

Cisco Virtual Workspace (VXI) Smart Solution: Automation and the Cisco Intelligent Automation for Cloud Framework

1 Executive Summary

1.1 Target Audience

The target audience for this whitepaper spans CIO and CTO decision makers, through IT Executives to IT Engineering Staff who are responsible for defining the cost model, requirements and technical designs for a Cisco Virtual Workspace (VXI) Smart Solution deployment. As this whitepaper addresses the use of Automation tooling and scripts to improve ROI for VXI deployments through reduced solution management overhead, a broad audience will find content in this document that touches on their domains.

1.2 Introduction

This whitepaper provides an overview of a number of key Cisco Virtual Workspace (VXI) automation use cases and discusses utilizing the Cisco Intelligent Automation for Cloud (CIAC) framework to alleviate the challenges associated with deploying, managing and reporting on pools of VXI desktops integrated into an environment with various other incumbent systems, such as Collaboration solutions. Although deploying individual VXI desktops or groups of Virtual Workspace desktops is not a particularly complicated task, those operations are far from sufficient for providing end users with full-featured Hosted Virtual Desktops (HVD) with all the collaboration and communications tools they already have on their thick desktops and which they require for their job functions.

Figure 1 details control points in the Data Center (DC) and network for a VXI deployment. In contrast to the traditional model of desktop PCs, in a VXI environment all of the compute and storage resources are located in one or more data centers and in upwards of 100 individual user desktops may be co-resident on the same compute resource. In the traditional model, each end user PC treated as an independently manageable entity. In a VXI environment, some aspects of the end user's desktop remain independently managed entities but much of the desktop effectively becomes a 'service load' running on shared resources in the DC. For example, a VXI HVD will have one or more virtual CPUs associated with it and each HVD will run within it's own independently managed virtual machine, however, the physical computing hardware is managed independently of the HVD itself. Similarly, in a traditional desktop PC environment, storage is local to the PC and exclusively dedicated to the PC whereas in a VXI environment, storage is a shared resource with a large number of users' storage funneled into the same Network Attached Storage (NAS) or Storage Area Network (SAN) infrastructure.

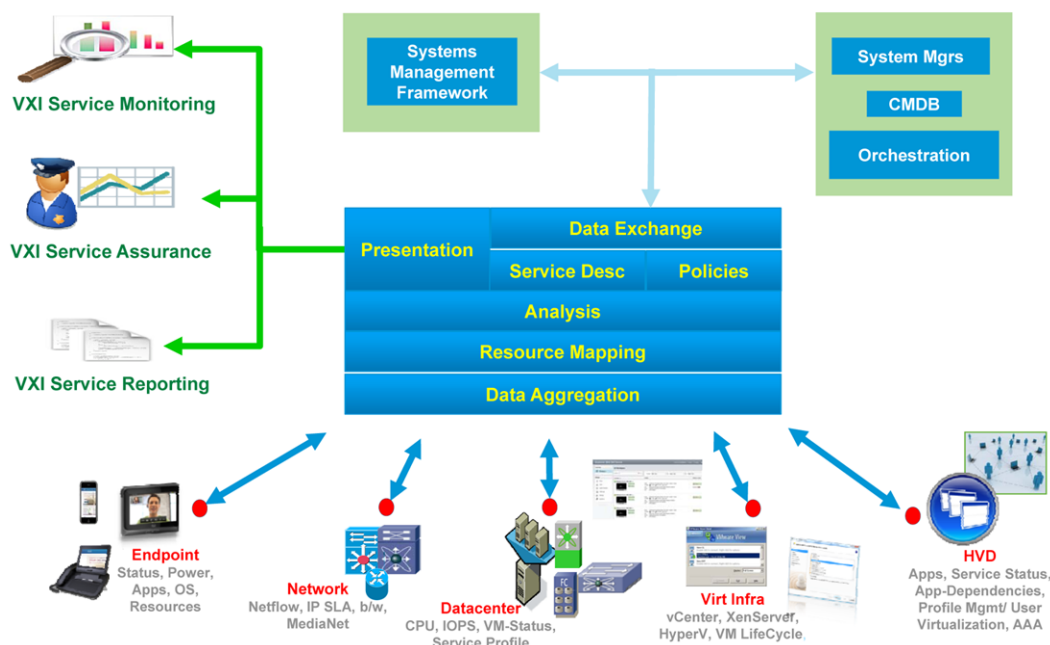


Figure 1. A high level diagram of the large number of management and reporting touchpoints in a VXI deployment.

