

# **Final Project**

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Enterprise Architecture

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## Executive Summary

Present paper is based on the GAO report (GAO 2012) which targets the ineffectiveness of Housing and Urban Development Department's IT environment and its partially successful attempts for modernization during the last several years.

The main concern behind the report is the significance of the services which HUD delivers to homeowners in particular and the profound impact they might have on the overall economic condition. Recent enacted legislation brings for HUD even more responsibilities related to strengthening the housing market. To be able to satisfy these new responsibilities, HUD will need to ensure effective collaboration with more external partners. All of these, result in increased demand for system processing capabilities that can support data collection and dissemination through the department and external parties.

It turns out, that the current IT environment is not capable to effectively support even the ongoing business operations. Duplicative, nonintegrated legacy systems; processes that require extensive manual workload or even non-automatized business processes; budget obligated exclusively for maintenance, just to name the major findings in the GAO report.

All the above-mentioned problems could be addressed separately one by one, which HUD indeed tried for the last several years. Results were rather suboptimal. The previous as well the present recommendation given by GAO propose a more holistic approach though, establishing effective and robust Enterprise Architecture. That's why, this paper and the prosed architecture are built around a widely recognized architecture framework – TOGAF<sup>1</sup>. Despite the fact that HUD made some progress towards IT modernization, more work remains.

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<sup>1</sup>TOGAF is a registered trademark of The Open Group.

## Background

The Department of Housing and Urban Development (HUD) plays an important role in stimulating the economy through strengthening the housing market. HUD performs a wide range of significant home ownership and community development missions, such as creating strong, sustainable and inclusive communities, as well as quality and affordable homes. These missions are integral to the economic health and strength capabilities. Moreover, legislation enacted in 2008 (Housing and Recovery Act) “established a program intended to help families avoid home foreclosure by refinancing them into mortgages insured by FHA” (GAO 2012), increased HUD level of involvement and brought additional responsibilities. To be able to perform its daily duties and serve and satisfy homeowners expectations, HUD heavily relies on its IT department capabilities to deliver highly integrated and standardized, reliable, and qualitative services.

However, the current IT environment doesn’t support effectively HUD’s business operations, hence strategic goals couldn’t be achieved. The inefficiency demonstrated by HUD and recent unsuccessful attempt for IT modernization drew the attention of Congress which resulted in limitations on the funding provided to the department for this purpose. The actual limitations stated that “the department could not obligate more than 25 percent of fiscal year 2010 funds and 35 percent of fiscal year 2011 funds until the Secretary of HUD submitted to the appropriations committees in each year an expenditure plan that satisfies two sets of statutory conditions and had been reviewed by GAO”.

For the first statutory condition HUD was required to identify in the plan:

- Functional and performance capabilities to be performed

- Expected mission benefits
- Estimated lifecycle cost
- Planned key milestones

For the second statutory condition the plan should:

- Demonstrate that each project was supported by an adequately staffed project office
- Conform to capital planning and investment control requirements
- Comply with the department's Enterprise Architecture
- Be managed in accordance with applicable lifecycle management policies and guidance

### Current Operating Model

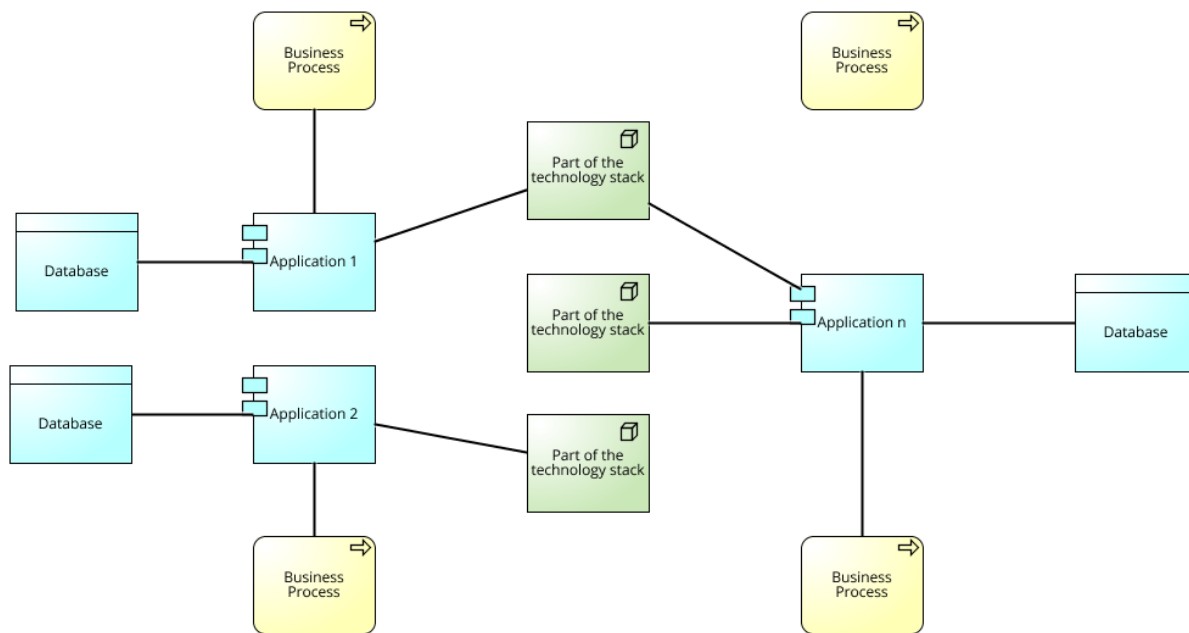
Although, the GAO report doesn't discuss explicitly the operating model, referring to the findings about the lack of integration and standardization, we could make an educated guess that HUD's current operating model is oriented towards Diversification Model. The book Enterprise Architecture as Strategy gives an "extreme" example of diversification model than fit surprisingly well to the HUD's case – "An extreme example of Diversification would be a total lack of an enterprise architecture..." (Ross 2006, 56).

The following diagram depicts the processes associated with the Diversification Operating model:



Figure 1. Diversification Core Diagram - Processes

Since Diversification Model is characterized by low integration and standardization, the only common process for all the business units is shared technologies. The following diagram describes the core diagram of HUD Architecture in correlation with the Diversification Operating Model.



