.2022
25	M/s Web Werks Internet Services Pvt. Ltd.	20-1371/2022-AS-I	14.06.2022 (Additional Authorization on 04.01.2023)
26	M/s Space World Digital Solutions Pvt. Ltd. (Erstwhile M/s P2P Innovations Pvt. Ltd.)	20-1386/2022-AS-I	12.01.2023
27	M/s Tejays Dynamic Limited.	File No. 20-1402/2022-AS-I Agreement No. 821-45/2013-DS dated 06.10.2016	06.10.2016 (Additional Authorization on 23.03.2023)
28	M/s ZVC India Private Limited	20-1309/2022-AS-I	18.11.2022 (Additional Authorization on 24.04.2023)
29	M/s National Internet Exchange of India	10-32/2022-CS-III	31.08.2023
30	M/s Infynix Communications Limited	20-1431/2023-AS-I	12.10.2023
31	M/s Tata Teleservices Limited	20-494/2015-AS-I	02.11.2016 (Additional Authorization on 14.11.2023)
32	M/s Kerala Fibre Optic Network Limited	DS-11/204/2022-DS-III (20-1452/2023-AS-I dated 20.02.2024)	14.07.2022 (Additional Authorization on 20.02.2024)
33	M/s Anonet Communications Limited	DS-11/108/2017-DS-III dated 11.10.2017	11.10.2017 (Additional Authorization on 28.05.2024)
34	M/s Lumina Cloudinfra Networks Private Limited	20-1464/2023-AS-I	12.06.2024
35	M/s DE-CIX Interwire Internet Services Pvt. Ltd.	821-20/2013-DS	17.05.2019 (Additional Authorization on 02.08.2024)
36	M/s Sterlite Convergence Limited	10-73/2023-CS-III	21.08.2024
37	M/s Netplus Broadband Services Pvt. Ltd.	821-181/2014-DS	19.12.2014 (Additional Authorization on 28.11.2024)
38	M/s DBYTE Facility Network Pvt. Ltd.	10-80/2024-CS-III	24.12.2024

3. **List of Companies having NLD Service authorization under UL(VNO) regime.**

Sr. No.	Name of Licensee	License No.	EffectiveDate of Authorization
1	M/s Speedon Network Limited	10-36/2017-CS-III	26.03.2018
2	M/s GTPL Broadband Pvt. Ltd.	10-100/2017-CS-III	13.07.2018
3	M/s NTT Communications India Network Services Private Limited	20-537/2016-AS-I	01.03.2017 (Additional authorization on 20.08.2020)
4	M/s Velrush Business Networks Private Limited	20-1233/2020-AS-I	24.06.2021
5	M/s Bharti Airtel Ltd	20-1218/2020-AS-I	21.10.2021
6	M/s Tata Communications Ltd.	20-1246/2021-AS-I	26.11.2021
7	M/s Lumen Communications India Pvt. Ltd. (Erstwhile M/s Centurylink Communications India Pvt. Ltd.)	20-1256/2021-AS-I	28.01.2022
8	M/s Avaya Cloud Services Private Limited	20-1279/2021-AS-I	23.05.2022
9	M/s ZVC India Private Limited	20-1310/2022-AS-I	24.05.2022
10	M/s Webex Communications (India) Private Limited	20-1214/2020-AS-I	25.05.2022
11	M/s Veeno Communications Private Limited	20-1176/2019-AS-I	28.09.2020 (Additional authorization on 09.09.2022)
12	M/s Verizon Communications India Private Limited	20-1381/2022-AS-I	14.12.2018 (Additional authorization on 29.11.2022)
13	M/s Honeycomb Telnet Private Limited	10-50/2022-CS-III	30.12.2022
14	M/s Equinix India Services Private Limited	20-1277/2021-AS-I	01.02.2022 (Additional authorization on 10.01.2024)
15	M/s Alliance Broadband Services Pvt. Ltd.	20-1319/2022-AS-I	10.06.2022 (Additional authorization on 21.08.2024)
16	Yotta Data Services India Pvt. Ltd.	20-1498/2024-AS	17.09.2024
17.	M/s Five9 Technologies India Pvt. Ltd.	20-1441/2023-AS-I	25.09.2024

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