GSA Public Building Service
Facilities Management & Services Program

Smart Buildings Program Guide

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1 Introduction

The GSA Smart Buildings Program Guide was written to introduce the GSA's Smart Buildings concepts and to ensure that the GSA continues to lead the industry in implementing the latest Smart Buildings technology in a thoughtful and consistent manner.

Implementing a Smart Buildings strategy has allowed the GSA to leverage the whole organization, bringing buildings, people, and technology together to modernize, optimize, and best utilize resources available. The GSA Smart Buildings strategy provides necessary alignment across multiple operational organizations, allowing Facilities, IT, Tenants, Design and Construction a pathway to work in unison toward the ultimate goals of: lowering operations costs, reducing government energy usage, and providing a better environment for GSA tenants.

1.1 Audience and Use

The GSA Smart Buildings Programs Guide is intended to educate and assist GSA Portfolio, Project Executives, Project Managers, and Program Leaders of GSA Smart Buildings. The guide covers GSA Operational Technology, Smart Buildings Pillars and considerations for design and construction of Smart Buildings. The guide also introduces the systems that may be included in a GSA Smart Buildings.

This guide should be used in the development of a new construction or repair and alteration (R&A) project prospectus that include building automation, lighting control or other smart building implications. By reading and understanding this guide, a project team should have a full understanding of the benefits and challenges of implementing Smart Buildings in the GSA environment. By the end of this guide, project executives should have the information they need to develop a Smart Buildings narrative to accompany any new project or R&A prospectus. This guide, in conjunction with the GSA Smart Buildings Implementation Guide, creates a roadmap for all GSA projects to successfully implement Smart Buildings Systems.

2 Operational Technology

As building systems evolved, they began to follow the advances of information technology (IT). These direct digital control (DDC) systems allowed for more detailed monitoring and control of buildings, but with the complexity comes the requirement for more careful management of these systems. The term “operation technology” (OT) was coined to describe these new systems (hardware and software) that detect or create a change in physical devices, processes and events through direct monitoring in the enterprise environment. The organizational management of OT is critical for the GSA to ensure the utilization, cost reduction, reliability, and security of building systems.

GSA’s Smart Buildings programs are largely built upon this OT infrastructure. Figure 1 explains the building blocks of OT that are needed to have a fully connected Smart Buildings. The blocks in red show the minimum building system requirements. The building system must meet certain minimum requirements (digital control, internet protocol communications, etc.). Additionally, there must be a GSA network presence in order to connect the information from the building system back to the GSA network. Lastly, the system must be integrated into the GSA enterprise network. By meeting these foundational steps, a GSA building is capable to participate in GSA’s Portfolio Business Smart Buildings Programs. With this minimum foundation, GSA can apply a normalization layer and introduce the programs that utilize building data. The normalization layer and Smart Buildings programs will be explained in detail later in this guide.