*Figure 2. Diversification Core Diagram - Outcomes*

The diagram shows that there are business processes which depend on a “local solution” – applications that solve particular problem and work in isolation comparing to the IT environment. Moreover, some business processes are not automatized, hence they are not addressed by any application. Some applications share different parts of the technology stack, while others are based on technologies solely dedicated to support their existence. Also, the data is dispersed all over the applications but these applications are not capable of sharing data, hence data accessibility, management and storage are very ineffective.

## HUD's current Enterprise Architecture

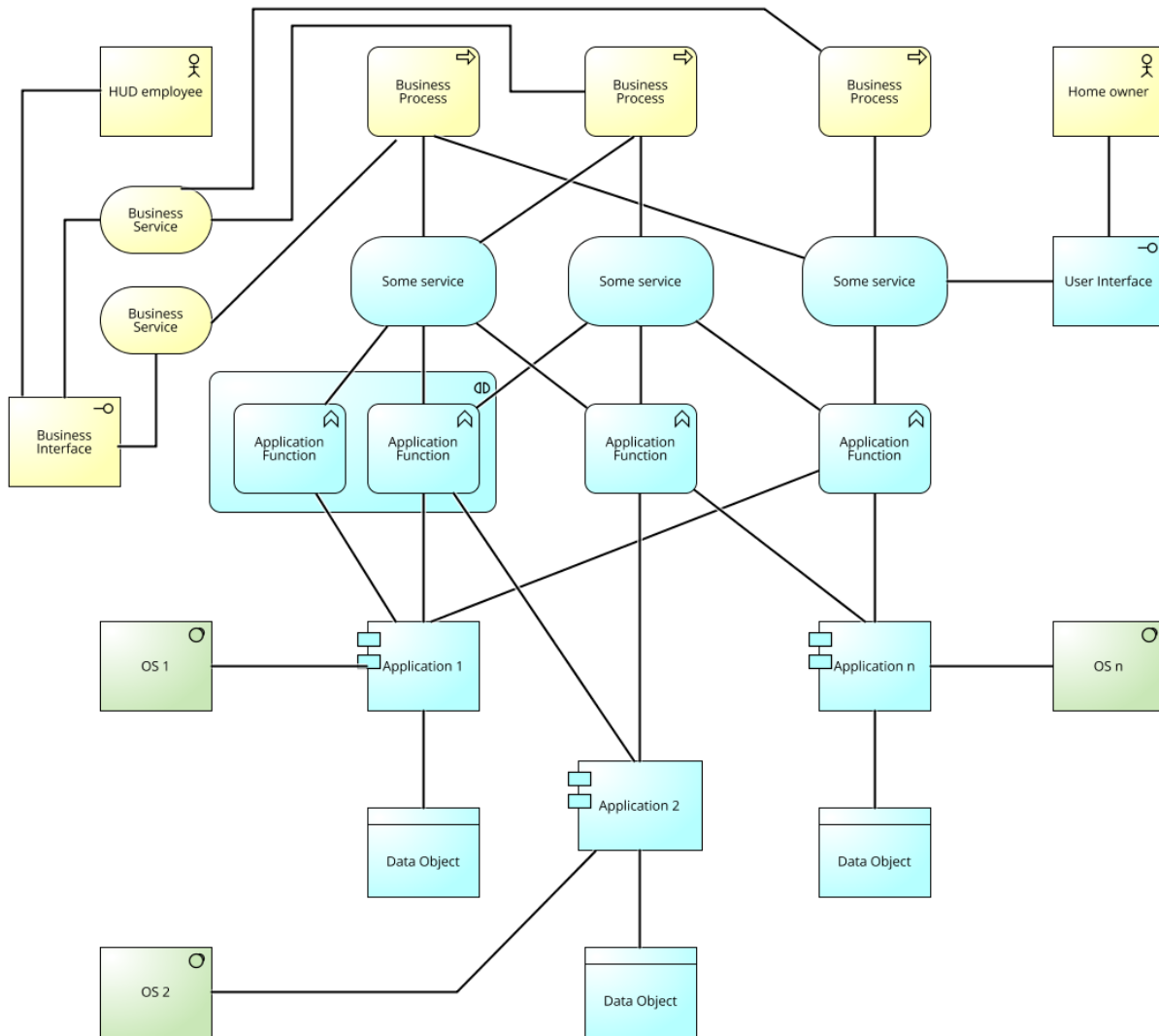
There is a significant discrepancy between growing mission and responsibilities and the capability of HUD's IT environment to support its business operations and achieve strategic goals. In 2009 the U.S. Government Accountability Office (GAO) reported the following weaknesses and flaws with regards to the HUD's IT environment:

- Existence of more than 200 distinct information systems with overlapping and duplicative functions
- Stove-piped, nonintegrated systems which operate in isolation and are not capable of sharing data
- Multiple business process that are poorly automatized or even not automatized at all, hence require manual processing
- Presence of old and completely outdated systems
- Multiple applications developed and operated in several operating systems
- Applications developed in 35 different programming languages

Managing and maintaining such a heterogeneous environment is an extremely difficult, time consuming and expensive task. HUD made the mistake to direct all the efforts and available resources (human and financial) towards maintenance instead of towards gradual optimization and modernization. For example, during the fiscal year 2008, they spent only 2 percent on new development activities and the remaining 98 percent were obligated for operating and maintaining the legacy systems.

The following diagram represent the current Enterprise Architecture:





*Figure 3. Current EA*

From the diagram we could recognize the abundance of operating systems and different applications based on them. We could also see that one function is implemented by several applications. For simplicity we don't represent each duplicative function but instead, we draw lines between the function and the multiple applications that implement exactly the same or very similar function. This might create a perception that different applications work in collaboration but this is not the case.

One more important aspect of the current architecture is that each application is fed by its own database. This doesn't necessary imply that data could not be shared (which actually is the case) but it is an obvious sign for poor EA.

