PATHFINDER REPORT

Managing Complexity in Hybrid IT Environments

COMMISSIONED BY

hyperview

About this paper

A Pathfinder paper navigates decision-makers through the issues surrounding a specific technology or business case, explores the business value of adoption, and recommends the range of considerations and concrete next steps in the decision-making process.

About 451 Research

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EXECUTIVE SUMMARY

IT environments are becoming increasingly hybrid as enterprises add more capacity off-premises in public cloud, managed hosting and colocation datacenters. Outsourced datacenter capacity has been growing for various reasons, such as increasing IT capacity requirements, lower cost and more efficient infrastructure, and the need to access new technologies. Digital transformation means that datacenter requirements will also continue to evolve, challenging enterprises to find the best execution venue for each workload.

451 Research's global Voice of the Enterprise survey suggests that by 2019, less than half (46%) of all workloads will run in on-premises environments. While the consolidation of enterprise datacenters, often into larger facilities, is ongoing, we believe that enterprises will continue to own and operate on-premises, privately owned datacenters, in addition to various outsourced options. Although hybrid IT environments provide numerous benefits, they also create increased complexity.

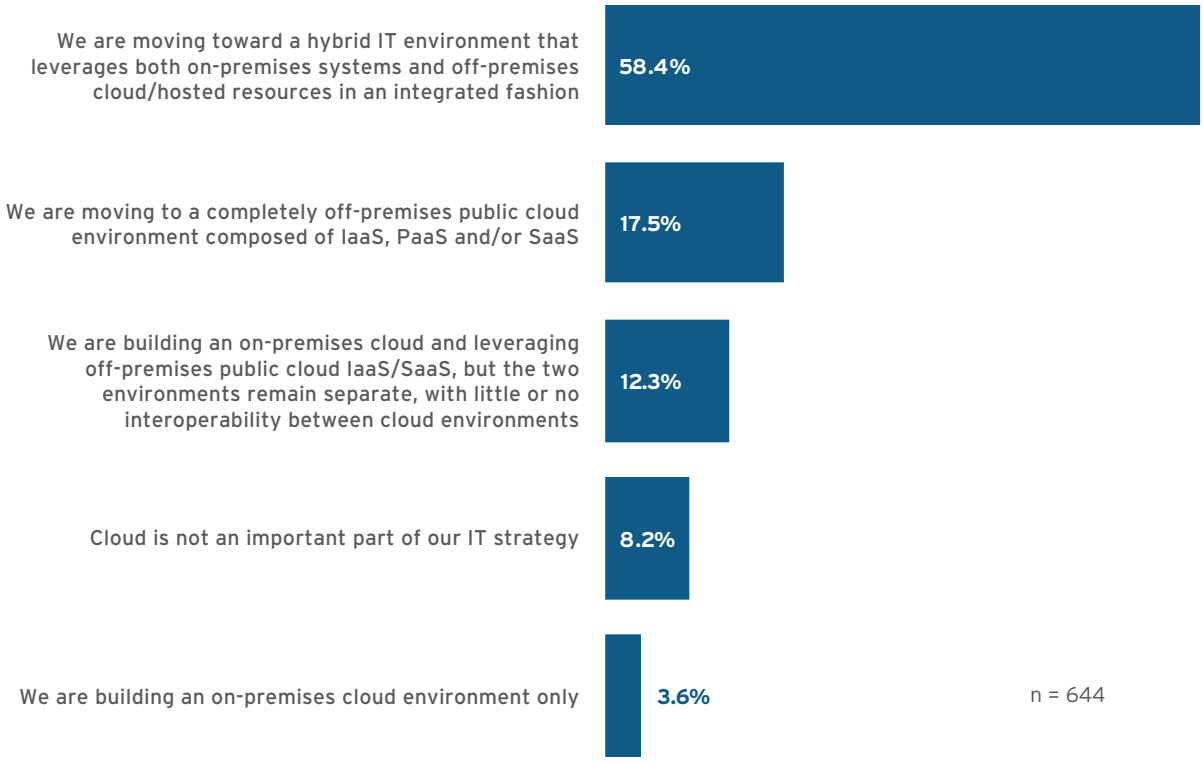
Hybrid IT: Outlook is only Partly Cloudy

We expect organizations to continue to migrate workloads to public clouds to take advantage of their consumption-based, on-demand, scalable and service-driven offerings. Off-premises capacity, whether it is colocation, wholesale, 'X as a service' or public cloud, is being driven by the need for faster time to deployment for new applications and by the move from capital to operational expenditure, among other factors. Demand for colocation capacity, in particular, is coming from organizations seeking highly connected capacity, including interconnects to public cloud services and partners.

According to 451's latest Voice of the Enterprise: Hosting, Cloud and Managed Services, Budgets and Outlook survey, 58% of enterprises are moving toward a hybrid IT environment with on-premises and multiple off-premises resources (Figure 1). Datacenter capacity is becoming increasingly distributed, as well as integrated across organizational and geographical boundaries.

