



# ABSTRACT PONDERINGS

## A 10 YEAR RETROSPECTIVE

**ROB SHAKIR, GOOGLE**  
**NANOG 90. 2024-02**



**AUTOMATION ISN'T NEW**

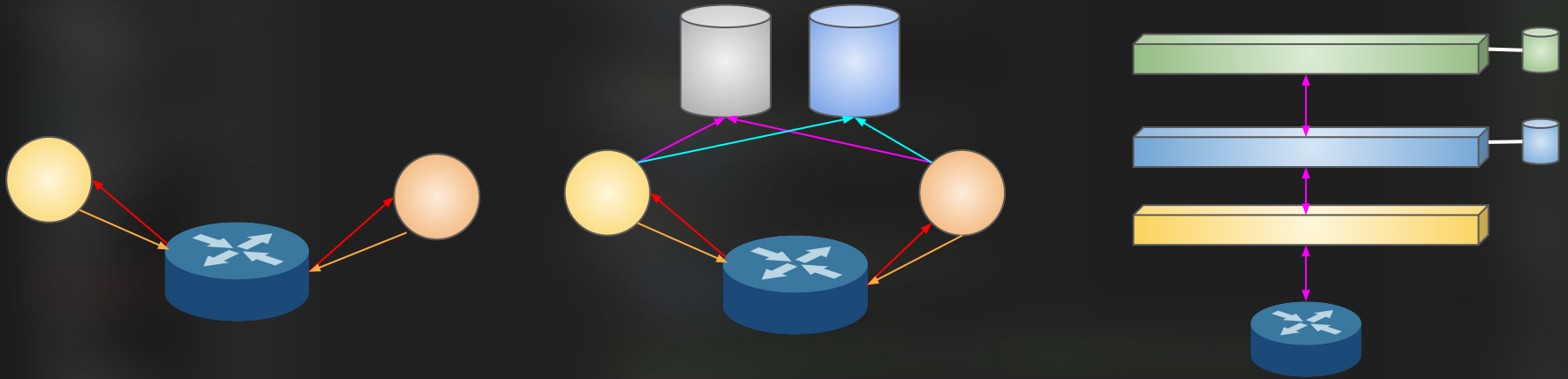




**THE NETWORK IS CRITICAL INFRASTRUCTURE**

**⇒ 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

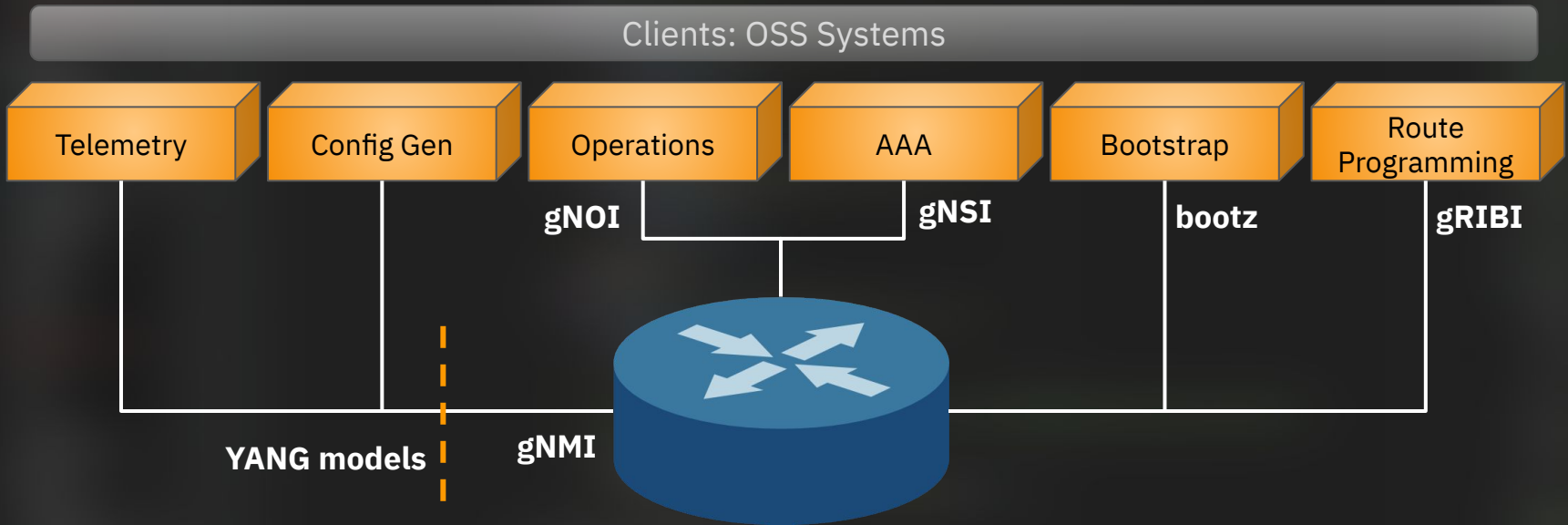
30

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28



