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Explorer Traffic Engineering

The Explorer Traffic Engineering application (TE application) is an example of the intelligent automation capabilities that can be achieved with the Blue Planet® Route Optimization and Assurance (ROA) products. The Traffic Engineering application leverages the ROA's rich IP/MPLS network telemetry and analytics to automate the difficult and time-consuming task of balancing network loads. It does this by creating tunnels to shift loads from heavily-congested links to lightly-used links. This results in better use of network resources and smoother service delivery.

The TE application taps into several components of ROA, including real-time and historical routing, traffic and TE Tunnel telemetry, predictive modeling, path computation engine, optimization algorithms, and policy setting, to provision new

Benefits
- Optimize and balance the use of network resources by redistributing traffic loads
- Quickly resolve service slowdowns caused by congested links
- Increase business agility and competitiveness by accelerating TE tunnel-based service activation
- Reduce the operational expense of complex traffic engineering tasks
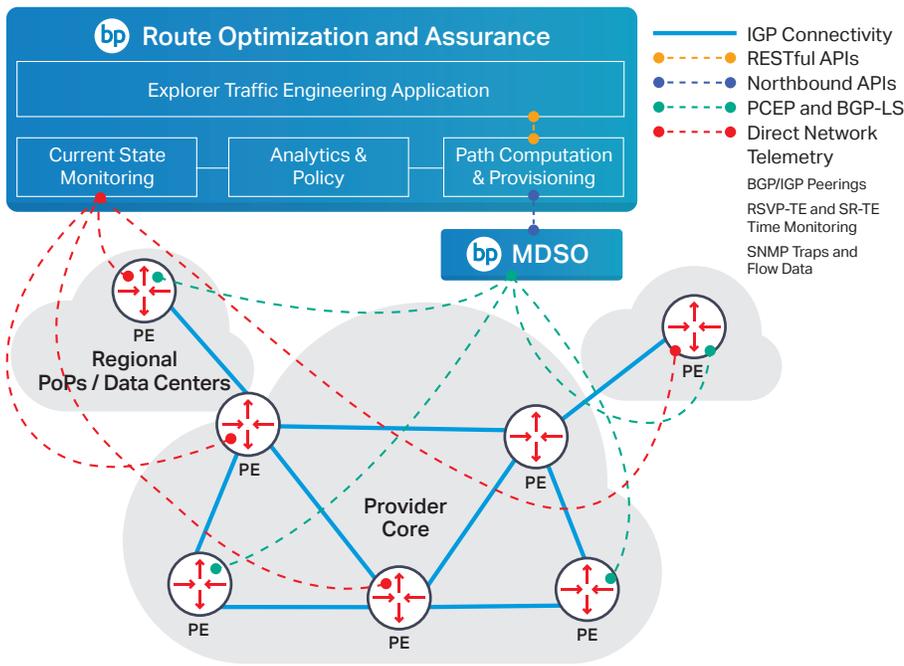- Eliminate the risks of service impacts from traffic engineering miscalculations

Figure 1. Blue Planet ROA Product with Explorer Traffic Engineering Application
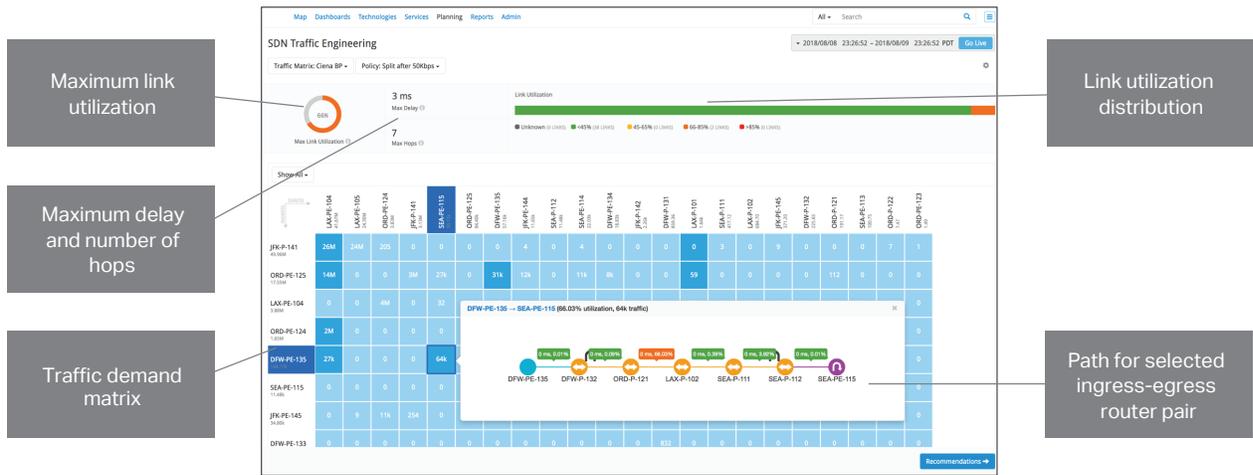
Figure 2. Network Assessment

traffic engineering tunnels via Blue Planet Multi-Domain Service Orchestration (MDSO) or any third-party SDN controllers. It accesses these components via open RESTful APIs.