In addition to the fundamental change in compute and storage resources, the role of the network changes dramatically for VXI deployments. In the traditional desktop PC model, the network is used primarily for 'transactional' operations, such as interacting with web or thick-client DB applications, as well as for streaming of compressed rich media from a content delivery network and for peer-to-peer VOIP communications. In a VXI environment, the end user's desktop is transported as a near real-time media stream running from the data center to the user's Virtual Desktop Infrastructure (VDI) endpoint. Additionally, deployment of traditional media players and softphones in an HVD will result in hairpinning of the real-time video and voice media through the DC and transcoding of the media from optimized multimedia formats to VDI protocol formats which typically do not perform well for video or audio encoding. Cisco is addressing the 'bandwidth explosion' challenge associated with delivering Unified Communications (UC) and rich media in a VXI environment by moving the media stacks back to the user's endpoint and delivering VOIP and rich media directly to the endpoint without hairpinning through the data center or transcoding the media into VDI protocols. In this improved VXI model, delivery of real-time media to the end user is returned to its pre-VDI state but the desktop itself becomes another stream on the network.

In total, VXI provides exceptional value to enterprises in terms of data security, business continuity, disaster recovery, mobility and collaboration. That value does come at the expense of operational and management changes to the traditional desktop delivery model, which is disruptive but also provides an inflection point at which automation tools may be brought to bear to improve overall desktop configuration control, management and service assurance. A best-practice based VXI model with appropriate automation scripting will provide the benefits of virtualized desktops as well as accelerating VXI ROI by reducing on-going operational management expenses compared to traditional desktop PC deployments.

The Cisco Intelligent Automation for Cloud platform provides a rich process automation and service orchestration environment complete with pre-built adapters to a variety of existing IT management infrastructure solutions as well as a visual, drag-and-drop design environment for creating domain specific workflows or event-driven processes. The CIAC platform may be used to quickly deliver best-practice based automation solutions for VXI deployments as well as delivering the ability to monitor, report and audit VXI environments for Service Level Assurance (SLA) or Compliance purposes. The platform also includes a self-service portal framework which may be used to deliver end

user self-service tools to an IT organization's user population; accelerating the move to delivering IT as a Service (IaaS).

1.2.1 Provisioning

In traditional desktop PC environments, provisioning a desktop tends to be primarily a process of ordering a PC or laptop for an end user, having a base OS and application set image applied to that PC and having the PC shipped to the user. Once the PC has reached the user, there is usually some manual setup required of the user which may include generating support tickets to get collaboration resources associated with the PC. Within the Data Center, the main operation would be one of adding the user to Active Directory and creating email and voicemail accounts. All of these operations can be coordinated but typically take place over several days due to the time lag between ordering of new equipment and delivery of that equipment to the end user.

In a VDI environment, an end user may have only a stateless VDI endpoint appliance or perhaps a VDI client installed on their personal PC or laptop in a Bring Your Own Device (BYOD) environment. Within the data center, compute resources and storage for the new desktop must be provisioned from the DC's pool of server resources and SAN or NAS storage solutions. Once the compute and storage resources have been provisioned, an OS image and potentially application images must be associated with the VM in addition to the traditional need to create AD entries for the new user and creation of email and voicemail accounts. In an HVD model, the end user cannot provide any self-service assistance in the provisioning process; everything must be done on the end user's behalf within the DC before the user has any desktop services available.

VDI vendors provide tooling to ease the burden of allocating storage and compute resources for HVD desktops and for association of those desktops with pools sharing a common OS and application image set; but current tooling tends to drop off rapidly from there. There is no 'out-of-the-box' support for provisioning collaboration resources and associating those with the HVD desktop. This process can be handled manually, but in a very common scenario of an enterprise wishing to migrate hundreds or thousands of users from a traditional desktop PC model to a VDI environment, manual configuration of voice and collaboration resources with individual HVD desktops simply doesn't scale. A similar scenario would be one of seasonal addition of large numbers of call center workers for catalog mail-order businesses or the rapid addition and removal of large numbers of contract workers brought in for specific project work. In a traditional desktop model, the contractors may supply their own PCs or laptops and would primarily require access to network resources. In a VDI environment, these contract workers would require having desktops provisioned for them in the data center.

