

# Assuring Compliance in the Cloud

Zeal Somani, Dr. Anton Chuvakin



# Table of Contents

<b>Introduction</b>	<b>3</b>
<b>What is Compliance Modernization or Cloud Native Compliance?</b>	<b>4</b>
Security and Compliance: Understand the differences	5
<b>Compliance and Cloud: a Brief History</b>	<b>6</b>
<b>Compliance in the cloud: requirements for a happy future</b>	<b>7</b>
Migrating from data centers to cloud -- what is the new normal for Cloud-based Architectures?	8
Shift to zero-trust and IAM as the firewall:	8
Microservices based architectures:	8
Fluid asset inventory:	8
Key Considerations for Modernizing Compliance in the Cloud:	9
Work with the regulators and build confidence in the cloud:	9
Ask more of your cloud provider regarding shared responsibilities for regulatory compliance:	9
Understand the differences in the frameworks that impact your business:	10
Have an Integrated Risk Management program:	10
Gain visibility of cloud assets and gain visibility on risks:	11
<b>How to modernize compliance in the cloud</b>	<b>12</b>
Harmonize and rationalize controls within different frameworks:	12
Shift the mindset and the culture:	13
Use the right tools - what can Google Cloud offer:	14
3.1 Setting up regulated workloads - Day 0 and Day 1 assets:	15
3.2 Gain centralized visibility and control through Security Command Center:	16
3.3 Maintain compliance and enable risk transference	16
3.4 Shift left for regulatory compliance requirements for:	16
3.5 Tying it all together — add automation to your compliance program:	17
<b>Conclusion</b>	<b>17</b>



For the purposes of the paper, compliance is about adhering with laws, rules, regulations and industry frameworks that affect IT; essentially IT-focused compliance. Examples of the frameworks are HIPAA, PCI DSS, ISO27001, NIST CSF, FedRAMP, etc.

This paper is for key security and compliance decision makers like Chief Information Security Officers and Chief Compliance Officers — all collectively referred to as Security and Compliance leaders. It is also useful for their teams and others tasked with implementing compliance and modernizing a compliance function that leverages public cloud environments.

This guidance is important not only for those organizations that are embarking on the use of cloud computing in support of a broader digital transformation of the organization and those who are looking to sustain and expand their use of cloud computing. You may also wish to read this paper together with our [“Risk Governance of Digital Transformation in the Cloud”](#) paper.

## Introduction

With the ongoing shift towards cloud technologies, modernization of regulatory compliance is no longer optional. The IT compliance function is there to reasonably ensure that your organization is complying with all applicable laws, rules and regulations, as well as internal codes of conduct, policies and procedures. As an organization transforms itself by adopting modern technologies like cloud, this brings both opportunities and challenges for the compliance function. Compliance modernization is a broad mandate that spans the way the function is governed; the tools, technology, and analytics it uses; the number and nature of its connections to other parts of the business; verifiability and auditability of the controls’ evidence, the expectations assigned to it; and more.

Public cloud technology is becoming a core part of many industries today, and with this comes some potential risks such as cloud misconfigurations exposing intellectual property, loss of physical control of assets, skillset scarcity around cloud based security and compliance. Given the constantly changing risk landscape, it is critical that regulations more closely align to address these risks. As regulations and risks evolve, the aim of a modern compliance function is to help an organization stay compliant as it goes through a digital transformation. As organizations go through digital transformation, IT compliance also needs to transform -- via upgrading the technology stack, modifying the business processes and most importantly re-skilling people to become cloud aware.

Through this paper we present our observations, and our tools that Risk, Compliance and Audit teams can leverage to add value to enterprises, both by charting a course to the safe use of cloud technology and by reducing risk through the use of the public cloud.



# What is Compliance Modernization or Cloud Native Compliance?

**Defining Compliance Modernization or Cloud-Native Compliance:** “cloud native” or modernization -- these are two popular terms used interchangeably when an organization is transforming itself via cloud and so we should pin a definition in the context of compliance.

If you stop what you're doing right now and ask ten of your colleagues to define the term "Cloud-native" or "Modernization" there is a good chance you'll get ten different answers. The most common response we've got is that modernization is all about increasing the use of containers and cloud-native tooling. Sounds simple - but is it that simple?

The compliance mindset should be about validating compliance, irrespective of the technology. In this context, it is much more than just adopting containers, shifting left, and cloud in general. Compliance Modernization is much more than just changing the technology stack. It is about evolving the processes and the mindset of people around the compliance function - as well as broader IT and security - as they embark on the modernization journey.

