The bridge to possible

Enterprise Network Automation Strategy, Framework, Best Practice & Case Studies

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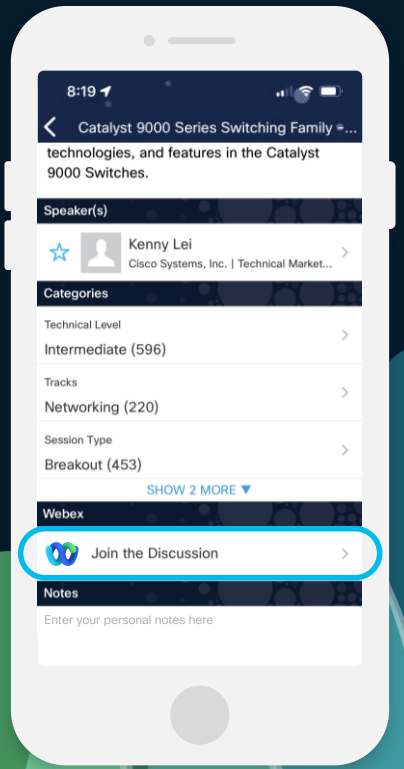


Anis Edavalath- Principal Architect(CX)

- 11 years with Cisco Customer Experience (CX)
- Focused on Strategizing and implementing Automation , Digital Transformation of Security , Observability and Hybrid Cloud adoption
- Healthcare, Finance, Tourism, Hospitality, Manufacturing industry verticals
- Enterprise Campus and Datacenter across different verticals
- Worked 10 years with BU engineering groups in Security , switching, datacenter and Network Management products
- Design and deployment of Next Gen Data center architecture enterprise and cloud customers
- CX team lead for ACI, VxLAN, Tetration, SDA (uniform policy)
- Worked with major telecom vendors and Cloud providers prior to Cisco
- CCIE Datacenter # 48152

Azharuddin Mohammed - Sr Solution Architect(CX)

- 14+ years @ Cisco
- MSEE and MBA
- CCIE # 35842 (R/S, DC)
- U.S. Patent No. 11,582,137
- Focused on providing professional services in Enterprise Architecture, including Intent-Based Networking(IBN), Automation, Security, Hybrid Cloud, and Observability
- Specialized in designing and implementing large-scale, multi-domain enterprise architecture solutions tailored to diverse industry verticals
- CX architecture lead for SASE, SD-WAN, ACI , and Secure Workload
- When I am not working, I enjoy playing cricket, tennis, and racquetball, and spending time with my family and friends

Course Objective and Goal

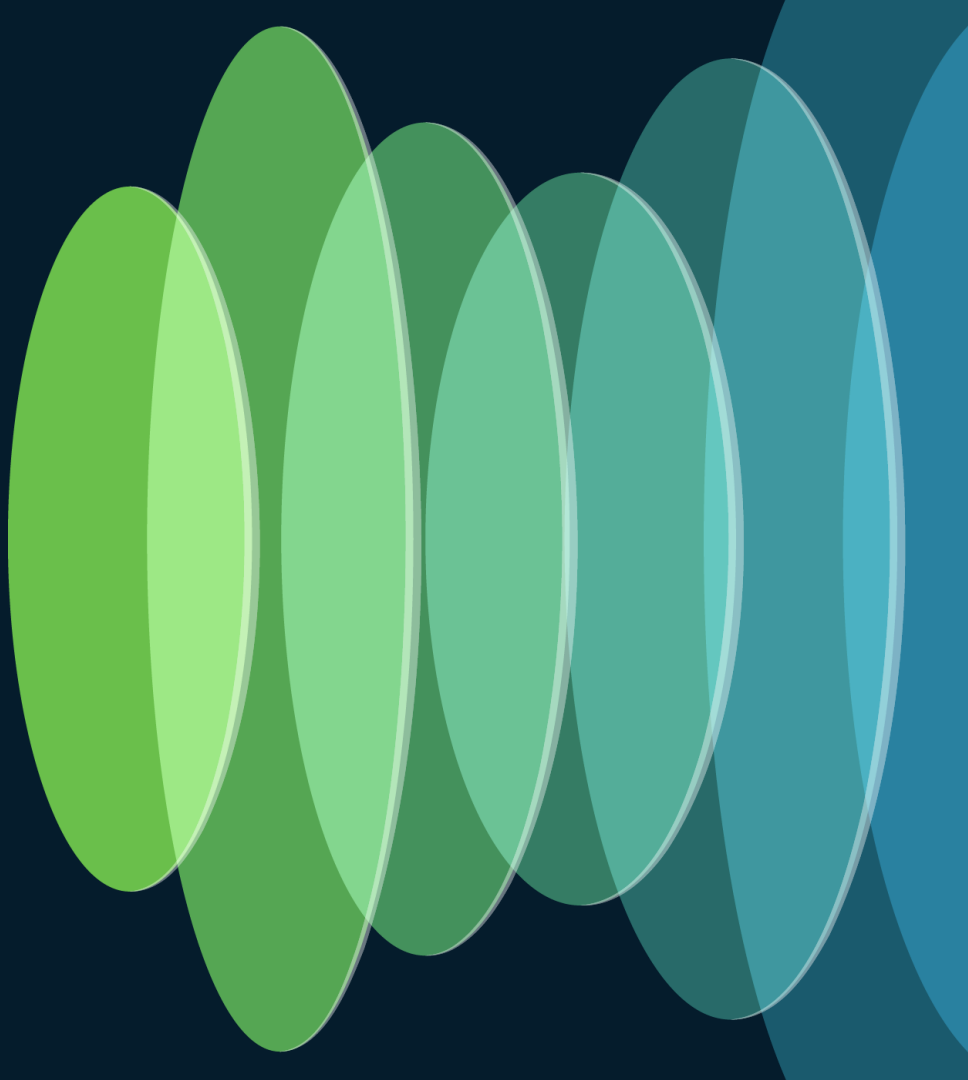
- To help the Enterprise Networking teams define an effective automation strategy. Help enterprise customers develop a journey map to implement the automation ecosystem and mature it to the level of an Automation Center of Excellence (CoE).

- Attendees should leave the session with a firm understanding of
  - The Automation Maturity Analysis
  - foundational Pillars for implementing an effective Automation strategy
  - Relevance of Automation platform
  - Relevant use cases from the field
  - Customer Case studies

Agenda

- Introduction to Automation and The Business Need
  - The Why, What, and How
- Automation Maturity Analysis
  - Automation Maturity Model
  - Automation Maturity Assessment
- Defining Automation Strategy
  - The Key Elements
  - Automation Advisory Engagement
- Automation- Strategic Transformation pillars
  - People
  - Process
  - Technology
- Automation Strategy Implementation Roadmap
- Usecases
- Case Study
- Takeaways

Introduction to Automation & The Business Need



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Infrastructure Automation – The Executive Drivers

Efficiency

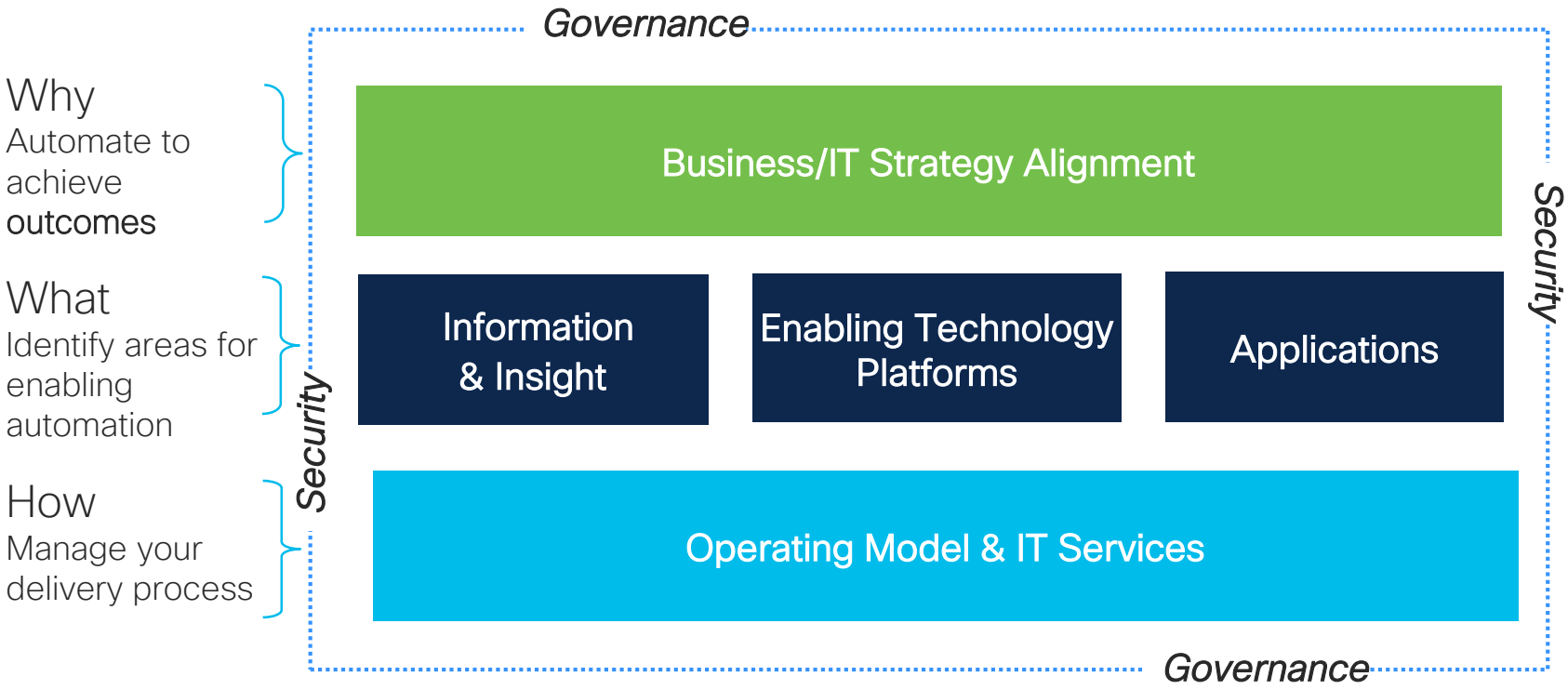
Scalability

Consistency

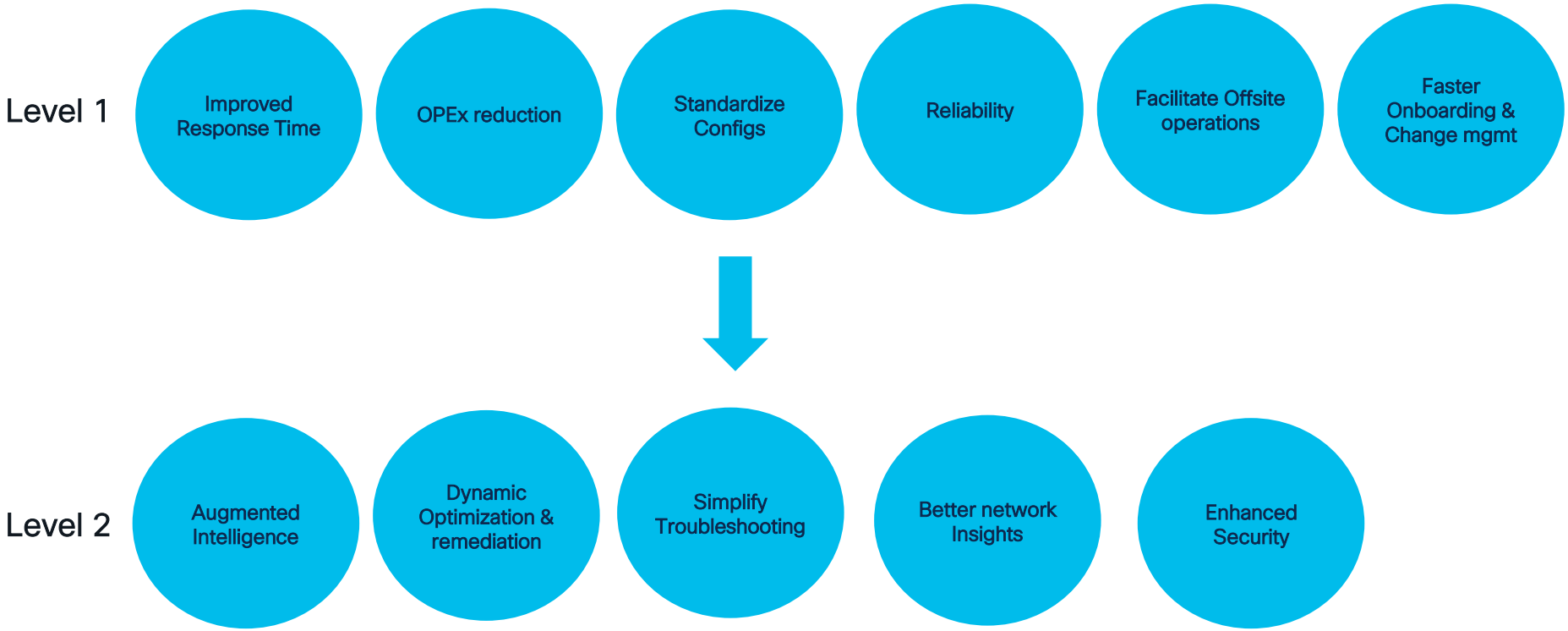
Resource Optimization

Risk Mitigation

Holistic Approach for Automation Strategy



Why Automate.. Identify the Outcomes



What to Automate

Use Cases Across technology Domains

Campus

- Software-defined Access fabric
- VXLAN EVPN fabric
- SD-WAN
- Lifecycle Operations
- AI Capabilities

Datacenter

- On-Prem Datacenter
- Hybrid/Multi-Cloud
- Services – LB, Firewall
- Compute-Virtualization
- SDWAN
- Lifecycle Operations
- AI Capabilities

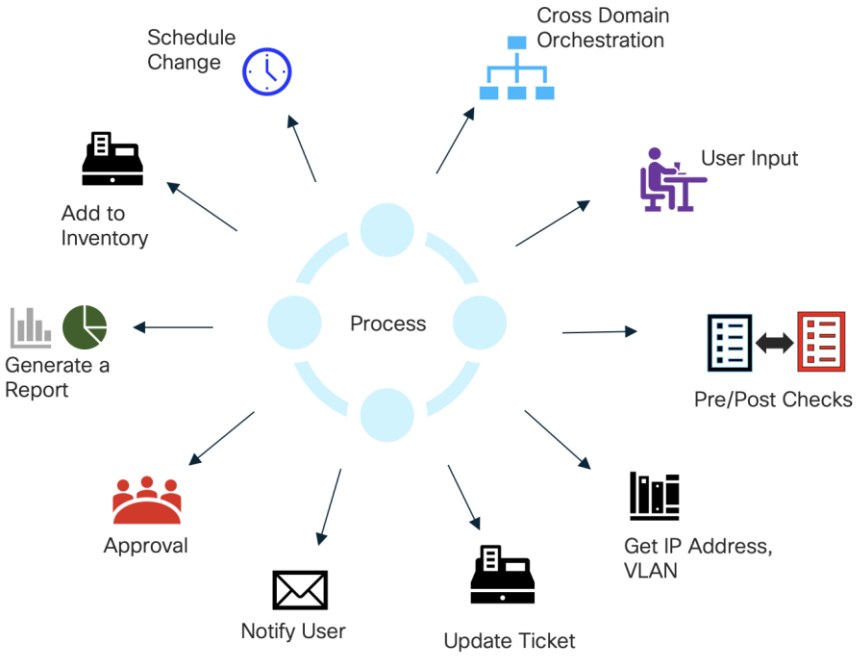
Security

- Zero Trust
- Remote Access and Posturing
- Multicloud Protection
- Lifecycle Operations
- AI Capabilities

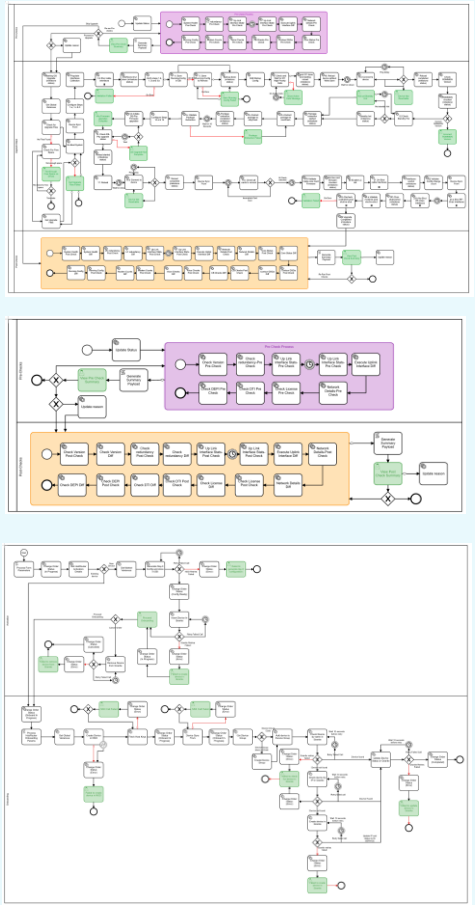
Operations & management

- Golden Configurations
- Compliance
- Day 1 Operations
- Day 2 Operations
- Observability
- AIOPS

