

NANOG 87

February 2023

Cloud Network Engineering: A Closer Look

February 2023

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What is the cloud anyways?

- **In the old days people would bake bread at home**
- **They had private water wells**

What is the cloud anyways?

- **In the old days people would build their own (mini) data centers**
 - **Power**
 - **Space**
 - **Cooling**
 - **Server management and maintenance**
 - **OS Management and maintenance**
 - **Application management and maintenance**

What is the cloud anyways?

- **How about someone else builds and owns them at a much lower wholesale price?**
 - **A (Public) Cloud Service Provider (CSP)**
- **Today we can “rent” instead:**
 - **Power**
 - **Space**
 - **Cooling**
 - **Server management and maintenance**
 - **OS Management and maintenance**
 - **Application management and maintenance**

But who gets THAT job done?



A bit of history

- **Traditional Network Engineering (1990-2010)**
 - **Strong overlap with Systems Engineering**
 - **Smaller enterprises and jacks of all trades**
 - **Larger enterprises including service providers**

Major Employers

- **Traditional Network Engineering**
 - **Enterprise (largest sector)**
 - **Service Provider**
 - **Data centers**
 - **Vendors**
 - **Pre-sales**
 - **Post-sales**

Main Duties 1/2

- **Traditional Network Engineering**
 - **Occasional LAN/WAN/DC/Backbone design work**
 - **Network configuration; maybe some security**
 - VM networking
 - **Regular maintenance**
 - **Code and hardware upgrade etc.**
 - **QoS?**

Main Duties 2/2

- **Traditional Network Engineering**
 - **Monitoring**
 - **No DevOps**
 - **Syslog/SNMP**
 - **Capacity planning**
 - **Links and devices**
 - **Maybe some automation**
 - **TCL?**
 - **Vendor specific**
 - **Break/Fix**

Past 10 years...

- **The two waves of migration (forks)**
 - **The concept of NDE (Network Dev Engineer)**
 - All the above + some coding/scripting
 - Build > Buy
 - **The concept of DevOps**
 - Modern day Ops with even more tooling/coding/automation
 - Build >> Buy

Still Classic But...

- **Modern but Classic Network Engineering**
 - **“SDN” use cases**
 - SD-WAN management
 - SDN in Data Centers
 - **NFV/VNF**
 - **Dense virtual networking**
 - Containers networking
 - **Maybe some “cloud networking”**
 - SaaS applications counts!

Eventually...

- **Cloud Network Engineering (CNE)**

Cloud Network Engineering (CNE) Main Employers

- **Enterprises (largest sector)**
 - All sectors
- **“Service Providers” (ISVs)**
 - SaaS
- ~~Data centers~~
- ~~Vendors Public Cloud Service Providers~~
 - Pre-sales
 - Post-sales

Cloud Network Engineering (CNE) day-to-day activities



Cloud Network Engineering (CNE) day-to-day activities

- **Enterprises (largest sector)**
 - **Bring new workload to the cloud**
 - **Design expansion plans (same CSP)**
 - **Build/configure constructs/services/subnets**
 - **Design multi-cloud connectivity**
 - **Design and configure DC/HQ to cloud connectivity**
 - **Design and configure DR**
 - **Security measures**
 - **Monitoring**
 - **Capacity planning**
 - **Billing**

Cloud Network Engineering (CNE) day-to-day activities

- **ISV (Independent Software Vendors)**
 - **SaaS applications**
 - **Almost everything that an enterprise engineer does**
 - **Client management**
 - **Design and implement segmentation strategies**
 - **Design and implement scaling strategies**
 - **Misc. tasks**

Cloud Network Engineering (CNE) day-to-day activities

- **Public Cloud Service Providers (aka. vendors)**
 - **Pre-sales**
 - **Mainly Solutions Architects or Cloud Network Architects**
 - **Workshops and product discussions**
 - **POCs**
 - **Initial design and architecture discussions**
 - **Post-sales**
 - **Professional Services**
 - **Tech support**
 - **Engineering and product development**

