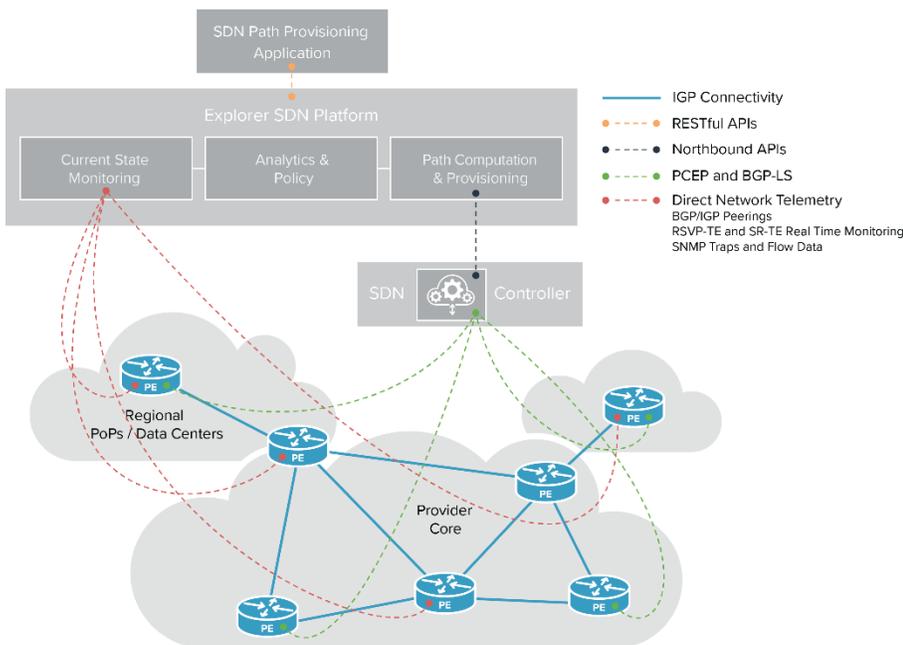


## EXPLORER SDN PATH PROVISIONING

The Explorer SDN Path Provisioning application is built on Packet Design’s SDN Platform. Like the SDN Traffic Engineering application, it leverages the Platform’s vendor-agnostic IP/MPLS telemetry and analytics to give network operators powerful automated service provisioning capabilities. With Packet Design’s SDN Path Provisioning application, service providers can quickly and easily create a catalog of transport services that can be used to automate fulfillment of subscriber requests, based on various constraints. Constraints may be applied to address a variety of path provisioning use cases, such as diversity, low latency, disaster recovery and data sovereignty.

For most communications service providers, provisioning new service paths based on subscriber demands can take days or even weeks. Typically, the network provider will use offline planning tools to compute the best possible paths based on the constraints required by the subscriber. Then, during a maintenance window, the PE devices are configured with the new paths in the production network. This time-consuming process defeats the rapid service provisioning that subscribers typically want.

The Explorer SDN Path Provisioning application gives network providers greater agility, enabling customer requests for new services to be fulfilled in minutes with a few mouse clicks. The process can even be fully automated, if desired. The SDN Path Provisioning application works with physical and virtual devices from all major network equipment vendors as well as the popular SDN controllers.



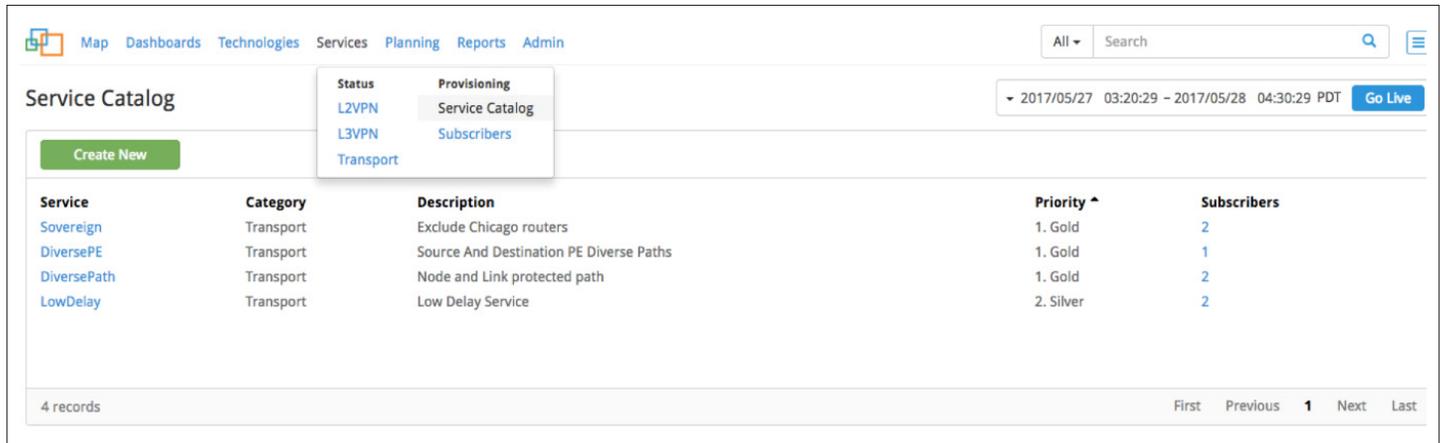
The Explorer SDN Path Provisioning Application and SDN Analytics and Automation Platform