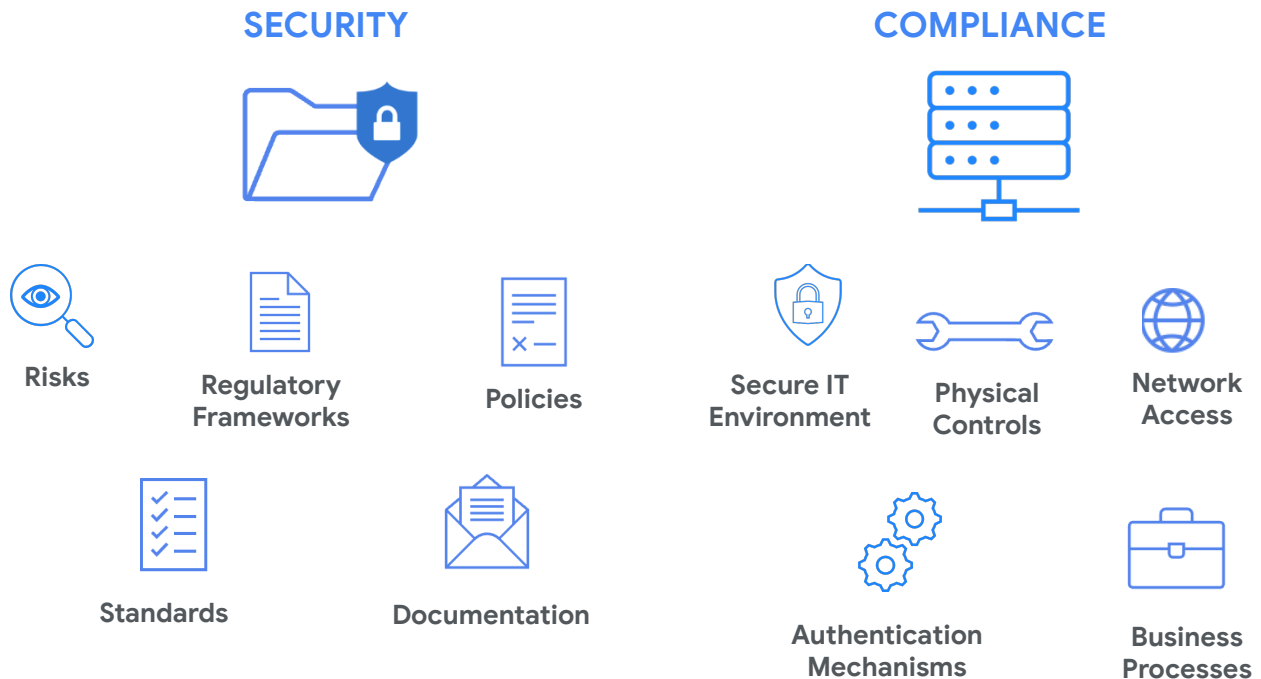
Today, Security and Compliance functions within an organization have board-level visibility. There is a subtle difference between Security and Compliance and it is critical to understand them.

## Security and Compliance: Understand the differences

For some IT leaders and professionals, the line between security and compliance becomes easily blurred; they seem the same and then suddenly not the same. How do we create comprehensive security programs while meeting compliance obligations? Is checking the compliance box really enough? Also, enough for what — it is clearly not enough in order to never be breached? And how does all this enable the business to function and move forward? These are questions that can shape the direction of an organization and ultimately cause it to succeed or fail.

One of the fundamental differences between security and compliance is that “security” is practiced for the sake of reducing the impact of threats (whether by preventing threats or detecting them) vs. “compliance” is practiced to satisfy external requirements, which often includes reducing the impact of threats.





Security and Compliance leaders are handed a considerable challenge to transform and modernize their compliance function while also reducing the risk to their organizations. But what does such an evolution look like when it leaps off the drawing board and takes hold in real life? To find the answer, organizations need more than just a fresh view of the Compliance function, but a change in their approach to compliance lifecycle. Furthermore, simply migrating to modern environments such as public cloud does not automatically modernize compliance, and in fact brings more challenges.

Organizations often struggle to execute day-to-day compliance activities because compliance is usually rearward looking and reactive. Addressing compliance issues eat up time that might otherwise be used toward forward-looking risk management. Some of the compliance activities are further complicated by the typical cloud characteristics such as scaling, agility, fast automation, etc, especially if the teams involved with the project do not have the cloud skills.

