Securing the Build, Infrastructure, and Workloads Across Cloud Native Environments

An illustrated guide to cloud native security with Aqua
The Value of Cloud Native Security

Aqua Security helps organizations to minimize their security risk exposure and enforce compliance across their cloud native application lifecycle and infrastructure. Aqua’s solutions empower security, operations, and DevOps teams to facilitate best practices without impeding established workflows. Aqua provides comprehensive controls and deep, actionable insight to accurately detect and prioritize risks and to accelerate remediation.

Aqua can be delivered as a SaaS-based or on-prem solution, designed to address security and operational requirements of any cloud native maturity and can be tailored for organizations of any size. Aqua functions across all platforms and clouds (public, private, and multi-cloud scenarios), and helps to secure containers, virtual machines (VMs), and serverless functions.

Aqua’s core capabilities are part of a unique three-pronged approach to cloud native security, aligned to the industry’s premier standard for minimizing risk in applications across modern cloud ecosystems.

The Aqua Approach

- Secure the Build
  - Help developers address issues earlier in fast-moving pipelines of code artifacts
  - Shift security left: Analyze images/functions and remediate risks during the build
  - Create and automatically enforce policies to ensure security before deployment

- Secure the Infrastructure
  - Leverage a single pane of glass to manage your cloud security posture
  - Automate compliance for public cloud and Kubernetes infrastructure
  - Apply consistent controls on any orchestration platform and across cloud providers

- Secure the Workload
  - Ensure immutability and least-privilege enforcement of behaviors
  - View running workloads, namespaces, and risks for root cause investigation
  - Visualize workload network connections and prevent unauthorized connections
Prioritize Threats in Running Workloads in Real Time

Do you have all the correct information on your running workloads to perform a real-time analysis?
Are you able to make quick decisions and mitigate the most critical risks at the right time?

Aqua Risk Explorer simplifies security risk management in large production environments where security risk assessments often present unwieldy amounts of results without effective prioritization. Aqua Risk Explorer provides a dynamic, real-time, logical view of running workloads in Kubernetes environments and associated security risk insights. This helps DevSecOps teams to identify the most vulnerable deployments and nodes and to prioritize remediation efforts.

- Help security teams save time by viewing a live map of all running workloads, focus on the high-risk items, and take steps to improve security
- View detailed risk information on a selected item and all the components that are associated with it, including the reasons for its risk classification
- Drill down into namespaces, deployments, nodes (hosts), containers and their originating images, as well as network connections between, and within, namespaces
- View risks associated with vulnerabilities, embedded secrets, bad configurations or policy violations, and malware
- Support regulatory compliance initiatives, such as PCI-DSS requirements 6 & 10
Shift-Left Security Scanning for DevOps

Can you automate image scanning for vulnerabilities, secrets, and configuration errors across CI/CD pipelines, in function stores, and in registries?

Do you have access to actionable risk insight in CI environments to accelerate remediation?

Aqua helps to “shift security left,” scanning directly within the CI/CD pipeline, function stores, and image registries to provide complete risk analysis and to facilitate rapid remediation before the build.

- Scan VM images, container images, and serverless functions
- Detect and identify known vulnerabilities, hidden malware, embedded secrets, open source license issues, configuration errors, and over-provisioned permissions
- Configure automated, scheduled scans at regular intervals to detect emergent vulnerabilities
- Identify and analyze OS packages (RPM and deb) and 40+ language packages (e.g., Java, NodeJS, Ruby, PHP, Python, C/C++)
- Generate an image bill of materials, detailing packages, files, OSS license information, and layer history
- Leverage the Aqua CyberCenter data feed, which is curated and refined to provide accurate detection and analysis of CVEs, vendor-issued advisories, proprietary Aqua cybersecurity research, and malware
- Focus on the most urgent security issues first using Aqua’s risk-based insights (discussed further in the next section)
- Use Aqua’s flexible assurance policies to set risk thresholds that flag artifacts as non-compliant and prevent their progression through the pipeline to production (discussed further in later sections)
Intelligently Prioritize and Remediate Vulnerabilities

Can you easily identify the greatest risks from a lengthy list of identified vulnerabilities?

