

# JOURNEY TO THE CLOUD

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## Abstract

*This article gives the basic concept, defines the terms used in the industry, and outlines the general Architecture, SaaS, PaaS and IaaS of Cloud computing. It gives a summary of Cloud Computing and provides a good foundation for understanding of the concepts. Cloud computing is a better way to run your business. Instead of running your apps on your data center, they run on a shared data center.*

## 1. Overview

Cloud computing (from Information Technology – IT) is offered as a service based on demand. It eliminates the need for organizations to build and maintain expensive data centers plus software costs, too. It enables organizations to stand up new systems quickly and easily. It provides elastic resources that allow applications to scale as needed in response to market demands. Its “pay as you go” rental model allows organizations to defer costs. It increases business continuity by providing inexpensive disaster-recovery options. It will also reduce the need for organizations to maintain a large IT staff.

Cloud computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

The name “cloud computing” was inspired by the cloud symbol that's often used to represent the Internet. Cloud computing is an evolution in which IT consumption and delivery are made available in a self fashion via the internet or internal network, with a flexible pay-as-you-go business model. But moving to the cloud turns out to be more challenging than it first appears. The cloud-computing business model is still in development stages for large organizations to use cloud tech for high critical applications, and quite a few issues remain for vendors to work out.

## 2. Pros that can be garnered from moving to the cloud (as of current Cloud Technology)

- **Fast start-up:** Cloud computing is good for any start-up because it allows us to test your business plan very quickly for little money. We can also scale as we grow.
- **Scalability:** Like electricity, gas and water, cloud computing services allow businesses to only pay for what business use. And as your business grows, you can accommodate by adding more resources.
- **Faster product development:** We can build and deliver applications four times faster, at about a half of the cost of traditional software platforms. We can deliver a complete platform with a simplified programming model so anyone can use it to install their applications.

- **No capital expenditures:** Cloud computing reduces paperwork, lowers transaction costs, minimizes investment in hardware and the resources. Moving your business to ‘the cloud’ also reduces the need for an IT staff.
- **Lower computer costs:** We don't need to maintain a high-powered and high-priced computer to run cloud computing's web-based applications. Because applications run in the cloud, not on the desktop PC. When we are using web-based applications, our PC can be less expensive, with a smaller hard disk, less memory, more efficient processor, we don't even need a CD or DVD drive, we don't have to install any software's, we access all the software from a cloud.
- **Instant software updates:** When the application is web-based, updates happens automatically and are available the next time when log into the cloud. When you access a web-based application, you will get the latest version.
- **Unlimited storage capacity:** Cloud computing offers limitless storage. Your computer's current 100 gigabytes hard drive is peanuts when compared to the hundreds of terabytes.
- **Increased data reliability:** For desktops hard disk crash can destroy all your valuable data, but computer crashing in the cloud shouldn't affect the storage of your data.
- **24x7 universal document accesses:** With cloud computing, we don't have to take our documents with us, they stay in the cloud, and we can access them whenever we have a computer and an Internet connection. All our documents are instantly available from wherever you are.
- **Latest version availability:** If company moves to cloud computing, everyone can access same latest version from cloud, which also helps to migrate all users to latest version with one install
- **Easier group collaboration:** Multiple users can collaborate easily on documents and projects, because the documents are hosted in the cloud, not on individual PC's, all you need is a computer with an Internet connection.

### 3. What's the fear with current Cloud tech for large organizations?

- **App performance can suffer:** Generally we do not see performance issues if application are running on private cloud, but performance issues can me be more on public cloud, so high rated application required to be on private cloud.
- **Losing Internet connection:** We should ask ourselves whether the risk of losing Internet connection and therefore access to your database will affect. It is a risk some companies are willing to take, but something to consider.
- **Data might not be secure:** With cloud computing, all your data is stored on the cloud may not be a secure. How do we know how secure is our data? We know that all cloud computing venders are saying that data is secure, but we do not know that for sure.
- **Security:** Security is still big concern to adopt venders cloud computing, venders still need to develop more secure layers and also required to convince their clients.

