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Docker is an open platform for developing, shipping & running applications.

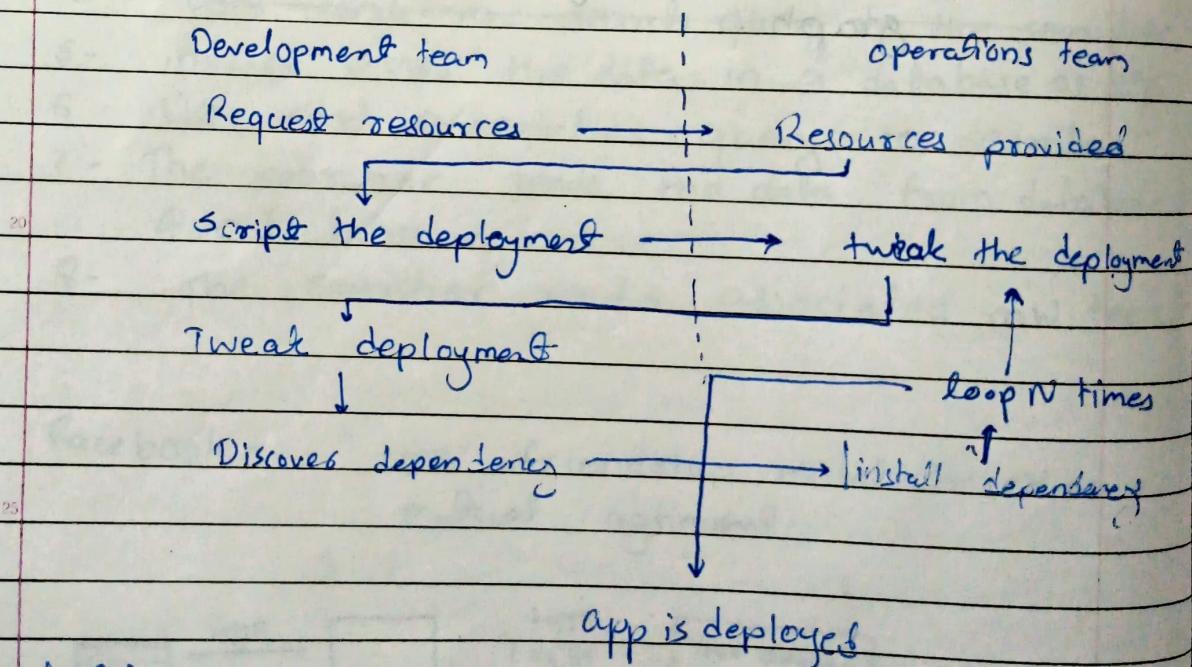
It uses OS level virtualization to deliver software in packages called containers.

Benefits → application software + OS file systems together in single standardized image.

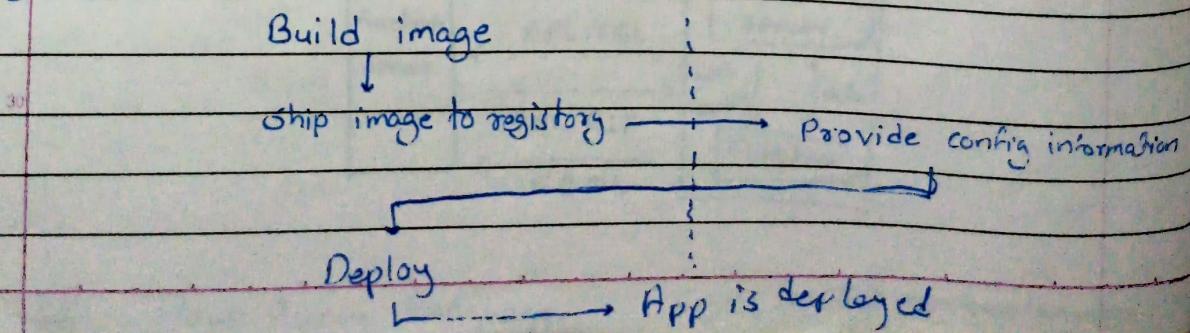
abstraction of software applications from the hardware without sacrificing resources.

