chapter 2

Cloud computing Fundamentals

Computing Generations:

MainFrame → pc → Network → internet

```
Cloud
Computing
```
← Grid compute.

المكلود يغرب شوبة ال MainFrame
بيمن و مشوي فروقات
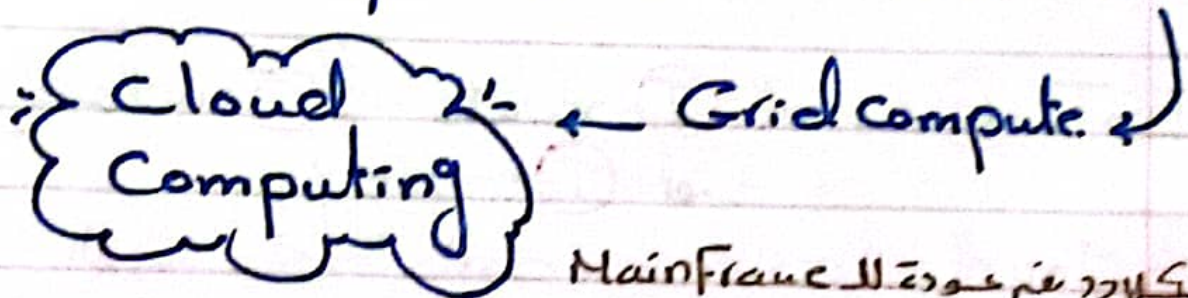
Mainframe	Cloud computing
• finite computing Power	• infinite power and capacity
لو كانت قوة محدب سطى محوية
محدية ، تقف limit	قدرة اهلا تكون مال كن
من cpu مشا مسب
• terminals as UI	• local computing and caching
ال UI بزب عبارة عن سوايا
باطبة معرفة	

Consoles / terminals

Deffinition

it's a computational environment that provides transparent access to a shared pool of computing resources matching the users needs ↘

ليتام دہ يحفظ
زى ماهو

NIST: (N)ational (I)nstitute of (S)tandards and (T)echnology

المؤسسة دى طلعت تعريف تاني لل Cloud ؟

Computing model For enabling everywher convenient on demand access to a shared pool of configurable computing resources

‑ Cloud model promotes **Availability**

‑ Cloud model has ⑤ characteristics , ③ Service models and ④ deployment types.

Characteristics of Cloud

[1] On-demand self-service

Consumer can provision Computing capabilites automatically without requiring any human iteraction with each service provider

حال اليوس بيطُلب الـ Service بتتحجر لعلى طول من غير ما يحتاج اي موافقة من حد (هفيشه صدام عناك السر الرابع)

[2] Broad Network access

Capabilites available over Network and acessed through Standard mechanisms using heterogeneous platforms

8 ان يبقى فيه في تقنيتات مش مهتمـ بـ Network خدمات الـ Cloud acces (بريجي)

[3] Resource pooling

Computing resources are pooled to serve consumers according to their demand.

(تَجميع)

