Step 0: Test the Network!

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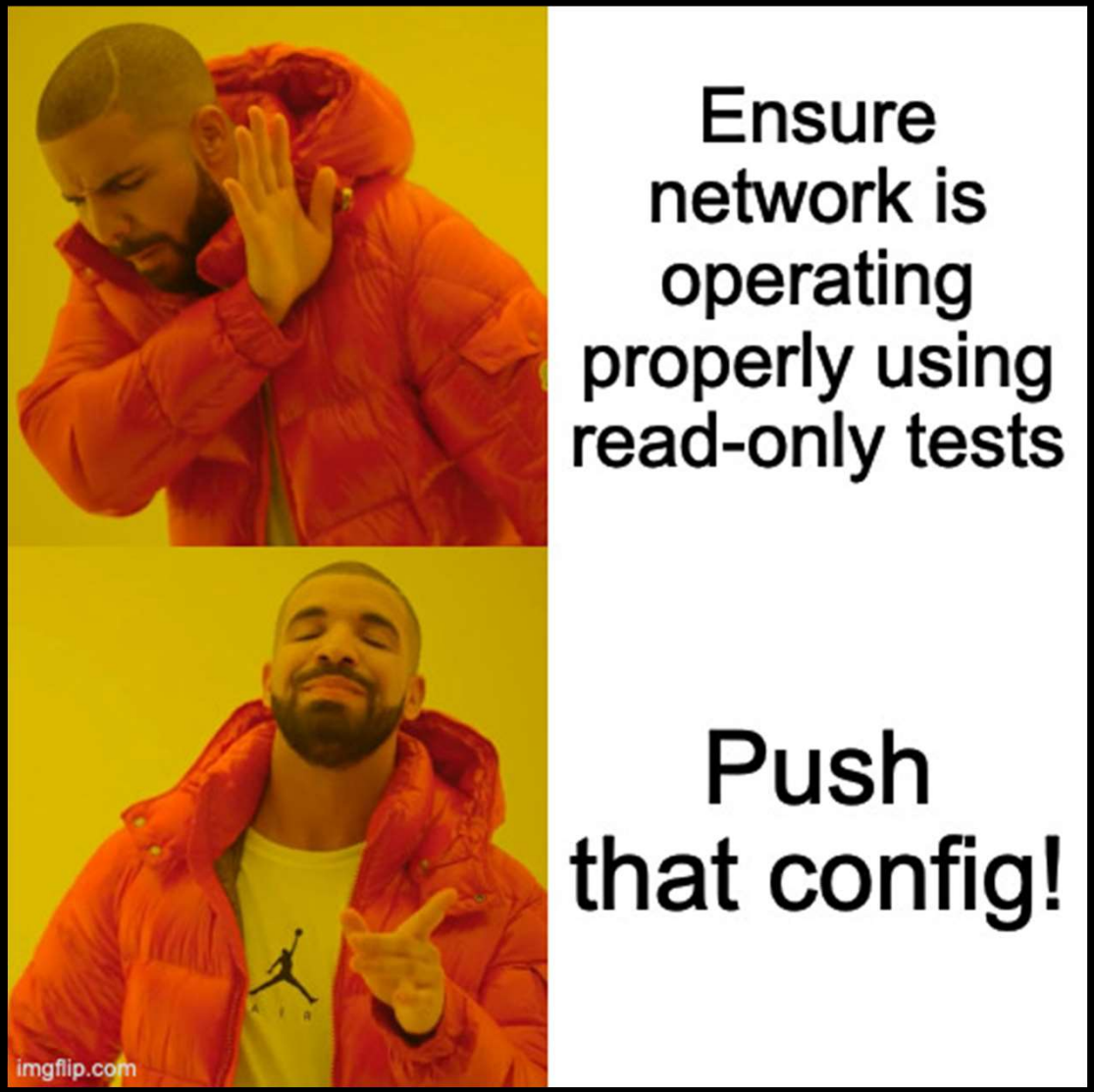
THE NETWORK AUTOMATION CONFERENCE

Intro - whoami

- Practice Lead, Network & Infrastructure Automation @ BlueAlly
- Cisco Press Author // Cisco pyATS - Network Test and Automation Solution
- Blogger/YouTuber // @devnetdan

Why Aren't We Seeing Network Automation Adoption?