[The evolution of business and digital transformation](#) adds new pressures on Security and Compliance leaders as there is an ever-changing threat landscape and regulators expecting more. Some of the tangible problems of Security and Compliance functions are covered in the next section.

## Compliance and Cloud: a Brief History

The cloud computing era is relatively young, having gotten its start in the mid-2000's. Since that time, adoption has been extremely swift, and the pace of migration and innovation has been much faster than the ability of regulators to keep up. As a result, many organizations have to comply with regulations and standards that were born years, if not decades, before the birth of cloud computing in the mid-2000s. Trying to adopt requirements and controls built in the 1980s and 1990s for 2020's environment is difficult for any organization.



This is made more complicated by the fact that some of those in charge of validating compliance — auditors — were educated and gained their experience before the public cloud was born. This sometimes means that their approaches and tools may be anchored in the pre-cloud era, and not be optimal for modern IT realities.

Next, prescriptive technology advice that is present in some standards and industry frameworks, such as PCI DSS, occasionally conflicts with cloud realities (what specifically does “use firewall for a DMZ” mean for a modern microservices based application? ). Some controls work differently; don’t apply at all; or have better cloud-native compensating alternatives within public cloud environments to meet the same risks and challenges. Note that this is true for both technical and process controls.

And then there is a question of speed. Public cloud technology develops at a rapid pace and leading cloud providers such as Google Cloud develop new features, new security controls, as well as new services on a monthly if not weekly basis. Contrast this to the rate of change of regulations. Some of them have not changed since the 1990s while others are on a multi-year change cycle, and these are the fast ones. For example, HIPAA relies on a lot of concepts from 1996, and FIPS 140-2 was last refreshed in 2002. However it is worth noting that writing a good regulation is hard, especially when you have to balance standards that can be measured (but can be outdated quickly) vs. principles to follow (that can create some degree of enforcement ambiguity).

Finally, this again raises the topic of security and its relationship with compliance. Cloud computing has a potential of making this question even more painful, because of situations where old style controls are being pushed in modern environments, for compliance sake alone. It is not difficult to imagine a situation where applying old compliance ideas to new environments will actually reduce security. This applies to technical controls that are misused and processes that don’t fit leading to reduced productivity, business benefits, and - sometimes - increased risk.

Regulations may not necessarily be about security and cyber crime, but they often affect security controls such as encryption, key management, and access control. In the early days of compliance and cloud, many organizations tried many naive approaches to compliance in the cloud. For example, years ago, one organization stated that their cloud is suitable for payment payloads for as long as clients don’t actually keep any card numbers in their cloud systems.

Today, business necessitates cloud agility, a high degree of security, and full regulatory support. This requires compliance in the cloud to be modernized and done in a set of new ways, described in this document.

## Compliance in the cloud: requirements for a happy future

Migrating to the public cloud introduces several changes to the compliance function. It is true that compliance helps with security and creates a baseline of security controls. But the end goal for each discipline is quite different.



For more information visit [gcat.google.com](https://gcat.google.com)





However a key question is: Is your approach to compliance fit for the future? As more and more of an organization's intellectual property and critical assets shift to the cloud, this migration presents not a challenge, but an opportunity for innovative organizations. By applying continuous controls monitoring, management, and enforcement to compliance, these organizations are architecting for a future where adherence to rules and regulations also helps improve baseline security controls.

The compliance function is responsible for ensuring that the organization is compliant with regulatory requirements (and internal policies) and efficiently tracks and reports status. An astute security and compliance professional will see that security and compliance go hand in hand, and complement each other in areas where one may fall short. For example, a well-designed compliance mandate helps motivate organizations to improve their security baseline in the absence of immediate threat evidence. In this case, the compliance function leads to an establishment of a comprehensive baseline for an organization's security posture.

## Migrating from data centers to cloud -- what is the new normal for Cloud-based Architectures?

### 1. Shift to zero-trust and IAM as your “firewall”

One of the fundamental differences between public cloud and traditional datacenters is the fading of network based VLANs for segmentation leading to zero trust security models. Powerful identity and access (IAM) models of public cloud enable the deployment of applications and data with far greater protection than what is possible in traditional data centers. However, these IAM solutions are not without risk when used incorrectly, and the risk is very different (and sometimes greater) than old-world enterprise IAM in the new cloud native world. As sometimes configured, cloud services may be one IAM mistake away from a compromise or a data exposure. Hence moving away from traditional perimeters and IAM as the main line of defense are new normal for public cloud.