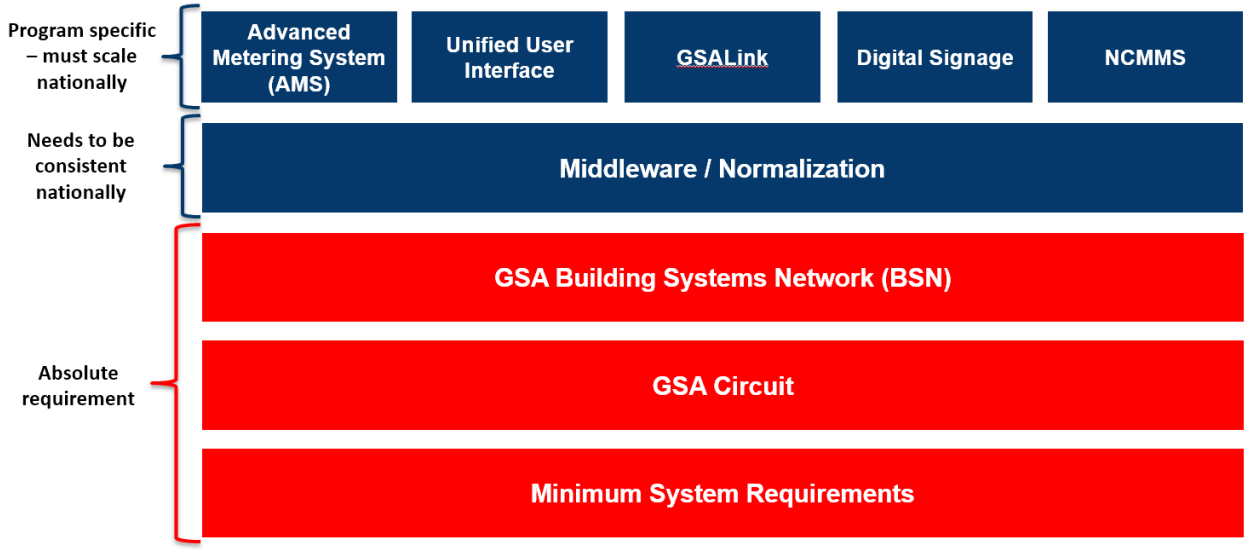


Figure 1: FMSP Smart Buildings Program Building Blocks

2.1 OT System Architecture

Modern system architectures are based on a three tier hierarchical network. The following tiers should be referenced when discussing networking related to building systems in coordination with the *Building Technologies Technical Reference Guide*.

2.1.1 Device-Level Network

The device level network is often also referred to as the field bus or control network. These networks typically connect the edge devices back to managing controllers. They are typically twisted pair cable networks that communicate via a master/slave token passing (MSTP) or free topology twisted pair (TP/FT-10) protocols. They are more cost effective than IP and are still commonly deployed by system vendors, but the communication protocols are limited and therefore only used on the edge device level.

2.1.2 Building-Level Network

The building network is the network that GSA uses to support the business applications and workstations. This internet protocol network level acts as the point of convergence for all building sub-systems. In building automation systems, this network includes the network controller (JACE, NAE, PXC, etc.). GSA IT, along with the *Building Technologies Technical Reference Guide* and *Telecommunications Distribution Design Guide* should be consulted when deploying this level of system architecture.

2.1.3 Enterprise-Level Network (Building Systems Network)

The enterprise network is the wide area network that connects all GSA buildings nationally. This network connects data centers, business applications, workstations and servers. The smart buildings standards rely on the ability to connect and share data across the portfolio. This connection between the various portfolio applications and building systems that have applications on virtual servers allow the GSA to communicate across the country. GSA IT must be consulted prior to deploying systems that communicate across the enterprise network.

3 Smart Buildings Pillars

GSA Smart Buildings are dependent on operational technology that is developed with the future in mind. The individual building systems, as well as the GSA's structure, must be built capable of expanding and advancing with improving technologies. To help ensure this concept is known, GSA Smart Buildings and FMSP have created the Smart Buildings Pillars. These pillars are "Open," "Converged," and "Normalized." Operational technology and building systems that incorporate control, monitoring, and data collection should meet the Smart Buildings Pillars outlined below as general policy, unless dictated otherwise by Regional GSA authorities.

3.1 Open

In GSA Smart Buildings, the term "Open" takes on multiple meanings. The basic concept of open is that by purchasing a system, product or contract the GSA is not restricted to a single source or product to control, maintain, update or replace any components of the system. Pressure from large customers of building automation systems has helped to drive the industry to adopt more of these open concepts, but the GSA must enforce these requirements to continue to drive the industry to complete open standardization. "Open" applies to communication protocols, software and business practices.

3.2 Communication Protocols

Open protocol requirements are focused on BAS, lighting, and metering systems. Other systems should support these requirements where sufficient market research is provided to demonstrate that competition and open system benefits can be preserved by utilizing open protocol requirements.

- **Open Device-Level Protocol Implementation:** On a control network, the device-level protocol refers to the communication language in which a device speaks to share information with other devices in the architecture. Consistent and open protocol implementation at this level is essential to promote interoperability between devices and ease of data sharing on the network media. Communication protocols that meet open and published standards, such as BACnet or LonTalk, must be used when designing and installing systems in GSA buildings, per regional and national guidance.
- **Enterprise-Level Protocol Requirements:** Building system data points must be exposed on the GSA network for future third party integration (for information on the data points that shall be exposed, please reference *The GSA Minimum Point List)*. Systems must include the ability to transfer data to a third party using an open and published methodology, concurrent with GSA IT, and national requirements. Vendors must document a proposed means of data transfer that works most efficiently within the configuration of the system being installed or upgraded, and its capabilities. Submittal or design documentation shall include any additional licensing, hardware

and data capacity associated with the proposed transfer method. Integration should also be possible at varying tiers in the architecture and not just limited to a centralized server.

