Updated August 2019

Cisco Workload Optimization Manager

Workload optimization and automation for multicloud environments

Speaker name
Speaker title

Agenda

- What is Cisco Workload Optimization Manager?
- Customer benefits
- How it works
- Integrations with broader Cisco Multicloud portfolio
- Cisco IT success story
- Appendix: Complementary capabilities in VMware environments

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Workload assurance and optimization is a complex problem

- Workload deployments will continue to increase in volume and frequency.
- Multi-cloud environments expand workload placement options, increasing cost overruns and compliance risks.
- Tradeoffs must be made in real time to keep pace with the business.

Decision automation is required

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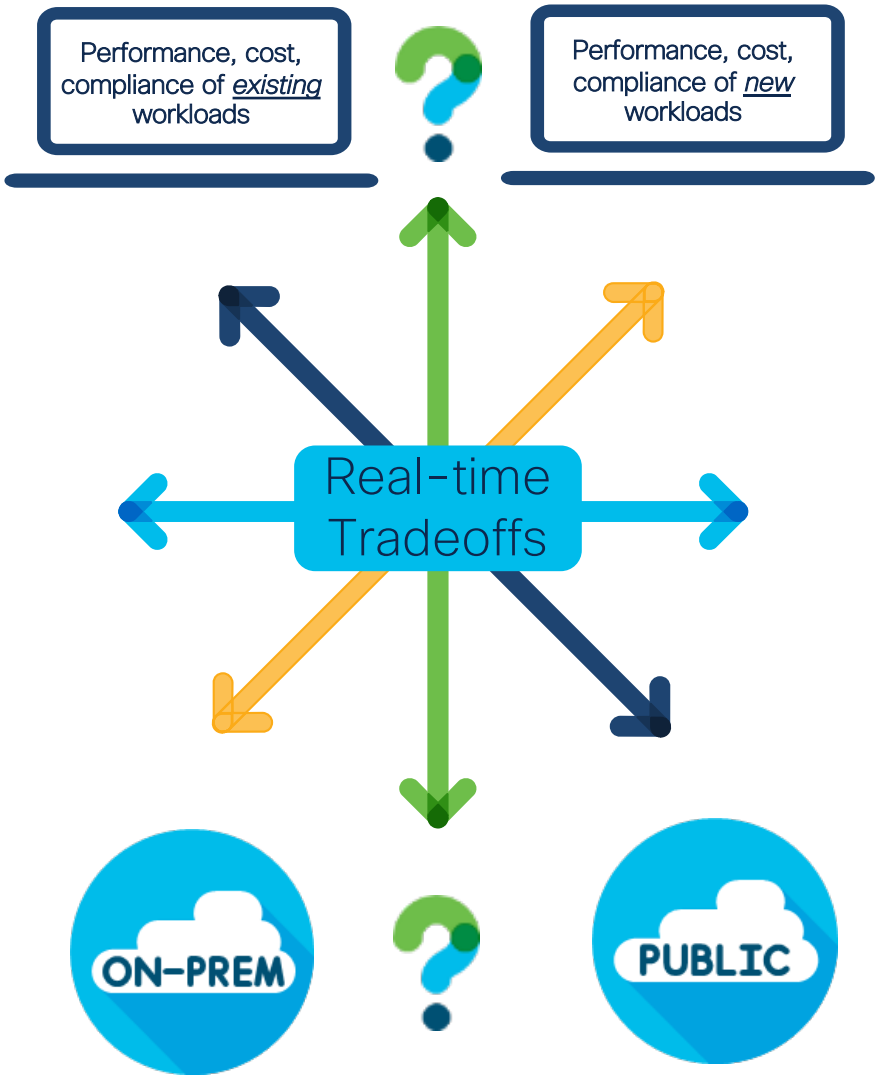

Simultaneously assuring workload performance and compliance while maximizing utilization

The Desired State

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CCWOM: Driving Toward the Desired State

Always solving for, simultaneously:

1. Better Performance
2. Increased Compliance
3. Lower Costs

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What is Cisco Workload Optimization Manager?

A decision engine for hybrid cloud environments

- Software that continuously analyzes workload consumption, costs, and compliance constraints and automatically allocates resources in real-time, on-premises and in the cloud.
- It assures workload performance by giving workloads the resources they need when they need them.

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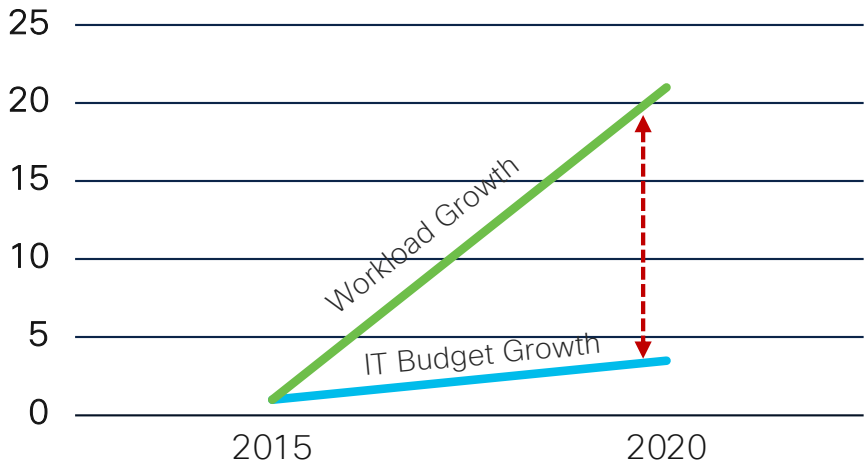
Performance is Critical, but Budgets are Flat

- Outages are labor intensive
- Workloads grow but hardware spend doesn't
- IT fights to keep head above water



How do you assure performance?

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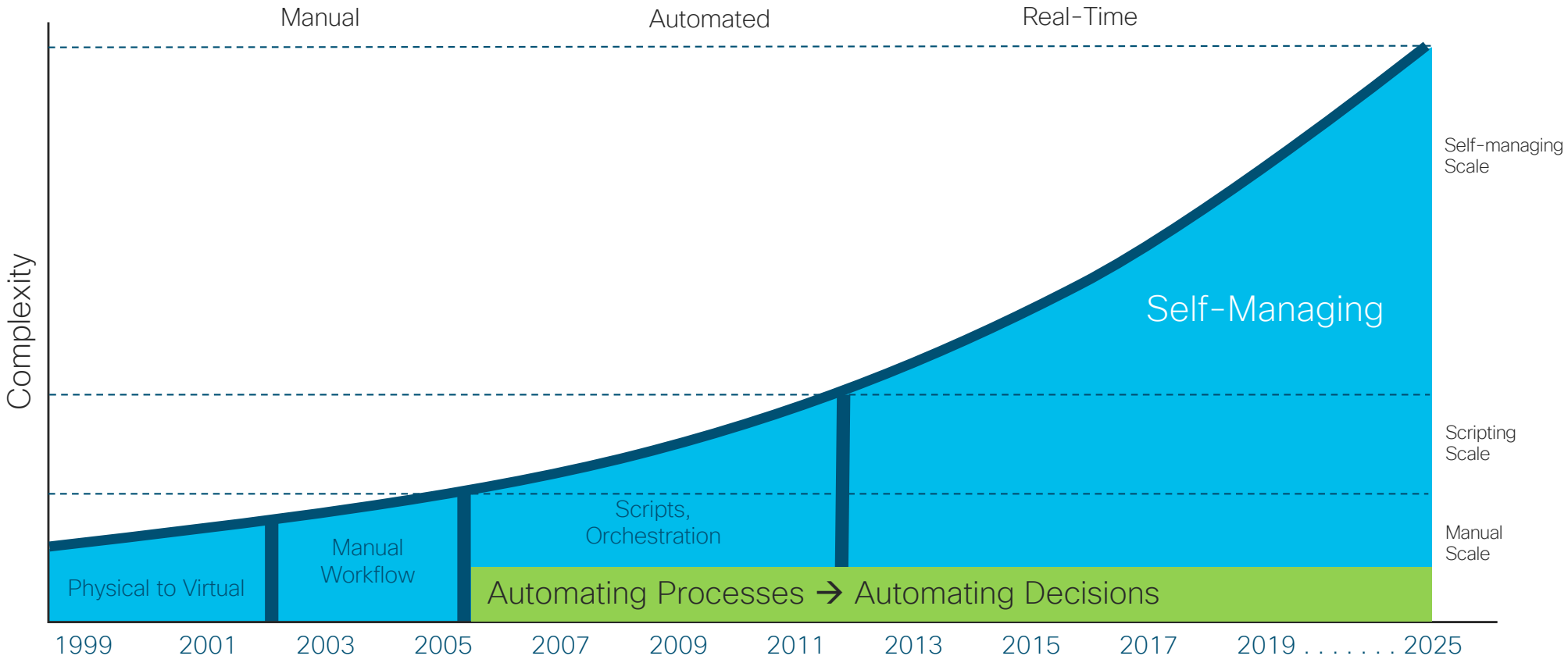
Evolution of Automation



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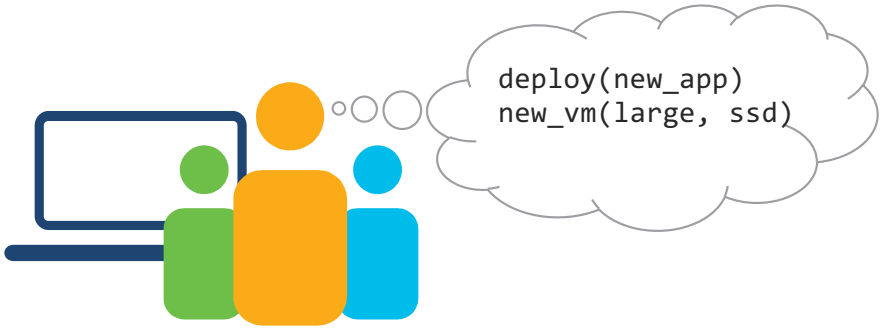
Process Automation versus Decision Automation

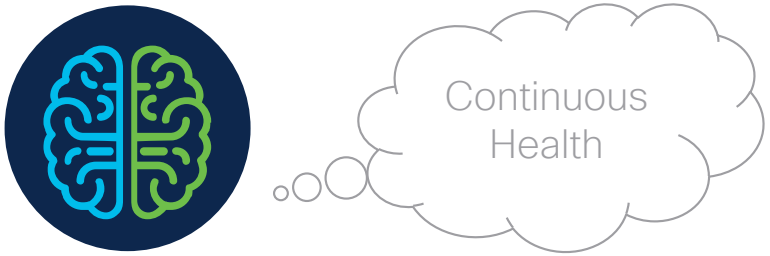
Process

- Problems typically addressed after alerting—reactive
- Labor intensive
- More data = more noise



Decision

- Problems typically addressed before alerting—preventative
- Little to no human intervention
- More data = better decisions



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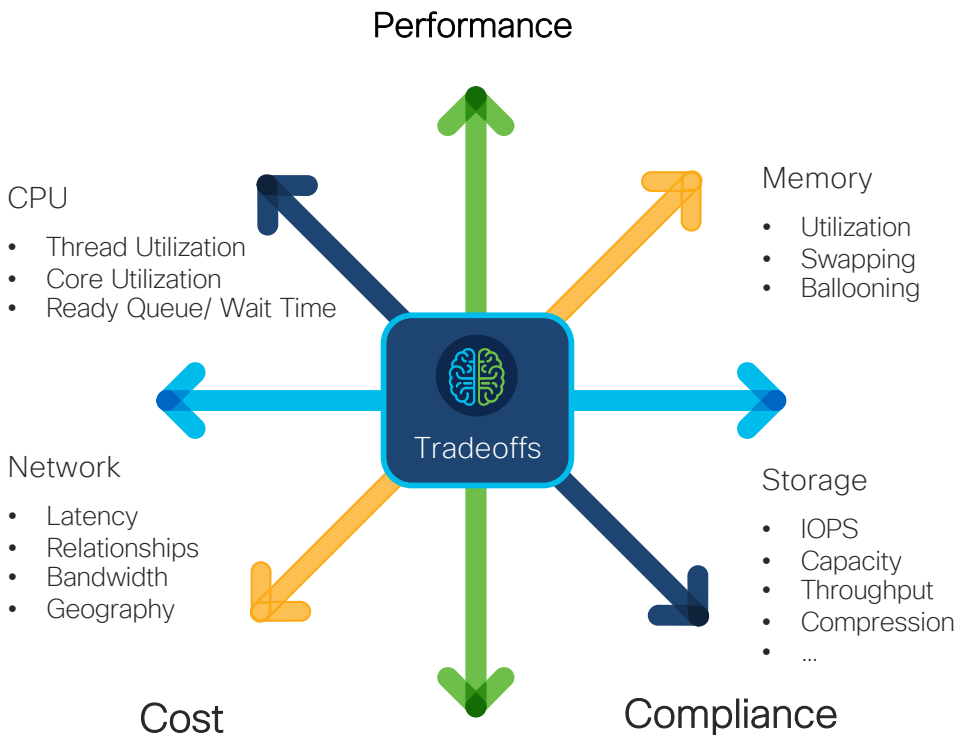
Dynamic Adjustment

- Navigate multiple tradeoffs
- Operate in real time
- Self-managing

- Initial Workload Placement
- Increase Resources
- Decrease Resources
- Move Workload
- Retire Resources



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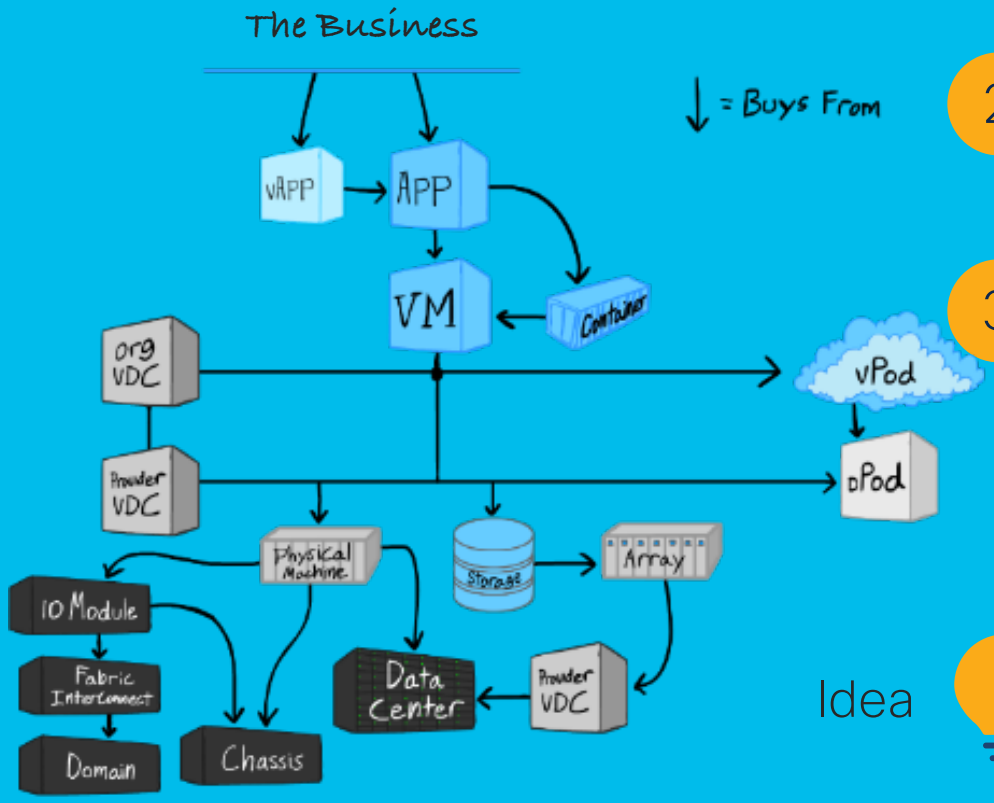
How does CWOM automate decision-making?

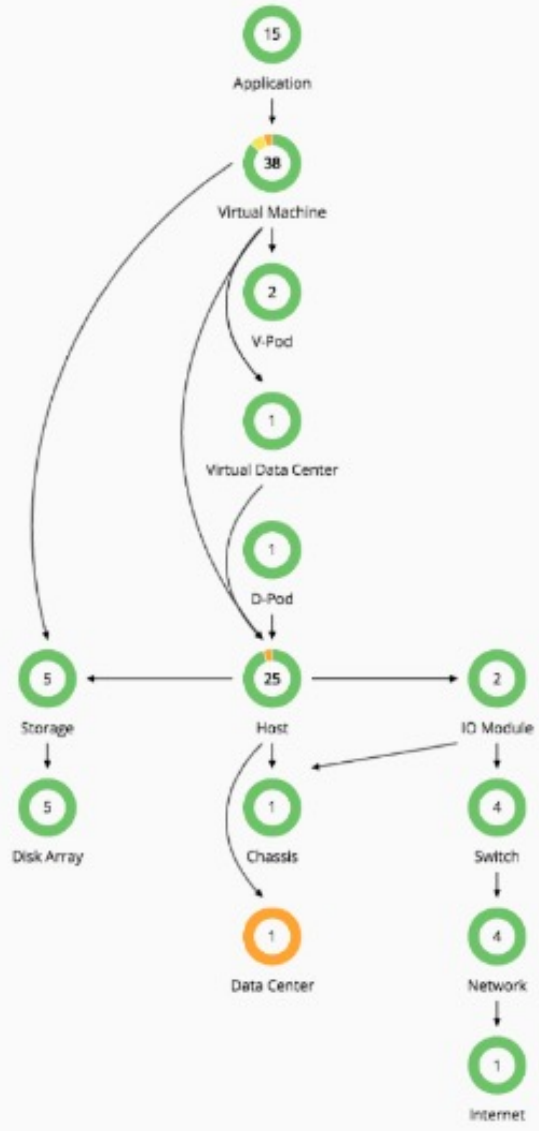


1 **Abstraction:**
Supply Chain

2 **Analytics:**
Supply, Demand, Price

3 **Automation:**
Real-time action
- Placement
- Scaling
- Capacity

Idea → Solution



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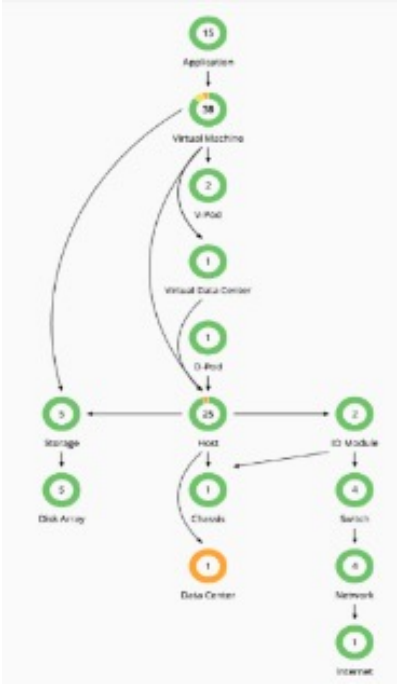
Cisco Workload Optimization Manager
Integrations with broad ecosystem

Microsoft Hyper-V
kubernetes
vmware vSphere
cloudstack
openstack
CITRIX XenServer
CISCO
Compute Platform

Microsoft Azure
SOFTLAYER an IBM Company
amazon web services™
Public cloud

UCS Manager
UCS Director
CISCO
HYPERFLEX
APPDYNAMICS
ACI
Tetration
CloudCenter
Cisco Integrations



Storage
NetApp
PURE STORAGE
HITACHI
DELL EMC
Hewlett Packard Enterprise
3PAR

Applications
IBM WebSphere
Exchange
ORACLE FUSION MIDDLEWARE WEBLOGIC SERVER
Apache Tomcat
JBoss by Red Hat

Databases
MySQL
Microsoft SQL Server
ORACLE

Cisco Workload Optimization Manager Integrations
Delivering value across the stack and into the cloud

Application-Aware Infrastructure
Drive better optimization through the infrastructure with AppDynamics metrics.

Self-Managing Container Platforms
Accelerate cloud native projects with production-scale Kubernetes, OpenShift & Cloud Foundry.

Multicloud Deployment
Deploy workloads with Cisco Cloud Center, optimized for performance, cost, & compliance with Cisco Workload Optimization Manager.

Cloud Elasticity On-Prem
Safely maximize cloud elasticity in Cisco HyperFlex & UCS environments.

Super Cluster Optimization
Extend the hypervisor platform and maximize virtualization and Cisco Hyperflex investments.

Multicloud Dynamic Optimization
Optimize performance, cost, & compliance in the data center or public cloud (AWS and Azure) with one platform.