[4] Rapid elasticity   بتتجنن وتشاب جـ طوله Cool

capabilities can be provisioned and Released automatically to scale up and down according to consuming fate.
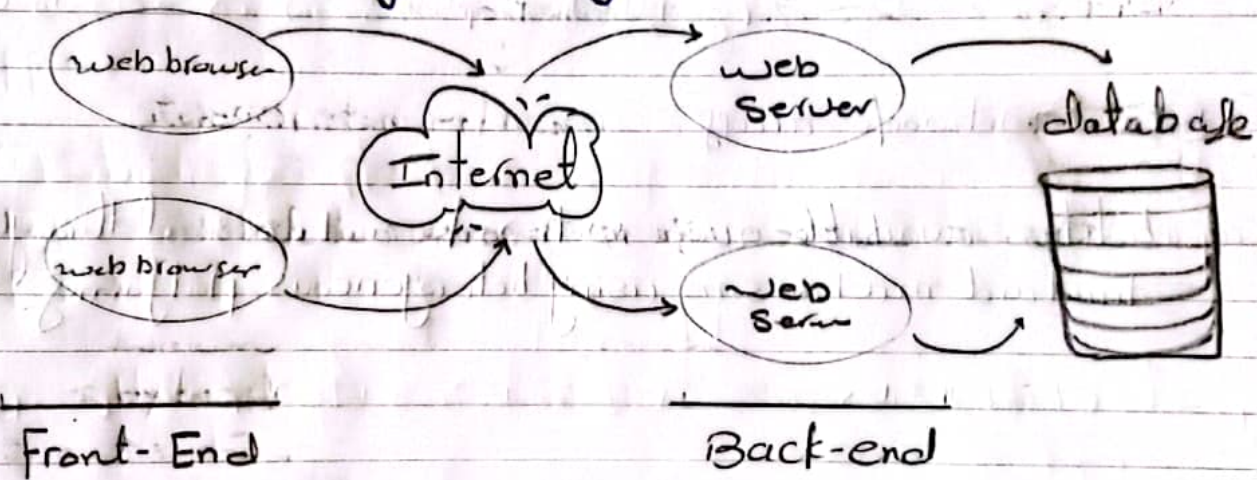
الـ resource بتتحجن automatic لما الطلب يطلع ترجيع خلافية تاك (اللي علىه استغلايها (يعني اللي بيخلى الـ cloud سريني يعني)

[5] Measured Service

resource usage can be **monitored, controlled, and reported** For both provider and Consumer.

(استخدام ال resources بيكون متراقب ومشروط يستخدم على قد ما ... (الزبائن بستخدم ساعة ودي 2 مثن)

Cloud computing accessing.

Front-End   Back-end

Service models

[1] Infrastructure as a service (Iaas)

physical layer(Hw) ال فوق ده virtual layer لاجينا virtualization ده فايدة ع support ده ال access layer ده فوق بعت.

Iaas : creates a virtual Instance from the resources and put it in a capsulated Box named (Virtual machine) with different Configurations to be sent to paas

Iaas ⟶ Organizations
Saas ⟶ External user
Paas ⟶ Developer

Development types: ① public   ③ Community
                   ② private   ④ Hybrid.

① Private ⟶ Single Organization
                    ↓
               own | Manage | operate

② public ⟶ open use by general public

    owned, Managed, operated by — business ✓
                                 — Academic ✓
                                 — Government ✓

③ Community ⟶ Specific community of
                  consumers with shared concern
⟶ owned. Managed and operated by one or more Organization.

④ Hybrid cloud. ⟶ two or more distinct cloud
                      Infrastructure bound together

private ⟶ Critical workloads   Cloud bursting ⟶ load balancing
public ⟶ workload bursts
        or demand spikes

⑤ Multi cloud ⟶ Combination of private, public, Hybrid
       ↓   From different vendors.
one or more cloud deployment of the same type

Multi Cloud challanges:

[1] Migrate workloads
[2] different Apis (Communication)
[3] different Storage services.
[4] different Managment windows (getting lost)
[5] different Monitor tools
[6] environmt highly Compatible to simplify
           introperability.

Approaches to run Smoothly

[1] Standardize as much as possible.
[2] Consolidate Managment (Single interface)
[3] Monitor the results.

(Hybrid)   (Multi-cloud)
    ↓   ↓
Single entity   not Single entity
       ↳ Similar but diffrent it infrastructure model ↵

