

Curso de Especialização em Aprendizagem de Máquina em Inteligência Artificial

Disciplina: Computação em nuvem

Aula 03

Prof. Dr. Renato Manzan

27 de agosto de 2020



Entrega Parcial 01 – Data de Entrega: até 26/08/2020 – 18:00

Dado o processo de negócio de sua empresa ou cliente e seus sistemas computacionais críticos (que apoiam os processos de negócio críticos), elaborar um resumo de no máximo 2 páginas elencando os seguintes pontos:

- A. Possibilidade de uso de *Cloud Computing* ? Justificar.
- B. Que problema o uso de *Cloud Computing* poderia resolver ?
- C. Que modelo de serviço (IaaS, PaaS ou SaaS) adotaria para aplicar *Cloud Computing* no problema descrito no item B;
- D. Descrever 2 riscos;
- E. Descrever 2 benefícios.

Forma de entrega: enviar por email para manzan@uol.com.br até a data de entrega.

Observação importante: respeitar NDAs e informações sensíveis da empresas e/ou clientes. Caso necessário, descaracterize as informações.

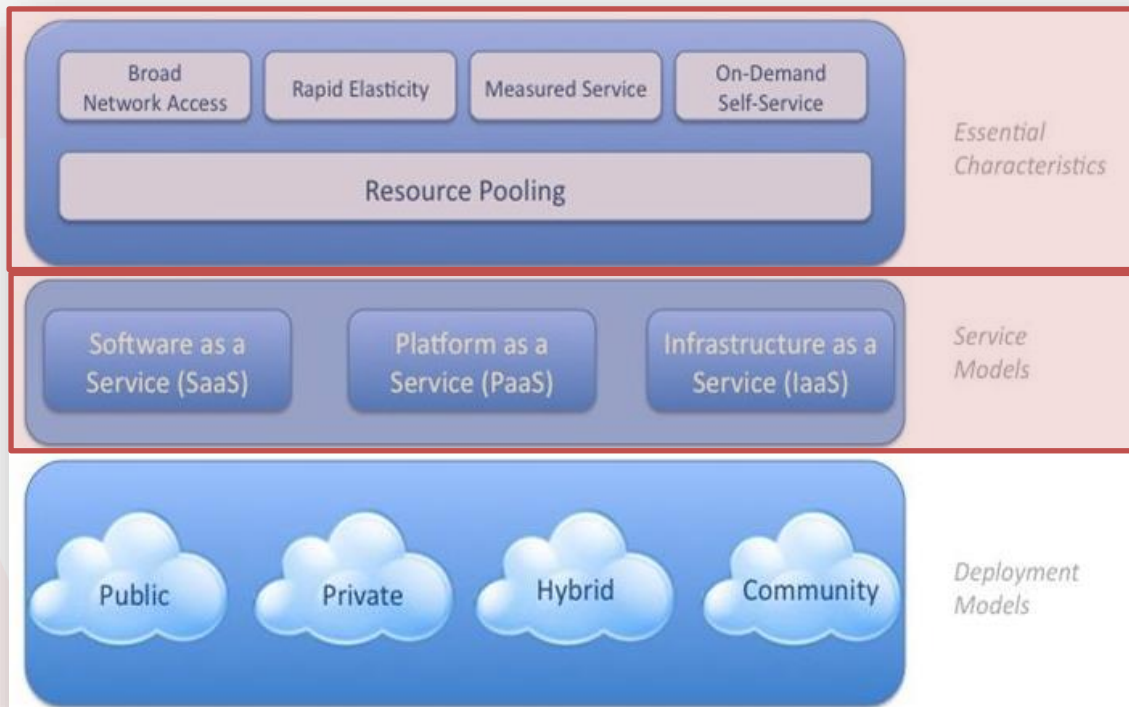
Debriefing da Entrega 01

- **Erick Munekata** - movimentação de grande volume de acessos, a indisponibilidade de serviços da web. Modelo de serviço PaaS.
- **Fernanda:** CRM – Módulo de Marketing (SaaS)
- **Marcos:** agilidade e elasticidade a infraestrutura necessária para implantação desse tipo de serviço, otimizando custos financeiros para empresa (IaaS)
- **Paulo Braga:** Agilidade no atendimento ao cliente em cenários de suporte para clientes e parceiros (IaaS)
- **Paulo Sergio:** Escalabilidade Horizontal e Vertical (IaaS, PaaS, SaaS). SRE (*Site Reliability Engineering*) para criação de ambiente monitorado.
- **Tarcizio:** Utilizar máquinas virtuais para efetuar testes de software (IaaS)
- **Wal:** migração de Apps para Cloud. *Right Sizing* (Elasticidade) - IaaS

Objetivos da aula

1. Apresentar modelos de deployment de *Cloud Computing* – Complementação das definições do NIST
2. Prover base conceitual de *Cloud Computing* por meio de Referência Arquitetural amplamente conhecida pela indústria e pela academia
3. Apresentar os principais padrões da indústria de *Cloud Computing*
4. Atividade para a próxima aula

Cloud Computing – Modelo conceitual do NIST



Fonte: Peter M. Mell and Timothy Grance. 2011. SP 800-145. the **NIST Definition of Cloud Computing**. Technical Report. NIST, Gaithersburg, MD, United States.

Modelos de *Deployment* – *Private Cloud*

*The cloud infrastructure is provisioned for exclusive use by a **single** organization comprising **multiple consumers** (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.*

Exemplos:

- *Itaú – CTMM ([Reportagem Exame – 13/03/2015](#))*
- *Nuvens privadas governamentais ([Azure Government](#))*

Modelos de *Deployment* – *Community cloud*

*The cloud infrastructure is provisioned for exclusive use by a specific **community of consumers from organizations that have shared concerns** (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.*

Exemplo:

- Sales Force ([Community Cloud Einstein](#))

Modelos de *Deployment* – *Public Cloud*

The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.

Principais exemplos:

- Amazon ([AWS](#))
- Google ([GCP](#))
- Microsoft ([Azure](#))

Modelos de *Deployment* – Hybrid Cloud

The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).

Principais exemplos:

- Amazon ([AWS Outposts](#))
- Google ([Ferramentas para Cloud híbrida](#))
- Microsoft ([Azure Stack](#))

Modelos de Deployment

Private x Community x Public x Hybrid



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Discussão em sala:

- *Quais são os business drivers/IT drivers que nos orientam na escolha do modelo de deployment ?*
- *Quais atributos devem ser avaliados para a escolha ?*

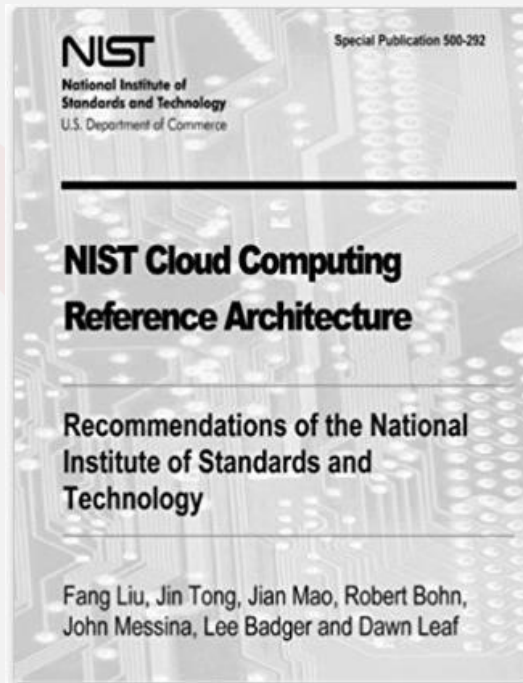
Modelos de Deployment

Comparison of Cloud Deployment Models

	Private	Community	Public	Hybrid
Scalability	Limited	Limited	Very high	Very high
Security	Most secure option	Very secure	Moderately secure	Very secure
Performance	Very good	Very good	Low to medium	Good
Reliability	Very high	Very high	Medium	Medium to high
Cost	High	Medium	Low	Medium

Fonte: John R. Vacca. 2017. *Cloud Computing Security: Foundations and Challenges*. CRC Press, USA.

NIST Cloud Computing Reference Architecture



Fonte: Fang Liu, Jin Tong, Jian Mao, Robert Bohn, John Messina, Lee Badger, and Dawn Leaf. 2012. *NIST Cloud Computing Reference Architecture: Recommendations of the National Institute of Standards and Technology (Special Publication 500-292)*. CreateSpace Independent Publishing Platform, , USA.

