VMware® Horizon™ with View™ 
Reference Implementation 
Case Study for European IT and 
Network Services Provider 

Including a Reference Architecture for 5,000 End Users 
in a Multi-Data Center Implementation 

TECHNICAL WHITE PAPER
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Introduction

This document is a reference implementation case study for VMware® Horizon™ with View™ at Colt, a major European IT and Network service provider consisting of a 5,000-user environment across 62 sites in 17 countries.

The intended audience for this document is the technical decision-maker who is considering deploying View at scale. The Executive Summary and Business Benefits sections of this document are also suitable for non-technical decision-makers.

The purpose of this case study is to illustrate how the technical solution provides tangible business benefits. The document includes an overview of business benefits and cost savings (where possible); an architectural overview; and key configurations that Colt used to deploy the solution.

About VMware Reference Implementation Case Studies

A reference implementation case study exists to show how specific customers in a variety of locations and industry verticals have deployed and benefited from View. A reference implementation describes in detail the project approach, architecture, and business benefits at a real customer site, and provides lessons learned for that particular deployment. These implementations are often built on reference architectures validated by VMware.

While a reference implementation is often built on best practices, sometimes tradeoffs are made to meet project requirements or constraints. When referencing these implementations, it is critical to understand where the architecture has deviated from best practices, and where improvements can be made. This is easily achieved by comparing a reference implementation to reference architecture documentation provided by VMware. For further information regarding this and other technical reference architectures, visit the VMware Horizon with View Design resources on the VMware Web site.

This case study is intended to help customers—IT architects, consultants, and administrators—involved in the early phases of planning, design, and deployment of View solutions. The purpose is to provide an example of a successful architecture that represents specific industry vertical challenges met, and the benefits gained from the solution.
Executive Summary

The Colt Group initiated a desktop computing network for all permanent and contract employees, and chose View for the virtual desktop infrastructure (VDI). Colt Group is a multinational telecommunications, IT managed services, and data center services company with offices in 22 European countries, the United States, and India. The model for Colt’s IT organization was virtualization as a key enabling technology, which it rolled out to its domestic and international users through the “Colt Workspace” VDI project.

With a clear plan to deliver VDI, Colt evaluated vendors across their technology stack, ranging from hardware, desktop session management and brokering, to storage, profile management, and application-virtualization technologies.

The View solution was chosen because it simplifies Colt’s desktop management strategy, increases control of corporate assets, and significantly improves end-user data security. Specifically, Colt has used View to provide access to virtual desktops for back-office staff based abroad, and remote access for employees that are not on site at Colt offices.

Implementation Overview

As a Virtualization First organization, Colt realized the benefits of using View as a desktop infrastructure. The Colt View implementation provided a scalable, highly available solution with disaster recovery across two active data centers. This environment is designed for 5,000 users with up to 4,100 concurrent virtual desktops, of which 4,000 are floating and 100 are dedicated to provide access to legacy applications. The modular design, based on the concept of View pods and building blocks, is easily scalable beyond the original designed capacity.

Business Drivers, Business Case, and Benefits

Colt’s business drivers for the implementation were to enable employees to work remotely, and to reduce or eliminate costly desktop and laptop replacement. With this implementation model, employees are able to use their own laptop, desktop, or mobile device; and to access a Colt virtual desktop from any location.

In addition, Colt no longer provides devices to their substantial contract staff. The main driver for the business case was to unlock the three-year laptop and desktop refresh cycle, enabling employees to conduct a self-service refresh at the time of their choosing. Business benefits include an overall estimated savings of 61 percent on hardware costs and 68 percent on maintenance costs over four years. Employees also gain greater flexibility in working across multiple devices and by having the ability to work remotely.
Project Overview

Colt launched the VDI project as part of a large transformation program. The company invited VMware Professional Services to architect a View design. VMware performed an initial VDI assessment to understand and measure the resource requirements of Colt’s users and software, and to input them into a View design. Following the completion of the design, the View environment was implemented and the initial pilot staged.

During the pilot phase, Colt made the decision to keep its version of View in line with current production releases, to enable improvements and introduce features which were part of the original Colt requirements. Colt and VMware completed the Colt Workspace project and a full rollout to all business lines in summer 2013.

All 5,000 employees have been enabled to use View. However, the main target number of users from the original analysis were:

- All existing users of the legacy server-based computing platform (300 users)
- All India staff (1,500 users)
- All Colt contract staff (500 users)
- All Colt staff fitting the standard “task worker” profile (1,000 users)

Colt developed the rollout plan alongside the phases of the project to ensure focus was maintained on the key business requirements. As the View product improved with new releases, the rollout expanded to all areas of the Colt business.

Lessons Learned

As is common with companies that deploy new technology for the first time, Colt faced many challenges along the way. They divided the key lessons learned into Project, Technical, and Operations categories, outlined in Figure 2.