For provisioning, automation can be extraordinarily useful to implement workflows linking provisioning operations across the management domains in Figure 1. For example, Cisco Advanced Services has created and demonstrated example automation workflows that provide the ability to automatically provision compute, storage, OS and application images, email, voicemail and collaboration resources for new or existing users from a single entry screen. New users or existing users can be added to a VDI deployment by a single IT resource using a single tool and with assurance that each user is provisioned in a consistent, approved and validated manner. The scripts may also be run in a bulk mode to facilitate the automatic migration of a multiplicity of users from a traditional desktop PC model to a VDI model quickly and with a bare minimum of IT operational overhead. Finally, these scripts can be exposed as a self-service portal for new or existing users which they can access from a web browser and automatically kick off the provisioning process themselves, on-demand. Once the request has been made, a VDI desktop with collaboration resources would be available to the user within minutes. This is a degree of automation which exceeds what is available in most traditional desktop PC environments and is achievable in a VDI environment due to the centralization of resources and the treatment of desktops as a combination of 'services' instead of as an aggregation of an OS and applications running on a distinct PC or laptop.

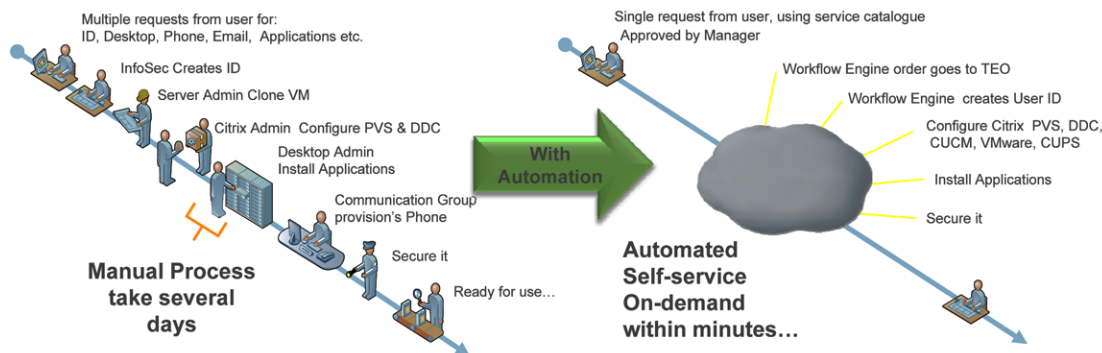


Figure 2. Use of Automation to facilitate VXI user provisioning in a Xen Desktop deployment

1.2.2 Capacity Management and Virtual Desktop Inventory

In a desktop PC model, capacity management and desktop inventory are fairly straightforward and are largely a matter of purchasing and physical inventory management. In a traditional model, each desktop is an independent physical entity which will be associated with a specific 'owner' and tracked using standard physical inventory management tools. Compute and storage capacity is allocated local to the user, not in the data center. When a user leaves the organization, reclaiming the desktop is as simple as removing the user's AD entries, recovering the physical PC, and shipping it back to IT for redeployment. Adding new users may have a direct impact on network resources and an indirect impact on DC resources but in general, traditional data center and network operations are not tightly coupled to the addition or removal of individual users. DC and network capacity is typically managed by watching trends in resource utilization and adding more resources as necessary to keep services within SLAs.

Virtual desktop deployments break traditional capacity management and desktop inventory models. Adding new users has a direct impact on DC operations as each new user will consume DC compute and storage resources and will result in adding a nailed-up, near real-time VDI network stream linking the HVD in the DC to the user. Provisioning a large number of users at once may result in the need to add a large amount of DC compute and storage capacity as well as campus and WAN network capacity prior to the introduction of the VXI users. Further complicating matters, adding new applications to a large number of HVD desktops could also have a direct and immediate impact on DC resource consumption. In a desktop PC, compute and storage is not shared, so if a CPU or disk hungry application is added to a desktop, typically there is excess local compute and storage in the PC to handle the application or only the users of the application will individually feel the impact of the additional loading to their desktop. In a VXI environment, addition of CPU or storage hungry applications into an existing deployment can negatively impact many desktops in the environment by introducing a step-change increase in DC capacity utilization.