Network-Aware Optimization
Reduce latency by dynamically localizing "chatty" workloads with Tetration Analytics

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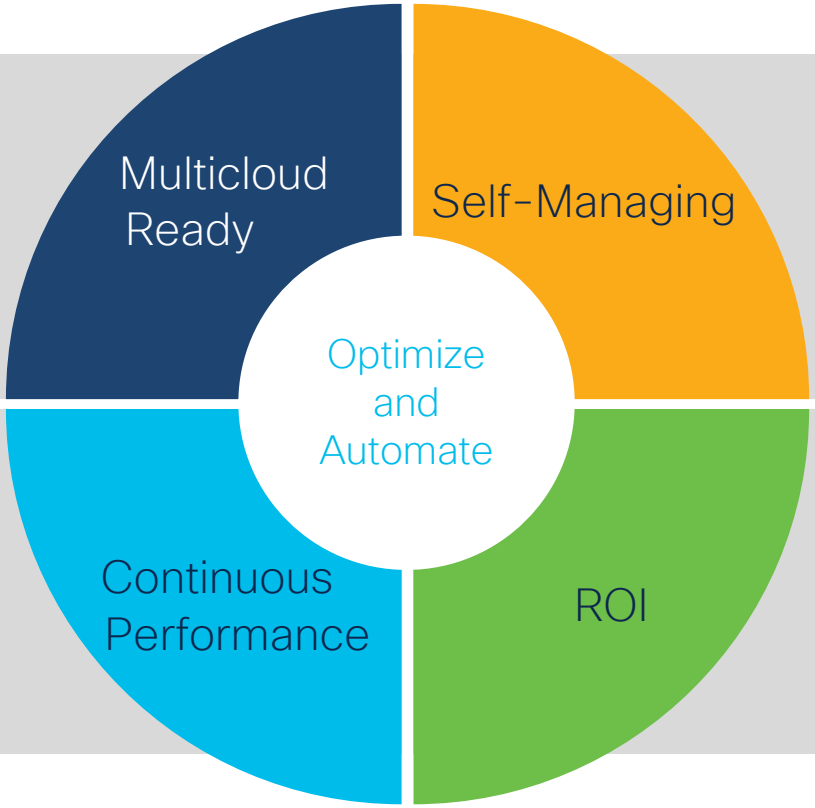
Cisco Workload Optimization Manager
Ensure continuous application performance

Any workload, any infrastructure, anywhere



Decision automation enables real-time optimization at scale

Real-time micro improvements preempt degradation

91% of users see ROI in 90 days or less [1]

[1] TechValidate Research

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Proven Business Outcomes

Better application response time.[1]

Increase utilization by 20% or more.[2]

Reduce user generated tickets by 20% or more.[3]

See ROI within 90 days or less.[4]

1. Principled Technologies Report
2. TechValidate Research
3. TechValidate Research
4. TechValidate ResearchechValidate Research

- Performance
- Efficiency
- Compliance

Let's Get Started

- 30-minute install through VM & single OVA file
- Improvement actions appear within 1 hour
- Agentless

What to Expect

Continuous Optimization

Real-time actions drive continuous performance, efficiency, and compliance.

Capacity Management

Quickly & accurately model what-if scenarios: workload growth, add/remove hardware, cloud costs

Compliance & Business Policies

Easy custom policies ensure CWOM actions abide by business and compliance requirements.

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When application workloads get the resources they need, when they need them . . .

Applications continuously perform

Resources are efficiently utilized

Cloud spend is on budget

Policies are followed

IT can innovate

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How does CCWOM work?

(How do you automate decisions?)

- Abstraction
- Analysis
- Automation

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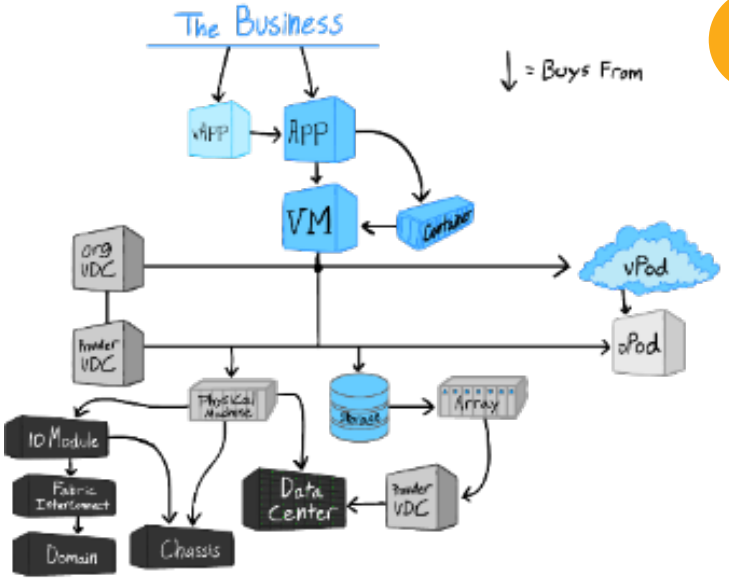
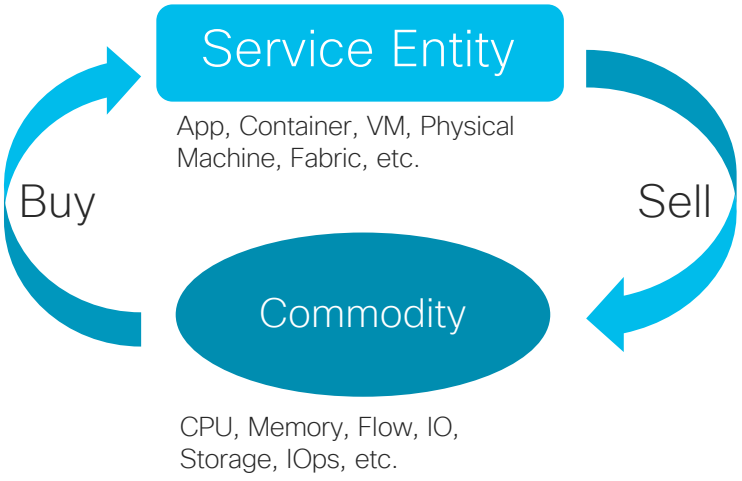
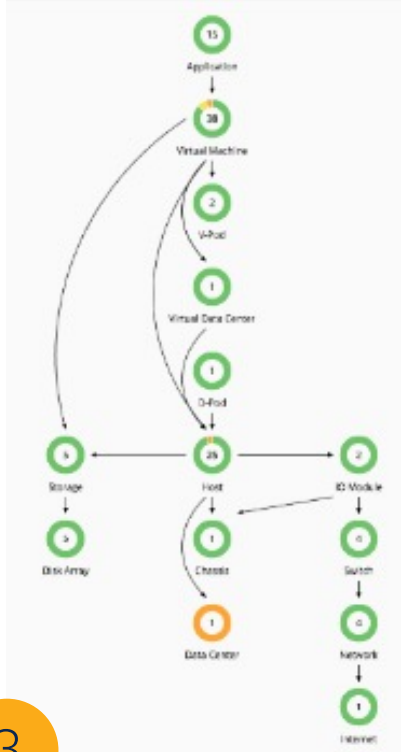
Abstraction: The Supply Chain Market



1 Everything in the data center is abstracted into a supply chain market.

2 Services entities shop for the best overall price for every commodity (resource) they need to perform.





3 Within 1 hr. you see these relationships in the CWOM UI.

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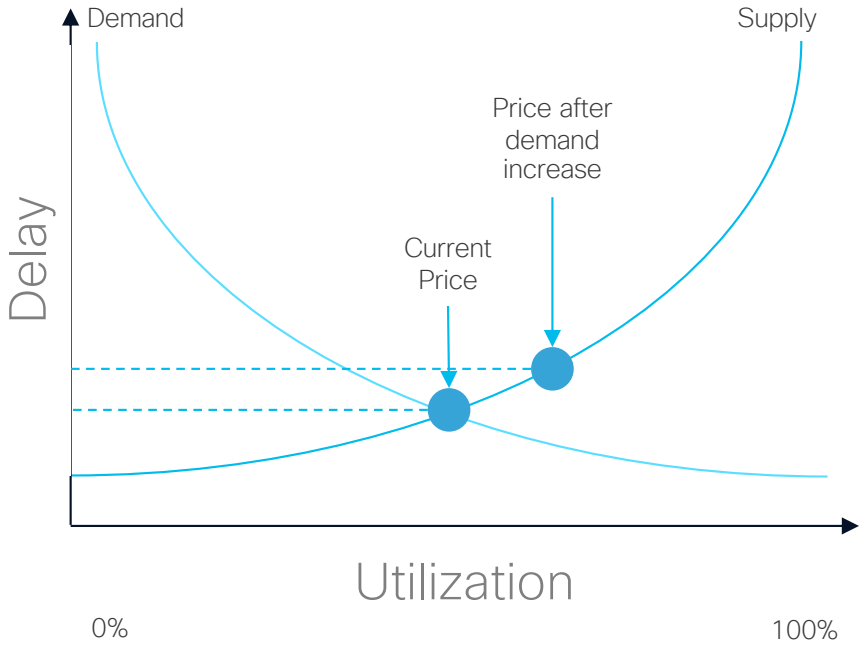
Analysis: Economic Supply, Demand, and Price



- Utilization (demand/supply) determines price.
- Workloads/service entities make scaling, placement, and capacity decisions based on *all* the resources they need.

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Automation: Real-time Action

Continuous Optimization

Real-time actions drive continuous health:

- Placement
- Sizing
- Provisioning

Capacity Management

Quickly & accurately model what-if scenarios:

- Workload growth
- Add/remove hardware
- Cloud costs

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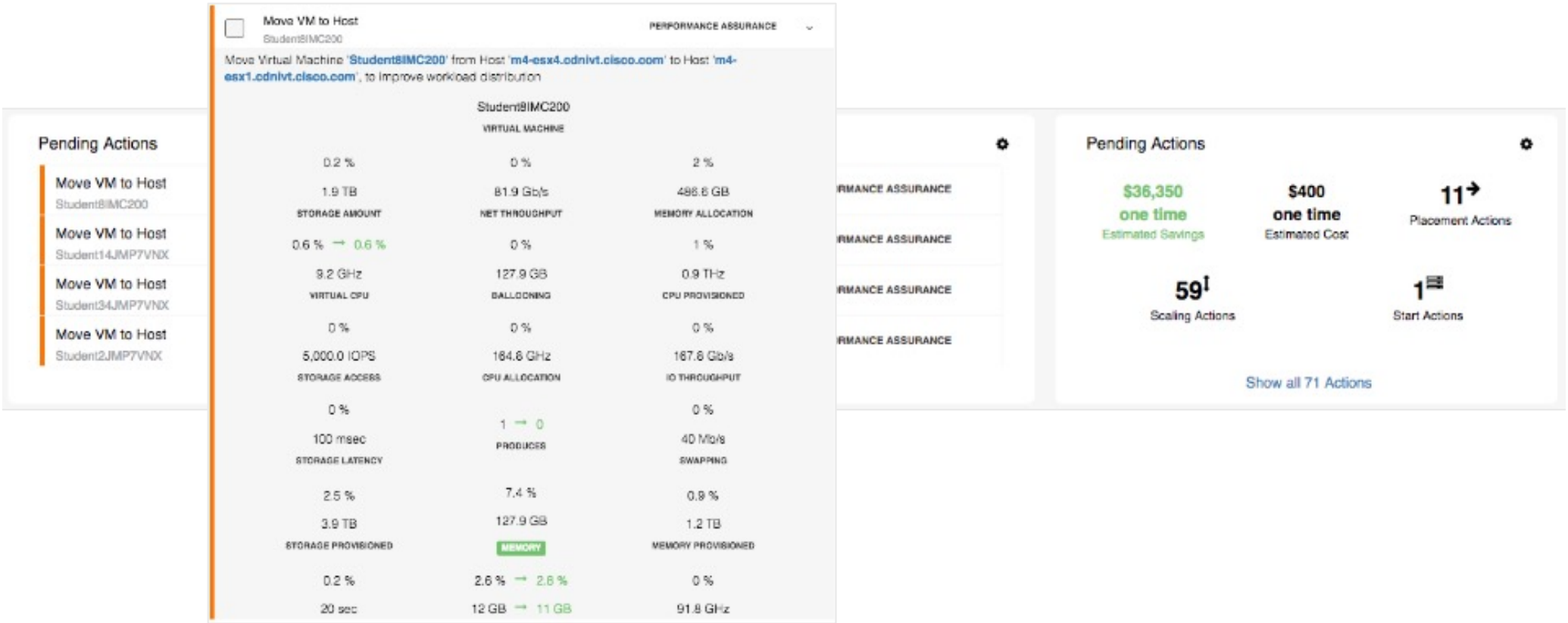
Automation: An Action, Examined

What is the logic behind an action?

Automation: Why Move?



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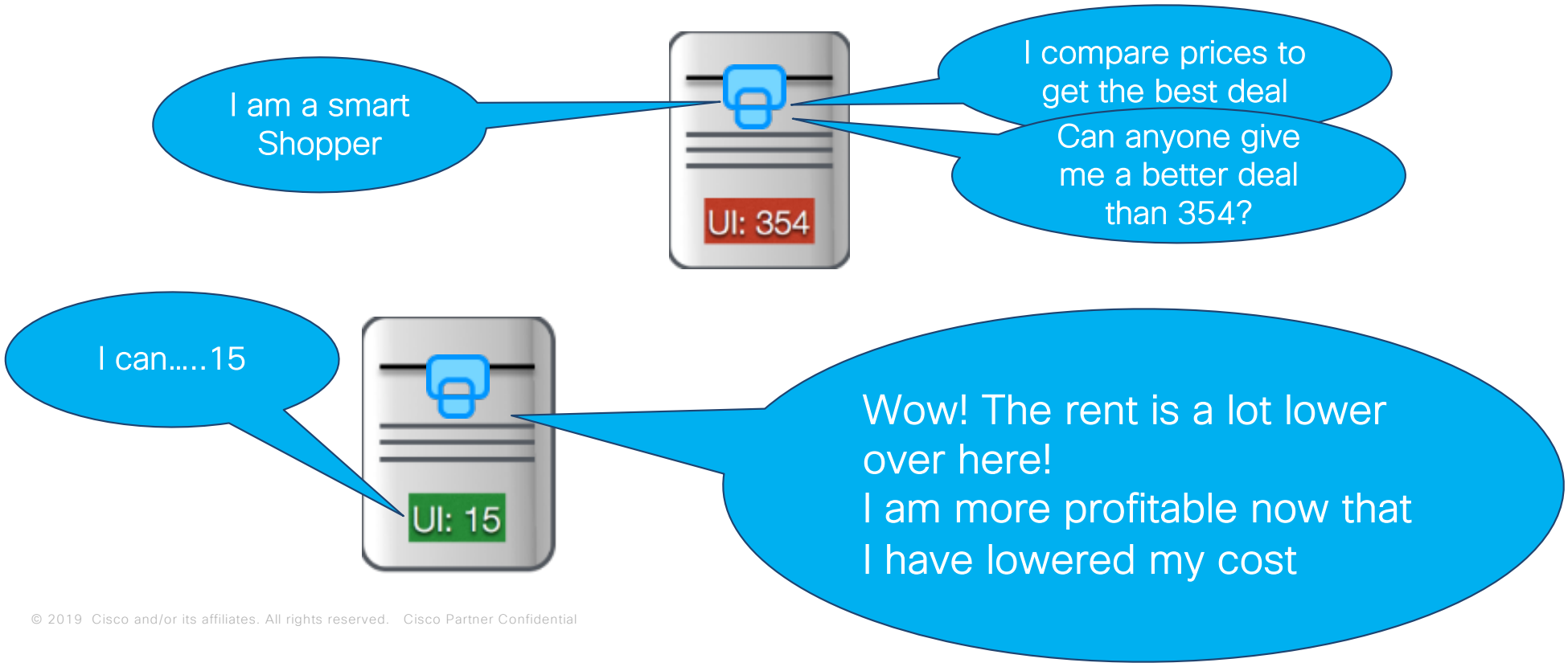
Entities in Cisco CWOM are Smart Shoppers



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Entity Behavior

- Entities in CWOM behave according to few simple heuristics
  - Shop around for resources, buy (move to) at the lowest price
  - Evaluate my ROI (Revenue - Expenses) and act accordingly
    - At Equilibrium – hold
    - Very profitable – expand my business
    - Unprofitable – contract my business

- An entity does not know (and does not need to know) the whole supply chain, just the current prices offered by all eligible providers

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Basket of Goods

- An entity buys a basket of goods from a provider
  - Example: A VM buys CPU, Mem, ReadyQueue, Ballooning, Swapping, and many other commodities from PMs

- The price charged by the provider is a function of the utilization of every commodity in the basket
  - Higher Utilization → Higher Price
  - Because of the way pricing works, the most utilized resource has the biggest effect on the overall price

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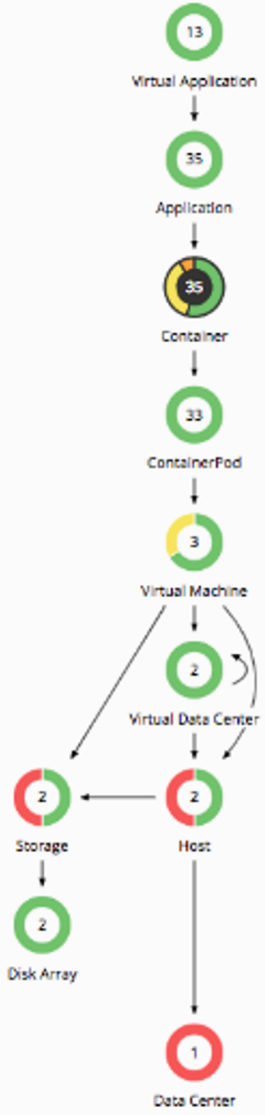
CCWOM 2.2 Highlights

- *True* application-aware infrastructure
- Dynamic optimization on HCI–super clusters!
- Self-managing container platforms
- New public cloud savings with continuous optimization of AWS RIs



APPDYNAMICS

kubernetes

OPENSHIFT

CLOUDFOUNDRY

amazon webservices

cisco HyperFlex

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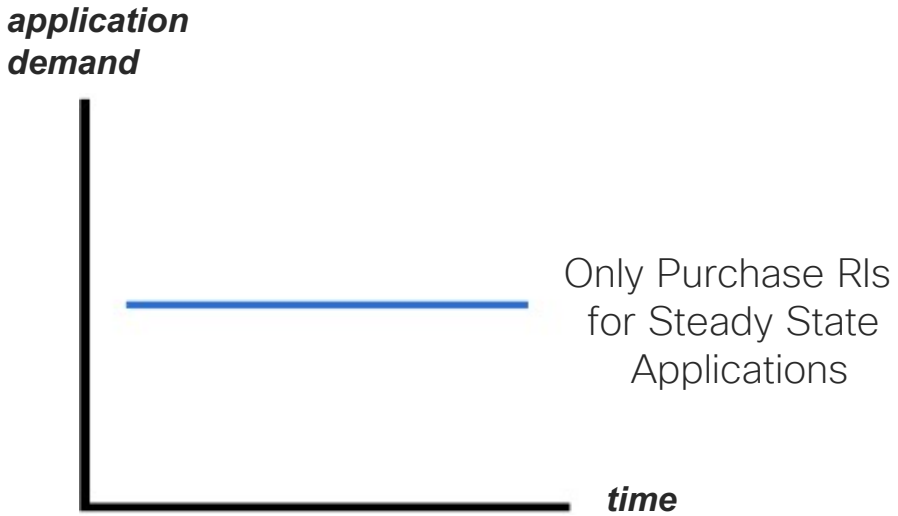
Cloud Customers Tell Us They are Struggling to Balance Elasticity and RI Savings

