

History digital leased lines in Australia

The history of **digital leased lines in Australia** reflects the critical transition from voice-centric networks to dedicated data infrastructure. Before the arrival of standard commercial internet or broadband, these point-to-point digital circuits laid the groundwork for modern enterprise networking, banking systems, and early internet infrastructure across the country.

1. The Pre-Digital Era: DATEL (1969)

Before true digital leased lines arrived, data transmission over long distances in Australia relied on standard copper telephone wires designed primarily for voice.

- In 1969, the Postmaster-General's Department (PMG) introduced the **DATEL (Data over Telephone)** service.
- DATEL allowed businesses to lease analogue phone lines specifically for data.
- Large, PMG-supplied acoustic modems converted computer digital data into analogue sound frequencies to transmit it across the network.
- Speeds were severely constrained, maxing out at nominal transfer rates like 1200 bit/s up to 9600 bit/s, because the line quality suffered from severe distance-based signal degradation (known as "slope").

2. The Birth of True Digital: The Digital Data Service (Early 1980s)

By the late 1970s and early 1980s, corporate and government demand for reliable, high-volume data transmission outgrew modulated voice channels. In response, Telecom Australia (which took over domestic telecommunications from the PMG in 1975) launched the **Digital Data Service (DDS)**, powered by a dedicated nationwide **Digital Data Network (DDN)**.

- **The Technology:** DDS completely bypassed the noisy analogue phone exchanges. It provided a clean, purely digital end-to-end connection between two fixed customer sites.
- **The Hardware:** Instead of modems, businesses connected their mainframe computers or early routers via specialized Network Terminating Units (NTUs) using Time Division Cross-Connect (TDCC) systems.
- **Speeds and Adoption:** Initial standard speeds ranged from 2.4 kbps up to 48 kbps, eventually standardizing to 56 kbps and 64 kbps links. By 1985, the DDS network handled over 10,000 corporate terminations nationwide—heavily utilized by major institutions like Ansett Airlines, Commonwealth Bank, and Westpac to power early ATMs and reservation hubs.

3. Fuelling the First Australian Internet (1989)

Digital leased lines were the unsung heroes behind the arrival of the public internet in Australia.

- When the **Australian Academic and Research Network (AARNet)** officially connected Australia to the global internet backbone in **May 1989**, it relied directly on leased DDS lines.
- Universities and early commercial ISPs (like Connect.com.au) bought permanent, leased point-to-point connections to route data packets between capital cities.

- In 1989, a single 56 kbps satellite and leased-line circuit between the University of Melbourne and Hawaii represented the entirety of Australia's international internet throughput.

4. Deregulation, ISDN, and Megabit Speeds (1990s)

The Australian telecommunications sector was completely transformed in the 1990s. In 1991, the government ended Telecom Australia's monopoly, introducing Optus as a competitor and eventually rebranding the incumbent as Telstra.

Competition drove a massive upgrade in digital leased line capabilities:

- **ISDN Arrival:** Integrated Services Digital Network (ISDN) lines emerged as a highly sought-after alternative, offering flexible, switched 64 kbps and 128 kbps digital connections.
- **High-Capacity Megabit Lines:** For high-end enterprise clients, carriers began moving past copper lines to deploy fibre-optic and coaxial-backed digital leased lines. These achieved "T1/E1" speeds of **2 Mbps**, scaling up to high-capacity ATM and Frame Relay services reaching **45 Mbps to 622 Mbps** by the early 2000s.

5. Legacy & Policy: The Digital Data Service Obligation (DDSO)

Leased digital lines were considered so critical to the country's economic baseline that they entered federal legislation.

During the progressive privatization of Telstra in the late 1990s, the Australian Government enacted the **Digital Data Service Obligation (DDSO)**. This legally required Telstra to provide an equitable, high-speed digital data connection of at least 64 kbps upon request to *any* business or consumer in Australia—ensuring regional and remote commercial centres weren't entirely left behind during the dawn of the internet era.