Figure 1: Hybrid is the new norm

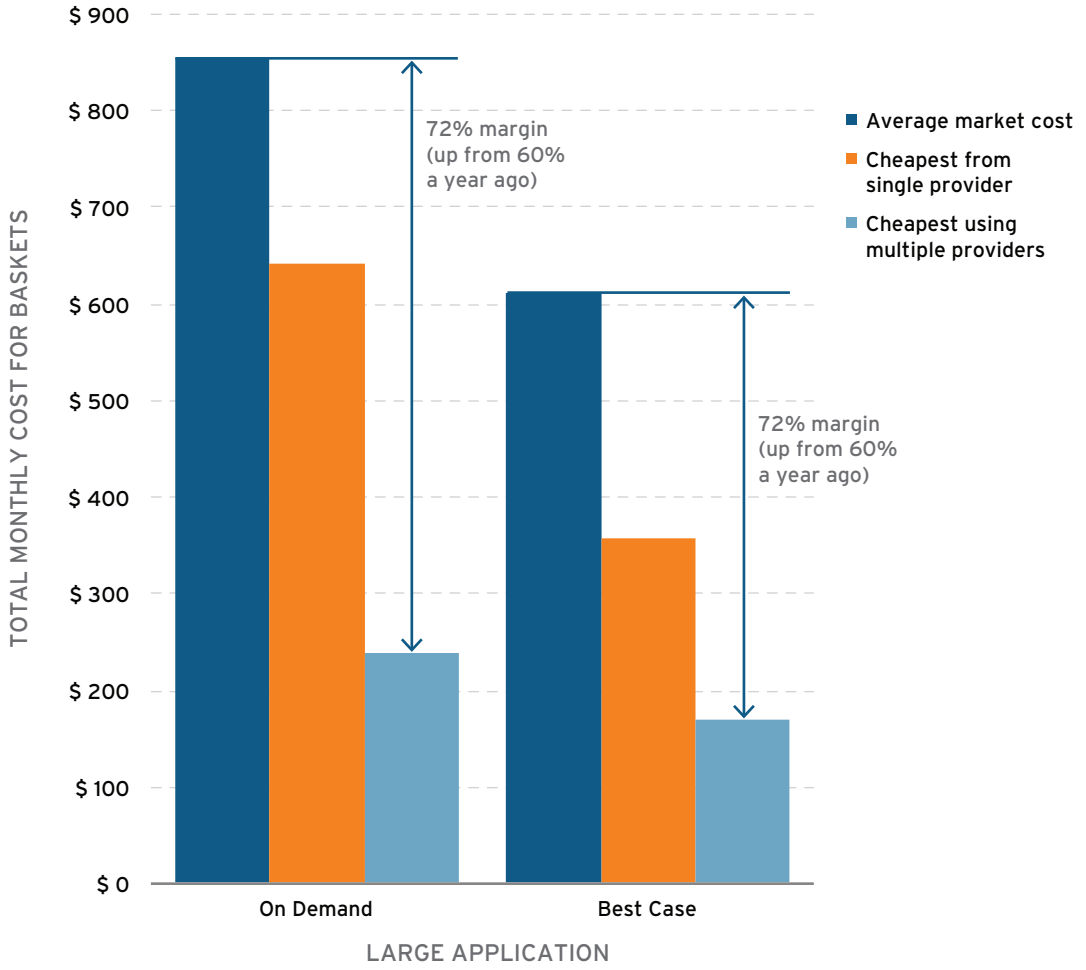
Q. Which of the following best describes your organization's overall IT approach and strategy?
Base: cloud, hosting and managed services users



Source: 451 Research, Voice of the Enterprise: Hosting, Cloud and Managed Services, Budgets and Outlook 2017

Our research also shows that organizations favor multi-supplier or multi-cloud strategies to best balance performance and cost, and to meet their specific workload needs. In particular, a multi-cloud approach can have significant cost benefits. 451 Research's Cloud Price Index data suggests that the cost of sourcing various cloud services for a large basket of goods (consisting of applications, virtual machines, object storage, databases, bandwidth and other services) from multiple cloud providers can provide material savings compared to the average market cost or the cheapest single provider (Figure 2). The difference between the average market price for a large basket of goods and the multi-cloud price can be a 72% margin.

Figure 2: Sourcing from multiple providers can save up to 72% on direct expenditures



Source: 451 Research Cloud Price Index, Public Cloud Annual Summary, Q4 2017

The savings from using multiple providers, for both on-demand public cloud services and for those that have a discounted rate based on a longer-term commitment (the 'best case' scenario), has never been greater. Taking a multi-cloud approach, however, adds layers of management and integration complexity.