- **Need constant Internet:** It is impossible to access applications that are running in the cloud if we can't connect to the Internet. Since we all use the Internet to connect to applications, if we do not have an Internet connection it means we cannot access anything. No Internet connection means no work.
- **Stored data can be lost:** Data stored in the cloud is unusually safe, replicates across multiple nodes. Our data can be missing, we have no local backup. (Unless we download all our cloud data to our own desktop). Relying on the cloud puts us at risk if the cloud goes down.
- **Doesn't work with low-speed connections:** A low-speed Internet connection, like dial-up services, makes cloud computing very painful, sometimes we cannot even use application. As we know web-based apps require a lot of bandwidth to download, as do large documents.
- **Application access can be slow:** Even you have fast Internet connection, web-based applications can sometimes be slower than using application on your desktop. It all depends on load on the application and bandwidth of connection.

#### 4. Types of Cloud Computing

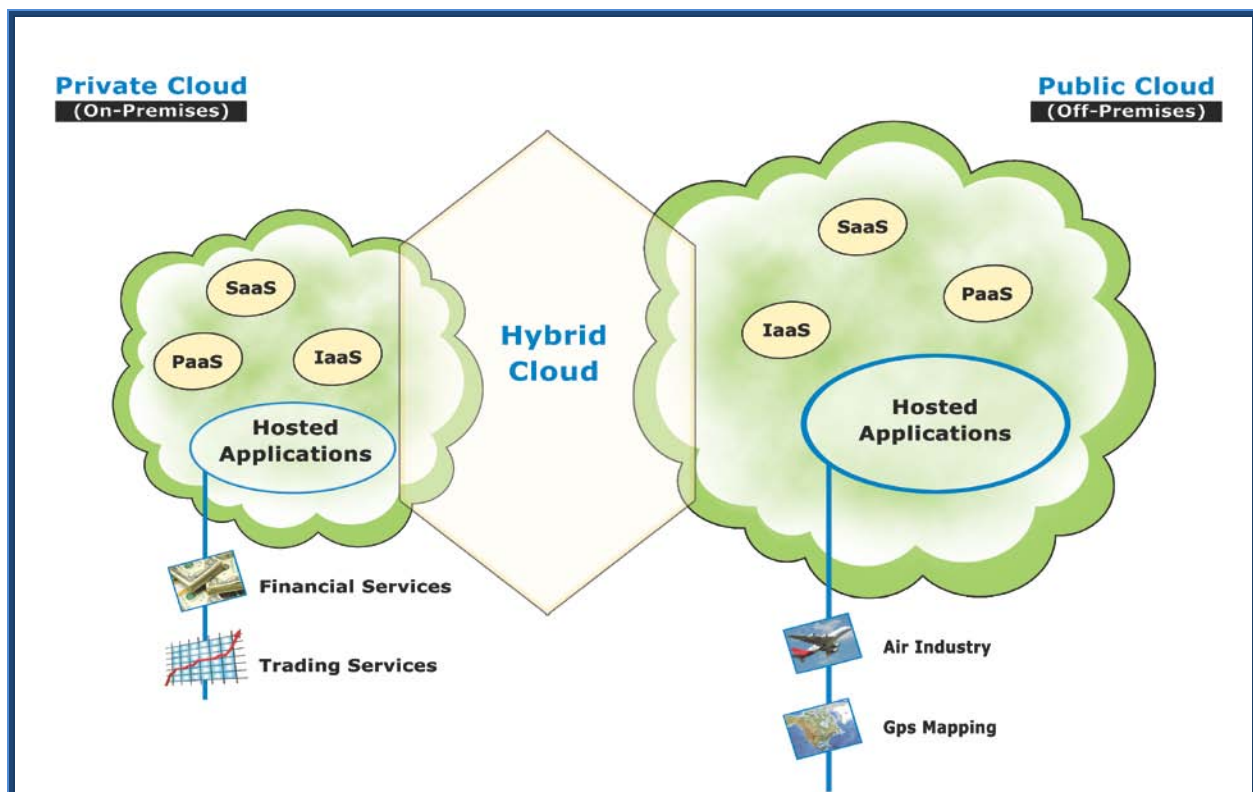


Figure 1: Types of Clouds

1. **Public cloud:** Computing infrastructure is hosted by the cloud vendor on the vendor's premises. The customer has no visibility and control over where the computing infrastructure is hosted. The computing infrastructure can be shared between any organizations See Fig. 1 for more details.
2. **Private cloud:** The computing infrastructure is dedicated to a particular organization and it is not possible to share with other organizations. Private clouds are more expensive and more secure when compared to public clouds. See Fig. 1 for more details

There are two types of private clouds: On-premise and externally hosted. Externally hosted private clouds are exclusively used by one organization, but are hosted by a third party specializing in cloud infrastructure. Externally hosted private clouds are cheaper than On-premise private clouds, but required more security. See Fig. 1 for more details.