Some Customers try to be "Elastic" with People and Spreadsheets

Some Customers Consume the Cloud in "Static" Mode



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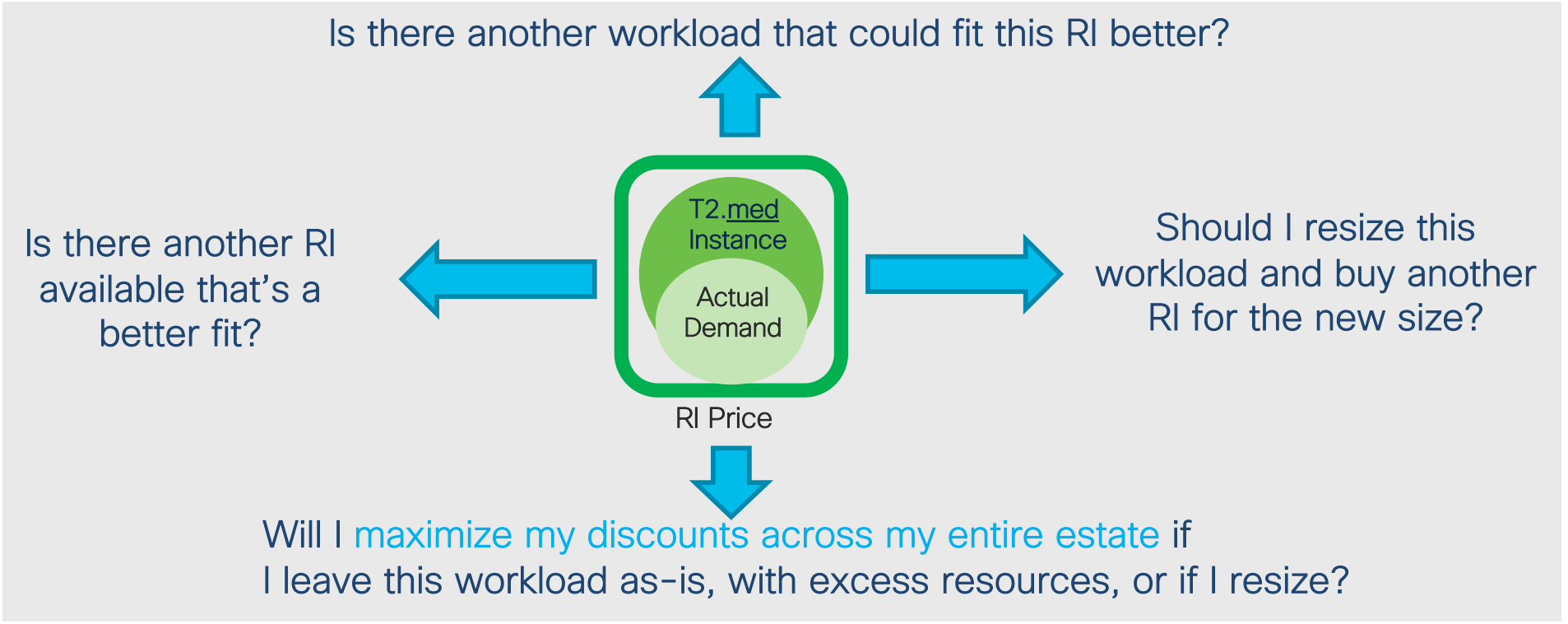
Correct sizing and coordinating with RIs is incredibly complex for even one instance

Example: AWS Instance is Over-Provisioned



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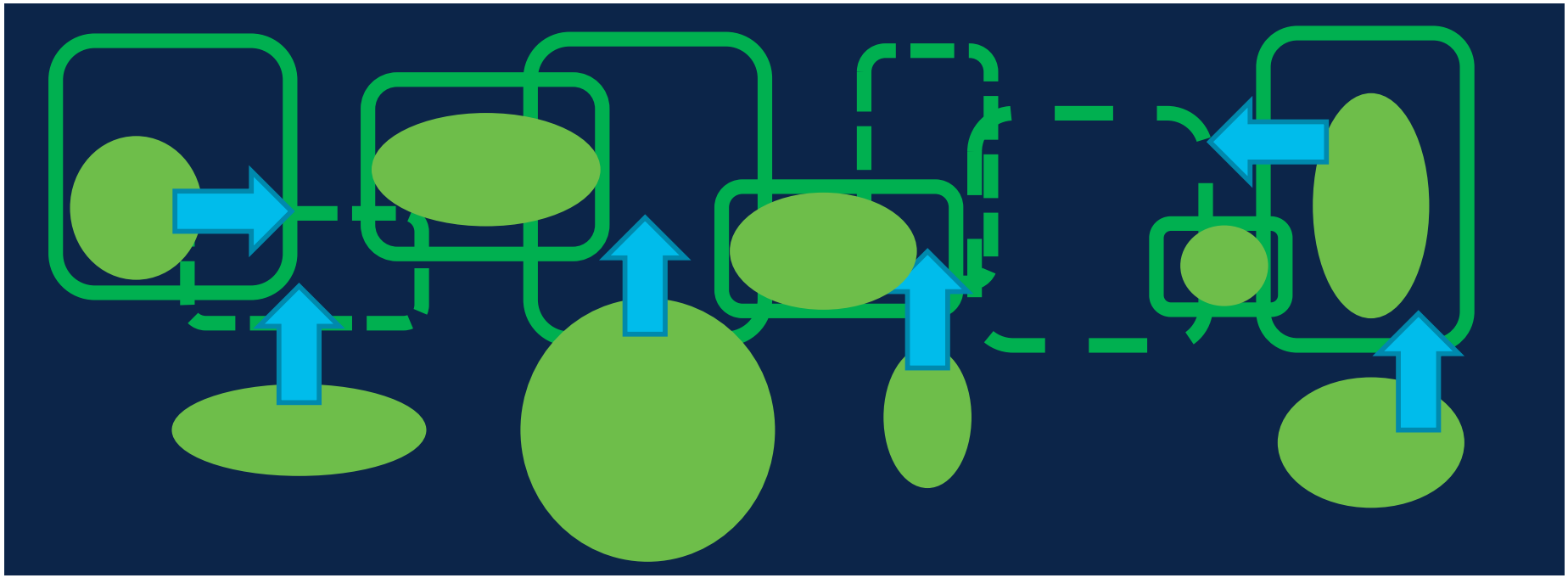
Manually Driving the Maximum Cost Savings from RIs – at Scale – Simply isn't Possible



Our customers report fluctuating workload demand that they are unable to optimally match to existing – or future – RI purchases

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New in Cisco CWOM 2.2
Continuous optimization of AWS RI consumption – in concert with resizing automation

The Cisco CWOM Decision Engine uses one "brain" to holistically:

1. Look at what RIs are available
2. Look at the workloads and their demands
3. Decide and action "best fit at best cost" for **all workloads**

- Resize up or down
- Maximize use of available RIs
- Recommend new RI purchases

Result: Continuously Maximizes RI Savings Across the Entire AWS Estate

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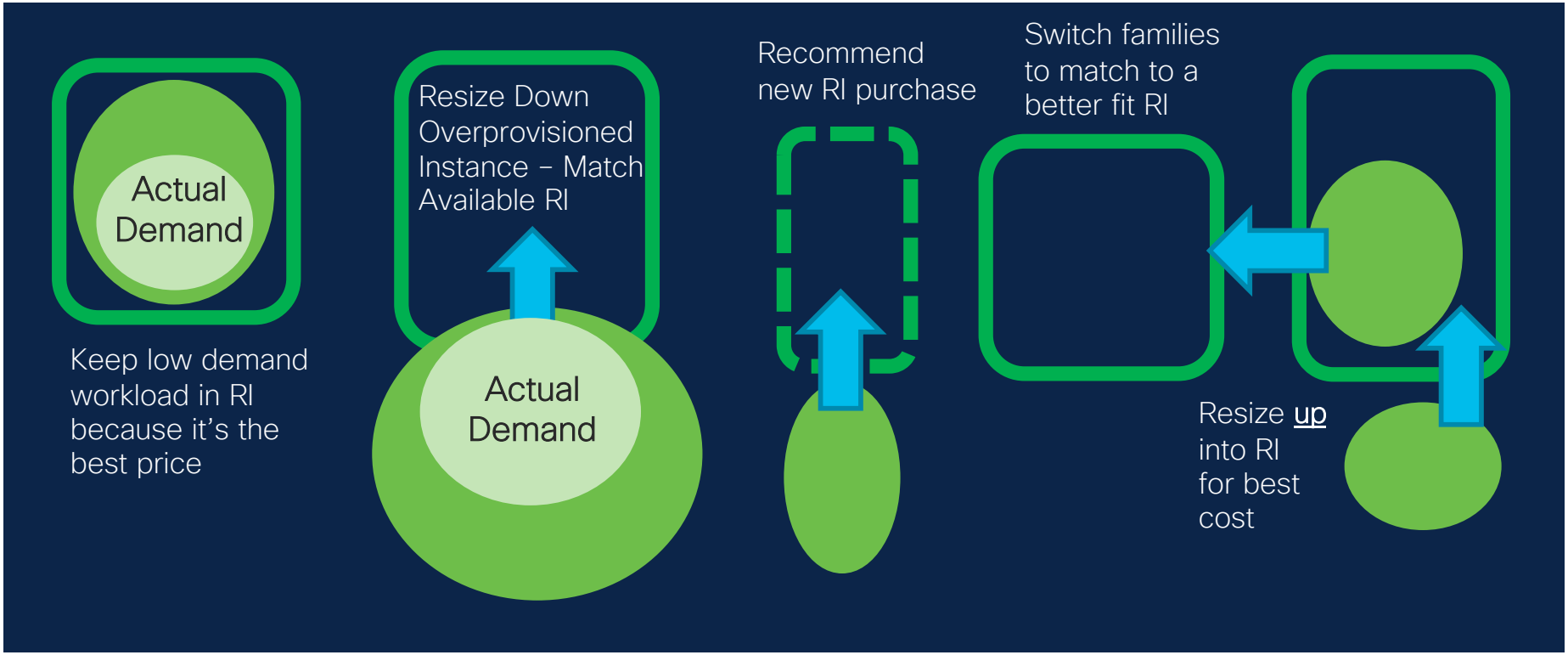
New Cisco CWOM 2.2
Example: Cisco CWOM decisions that are coordinated across the estate to maximize AWS savings



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Container Projects Underway and Growing Rapidly

Management challenges, resource contention, cost over-runs are right behind

CCWOM now optimizes and automates container platforms

kubernetes

RED HAT OPENSHIFT

Pivotal Cloud Foundry

Smooth sailing with Self-Managing Kubernetes

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Self-Managing Container Platforms

Self-managing workloads optimize container platforms so IT organizations can scale and accelerate cloud native strategies.

Results:

- ✓ Minimal human intervention – no thresholds to set!
- ✓ Automated rescheduling of pods assures performance
- ✓ Intelligent cluster scaling ensures elastic infrastructure
- ✓ Full-stack control unites DevOps and Infrastructure

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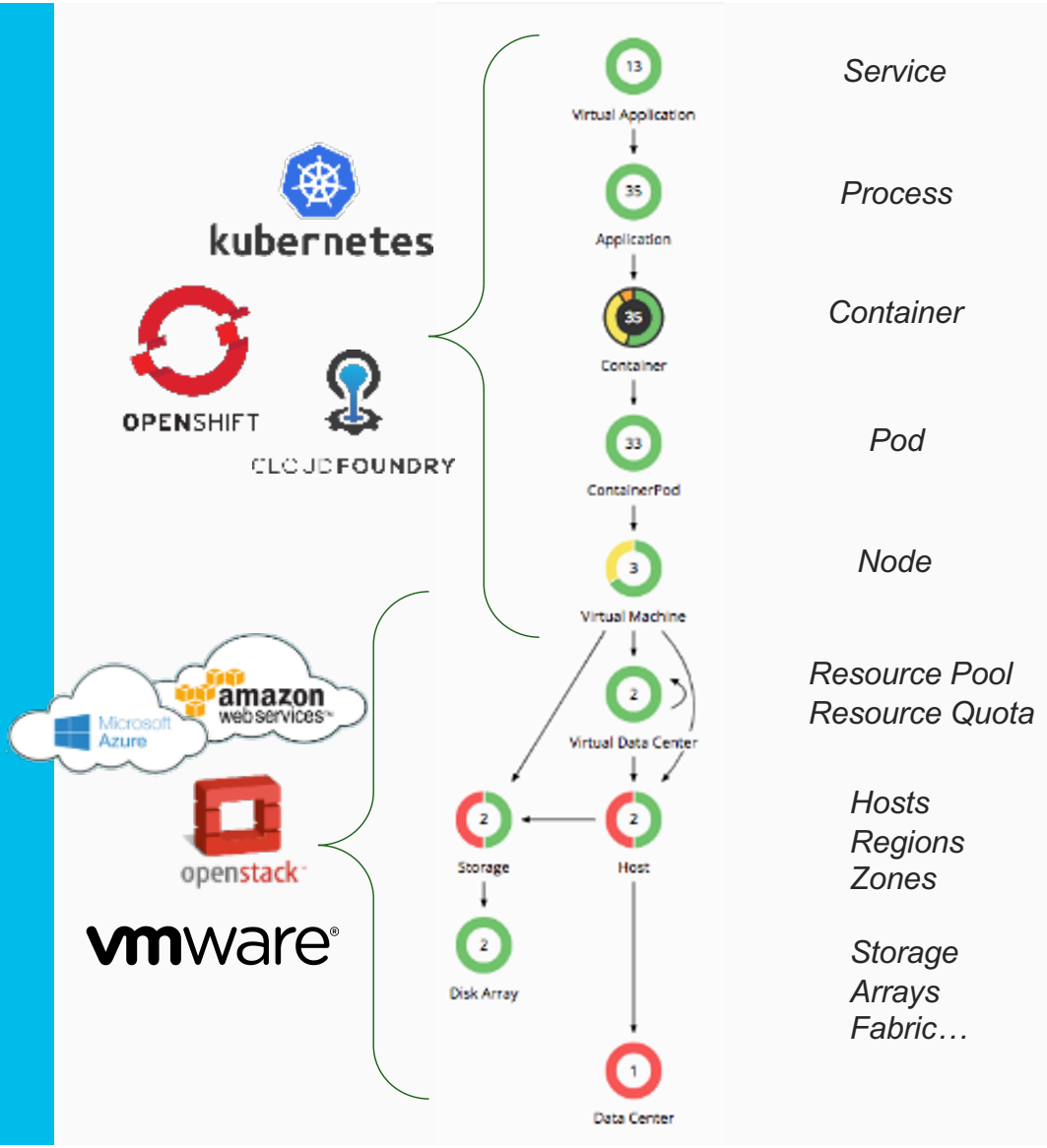
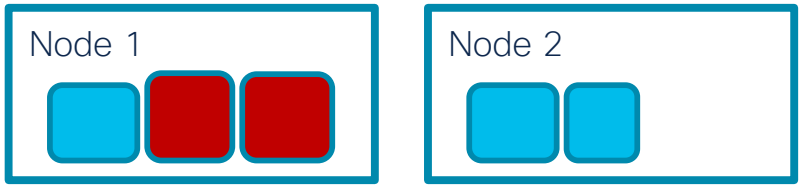
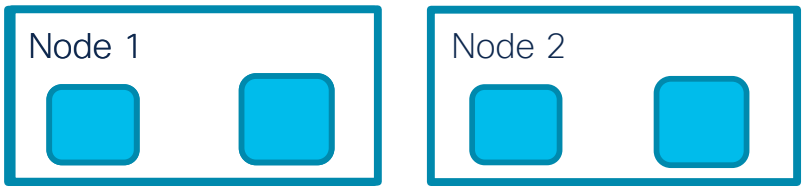


The Need for Continuous Placement: Pod Rescheduling



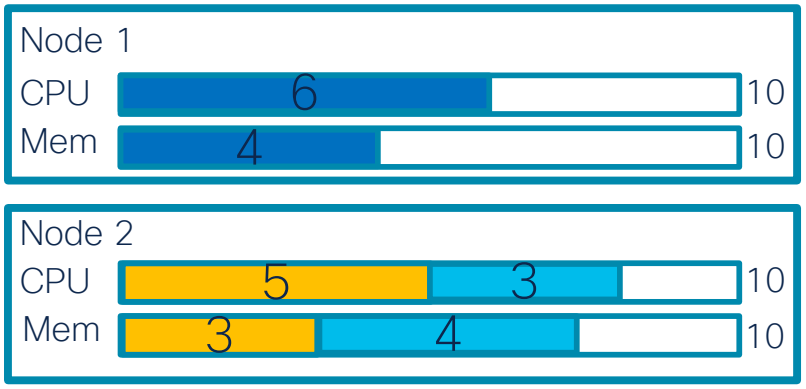
Avoid Noisy Neighbor

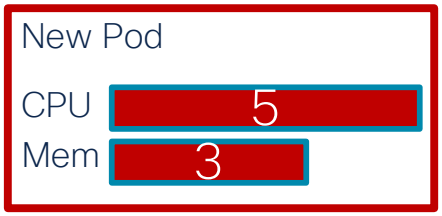
- Workload that always peaks together



Avoid Performance Degradation

- CPU starvation due to node cpu congestion





Avoid long pending pod

- Resource Fragmentation

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General 2.x Platform Enhancements

CCWOM 2.0 introduces an enhanced decision engine which will provide the following benefits:

- Greater speed in Real-Time Operations and Decisions
- Significantly faster run-time for environment modeling, simulations via plans
- CPU Capacity support: now understands differences between different generations of CPU architectures for more accurate planning and recommendations

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Industry Standard SPEC CPU Benchmark

CCWOM 2.0 understands the differences between CPU generations/architectures

Vendors publish metrics

CCWOM gets periodic updates

Hardware Vendor	System	# Chips	# Cores Per Chip	Processor	Processor MHz	Baseline
Cisco Systems	Cisco UCS C220 M4 (Intel Xeon E5-2637	2	4	Intel Xeon E5-2637 v3	3500	61.1
Cisco Systems	Cisco UCS C220 M4 (Intel Xeon E5-2637	2	4	Intel Xeon E5-2637 v4	3500	65.1

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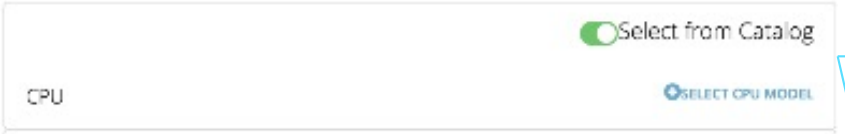
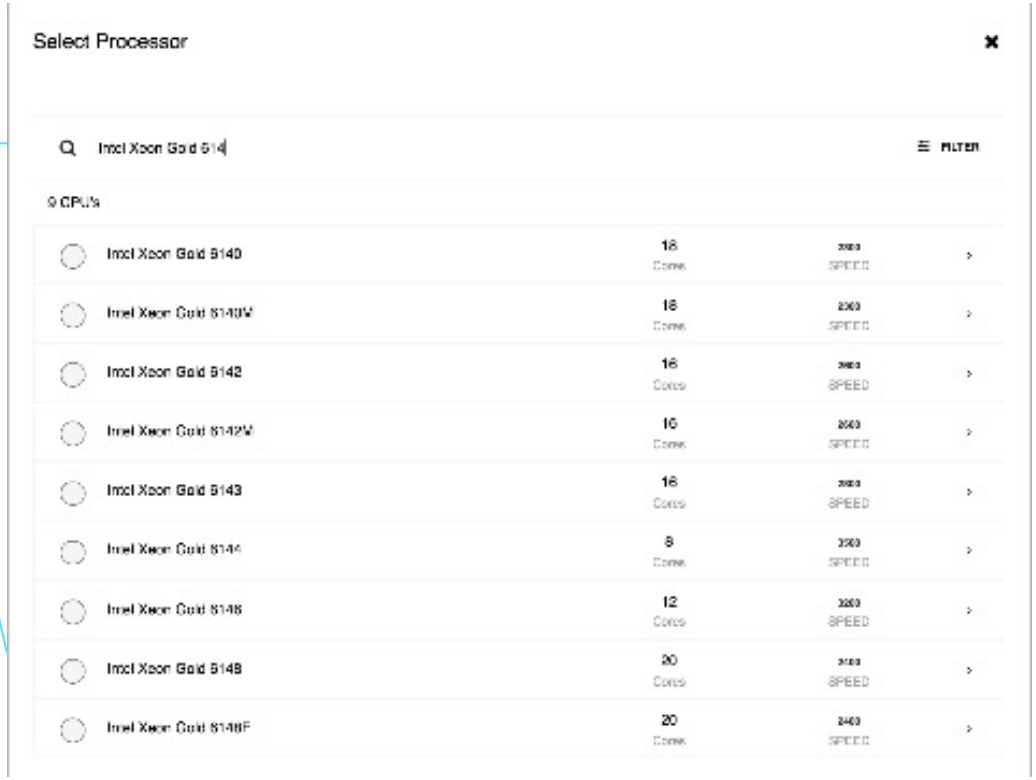
How to enable CPU Capacity





- To add CPU model to existing template:
  - Settings → Templates
  - Edit Template
  - Toggle “Select from Catalog”
  - Choose specific CPU
- Run any plan with this template

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CWOM & UCS Manager

Optimize workloads across UCS estates with integrated knowledge of fabric, IO modules, power & cooling.

Context

- IT must move quickly to keep up with business needs.
- Programmable infrastructure increased IT agility.
- But, what about the workload?

