



# ABSTRACT PONDERINGS

## A 10 YEAR RETROSPECTIVE

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**NANOG 90. 2024-02**



**AUTOMATION ISN'T NEW**



**FASTER  
TYPEWRITERS**



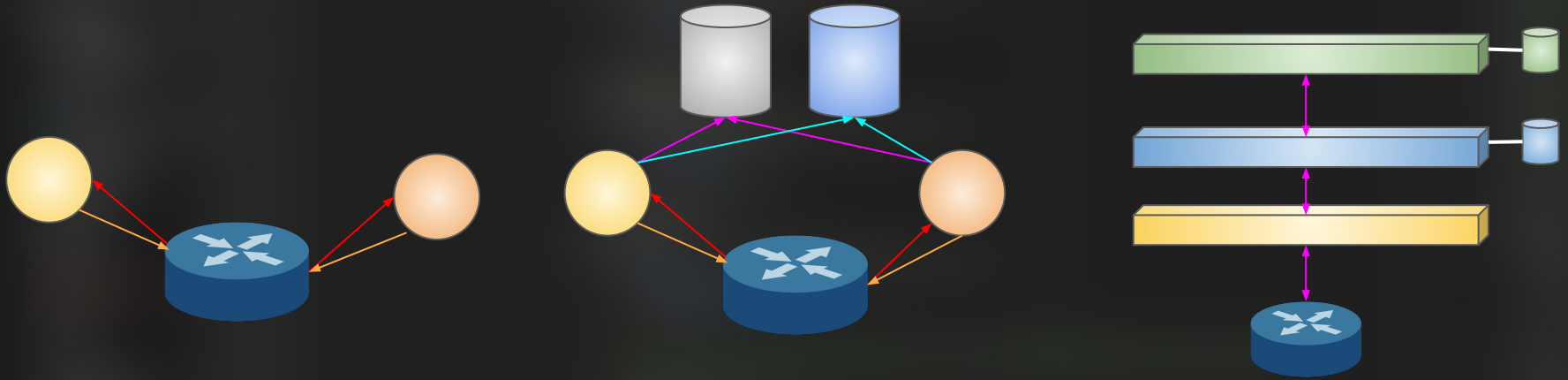
**AUTOMATION  
SYSTEMS**



**THE NETWORK IS CRITICAL INFRASTRUCTURE**

**⇒ WE MUST AUTOMATE**

# ROBUST AND MAINTAINABLE



# MEANS BUILDING LAYERED SYSTEMS

# WE NEED ABSTRACTIONS

**CONSTRAIN COMPLEXITY**

**ALLOW REUSABILITY**

**ALLOW INDEPENDENT  
EVOLUTION**

**ENABLE TESTABILITY**

# WHY OPENCONFIG?

**VISION: MACHINES ARE THE ONLY WAY TO MUTATE  
THE NETWORK AND NEED PROGRAMMATIC APIS**

**ACCESSING INTENDED AND ACTUAL STATE**

**ABSTRACTING AWAY IMPLEMENTATION DETAILS**

# 10 YEARS OF ABSTRACTIONS

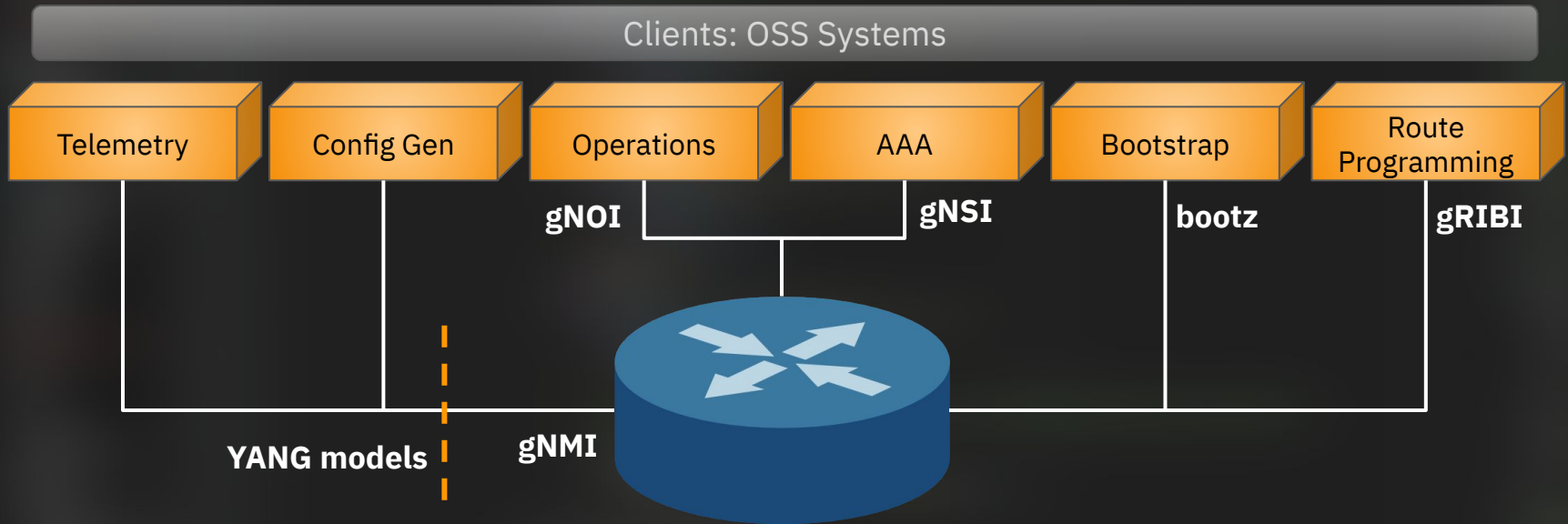
30

29

28



# OPENCONFIG IS THE DE FACTO DEVICE LAYER ABSTRACTION



Users:  
Developers

ygot

ygnmi

ONDATA

KNE

featureprofiles



**NO ABSTRACTION IS PERFECT FOR EVERYONE**

```
Total Path Attribute Length: 35
+ Path attributes
  - Path Attribute - ORIGIN: IGP
  - Path Attribute - AS_PATH: 65506
  - Path Attribute - NEXT_HOP: 192.168.51.2
  - Path Attribute - MULTI_EXIT_DISC: 0
  - Path Attribute - COMMUNITIES: 321-654
+ Network Layer Reachability Information (NLRI)