Assessing the opportunity for optimization

The TE application assesses the current network state to determine if optimization is needed and possible. Overall network performance is summarized in a single display for the current set of paths and traffic demands, and graphically shows the maximum link utilization, maximum delay, and maximum number of hops. It also charts the number of links that are uncongested, moderately congested, and heavily congested. The goal of the TE application is to reduce the utilization of these overly congested links.

Traffic matrices

The TE application calculates traffic demand matrices that show how much traffic is flowing from each ingress router to each egress router. The cell colors indicate the utilization of the most congested link along the path for each ingress-egress pair. Right clicking on a cell and selecting 'Show Map' shows the path for that pair and the utilization on all links along the path.

The TE application supports full-mesh traffic engineering as well as tactical traffic engineering to manage isolated congestion. Both RSVP-TE and Segment Routing (SR-TE) are supported. The user may select daily, weekly, monthly, or a specific period for the traffic engineering calculations and use either maximum, minimum, or the 95th percentile for traffic utilization levels. Routers can be added to the matrix manually by selecting router groups allowing users to view the demand matrix for specific geo locations, edge routers, core routers, etc.

This can also be automated by specifying a 'Maximum utilization per link' value, based on which any link with utilization above the specified threshold is selected and its ingress and egress routers are automatically inferred. Additional filters are available to ignore traffic flows less than a user specified data rate, and to choose traffic flows with a specific Class of Service (CoS) value.

The TE application presents the user's requests to the Blue Planet ROA product and the resulting traffic demand matrix for the selected time period and router groups is displayed. Multiple traffic demand matrices can be created simultaneously and they can either be optimized for the same time or for different times of the day to satisfy the needs of the multiple services running on the network.

Policy

With the TE application, a user can set policies to define allowable tunnel characteristics. Foremost, a policy specifies an optimization algorithm to use, where users can choose between fast global constraint-based optimization or capacity optimization algorithms. Users can also choose to split tunnels if bandwidth exceeds a specified rate, create diverse paths, and over- or under-provision tunnel bandwidth. Other advanced policy configurations include options to balance load or bandwidth, specify the CSPF metric, traffic forwarding mechanism, and tunnel forwarding metrics. The vivid set of policies supported by the Explorer TE application allows users to gain more granular control over the automated provisioning of traffic engineering tunnels.

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Figure 3. Explorer TE Policy Setting

Intelligent automation

Once the traffic demand matrices are calculated and the policies established, it can be determined if there are traffic engineering optimization opportunities. With a click of the mouse, the TE application presents the user with a list of new tunnel recommendations and updates to existing tunnels.

The application displays before and after measures for maximum link utilization, delay and number of hops, and the link utilization distribution. These metrics provide an at-a-glance view of the impact that the calculated new paths will have on network utilization, and if the recommended tunnel changes will eliminate the heavily congested links by redistributing traffic to the under-utilized links.

Once the user is satisfied that the recommendations will have the desired impact, clicking the TE application's 'Provision' button signals the Blue Planet ROA product to communicate these paths to the SDN controller (such as Blue Planet MDSO) via the controller's northbound API. The controller uses a southbound protocol to configure the paths in the network devices and ensures these paths are persistent. The user may update or un-provision them at any time using the Explorer TE application.

The newly-provisioned tunnels can be monitored by the Blue Planet ROA product. The TE monitoring feature in ROA provides tunnel inventory and helps with tunnel analysis. These include the number of tunnels, headend routers, tunnels that are up and down, tunnels that share Shared Risk Link Groups (SRLG), those not protected by Fast Re Route (FRR), and those with no secondary paths.

The Explorer TE application helps network engineers alleviate congestion on the network in a few clicks without the need for manual traffic engineering planning and provisioning.
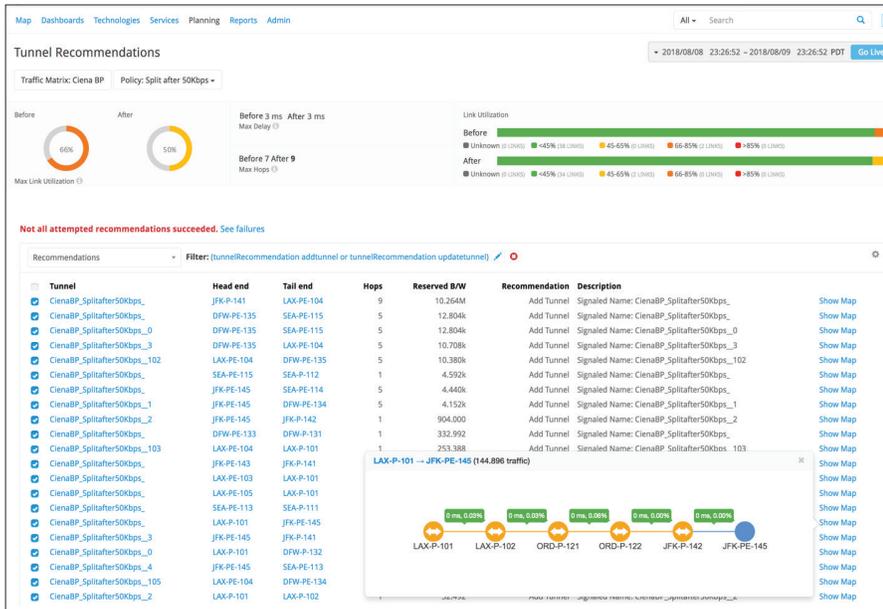

Figure 4. Tunnel Recommendations and Predicted Impact

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