Eventually, the rise of cheap, asymmetric commercial broadband (ADSL) in 2000, followed by the National Broadband Network (NBN) fibre rollouts in the 2010s, shifted leased lines from a general requirement into a premium product. Today, descendants of these early networks live on as Dedicated Enterprise Ethernet and dark fibre links used by corporate offices and data centres.

High-capacity ATM is 53 byte packets with a 5 byte header. What did high capacity frame relay use?

Unlike ATM (Asynchronous Transfer Mode), which relies on fixed 53-byte cells to ensure predictable, low-latency timing for voice and video, **Frame Relay uses variable-length frames.**

Frame Relay was designed strictly to maximize data throughput by dropping ATM's rigid cell structure and minimizing overhead. A standard Frame Relay packet employs the following structure:

1. Header Size

The standard Frame Relay header is typically **2 bytes (16 bits) long.**

- In more complex networks requiring larger addressing spaces, the header can be extended to **3 or 4 bytes.**

- The header primarily holds the **DLCI** (Data Link Connection Identifier), which identifies the virtual circuit, alongside basic congestion notification bits (FECN, BECN, and DE).

2. Variable Payload (Information Field)

Instead of forcing data into a tiny 48-byte payload like ATM, Frame Relay allows data blocks to be sent intact.

- The minimum standard payload size is **262 bytes**.
- In practical corporate and ISP setups, carriers typically configured maximum frame sizes up to **1,600 bytes** (to cleanly transport standard 1,500-byte Ethernet packets without fragmenting them) or even up to **4,096 to 9,000 bytes** for jumbo high-capacity traffic.

3. Total Frame Structure

A complete Frame Relay packet traveling across the wire uses a modified High-level Data Link Control (HDLC) format, consisting of:

- **Opening Flag (1 byte):** A specific bit pattern (01111110) indicating the start of the frame.
- **Header (2 to 4 bytes):** Containing the routing and congestion controls.
- **User Data (Variable):** Up to thousands of bytes of payload.
- **Frame Check Sequence (FCS) (2 bytes):** A 16-bit Cyclic Redundancy Check (CRC) used to detect bit-level corruption. If a frame contains an error, Frame Relay simply discards it and relies on upper-layer protocols (like TCP/IP) to handle the retransmission.
- **Closing Flag (1 byte):** The ending bit pattern (01111110).

By omitting the intensive process of chopping packets into tiny cells and reassembling them at the other end (Segmentation and Reassembly, or SAR), Frame Relay offered a cheaper, highly efficient way to move bursty, high-volume LAN traffic across Australian wide-area networks.

How Australian telcos priced these services?

During the 1980s and 1990s, pricing for enterprise digital data services in Australia—dominated heavily by Telecom Australia (later Telstra)—was notoriously high and deeply protective of traditional voice revenues.

Australian telcos priced these services using a rigid, tiered model combining **fixed physical distance, port speeds, and bandwidth guarantees**. Unlike consumer internet today, there was no single "flat rate."

1. The Structure of the "Telstra Tariff"

To connect two offices via a digital leased line or Frame Relay, an Australian business faced a complex monthly bill broken into three distinct components:

- **The Access/Installation Fee:** A massive up-front capital expense just to get the carrier to physically wire the dedicated connection from the nearest local exchange to the corporate building.

- **The Exchange Port Charge:** A fixed monthly subscription cost based strictly on the speed tier of the port (e.g., a 56/64 kbps port vs. a high-capacity 2 Mbps "E1" port).
- **The Distance Component ("Inter-Exchange" Charge):** For point-to-point lines, telcos charged a flat monthly base rate plus a **per-kilometer surcharge**. Connecting an office in Sydney to an office in Melbourne incurred astronomical ongoing costs because the line physically reserved bandwidth across hundreds of kilometers of the copper or fibre backbone.

2. Digital Data Service (DDS) Pricing (The 1980s Benchmark)

In the 1980s, if an institution like a major Australian bank wanted a dedicated DDS line to link a regional branch to its capital city mainframe, they paid heavily for the absolute guarantee of a clean, dedicated digital wire.

