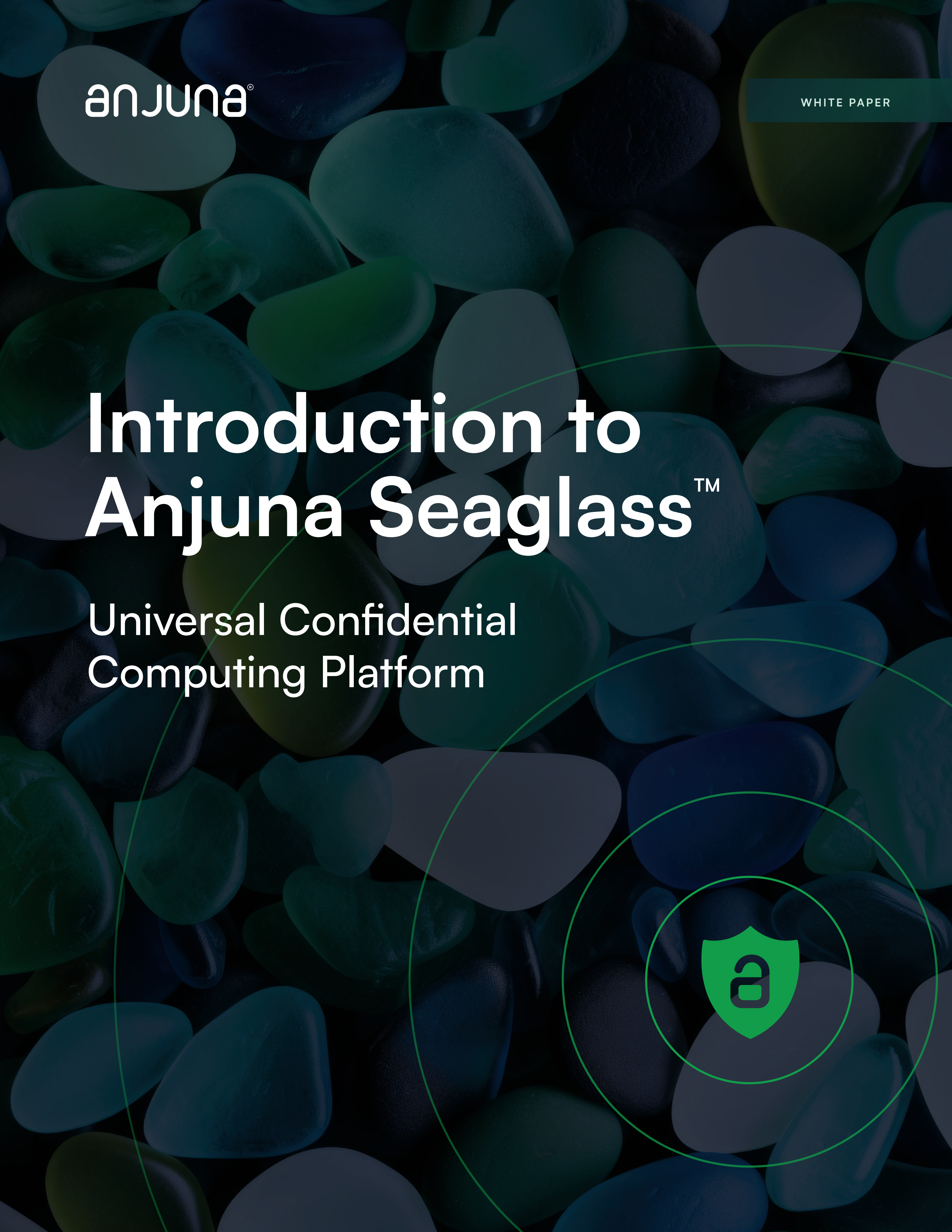


WHITE PAPER

Introduction to Anjuna Seaglass™

Universal Confidential Computing Platform

Introduction

Any organization that deals with sensitive data, especially in the cloud, is challenged by the risk of data exposure and compromise when security controls are limited to strictly software. Software is always vulnerable to those who can access lower layers in the compute stack. Anyone with host access can easily get data. Without hardware-backed roots of trust and trusted execution, software-only security remains the weakest point in even the most resilient infrastructure. It cannot adequately shield data from attackers, insiders, or cloud operators. These concerns have kept many organizations from migrating sensitive workloads to the cloud.

