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5 Reasons
Why Broadband Providers are Deploying Virtual BNG and CGNAT

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SVP Sales & Marketing, netElastic Systems

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Our Speaker

David Williams
Senior VP Sales & Marketing
netElastic Systems

About netElastic

- Software company focused on Service Provider Virtual Routing and Gateway Solutions
- Emphasis on market-leading performance and scalability
- Based in Santa Clara, CA / Silicon Valley
- Serving the Broadband Industry since 2015

Intel® Network Builders
Winners' Circle Titanium
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intel.

Leading Lights AWARDS 2018 FINALIST

NETWORK TRANSFORMATION AWARDS 2018
10 October 2018
2018 SHORTLIST
LAYER 123

Hot Tech Innovator
Telco Cloud Q3 2017
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ABIresearch

Network Virtualization AWARDS FINALIST

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netElastic Customers (subset)
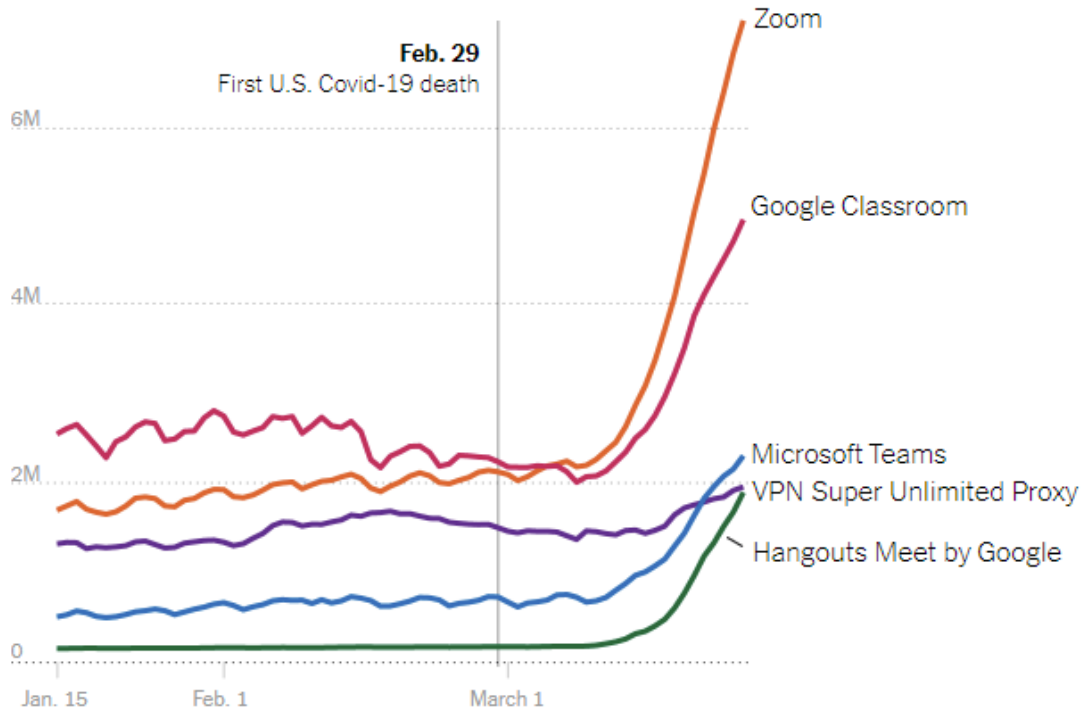
Bandwidth Growth – By the Numbers

29 Annual Global Traffic Growth %

786 Global Bandwidth in Tbps

42 Fixed Data Traffic Growth %

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"The Virus has changed the way we Internet" - NYT

Daily app sessions for popular remote work apps

Feb. 29
First U.S. Covid-19 death

- Zoom
- Google Classroom
- Microsoft Teams
- VPN Super Unlimited Proxy
- Hangouts Meet by Google