**Project**
- Application virtualization timeframe underestimated which impacted project duration and cost
- The approach favoring invitational use versus mandatory affected rollout adoption
- Communication workstream ensured user buy-in during project
- A manual discovery and analysis period to validate customer data added time to project

**Technical**
- Determine if VDI technology adds value to the user role and experience
- Ensure that existing infrastructure services will support additional load that new technology brings
- New versions of technology may solve technical or use case challenges during the project
- A technology-led project must never forget business and user requirements and suffer scope creep

**Operations**
- The breadth of technology for a VDI solution affects multiple support teams
- Create a transition team, including help desk and operational support teams, as early as possible
- Review overall operational workflows for new user service creation and management

Figure 2: Key Lessons Learned
Architecture Overview

Colt required a VDI solution that included disaster recovery without the need for a passive standby data center. A two-data center design in active-active configuration, architected and implemented with View 5.3, brokers the desktop sessions to users and is tightly integrated into VMware vSphere® 5.3. This provides ease of management and less complexity than comparable VDI solutions.

The solution is deployed on a vBlock with Cisco UCS compute and EMC VMAX storage technology. The architecture follows the VMware best-practice reference architecture approach of View blocks. The blocks make up a single 2,050-desktop pod consisting of 2,000 floating desktops, 50 persistent desktops, and a View management building block. Colt duplicated this pod approach in a second data center to provide multisite failover and disaster recovery. Figure 3 diagrams the Colt VDI solution architecture.

Figure 3: Colt VDI Solution Architecture
Conclusion

Since the project launch, Colt has completed the journey from project initiation, assessment, architecture and design, proof of concept, pilot, and implementation to full production rollout.

With the View design implemented, Colt has successfully migrated all 5,000 users into the production environment. The flexible, highly available environment now supports up to 4,100 concurrent users from two data centers, with disaster recovery capabilities for 62 sites located in 14 countries. This is a major success story that will gain significant financial savings and business benefits for Colt. It will enable the IT organization to centrally manage and support a productive virtual desktop environment in an effective and efficient manner.

About VMware Horizon with View

Horizon with View is a desktop virtualization solution that simplifies IT manageability and control while delivering the highest-fidelity end-user experience across devices and networks.

The Horizon solution helps IT organizations automate desktop and application management, reduce costs, and increase data security by centralizing the desktop environment. This centralization results in greater end-user freedom and increased control for IT organizations. By encapsulating the operating systems, applications, and user data into isolated layers, IT organizations can deliver a modern desktop. IT managers can then deliver dynamic, elastic desktop cloud services such as applications, unified communications, and 3D graphics for real-world productivity and greater business agility.

Unlike other desktop virtualization products, Horizon is built on and tightly integrated with VMware vSphere, the industry-leading virtualization platform, allowing customers to extend the value of VMware infrastructure and its enterprise-class features such as high availability, disaster recovery, and business continuity.

Horizon delivers important features and enhancements that improve the performance, security, management, and flexibility of virtual desktops.

Support for VMware vSphere 5.1 leverages the latest functionality of the leading cloud infrastructure platform for highly available, scalable, and reliable desktop services.

For additional details and features available in Horizon with View, see the release notes.
View Solution Components

Typical Horizon with View deployments consist of several common components, shown in Figure 4, which represent a typical architecture. The solution includes View components as well as other components commonly integrated with View.
Colt Reference Implementation Overview

Colt was challenged to transform its physical desktop experience, and chose to innovate with a virtual desktop environment as part of a wholesale desktop transformation project. This covered all of Colt’s 5,000 users in 62 locations in 17 countries.

“**The Roadmap for development of View, the alignment of VMware as a strategic partner to Colt, and the willingness to provide resources to help adopt the technology told us that going with VMware was definitely the right decision.**”

Colt engaged VMware Professional Services to assess its current physical environment, and deliver an architecture design. The implementation, pilot, and full rollout to all Colt users from all business areas was completed over an 18-month time frame; and work continues to enhance the workspace experience, including voice integration.

This Reference Implementation Study details how Colt successfully addressed each of the requirements, and how Colt and its key partners were able to plan and implement a workspace solution serving 5,000 users with a concurrency of 4,100 virtual desktops. The key lessons learned are also described in more detail, including valuable information and insights for other companies contemplating a move to VDI.

Business Drivers, Business Case, and Benefits

For Colt, moving to a VDI platform was an obvious and natural decision, as it already had a mature virtual server infrastructure in place and understood the technology. Before it initiated the Workspace project, Colt’s IT managers had been seeking a more cost-effective way to deliver desktop services to employees and enable flexibility. The Colt IT organization also wanted to introduce “consumerization” via Bring Your Own Device (BYOD) practices.

The key business drivers were: unlock Colt from a costly three-year hardware refresh cycle on all its laptops and desktops; provide centralized management and support for the infrastructure; and enable choice and flexibility for employees using their own devices.

“We wanted to break the paradigm of a traditional and costly three-year laptop and desktop refresh project. We wanted to release our employees from their reliance on internal IT, and give them the freedom to use any device from any location to access corporate applications.”