- **The Cost:** In the late 1980s, a modest **9.6 kbps or 56 kbps** inter-capital DDS link cost thousands of Australian dollars *per month*.
- **The Reality:** The pricing was high enough that it was exclusively the domain of government departments, airlines, and financial corporations. Smaller enterprises were completely priced out, relying instead on dial-up analogue lines.

3. How Frame Relay Transformed the Pricing Model (The 1990s)

When Frame Relay arrived in the 1990s, it introduced **Statistical Multiplexing**. Telcos realized they no longer had to reserve a dedicated, physical end-to-end pipe for every single customer across the country. Because multiple companies could share the same backbone link, telcos could completely restructure their pricing:

Instead of paying massive per-kilometer distance fees, Frame Relay introduced a hybrid pricing system:

Pricing Component	What You Paid For	How It Kept Costs Down
Port Speed Fee	The maximum physical capacity of your local link (e.g., 64 kbps up to 2 Mbps).	You only paid a flat rate to connect to the nearest local carrier cloud, drastically cutting down long-distance distance costs.
CIR (Committed Information Rate)	The minimum bandwidth the telco guaranteed your traffic would never drop below during peak network congestion.	Choosing a lower CIR (e.g., a 128 kbps CIR on a 512 kbps port) made the service significantly cheaper.
EIR (Excess Information Rate)	The ability to "burst" past your guaranteed CIR up to your maximum port speed if the carrier's backbone network wasn't busy.	This "bursting" was completely free, though the telco marked these excess packets as "Discard Eligible" (DE) if the network choked.

4. The Price War and the "ISDN Disruption"

By the late 1990s, two factors forced Australian telco data pricing down: Deregulation (the arrival of Optus to challenge Telstra) and the introduction of ISDN.

ISDN offered dial-on-demand 64 kbps data channels. Instead of paying a flat, punishing monthly fee for a leased line that sat idle overnight, businesses could use ISDN to pay a cheaper monthly rental fee plus call-connection charges only when they actually transmitted data.

To protect their immensely profitable leased-line revenues, Telstra deliberately kept ISDN pricing artificially high for years. However, by the dawn of the 2000s, the Digital Data Service Obligation (DDSO) legally forced Telstra to provide 64 kbps digital access equitably across Australia, breaking the premium monopoly on basic digital data transport and paving the way for the flat-rate broadband era.

Would you like to look at the **exact dollar figures** from historical Telstra price schedules from the 1990s, or should we look at how **Optus structured its corporate network pricing** to compete?

Both

The 1990s telecommunications duopoly between **Telstra** and **Optus** transformed Australian enterprise data pricing from an expensive, distance-punishing monopoly into a fierce battleground of corporate discounting and service-level agreements.

Part 1: Historical Dollar Figures & The Telstra Tariff

To understand how staggering the pricing was, you must look at the exact structures Telstra (and before 1993, Telecom Australia) enforced. Because data from the 1990s reflects Australian dollars of that era—where average corporate salaries were a fraction of today's—these data lines represented a massive chunk of a company's IT budget.

Legacy Point-to-Point DDS (Digital Data Service) Pricing

Before Frame Relay dropped distance metrics, standard digital lines were calculated by adding an exchange fee to a **per-kilometre trunk charge**.

- **The Up-front "Sticker Shock":** Installing a new digital leased line in the early 1990s usually required an upfront connection fee ranging from **\$2,000 to over \$5,000 AUD** per site just to run the copper/fibre extension and provision the NTU (Network Terminating Unit).
- **Monthly Inter-Capital Costs:** A standard **64 kbps dedicated DDS link** between Sydney and Melbourne cost approximately **\$3,000 to \$4,500 AUD per month**.
- **The Megabit Premium:** If a company wanted a high-capacity 2 Mbps "E1" pipeline across the same distance, the monthly cost scaled exponentially, frequently exceeding **\$15,000 to \$20,000 AUD per month**.

Frame Relay Pricing Breakdown

When Telstra introduced its National Frame Relay tariff in mid-1995, pricing shifted away from absolute distance to **Port Speed** and **CIR (Committed Information Rate)**.

