



# Empowering Cloud Utilization in the Federal Market

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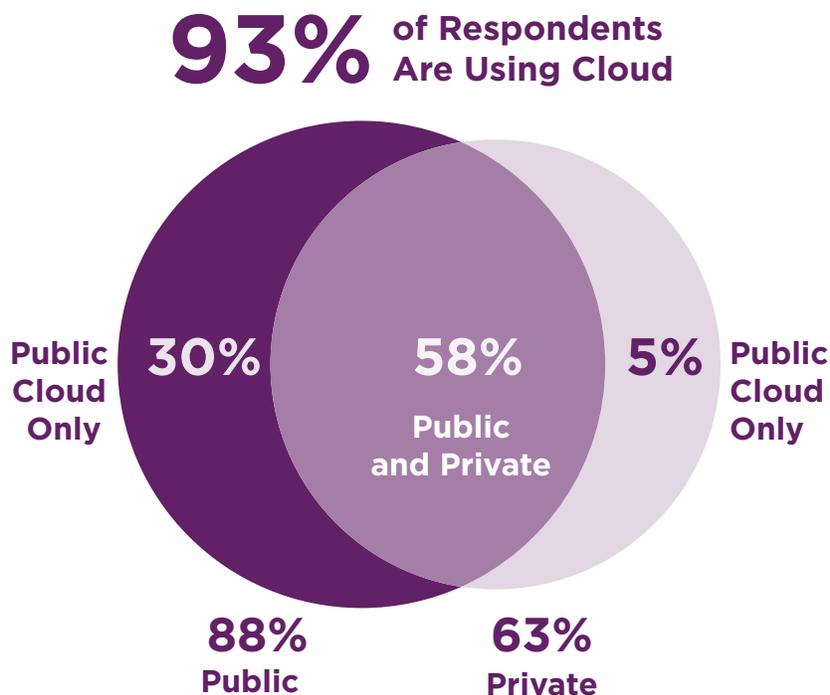
All questions and enquiries regarding this white paper should be directed to:

**Dan Cybulski**  
Chief Technology Officer  
[dcybulski@cognitiocorp.com](mailto:dcybulski@cognitiocorp.com)



# Background

Cloud computing is a pervasive technological trend that has penetrated nearly every commercial and government market over the past several years. The cloud computing paradigm treats IT services as a commodity, focusing on providing ubiquitous access to shared computational and storage resources, and leveraging economies of scale to achieve lower variable costs. Generally speaking, cloud computing provides organizations with on-demand access to a nearly infinite amount of highly available IT services and infrastructure, promising less IT overhead, unlimited scale, and on-demand pricing. According to the *RightScale 2015 State of the Cloud Report*<sup>1</sup>, 88 percent of enterprises are putting workloads in public cloud infrastructure, while 63 percent are leveraging private clouds. While similar cloud adoption statistics for the federal market are not available, our research indicates that adoption among federal agencies is occurring at a much slower pace.



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<sup>1</sup>RightScale. *RightScale 2015 State of the Cloud Report*. PDF. <<<http://assets.rightscale.com/uploads/pdfs/RightScale-2015-State-of-the-Cloud-Report.pdf>>>

Despite a federal “Cloud First” mandate, organizations across the federal ecosystem are continuing to proceed to the cloud cautiously. Regardless of whether the focus is on public or private cloud, agencies are managing risk by deploying only their lowest value assets into the cloud. This is particularly true within the Intelligence Community (IC) where, despite significant investments made in commercial cloud solutions, mission elements have continued to maintain their own separate IT infrastructures for their most critical and sensitive workloads. In most cases, these organizations perceive federal and IC cloud initiatives as unproven against political, cultural, procedural, and technical challenges not present in the commercial market. This risk avoidance, while intended to preserve the functionality of existing mission critical capabilities, is actually to the detriment of these capabilities, as it fails to expose them to the rich, on-demand capabilities of cloud infrastructures.

