Demystifying Multi-tenancy

By Gaurav Singh

gauravsingh@xecurify.com

Connect with me

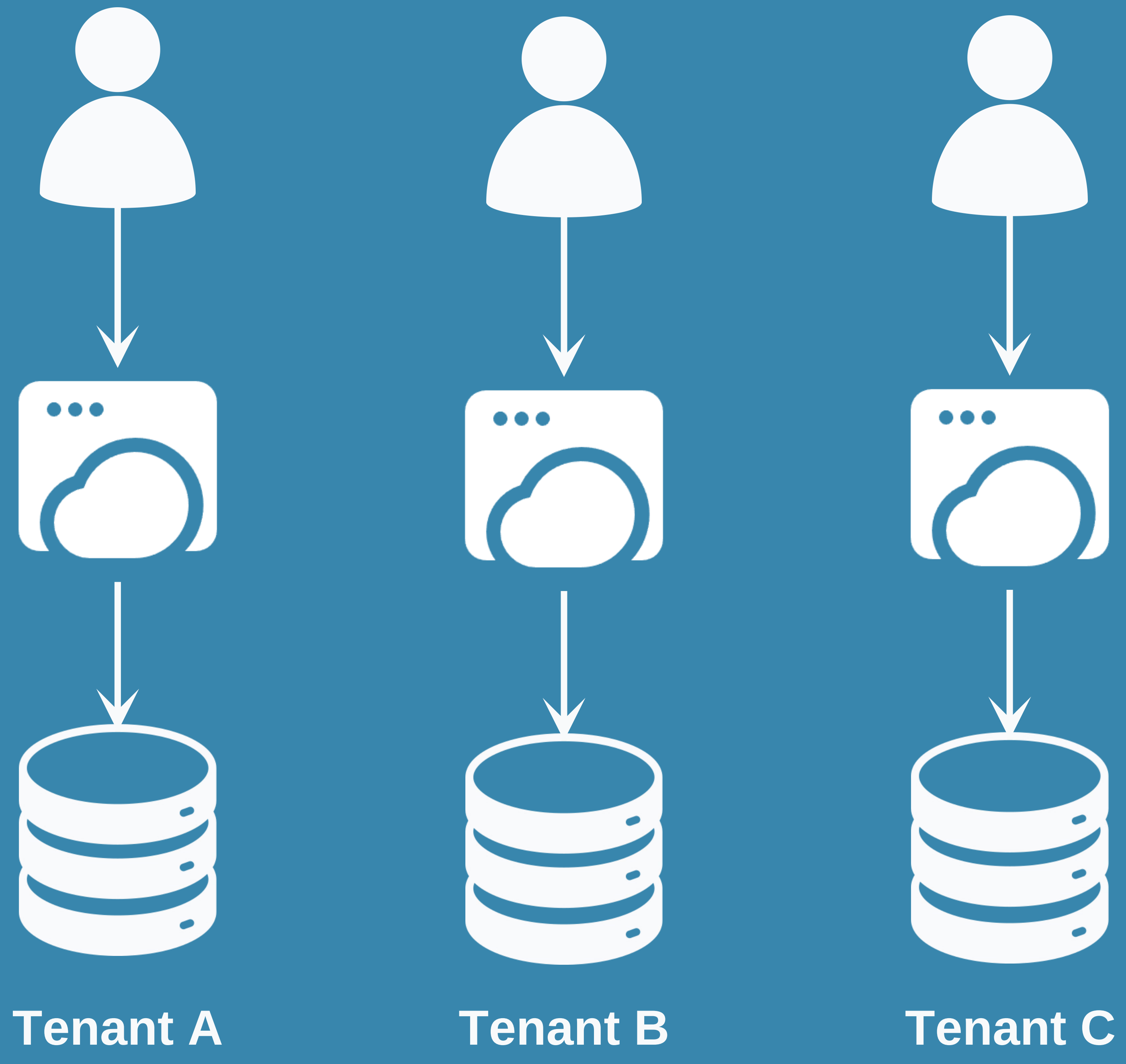
About me

- The **SaaS**sy Engineer
- Collaborated on designing and developing multiple SaaS products
- Coder/Gamer

Agenda

Single Tenant Architecture

- Dedicated Instance of the software for each tenant.
- Each instance of the software can be customized as per tenant's business needs.



Single Tenant Architecture

- Reliable performance, advanced data security and backup, complete control.
- Examples: Oracle Cloud, ServiceNow

Tenant A
Tenant B
Tenant C
Tenant D

Challenges of Single-tenancy

Complex Management

Supporting customized instance for each tenant is complex

Expensive infrastructure

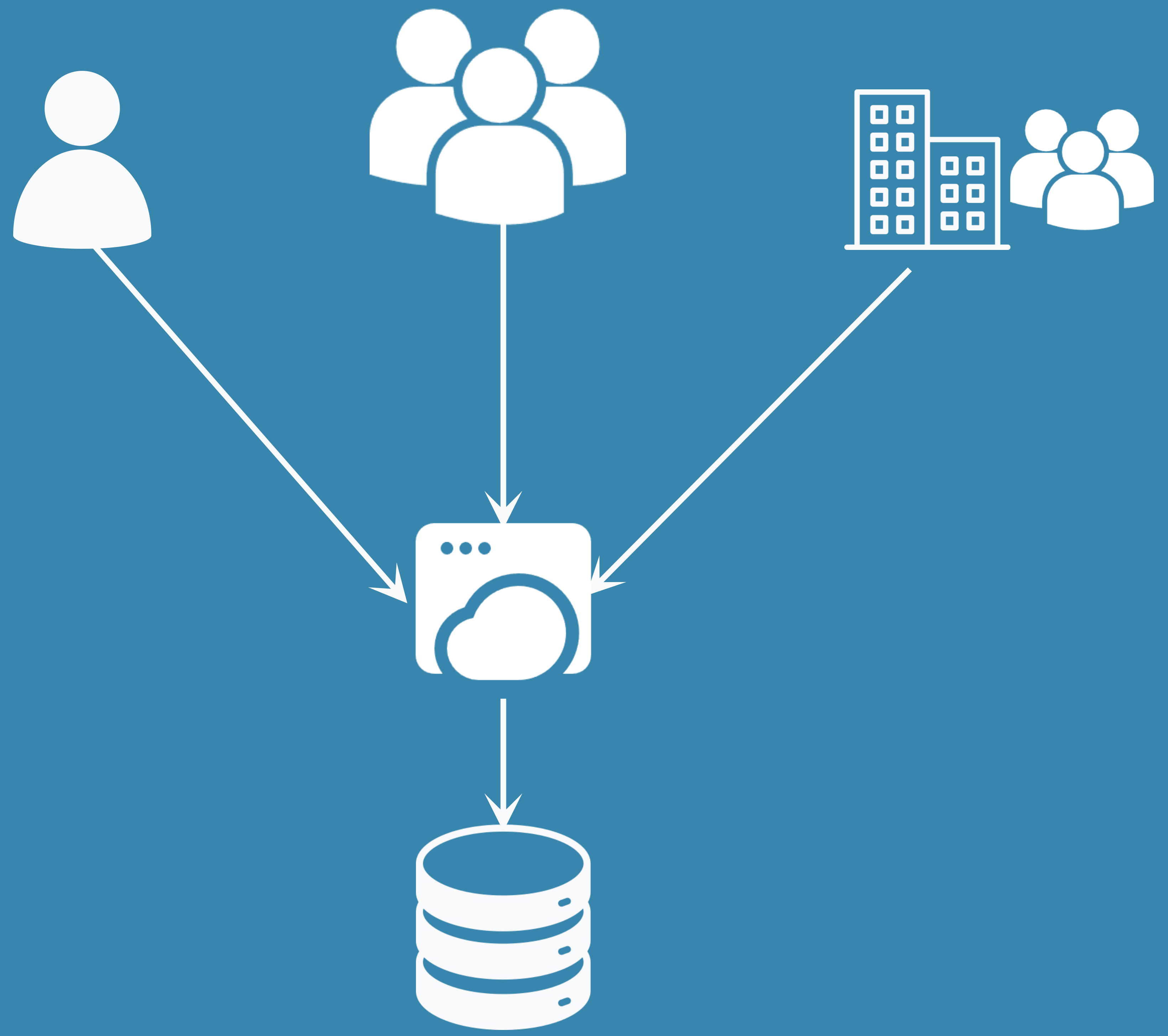
High setup, customization and maintenance costs.

