IT'S HOW
WE CONNECT

TECHNICAL GUIDE

DATA CENTRE INTERCONNECT

CATEGORY: GLOBAL ENTERPRISE & SERVICES

PORTFOLIO: CLOUD NETWORKING

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1 INTRODUCTION

1.1 What is Data Centre Interconnect

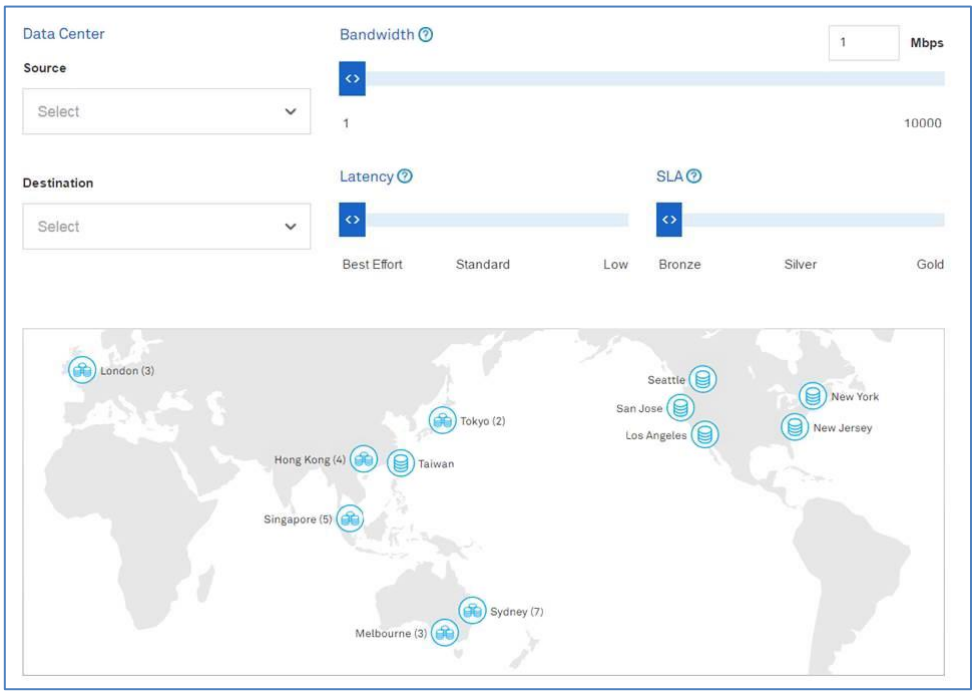
The requirement to operate multiple, geographically dispersed data centres is critical for many organisations because of the benefits associated with distributing applications and data in more than one data centre, such as increasing levels of service availability, improving application performance and driving operational efficiencies. Data centre interconnect is required to ensure that data is consistent, virtualised workloads can be moved rapidly across data centres and applications can be deployed in high availability solutions between locations.

The data centre interconnect (DCI) market has traditionally focused on near real-time disaster recovery and business continuity and has typically been driven by two concerns: bandwidth and latency. However, with the move of virtualising more and more data centres and connecting them in a cloud of virtualised compute and storage using Software Defined Networking (SDN) to automatically allocate resources as required becomes mainstream, it poses a new set of requirements on data centre interconnect. In addition to bandwidth and latency, customers are now asking more demanding questions, like:

- How can I get maximum agility, flexibility and control of my data centre connectivity, whether in terms of bandwidth, latency, service level or the duration that I want a specific service for?
- How quickly can I scale-up and scale-down new services between my data centre resources?
- How can I increase (burst) bandwidth on demand to avoid paying for bandwidth capacity when I don't need it?
- How can I associate my bandwidth flows with my applications, so they can be managed independently of each other?
- How can I ensure the optimal utilisation of bandwidth according to my application requirements?

1.2 Telstra's Data Centre Interconnect

Telstra's Data Centre Interconnect provides on-demand connectivity between a global network of private and public data centres and clouds. It offers Ethernet based point-to-point connectivity between domestic and global data centres in just a few clicks.



Built using the latest in Software Defined Networking (SDN) technology, Data Centre Interconnect offers unprecedented agility, flexibility and control to customers, all via an intuitive self-service portal. Once connected to the service, customers are able to configure virtual circuits between compatible data centres across the globe with bandwidths ranging from 1Mbps to 10Gbps.

With self-service capabilities, instant provisioning and self-healing technology, Data Centre Interconnect empowers organisations to be more agile and efficient in the way they manage cloud, critical applications and business continuity solution.

Simplicity: Point-to-point connections and configurations can be done in just a few clicks via the intuitive self-service portal.

On-demand connectivity: Point-to-point connectivity between domestic and global data centres in near real-time.

Agility & Flexibility: Consume virtual services in near real-time to respond quickly to customers and changing market dynamics.

Highly configurable solution: Customers can configure bandwidth, latency, service level and contract terms for each flow via an intuitive self-service portal, giving them an unprecedented level of control.

Flexible billing options: Flexible contract periods mean that customers can control their network expense by the required duration. They can select from hourly, daily, monthly and longer term contract options.

Scalable Bandwidth: Customers can dynamically allocate and scale the bandwidth for their business requirements by adding temporary bandwidth bursts to their flows. A bandwidth burst is an additional short-term bandwidth, ranging from 1Mbps to 10Gbps, and can be requested from 1 to 720 hours, depending on the customer's needs.

Safe and reliable management of data: Built on a highly available, self-healing network with no single point of failure, ensuring a reliable connection regardless of data centre locations.

Visibility and control: Complete control and visibility of the customer's data centre ecosystem via an intuitive self-service portal.

Automatic Provisioning: Data Centre Interconnect is a completely automated product with the SDN controller and Service Orchestrator performing all the back-end processes without any human intervention. Initial physical connection of ports will require cross-connection.

1.3 Key Use Cases for DCI

On-demand connectivity to data centres across the globe:

Data Centre Interconnect (DCI) provides customers with point-to-point connectivity between domestic and global data centres in near real-time. The solution is built using the latest innovations in Software Defined Networking (SDN) technology that enables instant provisioning of data centre services and on-demand bandwidth bursting to meet rapidly changing application demands.

The SDN controller and service orchestrator perform all the back-end processes without any human intervention. The intuitive self-service portal means that changes and configuration and changes can be done in a matter of clicks.

Flexible and agile approach to managing your data centre ecosystem/environment:

Data Centre Interconnect provides customers with a more agile approach to consuming virtual services on demand, allowing them to respond quickly to customers and changing market dynamics. Network

requirements are no longer static, and as a result, DCI is highly configurable in real time, with the ability to configure bandwidth, latency, service levels and contract terms via an intuitive self-service portal.

Data Centre Interconnect is highly scalable, enabling customers to connect with data centres across the globe, when and where the demand is needed. Flexible payment methods mean that customers only pay for increased bandwidth when they use it, with hourly, weekly and monthly charging models available. This meets customer demands for both short-duration bandwidth and more economical ongoing bandwidth between data centre resources.

For example, if a customer requires 1Gbps connectivity into a data centre, but once a month they require 10Gbps connectivity, they wouldn't want to pay for 10GBps connectivity all the time. On-demand bandwidth with DCI means the customer would only pay for short-term increased bandwidth when it's required.

Safe and reliable management of data:

Data Centre Interconnect is built on a highly available, self-healing network with no single point of failure, ensuring a reliable connection regardless of data centre locations. Customers also have peace of mind that DCI has full redundancy with diverse paths and options available to any connection between data centres across the globe. Customers will also have complete control and visibility of their data centre ecosystem via an intuitive self-service portal.

1.4 Product and Service Elements

There are three major components of the product construct for DCI: physical ports on Telstra's DCI PoPs that customers connect to, bandwidth flows that customers can dynamically configure once connected to at least two ports and bandwidth bursts. You will be charged separately for the number of ports you connect at various data centres and the flows that you configure between those ports.

A. Ports

The first step is to establish physical connectivity between customers' resources in a given data centre and a Telstra DCI switch. All ports on our switches are pre-connected to cross-connect (meet me room) within the respective data centres.