System data must be able to be obtained from any point or collection of points, be it a physical point, virtual point, trend log, or schedule. This data must be able to be transmitted via the methodology chosen. The data stream should include points with the following information, at a minimum, with the assumption that point data will be obtained from the system on a short interval basis:

- Name
- Description
- Value
- Units
- Source
- Time Stamp

- **Certified Devices:** Even with widely accepted open protocols, it is critical to implement these open protocols consistently. Devices need to be tested and certified to ensure that the protocol is properly applied and to comply with the application requirements for sharing data between devices. All communicating control devices installed in GSA buildings shall be certified for protocol conformance and functional performance by third-party organizations that create standards. Certified devices are more likely to be interoperable, but certification is not a guarantee of interoperability. Industry examples for building automation include:
  - BACnet (ANSI / ASHRAE 135) – Controllers communicating the BACnet protocol shall be tested and certified by the BACnet Testing Labs (BTL) using the latest version of Standard 135 that is consistent with product availability. This certification is available at http://www.bacnetinternational.net/btl/. Additionally, Protocol Implementation Conformance Statements (PICS) must also be available for any device to identify all the portions of BACnet that are implemented.
  - LonTalk (ANSI / CEA 709.1) - LonTalk controllers shall be LonMark certified with a profile that provides a data model and services appropriate for their building automation application. LonMark certified devices can be found at http://www.lonmark.org/certifications/device_certification/product_catalog/.
  - Niagara controllers must utilize the Open Niagara Compatibility Statement (Open NICS) to ensure that Niagara OEM controllers utilize open protocols and standards.

3.3 Software

Buildings systems traditionally rely on network management software, application configuration software, system monitoring software, and other system software tools. Where commercially available, it is desired to use openly available software tools to manage and support the system. When the installing controls contractor uses proprietary network management tools, these tools must become property of the GSA including tools needed for configuration and databases. At completion of the system install, the GSA should have any required software to maintain, update or configure the system. This may include, but is not limited to:

- **Network Management Software:** Software used to add or modify the devices or nodes on the network and also used to define the communication parameter of each node on the network.
- **Application Configuration Tools:** Software tools used to program or configure the logic of a controller and its sequence of operation.
- **User Interface Development Tools:** Software tools used to develop and modify the system graphics and related supervisory features (scheduling, alarming, and trending).
- **Licenses:** The GSA must own the Licenses for the software. Software and technology EULAs must be approved by the GSA prior to implementation. Software must be licensed to the GSA and not vendor restricted outside of the EULA agreement on either the hardware or software. Considerations should be made on required number of devices, seats, and concurrent logins and include appropriate language to address any legal concerns. (e.g., EULAs shall not include indemnification clauses, non-federal jurisdiction or venue clauses, foreign choice of law clauses, etc.) Software licensing is preferred over hardware licensing and where possible must **not** limit:
    - The number of points that can be communicated on the GSA network or system within a building. (when license is sized by point count, projects shall account for 50% growth of system points)
    - The number of clients or operator workstations in a building
    - Access to the system or data from an external computer or system
    - *Who* can use the system
- **Administration-Level Credentials:** In addition to the software, GSA must be provided usernames and passwords used to access the root level of system operation. System credentials should be unique to the user. General “admin” or “engineer” user credentials do not offer acceptable security.

3.4 Business Practice

Open business practices are critical for ensuring the GSA is able to maintain, update and upgrade their building systems. Open business practices include the availability of services and support, methods of product procurement and availability of software. Business models developed by some vendors significantly restrict distribution and competition so that only one installer can provide certain products and the support for those products in a given region. When evaluating a system or technology for use in a building, the following elements shall be considered and vetted prior to selecting the operational technology or vendor:

- Open Procurement: Services, hardware, and software used to install and support the system can be purchased from multiple competitive sources. Preference is to procure systems and products that are not regulated or restricted on a national or local level when possible, subject to a review of the market and local support availability.
- Open Distribution: Services needed to support and maintain the solution can be obtained locally from multiple sources without limitations set by the manufacturer or parent company on territories or service agreements.