CNE Key Skillsets



*That's actually
pretty accurate!*

Cloud Network Engineering is a Combo Pizza

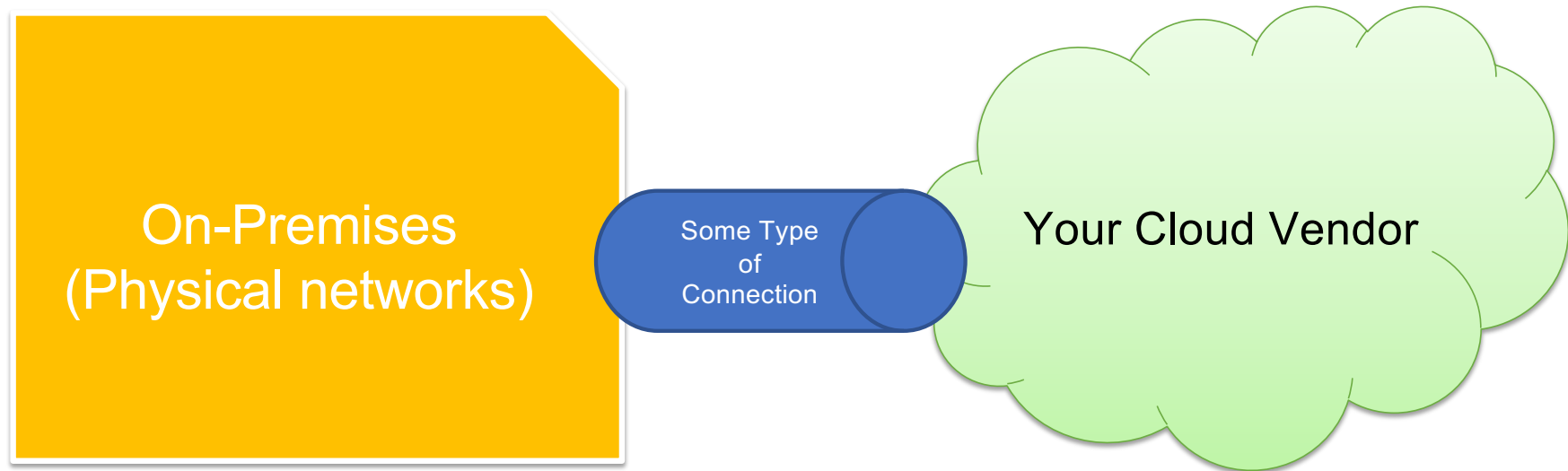
- **Network Engineering**
- **Systems Engineering**
- **Security Engineering**
- **Sometimes maybe more...**
 - **DevOps**
 - **Compliance**
 - **Soft skills**

I like it; but what's needed?

At least where to begin...



The Most Basic View



CNE Key Skill sets

- **Routing 1/2**
 - **You still have subnets and sites/segments**
 - **Virtual routers; hence the concepts of routing**
 - **Intra-cloud communications**
 - **Cloud <-> physical network (on-premises)**

CNE Key Skill sets

- **Routing 2/2**
 - **Static routing**
 - **BGP**
 - **iBGP vs eBGP**
 - **Main attributes (AS_PATH, MED, LOCAL_PREF etc.)**
 - **BGP communities**
 - **BGP decision tree**
 - **BGP filters**
 - **Concepts of import/export or redistribution**
 - **Convergence optimization techniques such as BFD**

CNE Key Skill sets

- **Routing: OUT OF SCOPE**
 - **IGPs**
 - **OSPF**
 - **ISIS**
 - **Exceptions (customer/job demand)**

CNE Key Skill sets

- **Sample Project**
 - **The customer wants to have full connectivity between their physical data centers and the cloud**
 - **BGP**
 - **Static Routing**

CNE Key Skill sets

- **Encryption Technologies**
 - **Mainly in-transit (remember the “sites”?)**
 - **IPSec**
 - **Primarily Site-to-site VPN**
 - **Mechanics**
 - **Configuration on various devices**
 - **Phases and troubleshooting**
 - **Overhead**
 - **NAT Traversal**

CNE Key Skill sets

- **Encryption Technologies**
 - **MACsec**
 - Recent architectures
 - **TLS/SSL**
 - How it works?
 - Who likes it?
 - Enough for my SaaS?

CNE Key Skill sets

- **Sample Project**
 - **Now that the customer has full connectivity between their physical data centers and the cloud their CISO wants to make sure everything between on-premises and the cloud is encrypted.**
 - **IPSec**
 - **MACsec**
 - **Each supported in certain architectures with specific pros and cons**

CNE Key Skill sets

- **Load Balancers (Local) 1/3**
 - **Layer 3/4 (IP/Port)**
 - **High throughput**
 - **Minimum “touching and handling”**
 - **Layer 7**
 - **Deeper header processing**
 - **Layer 7 decision making (HTTP headers)**
 - **Mostly suitable for Web applications**

CNE Key Skill sets

- **Load Balancers (Local) 2/3**
 - **Traffic distribution algorithms**
 - Round Robin
 - Hash codes based on IP, port etc.
 - **Sticky session and cookies**
 - **TLS/SSL offloading**
 - **End-to-end TLS/SSL**
 - **Source IP preservation**
 - **Health checking (TCP, UDP etc.)**

CNE Key Skill sets

- **Load Balancers (Local) 3/3**
 - **Advanced architectures**
 - **Sandwich designs**
 - **Proxy Servers**
 - **Hybrid architectures**
 - **IPv6 load balancing**
 - **Containers and the concept of load balancing**
 - **Monitoring and troubleshooting**