# OPENCONFIG IS THE DE FACTO DEVICE LAYER ABSTRACTION



Users:  
Developers

ygot

ygnmi

ONDATA

KNE

featureprofiles



**NO ABSTRACTION IS PERFECT FOR EVERYONE**

**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**



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



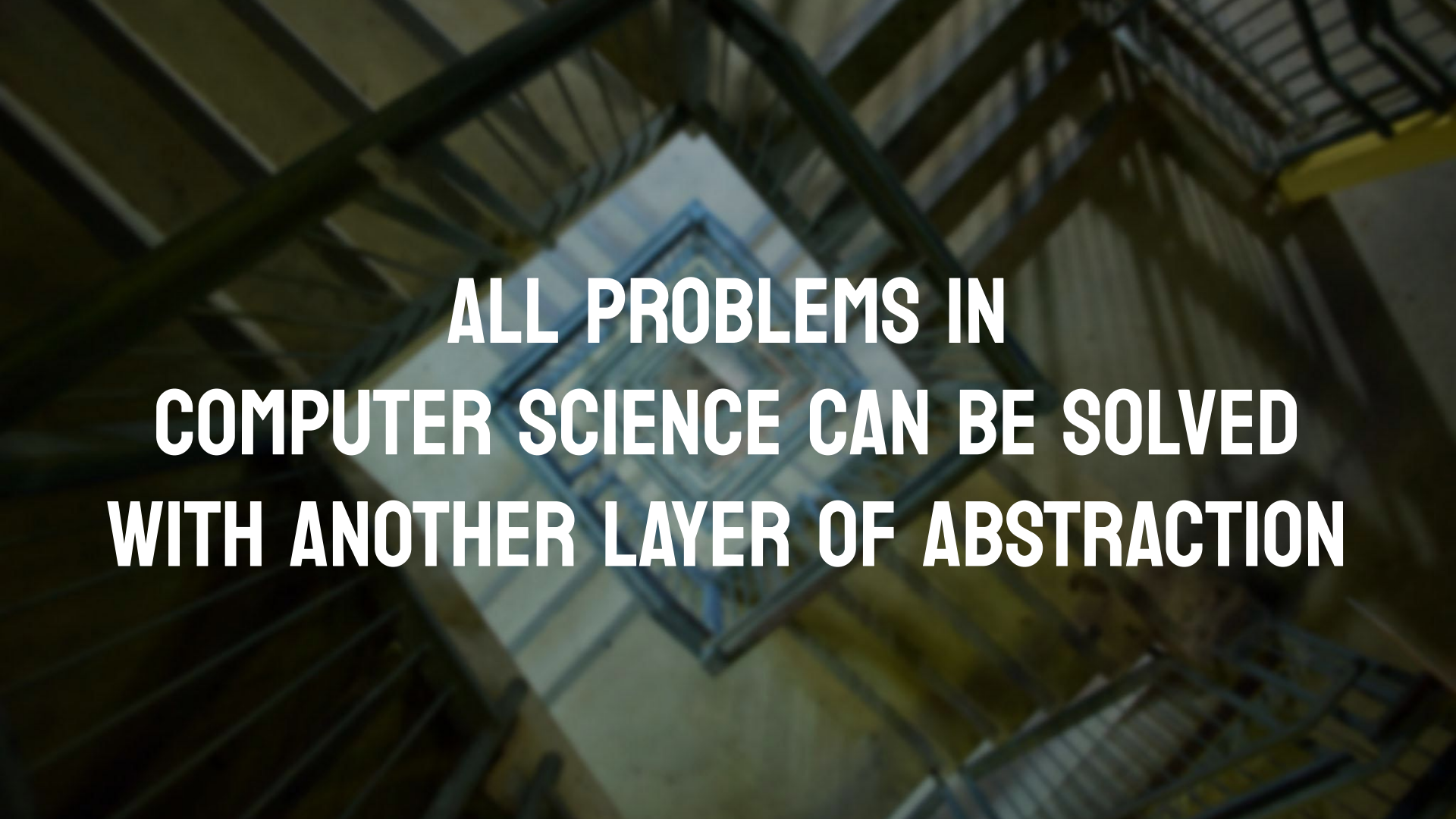




**ABSTRACTIONS/APIs == CONTRACTS**



**WE NEED AN AUTOMATION  
SYSTEM ARCHITECTURE.**