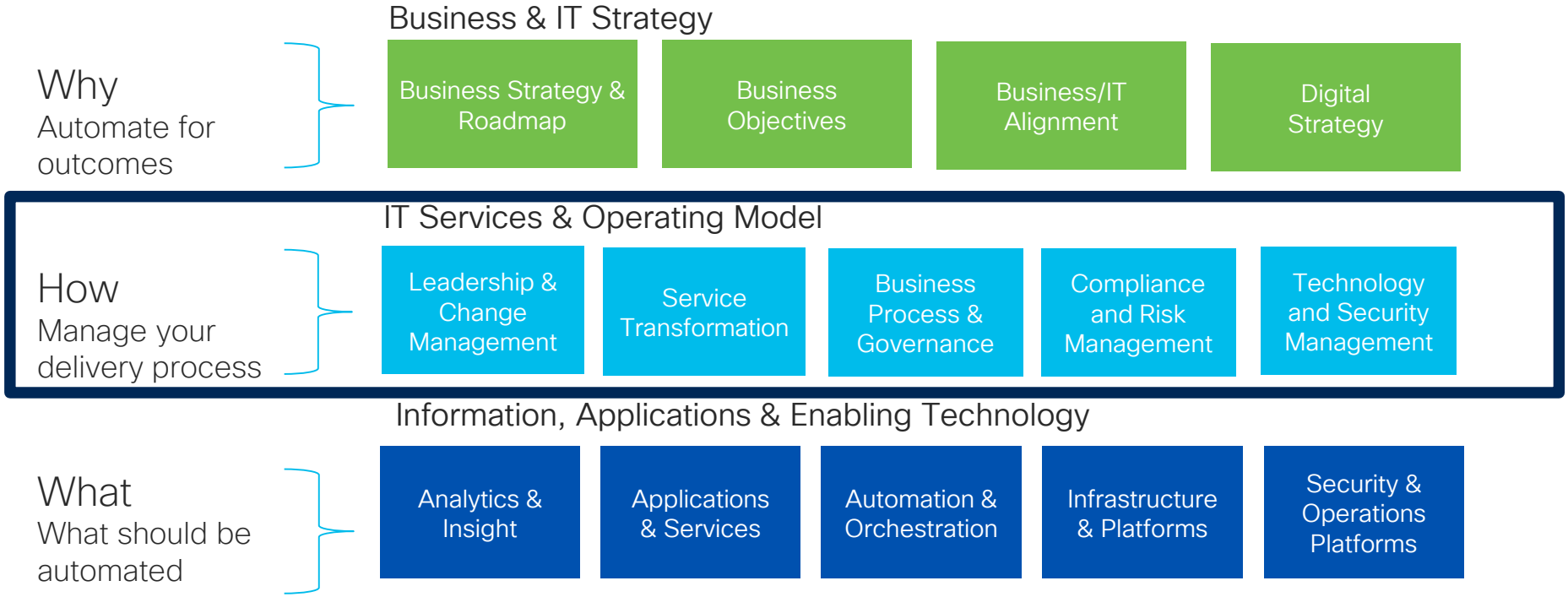
Evolution of Automation Use cases and methodology



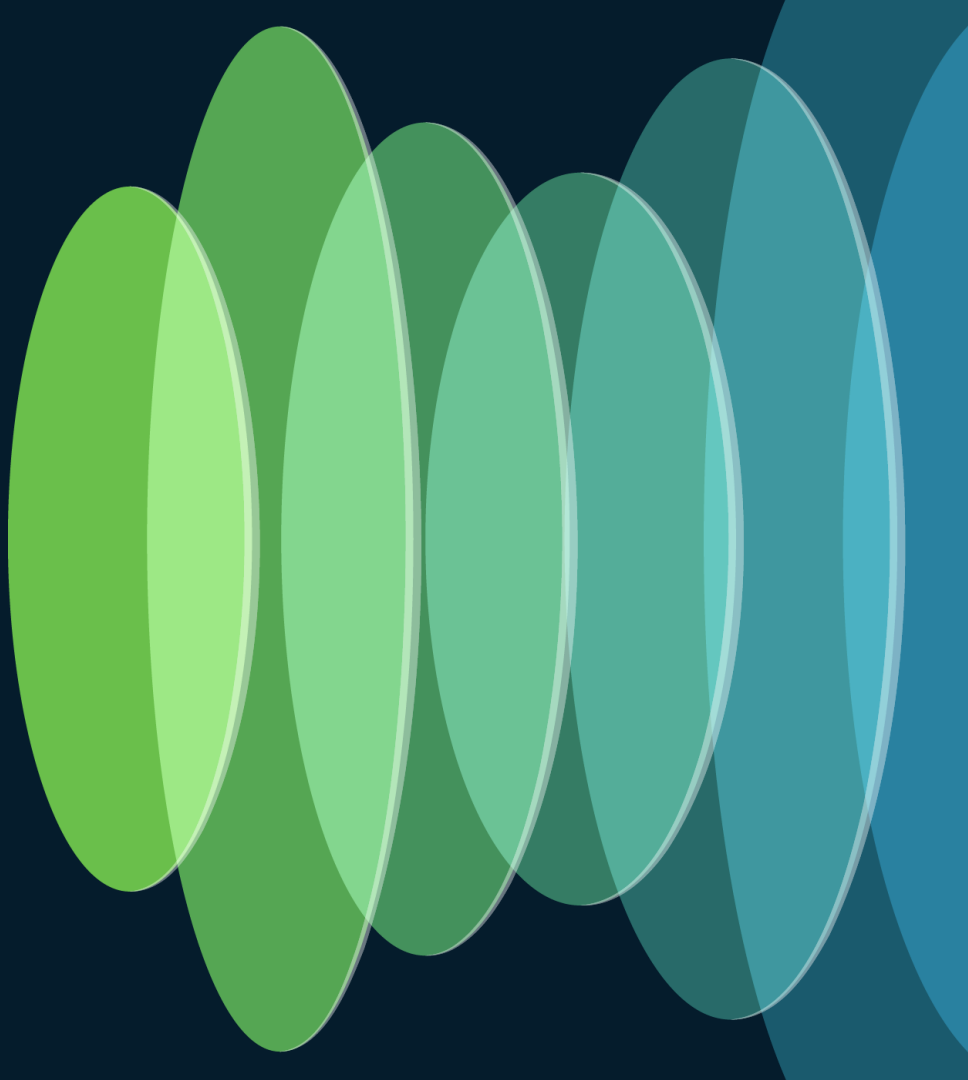
Workflows



Automation Assessment Framework



Automation Maturity Analysis



Understanding the Automation IT Business Priorities

Improve Service Quality

Reduce manual activities, human errors and hand offs. Improve service consistency and standards compliance. Reduce rework and IT incidents

Increase Service Delivery Speed

Respond more quickly to rapidly changing business requirements. Deliver software defined services at scale to keep pace with LOB demand

Reduce Risk

Leverage automation to enforce secure configuration standards and reduce time to remediate vulnerabilities and respond to security incidents

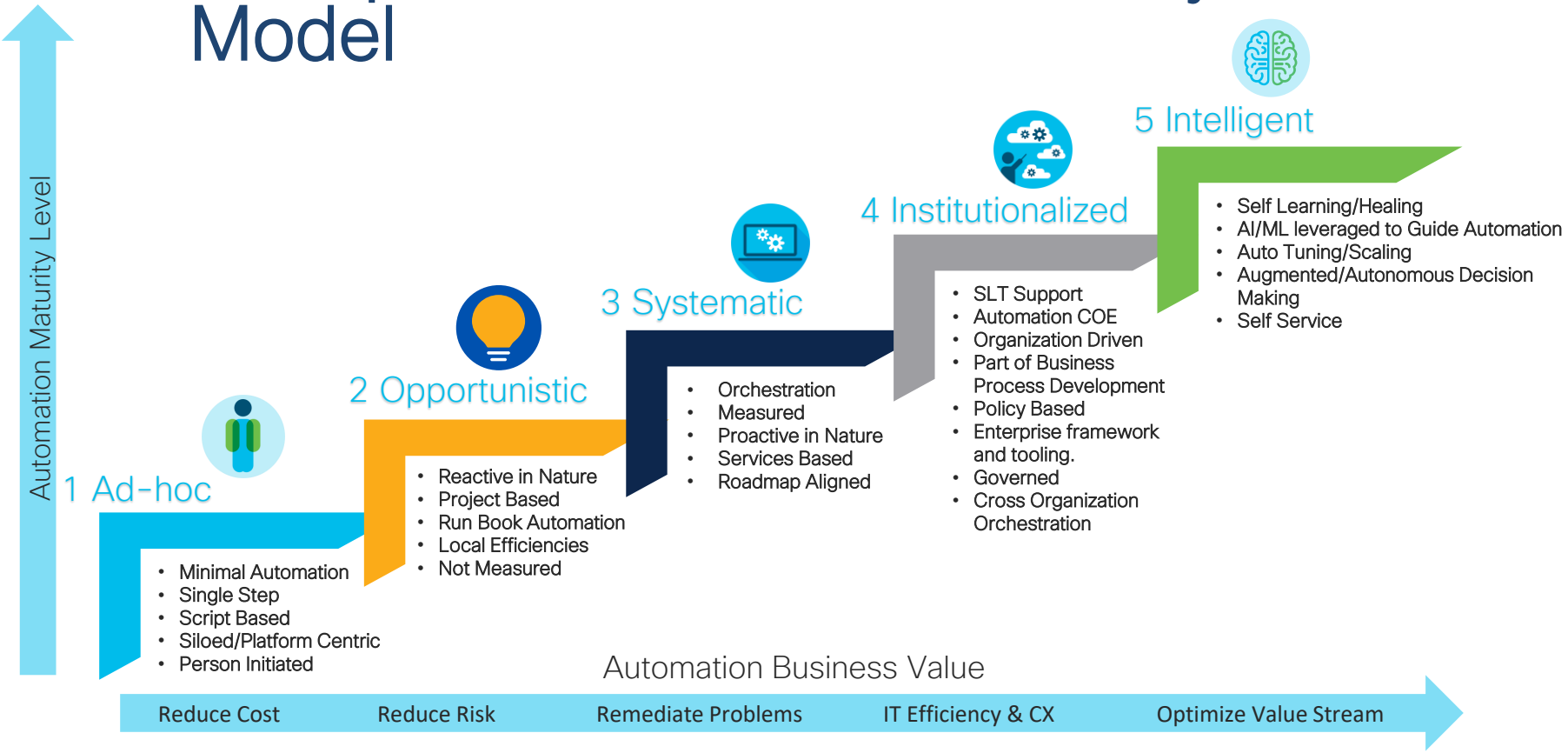
Improve Customer Experience

Provide self service customer facing consumable services leveraging automation and orchestration to manage end to end request to fulfillment process .

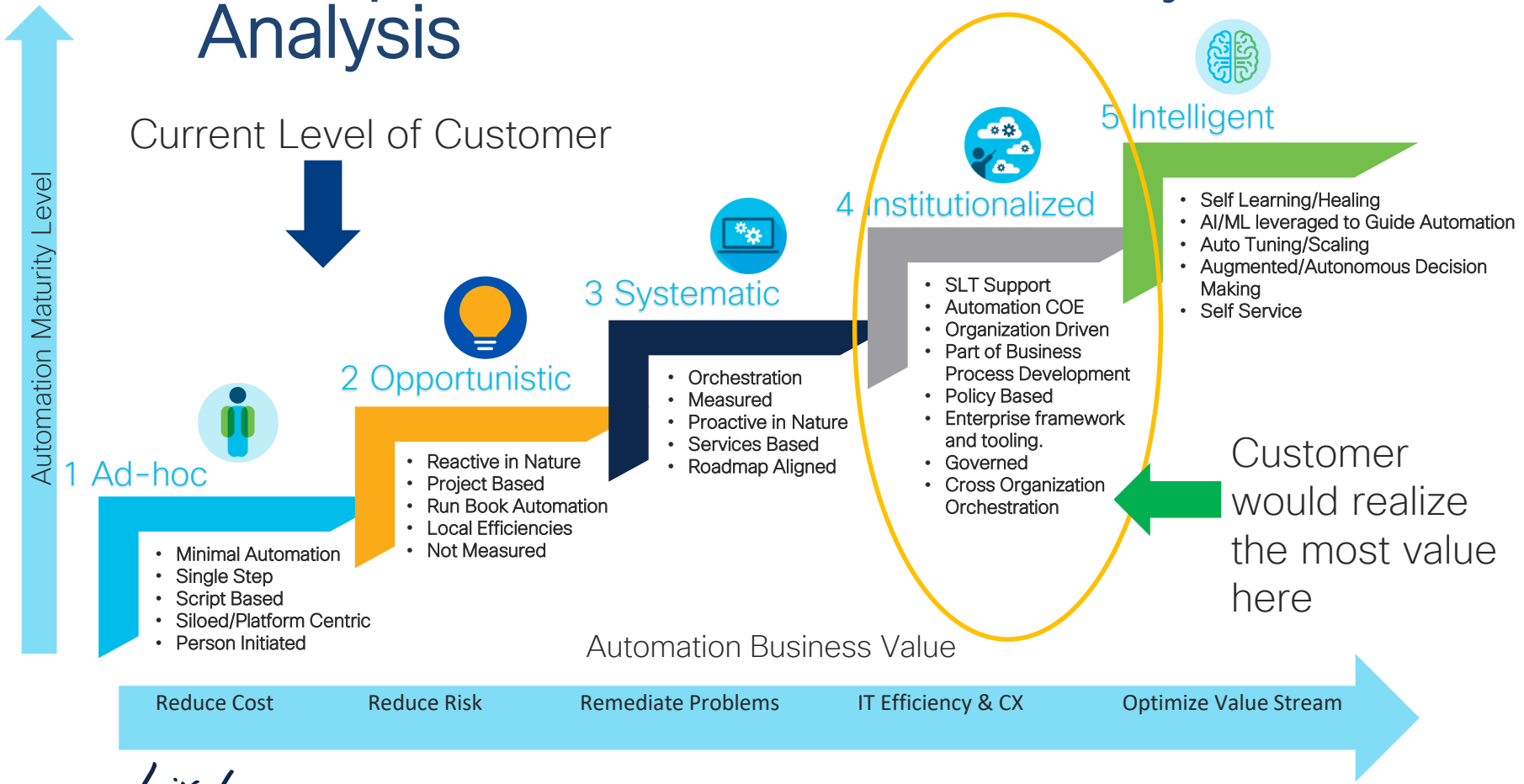
Operational Efficiency

Reduce labor intensive toil and re-deploy high value resources on “grow the business” activities. Optimize the automation TCO with a high functioning outcome focused automation program

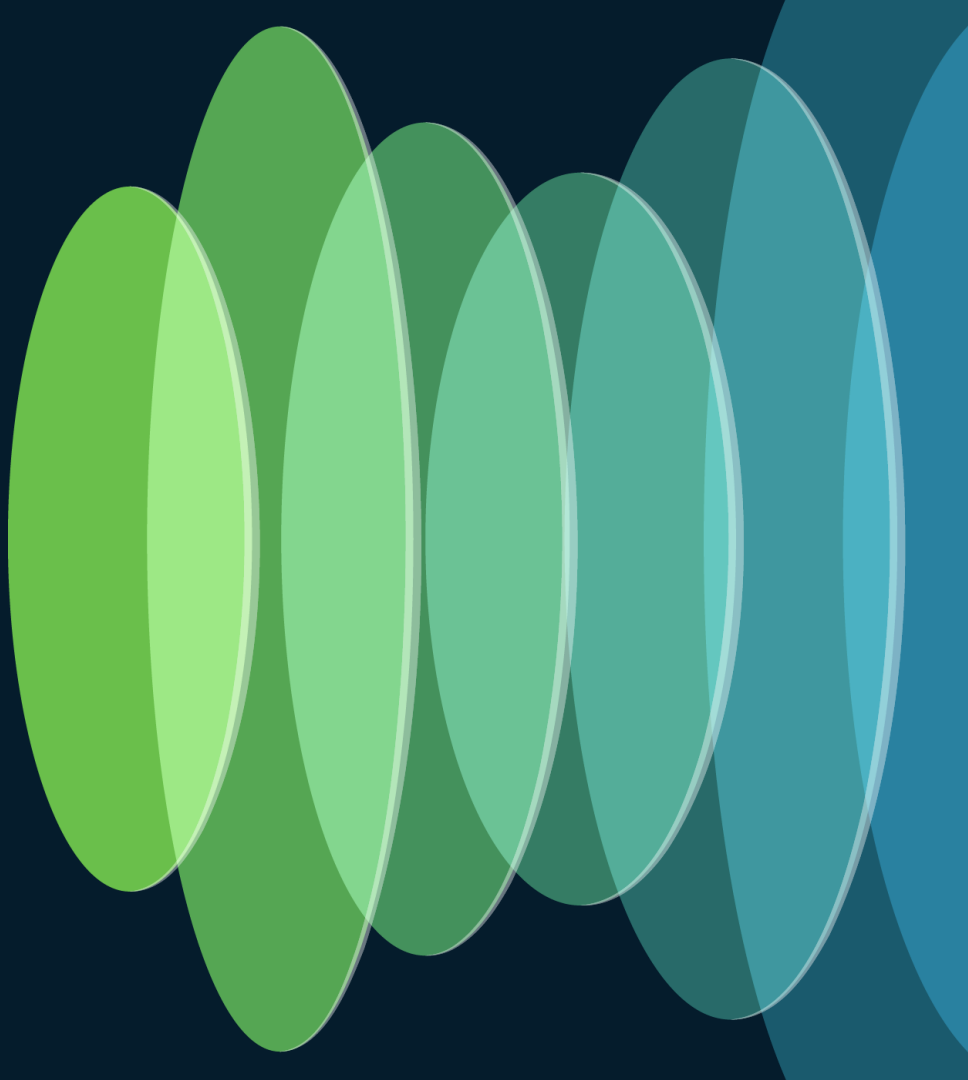
Enterprise Automation Maturity Model



Enterprise Automation Maturity Analysis



Defining the Automation Strategy



Enterprise Network Automation Strategy - Journey map

Define	Influences	Execute	Measure(KPI)
Goals	Technology	Execution Plan	Specific
Objectives	Org Structure	Reuse	Measurable & Assignable
Strategies	Culture	Pipeline	Realistic
Tactics	Skills	Tactics	Time bound

