
URBAN INFORMATION SYSTEMS
Prof. Dr. Tahsin YOMRALIOĞLU
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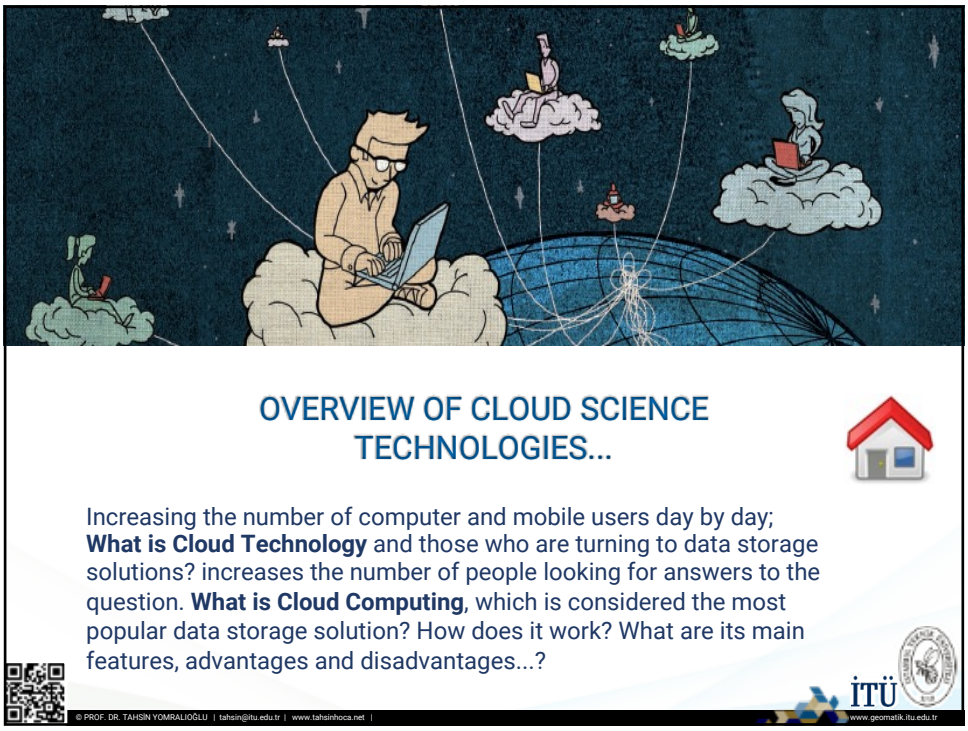
OVERVIEW OF CLOUD SCIENCE TECHNOLOGIES...
Increasing the number of computer and mobile users day by day; **What is Cloud Technology** and those who are turning to data storage solutions? increases the number of people looking for answers to the question. **What is Cloud Computing**, which is considered the most popular data storage solution? How does it work? What are its main features, advantages and disadvantages...?
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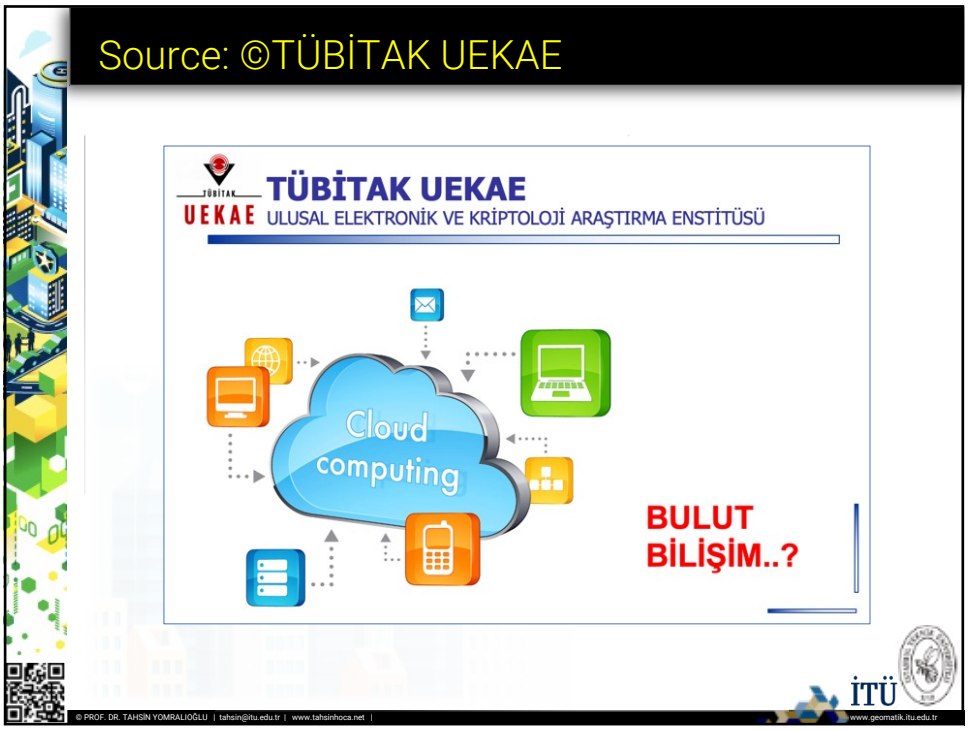
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UEKAE ULUSAL ELEKTRONİK VE KRİPTOLOJİ ARAŞTIRMA ENSTİTÜSÜ
Cloud computing
BULUT BİLİŞİM..?
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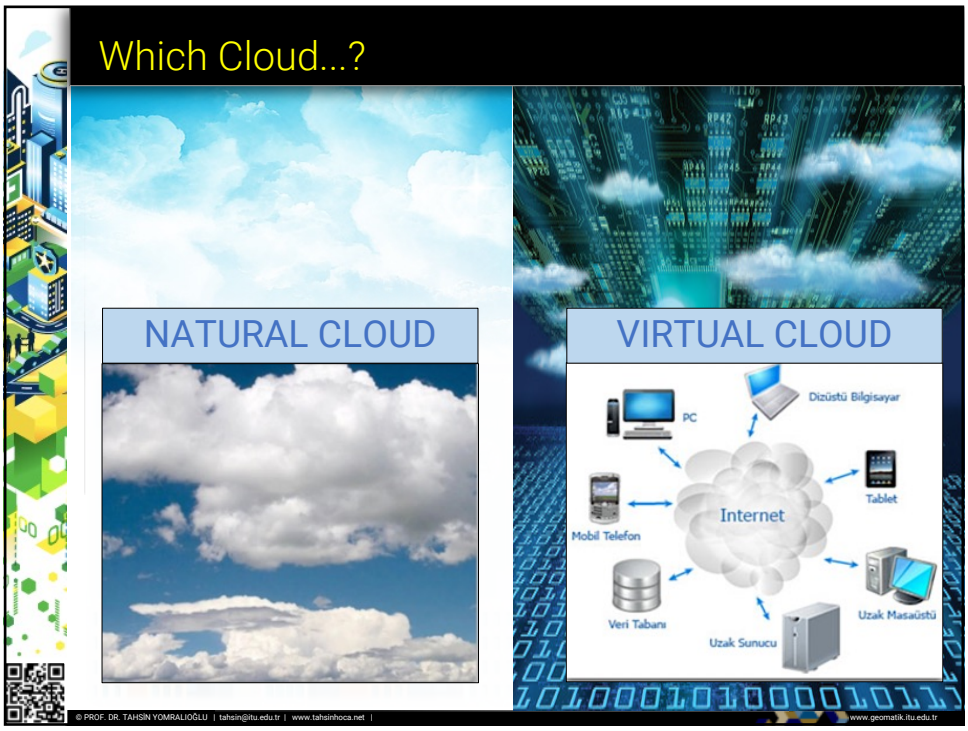
Which Cloud...?
NATURAL CLOUD
VIRTUAL CLOUD
PC
Dizüstü Bilgisayar
Tablet
Mobil Telefon
Internet
Veri Tabanı
Uzak Sunucu
Uzak Masaüstü