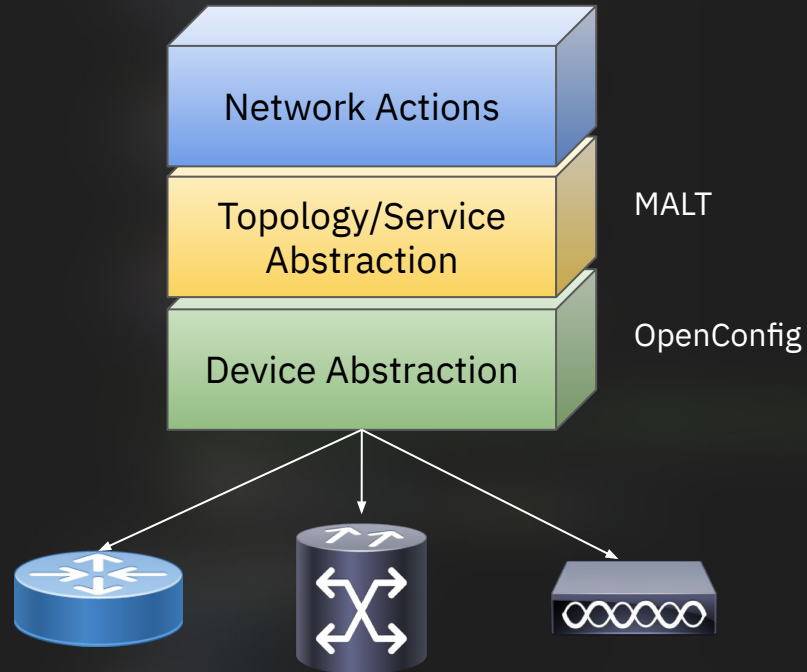


**ALL PROBLEMS IN  
COMPUTER SCIENCE CAN BE SOLVED  
WITH ANOTHER LAYER OF ABSTRACTION**

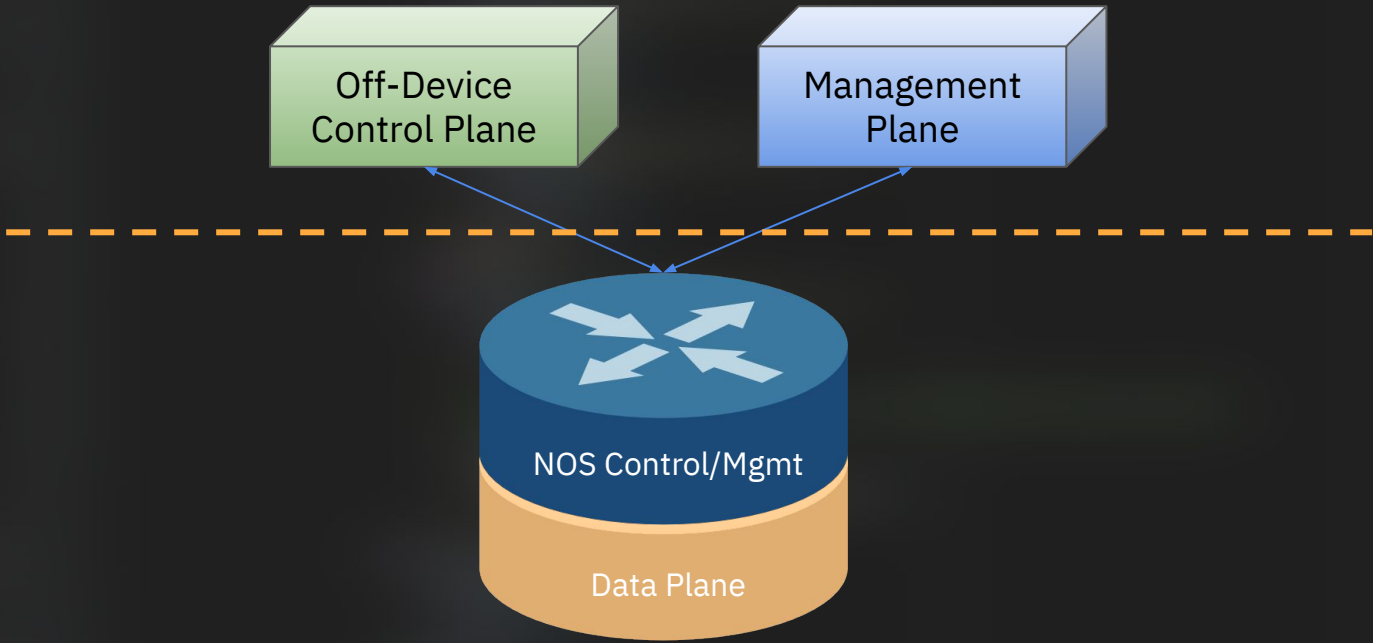
The background is a blurred image of a server room. It shows rows of server racks with various colored lights (yellow, green, blue, red) and cables. The text is overlaid in the center.