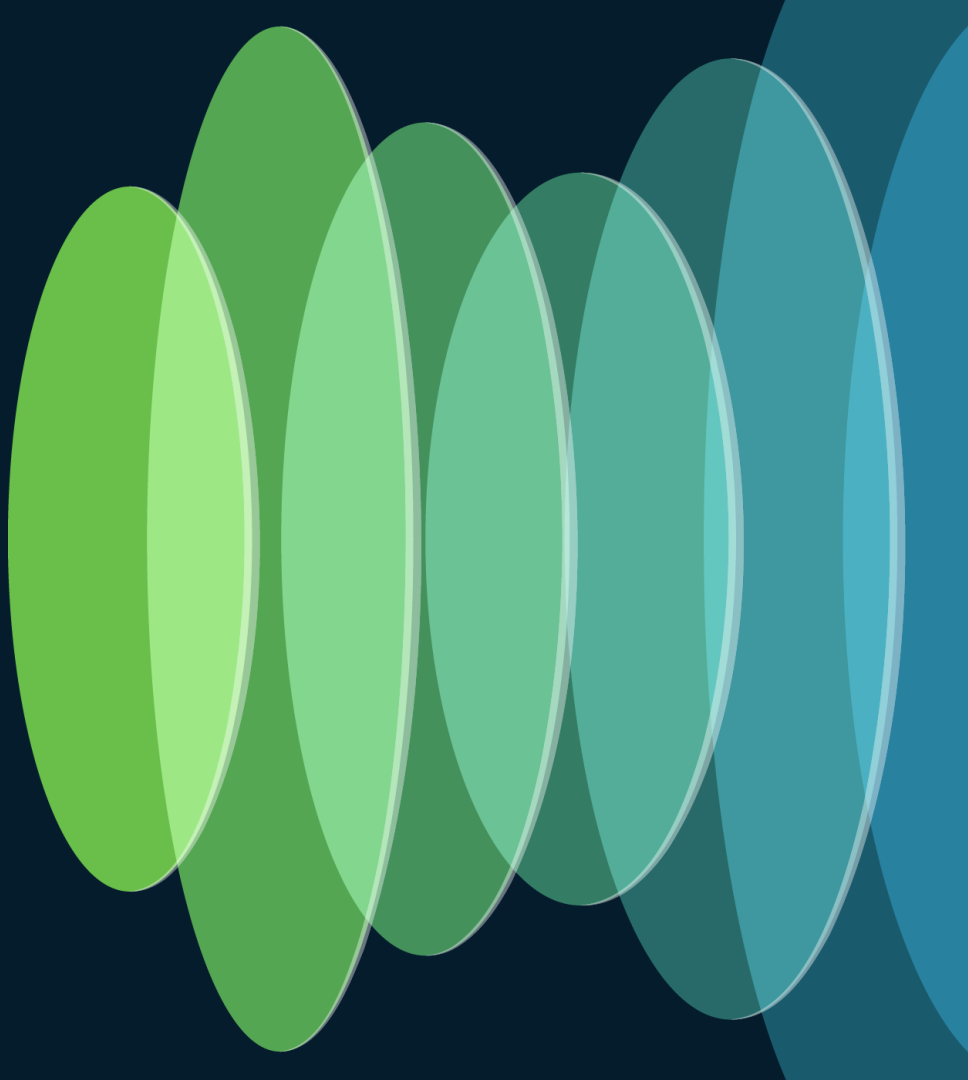
Automation Advisory Engagement Summary

	PREPARE	DISCOVER	SYNTHESIZE	READ OUT
				
Activities	**Preparation** ▪ Identify Stakeholders ▪ Collect Artifacts ▪ Customer Kickoff	**Interviews & Working Sessions** ▪ Issues, Pain Points & Gaps ▪ Current State Process & Tools ▪ Automation Solution Inventory & Initiatives ▪ Cross Domain Integrations ▪ Skills Assessment/Availability ▪ Use Case Identification	**Analysis** ▪ Strategic Alignment ▪ Automation Maturity ▪ Use Case Business Value Assessment ▪ Workforce Model/Readiness ▪ Process & Op Model Optimization ▪ Capability Gap Analysis	**Recommendations** ▪ Executive Summary of Findings and Recommendations ▪ Next Seps
Output Summary	▪ Establish Success Criteria ▪ Define/Refine Scope ▪ Assumption & Constraints	▪ Blockers/Show Stoppers ▪ Automation Strengths/Opportunities ▪ Current State Assessment	▪ Strategy Assessment ▪ Target State Capability Model ▪ High Value Use Cases ▪ Op Model Recommendations ▪ Workforce Recommendations	▪ Findings & Recommendations Presentation

Defining Focus Area Definitions and Values

Focus Areas	Definitions	Impact to Business Priorities				
Governance	▪ framework for effectively governing the automation initiatives	✓	✓	✓	✓	
Skills Transformation	▪ Assessing the skills & identify the gaps and training needs	✓	✓		✓	✓
Technology-driven transformation	▪ Leverage Technology to enable a self-onboarding services framework	✓	✓	✓	✓	✓
Transform to Services Led IT Organization	▪ Shifting the organization's IT structure to a services-led approach.	✓			✓	✓
Automated Resiliency Process	▪ Adopt automated resiliency processes to enhance the reliability and availability			✓	✓	
Automate expansion of services	▪ Evaluate the organization's ability to automate the expansion of services		✓			✓
Expand to Netops and SecOps	▪ Accelerate Journey to AIOPS by automating Netops and SecOps	✓	✓	✓	✓	✓

Automation Transformation Pillars



Automation Transformation Pillars

People

Augment
Recruit
Supplement

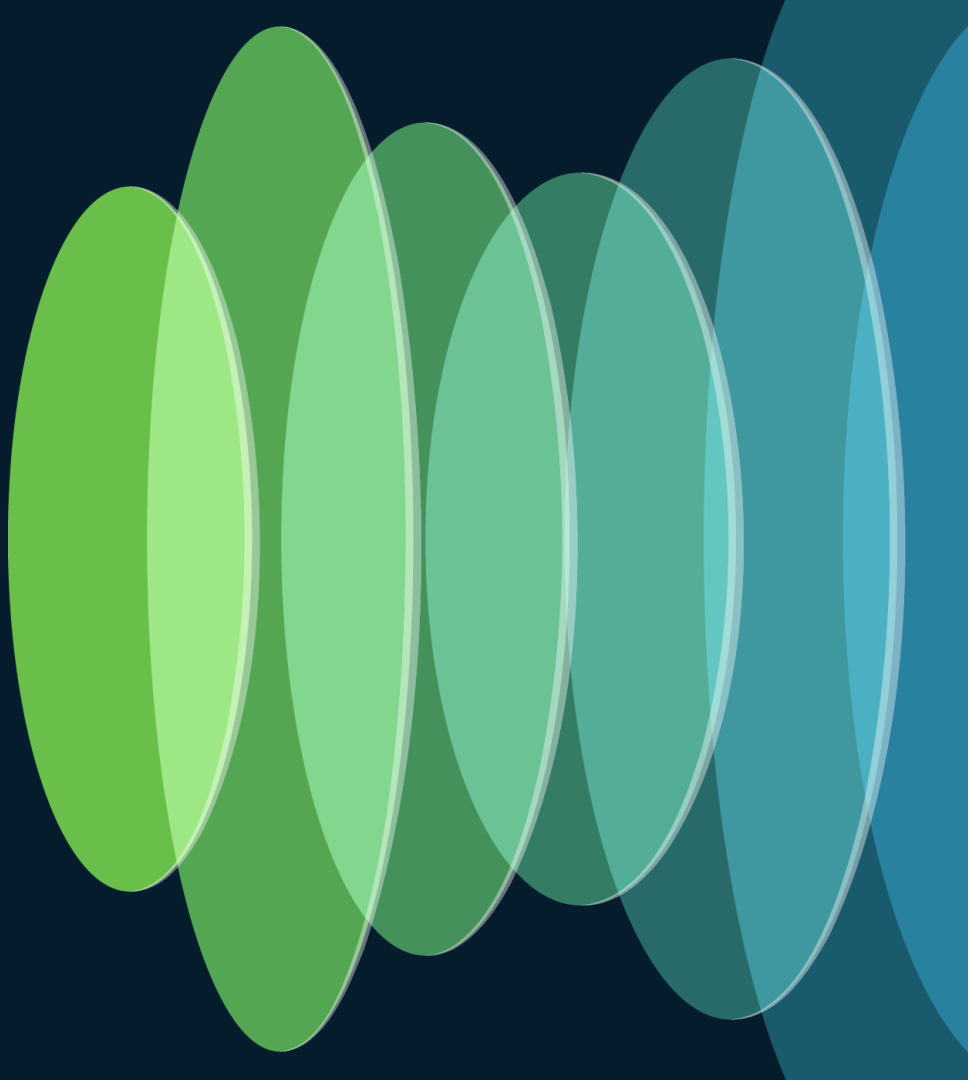
Process

Culture
Mindset
Infra As Code

Technology

Controller based
New Practices
Transformation

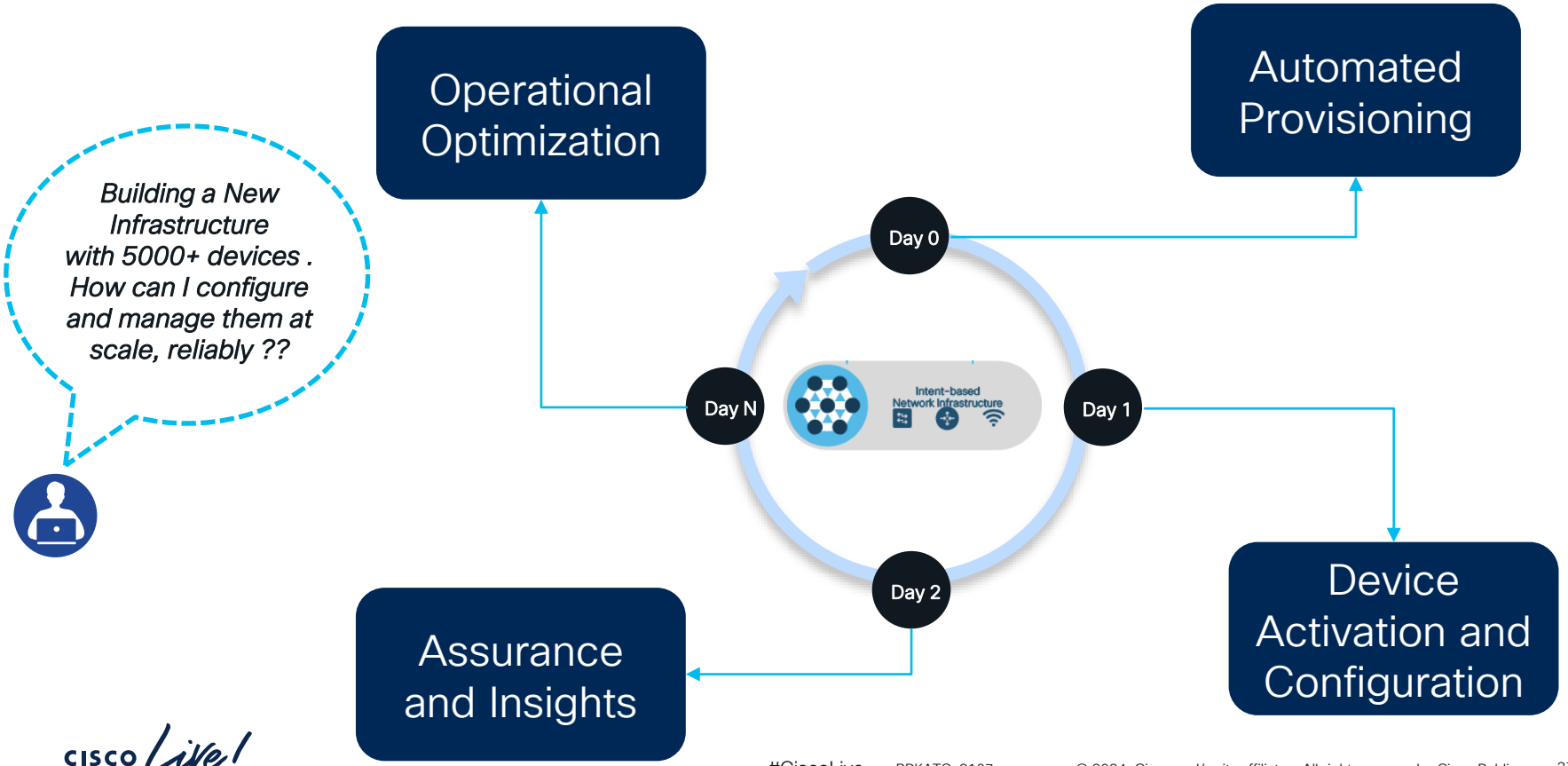
Process



Process Improvements and Changes

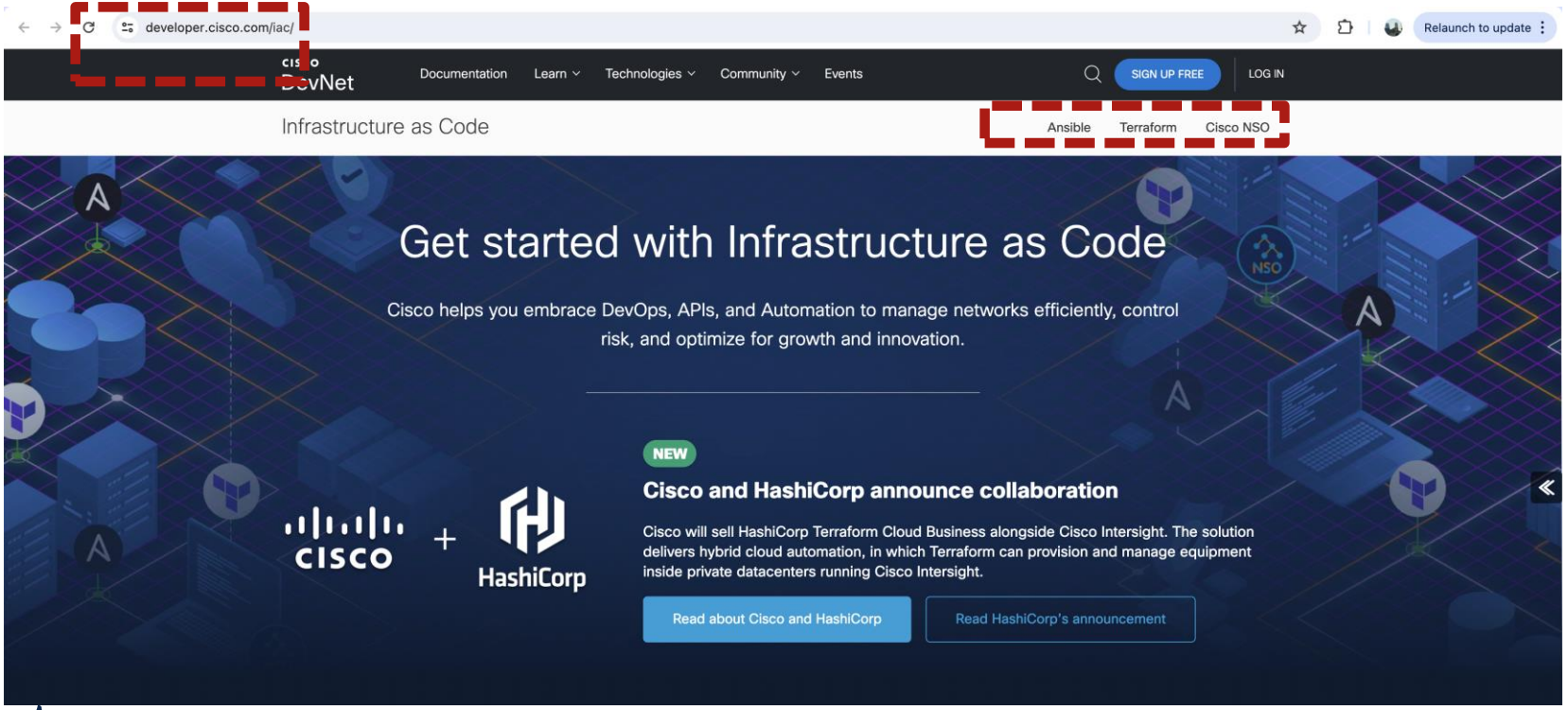
- Transform the culture to adapt to Infrastructure as Code Methodology
- Introduce CI/CD Pipelines to Infrastructure management and operations
- Adopt the Simulated Validation environments
- Understand and implement the tiered validations
- Redefining The operational model to a service-oriented approach

Journey to Infrastructure as Code



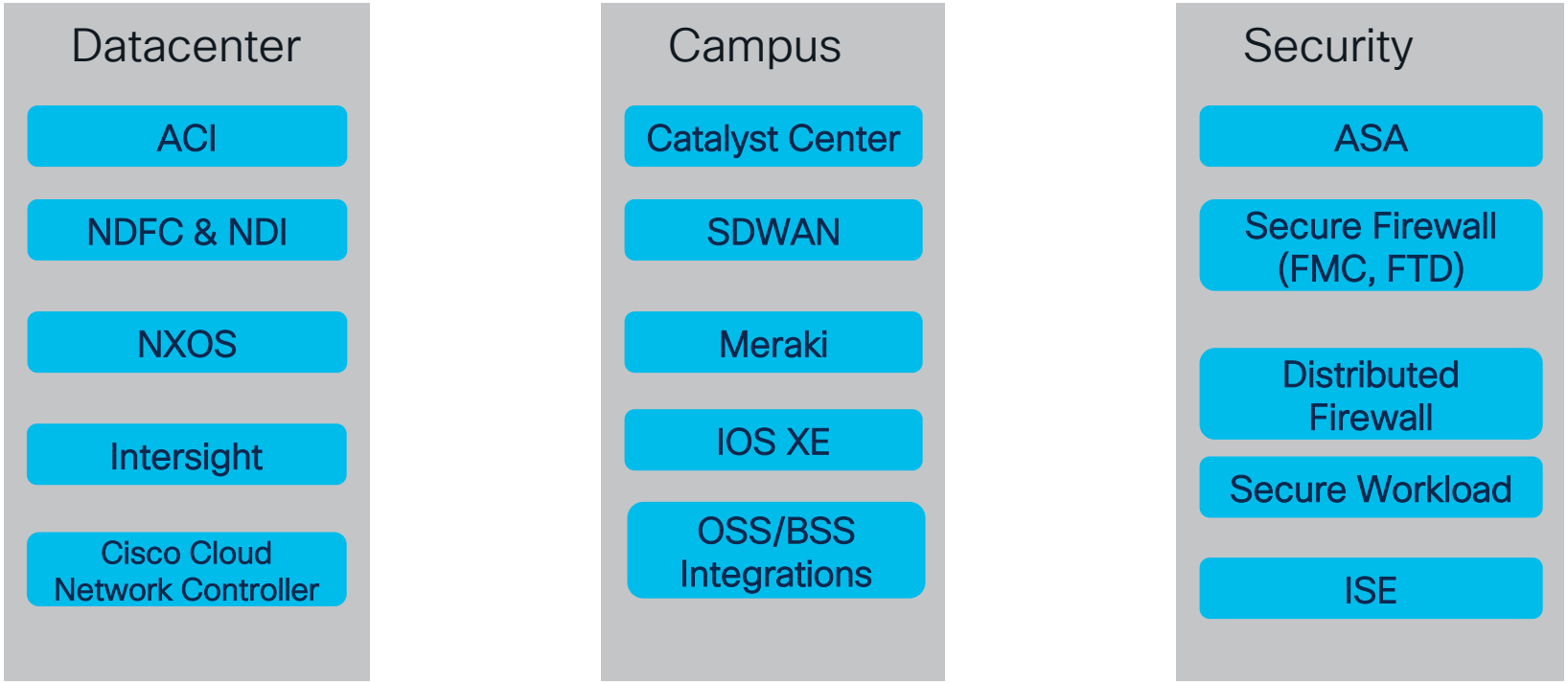
Getting Started with Infrastructure As Code