4 Converged Networks

Control systems installed in a building have historically been deployed with their own network infrastructure as independent systems, both physically and logically. As these systems evolved and began to utilize internet protocol (IP) based communication, they mimicked the existing network infrastructure in many buildings across the portfolio. Noticing this industry change, Facilities Management and Services Programs (FMSP), the Office of Design and Construction (ODC) and GSA Public Buildings IT Services (PBITS) jointly sponsored the first policy to address GSA's approach to building system technology. The *Technology Policy for PBS-Owned Building Monitoring and Control Systems* established the policy for driving network convergence in all new GSA Construction, renovations and energy savings performance projects. To support the issuance of the policy, the *Building Technologies Technical Reference Guide* was released as a comprehensive guide that details GSA IT's requirements for integrating building monitoring and controls systems onto the GSA network.

The *Building Technologies Technical Reference Guide* lays out the steps for the convergence of these building system networks with the existing network infrastructure. This convergence allows for the GSA to lower the footprint of the network equipment while maximizing security and uptime for all network communication. This convergence requires all IT network equipment (switches, routers, etc.), as well as network edge devices (servers and workstation) to be government furnished and maintained.

Physical media required to support the building systems (copper and / or fiber) shall be installed by the project and shall comply with the *Telecommunications Distribution Design Guide**. Project contractors must work with GSA IT to obtain the necessary network design and equipment requirements to support the building and project. The network design must be approved by GSA IT, and IP addresses are provided to the installers by GSA IT. Network routing and switching gear, servers, workstations, and peripheral devices are to be furnished by the GSA. Care should be taken to ensure that the contractors are aware of this policy. Network equipment, workstations, or servers not provided by the GSA shall not be included in the contract or turned over to the GSA at completion of the project.

**Some network devices are excluded from the GSA network requirements. Fire and Life Safety networks, security networks or other sensitive networks may require separate networks. Please discuss with FMSP and GSA-IT before contracting installation of these networks.*



5 Normalized Data

Open systems and converged networks allow for these systems to share data, but this data needs to be processed and understood by the recipient. In order to make useful, data driven decisions, the data across multiple building systems must be made into a uniform and recognizable format. This process is known as data normalization. Normalization allows for enterprise applications to identify similar points of data coming from different systems, over different protocols or with different naming conventions. In order to best prepare a system for normalization, all new installations and major R&A projects impacting buildings systems shall follow the requirements identified below:

- Point data shall follow a common and documented point naming or tagging scheme. Not all systems may be able to follow these requirements and this should be noted as soon as the system vendors are identified in a project. Accommodations can be made in these scenarios as necessary. Contact Chip Pierpont (chip.pierpont@gsa.gov) for the latest version of the point naming guidance.
- While not a requirement, GSA projects are encouraged to follow the industry guidance issued by the following open source industry consortium: http://project-haystack.org

6 Design and Construction Considerations

Critical to successful implementation of GSA Smart Buildings is early implementation and understanding of the goals of Smart Buildings projects. This guide is designed to help ensure this understanding and implementation. The following sections will explain specific considerations that should be included in the project design and construction stages.

6.1 Concept Development / Pre-design

Concurrent with most standard processes and the P100, the pre-design effort should outline concepts, goals, and metrics, developed from performance requirements / expectations, existing conditions, available technologies, tenant or lease requirements, and budgets. Project prospectus development should include the creation of a narrative that identifies components of the design concept along with high level system interactions, feature, benefits, and potential costs (Note: Cost should not be a primary consideration as to disqualify features that may prove cost effective in an integrated design approach). Having these details thought out in the pre-design phase will assist in the development of a scope and budget in addition to future planning.

6.2 Design and Construction Document Development

The design development process for new and R&A projects is the stage when the Smart Buildings attributes will expand past the narrative, into more definitive Smart Buildings solutions. When in design development, it is critical that the following items are outlined for review and approval of the GSA project team:

- Network Architecture – IP network architectures must be explicitly designed and coordinated with GSA IT. No IP infrastructure should be built out or installed without prior approval of the design. GSA IT owns all network designs and projects must request these drawings, if previously developed, during either the design or construction phase of a project. Riser diagrams must be kept up to date in their native format (AutoCAD or Visio) by either GSA IT or the project team. When network designs do not exist for a building, project teams must work with GSA IT to develop the preferred architecture and layout. Network designs can be submitted per building system but ultimately need to be merged onto the overall IP riser diagram for the building. Care must be taken to exclude any network equipment (switches, routers, etc.) from all installer's scope. *Note: Cabling must be included in installer's scope, where applicable.*
- Integrated Sequences of Operations – The designer must outline sequences of operations for both the overall building and sub-systems based on the narrative developed during pre-design or concept development. Integrated sequences of operations should include high-level interactions between the systems. Communication protocols, points to be shared and ownership of integration should be outlined, specifically if an MSI is to be utilized.
- System Sequence of Operations - Individual building system sequences of operations (HVAC, lighting, etc.) must also be developed into specific, programmable, sequences for each system or component. Detailed sequences including, logic diagrams, schedules, and other supplementary information should be included in the design and construction documents. If a project is being performed using a design-build methodology, the design build contractor must submit these detailed sequences in advance of beginning any programming work. *Note: Patented or proprietary*

sequences of operations for systems or equipment must not be used without advanced permission of GSA. This is especially important for packaged controls and optimization controllers commonly seen in ESPC projects.

- Instrumentation / points lists – The designer must detail the required instrumentation, sensors, or other components needed to accomplish the integrated sequence of operations. This point list should be used to verify commissioning.
- MasterFormat Division 25 Specifications - Architects, engineers, and project managers must consider the development of Division 25 specifications to realize potential Smart Buildings benefits and goals. While the necessity of such a specification depends on the project scope, specification development helps clarify the system integration requirements amongst systems that are commonly specified in their respective divisions.

6.2.1 Migration and Expansion of Existing Proprietary Systems

The level of integration and expansion possible for existing proprietary systems varies tremendously depending on the manufacturer, model and version of the system. Options often include front-end integrations or upgrades, use of 3rd party drivers, or gateways to accomplish desired goals. Each system requires thorough evaluation to determine the most effective means for integration or upgrade. Requirements and policies outlined in this document do not require that existing building systems be fully replaced to be brought up to standard. Individual evaluations should be conducted and include engagement by the regional Smart Buildings team to determine the best upgrade or migration path to fit regional requirements, both short term and long term.

Major repair and alteration or ESPC projects that include upgrades to operational technology, specifically BAS, must take care to prevent the installation of two different vendor solutions or front ends unless specifically desired by the region or project team. Although there may be different vendor controls present within the building, all controls must be integrated into a common system to prevent the use, maintenance, and configuration of two front-end platforms.

Energy savings companies (ESCO) evaluating systems as part of an energy savings performance contract (ESPC) must work to develop an energy conservation measure (ECM) that incorporates either full replacement or an integration of existing controls or features into a new system without significantly compromising functionality if the existing system needs to be upgraded. In the event this cannot be done without significantly impacting savings, the ESCO's findings must be presented to GSA for evaluation. The GSA should not invest in the installation of two systems, nor should it continue to invest money in an outdated system.

6.2.2 Construction Phase

When kicking off the construction phase, coordinate with the regional Smart Buildings team to assist in the development of the submittal schedule to ensure all related items are covered based on the scope of the project and design.

Careful coordination during the construction phase of a project is also required between system vendors and GSA IT. Building system installers or integrators will be required to meet with GSA IT to discuss network configuration, server configuration, end user license agreements (EULA) and workstation requirements.

These Server Solution Meetings and Network Requirements Meetings should be coordinated through GSA IT Building & Energy project managers.

6.2.3 Commissioning

Commissioning is a vital step in producing valuable and effective Smart Buildings. Commissioning should focus not only upon point-to-point validation of systems but should also verify the holistic system goals as laid out in the design. Commissioning should ensure that systems are operating within the parameters defined in the design and construction documents and that all sequences and integrated sequences of operations are working properly.