### 2. Microservices based architectures

Regardless if you call them microservices, micro-frontends “cloud native” is the current best paradigm for developing applications to take advantage of the latest trends in technology, including public clouds and containers. Using the cloud native approach is not just for new applications either, but as the foundation for new projects that are decomposing the large monolithic applications enterprises rely on. Traditional approaches to maintaining compliance via quarterly audits do not translate well to a cloud-native application deployment or the underlying dynamic infrastructure. They also don't work well for common cloud practices — think hourly code changes, but quarterly audits.

### 3. Fluid asset inventory

The traditional approach often depends on physically knowing where things are deployed, then relying on network security monitoring and perimeter access controls like VPNs to handle identification. In the world of clouds – even private clouds within a company's own datacenter – the exact location can be dynamic based on load. And with the number of cloud-native apps constantly growing, tracking who is calling what service is just not manually possible anymore. For example, a PCI QSA may ask for a network diagram, and then be unable to read one that does not have familiar server names and firewall rules between them. On the other hand, many security assertions are easier due to software defined infrastructure - you can be consistent with secure configuration and enforce secure configuration.



## Key Considerations for Modernizing Compliance in the Cloud

Modernization through cloud and compliance don't need to be at odds -- even when an organization uses services from multiple cloud providers. Here are some things to consider as you modernize your compliance function:

### 1. Work with the regulators and build confidence in the cloud

When moving to the cloud, meeting risk, legal and compliance requirements is non-negotiable. While regulatory bodies are catching up on updating their standards and requirements to be inclusive of cloud and cloud-native technologies, some requirements do not reflect these differences. However, a regulator will likely not accept a mere "N/A" answer for a control and more detailed explanation and analysis will be needed. Some of the areas where you would need to work closely with your regulator are data residency, business continuity and disaster recovery, and modernization of regulations

As a cloud provider, Google works closely with the regulators and industry bodies such as the PCI SSC (Payment Card Industry Security Standards Council) to make the standards and requirements more cloud-friendly and harmonized. With the PCI SSC, Google Cloud has been very active in the cloud task-force to educate the standards body about cloud-native technologies. As a result of our involvement we also championed the formation of Best Practices for Container Orchestration Special Interest Group. As you go through your audits, you should align with your auditor and regulator on expectations about running workloads in the cloud.

## Google Cloud's work with the regulators...

- 1 Educate on Cloud** - Directly and via coalitions we build with external allies, we help regulators understand cloud computing and how it meets, and in the case of Google Cloud, often exceeds their security, AI, compliance, interoperability and other expectations.
- 2 Support Customer's Regulator Engagement** - Provide background & context, collateral, policy expertise, and personnel support for our customers when they meet with regulators.
- 3 Address Regulation Impacting Cloud Services** - Monitor proposed legislation and regulation in key markets that could negatively impact cloud adoption in the financial services industry. We respond to regulators' information requests, provide line edits for legislative proposals, and work to mitigate problematic proposals.
- 4 Promote Policies Favorable to Cloud Adoption** - Develop and promote legislative and regulatory proposals that protect Google Cloud's global operations, infrastructure, and customers. We advocate for cloud adoption and procurement by promoting cloud security, hybrid and multi-cloud solutions, AI, and other key issues.
- 5 Partner with FinServ Regulators** - We develop strategic partnerships with key regulators to build trust, promote information sharing, and support Google Cloud and its FinServ customers.

