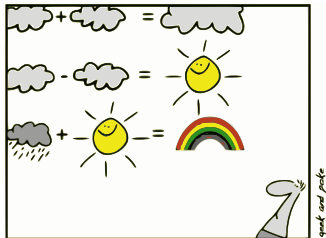


Agenda for Today

- Classic/Traditional IT
- What is Cloud Computing? \implies Definition
- Why using Cloud Computing?
- Cloud vs. (own physical) Servers
 - Chances and Risks



SIMPLY EXPLAINED - PART 17:
CLOUD COMPUTING

„There is no cloud – it's just someone else's computer“ (Source: unknown)

- Organizational types of Cloud services
 - Public / Private / Hybrid Cloud services
- Categories of Cloud systems
 - HaaS / SaaS / PaaS / FaaS / IaaS
- Additional concepts (HaaS, Cloud print, Cloud gaming, Cloud operating systems – DaaS)

RESTful Web Services

- Requested via the **HTTP interface**
 - More simple way of interaction in contrast to SOAP (XML-based)
- **Stateless communication**
 - Each HTTP message contains all information to understand it
 - The server doesn't hold any status or session information about the client
 - Each request is an transaction, independent from other transactions
- 4 HTTP methods are enough to work with different **resources**

HTTP	CRUD Actions	SQL	Description
PUT/POST	Create	INSERT	Create or replace a resource
GET	Read/Retrieve	SELECT	Request a resource
PUT	Update	UPDATE	Modify a resource
DELETE	Delete/Destroy	DELETE	Erase a resource

- Further useful HTTP methods:
 - HEAD – requests metadata about a resource
 - OPTIONS – requests, which methods are supported by a resource

Cloud Computing – Services

- Cloud computing is an umbrella term for different **services**
 - A service provider provides an IT service to one or more customers
 - Service provider = external provider or in-house department
 - Typical scenario: **Outsourcing** \implies Outsourcing of IT services
 - Functionality and quality of service should be defined by a **Service-Level-Agreement (SLA)**

How can Cloud services be distinguished in an **organizational** way?

Organizational Distinction of the Services

● Public Cloud

- Customer and provider belong to different organizations
⇒ **Outsourcing**
- (Almost) no costs for purchasing, operating and maintaining your own hardware
- Resources are immediately ready for use and (almost) unlimited available

● Private Cloud

- Customer and provider belong to the same organization
- Costs are similar to a non-Cloud-based architecture
- Based on classic/traditional IT

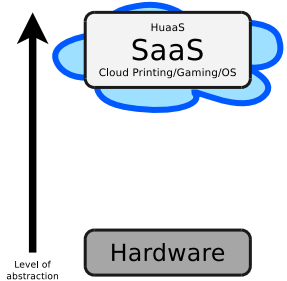
● Hybrid Cloud

- Public and private Clouds are used together
- Application examples
 - Manage load peaks with public Cloud services
 - Store backup data in public Clouds,

How can Cloud services be distinguished according to their **functionality**?

Functional Distinction of the Services – SaaS

- **Software as a Service (SaaS)**
 - Provider runs web applications
 - **This also includes storage services** such as Dropbox, MEGA, iCloud, OneDrive, . . .
 - Customers only need a browser
 - Scalable solution
 - Also in terms of data storage
 - Can be used from any place



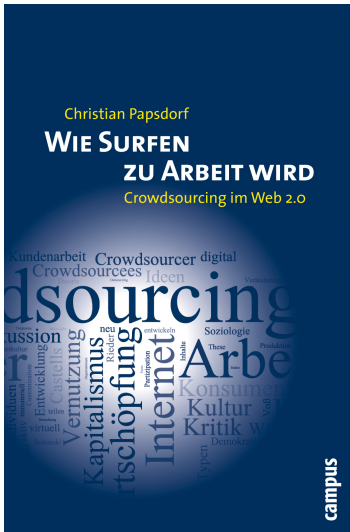
Softwaredienste gibt es schon länger als den Begriff „Cloud Computing“

- (Free) solutions for building software services exist since more than 15 years
- Web server: Apache HTTP server, nginx, . . .
- Application server for web applications: Apache Tomcat (Java), JBoss (Java), Zope (Python)
- Scripting language for dynamic web pages: PHP, JavaScript (NodeJS)

Humans as a Service (HuaaS)