Underutilized resources

Not all resources may be utilized, making the system inefficient.

Multi-tenant Architecture

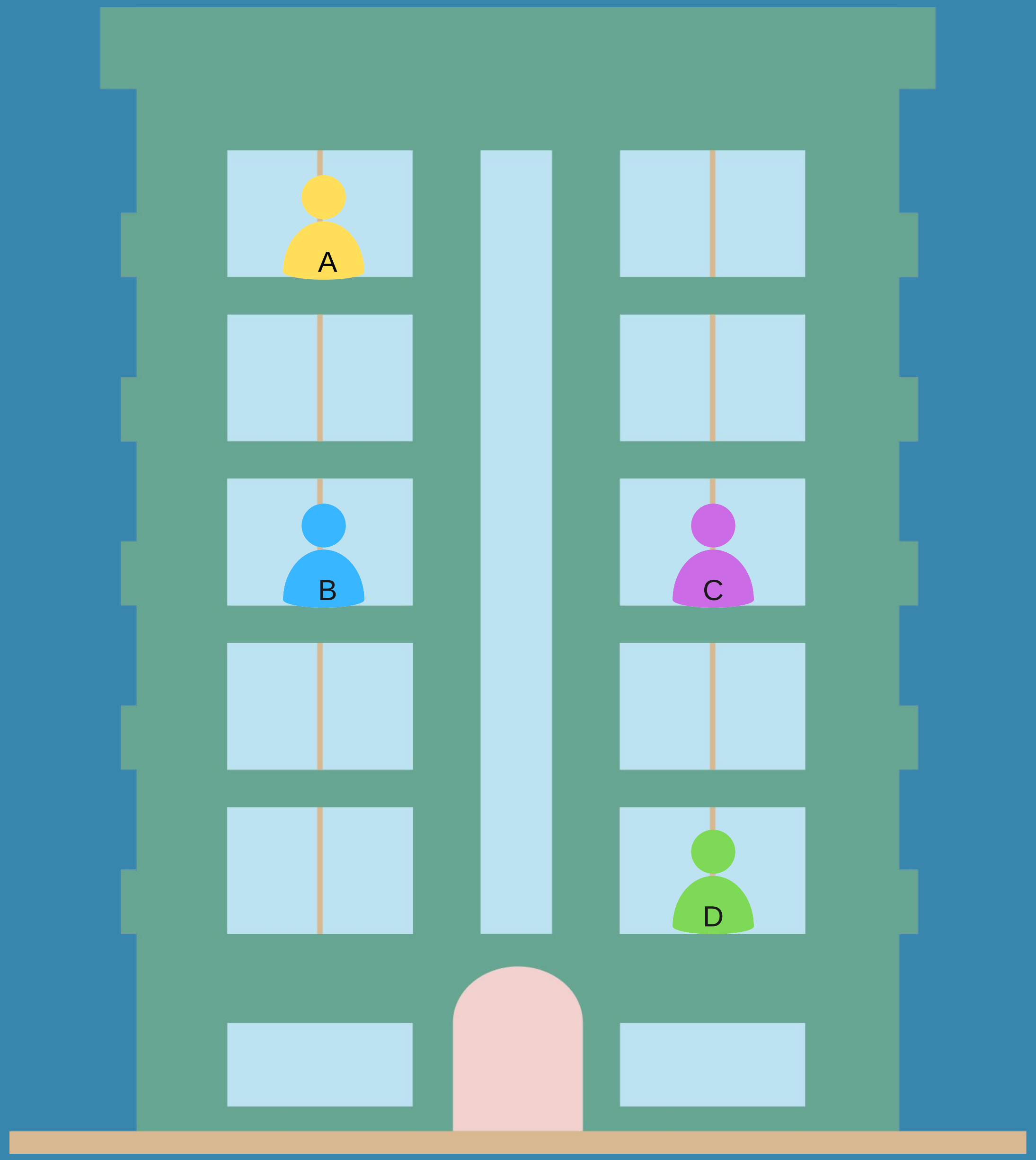
- Software instance and its infrastructure serve multiple tenants.
- Tenants share database and computing resources but their data is isolated.



Multi-tenant Architecture

Examples

- Yahoo, Gmail, Outlook
- Google Drive, OneDrive, Dropbox
- Shopify, Wix
- Slack, Skype, Trello



How is it better?

Efficient use of Computing Resources

Easy Maintenance and Upgrade Management

Customization and 3rd Party integration.

How is it better?

Fast Scaling of Resources

Cost-Effective Infrastructure

Rapid Onboarding

Designing a SaaS

- ☐ Achieving Multi-tenancy
- ☐ Scalability
- ☐ Analytics
- ☐ Onboarding process
- ☐ Tenant configuration

Achieving Multi-tenancy

- Define a tenant
- Tenant Isolation

Define a Tenant

- Depends on who your customer is.
- What’s your business model:

  B2B or **B2C**

B2B

B2B tenants

- Organizations, and departments or teams.
- Need regulatory compliance, the isolation of their data, and ensuring that you meet a specified service-level objective (SLO), like uptime or service availability.