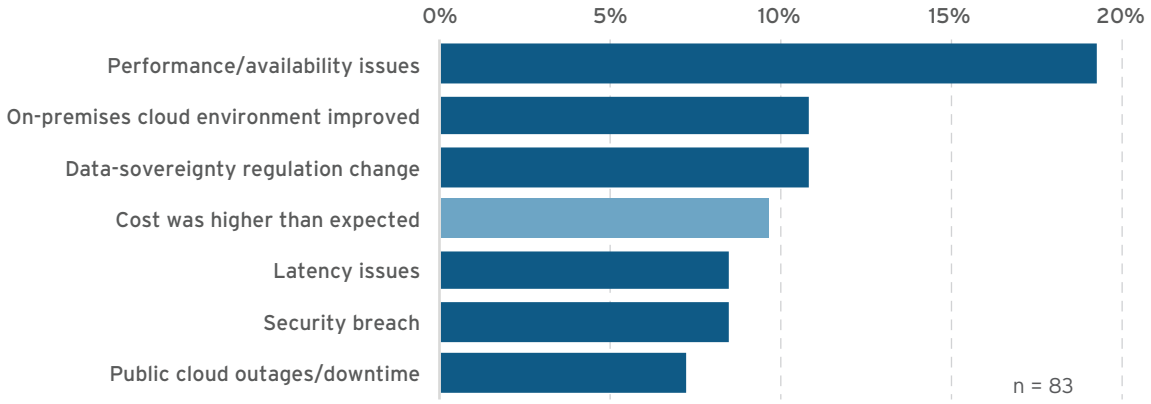
Not all workloads will move to a public cloud, particularly legacy applications that are typically not suited to run in cloud environments. Organizations are starting to require that all net new applications be built for the cloud or delivered as a service, and they are modernizing existing workloads where possible. Security, data sovereignty, service availability and latency are also key considerations for organizations considering public cloud options.

Some workloads are moving in reverse – out of public clouds and into private clouds, colocation or on-premises datacenters. According to our Voice of the Enterprise survey, the top reasons for migrating workloads from a public cloud (Figure 3) include:

- Performance and availability issues
- More robust on-premises private clouds
- Data-sovereignty regulations
- Higher than expected costs

Figure 3: Cloud repatriation: primary drivers

Q. What was the primary driver for migrating workloads from a public cloud to a private cloud or non-cloud environment?
Base: cloud-familiar respondents using cloud computing



Source: 451 Research, Voice of the Enterprise: Cloud Transformation, Organizational Dynamics 2017

While cost is also often cited as a strong driver for public cloud, it should not be considered in isolation. Factors that could drive cloud costs higher than anticipated include a sprawl of unused/underutilized cloud instances and workload-specific service requirements, such as availability and security.

The migration of workloads into and out of public clouds underscores the relative immaturity of the hybrid IT model. We expect enterprises will continue to trial and refine their off-premises capacity strategies, using a mix of outsourced options and on-premises capacity.

A SHORTAGE OF STAFFING SKILLS

As IT outsourcing grows, more qualified staff to manage and maintain datacenters are moving from on-premises facilities and into highly paid positions at public cloud, colocation and other off-premises datacenters. This is creating an overall shortage of datacenter staff in some regions, an issue that is expected to intensify over time.

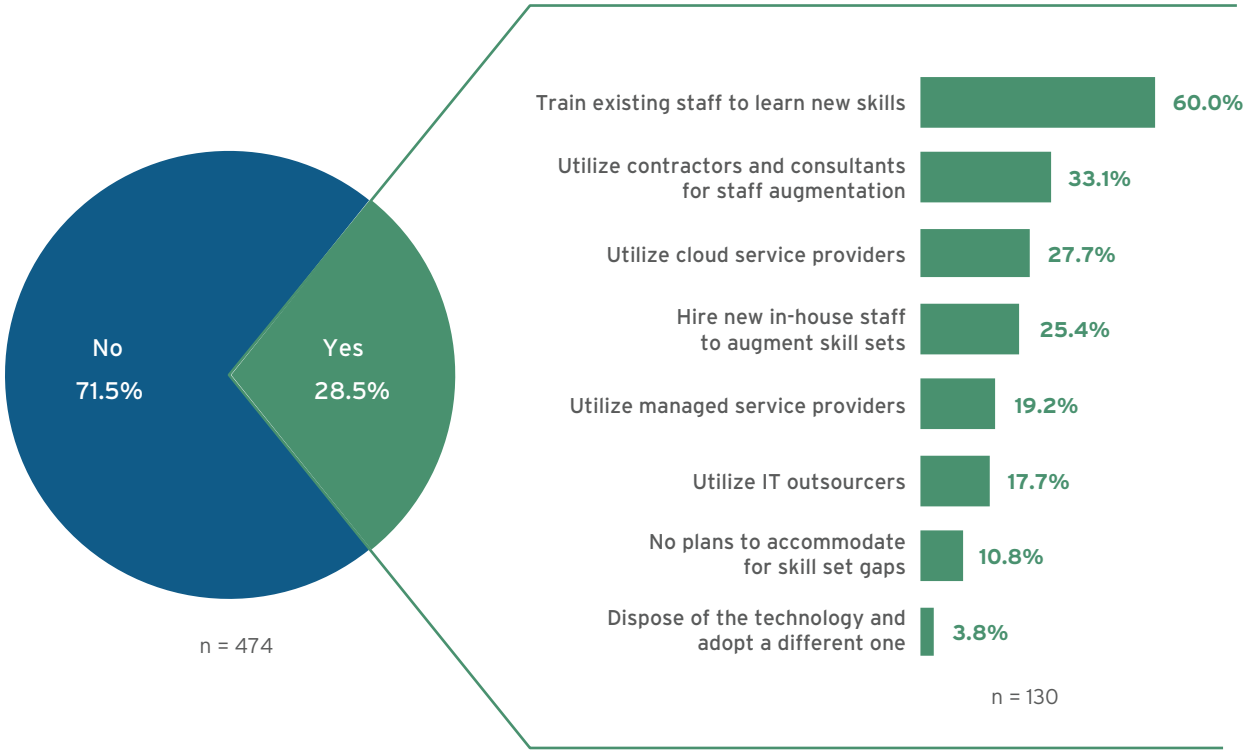
In addition to a lack of qualified people for enterprise datacenters, many organizations that are taking a hybrid IT environment approach also often struggle to find IT staff with adequate skill sets; hybrid IT management skills are different than traditional on-premises-only IT and facilities roles. For example, managing different service provider contracts and service-level agreements could, in some cases, require dedicated personnel, particularly in regulated industries. Hybrid environments may also introduce more software-defined technologies for workload orchestration and automation, for example, that require additional scripting and software management skills.