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

# LAYERED MANAGEMENT SYSTEMS



# HYBRID SDN





# **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. In the foreground, a still body of water perfectly reflects the mountains and the overcast, grey sky. The overall mood is serene and majestic. The text 'THANKS! QUESTIONS/COMMENTS?' is overlaid in the center of the image in a bold, white, sans-serif font.

**THANKS! QUESTIONS/COMMENTS?**

# IMAGE CREDITS

SLIDE 1:

LAKE MCDONALD, ROB SHAKIR

SLIDE 2:

SMALL NETWORK, ROB SHAKIR

SLIDE 3:

TYPEWRITER, JE THERIOT

([HTTPS://WWW.FLICKR.COM/PHOTOS/JETHERIOT/639955866/](https://www.flickr.com/photos/jetheriot/639955866/))

CODE, ROB SHAKIR

SLIDE 4:

FIRE ENGINE, ENOCH LEUNG

([HTTPS://WWW.FLICKR.COM/PHOTOS/CZAR\\_HEY/5206292800/](https://www.flickr.com/photos/czar_hey/5206292800/))

SLIDE 8:

CALENDAR, DAFNE CHOLET

([HTTPS://WWW.FLICKR.COM/PHOTOS/DAFNECHOLET/5374200948/](https://www.flickr.com/photos/DAFNECHOLET/5374200948/))

SLIDE 10:

DROP OF WATER, MAURITS VERBIEST

([HTTPS://WWW.FLICKR.COM/PHOTOS/MAURITSVERBIEST/24348250719/](https://www.flickr.com/photos/MAURITSVERBIEST/24348250719/))

SLIDE 11:

WIRESHARK, ROB SHAKIR

SLIDE 12:

WORKING STUDYING, THOROUGHLYREVIEWED.COM

([HTTPS://WWW.FLICKR.COM/PHOTOS/I43842337@N03/30598512635/](https://www.flickr.com/photos/i43842337@N03/30598512635/))

SLIDE 13:

MARIN HEADLANDS, ROB SHAKIR

SLIDE 15:

[HTTPS://WWW.GOOGLE.COM/ABOUT/DATACENTERS/GALLERY](https://www.google.com/about/datacenters/gallery)

SLIDE 16:

CODE, ROB SHAKIR

SLIDE 17:

FILES, [HTTPS://WWW.MECHANICALCAVEMAN.COM/](https://www.mechanicalcaveman.com/)

SLIDE 18:

IETF WHITEBOARD, ROB SHAKIR

SLIDE 19:

MAXX@NIGHT, LAYERS

([HTTPS://WWW.FLICKR.COM/PHOTOS/I87543158@N07/50307522318/](https://www.flickr.com/photos/i87543158@N07/50307522318/))

SLIDE 20:

[HTTPS://WWW.GOOGLE.COM/ABOUT/DATACENTERS/GALLERY](https://www.google.com/about/datacenters/gallery)

SLIDE 25:

LAKE MCDONALD, ROB SHAKIR