Customers can select the port type and mode when requesting to connect to one or more data centres through the online portal. Telstra DCI switches support 1GE and 10GE ports with both fibre and copper connectivity options. Customers can select a suitable option based on the distance between their racks and the DCI switches.

These ports can be configured with single or multi-flow support. If a port is configured with Single Flow support, customers will not have to allocate VLAN for their flow but they will be able to configure only one flow on that port (Access mode).

Multi-flow ports can support up to 4,095 flows from the same physical port (Trunk mode). Customers will have to allocate a VLAN-ID at each end for their flows (range 1-4095). If customers wish to use one physical port to create more than one flow (either now or in the future), they should select multi-flow support.

Ports will be allocated to the customers upon request and reserved for their use. Telstra will send a Letter of Authority (LOA) via DocuSign to customers with all details of our DCI switch.

Customers will need to use this LOA to arrange the cross-connect in the respective data centre. This process can take anywhere from two days to several weeks, depending on the customer and the data centre providers. Once the cross-connect is up, Ports will become 'Up' in the portal and customers will be able to configure Flows between them.

B. Bandwidth Flows

Once a customer has at least two ports connected and active, they can start configuring flows between these ports. In case of Access ports, customers can only configure one flow per port, while with Trunk ports, customers can configure up to 4,095 flows per port.

Charges for flows and bursts are determined based on the distance between data centres, choice of service level and contract duration. You can refer to DCI Pricing Calculator on **www.telstra.com/dci** to determine these charges for their desired configuration. Customers can select following parameters for their Flows:

1. DC Locations (DC-A and DC-B)

Customers can select their ports at both ends (DC-A and DC-B) between whom they want to configure a flow. Their active ports will be pre-populated.

2. Bandwidth

Customers can enter any bandwidth between 1Mbps to 10Gbps with increments of 1Mbps, up to their port capacity or the network capacity of the DCI infrastructure (whichever limit occurs first).

3. Latency

Customers can select the desired latency path of their connections. Further details are included in Chapter 2.

4. Service Level (SLA)

Customers can select the desired Service Level for each of their flows. Service Levels define the service restoration target times. Further details are included in Chapter 2.

5. Contract/Billing Period

After selecting available ports, required bandwidth and Service Level, customers will be presented with a number of contract/billing options, starting with hourly billing for maximum flexibility and going up to a 36-month contract term, so you can select the most economical option for their flows.

1) **Hourly**
   Flows will be charged on an hourly basis from the time they are active, until they are cancelled. Any partial duration will be charged as a full hour. There won't be any other penalty to cancel the flow.
   Example: A customer cancels an hourly flow after usage of 2 hour and 15 minutes. He will be charged hourly rate for 3 hours.

2) **Daily**
   Flows will be charged on a daily basis from the time they are active, until they are cancelled. Any partial duration will be charged as a full day. There won't be any other penalty to cancel the flow.
   Example: A customer cancels a daily flow after usage of 15 days and 2 hours. He will be charged daily rate for 16 days.

3) **Monthly**
   Flows will be charged on a monthly basis from the time they are active, until they are cancelled. Any partial duration will be charged as a full month. There won't be any other penalty to cancel the flow.
   Example: A customer cancels a monthly flow after usage of 3 months and 4 days. He will be charged monthly rate for 4 months.

4) **12 Months Contract**
   You get a better monthly pricing when you commit to a 12 month contract. This is ideal for ongoing capacity usage between data centre resources. If you cancel a flow before the expiry of the contract term, you may be charged ETC (early termination charges).

5) **24 Months Contract**
You get a better monthly pricing when you commit to a 24 months contract. This is ideal for ongoing capacity usage between data centre resources. If you cancel a flow before the expiry of the contract term, you may be charged ETC (early termination charges).

6) **36 Months Contract**
You get the best monthly pricing when you commit to a 36 months contract. This is ideal for ongoing capacity usage between data centre resources. If you cancel a flow before the expiry of the contract term, you may be charged ETC (early termination charges).

C. Bandwidth Bursts (Bandwidth on demand)

As network requirements are no longer static in the cloud era, DCI provides complete flexibility to the customer where you can add one or multiple bandwidth bursts to their existing flows. A bandwidth burst is additional short-term bandwidth using the same parameter of the existing flow. Customers can request bursts between 1 to 720 hours, depending on their requirements.

There is no upper limit with these bandwidth bursts, and customers can burst up to their port capacity or network capacity (whichever comes first).

24/7 Helpdesk

DCI Customers can log their faults or issues with a 24/7 Helpdesk and Telstra will target to resolve those issues within the service level subscribed by the customer.

Item	Description

Customer Contact Points	There are three Customer Contact Points to log tickets with the Service Desk:
	• Phone - 1800 620 345 (Option 1: Faults, then Option 2: Requests)
	• Email - cloudservicessupport@online.telstra.com.au
	• From Single Sign-on
	  ○ Click **Support** link. This takes us to the **Cloud Services Store**.
	  ○ Click **Portal** .This takes you to the **Cloud Services Portal**.
	  ○ Click **Support** where you can **Log an Incident**.

1.5 Why Telstra?

Telstra's Data Centre Interconnect (DCI) is designed to meet the requirements of hybrid data centre and cloud requirements where you, as a customer, can create flows and determine the bandwidth, latency, service level and duration most suited for your specific requirements. Using DCI, you not only get higher service agility and availability, but also reduce your networking costs.

Telstra uses the latest in Software Defined Networking (SDN) technology to connect leading data centres (both Telstra and third party) within Australia and across the globe to provide unprecedented agility, flexibility and control to customers, all via an intuitive self-service portal. Once connected to the service, customers are able to configure flows with any bandwidth from 1Mbps to 10Gbps. With self-service capabilities, instant provisioning and self-healing technology, DCI allows organisations to be more agile and efficient in the way you manage cloud, critical applications and business continuity solution.

2 ORDERING AND PROVISIONING DCI

2.1 Ordering

How to register for DCI

If you're an existing Telstra customer, login to the Cloud Services Store with your credentials. If you don't have Telstra login details, you'll need to register for a Telstra ID.

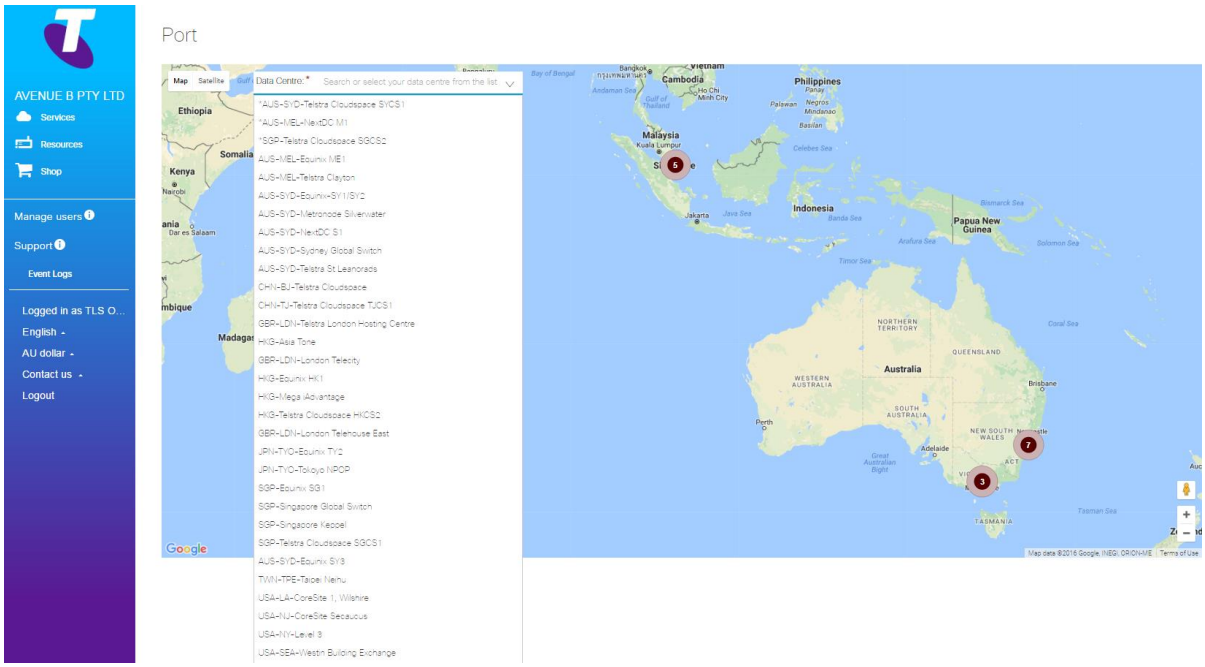
After you've logged in to the Cloud Services Store, you'll need to complete the registration form. You'll then get an email with a link to the Dynamic Network Portal to purchase your Data Centre Interconnect. This is a secure self-service online portal that provides you with a simple way to select, subscribe to and activate your service. It provides visibility to all of your DCI products and helps you quickly make changes as required. The portal also allows you to track the status and performance of your service package.