- Principle of crowdsourcing
- Human creativity is offered for low cost or donated from volunteers
- Interesting for...
 - Low-skilled jobs
 - Activities, which a computer cannot do, or requires an unreasonably high development time
- Possible applications are among others:
 - Image recognition
 - Personal Perspective (subjective) reviews for products
 - Translations
 - (Product) assignments to (product) categories
- Examples of public Cloud HuaaS
 - Investigation of the British expenses scandal by The Guardian in 2009
 - GutenPlag, VroniPlag
 - Marketplace for HuaaS: Amazon Mechanical Turk
- In the private Cloud area: HuaaS does not take place

Recommended literature to Crowdsourcing



- Christian Papsdorf. *Wie Surfen zu Arbeit wird*. Campus (2009)
- Consumer Write reviews, develop ideas, create logos, . . .
- These value-adding activities are of high economic significance
- Companies use the internet culture (participation, engagement, self-realization, . . .) to let the users mostly work for free
- Why do the consumers accept this and work for free?

Pril Competition



- On April 1st 2011, Henkel launched a crowdsourcing campaign
 - Despite the date, it was no joke!
- Everyone was able to create a new design proposal for the 600ml bottle at <http://mein.pril.de>

- There were material prizes to win
- The two best designs should go on sale for a short time
- Users of Facebook were able to vote their favorite
- Huge feedback: > 30,000 proposals were submitted

Pril Competition – Outcome

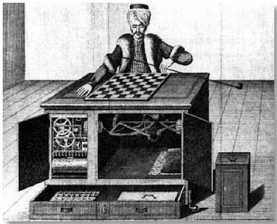
- Not all proposals matched Henkel's expectation



- After a short time, 2 proposals of Peter Breuer (a professional advertising copywriter) became favorites
- The *chicken* proposal was ranked 1st place with several thousand votes ahead
- 2nd place
- Reaction of Henkel: They changed the rules
 - Now, proposals needed to be previously evaluated and release by a jury
 - Only after the jury evaluation, the users were allowed to vote for the proposal
- Result: Wave of anger

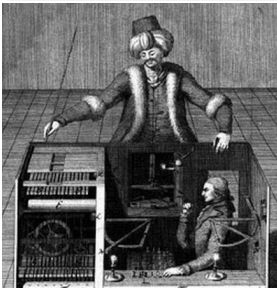


Amazon's Mechanical Turk – Cloud Marketplace



- March 8th, 2006 – Sam Williams
- Pennies for Web Jobs

Speaking to a room filled with Internet developers at the O'Reilly Emerging Technology Conference in San Diego this week, Luis Felipe Cabrera, Amazon's vice president of software development, outlined a project to **harness human intelligence for tasks that computers can't handle well**, such as recognizing objects in images.



The backbone of the plan is a Web-services platform called Mechanical Turk. It uses an **auction-style system to farm out complex tasks – complex for a computer**, that is – such as **recognizing the difference** between a human face and a nearby bush, or **accurately transcribing** an audio recording. Cabrera likes to call the platform „artificial artificial intelligence“ – it's **computers asking humans to do tasks, rather than the other way around**.

...

Image source: Google image search

Source: <http://m.technologyreview.com/web/16519/>

Another Crowdsourcing Marketplace – Samasource

- <http://www.samsource.org>
- Founded in 2008
- Nonprofit project, which gives digital work to people in developing countries
 - *Workers* are in Haiti, India, Kenya, Pakistan, South Africa and Uganda
 - In these countries, school education includes for historical reasons a good basic education in the English language
 - But these countries don't have enough jobs
- Infrastructure is financed from donations
 - Donors are among others the Rockefeller Foundation and Google
- Wages of about \$300 are low from a European perspective, but in developing countries this is a desirable monthly income
- Example for a customer: Ask.com
 - Up to 50,000 requests from Ask.com are processed per month

Google Cloud Print

Image source: Google



- Provides printing via the Cloud
- Internet enabled devices such as netbooks, touchpads and mobile phones get more and more popular
- Connection of local printers is difficult
 - Printer drivers are missing
 - Some devices lack enough resources
 - Several operating systems (iOS, Android, Windows, Linux. . .) exist
- Solution: Google Cloud Print (<https://developers.google.com/cloud-print/>)
- HP and Samsung offer compatible printers
 - Via an e-mail address, the devices can be identified and added as a Cloud printer inside Chrome OS
- The user sends his document to be print to the service, sets the printer settings and receives a feedback about the successful job execution