Infrastructure as Code (IaC) is the process of managing changes through code, rather than a manual process



Getting Started with Infrastructure As Code

IaaC is supported across Cisco Product line and Solutions

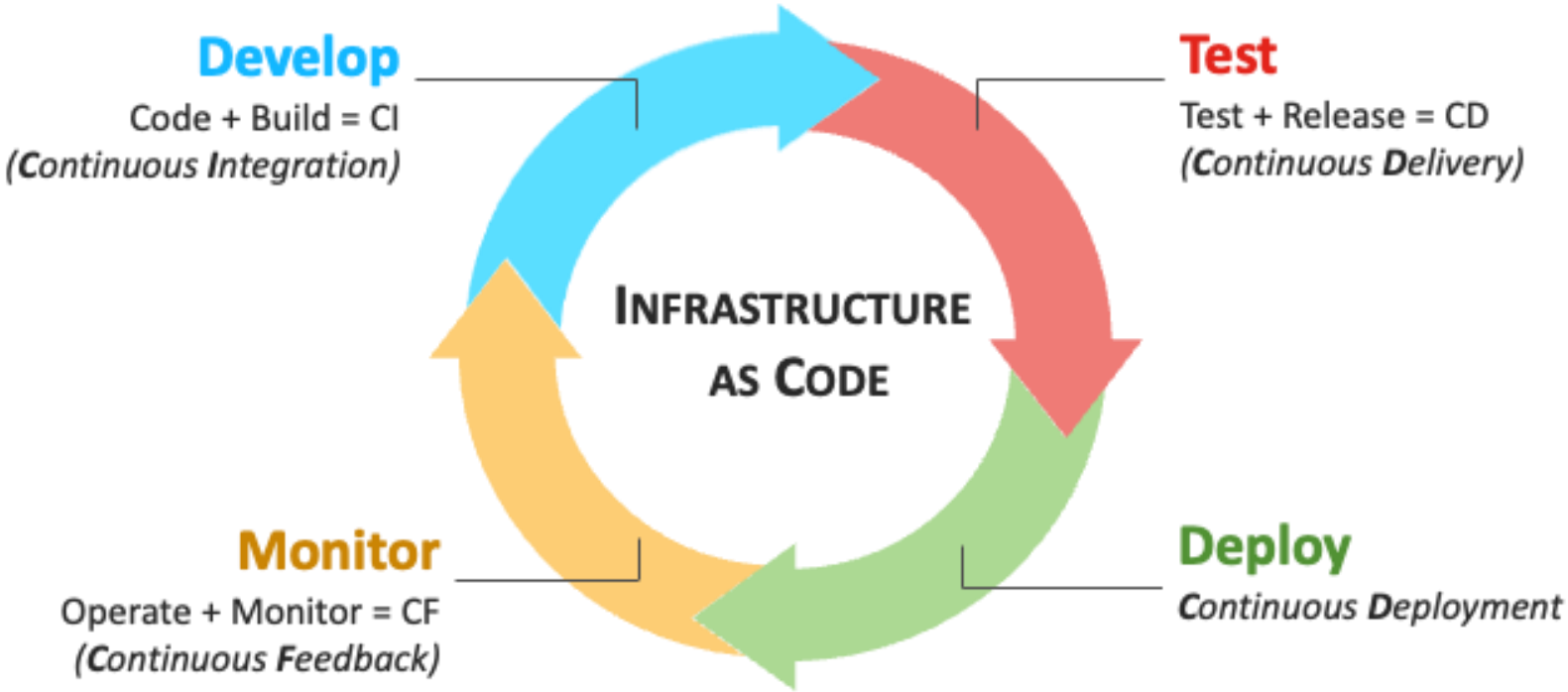


Devops Methodology

Developer

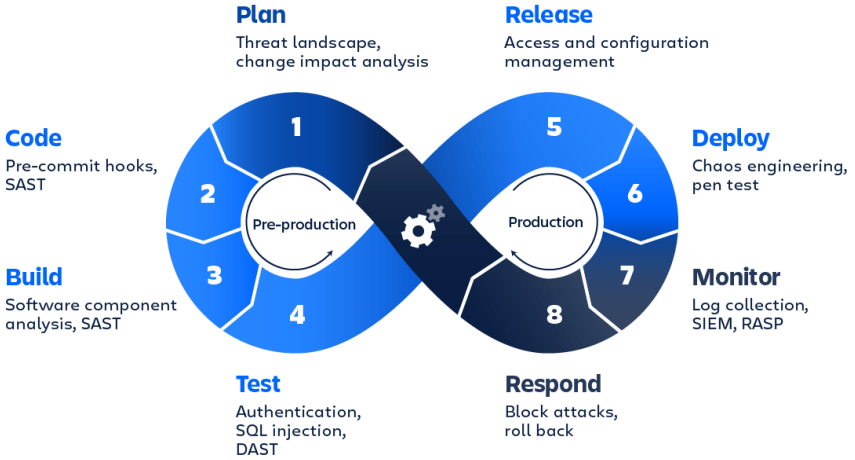
Code

CI/CD Methodology



What is DevSecOps Why do I need it ?

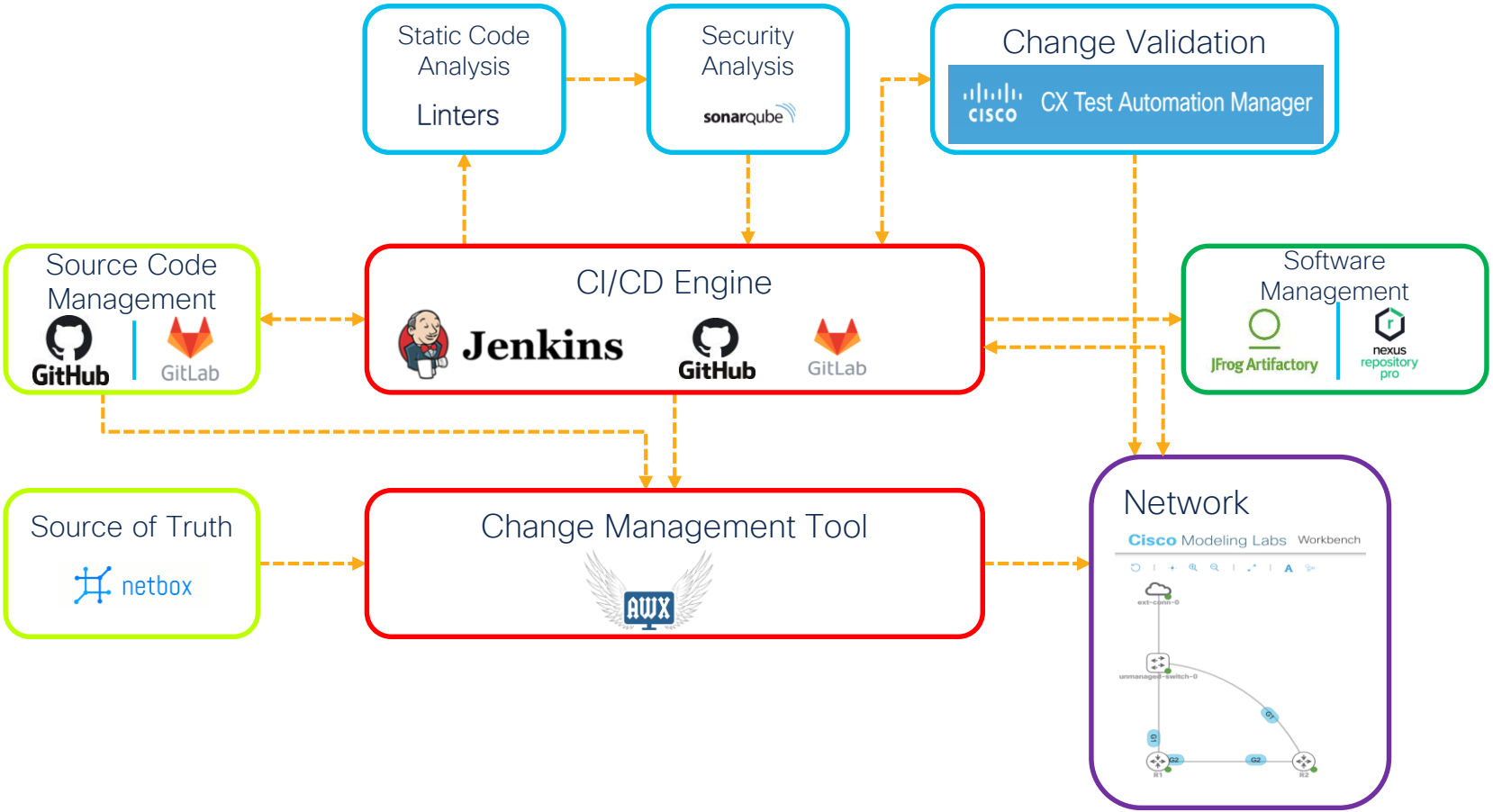
- Ensure that security considerations are integrated throughout the network infrastructure lifecycle.
- Enable secure and efficient network operations.



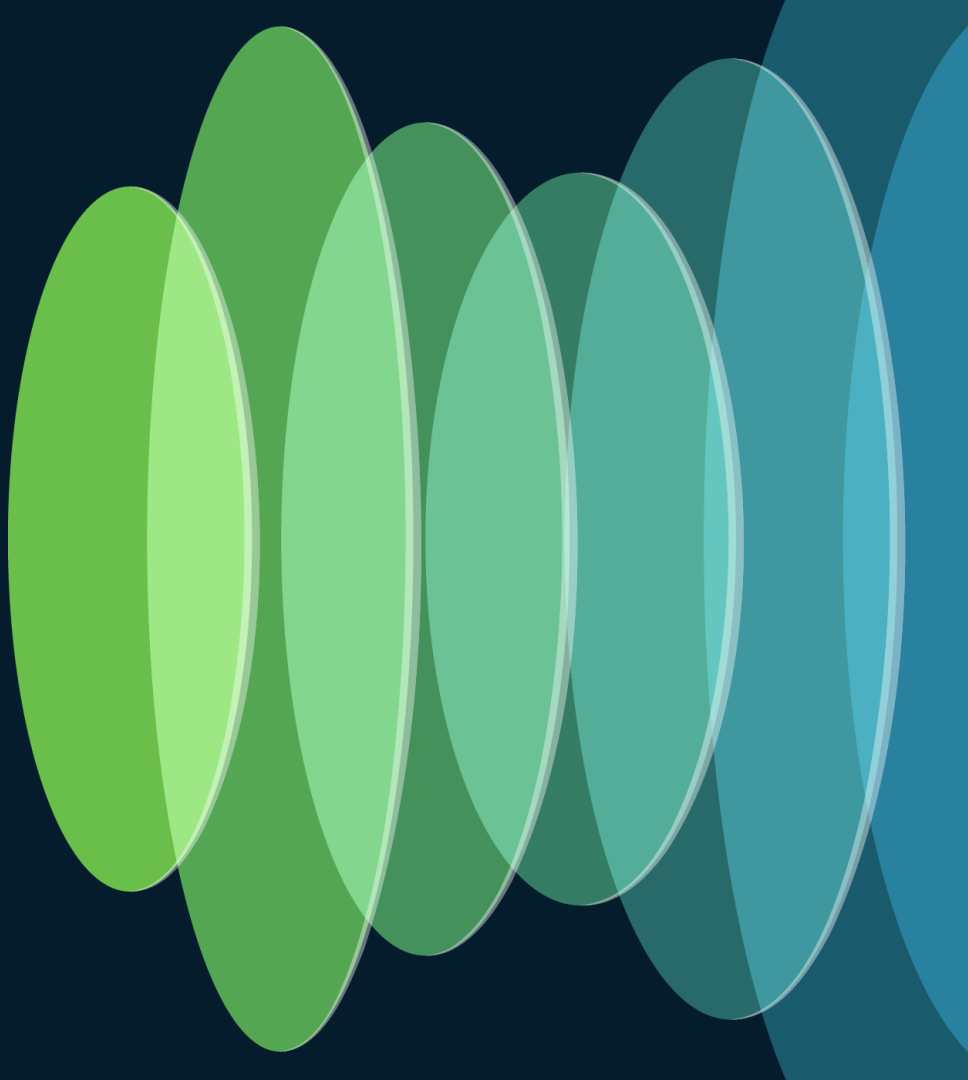
DevOps + Security = DevSecOps

- DevSecOps takes a holistic approach to security.
- Embed security into the development process
- It integrates security into every stage of the SDLC, from conception to deployment.
- This includes threat modeling, code reviews, and penetration testing.
- DevSecOps prevent security vulnerabilities from being introduced into the software

DevSecOps Core Components – Security with IaaC



People



People: Driving Automation Success

Empowering and Training Employees	• Skills Development • Training Programs • Certifications
Fostering a Culture of Innovation	• Encouraging Innovation • Rewarding initiative • Collaboration
Enhance Communication and Collaboration	• Interdepartmental Communication • Collaboration Tools • Feedback Mechanisms
Leadership and Change Management	• Strong Leadership • Change Management • Role models
Define Clear Roles and Responsibilities	• Role Clarity • Team Structure • Ownership
Organizational new Roles	• Service Owner • Service Architect • Platform & DevSecOps Engineer

Service Owner Role

Service owners are accountable for **end-to-end** service delivery.
They break down silos within the organization and look at things holistically.

Key duties:

- Understanding end-user needs and ensuring that they are met day in and out
- Working with the architects on developing future capability needs
- Defining vendor performance requirements and regularly reviewing that they are being met
- Ensuring that all vendor service issues are being resolved and communicated appropriately
- Resolving any roadblocks that are limiting the delivery of the service
- Responsible for managing the total cost and metrics of their service

Adopting the service owner role is critical for ensuring success in the new model that is built around services

Service Architect Role

SAR plays a crucial role in aligning IT services with the organization's goals and objectives

Key duties:

- Work with stakeholders to understand the organization's strategic goals and translate them into IT service requirements. Analyze business processes, define service strategy that aligns IT capabilities with Customer objectives.
- Design and develop IT service models and architectures and define service offerings, service catalogs and SLAs based on business requirements.
- Manage the IT infrastructure team's service portfolio, which includes identifying, prioritizing, and evaluating services
- Ensure that IT services integrate smoothly with other systems, applications, and platforms. Contribute to service governance by establishing policies and standards

Platform Engineer Role

Platform Engineer focus on combining software engineering and operations principles to build and maintain scalable, efficient, and resilient systems

Key duties:

- Monitoring the performance and reliability of systems and services.
- Analyze system metrics and logs to identify bottlenecks and areas for improvement and optimize system performance.
- Response to incidents, diagnose root causes and work with cross-functional teams to resolve issues quickly and efficiently.
- Develop and maintain automation scripts and tooling to streamline system operations.
- Analyze system usage patterns and trends to forecast future capacity needs.
- Collaborate with other teams to enhance system reliability and operational efficiency.