AW
S

Salesforce

Slack

Shopify

B2C tenants

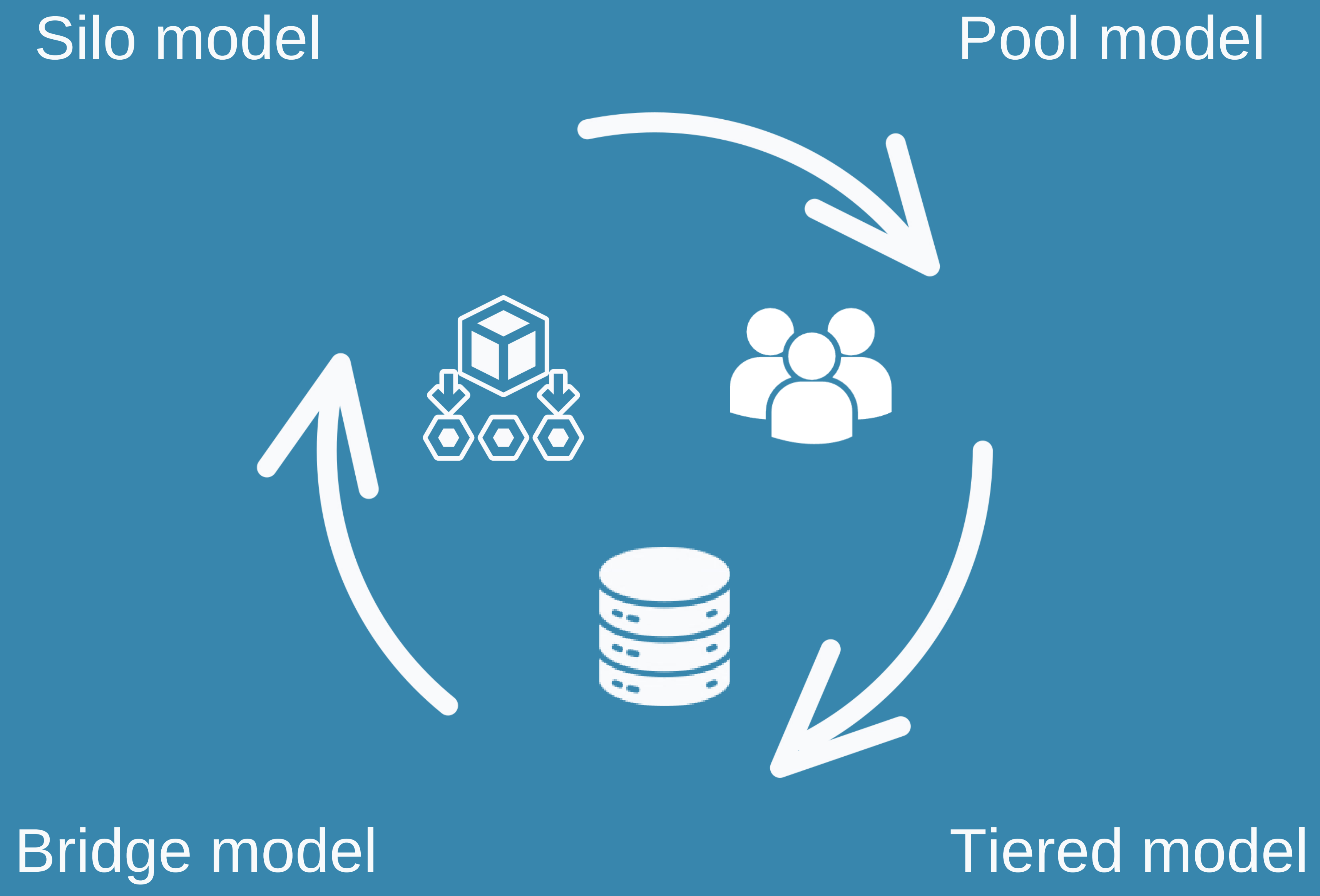
- Individual users, families, clubs or associations.
- Need to be concerned about how you handle personal data, and the data sovereignty laws within each jurisdiction that you serve.