Most organizations are responding to datacenter staffing challenges by increasing in-house training (Figure 4). Some have revamped their training programs to build specific skills in areas such as virtualization, public cloud services management, software and automation. Others are transitioning IT specialists (siloed skills in IT and facilities divisions) to generalists through cross-functional training. Some are tightly integrating their IT and facilities departments to enable more informed and coordinated capacity planning and management, including conducting performance reviews of off-premises providers.

Figure 4: Solving datacenter personnel skills shortages

Q: Does your organization currently face a skills shortage for datacenters and facilities personnel?

Q: What do you expect your organization to do about the skills shortage for datacenters and facilities? Please select all that apply.



Source: Voice of the Enterprise: Datacenter Transformation, Organizational Dynamics 2017

A growing number of organizations are implementing datacenter infrastructure management (DCIM) software to digitize manual tasks, which can lower the staff burden while reducing risk and increasing operational efficiency. DCIM asset management, for example, enables auto-discovery of IP-connected datacenter and IT assets, and ongoing real-time asset tracking with a high degree of accuracy. DCIM workflow management simplifies and tracks asset moves, adds and changes, minimizing human error and creating an automated audit trial. In addition to significantly reducing time spent on deploying, locating and managing assets, as well as reducing auditing costs, DCIM software enables faster issue resolution times, among other benefits as described in the following section.

Visibility Through DCIM Data

One of the greatest challenges that enterprises mention most often is the need for end-to-end visibility and transparency across a mix of hybrid datacenter infrastructures and IT operations. We believe DCIM software will play an increasingly integral role in providing visibility and enabling effective hybrid IT strategies.

Modern DCIM suites have monitoring, asset management, workflow management, capacity planning, what-if scenario analysis, predictive analytics and third-party data-integration capabilities, among other features. DCIM can provide facilities and IT with greater visibility (and improve responsiveness) across hybrid datacenters including:

- Monitoring operational status of facility and IT assets – establishing alarms to spot anomalies and to identify issues before they happen.
- Visualization of assets, including physical location, utilization, connections and components, as well as characteristics such as operational thresholds, weight and maintenance records, and so on.
- Predictive 'what if' scenarios that enable managers to model the effects of moves, adds and changes before they happen.
- Datacenter capacity planning – understanding available capacity and forecasting needs with a high degree of accuracy.
- Customized dashboards that present different data and analysis for different organizational roles.

DCIM reduces the complexity of managing hybrid IT environments, enabling organizations to make more informed decisions regarding their capacity choices, taking into account risk, cost and availability. Having this information increases overall IT agility. In Figure 5 below, we present some of the key benefits derived from DCIM with regard to lowering the risk of potential IT disruption and increasing datacenter efficiency and cost benefits.

Figure 5: Select benefits of datacenter infrastructure management software

LOWER RISK OF IT DISRUPTION	INCREASE EFFICIENCY AND LOWER COSTS
Improved fault detection	Identify stranded power, cooling/avoid over-provisioning
Root-cause analysis of failures	Forecast capacity
Real-time visibility of redundancy	Reduce operator time/resources
What-if scenarios = avoid errors	On-demand audits
Forecast/anticipate capacity issues (power use, hot spots, etc.)	Power usage data for efficient technology refreshes

Source: 451 Research, Datacenters & Critical Infrastructure

MULTIPLYING THE VALUE OF DCIM DATA

The value of DCIM data is multiplied when integrated with data from third-party systems, such as IT systems (e.g., ITSM, VM and container management) and business systems (e.g., CRM and financial). DCIM platforms that enable DCIM data to be combined and analyzed with data from other systems are known as datacenter service optimization (DCSO) systems.