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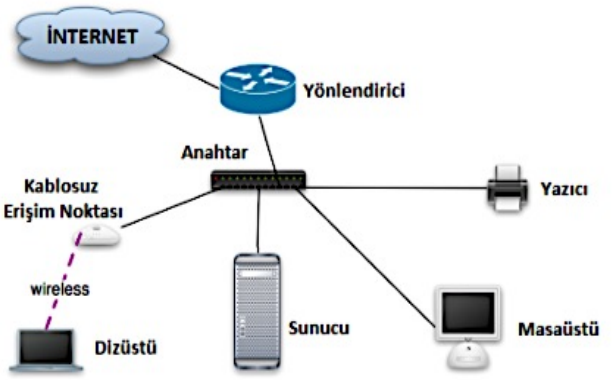
What is a cloud – I

Cloud in network **topology** = **internet**,

Abstracts from the detail of internet infrastructure and environment



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What is a cloud – II

In cloud computing, the **cloud**;

abstracts hardware and software infrastructure in data center

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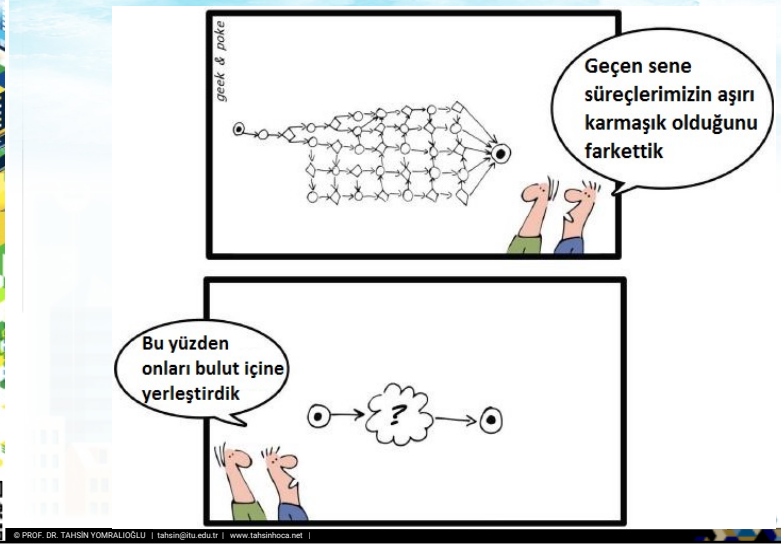
What is a cloud...?



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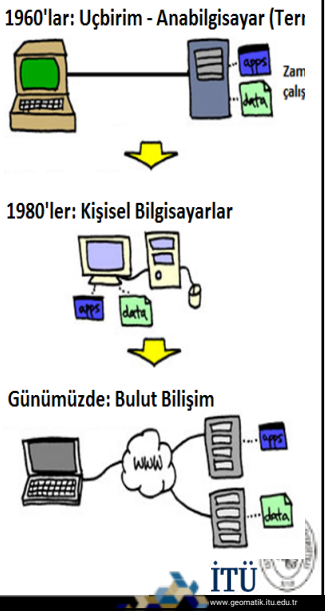
The evolution of cloud computing...?

