

October, 2012



Leveraging IBM Federal Data Centers (FDCs) White Paper

R1.0

Abstract: This paper describes the appeal and viability of leveraging IBM's Federal Data Centers for hosting US Federal Agency IT capabilities, meeting key Federal Agency requirements when hosted by third party vendors. It also positions IBM's ability to move to these data centers as a means for implementing data center consolidation, virtualization, optimization, and/or cloud computing.

Introduction and Challenge

US Federal Agencies have been leveraging vendor-provided IT since the advent of the IT industry. Over time, agencies and their supporting communities needed to be responsive to unique agency needs, and have their own infrastructure and/or applications implemented on a shared infrastructure. This trend has become more prevalent with the introduction of client-server distributed computing, commodity systems, ubiquitous access to technology, and low-cost initial investment.

As the heterogeneous asset set has become pervasive, managing the IT infrastructure has become more challenging across all industries. Custom applications, COTS solutions, and mission pressures have increased the diversity of IT portfolios. IT leaders in agencies are also faced with the challenge of providing infrastructure to mission clients tasked with managing their own IT assets and applications, and trying to gain control of costs related to mission servers maintained by the mission owners.

Despite virtualization efforts in various agencies, there have been increasing costs relating to power, space, cooling costs, and server count. These efforts have often cost millions of dollars and failed to provide an understanding of what is in the data centers. A common one-size-fits-all approach focuses on new investment rather than systematically addressing the costs, capacity, and/or agility of legacy systems.

The 2010 White House/OMB 25 Point IT Reform Plan outlined goals to consolidate at least 800 Data Centers by 2015, and to prioritize cloud computing with the "Cloud First" initiative - to choose cloud whenever possible. In the DoD 23 point Acquisition Reform, Former Secretary of Defense Robert Gates directed \$100B reduction over 5 years to reduce

duplication and mandate affordability (setting affordable acquisition targets).

Many agencies have been considering leveraging data center hosting services, potentially optimizing and implementing cloud capabilities, each provided by third party vendors. They want to know how to reduce IT costs, increase standardization, remove user complexity, and implement agency directives. To accomplish this, agencies need to overcome challenges caused by diverse heterogeneous platforms, address widely distributed compute and storage systems, efficiently manage systems with significant security requirements, keep their IT supply chain under control, reduce the investment required for new capabilities, and implement configuration baselines and processes for their IT assets. The biggest hurdle in doing so on a broad scale within a US Federal agency appears to be overcoming cultural and funding boundaries between stakeholders within an agency, each of which can have different priorities, funding allocations, and goals.

Vendor Hosting of Federal IT

Leveraging vendor-hosted data centers for US Federal Agency IT capabilities is appealing for various reasons, including the ability to leverage enterprise class and broad experience, economies of scale, support for a wide range of standards/technologies, and the ability to take advantage of a catalog of services and capabilities uniquely designed to meet the needs of Federal agencies. Besides implementing data centers with these characteristics, IBM has been successful in moving a vast array of existing customer workloads into our data centers, including those designed for the US Federal government.

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Federal Hosting Needs

US Federal agencies are asking for key features in potential third party vendors to host their IT capabilities, such as:

- Policy compliance:
 - FedRAMP (reducing C&A work using a third party assessor)
 - FISMA (physical and policy based controls)
 - Cost Accounting Standards (CAS) compliance
 - NIST security standards, especially lifecycle, controls, categories, and plans.
- Personnel:
 - US-citizen staff for on-site O&M
 - Appropriate agency clearances
 - Access by agency administrators
- Data centers:
 - Separate security domains
 - Agency-specific connectivity
 - Disaster Recovery (CONUS)

IBM Data Center Experience

IBM has experience in successfully delivering solutions and services to the public sector for 100 years, and as the largest managed hosting vendor, passes economies of scale on to our clients:

- IBM manages 450 data centers globally with 8+ million sq. ft., 1,100 mainframes, and 200,000 midrange servers
- IBM operates 238 data centers for clients in the United States, including three FISMA compliant Federal Data Centers, as well as 10 call centers with Tier 1, 2, and 3 help desk capabilities
- Our solutions include mainframe, client/server, and internet/web-based domains
- IBM creates/offers methods, tools, processes, and intellectual capital to create high service levels

IBM's Federal Data Centers

IBM supports managed hosting for Federal agencies in IBM Federal Data Centers (FDCs). IBM FDCs are FISMA/DIACAP-compliant, green data centers that incorporate IBM's "Cool Blue" portfolio of tools for achieving energy efficiency (from LEED Silver to Gold). IBM FDCs house the hardware, software, middleware, data center networks, and peripherals suitable for US Federal agencies.