3. **Hybrid cloud** Organizations may host critical applications on private clouds and applications with relatively less security concerns on public cloud. The usage of both private and public clouds together is called hybrid cloud. In Hybrid cloud, an organization uses their own computing infrastructure for normal usage, but accesses the cloud for high and peak load requirements. This ensures that a sudden demand in computing requirement is handled gracefully. See Fig. 1 for more details.
4. **Community cloud:** involves the sharing of computing infrastructure between organizations of the same community. For example, all government organizations within the state of Massachusetts may share computing infrastructure on the cloud to manage data related to citizens residing in Massachusetts.

## 5. Cloud Tech Services Delivery Models

### 5.1 Software as a Service (SaaS)

Software as a Service (SaaS) is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet.

SaaS has become a common delivery model for most business applications, including accounting, collaboration, customer relationship management, enterprise resource planning, human resource management, content management, and help desk management. SaaS has been incorporated into the main strategy of all leading enterprise software companies with cloud. Refer to Fig. 2 for more details.

Benefits of the SaaS model include:

- Easier administration
- Automatic updates and patch management
- All users will have the same version of software
- Easier collaboration, for the same reason
- Global accessibility
- Less administrative costs.

### 5.2 Platform-as-a-Service (PaaS)

Platform as a Service (PaaS) is a delivery method of a cloud computing platform over the web. PaaS enables you to create web applications quickly, without the cost and complexity of buying and managing the underlying software/hardware.

It also provides all the facilities required to support the complete life cycle of building and delivering web applications entirely on the web. Refer to Fig. 2 for more details.

Benefits with PaaS include the following:

- Time to Market
- Requires no up-front investments
- Minimize operational costs
- Centralized information management
- Enhanced productivity
- Access to information anywhere, anytime
- Easy collaboration.

### 5.3 Infrastructure-as-a-Service (IaaS)

Infrastructure as a Service is a provision model in which an organization outsources the equipment used to support operations, including storage, hardware, servers and networking components. The service provider owns the equipment and is responsible for housing, running and maintaining it. The client typically pays on a per-use basis. Refer Fig. 2 for more details.

Infrastructure as a Service is sometimes referred to as Hardware as a Service (HaaS).