B2C

Netflix	Youtube
Discord	Duolingo

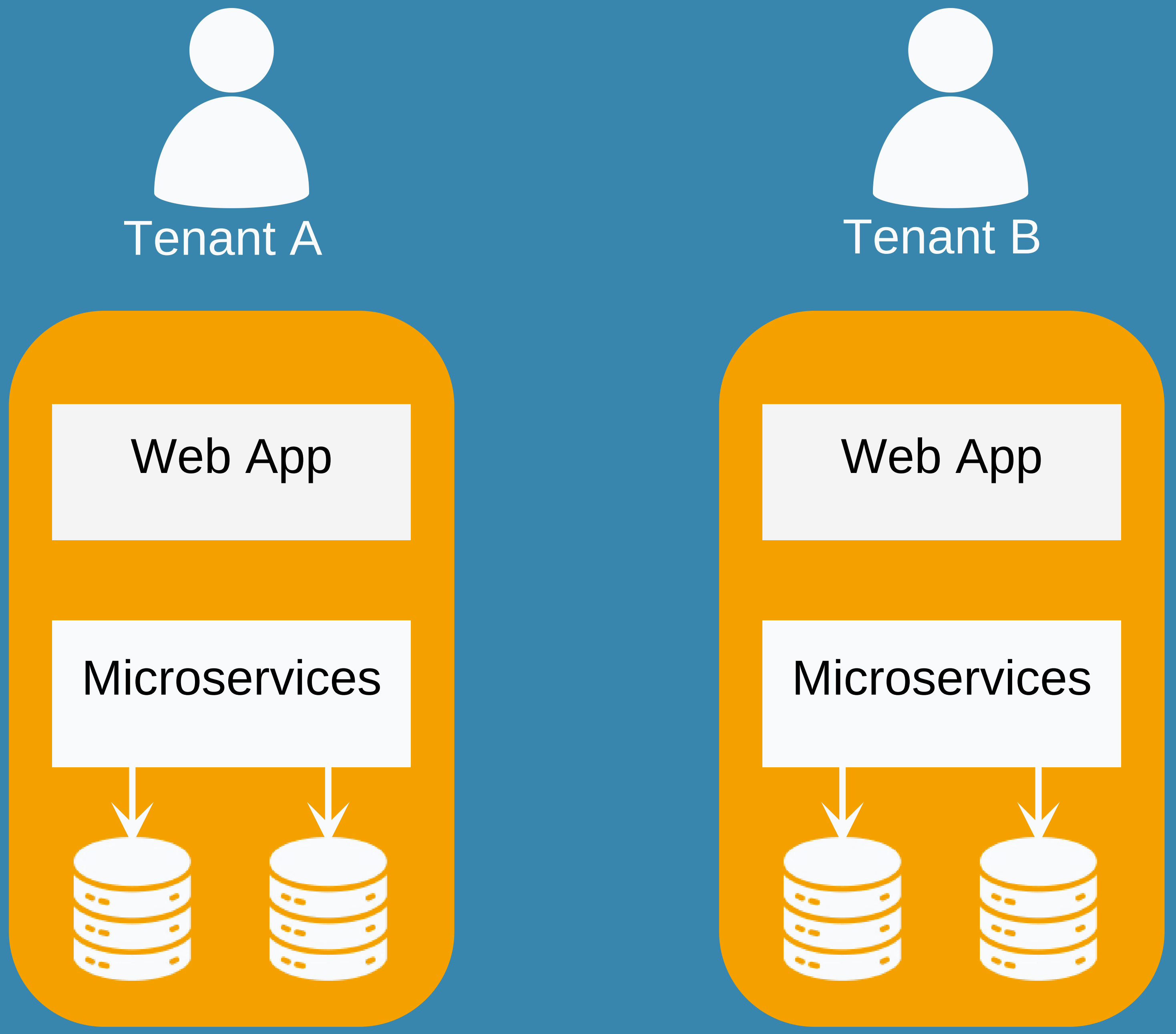
Tenant Isolation

- Governs how a tenant's data is protected within a multi-tenant environment.
- Authentication & Authorization aren't equal to isolation.
- Isolation is not only a resource-level construct.



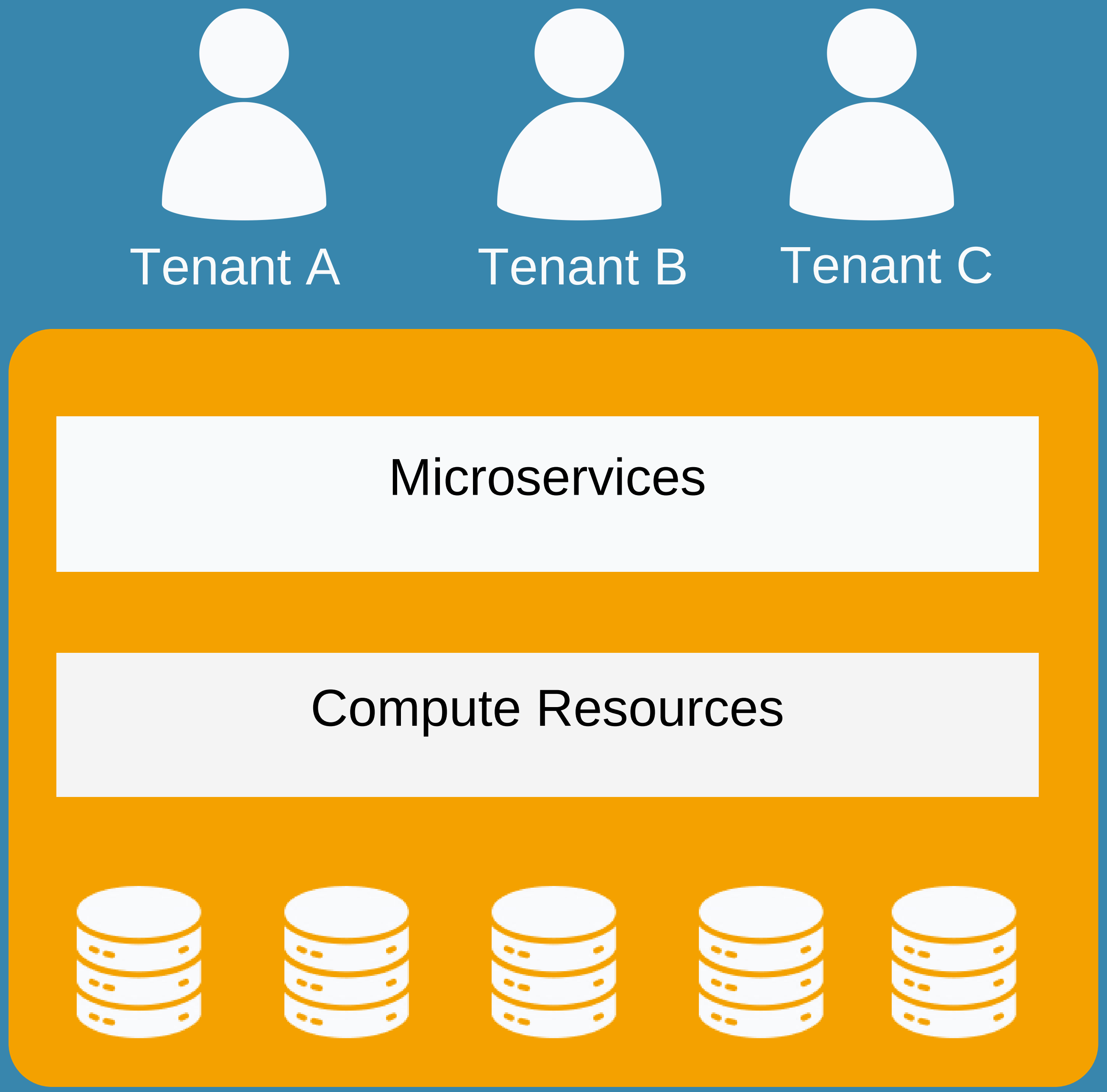
Virtualization / Silo Model

- Divides tenants into clusters with isolated infrastructure resources.
- Highest maintenance cost
- Typically used for Single-tenant SaaS apps such as Oracle Cloud.