- The problem isn't that network automation isn't being developed - Many develop network automation
- *Most* enterprises provide "guard rails" with change management processes and standard procedures
- The problem lies in the *lack of confidence* in execution
  - Symptoms: Lack of test environment, little confidence in automation logic, code execution deficiencies


Ensure network is operating properly using read-only tests
Push that config!
imgflip.com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Why Network Testing?

TL;DR - Network Testing Benefits

- Minimal risk
  - Extracting data is read-only
- Wealth of data
  - The network is just data…
- Assurance
  - Network is running as expected
  - Regression testing


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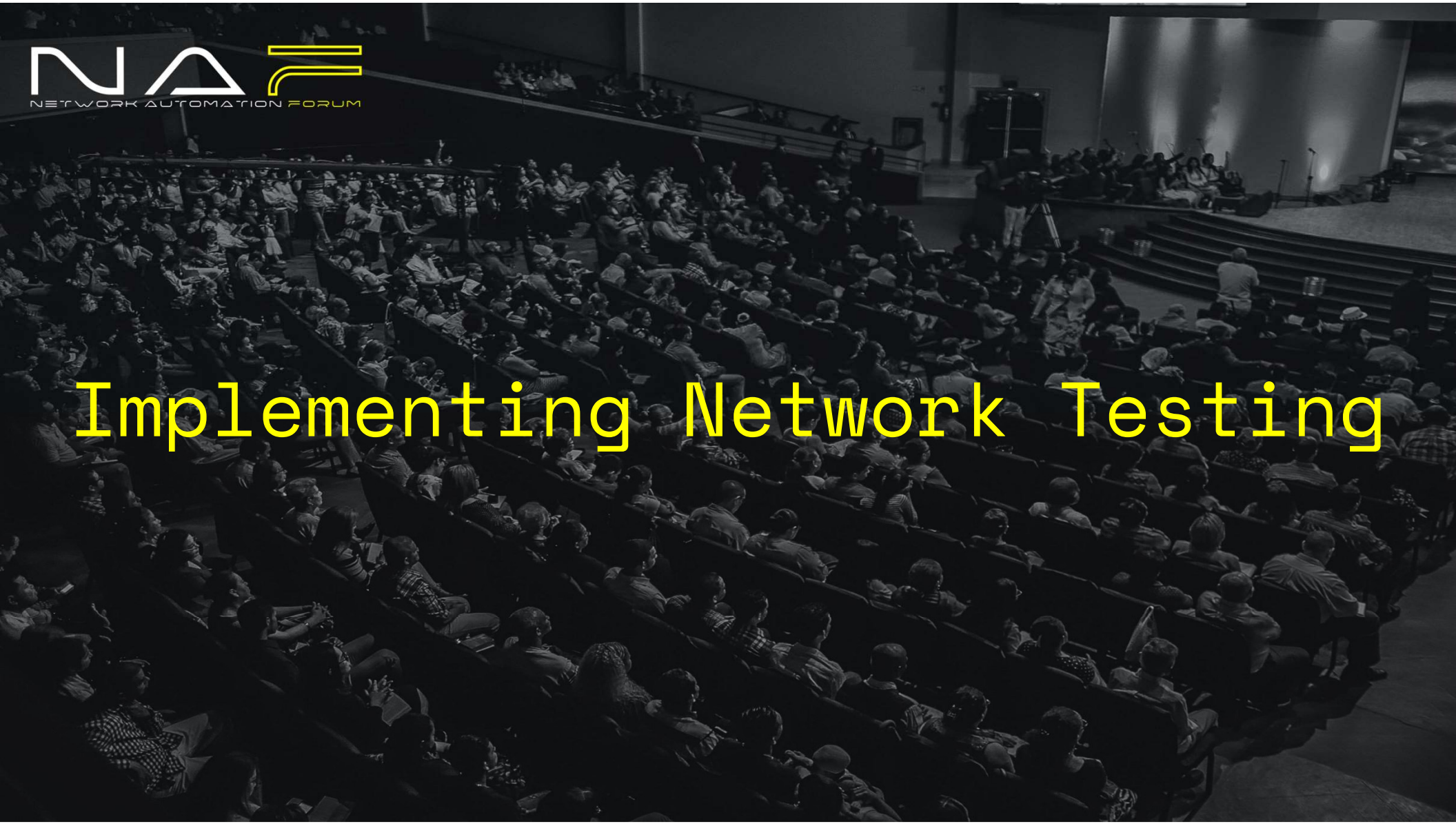
Testing is not new…