Today though, a new deployment paradigm, known as cloud bursting, has emerged as a means to enable federal agencies and organizations alike to leverage the substantial investments made in the deployment of both commercial and open source cloud ecosystems, in concert with their existing mission-focused infrastructure. Platforms like the Bright Cluster Manager from Bright Computing Inc. enable cloud bursting, allowing organizations to seamlessly partition workloads across on-premise and cloud infrastructures in order to handle excess workloads and “bursty” resource requirements, while only paying for the additional resources when they are needed. Moreover, cloud bursting with Bright Cluster Manager allows organizations to minimize the potential risks of cloud adoption by enabling strategic workload migration

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# Benefits of Approach

The use of Bright Cluster Manager can immediately improve the utilization of existing infrastructure and lower the risk of cloud transition by enabling missions to:

## 1. Minimize Risk Through Cloud Bursting

Not managed effectively, cloud transition can pose a risk to an organization's ability to meet mission needs. This risk causes organizations to continually put off cloud migration, keeping them from leveraging the potential mission enhancing features of cloud infrastructure. By utilizing Bright Cluster Manager, it is possible to minimize risk for organizations as they start their cloud transition by providing managed bursting of workloads from existing infrastructure into cloud environments.

## 2. Drive Utilization in HPC

In many cases, High Performance Computing (HPC) systems are considered to be candidates for cloud migration due to low overall utilization that does not appear to justify the cost, with little consideration given to the potential performance impact of such a move. By leveraging Bright Cluster Manager it is possible to introduce and manage new or consolidated workloads within the HPC infrastructure to drive increased utilization and improved return on investment (ROI).

## 3. Scale to Meet Demand

As clusters grow and evolve from on-premise to cloud or hybrid architectures, they become increasingly difficult to manage and use. By leveraging cloud bursting and Bright Cluster Manager to remove this complexity, it is possible for organizations to scale their systems and applications to meet the unique demands of IC missions.

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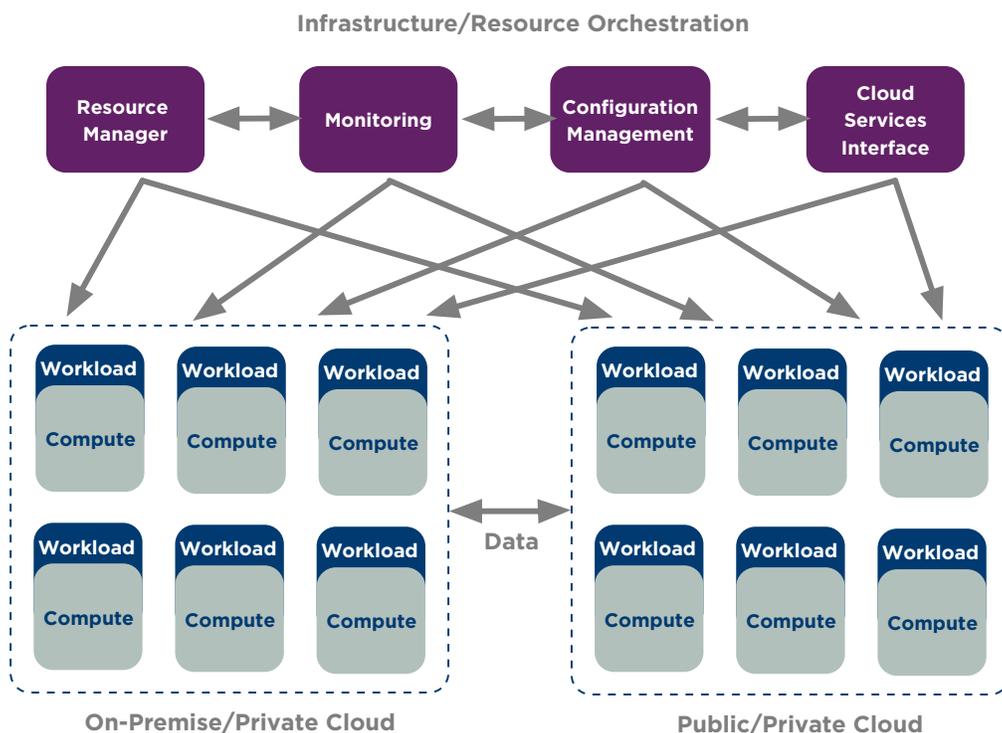
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# Cloud Bursting

Cloud bursting is a deployment model in which an application, or a workload, runs on-premise or in a public cloud and bursts into a public or secondary private cloud when certain criteria are met, or when demand for resources exceeds the capacity of the original environment. For example, consider an online retailer that operates and maintains its web services within an on-premise data center. For most of the year, the resource burden for servicing online shoppers is predictable, allowing on-premise infrastructure to be properly sized to efficiently service the load. However, as traffic spikes during the holiday season, the on-premise infrastructure struggles to meet the demand, leading to possible service outages and sales losses.

