Network Emulation with Calnex NE-ONE

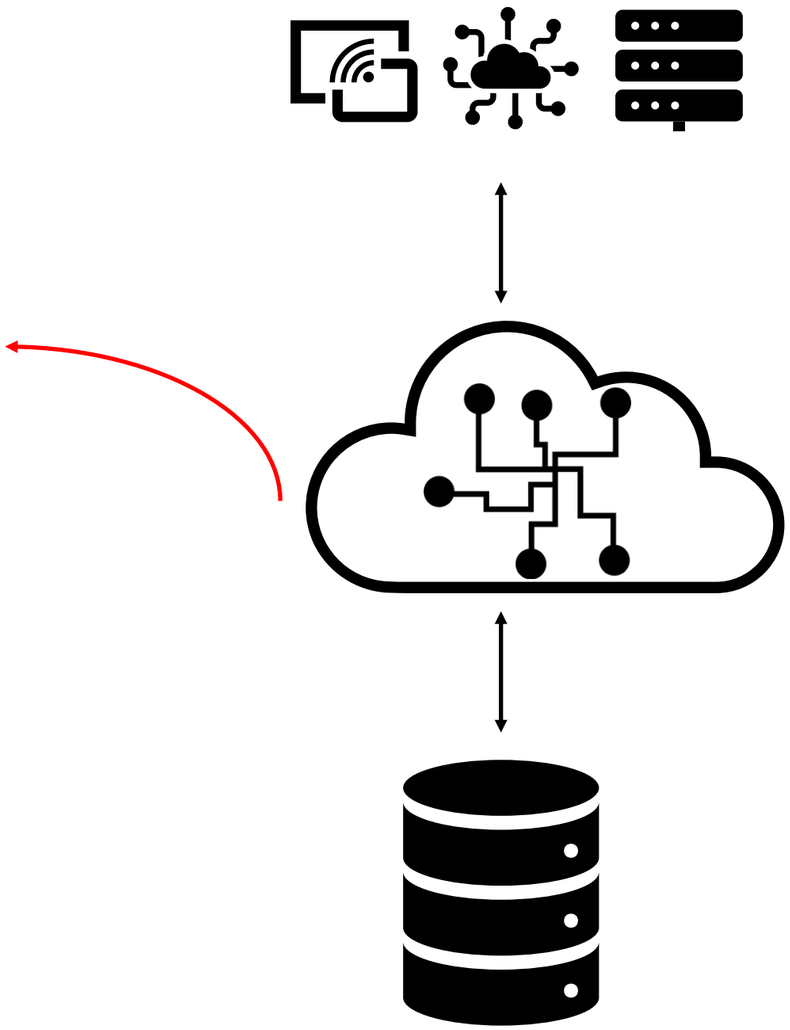
Test real-world network scenario responses for

- connected IoT devices
- applications reliant on network performance
- connected OT devices
- network equipment

What is Network Emulation?

Real world networks are far from ideal!

Real world networks suffer from
- Inherent latency
- Packet losses
- Corrupted data
- Poor throughput
- and many other imperfections



Connected devices and applications
- IoT devices
- Streaming apps
- Network equipment

Real-world network Infrastructure with switches, routers and forwarders

Servers and services on the cloud or remote locations

Network Emulators help generate real-world scenarios in a lab / test setup for development and testing network-connected devices and apps