The Colt Workspace project had a clear definition of requirements and measurements for success, which were met by an accurate architecture design and by the capabilities of the View platform, as outlined in Figure 5.
Business Drivers

- Reduce costly desktop and laptop replacement projects
- Enable employees to work remotely without the need for Colt to provide equipment
- Enable consumerization of IT (BYOD) by allowing employees to securely access Colt services on any device
- Support Colt’s business continuity planning in case of loss of a device or office
- Enable Colt to act as its own reference site for selling Workspace solutions
- Enable the development of internal skills and knowledge that Colt will use to implement and support customer solutions
- Demonstrate Colt’s technical knowledge and thought leadership in VDI and BYOD

Business Case

- Unlock the organization from a costly three-year laptop and desktop refresh cycle
- Enable BYOD and employee choice to use their own device to access Colt workspace services reducing number of Colt-supported devices
- Reduce support costs by centralizing desktop infrastructure and moving support to a shared service center
- Enable Colt to reduce cost for devices for external contractors who now use their own devices to securely access a Colt desktop
- Replace legacy Citrix desktop infrastructure, scheduled to go out of support

Business Benefits

- Overall savings is estimated to be 61% on hardware costs and 68% on maintenance costs over four years
- Reduction in hardware and software setup time of 75% for contractor staff—from days to hours
- Significant success in new company acquisition integrations, reporting 40% quicker than usual deployment methods
- Increased revenue opportunities by offering Colt’s customers a hosted workspace solution
- Improved user experience with staff reporting improved login experience
- IT productivity benefits when deploying new applications to devices
- Supports business continuity and productivity during major disruptions, adverse weather, and transport issues

Figure 5: VDI Business Drivers, Business Case, and Business Benefits

Business Drivers

As Colt had a Virtualization First policy in place and a vision of virtualization as a key enabling technology, it had already gained benefits from virtualization of its server estate. These included energy savings, centralized management, lowering of the data center footprint, faster server provisioning, and increased server and service uptime. Moving to VDI was a natural and obvious direction for Colt, as it could realize further benefits such as high availability, follow-me desktop sessions, reduced support costs, and simplified and cost-effective disaster solutions. All of these were not possible or too expensive to implement with a physical desktop infrastructure.

“VMware was working with Colt as a strategic partner around the VMware vCloud® Datacenter Services™ launch, and virtualization of the desktop was the next logical step.”
In addition to the main business drivers, Colt had an expectation that the new View desktop environment would provide faster user login, integration with third-party profile management solutions, integration with application virtualization, and secure two-factor authentication capabilities for remote access.

With 62 locations in Europe, the U.S., and India, and the ability to blend its own network and IT infrastructure, Colt was able to centrally host the View environment in two data centers and guarantee performance to its virtual desktops. As the infrastructure was centralized, desk visits have been greatly reduced and administrative tasks simplified, which has vastly reduced the support costs and the effort required by IT technicians to resolve problems.

**Business Case**

Colt faced a key decision of whether to replace its existing physical desktop infrastructure with a virtual one. While the hardware refresh program for its laptops and desktops was expensive, would VDI deliver the user acceptance and take-up that would enable Colt to walk away from its three-year hardware refresh cycle?

The growing mobility of Colt users and the pan-European nature of the business made hot-desking an important requirement, as it allows users to connect to their workspace environment by any available and approved device. Users no longer have to log in from the same physical location to access their data, which enables further flexibility for those that travel to different Colt offices or work remotely.

Due to the dispersed geographical locations of Colt sites, the company’s desktop operational support had historically been expensive, and every desktop-related technology that the IT organization introduced had to cater to deployment and support in widespread locations. With centralized data centers hosting the View environment, Colt’s support costs were greatly reduced while the ability to roll out new services was greatly increased.

Colt also historically had a Citrix solution implemented for the 1,500 remote users in India. This was a cumbersome environment to manage, maintain, and use. User productivity was negatively affected by this platform, and the business determined it had to be improved or replaced. View provided a much better platform and solution for these users. With WAN optimization applied on the PCoIP protocol, user satisfaction increased, with users reporting a far superior experience.

**Business Benefits**

Over a four-year period, overall savings have been estimated to be 61 percent on hardware costs and 68 percent on maintenance costs. In addition to this, the following benefits were realized:

- Overall hardware spend significantly lower than previously planned in 2013.
- Substantial CapEx expenditure avoidance as over 75 percent of contractors are mandated to use VDI instead of being supplied a Colt desktop device.
- A productivity benefit has been achieved by faster time to value by provisioning contractors and new starters with a Colt workspace service.
- Significant WPT support savings have been accrued by taking advantage of VDI and centralizing services.

As Colt has always had a large number of external staff working on-site, the company used a traditional process to provision desktops or laptops for them in the Colt environment. This process had an average turnaround time of two days. View reduced setup time by 75 percent, down to less than half a day.

Moreover, with a View infrastructure, hot-desking, flexibility, and mobility of desktop sessions following users has become a great benefit for those working in Colt’s virtual environment and the external staff visiting Colt offices. Deploying View has also enabled Colt to implement a Bring Your Own Device (BYOD) policy, which allows employees to use any device to access their desktop.