(Cloud Benefits)   ↙ CapEx

[1] No up-front Investment (pay as you go)
              ↙ OPEX
[2] lowering operating Costs (resources allocated and
                        de-allocated on
[3] Highly Scalable   demand)
          ↳ Infrastructure providers ✓
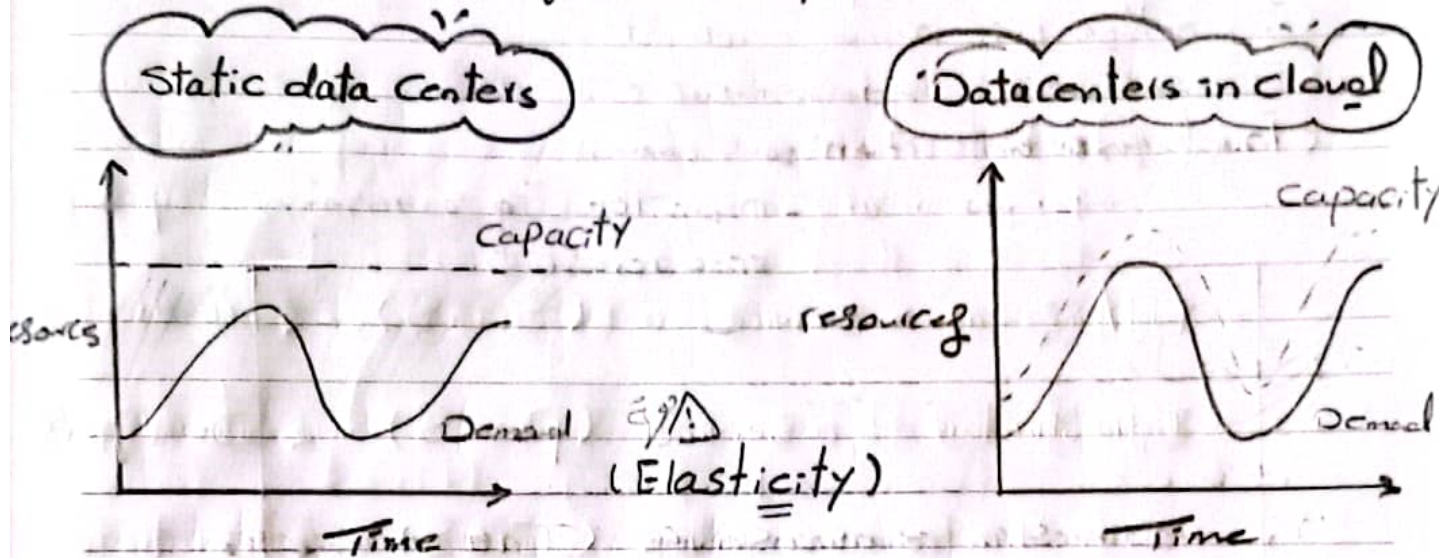   ↳ Service providers ✓

[4] Easy access (Services are web based) ↓
                     need
        Internet connection.   Hi . Star

PAGE
DATE   opEx

5) Reducing business risks and maintenance expenses
Service providers shif risks to
Infrastructure providers.

Static data Centers   Data Centers in cloud

(Elasticity)

6) Elasticity.

Degree to which a system is able to adapt to workload changes by provisioning and de-provisioning resources in an automatic manner.

↓

to avoid
=

(lost revenue)   (lost users)

1) Over-provisionning   2) Underprovisioning
(Allocating more resources   (Allocating fewer resources
than required)   than required)