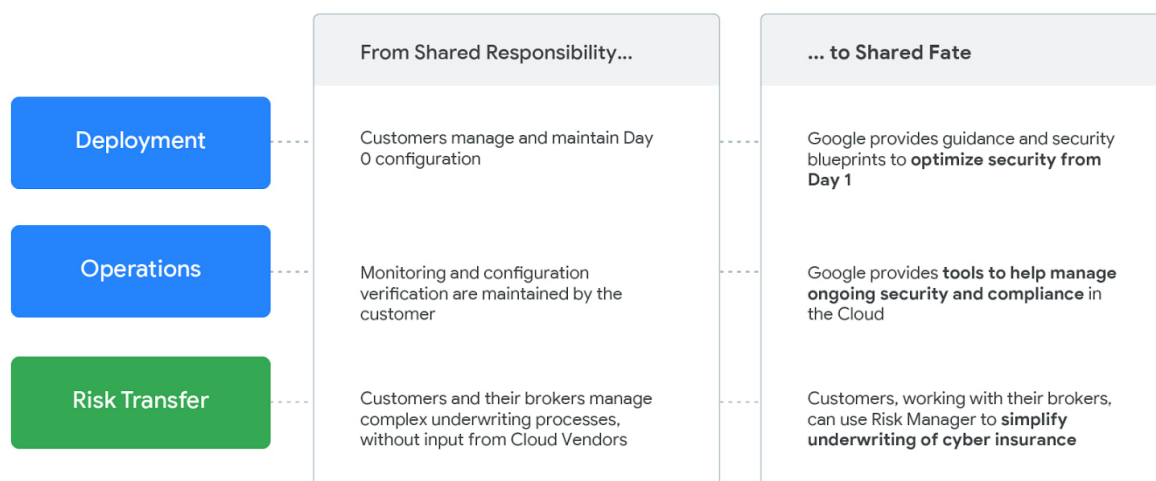




## 2. Ask more of your cloud provider regarding shared responsibilities for regulatory compliance

Realize that a compliant cloud services platform will not inherently make your workloads compliant. The myriad certifications that cloud providers can attest to are excellent and required foundations for compliant workloads. However, there is an important distinction between compliance of a cloud platform and how one must configure settings within cloud products and services for workloads to remain compliant. In order for you to meet your responsibility for regulatory requirements you need transparency from the cloud provider.

At Google Cloud, we are evolving from a Shared Responsibility to a Shared Fate model that goes beyond the existing cloud security model, and directly helps customers not only reduce risk, but build a more comprehensive and efficient risk management program.



We are doing this because we know that better risk management will, in turn, accelerate your digital transformation. We believe that it's our responsibility to be active partners as our customers deploy securely on our platform, not delineators of where our responsibility ends. We stand with you from day one, helping you implement best practices for safely migrating to and operating in our Trusted Cloud.

## 3. Understand the differences in the frameworks that impact your business

As you embark on your cloud journey, it is critical to understand the framework, its goal, and knowledge on how the controls get assessed. This will give you an understanding about what controls you inherit from your Google Cloud and what you have to configure or even build on your own. For example, there are frameworks that end in a certification or attestation (e.g., PCI DSS and FedRAMP). When an organization is being assessed for such a framework on cloud, you can expect a customer responsibility matrix from the cloud provider. Such a matrix will have controls that are joint or marked “both”, and they typically require additional analysis.

The differences are even more dramatic for some regional regulations. [Unified Compliance Framework \(UCF\)](#) lists about 800 authoritative documents affecting IT decisions. Many of them have been developed in environments that are very different from those of companies developing cloud computing.



#### 4. Have an Integrated Risk Management program

Organizations have relied on traditional Governance, Risk and Compliance (GRC) tools — with their modular and siloed approach — to address their risk management and reporting compliance posture. By becoming cloud-native, an increasing number of organizations are looking at the Integrated Risk Management (IRM) path. It's quite clear that customers want a scalable and dynamic way to define the scope of risk and audits, whether it's for the assets or the controls which reside on cloud. However, a mere name change from GRC to IRM is not enough. You need a risk management program that truly integrates processes such as:

- Definition of your harmonized list of control objectives, derived from all your compliance requirements and risk objectives
- Operationalization of these controls through security tools for your in-scope IT assets, vendors, and processes
- Continuous optimization and improvement of controls by looking for risk check-ins in the CI/CD itself.

#### 5. Gain visibility of cloud assets and gain visibility on risks

You can only protect what you know and what you can see. Your risk management function — and so compliance — is effective as long as it has visibility into the risks that your cloud assets carry. Naturally, we need reliable visibility into the assets themselves before we can see the risks. With the cloud, virtualized resources are your assets, including the micro-services and APIs -- these need to be accounted for in your asset inventory. For successfully implementing a Risk Program for the cloud, read our [guide for Chief Risk Officers, Chief Compliance Officers and Head of Internal Audit](#)

The first step in gaining visibility of your assets is labeling and grouping them. Because of the dynamic and ephemeral nature of cloud-native infrastructure, it is extremely important to group application assets together as best as possible, and consistent labeling and structure in the resource hierarchy in Google Cloud organization. Defining the strategy and specific taxonomy for the labels that will be applied, requires the involvement of any existing security and compliance organizations within the company. They will provide insight into how things are currently tracked and categorized, and will be a solid checkpoint to ensure the new cloud labeling will go beyond the basic needs of the DevOps and SRE teams



# How to modernize compliance in the cloud

It is very clear that the modern security function is all about using the digital tools to proactively identify, block, predict, monitor and recover from bad behavior and bad actors. However, managing security well doesn't mean managing compliance well.

