



Cisco Cloud infrastructure Engineering Self-Healing Networks

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 @chadell0





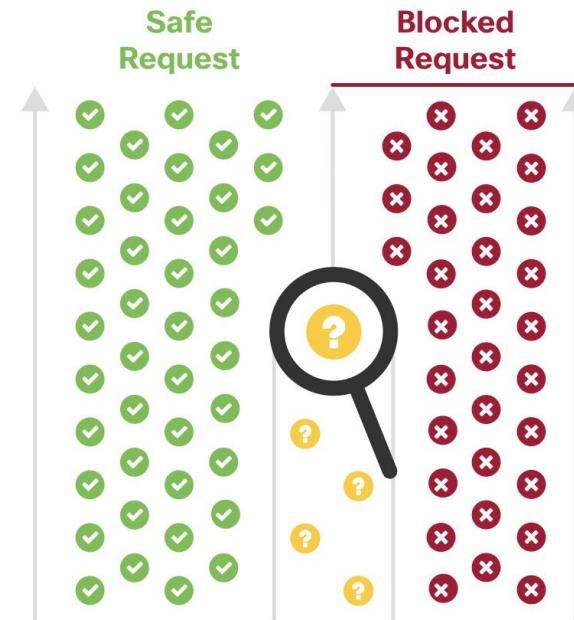








Cisco Umbrella



Internet Requests



175B

legitimate
queries per day

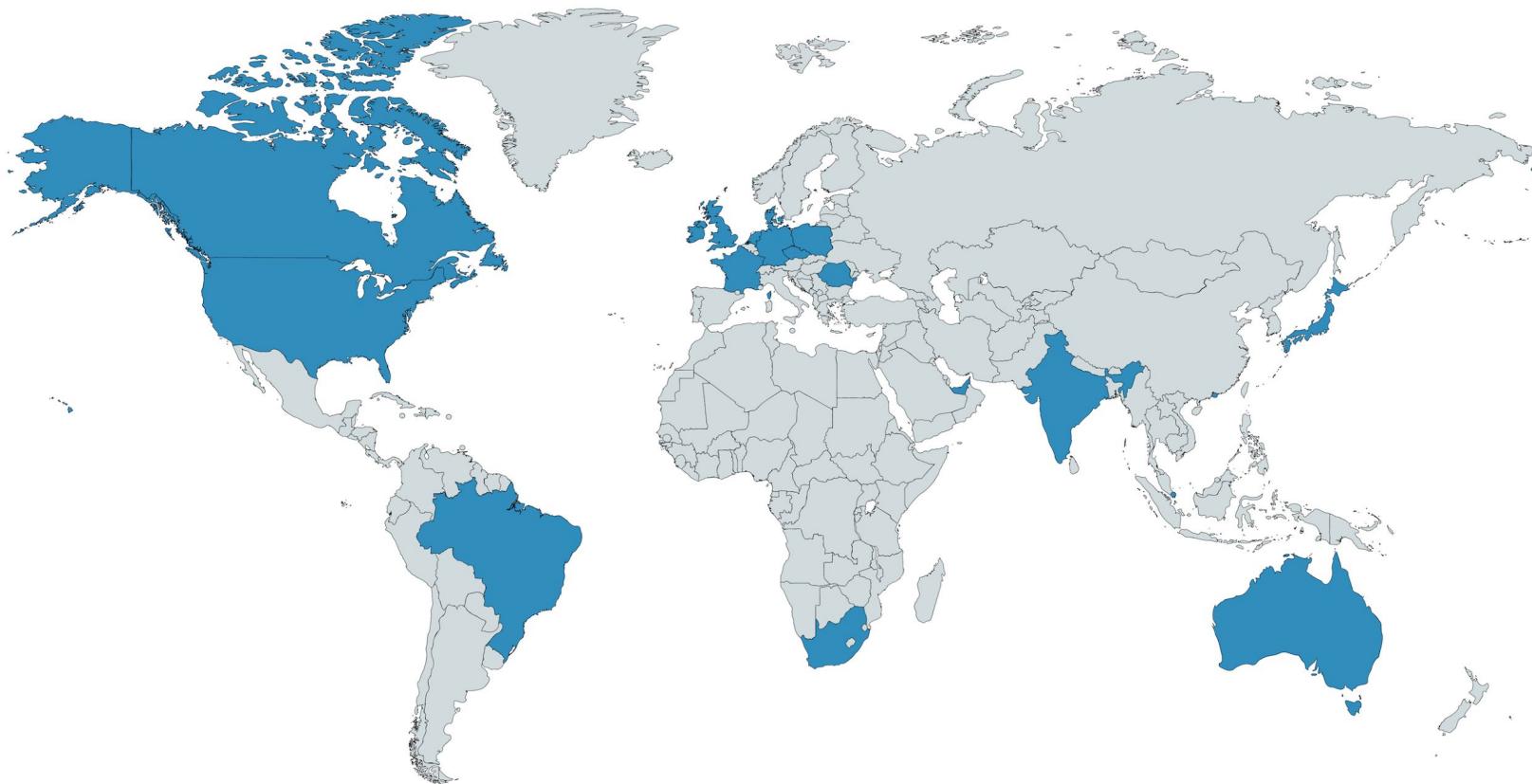
90M

daily active
users

16K

enterprise
customers