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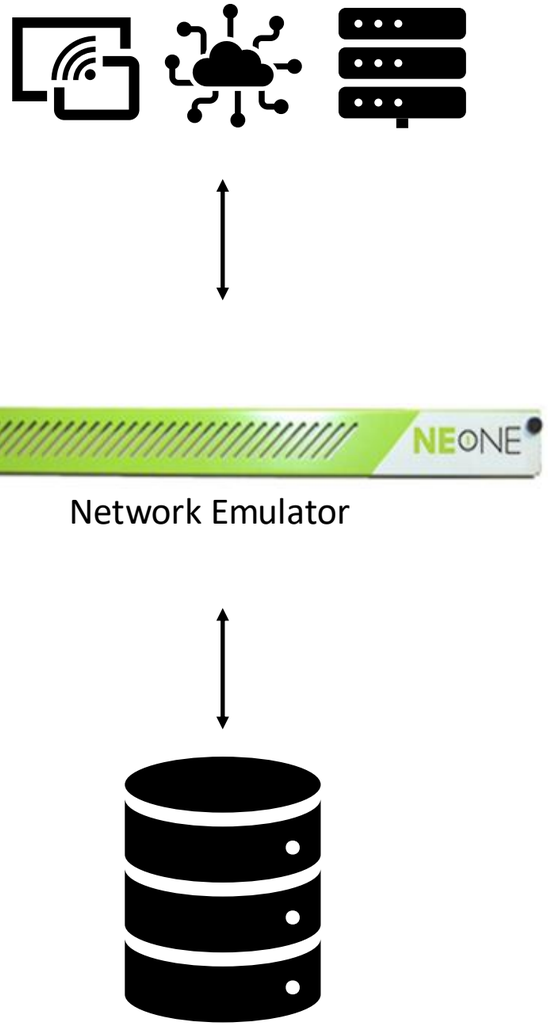
Need for Network Emulation

Network Emulation during product development and testing helps ensure predictable performance and behaviour for your connected devices & applications.

Unexpected app/device behaviours due to network issues

- Waiting endlessly without timeout
- Expected tasks are aborted or not performed
- Unknown errors that are difficult to diagnose
- Critical tasks affected, resulting in system failures
- Delayed packets / error packets resulting in incorrect behaviour



A **network emulator** helps create real-world network impairments in a lab. This can be used to test your device / application behaviour in a wide set of real network conditions.

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Where to use Network Emulators?

It is critical to test connected devices and applications using network emulators. Below are examples where it is important to use network emulators for product development and testing.

- IoT devices
  - Medical applications
  - Connected home appliances
  - Operation tech
  - Power plants and controllers
  - Railways and Signalling
- SD-WAN devices and end points
- Broadcast networks
- Streaming applications
- Online gaming apps
- Data center performance evaluation
- Satellite connectivity simulation
- Network setup benchmarking & migrations
- Recreate field issues reported by customers

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Calnex Network Emulation Products

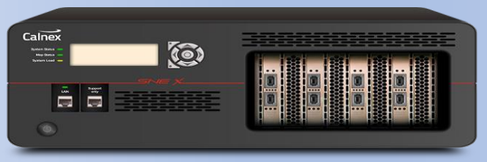
Calnex offers a wide range of network emulators for all use-cases

Network Emulation for all use-cases

Infrastructure

SNE Ignite

Prove compliance and interoperability of 5G O-RAN fronthaul devices



SNE-X

Impair hundreds of 5G packet streams simultaneously to reduce the cost of test

SNE

Simulate complex networks and emulate real-world conditions

IoT & Applications

NE-ONE

- A complete suite of test networks in a box
- Verify application performance across all types of network topologies