Software Testing -> Network Testing

- **Unit testing**
  - Local testing
  - Ex. Check network features/functionality local to the device (ACLs, VLANs, NTP, logging)
- **Integration testing**
  - How multiple systems (network devices) interact
  - Ex. Checking routing tables and other connectivity (i.e. L2, port status)
- **End-to-end testing**
  - How the complete system (network) interacts
  - Use ping/traceroute/iperf tests across the network
- **Regression testing**
  - Check whether a new feature breaks/degrades the system (network)
  - Run validation tests before and after a network change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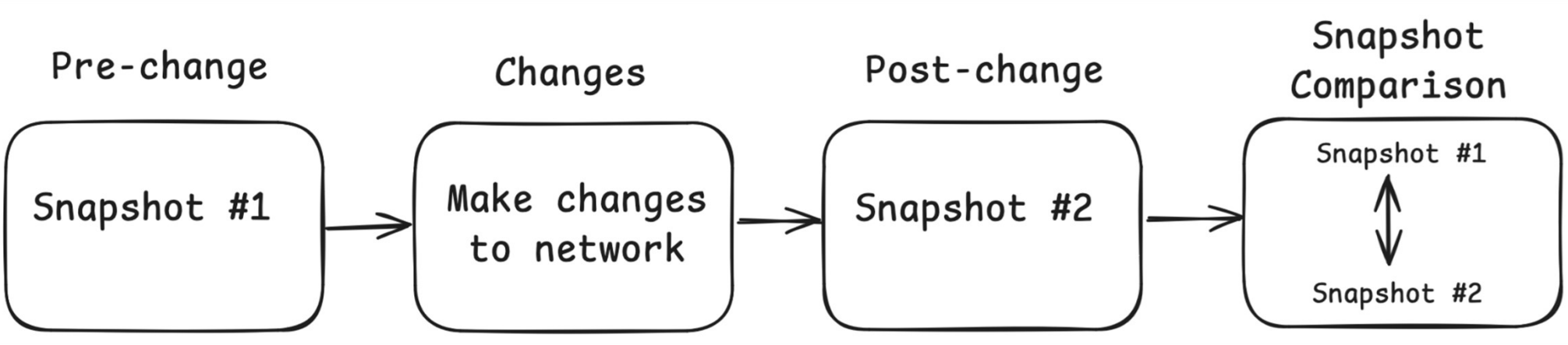
Implementing Network Testing

Typical Network Validation Workflow

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Network Testing -
Data Collection