“It’s better than working over VPN with my old laptop, and I don’t have to carry my Colt laptop bag to and from my home and office each day. I can work on a document in the office, go home, and work on the same session on my Mac seamlessly.”
Companies typically face integration challenges when acquiring or merging with other companies. Colt was able to quickly deploy its VDI service to enable the integration of its acquisitions of ThinkGrid and MarketPrizm, which was completed 40 percent faster than using traditional desktop deployment methods.

Project Overview

Colt implemented the project with a select number of users, and then progressed into a full rollout. Although the total number of users to be migrated was 5,000, Colt also had main target numbers from different areas. These targets were:

• **300 users from the legacy server-based computing platform** – These users traditionally used Terminal Services (Remote Desktop) to access individually assigned desktops hosted at a data center. It was important to move the users away from this platform, as it had become expensive to manage and support.

• **1,500 users in India** – These users accessed the Colt environment via a Citrix solution.

• **500 Colt contract staff** – These users were external staff, and Colt required that they work on Colt desktops.

• **1,000 Colt staff with the standard “task worker” profile**

With the whole desktop stack to consider, Colt faced challenges on evaluating technologies and vendors for a virtual desktop infrastructure solution. All had to be carefully assessed, and technologies researched and evaluated, then architected and designed to meet Colt requirements. In this case, VMware, VCE, Atlantis Computing, Microsoft, and RES were the main partners that provided the design and subject matter expertise. Figure 6 shows the project overview timeline.

![Figure 6: Project Overview Timeline](image-url)
Technology Evaluation

Colt’s evaluation between View and Citrix XenDesktop consisted of the following steps:

• Colt invited vendors to provide installation and configuration services.
• Colt staff applied required configuration from core technologies.
• Colt established the acceptance and test criteria.
• Colt selected test users.
• Colt IT staff conducted testing.
• Colt IT staff analyzed the results.
• Colt selected the technology.

The analysis of the results from the acceptance and test criteria, responses from all the test users, and the alignment with the vendor resulted in Colt choosing Horizon with View.

Following the decision to leverage Horizon with View as the VDI platform, Colt engaged VMware Professional Services (PSO) to architect the View design.

Design Phase

The VMware Professional Services Organization (PSO) was engaged from project kickoff to provide guidance, and assist in understanding and making technical decisions on a virtual desktop infrastructure. Colt and VMware PSO also conducted the View proof of concept, with PSO providing the View design.

“The VMware roadmap for development of the Horizon with View product, the alignment of VMware as a strategic partner to Colt, and the willingness to provide resources to help us adopt the technology, were the main points that validated our decision to go with VMware over Citrix.”

Pilot Phase

The key purpose of the pilot phase was to test user experience, functionality, and integration with the Colt environment. Test users were provided with a View desktop session to perform their day-to-day tasks, and were encouraged to use the virtual desktop rather than their normal physical desktop. Through the pilot phase, all test users provided feedback on the environment, which was fine-tuned to resolve discovered issues. The general feedback from the pilot users included:

• “It is simple to use.”
• “The App Store (a Colt-developed solution) means I can get applications without contacting the help desk.”
• “It supports the ability to work from any place from any device at any time.”
• “Performance has improved when opening applications and documents.”
During the Pilot

Colt experienced a particular challenge that affected its core infrastructure. The introduction of the VDI platform reduced network performance for wireless users and contract staff. This resulted in oversaturation of the Colt Wi-Fi network. Colt subsequently upgraded the Wi-Fi infrastructure, and introduced network access control to resolve the issue.

With a large number of users and limited bandwidth in India, enhancing user experience and performance became a requirement for enabling the region. Colt fine-tuned network optimization for the PCoIP protocol, which resulted in a productive setup specifically for these users.

“We were a victim of our own success, as uptake of VDI especially for contractors resulted in congestion on our Wi-Fi network. This required further capacity improvements, and for us to investigate network access control as another connection mechanism. As we were early adopters of View, we encountered challenges as roadmap capabilities were developed to meet our user cases and requirements.”

The original design and implementation was based on View 4.5. As new versions of View were released, Colt decided to stay current with its release cycle. VMware PSO assisted in updating the Colt design with new features. Updating to the latest version also meant that Colt experienced improvements in other areas. These included:

• Bandwidth requirements in the PCoIP protocol were reduced and user experience improved.
• Compatibility with RADIUS, Colt’s two-factor authentication provider, was boosted.
• Support for Android and Apple Mac OS clients.

Following the pilot, Colt decided to invest in Atlantis ILIO for the VDI technology stack. This significantly reduced the disk and storage requirements for the View implementation. Atlantis ILIO is now an integral part of the Colt View design, which IT staff leverages for onboarding users within the organization.

Project Rollout

Technology-led projects are generally run by technical teams, and it’s unsurprising that business and operational teams are often not invited to participate in decision-making discussions. Business and operational requirements might be overlooked, which will negatively affect the project further down the line.

As the Colt Workspace project involved migrating users from all areas within the organization, including technical and business teams, it was important for the VDI project managers to include representation from these teams in the communication lines of the project.

