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# Data center interconnect for the enterprise hybrid cloud

The world is moving to the cloud. Everything from entertainment and consumer mobile applications to enterprise software and government services is either already living in the cloud or will be headed there soon. But in the rush to proclaim the inevitable dominance of the cloud, it's easy to forget that there are many paths to the future. For enterprises, moving to the cloud can be a challenging, multi-year journey. As they embark on this journey, most enterprises are planning hybrid cloud strategies, incorporating both public and private cloud infrastructures and using multiple cloud services.

This whitepaper examines why the growth in cloud-based applications is driving enterprises to evolve their network strategy, and recommends best practices for the  implementation of a hybrid cloud solution.

In a hybrid, multi-cloud environment, the data center interconnect (DCI) becomes the critical connective fabric of IT infrastructure. Increasingly, enterprises are adding high-capacity optical interconnection technologies to ensure that they can connect all the pieces of their hybrid cloud with security, scalability, performance and control.

## You will learn the following from this whitepaper:

**1** The reasons for choosing a hybrid cloud strategy

**2** The reasons for using varying infrastructures in a hybrid cloud strategy

**3** Trends that are driving new DCI network demands

**4** Hybrid cloud DCI options

**5** The benefits of fully integrating cloud capabilities into existing WAN environments

**6** The advantages of Cloud Connect and Wavelength Services for DCI

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# Enterprise hybrid cloud momentum

A large majority of enterprises already use or plan to use a hybrid cloud infrastructure. For example, in a recent enterprise survey,[1] 71 percent of respondents are hybrid cloud users, employing both private and public cloud services, meaning infrastructure as a service (IaaS) and platform as a service (PaaS) offerings, such as those from Amazon Web Services (AWS), Microsoft Azure and Google Cloud Platform (GCP).

The same survey notes increasing interest in using multiple public clouds, from 16 percent in 2016 to 21 percent in 2018. The implication of this is clear: few enterprises are ready to move all of their applications to a single public cloud.

The reasons for choosing a hybrid cloud strategy are numerous, including:

Enterprises want to maintain tight control over mission-critical data

Enterprises want to evaluate cloud services methodically, validating performance, security and operational processes on some applications before moving to others

With dozens of applications to consider and limited IT staff, cloud migration takes time

Some legacy applications are hard to "cloudify" (i.e., make modifications to run in the cloud)

Even though enterprises may hesitate to run everything on a public cloud environment, they are also reluctant to invest further in their own data center infrastructure. That leads to a growing market for colocation and managed or hosted cloud infrastructure services that provide many of the benefits of a private cloud with more flexibility and reduced investment risk.