### Architecture Maturity

An IT environment built of legacy systems, applications working in isolation, poor automation of the business processes, low integration and standardization, significant gaps between available human skills and skills in demand, budgets oriented towards maintenance instead of optimization and modernization, all of these imply that HUD's Enterprise Architecture Maturity level is at the lowest possible stage - Business Silos.

## HUD's future (desired) Enterprise Architecture

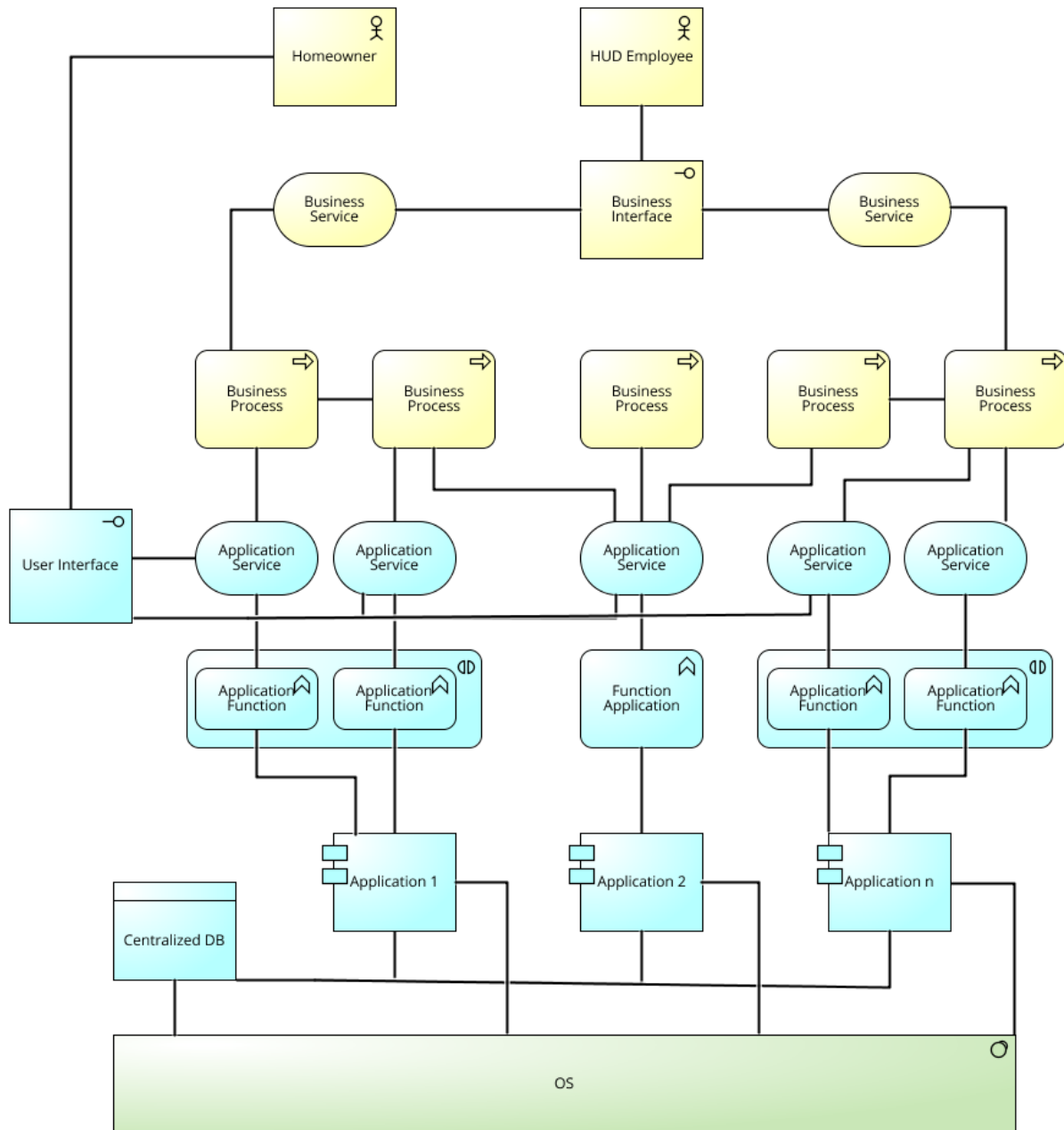


Figure 4. Future Architecture

What the proposed architecture offers is:

- Working towards identifying the most appropriate OS and eliminate the rest of them
- Develop an effective Enterprise Data Architecture. Migrate all the data to a centralized database with a capability to feed all the applications living in the environment

- Identify all the duplicative application functions and the applications associated with them. Eliminate the duplications.
- Choose industry compliant software frameworks, libraries, programming languages, platforms, etc.
- Provide standardized user interface to the end customers

It requires:

- Closing the existing gaps in the human resources
- Refine the Architecture Vision
- Redefine Business Architecture – “develop the Target Business Architecture that describes how the enterprise needs to operate to achieve the business goals, and respond to the strategic drivers set out in Architecture Vision”, taking under consideration stakeholder concerns (The Open Group 2011).
- Redefine Information System Architecture to “enable the Business Architecture and the Architecture Vision, while addressing the Request for Architecture Work and stakeholder concerns. Identify candidate Roadmap components based upon gaps between the Baseline and Target Application Architecture” (The Open Group 2011).
- Establishing effective governance model on all the architecture levels – corporate, technology, IT and architecture.

Obviously, the current economic conditions, the rising involvement and responsibilities of HUD forced by the legislators, inefficient and expensive IT environment, inability to meet customers’ expectations and the financial restrictions compel immediate action.

## **Identification of Major Architecture Issues**

During the analysis of the GAO (GAO 2012) testimony and findings described in the document, four major architecture related issues were identified:

### **Issue 1: Stove-Piped, Nonintegrated Systems**

Current IT environment is comprised by vastly overlapping, duplicative and not integrated systems that are not capable to share data and necessitate manual workloads.

### **Issue 2: Technology stack polluted with antiques technologies**

The technology stack is not homogenous but instead, there are systems nearly 15 years old, including several different operating systems and software products based on 35 different programming languages.

### **Issue 3: Lack of Architecture Governance and Controls**

Although, HUD have had established an EA that met key aspects of related best practices, they haven't had established a policy to guide the development, maintenance and use of this architecture.