6M
4M
2M
0

Jan. 15   Feb. 1   March 1

App popularity according to iOS App Store rankings on March 16-18. · Source: Apptopia
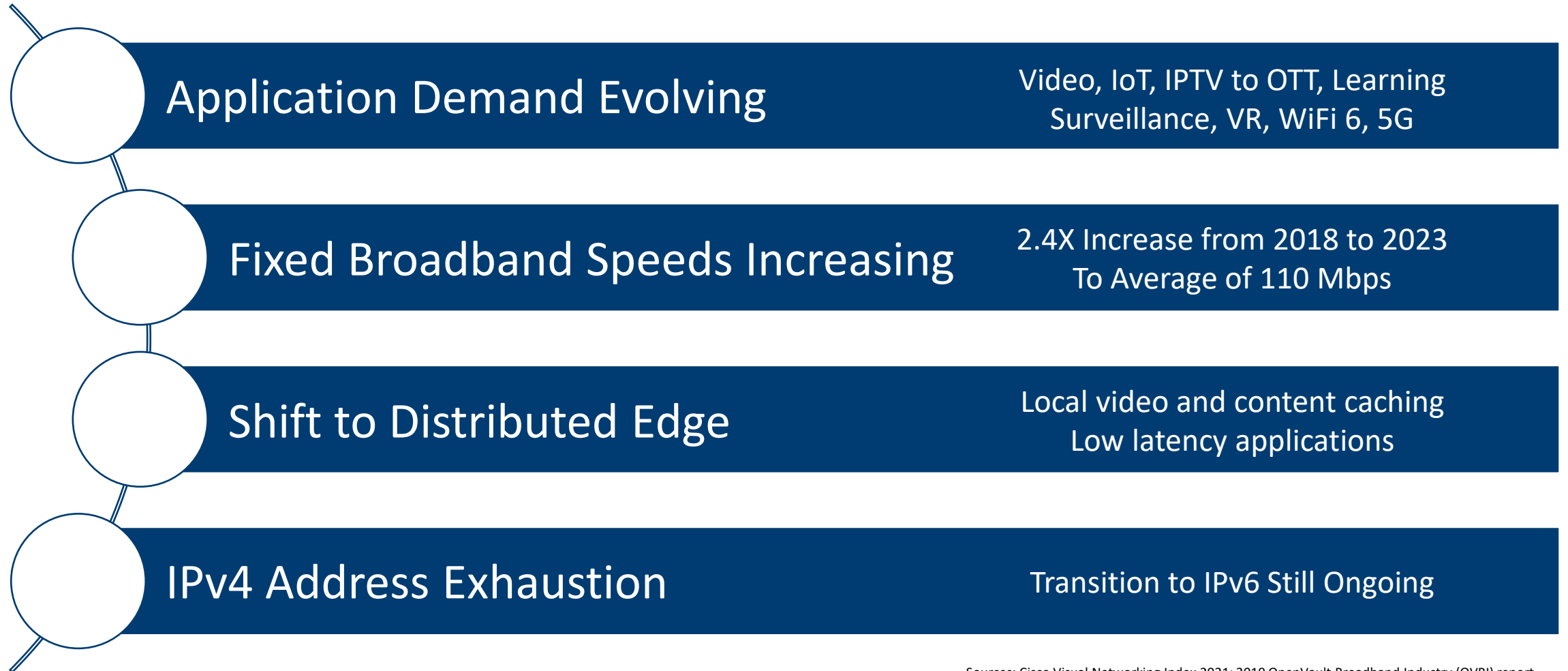
- Effects of Pandemic
  - Huge rise in <u>Residential</u> Internet Traffic
  - Highlight broadband inequalities
- Results:
  - More Fiber being pulled
  - More Bandwidth (upstream) demands
  - Rapid growth of WISPs
  - Rise of the Utility and Muni broadband
  - Significant funding for expansion
 - Demand for infrastructure upgrades

https://www.nytimes.com/interactive/2020/04/07/technology/coronavirus-internet-use.html

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Service Provider Challenges

Application Demand Evolving

Video, IoT, IPTV to OTT, Learning
Surveillance, VR, WiFi 6, 5G

Fixed Broadband Speeds Increasing

2.4X Increase from 2018 to 2023
To Average of 110 Mbps

Shift to Distributed Edge

Local video and content caching
Low latency applications

IPv4 Address Exhaustion

Transition to IPv6 Still Ongoing

Sources: Cisco Visual Networking Index 2021; 2019 OpenVault Broadband Industry (OVBI) report

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Flexibility

- Separate Hardware Decisions
- Move Network Functionality
- Scale Up / Down. Vertically or Horizontally.
- Pay-As-You-Go

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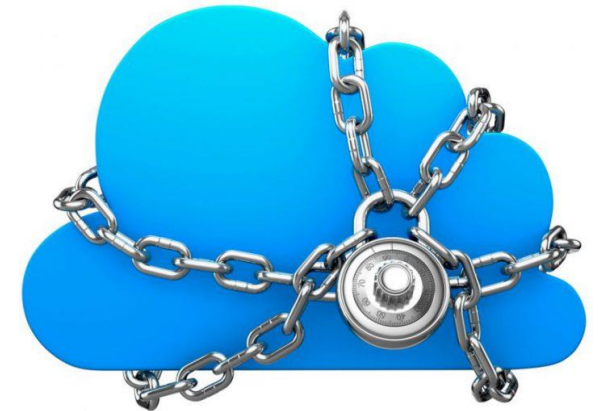
Flexible Scalability

- Vertical scaling (upgrading to larger hardware)

