Continuous Auditing in Cloud

37 WCARS

14 – 15 September 2016 – Gold Coast, Australia

Continuous Auditing in Cloud

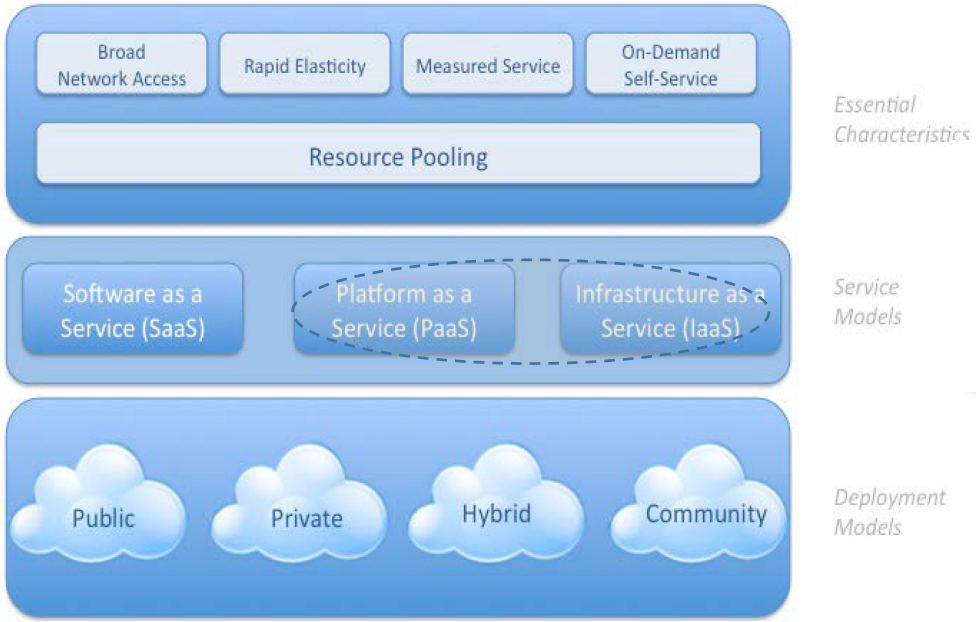


Figure 1—NIST Visual Model of Cloud Computing Definition[2]

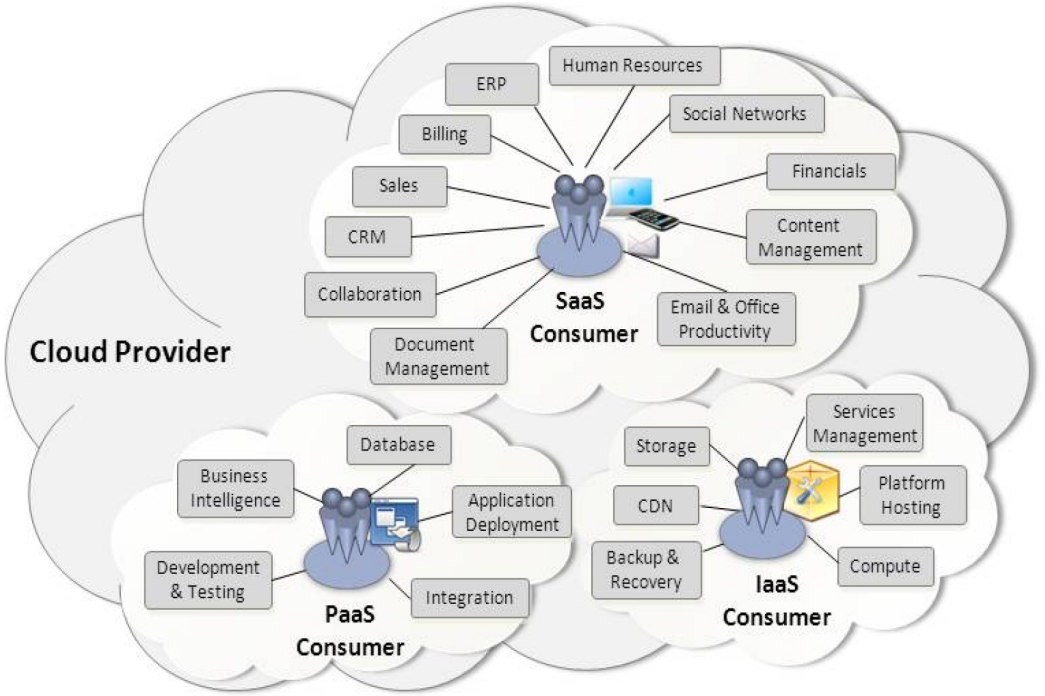


Figure 4: Example of Services Available to a Cloud Consumer (NIST SP 500-292)

Cloud computing, is "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."
National Institute of Standards and Technology (NIST)

Cloud Characteristic	Potential Audit concern
On Demand Self Service	• User driven versus IT driven • Shadow IT • Cloud Services discovery
Broad Network Access	• Enhanced threat profile, attack surface • Perimeter definition
Resource Pooling	• Multi-tenancy • Co-mingling of data and assets
Rapid Elasticity	• VM Sprawl- uncontrolled scale up • Data Remanance
Measured Service	• Proliferation of cloud services due to initial low opex

Cloud Risks

Cloud Risks

Policy & Organisational Risk	• Provider Lock in • Loss of Governance • Compliance Risk • Provider Exit
Technical Risks	• Consolidation of IT Infrastructure – single point of failure • Control over technical risk shifting to provider • Insecure or incomplete data deletion • Lack of Portabilty
Virtualisation Risks	• Guest Escape – Break out of OS – Access by Hypervisor or other guests • Sprawl – Loss of control over image store • Multitenancy
Legal Risks	• Data Protection
Non Cloud Specific Risks	• Natural disasters • Unauthorised facility access

Shared Responsibility model in cloud

SERVICE OWNER	SaaS	PaaS	IaaS
Data	Joint	Tenant	Tenant
Application	Joint	Joint	Tenant
Compute	Provider	Joint	Tenant
Storage	Provider	Provider	Joint
Network	Provider	Provider	Joint
Physical	Provider	Provider	Provider