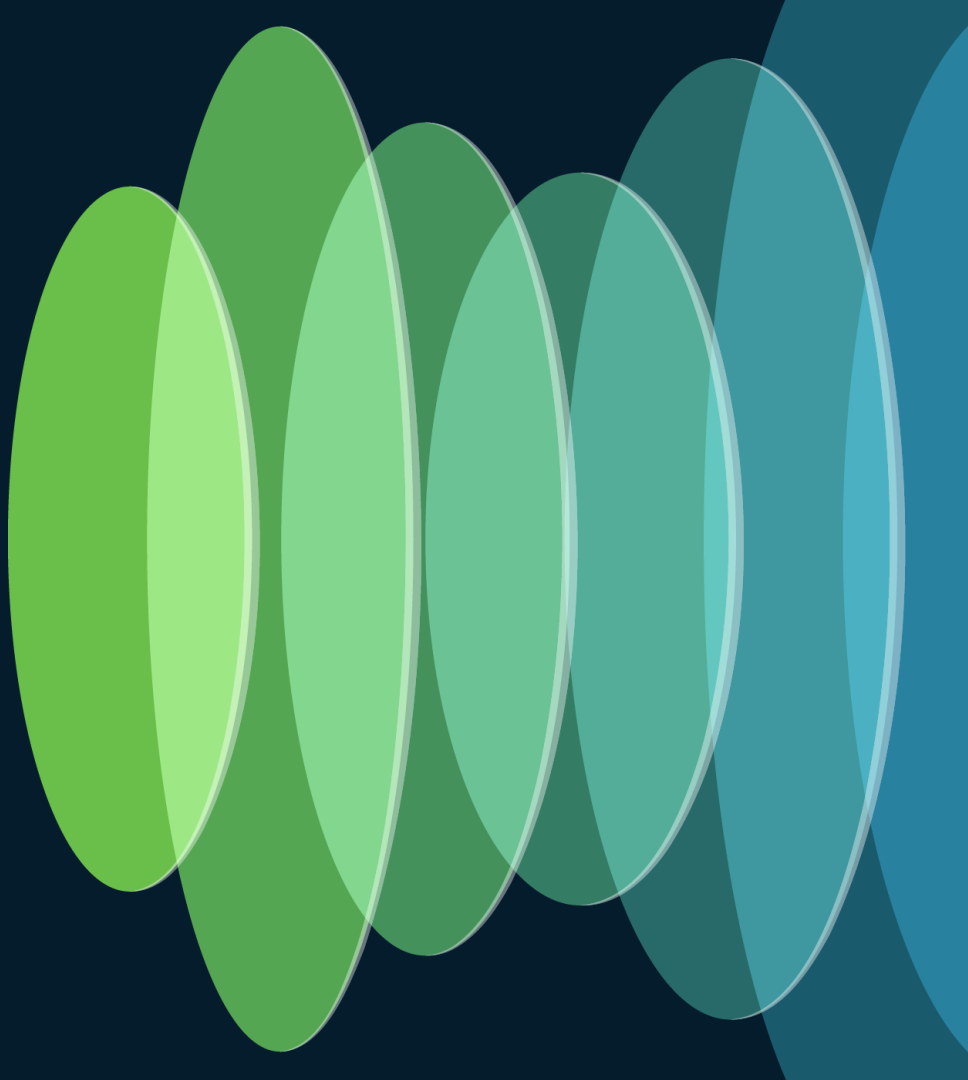
DevSecOps Engineer Role

DevSecOps Engineer focus is to ensure that security is embedded at every stage of the software development lifecycle, from initial design through integration, testing, deployment, and software delivery

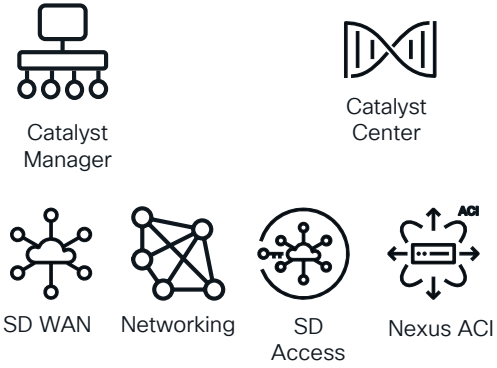
Key duties:

- Integrate security practices and controls into the network automation workflow.
- Enable automation of security-related tasks and processes.
- Establish and maintain monitoring systems that track and analyze network activity, identifying potential security risks or breaches.
- DevSecOps professionals play a key role in incident response and management.
- Promote security awareness and best practices within Customer SC.

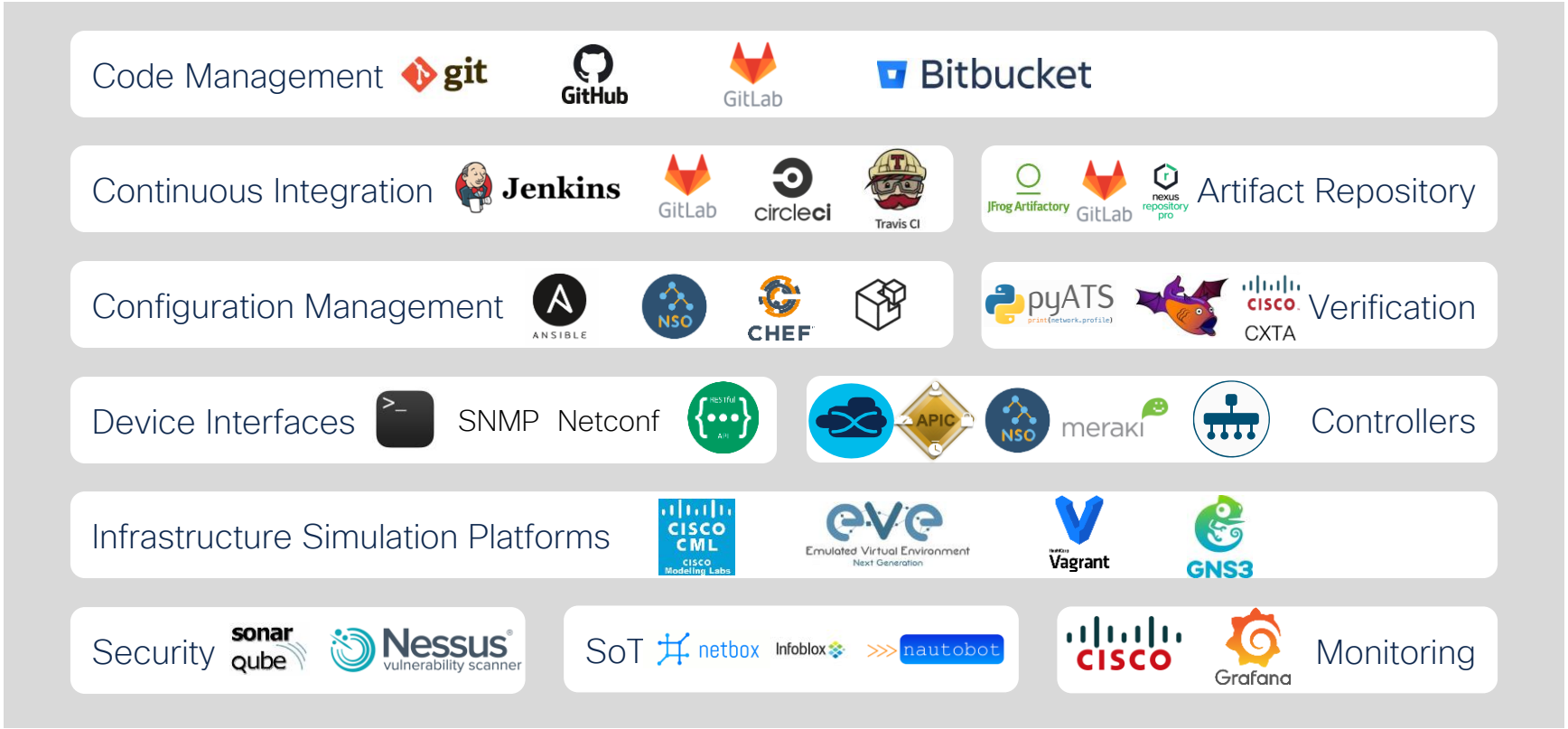
Technology



Infrastructure Elements



DevSecOps Technology and Tools Landscape



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Choosing the Right Development Tools or Languages

Python vs Ansible vs Terraform

Python

- Data Analysis and Visualization
- Web Development
- Automation and Scripting

Ansible

- Configuration Management
- Application Deployment
- Infrastructure Provisioning

Terraform

- Cloud Infrastructure Management
- Multi-Cloud Deployments
- Infrastructure as Code (IaC)

Choosing the Right Development Tools or Languages

Python vs Ansible vs Terraform

- Python, Ansible and Terraform can coexist
  - It's not an either/or story
  - Terraform can call Ansible for ad-hoc tasks after deploying a VM
  - Python can be used for data integration, analysis, and management on VM
- But what about network provisioning?
  - Both Ansible and Terraform are very powerful tools for network infrastructure provisioning
  - Choosing the right tool requires a careful analysis, considering:
    - What is going to be automated
    - What is the desired process
    - Current skillsets in the organization
    - Organization's preference

It is critical to know where they excel and the limits

Choosing the right tools

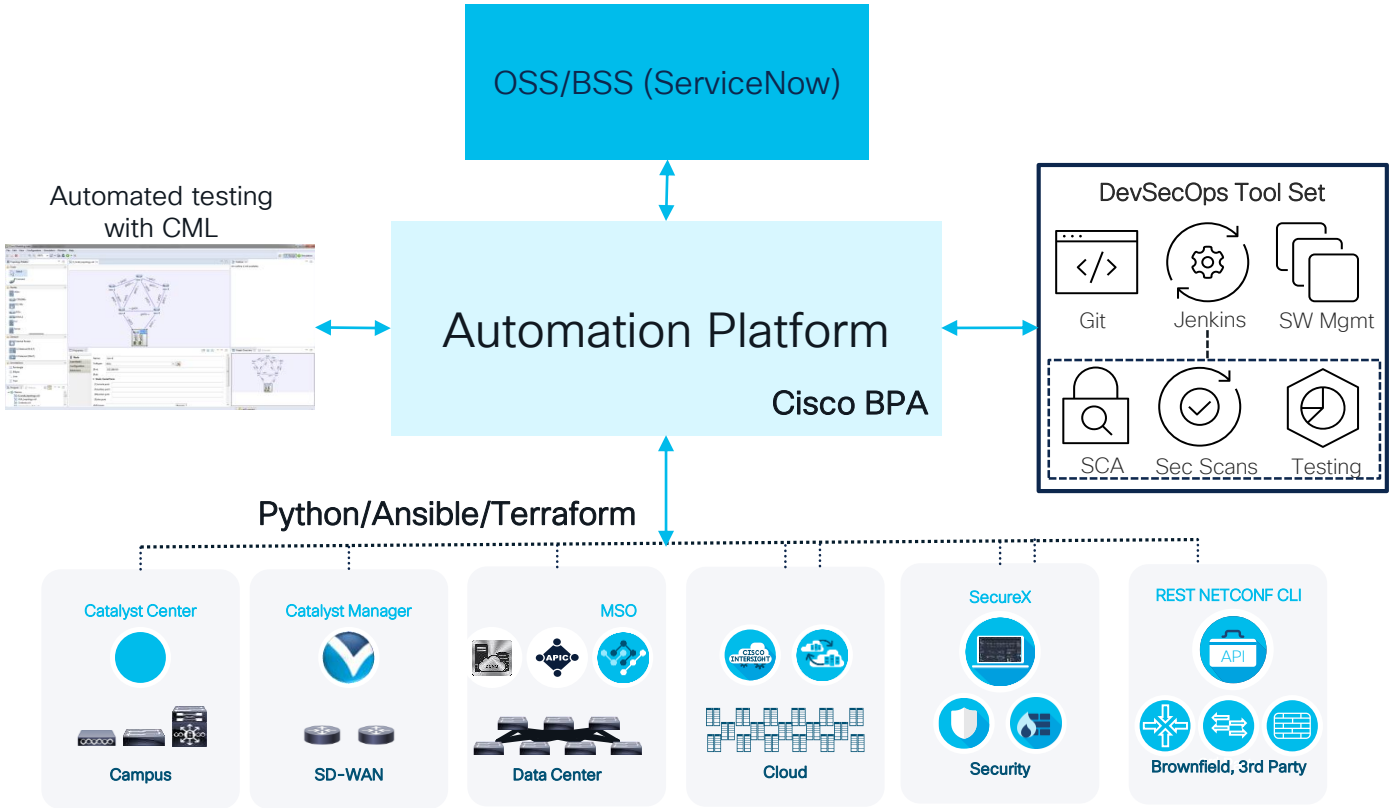
Python vs Ansible vs Terraform



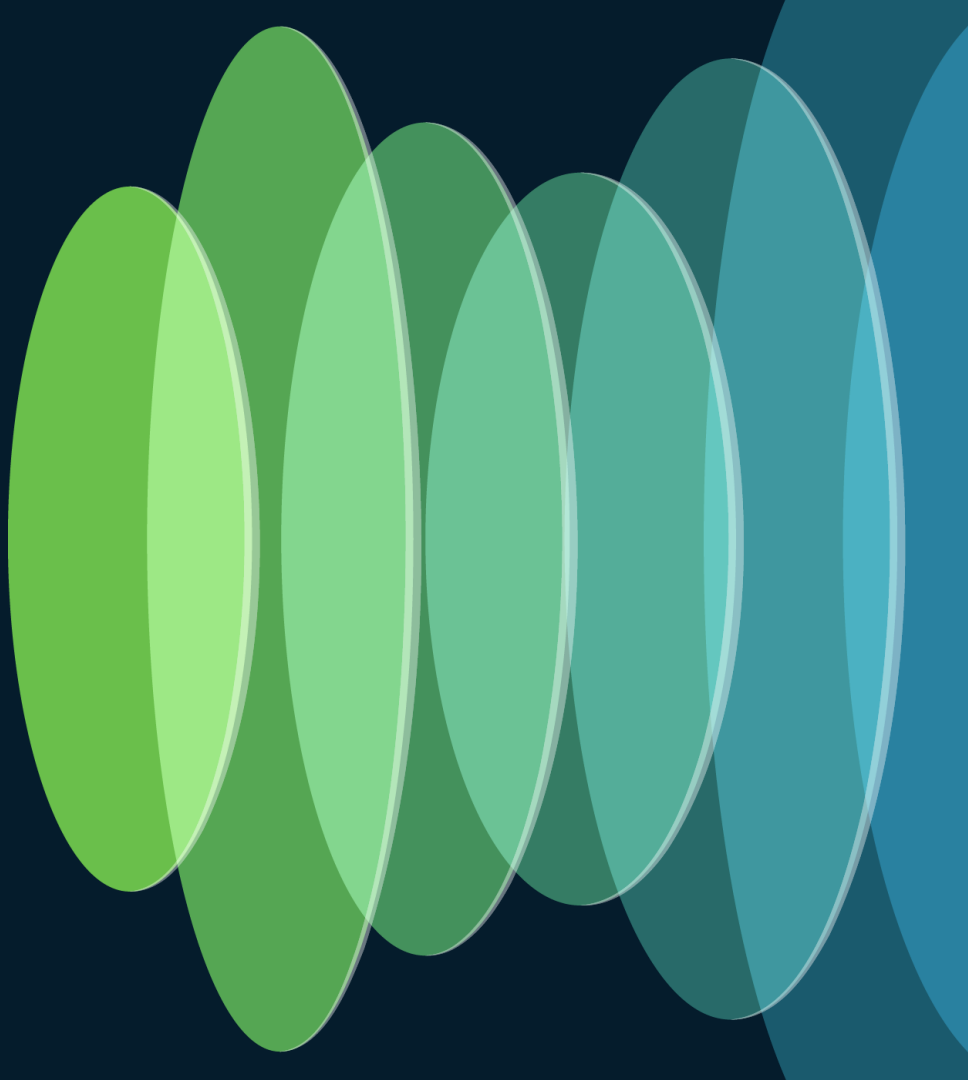
Attribute	Python	Ansible	Terraform
Tool category	General purpose programming	Configuration management	Orchestration
Approach	Object-oriented, Imperative and Functional	Imperative	Declarative
Language	Scripting, Data Analysis	YAML	HCL
Provisioning	Not typically used for Infrastructure provisioning but can interact with APIs	Limited support for infrastructure provisioning	Specializes in infrastructure provisioning
Lifecycle management	No built-in Lifecycle Management	No lifecycle awareness	Lifecycle aware. Maintains state of deployments
Command line operation	Yes	Yes	Yes
Agentless	N/A	Yes	Yes

Automation Platform

- Platform
  - WebUI
  - Service Chaining
  - OSS/BSS Integration
- DevSecOps Tools
  - Security
  - Release Management
  - CI/CD Pipeline
- Controller-based Infrastructure Orchestration
  - Software Defined Architecture
  - Orchestration language
- Service Assurance Platform
  - Cross Domain Assurance



Measure



KPIs for Infrastructure Automation

Cost

- Labor Costs
- Cost saved due to Error reduction
- Cost saved due to Resource Optimization

Quality

- Security compliance Score
- Company standard compliance Score
- Reliability – number of incident cases
- Service Availability – downtime
- The number of reworks and rollbacks

Speed

- MTTR-Mean Time to Repair
- Time-saving (compared to manual processes on daily tasks)

User Experience

- Customer Satisfaction
- Improved SLAs

KPI for Costs

Labor Costs: The labor cost KPI measures the reduction in manual effort and associated labor costs achieved through IT infrastructure automation implementation.

Cost saved due to Error Reduction: This KPI quantifies the financial savings resulting from a decrease in errors, incidents, and troubleshooting efforts due to the improved accuracy and reliability provided by automation.

Cost saved due to Resource Optimization: This KPI reflects the financial benefits gained from the efficient utilization of resources, such as servers, network bandwidth, and storage capacity, enabled by automation, resulting in reduced infrastructure costs.

KPI for Quality

Security Compliance Score: This KPI assesses the level of adherence to security policies, standards, and regulatory requirements, providing a measure of Customer's security posture.

Company Standard Score: This KPI evaluates the degree to which the IT infrastructure aligns with established company standards.

Reliability: This KPI tracks the number of incident cases, measuring the stability and robustness of the IT infrastructure.

Service Availability: This KPI measures the amount of time the IT infrastructure services are accessible to users.

Number of Rework and Rollback: This KPI captures the frequency of rework and rollback actions required for IT infrastructure changes.