32 edge datacenters

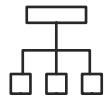




>4600 of peering sessions at
dozens of Internet Exchanges



Hundreds network devices



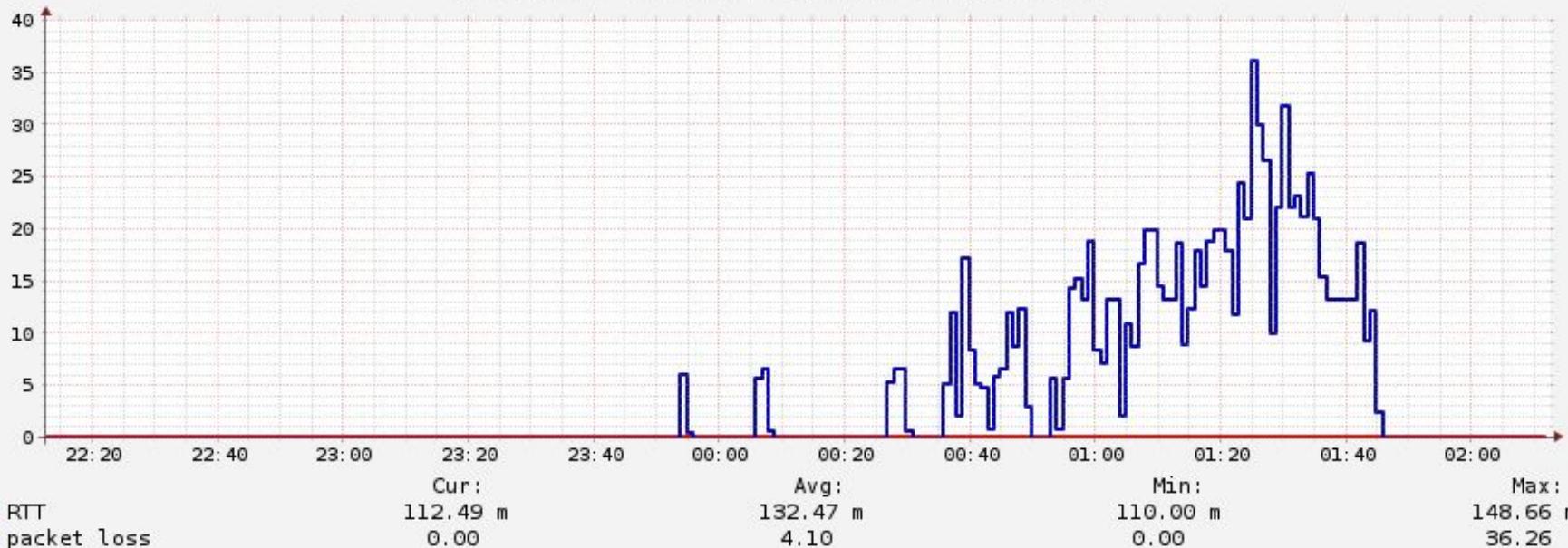
>200 Transit connections

INTERNET





packet loss on some random ISP in Sao Paulo



From: 10-04-2018 22:12:00
To: 11-04-2018 02:12:00