Do you have visibility into vulnerability severity metrics, exploits, and impacted running workloads from one location?

Only Aqua’s risk-based insights enable teams to invest time and effort efficiently, where their activities can have the most impact, and to effectively scale existing resources to address the remediation requirements of large deployments. Risk-based insights automatically consider risk-related contextual factors to generate a complete list of vulnerabilities that can be narrowed down and refined based on factors like exploitability, severity, and whether the workloads are running, helping to clearly prioritize vulnerabilities for remediation.

- Refine vulnerability scan results to manage remediation priorities and scale efforts effectively
- Easily prioritize vulnerabilities present in actively used packages
- Mitigate vulnerabilities with ready access to vendor fixes (when available) or using Aqua’s proprietary vShield technology (discussed further in the next section)
Mitigate Known Vulnerabilities in Container Images

How do you protect vulnerable components against potential exploit when no fix is available?
Can you attest to compensating controls that mitigate specific vulnerabilities for compliance?

Aqua Vulnerability Shield (vShield) provides a compensating control for known vulnerabilities detected in container images when a patch or vendor fix is unavailable. Aqua vShield leverages Aqua’s proprietary dynamic runtime capabilities to provide a “virtual patching” mechanism that automatically detects, and can prevent, attempts to exploit the vulnerability to which it is applied.

- Maintain business continuity by virtually patching running workloads, ensuring that mission-critical applications are not impacted
- Avoid interruption to developer workflows with non-intrusive vShields that do not change the image code
- Generate vShields to protect against newly discovered vulnerabilities
- Protect against multiple attack vectors that target networks, file systems, packages, and executables
- Enable compliance teams to demonstrate compensating controls for high-risk vulnerabilities
- Automatically notify security teams of exploit attempts and block the exploit

Define the scope for which a vShield will be applied

Receive notifications of risk in Audit mode, or automatically apply virtual patching in Enforce mode

Clearly define actions to be taken when a vShield is invoked

Configure a schedule that establishes a period of Audit before Enforcement
Dynamically Detect Hidden Malware Before Deployment

Can you detect hidden, polymorphic malware in your pipeline? Can you safely trace and categorize the steps of an attack kill chain?

Increasingly sophisticated attacks in the wild use evasion techniques that poison the cloud native supply chain with malware that is undetectable using signatures or static scanning methods. Only Aqua’s Dynamic Threat Analysis (DTA) ensures that those advanced threats and malware in container images are detected before they are pushed to production. Aqua DTA helps to mitigate the risk of data theft, container use for DDoS, and resource abuse by advanced persistent threats and polymorphic malware.

- Run and test images in a secure, pre-production sandbox environment to identify hidden and sophisticated risks
- Analyze container behavior directly from your registries and CI pipelines and help incident response to “shift left”
- Identify indicators of compromise (IOCs) like container escapes, reverse shell backdoors, malware drops, cryptocurrency miners, code injection, and network anomalies
- Map communications between containers and external destinations, including file downloads, C&C servers, and data exfiltration destinations
- Trace and visualize key activities in the kill chain to understand attacks before they happen
- Support SecOps and forensics by automatically classifying detected behaviors by the MITRE ATT@CK framework

Identify malicious or suspicious behaviors, including weaponization, propagation, communications, and data collection and exfiltration

View a detailed, step-by-step breakdown of the attack kill chain

Quickly detect and trace network activity and identify anomalous communications
Securely Deliver and Rotate Secrets

Can you securely deliver secrets from a central vault to the containers that need them?
Can you rotate secrets with no downtime or restart to the running container?
Can you ensure that secrets are not visible on the host, orchestrator, or network?

Aqua helps to ensure the security of your secrets to protect sensitive data and intellectual property and to avoid tampering. Aqua securely delivers secrets to runtime containers in memory, with no persistence on disk. Secrets can be rotated, updated, and revoked with no container downtime or restart, all managed by using your existing enterprise secrets vaults.