Relembrando a definição

“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”

Fonte: NIST (National Institute of Standards and Technology): <https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf>

Modelo de referência



Provides a blueprint of all the components and decisions that must be made to construct particular functionality or area of interest.

Utilidade:

- *Creating standards*
- *Education*
- *Improving communication*
- *Creating clear roles & responsibilities*
- *Allowing a comparison between different things*
- *Ensuring consistency and quality across the development and delivery process*

Fonte: Bohn, R. & Messina, John & Liu, Fang & Tong, Jin & Mao, Jian. (2011). NIST Cloud Computing Reference Architecture. 594-596. 10.1109/SERVICES.2011.105.

Modelo de referência – Objetivo

*Lead interested USG agencies and industry to define a **neutral** cloud computing reference architecture and taxonomy to extend the NIST cloud computing model to:*

- Use as a frame of reference to facilitate communication*
- Illustrate and understand **various cloud services in the context of an overall cloud computing model***
- use as a tool to communicate and analyze candidate security, interoperability, and portability candidate standards and **reference implementations***

Fonte: Bohn, R. & Messina, John & Liu, Fang & Tong, Jin & Mao, Jian. (2011). NIST Cloud Computing Reference Architecture. 594-596. 10.1109/SERVICES.2011.105.

Modelo de referência – Taxonomia

The science of categorization, or classification, of things based on a predetermined system.

Main Attributes:

- *Typically a controlled vocabulary with a hierarchical tree-like structure*
- *Terms in a taxonomy have relationships with other terms*
- *Usually in the form of a parent (broader) / child (narrower)*

Benefits:

- *Encompasses and labels all significant concepts within a given domain*
- *Allows users to understand the context of each label*

Fonte: Bohn, R. & Messina, John & Liu, Fang & Tong, Jin & Mao, Jian. (2011). NIST Cloud Computing Reference Architecture. 594-596. 10.1109/SERVICES.2011.105.


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graph LR
    CT((Cloud Taxonomy  
Level 1: Roles  
Level 2: Activities  
Level 3: Component  
Level 4: Sub Component))
    CT --- CSP[Cloud Service Provider]
    CT --- CSC[Cloud Service Consumer]
    CT --- CB[Cloud Broker]
    CT --- CA[Cloud Auditor]

    CSP --- SD[Service Deployment]
    SD --- PC[Private Cloud]
    SD --- CC[Community Cloud]
    SD --- PubC[Public Cloud]
    SD --- HC[Hybrid Cloud]

    CSP --- SO[Service Orchestration]
    SO --- SL[Service Layer]
    SO --- RACL[Resource Abstraction and Control Layer]
    SO --- PRL[Physical Resource Layer]

    CSP --- CSM[Cloud Services Management]
    CSM --- PI[Portability/Interoperability]
    PI --- DP[Data Portability]
    PI --- SI[Services Interoperability]
    PI --- SP[System Portability]
    CSM --- PCON[Provisioning/Configuration]
    PCON --- RP[Rapid Provisioning]
    PCON --- RC[Resource Change]
    PCON --- MR[Monitoring and Reporting]
    PCON --- M[Metering]
    PCON --- SLA[SLA Management]
    CSM --- BO[Business Operations]

    CSP --- S[Security]
    CSP --- P[Privacy]

    CSP --- CC[Cloud Carriers]
    CC --- CD[Cloud Distribution]
    CD --- ET[Electronic Transfer]
    CD --- PT[Physical Transfer]
    CC --- CA[Cloud Access]
    CA --- ME[Mobile Endpoints]
    CA --- FE[Fixed Endpoints]

    CSC --- SaaS[Software as a Service (SaaS)]
    CSC --- PaaS[Platform as a Service (PaaS)]
    CSC --- IaaS[Infrastructure as a Service (IaaS)]

    CB --- SC[Service Consumption]
    SC --- SI[Service Intermediation]
    CB --- SP[Service Provision]
    SP --- SA[Service Aggregation]
    SP --- SA2[Service Arbitrage]

    CA --- SAud[Security Audit]
    CA --- PIA[Privacy-Impact Audit]
    CA --- PA[Performance Audit]
  
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Modelo de referência – Taxonomia - Exemplo de leitura

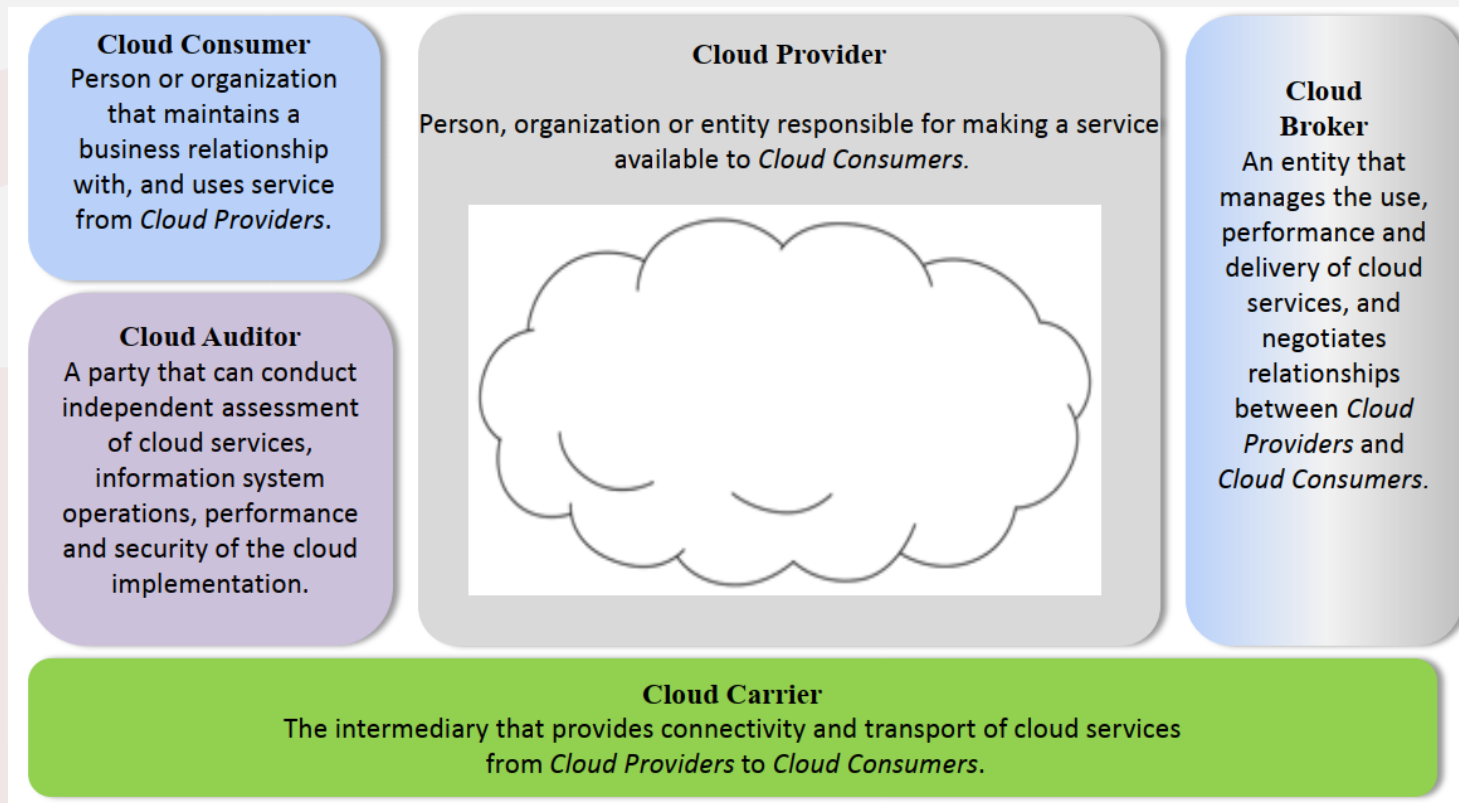
Level 1 - Cloud Service Provider – Person, organization or higher-level system responsible for making a *service* available to *service consumers*.

Level 2 - Cloud Service Management – Cloud Service Management includes all the service-related functions that are necessary for the management and operations of those services required by or proposed to customers.