Google Cloud Print (2 Types of Printers)

Image source: Google

- **Google Cloud Print compatible network printer**

- The printer is registered at the service
- Print jobs are sent to a service
- The service prepares the print job and forwards it to the printer

- **Legacy printer** (not compatible with Google Cloud Print)

- Locally attached printer (USB) or network printer
- A proxy is installed on a local PC
 - The proxy registers the printer and sends print jobs to the service
 - Prepared print jobs are sent via the proxy to the printer
- Drawback: The proxy computer must be switched on for printing



Devices you can print from: Tablet, Phone, Chromebook, PC/Mac/Linux

Google Cloud Print

A PC with Chrome browser using a wired or WiFi capable printer.
B Cloud-ready printer.
C Print Server with network printer.

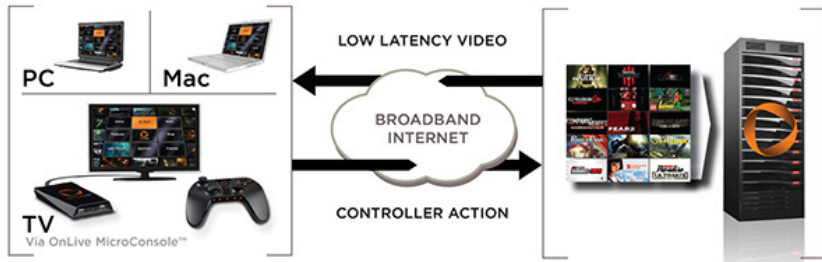
Google will terminate the Google Cloud Print service on December 31, 2020 after a decade for no reason

:-)

Cloud Gaming (1/6)

Image source: OnLive

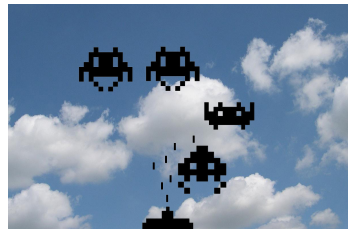
- Cloud gaming services make high-end video games available on low-end devices (older PCs, TVs, mobile phones)
 - The video games run at the servers of the provider
 - The users' devices are only used to display the games
 - The video output is transmitted as a compressed video stream
 - User input is sent to the provider and processed there



Cloud Gaming (2/6)

Image source: computerlearnhow.com and gamelist.com

- Drawback: The required compression reduces the optical quality
- Problem: The network latency must be low because the user input is transmitted to a remote server and processed there
 - Period between the user input and results on the local display must be small in order not to disrupt the game flow
- Positive side effect for the providers: Pirate copies are impossible



Cloud Gaming (3/6) – Providers

Image source: Onlive and Gaikai

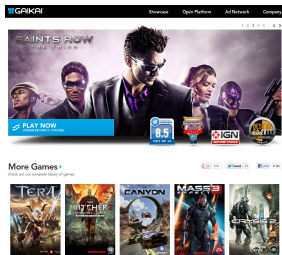
ONLIVE®

**Free your games.
Free yourself.**

OnLive delivers top-tier video games on demand to your TV, PC, Mac® or tablet – whatever you have on hand. Sign in. Play. It's that simple.

- <http://www.onlive.com>
- Available in the U.S. between June 17th 2010 and April 30th 2015
- Requirements:
 - Network link with low latency and < 1000 km distance to the OnLive data center used
- The service itself is no longer available

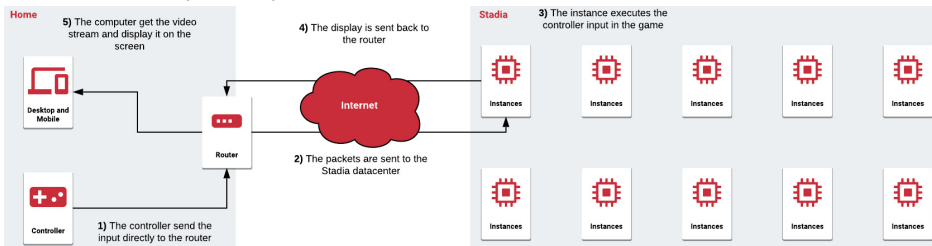
- <http://www.gaikai.com>
- Available since February 27th 2011
- July 2012: Sony buys Gaikai for \$380 million
- Is used to stream PS3 games to the PS4 and PC
⇒ PlayStation Now
- The service itself is no longer available