### **Issue 4: Lack of Adequate Metrics and Key Performance Indicators (KPIs)**

HUD haven't had established metrics and Key Performance Indicators for evaluating its portfolio, hence is not capable of assessing its performance against established goals.

## **Analysis of the Architecture Issues**

### **Issue 1: Stove-Piped, Nonintegrated Systems**

#### **Business Case**

The GAO report about HUD's IT environment reveals a messy field where "information systems were overlapping and duplicative, were not integrated, necessitated manual workloads, and employed antiquated technologies that were costly to maintain" (GAO 2012, 1). To be even more specific GAO states: "department's IT had consisted of: ... stove-piped, nonintegrated systems that could not share related data...".

So the described picture implies that each part of the department uses its own set of applications and produces, collects, processes and maintain its own set of data. In other words, each part works in isolation and is not able to share with or consume data from the other organization's parts. This vastly contradicts with HUD's growing mission and its ability to support data collection and "dissemination through the department and external parties" (GAO 2012, 3).

#### **Base Architecture**

Back in 2010 the Office of the Chief Information Officer established four management goals:

- Enhance the quality, availability, and delivery of HUD information to citizens, business partners, and government
- Promote an enterprise approach to IT that will foster innovation and collaboration
- Achieve excellence in IT management practice

- Transform the OCIO to a culture of operational excellence that can achieve current and future departmental goals

Obviously, above described stove-piped, nonintegrated systems prevent HUD from achieving all the established goals. Moreover, with so disorderly fragmented data and with so many data owners it is really difficult to organize smooth maintenance and successful repair processes. At least, in an event of application or database failure it is not clear who should be contacted nor which segment of the environment is affected.

### Target Architecture

Future architecture will be based on federated metadata models such as Data Grids, Digital Libraries and Persistent Archives. Such technologies will deliver a robust software infrastructure and an integrated approach to sharing, publishing and archiving data. Indeed, those are the primary responsibilities of HUD. “Data grid technology provides the fundamental management mechanism for distributed data. This includes support for managing data on remote storage systems, a uniform name space for referencing the data, a catalog for managing information about the data, and mechanism for referencing to the preferred access method” (Moore 2005, 578). In addition, data libraries could be implemented on top of the data grids.

### Gap Analysis

HUD should find appropriate solutions for the discussed flaws and should integrate the applications living in the IT environment so as to meet the needs of all internal and external customers. In other words, the environment should be reorganized and modernized in a way that ensures high levels of integration and standardization.

## Issue 2: Technology stack polluted with antiques technologies

### Business Case

Current IT environment is heavily polluted with legacy systems with duplicative functions, poorly or even not integrated and not standardized. GAO report reveals that there are more than 200 heavily overlapping systems, some of which 15 years old, a myriad of operating systems and applications written in numerous programming languages. Moreover, still there are key business processes that are not automatized. Such an environment could not keep up with the increasing load and demand for system processing capabilities, could not effectively support HUD's business operations, hence could not support HUD's growing mission. Analysis of the GAO report shows that there are two major factors that played significant role and caused the present unenviable situation – project-oriented IT investment management and “...focus, primarily on the maintenance of the existing systems and infrastructures, rather than on the modernization” (GAO 2012, 3). HUD obligates a huge part of the annual budget (about 98%) for maintenance and only about 2% for development of new systems and research.

### Base Architecture

Back in 2009 GAO reported that HUD's IT environment consisted of:

- Over 200 information systems that have duplicative functionality – many systems address the same business processes
- Several different operating systems (OS)
- Applications written in 35 different programming languages
- Some of the above-mentioned systems, OS and applications are nearly 15 years old



The presence of so many overlapping systems implies that standardization of the business processes and data sharing (integration) are significantly compromised. This is confirmed by the GAO report that points out that some systems require – “manual processing for key business processes” (GAO 2012, 3). Although, all the HUD’s sub departments operate with the same customer base, because of the limited IT capabilities (in terms of standardization and integration), they could not benefit from seamless end-to-end transaction processing and could not achieve the required predictability, efficiency, coordination, transparency and agility. The absence of integration is also recognized as an architecture issues by the present paper and is described in Issue 1 – Stove-piped, Nonintegrated Systems.

Last but not least, an environment polluted with antique technologies requires extensive maintenance just to be kept running. It is very difficult and it is getting more and more expensive to find specialists familiar with the legacy systems and programming languages dropped out of use. Indeed, GAO reported that HUD is spending about 98% of its annual budget just on maintenance which vastly impacts its ability to invest in research, improvements and new development.

### Target Architecture

Dealing with a myriad of vastly overlapping non-integrated and non-standardized information systems is a huge problem. The presence of legacy systems, several different operating systems, and applications written in 35 different programming languages in the current IT environment brings this problem close to unmanageable. To address such a difficult situation, HUD should perform extensive analysis of the IT environment oriented towards:

- Determine are there already abandoned legacy systems which could be retired with minimal negative impact.

- Determine which systems are suitable to be retired but require additional work
- Determine which systems are not suitable to be retired but allow for useful interfaces to be built around them and be used conveniently with modern systems
- Determine which systems are still in use but not suitable for retirement, and building an interface will be too difficult and expensive. Prepare a plan how to deal with such systems
- Consider reducing the number of operating systems in use. Ideally, bring them down to a single OS suitable to satisfy all the performance, security and financial requirements
- Consider the number of applications in use
- Perform deep analysis of the programming language in use, rethink development needs, strategies, architecture and ongoing maintenance in the context of reducing their number to a small set of well-known, powerful and industry accepted programming languages

Since, all the departments inside HUD are using the same customer base, the same regulation base and the same vendors, special emphasis will be put on achieving the required levels of integration and standardization.

### Gap Analysis

Current IT environment requires significant reduction of the number of legacy systems, operating systems and programming languages. Taking under consideration the new responsibilities imposed by the legislation and the important role that HUD plays to the overall

economic condition, we can conclude that future success of HUD heavily relies on IT and in particular, on a lean but robust technology stack.