- Centralize control of secrets and the way containers access them
- Deliver secrets securely across environments and encrypt secrets in transit
- Accomplish secrets injection and rotation in runtime with no container downtime
- Manage and monitor container secrets activity
- Manage secrets seamlessly using AWS KMS, HashiCorp Vault, Azure Key Vault, and CyberArk Application Access Manager and Enterprise Password Vault
Configure and Enforce Assurance Policies

Can you ensure that only trusted artifacts run in your environments? Can you unify policies across platforms and tools?

Aqua assurance policies help to verify that the artifacts (images, functions, VMs, Kubernetes pods) that run within your environments are trusted per your compliance and security standards and ensure that a workload does not pass a threshold for risk tolerance. Assurance policies provide persistent controls to ensure artifact integrity throughout the full lifecycle and to prevent unapproved or unvetted artifacts from running.

- Define and automatically enforce the conditions an artifact must meet to run, applicable to images, functions, VMs, and Kubernetes pods
- Ensure that only the latest, authorized artifacts are being instantiated across your IT environments
- Prevent image tampering, spoofing, and control promotion from staging into production
- Identify and flag artifacts that cannot be traced back to approved images
- Prevent the execution of untrusted or risky functions, such as those that have unused roles, over-provisioned permissions, high-risk CVEs, or that contain sensitive data
- Apply advanced application scoping to manage policies and establish scope across clusters, labels, registries, and more
- Enforce assurance policies across multiple orchestration tools (e.g., Kubernetes, OpenShift, DC/OS, and Tanzu)
- Establish policy-driven security gates to enforce best practices on Kubernetes, compatible with Open Policy Agent (OPA) using Rego expressions to add out-of-the-box and custom rules to support your own distinct security requirements

Select desired actions when an artifact violates a policy

- Create an audit message when an image fails this policy
- Fail the Aqua step in CI/CD
- Mark failed images as non-compliant

Exceptions
- Ignore vulnerabilities that have no available fix
- Ignore vulnerabilities that were published in the last 30 days
- Ignore specific vulnerabilities
- Ignore vulnerabilities and malware found in specific path

Easily define exception criteria to policy violations

Balance risk and efficiency with policy applicability scope criteria (e.g., image name, label, registry)

Select and customize dozens of controls to refine precise policies (e.g., Vulnerability Score)
Protect Workloads in Runtime – Controls

Do you have full visibility into workload behavior in runtime and an ability to detect suspicious activities?

Can you establish granular policies that create a zero-trust “safe zone” for how workloads behave, limiting privileges, access to resources, and behaviors?

Can you enforce consistent runtime policies across the entire cloud native spectrum (VMs, containers, and functions)?

Aqua enables you to configure runtime controls that are applicable to all containers, functions, and VMs, permitting only legitimate behaviors and preventing several types of privilege abuse, suspicious behaviors, and attack vectors. Get alerted to configuration violations and view detailed remediation steps.

- Set policies scoped by workload profile (defining preapproved image actions) or runtime profiles (defining general runtime characteristics, privilege management, etc.) to create zero-trust zones for specific applications, VMs, or cloud environments and requirements
- Enforce policy changes or stop unauthorized processes with no downtime to running workloads
- Support containers running on Linux and Windows hosts, multiple flavors of Kubernetes, and container-as-a-service environments (e.g., AWS Fargate, ACI)
- Implement file integrity monitoring, system integrity monitoring, user activity monitoring, and other runtime protection controls to ensure VMs are properly hardened
- Leverage a set of pre-defined runtime policies based on security standards such as NIST, CIS, PCI, and HIPAA, or customize runtime policies to specific runtime environments (e.g., per namespace or cluster)
Protect Workloads in Runtime – Enforce Immutability

Can you ensure that currently running workloads are identical to their originating images or artifacts?

Can you stop zero-day attacks by preventing code injection and unauthorized changes to running workloads?

Aqua enables you to ensure workload integrity and immutability (image, host, function) without sacrificing application performance and availability. Detect and prevent any change to running workloads, as compared to their originating images or artifacts, and leverage Aqua’s proprietary Drift Prevention feature to prevent any attempt to alter workloads in runtime (e.g., adding new executables or files).