Once in the Dynamic Network Portal, you'll be directed to the Shop tab where you'll see a number of products, including Data Centre Interconnect. Select that tile, and you'll be given the option to buy a port or a flow.

How to order ports

Ports can be ordered from a number of available data centres. You have to purchase two ports before you can purchase a flow. If you try to purchase a flow without purchasing ports first, you'll see an error message asking you to purchase a port.

To order a port, select a data centre from the drop-down list and choose the port's location.



Each port you buy needs to be configured with the following information:

- **Port ID:** choose a unique name for each port
- **Speed:** Select the maximum speed you want to configure on this port. Note that the total sum of all flow speeds to each port is limited to speed of the port. 1Gbps can only be used with Copper and Fibre-LX. 10Gbps must be used with Fibre-LR
- **Multi-flow support:** You can configure multiple flows to a single port by assigning separate VLAN-IDs to each flow. If you will only ever require a single flow for this port, select Single flow, and we will assign you a single VLAN-ID for simplicity. You will not be able to change this setting later
- **Port type:** Do you want to connect to a Fibre or Copper port? Note that Copper and Fibre-LX are only available with 1Gbps port speeds, and Fibre-LR must be used with 10Gbps port speeds

Once these fields have been configured, review your order and accept the Terms and Conditions before submitting your order.

2.2 Provisioning process, notifications and times

Letter of Authority

Once you've purchased a port, you'll receive two emails: a confirmation with your order details, and one with a secure link via DocuSign to access your Letter of Authority. You'll need to review this letter and confirm everything is correct.

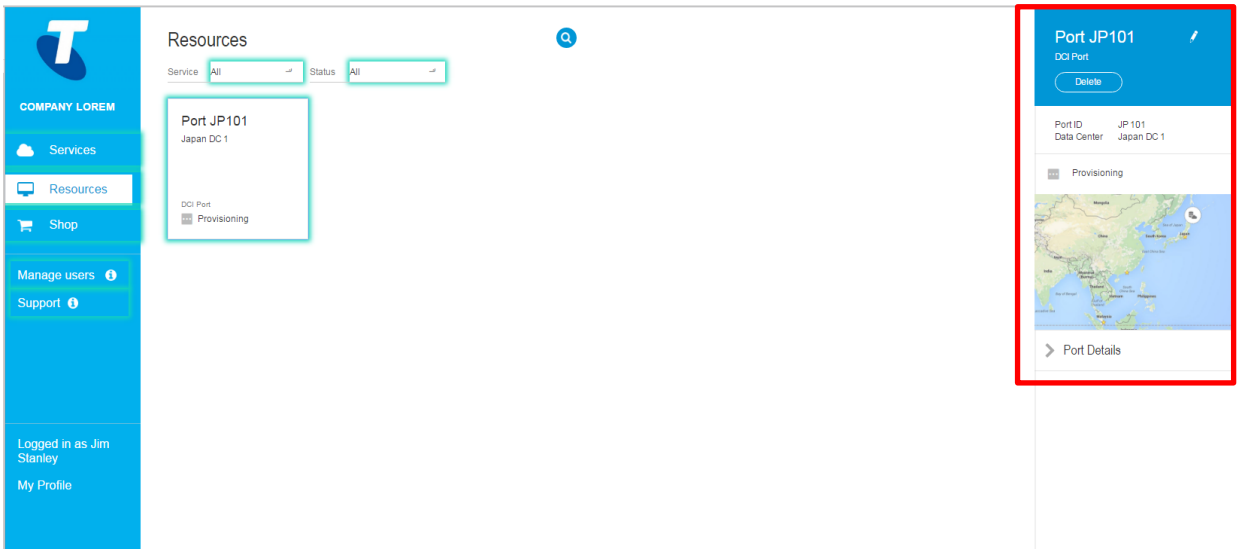
You'll then receive a PDF version of the Letter of Authority by email that you'll need to give to the data centre where you have allocated a port, and a cross connection will be made between your equipment and that port.

This Letter of Authority expires in 90 days. If you don't arrange a cross connection to this port before the expiry date, you'll need to cancel the port, and purchase a new one before you can make a connection with this data centre.

Please note, your data centre may impose additional charges to perform a cross connection to this port.

Provisioning

Your service will appear in Provisioning status on the Services screen until two ports have been purchased and a cross connect has been completed. The details of your port will appear on the right hand side when you click on the Port tile.



Service Provisioning Time

The SDN controller and service orchestrator perform all the back-end processes without any human intervention.

New service requests are provisioned within two minutes in most cases. For some exceptional circumstances, this time can increase up to 10 minutes before you may be informed about the success or failure of your service request. This time applies to provisioning of flow using active ports.

Ordering and configuring a flow

Once you have two active ports, you can then purchase a data flow connection between the two ports with the Data Centre Interconnect Flow tile in Shop.

You'll be asked for information about your ports. Choose the first port you want to use and assign a unique VLAN-ID between 1 and 4,095 to distinguish it from existing IDs and save the port details.

Repeat the same for the second port.

To configure the flow, click on the line joining the two ports, and enter the flow details.

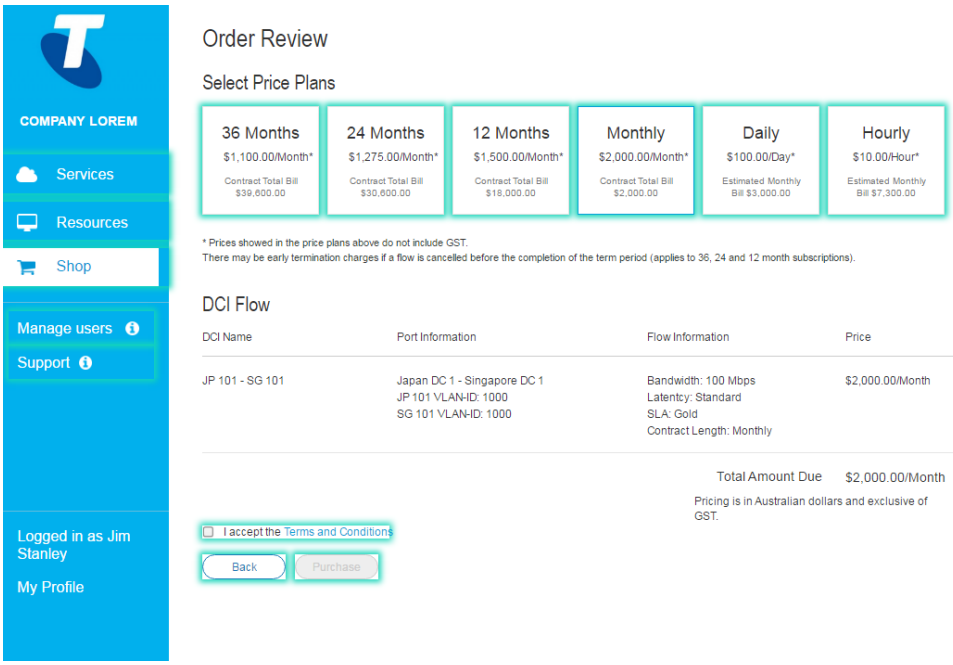
You can selected the latency and service level for each flow at the time of provisioning. This defines the latency of the path between their data centres and the service restoration targets from Telstra, should anything go wrong.