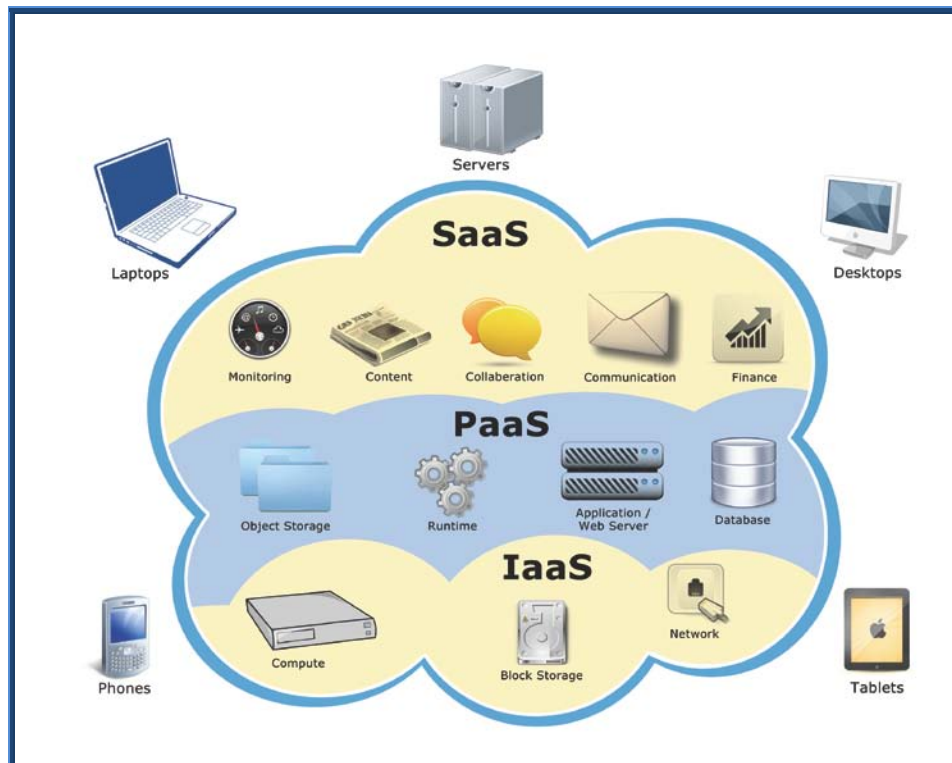


Figure 2: Cloud Delivery Models

## 6. Big Cloud Competitors in Market



**Figure 3: Some Cloud Service Providers**

**Gmail:** A web mail from Google Inc. Webmail is an email client implemented as a web application accessed via a web browser. It is an oldest and popular SaaS provided by players like Microsoft, Yahoo, Google, etc. Most of them are ad-revenue driven and free for public.

**Go Daddy:** They are into internet domain registration, web hosting, email hosting, etc.

**Net Suite:** They are into cloud based integrated business management software delivered in SaaS model.

**3Tera:** 3Tera's flagship product, AppLogic, is an IaaS enabler. AppLogic is used to convert arrays of servers into virtualized resource pools that users can subscribe to in order to power their applications.

**VMware:** VMware vSphere is a virtualization platform that enables organizations building their private clouds. vSphere make available collective resources of all the physical hosts available in a cluster to the virtual machines dynamically as per the administrative policies.

**Eucalyptus:** Eucalyptus enables the creation of on-premise private clouds out of organizations existing data centre. Eucalyptus implements IaaS private cloud that is accessible via an API compatible with Amazon EC2 and Amazon S3. This compatibility allows any Eucalyptus cloud to be turned into a hybrid cloud, capable of drawing compute resources from public cloud.

**Amazon:** Amazon Elastic Computing Cloud (EC2) is a well known service of Amazon Web Services (AWS). EC2 allows users to rent virtual computers on which to run their own computer applications. EC2 allows scalable deployment of applications through a Web service.

**Rack Space:** Rack space is into web hosting, application hosting, email hosting, cloud servers, cloud storage, etc. Their products are implemented on different type of cloud delivery models ranging from PaaS to IaaS

**Right Scale:** They are web based cloud management platform for managing cloud infrastructure from multiple providers including private and hybrid clouds. RightScale enables users to migrate workloads between their private clouds and public clouds operated by Amazon Web Services (AWS), Rack Space, etc.

## 7. Large organizations concerns on current Cloud Tech

- **How can Cloud providers secure our products or data?** Cloud security remains a top concern for enterprise cloud deployments, protecting information is everyone's responsibility, as per current security tools or layers organizations can only put the lowest-risk data and applications into the cloud. Cloud vendor required to justify and prove how they will secure critical products and customer data, they will also required to show all the security layers are in place.
- **Can they utilize our manpower to support our product?** The question in large organizations before they move their products or data into vender cloud infrastructure, since our current internal team has lot of experience and Knowledge on our products, would same vender take our manpower to support our products instead of requiting new manpower.
- **Do they use onshore team to support infrastructure?** Most Lot of high risk application cannot support by offshore teams due to Federal Laws, in those cases vender has to provide support with local teams only. So organizations required to confirm same with provider before they move to vender cloud Infrastructure. Condition like those will increase operational costs to providers.
- **Where will Cloud providers place Cloud servers?** Organizations are concerned about Cloud infrastructure physical location where provider will install our application and store the sensitive data, because, as per federal laws, high rated applications and data required to be local, therefore, this will increase operations costs.