In addition to the capacity management complexity introduced by coupling all desktops to common compute and storage resources, inventory of virtual desktops is also more complicated than in the traditional model. In a pooled, non-persistent VXI desktop deployment, if a user's desktop hangs or becomes unresponsive the user can simply disconnect from the HVD in the data center without shutting down the HVD itself (in the case of a hung desktop that might not even be possible) and they can then reconnect to a new desktop, leaving the prior desktop running but unused. From an operations standpoint, current management tools do not differentiate 'hung' desktops from 'idle' desktops well. Hung desktops should be killed to reclaim the compute resources that they reserve from the server pool. As thousands or tens of thousands of desktops may be hosted in a VXI deployment, manual intervention to reclaim hung desktops is not feasible.

Automation may be applied to directly address the challenges of VDI desktop capacity management and virtual desktop inventories. While current Hypervisor and VDI management tools exist to add compute and storage capacity to existing compute and storage pools and tooling exists to dynamically move users from one compute node to another to load balance HVD servers, these tools are typically not orchestrated by an automated workflow which would facilitate rapid addition of compute and storage resources to a VXI environment or rapid removal of compute and storage resources with the additional step of consolidating active VXI desktops onto a smaller number of compute servers. Currently, these operations may be handled manually but the time required for IT staff to recognize a capacity exhaustion problem, identify additional resources to add to the HVD environment and manually work through the steps to add the resources and load-balance users could take hours if not days. Given that negative performance of a HVD deployment may have a broader enterprise productivity impact than poor performance spread across a limited number of individual desktops, rapid, automated capacity management facilities may be extraordinarily valuable.

1.2.3 VXI Troubleshooting and Service Assurance

Given the dependency of a HVD desktop on a coupled collection of Data Center and Network resources, troubleshooting problems encountered by VXI users is no longer as simple as having a IT Professional use Remote Assistance to connect to a user's PC and examine the local environment. In a VXI environment, the user may only have a VDI endpoint appliance and desktop performance issues may be related to issues with compute resources, storage resources or network connectivity between any parts of the VXI environment in the DC as well as to the end user on the campus or WAN network. For example, failure of a storage controller may manifest itself as odd behavior spread across a collection of HVD desktops.

Similarly, Service Assurance in a VXI deployment is more complicated than Service Assurance in a traditional desktop PC model. Given the very light dependency of traditional desktop user experience on Data Center or network resources, SLAs for traditional PC users tend to be rather binary in nature – does your PC work or not. If not, IT will get you a new PC in 48 hours. Until then, look for a loaner in your office. For VXI desktops, the desktop itself is a service provided to users from Data Center via Network resources so simply drop-shipping a new endpoint to a user is unlikely to address desktop service availability or experience issues for users.

As desktop issues may be related to resource constraints or equipment failure in a number of different IT domains, localizing desktop performance issues typically requires collecting and analyzing end-to-end performance metrics from the user's endpoint right through the network to the compute pools and into the storage pools. Problems anywhere along the end to end path could manifest themselves as VXI desktop performance issues.

A variety of tools exist to report on the operational status of the different elements of a VXI deployment, however, each tool tends to focus on a specific portion of a VXI deployment, such as storage, compute, desktop OS performance and the network. To quickly determine the root cause of a user's HVD desktop experience issue, it may be necessary to examine performance metrics from all those elements to identify the element causing the problem. This can be done manually by IT resources responsible for each operational aspect of the enterprise's IT environment but that process can be excessively time and human resource consuming to scale for support of thousands of VXI users.