Although the technology platform had to be built to support the full rollout during this phase, Colt IT management realized that change was also required in the business processes to move from the current support model to a centralized support team. IT management set in motion gradual organizational change to retrain and transfer ownership to the new support teams. These teams were involved in the installation and configuration phases all the way to rollout and support.

Colt and VMware developed the rollout plan alongside the phases of the project aimed at addressing key business and user requirements. View improved with each new release, and Colt ensured regular updates and patching as part of the rollout to ensure full advantage was taken of new functions and capabilities. Colt has implemented View 5.3, which has enabled them to add integrated voice into the workspace environment. The latest version also supports Colt’s in-house TV channel by providing video streaming offload.

A key factor in approaching the rollout phase was the completion of application virtualization. The pilot focused on core office applications—by extending application virtualization to support all business applications, IT managers were able to add more users to the rollout.
Throughout the project, Colt identified its key team members. Their participation in technical discussions and project decisions, through their knowledge of the Colt environment, enabled the IT team to deliver the project successfully. Without recognizing the importance of these team members and their roles, the IT organization would have faced unnecessary challenges and delays.

Although Colt’s vision was to enable all users to the VDI platform, some use cases were not necessarily suited for it. There were cases that proved difficult to migrate, such as when an application had a peripheral that is not supported on a virtual desktop. By conducting an assessment of Colt users prior to migration, Colt was able to identify unsuitable use cases and take action regarding them, instead of avoiding or ignoring potential issues.

Lessons Learned

IT organizations nearly always encounter fresh challenges when delivering projects at the scale of the Colt rollout, especially when they introduce new technologies. This section shares these challenges and the corresponding lessons learned, outlined in Figure 7.

<table>
<thead>
<tr>
<th>Project</th>
<th>Technical</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Application virtualization timeframe underestimat-ed, affecting project duration and cost</td>
<td>• Determine if VDI technology adds value to the user role and experience</td>
<td>• The breadth of technology for a VDI solution affects multiple support teams</td>
</tr>
<tr>
<td>• The approach favoring invitational use versus mandatory affected rollout adoption</td>
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<td>• Communication workstream ensured user buy-in during project</td>
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<td>• Review overall operational workflows for new user service creation and management</td>
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<tr>
<td>• A manual discovery and analysis period to validate customer data added time to project</td>
<td>• A technology-led project must not ignore business and user requirements and suffer scope creep</td>
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Figure 7: Key Lessons Learned

Project Approach

Application virtualization is a key part of any major desktop transformation project, and contributes to the benefits derived from any VDI project. Early in the project, Colt completed a thorough discovery and audit of all applications in use across the organization. This provided important data that enabled an assessment of the applications used by each business unit, which allowed rationalization to take place. As applications were virtualized, the data was also incorporated into the project rollout schedule to ensure that all migrated VDI users had access to all their applications.
Colt found that some legacy applications were particularly complex and challenging to virtualize, or could not be virtualized at all by Colt’s chosen technology, which resulted in a longer project delivery cycle. Some applications were incorporated into the standard VDI desktop image or delivered through existing application delivery mechanisms, which allow all applications to be available from the View desktop.

While Colt mandated a new policy for contractors to use VDI, the IT team decided to allow permanent employees to use the device of their choice. In the early days this resulted in a slower take-up of VDI than was anticipated by the project team, until permanent employees realized the productivity and performance benefits of using the VDI service.

Regular communication with Colt’s employees was key to achieving adoption and employee buy-in. Colt employed a variety of communication channels with their employees, including standard email, intranet announcements, conference calls, workshops, and interactive drop-in sessions, which produced a positive and refreshing user experience.

Colt realized at an early stage that a VDI desktop was not suitable for all business roles in the organization. While mobile and task-based workers were good candidates for VDI, some engineering roles still required access to a full desktop. However, all Colt employees are automatically enrolled for VDI, supporting Colt’s policy of business continuity and disaster recovery planning.

**Technical Challenges**

One of the challenges with implementing a VDI project is integrating early technology versions from a number of vendors into a unified solution. Technologies that Colt used included compute and storage hardware and software; persona management; and application and OS vendors. As the project evolved over time, new version releases helped the IT team address business challenges such as voice integration. This encouraged further adoption of VDI in the organization.

The infrastructure in the technology stack covered a range of operational support teams in Colt’s traditional support structure, including storage, server, desktop, and help desk. Colt included representatives from all support teams in the project from an early stage, from design, build, and operate. IT management created a dedicated support team and help desk categorization for the new VDI service. The IT team greatly improved end-user experience by creating a multiple-disciplinary transition team during the project rollout phase. The transition team was able to quickly resolve any questions or technical issues.

Although the VDI project is largely technology-focused, Colt reviewed its end-to-end business processes during the project. This resulted in efficiencies in new user creation, help desk call handling, and application distribution; and achieved cost savings in application license management.
Conclusion

Since the launch of the Colt Workspace project, the journey from initiation to full migration has been a challenging but beneficial one. The wide range of vendor technologies integrated within Colt’s View environment added extra complexity, but resulted in an optimized, efficient, and cost-effective solution. Colt has already seen benefits from the VDI solution, shown in Figure 8.