- **Can cloud vendors provide Disaster Recovery strategy?** Disaster recovery from an IT perspective is making sure we can recover our systems and our data. Disaster recovery in the cloud is a relatively new concept, but recovery plan is the main aim of the entire IT disaster recovery planning project. For these plans that cloud vendor will set out the detailed steps needed to recover your IT systems to a state in which they can support the business after a disaster, those plans required to test before organizations adopts the Cloud concept.
- **Can we have our own cloud?** This is still an ongoing effort. All the organizations are in the process determining same, for what services can go for vendor, which we still required to keep in-house cloud. I personally believe, high rated application and data still required to be in-house cloud.
- **Should vendor cloud infrastructure be used for all applications or only those with certain criticality ratings?** This is one of the main concerns for large organizations, since security is not in place for 100%. I believe it is good idea to have vendor cloud for less critical application.
- **How can we address latency?** Latency means the time taken for data to be transmitted over the Internet between the provider and the customer, higher latency values mean longer response times. This is the one of the main issue for large organizations and cloud providers, many cloud providers are still failing to get good grips with latency issues in the cloud, many organizations may locate their office in a different country from their datacenter, datacenter is one side of the world and their customer from other side of the world, latency issue can be any reason, so cloud providers should consider this before they setup cloud Infrastructure for any organizations, good idea to have servers in multi location based on their customers.
- **How can we address external network issues?** No one can control or predict external network issues, so cloud providers should have at least few net providers, if one provider servers goes down or performance issues, backup one can address same.

## 8. Cloud Computing vs. Conventional Computing

### Cloud Computing

Self-Control:	Individual can increase or down resources
Shared Hardware:	Common hardware for multi organizations
Elastic Capacity:	Easy to increase and decrease resources based on demand
Post paid:	Pay after the use based on usage, like phone bill
Operational Expenses:	Operational costs will go down by 20 to 25%
Managed via APIs:	Increase or decrease resources can be done by API's.

### Conventional Computing

Manually Control:	Manual interaction required for steps
Dedicated Hardware:	Dedicated hardware for each organization
Fixed Capacity:	Whatever the capacity we have we can use, if we need to expand it will take more time than cloud computing
Pre paid:	It's required to spend money before we use resources.



Capital and Operational Expenses: In this case Capital required and also high operational expenses required.

Managed via System Administrator: Admin is required increase and decrease resources.

## 9. Cloud Security

As we all know, there are a number of security issues and concerns associated with cloud computing but these issues falling into two mainly categories: security issues faced by cloud providers who are providing SaaS, PaaS and IaaS via the cloud, and security issues faced by their customers. In most cases, the cloud provider must ensure that their infrastructure is secure and their client's data and applications are protected. This enables the client to be able to communicate to their customer that the cloud provider has taken the proper security measures to protect their information.

Sometimes Cloud Computing Security is an evolving sub-domain of computer security, network security, and, more broadly, information security. Cloud providers need to ensure that data is secure, it cannot be accessed by any unauthorized users or simply lost, and that data privacy is maintained. Cloud providers will need to justify the areas described below:

### 9.1 Protecting the data

To be considered protected, data from one customer must be properly segregated from another. It must be stored securely when "at rest" and it must be able to move securely from one location to another. Cloud providers should have systems in place to prevent data leaks or access by third parties. Proper separation of duties should ensure that auditing and monitoring cannot be defeated.

### 9.2 Identity management

All enterprise will have its own identity management system to control access to information systems and computing resources. Cloud providers either integrate the customer's identity management system into their own infrastructure, using SSO technology, or provide an identity management solution of their own.

### 9.3 Physical and personnel security

Providers must ensure that physical machines are adequately secure.

### 9.4 Availability

Cloud providers must ensure that applications available as a service via the cloud are secure by implementing application security measures and application-level firewalls in the production environment.

### 9.5 Application security

Cloud providers must ensure that applications available as a service via the cloud are secure by implementing application security measures and application-level firewalls to be in place in the production environment.

## 9.6 Privacy

Cloud providers must ensure that all critical data are masked and that only authorized users have access to that data in its entirety.