Process Simplification / work flow -

without docker →



with docker →



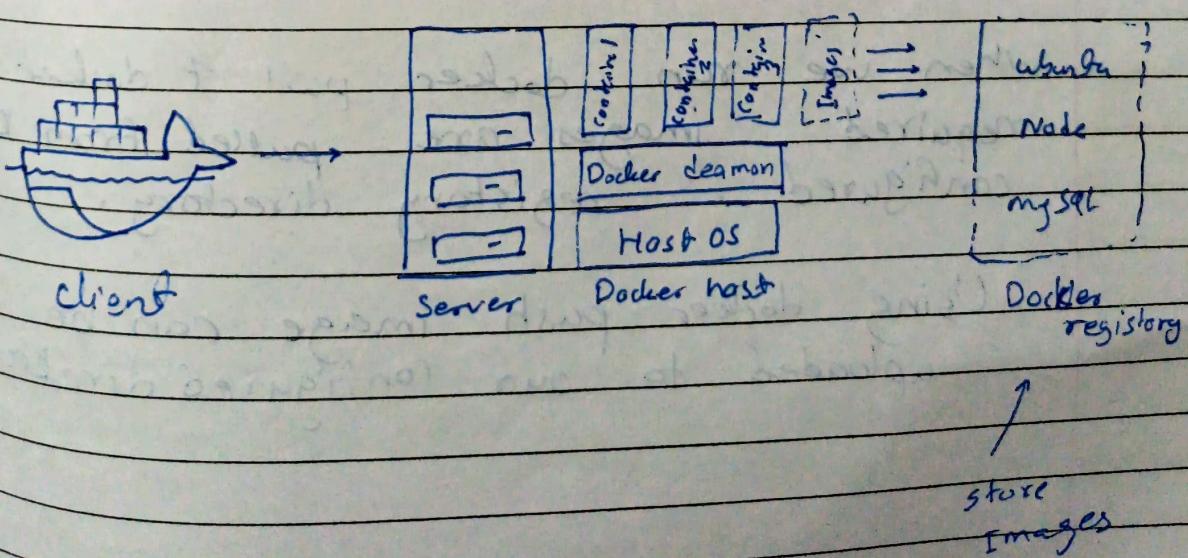
Broad Support & Adoption →

- Docker runs on AWS, GAE, IBM, Azure.
∴ well supported.
- Docker-client run directly on most major operating system but docker server runs only on Linux system.
- Docker was traditionally developed on Ubuntu Linux distribution, but today most Linux distribution + OS are supported.

Architecture →

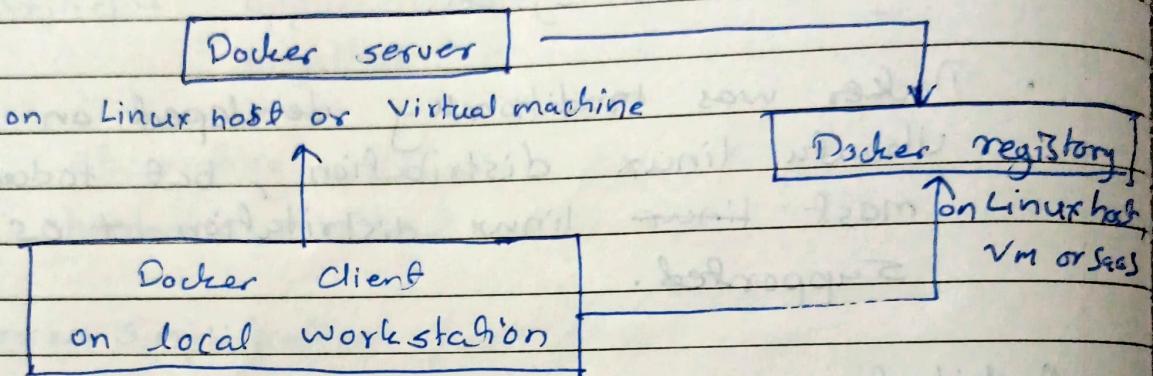
Simple client-server model, with only one executable.