<table>
<thead>
<tr>
<th>Users</th>
<th>Reduced Cost</th>
<th>Productivity</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Staff reporting improved login times and user experience</td>
<td>• Centralized desktop infrastructure has enabled a centralized support center</td>
<td>• Applications launch faster in a View session</td>
<td>• Secure remote access with two-factor authentication with RADIUS</td>
</tr>
<tr>
<td>• Users now have improved flexibility to access their applications and data from any device and any location</td>
<td>• Reduced hardware spend: contract staff do not have to be provided with Colt devices</td>
<td>• Enables true hot-desking at Colt offices</td>
<td>• Data remains in Colt locations reducing risk of data leakage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reduction in hardware and software setup times by 75%</td>
<td>• Greater control over user access management</td>
</tr>
</tbody>
</table>

Figure 8: Overall Benefits of the VDI Solution

Colt now enjoys a robust and mature VDI implementation with View, which acts as its own reference site for selling VDI and workspace solutions. Colt also seeks to continually stay in line with the technology by moving forward with each Horizon with View release. This enables the Colt IT organization to develop internal skills and knowledge they will use to implement and support their own customer solutions, and ensures that end users see a continual commitment to improvement of their day-to-day working environment.
Architecture Overview

The Colt VDI solution is a hosted model, where desktops are virtualized and run on Type 1 hypervisors hosted in two data centers. View is the software component that brokers client requests, and authenticates and allocates virtual desktops to users. The solution uses Atlantis ILIO for storage savings and performance increases. View is tightly integrated into VMware vSphere, which provides ease of management and less complexity than comparable VDI solutions.

For this implementation, Colt used a building block-based desktop solution. The VDI team designed separate building blocks, one for floating desktops and one for dedicated desktops, due to the different underlying architecture between the two and the Atlantis ILIO component. The building blocks used by the Colt VDI solution in each data center are shown in Table 1.

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>BUILDING BLOCK</th>
<th>NUMBER OF ESXi HOSTS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Management</td>
<td>4</td>
<td>For VMware vCenter and Horizon View components</td>
</tr>
<tr>
<td>2</td>
<td>Floating desktops</td>
<td>10</td>
<td>2,000 desktops</td>
</tr>
<tr>
<td>1</td>
<td>Dedicated desktops</td>
<td>2</td>
<td>50 desktops</td>
</tr>
</tbody>
</table>

Table 1: Colt VDI Building Blocks

Colt can further expand the View implementation by adding building blocks to the solution. The solution includes the typical components necessary to integrate up to 10,000 users into a View pod that can be managed as a single unit, leveraging both types of building blocks.

In addition to the building blocks, Colt implemented a View management cluster as a separate, dedicated cluster to manage the View environment. This management cluster is a stretched cluster over the two data centers, and is managed by a different vCenter instance. As a stretched cluster for a View environment, the following rules are strictly followed:

- Boot LUNS cannot be cross-site (ESXi hosts must boot from local shared storage).
- View infrastructure must remain on hosts in the local site they manage and must not be migrated onto the remote site hosts even in the event of a site outage.
- Additional Colt services should stay on local site hosts, unless a site or host outage occurs. In the event of an outage, they can be powered-on onto the remote hosts, if required.
- If vSphere Storage vMotion® (active migration) is required across sites, the sites must be less than 100km apart with a minimum of 622Mbps redundant network links, and must have a round-trip latency of 5 milliseconds or less. These network requirements are due to the fact that although there are two physical data centers, they will be managed as a single logical data center.
- The stretched cluster requires what is in effect a “single storage subsystem.” The given datastore must be able to read and write simultaneously at both sites.
- The Atlantis ILIO Center appliance should not be allowed to DRS across data centers—it is tied to the data center where it is managing ILIO appliances through its communication with vCenter.

The VMware architecture that Colt deployed is diagramed in Figure 3. There are two View pods, one in each data center, with each pod consisting of three building blocks. Additional building blocks can be added to support more users. The two data centers are for BCDR purposes, and are configured as active-active with production virtual desktops running in both data centers concurrently, Table 2.
### Colt VDI Solution Elements

The following elements are integrated into the Colt Workspace VDI solution.

- **Wyse Windows embedded thin clients / repurposed PCs** – Users connect to their virtual desktop via Wyse thin clients or software clients installed on existing PCs. Each user is assigned desktop access in one of the two data centers via a load-balanced URL.

- **Cisco ACE load balancers** – The Cisco ACE load balancers are implemented in both data centers, and redirect connection requests between the View Connection Servers within their respective data center.

- **Connection brokers** – Five connection brokers exist within each data center, and are hosted on the dedicated infrastructure hardware. They perform the initial authentication and desktop allocation as well as monitor the state of the desktop session.

- **View block** – The underlying vSphere infrastructure is built on Cisco and EMC and configured as per Cisco, EMC, and VMware best practices.

- **Management cluster** – The VDI vCenter servers (two per data center) are hosted within the dedicated management cluster hardware.

- **Core infrastructure components** – All fundamental core infrastructure services such as the Active Directory, user profile, data, printing, software deployment, and management are available locally in both data centers.