© - Cloud Security Alliance

Figure 1: The AWS Shared Responsibility Model

Complexities in Security Controls

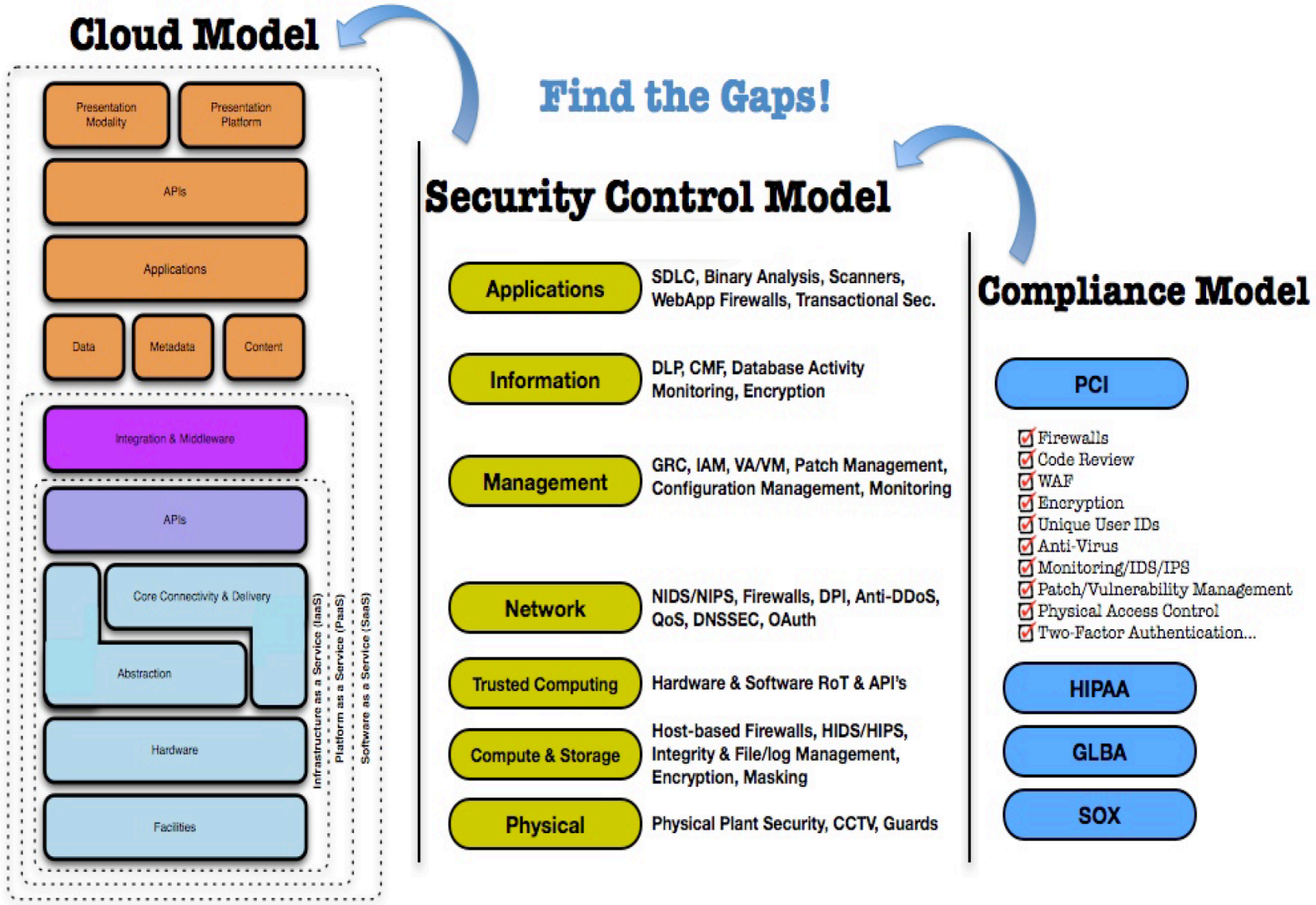


Figure 5—Mapping the Cloud Model to the Security Control & Compliance

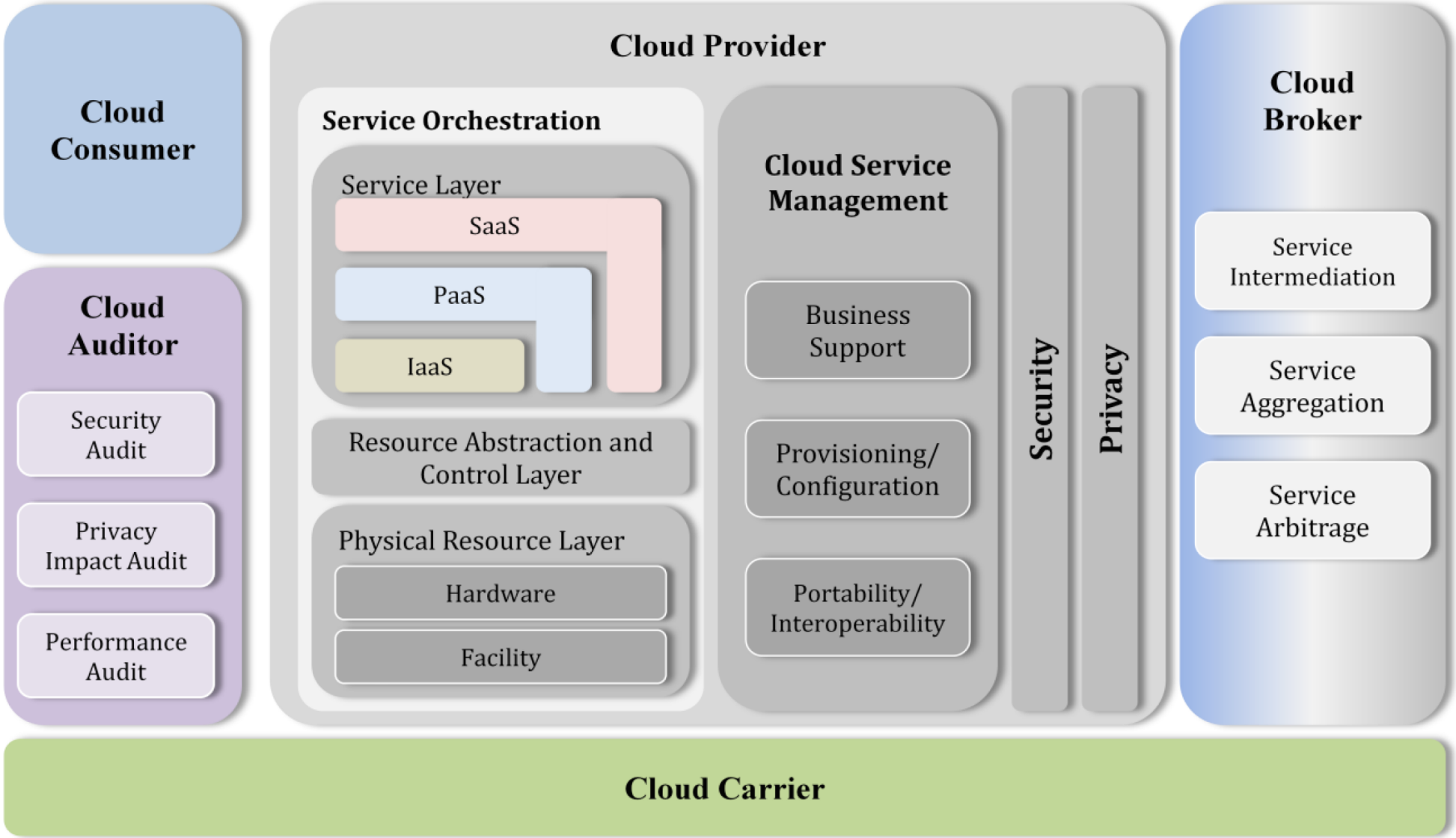


Figure 1: The Conceptual Reference Model

Assurance

ISACA defines an assurance initiative as an
"objective ***examination of evidence*** for the purpose of providing an assessment on risk management, control or governance processes for the organization."[2]

With shared resourcing, multitenancy and geolocation in mind, cloud computing requires an ***entirely new approach to providing assurance***.

Assurance needs to become more real-time, continuous and process-oriented vs. transactional in focus, while CSPs need to provide greater transparency to their clients regarding the movement of the clients' data.

Cloud computing requires ***continuous monitoring of compliance***

CONTROLS AND ASSURANCE IN THE CLOUD: Using COBIT 5

Assurance Frameworks

- **Technology Neutral** widely accepted frameworks customizable for the cloud (i.e., COBIT, ISO 2700x)
- **Cloud Specific** (i.e., CSA Cloud Control Matrix, Jericho Forum¨ Self-Assessment Scheme, NIST)

Existing Std. & Framework Adequate	Supplement existing Std.	New Standards and Framework

Jungwoo Ryoo, Syed Rizvi, William Aiken, John Kissell

- Auditing has made great strides in the past decade, but it has not seemingly kept pace with the real-time economy. ***Some auditing approaches and techniques that were valuable in the past now appear outdated.