One of the biggest challenges a security and compliance decision maker faces is complying with a multitude of standards that are catching up with cloud-native language. There was a time when complying to one of the ISO standards was considered more than sufficient, but, is that enough today? For many large and compliance organizations, you need to be compliant to various regulations, frameworks and standards like HIPAA, Sarbanes-Oxley (SOX), ISO 27001, NIST CSF, FedRAMP, PCI DSS and the list goes on and on. There are also regional requirements, enforced by other countries or even US states. The organizations are also under constant pressure to modernize their overall IT footprint and adapt their business to an ever-changing world.

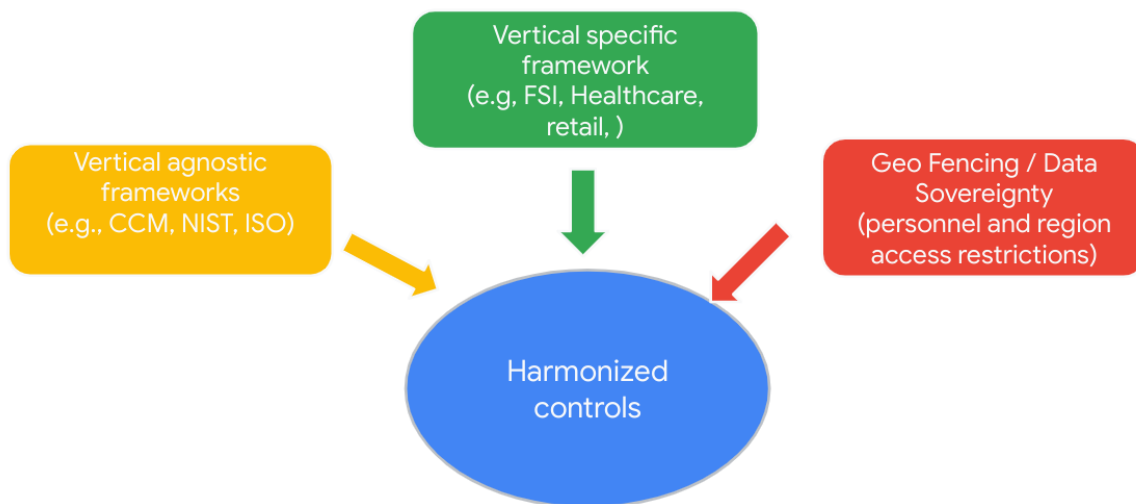
So the question really is -- how to get started? How to modernize the compliance function and at the same time continue to meet the compliance requirements. What role does the cloud play in this modernization? The answer is not just about upgrading your tools and technology but it also involves a shift in culture and processes.

One of the first steps towards modernization an organization can take is to harmonize their security controls. Control Harmonization is less talked about when it comes to modernizing security or making it more cloud-native, but it is imperative for compliance in the cloud. People tend to directly jump into tools and technologies that they can adopt to make their security controls more cloud-native vs. taking a holistic approach that involves people, processes, and technology.

## 1. Harmonize and rationalize controls within different frameworks

"Control Harmonization" is an activity that upgrades your technology stack, people and processes in which compliance experts from the organization look into various standards and security controls that need to be implemented within the organization. Requirements from each standard are interpreted clause by clause and a comprehensive list of controls is defined which should be implemented to meet the requirements. The idea is to come up with a set of common requirements and controls (often termed as generic controls or baseline) which can be implemented and would help meet the majority (70-80%) of the compliance requirements that an organization has to meet. By doing so, you have defined and implemented a common set of controls which makes you compliant to standards like FedRAMP, PCI DSS, NIST CSF, ISO 27001 etc. This newly defined control set is termed as "harmonized control" and the overall process is "control harmonization". There are even industry projects like [Unified Compliance Framework \(UCF\)](#) that help solve this problem by mapping hundreds of regulations to harmonized controls ([example](#)).





There are several benefits to controls harmonization such as

- Improved compliance posture that is cost effective, helps with faster decision making, and provides transparency into the risk that your assets carry
- Well-defined controls that are harmonized across multiple standards allowing you to control once and comply multiple times
- Streamlined controls make it easy to change or remove them
- Provides an extensible framework for introduction of a new standard or a regulation rather than individually chasing them

Control harmonization can be readily applied to several control families like Risk Management, Incident Management, Business Continuity Management, and Asset Management. Once you have achieved an internal control harmonization, the next step is to review your security controls and map them out to your cloud providers' security controls. Easy enough, right? With the ever expanding list of regulations and compliance requirements, this mapping exercise is much easier to describe than to implement in practice. For this reason, Google Cloud is hard at work addressing the management, drift, and enforcement of technical controls in customer cloud environments. We recognize that a compliant cloud platform does not necessarily equate to a compliant workload. The gap between compliant clouds and compliant workloads is the root cause of many delayed or unsuccessful cloud migrations. Look for more updates in the coming months on how we intend to help bridge this gap.