- **Atlantis ILIO** – Storage efficiency and performance.

- **RES Workspace** – User workspace and profile management.

- **App-V** – Application virtualization for View floating and persistent desktops.
Figure 9 shows the technology layers chosen by Colt for the VDI solution.

The IT team architected the VDI solution to accommodate View 5.3, a release that provides enhanced scalability and functionality over previous versions. Improvements include the ability to use multiple tiers of storage to run the virtual desktops. IT staff also strengthened PCoIP performance, including fine-tuning WAN optimization scenarios. This was a key factor in the success of remote access from widely distributed geographical sites.

The VDI desktops are hosted in two data centers with an identical implementation running on dedicated Cisco server technology and an EMC VMAX storage solution. The hardware runs the VDI desktops and View Brokers, while the vCenter servers run within the dedicated hardware separate from the desktop workloads. The load between data centers is handled manually via DNS record, with Cisco ACE load balancers to distribute the load to local View Connection Servers within each data center.
**VMware Infrastructure**

The VMware vSphere infrastructure is deployed on Cisco UCS blade technology with EMC VMAX back-end storage. The types of blade server models and configurations that the solution uses to host the View virtual desktops are shown in Table 3.

<table>
<thead>
<tr>
<th>CLUSTER TYPE</th>
<th>HARDWARE MAKE AND MODEL</th>
<th>CPU</th>
<th>RAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>Cisco UCS B200</td>
<td>Dual-socket, six-core</td>
<td>96GB</td>
</tr>
<tr>
<td>Floating desktop</td>
<td>Cisco UCS B200</td>
<td>Dual-socket, eight-core</td>
<td>384GB</td>
</tr>
<tr>
<td>Dedicated desktop</td>
<td>Cisco UCS B250</td>
<td>Dual-socket, six-core</td>
<td>128GB</td>
</tr>
</tbody>
</table>

Table 3: Colt VDI Blade Servers

Each data center is sized for up to 2,050 concurrent desktop sessions for a total of 4,100 concurrent sessions.

Following VMware best practices, the View pod and block design concepts introduced a vCenter for every 2,000 desktops—one for every View block. As there are two vCenters in each data center, further instances will not be required until there are more than 4,000 virtual desktops in a data center.

Colt has an EMC Symmetrix VMAX fiber channel SAN storage array in each data center, which provides the storage solution to the View implementation. The storage solution does not tier storage, but instead configures it to provide the calculated storage requirements for the View environment. The datastores presented to the ESXi hosts are shown in Table 4.

<table>
<thead>
<tr>
<th>CLUSTER TYPE</th>
<th>MINIMUM SIZE</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>1.12TB</td>
<td>2</td>
</tr>
<tr>
<td>Boot from SAN</td>
<td>10GB</td>
<td>52 (26 per data center)</td>
</tr>
<tr>
<td>Atlantis ILIO OS</td>
<td>10GB</td>
<td>48</td>
</tr>
<tr>
<td>Atlantis ILIO desktop</td>
<td>700GB</td>
<td>2 for dedicated desktops, replicated across data centers</td>
</tr>
<tr>
<td>Images/templates</td>
<td>1.12TB</td>
<td>2 (1 per data center)</td>
</tr>
</tbody>
</table>

Table 4: Colt VDI Datastores

Floating desktops use Atlantis diskless architecture, where the Atlantis ILIO appliance presents storage from physical RAM back to the host via NFS. The datastores for View desktops reside entirely in physical memory, which provides a significant performance gain over shared storage, even when compared to local solid-state disks.

In a typical logical storage design for View, virtual desktop replica disks would be placed on a fast storage tier such as enterprise flash disks (SSD). This is so they can benefit from high performance during heavy-read operations such as a boot storm. Linked clones would then be placed on another tier, such as 15K SAS in a RAID 1+0 configuration.

Implementing Atlantis ILIO Diskless architecture changes the typical View design principle, however, as View treats the NFS datastore as if it were local storage. Each replica disk and its associated linked clones reside on each datastore (one per host), further maximizing the performance of the desktop.
Persistent desktops also use the Atlantis ILIO technology; however, these desktops are full clones and require SAN attached storage to the ESXi hosts. As BCDR is required for persistent desktop users and these users must have their desktops available in the event of a data center outage, the persistent desktop datastores are replicated across data centers.

The Cisco UCS uses the Palo adaptor technology, a converged networking solution to provide gigabit networking and virtual HBA connectivity. This allows up to 56 virtual devices on the Cisco blade servers within the enclosure.

Two types of configuration are implemented, one for the Management cluster ESXi hosts and the other for the Desktop VDI cluster ESXi hosts, shown in Table 5.