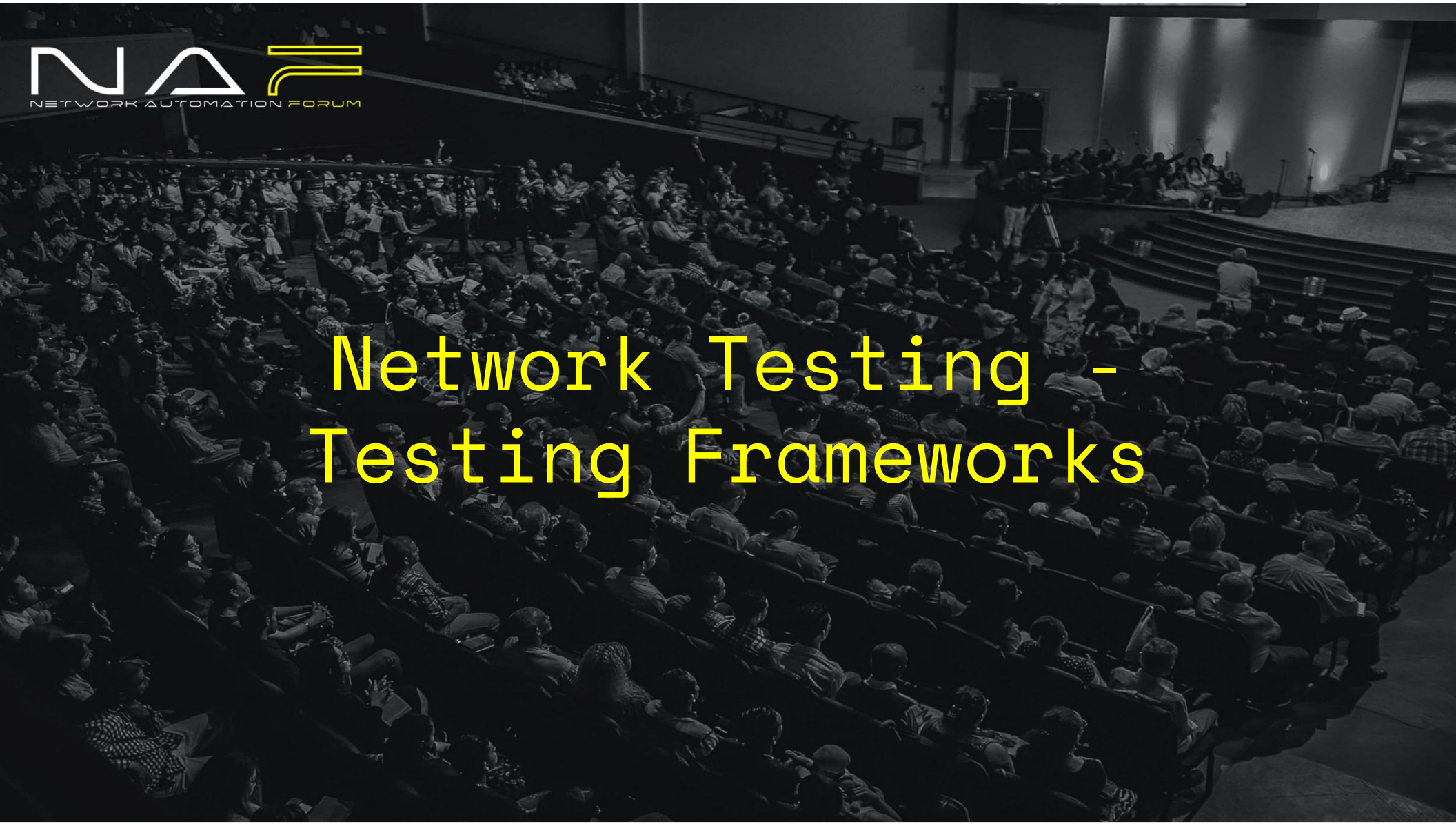
What's a Snapshot?

- Normalized data model consisting of network operational and configuration data
  - Better data organization
  - Reduces data redundancy
  - Provides data consistency

Source: Why is Data Normalization Important?