*** Also, the auditing evolution has reached a critical juncture whereby auditors may either lead in promoting and adopting the future audit or continue to adhere to the more traditional paradigm in some manner. Future audit approaches would likely require auditors, regulators, and standards setters to make significant adjustments.

Auditor Skills

According to Ryoo et al. (2015), “An audit’s quality depends heavily on the auditor’s cloud computing experience and knowledge” (para. 41). This audit experience could cause a major problem if an auditor is more familiar with in-house systems as opposed to constantly evolving cloud systems.

These secure services needs create greater demand for
more quality auditors, and as systems grow with the advent of multi-vendor systems,
there will be a need for audit standardization of cloud-computing services.

Cloud Security framework and audit methods 36922 - SANS 2015

More than half of CAEs (57 percent) are not convinced that their teams have the skills and expertise needed to deliver on stakeholders’ current expectations—let alone future demands. If Internal Audit can’t fulfill stakeholder expectations, how can it exert influence
and have an impact on the organization?

deloitte-audit-executive-survey-2016

Continuous Audit

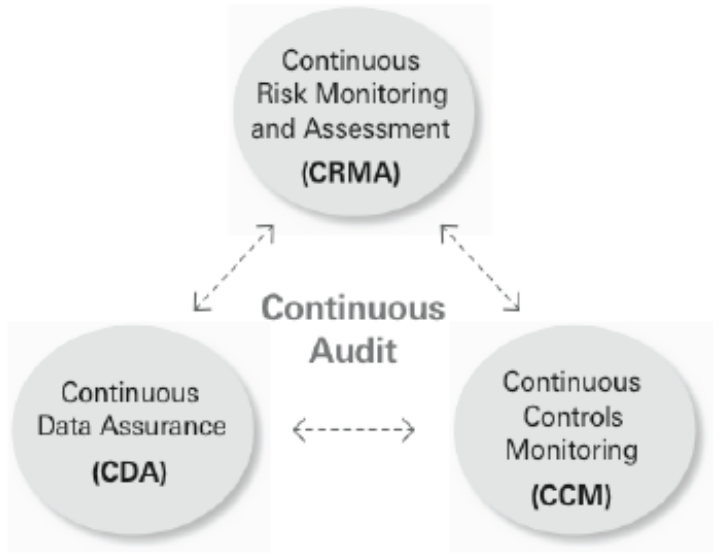
A continuous audit is a methodology that enables independent auditors to provide written assurance on a subject matter, for which an entity's management is responsible, using a series of auditors' reports issued virtually simultaneously with, or a short period of time after, the occurrence of events underlying the subject matter (CICA/AICPA, 1999).