  - 10.30.0.0/24
+ Border Gateway Protocol - UPDATE Message
  Marker: ~~~~~
  Length: 63
  Type: UPDATE Message (2)
  Withdrawn Routes Length: 0
  Total Path Attribute Length: 35
+ Path attributes
  - Path Attribute - ORIGIN: IGP
  - Path Attribute - AS_PATH: 65506
  - Path Attribute - NEXT_HOP: 192.168.51.2
  - Path Attribute - MULTI_EXIT_DISC: 0
  - Path Attribute - COMMUNITIES: 321-654
+ Network Layer Reachability Information (NLRI)
  - 10.40.0.0/24
+ Border Gateway Protocol - UPDATE Message
```

**PROTOCOLS ⇒ ABSTRACTIONS**

A black and white photograph of a man with a beard, wearing a plaid shirt, sitting on the floor. He is looking down at an open book he is holding in his hands. To his left, a laptop is open on the floor. The background is dark, with a bookshelf visible on the right side. The overall mood is quiet and focused.

**SO, WHAT HAVE WE LEARNT?**

# MANAGEMENT PLANE APIS SHOULD SEPARATE TRANSPORT AND DATA





**BUILD GENERAL PURPOSE ABSTRACTIONS**

A blurred background image of a server room with multiple rows of server racks. The racks are filled with various components, and some blue cables are visible at the top. The overall scene is out of focus, emphasizing the text overlay.