Docker leverages kernel mechanisms such as iptables, virtual bridging, cgroups, namespaces & various file system drivers.



Docker engine has following components.

- A server → continuously runs demon process
- A REST API → talks with demons
- A command line interface client.



Images → read-only template with instructions to create a docker container.

(Building block of docker)
(stored in Docker registry)

When we run docker pull & docker run required images are pulled from our configured registry directory.

Using docker push image can be uploaded to our configured directory.

Cloud computing 6 - Future of cloud Comp.

• How cloud will change as.

① Shift towards thin clients →

(light-weight devices which rely heavily on cloud resources)

② Increased Reliance on Internet connectivity →

to access remote resources. this has influence as to adapt prioritizing network connectivity.

③ Focus on web based application -

OS has increasingly integrated web tech & browsers as a core component.

④ Shifting storage Paradigm - cloud storage providers as native option.

⑤ Virtualization & containerization -

allows creation management of isolated & encapsulated environments allowing apps to run consistently across different operating systems.

⑥ OS responded with ensuring compatibility with popular virtualization & containerization platform.

⑦ Enhanced scalability & flexibility → OS adopted features like auto-scaling & dynamic resource allocation to optimize the use of cloud resources.

⑧ Security & privacy → encryption, access control, secure communication protocol.

provide tools for managing & ensuring policy permissions compliance

Just enough OS (JeOS), browser only, Ubuntu has a JeOS version
Novell's SUSE, Linus enterprise JeOS, Oracle's JeOS,
Sun's Open Solaris JeOS.

M	T	W	T	F	S	S
JeOS					YOUVA	

Location-aware application-

fundamental aspect of mobile web-enabled service

usefulness of mobile app depends on where Ur at exact moment when Ur using the service.

- Location based service is a service where-
 - User determines location
 - User is offered 2 ways interaction with location information
- Component of location based services-
mobile device, content provider, communication network & positioning component.

They use GPS. geographical position
Location detected through GPS (Satellite tech)

ex → fleet management app with mapping, navigation & routing functionalities.

advantages →

- ① Provides an affordable implementation without using extra hardware.
- ② It offers location awareness within building or area where GPS cannot be used.
- ③ It helps building customized maps.

Intelligent Fabrics & paints.

A set of compute, storage, memory & I/O components joined through a fabric & software to manage them.

~~xed go!~~

∴ fabric provides capacity to reconfigure all system components - server, network, storage & speciality engines at same time.

Smart materials are the materials, which can sense & react to environmental conditions. According to the manner of reaction they are divided into 3 categories.

Passive Smart → sense env conditions.

Active Smart → sense & react to env conditions.

Very smart → sense, react & adapt to env condn.

The fabric can attach to existing adjacent systems including infrastructure, wifi or lan, servers & user devices.

also called as iFab. self healing tech.

Applications →

Health care → life bed, health monitoring.

military defense → protection & survivability increase.

sports wear → monitor heart rate & bp.

Future of cloud TV.

OTT, changing usage patterns brought by traditional TV.

STB (Set -Top box) will disappear.

Pay TV providers pose, susceptible to these trends.

Traffic will be all unicast (.broadcast X)

cloud DVR tech makes all TV content available on demand, on any device & in any location.

cloud-based services - the key benefits are the service is software-based, so one doesn't need a physical location to run operations. As a result real estate, infrastructure & manpower cost will get reduced.

- Mobile cloud computing →

paradigm that combines power of cloud with mobility & ubiquity of mobile devices.

accessing cloud resources & services using smartphone, tablets & other portable devices.

revolves around off loading.

availability of cloud-based applications & services.