**Figure 1 highlights the reasons for using varying infrastructures in a hybrid cloud strategy.**

**FIGURE 1:** Advantages of different infrastructures in a hybrid cloud



PUBLIC CLOUD ←→ APP MOBILITY ENTERPRISE DATA CENTER APP MOBILITY ←→ PRIVATE CLOUD

Lowest cost

Easiest scaling

Multi-cloud flexibility

Built-in redundancy

Maximum control of critical apps, data

Maintain legacy apps

Phase migration to cloud

Ease of regulatory compliance

Offload management

Improve scalability

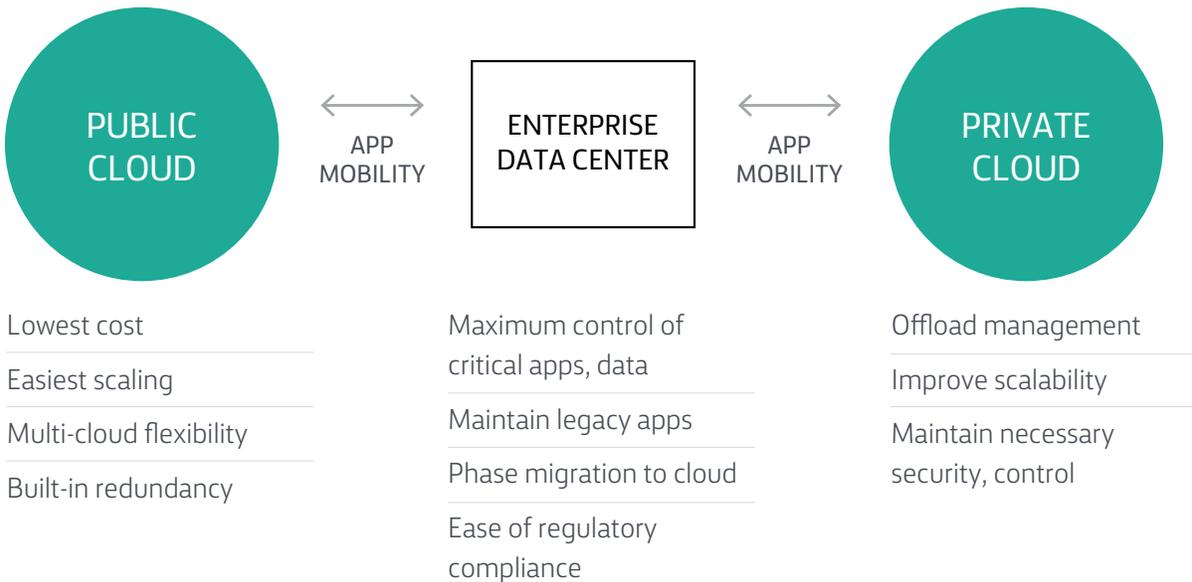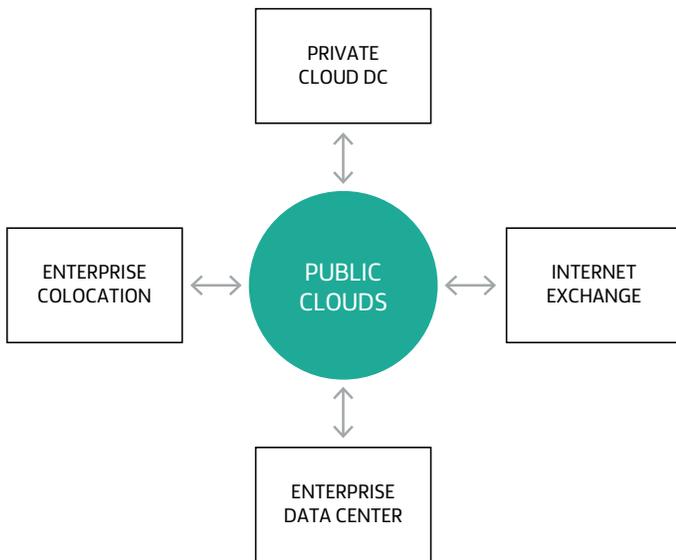Maintain necessary security, control

**FIGURE 2:** Data centers playing a role in hybrid clouds



Hybrid cloud adoption is growing and will demand that customers make decisions on how much private versus shared infrastructure they want to have. As a result, for many enterprises, the hybrid cloud runs in multiple different types of data centers, as depicted in Figure 2:

Enterprise-owned and -managed data centers

Enterprise-managed infrastructure in colocation facilities

Hosted or managed private cloud service provider data centers, referred to as "private cloud" data centers

Public cloud service provider data centers, often reached via direct connections at an Internet exchange (IX) data center or a similar carrier-neutral facility

Connecting a hybrid cloud means connecting many or all of these types of data centers. Let's examine the requirements for such data center interconnection.

# Hybrid cloud creates new DCI requirements

DCI for a hybrid cloud can have very different requirements than traditional data center interconnections, or even, some early approaches to public cloud connectivity.

Historically, DCI requirements have varied widely depending on the application. The most demanding DCI scenarios typically involved high-capacity and low-latency synchronous data

mirroring, in which storage area networks (SANs) were directly connected across fiber optic networks to enable all data to be replicated in two locations to guarantee zero data loss in the event of a failure in one location. Such DCI links had to be no more than 60 miles apart to limit the delay experienced by applications waiting for a remote disk write operation to be completed. And since fiber optic networks were historically complex and costly, only the most sophisticated enterprises in financial services and a few other industries could afford to build and operate them. A much larger proportion of historical DCI links were set up with lower capacity and less stringent latency requirements to support asynchronous backup and replication, and occasional data or application migration, with more manageable costs.

When it comes to public cloud services, many enterprises started off experimenting with connecting via virtual private network (VPN) over the Internet. This was sufficient for small applications with a limited need to exchange data outside of the cloud environment, such as software development, compute-intensive simulations or batch processing jobs. As other applications requiring more reliable connectivity and performance moved to the cloud, enterprises have tended to move cloud connectivity to a managed connectivity service such as MPLS VPN. But as hybrid cloud DCI bandwidth requirements continue to grow, these services can become very expensive and may not provide the consistently high performance needed.

Looking forward, hybrid clouds will need far more from their networks than some of these past DCI applications. Several trends are driving new DCI network demands, including:

**Distributed application architectures**: In a hybrid cloud environment, applications may contain multiple components. With a front-end web server in a public cloud, specialized applications running in a hosted private cloud environment and a back-end database with highly sensitive data running in a tightly controlled enterprise data center, communication between these components might require several times more bandwidth than the user-to-application traffic, and the application's performance can be highly sensitive to network latency or packet loss between these components.