An innovative technology called Confidential Computing delivers a breakthrough approach to protecting data. Confidential Computing secures the processing and handling of sensitive data through hardware-level technologies in modern CPUs such as AMD (AMD-SEV), Intel (SGX), and AWS (Nitro Enclaves). Cloud providers have embraced these chip advancements and made Confidential Computing features widely available, enabling organizations to process workloads securely with trusted hardware. However, hardware alone is insufficient to fully embrace this new approach, as organizations would need to rearchitect their application and hire developers with kernel and cryptographic expertise. Moreover, the heterogeneous nature of Confidential Computing hardware would lead to operational silos and management complexity.

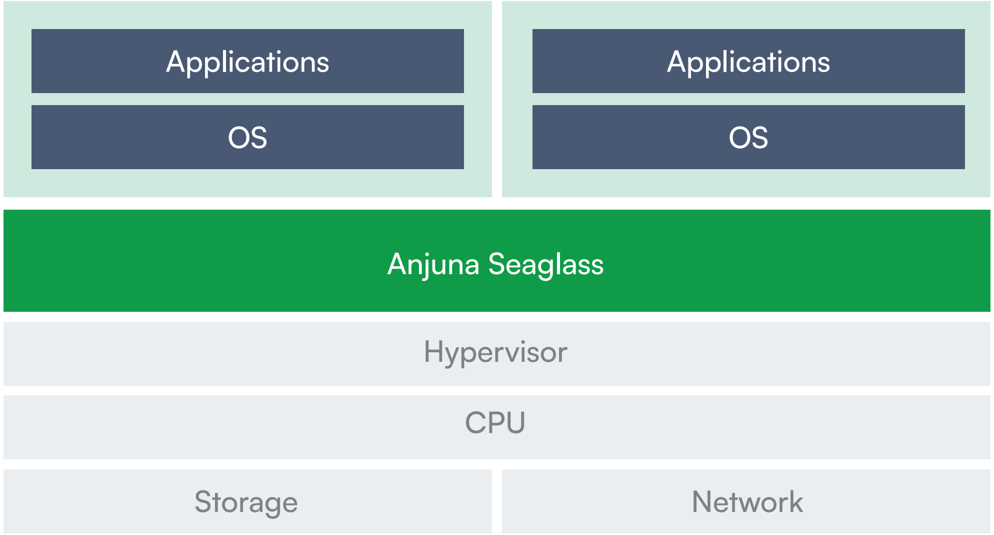
Anjuna Seaglass eliminates this heavy lifting by offering a software platform that abstracts the underlying confidential CPU hardware and interfaces directly with customers' applications at runtime to provide complete protection of data in use, at rest, and in motion without requiring changes to the application. Furthermore, Anjuna Seaglass provides additional capabilities that organizations need to take full advantage of Confidential Computing and offers a uniform approach across clouds and processors.

Anjuna Seaglass Protects Workloads With Unprecedented Security

Anjuna Seaglass helps enterprises create high-trust environments in the cloud where data is always encrypted and code is verified for authenticity. With Anjuna Seaglass, workloads stay confidential and trusted during execution, enabling enterprises to embrace the cloud and innovate without the threat of attackers or insiders eavesdropping on or tampering with code or data. Unlike other data security solutions, Confidential Computing is rooted in chip hardware, which offers substantially higher levels of trust, integrity, and security. Anjuna Seaglass lets enterprises leverage those properties through its platform to protect applications with minimal performance impact. Enterprises can instantly secure all aspects of data, memory, storage, networks, and the cloud without needing to recode their applications.