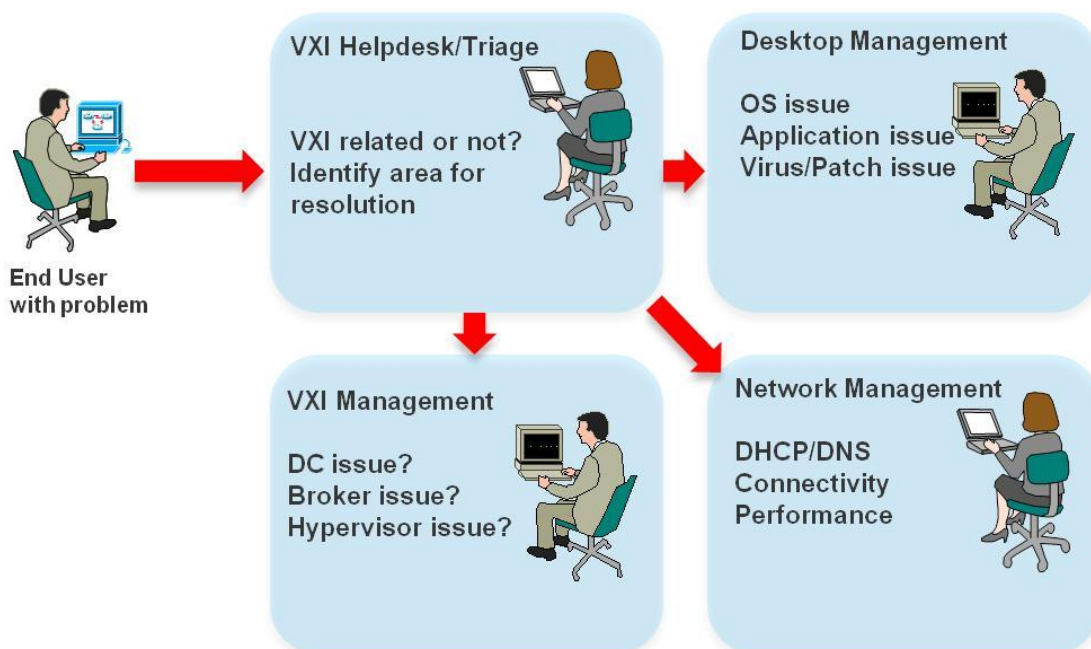


Figure 3. Multifaceted approach to VDI user issue triage and troubleshooting.

Automation can be used to create workflows that automatically collect, consolidate, analyze and report on the operational status of all the elements of a VDI deployment from the user's endpoint through to the storage pools. This capability can be used to automate troubleshooting processes for individual desktops or for trend reporting across the entire VDI desktop deployment to proactively identify potential resource constraints which might arise as the user and application mix in the deployment evolves over time. Meeting aggressive VDI desktop SLAs would benefit greatly from the use of automation for end-to-end diagnostics and user trouble-ticket triage. The manual techniques which may typically be sufficient for small scale Proof of Concept deployments typically will not scale well to broader enterprise-wide deployments.

1.3 Cisco Intelligent Automation for Cloud

Through a combination of acquisitions and internal development, Cisco has delivered the Cisco Intelligent Automation for Cloud solution to provide a foundation for best-practice driven, policy based automation of physical and virtual IT infrastructure components within the data center and beyond into the broader campus and WAN environments.

Cisco Intelligent Automation for Cloud provides pre-built modules to facilitate:

1. Quick creation and deployment of service request portals able to initiate automated workflows to provision, manage and report on data center resources
2. Leveraging application triggers to start workflows to initiate infrastructure changes responding to events such as changes in data center loading or equipment failure
3. Intelligently managing application and infrastructure changes using best-practices to comply with policy, auditability and regulatory requirements

The Cisco Intelligent Automation for Cloud solution is composed of the following elements:

Cisco Cloud Portal: A comprehensive service catalog with capabilities for service design and lifecycle management, a web-based self-service portal that allows users to order and manage services, and built-in policy enforcement and tracking. The portal has a configurable and brand-able interface for different departments and roles.

Cisco Process Orchestrator: A global orchestration engine for automation of order-to-delivery, service management, and assurance workflows. This automation core includes a process orchestration engine, an interactive automation design studio, and a reporting and analytics module

Cisco Process Orchestrator Integration Framework: A framework facilitating easy integration of the Cisco Intelligent Automation for Cloud solution with any data center infrastructure element. Using both out-of-the-box integration modules and field built integration components, infrastructure elements and boundary IT service management tools may be connected into streamlined, comprehensive automated processes. A rich set of available integrations covers Cisco UCS Manager, VMware, Remedy, SAP, Windows, Oracle DB, web services, network, storage, server resources, Microsoft SCOM, and many more IT systems. In addition, the design studio facilitates field integration and automation through interfaces from command-line interface and web services (SOAP and REST) to scripting support using Perl and Windows Powershell, as well as database connectivity and SNMP integration.