KPI: Speed

MTTR (Mean Time to Repair): MTTR is a KPI that measures the average time taken to restore services or resolve incidents,

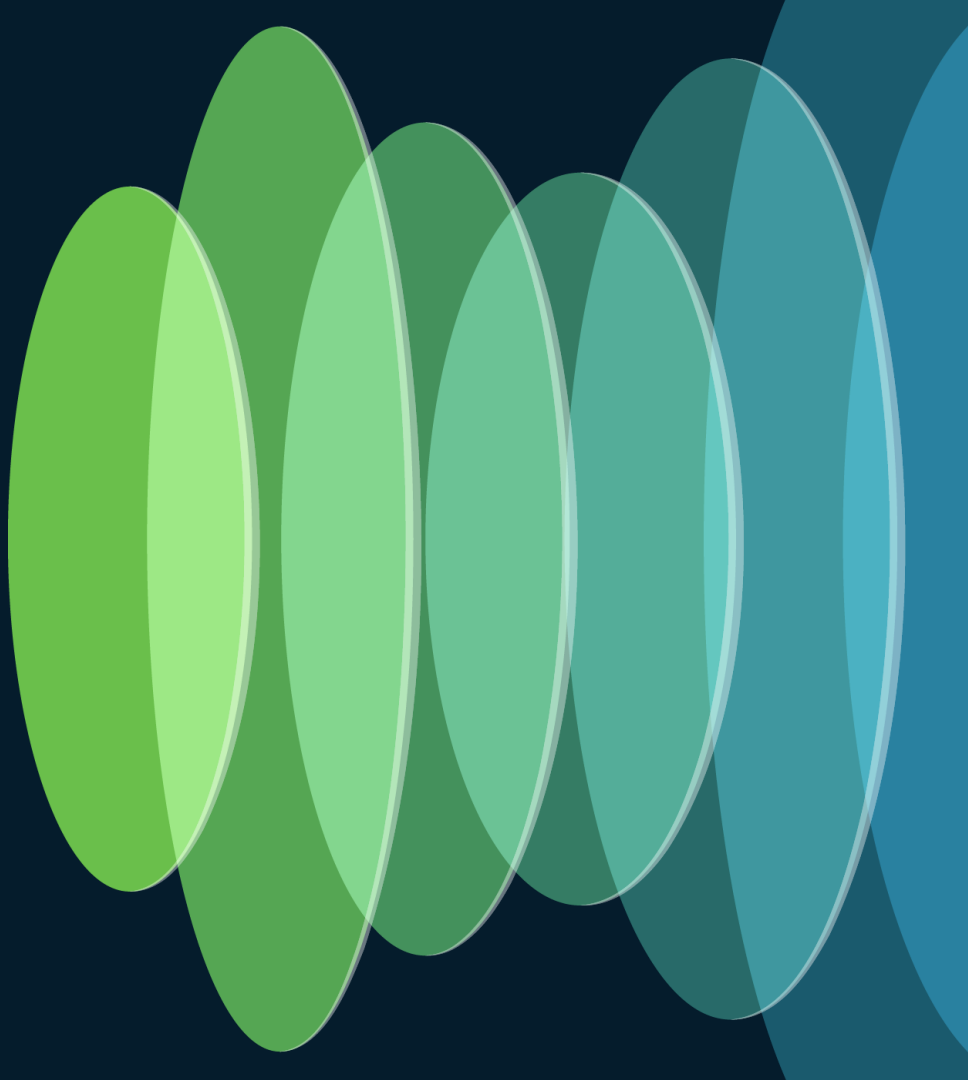
Time Saving: Time saving is a KPI that quantifies the amount of time saved through automation, enabling IT teams to allocate resources to more strategic tasks and accelerating operational processes.

KPI: User Experience

Customer Satisfaction: This KPI measures the level of satisfaction of customers with IT services.

Improved SLA: This KPI assesses the extent to which automation contributes to meeting or exceeding agreed-upon service level targets, ensuring consistent and reliable service performance, and enhancing customer trust and confidence.

Automation Strategy Implementation Roadmap



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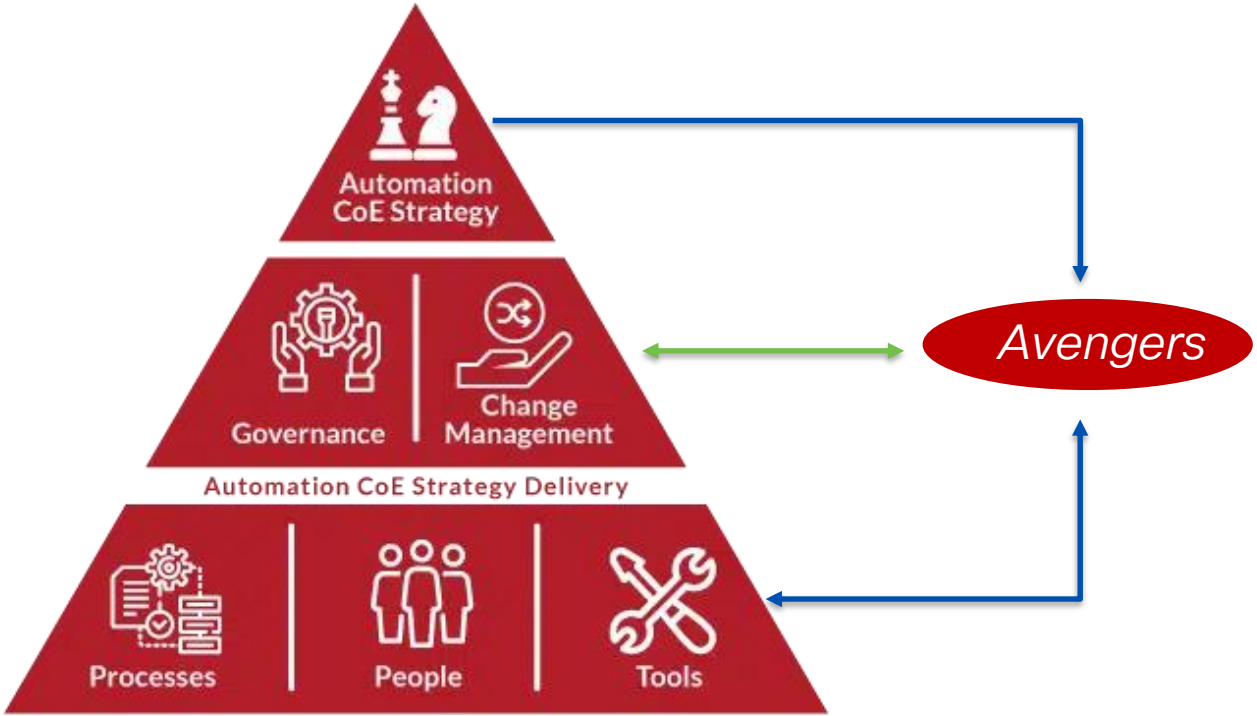
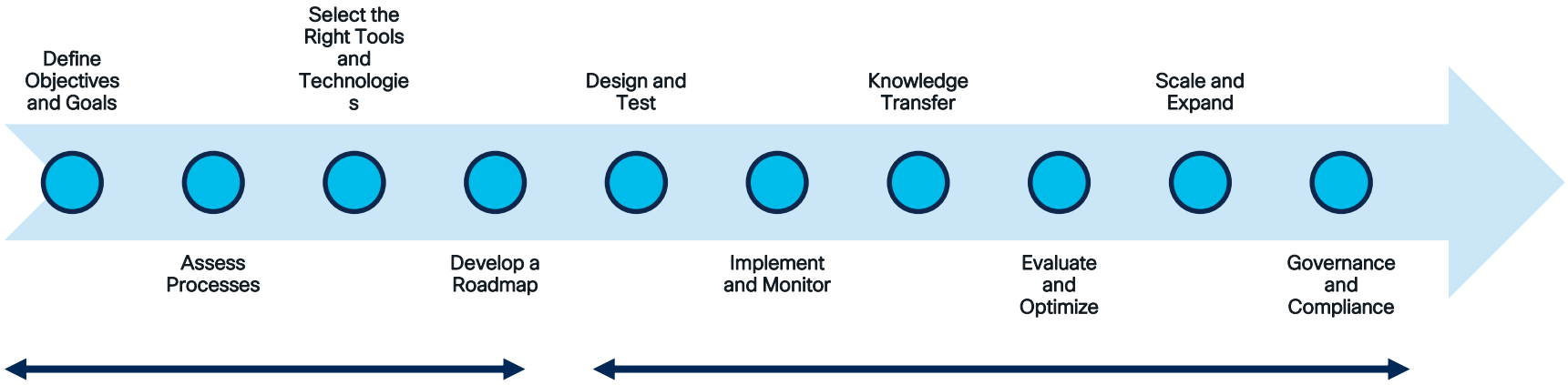
Automation Center of Excellence



Key Steps to Implement Automation Strategy



Strategy for Short Term automation goals - Foundational

• 3-6 Months

1

Executive leadership:

Define Vision , Goals and outcomes .

Setup the Automation Center Of Excellence

2

Set up Project Management & Architecture Management Office

Plan for a time bound and measurable outcome

3

Build Automation for few simple use cases

- Onboarding New Datacenter tenant
- Automate Health check CLIs

4

Automate individual tasks with existing tools (e.g. Nexus Dashboard, ACI, etc)

- Onboard a new application Network Profile
- Implement PnP
- Automate SDWAN template

Capability for Automation in Short & Mid Term

People

- Define the short-term goals and establish a program goal
- Define the Stakeholders
- Define success Criteria
- Identify and Form PMO and AMO
- Skills exchange between Infrastructure and Applications groups
- Upskill and reskill through training

Process

- Adopt Infra As Code
- Modify change management process
- Document the Current state and performance metrics
- Automation advisory Consulting engagement
- DevSecOps Tech Stack Implementation
- Controller based systems
- Test Automation with PyATS/Robo

Technology

- Identifying the right toolsets to use
- Software defined Networking adoption
- Identify and onboard the Service assurance tools like Nexus Dashboard or DNAC
- Creating Minimal CI/CD Pipelines
  - GitHub
  - Gitlab

Strategy for Mid-Term automation goals - Transformational

- 6 -18 months

Implement the Automation Framework

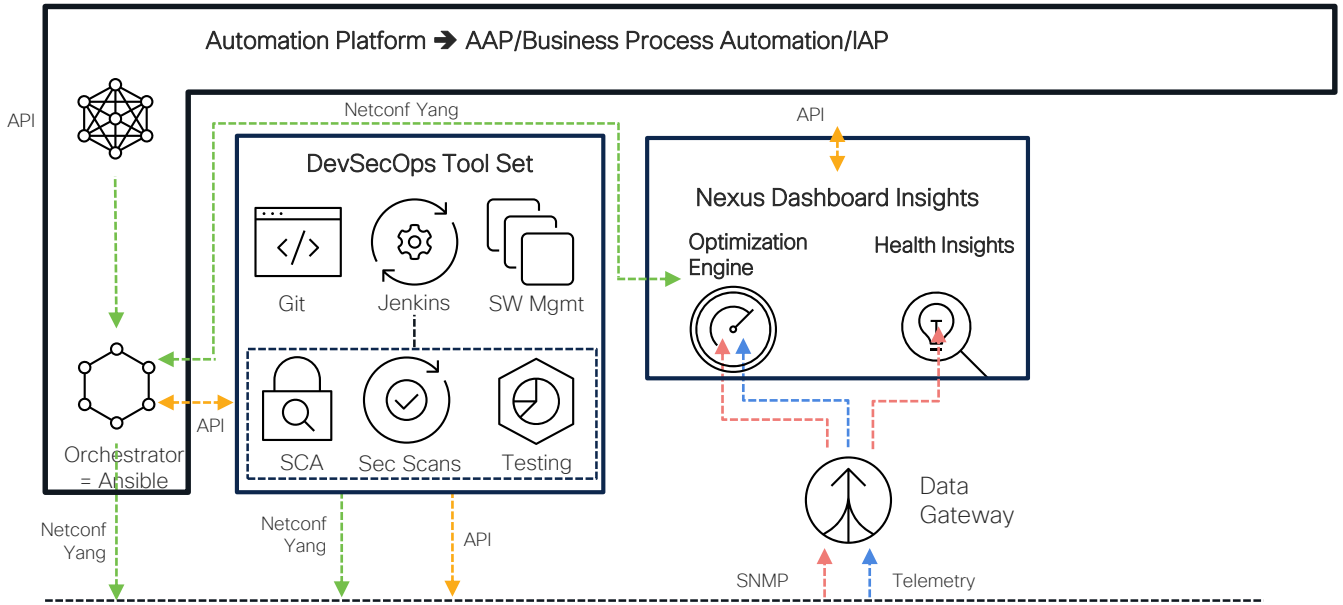
- DevSecOps Tech Stack Implementation
- Automation Platform Adoption
- Setup Validation Infrastructure
  - Implement & automate CML-based validation
  - Implement & Automate Physical validation Infrastructure

Infrastructure Services Integration (LB, FW)

Operations Use case automation

- Asset management
- Change management
- Code Upgrade
- RMA
- Vulnerability Management

Move Provisioning and de-provision into DevOps methodology

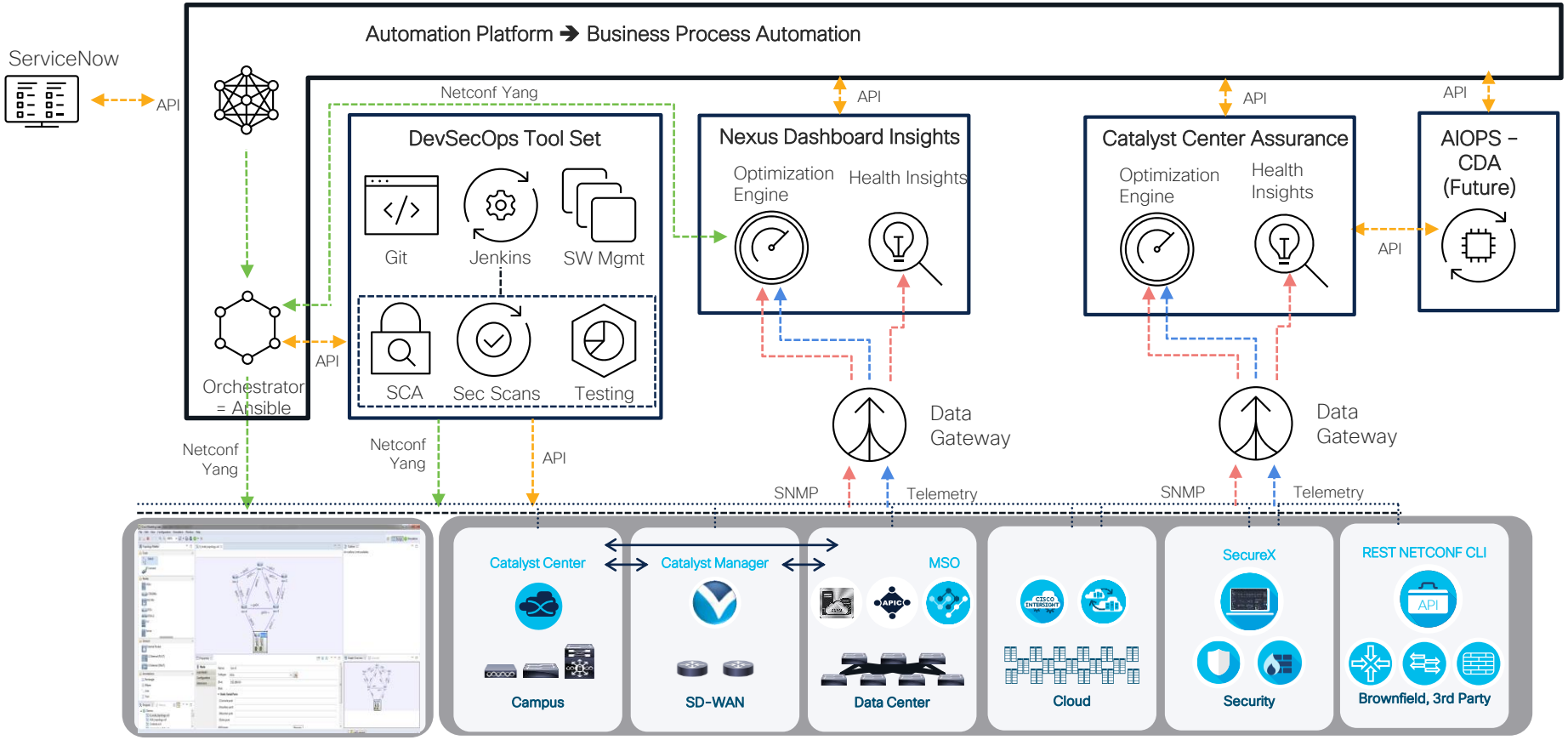


Strategy for Long Term automation goals – Strategic

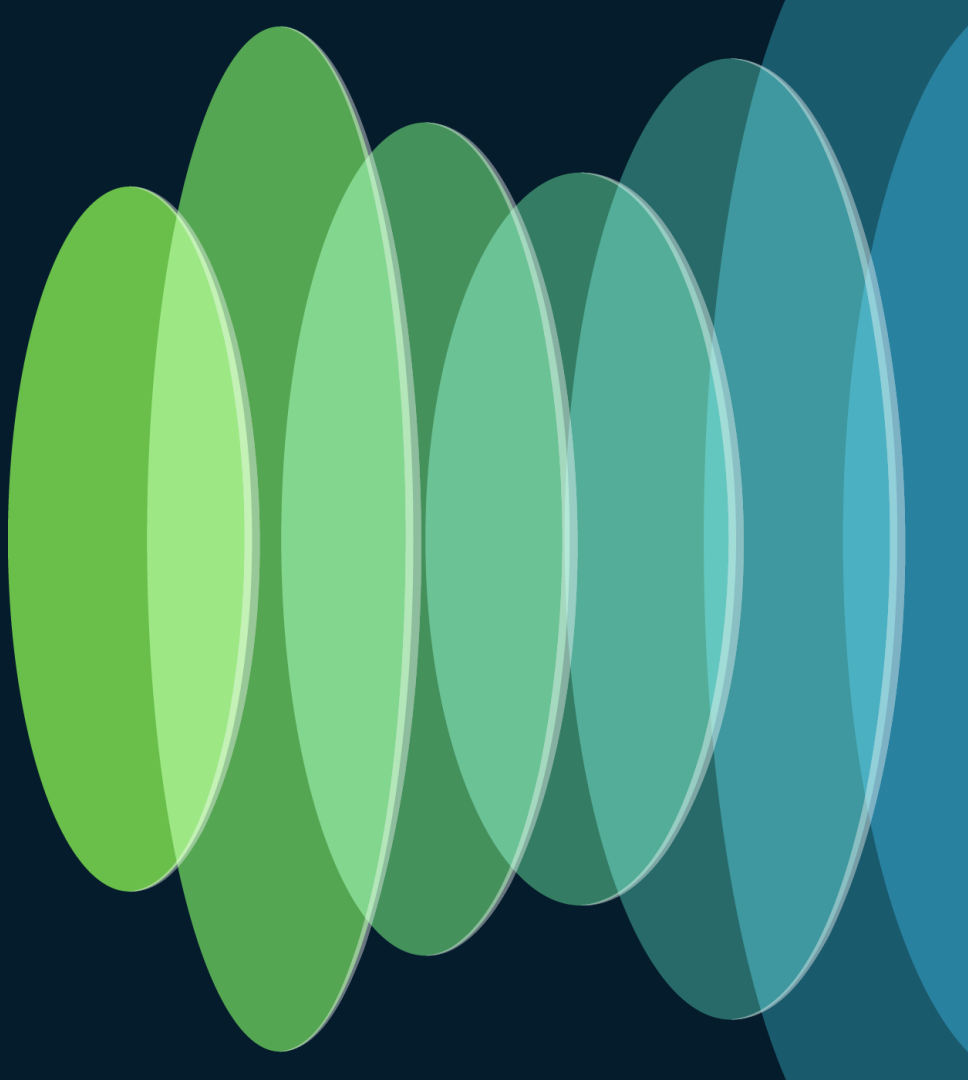
18+ months

OSS/BSS Integration – (SNOW)	Publish Self Onboarding & Service Catalogue	Event , Alarm Correlation
Optimize Operations	AIOPS Enablement Pilot	Define AIOPS use cases and operationalizatio n