DCSO systems extend the capabilities of DCIM beyond the critical physical infrastructure layer and into the dynamic management of logical and virtual resources that may be spread across geographically dispersed facilities, including in hybrid IT environments. By integrating DCIM with other tools, managers can have a clearer, more accurate, real-time view of IT service delivery, and this ultimately supports moves toward automation. DCSO approaches enable end-to-end management, planning and costing of datacenter services.

Some DCIM offerings enable DCSO energy optimization, such as automated server power management, or proactively managing or configuring energy supplies and power distribution. The effective use of this type of DCSO capability, which typically combines data from DCIM, VM management and other software, is being used by organizations to increase efficiency and to preemptively move workloads away from potential failure points.

In Figure 6, we present some of the key benefits of a DCSO approach. For example, in a hybrid environment where workloads may run in different datacenter locations, a DCSO system could match IT service demand with specific assets to ensure infrastructure resources (power, cooling, etc.) are available and appropriate for the performance of that workload.

Figure 6: Select benefits of datacenter service optimization approach

LOWER RISK OF IT DISRUPTION	INCREASE EFFICIENCY AND AGILITY
Map workloads to assets	Load shed, load cap
Ensure resource availability and performance	Precision/tiered load placement
Real-time load shifting, including preemptively	Understanding interdependencies = faster response times
Automatic, traceable work orders, reduce errors	True cost showback/chargeback

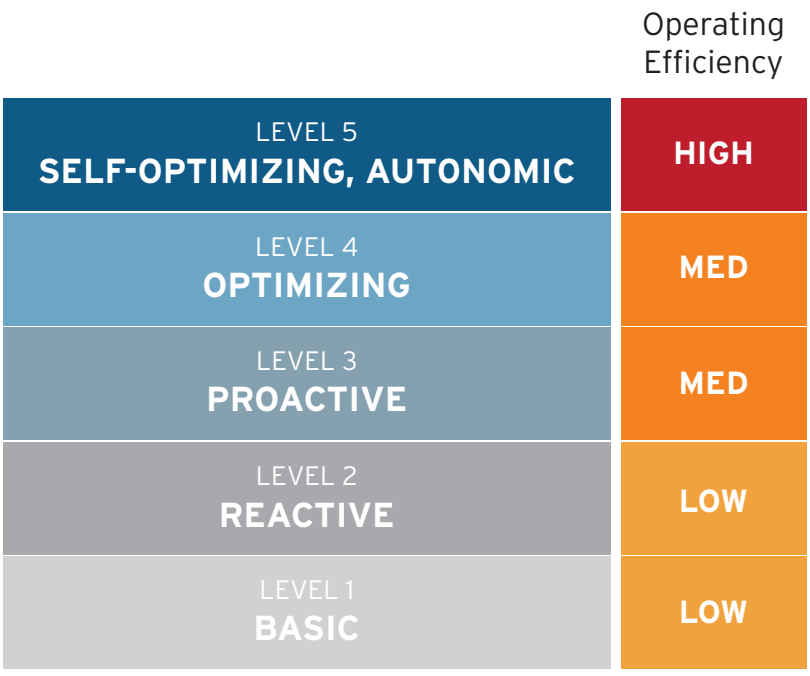
Source: 451 Research, Datacenters & Critical Infrastructure

451 Research has been tracking the development and deployment trends of datacenter management software for many years, and has developed a maturity model (Figure 7). Level 1 is where DCIM is not deployed, and managers use a collection of ad hoc data, such as basic monitoring from various equipment. Level 2 applies to datacenters that have deployed DCIM monitoring and/or asset management, change and configuration modules, which enables organizations to better react to changing environments.

As datacenters and datacenter environments become more complex, the integration and orchestration of the physical, virtual and logical layers, as well as the business layer (costing and service level agreements), is necessary. Achieving the upper levels of our maturity model requires a DCSO approach, with analysis of integrated data about physical and virtual IT and datacenter subsystems for effective service management, prediction and optimizing in near-real-time. Level 3 enables organizations to take proactive actions (as described in Figure 6 above) for greater efficiency, lower risk and improved agility.

The 'Optimizing' level reflects software-driven datacenters that are programmed for automated actions, and that are optimized for their purpose. This includes greater use of machine-learning intelligence to drive improved infrastructure management, insights and forecasting. In the coming years, we expect there will be self-optimizing, self-healing and autonomic datacenters for the highest degree of operating efficiency – level 5 in our model.

Figure 7: 451 Research's datacenter management maturity model



Source: 451 Research, Datacenters & Critical Infrastructure

In hybrid IT environments, organizations are likely to favor DCIM platforms that can manage and integrate data across on-premises, colocation, cloud and the anticipated wave of edge infrastructure for IoT and other workloads. Some DCIM platforms have extended monitoring capabilities out to cloud instances, providing a view into enterprises' public cloud capacity at the cloud instance and server level. (Visibility into cloud providers' underlying facilities-level infrastructure is currently limited, although this may change in the coming years as providers seek to give their customers greater insight.)

