## **Single-Tenant Solutions:**

A Superior Fit For Highly Regulated Government Agencies

### **MULTI-TENANT vs. SINGLE-TENANT**

For the vast majority of government agencies striving to maximize the return on investment from new technology investments, the question is no longer whether to embrace the cloud, but rather, what is the software and services delivery model that will provide the best fit for both immediate operational requirements and long-term business objectives? In fact, a 2019 NASCIO survey indicates that 92% of State CIOs surveyed plan to expand their adoption of "As-a-service" models (e.g. SaaS, PaaS, IaaS, etc.) compared to a mere 17% planning to expand State-owned-and-operated data center(s).<sup>1</sup>

With the question no longer being, "To Cloud or Not to Cloud," the primary emphasis has now shifted to an evaluation of multi-tenant vs single-tenant solutions and the respective pros & cons associated with each of these systems.

While multi-tenant solutions have received much of the hype in recent years, much of that publicity is a function of the enterprise cloud vendors themselves supporting a narrative for a multi-tenancy shared cost business model that minimizes operational overheads to maximize profit margins, at the expense of client performance, reliability, autonomy, and system configurability.

For most government agencies however, particularly those operating in highly regulated, public-safety-oriented domains, a single-tenant solution offers distinct advantages that should be considered by agencies seeking to accurately quantify both the immediate and lifetime benefits of a dedicated and highly configurable environment.

To ensure this theorem holds up under detailed investigation, let's drill down into the acknowledged pros and cons for each tenancy system to get a better sense of the distinct advantages and disadvantages each can offer the prospective government agency. In doing so, we'll strive to separate the facts from the hype that have 'clouded' such investigations in the past, by keeping one key consideration uppermost in mind. Does this feature primarily benefit the customer or the vendor, or both?

1. 2019 State CIO Survey, "The Responsive State CIO: Connecting to the Customer," October 15, 2019





### **DEFINITION: MULTI-TENANT SOLUTION**

A multi-tenant solution shares common resources and applications, frequently including a backend database. Properly configured, this solution facilitates a logical separation of data and permissions to prevent data bleed: isolating information, configurations, and runtime from other user groups as appropriate.

Best envisioned as a high-rise building where the floorplans are set, but only minor changes can be made to individual suites, multi-tenant solutions are capable of scaling rapidly but prove cost prohibitive when extensive configuration is required to meet the specific needs of the business.



## **DEFINITION: SINGLE-TENANT SOLUTION**

In a single-tenant environment, runtime and data is dedicated to a single company and/or department with role-based permissions used to control access and isolate datasets.

A single-tenant solution does not share common resources or applications with other operating instances, instead providing a dedicated server and supporting infrastructure.

Best envisioned as a neighborhood built by a single developer, where every homeowner can modify their property to their own specific needs, a single-tenant solution is most desirable when operations require the ability to configure the software to meet unique and exacting business requirements.

## Pros & Cons of a Multi-Tenant Solution

## **PROS OF A MULTI-TENANT SOLUTION**

#### Scalability

Within multi-tenant environments, scaling presents fewer infrastructure implications than a single-tenant solution, because additional users get access to the same basic software. From large organizations requiring virtually unlimited computing resources to smaller operations whose scale may not warrant dedicated infrastructure, a multi-tenant solution can scale accordingly.

#### **Shared resources**

Since multi-tenant solutions enable common access to services, resources, and applications, it enables organizations to share software and data center operational costs without having to manage or provision additional infrastructure beyond internal resources.

#### Lower maintenance costs

Maintenance costs are rolled into the typical multi-tenancy agreement, with an ongoing SaaS subscription typically replacing the per project costs common to a single-tenant upgrade.

#### **Code change restrictions**

Given their lack of customization options compared to single-tenant solutions, the more modest configuration options available to multi-tenant software can be applied without changes being made to the application's underlying codebase.

### **CONS OF A MULTI-TENANT SOLUTION**

#### In-app disturbances

Within the shared databases of a multi-tenant environment, there's a higher chance that your workflow can be disturbed. If a single customer is impacted; it can affect all other customers. If hardware and/or software issues occur within the hosted environment, it can lead to an outage for all customers.

#### **Customization restrictions**

Due to the shared resources consumed, multi-tenant vendors prohibit extensive configuration options to enable customers to personalize software solutions specific to business rules or requirements. While such configuration limitations are often positioned by multi-tenant vendors as an advantage to avoid customized obsolescence, such restrictions can cause distribution and unnecessary rework when APIs or features become deprecated as new versions are released.

Pros & Cons of a Multi-Tenant Solution

#### **Change control limitations**

Multi-tenant customers have limited to no control over how or when software is redesigned, upgraded or patched, creating the following complications:

- Forced upgrades during limited maintenance windows, with limited ability for the client to set optimal implementation timeframes and upgrade parameters.
- No ability to limit, phase or rollback undesirable changes when updates introduce an undesirable bug(s) or incompatibility, since multiple organizations are sharing the same multi-tenant resources.
- Additional time, effort and costs to train staff to adopt unfamiliar or unexpected UI changes.