Scalability & cost effectiveness.

Seamless software updates & maintenance.

Overall, mobile computing revolutionizes the capabilities of mobile devices by extending their functionality.

Adv → save battery power
make execution faster

Improves data storage capacity & processing power
Improves reliability & availability.
Dynamic provisioning.

Disadv → dynamic on-demand
Network latency can lead to execution delay.

Must send program states (data) to cloud servers.

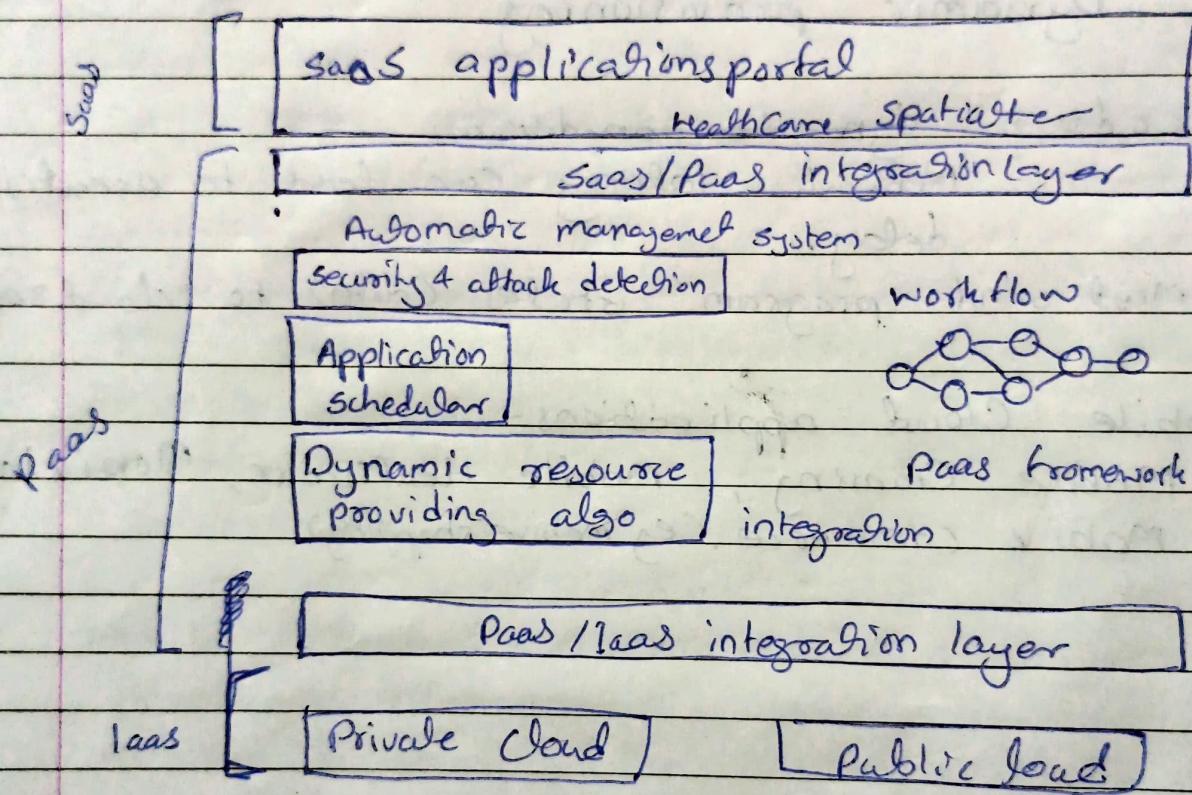
Mobile Cloud applications →

Mobile Gaming, Mobile Healthcare, Mobile learning
Mobile commerce (e.g. mobile shopping)

Automatic cloud engine -

ability of distributed system to manage its resources with little or no human intervention.

auto monitoring mostly implemented on specific layers of cloud arch.