- According to researchers, the first studies on cloud computing were made in the 1950s by scientist Herb. They state that Grosch is based on the assumption that the whole world will use a system running from 15 large data centers using dumb terminals.
- Cloud computing model, put forward by John McCarthy in the 1960s, 'One day computation will take place over large public networks.' based on opinion.
- Eric, chairman of the board of Google company Schmidt expressed his views on the web in 1993 as follows: 'When networks become as fast as the processors on computers, computers will start to do all their operations on the network, they will spread over the network.' This idea represents the transition to the technology that we encounter today as cloud services.
- In 2007, Google, IBM and many universities started working on large-scale cloud computing research projects. "Considering information technology service users as service providers and service recipients; The view that companies offer their own hardware and software in the form of service-based models has been a turning point in the full realization of the concept of cloud computing.



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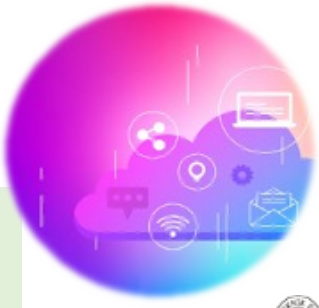
What is cloud computing…?

Definition of cloud computing –

NIST (US National Institute of Standards and Technology)

Cloud computing; It is a model that provides on-demand and convenient network access to a shared pool of adjustable computing resources that can be quickly imported and released , with low management effort or service provider interaction .



Cloud technology; It can be defined as the online provision of information processing services such as storage space, databases, network and software.

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What is cloud computing…?

Definition of cloud computing –

Cloud Technology; It is the storage of existing data on physical or virtual servers by third-party service providers, in a way that can be accessed over the internet, instead of being stored on the hard disk of the personal computer. . ”

Thanks to cloud technology, it is possible to store files and applications belonging to users and access them over the internet by service providers with cloud infrastructure such as

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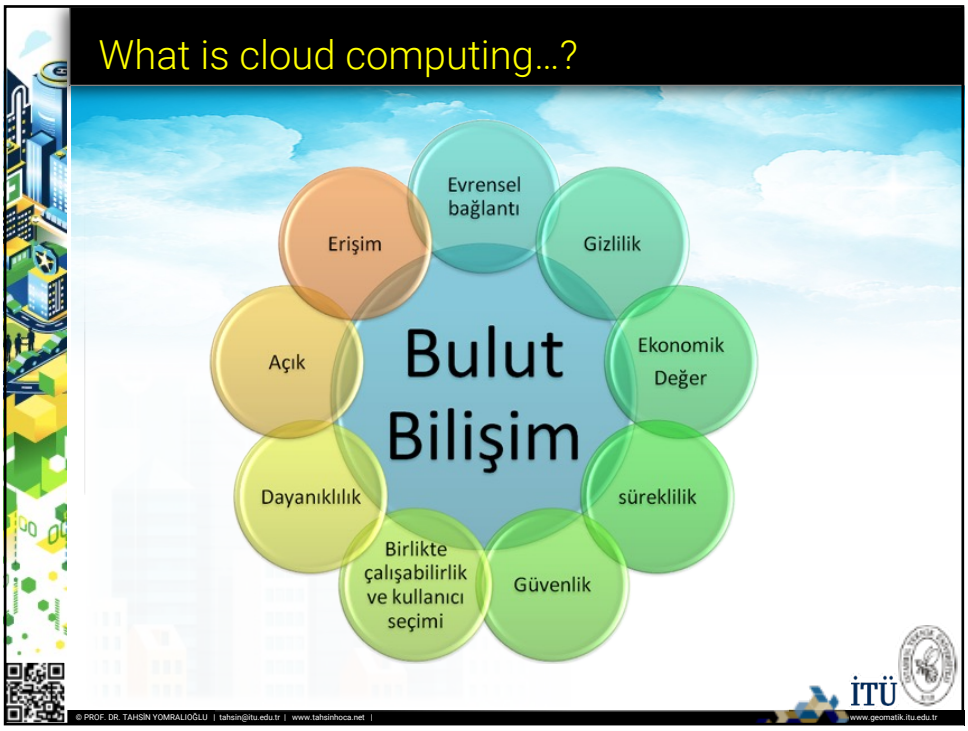
What is cloud computing…?
Bulut Bilişim
Evrensel bağlantı
Erişim
Gizlilik
Açık
Ekonomik Değer
Dayanıklılık
süreklilik
Birlikte çalışabilirlik ve kullanıcı seçimi
Güvenlik
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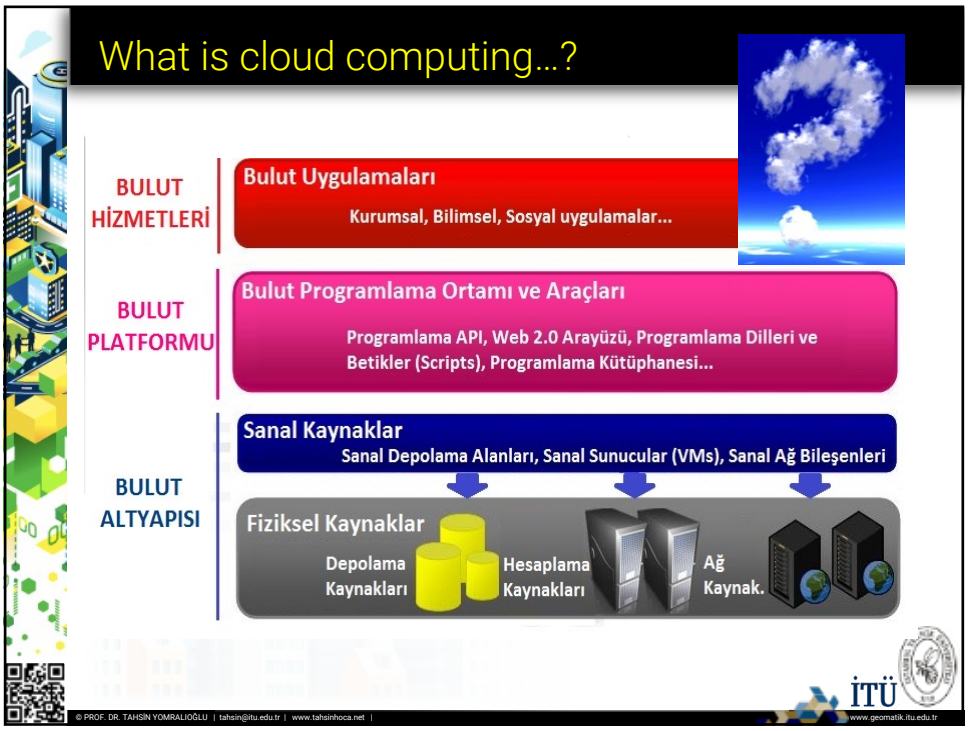
What is cloud computing…?
BULUT HİZMETLERİ
Bulut Uygulamaları
Kurumsal, Bilimsel, Sosyal uygulamalar...
BULUT PLATFORMU
Bulut Programlama Ortamı ve Araçları
Programlama API, Web 2.0 Arayüzü, Programlama Dilleri ve Betikler (Scripts), Programlama Kütüphanesi...
BULUT ALTYAPISI
Sanal Kaynaklar
Sanal Depolama Alanları, Sanal Sunucular (VMs), Sanal Ağ Bileşenleri
Fiziksel Kaynaklar
Depolama Kaynakları
Hesaplama Kaynakları
Ağ Kaynak.
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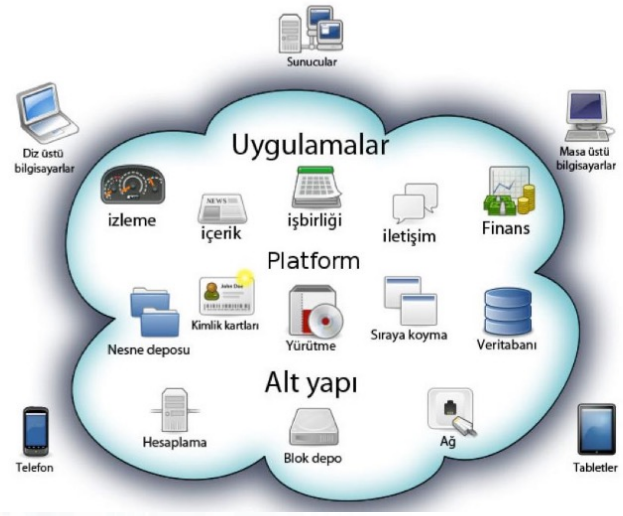
General components of cloud computing…