Prior to the development of the Commissioning Plan and beginning commissioning activities, it is recommended that the chosen commissioning agent schedule a meeting with the regional Smart Buildings team to further define any unique Smart Buildings related requirements. Smart Buildings commissioning should include commissioning of:

- Third party system data accessibility
- Systems Continuation of Operation Procedures (COOP) in cases of network outage or system failure
- System integration and integrated sequences of operations

7 Additional Smart Buildings Support Organizations

The GSA has provided its project teams numerous support tools to assist with the successful implementation of the Smart Buildings program. These include:

7.1 GSA IT

Previously referred to as PBS CIO / OCIO, GSA IT must be involved throughout the lifecycle of the design / build / operating process to ensure compliance with IT and security requirements. Their role includes:

- Facilitation of the conformance and requirements between different IT groups
- Assistance with converged network design
- Building System Network (BSN) / VLAN establishment
- Device scanning review process
- Procurement of Government Furnished Equipment (GFE)
- Server maintenance
- Routine troubleshooting and maintenance
- Providing addresses for all IP related equipment
- COOP and technical support of systems

Refer to the latest version of the *Building Technologies Technical Reference Guide* for more information on the role of GSA IT in projects. For more information contact pbs.pbios@gsa.gov

7.2 GSA Smart Buildings Consultants

GSA Central Office retains a team of industry experts to assist on a consulting and advisory basis for any aspect of Smart Buildings design or implementation projects. These resources are available at no added cost to the project team and it is recommended that they be engaged as early in the project development or design process as feasible. For more information contact Chip Pierpont (chip.pierpont@gsa.gov).

7.3 *PBS Building and Energy Systems*

The Public Buildings and Energy Systems group are connected to GSA Smart Buildings. This group is focused on energy applications, metering, system servers and measurement and verification. For more information contact pbs.pbios@gsa.gov

8 Smart Buildings Attributes

Smart Buildings principles and considerations have been defined, thus far, but the composition of a truly "Smart Buildings" is the combination of its systems and attributes. Below a number of Smart Buildings Attributes are defined. It should be remembered that every project is unique in terms of goals, budgets, operational plans, and existing systems and that not every project will include every Smart Buildings attribute. However, it should be noted that many attributes are related to maximizing the use and potential of software and networks already planned for a project. Additional value and efficiencies can be achieved at minimal or no additional cost to the project if the design and construction processes are guided by a knowledgeable resource on these principles.

Although there is no single combination of elements that define Smart Buildings, the following attributes listed are the most common elements found in many existing project scope documents and, therefore, are the attributes typically targeted for inclusion when planning and designing a project.

8.1 Smart Buildings System Interaction Attributes

8.1.1 Master System Integrator (MSI)

Smart Buildings can be effectively realized by strategically executing with an MSI leading the integration side of the project. Open, converged, and normalized technology allows cross-communication between systems, enabling integrated control and monitoring across previously disparate systems. Introducing an MSI allows a party to take primary responsibility for integrating these individual systems and ensuring that the building is controlled holistically.

The role of the MSI varies greatly by the technical capability of the MSI and the goals and requirements of the project. At a minimum, the MSI's role is to coordinate the network convergence and ensure the individual systems are connected and coordinated properly. In more complex projects, the MSI may take on the role of system integrator, engineering integrated sequences of operations and user interfaces. It is important to define these expectations when introducing the MSI role.

Utilizing an MSI opens the door for more potential Smart Buildings aspects like unified user interfaces and integrated sequences of operations. The MSI can ensure that the whole building is considered in system integration, commissioning, system training and maintenance. Regional project teams should work with the regional Smart Buildings teams to determine if an MSI is appropriate for their project and how to execute with this strategy.

8.1.2 Unified User Interface (UUI)

UUIs represent a singular graphical user interface that can be used to monitor and control various building systems. When implementing a UUI it is important to ensure that the interface includes graphics for monitoring and controlling the systems for daily operations and maintenance. This user interface should be the centralized tool for O&M contractors and building managers to operate a building.

UUI's should be considered when multiple systems will be maintained by a singular group and the project is utilizing an MSI. When implementing a UUI it is also important to limit the graphics requirements from the scope of any other system. Graphics development can be costly and efforts should not be duplicated. If a UUI is implemented, it must include all functionality of system management that the individual system graphics would include.

8.1.3 Integrated Sequence of Operations (ISOO)

Integrated interaction between building systems and the functions they perform allows for a building to act as a single entity rather than a combination of individual systems. Systems integration allows for more unified controls strategies and can not only save energy but improve the tenant experience. By allowing building systems to act in unison and react to changing conditions identified by each system, a smarter, more efficient solution can be realized. Connecting the occupancy sensors in a lighting system to control the ventilation of an HVAC system is an easy example of an ISOO.