20 GbE / 4,000 Subs

16 Core CPU

32G RAM

Quad Port x710 NIC

20G vRTR License w/ BNG

+ 2,000 subs License

40 GbE / 12,000 Subs

+ 20G vRTR Upgrade License

+ 8,000 subs License

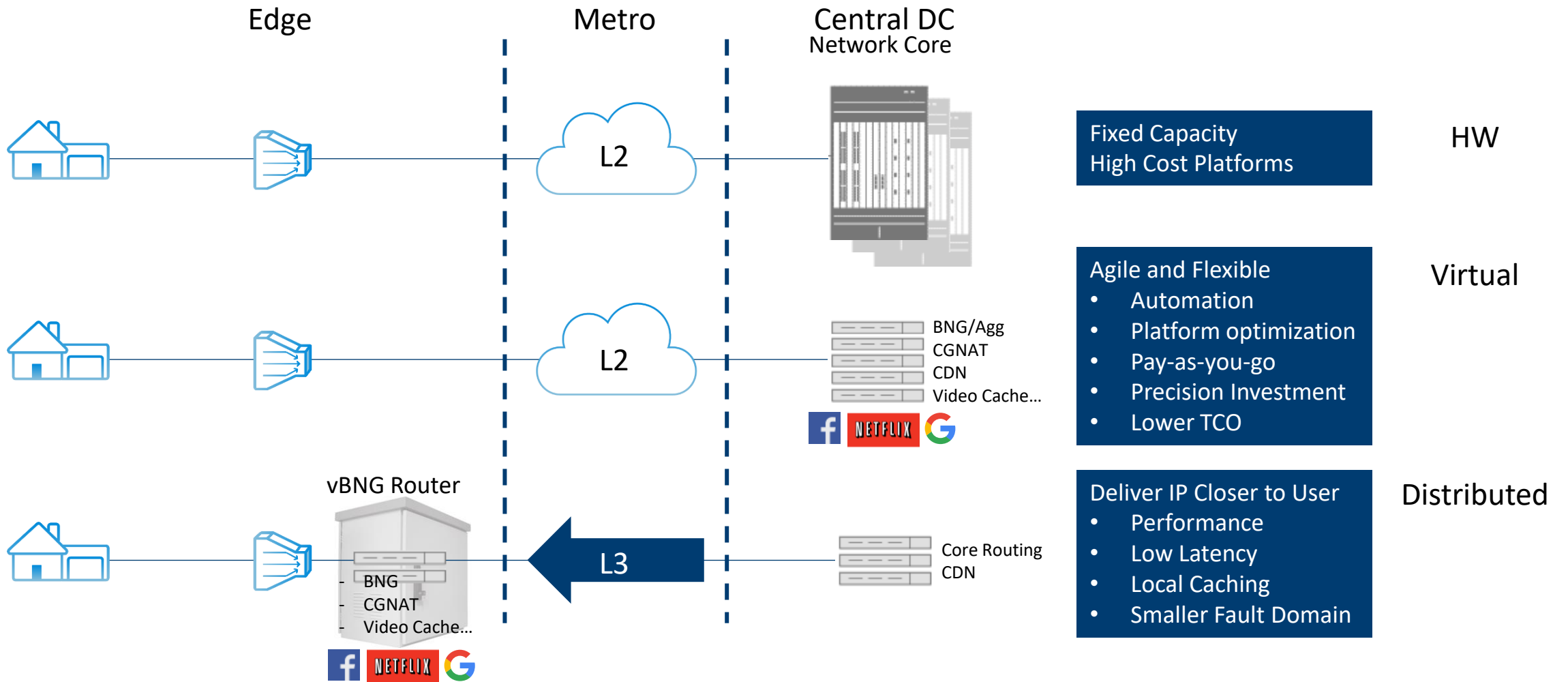**160 GbE / 34,000 Subs**

Upgrade CPU – 24 Core

Add 32G RAM

+ 4 Quad Port x710 NICs
(or 4x XL710 40G NICs)