Cloud Gaming (4/6) – Google Stadia

Image source: Google

- Available since November 19th 2019. <https://stadia.google.com>
- Supports (almost) all terminal devices with the Google Chrome browser



- Games run on Linux servers and are developed to run on Stadia
- A Customer, starting a game, gets a Linux instance with the build already available on it
- The Stadia controller sends input directly to the WiFi router
 - This avoids one additional hop

Quelle: <https://medium.com/@kevinp11/cloud-gaming-stadia-vs-nvidia-geforce-now-2789c4575826>

Cloud Gaming (5/6) – Google Stadia

Image source: Google



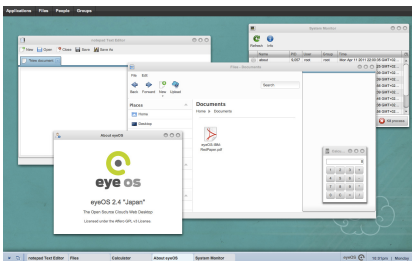
Resolution	Data usage
4K	Up to 20 GB/hr
1080p	Up to 12.6 GB/hr
720p	Up to 4.5 GB/hr

Stadia Streaming Tech: A Deep Dive (Google I/O'19)

<https://www.youtube.com/watch?v=9Htdhz60p1I>

Cloud Operating Systems = DaaS

Image source: Wikimedia (GPL)



- Web desktops, „Cloud operating systems“, Desktop-as-a-Service (DaaS)
 - Popular products: eyeOS + oneye

Last free software version (AGPL license): v2.5 (2011)
<https://github.com/nawawi/eyeOS>
<https://github.com/jonrandoem/eyeos>
<https://github.com/cloudspaces/eyeos-u1db>
 Since 2014 a part of Telefónica
 Successor project: **oneye**. <https://github.com/oneye/oneye>

- The operating system, all installed applications and the user data are located on the servers of the provider
 - The users only need a browser and internet access
- The term Cloud operating system is misleading here (DaaS is better!)
 - For using a Cloud operating system, a computer with a browser and therefore with an operating system too is required
 - The native operating system is not replaced
 - Only the applications and user data are outsourced

Cloud Cooking – the Future ?!

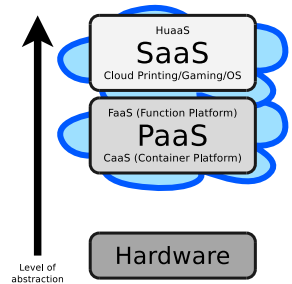
Image source: Heise Zeitschriften Verlag



Functional Distinction of the Services – PaaS + FaaS

● Platform as a Service (PaaS)

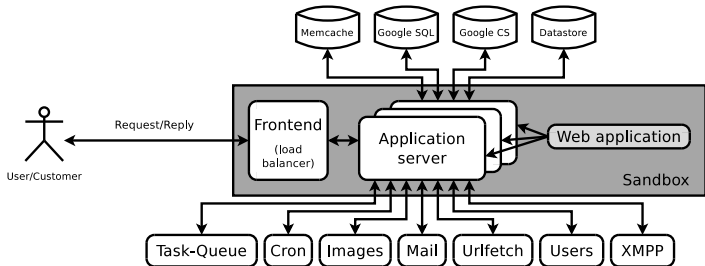
- Provider run scalable runtime environment(s)
- Customers run their own web applications in the infrastructure of the service provider
 - Applications can use various infrastructure and storage services
- Target group: **developers and operators of web applications**



Function as a Service (FaaS) are a subcategory of PaaS

- Customers can run their own functions (scalable) on the infrastructure of the service provider
- Typically, the services support JavaScript (Node.js), Python and/or Java
- Functions are triggered by external requests or events (e.g. HTTP request, reception of an Email, ...)
- The backend is *invisible* for the customers ⇒ **serverless architecture/computing**

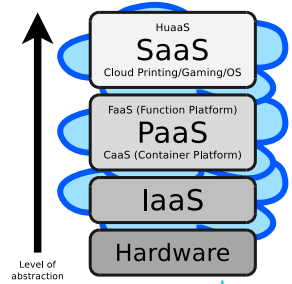
Platform Service Examples – App Engine



- Customers run their own web applications (Python, Java, Go, PHP, ...) in the Google infrastructure
- Automatically scales on demand
- Applications can use different infrastructure and storage services
- The image shows the 1st generation of App Engine runtimes
- The 2nd generation is more integrated into other Google Cloud services
- Free reimplementations (unique selling point of the GAE):
 - AppScale GTS (+), typhoonAE (+), CapeDwarf (+)