Although ISOOs can be implemented by individual controllers coordinating with each other, successful implementation benefits from an MSI ensuring proper coordination between multiple systems.

8.2 Smart Buildings Systems

8.2.1 HVAC/ Building Automation Systems (BAS)	Building Automation Systems are often thought of as the central system for Smart Buildings. These systems are designed to control the Heating, Ventilation and Air Conditioning (HVAC) equipment from the chiller plant to the thermostat on the wall. HVAC is a major energy consumer in most commercial facilities and therefore offers a big opportunity for energy savings. BAS design should consider energy saving features including optimal stop / start, scheduling, chiller optimization, and other available technologies.
8.2.2 Networkable / Digital Lighting Control	Networkable / digital lighting control offers a means of controlling and monitoring one of the largest utility cost centers in commercial buildings. Intelligent lighting control allows for advanced strategies such as load reduction/shedding, demand response, occupancy strategies, daylight harvesting and the collection of data for analytics. Integration of lighting with other building control system is also strongly encouraged to improve the tenant experience.
8.2.3 Shade Control	Shade control, often implemented as a function of the lighting control, allows for automated adjustments in natural light into spaces. Shade control systems can be programmed to operate on a schedule or adjust dynamically to the lighting conditions present. Introduction of natural light offers opportunities to lower the demand on artificial lighting and reducing energy consumption. Shade control helps to ensure tenant satisfaction and limit unpleasant sunlight glare while capturing the most available natural light. Shade control should be strongly considered if using a digital lighting control system.
8.2.4 Metering and Sub-Metering	Projects are recommended to go beyond main utility metering and consider sub-metering for the following: lighting, plug, HVAC (whole building and individual floors), tenants, special use space, after hour areas, major energy consuming equipment/systems. Consumption data generated from any meter, communication interface, or sensor should be integrated into the BAS or energy application for monitoring, trending, and reporting. Metering designs must also match plans for energy reporting and M&V plans depending on the project.
8.2.5 Automated Demand Response (ADR)	Innovations in the power distribution grid allow buildings and the systems within to dynamically react to valuable utility data such as real time pricing and load shed commands. By utilizing energy when the costs are lower and lowering the energy use when the demand and therefore costs are high alleviates the demand on the grid and the cost of the energy. Project teams are strongly encouraged to consider implementing demand response plans and utilizing automated demand response sequencing. These sequences can be triggered by building operators or may utilize OpenADR or other connected technology.
8.2.6 Digital Signage	Digital Signage is comprised of three main components; interactive/non-interactive Display, media player and content management software. Digital Signage is used to convey various types of communications and content including; emergency notifications, national, regional and building level internal communications, news, weather, traffic, building directory and interactive applications such as a building energy dashboard and dynamic way-finding. Digital Signage should be implemented in high volume foot traffic areas including lobbies or near elevators to ensure the best tenant experience.

8.2.7 Hoteling & Space Utilization	Effective management of tenants and space utilization presents another unique way to save resources across a portfolio. Hoteling systems allow for automated control of building populations and space sharing. Implementing a system that can dynamically control population, and distribution of tenants can allow for a greater balance of resources in a smaller footprint. These systems, in unison with mechanical and electrical building systems, can provide not only efficiencies but can improve tenant satisfaction. Hoteling systems should be considered when building populations are flexible and operations allow for a mobile tenant.
8.2.8 Occupancy Detection / People Counting	Public buildings or offices that share spaces can have large fluctuations in the building population and these variances often go unnoticed by building systems. Deploying occupancy detection or people counting technology can help maximize building utilization, manage effective use of shared workspaces, and improve the operation of mechanical systems. Reporting energy use per person, for instance, can be a powerful way to engage tenant and provide a way to relate the performance of a building to their daily interactions while inside. People counting can be accomplished by physical access control systems or passive sensor technologies placed at entries and exits. This technology should be considered when optimizing systems based on occupancy or when there is a plan to communicate building performance or energy savings to tenants through digital signage or other methods.
8.2.9 Native Power	Enterprise workspace is increasingly converged to IP network infrastructure. Power over Ethernet (PoE) is one of the most widely deployed technologies to provide power to networked devices. System contractors and designers should consider utilizing POE if controls and edge devices can be purchased with PoE configurations, where the application presents itself and is life cycle cost effective. These PoE devices may be controllers, edge devices or sensors.