By implementing cloud bursting, as depicted in figure 1 below, this retail organization can dynamically leverage cloud resources, paying only for what they use, to handle the spikes in resource demands. Likewise, federal organizations can leverage cloud bursting to seamlessly extend their current environments onto cloud infrastructure, simultaneously maintaining and enhancing mission critical functionality. Moreover, the ability to dynamically provision and utilize cloud resources enables these organizations to effortlessly absorb spikes in peak loads driven by world events.

**Figure 1: Cloud bursting architecture**



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Successful cloud bursting is about building an environment that seamlessly extends into the cloud. As depicted in figure on previous page, overflowing resource demands are addressed by provisioning cloud resources to absorb the load. The primary challenge with cloud bursting is the orchestration layer, which is used to automate the process of bootstrapping resources in the cloud in response to load events or specific workload scenarios. Historically this orchestration has required a complicated suite of tools to provide:

- **Resource Management** - Provision and manage resources within the on-premise environment
- **Monitoring** - Monitor resources identify peak-load events that can trigger cloud burst activity
- **Configuration Management** - Implement and manage configurations to maintain functionality and operational consistency across provisioned resources
- **Cloud interfacing** - Interaction with cloud service provider APIs and management applications (e.g AWS CloudFormation) to execute resource provisioning and de-provisioning

In this scenario, orchestrating cloud bursting activity across these tools can require a significant amount of effort to enable interaction among tools. At a minimum it requires, developing custom triggers within the monitoring applications that can detect the existence of a load event, and developing a mechanism for using those triggers to interact with cloud providers and dynamically provision resources. However, with Bright Cluster Manager, this orchestration layer is consolidated into a single platform that provides all of this functionality.

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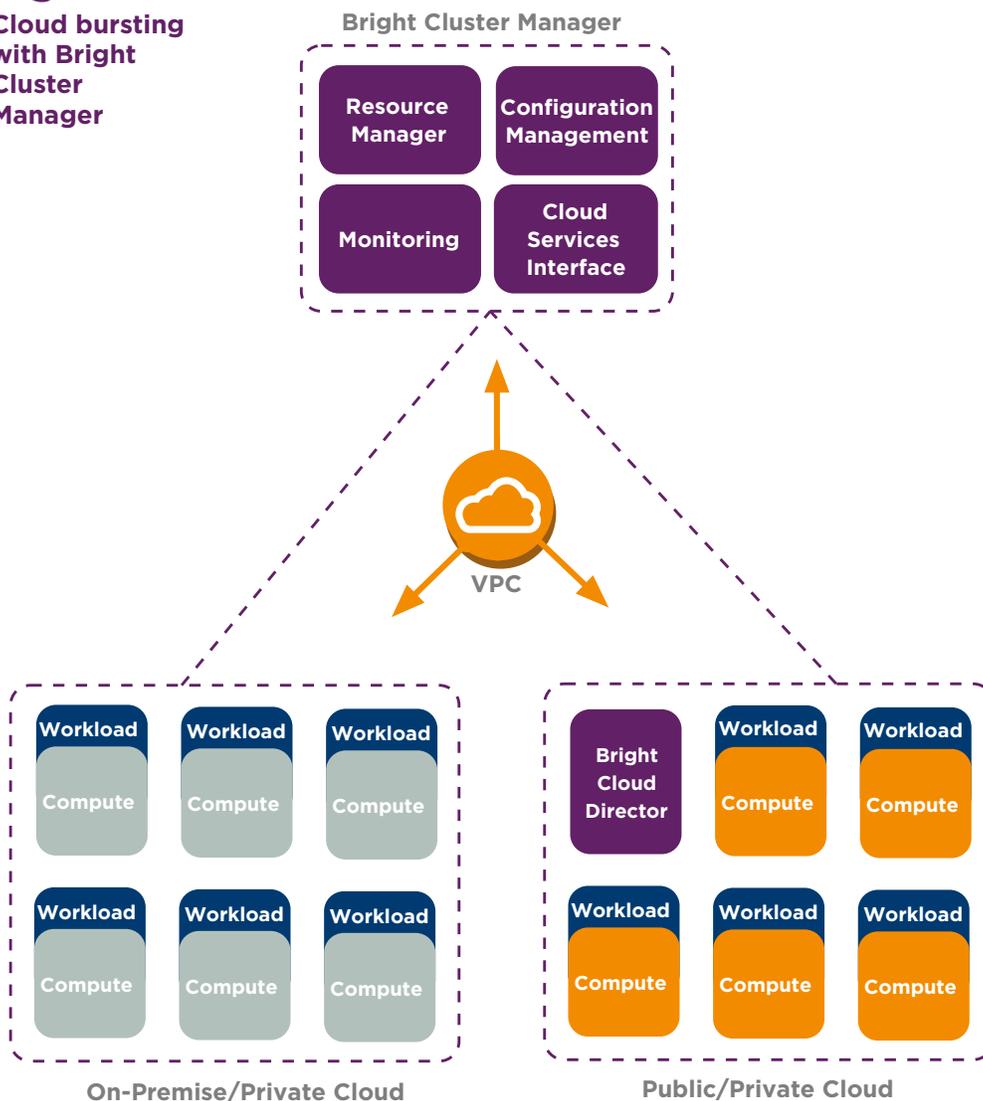
“The orchestration layer ... is used to automate the process of bootstrapping resources in the cloud in response to load events or specific workload scenarios.”