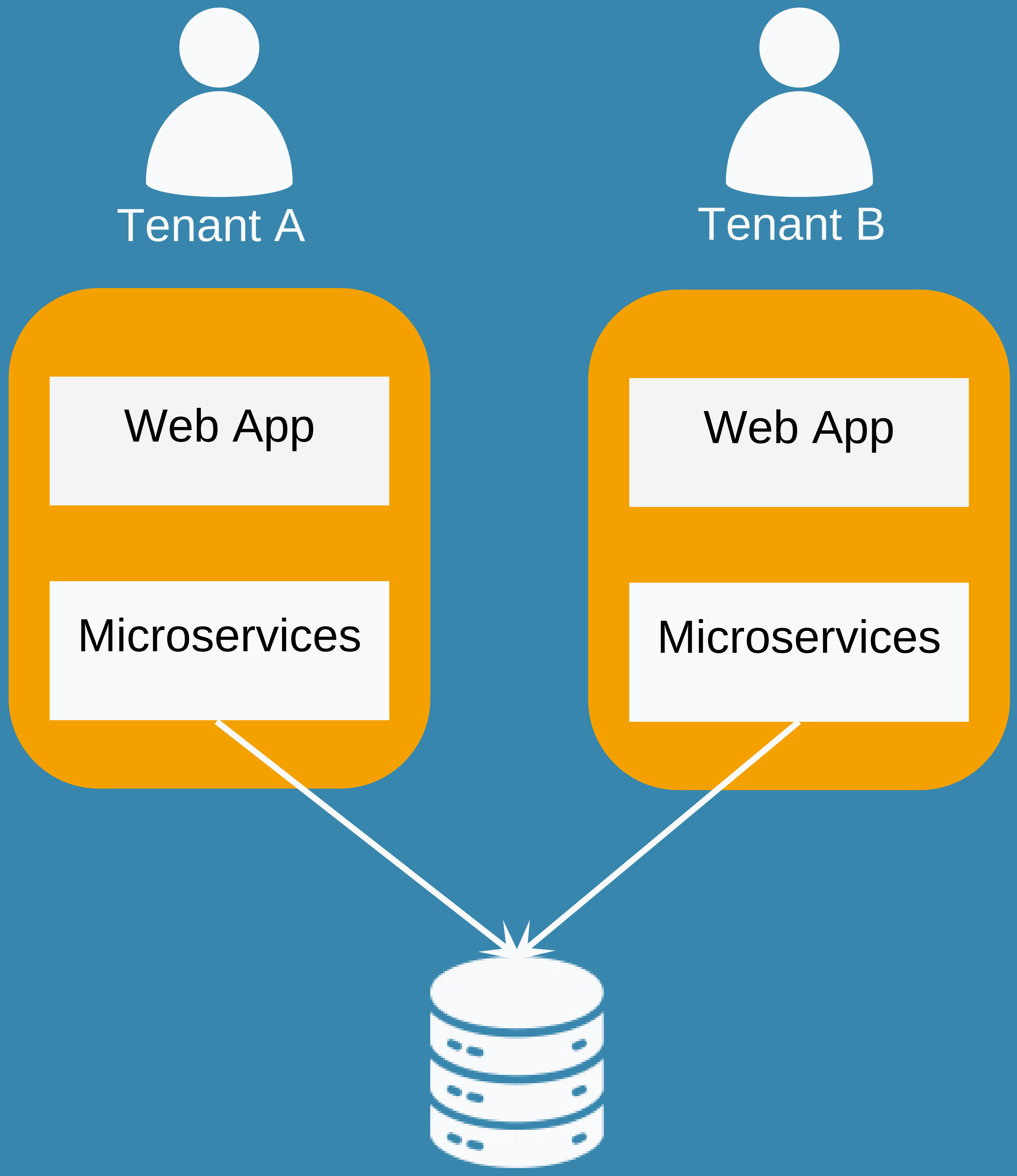
Pool Model

- Users share the infrastructure and resources.
- Cost efficient, agile and streamlined.
- Prone to issues like Noisy neighbor.



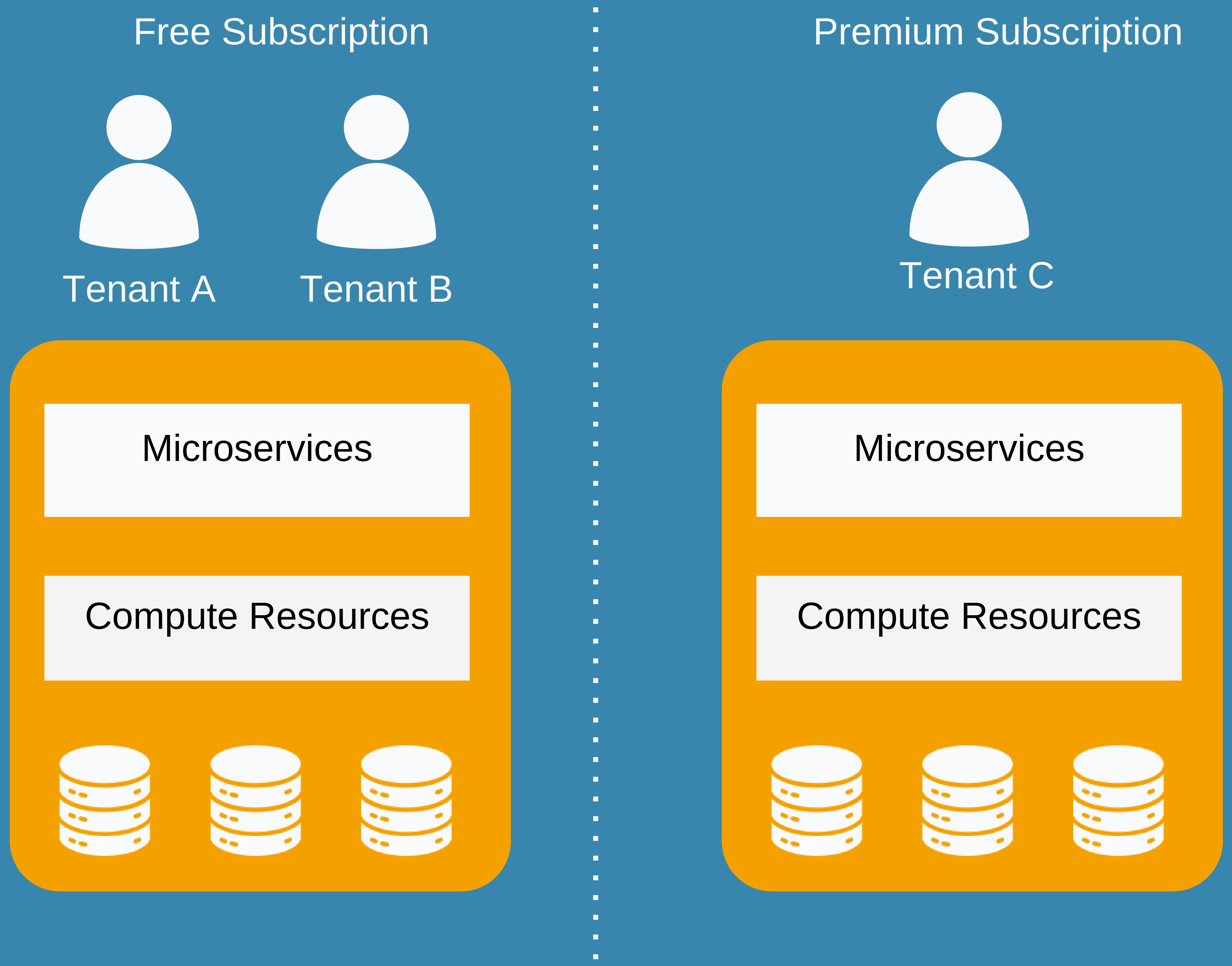
Bridge Model

- Combination of Silo and Pool models.
- Tenants share a database or server while using isolated microservices or vice-versa.
- Can be used in cases where some tenant's data is subject to strict laws and need to be isolated from other tenants