**Dynamic application mobility and scalability**: A hybrid cloud offers the potential to use multiple cloud infrastructures for the same application, whether to scale compute capacity beyond the limits of a single data center, move application workloads based on cost or performance, or simply migrate applications to a different environment over time without incurring any downtime. Application mobility can be particularly valuable in providing mobile end-users the best experience as they travel, minimizing latency by moving their applications and data, such as an email inbox, to a cloud data center near their current location.
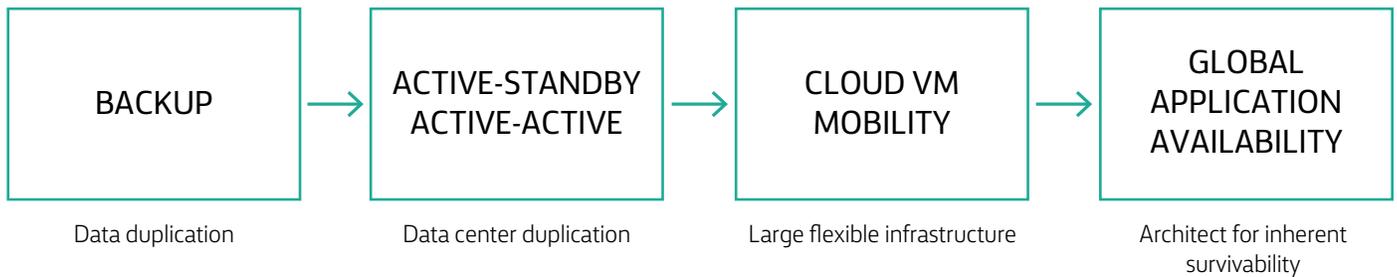
**Cloud-based data replication**: Hybrid clouds based in multiple physical locations offer new business continuity opportunities. For many hybrid cloud users, the first step in taking advantage

of these opportunities is to use cloud-based data backup and replication to complement other data protection schemes.

**Continuous application availability**: Sophisticated enterprise users are moving toward a completely new model for continuous global application availability that is not based on bulk data replication and recovery plans, but rather on distributed systems architectures (reference Figure 3). By running applications in multiple locations and continuously synchronizing critical data across locations, an enterprise can ensure that the applications are protected against the loss of any server or application instance, any copy of application data, or even the loss of an entire location.

**FIGURE 3:** Evolving business continuity and application availability strategies

| BACKUP | ACTIVE-STANDBY ACTIVE-ACTIVE | CLOUD VM MOBILITY | GLOBAL APPLICATION AVAILABILITY |
|---|---|---|---|
| Data duplication | Data center duplication | Large flexible infrastructure | Architect for inherent survivability |

ENABLERS
Virtualization, shift to cloud architectures

Widely available, highly connected colocation

Declining cost of massively scalable bandwidth

These architectural shifts dictate two key performance requirements for hybrid cloud DCI: regardless of the network selected, latency and packet loss must be configurable so that mission-critical applications get the priority and reliability required.

Another key requirement is ensuring that enough bandwidth is available and that scalability exists to meet projected future demands.

Another critical requirement for hybrid cloud DCI is security. Overall, security is one of the top concerns for enterprises moving applications to the cloud, and the security of DCI links must be considered within that broader context. To ensure DCI security, in-flight data encryption is an emerging requirement for many enterprises.

One final requirement for hybrid cloud DCI is operational efficiency, which translates into low operational expenses due to monthly recurring telecom service charges, equipment space, power requirements and operational staff costs.

## DCI considerations are dependent on your hybrid cloud requirements:

Latency tolerance - fixed vs. flexible

Reliability tolerance - 100% uptime vs. best effort

Scalability to meet demand - daily variability vs. consistent workload

Security - multi-layered vs. low risk

Budget considerations - mission-critical vs. nice to have

Space and power

Operational efficiency - no touch vs. manual

# Hybrid cloud DCI options

Based on the DCI requirements, an organization should evaluate the full spectrum of options, from an entirely private platform to a completely shared platform. Windstream Enterprise offers this complete spectrum of options to help you design the right solution for your business.

For lower bandwidth options, SD-WAN and MPLS are well suited to provide the security and application performance to support cloud-based applications. SD-WAN can utilize public broadband in active/active configurations to deliver cost-effective reliability.