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# Cloud Adoption with Bright

The Bright Cluster Manager is an advanced resource management tool suite focused on simplifying the installation, management, and use of application clusters including High Performance Computing (HPC) clusters, Hadoop clusters, and even OpenStack private clouds. As depicted in figure 2 below, Bright Cluster Manager supports cloud bursting by simplifying the orchestration layer, providing native support for interacting with public cloud infrastructure to enable seamless and dynamic scheduling and deployment of resources across environments.

**Figure 2:**  
Cloud bursting with Bright Cluster Manager



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“Bright Cluster Manager supports cloud bursting by simplifying the orchestration layer, providing notice support for interacting with the public cloud infrastructure.”

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In this scenario, the Bright Cluster Manager head node is deployed outside of the cloud, within the primary environment, either on-premise infrastructure or private cloud, and used to provision and manage an arbitrary number of resources across the primary environment as well as within the secondary cloud infrastructure. In order to speed up communications and ensure greater resource efficiency, Bright Cluster Manager deploys a cloud director into the secondary cloud to provide limited head node functionality within the cloud environment, and to interact with the primary head node over an isolated VPN (Virtual Private Network) tunnel. The implementation of a cloud director serves to decrease latency and bandwidth utilization during the provisioning of resources in the secondary environment, ensuring that cloud based resources can be rapidly and dynamically provisioned to meet resource requirements.

While support for additional public cloud infrastructures is imminent, today Bright Cluster Manager is specifically tailored to enable cloud bursting into the Amazon Web Services (AWS) public cloud. Once Bright Cluster Manager is deployed in the primary location, clusters can be provisioned and extended into AWS with just a few clicks in the Bright Cluster Manager web-based management interface, providing the same level of visibility and control in the cloud as onsite systems.

Moreover, Bright Cluster Manager provides data-aware scheduling to ensure that input and output data for analytic workloads is automatically transferred to and from the cloud environment, and enables organizations to leverage unique cloud features including:

- **Spot instances** - enables users to specify the use of spot instances to take advantage of the associated cost savings without having to manually monitor spot prices
- **VPC** - supports virtual private cloud implementations to isolate network traffic
- **HVM** - supports the use of hardware virtual machine instances to take advantage of specialized hardware extensions for improved performance in the cloud

Ultimately, Bright Cluster Manager simplifies the process of deploying and managing resources across disparate infrastructures, enabling customers to rapidly deploy and operationalize clustered applications both on-premises and in the cloud. This allows organizations to begin to harness the power and infinite scalability of cloud to empower their workloads, while also enabling them to seamlessly take advantage of the elasticity of cloud to experiment with their workloads on cloud infrastructure without risking impact to mission.