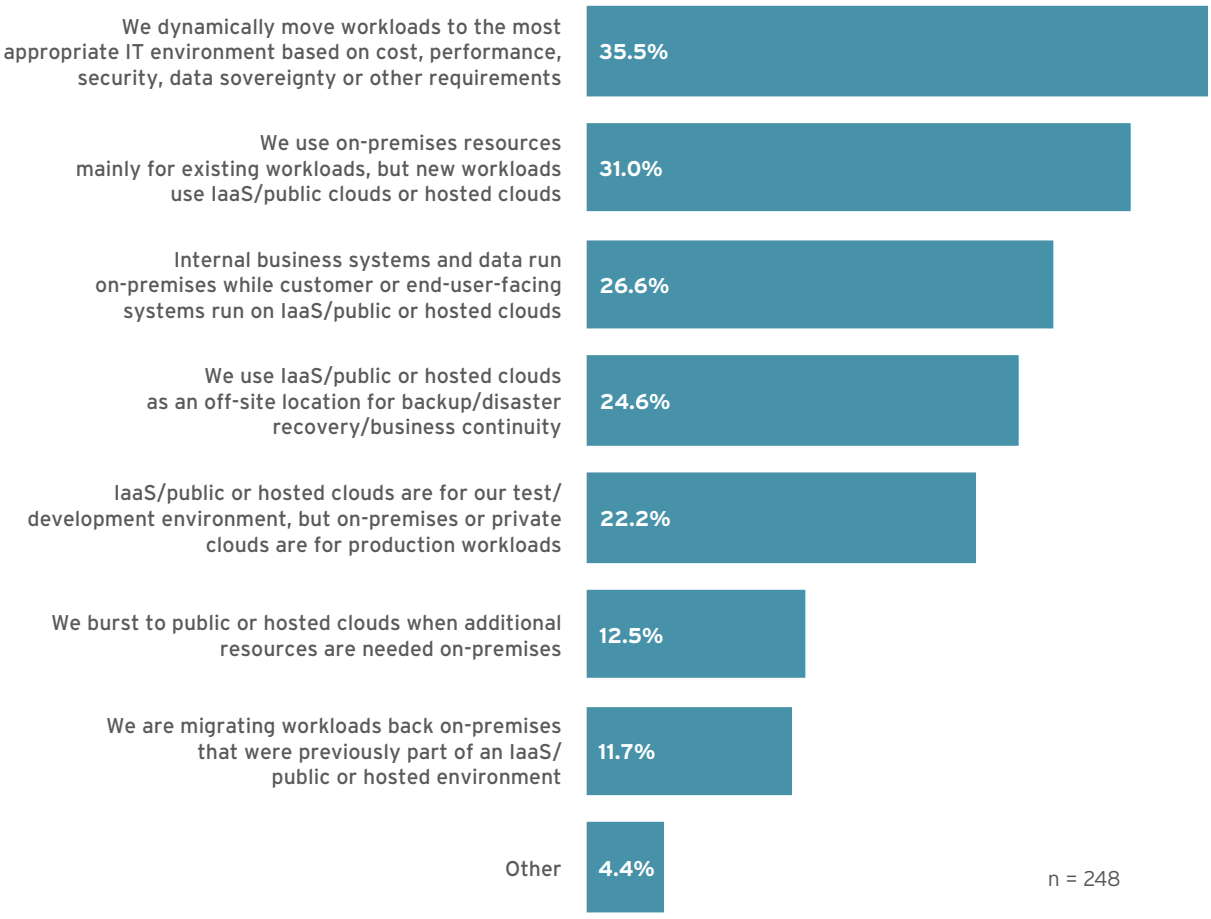
Best Execution Venue: Data-Driven Decisions

In terms of capacity management, a hybrid IT environment can present increased flexibility. Determining the best execution venue (BEV) – the optimal infrastructure resources for a specific workload, taking into account cost, availability, reliability, latency, data governance and business requirements – can be a challenging and ongoing process.

Our Voice of the Enterprise data shows that more than a third of enterprises surveyed are already dynamically moving workloads to optimal datacenter locations based on pre-determined factors (Figure 8). Others are running legacy workloads on-premises but are using cloud environments for all new workloads. About of quarter of those surveyed are using public and hosted cloud for backup, disaster recovery and business continuity. The fairly dispersed responses suggest that hybrid strategies are still maturing.