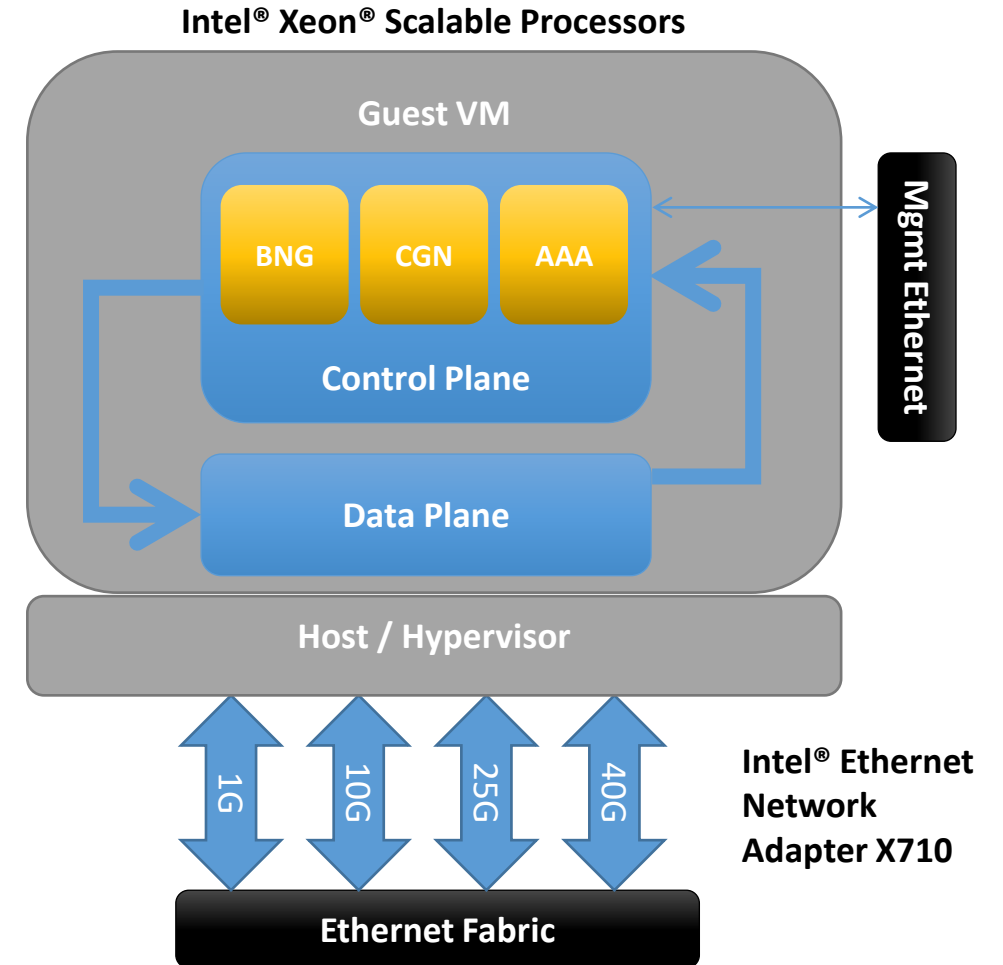+ 80G vRTR Upgrade License

+ 32,000 subs License

- Horizontal scaling by adding new 1 RU servers

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The Distributed Edge

Edge | Metro | Central DC
Network Core

HW

Fixed Capacity
High Cost Platforms

L2

Virtual

BNG/Agg
CGNAT
CDN
Video Cache...

L2

Agile and Flexible
- Automation
- Platform optimization
- Pay-as-you-go
- Precision Investment
- Lower TCO

Distributed

vBNG Router

- BNG
- CGNAT
- Video Cache...

L3

Core Routing
CDN

Deliver IP Closer to User
- Performance
- Low Latency
- Local Caching
- Smaller Fault Domain

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Scalable SDN Architecture

- ## Separate Data Plane and Control Plane
  - ### Each can be scaled independently

- ## Data Plane
  - ### 10 to 700 Gbps per Server
  - ### 10 Gbps per CPU Core

- ## Control Plane
  - ### Scales with Subscriber & Route needs
  - ### Add subscribers granularly to keep costs in line with user growth

- ## vs. CUPs
  - ### Lower cost x86 hardware
  - ### Smaller fault domain with 1:1 CP/DP
  - ### Supports large POPs as well as small remote POPs
  - ### Less hardware for large subscriber bases

Intel® Xeon® Scalable Processors

Guest VM

| BNG | CGN | AAA |

Control Plane

Mgmt Ethernet

Data Plane

Host / Hypervisor

1G 10G 25G 40G

Intel® Ethernet Network Adapter X710

Ethernet Fabric

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Reason 2

Agility

- React quickly to changing network demands
- Modify capacity as needed – quickly & easily
- Add new revenue generating services
- Implement IPv4 conservation with CGNAT
- Avoid supply chain and delivery delays

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Real-World Example

- WebSprix – Ethiopia
  - First privately-owned broadband service in Ethiopia
  - Mission: Close the Digital Divide
- Challenges
  - Flexibility and Scalability
  - Performance and Stability

Outcomes
Rapid Expansion to 4 Additional Cities
1 Week – Procurement to Deployment

"netElastic has definitely contributed significantly to our success and is one of the main ingredients in our solution."

Dawin Birhanu, CEO, Websprix

Source: netElastic Case Study at https://netelastic.com/resources/

Reason 3 - Transition to IPv6

- Industry is still in transition
- Globally: 36% of user traffic is IPv6
  - USA: 46%
  - UK: 33%
  - India: 62%

- BNGs need to support IPv6 transition
  - Dual Stack IPv4+IPv6
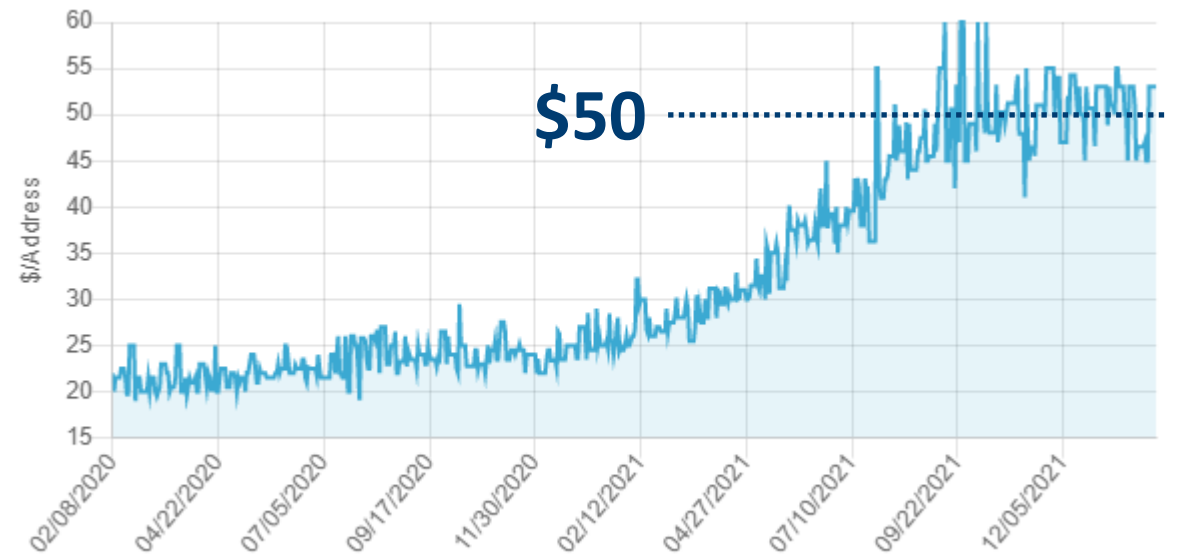 - Integrated / In-line CGNAT