The flow will need to include the following:

- **Bandwidth:** enter any bandwidth between 1Mbps and 10Gbps in increments of 1Mbps up to the port capacity or the DCI network capacity (whichever limit occurs first)
- **Latency:** select Low for the lowest latency path available; Standard will fall into Telstra's latency range; and Best Effort will not have any target latency
- **Service Level Agreement:** select the target restoration time for your flow in case of connectivity failure – select Gold for 8 business hours; Silver for 12 business hours; Bronze for two business days

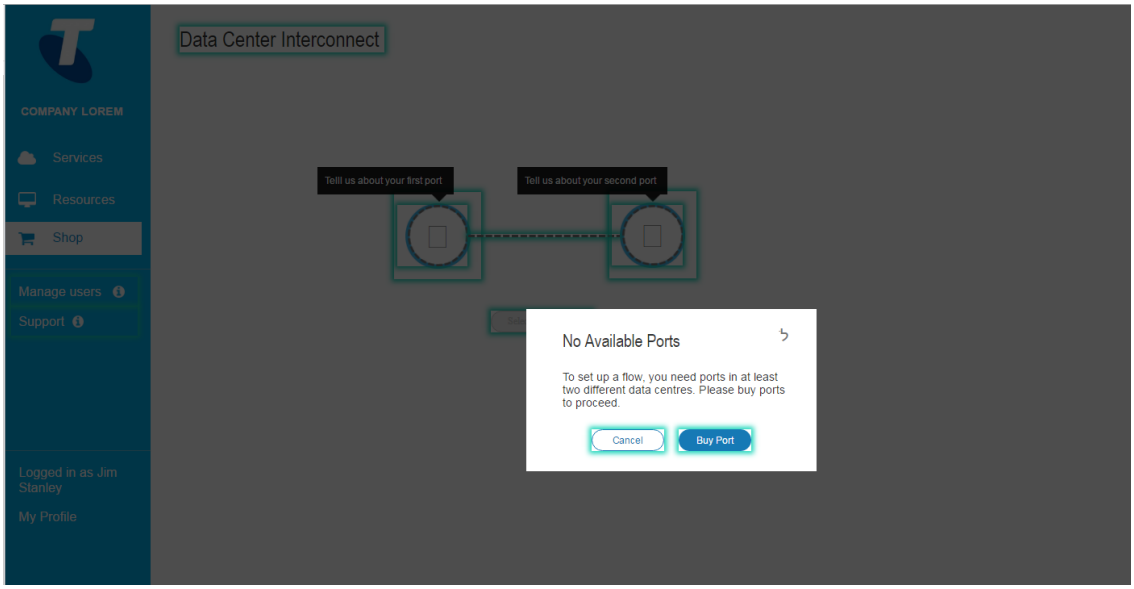
Once you've configured your flow, you'll need to select a price plan.

All price plans renew automatically monthly. Daily, hourly and monthly plans show individual and estimated monthly costs; 12, 24 and 36 month plans have contract terms, and early termination charges may apply for early cancellations. The total price will update with the selected plan details.



Error messages and email notifications

The only error message you may receive is when you try to purchase a flow before you have bought two or more ports. You'll see this message:



You'll receive automatically-generated email notifications at the following steps:

- Successful port purchase
- Letter of Authority review via DocuSign

- Letter of Authority confirmation, with LOA attachment
- Flow active
- Burst added

If your order requests have been unsuccessful, you'll receive the following email notifications:

- Port failed
- Flow failed
- Burst failed

If you choose to cancel your port or flow, you'll receive one of the following email notifications:

- Port cancelled
- Flow cancelled

2.3 Services and resources status

You can view the status of your services and resources status in dynamic networks portal.

Port Status

Status for your Ports can be viewed in 'Resources' tab, below are the possible Port status messages that you might see on the portal.

No.	Port Status	What does it mean	When should you see it
1	Ordering	Order request is submitted from UI but yet to be accepted by the Network Orchestrator	Can appear for a very short duration when you submit the order.
2	Provisioning	Your Port order has been accepted and is currently being provisioned by SDN controller	Few seconds after submission of the Port order till it gets Provisioned.
3	Provisioned	Your Port is successfully provisioned and ready for use. LOA will be issued after successful provisioning.	Successfully provisioned the port, billing will start at this point.
4	Provisioning Failed	If your Port could not be provisioned for reasons like switch port capacity	Port provisioned has failed and you will not be billed for this port.
5	Unknown	The Port is provisioned and customer equipment is being discovered	Can happen for less than 5 min after port is provisioned, after that port will move to Up or Down status
6	Up	Customer equipment is connected to the DCI port and it is ready for Flows to be provisioned	Standard behaviour

No.	Port Status	What does it mean	When should you see it
7	Down	Customer equipment is disconnected from the DCI switch or cross-connect or DCI port are down.	Standard behaviour when Port is down

Flow Status

Status for your flows can be viewed in the 'Services' tab, below are the possible Flow status messages that you might see on the portal.

No.	Flow Status	What does it mean	When should you see it
1	Ordering	Order request is submitted from UI but yet to be accepted by the Network Orchestrator	Can appear for a very short duration when you submit the order.
2	Provisioning	Your flow order has been accepted and is currently being provisioned by SDN controller	Few seconds after submission of the Flow or Burst order till it gets Provisioned.
3	Provisioned	Your flow is successfully provisioned and ready for use	Successfully provisioned flows, billing will start at this point.
4	Provisioning Failed	If your flow could not be provisioned for reasons like network/port capacity or availability.	Flow provisioned has failed and you will not be billed for this flow.
5	Unknown	The flow is provisioned but there is not traffic passing through the flow	Can happen for less than 5 min after flow is initially configured or till traffic is passed through
6	Active	Flow is provisioned and traffic is passing through	Standard behaviour when traffic is passing through
7	Inactive	Flow is provisioned but traffic is not passing through	Standard behaviour when traffic is not passing through
8	Updating	Burst order has been submitted to the network orchestrator. Once the request is accepted, status will change to 'Provisioning'	When you have requested a burst on existing Flow and it is being ordered

Burst Status

You can view the status for your Bursts in 'Services' tab by clicking on your respective Flow and then on 'Bursting Information'. If you have multiple bursts on the same Flow, this information will reflect the status of your most recent burst.

No.	Burst Status	What does it mean	When should you see it
1	Active	Your burst has been activated and is currently active	Active bursts
2	Expired	Time for your burst has lapsed and it is not available for use anymore.	Expired bursts

2.4 Managing the product

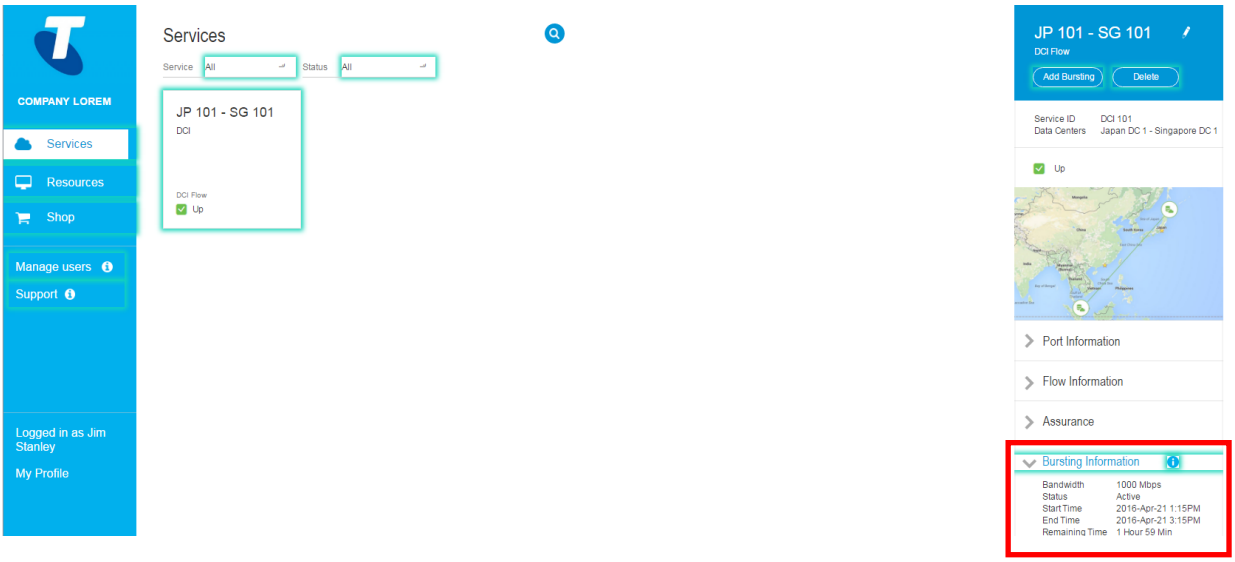
How to order and configure bursts

You can temporarily increase the bandwidth of your existing flow by adding one or multiple bursts. You can do this from the Flow information tile in Services and clicking 'add bursting'.