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# Summary

There is a clear push across the federal market to increase the utilization of cloud infrastructure for both enterprise and mission focused workloads. However, not all clouds are created equally, and not all workloads are suitable for cloud infrastructure. As such, organizations are faced with the unknowns of cloud transition, and often dedicate significant resources to the instantiation and management of cloud resources, in parallel with existing infrastructure. This allows the organization to begin experimentation within the cloud while maintaining the services provided by existing infrastructure, but in doing so it consumes precious mission assets to manage the redundant ecosystems.

Bright Cluster Manager is ideally suited help organizations begin to realize the benefits of cloud without impacting current operations. Through cloud bursting, Bright Cluster Manager helps organizations extend their workloads onto cloud infrastructure in order to achieve new levels of efficiency and mission capabilities, while also minimizing the risk and resource burden of traditional cloud transition.

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# About the Authors

## **Dan Cybulski - CTO**

Dan is currently the CTO of Cognito. Runner-up for Central Intelligence Agency (CIA) Technologist of the Year in 2014, Dan is recognized as a proven technologist, leader, and decision maker. Prior to joining Cognito as CTO, Dan spent over ten years supporting the High Performance Computing (HPC) mission at the CIA, including serving as both an engineering lead and chief architect, before ultimately serving as acting chief, prior to his departure from the Agency. In this capacity, Dan developed broad-based experience and hands-on technical skills supporting every aspect of this unique HPC infrastructure.

Dan's experience includes building, deploying, and supporting operational technical infrastructure including complex heterogeneous High Performance Computing grid systems, high performance networks, and multi-petabyte storage subsystems. Finally, Dan is recognized for his broad understanding of computing hardware and software including the evaluation of leading edge technology against known and anticipated requirements.

## **Roger Hockenberry - Co-founder - Partner - CEO**

Roger is currently CEO and co-founder of Cognito. He is a proven technologist and business executive with over twenty years of experience working with all aspects of IT to assist enterprises in better utilizing technology to create, deploy and operate unique and innovative solutions and provide mission and competitive advantage. He is the former CTO for the National Clandestine Service of the Central Intelligence Agency where he helped shaped mission capabilities across a broad spectrum of activities.

Prior to this, Roger served with the Agency's CIO to help create and realize the community cloud capabilities, future desktop and field architecture, large data initiatives, and served as the Agency's Chief of Cyber Solutions. Prior to government service, Roger was a Managing Partner at Gartner responsible for several practices, including their security practice across

their North American consulting business.

### **Bob Gourley - Co-founder - Partner**

Bob Gourley is the publisher of CTOvision.com and is a co-founder and partner of Cognito. Bob's first career was as a naval intelligence officer, which included operational tours in Europe and Asia. Bob was the first Director of Intelligence (J2) at DoD's cyber defense organization JTF-CND. Following retirement from the Navy, Bob was an executive with TRW and Northrop Grumman, and then returned to government service as the Chief Technology Officer (CTO) of the Defense Intelligence Agency (DIA).

Bob was named one of the top 25 most influential CTOs in the globe by Infoworld. He was selected for AFCEAs award for meritorious service to the intelligence community, and was named by Washingtonian as one of DC's "Tech Titans." Bob was named one of the "Top 25 Most Fascinating Communicators in Government IT" by the Gov2.0 community, GovFresh. Bob was noted as "Most Influential on Twitter for Big Data" by Forbes. The blog he founded and publishes, CTOvision, is now ranked among the top 50 federal technology blogs. At Cognito, Bob leads research and analysis activities, due diligence assessments and strategic consulting.

# About Cognito

Cognito is a Senior Leveraged Consulting firm focused on several key practice areas including Cyber Security, Research and Influence, Government Services, and Technology Discovery and Innovation. Our partners are senior leaders with a wide array of government, Intelligence Community, and commercial experience, enabling us to bring both technology and business perspective to client engagements. Additionally, our engineering team boasts extensive experience designing and building high performance computing (HPC) and advanced analytic systems for the U.S. Intelligence Community (IC). With its broad experience, Cognito is adept at driving impactful change, helping clients see clear paths to success, and helping to change perspectives in order to drive higher value in their enterprises.