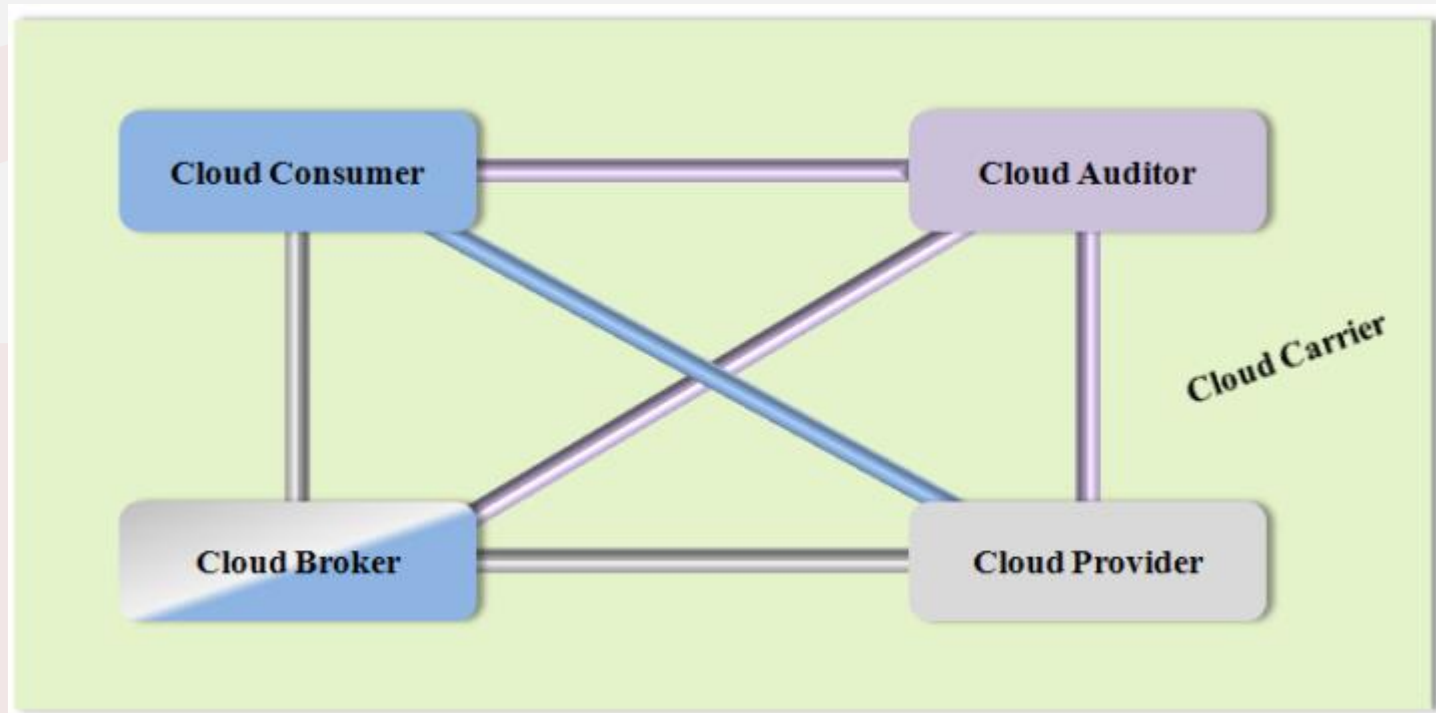
Level 3 - Public Cloud - The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services

Level 4 - Data Portability – The ability to transfer data from one system to another without being required to recreate or reenter data descriptions or to modify significantly the application being transported.

Modelo de referência – Atores e Papéis



Modelo de referência – Interação entre os atores

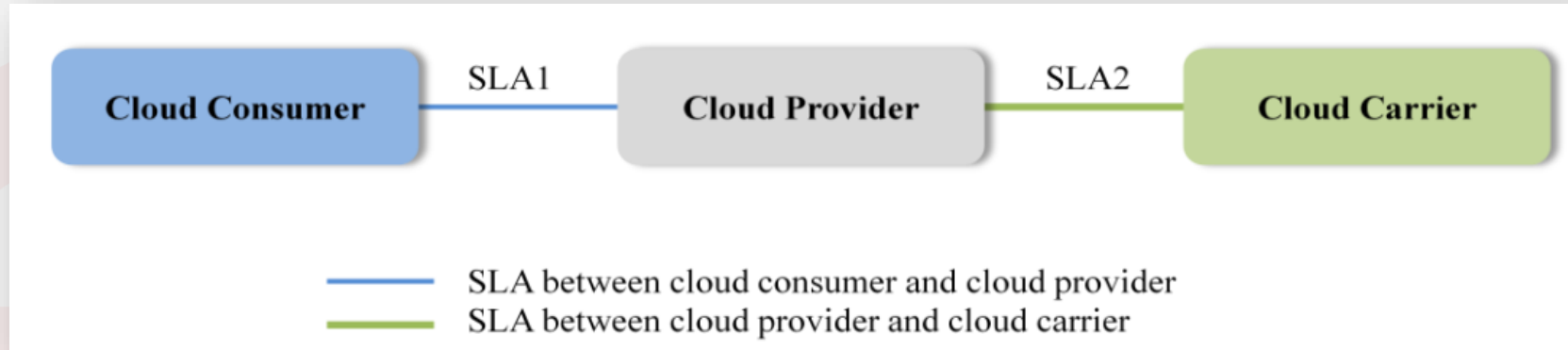


Exemplo de interação 1 - Cloud Brokers



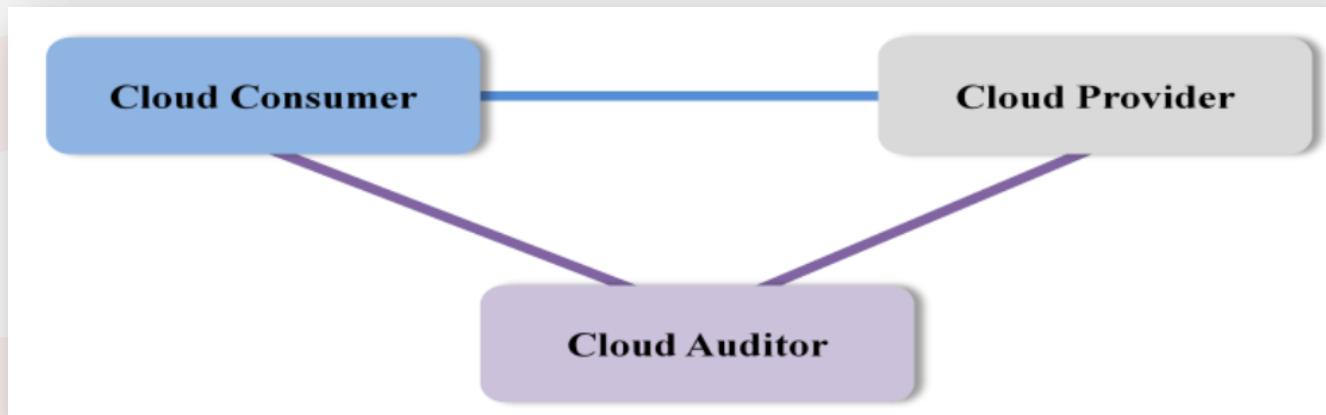
A cloud consumer may request service from a cloud broker instead of contacting a cloud provider directly. The cloud broker may create a new service by combining multiple services or by enhancing an existing service. In this example, the actual cloud providers are invisible to the cloud consumer and the cloud consumer interacts directly with the cloud broker.