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What is cloud computing…?

Basic features;

- ❑ Self service on demand
- ❑ Wide network access
- ❑ Location-independent resource pool
- ❑ Quick flexibility
- ❑ Measured service

Software as a Service (SaaS)
Platform as a Service (PaaS)
Infrastructure as a Service (IaaS)

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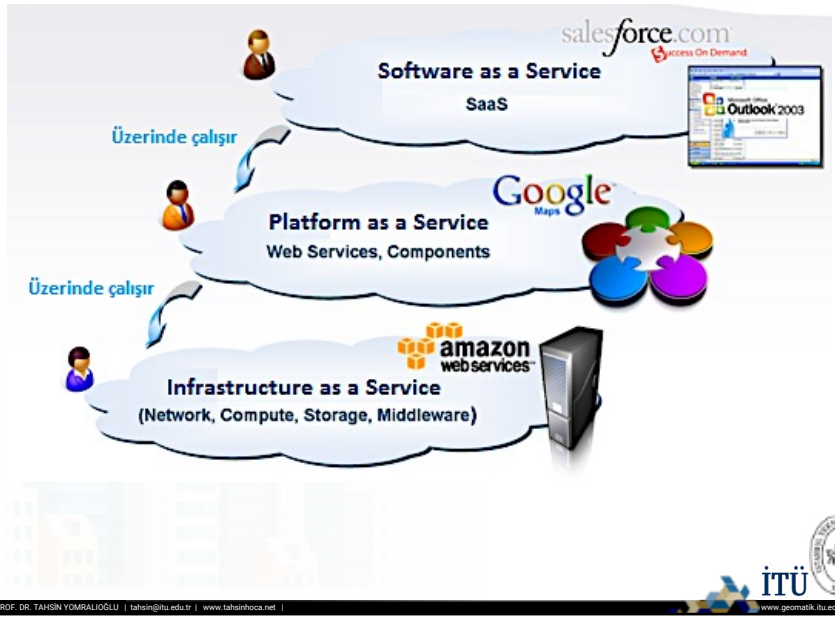
Cloud service models…