- **The Port Charge:** A 64 kbps port was roughly **\$300 to \$400 AUD/month**. Stepping up to a high-capacity 2 Mbps port jumped to roughly **\$2,500+ AUD/month** per site.

- **The CIR Component:** You paid an additional fee for your guaranteed bandwidth. For example, buying a 2 Mbps port but only choosing a **512 kbps CIR** (meaning your data could drop down to 512 kbps during heavy regional congestion but burst up to 2 Mbps for free) saved businesses up to 40% compared to buying a full 2 Mbps 1:1 dedicated circuit.

Part 2: How Optus Structured Pricing to Compete

When Optus launched its corporate network services in 1992 (after buying out the government's AUSSAT satellite network), it couldn't match Telstra's massive, pre-existing underground copper and fibre footprint. Optus had to build its own inter-capital fibre backbones and use microwave links to reach corporate buildings.

To win market share, Optus targeted Telstra's high-profit margins using distinct pricing strategies:

1. The Fixed Percentage Discount

Optus's initial strategy was simple: **"The 10% to 15% Under-Cut."** If Telstra quoted a financial institution \$10,000 a month for a network of data links, Optus would look at the bill and contractually guarantee the exact same network topologies for 10% to 15% less. This forced Telstra to rapidly implement "special standard rate reductions" and individual corporate discounts to stop massive churn.

2. Bundling Data with Voice Traffic

Optus revolutionized corporate account management by introducing **Total Network Bundling**.

- Because Optus owned long-distance infrastructure, they would tell corporations: *"If you switch all your long-distance corporate voice traffic (STD and international) to Optus, we will drastically discount or completely waive the installation fees on your high-capacity Frame Relay data links."*
- This approach was incredibly successful for major national retail chains and banks that generated massive call volumes.

3. Free "Bursting" over Satellite

Optus leveraged its AUSSAT satellite fleet to offer unique pricing structures for regional and remote operations (like mining sites in Western Australia or remote Queensland towns). While Telstra charged punishing regional distance fees to run copper out to the middle of nowhere, Optus provided flat-rated satellite data loops that bypassed landline distance entirely.

The End of the Era: ACCC Intervention (1997–1999)

By 1997, the Australian telecommunications market was fully deregulated, and the [Australian Competition and Consumer Commission \(ACCC\)](#) stepped in. Service Providers (ISPs) complained that Telstra was practicing "anti-competitive margin squeezing"—charging wholesale ISPs almost the same price for raw digital links as it was charging its own retail corporate clients.

The ACCC issued formal competition notices against Telstra. This regulatory pressure, combined with Optus expanding its own fibre networks, caused enterprise data transit prices to plummet by over **40% to 60%** between 1995 and 1999, laying the financial foundation for cheap, accessible business internet in the early 2000s.

What date did Frame Relay first get established in Australia. Did anyone use ATM prior to August 2000.

1. Frame Relay's Establishment in Australia

Commercial Frame Relay was first established and became generally available in Australia in **late 1993**.

Before its widespread commercialization, early network providers and advanced tech companies conducted local infrastructure trials throughout late 1992 and early 1993. By mid-1995, Telstra formally structured these offerings under a regulated framework known as the **National Frame Relay Tariff**. This official filing cemented Frame Relay as a primary, mainstream option for corporate Wide Area Networks (WANs) across the country, prompting competitors like [Optus](#) and BT Australia to launch their own competing domestic and international Frame Relay services shortly after.

2. ATM Usage Prior to August 2000

Yes, numerous major organizations and networks in Australia heavily utilized ATM (Asynchronous Transfer Mode) long before August 2000.