Exemplo de interação 2 - Cloud Carriers



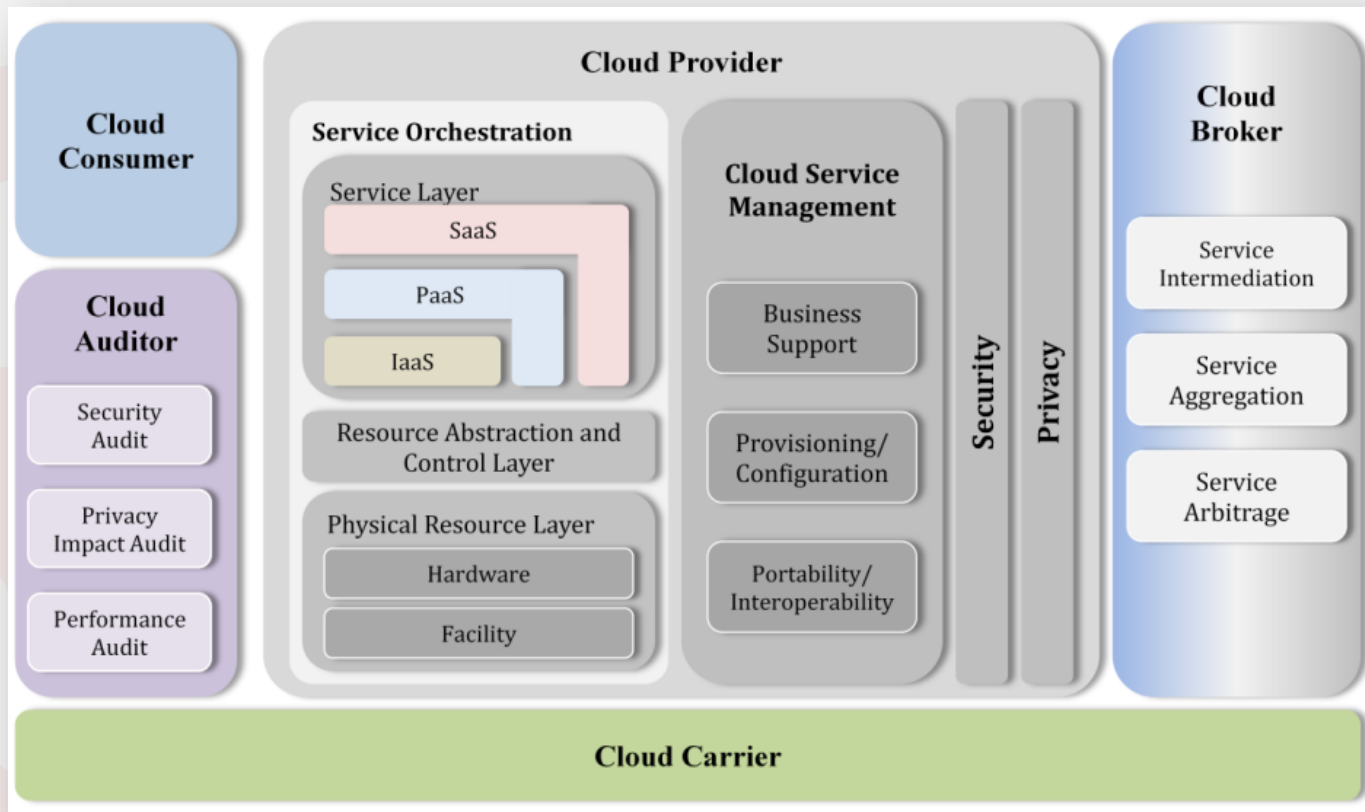
Cloud carriers provide the connectivity and transport of cloud services from cloud providers to cloud consumers. A cloud provider participates in and arranges for two unique service level agreements (SLAs), one with a cloud carrier (e.g. SLA2) and one with a cloud consumer (e.g. SLA1).

Exemplo de interação 3 - Cloud Auditors



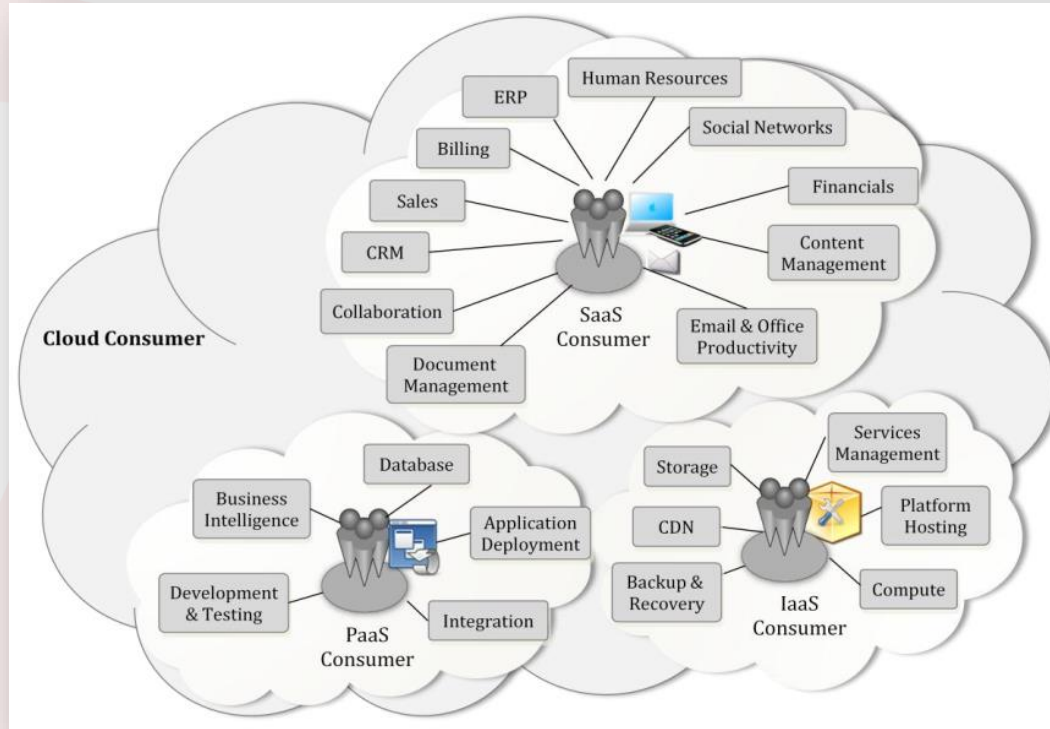
For a cloud service, a cloud auditor conducts independent assessments of the operation and security of the cloud service implementation. The audit may involve interactions with both the Cloud Consumer and the Cloud Provider.

Cloud Computing Reference Architecture



Cloud Consumer

The cloud consumer is the principal stakeholder for the cloud computing service.



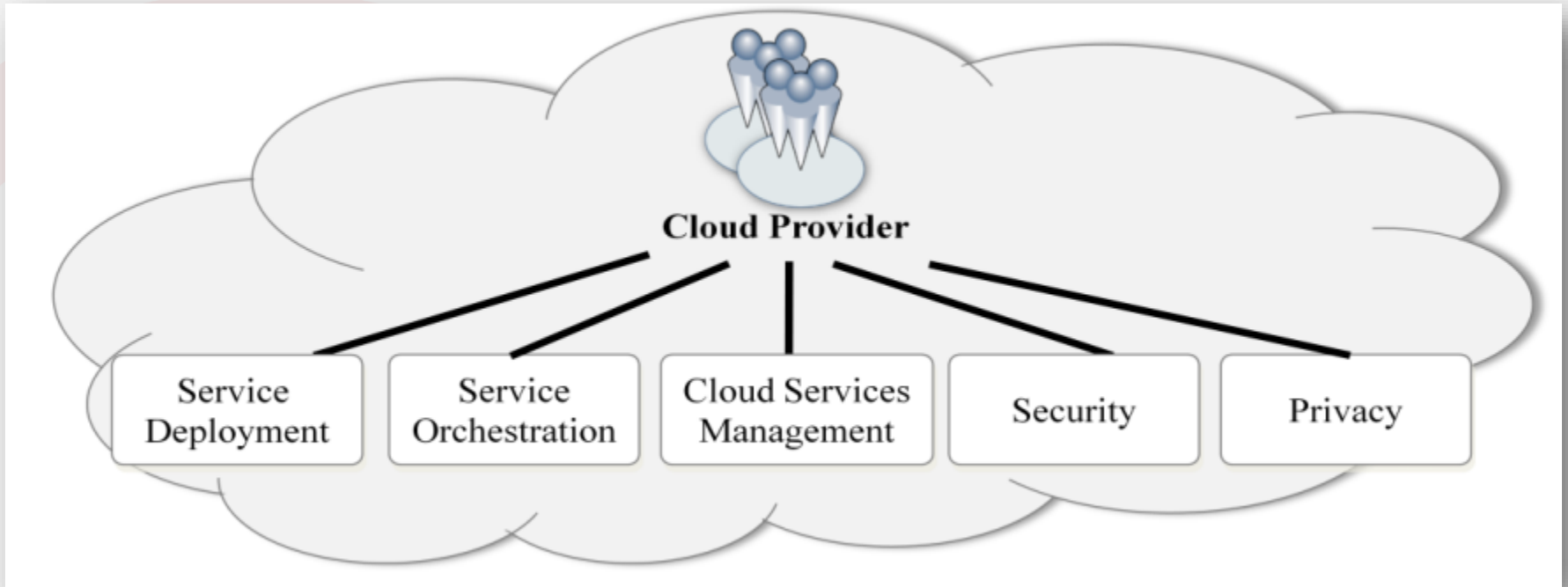
Cloud Provider

A cloud provider is an organization; it is the entity responsible for making a service available to interested parties.