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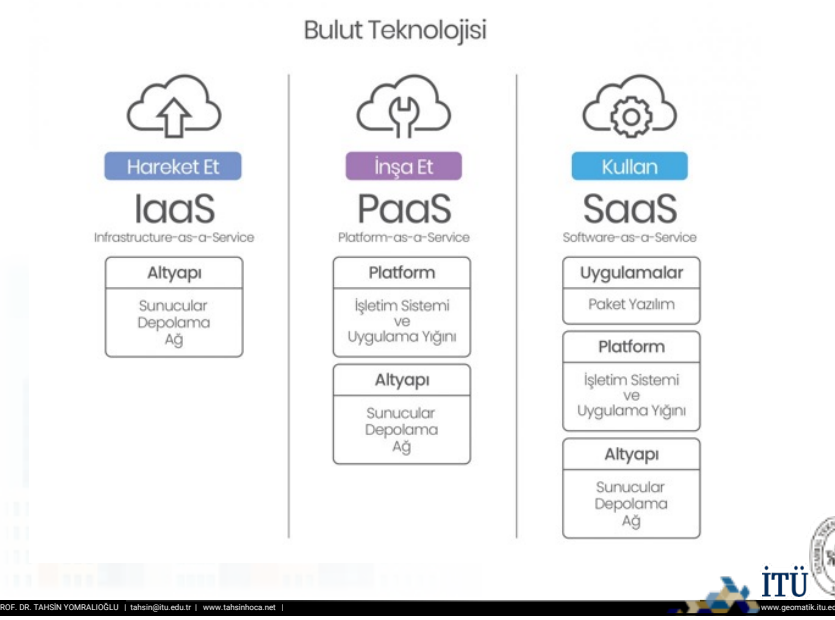
Cloud computing infrastructure models…?



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IaaS (Infrastructure as a Service)

- IaaS is a pay-as-you-go cloud infrastructure service that provides services such as storage, networking and virtualization to businesses.
- IaaS, businesses avoid investing in expensive resources. With IaaS, you can buy what you need, as much as you need, and demand more as your business grows.
- IaaS cloud infrastructure, companies have all the control over the software and hardware, but the company itself is responsible for keeping them safe as they work technologically properly.
- IaaS offers highly flexible and scalable solutions, is low cost and can be accessed by multiple users. It also leaves the infrastructure control to you, if you wish, you can access and control the IaaS platforms yourself.
- IaaS is a cloud computing model that fits most businesses and any budget. DigitalOcean , Microsoft Azure , Google Compute Engine, Rackspace , Amazon Web Services are examples of cloud-based infrastructure services.

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PaaS (Platform as a Service)

- PaaS is a cloud service model that provides hardware and software tools over the internet, such as Google App, to those who want to develop software and applications.
- PaaS is not software, but provides an online platform that different developers can access to build software.
- PaaS allows developers to focus on creativity rather than tasks such as software updates and is often the most cost-effective way to develop an application.
- Also PaaS ; Accessible by multiple users, scalable to the size of your business, based on virtualization technology and easily operated without extensive system administration knowledge. It is on a pay-as-you-go basis.
- PaaS is a popular choice for businesses that want to develop applications without spending a fortune or taking full responsibility for resources.
- PaaS is often built on top of an IaaS platform to reduce the need for systems administration .
- PaaS , developers don't have to start from scratch when building applications and spend a lot of time writing extensive code.

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SaaS (Software As a Service)

- SaaS platforms allow users to use software such as a website or email over the internet, usually for a monthly subscription fee.
- SaaS allows you to use software by logging into your account over the internet without the need to install software applications on your computer.
- You can access the software at any time, from any device, as long as there is an internet connection. This applies to anyone using the same software.
- Most modern SaaS platforms are built on IaaS or PaaS platforms.
- In addition, thanks to SaaS, you do not need to download the software to more than one computer in your office and try to keep it updated on each computer. **Dropbox,** Salesforce, Cisco WebEx are examples of cloud-based software service.

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Types of cloud computing…?

- (1) Public **Cloud** cloud)
- (2) Private **Cloud** cloud)
- **(3) Affiliate Cloud** (Community cloud)
- (4) Hybrid **Cloud** cloud)

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Types of cloud computing…?

- **(1) Public Cloud -** In the public cloud, the entire computing infrastructure of the organization is carried out. In other words, all information-processing activities are carried out on resources to be leased on the infrastructure established by third-party companies. This solution is particularly suitable for personal use. Gmail is one of the best examples for public cloud computing, for example. It is possible to benefit from a very well-managed e-mail service without making any investment to use e-mail services.
- **(2) Private Cloud-** It caters mostly to large companies and companies of all sizes where data security is important. The company builds its own cloud. The closed cloud is shared within the company. Although it does not provide as big savings as the public cloud, it provides very important advantages in computing investments and expenses. To give an example of public cloud and private cloud from daily life, we can compare the first to public transportation and the second to private cars. In the public cloud, just like in public transportation, resources are shared with others at the same time.
- **(3) Affiliate (Community) Clouds - Interconnected** groups of companies that wish to benefit from a common Cloud Computing environment are preferred. For example, different units of an army, all the universities in a particular region, or all the suppliers of a large manufacturer can form such a community.
- **(4) Hybrid Cloud – In** hybrid cloud, private cloud and public cloud are used together. Systems where public cloud is used for some applications where the degree of privacy or reliability is not so important, and private cloud is used for areas where privacy and reliability are important. For example, it is preferred to use private cloud for data storage and public cloud for word processing. Which one to choose depends on the needs. The general rule is to use the public cloud for personal use and private cloud for corporate use.

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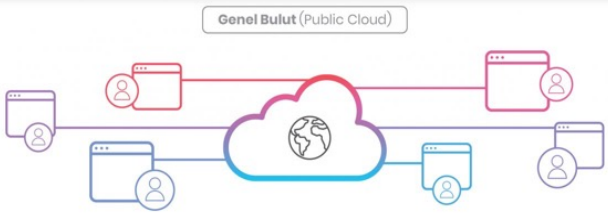
Public Cloud



- **public cloud** is when a service provider makes its resources available over the internet to anyone who wants to use it. Giant tech companies like Amazon, Microsoft, and Google are among the public cloud providers.
- The public cloud provider is responsible for the management and maintenance of its data center (all hardware, software and supporting infrastructure components).
- Public cloud deployments are mostly used for web-based email (Gmail, Yahoo, Hotmail etc.), online office applications, storage, testing and development.
- Some of the public cloud providers offer free resources, while others provide services for a subscription or fee.