IBM has a wealth of data center assets specifically for supporting our Federal clients. Our FDCs provide a comprehensive set of capabilities and services allowing Federal agencies to quickly and accurately migrate to, manage, monitor, and analyze complex computing environments.

These geographically separated centers in the US (CONUS) are on separate power grids. They represent IBM's industry-leading approach to data centers and afford the benefits needed to address federal hosting requirements such as those listed above.

The personnel supporting IBM's FDCs are:

- Locally-managed, US-citizen staff for on-site O&M
- Personnel with agency-level background checks needed to support IT access positions
- Experienced Federal C&A Personnel
 - Experienced in writing, reviewing, and implementing systems supporting NIST, DIACAP, FedRamp and DARPA policies

The policies supported by IBM's FDCs include:

- Hosting services at varying security levels from unclassified (FISMA & DIACAP compliant) to DoD certified classified and HIPAA Sensitive
- Preparation for leveraging FedRAMP services

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- FISMA-Moderate and High environments, covering NIST security requirements

The data center features supported by IBM's FDCs include:

- Redundant electrical/mechanical power feeds and communications lines
- Segregated networks from both IBM internal and commercial customer environments
- Supports Federal shared networks or access to dedicated networks (e.g. NIPRNet, SIPRNet)
- Connectivity that includes client VPN with two-factor authentication, site-to-site VPN, direct WAN connections, and agency specific circuits are supported
- ITIL® v3 standards implemented
- DR and COOP
- Meets Federal CAS standards

Differentiating capabilities in IBM's FDCs include:

- Security Operations Center Services
- Network and Host-based Intrusion Prevention
- Software Encryption
- Virtual Network Firewalling
- Virtual File Isolation
- Hypervisor Isolation of Computing Resources
- For Cloud hosting, dedicated physical firewalls / IPS on the cloud edge
- GOCO (Government Owned/ Contractor Operated) world class, secure government facility
- Continued growth - customized, dedicated, expansion, and capacity
- Specialized capabilities (e.g. Big Data)
- Globally unique capability (IVC Cave, SEER Dome, HALO and SVC theater)
- Full SDLC Services (Dev., Test, etc.) offered in a single solution stack

IBM uses a 4-level data center grading system, rating facility and data availability characteristics. IBM FDCs are also designed to meet IBM Level 3 data center

requirements, including: redundant active capacity components and distribution paths, concurrent maintenance, fault tolerance, compartmentalization, and continuous cooling.

In addition, IBM takes the following approach to meeting agency-specific requirements, such as network connectivity coordination and addressing application hosting requirements.

IBM provides disaster recovery or COOP through client IT deployment at multiple data centers. FDC facilities are designed to meet at least a FISMA Moderate security baseline for the Physical and Environmental IA control family. Data backup is performed at least weekly, or to the backup frequency specified by the client. Disaster recovery plans specify the mission resumption time and include business recovery plans, system contingency plans, facility disaster recovery plans, and plan acceptance. Disaster recovery and COOP exercises are scheduled annually or semi-annually, per client specifications.

The physical and environmental security for FDC sites protects government systems and assets managed by IBM by preventing unauthorized access, damage, or interruption of IT services. Controls include separate caged area, biometric reader entry, security monitoring cameras, 24x7 site security, locked racks, and controlled access.

Migrating to IBM FDCs

Successful migration to a new infrastructure hosting environment and coexistence during the data center consolidation period requires depth and breadth of expertise to minimize disruptions to mission critical business operations and enable significant cost savings. IBM has a proven track record to meet this challenge and help an agency with a successful IT transformation.

Data Center Migration Challenges

An agency that consolidates data center IT capabilities can realize significant long term benefits in cost reduction due to savings in space, power, cooling, maintenance support, and reduced investment in new capabilities. Such efforts are inhibited when extensive and detailed information about the current environment is lacking. Servers with heterogeneous configurations, distribution, ownership, and management greatly magnify the challenge and increase risk.