Such a technology stack will allow for business processes to be effectively automated (including these processes that currently are not automated or require extensive manual labor), integrated and standardized, and will enable application development to stay SOA oriented. A modernized technology stack will allow for reducing development time and costs, and increasing productivity and agility.

HUD will need to perform thorough analysis considering the scale, complexity and risk of failure for each legacy information system related (LIS) project. This will aid to determine which solution category the project falls into:

- Wrapping – provides “a new interface to a component, making it more easily accessible by other software components” (Bisbal 1999, 104).
- Migration – “which moves the LIS to a more flexible environment, while retaining the original system’s data and functionality” (Bisbal 1999, 104).
- Redevelopment – “which rewrites existing applications” (Bisbal 1999, 104).

Besides the analysis, HUD will also need to rethink its IT investment strategy and make a shift towards a portfolio-based approach.

### Issue 3: Lack of Architecture Governance and Controls

#### Business Case

As it was mentioned in the background section, HUD plays an important role in strengthening the housing market, hence has significant impact on the overall economy condition. To satisfy homeowners’ needs and meet the legislative requirements, HUD heavily

relies on information technologies. An Enterprise Architecture (EA) was established in an effort to align business strategic goals with the organization IT environment through optimization of the fragmented legacy of processes into an integrated environment. To ensure that EA and other architectures are managed and controlled at an enterprise-wide level, HUD also needs to establish effective Architecture Governance. "Governance is about ensuring that business is conducted properly. It is less about overt control and strict adherence to rules, and more about effective usage of resources to ensure sustainability of an organization's strategic objectives" (Harrison 2011, 115).

Currently, HUD lacks "sound management controls that are essential to achieve successful outcomes. These controls include strategic planning, investment management, enterprise architecture, and human capital planning" (GAO 2012, 4).

#### Base Architecture

In accordance with the recommendations given by GAO, HUD have considered and actually established an Enterprise Architecture that meets the key aspects of related best practices in an effort to develop segment architectures. Although, the segments that need to be modernized are properly identified and prioritized, HUD don't adhere to these priorities. Moreover, most of the segments developed are out of date and/or do not reflect important elements of federal guidance. Hence, the architecture does not provide a solid basis for guiding and directing the individual projects in a way that ensures the system enhancement and new product development were properly sequenced and not duplicative. Currently, there are no effective controls and governances that link IT processes, resources and information to department's strategic goals and objectives. In other words, HUD needs first to establish and

approve a policy to govern the EA prior to proceeding with further development of segment architectures.

### Target Architecture

The target architecture will be based on the six principles outlined in TOGAF Foundation Study Guide – Discipline, Transparency, Independence, Accountability, Responsibility and Fairness. It will incorporate controls and governances that will ensure the problems are identified as early as possible, subsequent changes occur in a controlled manner and the department's strategic goals, and objectives could be effectively met. Clear emphasis will be put on compliance with the internal and external standards and any applicable legislative obligations, and "practices that ensure accountability to a clearly identified stakeholder community, both inside and outside the organization" (Harrison 2011, 114). Finally, target architecture will encourage active and effective communication among multiple business and IT levels in an effort to achieve so called "network awareness", hence all the parties will be well versed in the established rules and regulations but also could participate in their further refinement.

### Gap Analysis

Despite the progress made since last GAO report, HUD still lacks some internal controls and governances. In particular, there are no policies and procedures for control and evaluating the IT investments and Human Capital capabilities. Also, HUD is yet to begin working on controls and governances for the undergoing EA development. Establishing these controls and governances will ensure that EA and other architectures are managed and controlled effectively, and efficiently at an enterprise-wide level.

## Issue 4: Lack of Adequate Metrics and Key Performance Indicators (KPIs)

### Business Case

Before proceeding further with our analysis, we need to clarify those two terms – Metrics and Key Performance Indicators. Although, they experience wide use and great popularity, the line between them is somehow blurry. Business metrics are used to track all areas of business comparing current state/values to a predefined goal. On the other hand, KPIs target critical areas of performance. For example, how current state/values contribute to achieve predefined goal/s.

Despite the progress HUD demonstrates towards modernizing its IT environment, still there are areas where more effort is required for successful outcomes to be achieved. It was mentioned above that in 2009 GAO reported three areas – strategic planning, IT investment management, and human capital planning where HUD haven't established adequate metrics and Key Performance Indicators (KPIs). GAO also made some recommendations for each area in an attempt to facilitate future improvements.

In 2011 GAO reported that HUD had fully implemented all the recommendations associated with strategic planning by implementing a performance management framework. This way, strategic business goals were aligned with the IT strategic goals, developed by HUD's Office of the Chief Information Officer (OCIO).

HUD realized the negative impact of project-centric investment management and started transition to a much more promising portfolio-based approach. This approach allows for an organization to "... consider new investment proposals, along with previously funded investments, and identify the appropriate mix and synergies of these investments to best meet mission needs, technology needs, and priorities for improvement" (GAO 2012, 5).

HUD also realizes the importance of the human capital for the ultimate success of the organization. They started working towards creating a plan that includes identifying challenges, developing performance metrics and strategies, and addressing the identified IT skill gaps.

### Base Architecture

At the moment, the organization have established IT investment management governance structure and applies it to the portfolio of IT associated modernization projects. However, they haven't defined metrics and KPIs and haven't defined and collected data consistent with them. In other words, currently HUD is not able to compare current state to IT strategic goals nor to assess portfolio performance.

With the human capital planning the situation is very similar – HUD is still working on the above-mentioned plan and haven't defined metrics and KPIs, and even haven't started collecting the appropriate data.

In conclusion we could say that HUD fails to meet the two sets of statutory conditions imposed by Congress and reviewed by GAO.