Global IPv6 Adoption
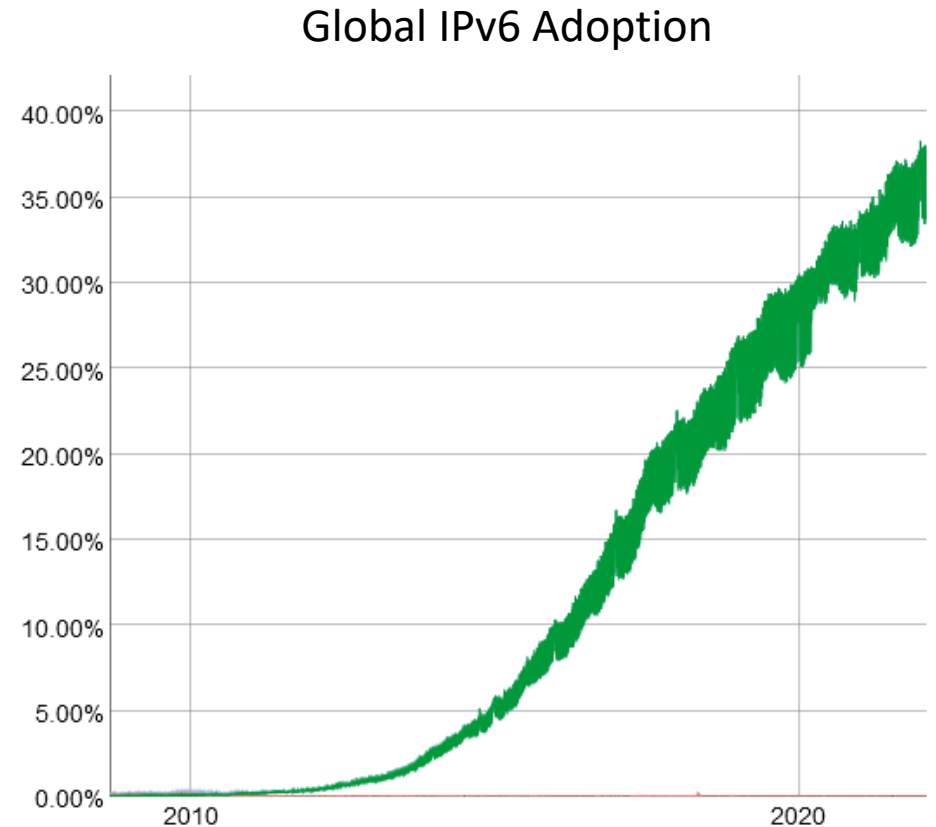
Sources: Google IPv6 Statistics 2022

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Cost of IPv4 Addresses

- Top-level IPv4 Addresses exhausted in 2019

- Secondary IPv4 market emerged
  - Sellers offering unused IPv4 for sale or lease
  - Demand driving prices up 2-3x since 2020
  - Many IP Blocks for lease/sale have tarnished history (blacklists, etc.)

- 20,000 subscribers
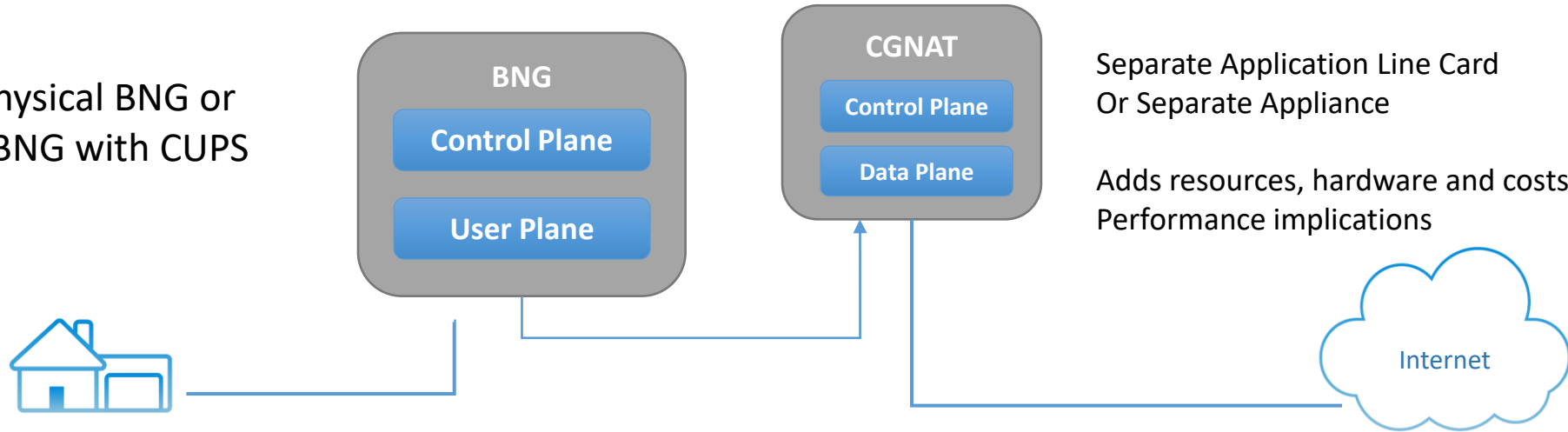 - Public IPv4 Addresses = $1 Million
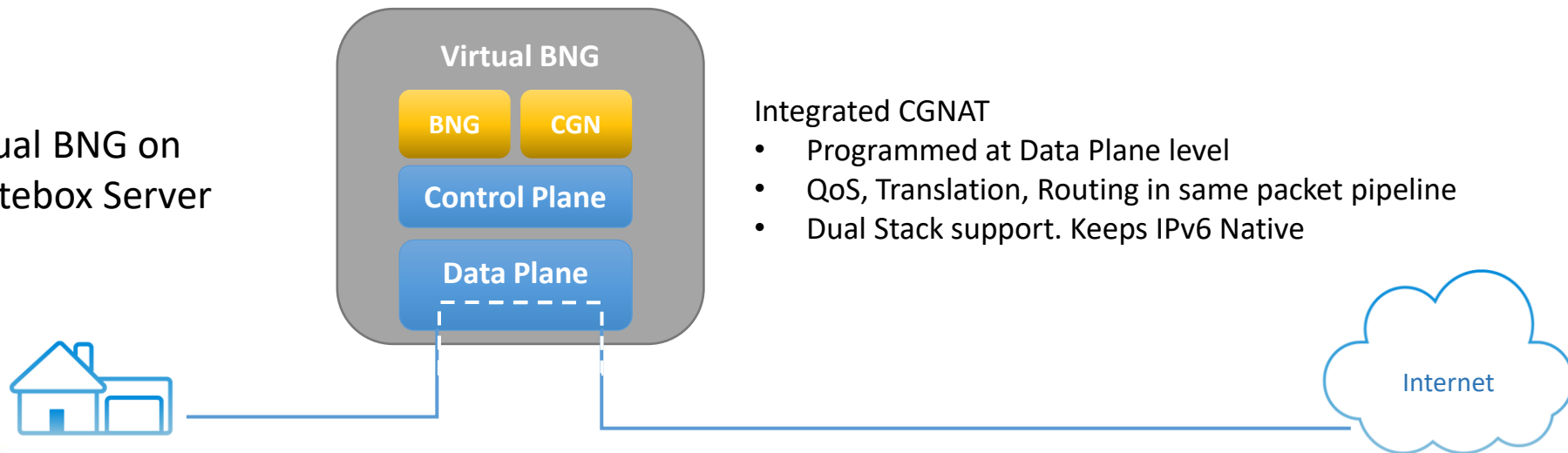 - CGNAT = Small $ Add-on to vBNG