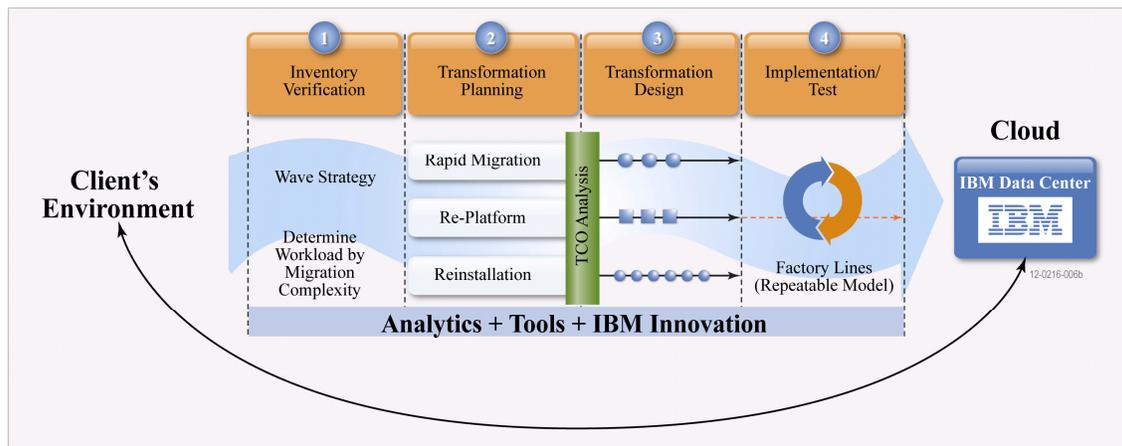
Any major enterprise transformation effort depends on having complete, accurate, and pertinent information available to be successful in the transformation, especially information to effectively and efficiently execute in a timely fashion. Detailed knowledge is needed about the inventory, configurations, utilization/workloads, interdependencies, and mission functionality of the technical

Data Center Migration Process

IBM uses a comprehensive approach to demonstrate an understanding of migration and coexistence strategies that support uninterrupted delivery during transition. IBM services are built upon the foundation of our portfolio of infrastructure offerings, which encompass hardware and software solutions. These services are supported by skills, methods, and automation/enabling tools used by IBM to help thousands of clients of all sizes enhance infrastructure flexibility through consolidated and virtualized IT infrastructure, improved energy efficiency, and enhanced operational management. We conduct the migration according to our best practice Smarter Migration methodology phases—assess strategy and analysis, design, develop and test, and implement.

Our automation focused approach, illustrated in Figure 1, covers the breadth of migration, co-existence, and workload-

Figure 1: Migration in Phases
Automation is used at every stage of opportunity.



components. Such detailed knowledge is necessary to map and transition as-is workloads to an optimized and cost-effective IT environment, especially if a migration to consolidated IT capabilities is extended to include virtualization, IT optimization, or cloud capabilities.

appropriate migrations. Our strength in large scale migrations and consolidation is based on robust methods with a supporting suite of tools that enable maximizing the efficiency and effectiveness of the data center (including possibly IaaS cloud resources) allocated to the target operational environment for

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the agency, as well as the transition to using those resources.

- IBM uses repeatable processes to discover the agency asset inventory and design an optimized target operating environment.
- Specific to the workloads in the inventory of the agency operating environment, IBM can assess, analyze, plan / roadmap, design, install/ provision, migrate to the target environment, and test to confirm the success of the migration.
- If IT Optimization is needed, maximizing the efficiency and effectiveness of the migration is accomplished through an in-depth analysis of the complete system stack across the complete set of applications and services provided by each agency data center.
- The detailed design for server and application migration produces an actionable plan for the execution, which contains a detailed wave plan needed to support the coexistence strategy, leveraging application affinity, a migration workbook, test plan coordination and execution, and cutover and decommission plans.
- The Data Center transition detailed design typically includes Move Day Timelines (equipment plans, Move-via-Truck plans, Vendor plans and Facilities), and contingency plans.
- A Data Center relocation plan includes detailed sub-plans for key function teams, i.e. operating systems, storage management, facilities, communications, hardware planning, site recovery, and installation. Prior to the relocation, a final dry run of the migration plan with key business and technical stakeholders is held. With agreement and approval of the agency and IBM stakeholders, communications is distributed with the migration date, high-level timeline, and other pertinent information. IBM,

with support of the agency, executes the migration plan.