You'll need to configure the bandwidth and duration of your desired burst.

- **Bandwidth:** A burst adds additional bandwidth for a short period of time using the same parameters as your existing flow. There is no upper limit of the bandwidth; you can burst up to your port capacity or network capacity (whichever comes first).
- **Duration:** Bursts are only available in hourly durations and you can configure these bursts from 1 to 720 hours.

Once you've successfully added a burst, you'll be able to view information about your current or most recent burst at the bottom of the right hand panel in the Services screen.



Changing your flow size

Once you have an active flow, adding a burst is the only way you can change the size of the flow. If you want to permanently increase or decrease the size of your flow, or modify the Bandwidth, Service Level or Contract Terms, you need to cancel that flow and create a new one.

2.5 Cancellation

Cancelling your flow

You can delete or unsubscribe your existing ports, but you'll need to cancel any flows connected to those ports before you do. Any flows that are cancelled before the completion of their contract term may be charged an early termination charge (ETC).

If you create a new flow with a higher Bandwidth, Contract Duration or Service Level after cancelling an existing flow, any ETCs on that contract will be waived.

Calculation of Early Termination Charges

If you cancel a flow before the expiry of their contract term, you may be charged an early termination charge (ETC). These charges will be calculated as follows:

$$ETC = (F – f) x n$$

where f = contracted monthly flow price

F = new monthly flow price for shorter term

n = number of whole months consumed

For example, if you take a 36 month contract with price of $100 per month, but cancel after 18 months, where 12 month contract price would have been $120 per month, then the ETC will be calculated as follows:

$$ETC = (\$120 - \$100) x 18 = \$360$$

Please note, this is an example for illustration only. An actual discount amount can be determined from the DCI Pricing Calculator.

Deleting a port

You are able to delete an existing and active port, but first you need to cancel any flows connected to that port.

In Services, your port details can be viewed on the right hand side. To cancel a port, hit the Delete button. You'll receive an email notification acknowledging your request.

The port may remain active in the Dynamic Network Portal until the cancellation is finalised. This may take two business days, but you won't be billed for this time.

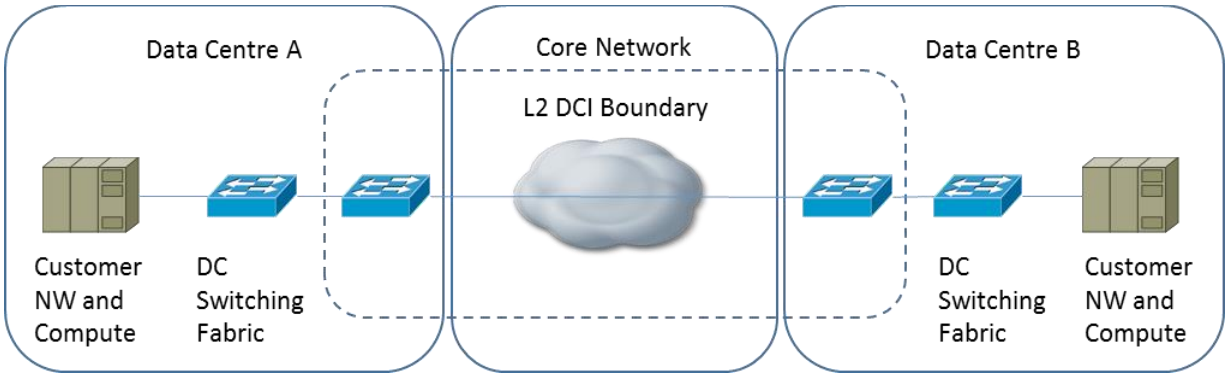
If you decide to purchase another port, you'll need to submit a new request.

3 TECHNICAL SPECIFICATIONS

3.1 End-to-End DCI Connectivity View

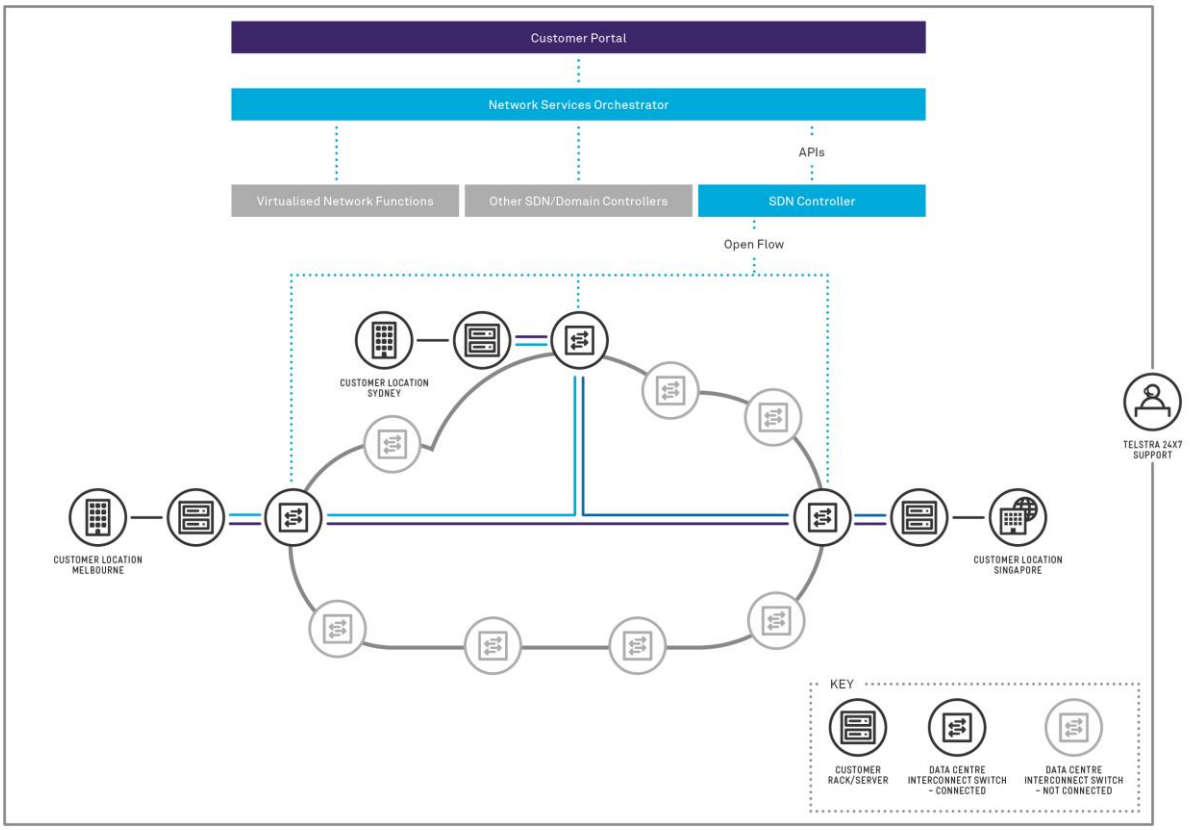
Data Centre Interconnect (DCI) services are basic access or carriage services to connect two or more sites using Ethernet. The service hand-off is a customer-facing port on the Network Termination Unit (NTU). The customers will run upper-layer protocols over these Ethernet-based services.

DCI service boundary is highlighted in the diagram below:



The physical connections are pre-provisioned and the subsequent ordering and activation of the services are carried out online without any paper-based activities. Figures below illustrate some service flow topologies that are support for the initial phase of DCI. More topologies like E-LAN and E-Tree will be added in the future.