Final state of Automation Framework

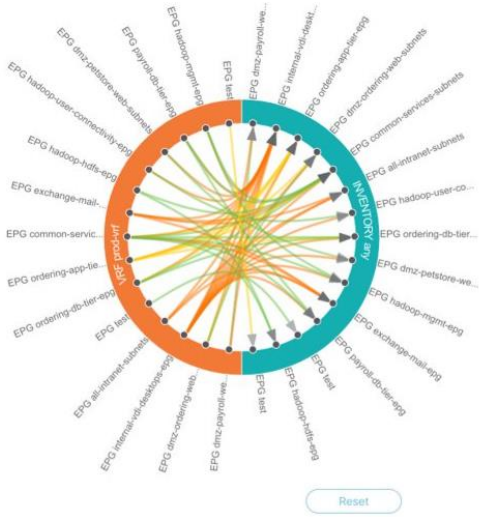


Usecases



Datacenter Application Lifecycle Management On Prem and Cloud

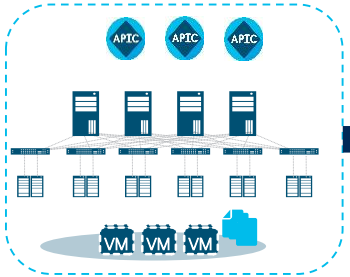
ADM – Secure Works



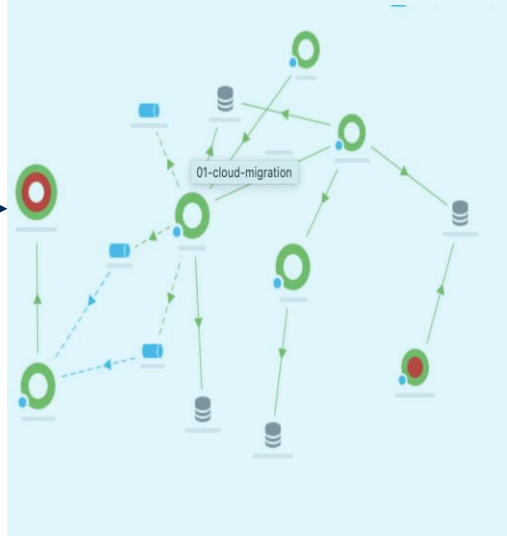
Cloud Native Applications across Multiple Public Clouds

Application Data Model

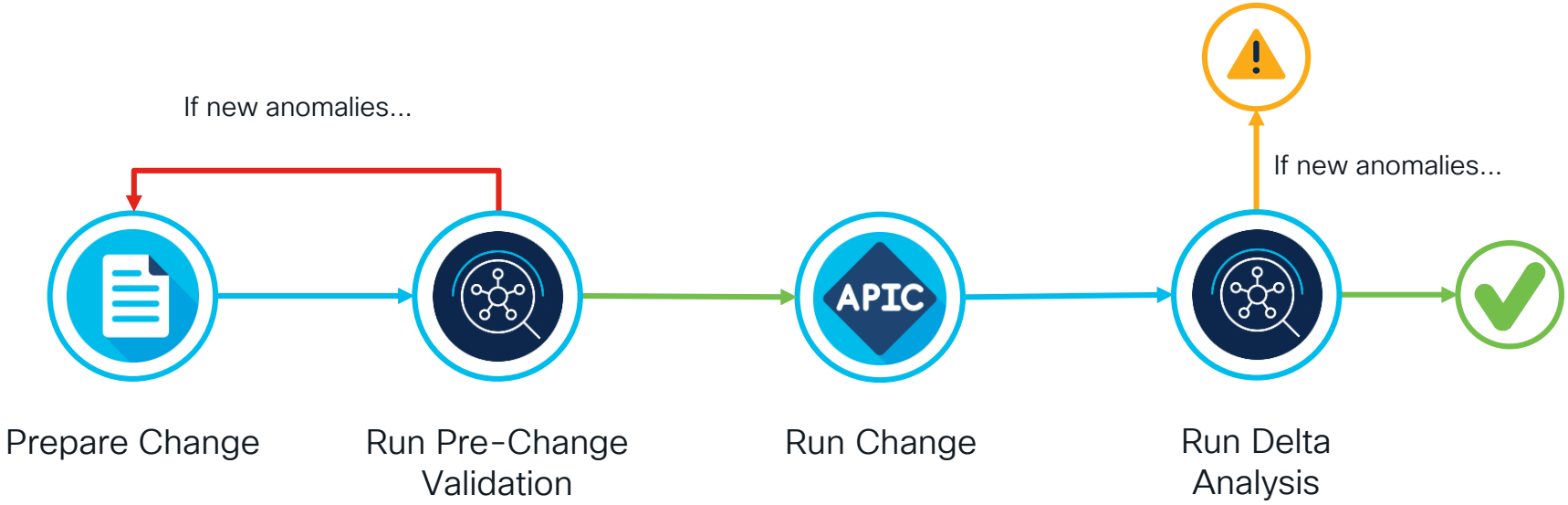
On Prem Datacenter



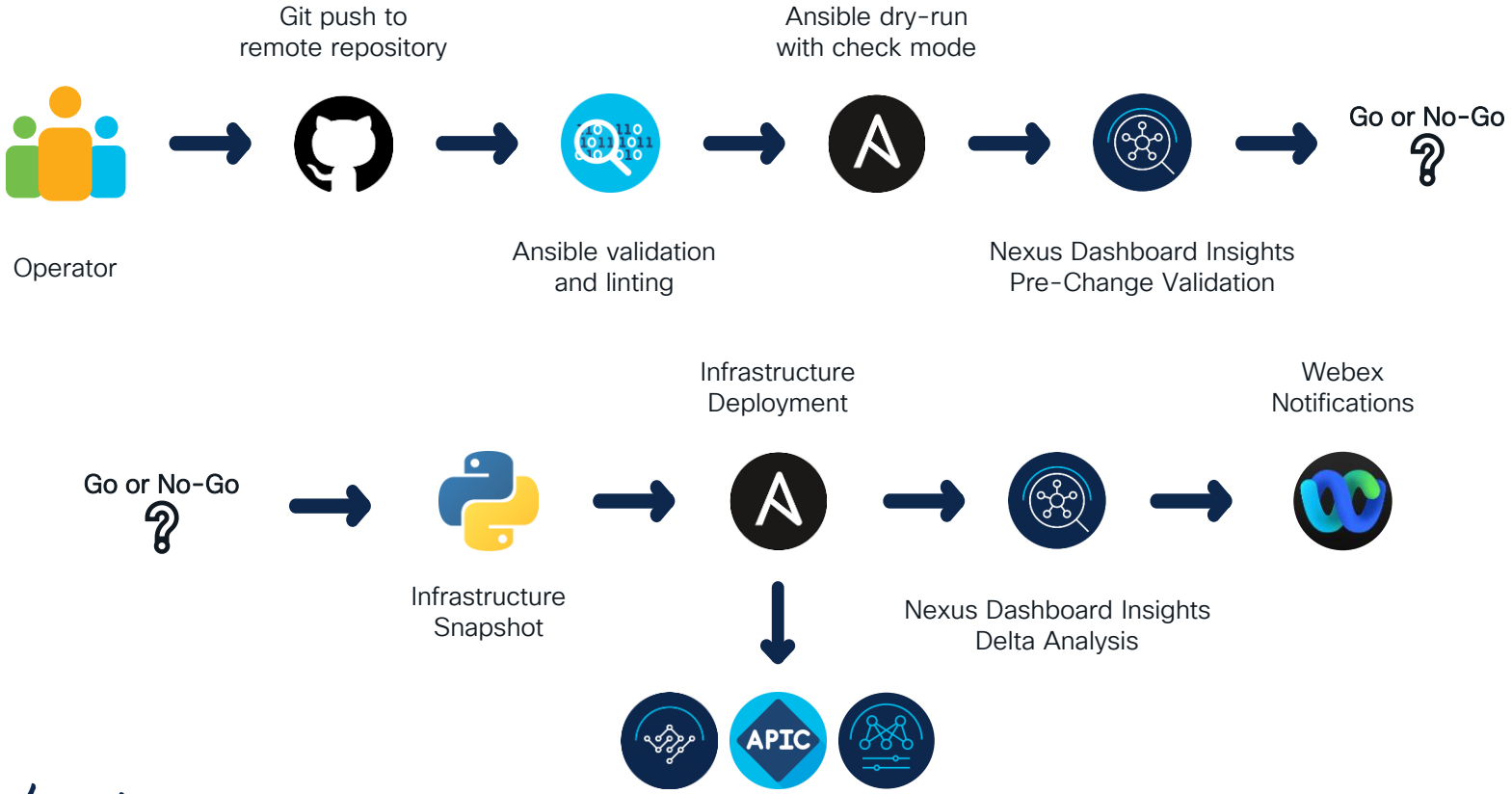
AFM – AppDynamics



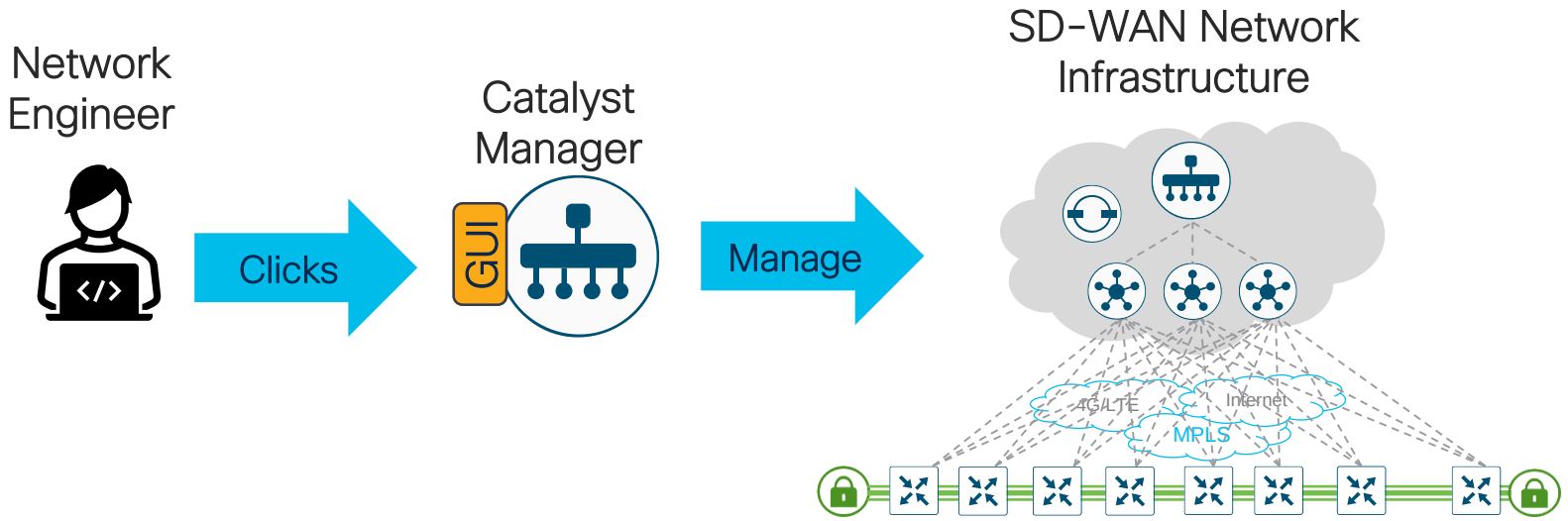
Pre-Change and Post Change Validations Flow