Continuous assurance for now economy Prof Miklos Vasarhelyi et al

Continuous Assurance Components

Continuous controls monitoring (CCM) - consists of a set of procedures used for monitoring the functionality of internal controls
Continuous data assurance (CDA) - verifies the integrity of data flowing through the information systems
Continuous Risk Monitoring and Assessment (CRMA) - used to dynamically measure risk and provide input for audit planning.

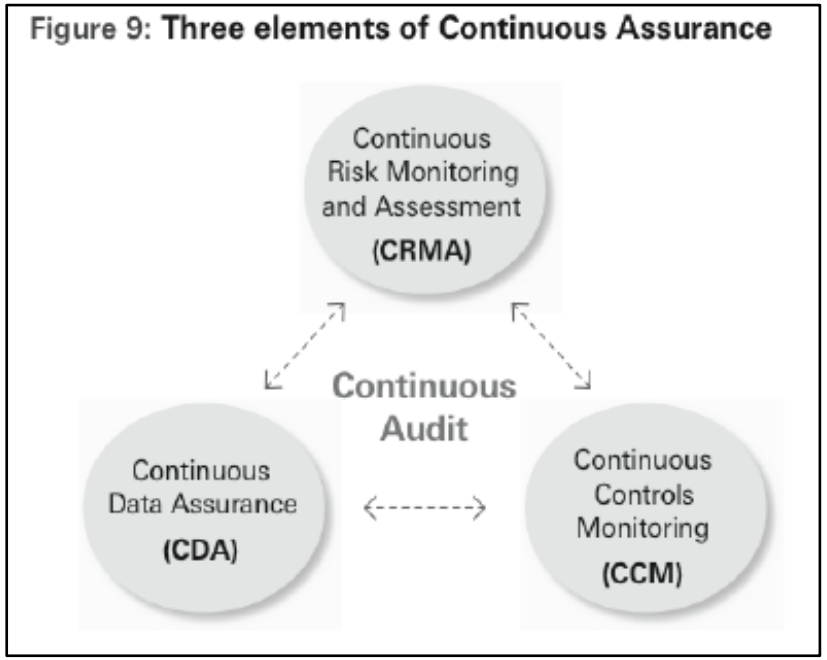
Figure 9: **Three elements of Continuous Assurance**



Examples of CCM include procedures for monitoring
Access control and authorisations
System configuration
Business process settings.
Examples of CDA include procedures for verifying
Master data
Transactions
Key process metrics using analytics (including continuity equations [CEs]).
CRMA includes processes that
Measure risk factors on a continuing basis
Integrate different risk scenarios into some quantitative framework
Provide inputs for audit planning.

Source : Prof Miklos Vasarheyli

Continuous Assurance opportunities



- Transaction verification
- Data analytics
- E-discovery – data dispersion

CSA Cloud Control Matrix

Provides fundamental security principles to guide cloud vendors and to assist cloud customers in assessing the overall security risk of a cloud provider

- What controls can be automated ?