3.2 End-to-End Network Architecture



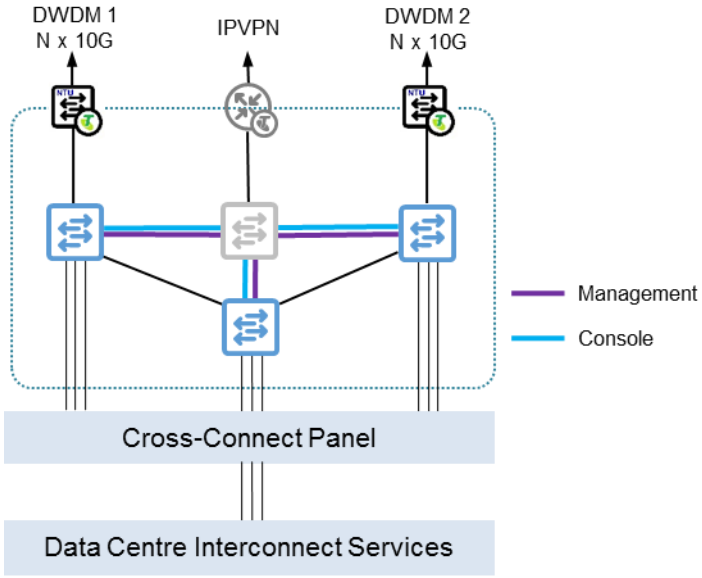
DCI uses Network Services Orchestrator and an Open Daylight-based SDN Controller using Open Flow as a control plane and Layer-2 Ethernet as the forwarding plane. The simplified diagram showing end-to-end architecture is shown below:

Within each data centre, there are three customer-facing switches that provider the Layer-2 DCI services. These switches are connected in a linear, concatenated topology. The first and last switch in the series are connected to the DWDM services that provide the inter-data centre links with multiple 10G capacity. From Telstra Rack, fibre-optic cables are used to connect the switch ports to the cross-connect patch panel (typically hosted by the data centre operator).

Both 1G and 10G connections are available:

Service	Interface	Optical Fibre
1G	LC Connector, up to 10km	Single-mode 1310nm
10G	LC Connector, up to 10km	Single-mode 1310nm

The diagram below also shows the management and console connections. The management network is used by the SDN controller to send configuration commands to the switches using Open Flow protocol. The SDN controller is also deployed in a cluster to avoid single point of failure.



3.3 Demarcation Points and Responsibilities

Type	Telstra	Customer
Control Plane (IPVPN)	Yes	No
Control Plane PE	Yes	No

Type	Telstra	Customer
Forwarding Plane	Yes	No
PEN Switch Failure	Yes	No
Faulty SFP	Yes	No
Customer Flow Down	Yes	No
Cross Connection	No (but will help to troubleshoot)	Yes
Layer 3 configuration	No	Yes
CPE device	Managed only	Yes

3.4 Bandwidth Management

DCI service does not oversubscribe, so customers get the bandwidth that has been committed at the time of provisioning. DCI flows and bursts have guaranteed bandwidth during the duration of their existence.

The inter-data centre links are capacity-managed to ensure adequate capacity for the services that are carried between these data centres. The capacity planning rule stipulates a limit of 90%. If there is not enough capacity on one link at the time of customer request, the SDN controller will allocate other links or reject the request.

3.5 Network Features

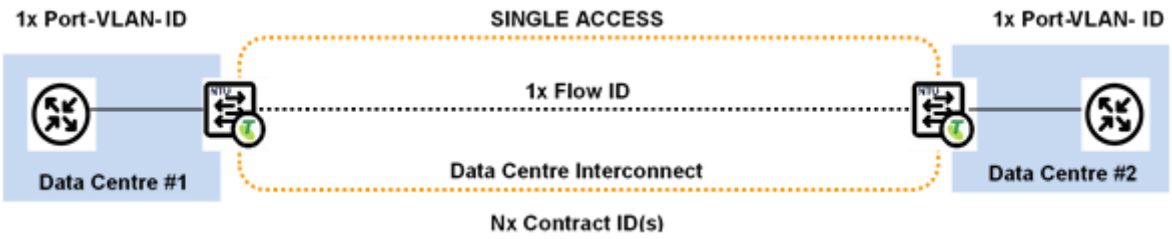
The services provided by DCI are Ethernet-based services.

Customers can nominate their services to be either:

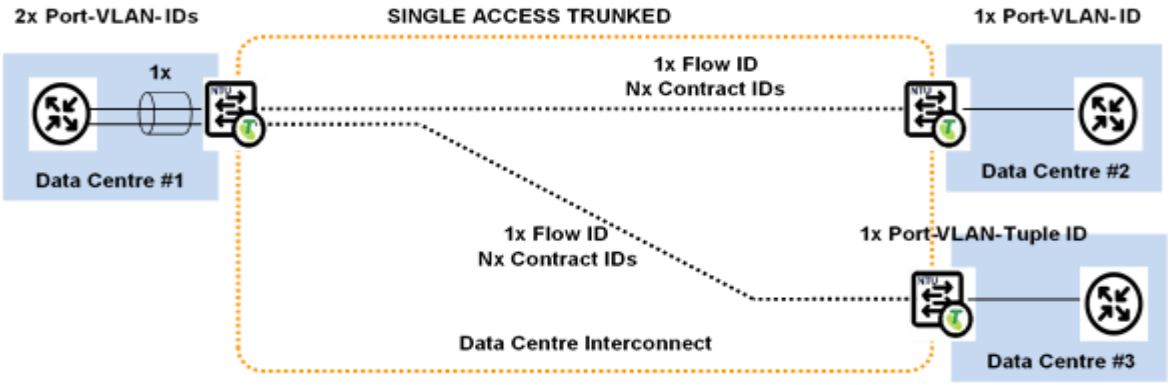
- Untagged Ethernet
- 802.1Q tagged Ethernet

The diagrams below show the differences between the two types of services.

Untagged Ethernet service

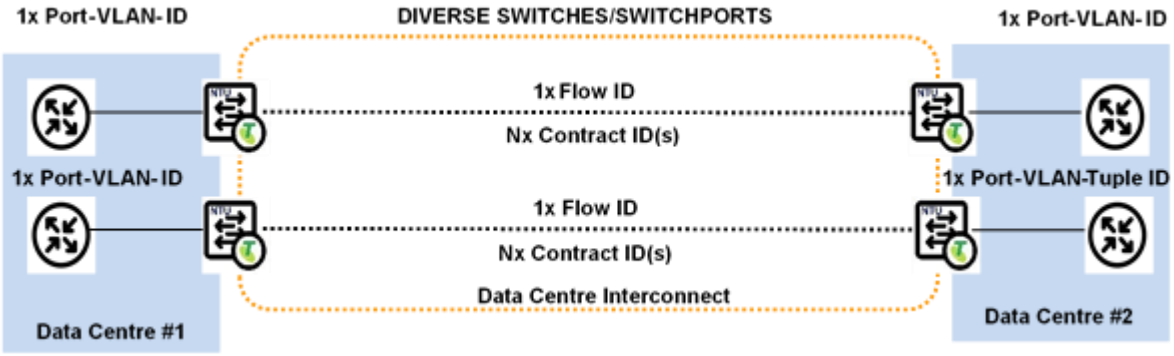


802.1Q Tagged Ethernet service



End-to-end protection of flows

For redundancy, the customer can buy 2 x single services as shown below:



Other Network features

- **Jumbo frame support:** Ethernet frames up to 9000 bytes payload
- **Class of Service Support:** Existing customer CoS markings including L3 DSCP and L2 PCP markings will remain unchanged as the packets/frames traverse the service. DCI service does not provide/override CoS markings

3.6 Self-Healing Network

Each DCI switch has multiple back-up links and the network provides SDN controlled self-healing with fast failovers at the service handoff points. The time for service failover will be up to 10 seconds

3.7 Performance Targets

Service Provisioning Time

DCI is a completely automated product with the SDN controller and service orchestrator performing all the back-end processes without any human intervention.

New service requests are provisioned within two minutes in most cases. For some exceptional circumstances, this time can increase up to 10 minutes before you may be informed about the success or failure of your service request. This time applies to provisioning of flow using active ports.