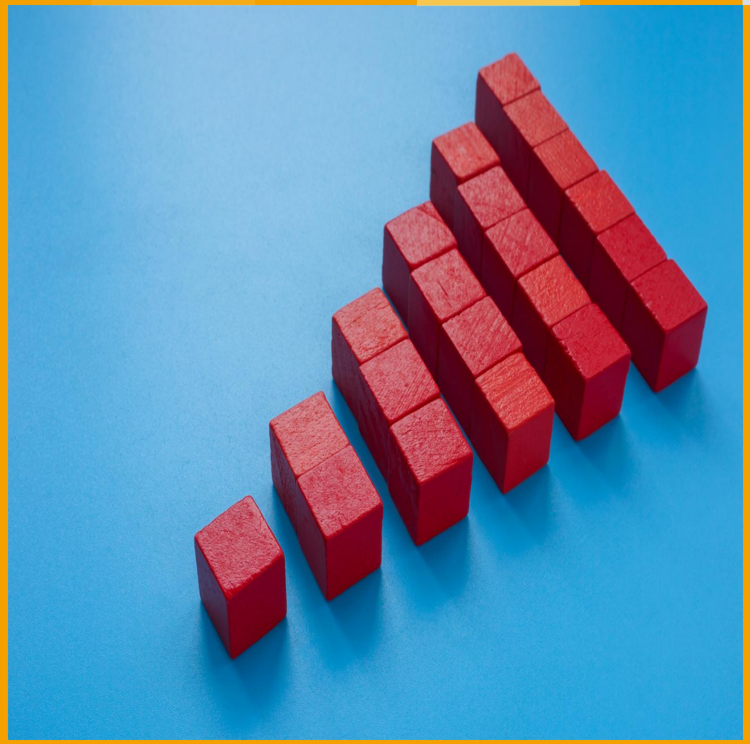
Tiered Model

- Isolation relies on customer’s subscription tier.
- Typically free plan offer a single shared infrastructure and premium tiers offer dedicated environment and resources.
- For example, AWS offers dedicated Server Hosting in addition to their lower-cost shared hosting.



Designing a SaaS

- ✓ Achieving Multi-tenancy
- ☐ Scalability
- ☐ Analytics
- ☐ Onboarding process
- ☐ Tenant configuration



Scalability

Resource Strain

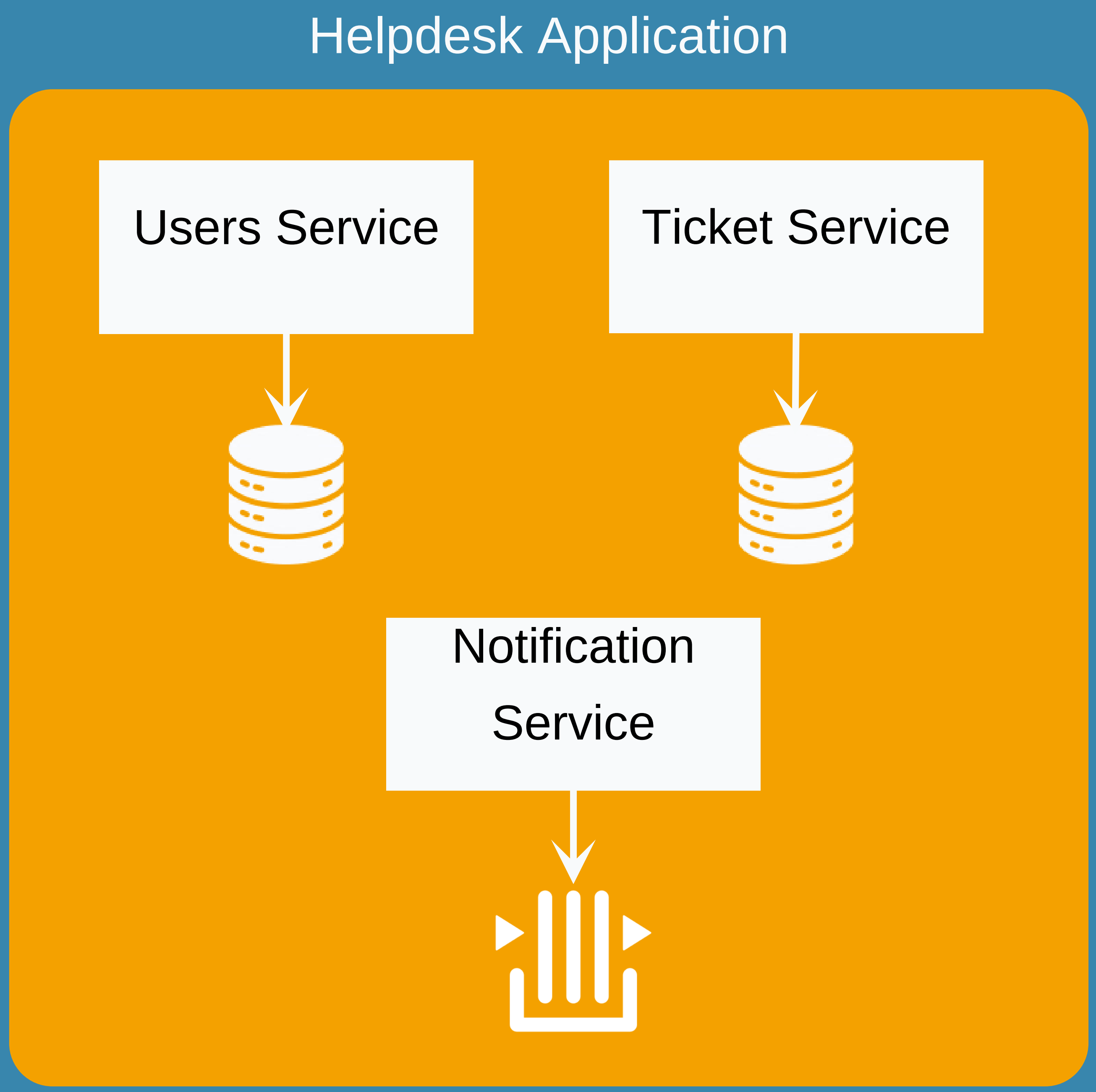
- Few tenants may monopolize CPU, memory, and storage, leaving other customers with fewer resources.