Move and Migration Methods

IBM employs several move methods to balance the constraints of application outage windows with cost and tolerance for risk. We would evaluate and select the most optimal migration technique considering risks, cost, and schedule.

Overall methods to move the workloads to a new data center include the following:

- **Data Mirroring:** In this method, data is mirrored and synchronized to a duplicate environment, typically using a vendor software tool. This approach transitions the current environment to the FDC. Data mirroring is typically used when applications have very limited outage windows or a refreshed infrastructure is installed in the new data center.
- **Leapfrog Over High-speed WAN:** In this method, redundant or backup equipment is used to create a duplicate environment during the relocation of the original workload. Leapfrog is typically used when applications have very limited outage windows and a full duplicate infrastructure is not available.

Additionally, when platform migration is required, for each workload, there are different migration methods that may be appropriate. These are selected based on the need to optimize costs in the target Cloud environment and address other workload constraints and dependencies.

- During “Rapid Migration” IBM creates images of the Client’s servers and quickly moves them to an environment where they can be adjusted for use in the target environment (cloud or otherwise). Rapid Migration is assumed for most agency workloads, especially in cases when a major release of the existing OS is supported in the target cloud in a cost-effective manner, and when the

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technical dependencies match the standards of the target infrastructure (e.g. an IaaS cloud). In this scenario, application platform products are supported on virtual images, and it minimizes client effort for application remediation or re-certification by migrating an image of their existing server, updated to adhere to the data center standards.

- “Re-Platforming” is the process by which the source Operating System is ported from one Operating System to another in the target environment, and associated applications ported (re-compiled, rewritten) to work on a standard image. This approach also works well for applications that are binary compatible between OS platforms, and custom development is inside binary compatible modules or databases.
- “Re-Installation” is the process by which an application is re-installed onto a standard image, along with middleware and database. Then, the configurations and data are migrated to the new image.

Migrating to an FDC Hosted Cloud

If the target of the migration is a cloud infrastructure in an IBM FDC, migrating existing application workloads onto hosted IaaS virtual cloud instances will involve a similar migration approach that is used for data center consolidation and relocation. However, the target of the migration will be to instances that have already been enabled for the IaaS cloud services so that the agency can immediately use the cloud capabilities for supporting these instances following the migration.

IaaS cloud capabilities such as self-service, resource pooling, and rapid elasticity would be in place in the target operating environment ahead of migration of the application workloads. After application migration, these IaaS services will be available as needed to support the

migrated applications. Agency administrators would have nearly immediate access to the VM instances through the self-service interface, enabling government application maintenance as needed.

The hypervisor infrastructure and standard capabilities on which the virtual cloud instances are deployed, combined with the cloud capabilities used to manage the instances, can be used to create a clean separation between the IaaS cloud services management performed by IBM, and the OS and application management performed by the agency.

Optimizing during Migration

IT Optimization is an effort to maximize efficiency and effectiveness of a data center or the IT systems in it. To derive maximum value from the IT investment, there are various approaches for making an IT environment as effective as possible.

During the data center migration, existing workloads can be transitioned to a new optimized environment designed for those workloads.

Migration to the FDC infrastructure may involve migrating existing application workloads to an infrastructure that is optimized for its operational characteristics (a “Fit for Purpose”) within the FDC. This could enable more rapid savings return on the migration investment due to reductions in the power, space, cooling, and support footprint. Or, it could allow the government to use IaaS cloud capabilities for directly supporting these operating systems to further provision, install, patch, and configure the virtual OS images of migrated applications and integration middleware on a target cloud infrastructure.

If either increased savings or cloud capabilities are desired, IBM’s skills,

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tools, and methods can be used to design an optimized target environment and appropriately map existing assets.

Co-existence during Migration

Sustaining operations and maintenance of systems in the target operating environment during the transition to the target operating environment will require co-existence of the migrated workloads with those not yet migrated from the current operating environment.