<table>
<thead>
<tr>
<th>VIRTUAL SWITCH</th>
<th>PORT GROUPS</th>
<th>VLAN DESCRIPTION</th>
<th>ACTIVE NIC</th>
<th>STANDBY NIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>vSwitch0</td>
<td>Management network</td>
<td>Management VLAN</td>
<td>vmnic0</td>
<td>vmnic1</td>
</tr>
<tr>
<td>vSwitch0</td>
<td>vMotion</td>
<td>vMotion VLAN</td>
<td>vmnic1</td>
<td>vmnic0</td>
</tr>
<tr>
<td>vSwitch1</td>
<td>NFS ILIO</td>
<td>Atlantis ILIO NFS VLAN</td>
<td>vmnic2</td>
<td>vmnic3</td>
</tr>
<tr>
<td></td>
<td>(for VDI clusters only)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dvSwitch0</td>
<td>Virtual machines</td>
<td>Production desktop and server VLANs</td>
<td>vmnic4</td>
<td>vmnic5</td>
</tr>
<tr>
<td></td>
<td>(desktops and servers)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Colt VDI Configurations

Each vSphere ESXi host is connected to both standard vSwitches and a distributed vSwitch; they are connected to the Cisco Palo CNA adapters, which provide 2x10Gbe connectivity to the blade enclosure.

vMotion and Management are kept on a separate vSwitch to ensure network-related performance of desktop connectivity, where communication protocols like PCoIP are not affected.

**VMware Horizon with View**

Primarily, Colt IT staff uses thin clients and repurposed PCs to access the View environment; however, to promote consumerization, they also include iPads and Mac OS laptops as part of the Colt Workspace project.

As there are two separate data centers, each with its own View pod, users are entitled to desktops in one of the two pods. Access is provided by a DNS alias to a Cisco ACE load balancer in the data center the user is entitled to. Users use their assigned DNS alias whenever they log into a machine. This allows hot-desking, and any Colt user can log into their virtual desktop via any Colt access device.

Following VMware best practices, each View Connection Server is sized for 2,000 concurrent connections to allow for future growth, and the potential 10,000 concurrent connections for a View pod. This requires four vCPUs and 10GB of memory in each View Connection Server. Colt has four Connection Servers in each data center, of which two (in each data center) are paired with View security servers for remote access.

Each of the desktops is configured with one vCPU and 2GB of memory. The IT team chose this approach to maintain only a single master image, virtual machine configuration, as this would span all users and their resource needs. The solution utilizes VMware vSphere Transparent Page Sharing (TPS) and Zero Pages, so physical memory is used efficiently when the underlying vSphere platform eliminates redundant copies from memory.
End-User Persona, Session, and Device Design

Although the Colt Workspace solution used existing Active Directory user accounts, the solution uses RES for workspace and profile management, due to previous experiences and challenges with the standard Microsoft roaming profiles.

Floating desktops are the main type of desktop that Colt provided to end users, so application virtualization was key to the overall solution. This allowed Colt to keep the number of desktop images to a minimum, and also allowed flexibility so users could add applications on top of the common base image. As Colt already had a Microsoft SCCM environment, App-V was chosen as the application virtualization technology.

Colt provided dedicated desktops to users only in cases of approved exceptions, where IT managers had deemed a floating desktop not suitable. Typical reasons for this are:

• The desktop may contain applications that cannot be virtualized and require a different workstation image.
• Users require the same machine each time they log in.
• Users require local administrator rights on the desktop.

Devices

Colt provided users with Wyse Windows-embedded thin clients to access the Horizon Client. Colt was able to repurpose traditional desktops and laptops with the Horizon Client to access the View environment, which prolongs the life of older devices and avoids CapEx expenditure. Additionally, users can also use their own devices, including tablets such as Apple iPad, with the View application.

External Access

Colt deployed View security servers into its DMZ to provide external access for approved Colt devices. External users connect and authenticate to the View security servers over the Internet. These connections are protected by RADIUS two-factor authentication, where a secure key code is required.

Resiliency, Business Continuity, and Disaster Recovery

The IT team incorporated resiliency in this design to prevent a single point of failure. With this in mind, there are certain situations where a host may be offline, either due to hardware failure or scheduled maintenance.

Colt’s DR requirement is to enable 50 percent of users to access a virtual desktop in the event one of the two data centers is unavailable. The DR solution in this design is to have the two data centers in an active-active configuration supplying a total of 4,100 virtual desktops. In the event a data center becomes unavailable, the remaining data center can still service 2,000 floating desktop users and all 100 dedicated desktop users. Colt will identify the business-critical users, and grant them access to a desktop so they can keep the business running. The remaining users will be instructed to log out or will be forced out of their session.

In the event of a DR, the business-critical users will access their virtual desktop via the URL to the remaining data center. A DR group is created for these users, which will entitle the pools in the remaining data center. This will give the business-critical users access, and restrict non-business-critical users.

Persistent desktops rely on storage replication between the two data centers. In the event a data center becomes unavailable, the affected persistent desktop files must be registered against the remaining data center’s vCenter that manages the persistent desktops. IT staff must create a manual View pool, and must add the virtual machines entitled to the pool.
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References

View
VMware vSphere
View Technical Resources

Additional Resources

For more information or to purchase VMware products, call 1-877-4VMWARE (outside of North America dial +1-650-427-5000), or visit www.vmware.com/products, or search online for an authorized reseller. For detailed product specifications and system requirements, please refer to the View documentation.

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