IT agility =

simplified infrastructure management
+
workload performance

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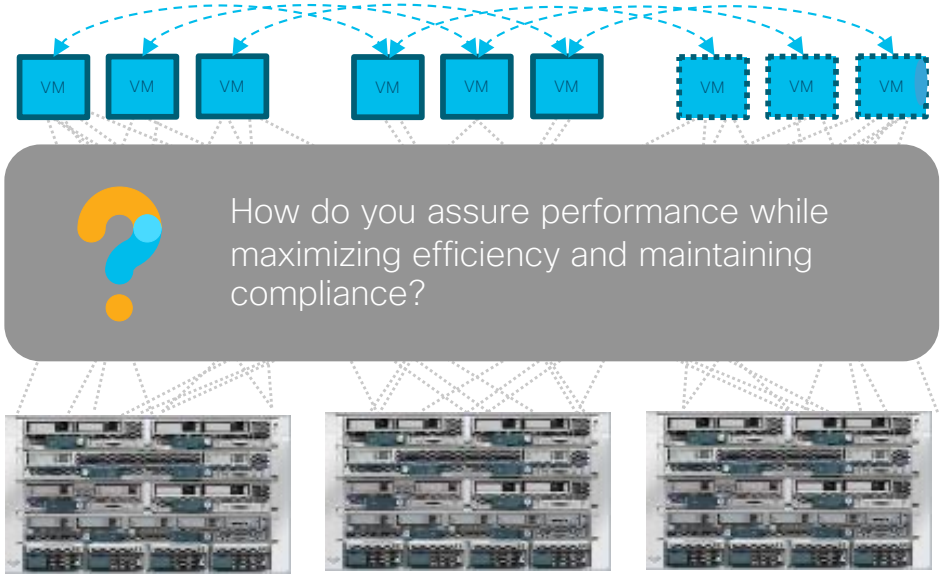
Problem

Application consumption has implications from the virtualization layer to the physical layer, including fabric, IO modules, power & cooling.



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What actions does it automate?

Documented benefits of CWOM automated on UCS...

- 33% increase in orders per minute
- 24% better response time

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Enhanced VM intelligence when...
- Provisioning additional resources (vMem, vCPU)
- Moving Virtual Machine
- Moving Virtual Machine Storage
- Reconfiguring Storage
- Reconfiguring Virtual Machine

Physical Machines
- Start Physical Machine
- Provision Physical Machine
- Suspend Physical Machine

Chassis
- Provision New Chassis (recommend only)

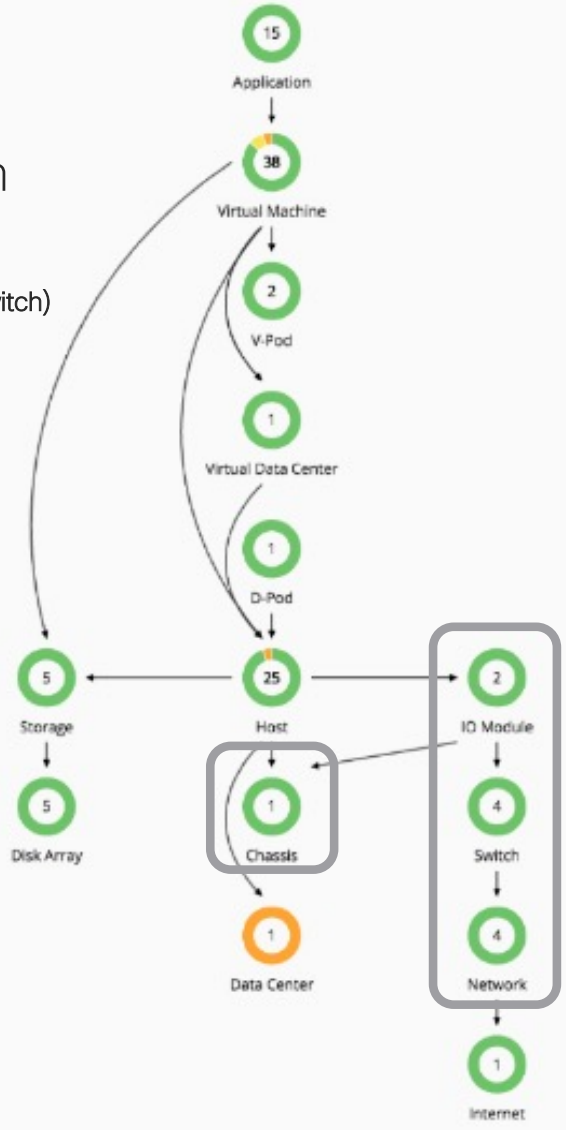
Fabric Interconnect
- Add Port to Port Channel (recommend only)
- Remove Port from Port Channel (recommend only)
- Add Port (recommend only)

How does CWOM make its decisions?

1

Extend the Supply Chain

- IO Module
- Fabric Interconnect (Switch)
- Domain (Network)
- Chassis



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How does CWOM make its decisions? (cont'd)

2

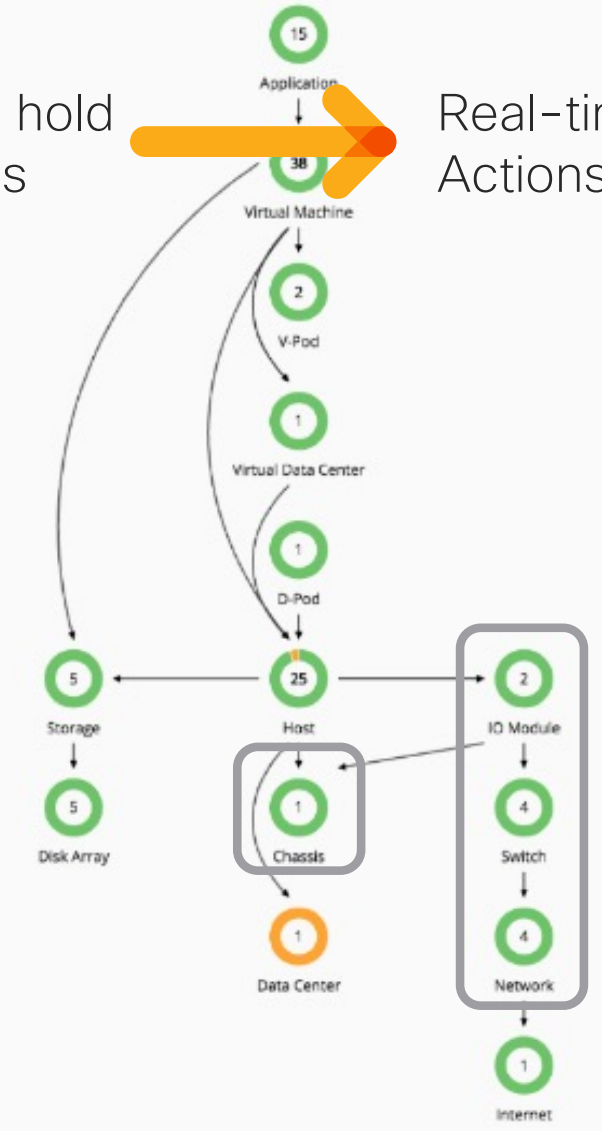
Buy, sell, or hold commodities

Real-time Actions

Chassis
- Space
- Power
- Cooling

IO Module
- NetThroughput
- PortChannel

Fabric Interconnect
- NetThroughput



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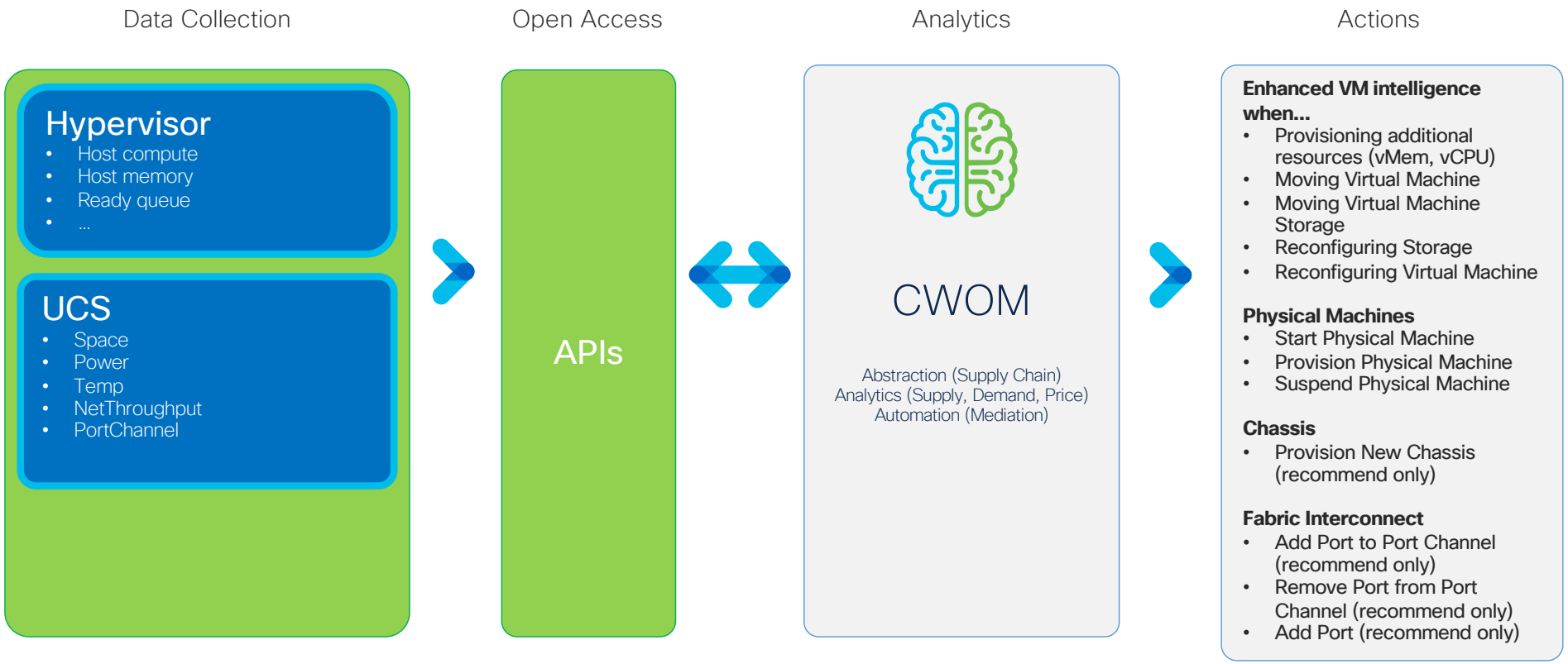
How does it work together?



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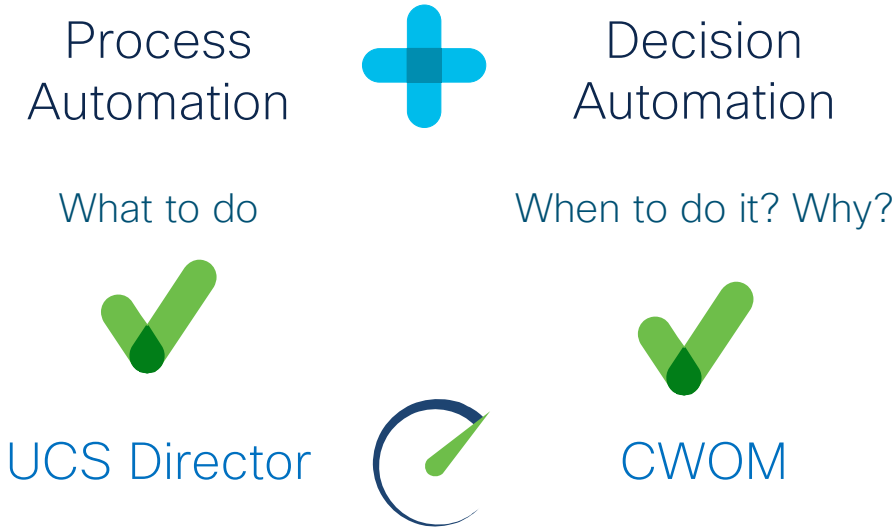
CWOM & UCS Director

End-to-end automation of the virtual, network, storage, and physical stack based on real-time workload demand.

Problem

Elastic real-time infrastructure requires two types of automation.



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What actions does it automate?

End-to-end automation...

- Provision new host
- Provision new storage
- Decommission host
- Decommission storage
- Resize storage

...based on real-time workload demand.

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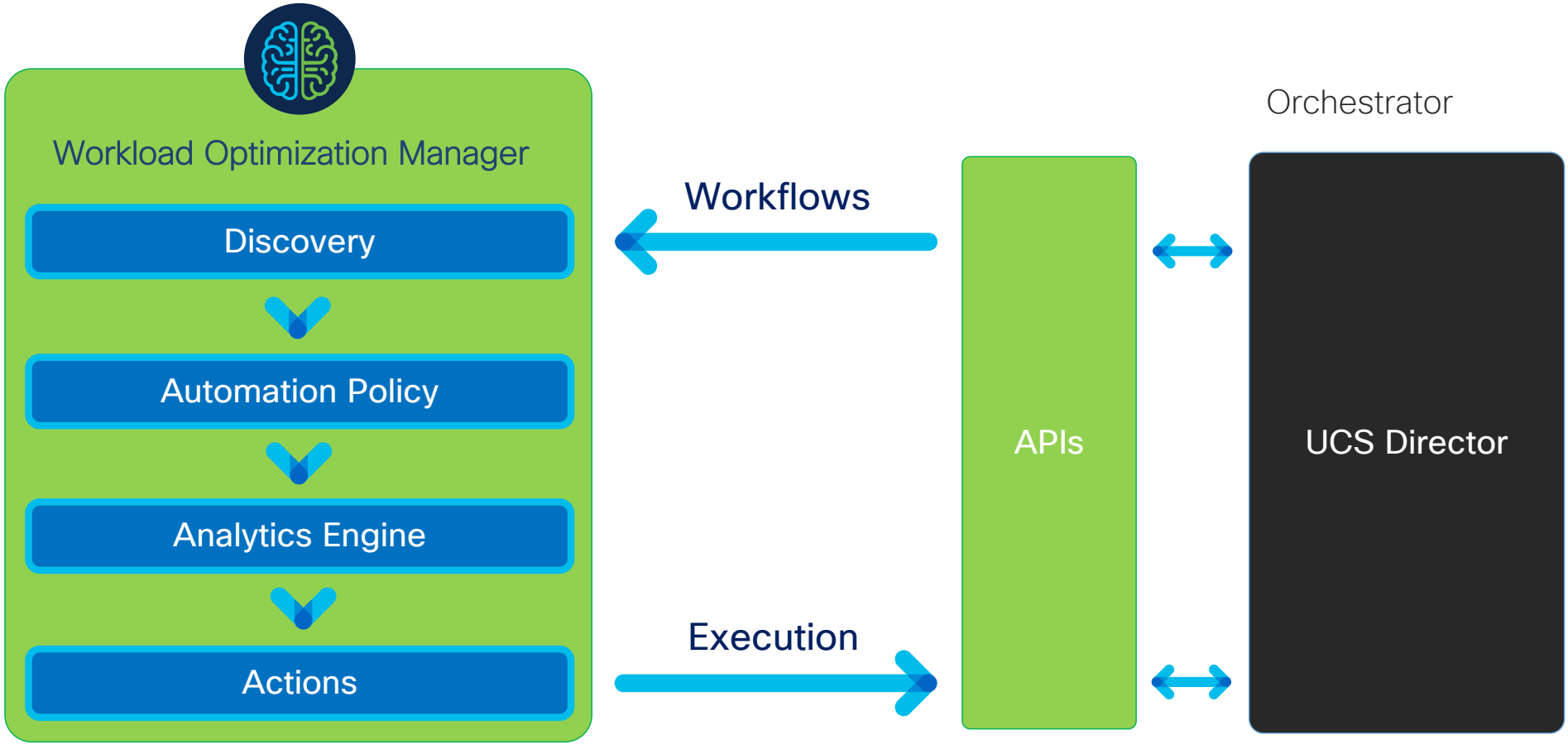
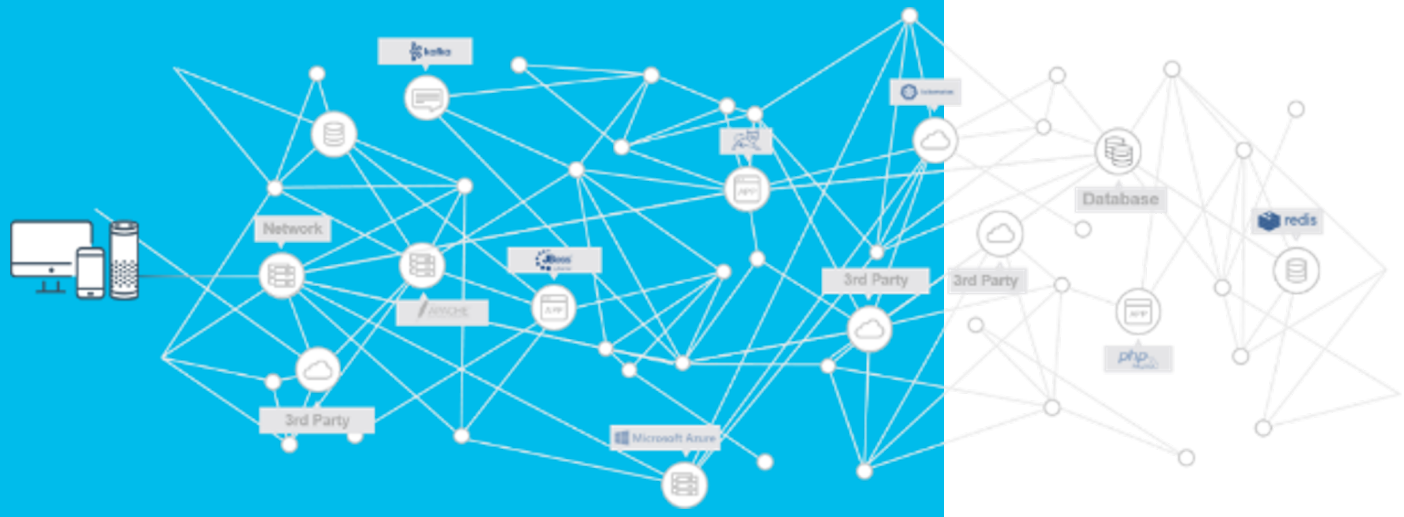
How does it work together?



CWOM & Tetration

Network-aware optimization for distributed applications

Context



New application architectures increase east-west traffic and risk network congestion.

By 2020, 86% of data center traffic will be east-west…

Network-aware optimization reduces latency.

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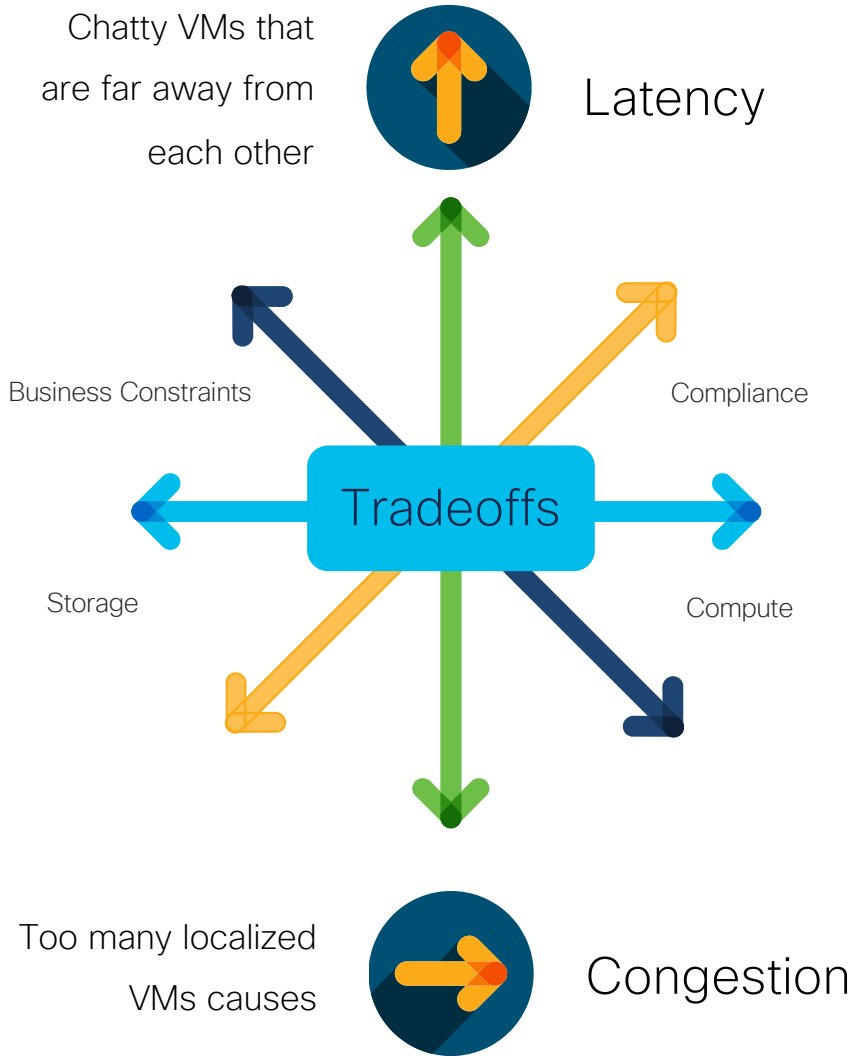
Problem

- East-west traffic growth
- More dynamic demand on networks



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What is being optimized?