7) Energy saving (Energy consumption and GHG)
                                                    ↓
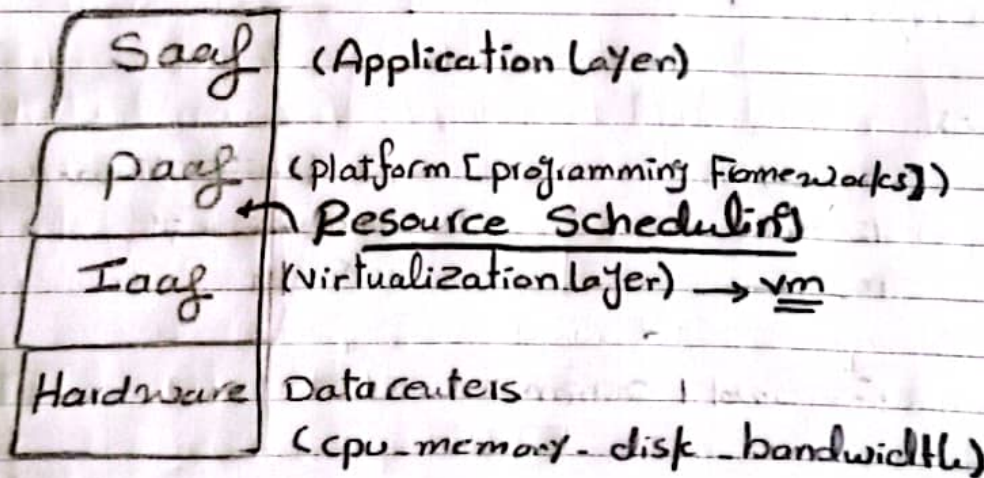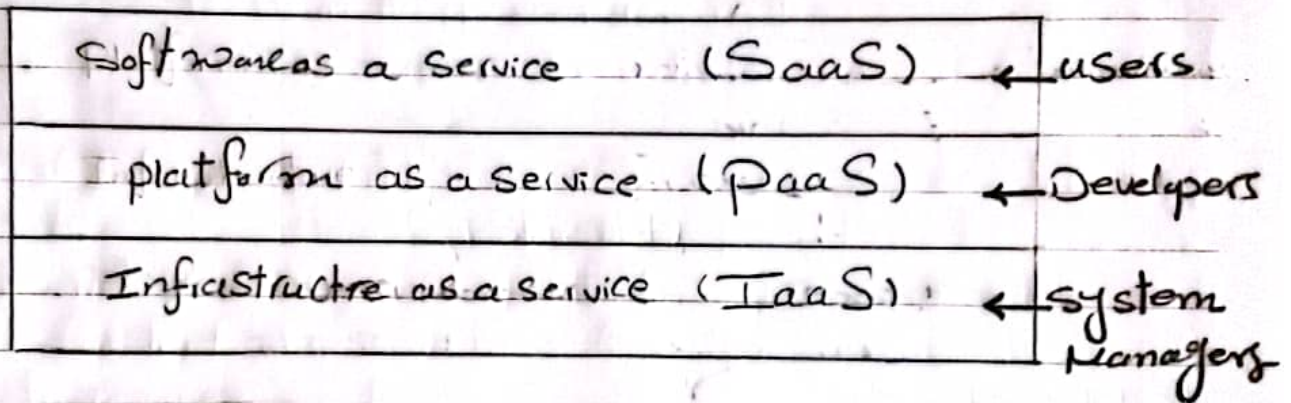8) Noe advantages :— reduced costs   (green house gas)
                   — Unlimited storage capacity
                   — Easy group Collaboration
                   — device Independent.

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[Disadvantages of cloud :]

[1] requires Instant Internet connection
[2] limited Features
[3] large latency time.

Cloud Architecture

Software as a Service (SaaS)	← users
platform as a service (PaaS)	← Developers
Infrastructre as a service (IaaS)	← System Managers

SaaS	(Application Layer)
PaaS	(platform [programming Fomeworks])
	↑ Resource Scheduling
IaaS	(virtualization layer) → vm
Hardware	Data centers
	(cpu - memory - disk - bandwidth)

- Resource Scheduling   → PaaS
- Resource provisioning   → IaaS
  [(dynamic resource Assingment)

Hardware Issues :   [1] Hw configuration
                    [2] Fault tolerance
                    [3] traffic managment
                    [4] Resource managment

Infrastructre Providers = Paas + Iaas

↓

often same organization

Commercial Clouds: 1 window azure
2 google app engine (3-tier app)
3 BlueImax → dash board
4 AWS

Contract

non-functional ← **SLA** with customers
requents (Service level Agreement)

ensures

⌢

User needs	provider needs
- Availabilty	- Utilization
- reliability	- Revenue

Components

① Responsibilities (limits - Restrictions)
② Recovery   ⑩ privacy
③ Redundancy   ⑪ Hw ensurace
④ Maintenance
⑤ Data location
⑥ Security
⑦ Transparency
⑧ Certification
⑨ Data encryption

Cloud Computing Challenges

1 performance   2 Security   3 Control   4 Bandwidth
(latency and   and privacy   Cost
delay)

5 Reliability

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