Functional Distinction of the Services – IaaS

- **Infrastructure as a Service (IaaS)**
 - Provider runs physical servers
 - Customers run **virtual machines** (VM) with (almost) any operating systems and unmodified applications
 - Customers have administrator privileges in their VMs and specify the firewall rules themselves



In an IaaS service offering, an entire data center can be virtually replicated

- IaaS offerings from major service providers typically include various services for VMs, storage (object storage and block storage), databases, virtual networks, IP addresses, firewalls, load balancing, and more.

Infrastructure Service Example – Amazon Web Services

- The AWS is a collection of different public cloud services
- Billed according to consumption
- Services of the AWS are among others



Elastic Compute Cloud (EC2)	⇒	Infrastructure service for virtual servers
Simple Storage Service (S3)	⇒	Storage service for web objects
Elastic Block Store (EBS)	⇒	Storage service for virtual storage volumes
Elastic Load Balancing (ELB)	⇒	Service for virtual load balancers
CloudWatch	⇒	Service for monitoring AWS resources
Auto Scaling	⇒	Service for scaling EC2 capacities
SimpleDB	⇒	Service for distributed database
Amazon Simple Queue Service (SQS)	⇒	Service for message queues
Amazon Mechanical Turk	⇒	HuaaS/Crowdsourcing marketplace

- Application examples:
 - Implementation of virtual data centers
 - Building up an elastic infrastructure (e.g. for a startup)
 - Acquire resources within a short time

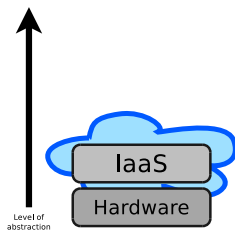
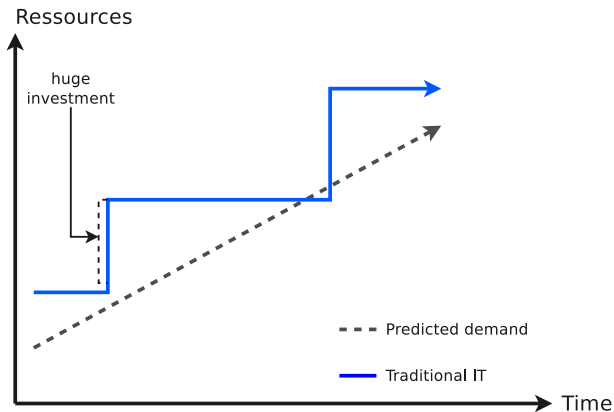
Do we still need own Server Hardware?



Dr. GoGrid said no!

The screenshot shows a web browser window with the address bar displaying 'http://nohardware.com/'. The page features a dramatic background image of server racks in a volcanic landscape. Three video thumbnails are visible on the right side, each with a 'WATCH NOW' button and a warning about server safety. The main text reads 'NO HARDWARE dot com' with a logo that says 'GOGRID MEANS NO HARDWARE'. Below this, it says 'POWERED BY GOGRID' and '32 DIGGS DIGG THIS'. At the bottom, there is a section titled 'Dr. GoGrid's Blog' with a post by Robert Scoble & Dr. GoGrid Exchange Words about "The Cloud" from Feb 06, 2009. A 'Coming Soon!' banner is also present.

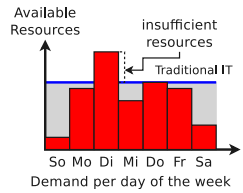
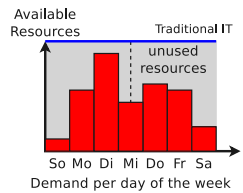
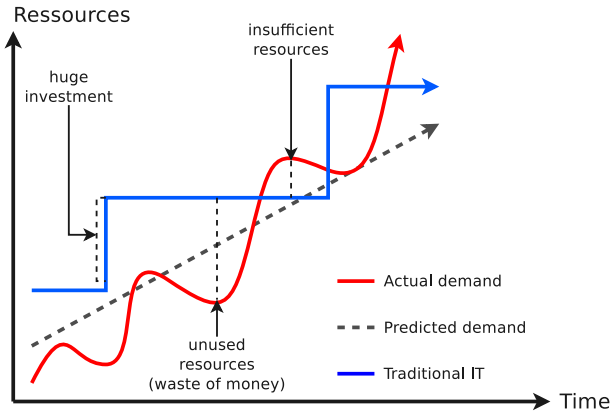
Opportunities: IaaS vs. own physical infrastructure (1/3)