CWOM reduces latency by dynamically localizing “chatty” workloads without risking host congestion and while adhering to customer’s business requirements.

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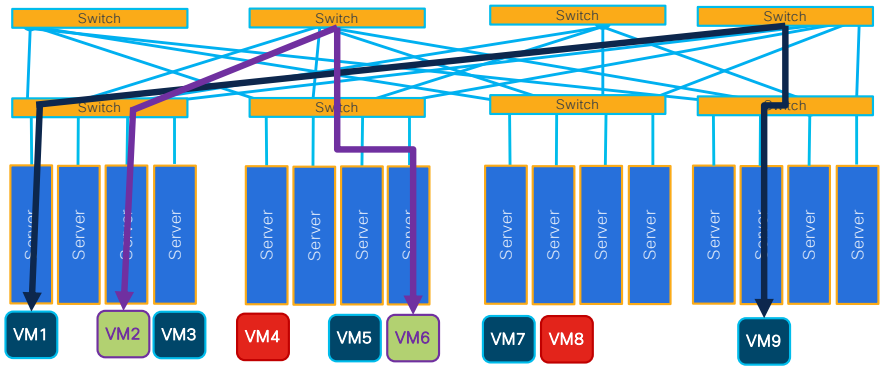
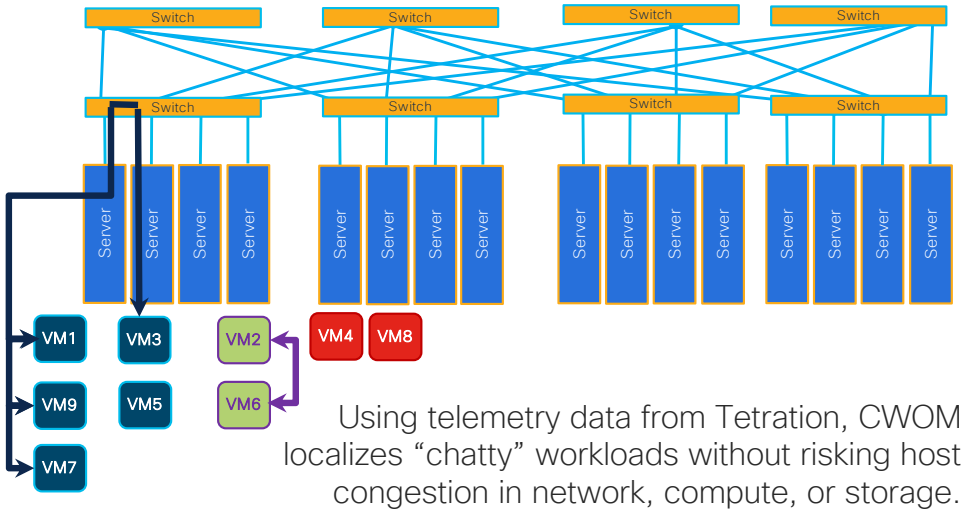


Chatty workloads across distances = latency.



Using telemetry data from Tetration, CWOM localizes “chatty” workloads without risking host congestion in network, compute, or storage.

How does CWOM make its decisions?

1

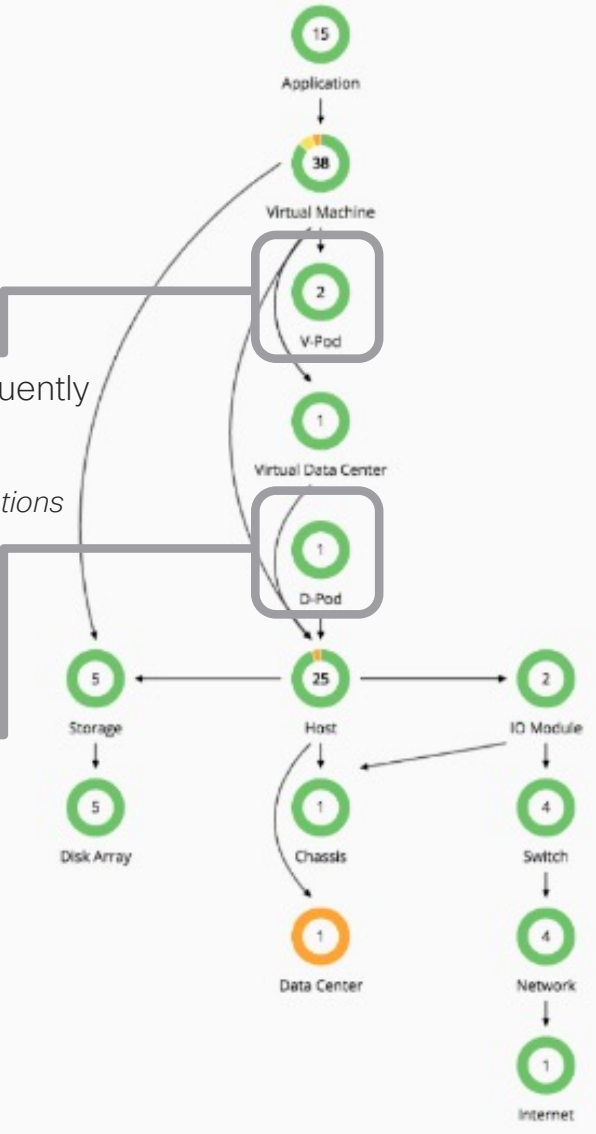
Extend the Supply Chain

V-Pod
Group of VMs that frequently communicates

Example: multi-tier applications

D-Pod
Group of Physical Resources that are closely located

Example: Servers in the same TOR Switch or UCS Domain



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How does CWOM make its decisions?

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2

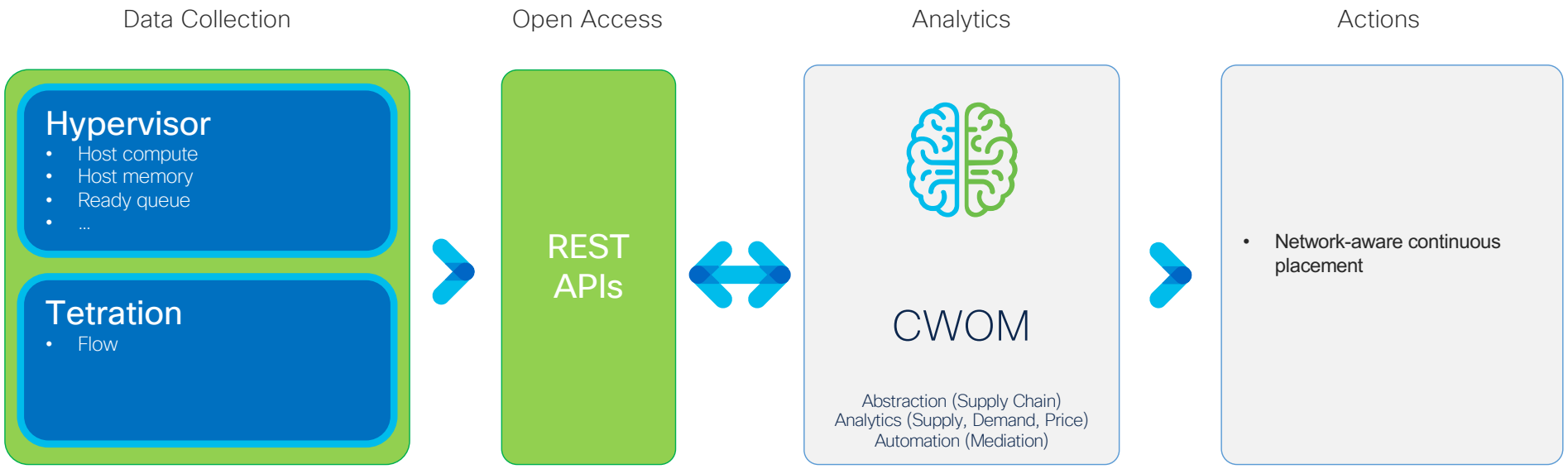
Add Flow as a Commodity

Level 0: Intra-host
Flow that represents chatty VMs in the same host

Level 1: Intra-D-Pod
Flow that represents chatty VMs in the same D-Pod

Level 2: Cross-D-Pod
Flow that represents chatty VMs across D-Pods

How does it work together?



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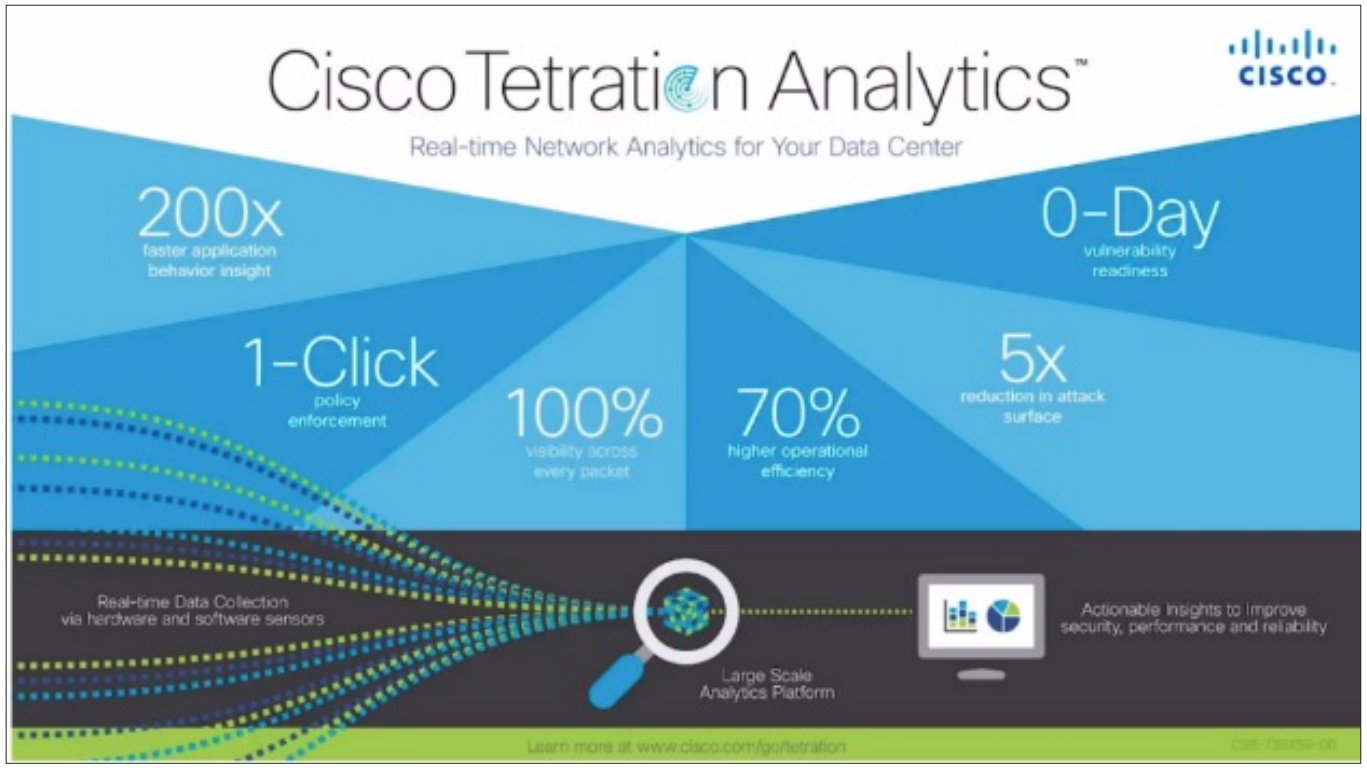
Demo: Tetration and CWOM



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CWOM & AppDynamics

End-to-end performance optimization, from applications to infrastructure.

Context

Applications are the business.

62%

of users have increasing expectations of how well digital services should perform.

RBS

The *busiest bank branch* is the mobile app on the 7:15 a.m. train

Pearson

Education publishing is no longer about text books

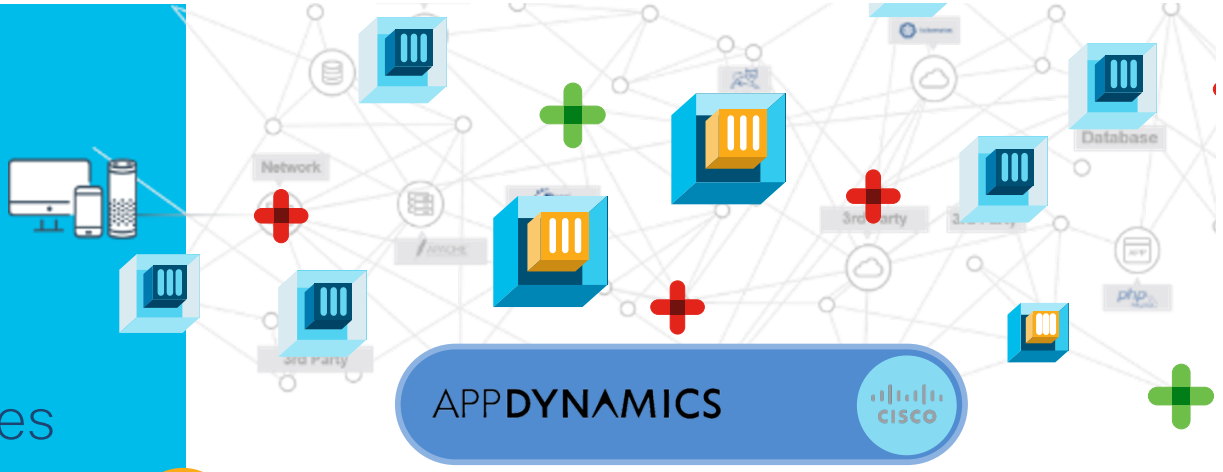
UBER

The world's largest *taxi company* owns no vehicles

sky BETTING & GAMING

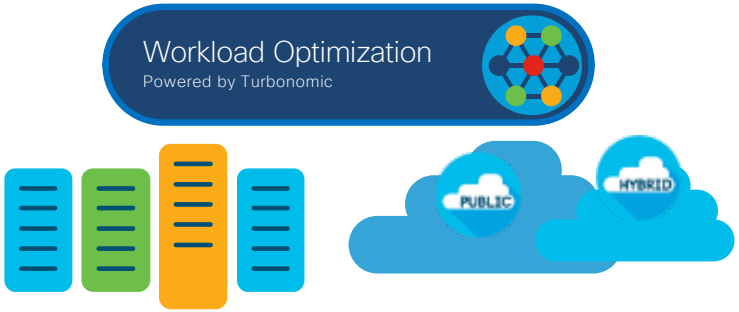
A technology business that happens to be in the betting industry.

Application performance relies on two interdependent things...



1. Apps are written and architected well.

2. Apps get the resources they need when they need them.



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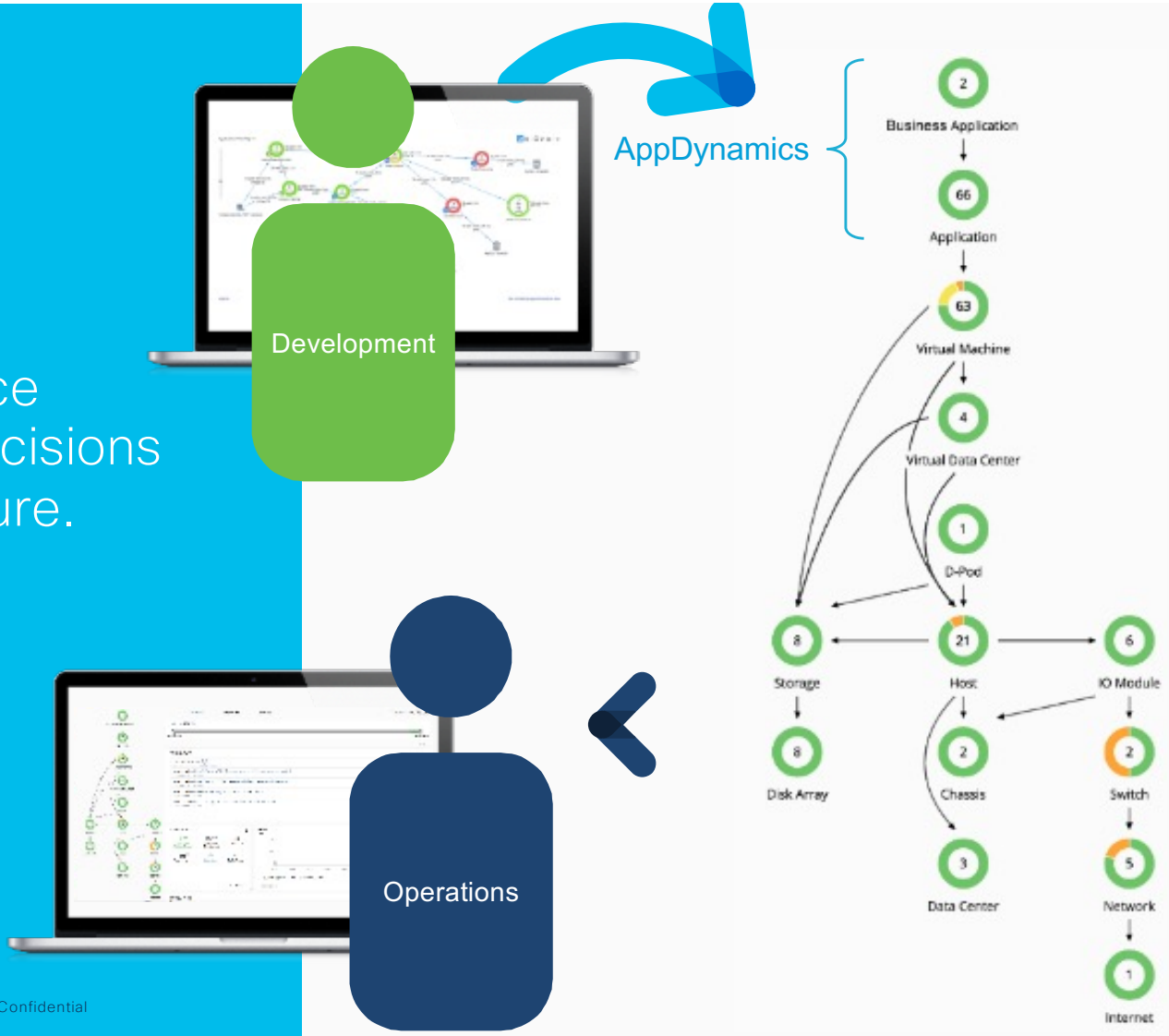
What's being optimized?

Application performance metrics drive better decisions through the infrastructure.



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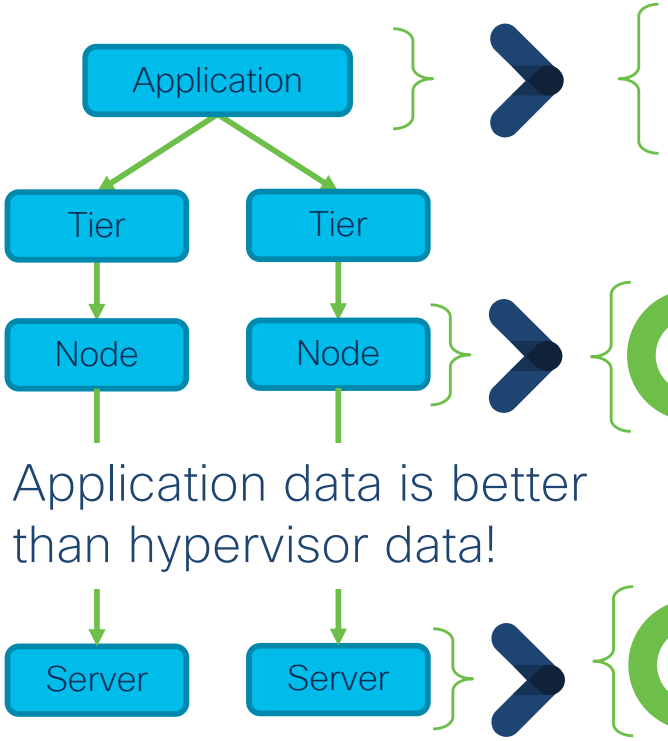
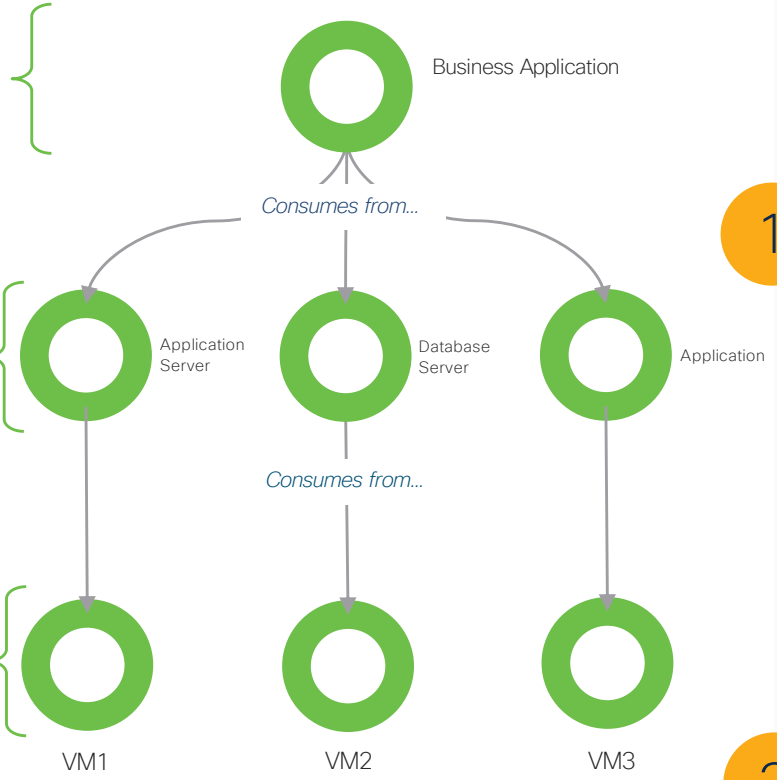
How does CWOM make its decisions?