### Target Architecture

Congress' increasing concerns about HUD's struggles with its IT environment modernization have grown to significant budget limitations. In addition, GAO established two sets of statutory conditions for assessing each project. To overcome these limitations, HUD should define adequate metrics and useful KPIs and apply them against each modernization project so to satisfy the requirements of the statutory conditions and be able to achieve the following:

- Functional and performance capabilities to be delivered

- Can plan and define expected mission benefits
- Can estimate lifecycle costs
- Each project is supported by an adequately staffed project office
- Conforms to capital planning and investment control requirements

### Gap Analysis

There is close interdependence between Issues 4 – “Lack of Adequate Metrics and Key Performance Indicators” and Issue 3 – “Lack of Adequate Governance and Controls”. The lack of effective metrics and meaningful KPIs makes establishing and applying an Architecture Governance impossible. The information provided by these metrics and KPIs enables the governance to ensure control and monitoring of all architectural components and activities, hence achieve early identification of the problems and develop an environment where changes occur in a controlled manner.

## Recommended solutions

### Issue 1: Stove-Piped, Nonintegrated Systems

#### Recommended Solution

The most suitable solution lays in development and implementation of federated metadata-operating system such as Data Grids, Digital Libraries and Persistent Archives. “Grids support for the organization, management, and application of processes. Data grids manage the resulting digital entities. Digital libraries provide support for the management of information associated with the digital entities. Persistent archives provide long-term preservation” (Moore 2005, 578). Grids and Data Grids are complementary technologies that ensure successful and effective data creation and management, while digital libraries organize



the information in collections. Last piece of this interrelated collaborative systems is Persistent Archives which preserve the information content of the collections.

Besides the other benefits, such a federated metadata-operating system will make problems like data ownership, data maintenance and storage less rigid and will discover new advantages for analysis of the business processes.

### Alternatives

Another significantly less beneficial alternative is Master Data Management System (MDMS). As it was discussed above, currently every system maintains its own database, hence the data is duplicative, outdates, polluted with erroneous records, and the most important couldn't be shared. MDMS could bring some relief by reducing the redundancy and providing a common data model. On the other hand, this approach will have a tangible negative impact on data maintenance and storage since only one entity will hold the ownership and control over all the organization's data.

### Issue 2: Technology stack polluted with antiquate technologies

#### Recommended Solution

Taking under consideration the budget limitations imposed by Congress, HUD's growing mission and the duration of the ongoing IT modernization, it seems the most suitable solution will be legacy information systems (LIS) migration. "LIS migration essentially moves an existing, operational system to a new platform, retaining the legacy system's functionality and causing as little disruption to the existing operational and business environment as possible" (Bisbal 1999, 106).

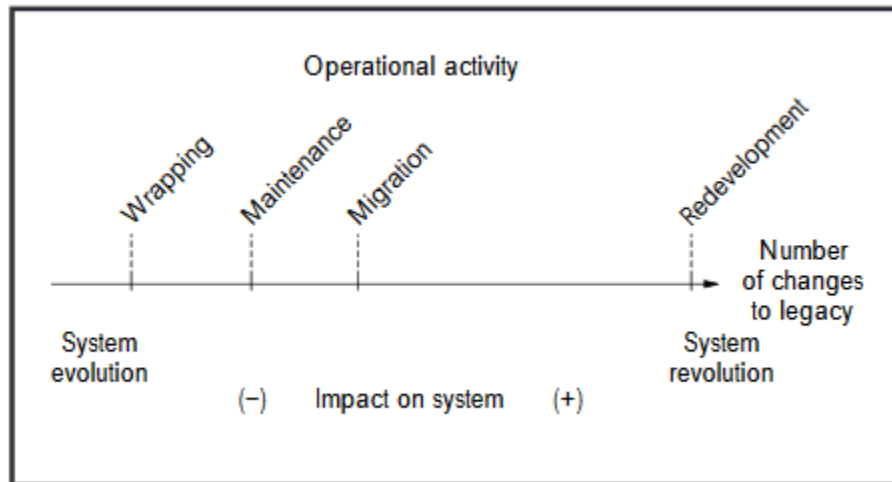


Figure 5. Solutions to Legacy Information System problems. Source: (Bisbal 1999, 104)

Fig. 5 demonstrates the interdependency between the different approaches and possible impact on the system. They put maintenance together with the other methods because “if a software system can be maintained within an acceptable budget it is usually not considered a LIS” (Bisbal 1999, 104). This is not the case with HUD’s IT environment.

Although, migration has its obvious advantages, many additional considerations are required for achieving successful outcomes:

- Database population – should address in sufficient detail LIS data quality, map LIS data scheme to target data scheme, etc.
- Testing and functional issues – target system testing during the migration process requires significant amount of time and hiring expensive high-qualified engineers. Often to justify the project’s expense and the associated risks, new functionality is also implemented during the migration. This brings another level of complexity.
- Cut-over – this is the last and most risky step of the migration process. This is the time when the engineering team have to deal with issues such as phased interoperability (LIS

and target systems operate simultaneously) and cutting over the target system where the organization's information flows in an untried and potentially risky system.

### Alternatives

It is crystal clear that maintenance is no longer a solution. Wrapping approach, to some extent could relieve current struggles by creating interfaces around existing data and individual applications, hence reuse some well-tested components. But it won't deliver significant reduction of the maintenance related costs.

Finally, redevelopment offers a Big Bang approach where current infrastructure, database and applications are swept out and redeveloped from scratch. Because of the continuously changing technology and business requirements, this method possesses too big a risk to be even considered like an optional solution.

### Issue 3: Lack of Architecture Governance and Controls

#### Recommended Solution

To address this issue and eliminate the problems reported by GAO, HUD will need to establish a governance structure based on discipline, transparency, independence, accountability, responsibility and fairness. It will require cultural shift as well as series of processes (e.g. policy management, compliance, dispensation, etc.) and set of owned responsibilities that support the integrity and effectiveness of the architecture. Although, there are three critical areas (investment management, EA and human capital planning) that need immediate attention, architecture governance should also cover "the management and control of all aspects of the development and evolution of architectures" (Harrison 2011, 115).

TOGAF Architecture Governance Framework splits the governance related initiatives into processes, content and context which in turn allows for new governance material to be included and at the same to mitigate the negative impact over the organization. The flexibility of the framework is ensured by content-agnostic approach. Due to its advantages TOGAF Architecture Governance Framework is a good candidate to fulfil the obvious need of a governance structure.