Cisco Server Provisioner: A software provisioning and imaging component for OS, hypervisor, and application provisioning to remote, unattended, native installations on virtual and physical servers.

Cloud Automation Packs: Sets of preconfigured workflows for both common and complex computing tasks, including VMware task automation, Cisco UCS Manager task automation, Cisco Server Provisioner task automation, and automation of core and common activities that span multiple domains.

The Cisco Intelligent Automation for Cloud solution provides the framework within which automation solutions for Cisco VXI deployments may be quickly and easily assembled using a combination of pre-built integration modules shipped in the Cloud Automation Packs and custom integration components built within the Cisco Process Orchestrator Integration Framework. As shown in Figure 4, the Cisco Process Orchestrator provides a robust, full featured platform for delivering both “Day 1” provisioning and service delivery operations as well as “Day 2” ongoing operational support and maintenance operations.

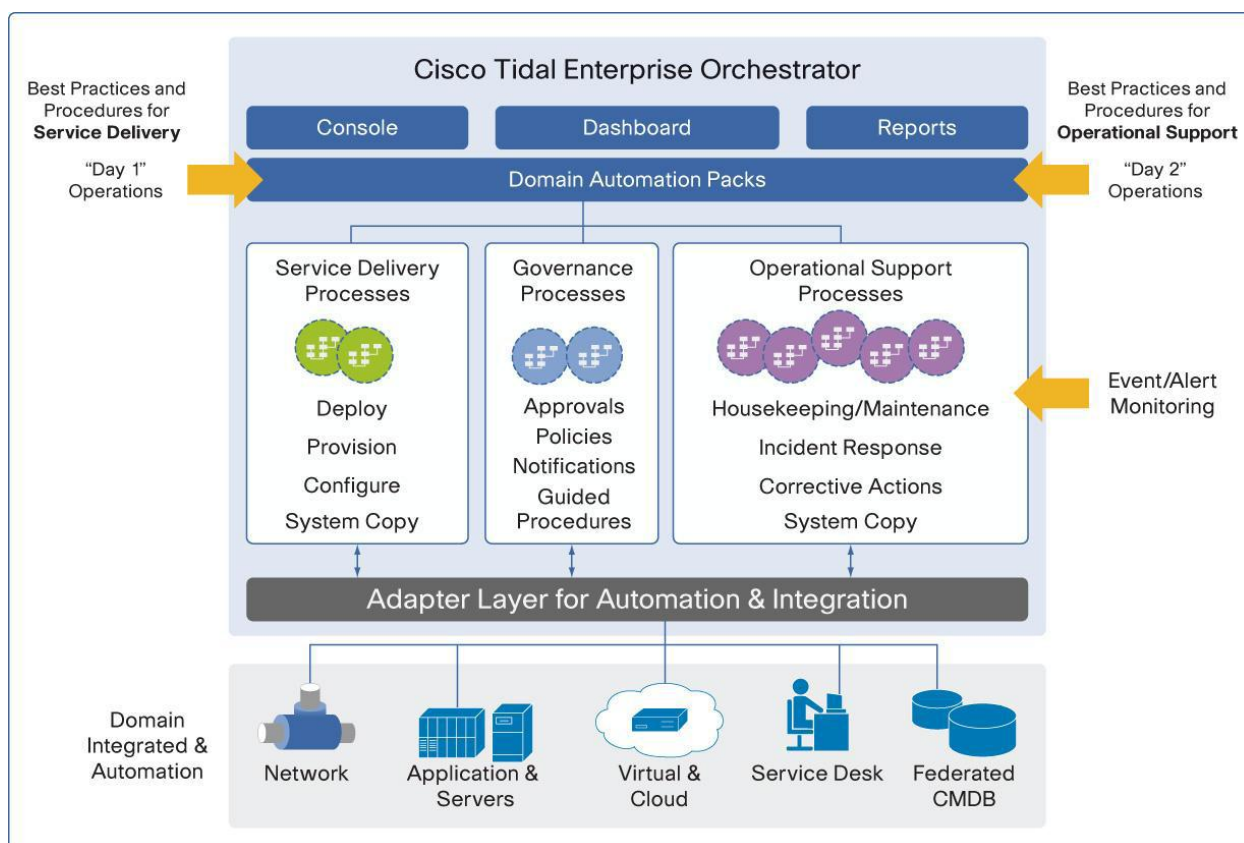


Figure 4. Cisco Process Orchestrator Integration of Events and Alert Management.