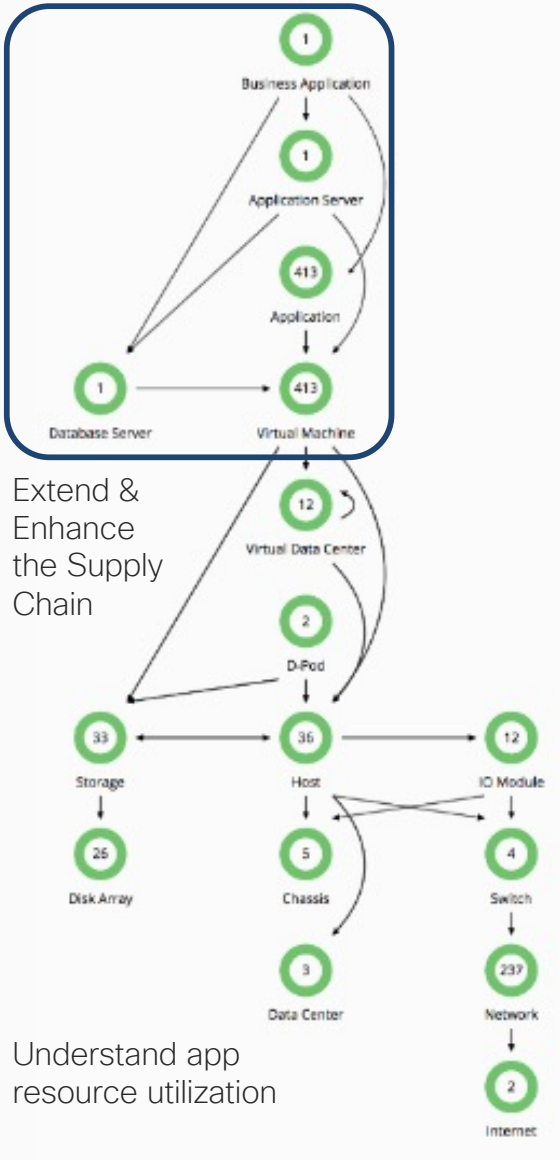
AppDynamics terminology:



Application data is better than hypervisor data!

CWOM supply chain:





1 Extend & Enhance the Supply Chain

2 Understand app resource utilization

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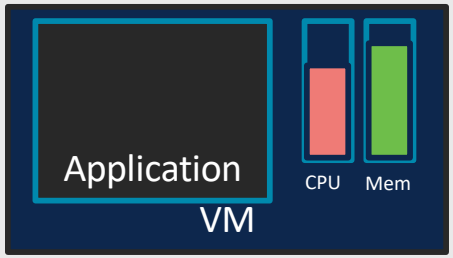
Cisco CWOM Integration with AppDynamics

Application-Level Understanding Enables Trustworthy Decisions, Automation

Traditional Infrastructure Monitoring

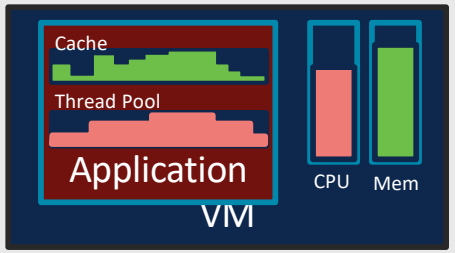


Application is a black box

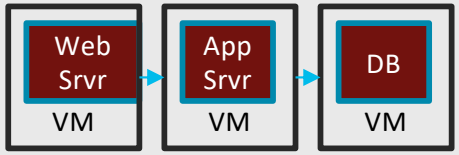
Components are a black box

No concept of application performance

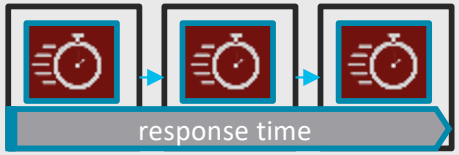
Application Aware Infrastructure



Understands application resource utilization



Understands application composition



Understands application performance

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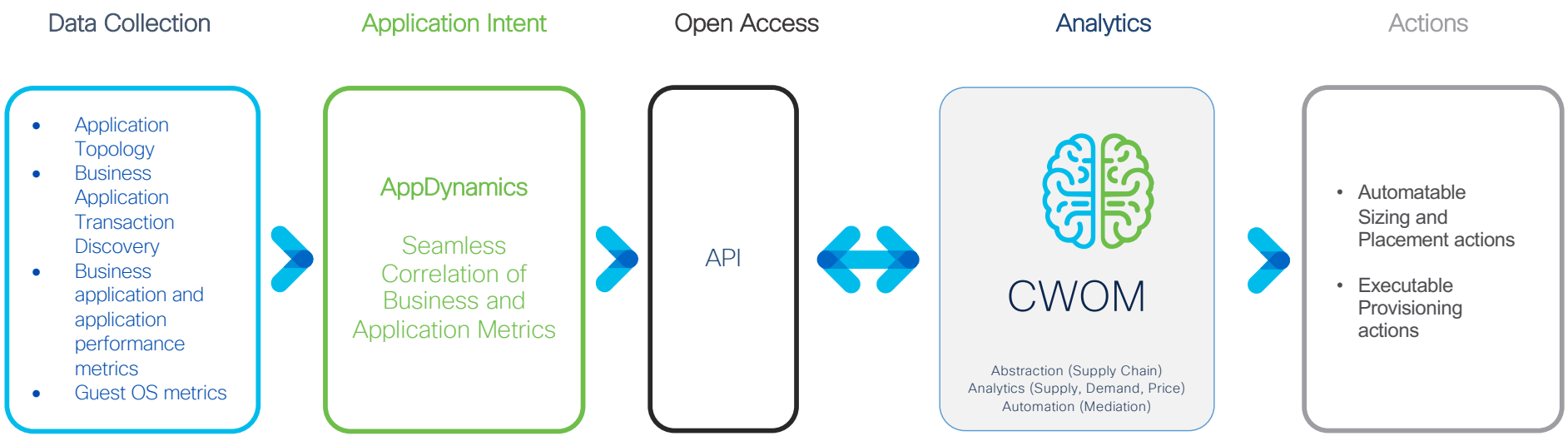
Architectural Overview

Application Metrics drive **sizing**, **placement**, and **capacity** actions across the stack.



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Benefits

Assure App Performance

Eliminate applications performance risk due to infrastructure, without over-provisioning.

Show IT's Business Value

Resource decisions in the infrastructure are directly tied to the performance of business critical applications.

Bridge the App-Infra Gap

Full-stack automation elevates teams, full-stack visibility provides a common understanding of app dependencies.

Accelerate App Migration

De-risk app migration projects with holistic understanding of app topology and the data center stack.

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Demo Video: AppDynamics & CWOM

- Just Turbo-AppD Demo Video: https://vimeo.com/238472559

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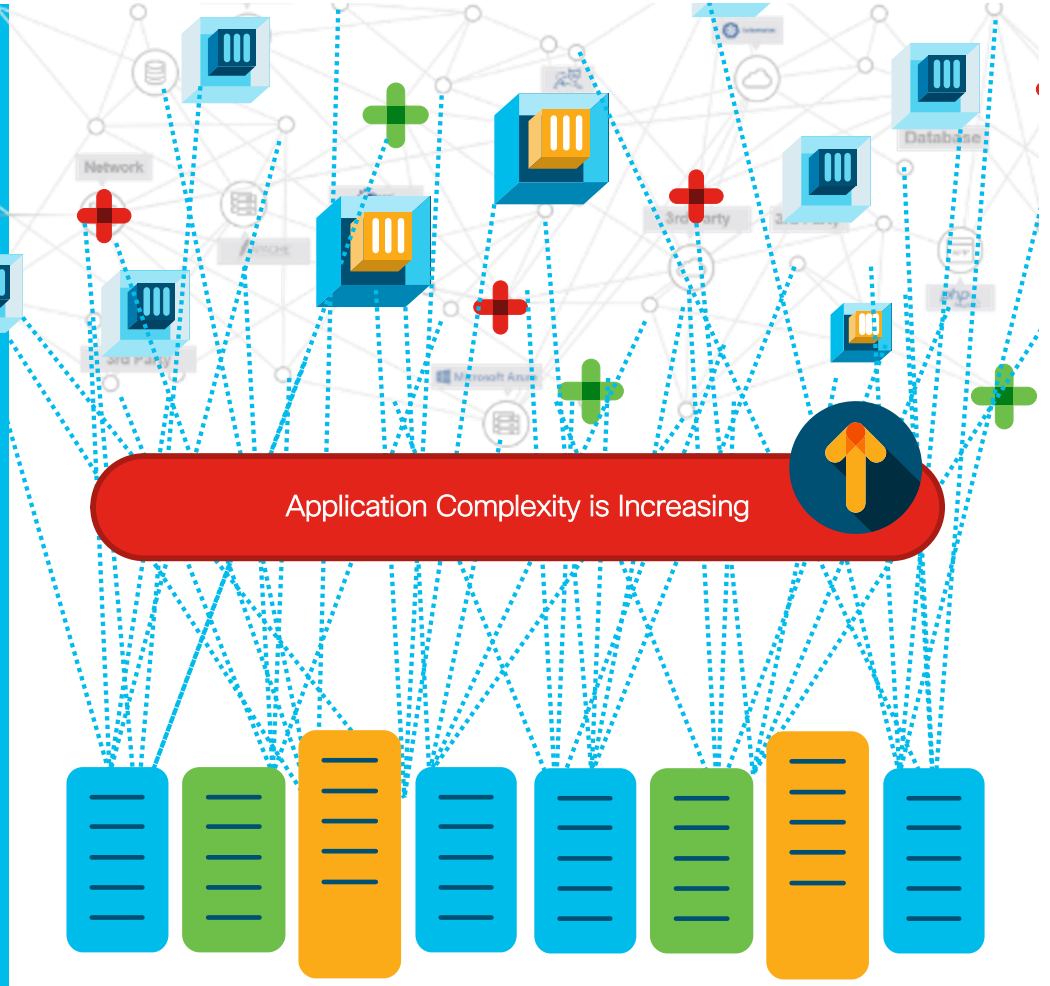
CWOM & HyperFlex

Achieving Agility & Predictable Performance with Self-Managing Hyper-Converged Systems

Context

- Application complexity is increasing…
- Cloud native & microservices are great for developers, but challenge IT agility.
- Hyper-converged is about simplifying infrastructure management to enable IT agility, but….



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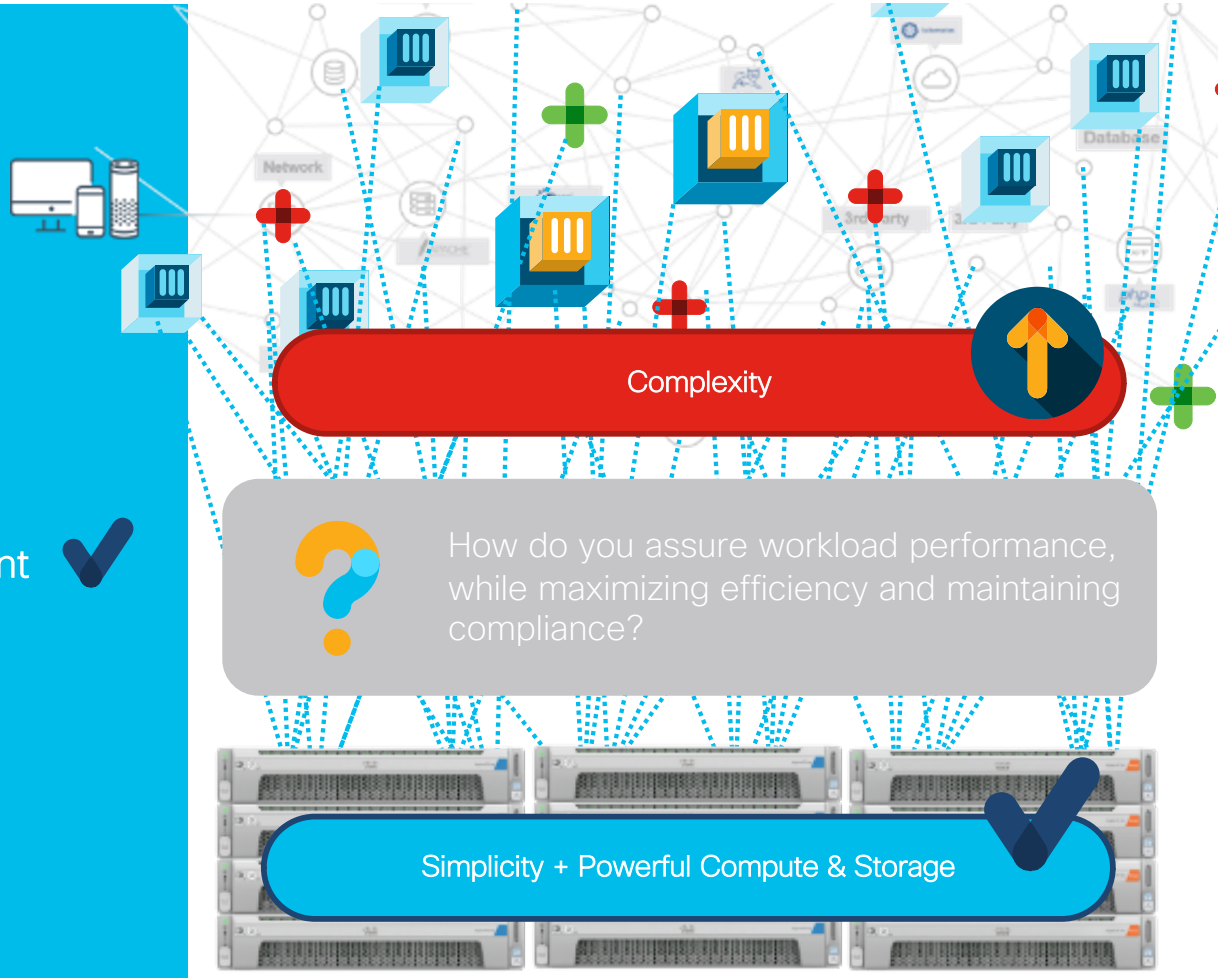
Problem

Agility requires two things:

Simplifying infrastructure management ✓

+

Performance ?



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What actions does it automate?

- Storage-aware workload placement (initial and continuous)
- Storage-aware workload sizing
- Resizing virtual storage
- Provisioning or suspending virtual storage (ex. datastore)
- Provisioning or suspending HyperFlex compute-only nodes (recommend only)
- Provisioning or suspending physical storage (ex. HyperFlex node) (recommend only)

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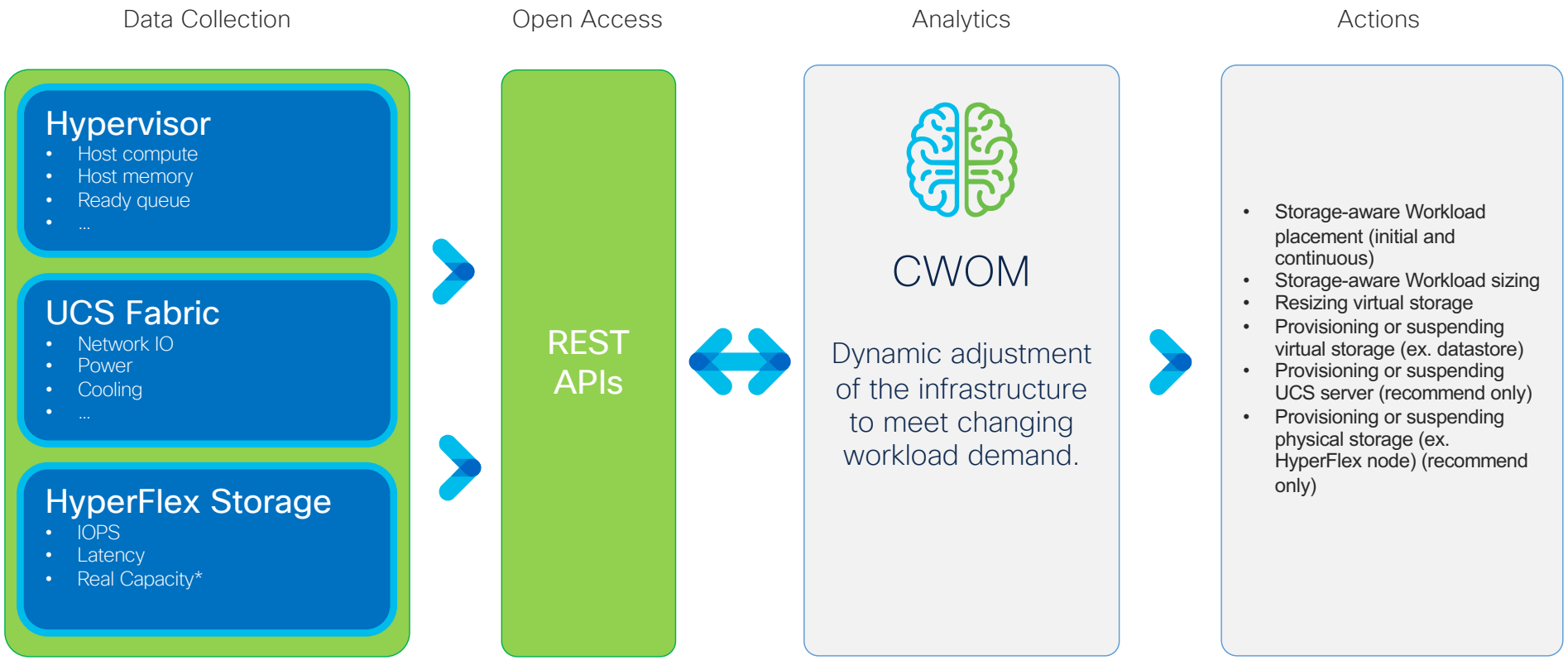
How does it work together?



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*Accessed from the HyperFlex API – storage amounts with calculated compression and dedupe values.

Key Use Cases for CWOM & HyperFlex

1. Super-Cluster Optimization
2. Intelligent Independent Scaling of Compute & Storage
3. Modernize at the Pace of Your Business

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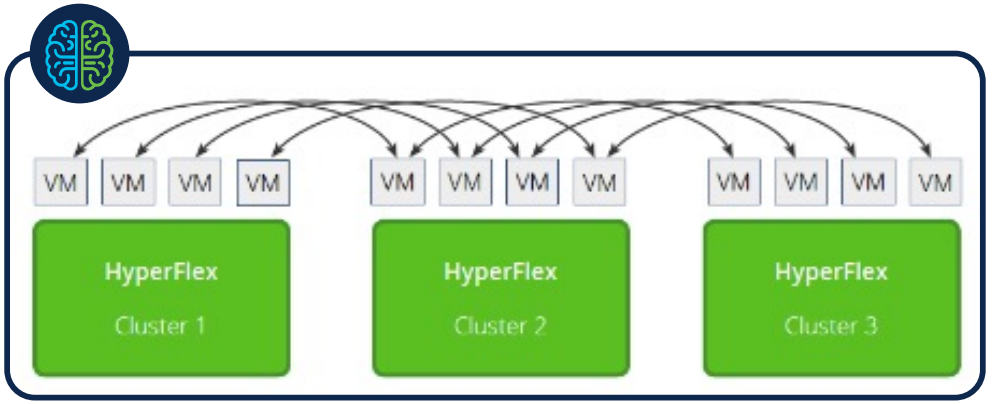
Self-managing HyperFlex systems continuously deliver predictable performance so IT can maximize agility.

Use Case

Super-Cluster Optimization



- CWOM continuously analyzes workload consumption across HyperFlex clusters to determine exactly when, where, and how to move and/or resize existing workloads.
- Analysis accounts for different versions of HyperFlex (hybrid or all-flash) so there's no need for storage tiering.