Snapshot Data Collection

- CLI Scraping + Parsing
  - Nornir, Netmiko, Scrapli, Unicon
  - TextFSM, Genie Parsers, TTP, Regex
- API
  - Apps: REST API, JSON-RPC, XML-RPC, gRPC, GraphQL, SOAP API 😭
  - Network: (RESTCONF, NETCONF, gNMI) + YANG
- Open-Source Tool Examples
  - NSoT: NetBox, Nautobot, Infrahub
  - Observability: Suzieq
  - Configuration Analysis: Batfish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Network Testing -
Testing Frameworks

Python Testing Frameworks

- Unittest
  - Part of the Python standard library
- Pytest
  - External
  - Extensible via Plugins
  - *Preferred (IMO)*

Python Network Testing Frameworks

- Pytest
  - Plugin integrations
    - Network Unit Testing System (NUTS)
  - *“Flask of network testing”*
    - *Bring your own ‘X’ (dev conn lib, parsers, etc.)*
- Cisco pyATS
  - “Batteries-included” network testing framework
  - *“Django of network testing”*
- Arista Network Test Automation (ANTA) Framework

*Not an all-inclusive list

Pytest

- Assertions - Pass/fail results
- Markers - Tag and customize test behavior
- Fixtures - Share context among tests
- Parametrization - Loop through multiple parameter sets

Cisco pyATS

- Testbed - Network topology
- AEtest Infrastructure - Testing framework
- Unicon - Device connectivity
- pyATS Library (Genie) - Data parsing
- Easypy - Runtime environment

Other Features:

- pyATS Blitz
- pyATS Clean
- pyATS Health Check
- Robot Framework support


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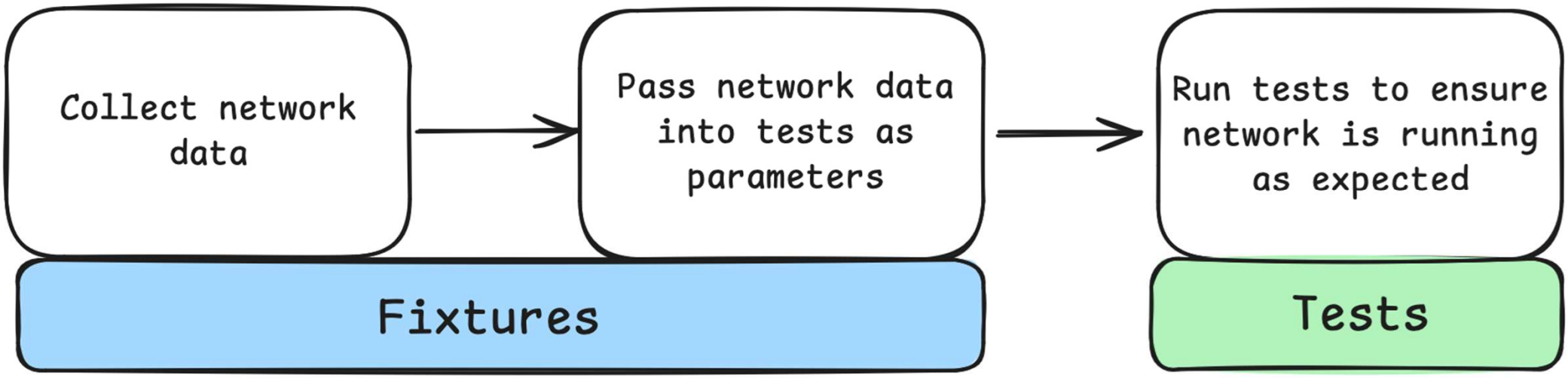
Success Stories