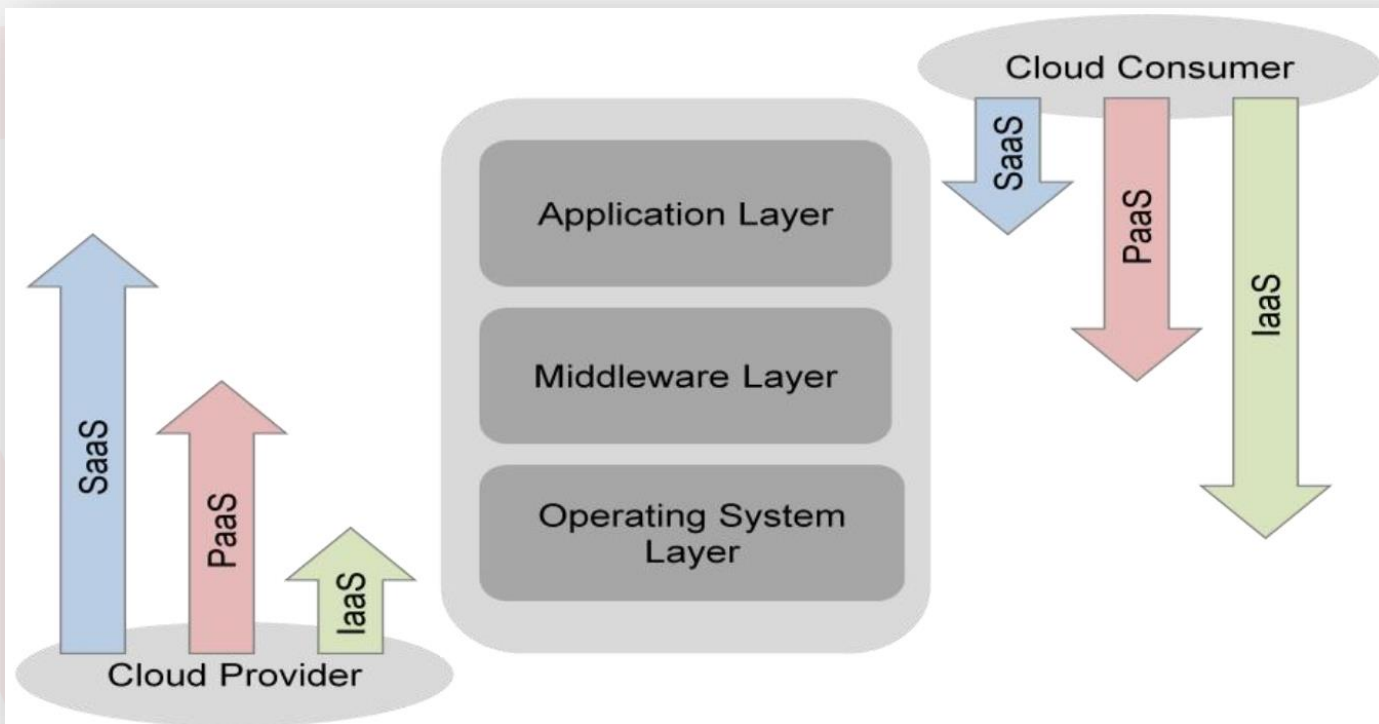
A Cloud Provider acquires and manages the computing infrastructure required for:

- providing the services,*
- runs the cloud software that provides the services,*
- and makes arrangement to deliver the cloud services to the Cloud Consumers through network access.*

Atividades do Cloud Provider



Escopo de controle na nuvem: Provider vs. Consumer



Infrastructure as a Service (IaaS) – Exemplos

Backup and Recovery: Services for backup and recovery of file systems and raw data stores on servers and desktop systems.

Compute: Server resources for running cloud-based systems that can be dynamically provisioned and configured as needed.

Content Delivery Networks (CDNs): CDNs store content and files to improve the performance and cost of delivering content for web-based systems.

Services Management: Services that manage cloud infrastructure platforms. These tools often provide features that cloud providers do not provide or specialize in managing certain application technologies.

Storage: Massively scalable storage capacity that can be used for applications, backups, archival, and file storage.

Plataform as a Service (PaaS) – Exemplos

Business Intelligence: Platforms for the creation of applications such as dashboards, reporting systems, and data analysis.

Database: Services offering scalable relational database solutions or scalable non-SQL datastores.

Development and Testing: Platforms for the development and testing cycles of application development, which expand, and contract as needed.

Integration: Development platforms for building integration applications in the cloud and within the enterprise.

Application Deployment: Platforms suited for general purpose application development. These services provide databases, web application runtime environments, etc.

Software as a Service (SaaS) – Exemplos [1/2]

Email and Office Productivity: Applications for email, word processing, spreadsheets, presentations, etc.

Billing: Application services to manage customer billing based on usage and subscriptions to products and services.

Customer Relationship Management (CRM): CRM applications that range from call center applications to sales force automation.

Collaboration: Tools that allow users to collaborate in workgroups, within enterprises, and across enterprises.

Content Management: Services for managing the production of and access to content for web-based applications.

Software as a Service (SaaS) – Exemplos [2/2]

Document Management: Applications for managing documents, enforcing document production workflows, and providing workspaces for groups or enterprises to find and access documents.

Financials: Applications for managing financial processes ranging from expense processing and invoicing to tax management.

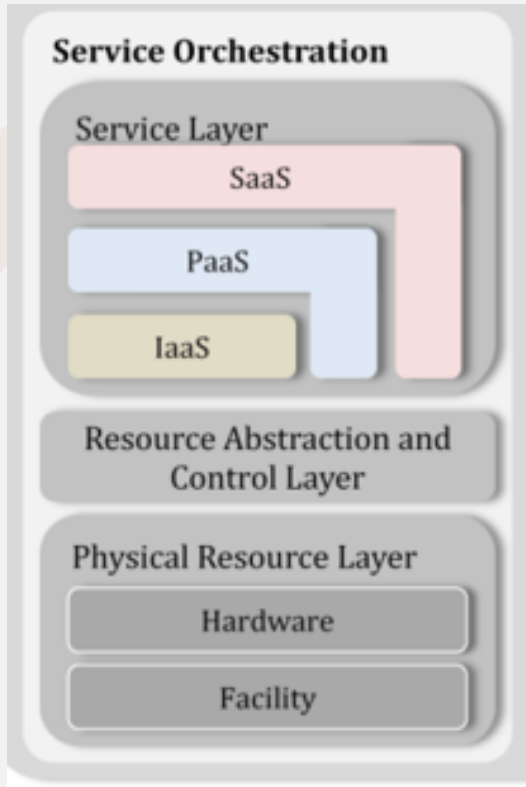
Human Resources: Software for managing human resources functions within companies.

Sales: Applications that are designed for sales functions such as pricing, commission tracking, etc.

Social Networks: Social software that establishes and maintains a connection among users that are tied in one or more specific types of interdependency.

Enterprise Resource Planning (ERP): Integrated computer-based system used to manage internal and external resources, including tangible assets, financial resources, materials, and human resources.

Cloud Provider - Service Orchestration



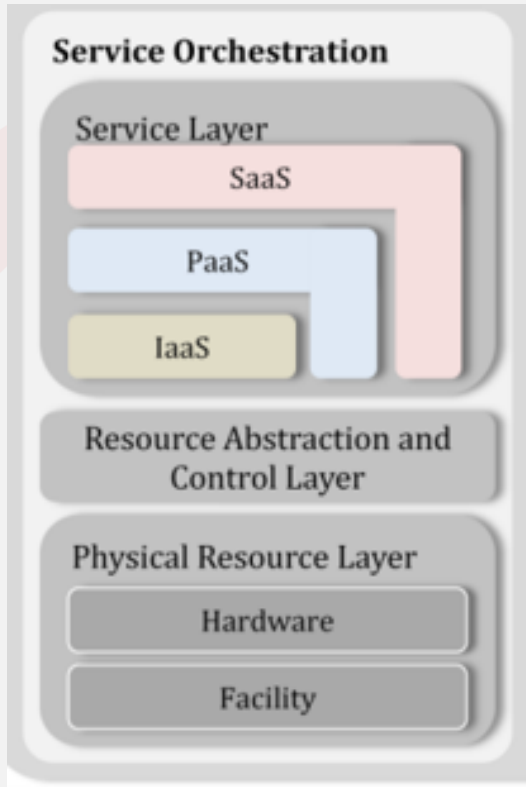
Service layer: where cloud providers define interfaces for Cloud Consumers to access the computing services. Access interfaces of each of the three service models are provided in this layer.

Resource abstraction and control layer.

This layer contains the system components that Cloud Providers use to provide and manage access to the physical computing resources through software abstraction.

Resource abstraction components include software elements such as hypervisors, virtual machines, virtual data storage, and other computing resource abstractions to ensure efficient, secure, and reliable usage of the underlying physical resources.