Challenge 1: Predicting resource requirements is difficult

- Own server hardware:
 - High purchase costs
 - Deployment is time-intensive

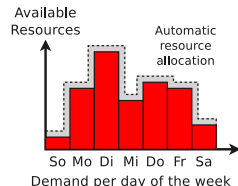
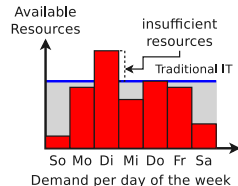
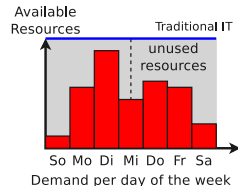
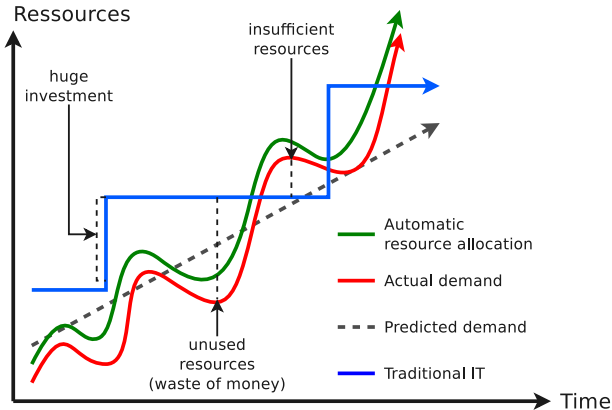
Opportunities: IaaS vs. own physical infrastructure (2/3)



Challenge 2: Predicted demand \neq actual demand

- Unused resources in the traditional IT model
- Resources may become insufficient if demand increases unexpectedly fast

Opportunities: IaaS vs. own physical infrastructure (3/3)

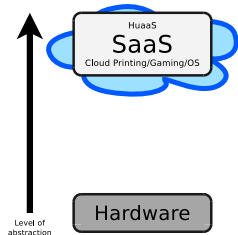


Ziel: Virtuelle Infrastruktur

- No high investment costs
- Always enough resources available
- Scales up and down on demand

Opportunities: SaaS vs. locally installed Applications

- Benefits for customers
 - Only a browser is required for use
 - operating system independent
 - No installation effort
 - No maintenance effort (updates)
 - can be used from any location



Major service providers have a huge competence due to the number of employees and experience.

- Benefits for service providers:
 - No pirate copies
 - All customers automatically have the latest software version
 - Reduced support effort

(1) Availability of Cloud Services

Es war die schlimmste Erfahrung seines Berufslebens. „**Zwei Tage lang war unsere Firma komplett lahmgelegt**“ ... „Sie können sich gar nicht vorstellen, was hier los war!“ ... Niemand in der ganzen Firma konnte mehr auf irgendein internes Dokument zugreifen; Kunden wunderten sich, dass ihre E-Mails unbeantwortet blieben; **48 Stunden lang war die Firma ohne Daten und Büro-Software**. Dabei war ... technisch alles in Ordnung, die Computer liefen, die Datenleitungen funktionierten. Der Grund für den Totalausfall ... ein **Fehler im Bezahlssystem von Google**.

Weil ein Rechnungsbetrag von wenigen Hundert Euro nicht abgebucht werden konnte, hatte der kalifornische Gigant der deutschen Firma kurzerhand den Zugang zu ihrer Büro-Software und den zugehörigen Unterlagen gesperrt. Ohne Vorwarnung. „Am liebsten hätte ich das Geld in einen Umschlag gepackt und persönlich hingetragen“ ... Aber er habe nicht einmal gewusst, wohin. Für mittelständische europäische Kunden ist die Google-Niederlassung in Dublin zuständig, **telefonisch erreichbar ist sie jedoch nicht**. Und jene Hilferufe, die der ... per E-Mail schickte und ins Formular auf der Google-Website eintrug, blieben zunächst unerhört.

Source: Dirk Asendorpf, Die Zeit, 17. February 2011, S.39
<https://www.zeit.de/2011/08/Cloud-Computing>

- It can always happen that locally installed software does not work or becomes unavailable
- But with cloud services, customers are completely dependent on the availability and helpfulness of the provider

What can you expect when something goes wrong?