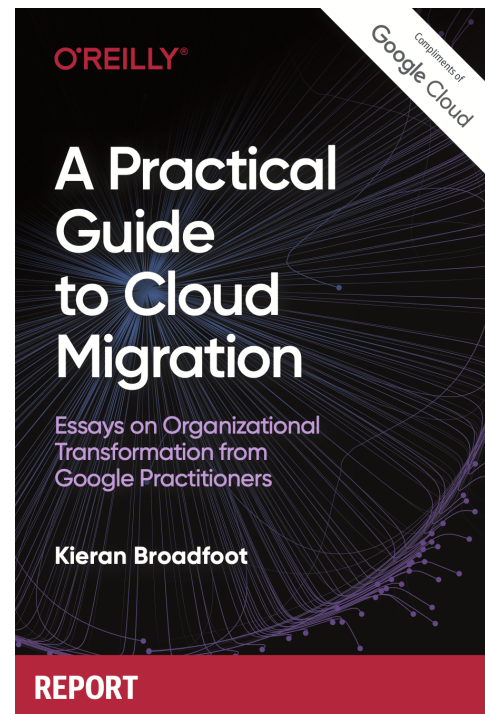


## 2. Shift the mindset and the culture

Any modernization effort is incomplete without touching the people and organization aspect. As we start speaking to security and compliance decision makers and their teams, we frequently get asked questions on how to build a culture around security (and compliance) around the entire organization

The shift in the culture is a make-or-break component of the modernization effort. A security-first development culture starts with leveling cloud-native and security skills across your development and security and compliance teams. Many security (and compliance) issues arise when developers author code without the proper guidance and without pipelines designed to ensure secure best practices are enforced. Understanding that security (and compliance) is a niche area, you must anticipate investing in training programs for secure coding practices for each of your development teams. In order to effectively shift left, we recommend organizations create a “security and compliance champions program” with tangible incentives and having shared KPIs (Key Performance Indicators) between developers and security (and compliance) teams. Security Champions are developers who have a direct impact on the resiliency and security of your applications. They are enthusiastic volunteers willing to participate in advanced software security training to perform an important role. Since Security Champions come from within the development organization, they have the right relationships to better assist developers, testers, and architects in accomplishing their goals and leading to a shift in mindset and culture towards adopting security earlier in the application development.

However you look at it, **modernizing compliance requires culture change** — in auditors, developers, IT managers and of course IT leaders such as CISOs. “[Practical Guide to Cloud Migration](#)” book reminds us that every successful cloud migration is about a culture change and compliance does not change that. Sure, deploy new tools, adopt novel practices but ultimately success is dependent on the culture change. Thus, invest resources in adjusting the organization culture change and seek to educate your regulators in the ways of the cloud.



### 3. Use the right tools - what can Google Cloud offer:

Along with the mindset and the culture shift, the right set of tools is key for a meaningful modernization. We offer a set of Google Cloud's security solutions and products that can help you with your own security and compliance with a modern twist.

The tools mentioned below helps you answer following questions:

1. How to set up a regulated workload?
2. How to evidence controls on Google Cloud
3. How to maintain compliance on an ongoing basis
4. How to shift left
5. How to automate controls



#### Continuous Compliance

Day N: Drift detection | Risk Manager and Cyber Insurance



#### Evidence Management

Day 2: Assured Workloads | SCC+



#### Set up a regulated workload

Day 0 and 1: Blueprints and Landing Zones | Assured Workloads | Key Management | VPC-SC

#### Harmonized Controls



#### Google's built-in infrastructure security

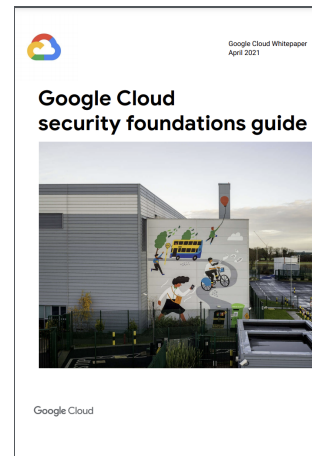
Strong trusted foundations: Titan | Default encryption | Self-built stack | Shielded VMs |  
Shielded GKE Nodes | Confidential Computing