Figure 8: In hybrid environments, BEV decisions are nuanced

Q. Which of the following best describes your hybrid or multi-cloud strategy?
Base: cloud-familiar respondents using cloud computing



Source: Voice of the Enterprise: Cloud Transformation, Workloads and Key Projects 2017

Factors used in determining the best execution venue for a workload will change over time. Real-time data from DCIM systems about location, infrastructure status, power, cooling and other data will be essential in the ongoing review process. A key component of the BEV process is using DCIM data to determine thresholds whereby at some point it may be more cost-effective to change workload locations, for example, including potentially moving them from cloud environments. Note that nearly 12% of respondents in our survey are migrating workloads back on-premises from a cloud or hosted environment.

To determine where workloads should run, managers require datacenter management tools that can pull together and integrate all relevant infrastructure data, which may reside in disparate systems in different locations. Importantly, all of the data also needs to reflect the same version of the truth.

In reality, management and operations protocols will likely vary from datacenter location to location. Cost and efficiency considerations, for example, need standardized quantifiable metrics for 'apples to apples' comparison across a hybrid environment. In Figure 9, we highlight key metrics provided by DCIM software, such as power and cooling capacity and utilization and infrastructure redundancy, to support BEV decisions. By comparing these metrics across different datacenters, including on-premises and colocation environments, managers are better equipped to determine the best venue to execute specific workloads.

Figure 9: Select metrics to support BEV decisions across hybrid IT

SELECT METRICS FROM DATACENTER MANAGEMENT SOFTWARE
Status/health for x equipment/space/facility
PUE/global PUE/% of PUE target
For power, space, cooling, connectivity ports per device/rack/row/room/datacenter and across a datacenter portfolio: • Capacity – actual utilization/reserve/time to 'zero' • Stranded capacity • Max, min, average, trending
Datacenter utilization
For assets (grey and white space) per device/device type/model/user-defined grouping through to the datacenter and datacenter portfolio level: • Actual power utilization/reserve • Inventory deployed vs. reserve (on-demand audits) • Weight • Warranty/service status • Regulatory compliance status
Redundancy, vulnerability for failures – for individual assets or groups of assets
Asset interdependencies
Time to recovery
Number of incidents, including 'Level A, Level B, etc.'

Source: 451 Research, Datacenters & Critical Infrastructure

BEV processes should also include ongoing review assessments that incorporate visibility on actual infrastructure and cost metrics vs. planned expectations over time.

DATACENTER SERVICE-BASED COSTING

Cost-comparison analysis across hybrid environments can be tricky. To better understand end-to-end IT services costs, it's important to consider the underlying physical resources, and DCIM and IT data from on-premises datacenters and from off-premises service providers needs to be integrated. This is a DCSO approach known as datacenter service-based costing. It is distinct from IT service-based costing, which typically does not adequately take into account the full or true cost of the supporting datacenter facilities and IT equipment components, even though it constitutes a significant portion.

In Figure 10, we list a sample of metrics derived from a datacenter service-based costing approach – such as cost per kWh, cost per server per hour, and cost per VM – that can be standardized and compared across datacenters for an end-to-end cost or business view of IT services in hybrid IT environments.

Figure 10: Select DCSO metrics for datacenter service-based costing

SELECT SERVICE-BASED COST METRICS FROM A 'FULL STACK' DCSO DATA APPROACH
Cost per kWh
Performance per watt per dollar
End-to-end costing: • Server cost per hour – min/max/average • Cost per VM • VMs per physical box • Compare/contrast total IT service cost across IT environments
Work orders (on-premises or remote) – average time to resolution, success ratios
For individual business units/customers/workloads/applications: • Average infrastructure utilization/cost • Total IT service cost (compare/contrast across IT environments)

Source: 451 Research, Datacenters & Critical Infrastructure

As DCSO approaches evolve, we anticipate more accurate real-time costing and predictive cost modeling of IT services. This could enable automated workload provisioning across datacenters in a hybrid IT environment based on BEV policies. This will ultimately require end-to-end information in real time about datacenter operating status, network paths, latency and bandwidth, performance, compliance, and capacity – not just IT, but datacenter cooling, power and redundancy, among other factors.