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Public Cloud Advantages …

- **Low Cost:** You do not need to purchase hardware or software as all data is stored in the service provider's data center. You only pay for the service you use. There are also no expenses that require a growing company to acquire additional hardware or build an expanding network.
- **Server Maintenance Exemption:** The service provider is responsible for maintaining the server where the data is stored. The user or customers have no such responsibility.
- **Time Saving:** Service provider; Since the server is responsible for processes such as procurement processes, installation and configuration of the operating system, users do not need to spend time on such issues.
- **Unlimited Scalability:** Your request to increase resources in proportion to your increasing needs is easily met.
- **High Reliability:** Generally, since data centers of enterprises are located in a single geographical region, they may be exposed to problems such as bad weather conditions and power outages. However, public cloud providers such as Microsoft and Google have a large server network in many different regions. In other words, even if one of the data centers collapses, it is tried to ensure that there is no disruption thanks to the others.

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Public Cloud

DISADVANTAGES …

- **Control:** Because businesses put their systems and data on hardware managed by a third party, they do not have full control over the privacy and digital security of their data.
- **Security:** Since the hardware resource is shared by multiple users, security issues such as data theft may occur.
- **Performance:** The performance of the service network offered depends on the speed of the internet connection.
- **Surprise Cost:** A sudden price increase for the use of the application may cause grievances for users. You may encounter surprise payments when you need to move large amounts of data in or out of the public cloud.

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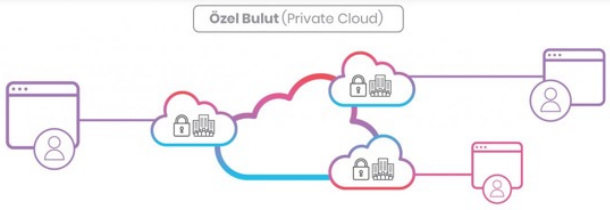
Private Cloud



- **Private Cloud;** It is the management and use of all cloud-based resources such as hardware, storage, and applications only by a single institution. In other words, the institution itself is the owner and administrator of the private cloud.
- Resources are used by the organization's employees, partners, and customers over the Internet or in-house network. Private clouds are mostly the choice of large organizations that care about data privacy.

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Private Cloud

ADVANTAGES ...

- **Control** : In addition to allowing to limit remote access, aspects such as storage, resource management, scalability and configuration are under the control of the organization.
- **Security** : Since the resources are user specific, infrastructure and systems can be configured to provide a high level of security.
- **Customization** : The company itself has the authority to customize hardware and other resources in line with the company's needs.
- **Privacy** : Organizations have greater assurance that only they can access the sensitive data they hold.
- **Performance** : The network is faster.
- **Predictable Pricing** : Private cloud costs are predictable, as the enterprise itself is responsible for procuring the hardware, software, and infrastructure needed.

DISADVANTAGES...

- **Cost** : Private cloud can be quite expensive, especially in the beginning because the organization has to procure almost everything itself.
- **Maintenance and Support: As the** organization is responsible for managing and operating its private cloud, it must actively monitor the deployment, provisioning, security and maintenance of private cloud resources.

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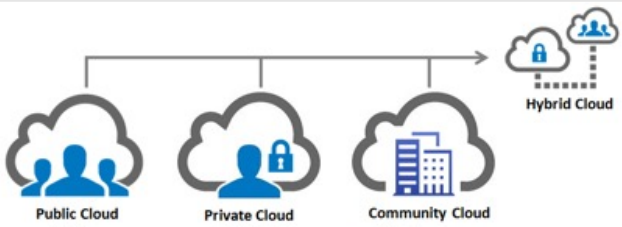
Community Cloud



- **A public cloud** , or Community cloud, is the sharing of infrastructure among various organizations in a private community that have the same interests and concerns (such as security, compliance, jurisdiction).
- It can be managed internally or managed by a third party and hosted internally or externally.
- Costs increase to fewer users than to public cloud (but more users to private cloud). Thus, only some of the cost-limiting potential of cloud computing is realized. For example, government organizations can meet their computing needs using a common cloud (eg : E-GOVERNMENT).

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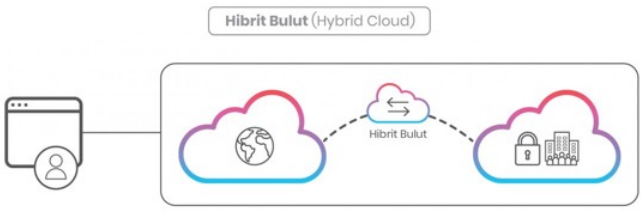
Hybrid Cloud



- **hybrid cloud is a** software solution that combines a private cloud service with one or more public cloud services and enables communication between the two .
- **hybrid cloud;** It enables an enterprise to use on-premises private cloud for sensitive workloads and public cloud for less critical situations such as workloads such as archiving, testing and development.
- **hybrid cloud;** It allows businesses experiencing spikes in demand during periods such as the holiday season to use the additional resources of the public cloud for their applications running in the private cloud. For workloads that vary in this way, as well as for big data processing, hybrid cloud is very convenient.

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Hybrid Cloud

ADVANTAGES …

- **Privacy** : Hybrid cloud has the advantages of private cloud in terms of data security. It ensures the securing of sensitive data belonging to businesses.
- **Continuity** : In case of any disruption in a part of the infrastructure, your work will not come to a standstill.
- **Flexibility** : It allows the instant and flexible addition or removal of required computing resources instead of adding expensive and maintenance-requiring new hardware during periods of increased workload.
- **Speed** : Data load times and transfer speeds can be configured to reach the optimum level.
- **Cost** : It has a cost advantage as only the service required by the institution is paid for the public cloud part.
- **Functionality** : Maximum workload management is provided.
- **Convenience in Test Phases:** With hybrid cloud; it becomes easier to maintain test studies, develop projects, complete them and move them to the appropriate environment with low costs and without loss of time.