OpenDNS CHDB, Image Generated on April 11, 2018, 2:12 mm









CARDS BY S. UTEEA
Deals in all kinds of Stationery and Books
Ph. 23842424

S.G. TRADERS
Distributors of
MANOJ POCKETS

Ph. 23842424

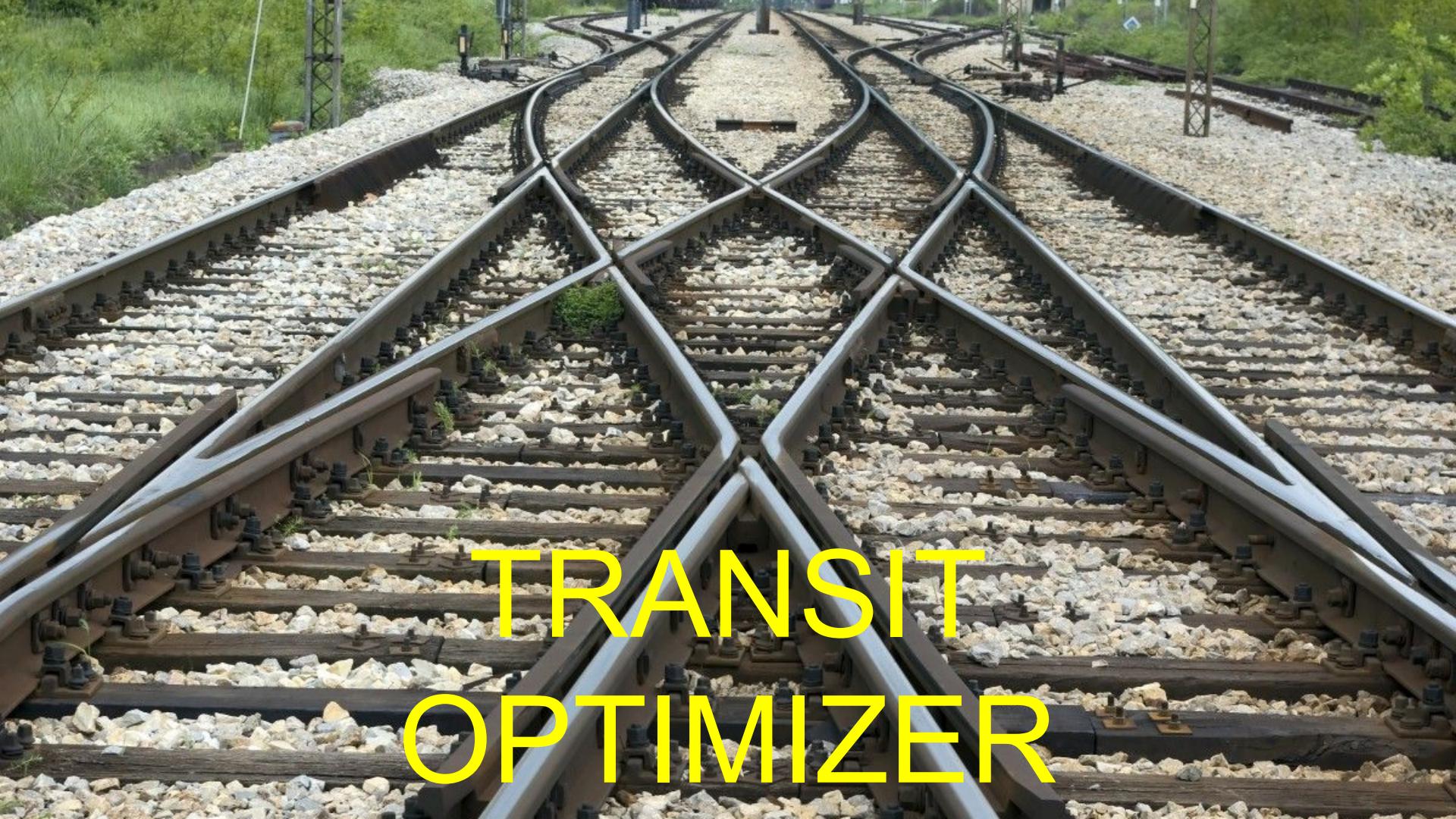
DL-18
S-2-104

D-15
AF-33-01

*"you always have a **test** network, and sometimes you also have an actual **production** one"*