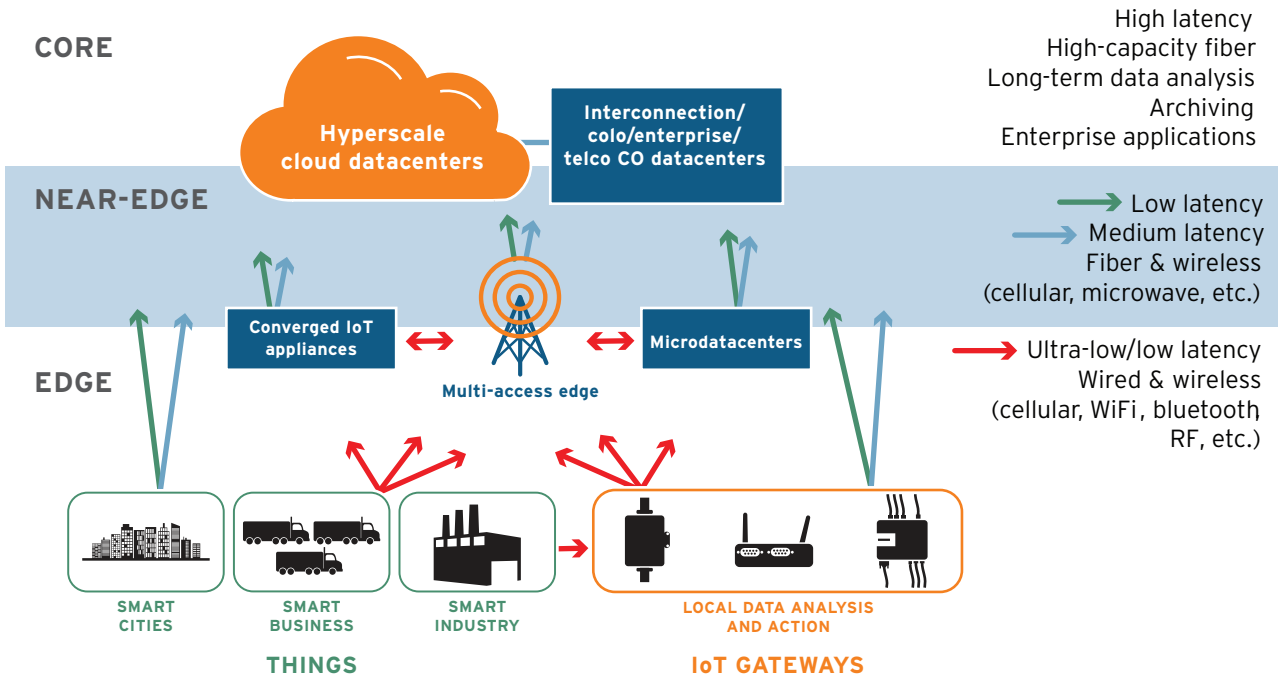
Looking Ahead: Next-Generation Edge

The expected growth in next-generation edge computing, including IoT and distributed cloud, will push the boundaries of managing hybrid IT environments even further. Demand for datacenter capacity at the edge is expected to be driven by workloads that require low latency, high availability, data sovereignty and security, etc.

IoT (and other edge) data will likely require a mix of datacenter environments (Figure 11). Organizations are starting to deploy micro-modular datacenters for data that will need to be processed at the edge (very close to the source and users), including to aggregate and integrate data from multiple IoT systems' appliances nearby. Data will often require further processing, including secondary analysis and integration with other data streams and services, which will be performed close by, at the 'near edge,' where datacenter capacity is available. This could include colocation, enterprise and hyperscale datacenters (including those sited in wholesale facilities). Interconnection facilities will play a key role.

For long-term data analysis, archiving and the use of IoT data in enterprise applications, organizations are likely to favor centralized datacenters sited farther away from data sources because they can cost-effectively deliver large-scale computing and data storage. These could include public cloud, colocation and enterprise datacenters, or a mix thereof.

Figure 11: Next-generation edge computing will require multiple IT environments



Source: 451 Research, Datacenters & Critical Infrastructure Datacenters at the Edge, May 2017

Edge architectures could potentially require more nodes of compute distributed across many locations (including remote locations), as well as different datacenter types as illustrated. This interconnected mesh of infrastructure supporting next-generation edge computing will add to the complexity of managing hybrid IT and will open up new opportunities for datacenter management software and services. Machine-learning analysis and automation will play an increasing role.

Recommendations

Hybrid IT environments require a dedicated business strategy and goals – lowest cost or 'cloud first' is not always the best starting point. Develop BEV evaluation methods that assess key factors per workload in addition to cost, such as application performance and latency, as well as the overall impact on business risk, including availability, redundancy and security.

Managing infrastructure in hybrid IT environments is complex. DCIM software is increasingly being deployed by all types of organizations to simplify the process by enabling visibility across datacenters, real-time monitoring and capacity planning. Combine data from DCIM and IT systems management software, as well as from financial tools, (known as a DCSO approach) to create standardized metrics and key performance indicators for BEV decisions.

Maximizing the benefits from DCIM data and analysis typically requires new internal operational and business procedures and workflows. For example, integrating the IT and facilities departments can more closely align IT demand with datacenter facilities resources to enhance capacity planning and management, and to more effectively review service provider performance in a hybrid IT environment. Create internal process blueprints for exploiting DCIM and DCSO information and features across each datacenter location.

Develop role-based information dashboards to present information – i.e., customized views for facility managers, IT managers, business line managers and executive management, for example. Also, implement an ongoing review process to determine whether each venue is meeting expected metrics.

Plan to invest in resources and staffing to manage hybrid IT environments, including implementing initiatives for retaining and retraining staff. In particular, training on software management tools, the creation of custom dashboards and new reporting functions may be required to efficiently and cost-effectively execute on hybrid IT approaches.

Proper implementation of DCIM can simplify the complexity of managing hybrid IT environments, enhance the productivity of the IT and facilities staff, and increase the efficiency and effectiveness of IT/infrastructure resources.