Additionally, Anjuna Seaglass supports multi-cloud and hybrid environments and does not require specialized skills to deploy or run, making it flexible and easy to use. Organizations leverage Anjuna to run existing applications in the cloud with complete privacy, security, and isolation. It supports applications, containers, and Kubernetes and runs workloads in trusted and secure hardware processors or enclaves. The powerful attestation capabilities of the hardware are simple to use with Anjuna Seaglass, enabling organizations to prove their workloads are authentic and haven't been tampered with and that their workloads are running on secure hardware. This mechanism allows organizations to establish the most robust levels of trust in their applications.

Anjuna Seaglass creates a barrier and provides hardware isolation, securing applications from modern cloud risks.



After customers deploy workloads to enclaves, their sensitive data and processes become fully shielded from modern cloud risks. Customers benefit from the following:

1. Memory encrypted by a dedicated processor protects code and data in use

All code, AI/ML models, and data are now secure in memory. Only a secure portion of the processor can decrypt memory with a key that it contains. Unlike traditional secure processors (e.g., HSMs), Confidential Computing chipsets operate with full core capability and large memory capacities. Memory encryption is handled by dedicated on-chip accelerators, ensuring no performance impact on running applications.

2. Compute that is logically isolated and separated from untrusted infrastructure

Workloads and data are no longer vulnerable if attackers, malware, insiders, or cloud admins access infrastructure. Not even admins or users who gain root access to hosts can view running workloads.

3. Hardware-isolated process management

The previously vast attack surface, comprising many parts of the infrastructure and compute stack, shrinks to an absolute minimum: the CPU.

4. Strong attestation enables workloads to be trusted by others

Workloads can prove that they 1) are authentic and havenot been tampered with and 2) are running on trusted hardware. Confidential Computing provides hard evidence, control, and proof of this. The most common use for attestation is securely bootstrapping applications with the secrets they need. Anjuna Seaglass cryptographically binds initial secrets to workloads at runtime, solving the “secret zero” issue. The Anjuna Policy Manager can securely distribute secret data, initial tokens, keys, and sensitive environment variables to applications. This is impossible to do securely in traditional workloads. But attestation provides a unique hardware-based application identity that serves as a trust anchor for further trusted processing and application interaction.

5. Comprehensive protection at run time for data in use, at rest, and in motion

Anjuna Seaglass automatically protects the entire workload, including code, data, dependencies, files, temporary files, caches, and other data usually exposed on disk or in memory. This dramatically reduces risk.

6. Hardware-based evidence of workload execution, location, and instance type

Strong guarantees that a workload ran as expected, in a specific location, or on a particular machine can aid in compliance reporting. They can also help in novel use cases requiring data to be processed in particular locations or jurisdictions with preferred regulatory conditions.

How Anjuna Seaglass Works

Anjuna Seaglass helps organizations deploy Confidential Computing simply and quickly with a comprehensive approach that comprises build, deploy, run, and trust stages.

Build

Customers take their applications, including containerized ones, and build an image of it that is compatible with their cloud provider's Confidential Computing solution.

Deploy

Customers enable other systems to trust their applications by configuring attestation. Customers first measure their image to get a fingerprint, which serves as an identity for their application. Then, for example, they create access policies in an attestation-aware secrets manager using the fingerprint. If the application presents the correct fingerprint at runtime, the secrets manager can securely give it secrets. This pattern can be extended to other systems.