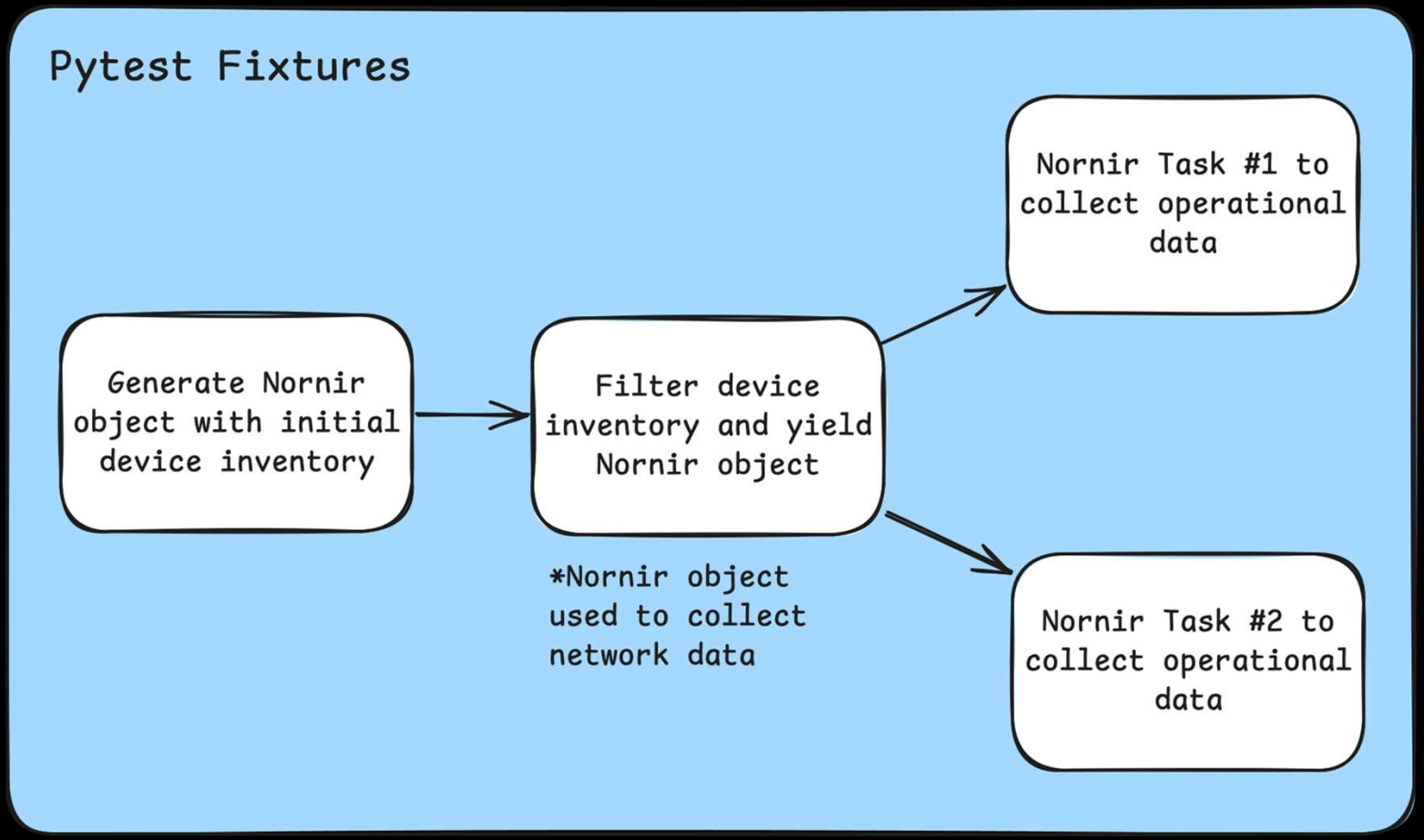
Success Story #1

- Project Overview: Implement network access controls on ports and ensure site operations
- Nornir + Pytest
  - Pytest Fixtures:
    - Setup Nornir
    - Filter device inventory
    - Collect network data via Nornir tasks
  - Tests are executed to validate command output and configuration to ensure site operations