IBM uses strategies for both migrating tightly integrated workloads and hosting those workloads in a way that allows for continued operations and interoperability across target and current data centers during the transition period. IBM's repeatable migration process is typically performed on one set at a time ("migration units") of related applications, data, storage, and other dependent IT capabilities. Some sets of tightly integrated capabilities will have been migrated while others remain not yet migrated, leaving less tight, or "loose" integrations between the current and target data centers. Co-existing sets with mostly loose integrations between them greatly simplifies the interoperability needed between data centers in areas such as bandwidth, latency, communications protocols, unique middleware, support, and change control.

Based on the planned interoperability needs during the transition period, the remaining interoperability requirements for supporting the loosely integrated applications are identified and addressed.

The database of server affinity and application dependency data supports analytics necessary to determine the optimal "migration units" of components to transform, focusing on the interdependencies between applications and each other, and between applications and other components such as data, appliances, middleware, etc. The interdependencies *between* waves are

considered during application assessment and detailed design, to determine the management and impact of the migration, which may cause re-evaluation of server and application grouping in each wave. This re-evaluation may be used to facilitate ideal interoperability during the transition, or may determine optimal scheduling of waves in relation to one another.

Projects are sized by technology diversity in source platform, number of servers (source and target), platform and data center migration method chosen, client time, and resource dependencies. Risks are mitigated using a phased methodology, starting with complete and detailed analysis of migration scope using a standard and proven work breakdown structure supported by the automation method planned for each workload. Generally, prioritization of migration units are based on workload characteristics, TCO analysis, proposed workload placement, and operating system (OS) and middleware modernization. Initial migration waves are intended to address the need to mature the customer-specific migration process, refine roles and responsibilities, address technical and information hurdles, and engage stakeholders.

Implementation/test activities move the workloads into the Cloud environment according to the Wave Plan and the Technical Solution Design. Automated migration enables successful transition to the target solution, with the automation supported by tools.

Data Center Interoperability

The completeness of IBM's data center hosting services allows for broad interoperability with US Federal agencies' installed base. IBM has an unparalleled scope and reach of services and partners in the IT industry. We are able to provide this interoperability with the least risk and at the lowest possible cost for enterprise

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data center hosting, virtualization, optimized operations, and enterprise-class cloud capabilities.

Typically, an examination of an agency's installed base shows a wide variety of Open Source components. IBM is an industry leader helping governments evolve toward greater openness and innovation. Our commitment and perspective on intellectual property, open standards, and open source software emerges from our experience in the marketplace and, of equal importance, from the direction in which we see IT taking the larger society. IBM contributes broadly to the Open Source community.

IBM also supports a wide range of operating systems, and products for database software, web hosting, application hosting, middleware, scripting/programming environments, and secure file (bulk data) transfer capabilities, as well as other platforms.

IBM's FDC hosting controls further enable interoperability with the government's installed base of standard software and hardware. For example, IBM policies and procedures protect the agency's, the agency's licensors, and partners' intellectual property and data ownership from theft and misuse with a hardened infrastructure leveraging intrusion detection tools, firewalls, network security policies, and routine vulnerability scans of the infrastructure.

Transition and Migration Services

The FDC provides transition services for hosted projects. Transition services are a standard service provided for most FDC customers. The typical transition timeframe is approximately 90 days.

The FDC provides transition project management to coordinate the on-boarding and off-boarding of FDC

services. The FDC also provides technical transition services to implement the hosting project. The transition services typically used are:

- Facility Infrastructure
- Asset Management (per asset)
- Network
- Server
- SAN/Storage & Backup
- Database
- Security (per device)
- C&A/FISMA Compliance
- Network & Security Ops Center
- Monitoring & Event Management
- Remedy ticket system
- Service Desk

Summary

US Federal Agencies expect to gain operational efficiency by moving to a vendor-provided data center. This efficiency may come from reduced costs, increased capacity, or increased agility to respond to change. Agencies are increasingly viewing vendor-provided data center hosting as a viable alternative to managing the infrastructure on their own premises.

IBM's Federal Infrastructure Managed Services (FIMS) organization delivers IBM's public sector hosting and cloud services from its Federal Data Centers (FDCs), designed to address US Federal data center requirements, and provides capabilities to maximize value and minimize costs for enterprise-class services for US Federal agencies.

IBM has vast experience with data center hosting, manager operations, data center consolidation, virtualization, IT optimization, increasing operational efficiency, and cloud computing. IBM would be pleased to support US Federal agencies in achieving such goals.

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New Orchard Rd.

Armonk, NY 10504

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