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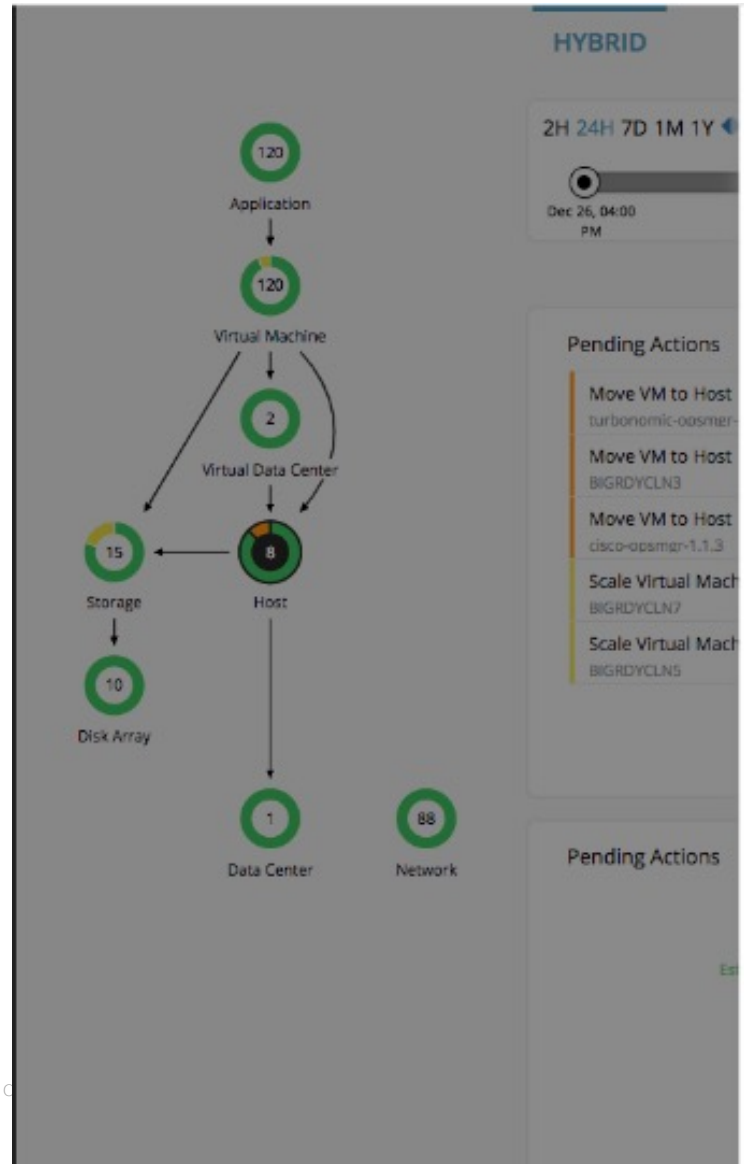
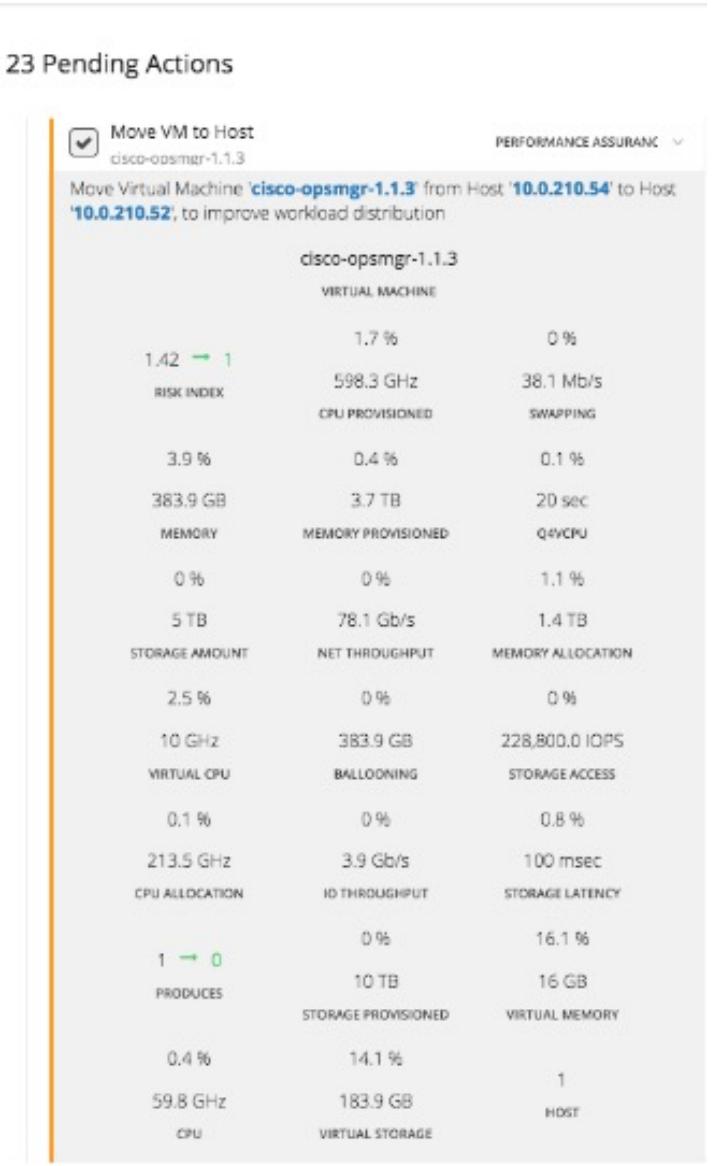
CWOM provides a specific action to **move the virtual machine** ‘cisco-opsmgr-1.1.3’ from host ‘10.0.210.54’ to host ‘10.0.210.52 to ensure workload performance.





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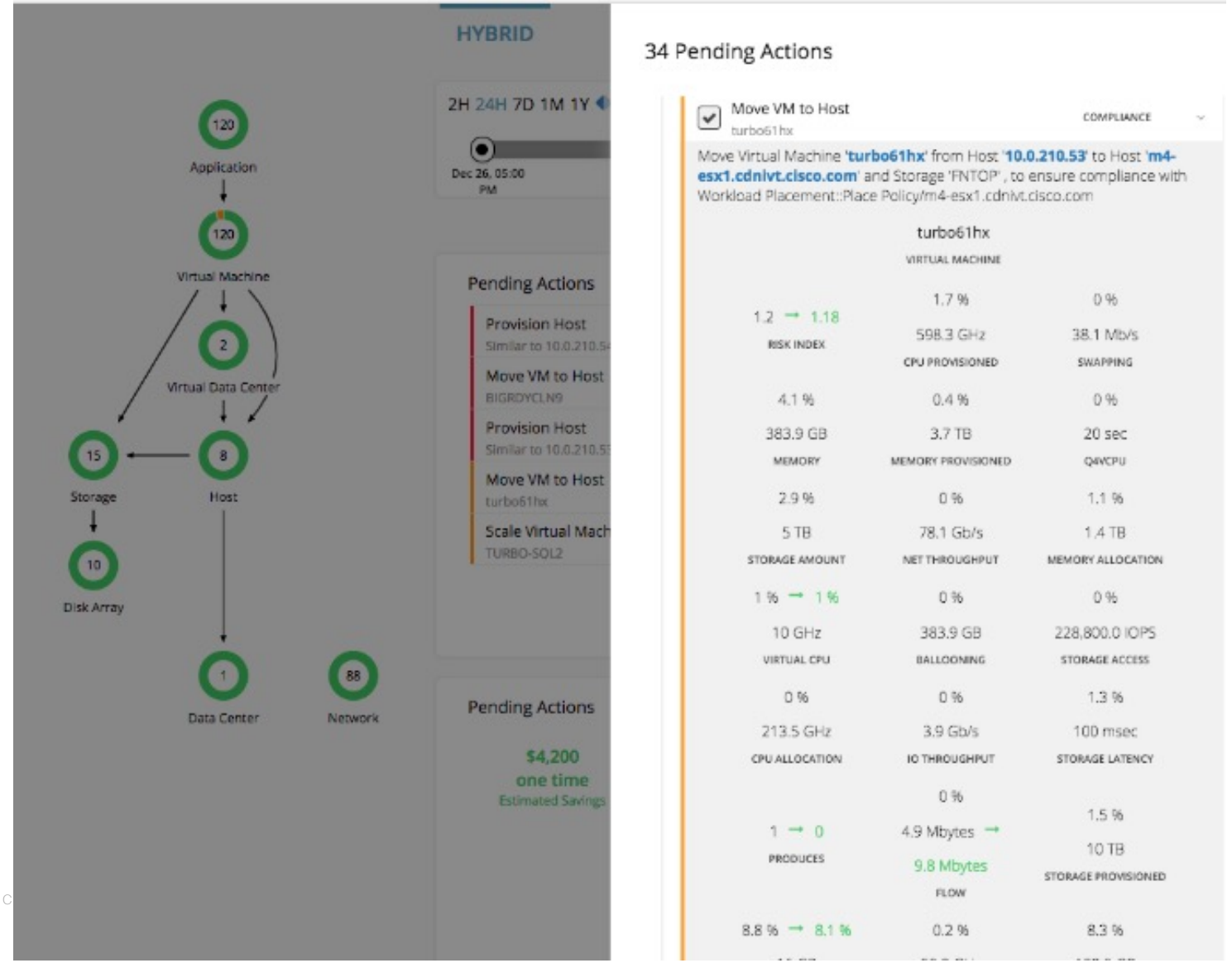
CWOM provides a specific action to **move the virtual machine** ‘turbo61hx’ **and storage** ‘FNTOP’ between clusters—from host ‘10.0.210.53’ to host ‘m4-esx1.cdnivt.cisco.com’—to ensure compliance with business policies.



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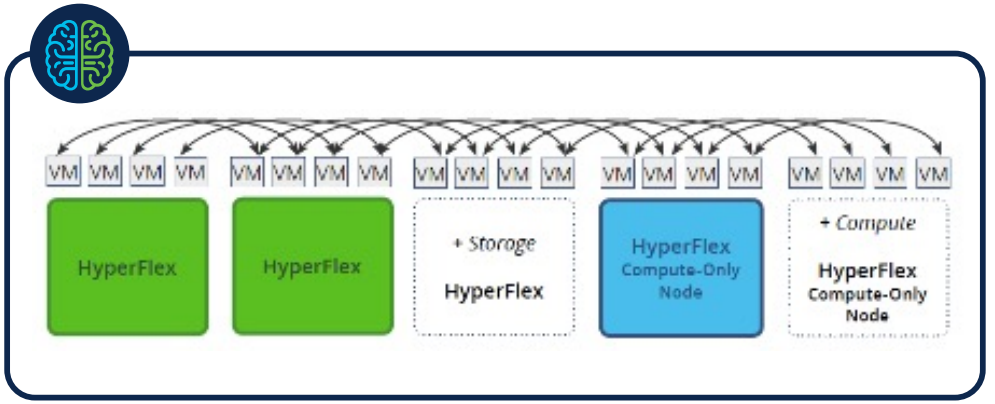
Use Case

Intelligent Independent Scaling of Compute and Storage



- HyperFlex gives customers the flexibility to scale compute and storage independently based on their unique requirements.
- CWOM scales these resources based on real-time workload consumption, providing intelligent elasticity in HyperFlex clusters that preempts performance degradation.

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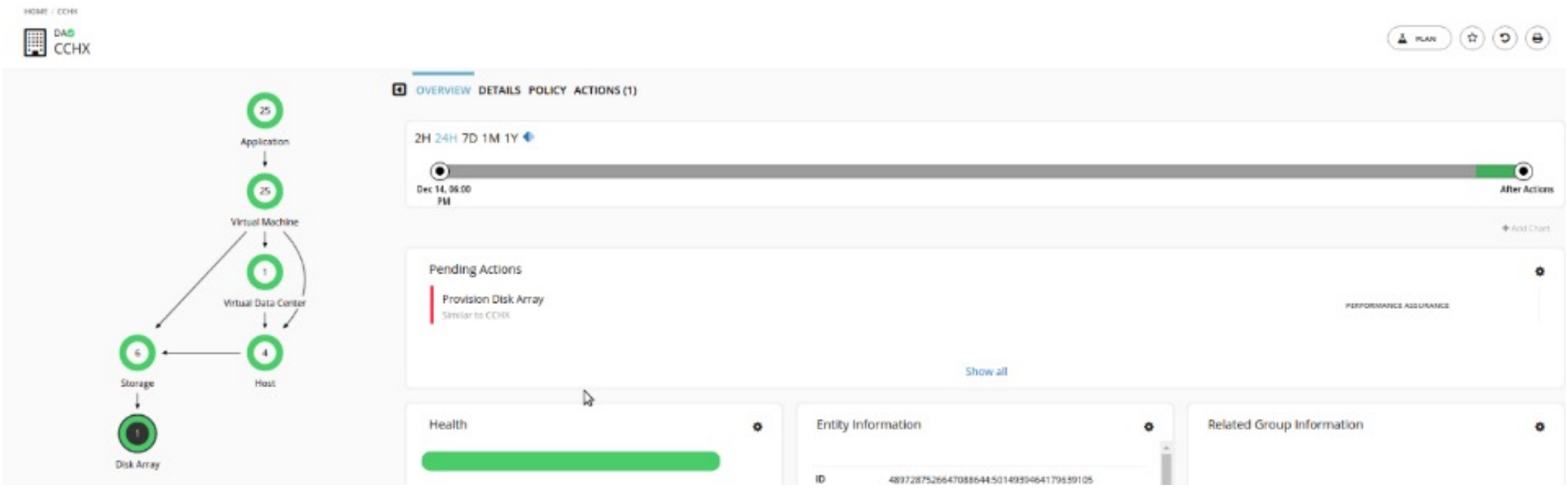
Below, CWOM provides the action to **provision a new disk array similar to** ‘CCHX’ (a HyperFlex cluster) in order to assure performance.



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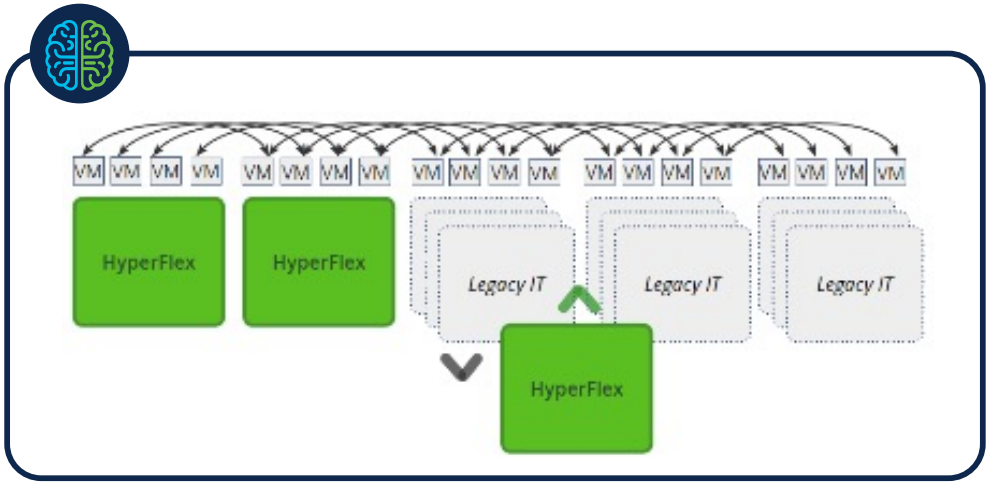
Use Case

Modernize at the Pace of Your Business



- HyperFlex Systems and CWOM seamlessly integrate with the data center you have today.
- Quickly model “what if” scenarios as your business grows and as you retire legacy infrastructure.

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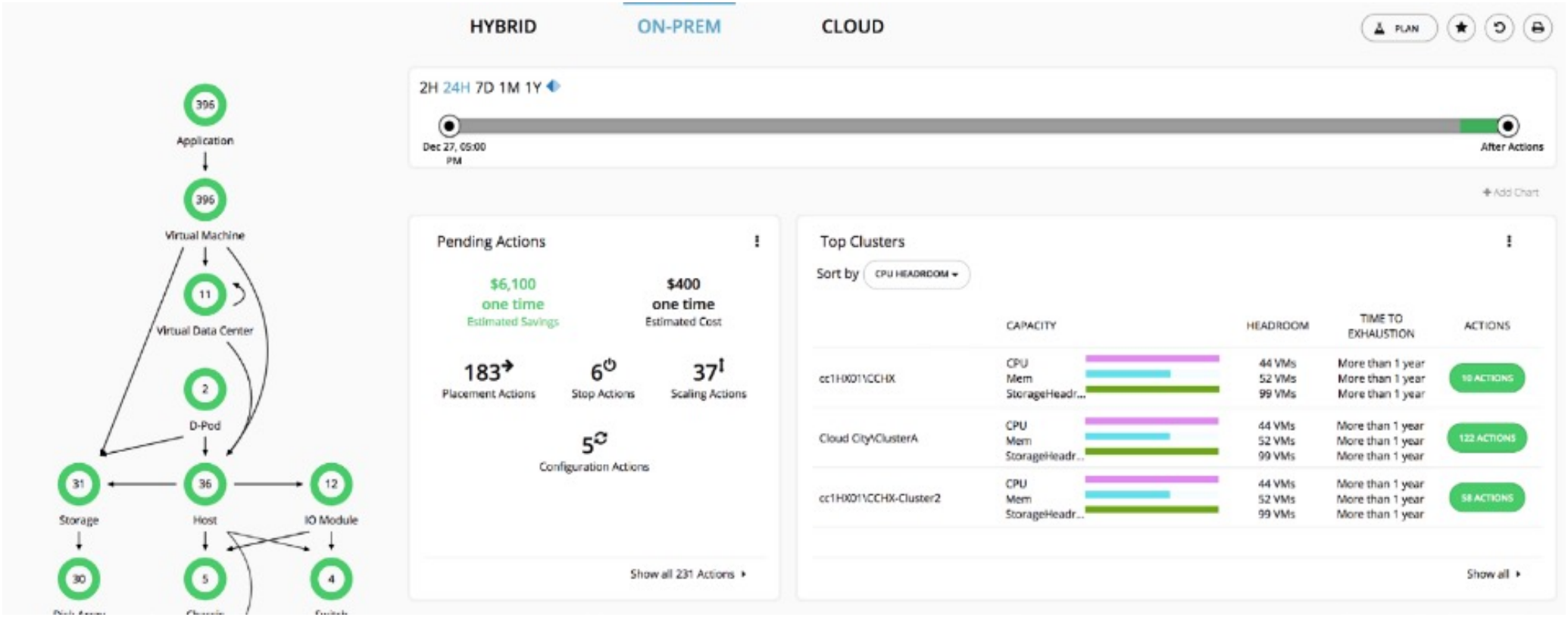
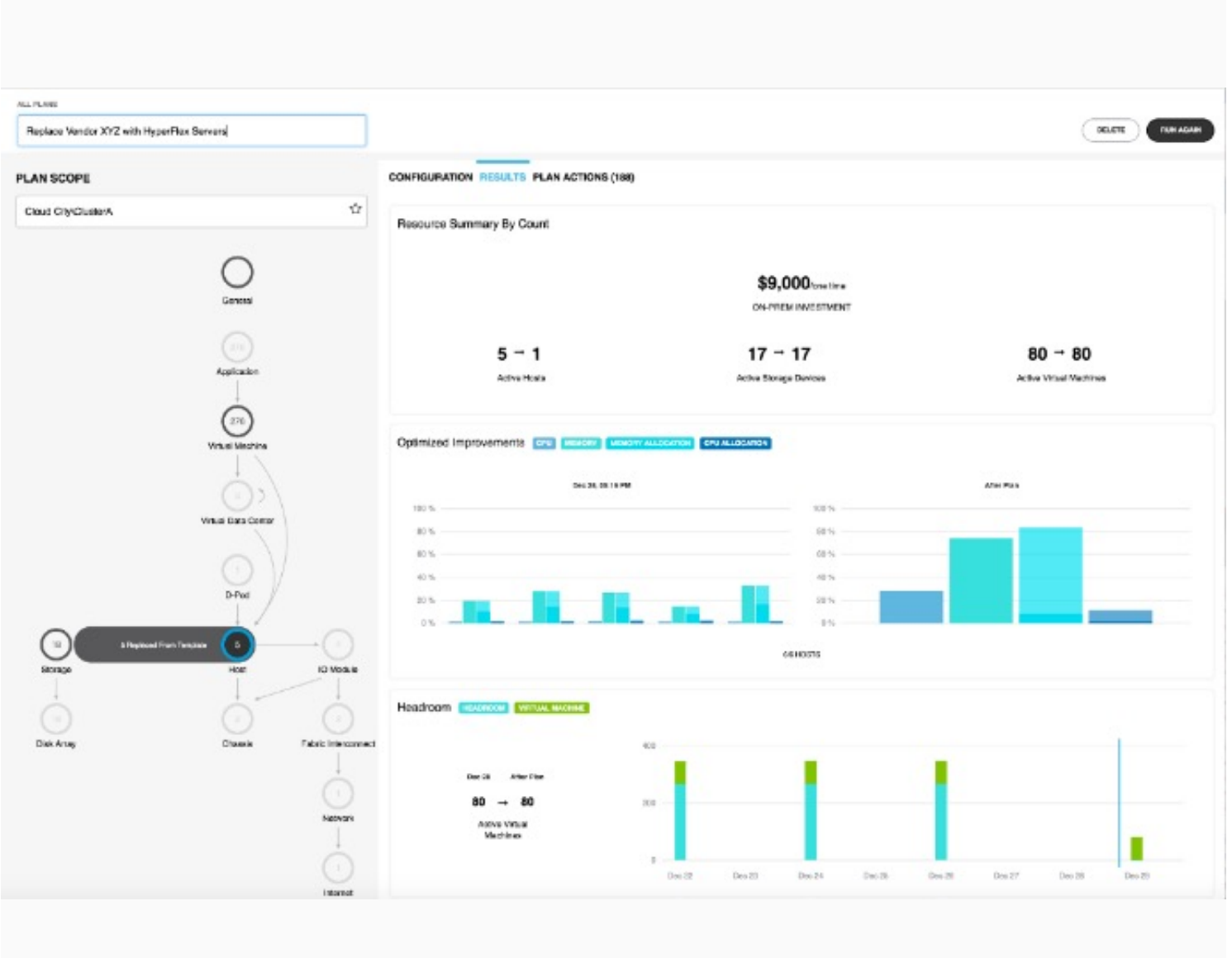
Below, CWOM analyzes workload growth trends to determine when new hardware will need to be purchased. Note the '**Top Clusters**' highlighted and their '**Time to Exhaustion**,' ensuring that you always have the hardware you need to support growth.