- Enforce immutability and ensure that updates are pushed only through the CI/CD pipeline, with no patching or changes allowed in runtime
- Protect Linux and Windows machines against drift and tampering by enforcing immutability of VM configurations
- Create cryptographic image fingerprinting for all layers within the image to ensure image integrity
- Detect and block attempts to add components or inject code into running workloads, preventing drift from the originally trusted images or artifacts

Customize enforcement actions to be taken upon policy violation

Prevent running containers from obtaining new privileges not originally provisioned

Prevent processes not in the original image, or images whose integrity has changed, from running...
Identity-Based Workload Segmentation Across Environments

Can you control network traffic between various cloud native workloads, no matter where they run?
Can you easily identify legitimate network connections and implement contextual firewall rules to allow them as trusted connections?

Aqua enables you to limit the blast radius of attacks by controlling the communications between workloads in your cloud native environment and implementing identity-based segmentation based on the application context. Aqua automatically discovers network topology and suggests firewall rules that allow legitimate connections.

- Visualize network connectivity for cloud native workloads within, and across, clusters
- Define network connections based on orchestrator concepts (pod name, namespaces), IP/CIDR addresses, and DNS
- Permit legitimate connections based on service identity, URLs, or IPs
- Alert on or block unauthorized communication flows automatically or limit network traffic to a specific process within a container or host without experiencing downtime
Securely Configure Public Cloud Services

Can you ensure your public cloud accounts are securely configured and in compliance?

Can you prioritize and fix configuration errors before they are exploited?

Can you automate these activities continuously and consistently across multiple clouds?

Aqua CSPM (cloud security posture management) delivers unprecedented control over your cloud security posture across public and multi-cloud ecosystems. Scan, monitor, and remediate configuration issues on AWS, Azure, Google Cloud, and Oracle Cloud. Aqua CSPM provides self-securing capabilities to ensure cloud accounts don’t drift out of compliance, with risk alerts and detailed remediation guidance.

- Define policies to identify specific configurations to be automatically fixed if they drift out of compliance
- Verify and demonstrate compliance with PCI-DSS, HIPAA, Well-Architected Framework, GDPR, SOC 2, and custom requirements
- Gain real-time visibility into control-plane API calls and analyze events for security-sensitive changes or potentially malicious activity
- Leverage an extensible architecture, based on an open source core, that uses plugins for hundreds of individual checks that can be easily customized

Clearly identify configuration issues across clouds

View a detailed breakdown of risk by cloud account
Shift-Left Security for Infrastructure-as-Code (IaC)

Can you easily identify and remediate risks in IaC templates?  
Can you ensure that your infrastructure is correctly configured before running applications?

Aqua provides powerful IaC template scanning capabilities to identify potential security risks as they are checked into source control before the infrastructure itself is deployed.

- Analyze AWS CloudFormation and HashiCorp Terraform templates for numerous security risks
- Detect misconfigurations services defined in IaC templates as part of your CI/CD workflow to prevent vulnerable infrastructure from being deployed
- Save time when managing IaC templates in multi-cloud scenarios

Quickly view and filter resource security risks to prioritize remediation
Get detailed rationale for risk classification and helpful insight for resolution
Holistic Kubernetes Security for the Enterprise

Can you ensure proper configuration of Kubernetes environments to minimize security risk exposure?

Do you have an automated way to identify and prioritize risks in Kubernetes environments?

Aqua KSPM (Kubernetes security posture management) helps to minimize the Kubernetes attack surface, prevent administrator errors, and protect against common attack vectors. Aqua KSPM enables security and compliance teams to enforce policy-driven security configurations and governance, and helps to secure the essential orchestration layer of cloud native applications with continuous security risk assessment and remediation.

- Validate Kubernetes configurations against CIS benchmarks for Kubernetes
- Detect security blind spots and automate identification of exploitable paths in Kubernetes clusters using Kube-hunter, Aqua's open source pentesting tool
- Ensure least-privilege access in Kubernetes environments while maintaining proper privileges for each user
- View a dynamic map of Kubernetes clusters and their associated risks, including all running workloads, namespaces, deployments, nodes (hosts), containers, and network connections
- Enhance the security posture of your Kubernetes workloads by controlling image contents, configurations, and pod attributes; use Aqua’s image assurance policies to prevent the deployment of unsafe and non-compliant workloads
- Provide workload runtime protection in any managed or unmanaged Kubernetes environment without using a privileged container on the host
- Achieve visibility into Kubernetes security events to facilitate compliance, forensics, and incident response

Gain a holistic view of risks in your Kubernetes clusters

View a detailed breakdown of risks measured against CIS benchmarks

Easily identify workloads that conflict with pre-defined policies

View a detailed breakdown of risks and assurance policy violations
Support Security Compliance Initiatives

Do you have an automated way to support PCI-DSS, NIST, GDPR, and HIPAA compliance requirements?