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Hybrid Cloud

DISADVANTAGES …

- **Infrastructure** : In order for the hybrid cloud to work efficiently; The private cloud must be able to access and interact with public cloud providers, so hybrid cloud requires API compatibility and robust network connectivity.
- **Technical Support** : The technical support required for the installation, management, security, maintenance of the private cloud included in the hybrid cloud and the API compatibility of the public cloud is the responsibility of the institution.
- **Cost** : While it is cost effective in the long run, the initial setup cost is higher compared to a public cloud. The hardware required to create a hybrid cloud environment requires a significant chunk of your budget.
- **Security** : Preventive steps should be taken by cloud technologists to ensure maximum data security.

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What are the advantages of cloud computing?

1. **Accessibility** : You can access your data or cloud-based applications in the cloud virtually from any location you want with any device connected to the internet.
2. **Collaboration** : Data in the cloud can be easily accessed by all stakeholders. This means team members can collaborate anywhere in the world regardless of location.
3. **Adaptive** : Cloud computing gives owners control over the underlying code while allowing for adaptive programs and customizable applications.
4. **Reliable** : Institutions and individual users have more security as cloud systems are hosted by third-party institutions. Customer support is easy to access should any issues arise.
5. **Safe** : Cloud computing can guarantee a safer environment due to backups within the network.
6. **Cost Savings** : It was very costly for companies to acquire, build and maintain the information management technology infrastructure. Currently, the cloud has replaced expensive server hubs.

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The benefits of cloud computing…

Reducing the cost…

It also offers businesses huge cost savings potential. Before the cloud became a viable alternative, IT infrastructure was costly for companies to purchase, build, and maintain. Currently, the cloud is replacing expensive server centers.

Large-scale data center can reduce the cost by 5-7 times compared to medium-sized ones.

technology	Cost mid-range data central (~1,000 servers)	Cost large-scale data center (~50,000 servers)	Ratio
Network	$95 Mbit/s/month	$13 Mbit/s/month	7.1
Storage	$2.20 Gbyte/month	$0.40 Gbyte/month	5.7
management	~140 servers/administrators	~1000 servers/administrators	7.1

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Benefits of Cloud Computing in the Public …

- Migrating to the Cloud in Government can be a rough road; however, the cloud comes with many benefits that enable organizations to perform their tasks more effectively and efficiently.
- The cloud is well equipped when it comes to **cybersecurity . It** offers the latest and most advantageous opportunity in terms of data protection, with the advantage of backing up and **restoring data** even when the worst-case scenario occurs . Government organizations can be confident that all data contained in cloud solutions certified with cybersecurity regulations will be protected against cybercriminals.
- Faster **access** and **enhanced citizenship services** are one of the biggest advantages of the cloud for public sector organizations.
- The cloud also allows enterprises to avoid **all costs** associated with maintaining **physical data centers** and **legacy infrastructures .** This means millions of dollars in savings annually.
- Cloud tools allow access to needed data or services when they are needed, empowering staff in the field. This means staff can stay **productive** even when away from their desk .

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The risks of cloud computing…

Opportunity = Risk

The importance and degree of risks are;

- ✓ in the field of activity,
- ✓ their internal structures and relationships,
- ✓ The trust relationship established with the service provider,
- ✓ It varies according to the specific conditions.

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The risks of cloud computing…!

☺ The risk that the cloud will rain and rain..!

1. Service continuity and availability,
2. Data security and privacy
3. Data auditability, compliance and legal regulations
4. Service provider dependency and data lockout
5. Management interface and remote access
6. Bandwidth and data transfer
7. Software licensing

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What are the Disadvantages of Cloud Computing?

- are inherently **risks in all the speed, efficiency and innovation** that comes with cloud computing .
- **The** cloud is always a big concern , especially when it comes to sensitive **medical records** and **financial information . Regulations** force cloud computing services to increase their **security** and **compliance measures, and encryption** protects vital information, but if this encryption key is lost, the data is also lost.
- Servers provided by cloud computing companies can also be subject **to natural disasters, internal errors,** and **power outages** . The geographic reach of cloud computing cuts both ways. A California outage could also paralyze users in New York, or a Texas company could also lose data if something causes the California-based provider to crash.
- When hosting and maintaining a service on a local network, you have full control over the features you choose to use. However, when you use a cloud service provider, you are under the control of the vendor. There is no guarantee that the features you use today will be available for the same price tomorrow. The seller can double the price and you may have to pay if you are committed to this service.

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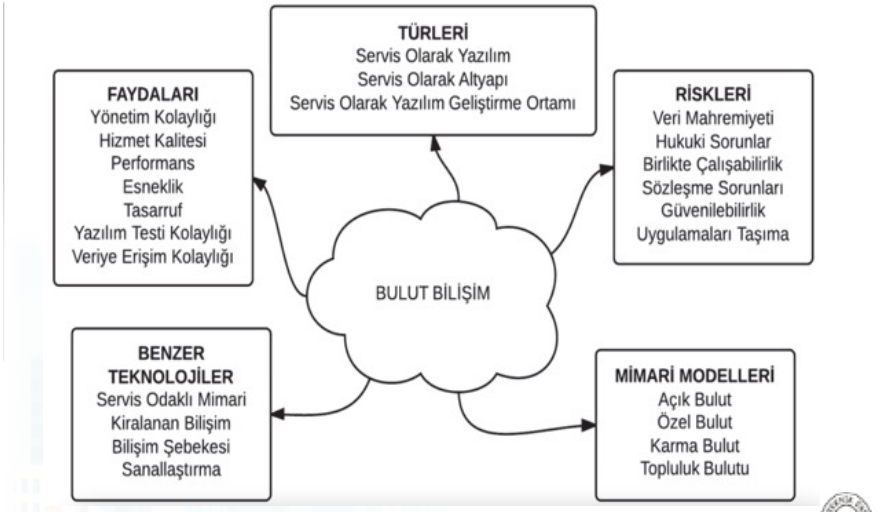
In summary...