What we are auditing

Operations

Compliance

ICFR

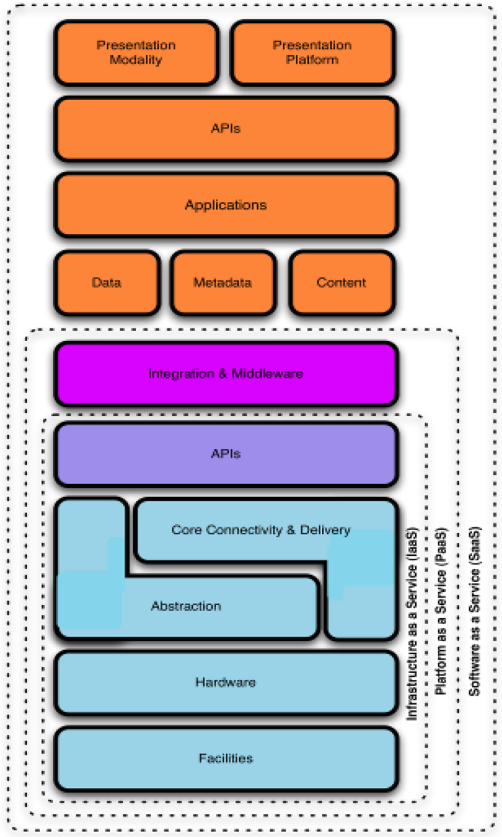
Information Systems

Which service model

SaaS

PaaS

IaaS



Which deployment model

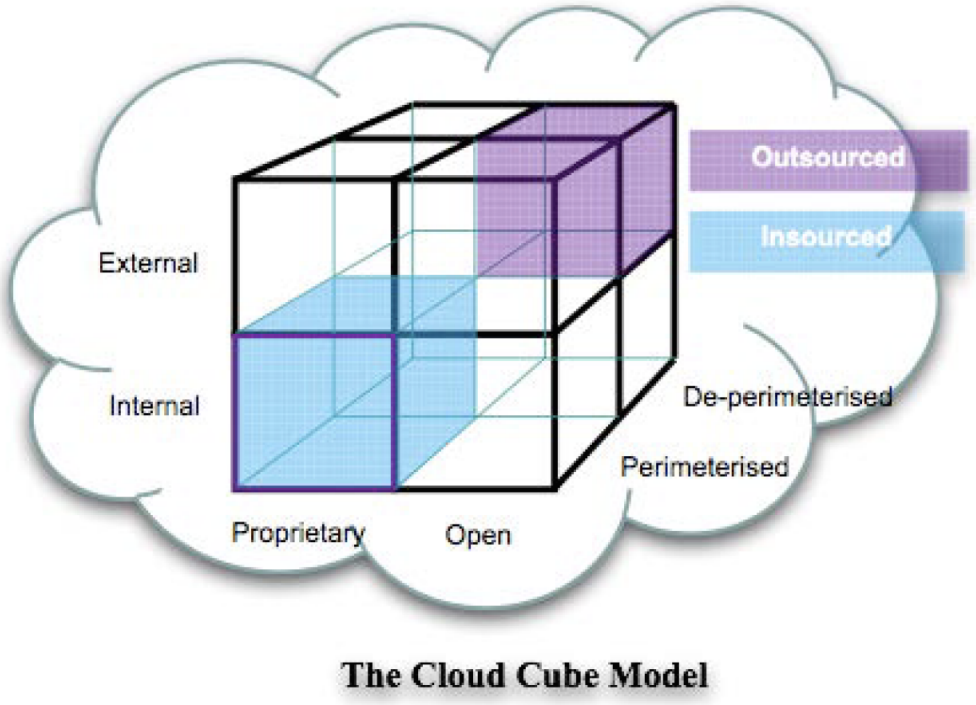


Figure 4—Jericho Cloud Cube Model

Public

Private

Hybrid

Community

Auditing SaaS

- Customisable reports
- Application Functionality Configuration options
- Application Security configuration options
  (aka ERP configurable controls)
- User driven data export /interface capabilities
- Limited or nil involvement in application development life cycle
- CAAT development is challenging

Auditing SaaS – Application Security

Monitor Setup Changes

The setup audit trail history tracks the recent setup changes that you and other administrators have made to your org. Audit history can be especially useful in orgs with multiple administrators.

Available in: both Salesforce Classic and Lightning Experience
Available in: **Contact Manager**, **Group**, **Professional**, **Enterprise**, **Performance**, **Unlimited**, **Developer**, and **Database.com** Editions

User Permissions Needed	
To view audit trail history:	"View Setup and Configuration"

To view the setup audit trail history, from Setup, enter `View Setup Audit Trail` in the `Quick Find` box, then select **View Setup Audit Trail**. To download your org's full setup history for the past 180 days, click the **Download** link.

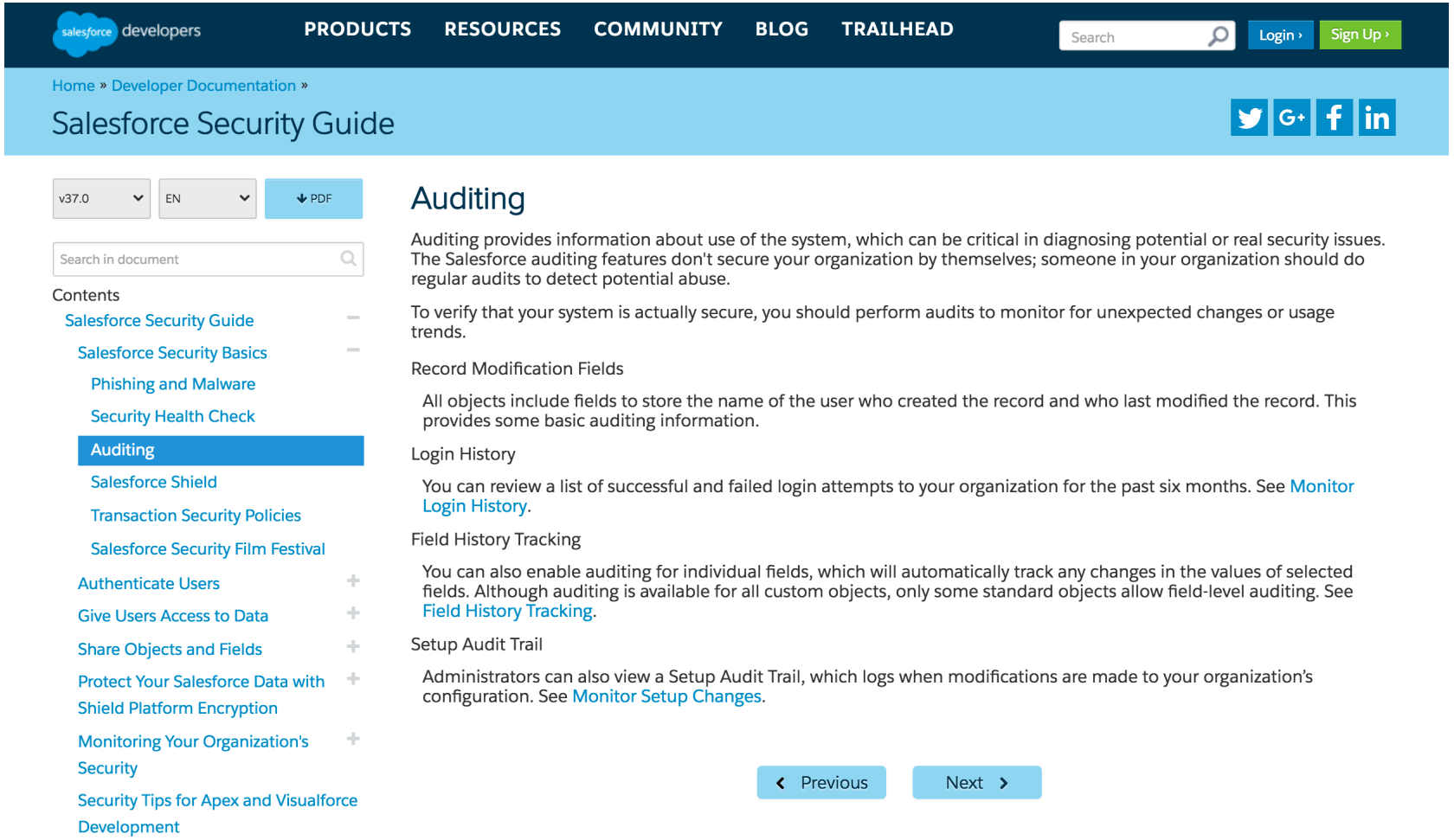
The setup audit trail history shows you the 20 most recent setup changes made to your org. It lists the date of the change, who made it, and what the change was. Additionally, if a delegate (such as an administrator or customer support representative) makes a setup change on behalf of an end-user, the Delegate User column shows the delegate's username. For example, if a user grants login access to an administrator and the administrator makes a setup change, the administrator's username is listed.

