

# NANOG 85

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# The Anatomy of the Trickiest\* Network Engineering Interview Question

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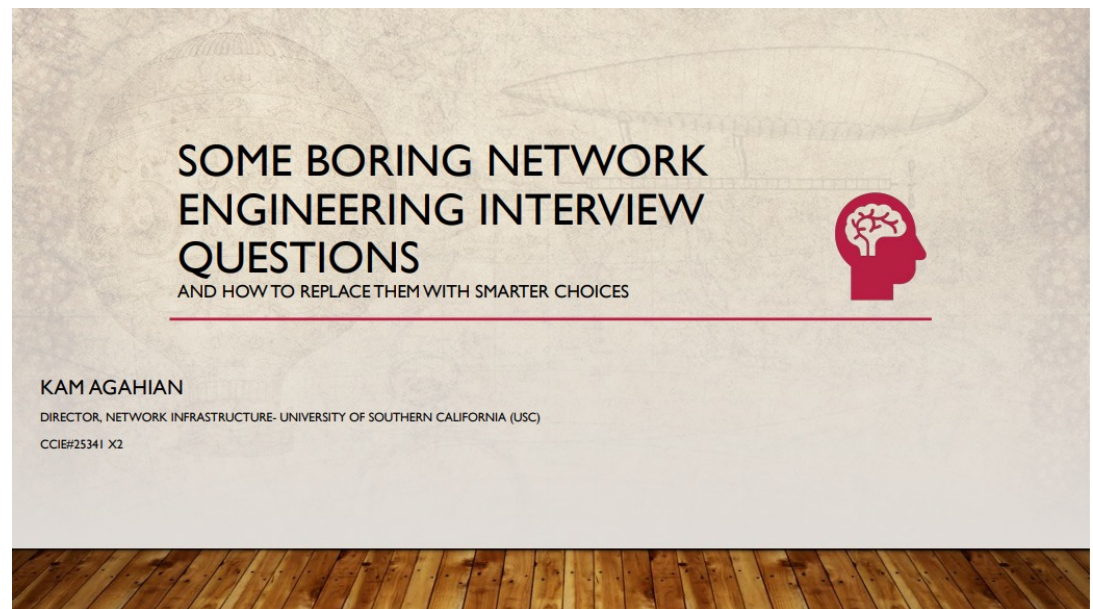
# Looking back...

- **Once upon a time in Austin, TX**
  - Different world
  - No masks
  - No WFH



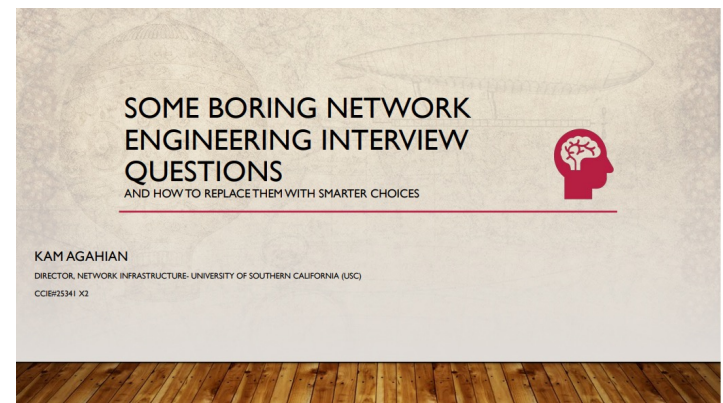
# Looking back...

- **“Different” topic**
- **Focus shift**
  - Departure from famous questions
  - Human beings
- **But also...**



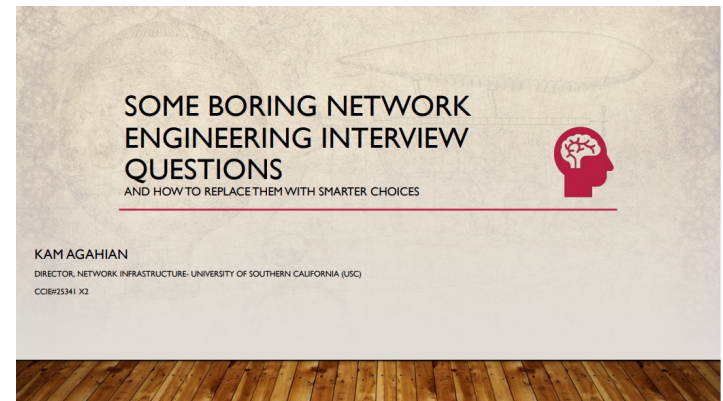
# Looking back...