Unique 'full-coverage' emulation portfolio

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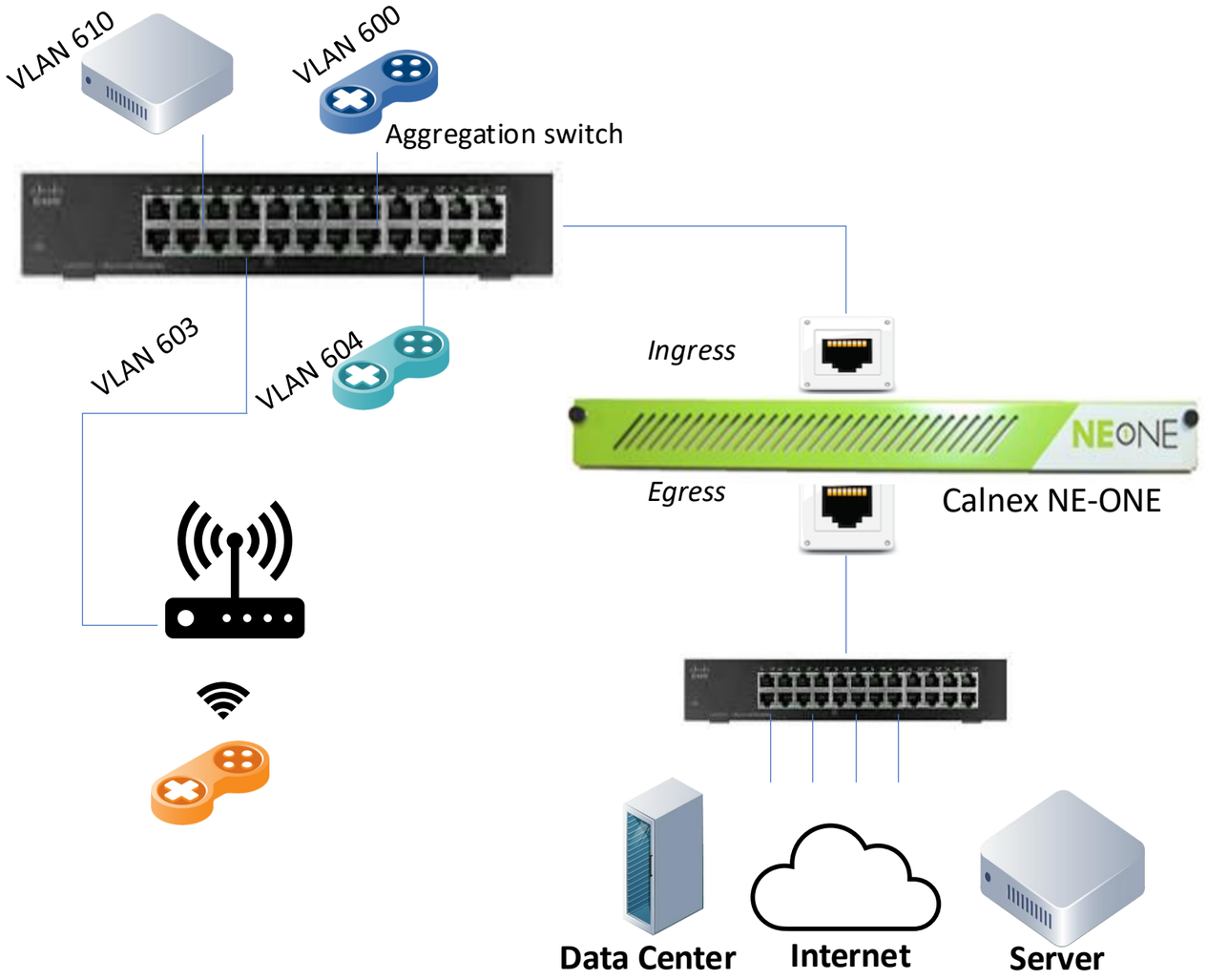
Calnex NE-ONE for Network Emulation



Calnex NE-ONE is an easy-to use feature-rich Network Emulation tool

NE-One can emulate

- Bandwidth Limiting
- Drop Packets
- Corrupt packets
- Introduce latency
- Re-order packets
- Fragment packets
- Duplicate packets