When things go bad



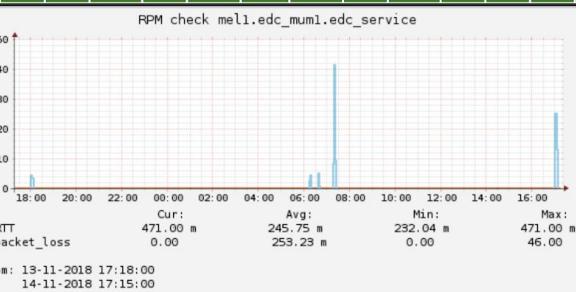


**TRANSIT
OPTIMIZER**

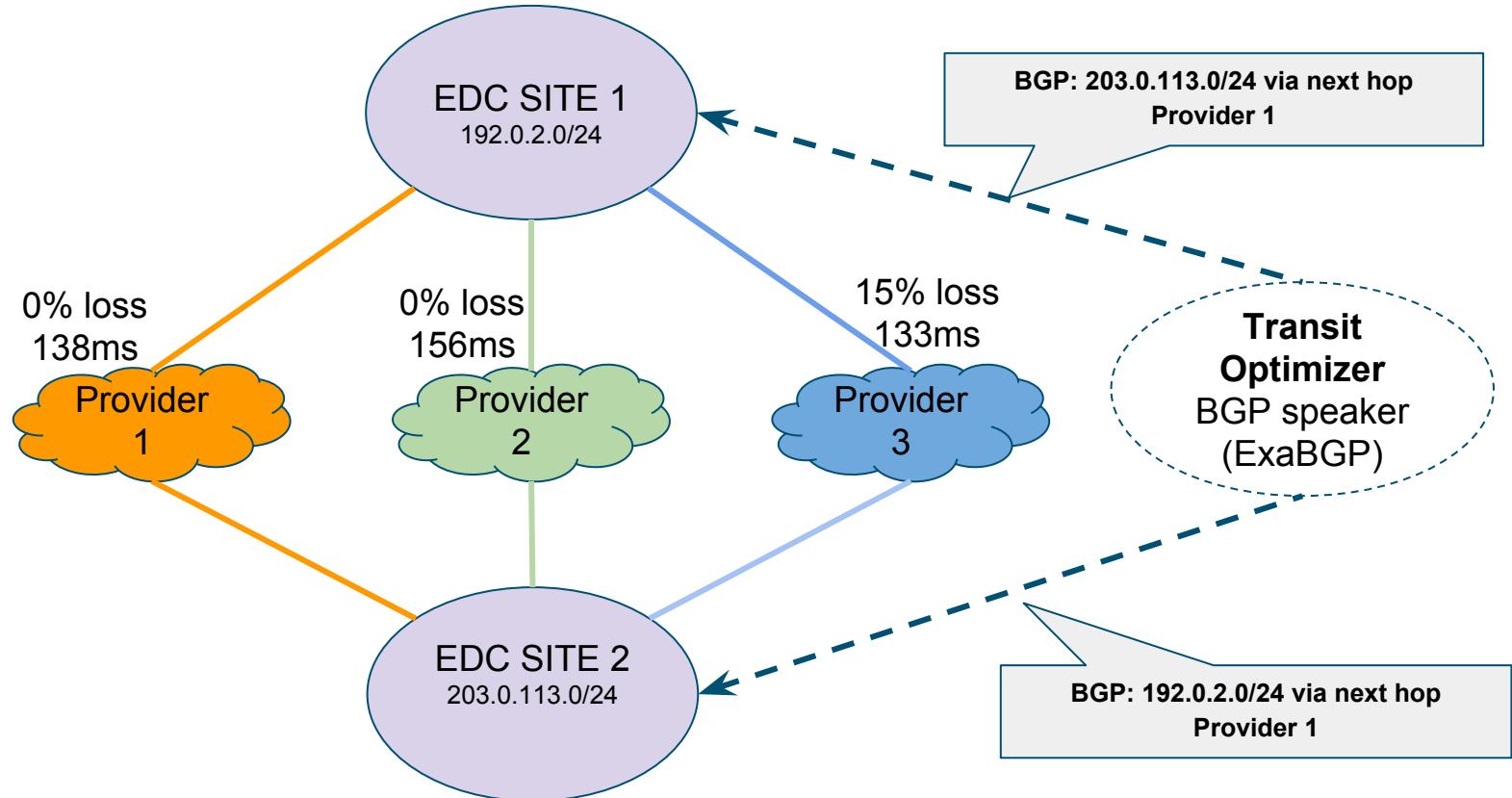
Performance Matrix

Service

	ams	ash	ber	cdg1.edc	chi	cph1.edc	den1.edc	dfw	dub1.cdc	dub1.edc	dxb1.edc	fra	fra1.cdc	hkg	jnb	lax	lon	mel1.edc	mia	mil1.edc	mum1.edc	nrt	nyc	otp1.edc	pao	prg1.edc	rst1.cdc	sao1.edc	sea	sea1.cdc	sin	sjc	syd	wrw1.edc	yvr	yyz
ams	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK			
ash	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
ber	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
cdg1.edc	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
chi	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
cph1.edc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
den1.edc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
dfw	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
dub1.cdc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
dub1.edc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
dxb1.edc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
fra	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
fra1.cdc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
hkg	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
jnb	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
lax	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
lon	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
mel1.edc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
mia	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
mil1.edc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
mum1.edc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
nrt	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
nyc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
otp1.edc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
pao	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
prg1.edc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
rst1.cdc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
sao1.edc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
sea	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