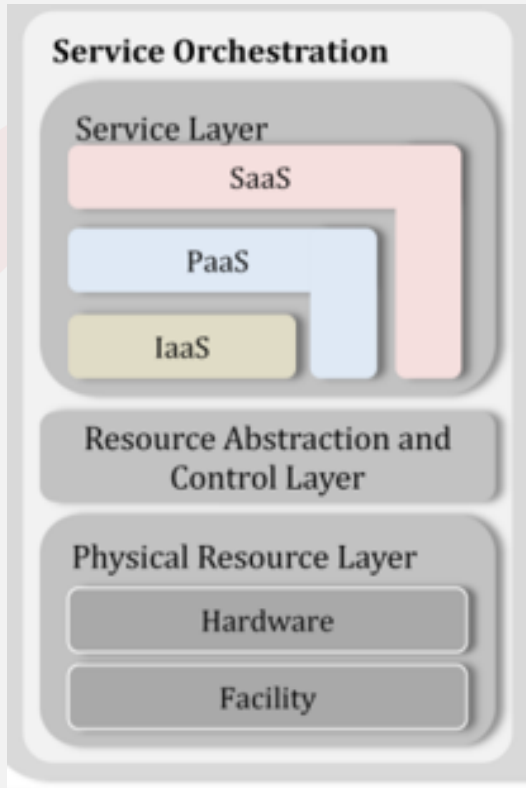
Cloud Provider - Service Orchestration



Resource abstraction and control layer.

***The control aspect** of this layer refers to the software components that are responsible for resource allocation, access control, and usage monitoring which ties together the numerous underlying physical resources and their software abstractions to enable resource pooling, dynamic allocation, and measured service.*

Cloud Provider - Service Orchestration



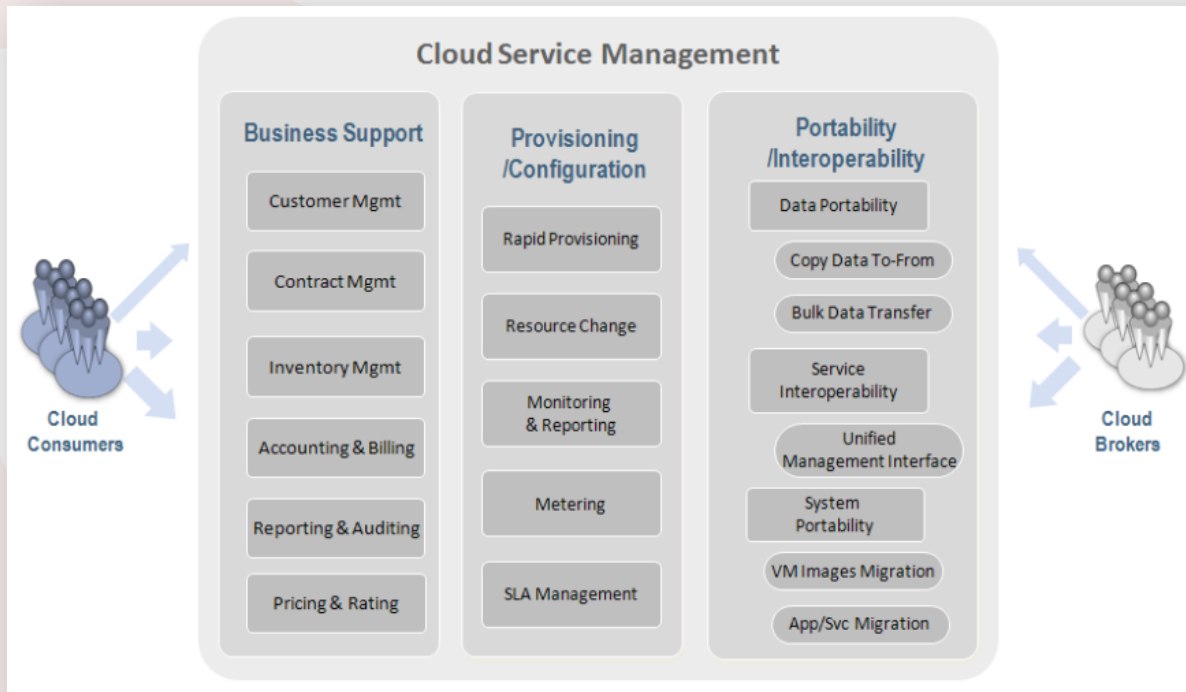
Physical resource layer:

*Includes all the physical computing resources. This layer includes **hardware resources**, such as computers (CPU and memory), networks (routers, firewalls, switches, network links and interfaces), storage components (hard disks) and other physical computing infrastructure elements.*

*It also includes **facility resources**, such as heating, ventilation and air conditioning (HVAC), power, communications, and other aspects of the physical plant.*

Cloud Provider - Cloud Service Management

Includes all the service-related functions that are necessary for the management and operation of those services required by or proposed to cloud consumers.



Security & Privacy

Security

Security in cloud computing architecture concerns is not solely under the purview of the Cloud Providers, but also Cloud Consumers and other relevant actors. Cloud-based systems still need to address security requirements such as authentication, authorization, availability, confidentiality, identity management, integrity, audit, security monitoring, incident response, and security policy management.

Privacy

Cloud providers should protect the assured, proper, and consistent collection, processing, communication, use and disposition of personal information (PI) and personally identifiable information (PII) in the cloud.

Cloud Auditor

Cloud Auditor

Security Audit

Privacy Impact Audit

Performance Audit

A cloud auditor is a party that can perform an independent examination of cloud service controls with the intent to express an opinion thereon.

Audits are performed to verify conformance to standards through review of objective evidence.

A cloud auditor can evaluate the services provided by a cloud provider in terms of security controls, privacy impact, performance, etc.

Cloud Broker



As cloud computing evolves, the integration of cloud services can be too complex for cloud consumers to manage.

A cloud consumer may request cloud services from a cloud broker, instead of contacting a cloud provider directly.

A cloud broker is an entity that manages the use, performance and delivery of cloud services and negotiates relationships between cloud providers and cloud consumers.

Cloud Broker – Tipos de Serviços



Service Intermediation: A cloud broker enhances a given service by improving some specific capability and providing value-added services to cloud consumers. The improvement can be managing access to cloud services, identity management, performance reporting, enhanced security, etc.

Service Aggregation: A cloud broker combines and integrates multiple services into one or more new services. The broker provides data integration and ensures the secure data movement between the cloud consumer and **multiple cloud providers**.

Service Arbitrage: Service arbitrage is like service aggregation except that the services being aggregated are not fixed. Service arbitrage means a broker has the flexibility to choose services from multiple agencies. The **cloud broker**, for example, can use a credit-scoring service to measure and select an agency with the best score.

Cloud Carrier

Cloud Carrier

A cloud carrier acts as an intermediary that provides connectivity and transport of cloud services between cloud consumers and cloud providers.

Cloud carriers provide access to consumers through network, telecommunication and other access devices.

Padrões de indústria de *Cloud Computing* - Histórico

- With the explosion of the Internet, service providers start to use the cheap commodity PCs as the underlying hardware platform.
- Various kinds of software technologies are invented to make these PCs work elastically, which has led to 3 major cloud computing styles based on the underlying resource abstraction technologies:
 - Amazon Web Services
 - Google App Engine
 - Microsoft Azure

Fonte: Qian, Ling, Zhiguo Luo, Yujian Du and Leitao Guo. "Cloud Computing: An Overview." CloudCom (2009).

3 principais *players* de Cloud Computing – Amazon



- Amazon's cloud computing is based on server virtualization technology.
- Amazon released Xen-based Elastic Compute Cloud™ (EC2), object storage service (S3) and structure data storage service (SimpleDB during the 2006 – 2007), under the name Amazon Web Service™ (AWS).
- On demand and cheaper AWS becomes the pioneer of Infrastructure as a Service (IaaS) provider

Fonte: Qian, Ling, Zhiguo Luo, Yujian Du and Leitao Guo. "Cloud Computing: An Overview." CloudCom (2009).

3 principais *players* de Cloud Computing – Google



- Google's style is based on ***technique-specific sandbox***.
- Google published several research papers from 2003 to 2006, which outline a kind of Platform as a Service (PaaS) cloud computing.
- The platform, which is called Google App Engine™ (GAE), is released to public as a service in 2008.



Discussão em sala:

- *Sandbox ? Uso em cloud computing ?*

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Fonte: Qian, Ling, Zhiguo Luo, Yujian Du and Leitao Guo. "Cloud Computing: An Overview." CloudCom (2009).