## 10. Predictions about how the cloud will evolve in the future

- **The cloud will be cheaper, more reliable, and easier to use:** This is a known fact, in future more organizations will adopt cloud concept, because it is going to be cheaper, more scalable, more secure, more reliable, and easier to deploy and manage.
- **The cloud will become a real engine of growth for early adopter companies:** The early companies adopt cloud concept, more they gain in profits, because then can save IT expenses.
- **Cloud provider costs will be less than 30% of what corporate data centers cost:** Because manpower costs will spread across organizations, this is similar to pay as you go concept, like our electric and phone services, you can increase or decrease resources based on demand, if we are not using resources, we don't pay anything, but, with internal datacenter we have to pay even we don't use, for new projects no initial costs required and minimum time required to setup environment.
- **Cloud mega-data centers:** In future cloud providers required to maintain mega data centers, because more organizations are going to adopt cloud concept, so vendors are required to have more resources in datacenter. As the connectivity options increase with decreased bandwidth costs, organizations tend to have more hybrid clouds using different services from different vendors on a robust network backbone
- **System or infrastructure outages will decrease with cloud adoption:** As we know cloud environment is cheaper than having our internal datacenter, so we can have more redundancy sites than before.
- **Open source will dominate the future of the cloud:** I personally believe open source is playing a dominant role in Cloud computing changing the platform and application dynamics. Open source is the foundation for cloud computing although ideas vary across the environment. Open source is also helping make the cloud more scalable
- **An ultimate ISO cloud standard will required:** In future all cloud providers required to adopt ISO cloud standards, this will help any organization to move from one vendor cloud environment to other provider, also going to help to have different cloud provider for DR strategy.
- **Government will lead enterprises in cloud adoption:** Government will encourage all organizations to adopt cloud concept since they can minimize their operational costs, if any organization can save their operational costs, it's good for their customers, because they can reduce monthly maintains costs.

- **SaaS concept will grow:** In cloud services Software as Services is one of the main concepts, this will grow in future, and all the vender products can go in SaaS adoption, so that clients do not have to maintain hardware and manpower.

## 11. Where are we now with Cloud Technology?

Though they have some of the most pressing concerns with regards to cloud computing, large companies are adopting the platform in ever greater numbers, according to a new survey.

Recently, market research firm Ovum published the findings of a survey aimed at large, multi-national corporations on cloud computing. The report found that cloud adoption is up 61 percent from 2010 and well known benefits, such as flexibility and cost-reduction, were among the reasons respondents chose to shift IT to the cloud.

This adoption is happening rather quickly. Most companies polled plan to move to the platform in a period of six to 24 months. Furthermore, 30 percent of businesses claimed they would make the switch within this time frame in order to improve data storage capabilities. Experts say that this may be one of the chief benefits of the cloud, as off-site information can be uploaded based on demand at specific times, saving the company valuable storage space.

The findings of the Ovum survey coincide with other market analytics within the field. According to a report by Advanced Micro Devices, 70 percent of businesses worldwide will make the switch to the cloud within the next couple of years.

## 12. Conclusion

As we all know, there are several advantages of cloud computing. Here is a summary.

- **Remote Access:** With cloud computing, your business is not restricted to be in a particular location. This applies to individuals also. You can access the services from anywhere. All you need is your ID and password. In some cases, there may be extra security requirements, but once in place you can easily access your cloud services from any part of the world.
- **Expansion is very Easy:** Cloud computing is very flexibility allowing you to quickly access more resources if you need to expand your business. You do not need to buy extra infrastructure. You simply inform your cloud provider on your requirements and they will allocate resources to you. In most cases, the entire process is automated so the expansion takes just a few minutes. The same is applicable if you wish to use fewer resources. One of the best advantages of cloud computing is easy re-allocation of resources and easy to re-locate manpower too.
- **Security to data in cloud:** Despite most people's doubts that cloud computing is secure, the reality is that clouds tend to be more secure than the traditional business models. Clouds offer real-time backup which results in less data loss. In case of an outage, your customers can use the backup servers that sync with the main ones as soon as they are up. Your business gets maximum uptime without any loss of data during the transitions. If a provider's cloud is compromised from any external threats, all of their customer's data is at stake. And threats from within the customer base can't be overruled. So we might see emergence of some robust standards based security framework to be in place for all public clouds with the intervention of Federal agencies.

Just like DOS was not the endpoint for user computing (eventually being replaced by a GUI OS like Windows), the cloud isn't an endpoint in technology evolution. We do not know what the next evolution will look like post-cloud but like teller-banking being replaced by ATM's, it can very well be radical.

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