Intermediate Python for Network Engineers Training

Duration: **5 Day**

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The **Intermediate Python for Network Engineers (IPYNE)** training provides a practical introduction to network programmability and automation using Python.

It is designed for network engineers who are new to programming as well as professionals who want to strengthen their automation skills through Python and Cisco APIs. The course focuses on practical scenarios such as automating device configurations, managing network inventories, and integrating with Cisco platforms including IOS XE, Meraki, and ThousandEyes through APIs.

Participants also explore how to create reusable programs using object-oriented programming, build web interfaces with Flask, and interact with large language models for more advanced network automation scenarios.

By the end of the training, learners will be able to write Python scripts, interact programmatically with network devices and services through APIs, and design automation workflows that make network management more efficient.

How You Will Benefit

This training helps participants:

- Gain practical experience using Python to configure, automate, and monitor network devices
- Improve operational efficiency while reducing errors associated with repetitive manual tasks
- Use modern tools and libraries such as Netmiko, PyATS, and REST APIs to develop scalable network automation solutions
- Build reusable automation components including scripts, web interfaces, and API wrappers
- Develop foundational knowledge of technologies such as CI/CD, telemetry, and large language models for modern network operations
- Earn **29 Continuing Education (CE) credits** toward recertification

Prerequisites

There are no mandatory prerequisites for this training. However, participants are recommended to have:

- Familiarity with core networking concepts
- A basic understanding of Cisco IOS-XE software or experience configuring and operating other Cisco network devices
- Cisco CCNA-level knowledge or equivalent networking experience

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What You Will Learn

By the end of the training, participants will be able to:

- Explain why Python is well suited to network programmability and automation
- Describe the need for network programmability and its role in modern automation
- Explain how network devices can be accessed programmatically
- Describe how automation supports the transition from traditional to programmable networks
- Identify practical network automation examples and commonly used Python tools
- Write and execute basic Python scripts using variables, data types, operators, decisions, and loops
- Use standard and third-party libraries and understand the Python`import` mechanism
- Work with the Python interpreter
- Accept user input and perform basic network-related tasks such as connectivity checks
- Apply good coding style and readability practices
- Prepare a development environment using Python, VS Code, virtual environments, Docker, and Git
- Build device inventory automation using variables, lists, and dictionaries
- Iterate through and filter device information
- Load and save inventory data using files
- Organise automation code using functions
- Use external libraries such as Netmiko to establish SSH connections
- Scale network configuration tasks using Python and templates
- Parse and analyse device output
- Handle exceptions
- Build command-line applications for device management
- Use PyATS and Genie to test and validate network device state
- Retrieve and verify configuration data
- Apply Python context managers
- Perform compliance validation
- Execute scripts on Cisco IOS-XE devices using Guest Shell
- Develop tools to back up device configurations
- Automate configuration backup storage using Git
- Compare configurations and perform scheduled backups
- Add logging to backup processes
- Use PyATS for configuration comparison
- Explain HTTP REST API fundamentals
- Work with interactive API documentation
- Create API requests using Python
- Parse JSON data
- Automate interactions with APIs such as Cisco Meraki Dashboard and ThousandEyes
- Manage API authentication securely
- Create, configure, and analyse network tests and monitoring data through API scripts
- Explain the importance of debugging, logging, and unit testing
- Understand how automation scripts can be integrated into CI/CD pipelines
- Handle API errors
- Implement rate limiting and retry mechanisms
- Understand the fundamentals of telemetry collection with OpenTelemetry

Training Outline

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1. Python Programming for Network Engineers

- The role of Python in network automation
- Network programmability concepts
- Traditional versus programmable networks
- Programmatic interaction with network devices
- Existing Python tools for network automation

2. Write Your First Python Scripts

- Basic Python syntax
- Variables
- Data types
- Operators
- Decisions and conditional logic
- Loops
- Standard and third-party libraries
- The import statement
- Using the Python interpreter
- Accepting user input
- Basic connectivity checking tasks

3. Python Development Environment Setup

- Installing Python
- Working with VS Code
- Virtual environments
- Docker
- Git
- Code style and readability

4. Device Inventory Automation

- Modelling device inventory data
- Storing information with variables
- Grouping devices with lists and dictionaries
- Iterating through device records
- Filtering device information
- Loading inventory data from files
- Saving inventory information
- Organising scripts with functions

5. Scale Configuration of Network Devices

- Working with external libraries
- SSH connectivity with Netmiko
- Configuring multiple network devices
- Using templates
- Parsing device output
- Exception handling
- Building CLI-based device management applications

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6. Network Monitoring and Validation

- Introduction to PyATS and Genie
- Device state validation
- Retrieving configuration data
- Verifying configuration state
- Python context managers
- Parsing outputs
- Compliance validation
- Running scripts on Cisco IOS-XE devices with Guest Shell

7. Device Configuration Backup Automation

- Creating device configuration backup tools
- Automating backup storage
- Using Git for configuration storage
- Comparing configurations
- Performing periodic backups
- Logging
- Configuration comparison with PyATS

8. HTTP API Fundamentals

- HTTP and REST API concepts
- Interactive API documentation
- Creating API requests with Python
- Parsing JSON
- Authentication
- API automation best practices

9. Cisco ThousandEyes Network Insights with HTTP API Automation

- Working with Cisco ThousandEyes APIs
- Creating and configuring network tests
- Collecting monitoring data
- Analysing results through APIs
- Automating interactions with other Cisco platforms such as Meraki Dashboard

10. Network Automation Debugging and Testing

- Debugging automation scripts
- Logging
- Unit testing
- API error handling
- Rate limiting
- Retry mechanisms
- Introduction to CI/CD integration
- Telemetry collection with OpenTelemetry

11. HTTP API Automation Wrapper

- Building reusable API abstractions
- Developing wrappers with Python

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- Simplifying repeated API operations
- Structuring automation code for reuse

12. Build a Web Interface for Network Automation

- Introduction to Flask
- Making automation scripts accessible through a web interface
- Supporting network automation workflows with a user-facing interface

13. Large Language Models for Network Automation

- Introduction to Large Language Models
- Programmatic interaction with LLMs
- Exploring LLM use cases in network automation
- Supporting more advanced automation workflows