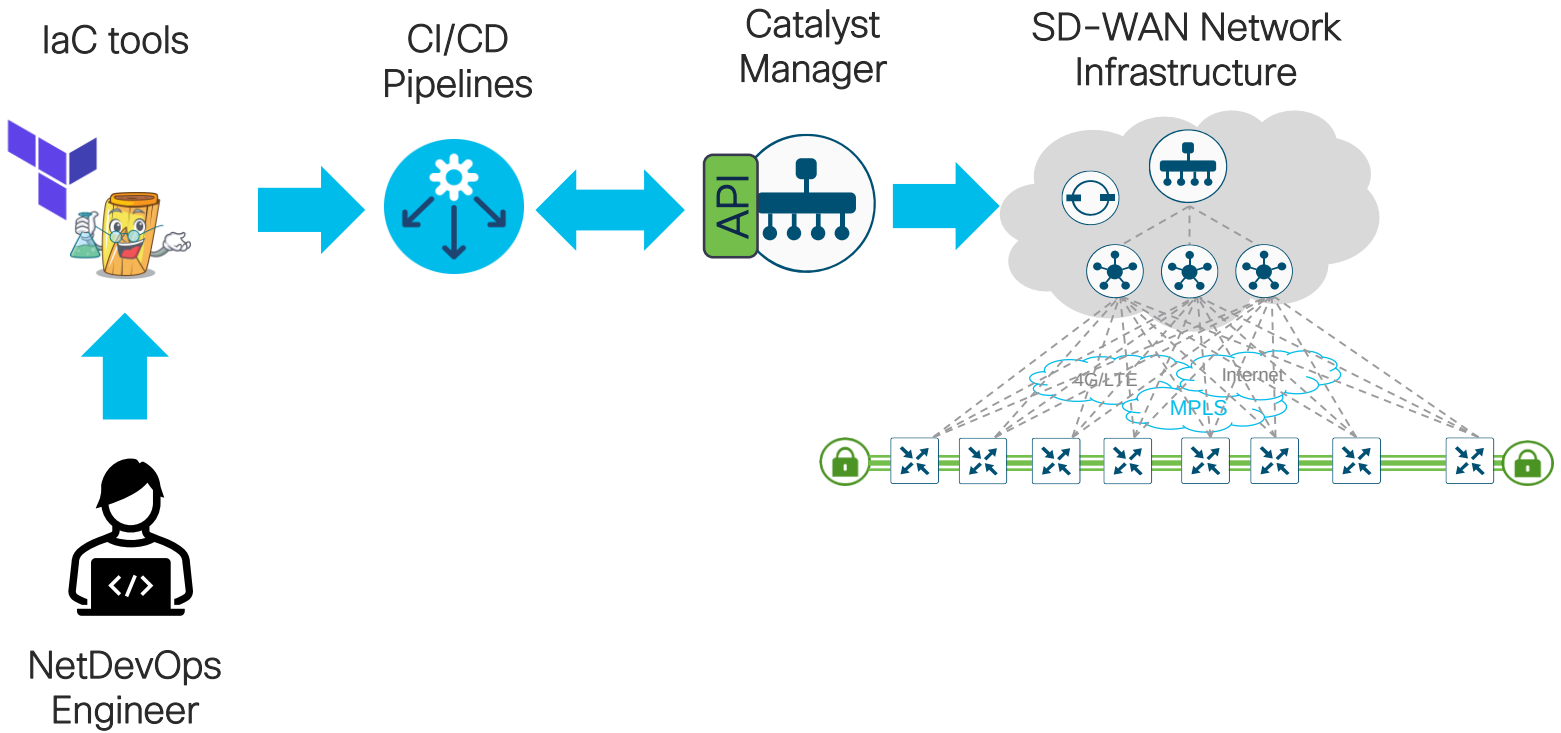
Datacenter Use cases - CI CD Pipeline



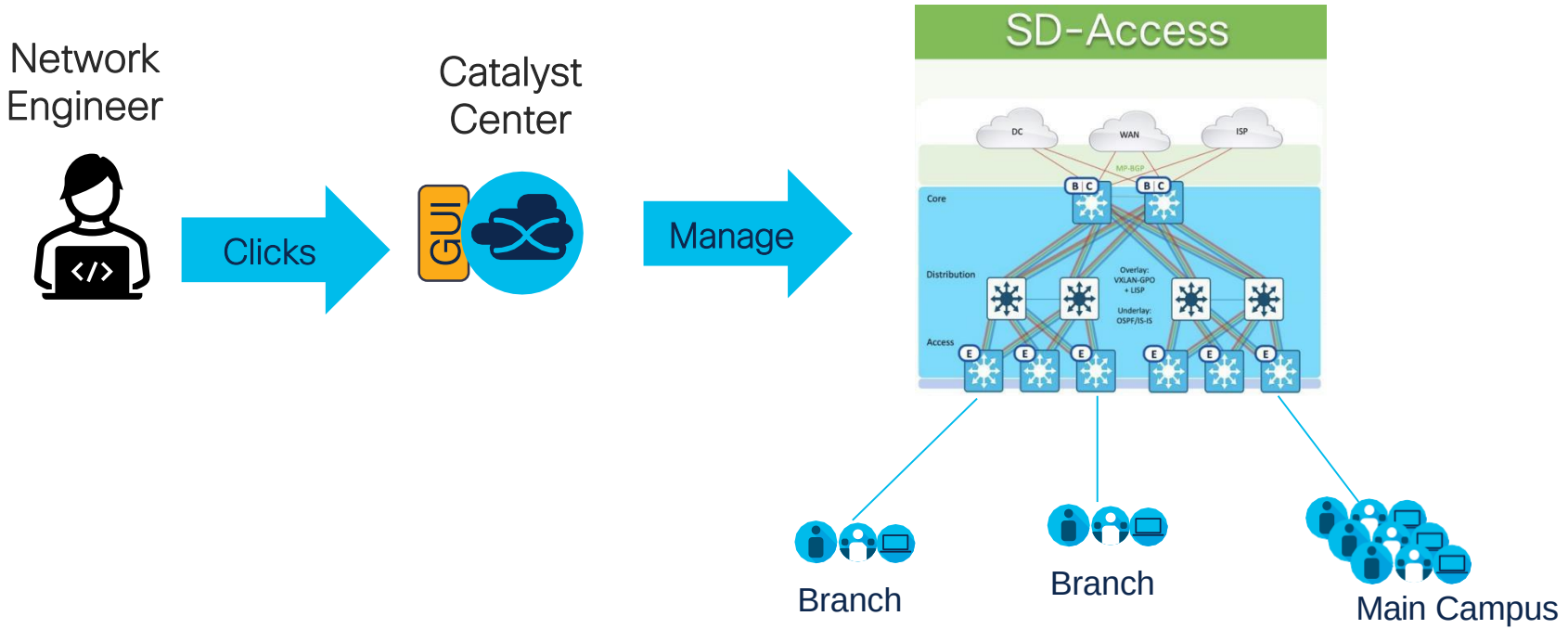
SD-WAN Branch Activation



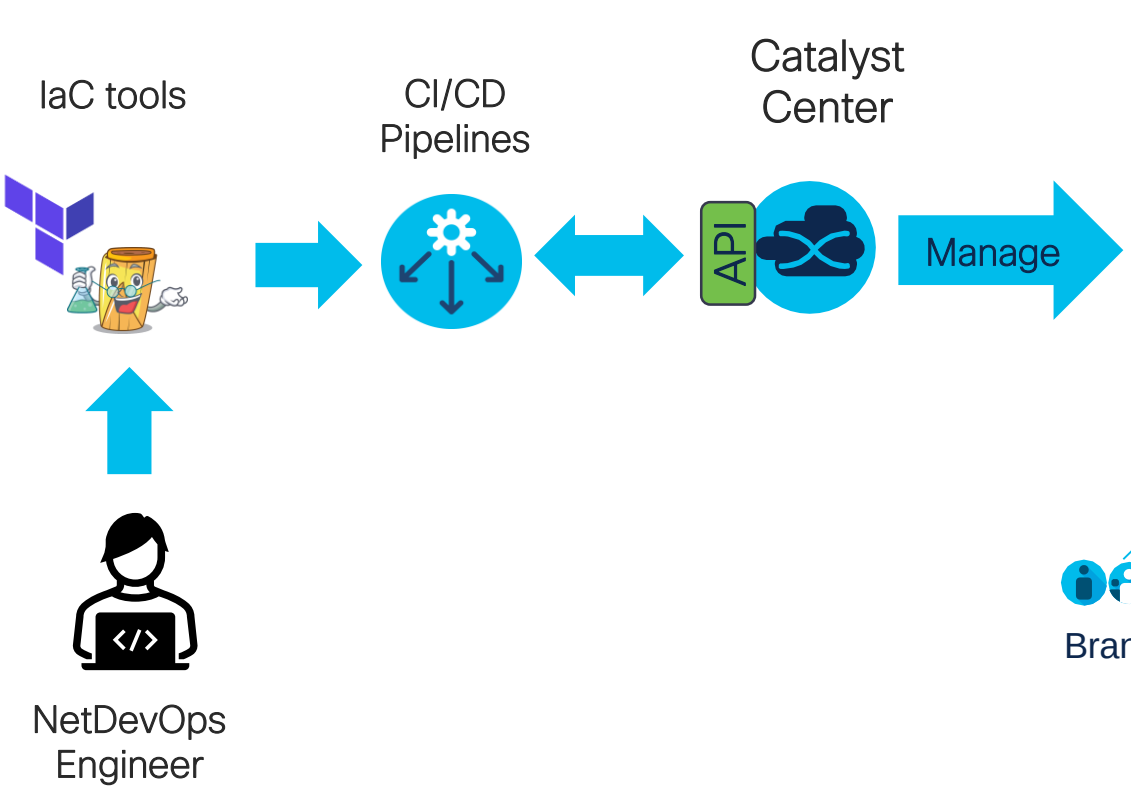
SD-WAN Branch Activation



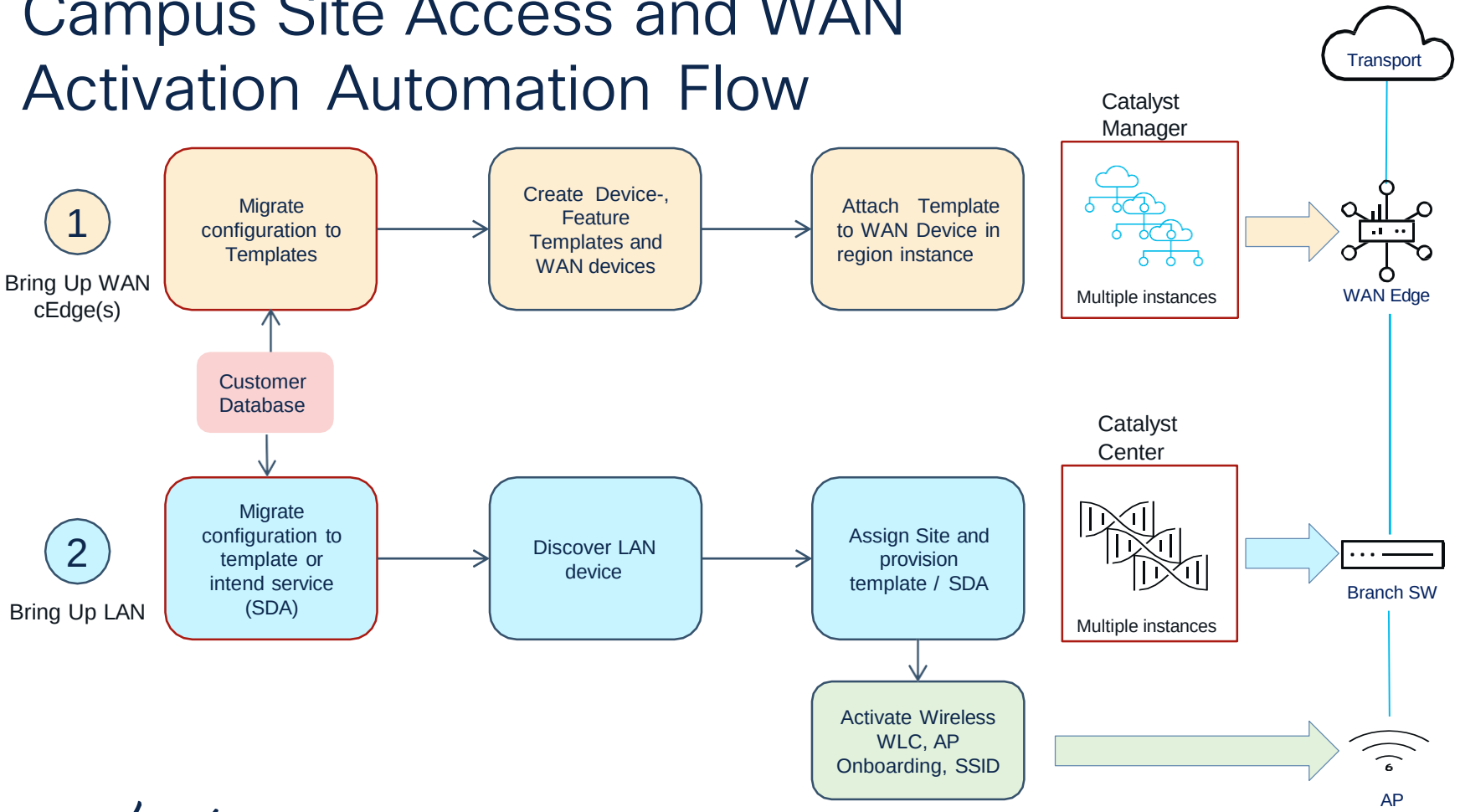
SDA Site Activation



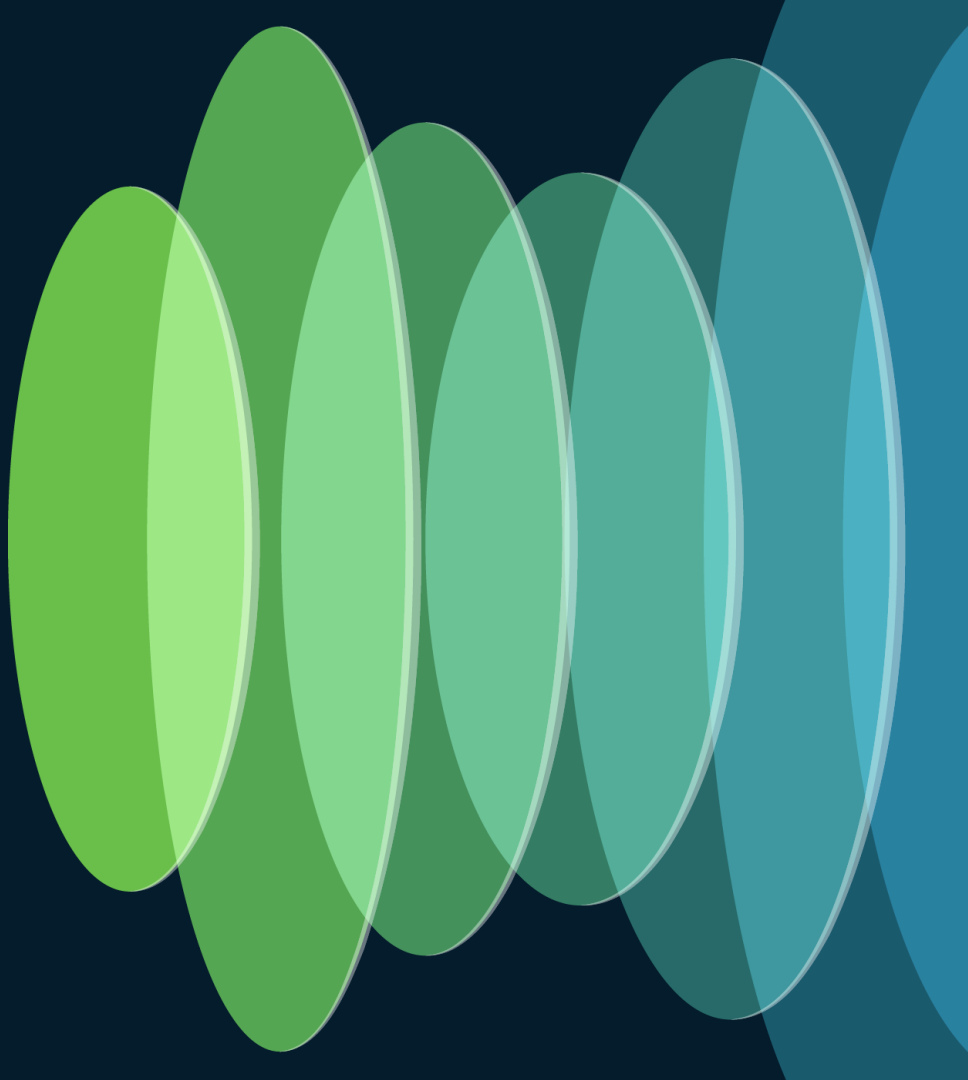
SDA Site Activation



Campus Site Access and WAN Activation Automation Flow



Case Studies



Case Study - Manufacturing

Challenge

- A global manufacturing company with a geographically dispersed network of factories and warehouses is needed to transform WAN Infrastructure
- Growing user consumption is increasing network demands and leading to capacity issues
- Slow provisioning response to network capacity issues results in bad user experiences
- Lack of tools and experience to effectively deploy automation across transport infrastructure
- Service standardization across multivendor and multidomain network

Solution

- Cisco experts delivered an end-to-end software-defined networking (SDN) controller solution design and architecture integrated with network elements
- Built and deployed a virtual automation lab in preparation for the production environment
- Developed and deployed custom Data models for service orchestration and visualization
- Developed custom templates to automate Day-0, Day-1 and Day-2 configuration and provisioning

Result

- WAN infrastructure Provisioning and Deployment timeline reduced from months to days
- Real-time topology and inventory visibility
- Dynamic capacity management
- Enhanced user experience through performance monitoring

Case Study - Healthcare

Challenge

- A large healthcare provider with distributed facilities in a US state needed to modernize its network infrastructure to support :
  - New application deployment in an agile way
  - Enhanced Security
  - Services while ensuring HIPAA compliance
  - Protect Patient Data
  - Operational efficiency

Solution

- DevSecOps toolset
- Cisco Experts developed and Implemented an automated solution using a combination of Python, Ansible, and Terraform
- Built a simulated lab before rolling out the solution into production
- Develop golden templates to automate network provisioning, application deployment and policy enforcement

Result

- New Application deployment time reduced from weeks to days
- End-to-end segmentation policies deployment timeline reduced from months to weeks
- Increased operational efficiency and business agility

Case Study : Financial Customer
Security Migrations and Chaos Engineering practices for Application availability

Challenge

- Large financial customer with international presence.
- Business customers running different flavors of VPNs to the bank need to be migrated to consolidate and control the security.
- Availability & redundancy are to be ensured during migration & operation.
- Datacenter utilizes an Active-Standby Redundancy model. Reliability of the Payment applications for business customers needs to keep up with zero downtime even during maintenance

Solution

- Design a modularized Firewall migration tool which converts multivendor firewalls to an intermediate form, and convert to the target firewall platform
- Bring in Chaos engineering practices to simulate the Datacenter gateway failures to ensure availability for Payment solutions applications
- Integrate Chaos engineering test procedures to the CI/CD pipeline

Result

- Firewall migration for 2500 sites completed within 6 months timeframe
- Application availability is assured by using the Chaos engineering test procedures implemented in the datacenter simulated environment to validate any hardware or software changes
- Extended the chaos engineering practices for Campus and WAN connectivity to ensure service availability before any production changes

Case Study : SaaS Customer
Customer Onboarding & Removal , Add on DR capability options

Challenge

- SaaS Customer who provides 30+ applications to mid and large market segments
- Security, admission control and Billing are the key business outcomes
- Time to Provision a new customer takes almost 8 weeks from order
- Scaling the existing customer requirement takes takes almost 3 weeks time
- DR functionality to Public cloud lacks security policy extension

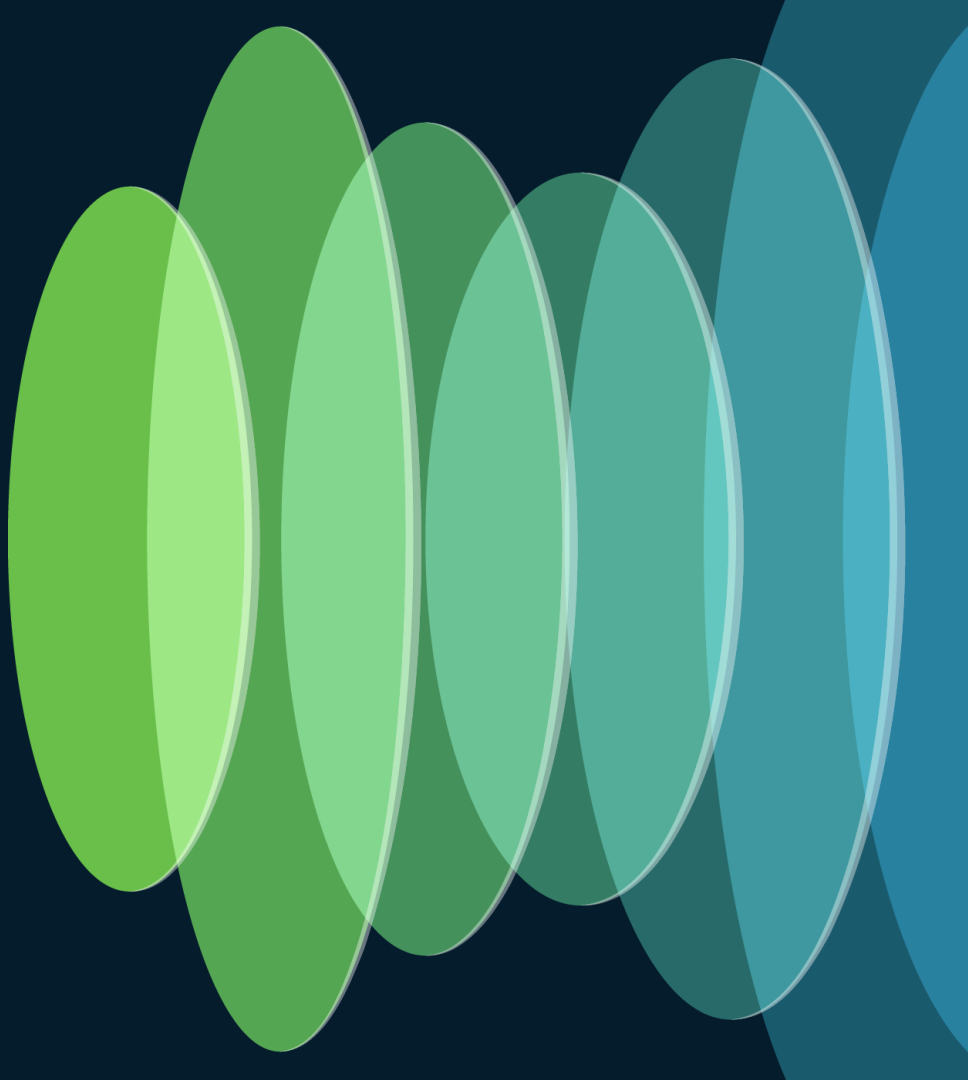
Solution

- Design
  - ACI multitenant environment to meet the security requirements
  - Public cloud extension for DR
- Automation
  - Automated the provisioning and Removal using Python SDK
  - Automated Public cloud provisioning using Terraform
  - Service device configs using Ansible
- Validations
  - Pre-change validations before software upgrades or policy change
  - Delta analysis ensured no anomalies after the change
- Integrated the whole process into CI CD pipeline to automate the overall change management procedure

Result

- Application Provisioning time reduced from 8 weeks to 20 minutes
- Scale out duration changed from 4 weeks to 1 day
- Ensured DR option at 20% of the cost to the customers to purchase as an add on option
- New datacenter build time reduced from months to weeks

Best Practices & Key Takeaways



Key Takeaways

- Executive Commitment
- Start with an Automation strategy advisory Consulting engagement
- Designated PMO and AMO office in place
- Focus on transforming People , Process & Technology Pillar
- Train Cisco resources – Devnet , Cisco-As-Code
- Select an enterprise-grade Automation platform
- Adopt SDLC by following DevSecOps methodology
- Build an Automation CoE
- Measure the Performance and aim for continuous improvement

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Thank you