Latency Targets

Customers can select their choice of latency levels for each flow:

- **Low Latency:** Flow will be configured with the lowest latency path available at the time of

request

- **Standard Latency:** Flow will be configured with the standard latency path available at the time of request. This may not be the best path, but will fall within latency range provided by Telstra
- **Best Effort:** Flow will be configured with best effort only. Customer will not be given any target latency with this service level

For a detailed list of latency target between each DC end-point, please refer to **Appendix-1**.

Service Level (SLA)

Customer can request from Gold, Silver and Bronze SLA for each flow. Troubleshooting and the logging of faults can be performed via a helpdesk and the Dynamic Networks Portal.

- **Gold SLA:** Telstra will provide service restoration target of 8 hours in case of failure due to Telstra's part of connectivity
- **Silver SLA:** Telstra will provide service restoration target of 12 business hours in case of failure due to Telstra's part of connectivity
- **Bronze SLA:** Telstra will provide standard service restoration target of two business days in case of failure due to Telstra's part of connectivity

Network Availability Target

Due to separation of data and control paths and full redundancy in both, the DCI SDN controller has much better visibility and control of how your traffic travels across the network. This means it has a higher service availability.

Connection Type	Network Availability Target
Network availability between DCI Switching Nodes	99.99%

This availability target does not include switch ports, cross-connects and any other items beyond Telstra's control.

3.8 Security

Standard security practices are in place to ensure security and safety of the services:

- The network devices are hosted in the Telstra Racks within the data centres
- Standard entry and accompaniment data centre policies apply for all the data centres listed
- The connections to the switches are provided via an inter-connect patch-panel hosted by the data centre operator
- The control plane commands are sent via a private Telstra IP VPN
- The console connections provide direct access to the switches for emergency or last-resort access to the switches
- The inter-Data Centre links uses Telstra DWDM services (including Telstra OpticWave)

3.9 Service modifications (Moves, Adds, and Changes)

The following Moves, Adds and Changes (MACs) are supported with DCI:

- Customers can add or delete their existing ports
- Customers can configure bandwidth burst for their existing flows
- Customers can cancel their flows, if you cancel before completion of their contract term, you may be charged an early termination charge (ETC)
- Customers can modify bandwidth, service level or contract term for their flows, by cancelling and then creating a new flow.
  When customers create new flows with higher bandwidth, contract duration or service level after cancelling their existing flows on long term contracts, we will waive ETCs on their previous contracts.

4 REPORTING, SERVICE ASSURANCE AND SUPPORT

4.1 Details of Customer Portals

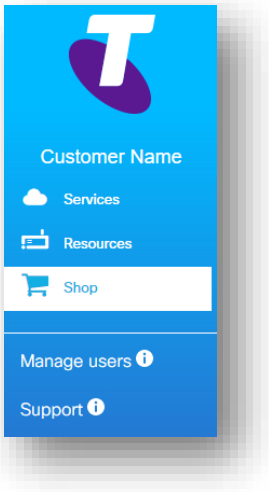
Telstra Data Centre Interconnect provides comprehensive online tools and portals for you to browse, buy, activate, manage and access support for the product.

BROWSE/QUOTE	**Telstra website** www.telstra.com/dci
BUY/ACTIVATE	**Telstra Cloud Store** https://buycloud.telstra.com **Dynamic Network Portal** https://symphony.telstra.com/
CONFIGURE/MANAGE	**Telstra Cloud Portal** https://mycloud.telstra.com/ Service Central Portal
SUPPORT	Support Library Knowledge Management

We will only be able to provide support for the Portal on the following internet browsers:

- Internet Explorer (7 and higher) for Windows
- Firefox (24.6 and higher) for Windows, Mac, and Linux
- Safari (5.0 and higher) for Windows and Mac
- The latest public release of Google Chrome for Windows and Mac

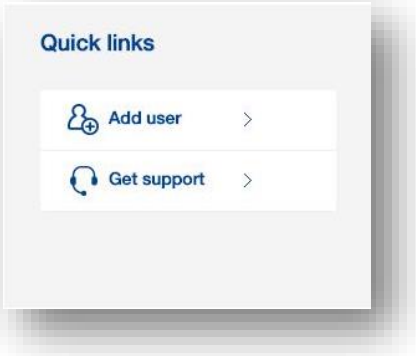
How to log support requests

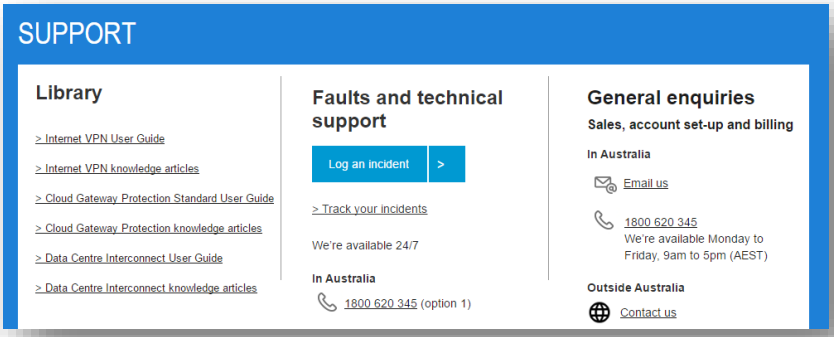


SSO INTO SUPPORT

Single Sign On (SSO) into the Cloud Services Support Portal, directly from the Dynamic Network Portal by clicking the support link at the bottom of the left hand navigation menu.

Then follow the Get support link in the Quick links menu in the Cloud Service Portal.

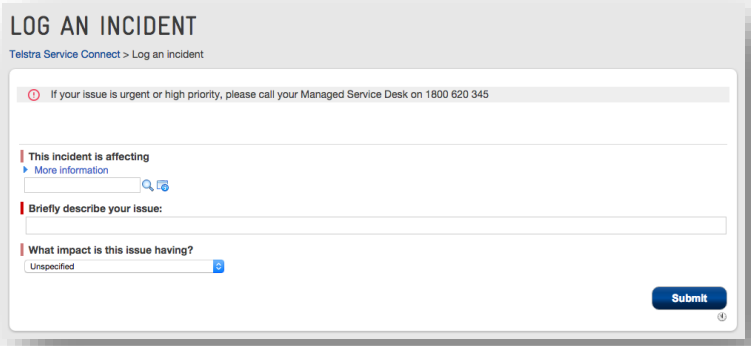




From here you can log and track incident tickets, find knowledge articles in our support library, or try contact us directly on any of the listed support numbers.

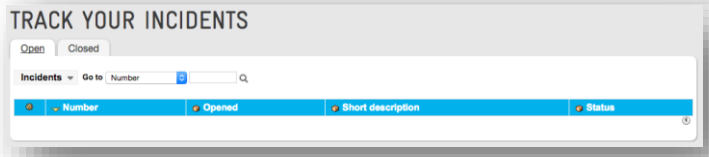
LOG AN INCIDENT

Select to log a new incident. You will be prompted to complete a series of questions highlighted red, some of which will be mandatory. Once, completed, they will turn green, you will then be able to submit.



TRACK INCIDENTS

Tracking your incidents couldn't be easier. On the primary landing screen you will see a dedicated area that will display your recent requests and/or incidents.



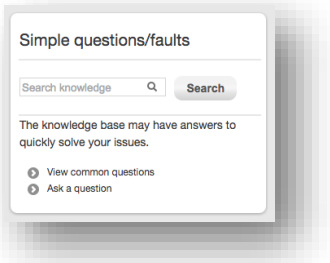
SUPPORT LIBRARY

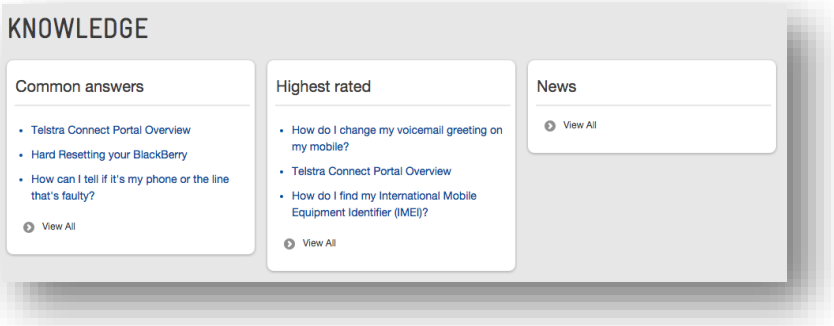
Got a specific product based question? Want to fix a basic issues yourself without having to wait in line, or can't find your user guide?