3 principais *players* de Cloud Computing – Microsoft



- Microsoft Azure™ is released in Oct. 2008, which uses Windows Azure Hypervisor (WAH) as the underlying cloud infrastructure and .NET as the application container.
- Azure also offers services including BLOB object storage and SQL service.

Fonte: Qian, Ling, Zhiguo Luo, Yujian Du and Leitao Guo. "Cloud Computing: An Overview." CloudCom (2009).

Discussões sobre padronização

- There is currently a lot of discussion about the role of standards in the cloud, along with a large amount of activity in standards development for the cloud.
- While some parties see the cloud as:
 - Something completely new that requires an entirely new set of standards,
 - Other parties see the cloud as a technology based on existing technologies that already have standards.

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Discussões sobre padronização

- Cloud Computing is a relatively **new IT industry** and has not yet been fully unified and standardized.
- Currently, there are several standardization groups that try to unify the use of Cloud Computing environments from users and providers.

Fonte: M. Moravcik, P. Segec and M. Kontsek, "Overview of Cloud Computing Standards," 2018 16th International Conference on Emerging eLearning Technologies and Applications (ICETA), Stry Smokovec, 2018, pp. 395-402.

Necessidade de padronização

- An IDC Survey of senior Information Technology (IT) executives/CIOs shows that limited or lack of security, reliability, interoperability, portability and compliance in the cloud are some of the top concerns for its **mainstream** adoption.
- The impact of these challenges and solution responsibility are not limited to the cloud providers, but span across all the players in the cloud ecosystem such as the service consumers, service providers and governing bodies.
- A possible approach to address these concerns should be built with consensus from all the players. Cloud Standardization is the means to such solutions.

Fonte: Nick Antonopoulos and Lee Gillam. 2010. Cloud Computing: Principles, Systems and Applications (1st ed.). Springer Publishing Company, Incorporated.

Necessidade de padronização



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Discussão em sala:

- Qual é o maior blocker para a adoção de cloud na sua empresa ?

Benefícios da padronização

- Standardization provides **predictability** for providers and consumers alike.
- It enables innovation, promotes vendor independence, **interoperability**, encourages repeatable processes and increases resources/skills availability.

Fonte: Nick Antonopoulos and Lee Gillam. 2010. Cloud Computing: Principles, Systems and Applications (1st ed.). Springer Publishing Company, Incorporated.

Benefícios da padronização – *Trade-offs*

- IT has a fair share of standards that has led to its maturity and faster adoption.
- Cloud computing can look at re-use/extension of the IT standards, restricting the creation of fresh ones to address unique scenarios and challenges of this model.
- For example, Amazon, a public cloud provider, could utilize the existing security standards for data centers like physical security, network security, etc., to protect its cloud environments.
- However, interoperability of a service between two public cloud environments would **need fresh standards**

Fonte: Nick Antonopoulos and Lee Gillam. 2010. Cloud Computing: Principles, Systems and Applications (1st ed.). Springer Publishing Company, Incorporated.

Principais organizações de padronização

2 tipos principais:

- 1. Organizations that deal with business relationships between individual participants*
- 2. Organizations dealing mainly with the Cloud Computing aspects of technology*

Fonte: M. Moravcik, P. Segec and M. Kontsek, "Overview of Cloud Computing Standards," 2018 16th International Conference on Emerging eLearning Technologies and Applications (ICETA), Sary Smokovec, 2018, pp. 395-402.

Organizações de padronização



1) *Business relationships*

- **Cloud Select Industry Group (C-SIG)**
 - **Cloud Select Industry Group on Service Level Agreements (C-SIG SLA):** deals with the standardization of SLAs between providers and users.
 - **Cloud Select Industry Group on Code of Conduct:** It collaborates with other organizations and creates and suggests behavior policies Cloud environments to offer unified services and keep user data in privacy

Fonte: M. Moravcik, P. Segec and M. Kontsek, "Overview of Cloud Computing Standards," 2018 16th International Conference on Emerging eLearning Technologies and Applications (ICETA), Stry Smokovec, 2018, pp. 395-402.

Organizações de padronização



1) *Business relationships*

European Commission Expert Group on Cloud Computing Contracts: deals with suppliers and users of CC environments. Its task is to explore existing contracts between users and providers, to acquire best practices and to propose measures to protect cloud users.

- **European Telecommunications Standards Institute (ETSI)**
 - **Cloud Standard Coordination Group:** is to map the current state of the CC standards, especially in the area of security, data interoperability and portability.

Fonte: M. Moravcik, P. Segec and M. Kontsek, "Overview of Cloud Computing Standards," 2018 16th International Conference on Emerging eLearning Technologies and Applications (ICETA), Sary Smokovec, 2018, pp. 395-402.

Organizações de padronização

2) Technology



The ITU-T - Y series of recommendations is dedicated to:

- NGN (Next Generation Networks)
- Internet of Things (IoT)
- Smart Cities



IEEE Standards Association:

- P2301 (Cloud Profiles)
- P2302 (Intercloud)
- IEEE Adaptive Management for Cloud Computing (AMCC) Study Group

Fonte: M. Moravcik, P. Segec and M. Kontsek, "Overview of Cloud Computing Standards," 2018 16th International Conference on Emerging eLearning Technologies and Applications (ICETA), Stry Smokovec, 2018, pp. 395-402.

Organizações de padronização

2) Technology



OMG Cloud Working Group publishes vendor-neutral guidance on:

- Considerations for cloud computing adoption
- Highlighting standards
- Opportunities for standardization
- Cloud customer requirements
- Best practices to foster an ecosystem of open, standards-based cloud computing technologies.

Organizações de padronização



2) Technology



National Institute of Standards and Technology Cloud:

- Terms, models, roadmap, etc.

Fonte: M. Moravcik, P. Segec and M. Kontsek, "Overview of Cloud Computing Standards," 2018 16th International Conference on Emerging eLearning Technologies and Applications (ICETA), Sary Smokovec, 2018, pp. 395-402.

Principais áreas de padronização

1. *Interoperability Standards*
2. *Security Standards*
3. *Portability Standards*

Fonte: Nick Antonopoulos and Lee Gillam. 2010. Cloud Computing: Principles, Systems and Applications (1st ed.). Springer Publishing Company, Incorporated.

Interoperabilidade – Business Drivers

- In general, the cloud-computing community sees the lack of cloud interoperability as a barrier to cloud-computing adoption because organizations fear “**vendor lock-in.**”
- Vendor lock-in refers to a situation in which, once an organization has selected a cloud provider, either it cannot move to another provider or it can change providers but only at great cost.
- Risks of vendor lock-in include **reduced negotiation power in reaction to price increases and service discontinuation because the provider goes out of business.**

Interoperabilidade – Casos de Uso

- Use cases in the context of cloud computing refer to typical ways in which cloud consumers and providers interact.
- NIST defines 21 use cases classified into three groups: cloud management, cloud interoperability and cloud security

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Interoperabilidade – Casos de Uso - Gerenciamento

- **Cloud Management Use Cases**

- Open an Account
- Close an Account
- Terminate an Account
- Copy Data Objects into a Cloud
- Copy Data Objects out of a Cloud
- Erase Data Objects on a Cloud
- VM [virtual machine] Control: Allocate VM Instance
- VM Control: Manage Virtual Machine Instance State
- Query Cloud-Provider Capabilities and Capacities

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Interoperabilidade – Casos de Uso - Interoperabilidade

- **Cloud Interoperability Use Cases**

- Copy Data Objects Between Cloud-Providers
- Dynamic Operation Dispatch to IaaS Clouds
- Cloud Burst from Data Center to Cloud
- Migrate a Queuing-Based Application
- Migrate (fully-stopped) VMs from One Cloud Provider to Another

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Interoperabilidade – Casos de Uso - Segurança

- **Cloud Security Use Cases**

- Identity Management: User Account Provisioning
- Identity Management: User Authentication in the Cloud
- Identity Management: Data Access Authorization Policy Management in the Cloud
- Identity Management: User Credential Synchronization Between Enterprises and the Cloud
- eDiscovery
- Security Monitoring
- Sharing of Access to Data in a Cloud

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Standard - Related Efforts for Cloud Computing

- There are many cloud standardization projects.
- Some of these projects focus on standardizing parts of a cloud-computing solution such as workloads, authentication, and data access.
- Other efforts focus on standardizing how the parts should work together as a solution.
- The Cloud Standards Coordination Wiki maintains a list of some of these projects

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Standard-Related Efforts for Cloud Computing