SaaS application portal → hosts SaaS apps using web service-enabled portal system.

auto management system & paaS framework →

automatic manager is composed by the following components, with specific roles.

Application scheduler -

assign each task in app to a resource for execution

energy eff schedulers application needs to be scheduled in such a way that their total energy consumption is minimized without compromising SLAs and cost.

Dynamic resource provisioning algo-implements logic for provisioning and managing virtualized resources in private & public cloud.

Security & attack detection.

Comet cloud →

autonomic computing engine for cloud & grid envs.

Application

Programming layers	Master/Worker/BOT			Work Flow	MapReduce/Hadoop
	Scheduling	Monitoring	Task consistency		
Service layer	clustering/ Anomaly detection	coordination	Events	Publish/subscribe	messaging
Infrastructure layer	Replication	Load balancing		Content security	
	content-based routing				
	self-organizing layer				

Data centres / Grid / Cloud.

6.9.1 CometCloud

- CometCloud is based on a decentralized coordination substrate, and supports highly heterogeneous and dynamic cloud/Grid infrastructures, integration of public/private clouds and cloudbursts.
- CometCloud is an autonomic computing engine for cloud and grid environments.
- CometCloud is composed of a programming layer, a service layer, and an infrastructure layer.
- Fig. 6.9.2 shows CometCloud architecture for autonomic cloudbursts.

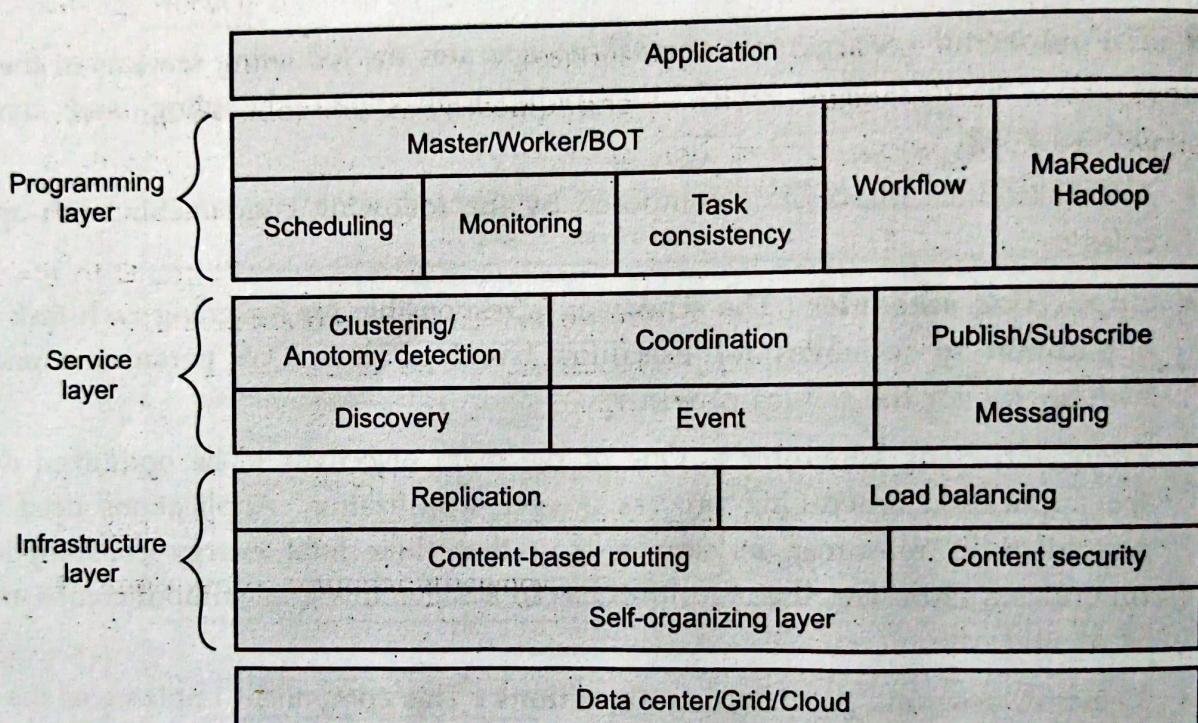
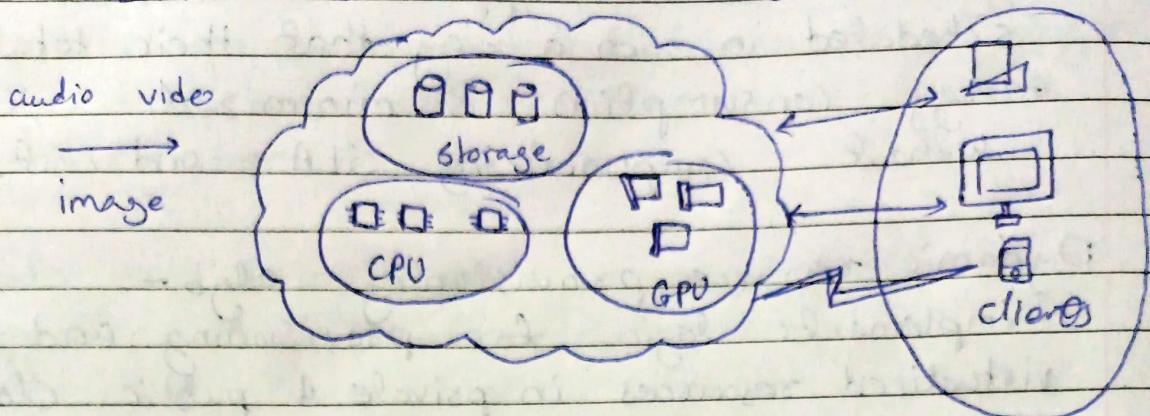