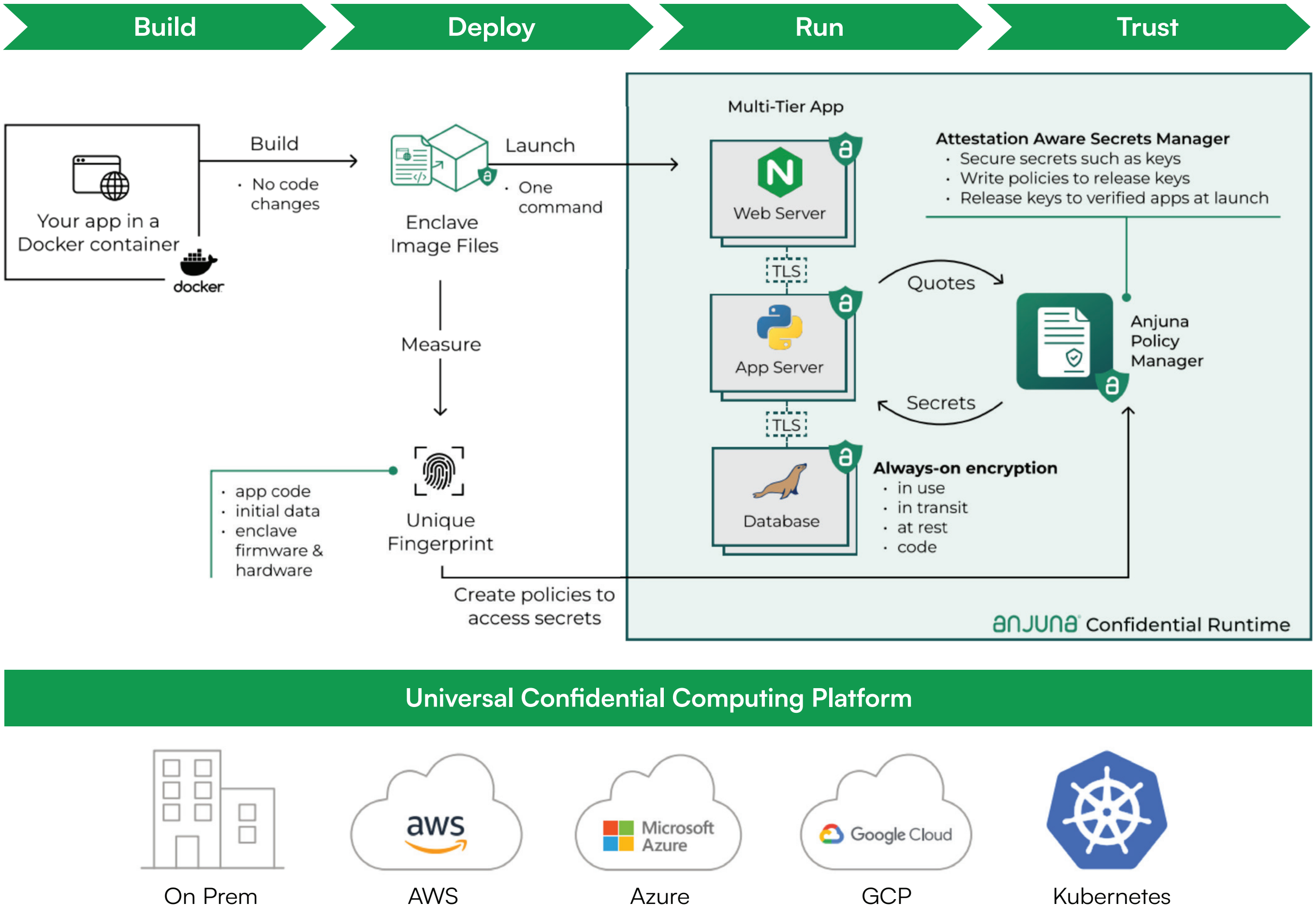
Run

Applications run fully protected by the Anjuna Confidential Runtime. They are shielded from eavesdropping and tampering. Even those who gain root access to the host machine cannot access or modify code and data.

Trust

Using the previously configured policies, applications securely establish trust with external services, such as a secrets manager from which it can get secrets such as keys, configuration settings, API tokens, etc. This mechanism eliminates the secret zero problem.