(1) People Can't Vacuum Or Use Their Doorbell. . .

People Can't Vacuum Or Use Their Doorbell Because Amazon's Cloud Servers Are Down November 26th 2020

<https://eminetra.com.au/people-cant-vacuum-or-use-their-doorbell-because-amazons-cloud-servers-are-down/74505/>


 **Matthew Green**
@matthew_d_green

Some part of AWS is down and apparently it's screwing up the Roomba.

9:48 PM · Nov 25, 2020



 

There is a problem with Amazon Web Services (AWS). And unfortunately, for those who own AWS-dependent vacuums or doorbells, many of the so-called “smart” objects will stop working.

 **SJP (சீ ஜி பி)**
@SJP1804

My fucking doorbell doesn't work because AWS us-east-1 is having issues 🤖

5:58 PM · Nov 25, 2020

Many of the services you know and love (Adobe Cloud Software, 1Password, Flickr) are all having problems due to outages.

 **Brian Ragazzi**
@brianragazzi

Anyone else unable to turn on their Christmas lights because of the AWS outage?

8:32 PM · Nov 25, 2020

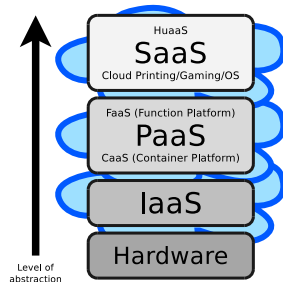
However, there were some unexpected issues as well. In short, many began to realize that they didn't realize that the cloud computing they needed was really very dependent.

What we can do now is probably not a good idea to rely on the same company for half of our Internet infrastructure.

Brave new world? Do your devices work even without a connection to the cloud service provider or without an Internet connection?

(1) Service Modifications happen almost every Day

- In **SaaS** service offerings, the features and the GUI often change
 - If a software is installed locally, it is up to the customer to decide when to „migrate“
- In **PaaS** and **IaaS** service offerings, the features and the tools often change
 - Modifications made by the service providers normally require adjustments to be made by the customer
 - Customers must continuously monitor the service offering and be able to react to modifications
- Difference between **Parental Computing** and **Personal Computing**



This source is very worth reading: [The Cloud's My-Mom-Cleaned-My-Room Problem](https://www.theatlantic.com/technology/archive/2011/09/the-clouds-my-mom-cleaned-my-room-problem/245648/)

Welcome to the era of parental computing, or how the cloud makes children of us all

<https://www.theatlantic.com/technology/archive/2011/09/the-clouds-my-mom-cleaned-my-room-problem/245648/>

Modifications by service providers, as described here, are not the worst scenario (see next slide).

(1) What happens if the Provider terminates the Service?

- Temporary service interruptions can always occur
 - It can also happen at any time, that a provider modifies a service offering or terminates the service



- Public Cloud IaaS service offering from Hewlett-Packard (HP)
 - 30.10.2015: Announcement that the service will be switched off on 31.10.2016
-



- 09/2016: Together with T-Systems as data trustee, Microsoft offers an IaaS service for privacy aware customers

Why an independent data trustee is relevant here will be explained on slide 55.

- 08/2018: Microsoft announces the termination of the service and refuses to accept new customers
 - 08/2019: Microsoft integrates two new data centers in Germany with „very high privacy levels“ into its IaaS service offering – but without an independent data trustee
-



- Public Cloud storage service from Nirvanix
- 16.9.2013: Notification that the service will be switched off on 30.9.2013

How long does it actually take to export data from a cloud service (see next slide)?

- The company declared itself bankrupt on October 1st, 2013

(1) Transfer Time of large Amounts of Data

- A HDD with 10 TB storage capacity currently costs about 300 €
 - 10 TB are today (2020) a quite moderate amount of data
- Scenario:
 - A customer stores 10 TB of data in a cloud storage service he is no longer satisfied with or will soon be shut down
- Exercise: Calculate the transfer time for 10 TB for these data rates: 10 MBit/s, 100 MBit/s and 1000 MBit/s

$$10 \text{ TB} = 10 * 2^{40} \text{ Byte} = 10,995,116,277,760 \text{ Byte} = 87,960,930,222,080 \text{ Bit}$$

- For 10 MBit/s data rate:

$$\frac{87,960,930,222,080 \text{ Bit}}{10,000,000 \text{ Bit/s}} \approx 8,796,093 \text{ s} \approx 2443.3 \text{ h} = \text{more than 100 days}$$

- For 100 MBit/s data rate: about 10 days
- For 1000 MBit/s data rate: about 1 day

Transferring large amounts of data has never been trivial.
When using cloud services, a „plan B“ always makes sense.