Average Selling Price per IPv4 Address

$50

Source: Hilco Streambank - https://auctions.ipv4.global/prior-sales

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Separate vs In-line CGNAT

Physical BNG or vBNG with CUPS

BNG
- Control Plane
- User Plane

CGNAT
- Control Plane
- Data Plane

Separate Application Line Card
Or Separate Appliance

Adds resources, hardware and costs
Performance implications

Internet

Virtual BNG on Whitebox Server

Virtual BNG
- BNG
- CGN
- Control Plane
- Data Plane

Integrated CGNAT
- Programmed at Data Plane level
- QoS, Translation, Routing in same packet pipeline
- Dual Stack support. Keeps IPv6 Native

Internet

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Real World Example

- Praction Networks
  - Tier 2 ISP w/ 20K Subscribers
  - Major vendor Services Router for BNG
  - Appliance for CGNAT

- Challenges
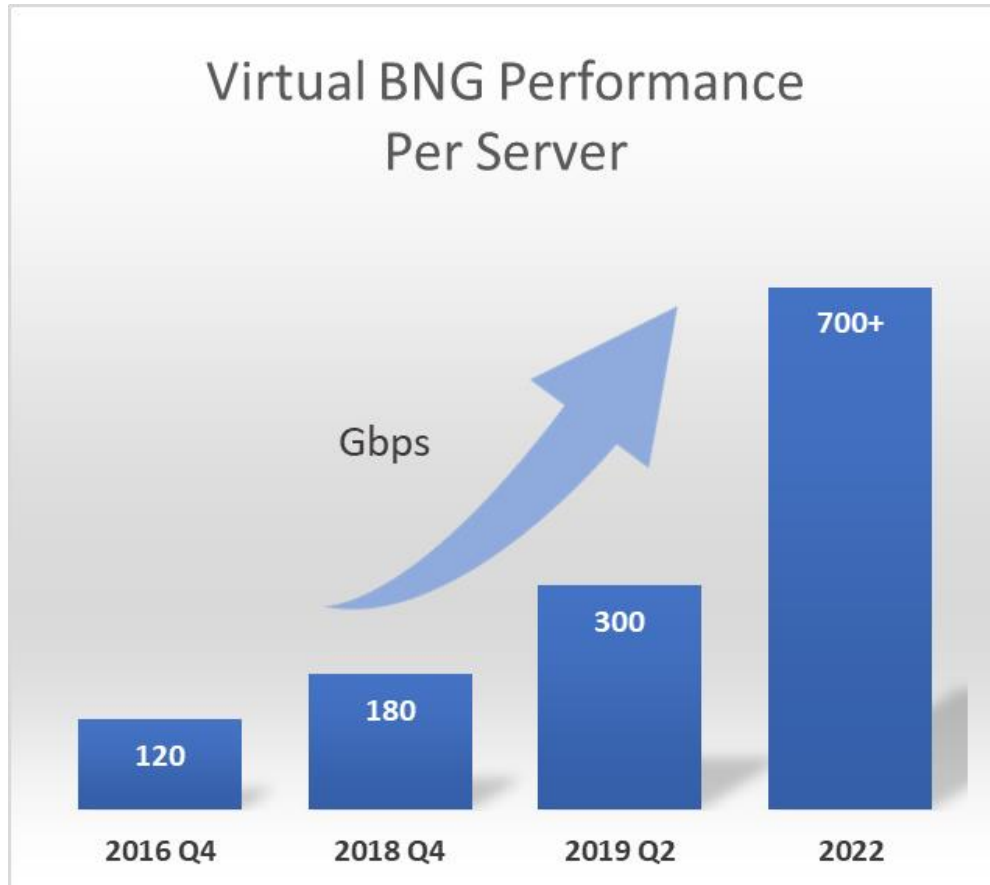 - "Scalability was really an issue with our previous routers."