Can you generate audit reports and track user activities to demonstrate regulatory compliance?

Do you have visibility into vulnerabilities and configuration issues across the entire application lifecycle?

Aqua helps organizations to maintain compliance with an array of regulations and standards, from the build and into production. Automate testing of public cloud and Kubernetes configurations to support hardening requirements. Collect detailed image-level and host-level data that documents security practices and events for auditing and reporting.

- Generate granular audit trails of all workload activity, including access events, scan events, Docker and Kubernetes commands, container activity, secrets activity, and system events
- Enable full user accountability and control super-user permissions
- Leverage pre-built alerts and reports for key compliance mandates, including PCI-DSS, GDPR, HIPAA, NIST 800-53, and NIST SP 800-190
- Automate checks against CIS benchmarks, including Linux, Docker, Kubernetes, and the various cloud foundation benchmarks
- Craft a complete audit trail by tracking changes in vulnerability status, frequency of scans, and remediation trends
- Leverage Aqua’s vShield to demonstrate established compensating controls for specific vulnerabilities
Separation of Duties Across Multiple Application Teams

Do you have a simple automated way to manage security across multiple teams, applications, and stakeholders in an environment that still requires separation of duties?

Can you provision least-privilege access to security controls and vulnerability data?

Aqua’s comprehensive role-based access controls (RBAC) deliver effective separation of duties (SoD) to support security and compliance initiatives in complex cloud native and multi-cloud deployments and provide the flexibility to support all deployment configurations and organizational structures. Aqua enables organizations to configure hierarchies and role-based permissions based on defined scopes, including distinct definitions of applications and environments.

- Separate projects or applications with multi-tenant RBAC to limit access to limit access by assignment, displaying information and providing capabilities only to those who need them
- Set scopes that encompass all aspects of an application and assign granular permissions (such as read-only or edit access to an asset or a capability) to specific roles
- Provide specific users with one or many roles, with the potential to map to LDAP or Active Directory groups, eliminating the need to define security groups or user roles from scratch
- Leverage out-of-the-box roles or customize roles from scratch, then combine roles with defined application scopes to maximize flexibility

Define the scope across which a role will be applied for assigned users and groups

Select pre-defined permissions sets for a given role

Define permissions relevant to policies, assets, compliance, & systems

Configure permissions for Editing or View Only access
Centralize Your Cloud Native Security Insights

Can you see security risk metrics of all workloads and environments in one location?

Are you and your colleagues able to customize security dashboards to reduce the noise and clearly present the most relevant information?

Aqua makes it possible to distill large amounts of diverse security risk metrics into clear, actionable insight and present the most relevant data to each user or team. The Aqua dashboard delivers complete flexibility for users to customize the datasets they require to carry out their day-to-day tasks to support security and compliance across all types of workloads and all stages of the cloud native application lifecycle.

- View real-time risk data across all workloads and environments, including public, private, and multi-cloud deployments
- Customize the Aqua dashboard with more than 20 possible widgets
- Leverage drag-and-drop widgets for easy-to-use WYSIWYG customization
- Save, reuse, and share dashboard templates with users across your organization
Seamless Integration Across the Ecosystem

Can you support the whole cloud native ecosystem and full application lifecycle with security risk analysis?
Can you integrate security risk insight and fix information directly into your security toolset (e.g., SIEM) to accelerate remediation and facilitate collaboration?

Aqua provides a wide range of integrations for all stages of the application lifecycle and across public and multi-cloud environments. Aqua integrations help security to shift left, support compliance initiatives, and ensure security of running workloads.