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Cloud Computing Statistics...

- ✓ Cloud adaptation statistics claim that by 2020, 83% of companies' workload will be stored in the cloud. (Source: LogicMonitor/Forbes)
- ✓ IDC , the three sectors that plan to spend the most on cloud computing services are: Manufacturing ($19.7 billion), professional services ($18.1 billion), and banking ($16.7 billion) (Source: IDC)
- ✓ cloud industry can be broadly divided into three different service models: Public , Private , and Hybrid. The public cloud market generated $130 billion in 2017. (Source: Statista)
- ✓ operational improvements within the first few months of using the technology . (Source: Multisoft)
- ✓ The main reason for the rise of the public cloud is its affordability . Small and medium businesses find using third-party cloud platforms is 40% more economical than maintaining an on-premises system. (Source: Multisoft)
- ✓ Cloud technology is very reliable in terms of security. 94% of businesses report significant improvements in security after moving their data to the cloud. (Source: Salesforce)
- ✓ What are the top reasons companies choose to trust the cloud? 71% choose speed improvement, 63% more flexibility, and 57% improved customer support as 1 reason. (Source: IDG)
- ✓ Dropbox is the leading cloud storage provider with 47.3%. Other top services include Google Drive (26.9%) and Microsoft OneDrive (15.3%). (Source: CloudRail)
- ✓ The global cloud services market will generate $555 billion in revenue by 2020. (Source: Allied Market Research)

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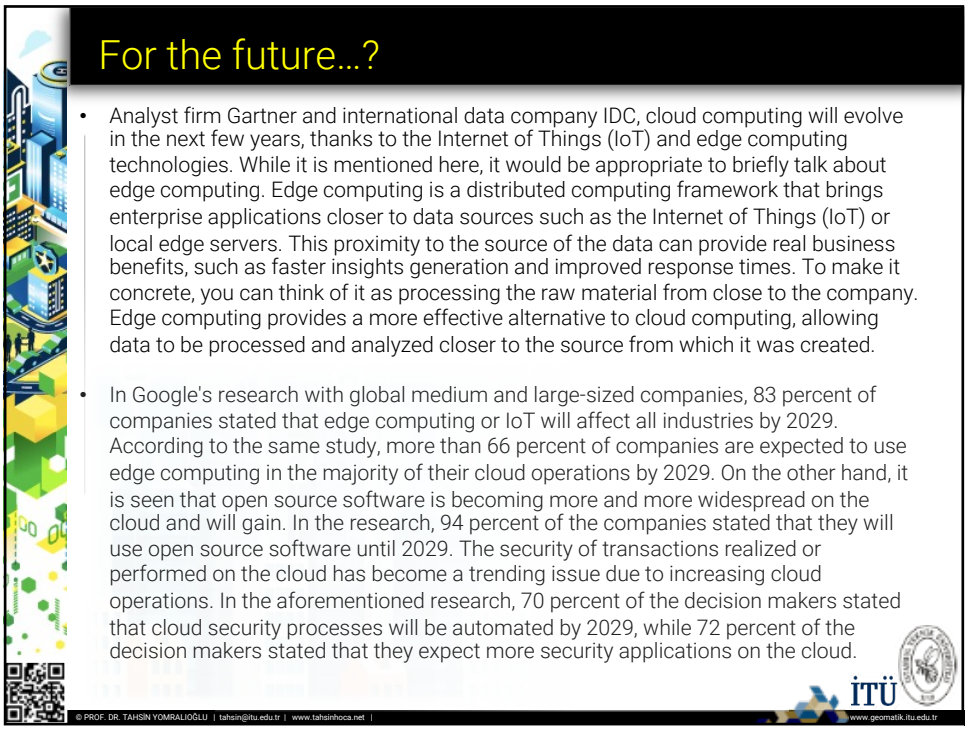
For the future...?
• Analyst firm Gartner and international data company IDC, cloud computing will evolve in the next few years, thanks to the Internet of Things (IoT) and edge computing technologies. While it is mentioned here, it would be appropriate to briefly talk about edge computing. Edge computing is a distributed computing framework that brings enterprise applications closer to data sources such as the Internet of Things (IoT) or local edge servers. This proximity to the source of the data can provide real business benefits, such as faster insights generation and improved response times. To make it concrete, you can think of it as processing the raw material from close to the company. Edge computing provides a more effective alternative to cloud computing, allowing data to be processed and analyzed closer to the source from which it was created.
• In Google's research with global medium and large-sized companies, 83 percent of companies stated that edge computing or IoT will affect all industries by 2029. According to the same study, more than 66 percent of companies are expected to use edge computing in the majority of their cloud operations by 2029. On the other hand, it is seen that open source software is becoming more and more widespread on the cloud and will gain. In the research, 94 percent of the companies stated that they will use open source software until 2029. The security of transactions realized or performed on the cloud has become a trending issue due to increasing cloud operations. In the aforementioned research, 70 percent of the decision makers stated that cloud security processes will be automated by 2029, while 72 percent of the decision makers stated that they expect more security applications on the cloud.
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