### Benefits

- Easily create a catalog of transport services to fulfill subscriber requests
- Provision specialized paths based on subscriber requirements in minutes
- Increase business agility and accelerate time to revenue for new services
- Improve operating efficiency by automating service path computation and provisioning
- Leverage existing assets by integrating the Explorer technology with current management systems

## Defining Transport Services

The SDN Path Provisioning application allows network providers to create a catalog of transport services using an intuitive web user interface. Each service can be defined with its own priority and optimization algorithm to be used for calculating the path, including lowest delay, shortest IGP or shortest TE metric. Additional constraints may be supplied, if needed. These include the use of RSVP-TE tunnels or Segment Routing, and path diversity and protection options, such as the inclusion or exclusion of nodes, links, interfaces, SRLGs, and user-specified affinities and masks.

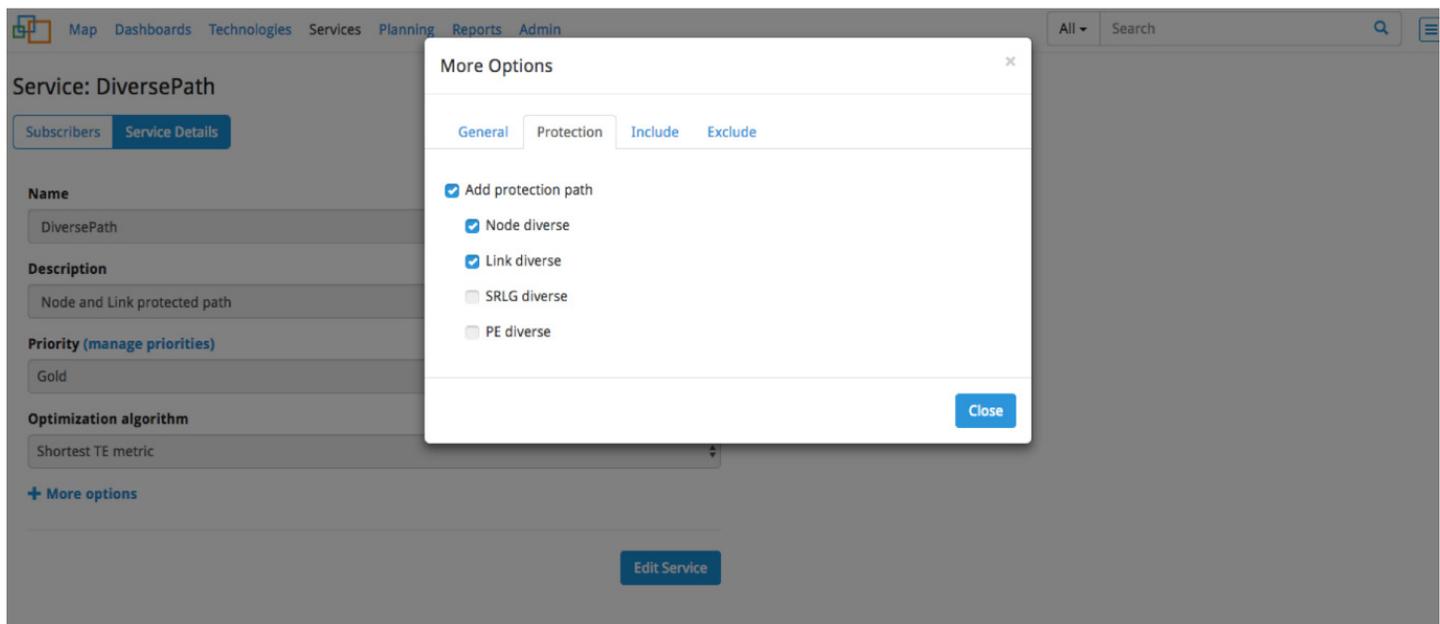


The screenshot shows the 'Service Catalog' page in the SDN Path Provisioning application. The page includes a navigation menu at the top with options like 'Map', 'Dashboards', 'Technologies', 'Services', 'Planning', 'Reports', and 'Admin'. A search bar and a date range filter (2017/05/27 03:20:29 - 2017/05/28 04:30:29 PDT) are also visible. A 'Create New' button is located on the left. The main content is a table with the following data:

Service	Category	Description	Priority ^	Subscribers
<a href="#">Sovereign</a>	Transport	Exclude Chicago routers	1. Gold	2
<a href="#">DiversePE</a>	Transport	Source And Destination PE Diverse Paths	1. Gold	1
<a href="#">DiversePath</a>	Transport	Node and Link protected path	1. Gold	2
<a href="#">LowDelay</a>	Transport	Low Delay Service	2. Silver	2

At the bottom of the table, it indicates '4 records' and provides navigation controls: 'First', 'Previous', '1', 'Next', and 'Last'.

*Catalog of services based on various constraints*



The screenshot shows the configuration page for the 'DiversePath' service. The page has tabs for 'Subscribers' and 'Service Details'. The service details include:

- Name:** DiversePath
- Description:** Node and Link protected path
- Priority (manage priorities):** Gold
- Optimization algorithm:** Shortest TE metric

A '+ More options' link is visible below the optimization algorithm. A 'More Options' dialog box is open, showing configuration options for path constraints:

- General** (selected tab)
- Protection** (tab)
- Include** (tab)
- Exclude** (tab)

The 'More Options' dialog box contains the following checked options:

- Add protection path
- Node diverse
- Link diverse

There are also unchecked options:

- SRLG diverse
- PE diverse

A 'Close' button is located at the bottom right of the dialog box. An 'Edit Service' button is visible at the bottom of the page.

*Specifying service path constraints*

## Assigning Services to Subscribers

When a subscriber requests a service path between two end points with a specific set of constraints, the operator simply selects the matching service from the catalog and associates it with the subscriber. The operator can now provision the new path by selecting the source and destination devices. Additional constraints, as described above, may also be specified if needed for this subscriber.

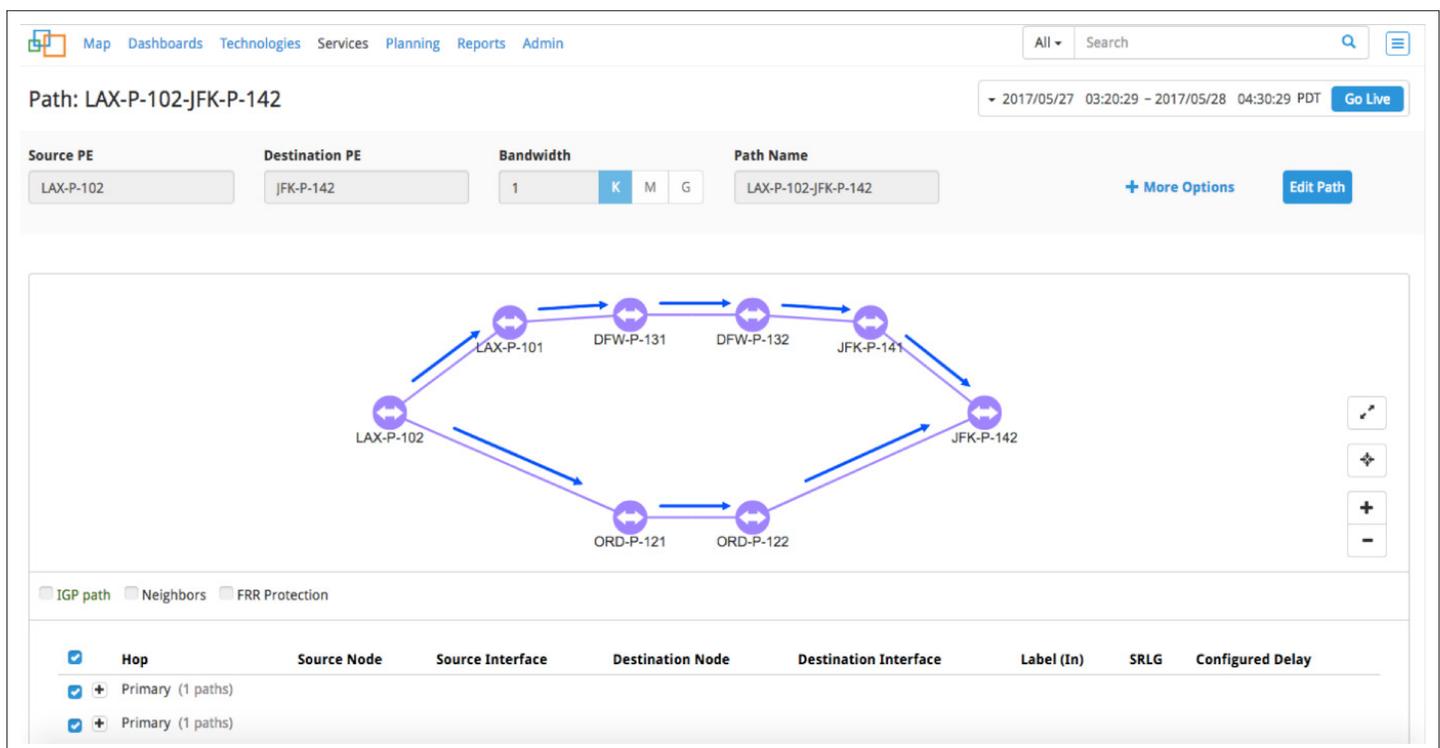
Subscriber ^	Description	Contract ID	Subscriber ID	Services
<a href="#">Coke</a>	Coke	123456789	Coke	3
<a href="#">Pepsi</a>	Pepsi	987654321	Pepsi	2
<a href="#">RedBull</a>	Red Bull	34567	RedBull	2