Aqua integrations help to manage risks and instill security best practices within:
- Software development and delivery
- Infrastructure
- Security and response
- Collaboration and issue management

For a full list of Aqua's most notable integrations, please visit www.aquasec.com/integrations/
Innovating Cloud Native Security with Open Source

Trivy detects vulnerabilities in open source software and provides a brief explanation of risk so developers can make more informed decisions regarding the components they incorporate into their applications and containers to secure the application before it ships. [github.com/aquasecurity/trivy](github.com/aquasecurity/trivy)

Kube-bench is a Kubernetes configuration security checker, helping to secure the infrastructure for cloud native application deployment and providing a way to constantly test a Kubernetes cluster to see if it complies with the CIS Kubernetes Benchmark. [github.com/aquasecurity/kube-bench](github.com/aquasecurity/kube-bench)

Kube-hunter is an open source penetration testing tool for Kubernetes that helps detect potential security risks or bad configuration issues in the Kubernetes cluster. Kube-hunter does what an attacker would do, looking for potential entry points or weaknesses that could be exploited. [github.com/aquasecurity/kube-hunter](github.com/aquasecurity/kube-hunter)

Tracee is a lightweight container and system-tracing tool, implemented using eBPF, that runs the container, observes system calls and system events in real time, and enables users to improve runtime security for cloud native workloads. [github.com/aquasecurity/tracee](github.com/aquasecurity/tracee)

Starboard enables results from vulnerability scanners, workload auditors, and configuration benchmark tests to be incorporated into Kubernetes custom resource definitions (CRDs) and accessed through the Kubernetes API. This means you can run solutions of your choice, integrate them into Kubernetes, and consume or compare their reports in the same location. [github.com/aquasecurity/starboard](github.com/aquasecurity/starboard)

Aqua believes in the viability of open source solutions for cloud native security for DevSecOps and encourages individuals and organizations to explore new security practices by testing out a full portfolio of open source projects supported and maintained by Aqua.
Aqua Cloud Native Security Platform Architecture

**Aqua Server**
Central management component that can be deployed on multiple instances or fully hosted for high availability. Provides capabilities for scanning, lifecycle controls, policies, monitoring, and reporting.

**Aqua Gateway**
Provides connectivity between the Aqua Server and the Aqua Enforcers.

**VM Enforcer**
Provides protection for hosts (VMs), monitors host images, and enforces host runtime policies to monitor and restrict unapproved runtime activities.

**Aqua CyberCenter**
Aqua's security risk intelligence database, curated and refined to provide accurate detection and analysis of CVEs, vendor-issued advisories, proprietary Aqua cyber security research, and malware.

**Aqua Enforcer**
Monitors workload runtime activity and ensures security by enforcing defined controls.

**Micro-Enforcer**
Provides runtime protection for containers in PaaS environments where host-based solutions cannot be deployed.

**Kube-Enforcer**
Aqua's cloud security posture admission controller, which ensures that only scanned, non-compromised or compliant images can be run in your Kubernetes environments.

**Nano-Enforcer**
Provides runtime protection for AWS Lambda functions, detects malicious behavior in runtime, and controls the types of executables that can run.
Why Choose Aqua

Aqua empowers organizations by providing unparalleled insight into cloud native security for large production environments and is the vendor of choice to more than 400 organizations worldwide. Among these are the world’s largest banks, financial institutions, manufacturers, retailers, internet providers, media vendors, transportation giants, and government organizations. The Aqua approach emphasizes five key areas that drive evolution in security technologies and security operations.

- **Open Source**
- **Built for Enterprise Scale**
- **Cloud Native Focus**
- **Customer Partnership**
- **Broad Platform Support**
Aqua Security is the largest pure-play cloud native security company, providing customers the freedom to innovate and run their businesses with minimal friction. The Aqua Cloud Native Security Platform provides prevention, detection, and response automation across the entire application lifecycle to secure the build, secure cloud infrastructure, and secure running workloads wherever they are deployed.

Aqua customers are among the world’s largest enterprises in financial services, software, media, manufacturing, and retail, with implementations across a broad range of cloud providers and modern technology stacks spanning containers, serverless functions, and cloud VMs.

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