“An enterprise architecture imposed without appropriate political backing is bound to fail” (Harrison 2011, 118). That means, HUD will need to establish a cross-organizational Architecture Board (AB) with regards to achieve successful control, monitoring and implementation of the governance strategy. This board should be comprised of a group of executives responsible for the review, maintenance and refinement of the overall architecture. Also, the AB should be representative for all involved architecture stakeholders.

### Alternatives

Some researchers fairly point out that “highly controlling organizations often destroy leadership by not allowing people to blossom, test themselves and grow” (Kotter 2012, 165). Over controlling is one possible extreme, the other one where HUD currently resides is absence of monitoring and control. HUD overlooked the GAO requirements and failed to establish Architecture Governance to ensure enterprise-wide effective management and control, and compliance with the internal and external standards, and regulatory obligations. Obviously, there isn't feasible and reasonable alternatives to a balanced Architecture Governance.

## Issue 4: Lack of Adequate Metrics and Key Performance Indicators (KPIs)

### Recommended Solution

Defining adequate metrics and KPIs should be based on the eight criteria proposed by Caplice and Sheffi:

- Validity – a metric is considered valid if reflects the actual state/value
- Robustness – determined by the user acceptance
- Usefulness – delivers clear value and aids decision making process
- Integration – “a metric is integrative if incorporates all of the major components and aspects of the process being measured” (Caplice 1994, 15)
- Economy – “is economical if the benefit of tracking it outweighs the cost to collect, process and report it” (Caplice 1994, 15)
- Compatibility – doesn’t require significant additional work to be used with the existing data collection, information systems and information flow
- Level of detail – level of aggregation or granularity of the data
- Behavioral soundness – ensures that metrics are highly unbiased and will consider the organization’s overall performance not an elusive one that exist only under particular conditions

Developing metrics that meet all the criteria is not possible nor desirable. Hence, we need to work towards metrics that lay equidistant between two major trade-offs.

The first four criteria form the primary trade-offs involved in performance appreciation (see Fig. 6) – “usefulness (providing action guidance) vs integration (promoting coordination) and validity (capturing specific aspect) vs robustness (allowing for compatibility)” (Caplice 1994, 27).

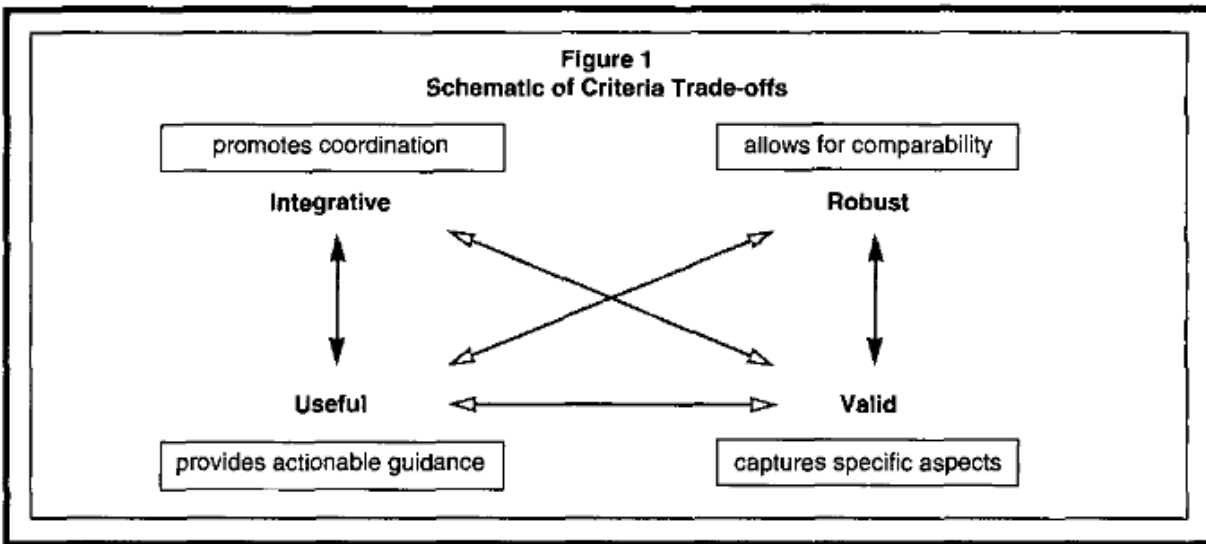


Figure 6. Schematic of Criteria Trade-offs. Source: (Caplice 1994)

This demonstrates that highly inclusive metrics lose their direct usefulness for some of the managers within the process.

The secondary trade-offs states that detailed and complex metrics could be counterproductive and cause lowered comparability.

Carefully thought out business metrics and KPIs will allow HUD to establish an effective governance structure and adequately assess its IT investment and human capital related projects, hence satisfy GAO's two sets of statutory conditions.

#### Alternatives

HUD could decide to keep using the "try-error" method for assessing its modernization projects. Taking under consideration the present budget limitations, increased responsibilities imposed by the emerging legislation and IT inability to effectively support HUD's mission, present significant threat for further intensification of the discussed problems.

## Roadmap

Phase	High-level steps
<p>TOGAF ADM Preliminary and Phase A</p> <p>Estimated duration: 3 months</p>	<ul style="list-style-type: none"> <li>• Organize and perform a kick-off meeting with all key stakeholders to define EA objectives, scope and ensure high-level management involvement and commitment</li> <li>• Review current EA, architecture frameworks, tools and organizational structure</li> <li>• Consider, define and establish organizational model and operating pattern</li> <li>• Discuss the need and forms of cultural adjustments</li> <li>• Discuss and start outlining governance and control structures</li> <li>• Develop high-level vision</li> <li>• Formalize the EA project</li> </ul>
<p>TOGAF ADM Phase B</p> <p>Estimated duration: 2 months</p>	<ul style="list-style-type: none"> <li>• Define and develop base and target architecture at an enterprise-wide level. Perform gap analysis</li> <li>• Identify, develop and agree upon core strategic objectives</li> <li>• Define Business Architecture addressing all the aspects of interest of business environment –</li> </ul>