The setup audit trail history tracks the following types of changes:

Setup	Changes Tracked
Administration	• Company information, default settings such as language or locale, and company message changes • Multiple currency setup changes • User, portal user, role, permission set, and profile changes

Auditing SaaS – Application Security

- Logs for access controls, Transaction activity, Change management etc.
- Existence of myriad of logs
- Need automation to map controls to Key Risk Indicators - KRIs
- Opportunities to leverage cloud infrastructure - it is more cost effective and efficient to develop on demand , elastic audit databases, implement audit automation



Auditing IaaS & PaaS

Example : Continuous Monitoring services in AWS

AWS CloudTrail
AWS CloudTrail is a service that logs API activity within an AWS account and delivers these logs to an Amazon Simple Storage Service (Amazon S3) bucket.

Amazon CloudWatch
Alarms Amazon CloudWatch alarms notify users and applications when events related to AWS resources occur.

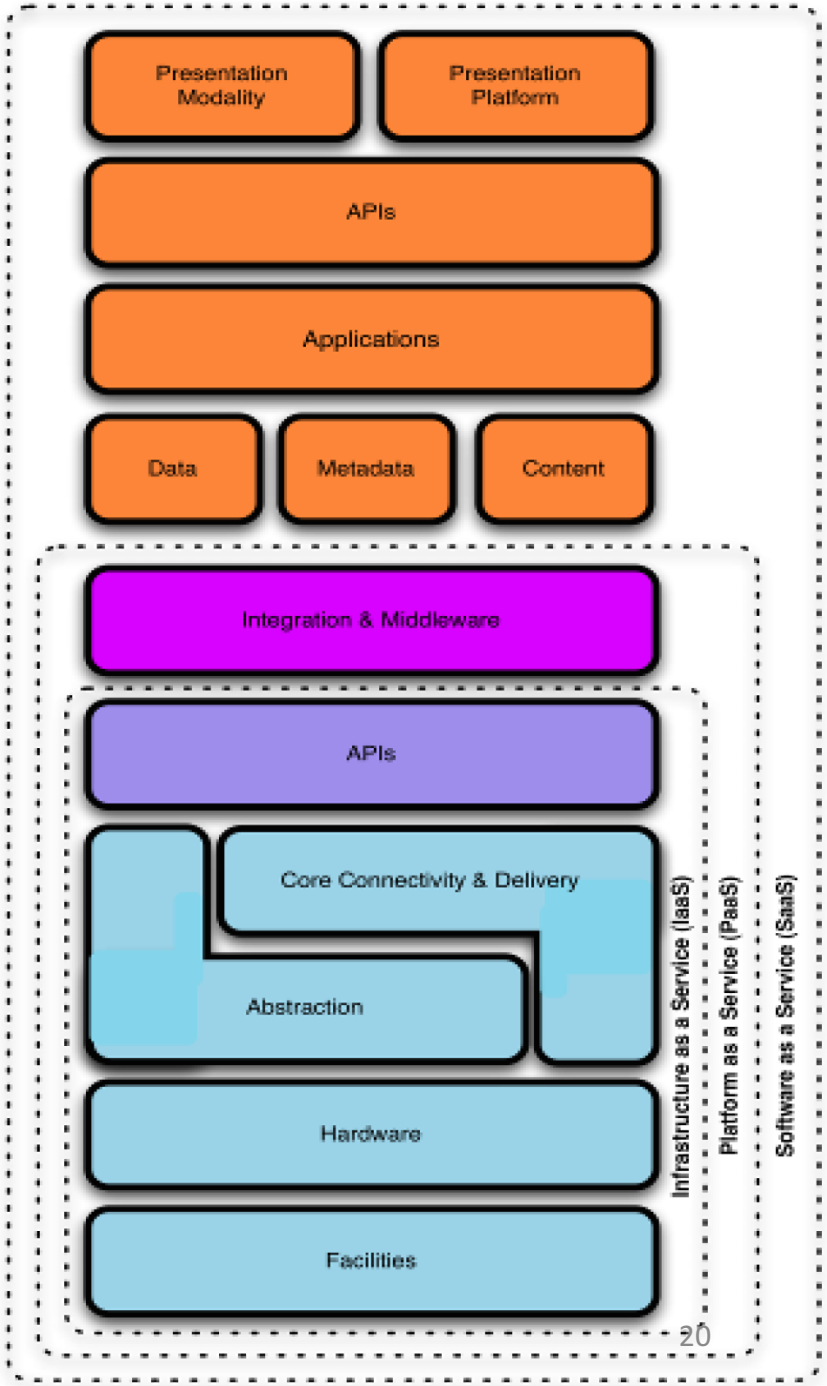
AWS Config AWS Config
AWS Config allows detailed tracking and notification whenever a resource in an AWS account is created, modified, or deleted.

Audit concerns

- Ensure PaaS Portability (open standard APIs)
- New approaches to auditing DevOps (DevOps Control Objectives)
- Audit Automation challenges