The Cisco Process Orchestrator platform provides a rich set of features and functions out-of-the-box to dramatically reduce time-to-delivery for key IT automation use cases. Process Orchestrator includes:

Automation Engine: The engine orchestrates automated processes and improves alerting, reporting, monitoring, and management of the tasks it automates. The engine supports process flow checkpoint restarts and multi-tenancy.

Visual Configuration Environment: A comprehensive, drag-and-drop workflow creation environment which allows users to build sequences of operations in a logical flow.

Logic Connectors: Connectors for parallel sequential processing providing looping constructs, completed status blocks and conditionals. The connectors are used within the Visual Configuration Environment and are useful for capturing domain-specific triage and diagnostic steps and procedures.

Event Driven Processes: Processes triggered by asynchronous or scheduled events. The event engine supports decision-driven complex event processing for intelligent alert filtering and correlation.

Work Spaces: Built-in views for stakeholders (Operations, Admin, Expert, etc.) for managing activities, processes and tasks.

Notification of Alerts and Incidents: Includes full support for email notification and assignment as well as integration into existing service desks and management platforms

Reporting Engine: Includes built-in ROI and auditing models

Automation Packs and Adapters: Automation packs include pre-defined best practice process flows that automate certain types of tasks for specific technologies or domains. Adapters include support for integration with service desk, configuration, and monitoring tools.

The tight integration of the Cisco Cloud Portal product with the Cisco Process Orchestrator platform provide IT organizations with the ability to quickly deploy configurable, self-service portals to their user population to improve service delivery whilst simultaneously streamlining and improving compliance in IT processes. As shown in Figure 5, IT can quickly and easily provide an intuitive “single-pane-of-glass” view for users, combining data from multiple sources into a highly configurable and flexible self-service portal interface.

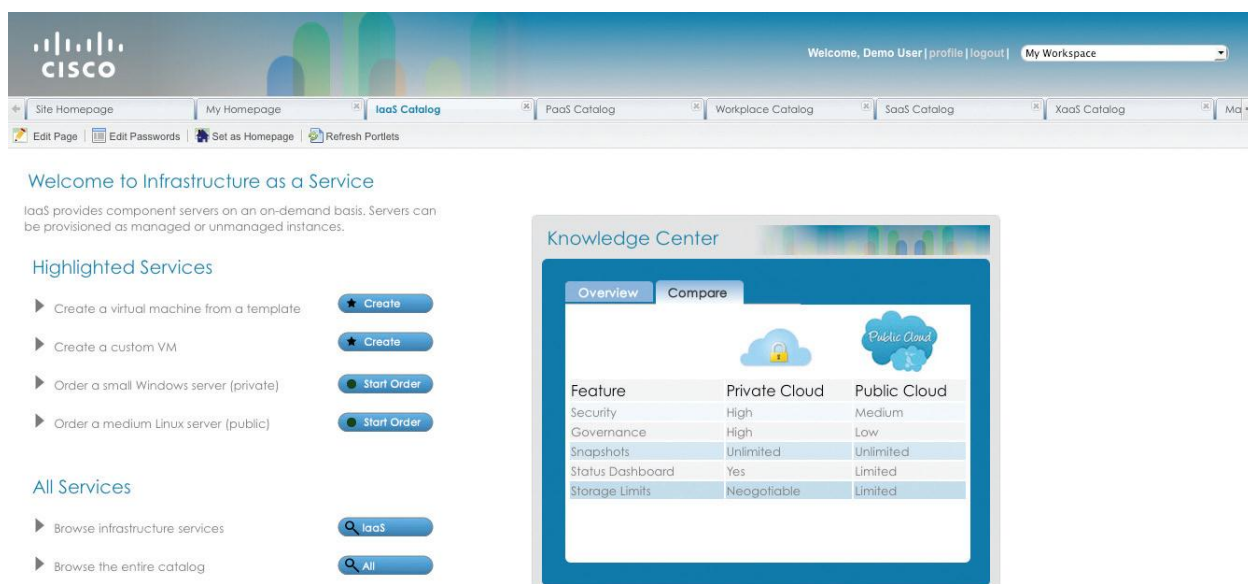


Figure 5. With Cisco Cloud Portal, IT can provide users with a configurable portal for self-service provisioning of infrastructure services.