CNE Key Skill sets

- **Load Balancers (Local): OUT OF SCOPE**
 - **Application placement**
 - **Load and capacity planning at the App level**
 - **Header processing (Maybe?)**

CNE Key Skill sets

- **Sample Project**
 - **Now the customer wants to distribute the users traffic among 32 virtual servers (or containers).**
 - **Determine the architecture**
 - **Determine the type of load balancers**
 - **Determine the number of load balancers**
 - **Design and configure the advanced settings**

CNE Key Skill sets

- **DNS 1/4**
 - **Why is it needed?**
 - **Cloud <-> Cloud (self and services)**
 - **Cloud <-> On-prem**
 - **Cloud <-> Internet**
 - **Main Architectures**
 - **Cloud Native**
 - **Hybrid**

CNE Key Skill sets

- **DNS 2/4**
 - **Basics of DNS (e.g., the hierarchical model)**
 - **Public vs Private DNS**
 - **Different record types (A, AAAA, PTR, MX etc.)**
 - **Concept of delegation**

CNE Key Skill sets

- **DNS 3/4**
 - **Global Load Balancing and Traffic Management**
 - **Latency**
 - **Geo-location**
 - **Active-passive**
 - **Etc.**

CNE Key Skill sets

- **DNS 4/4**
 - **Advanced Architectures**
 - **DNSSEC**
 - **Compliance (e.g., FedRAMP)**
 - **Dynamic DNS (DDNS)**
 - **Maybe automation**
 - **Maybe some IPv6**
 - **Monitoring and reporting**
 - **Compliance and regulations**

CNE Key Skill sets

- **Sample Project**
 - **The customer wants to have full name resolution for all their cloud-based and on-premises resources. They have had DNS servers in their physical data centers forever and now are using the Cloud provider's DNS service as well.**
 - **Hybrid architectures**

CNE Key Skill sets

- **External Appliances and Solutions 1/2**
 - **SD-WAN**
 - **Cloud footprint as a “location”/site**
 - **Even more complex scenarios**

CNE Key Skill sets

- **External Appliances and Solutions 2/2**
 - **3rd Party Firewalls**
 - **Need more than what “ACLs” can offer?**
 - **Run 3rd party firewalls on virtual machines OR**
 - **Layer 7 inspection**
 - **IDS/IPS**
 - **Advanced NAT scenarios**
 - **Networking only? Policies?**
 - **How to architect? Segments? Traffic flow?**

CNE Key Skill sets

- **Sample Project**
 - **The customer wants to treat their cloud footprint as one of their remote sites**
 - **The customer wants to bring their SD-WAN “brain” to the cloud**

CNE Key Skill sets

- **Automation and Scripting**
 - **Some job description**
 - **Mostly engineer vs architect**
 - **Very rich set of APIs are available**
 - **Python, C, Perl etc. to call the APIs**
 - **Terraform for pattern-based deployments**
 - **Don't be afraid to try!**

CNE Key Skill sets

- **Miscellaneous Services**
 - **Network Address Translation (NAT)**
 - Mostly PAT
 - **DHCP**
 - **NTP**
 - **CDN**
 - **CSP Firewalls**
 - **Access to other cloud services**
 - **Billing (YES, money and trees....)**

CNE Key Skill sets

- **Soft Skills (Pretty general)**
 - **Mostly pre-sales and customer facing positions**
 - **Presentation skills including time management**
 - **Learn how to talk and respond structured**
 - **How to stay calm?**
 - **How to take feedback?**
 - **How to take criticism even personal?**
 - **We always welcome women and minorities**

The Future Trends of CNE roles

- **More Construct Flexibility**
 - **NAT - From simplicity to complexity**
 - **Routing - More flexible Filtering/Advertisement**
 - **Firewall architectures**
 - **Mimic traditional networking? Abstraction? L2?**
- **Higher throughput and capacity**
 - **Cloud <-> On-premises**
 - **Cloud <-> Cloud (region to region or between regions)**
 - **Limits of various constructs (Routing, NAT, IGW etc.)**

The Future of CNE roles

- **Greater Variety of Services**
 - Real time and ultra low latency applications
- **More Cloud Locations**
 - Closer to you or your own cloud

Multi-Cloud

The most important transformation trend

The Future of CNE roles

- **Expanding Job Market**
 - **All verticals**
 - **Non-network/systems engineers**
 - **Non-IT folks**
 - **Medical doctors?**
 - **Mechanical engineers?**
 - **Aerospace engineers?**

Kam's old blog post still applies:

<https://packetpushers.net/how-to-break-into-a-cloud-engineering-career/>



Thank you

February 2023