#### **Cybersecurity threats**

Multi-tenant environment sharing a common data environment present an increased risk for both data bleed with other organizations and public data exposure. On May 17, 2019, for example, US tech giant Pardot facilitated a faulty database deployment granting unapproved access privileges to more than 100 cloud instances. This data exposure forced multi-tenant vendor Salesforce to restrict access, shutting out everyone using the same systems, whether they were using Pardot or not.<sup>2</sup>

From simple backend configuration errors to unsecured third-party adds-on creating unexpected network vulnerabilities, the most distressing aspect of such breeches is the almost inevitable odds of their escalation given the scope of and potential for human error inherent in the underlying business model. Further, given the larger data repositories and global footprints of multi-tenant environments, they represent inviting targets for nation state cyberterrorists and/or criminal hackers.<sup>3</sup>

#### **Data Recovery Challenges**

Given the time, complexity, and expense associated with attempting to facilitate an isolated data backup or recovery for individual clients within a global co-mingled data environment, multi-tenant vendors are increasingly terminating essential data backup and recovery services.

For example, as of July 31, 2020, Salesforce will no longer provide data backup recovery services in the case of client data loss. In a knowledge article (#000352139) summarizing the decision, Salesforce confirmed, "The data recovery process does not meet our high standards for customer experience due to the length of time and reliability of the process. This process takes a minimum of 6 - 8 weeks to complete and we cannot guarantee 100% data recovery."<sup>4</sup>

3. https://www.computronix.com/cybersecurity-solutions-part-1/

<sup>2.</sup> https://help.salesforce.com/articleView?language=en\_US&type=1&mode=1&id=000352139

<sup>4.</sup> https://www.salesforceben.com/salesforce-will-no-longer-recover-your-data-in-case-of-disaster/

## Pros & Cons of a Single-Tenant Solution

## **PROS OF A SINGLE-TENANT SOLUTION**

#### **Customization & Configurability**

With both database and software instance(s) unique to each customer, a single-tenant solution equips customers with the widest range of customization options. In a single-tenant model, the customer can configure the system more extensively to meet their precise business requirements without affecting any other tenants/organizations.

#### Cybersecurity

Customer data is completely isolated within a single-tenant environment. One customer can't access another customer's sensitive information. This facilitates an inherently more secure structure to fortify cybersecurity measures, while presenting a much less inviting target for cyberterrorists or hackers seeking to maximize the returns from illegal incursions.

#### Reliability

Unlike multi-tenant solutions where the actions of one client can impact the performance of many, single-tenant solutions are intrinsically more reliable. In a multi-tenant ecosytem, if one client experiences downtime during a complex integration, it can have a detrimental affect on other clients' software performance. As a single-tenant client, performance is reliable and predictable, with the dedicated system highly optimized to the specific needs of the operation. Moreover, when temporary scalability is required to immediately improve system performance, a single-tenant solution with its inherent data separation proves much more agile, easier and quicker to scale.

#### **Data Backup & Recovery**

Customers using a single-tenant environment can easily access, backup and restore data and system settings at their convenience. With system information backed up to a dedicated component within the SaaS server, customers can readily access information specific to their client account.

#### Upgradeability

The upgrade process is considerably more flexible and client directed with a single-tenant solution. In contrast to the universal updates forced by multi-tenant vendors, single-tenant operations can upgrade immediately as updates are available, or defer to a later date more conducive to the needs of the agency. Upgrades can even be performed during off-hours to ensure minimal downtime during daily operations.

#### **Self-Hosted Migration**

With all information stored in one location, single-tenant solutions can be more easily migrated from a SaaS to a self-hosted environment.

Pros & Cons of a Single-Tenant Solution

## **CONS OF A SINGLE-TENANT SOLUTION**

#### **Higher costs**

At its core, multi-tenant vs single-tenant is about the shared costs intrinsic to a relatively 'vanilla' multi-tenant solution vs the robust configurability and autonomy inherent within a single-tenant environment.

Given the need for dedicated client infrastructure, deployment and monitoring, a single-tenant environment can be more costly than a multi-tenant offering, albeit in some cases, the differences can be quite nominal. However, any difference in solution costs must be weighed alongside the benefits derived from enhanced security, reliability, data recoverability, and most importantly, the ability to configure a single-tenant solution to meet highly specific business requirements. Facilitating a costs/benefits analysis from this perspective is a recommended procedure to accurately quantify the true value proposition and lifetime ownership costs of your preferred solution.

#### Additional oversight

Single-tenant solutions afford customers much more flexibility in terms of how their software solution is customized, how and when it is upgraded, and how it is managed within their overall IT environment. For this reason, a single-tenant solution does carry the potential for more operational oversight being required, but such administration is directly correlated with the degree to which the customer has configured the solution specific to their business needs. Like multi-tenant systems, a single-tenant solution with minimal configuration can be expected to be almost fully automated in regards to ongoing control procedures and policies.