Scalable Architecture

- Microservices Architecture
- Container Orchestration
- Database Isolation

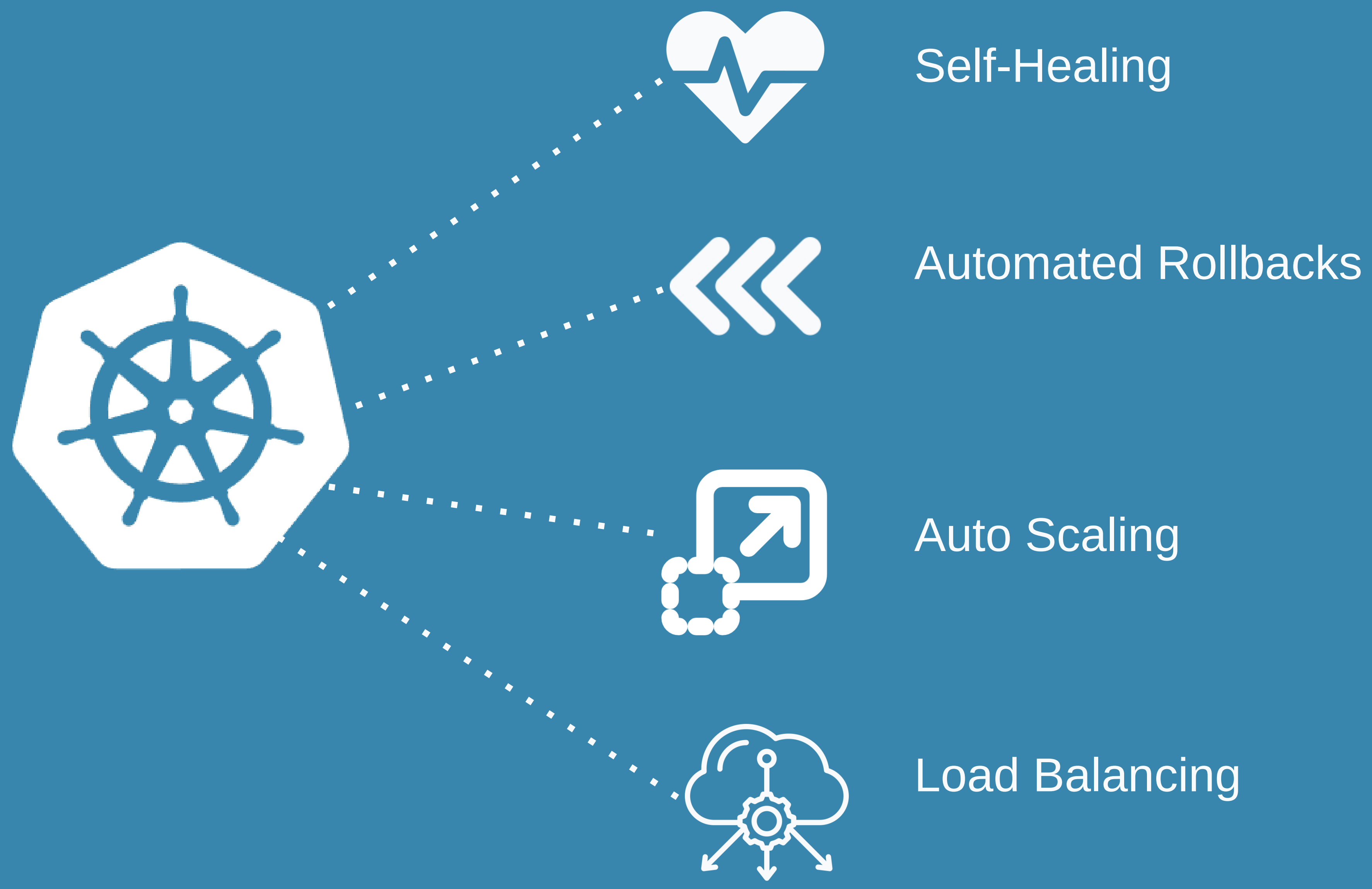
Microservices

- In this architectural style, a large application is segregated into smaller independent parts, and each part having its own realm of responsibility.
- Provides decentralized service discovery mechanisms to ensure the application is highly scalable.



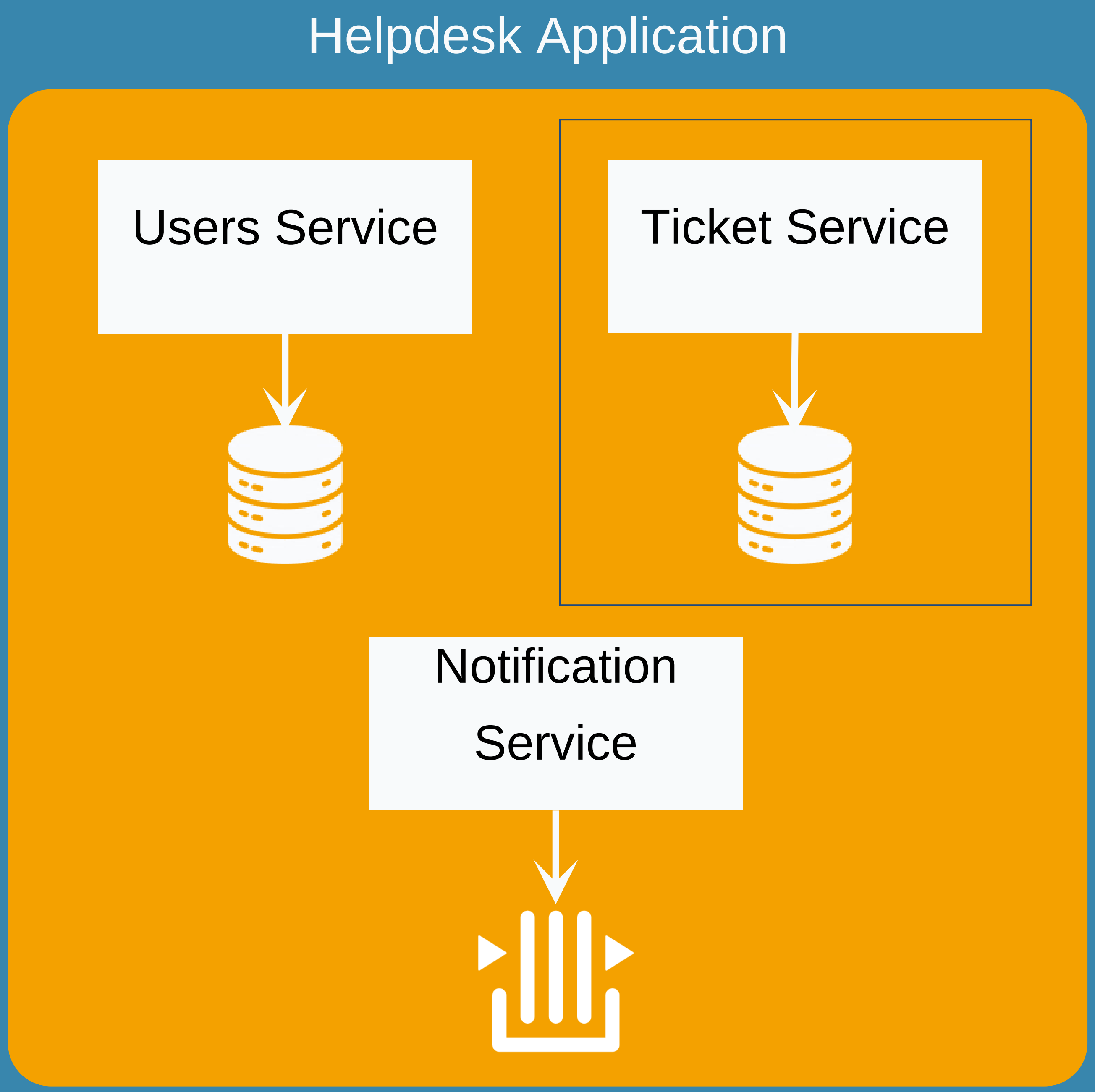
Container Orchestration

- Automates the provisioning, deployment, networking, scaling, availability, and lifecycle management of containers.
- Kubernetes, Docker Swarm, Amazon EKS