sea1.cdc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
sin	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
sjc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
syd	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
wrw1.edc	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
yvr	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				
yyz	OK	OK	OK	OK	OK		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK				



Transit Optimizer



1. Calculate best path between all datacenters (full mesh)
2. Recalculate best path every 60 seconds
3. Update best nexthop via BGP to all routers

This helps us route around packet loss between our datacenters

TRANSIT TERMINATOR



Provider experiences packet loss and the expected impact to customers is “noticeable”, so let’s shut it down.

NetHarbour · 10:16 AM

2018-12-09 09:16:36 UTC: Action should be triggered on hkg **ISP 1** Sites seeing issues to it: ams dxb1.edc fra jnb lon mil1.edc

NetHarbour · 10:18 AM

Transit Manager Scheduler

ISP 1 Hong Kong -> terminated 

Shutdown at 2018-12-09 09:16:41

Measurements continue... 10min later, our software determined it's stable again and will put the service back in production

NetHarbour · 10:36 AM

2018-12-09 09:36:43 UTC: Time to bring **ISP 1** back up on rtr1.hkg.opendns.com has been loss free for 10m 5s.
Total event duration: 20m 7s.

NetHarbour · 10:38 AM

Transit Manager Scheduler

ISP 1 Hong Kong Brought back up at 2018-12-09 09:36:48

T15 ST-615 USA



The NetDevOps Engineers Tool Bag

(Example tools, not comprehensive)

Distributed Source Control
(git, Subversion, Mercurial, GitHub, BitBucket, GitLab)

Build Server
(GitLab, Jenkins, Team City, Drone)

Configuration Management
(Ansible, Puppet, NSO, NAPALM, DIY)

Network Test Tooling
(pyATS, TRex, Robot, Behave)

Telemetry & Monitoring
(ELK, Grafana, Pipeline, UTM)

CLI

SNMP

NETCONF/
RESTCONF

gRPC

REST APIs

YANG/Native Data Model

Configuration Data

Operational Data

Network Device

Network
Virtualization
Platforms
(VIRL/CML, NFVIS,
Vagrant)

Development Environment
(Vagrant, NSO, VIRL/CML)

Test Environment
(VIRL/CML)

Production Environment