**ONLY BE  
NETWORKING-SPECIFIC  
WHERE WE MUST**



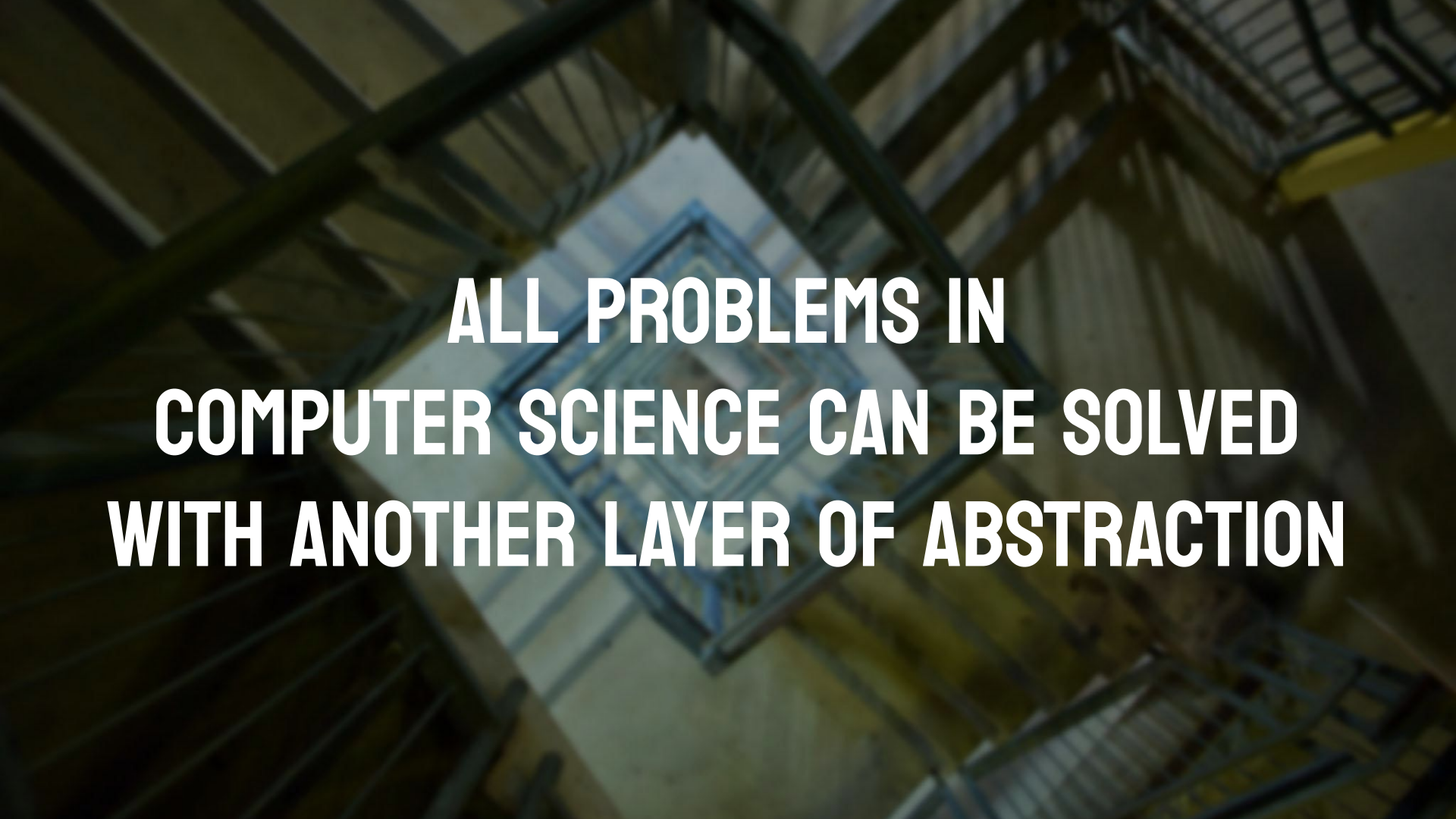




**ABSTRACTIONS/APIs == CONTRACTS**



**WE NEED AN AUTOMATION  
SYSTEM ARCHITECTURE.**

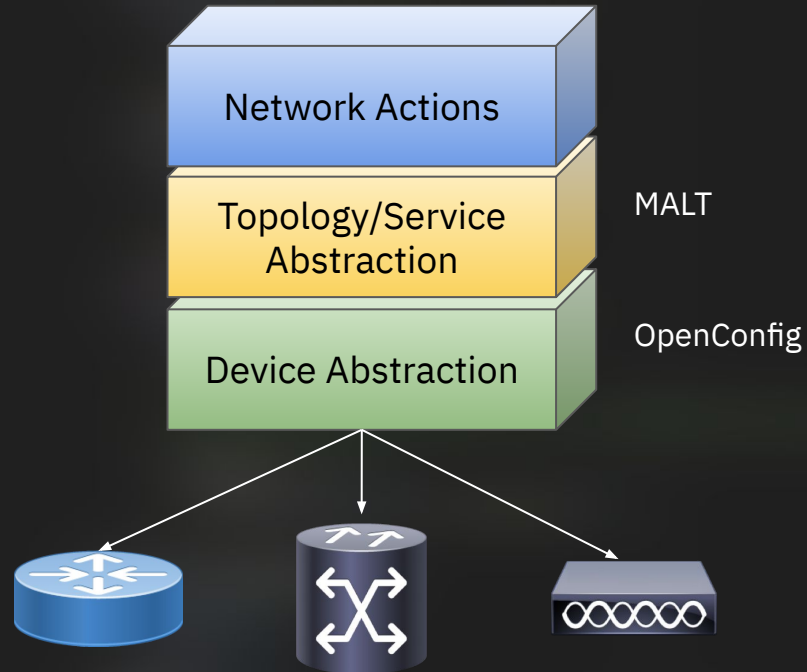


**ALL PROBLEMS IN  
COMPUTER SCIENCE CAN BE SOLVED  
WITH ANOTHER LAYER OF ABSTRACTION**

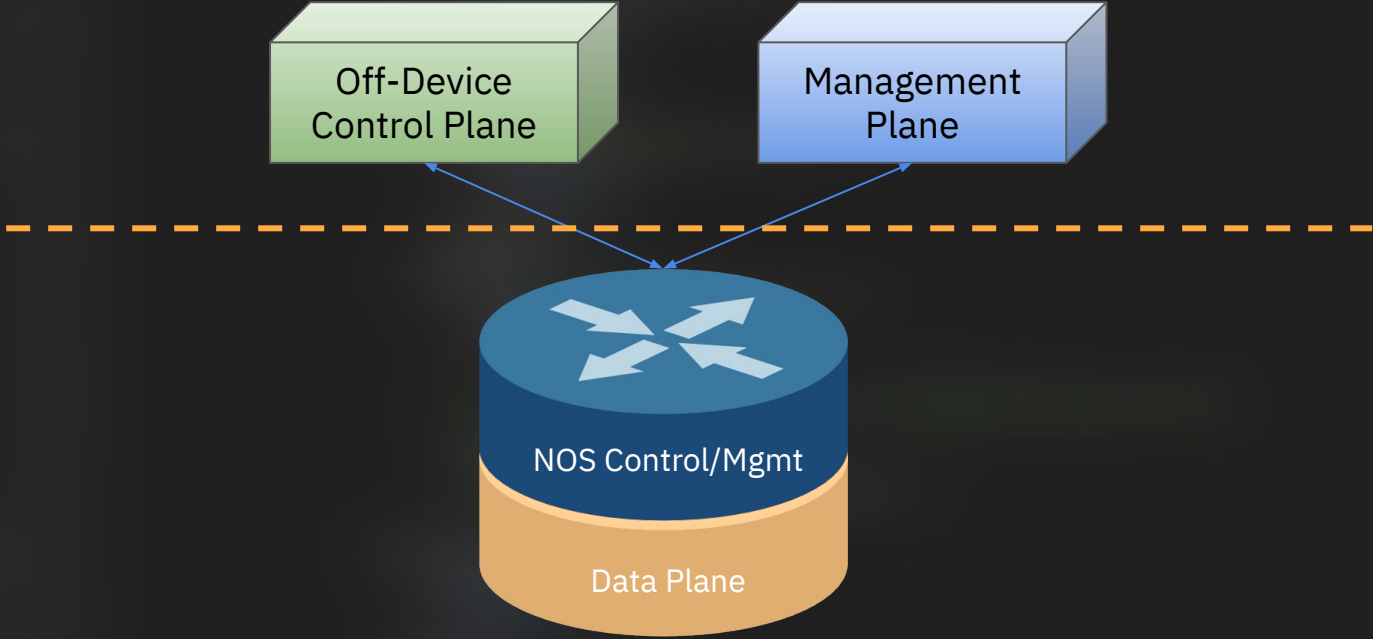


**WE (GOOGLE) HAVE  
LEARNT THESE LESSONS ITERATIVELY.**

# LAYERED MANAGEMENT SYSTEMS



# HYBRID SDN



```
def main():  
    # Create a simple HTTP server  
    server = http.server.SimpleHTTPRequestHandler  
    server.serve_forever()  
  
if __name__ == '__main__':  
    main()
```



# CULTURE: NETWORK & SOFTWARE ENGINEERING

# NETWORK AUTOMATION IS A SYSTEMS PROBLEM

WE'VE MADE SIGNIFICANT STRIDES IN THE LAST DECADE

WE SHOULD STRIVE TO LEARN FROM OTHER DOMAINS

WE NEED TO CONTINUE TO EVOLVE THE NETENG DISCIPLINE



A wide-angle landscape photograph showing a range of rugged, snow-dusted mountains. The peaks are partially covered in white snow, contrasting with the dark, rocky slopes. The mountains are reflected in a still, dark lake in the foreground. The sky is filled with soft, grey clouds, creating a moody atmosphere. On the right side, the dark silhouettes of evergreen trees are visible. In the center of the lake, several dark rocks protrude from the water. The overall color palette is muted, dominated by greys, blues, and whites.

**THANKS! QUESTIONS/COMMENTS?**