As mentioned already, Cisco Advanced Services has created automation workflows within the Cisco Intelligent Automation for Cloud platform that provide the ability to automatically provision compute, storage, OS and application images, email, voicemail and collaboration resources for new or existing users from a single entry screen. This capability is exposed as an end-user self-service portal with the Cisco Cloud Portal and uses workflows managed by the Cisco Process Orchestrator. Both off-the-shelf components from Cisco Automation Packs and custom integration components built with the Cisco Process Orchestrator Integration Framework are used in the workflows. The solution produced by Advanced Services provided the ability to fully provision a new user from the ground up in minutes, a capability afforded by a VXI environment which would be much more difficult to realize in a traditional desktop PC environment.

Capacity management and virtual desktop inventory management can be implemented within the Cloud Automation solution by leveraging the platform's ability to respond to application or service level events to reclaim, repurpose or potentially enrich data center VXI resources. Automated workflows to add additional compute servers or storage pools can be triggered as a result of SLA metrics trending downward or as a result of brokering services reaching

pre-defined capacity limits. Virtual desktop inventories may be generated by workflows which automate the process of looking for duplicate user desktops or gathering usage information from provisioned and running desktops.

Troubleshooting and service assurance can be addressed through a combination of desktop user facing self-service portals which can initiate automated workflows to capture end-to-end VXi system metrics for the user's desktop and then automatically initiate operations to improve the user's experience (such as VMotioning a user's desktop off of a heavily loaded server) or package the collected data for attachment to a trouble ticket to be sent to a desktop support technician. Service assurance challenges may be met through automated workflows that periodically monitor and report on Key Performance Indicators in the VXi environment or through automated workflows that may be triggered in response to equipment failure or operator intervention.

A key requirement for a successful automation project is to clearly identify use cases and align the appropriate tools to deliver the functionality desired. Although the Cisco Intelligent Automation for Cloud platform is a powerful process orchestration and automation tool, it relies on additional lower-level services for various functions. For example, the Cisco Process Orchestrator could execute an automated workflow to provision a new user for both VXi and UC by reaching out to a variety of vendor-specific management consoles for provisioning the VXi capabilities and CUCM for provisioning UC assets.

1.4 Cisco Advanced Services

Although the Cisco Intelligent Automation for Cloud platform includes a large number of pre-built integration and automation modules, it is very unlikely that a VXi automation solution could be assembled using only the out-of-the-box components. Given the large number of touchpoints for a VXi deployment into an existing IT ecosystem, it is to be expected that specialized integration modules and scripts would have to be created to support the seamless automation of VXi processes within a non-greenfield enterprise deployment.

Cisco Advanced Services is experienced in assessing the integration points for VXi automation solutions into incumbent IT environments, scoping the effort to develop the necessary integration components and deploy them within the Cisco Intelligent Automation for Cloud solution to meet an enterprise's requirements for VXi automation. Advanced Services engagements offer Cisco's customers the ability to quickly and cost effectively deploy automated workflows to reduce IT management overhead and increase end user satisfaction for VXi deployments, accelerating a VXi solution's ROI. Customers choosing this approach will exit a VXi deployment with a highly automated VXi solution running on a state-of-the-art cloud automation framework upon which internal IT resources can continue to enrich and expand their VXi and DC automation suites.

1.5 Conclusion

This whitepaper has discussed of a number of key VXi automation use cases and introduced the Cisco Intelligent Automation for Cloud framework as a cutting-edge solution for automating workflows to alleviate the challenges associated with deploying, managing and reporting on pools of VXi desktops integrated into an environment with various other incumbent IT systems. A well designed, best-practice based, automated VXi deployment can deliver both an accelerated ROI compared to traditional VDI deployments in addition to providing the opportunity to increase end user satisfaction with their desktop services by providing excellent SLAs, eliminating common PC equipment failures and providing end-user self-service capabilities difficult to achieve in traditional desktop PC models.

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