3 records

Inventory of subscribers and services

## Automating Path Provisioning

Once the operator has provided the service path constraints and endpoints, the SDN Platform's path computation and optimization engine calculates the best path(s) for the service using its real-time and historical routing telemetry and analytics. It presents the results within seconds, displaying a mini-topology map of the end-to-end path(s), including each hop. If the path computation engine determines that no path is available to satisfy the supplied constraints, the operator can adjust them and re-submit the request.



Mini-topology map shows results of diverse paths service request

Map Dashboards Technologies Services Planning Reports Admin

All Search

Path: LAX-P-102-JFK-P-142

2017/05/27 03:20:29 - 2017/05/28 04:30:29 PDT Go Live

Source PE: LAX-P-102 Destination PE: JFK-P-142 Diverse Source PE: LAX-P-101 Diverse Destination PE: JFK-P-141 Bandwidth: 1 K M G Path Name: LAX-P-102-JFK-P-142

+ More Options Edit Path

IGP path Neighbors FRR Protection

Results of diverse PE paths service request

When the operator is satisfied with the result, the new path may be activated with a click of the mouse. The SDN Platform passes the configuration data to the SDN controller or other orchestration software via published APIs for automated provisioning. The network change will be detected immediately by Packet Design's real-time routing data collection, completing the closed-loop automated provisioning lifecycle.

Create Path: LowDelay (Coke)

2017/05/18 12:46:27 - 2017/05/18 13:16:27 PDT Live

Source PE: ORD-P-121 Destination PE: LAX-P-102 Bandwidth: 50 K M G Path Name: ORD-P-121-LAX-P-102-1 Cancel + More Options Provision

IGP path Neighbors FRR Protection

Hop	Source Node	Source Interface	Destination Node	Destination Interface	Label (In)	SRLG	Configured Delay
Primary (1 paths)							
Hop 1	ORD-P-121	Fa1/0	DFW-P-132	10.67.18.132			1 ms
Hop 2	DFW-P-132	ge-0/1/0.0	DFW-P-131	10.67.24.131			1 ms
Hop 3	DFW-P-131	Gi0/2	LAX-P-101	10.67.23.101			1 ms
Hop 4	LAX-P-101	Fa2/0	LAX-P-102	10.67.1.102			1 ms

This low latency VPN request can be configured automatically by clicking the Provision button

## **Integration with Operations Support Systems and Service Orchestrators**

The SDN Path Provisioning application may be integrated with existing OSS and orchestration platforms via open REST APIs supplied with the SDN Platform. For example, a subscriber request with specified service constraints could be passed by an OSS to the Path Provisioning application via the APIs. The application would compute the best path and return the results to the OSS via the APIs for provisioning – with no human touch points.

## **Increasing Competitiveness**

The speed with which the packet Design SDN Path Provisioning application provisions new service paths can increase business agility for service providers and create differentiation in competitive markets. At the same time, engineers are freed from repetitive, time consuming planning and configuration tasks allowing them to focus on more strategic projects.

Some operators may be reluctant to fully automate service path provisioning, preferring to adopt automation more gradually. The SDN Path Provisioning application allows for human oversight and control at each step so that the process can be thoroughly vetted.

Packet Design's SDN Platform and SDN applications are futureproof investments. Network operators can use them today to achieve their network service assurance goals and be confident that the technology is fully SDN-enabled to support their network transformation initiatives of tomorrow.