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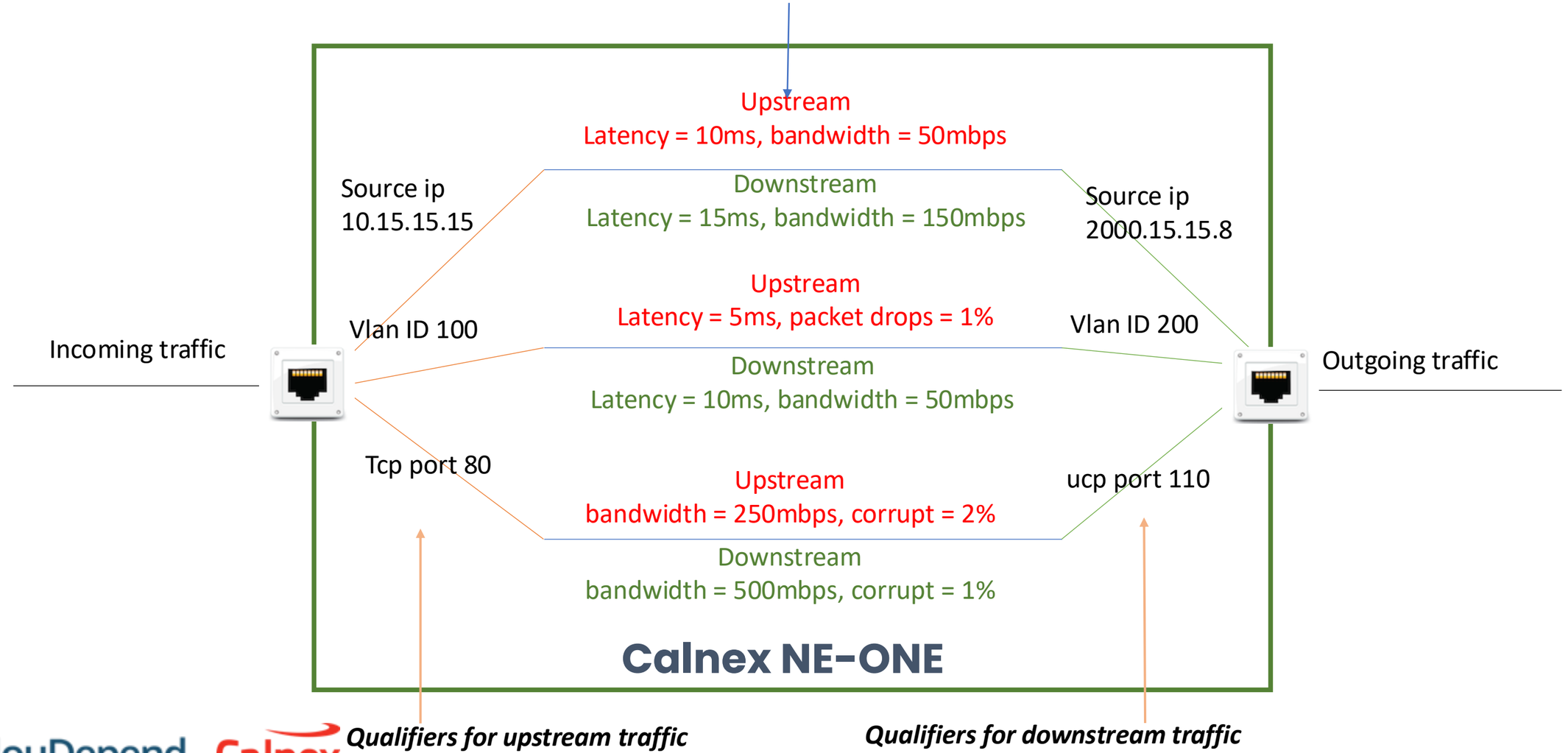
Calnex NE-ONE: One physical port pair for multiple link emulation

Different impairments get applied for different traffic based on incoming traffic qualification.
Impairments and qualifications can be different for upstream and downstream traffic



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NE-ONE: Feature-packed network emulation

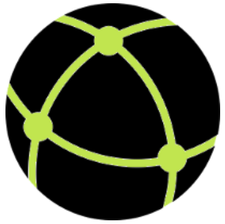
Superior Real-world Impairments

Congestion

Traffic Generation

Packet Replay

Intelligent Packet Replay



Geolocation Network Latency Calculator

Out-of-the-Box Test Networks

User Defined Protocols

Advanced Packet Handling

Cisco QoS Class of Service Handling & Traffic Shaping

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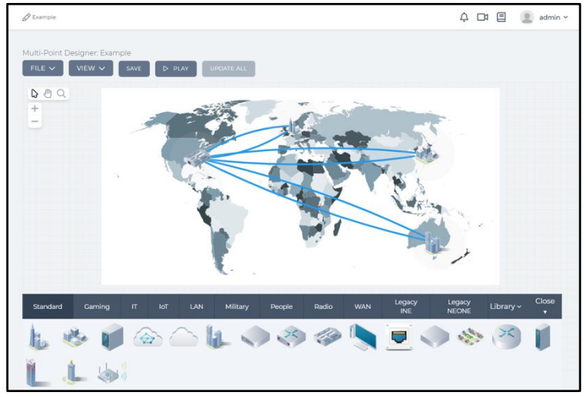
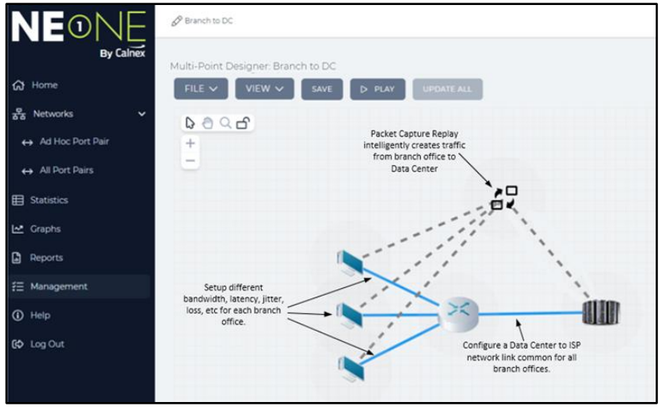
Easy to use: feature-rich friendly UI, ready for operations