- Third party attestation SOC 1/ SOC2

- No physical access to data centre

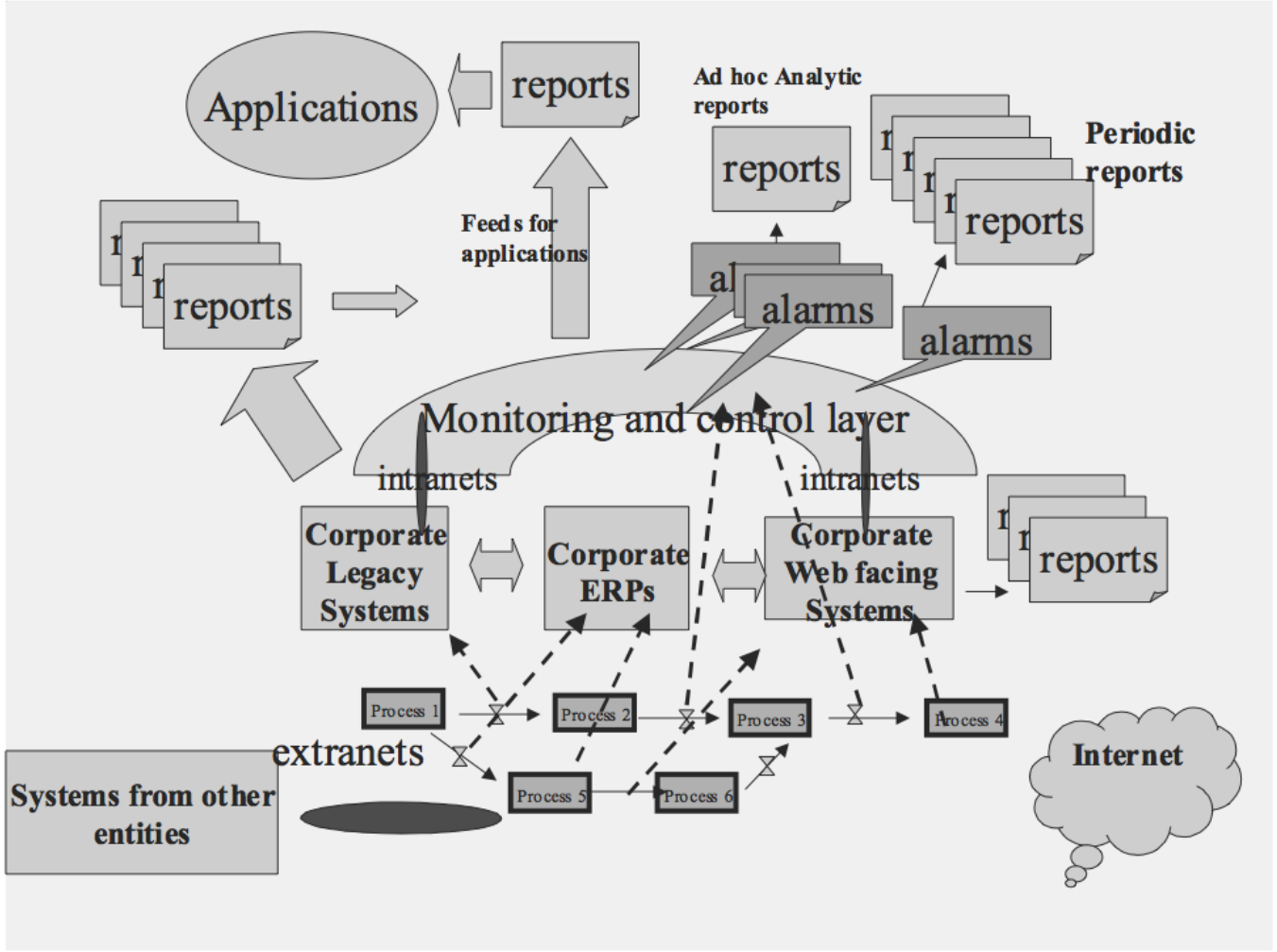


How can we leverage cloud platform to implement audit automation

Cloud provides unique opportunities for audit automation and audit analytics

- Ability to create VM instances on demand for analytics
- Measured service, low opex
- Rapid elasticity to address audit universe
- Ability to scale down
- Avoid slow data downloads
- Potential for "in memory" analysis
- Big Data - Hadoop/MapReduce

EXHIBIT 2
The Monitoring and Control (MC) Layer in Corporate System Architecture

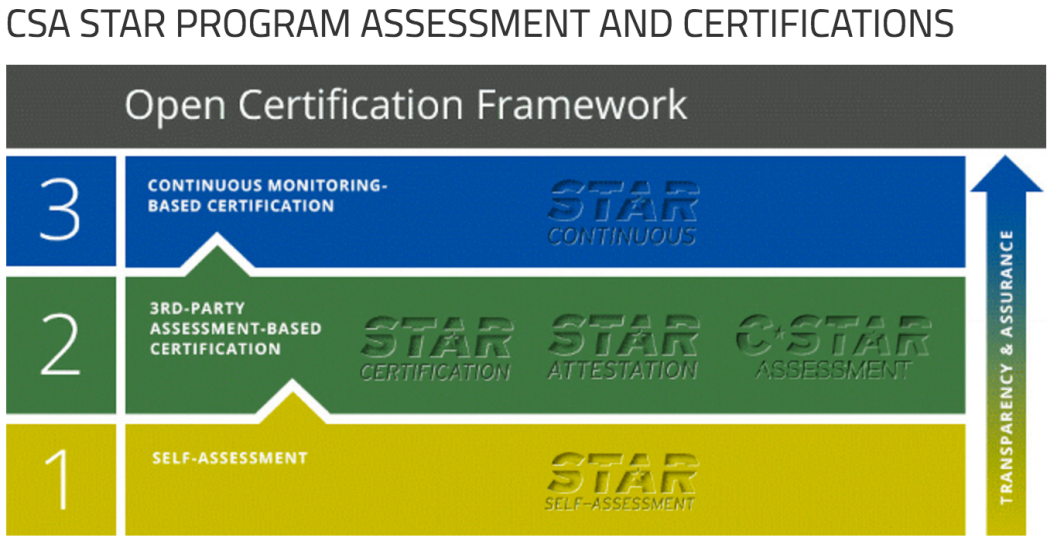


Source :Prof Miklos Vasarheyli

Cloud Security Alliance – Continuous Audit Initiative

CSA STAR Continuous will be based on a continuous auditing/assessment of relevant security properties.
It will built on the following CSA best practices/standards:

- Cloud Controls Matrix (CCM)
- Cloud Trust Protocol (CTP)
- CloudAudit (A6)

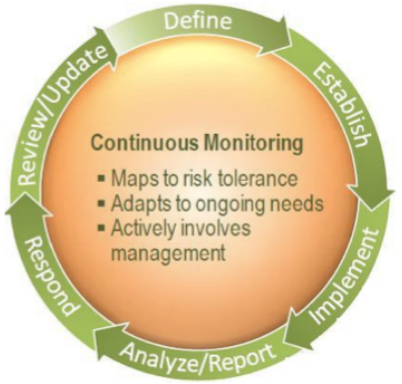


The CloudTrust Protocol (CTP) is the mechanism by which cloud service consumers (also known as "cloud users" or "cloud service owners") ask for and receive information about the elements of transparency as applied to cloud service providers. The primary purpose of the CTP and the elements of transparency is to generate evidence-based confidence that everything that is claimed to be happening in the cloud is indeed happening as described, …, and nothing else.