Organizations that require more bandwidth can deploy Switched Ethernet and Wavelength Services to deliver the security and control of a private network with higher capacity, scalability and performance.

Many enterprises need direct connections to cloud service providers (CSPs), but the cost and operational complexity of building these direct connections can be prohibitive. That's where Windstream Enterprise Cloud Connect comes into play. This solution provides security, performance and scalability utilizing multiple network technologies.

# Cloud Connect and Wavelength Services for DCI

Dedicated cloud connections provide the underlying network connectivity, technology and services to effectively connect and integrate cloud services and applications with IT infrastructure. These private connections to the cloud provide highly secure data transport and bypass unprotected Internet routes, which lowers the risk of DDoS attacks and other security threats.

# Performance-optimized access— Windstream Enterprise Cloud Connect

As organizations migrate mission-critical applications, workloads and business processes to the cloud, there is a growing need to fully integrate cloud capabilities into existing WAN environments.

Cloud Connect from Windstream Enterprise is a reliable, fast and highly secure private access hub that connects directly to third-party public and private cloud providers through an enterprise's existing WAN. It's an ideal add-on for a complete network solution that connects to leading cloud service providers. Some of the benefits include:

**Increased productivity**: Employees depend on PCs and mobile devices to access cloud-based applications. Cloud Connect ensures peak performance by using nearby regional connections, reducing latency and packet loss while delivering improved app performance and reliability.

**Flexibility**: Cloud Connect integrates with SD-WAN, Switched Ethernet, MPLS or Wavelength Service technologies.

**Scalability**: Cloud Connect provides flexible bandwidth speeds ranging from 50 Mbps to 10 Gbps with easy scalability to accommodate growing cloud resource demand.

**Secure private connectivity**: Dedicated connectivity to leading CSPs that physically bypasses the public Internet:

Amazon Web Services

Microsoft Azure

IBM Bluemix

Google Cloud

Oracle

Salesforce

# A high-capacity solution— Windstream Enterprise Wavelength Service

Today's enterprises need reliable and secure point-to-point fiber connectivity to accommodate increasing bandwidth demands without high upfront costs. Maintaining network capacity for high-bandwidth applications carries distinct requirements and often comes with certain challenges. Windstream Enterprise Wavelength Service provides reliable, secure, dedicated, point-to-point optical connectivity ideally suited to the performance demands and big data of web-scale applications. The WE CONNECT customer portal gives customers control, higher flexibility and faster deployment of bandwidth and applications for a seamless, dependable and future-proof network experience that can scale as needed, all without high capital expenditures.

**Agility and scalability**: Accelerated delivery of optical Wavelength Services and shorter upgrade intervals are necessary to meet growing bandwidth demands as application loads grow. Achieve predictable low latency and packet loss with virtually unlimited capacity and expert staff dedicated to helping your business scale.

**Improved risk management**: Protecting enterprise and customer data is mission-critical. When breaches happen, the economic and reputational cost to the business can be crippling. Encrypted Wavelength Service protects critical data from intrusions. Windstream Enterprise offers high-capacity, wire-speed, always-on optical encryption to protect all in-transit data without latency, giving an added security layer against theft of in-flight data.

**Cost savings**: Bit for bit, Wavelength Service is the most cost-effective managed transport option, delivering predictable recurring service costs.

1.  RightScale, 2018 State of the Cloud Report, 2018

**Business continuity**: As data center and application requirements expand, Wavelength Services provide multiple diversity options.

**Better application performance**: Underpinned by Windstream Enterprise Cloud Core™ Network, a proprietary nationwide architecture developed to empower business transformation for enterprises, Windstream Enterprise changed the fundamental way networks function to create an easily programmable, high-performing and agile network infrastructure. This enables enterprises to focus on desired outcomes, and to leverage the power of cloud-based and networked technology to achieve a competitive advantage and drive business innovation, growth and success.

# Windstream Enterprise DCI solutions make the hybrid cloud

Enterprises continue to move mission-critical workloads and business processes to the cloud at an ever-increasing rate. This creates a need to integrate disparate cloud capabilities into the WAN. With Cloud Connect, an organization's current WAN solution can add secure, performance-optimized connectivity to leading cloud service providers. Windstream Enterprise Wavelength Service provides highly secure, private access to cloud service providers, enabling enterprises to more confidently migrate workloads and processes to the cloud. Our private connections significantly reduce the risk of Internet-related threats, and flexible bandwidth options allow for scalability as utilization of cloud resources grows. Cloud Connect can be customized to suit your business needs and network architecture and create a cloud-optimized network solution.

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