- **What lingered was the FEEDBACK**
  - **Still after ~2 years**
  - **Sharing stories and memories**
  - **Shocking...moving**
  - **Sometimes funny too!**
  
- **But the outcome matters**
  - **Stories of improvements**



# Looking back...

- **You requested:**
  - **“Share more examples...”**
    - **A NANOG talk on the top 10 questions?**
    - **A NANOG tutorial on the top 10 scenarios?**
  - **Not so practical but still there are ways...**



# So that...

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- **The initial ideas:**
  - **The broken process**
  - **Cognitive bias**
  - **Training gaps maybe?**
    - **Expectations vs reality**

# Or a better idea...

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- **Let's analyze the anatomy of an example scenario**



# Or a better idea...

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- **Let's analyze the anatomy of an example scenario**
  - **Demonstrate the overall structure**
  - **30 minutes discussion to spark more thoughts**
  - **Show what happens vs what is expected**
  - **Evaluate why it could lead to biased interviewing**
  - **Provide suggestions**

# What makes an interview question tricky?

- **Technical depth** – Obviously.
  - Beyond memorizing
    - The usual suspects; BGP attributes, RR vs Confed, OSPF LSA/Area types etc.
  - Problem solving skills
    - Thought process
  - Takes some structuring
    - Sloppy vs structured answers

# What makes an interview question tricky?

- **Multi-dimensional questions**
  - **The horizontal space (the breadth)**
    - Candidate: I can see these components in the scenario
  - **The vertical space (the depth)**
    - Candidate: These are the parts and pieces I can see in each component
- **But wait a second...**
  - **How many “components” are out there?**
  - **How much details do I need to know about each “component”?**

# What makes an interview question tricky?

- **Example: Travel from Los Angeles to Las Vegas**
  - **Road trip? Flight? Train? Bike maybe?**
    - **Road trip**
      - **Rent a car**
        - **Rental companies?**
        - **Best prices?**
        - **Availability?**
        - **Insurance?**
          - **Need one? What are the changes?**
            - **Which one?**
              - **Self or their offer?**
- **What if someone decides to walk?! You lose point.**

# What makes a tricky interview question unfair?

- **When it turns into biased interviewing**
  - **Guess what I am thinking of? Or Alice in Wonderland.**
- **Example: BGP Route Reflectors vs Confederations**
  - **Not that...**
  - **Not that...**
  - **Not that one either...**

# So, what is the trickiest question?

- **It is multi-dimensional**
- **Easily ends up in Alice in Wonderland**
  - **"Why, sometimes I've believed as many as six impossible things before breakfast." ...**
- **But you all have seen it before...**

# So, explain to me what happens...

- **When you enter [www.nanog.org](http://www.nanog.org) in your browser and hit enter?**
- Interviewer's tip: Show your most innocent face...

# So, explain to me what happens...

- **No two engineers would agree on the dimensions**
- **We asked 26 seasoned interviewers**
  - **All with over 20 years of experience**
  - **Everyone answered from their perspective**
  - **Only 2 people asked for detailed clarification**



# So, explain to me what happens...

- **Some of the Vertical Dimensions**
  - **Layer 1**
  - **Layer 2**
  - **Routing (interior vs exterior)**
  - **DNS (Name resolution)**
  - **Systems engineering (OS internals)**
  - **Security (Firewalls, ACLs, IPSs...)**
  - **Hardware**
  - **And potentially many more...**

# So, explain to me what happens...

- **Sample tree; Horizontal view: Layer 1**
  - **How the packet travels after it's born**
    - **Copper**
    - **Fiber**
    - **Transceivers**
    - **Subsea**
    - **Wireless (4G, 5G, WiFi)**

# So, explain to me what happens...

- **Sample tree; Horizontal view: Layer 2**
  - **ARP**
  - **MAC address**
    - Why is it needed?
    - How the packet is structured?
  - **VLANs**
    - Same?
  - **Proxy ARP?**
  - **At each hop?**