The goal of CloudAudit is to provide a common interface and namespace that allows enterprises who are interested in ***streamlining their audit processes*** (cloud or otherwise) as well as ***cloud computing providers to automate the Audit, Assertion, Assessment, and Assurance of their infrastructure (IaaS), platform (PaaS), and application (SaaS) environments*** and allow authorized consumers of their services to do likewise via an open, extensible and secure interface and methodology

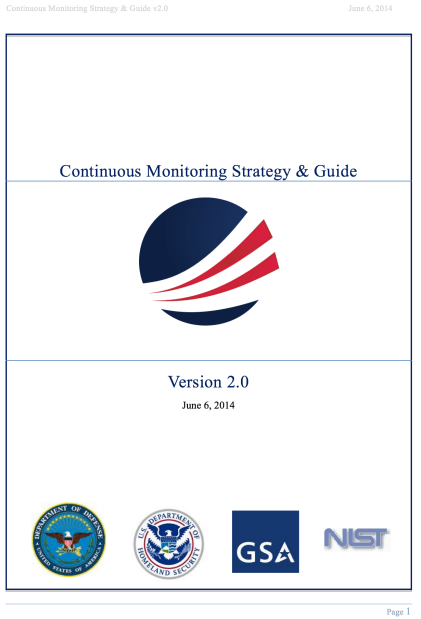
Source : Cloud Security Alliance

FedRAMP



Continuous monitoring is part of the risk management process of FedRAMP, and is a requirement for all CSPs to maintain an ATO. FedRAMP has chosen to implement continuous monitoring because it enables greater transparency into the CSP system and allows for timely risk-management decisions.

Continuous Monitoring Strategy Guide



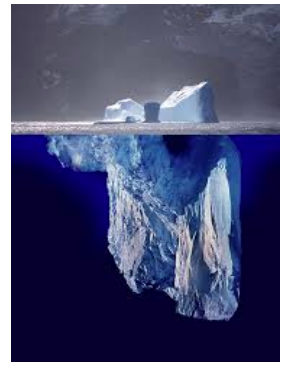
Information security continuous monitoring (ISCM) is defined as maintaining ongoing awareness of information security, vulnerabilities, and threats to support organizational risk management decisions.

Summary

- Cloud Computing has transformed business models, IT infrastructure ownership and operations models
- There is a growing awareness that assurance approach needs to change to address new risks and cloud models
- Cloud Security Alliance and cloud service providers have commenced initiatives / services in continuous auditing and monitoring of Cloud Security
- Cloud platform provides new opportunities to leverage cloud technology to automate Operational, Compliance and Financial auditing and use advanced audit analytics
- Auditor knowledge and experience in cloud computing are critical to quality of cloud audits

"There are known knowns" *(Donald Rumsfeld)*

"True wisdom is knowing what you don't know" *(Confucious)*



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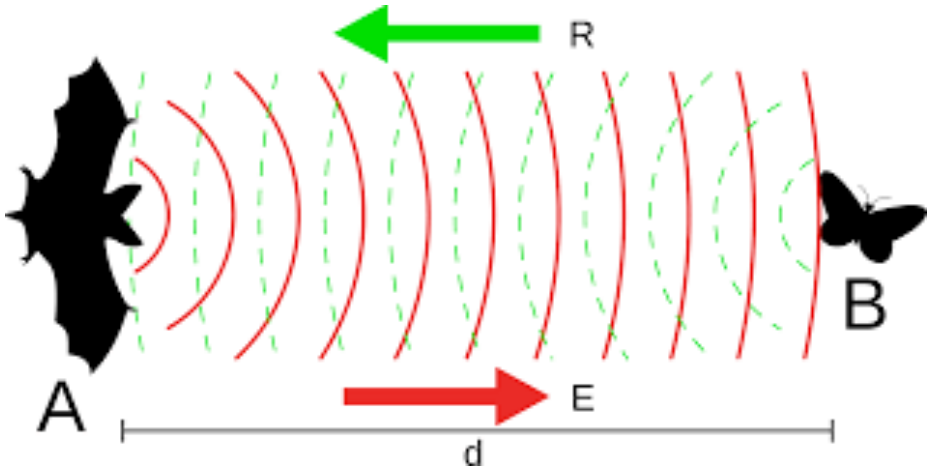

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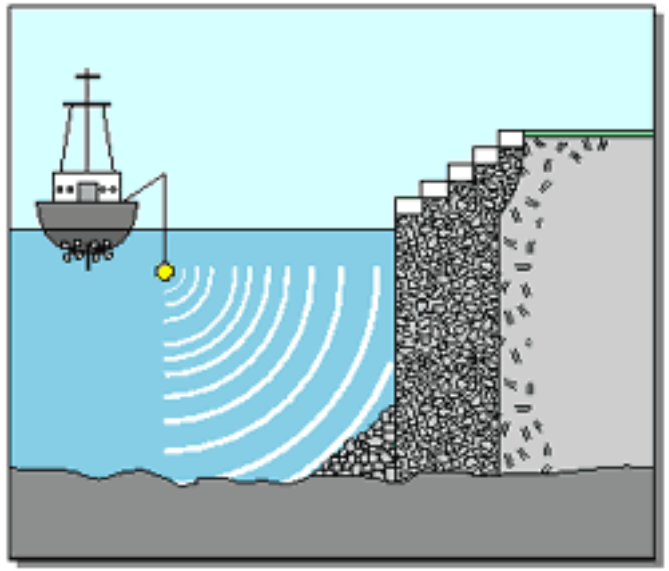

In 1960, Lewis Nixon invented the very first sonar listening device to detect icebergs.

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Thank You

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