Browse our comprehensive support library for up to date knowledge articles, links and the latest version of our product user guides.

KNOWLEDGE MANAGEMENT

Got a question based on Requests or Incidents? Use the search function under Knowledge to search for an answer. The Knowledge will provide information and problem resolution articles focused on the products and services provided by Telstra.





Find answers to common questions, highest rated articles and news articles, providing information about change, problem or outage notifications specific to you.

4.2 Reporting & Billing

How to read your bill - Mock-up of summary below

	Cloud Services				
	Data Centre Interconnect - Port				
	1632490				
	Telstra other Charges & Credits				
MOK0026	1 Port 1GE Recurring Port Charge 11-Jun-16				
	Connection	10 Jul - 9 Aug	91901-88927	$199.00	$218.90
		Total for 1632490		**$199.00**	**$218.90**
	1632491				
	Telstra other Charges & Credits				
MOK0027	1 Port 10GE Recurring Port Charge 11-Jun-16				
	Connection	10 Jul - 9 Aug	91901-88929	$399.00	$438.90
		Total for 1632491		**$399.00**	**$438.90**
		Total for Data Centre Interconnect - Port		**$598.00**	**$657.80**
	Data Centre Interconnect - Flow				
	1632494				
	Telstra other Charges & Credits				
MOK0032	1 DCI Flow Hourly 11Jun16-10Jul16				
	Connection	10 Jul	91901-88931	$1,000.00	$1,100.00
MOK0033	1 Monthly Total For Burst(s) 11Jun16-10Jul16				
	Connection	10 Jul	91901-88932	$100.00	$110.00
		Total for 1632494		**$1,100.00**	**$1,210.00**

1632495

Telstra other Charges & Credits

MOK0034	1	DCI Flow Daily 11Jun16-10Jul16 Connection	10 Jul	91901-88931	$950.00	$1,045.00
MOK0035	1	Monthly Total For Burst(s) 11Jun16-10Jul16 Connection	10 Jul	91901-88932	$100.00	$110.00
		Total for 1632495			**$1,050.00**	**$1,155.00**

1632496

Telstra other Charges & Credits

MOK0036	1	DCI Flow Monthly 11Jun16-10Jul16 Connection	10 Jul	91901-88931	$900.00	$990.00
MOK0037	1	Monthly Total For Burst(s) 11Jun16-10Jul16 Connection	10 Jul	91901-88932	$100.00	$110.00
		Total for 1632496			**$1,000.00**	**$1,100.00**

1632497

Telstra other Charges & Credits

MOK0038	1	DCI Flow 12 Months 11Jun16-10Jul16 Connection	10 Jul	91901-88931	$850.00	$935.00
MOK0039	1	DCI Burst Hourly 11-Jun-16 Connection	10 Jul	91901-88932	$100.00	$110.00
		Total for 1632497			**$950.00**	**$1,045.00**

1632498

Telstra other Charges & Credits

MOK0040	1	DCI Flow 24 Months 11Jun16-10Jul16 Connection	10 Jul	91901-88933	$800.00	$880.00
MOK0041	1	DCI Burst Hourly 11-Jun-16 Connection	10 Jul	91901-88934	$100.00	$110.00
		Total for 1632498			**$900.00**	**$990.00**

1632499

Telstra other Charges & Credits

MOK0042	1	DCI Flow 36 Months 11Jun16-10Jul16 Connection	10 Jul	91901-88933	$750.00	$825.00
MOK0043	1	DCI Burst Hourly 11-Jun-16 Connection	10 Jul	91901-88934	$100.00	$110.00
		Total for 1632499			**$850.00**	**$935.00**
		Total for Data Centre Interconnect - Flow			**$5,850.00**	**$6,435.00**
		Total for Cloud Services			**$6,448.00**	**$7,092.80**

Services and Usage Charges in CSP

Your services

Data Centre Interconnect -

Data Centre Interconnect - Flow
Subscription Id: 7263329
Manage

Data Centre A: JP101
Data Centre B: SG101
Bandwidth: 0.1 Gbps
Latency: Standard
SLA: Gold
Service Details: BBBB

Data Centre Interconnect - Burst
Subscription Id: 1632495
Manage

Data Centre A: Melbourne
Data Centre B: Singapore
Bandwidth: 1 Gbps
Latency: Standard
SLA: Gold
Service Details: BBBB
Burst Duration: 2 Hours

Data Centre Interconnect - Port
Subscription Id: 2832499
Manage

Protection: Protected
VLAN availability: Trunk
Port type: Fiber LR
Speed: 1 Gbps

Data Centre Interconnect - Port
Subscription Id: 2832502
Manage

Protection: Protected
VLAN availability: Trunk
Port type: Fiber LR
Speed: 1 Gbps

+ Add another service

Usage charges

Account activity is for the billing account 123456789

Showing current estimates before the application of bonuses and discounts exclusive of GST.

Billing period

12 Jan 2015 - 12 Feb 2015

Service	Estimate
Data Centre Interconnect	$1250
Estimated total for this period	**$1250**

4.3 Faults and Outages

Following are some faults that could occur on your service. For a timely resolution, it is important to understand, what we do to support it and what you, as a customer needs to do.

Port down

Customers to check with DC operator

Telstra support to check internally with SDN controller

Check if media converters are used

Port up – no flow

Customer to check VLAN configuration of customer equipment

Customer to check whether the equipment is transmitting data

Telstra support to check SDN admin for flow and port configuration

Telstra support to check network availability between those end-points

Performance issue

Telstra support to check with SDN admin tool for port statistics

Telstra support to check Network for errors in this flow

Customer to check port statistics of customer equipment

Check if media converters are used.

APPENDIX 1: LATENCY PERFORMANCE TARGETS

Below are latency performance targets according to the latency type selected by the customer at the time of ordering each flow.

Connection		Latency (ms)		
Endpoint 1	Endpoint 2	Low	Standard	Best Effort
Sydney	Sydney	6	7	9999
Sydney	Melbourne	26	29	9999
Melbourne	Melbourne	6	9	9999
Sydney	Hong Kong	146	171	9999
Sydney	Singapore	134	157	9999
Sydney	Taiwan	166	193	9999
Sydney	Tokyo	143	167	9999
Sydney	London	295	335	9999
Sydney	USA-NY/NJ	228	261	9999
Sydney	USA-LA/SJ	175	203	9999
Melbourne	Hong Kong	159	185	9999
Melbourne	Singapore	147	172	9999
Melbourne	Taiwan	179	207	9999
Melbourne	Tokyo	159	185	9999
Melbourne	London	309	350	9999
Melbourne	USA-NY/NJ	243	277	9999
Melbourne	USA-LA/SJ	190	219	9999
Singapore	Hong Kong	61	77	9999
Singapore	Taiwan	81	99	9999
Singapore	Tokyo	105	126	9999
Singapore	London	212	243	9999
Singapore	USA-NY/NJ	257	293	9999
Singapore	USA-LA/SJ	206	237	9999
Hong Kong	Taiwan	51	66	9999
Hong Kong	Tokyo	80	98	9999
Hong Kong	London	208	239	9999
Hong Kong	USA-NY/NJ	228	261	9999
Hong Kong	USA-LA/SJ	176	204	9999
Taiwan	Tokyo	60	76	9999
Taiwan	London	232	265	9999
Taiwan	USA-NY/NJ	217	249	9999
Taiwan	USA-LA/SJ	185	214	9999
Tokyo	London	254	289	9999
Tokyo	USA-NY/NJ	188	217	9999
Tokyo	USA-LA/SJ	135	159	9999
London	USA-NY/NJ	91	110	9999
London	US-LA/SJ	164	190	9999
USA-NY/NJ	USA-LA/SJ	98	118	9999