Project Name	URL	Focus
CloudAudit, also known as Automated Audit, Assertion, Assessment, and Assurance API (A6)	http://www.cloudaudit.org	<ul style="list-style-type: none">• Open, extensible, and secure interface, namespace, and methodology for cloud-computing providers and their authorized consumers to automate the audit, assertion, assessment, and assurance of their environments• Part of the Cloud Security Alliance since October 2010
Cloud Computing Interoperability Forum	http://www.cloudforum.org	<ul style="list-style-type: none">• Common, agreed-on framework/ontology for cloud platforms to exchange information in a unified manner• Sponsors of the Unified Cloud Interface Project to create an open and standardized cloud interface for the unification of various cloud APIs
Cloud Security Alliance	http://cloudsecurityalliance.org	<ul style="list-style-type: none">• Recommended practices for cloud-computing security• Working on Version 3 of the <i>Security Guidance for Critical Areas of Focus in Cloud Computing</i>• Nonprofit organization that includes Google, Microsoft, Rackspace, Terremark, and others

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Standard-Related Efforts for Cloud Computing

Cloud Standards Customer Council	http://cloudstandardscustomer council.org	<ul style="list-style-type: none">• Standards, security, and interoperability issues related to migration to the cloud• End-user advocacy group sponsored by the Object Management Group (OMG) and creator of the Open Cloud Manifesto
Cloud Storage Initiative	http://www.snia.org/cloud	<ul style="list-style-type: none">• Adoption of cloud storage as a new delivery model (Data-Storage-as-a-Service)• Initiative sponsored by the Storage Networking Industry Association (SNIA), the creator and promoter of the Cloud Data Management Interface (CDMI)• SNIA includes members from NetApp, Oracle, and EMC

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Standard-Related Efforts for Cloud Computing

DeltaCloud	http://incubator.apache.org/deltacloud	<ul style="list-style-type: none">• Abstraction layer for dealing with differences among IaaS providers• API based on representational state transfer (REST) with a small number of operations for managing instances• Currently has libraries for seven providers including Amazon EC2, Eucalyptus, and Rackspace
Distributed Management Task Force (DMTF)	http://dmf.org/standards/cloud	<ul style="list-style-type: none">• Management interoperability for cloud systems• Developer of the Open Virtualization Framework (OVF)• Runs the Open Cloud Standards Incubator
IEEE P2301, Guide for Cloud Portability and Interoperability Profiles	http://standards.ieee.org/develop/project/2301.html	<ul style="list-style-type: none">• Standards-based options for application interfaces, portability interfaces, management interfaces, interoperability interfaces, file formats, and operation conventions

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Standard-Related Efforts for Cloud Computing

IEEE P2302, Draft Standard for Inter-cloud Interoperability and Federation	http://standards.ieee.org/develop/project/2302.html	<ul style="list-style-type: none">• Protocols for exchanging data, programmatic queries, functions, and governance for clouds sharing data or functions or for federating one cloud to another
OASIS Identity in the Cloud (IDCloud)	http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=id-cloud	<ul style="list-style-type: none">• Profiles of open standards for identity deployment, provisioning, and management in cloud computing• Performs risk and threat analyses on collected use cases and produces guidelines for mitigating vulnerabilities
Open Cloud Computing Interface	http://occi-wg.org	<ul style="list-style-type: none">• REST-based interfaces for management of cloud resources including computing, storage, and bandwidth• Working group of the Open Grid Forum

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Standard-Related Efforts for Cloud Computing

Open Cloud Consortium	http://opencloudconsortium.org	<ul style="list-style-type: none">• Frameworks for interoperating between clouds and operation of the Open Cloud Testbed
Open Data Center Alliance	http://www.opendatacenteralliance.org	<ul style="list-style-type: none">• Unified customer vision for long-term data-center requirements• Developing usage models for cloud vendors• Independent IT consortium
OpenStack	http://www.openstack.org	<ul style="list-style-type: none">• Open-source software for running private clouds• Currently consists of three core software projects: OpenStack Compute (Nova), OpenStack Object Storage (Swift), and OpenStack Image Service (Glance)• Founded by Rackspace and NASA

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Standard-Related Efforts for Cloud Computing

Standards Acceleration to Jumpstart Adoption of Cloud Computing	http://www.nist.gov/itl/cloud/sajacc.cfm	<ul style="list-style-type: none">• Drives the creation of cloud-computing standards by providing key use cases that can be supported on cloud systems that implement a set of documented and public cloud-system specifications• Sponsored by NIST
The Open Group Cloud Work Group	https://collaboration.opengroup.org/cloudcomputing/	<ul style="list-style-type: none">• Works with other cloud standards organizations to show enterprises how to best incorporate cloud computing into their organizations
TM Forum Cloud Services Initiative	http://www.tmforum.org/community/groups/cloud_computing_services/default.aspx	<ul style="list-style-type: none">• Common approaches to increase cloud-computing adoption such as common terminology, transparent movement among cloud providers, security issues, and benchmarking

Fonte: G. A. Lewis, "Role of Standards in Cloud-Computing Interoperability," 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, 2013, pp. 1652-1661.

Cloud Computing Compliance List – Azure

Global	Governo dos EUA	Região/país específico	Específico do Setor		
CIS Benchmark	CJIS	BIR 2012 (Países Baixos)	IT-Grundschutz (Alemanha)	23 NYCRR 500 (EUA)	GLBA (EUA)
Atestado CSA STAR	CNSSI	CS (Alemanha)	LOPD (Espanha)	AFM/DNB (Países Baixos)	GxP (EUA)
Certificação CSA STAR	DFARS	CS Mark Gold (Japão)	MeitY (Índia)	AMF/ACPR (França)	HIPAA (EUA)
Autoavaliação CSA STAR	DoD L 2.4.5	Cyber Essentials Plus (EUA)	MTCS Nível 3 (Singapura)	APRA (Austrália)	HITRUST (EUA)
ISO 20000	DoE 10	DJCP (China)	Lei Meu Número (Japão)	CDSA	KNF (Polónia)
ISO 22301	EAR	EN 301 549 (UE)	CC Framework (Nova Zelândia)	CFTC 131 (EUA)	MARS-E (EUA)
ISO 27001	FDA CFR Título 21	IAF da ENISA (UE)	PASf (Reino Unido)	DPP (Reino Unido)	MAS/ABS (Singapura)
ISO 27017	FedRAMP	ENS (Espanha)	PIPEDA (Canadá)	EBA (UE)	MPAA (EUA)
ISO 27018	FIPS 140-2	Cláusulas de Modelo UE	PDPA (Argentina)	FACT (Reino Unido)	NBB/FSMA (Bélgica)
ISO 9001	IRS 1075	Defesa de Privacidade UE-EUA	TISAX (Alemanha)	FCA/PRA (Reino Unido)	NEN 7510 (Países Baixos)
SOC 1.2.3	ITAR	GB 18030 (China)	TRUCS (China)	FERPA (EUA)	NHS IG (Reino Unido)
WCAG 2.0	NIST CSF	G-Cloud OFFICIAL (Reino Unido)		FFIEC (EUA)	OSFI (Canadá)
	NIST 800-171	GDPR		FINMA (Suíça)	PCI DSS
	Seção 508 VPATs	HDS (França)		FINRA (EUA)	RBI/IRDAI (Índia)
		IRAP (Austrália)		FISC (Japão)	SEC 17a-4 (EUA)
		ISMS (Coreia do Sul)		FSA (Dinamarca)	Avaliações Compartilhadas
					SOX (EUA)

Fonte: <https://azure.microsoft.com/pt-br/overview/trusted-cloud/compliance/>

Cloud Computing Compliance List

[Google - Compliance resource center](#)

[Amazon - Security and Compliance](#)

Entrega Parcial 02 – Data de Entrega: 03/09/2020 até às 12:00

Dado o processo de negócio de sua empresa definido na Entrega Parcial 01, elaborar um resumo de no máximo 2 páginas elencando os seguintes pontos:

- A. Considerando as questões vistas nesta aula referentes à padronização, quais são os **requisitos não funcionais (segurança, disponibilidade, desempenho)** críticos ? Justificar.
- B. Quais seriam os principais *blockers* para adoção de *Cloud Computing* ?
- C. Esse *blocker* é impeditivo para o uso de *Cloud Computing* ou pode ser sanado ?

Forma de entrega: enviar por email para manzan@uol.com.br até a data de entrega.

Requisitos não funcionais



Fonte: <https://iso25000.com/index.php/en/iso-25000-standards/iso-25010>

Até a próxima aula

Muito Obrigado!

Feedbacks ?