# So, explain to me what happens...

- **Layer 2 - But hold on...**
  - **The candidate didn't cover Layer 2 along the path**
  - **MAC tables?**
  - **Caching?**
  - **What happens at each hop?**

# So, explain to me what happens...

- **Sample tree; Horizontal view: Routing 1/4**
  - **Where is the client located?**
  - **How is the local routing set up?**
  - **Interior first?**
    - **Static?**
    - **Default gateway**

# So, explain to me what happens...

- **Routing- But hold on...**
  - **The candidate assumed it was a Linux/Windows client with a default gateway, I meant a router...**
  - **My router had a specific route**
  - **Never asked about the topology**
    - **Hub and spoke?**

# So, explain to me what happens...

- **Sample tree; Horizontal view: Routing 2/4**
  - **Interior routing inside an enterprise campus**
    - **OSPF, ISIS, EIGRP, RIP...**
    - **How is nanog.org (104.20.199.50) reached?**
      - **Default route**
      - **What if we leaked in the 104.20 network? Just for TE or fun.**

# So, explain to me what happens...

- **Routing- But hold on...**
  - **The candidate assumed the routes were present and reachable**
    - **Convergence in progress**
    - **Encapsulation? Any tunnels? VPN? VXLAN?**



# So, explain to me what happens...

- **Sample tree; Horizontal view: Routing 3/4**
  - **Exterior routing**
    - **TCP 179**
    - **eBGP vs iBGP**
    - **2B vs 4B ASN**
    - **Stub AS**
    - **How many circuits/paths?**
    - **Path selection? Outbound BGP decision tree?**
    - **How many ASs to traverse through until NANOG is reached?**
    - **Inbound BGP decision tree**

# So, explain to me what happens...

- **Routing- But hold on...**
  - **The candidate assumed the entire Internet path was native BGP**
    - **My carrier has an MPLS backbone**
    - **I use MPLS VPN (L2/3)**
      - **I am sure the candidate didn't know the difference**
    - **Possibility of Route Reflectors and Confederations**
      - **Mergers**
      - **How RRs REALLY work?**
        - **Has changed from one RFC to another**
        - **Hierarchical RRs**
        - **Buffers and all other optimizations**

# So, explain to me what happens...

- **Sample tree; Horizontal view: Routing 4/4**
  - **Other nuances**
    - **Equal Cost Multi Path (ECMP)**
    - **Hashing algorithms**
    - **Route export/import (distributions) at the borders**
    - **Hardware vs Software processing/switching**

# So, explain to me what happens...

- **Sample tree; DNS**
  - **Probably that's how the whole scenario was born**
  - **Many steps are very much OS dependent but still...**
    - **DNS has a hierarchical model**
    - **Go to configured DNS server (e.g. Corporate servers)**
      - **Forwarder only?**
    - **Does it know?**
    - **If not hit the hierarchy and find out!**

# So, explain to me what happens...

- **Sample tree; DNS root servers “.” for [www.nanog.org](http://www.nanog.org).**
  - **Top Level Domains (.ORG)**
  - **All the way down to the public DNS hosting for [www.nanog.org](http://www.nanog.org)**

# So, explain to me what happens...

- **DNS- But hold on...**
  - **The candidate assumed there were only 13 root DNS servers**
  - **No mention of DNSSEC and lose track while talking about the keys**
  - **No mention of Global Service Load Balancing (GSLB)**
  - **Local files (hosts, nope not lmhosts...)**
- **The candidate never talked about the local cache!**
- **The candidate kept referring to DNS with Port UDP 53...**

# So, explain to me what happens...

- **The other possible verticals**
  - **Systems Engineering**
    - Nscd
    - Different files such as `/etc/resolv.conf`, `/etc/nsswitch.conf`, `/etc/host.conf` etc.
    - Linux System calls
    - Hypervisor? Container?
  - **Security Engineering**
    - Stateful/stateless along the way
    - L7 inspection

# Lessons Learned

- **Multi-dimensional questions are great but...**
  - So easy to be unfair
- **Clear questions? What are you testing?**
- **Guidance without penalties**
  - To put “the interview” back on track
- **Avoid the “Guess what I am thinking of?” model**





# Thank you

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