Fig. 6.9.2 CometCloud architecture for autonomic cloudbursts

- The infrastructure layer uses the Chord self-organizing overlay, and the Squid information discovery and content-based routing substrate built on top of Chord.
- The routing engine supports flexible content-based routing and complex querying using partial keywords, wildcards, or ranges.
- This layer also provides replication and load balancing services, and it handles dynamic joins and leaves of nodes as well as node failures.
- The service layer provides a range of services to support autonomics at the programming and application level. An application can switch between spaces at runtime and can simultaneously use multiple spaces.
- This layer also provides asynchronous (publish/subscribe) messaging and eventing services.

- The programming layer provides the basic framework for application development and management. It supports a range of paradigms including the master/worker/BOT. Masters generate tasks and workers consume them.

Multi media cloud multi media cloud



def → cc to store audio video & images.

key aspects.

- ① Storage → Amazon S3, Google cloud storage, Azure Blob.
- ② Scalability → handle traffic & handle volume.
- ③ Content delivery → (CDN) for faster delivery across globe.
- ④ Transcoding & processing → one format to another.
↳ video editing, image recognition.
- ⑤ Collaboration & sharing.
- ⑥ security and backup.

Energy aware cloud computing →

Use of cloud in manner that prioritizes energy and sustainability.

Designing & optimizing cloud infrastructure & app to minimize energy consumption.

key points-

- ① Power management → dynamic resource provisioning, workload consolidation, load balancing.
- ② Green data centres → energy efficient hardware, improving cooling techniques, implementing adv power distribution system.
- ③ virtualization → multiple machines on single server
Dynamic resource allocation & migration.

- ① energy aware scheduling & resource allocation.
- ② Green cloud services →
 - energy efficient VM
 - optimized storage solution
 - carbon neutral data centers.

- Jungle computing (distributed computing system)
consists of all computing resources available to end users.
- Reasons for jungle computing →
 - ① application may req more power than available in any one system a user has access to.
 - ② Diff part of app may have diff computational req.