While consumer broadband hadn't yet adopted it, ATM was the premier high-speed backbone technology of the mid-to-late 1990s. Significant networks deployed it years before the turn of the millennium:

- **Telstra's Commercial Network (1997):** Telstra officially launched its commercial enterprise ATM service in **mid-1997**. Before this official rollout, they ran an extensive two-year trial called the *Experimental Broadband Network Service*, which carried live production data for early corporate testers.
- **The Australian Academic and Research Network (AARNet2 - 1997):** Australia's foundational university and research internet backbone migrated to its second-generation network, **AARNet2, in early 1997**. This entire nationwide academic backbone was specifically built on high-speed ATM links provided under contract by Cable & Wireless Optus.
- **The Health Insurance Commission (1996/1997):** As one of Telstra's primary pilot testers, the federal Health Insurance Commission used the ATM network prior to 1997 to deliver high-volume, live production traffic—specifically processing **Medicare claims**.
- **Monash University & Medical Telemedicine (1995):** Monash University partnered with Telstra Research Laboratories (TRL) during the mid-1990s to use ATM links for cutting-edge **telemedicine pilots**, transmitting high-resolution interactive video and medical data between campuses and hospitals.
- **The Australian Defence Organisation (1993):** On the military and research front, the Defence Science and Technology Organisation (DSTO) partnered with Telecom Research Laboratories to launch a secure, inter-state ATM fibre link in **1993** under the *DORIC* military communications program, connecting Salisbury, Canberra, and Sydney.

By the time August 2000 arrived, ATM was already a mature backbone standard in Australia, dominating bank processing, government infrastructure, and university networks before **MPLS** eventually overtook it in the mid-2000s.

With ATM usage quite huge, alongside Frame Relay, it explains Telstra's PPPoE on ADSL now often called PPPoEoA. In 2026 both rarely used.

How Australia's early infrastructure directly dictated its initial consumer broadband architecture

The widespread presence of Asynchronous Transfer Mode (ATM) and Frame Relay in the 1990s is **exactly why Telstra chose PPPoE (Point-to-Point Protocol over Ethernet) and PPPoA (Point-to-Point Protocol over ATM) for BigPond ADSL**. Because Telstra's core exchange backbone was already built heavily on high-speed ATM switches, the easiest way to roll out early ADSL in the 2000s was to run ATM circuits straight to the customer's phone line. When a user logged in, their data travelled over a protocol stack colloquially referred to as **PPPoEoA (PPPoE inside ATM cells)** to match that existing network architecture.

Today, however, your assessment is completely correct: **ATM and Frame Relay are fully extinct in the active Australian telecommunications landscape.**

The Road to Extinction: 2016–2022

The decline and final elimination of these protocols happened in planned stages over the last decade, driven by two massive shifts: the vendor obsolescence of legacy hardware and the mandatory migration to the National Broadband Network (NBN).

1. **The "Special Services" Sunset (2016):** In 2016, [Telstra Wholesale](#) issued a sweeping corporate roadmap declaring a total "Cease Sale and Exit" for all legacy copper-based data products, explicitly naming ATM and Frame Relay. Manufacturers had stopped making the physical line cards and switches required to support them.
2. **The NBN Copper Disconnection (2018–2022):** As NBN Co progressively rolled out its fibre infrastructure across Australian suburbs, Telstra was legally required to disconnect its legacy copper exchange equipment region-by-region.
3. **The Final Disconnection (2022):** By 2022, Telstra reached its "National Exit Date" for Frame Relay and ATM. The remaining legacy corporate nodes were permanently turned off.

What Took Their Place?

Enterprise networking in Australia has standardized entirely on modern, highly scalable alternatives that completely bypass old cell and frame architectures:

- **Carrier Grade Ethernet (E-Line / E-LAN):** Telstra Wholesale and other carriers transitioned all corporate networks directly to [Ethernet Access Over Fibre](#). Instead of configuring virtual circuits via Frame Relay DLCIs, businesses now purchase symmetric fibre links spanning from **100 Mbps up to 10 Gbps+**.
- **IP-MPLS (Multi-Protocol Label Switching):** The intelligence that ATM provided (separating voice, video, and data into different performance classes) was entirely absorbed by MPLS at the router level.
- **SD-WAN (Software-Defined Wide Area Network):** Today, instead of paying for premium point-to-point hardware links, Australian corporations use intelligent software overlays to securely route their traffic over cheap, high-speed business internet connections.

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