### 3.1 Setting up regulated workloads - Day 0 and Day 1 assets

The catalog of Google Cloud offerings continues to grow rapidly. Each Google Cloud service exposes a wide range of configurations and controls so that you can customize it to match your business and security needs. In creating and setting-up your core infrastructure, our goal is to get you started faster and more securely by encoding key Google Cloud security best practices by default in this opinionated [security foundations blueprint](#) and running [PCI DSS workloads on GKE](#). You can then build on top of a reliable, secured foundation and either optimize the controls or take advantage of additional service-specific security guidance from our posture blueprints. Our security blueprints encode key Google Cloud security controls such as resource hierarchy and deployment, VPC-SC, key management, logging, and detective controls.



In addition to blueprints, Assured Workloads lets you secure and configure sensitive workloads to support your compliance requirements. Integrating with Google Cloud's products and features, Assured Workloads brings you added control to where your data is located, enforce key management requirements, and receive premium support from a US person, in a US location, with 15-minute target SLOs for P1 cases, to help meet compliance requirements where US personnel access requirements are needed. (requires additional support services purchase).

### 3.2 Gain centralized visibility and control through Security Command Center

The Security Command Center lets you understand the number of projects you have in your Google Cloud organization, what resources are deployed, and manage which service accounts have been added or removed. It also allows you for evidence management of specific controls on the resources via Security Health Analytics.

### 3.3 Maintain compliance and enable risk transference

The [Risk Protection Program](#) helps Google Cloud customers reduce security risk and connect with our insurer partners, Allianz Global Corporate & Specialty (AGCS) and Munich Re, who designed a specialized cyber insurance policy exclusively for Google Cloud customers, called Cloud Protection +.

We worked closely with AGCS and Munich Re to co-design the Risk Protection Program to ensure we could bring a differentiated risk management solution to Google Cloud customers to reduce risk, potentially reduce costs, and build further trust in our platform.



### 3.4 Shift left for regulatory compliance requirements

Traditionally, we tend to think of compliance as reactive or as something that is accomplished shortly before products are delivered to end users. You wait until your application is written, then identify and address compliance issues. A much better approach to compliance is to move everything to the left by integrating compliance planning and procedures directly into the software development lifecycle. That's what shift-left compliance is all about. Security controls should be implemented closer to the data, business logic, and much earlier in the development process.

IaC (infrastructure as code) and PaC (policy as code) is the impetus for organizations to move cloud security and compliance from being reactive (at runtime) to being preventative (during development). The key is integrating the right controls with the proper guidance directly into the CI/CD pipeline. [This paper from Google Cloud](#) discusses how to improve security of continuous integration and continuous delivery (CI/CD) pipelines by introducing best practices for source code, build and packaging infrastructure, software artifacts, artifact storage and serving infrastructure, and artifact deployment.

### 3.5 Tying it all together — add automation to your compliance program

Automate your compliance program wherever technical controls are implemented or verified. Specifically, verifying security controls manually can be difficult, costly and error-prone, and it can involve seemingly endless paper assessments and verifications. Using an end-to-end combination of IaC for Day 0 configuration, and Google Cloud's alerting, monitoring, and risk management tools (SCC and Risk Manager) lets you use code to run and monitor your compliance program, or at least the technical elements of it. You won't get stuck in an endless cycle of compliance assessments, but instead get alerts in real-time when you slip out of compliance for certain controls. And cloud-native tooling can revert any noncompliant changes to return your environment to its previous, compliant state. Finally, do remember that many mandates have the offline, people and (non-technical) process elements and they likely won't be automated for the foreseeable future.

## Conclusion

As we mentioned at the outset of this paper, migrating your organizations' IT assets to the cloud represents both a challenge and an opportunity for you to modernize your risk and compliance programs. Take advantage of the opportunity by focusing on the key considerations and recommendations detailed in the body of this paper above.

1. Harmonize and rationalize your controls
2. Shift your mindset and culture to adopt cloud-native practices
3. Use the tools that Google Cloud provides to augment periodic audits and create a continuous monitoring environment.

Remember that **an intelligence-driven risk & compliance program is an essential element of a successful cloud transformation journey**. The regulatory environment will only scale in breadth and complexity in the years to come. This means that your program should have strong executive sponsorship in the C-suite (CISO, CIO, CRO, etc), a well-defined mission and strong investment in automation and continuous monitoring. Invest in this way, and your risk & compliance program will not only remove governance roadblocks but may also help accelerate your cloud transformation.