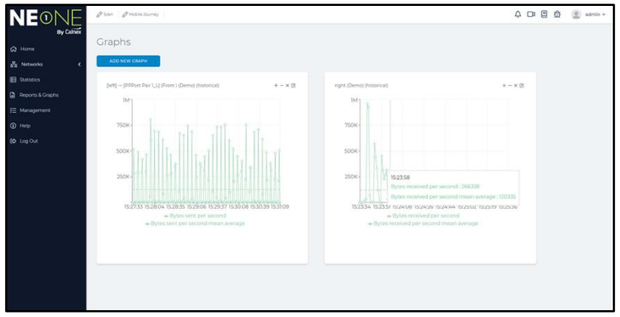
Topology-wizard to setup your network



Multi-point and mesh network designer



Packet capture and Intelligent packet replay



Rapid analysis graphs

Detailed statistics

Rest APIs

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Complete List of Supported Impairments

NE-One includes a collection of pre-defined impairment template for different type of networks. Supported Impairments include

- Link speed control, congestion & queuing
- Introduce Latency and jitter
- Introduce packet loss
- Introduce errors / corrupt packets
- Duplicate packets
- Send out-of-order packets / reordering
- Fragment the packets
- Link down and bring up (pause link)

Each impairment supports multiple configurations. For instance, packet losses can be introduced in random, burst, poisson drop, percentage etc.

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Setup in hours, deploy anywhere

NE-ONE is available as hardware as well as virtual appliance to suit your deployment needs

Hardware Appliances

- Port options and density
  - 1Gbps and 10Gbps
  - 2 ports to 8 ports per device
- Rack mounted server (NE-ONE enterprise)
- Table-top setup (NE-ONE professions 1Gbps)

Virtual Appliances

- For deployment on Cloud and virtual environments
- Available on VMWare, OpenStack, KVM
- Deploy on AWS and Azure Cloud

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Case Study

User profile: A leading global healthcare equipment provider

Problem statement: The customer is a supplier of critical healthcare equipment used in hospitals. These are interconnected and will also have data transfer to a centralized system for data gathering. Given the critical nature of data, the customer needs to validate the communication system for flawless operation in real-world conditions.

Solution: The customer uses Calnex network impairment devices to emulate real-world network conditions such as introducing delays, dropping packets, etc. New releases are tested for such impairments before being deployed.

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Case Study

User profile: A manufacturer of home security equipment

Problem statement: The customer designs home security equipment including connected locks that can be operated and managed remotely. The equipment relies on reliable connectivity and needs to handle delayed data transmission, errors and packet drops in the network and take necessary actions to ensure that their IoT devices continue to operate predictably. In addition to this, firmware upgrades and patch issues can create surge of traffic that needs to handled without issues.

Solution: The customer uses Calnex NE-ONE to create network issues. The IoT devices are tested for various network impairments. The device behaviour is analysed and corrective measures are implemented.

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Case Study

User profile: A financial technology company that need to performs online transactions

Problem statement: This company's core business relies on the secure and uninterrupted flow of sensitive financial data. Their systems must be able to handle network disruptions without compromising data integrity or failing transactions. They need to verify that their data validation and failover mechanisms work correctly when faced with network congestion, packet reordering, and data corruption.

Solution: Calnex NE-One simulates the impairments required for the above scenarios and provides a test environment where the application resiliency can be tested.

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