Anjuna Seaglass Platform



Build → Deploy → Run → Trust

Your app in a Docker container

docker

Build

- No code changes

Enclave Image Files

Launch

- One command

Measure

Unique Fingerprint

- app code
- initial data
- enclave firmware & hardware

Create policies to access secrets

Multi-Tier App

Web Server

TLS

App Server

TLS

Database

Attestation Aware Secrets Manager
- Secure secrets such as keys
- Write policies to release keys
- Release keys to verified apps at launch

Quotes

Secrets

Anjuna Policy Manager

Always-on encryption
- in use
- in transit
- at rest
- code

anjuna Confidential Runtime

Universal Confidential Computing Platform

On Prem

AWS

Azure

GCP

Kubernetes

= Enclave Protected

Hybrid Multi-Cloud

Anjuna Seaglass Features

The Anjuna Seaglass comprises the following features:

Confidential Runtime (CORE)

- Anjuna Confidential Containers
- Performance Optimization
- Enclave Lifecycle Management
- Multi-cloud and Hybrid-cloud Support
- Kubernetes Support

Always-on Encryption

- Confidential Data in Use
- Confidential Data In Transit
- Confidential Data At Rest
- Confidential Code

Always-on Trust

- Trusted Build
- Trusted Start
- Trusted Execution

Policy-Based Verification

- Anjuna Policy Manager
- 3rd Party Key Management Policy

Platform Operations

- Image Builder
- Debug Mode
- Monitoring, Events and Logs

How Customers Deploy Anjuna

Anjuna Seaglass is a software platform. It functions as a hardware security virtualization layer and installs on the operating systems that run on supported Confidential Computing chipsets. To support scalable deployments, most customers choose to instrument Anjuna Seaglass into their CI/CD or runtime launch processes. Our customers complete flexibility to deploy on multi-cloud, hybrid-cloud, and on-premises environments. Customers run our platform with a single command and point to the application they wish to protect. It s that simple. Anjuna Seaglass protects custom, open-source, and commercial applications - all without modification. Anjuna also supports containerized applications and Kubernetes.

Organizations Can Securely Transform and Rapidly Innovate

With Anjuna, organizations can deploy Confidential Computing technology to solve various challenges. Indeed, securingworkloads and keeping them private are often the primary goals, but organizations also apply the technology to unleash innovation, reduce risks, and collaborate in new ways. Common goals include:

1. Implement Confidential AI

Use secure enclaves to provide hardware-level isolation, confidentiality, and integrity protection for sensitive data, intellectual property and ML models. Confidential AI reduces the risk of handling sensitive or regulated training data, stops malicious attacks, and prevents even privileged insiders from accessing training data, inputs, outputs, and models.

2. Protect keys in key management or caching systems

Secrets exposed in memory in cleartext can be quickly protected, reducing a critical risk for many organizations that handle credentials, keys, and API tokens.

3. Unblock stalled cloud migration initiatives

Organizations blocked from moving sensitive workloads to the cloud because of concerns over data privacy or regulations can unblock those initiatives with Confidential Computing technology.

4. Secure Web3 infrastructure

Key exposure in blockchain processing is a significant risk. Confidential computing can protect the keys and protocols as transactions occur on validator or signing nodes.

5. Enable multi-party computing and multi-party analytics

In scenarios that require multiple entities to share data for analysis but cannot see each other's data, Confidential Computing enables complete analysis while preserving privacy.

6. Embrace simpler architectures for privacy compliance

Organizations can deploy an end-to-end Confidential Computing model that enables immediate data analytics without the complexity of traditional privacy tools. They can create computing instances that are the sole operator on data, yielding results on data whose privacy must be protected.

7. Prepare for future quantum computing risks

Running sensitive workloads on confidential hardware allows organizations to adapt to future quantum risks straightforwardly. This is important for future quantum-resistant strategies. Rather than refactoring applications, organizations can update the underlying hardware to new processors.

About Anjuna

Anjuna created the first Universal Confidential Computing Platform to run applications in any cloud with complete data security and privacy. Anjuna Seaglass isolates workloads in a hardware-assisted environment that intrinsically secures data in every state to create a zero trust environment for code and data. Anjuna Seaglass empowers enterprises to directly control application-level trust policies, ensuring that only trusted code can access sensitive data. Anjuna works with enterprises around the globe in industries such as financial services, government, and blockchain.

Get started with Anjuna Seaglass

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