Outcomes
Replaced multi-device solution with 1 vBNG
Increased performance and future scalability

"Scalability, performance, and cost effectiveness were the key criteria for us in evaluating BNGs. With netElastic vBNG, we got everything we were looking for."

- Rohit Kumar, Co-Founder and CTO at Praction

Full Case Study

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Reason 4 - Performance

Virtual BNG Performance Per Server (Gbps): 2016 Q4 = 120, 2018 Q4 = 180, 2019 Q2 = 300, 2022 = 700+

Scaling at 10Gbps per Core
Latency under 7 microseconds

Driving Performance through innovation

- Intel® Xeon® Scalable Processors
- Intel® Ethernet Network Adapter X710
- Intel® Ethernet Network Adapter E810
- Intel® DDP Feature
- Intel® Select Solutions for NFVI Forwarding Platform Hardware

INTEL® NETWORK BUILDERS PARTNER
A Global Ecosystem Driving the Next Wave of Digital Innovation in the Network
intel.

Source Whitepapers: https://networkbuilders.intel.com and www.netElastic.com

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Reason 5 – Lower Costs

- Most Virtual Solutions have lower-cost licensing options

- COTS – Commercially Available Off-The-Shelf Whitebox Servers

- Vendor Neutral Hardware

- Eliminate CGNAT Appliance Costs

- Operational Savings with Software Management Tools and APIs

"netElastic's pay as you grow licensing model helps reduce our risk in entering new markets and allows us to start small and stay profitable"
- Tom Bishop, CTO Harbour ISP

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Operational Savings with Modern Tools

- BNG Management Applications
  - Enables network and configuration management automation
  - Visibility and Troubleshooting tools
  - Role-based Access for Support Staff
- Familiar CLI
  - Eliminate retraining by leveraging existing expertise
- Supports NETCONF and YANG data models and a centralized configuration database
  - Delivers unified, programmable management capabilities
- Easier to Manage Lowers OpEx
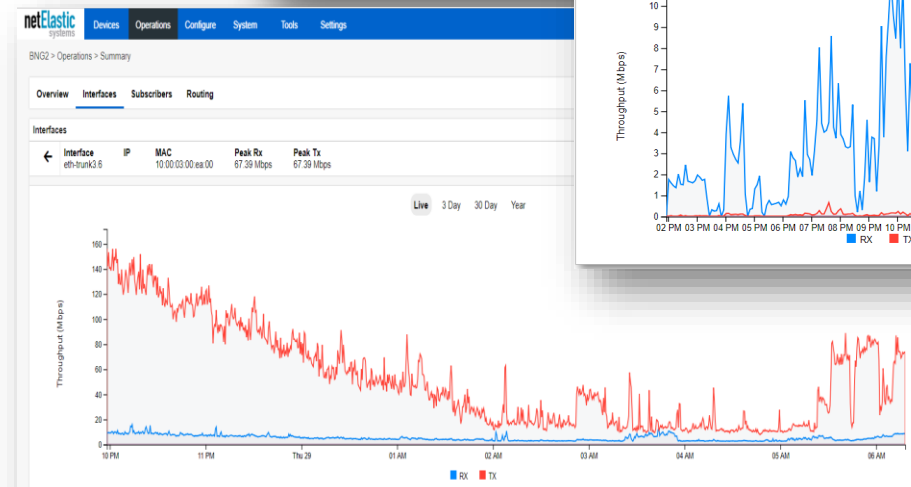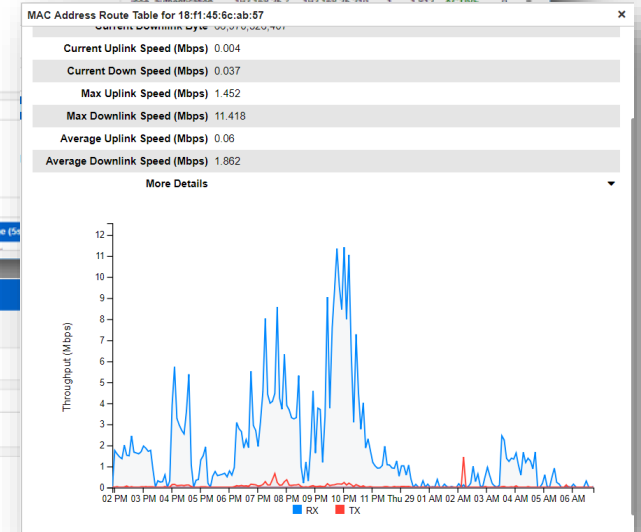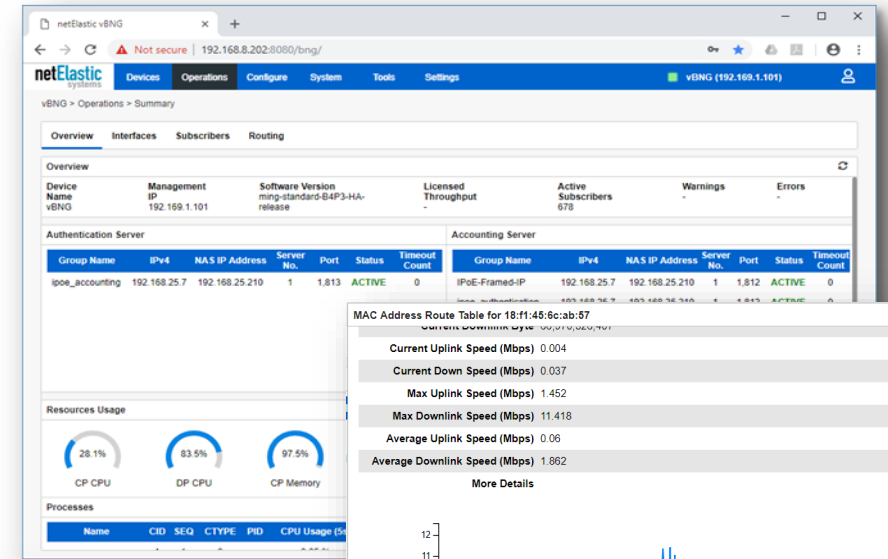
5 Reasons – And More