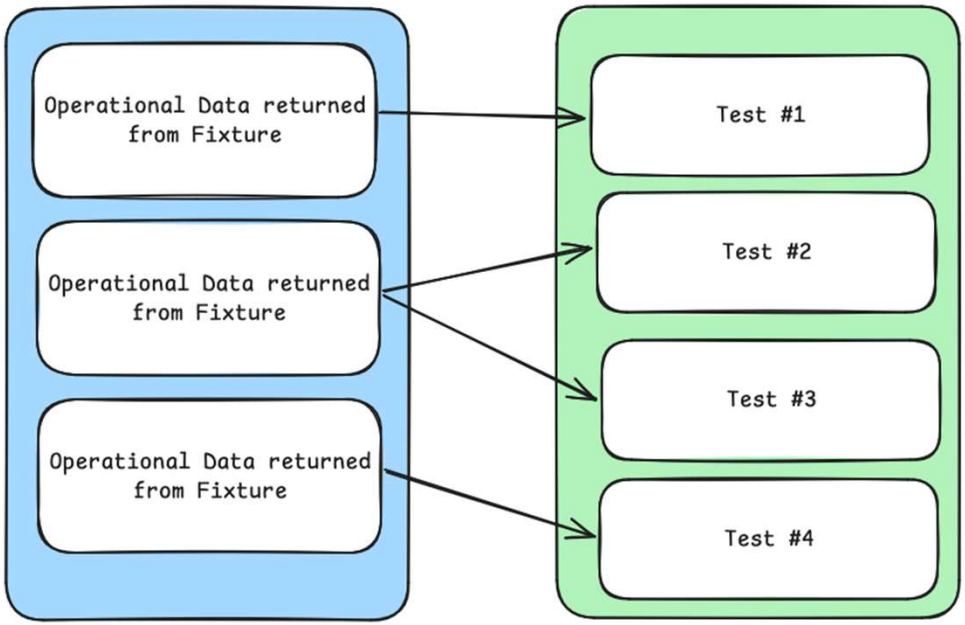
Network Testing with Nornir: Workflow



Network Testing with Nornir: Fixtures



Network Testing with Nornir: Testing

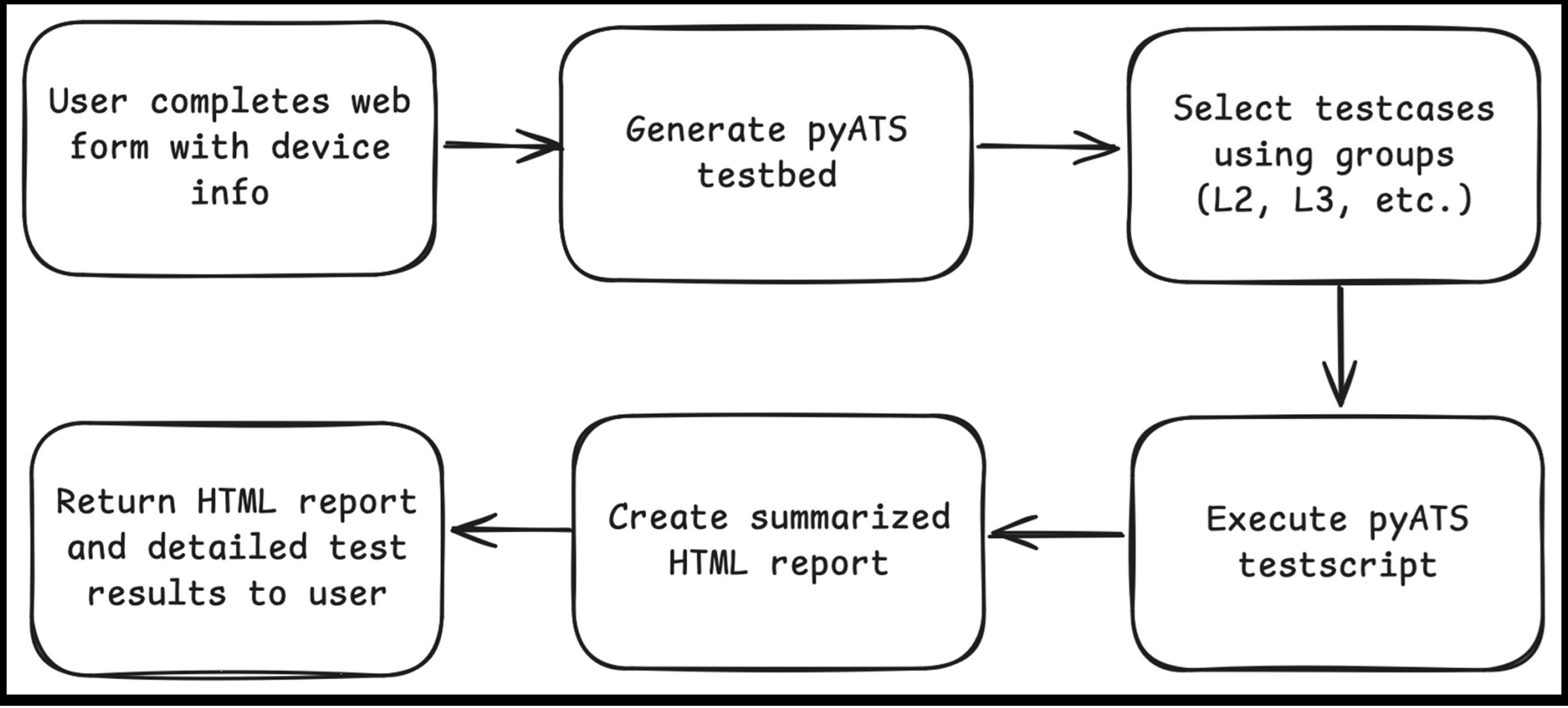



```
============================= test session starts ==============================
collecting ... collected 4 items

test_network.py::test_environ PASSED                                     [ 25%]
test_network.py::test_port_sec_config PASSED                             [ 50%]
test_network.py::test_port_sec_oper PASSED                               [ 75%]
test_network.py::test_dhcp_snoop_oper PASSED                             [100%]

================================== FAILURES ===================================
```