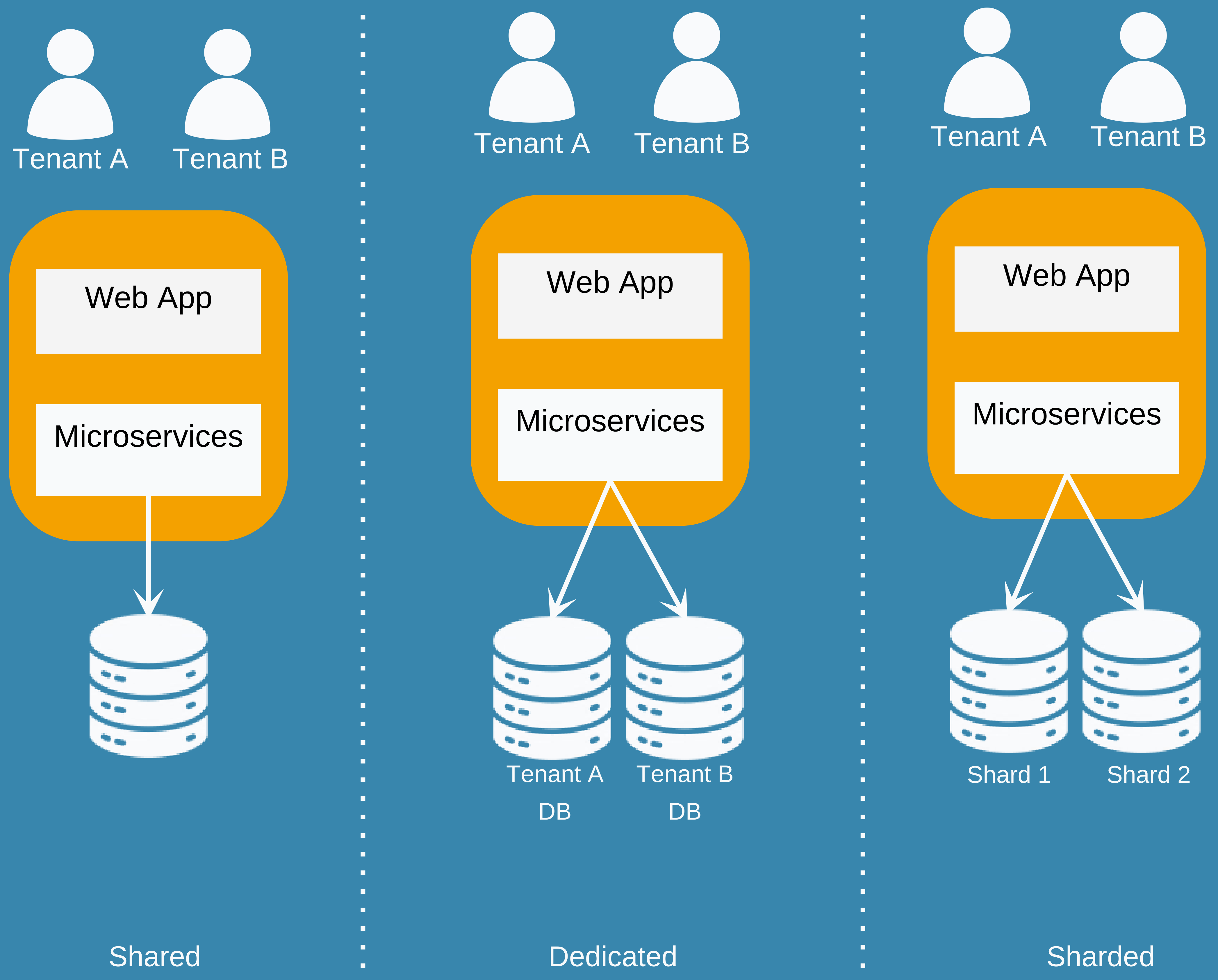
Container Orchestration

- Automates the provisioning, deployment, networking, scaling, availability, and lifecycle management of containers.
- Kubernetes, Docker Swarm, Amazon EKS



Database Isolation

- **Shared:** All users share the database. Identifier columns separate their information.
- **Dedicated:** Every tenant has a separate database.
- **Sharded:** A single tenant's data is spread across multiple databases in movable shards.



Designing a SaaS

- ✓ Achieving Multi-tenancy
- ✓ Scalability
- ☐ Analytics
- ☐ Onboarding process
- ☐ Tenant configuration

Analytics

- Memory and Storage usage
- Active tenants per subscription tier.
- Periods of increased activity
- Expenses (per tenant and subscription tier)
- Revenue (per tenant and subscription tier)

Onboarding

- Onboarding new customers should be seamless and straight forward.
- Involves training and support to ensure customers can use the application effectively.
- Comprehensive onboarding materials, documentation, and support channels.

Tenant Configuration

- Custom Branding
- Specific Integrations
- Varying data retention policies

Designing a SaaS

- ✓ Achieving Multi-tenancy
- ✓ Scalability
- ✓ Analytics
- ✓ Onboarding process
- ✓ Tenant configuration

Security Practices

- **Open Design:** the security of your application shouldn't depend on the secrecy of how it's built.
- **Fail-safe default:** security sensitive operations should be allowed only when a certain conditions are met, and fail otherwise.
- **Confidentiality:** define different permissions and access levels to data for users.
- **Least Privilege:** a program/user should only have the privileges they require and nothing more.
- No Caching of access control decisions.

Scan for Feedback

Q&A

References

- https://learn.microsoft.com/en-us/azure/architecture/guide/multitenant/considerations/tenancy-models
- https://docs.aws.amazon.com/whitepapers/latest/saas-tenant-isolation-strategies/the-isolation-mindset.html

Thank you

Email

gauravsingh@xecurify.com

Social Media

linkedin.com/in/gaurav-singh-3a71b1108