In fact, when government agencies execute a managed services agreement with a single-tenant solution provider for ongoing system monitoring and optimization, the customer experience for agencies is often much more positive than the multi-tenant paradigm. This is particularly so when system troubleshooting is required and the straightforward configuration of the separated system proves more advantageous for quick diagnosis and rapid response to optimize system performance.



## Single-Tenant Solutions: A Superior Fit For Highly Regulated Government Agencies

## **A SUPERIOR FIT FOR HIGHLY REGULATED GOVERNMENT AGENCIES**

In highly regulated and compliance driven organizations, the flexibility, reliability and security of your software solution is crucial. To meet the evolving needs of state & local ordinances, council resolutions, building code updates, and more, government agencies need to control:

- · How enterprise software solutions align with changing business requirements
- When updates and upgrades are made
- Who is responsible for approving and making critical system changes

While multi-tenant solutions justifiably hype the scalability inherent from a global shared data infrastructure, the inherent tradeoffs of this infrastructure are in the critical areas of security, reliability, and customization. Such compromises are especially punitive to government agencies with complex business rules and extensive compliancy requirements, creating significant tradeoffs and performance issues in the following areas:

#### Security

With each customer's data separate from the other, a single tenant approach is inherently more secure. Moreover, with data isolated in this fashion, a single-tenant solution is more conducive to meeting post GDPR compliancy requirements, including the rigorous requirements for electronic payment and information security.

Charged with keeping agency and citizen data private and secure amidst the growing global threat of both nation state cyberterrorism and organized crime cybertheft, a conventional multi-tenant solution with globally shared client data, represents both an inviting target to cybercriminals and a recipe for massive data breaches. This situation is especially fraught for government agencies, the majority of whom are tasked with creating and maintaining a secure financial reporting model within the scope of their agency's chosen enterprise solution.

#### Reliability

The superior reliability of a single-tenant solution stems from the fact that customers using an application don't affect one another. In contrast to a multi-tenant system that divides resources between customers, a single-tenant solution with its dedicated infrastructure provides the highest and most consistent level of performance. This is particularly true with resource intensive applications that place high demands on both software and hardware infrastructure.

Co-mingling client data reduces costs and headaches for the vendor, but in herding clients together, multi-tenant systems can suffer from the "noisy neighbor syndrome" that occurs when users in the shared client environment place heavy resource demands on the shared infrastructure, creating usage spikes that impair the performance of other users. It is here that the performance limitations of the shared client model are often revealed. This is especially problematic for high profile, mission critical government clients striving to achieve minimal downtime within the scope of their operational models. Single-Tenant Solutions: A Superior Fit For Highly Regulated Government Agencies

#### Customization

A single-tenant solution offers superior autonomy to operational users in three mission critical areas:

- 1. **Configuration**: Solutions can be tailored to the most exacting business requirements, yielding a lifetime product value unmatched by shared costs systems providing minimal opportunities for product customization.
- 2. System Architecture: Single-Tenant clients can more readily architect an environment to their own highly specific needs, choosing the network, memory, storage and performance capabilities that yield the best match for system performance and budget constraints.
- 3. Change Management: Clients within a single-tenant environment can enhance, optimize and upgrade their configured solution on a timetable designed to optimize their operational benefits whilst minimizing costly downtime. By contrast, a multi-tenant solution customer is completely reliant on the vendor's timetable for implementing a desired change, a timetable determined by the numerous and often conflicting demands of multiple clients.

#### Summary

Unlike the private sector where revenue growth and global scalability are often the most critical business drivers in considering the merits of multi-tenant vs. single-tenant solutions, government agencies must consider other key priorities in identifying their optimal environment for technology deliverance.

Chief amongst these priorities:

- · The mandate to protect, secure and encrypt sensitive citizen data
- · The mission to ensure reliable, convenient, and cost effective service delivery outcomes
- The responsibility of maintaining full compliancy with existing and emerging regulation
- The ability to stay agile and responsive as technology and citizen demands evolve

With these priorities uppermost in mind, it is abundantly clear that as government agencies are evaluating multi-tenant vs. single-tenant solutions, the preferred system must support the following attributes to ensure the optimal match between operational requirements and chosen solution:

- A private, dedicated and highly secure environment to ensure vigorous data protection
- A robust and reliable infrastructure capable of guaranteed system performance and availability
- A configurable automation platform adept at monitoring and maintaining compliancy standards
- A customizable solution to enable extended lifecyle usage and low lifetime ownership costs

The solution for government agencies, particularly those operating in highly regulated, public-safety-oriented domains, is a singular one. Given the innate strengths of its dedicated environment, Single-Tenant solutions are the best match for government leaders striving to innovate service delivery while simultaneously maintaining exceptional standards for security, compliancy, safety, and costefficiency. Computronix provides state and local government agencies with transformative enterprise software solutions for land management, alcoholic beverage control and enterprise licensing. Powered by POSSE, an award-winning platform included in the Smithsonian Institution's collection of ground-breaking software, this wholly integrated suite of enterprise products empowers public sector agencies to automate critical processes and streamline business workflows for improved efficiency, accessibility and civic engagement.

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