Success Story #2

- Project Overview: Hardware refreshes at multiple sites over a multi-year period
- Built over 46 tests using pyATS
- Tests included:
  - Environmental checks (CPU, memory, power)
  - Port configurations
  - CDP neighbors (wireless APs)
  - Routing (BGP)
  - Network reachability (ping + traceroute tests)
- Tests selected based on device type
  - Ex. Layer 3 (L3) tests would only run on L3 devices
- Artifacts generated - including pass/fail results and raw device logs (CLI output)

Network Testing with pyATS



Cisco pyATS

- Testing framework based on unittest + pytest concepts
- Parsers + device connection library included
- Reporting and archiving included

Nornir + Pytest

- Flexibility
  - “Bring Your Own…”
- Deeper understanding of pytest
- Plugin framework

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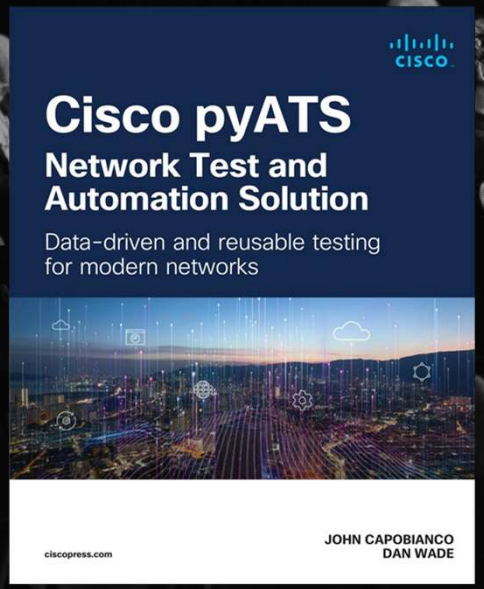
Book Giveaway: Scan QR code below for a chance to win a signed Cisco pyATS book!

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Questions?