	<p>functional, informational, organizational, strategy, etc.</p> <ul style="list-style-type: none"> <li>• Keep working on cultural changes and overall engagement</li> </ul>
<p>TOGAF ADM Phase C – D</p> <p>Estimated duration: 6 months</p>	<ul style="list-style-type: none"> <li>• Determine current physical and logical location of the data</li> <li>• Determine the relations between the different applications and their needs to consume and share data</li> <li>• Develop base and target Information System Architecture (ISA)</li> <li>• Perform gap analysis between base and target ISA and outline roadmap</li> <li>• Consider which legacy systems could be retired</li> <li>• Develop base and target Technology Architecture (TA)</li> <li>• Perform gap analysis between base and target TA</li> <li>• Integrate governance structure and internal controls</li> <li>• Keep working on cultural changes and overall engagement</li> </ul>
<p>TOGAF ADM Phase E – F</p> <p>Estimated duration: 4 months</p>	<ul style="list-style-type: none"> <li>• Create roadmap based on the existing gap analyses</li> </ul>



	<ul style="list-style-type: none"> <li>• Determine the most appropriate approach for each project from the portfolio</li> <li>• Consider priorities and interdependencies between the projects</li> <li>• Adopt the strategy “One Project at the Time”</li> <li>• Create final architecture roadmap</li> <li>• Perform the required for each project analysis – risk, cost/benefit, etc.</li> <li>• Keep working on cultural changes and overall engagement</li> </ul>
<p>TOGAF ADM Phase G – H</p> <p>Estimated duration:</p>	<ul style="list-style-type: none"> <li>• Assess architecture performance</li> <li>• Consider revision of governance structure and internal controls</li> <li>• Ensure changes won’t hamper daily business activities</li> </ul>

## Conclusion

With regards to the book Enterprise Architecture as Strategy, three elements are required to build an effective foundation for execution – operating model, enterprise architecture, and IT engagement model. Proposed (future) EA leans towards a well-planned and carefully executed migration to an operating model with characteristics close to these of the Unification operating model – improved business process integration and standardization for delivering quality service to the internal and external customers and aligning business

objectives with the technology capabilities. Moreover, not only align to the existing IT capabilities but instead, create an EA that successfully supports the business initiatives and evolves together with the environment and continuously varying strategic requirement.

Proposed solutions address in sufficient detail identified problems and will help to close the existing gaps between the base and target architectures.

## Appendices

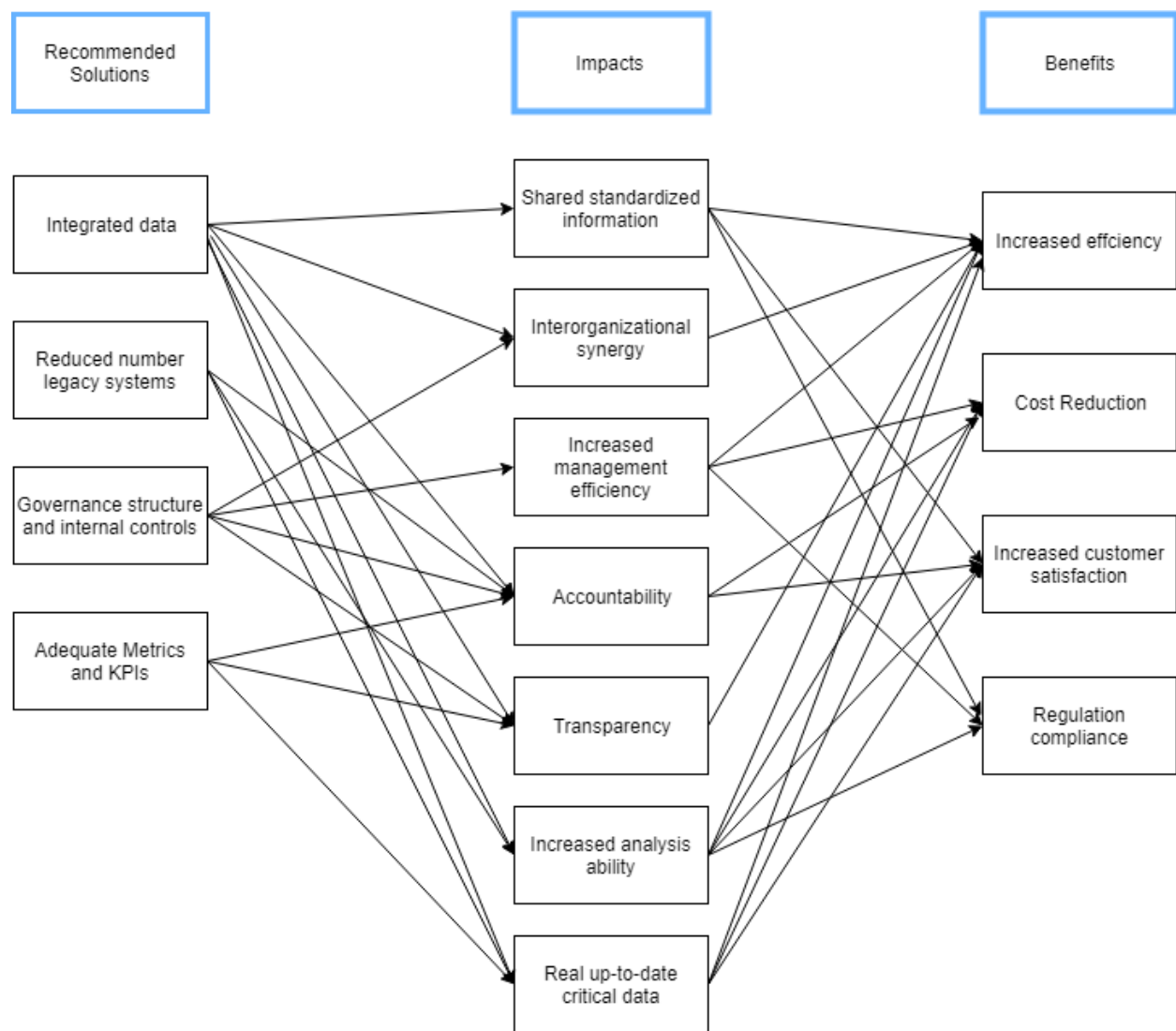


Figure 7. Benefits Diagram

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