- Flexiblity
  - Faster resource provisioning
  - Add HW and SW resources as needed (Scalability)
- Agility
  - Deploy functions and services quickly
  - Rapid Time to Market
- Integrated In-Line CGNAT
- Performance
- Drives down OpEx & CapEx
  - COTS Hardware
  - Pay-As-You-Grow Licensing
  - Ease of Management

REPORTED BENEFITS OF NV
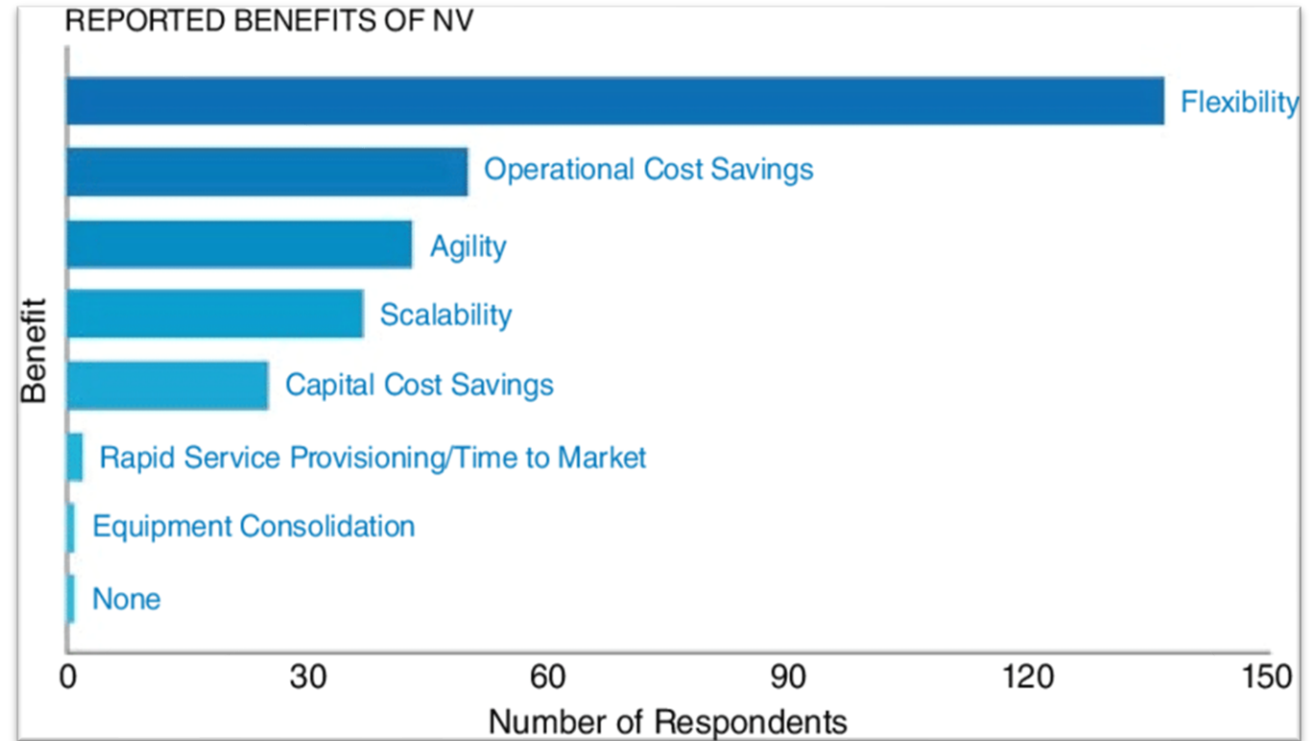
https://www.researchgate.net/figure/Benefits-of-network-virtualization_fig3_322466640

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For More Information

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