Below, CWOM plan results show that workload demand, in this case 276 virtual machines (see supply chain on left), on 5 legacy hosts can be supported with 1 HyperFlex host for a one-time investment of $9,000. Customers get specific before and after views in order to make fully informed decisions as they modernize their infrastructure.



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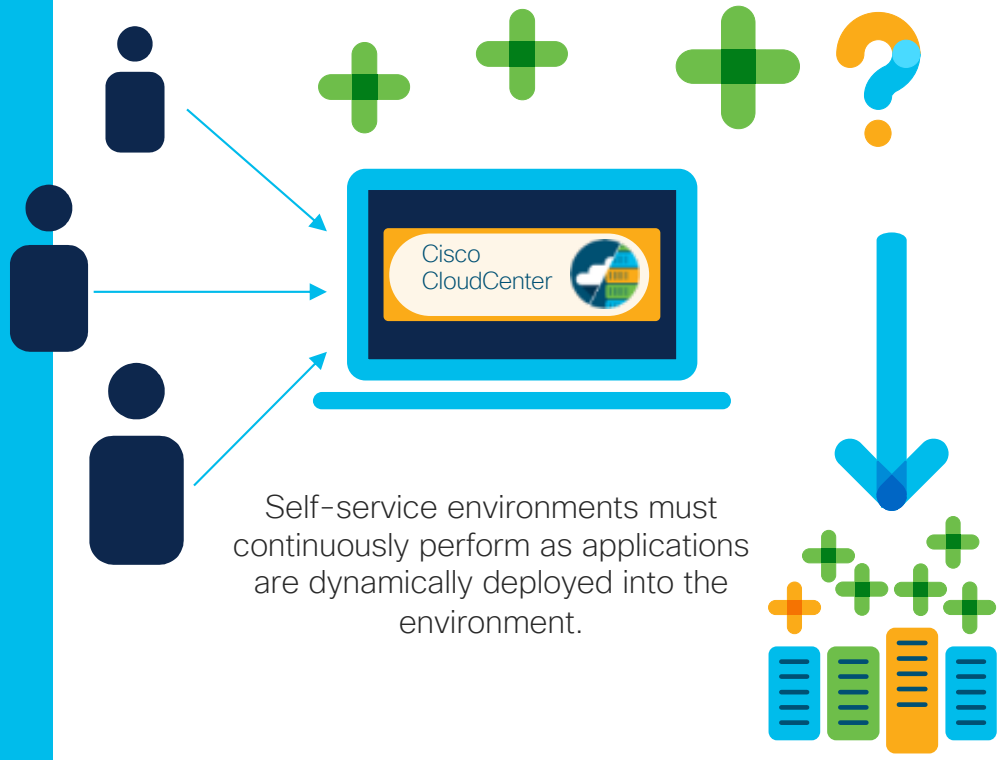
CWOM & CloudCenter

Assure Performance, Minimize Cost, and Maintain Compliance in Dynamic Self-Service Environments

Context

- By 2019 60% of workloads will run in cloud, whether on-premises or off.
- Workload deployments will increase in volume and frequency.
- 98% of organizations say a single hour of downtime costs over $100,000.



Self-service environments must continuously perform as applications are dynamically deployed into the environment.

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Problem

- Self-service = dynamic change.
- Multi-cloud estates expand workload placement options, increasing cost overruns and compliance risks.
- Tradeoffs must be made in real time to keep pace with the business.

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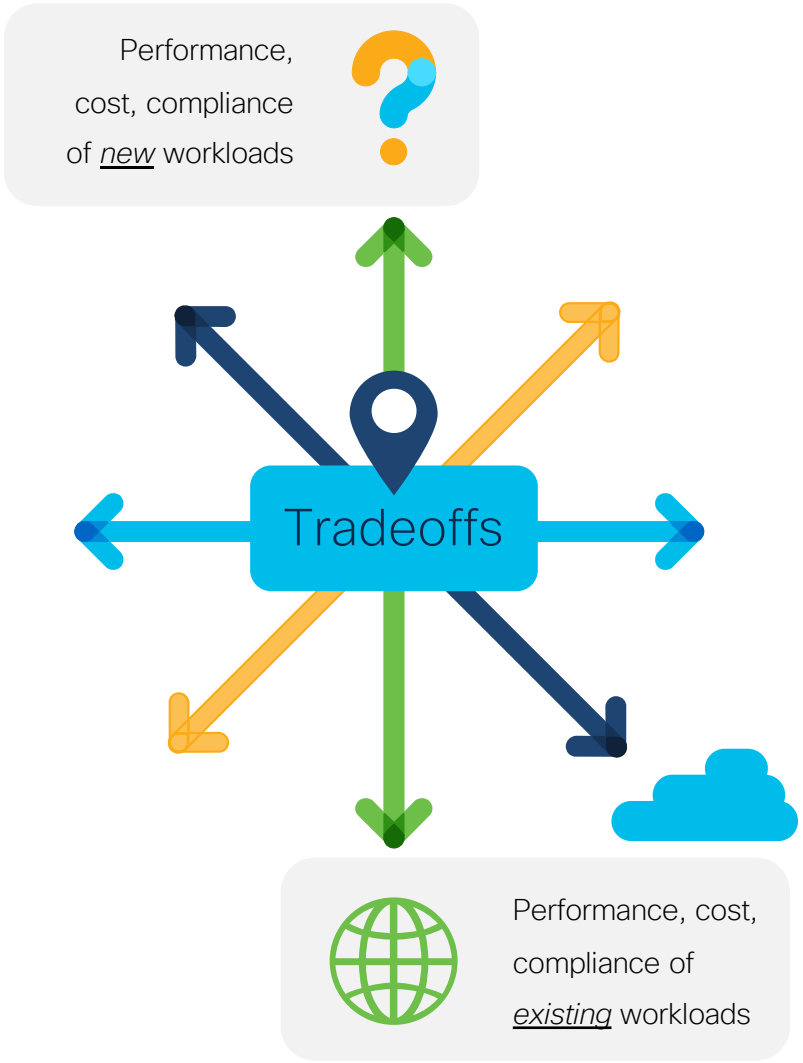

What actions does it optimize?

- Initial workload placement on-premises
- Initial workload placement across clouds*

*Future

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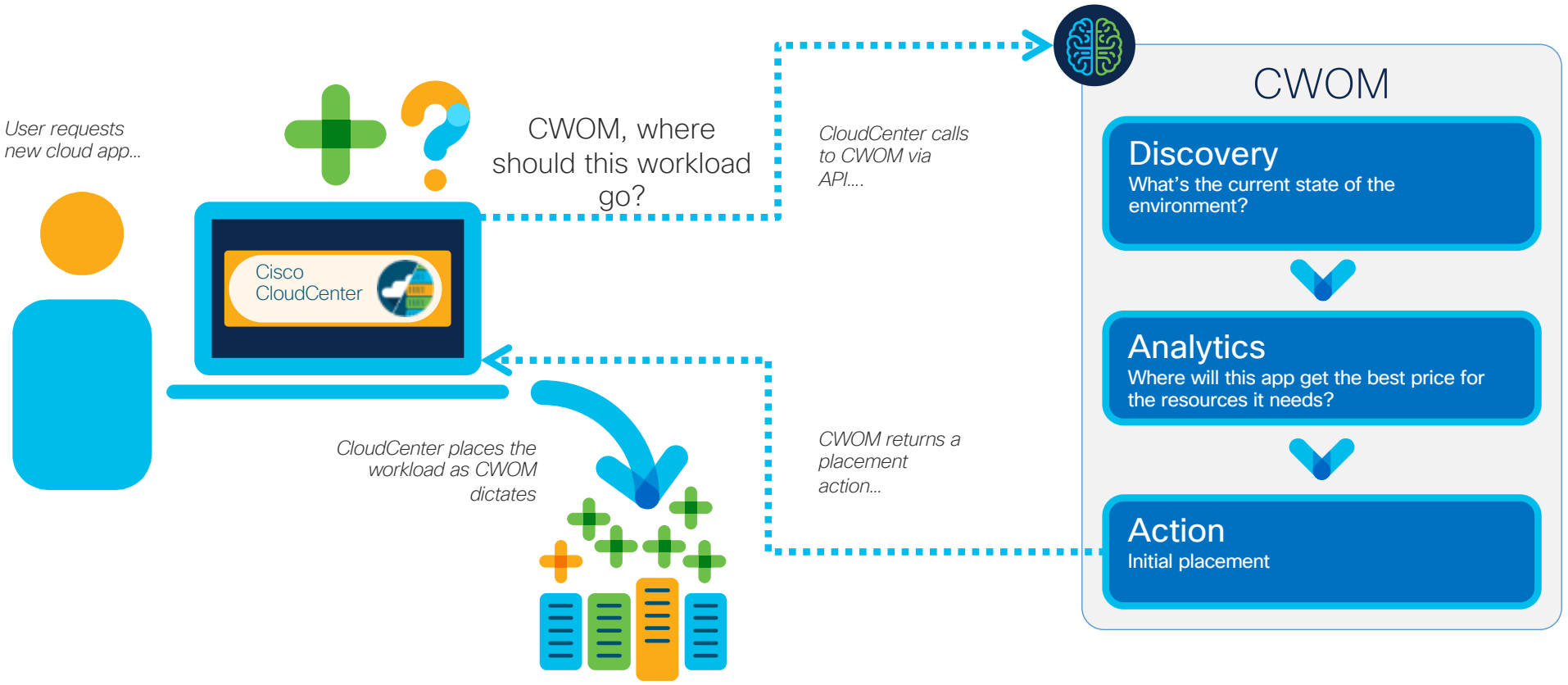
How does it work together?



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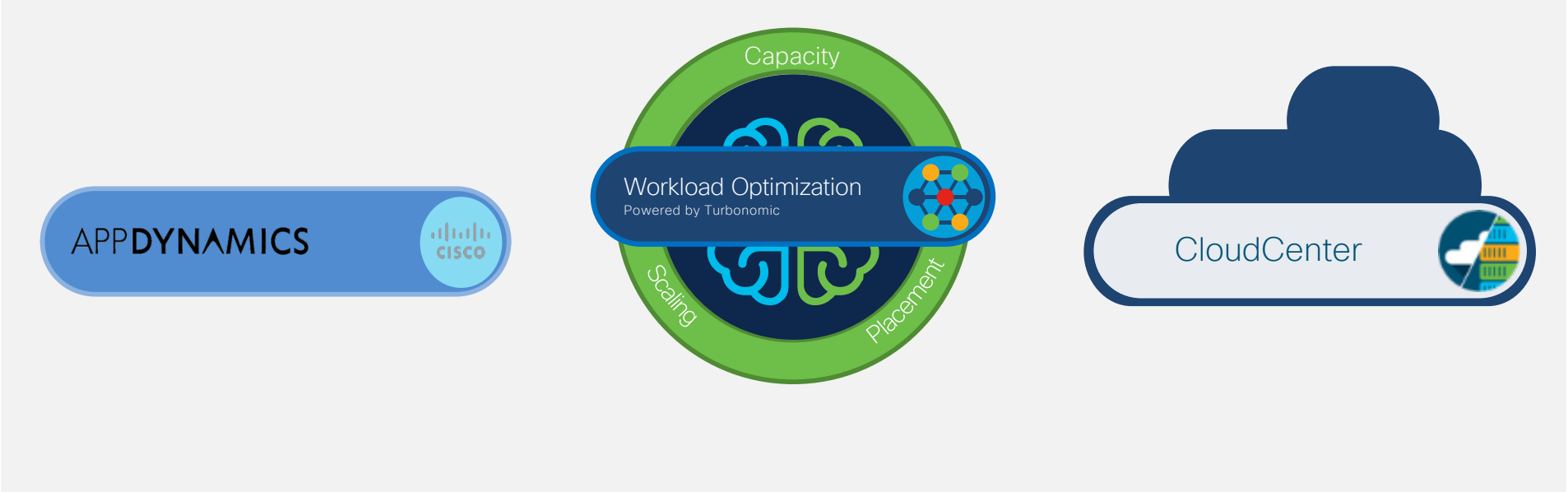
Demo Video: AppDynamics & CloudCenter with CWOM



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ACI

Multi-site mobility and disaster recovery with performance assurance and policy enforcement.

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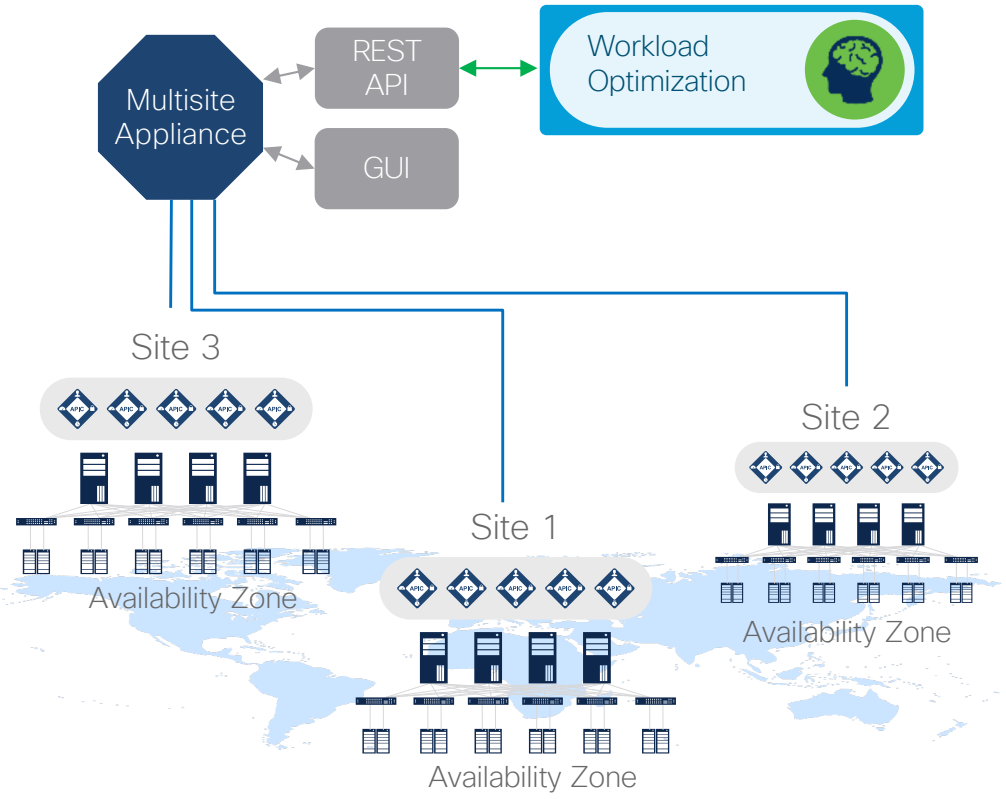
Roadmap

Real-time workload placement that satisfies resource, physical, and policy requirements across multi-site architecture.



Success Stories

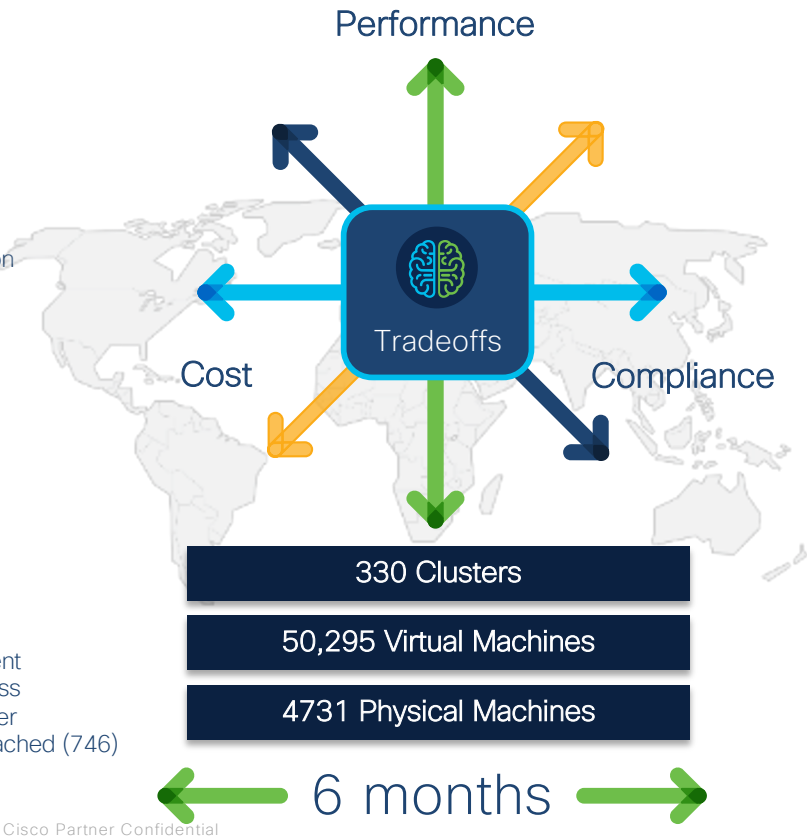
Cisco IT ...takes 2,500 CWOM actions / day to mitigate risks

1,514,100
Performance Risks / Automated:

- CPU
  - 299,376 CPU Congestion
  - 20,772 ReadyQueue Congestion
  - 398,226 CPUProvisioned Congestion
- MEM
  - 765,832 Mem Congestion
  - 3,812 MemProvisioned Congestion
- Throughput
  - 6,26 NetThroughput Congestion
  - 165 IOThroughput Congestion

6,028
Compliance Risks / Automated:

- 323 Affinity/Anti-affinity
- 4,959 Configuration Drift
  - 2,380 Violation of Storage Placement
  - 856 Misconfigured Storage Access
  - 1,723 Misconfigured Storage Cluster
- ESXi Management Agent could not be reached (746)



REAL-TIME Pending Resize Actions:

- **1,607** vCPU Decreases due to Ready Queue
- **9,272** vCPU Decreases due to under-utilization
- **410** vCPU Increases for CPU Congestion
- **13,827** vMem Decreases for under-utilization

Driving Efficiency / Automated:

- $2.8M Yearly Opex
- $17M Capex Savings
- 130 TB Allocated Memory
- 111 TB Consumed Memory
- 7 TB Allocated vMEM Reservation
- 32,610 Allocated vCPU's
- 3,403 Consumed CPU GHz (50,911 Total)
- 612,000 MHz of Allocated vCPU Reservation

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Cisco CWOM & VMware vRealize Suite

Only vRealize Does

- Hypervisor (vSphere)
- High-availability & Maintenance mode (DRS)
- Virtual network config (vSwitch)
- Automated new VM deployment and self-service (vRA)
- Log analysis (Log Insight)

Feature Overlap

- Balance load in a cluster (DRS)
- Visibility into performance and configuration issues (vROps)
- Capacity planning (vROps)
- Policy based VM deployment (vRA)
- Visibility into cost / showback (vRB)

Only CWOM Does

- Continuously optimize workload performance
- Improve resource & cost efficiency on-prem and in public cloud
- Deliver predictable SLAs
- Compliance assurance
- Heterogeneous platform to support any technology choice
- Performance based new VM deployment

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