9 Portfolio Business Application Systems

The top level of the GSA Smart Buildings Blocks (Figure 1) is the Smart Buildings Business Applications and Systems. These are the programs that take the now open and normalized data, and help those who operate the buildings to better manage and control their systems.

9.1 NCMMS

The GSA Public Buildings Service (PBS) is implementing a nationwide computerized maintenance management system (CMMS) to replace the current collection of GSA regional CMMS systems that support approximately 175 million square feet of workspace in over 1,530 government owned buildings. The PBS is responsible for the design, construction, operations and maintenance of this federal inventory.

The goal of National CMMS is to provide a single, consistent solution that the government will use to manage policies, procedures, inventory and maintenance of PBS facilities, monitor performance metrics, and control maintenance processes through roles and business rules. This includes complete and accurate inventories, maintenance histories, easy-to-use processes for work orders and customer (tenant) requests, and consistent process for GSA's many Operations and Maintenance (O&M) contractors.

Through strategic interfaces to systems such as REXUS and GSAlink, National CMMS will proactively detect, diagnose and trigger work orders to NCMMS resulting in improved building performance, improved tenant satisfaction, and reduced operations and energy costs.

9.2 GSAlink

The GSAlink initiative is one of GSA's strategic projects that leverages automated building analytics and fault detection & diagnostic technology to measure and lower operational expenses in the existing owned building portfolio. GSAlink is a hardware and software solution that captures building systems point data and applies rules-based analytics software to the data in order to spot trends and deficiencies while reporting actionable events to building operators, O&M contractors, and GSA Service Center property managers.

Integrations to GSAlink and support for the hardware and software platform is handled under a separate contract managed by GSA. GSA repair and alteration, ESPC, and other approved capital projects that require integration or programming work to GSAlink will be handled via individual GSAlink project requests (national) or as regionally funded projects. To accurately assess potential FMSP Smart Buildings program impacts, GSA requests that project managers and property teams consult with the regional energy branch and/or Smart Buildings point of contact(s) to ensure projects adhere to current and planned requirements.

9.3 Digital Signage

Central Office FMSP is commissioning a 50-building proof of concept digital signage project which will create a standardized technical architecture, content development and management platform that can be deployed and operated in a secure, consistent and cost effective manner.

9.4 Advanced Metering

In response to the Energy Policy Act of 2005, GSA established the Advanced Meter program and ION EEM metering systems to meet the requirements of all Government buildings. Concurrent with these requirements, GSA IT has also issued the *Advanced Metering System Implementation Guide* that describes GSA's IT policy regarding metering.

10 Regional Requirements

While this document presents national guidelines for the implementation of Smart Buildings technology and systems, it must be considered supplemental to any regional documents or requirements that exist. The table below indicates those regions that have separate or supplemental documents and/or requirements. Vendors, designers, and implementers must reach out to the regional points of contacts or Smart Buildings representatives in order to obtain and understand this documentation prior to starting their respective activities.

Region	Supplemental Regional Documentation	**Regional Point of Contact**
1	No	N/A
2	No	N/A
3	No	N/A
4	Yes	FMSP Building and Energy Branch
5	Yes	FMSP Energy and Sustainability Branch
6	No	N/A
7	Yes	FMSP Building and Energy Branch
8	Yes	FMSP Building and Energy Branch
9	Yes	FMSP Building and Energy Branch
10	Yes	FMSP
11	No	N/A

Note: Supplemental documents may include project/systems specifications, system requirements, design requirements, etc.

11 Reference Documents

Reference documents listed below include policy and supplemental documents for the Smart Buildings program and must be requested/understood by all project teams. Requests for these documents, if not already obtained, should be made to the GSA project team which will be designing, installing, or constructing a project.

1. Technology Policy for PBS-Owned Buildings Monitoring & Control Systems – Dated 3/31/11
2. Building Technologies Technology Reference Guide (latest revision) published by GSA IT
3. Facilities Standards for the Public Building Services P-100 (current version)
4. Telecommunications Distribution Design Guide published by the Office of Chief Information Officer (OCIO)
5. Advanced Metering System Implementation Guide
6. GSA Point Naming Standard
7. GSA Smart Buildings Implementation Guide