(2) Consider and prevent the potential loss of your Data

- Data loss can always occur when using **own physical hardware on premises**

- Reasons: User errors, technical issues, malware (viruses and trojans), natural disasters, theft (vandalism)...

WHERE THE HECK
IS MY DATA?

ITS THERE, UP
IN THE CLOUDS.



Brainstuck.com

- **The exact same threats exist for cloud service providers**

- These companies have a lot of manpower and experience, but 100% security cannot be achieved
- There are numerous examples of data loss in cloud services

Data loss in cloud services is not just a theoretical scenario!

(2) Data Loss ... is not just a theoretical Scenario



- **Microsoft 365 and Azure SQL (January 2019)**
- Some services were not available for one day (disturbed)
- Some customer data (SQL databases) permanently lost



- **Salesforce (May 2016)**
- One server site of the SaaS was down for one day
- Some customer data permanently lost



- **Amazon AWS (April 2011)**
- Thousands of websites offline for days
- Some customer data permanently lost
- Affected customers got **ten ten days free usage** (see slide 46)



- **Google Gmail (February 2011)**
- Emails/calendar entries/contacts of 150,000 customers (some permanently!) erased

Migration into a cloud service cannot replace a local backup!

(3) Protection of own Data against unauthorized Access

- If a customer runs virtual servers in an IaaS, he must take care of their security himself – just like with physical servers on premises
 - Only the security of the building is no longer in the hands of the customer
- Passwords are no more/less secure when a server runs at a cloud service provider
 - Operating systems and network services need to be updated regularly!
 - In case of new security vulnerabilities even very quickly

There can also be security Issues with SaaS

Dropbox was chosen as an example here because this provider communicates security vulnerabilities very transparently.



Dropbox

- 2011: Dropbox accepted any password for all user accounts for 4 hours
- 2012: 68 million customer credentials were stolen
- 2016: The credentials from 2012 were offered for sale on Darknet and already circulated in the four years before

There is no 100% security against the theft of your own data.

But two-factor authentication and using encryption when possible helps!

(4) Data Access by Foreign Authorities and Agencies

- Companies in the US have to comply with the **Patriot Act** (2001) and **CLOUD Act** (2018)
 - Companies must provide US authorities access to data even if it is not stored in the US
 - Companies may be prohibited by the requesting authority from informing their customers about a data request

Microsoft already clarified in June 2011 that US companies must hand over all customer data to US authorities upon their request. Customers would be informed wherever possible, but no US company can guarantee that the requesting authority will allow the customer to be informed.

<http://www.zdnet.com/blog/igeneration/microsoft-admits-patriot-act-can-access-eu-based-cloud-data/11225>



Alibaba Cloud

- Some large cloud service providers exist that are not US companies
- A popular example is the Alibaba Cloud from China
- China is a „single-party socialist system“
⇒ no independent justice system, intransparent authorities, surveillance. . .

- Solution: Use service offerings from Germany/Europe
- However, our service providers are rather small (we have no technology leaders!).

(5) Avoiding lock-in (by example of the AWS S3)

● Competitors

- Offer public services with the same functionality and API
 - For S3: Google Cloud Storage, HP Cloud Object Storage, (†2016), Connectria CS, Host Europe CS (†2014), Nirvanix (†2013), Dunkel Cloud Storage, Cloudian, IBM Cloud Object Storage...



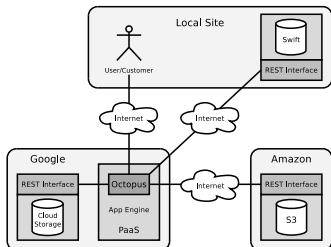
● (Free) implementations

- Running private Cloud services with the same functionality and API
 - For S3: Eucalyptus Walrus, Nimbus Cumulus, OpenStack Swift, Riak CS, Ceph Object Storage, Minio...



Competitors and/or free reimplementations often exist. However, the market is not static and free software projects appear and disappear. Getting familiar working with competitive offerings and free reimplementations is seldom trivial but it offers interesting opportunities like developing exciting software projects ⇒ see KOALA and the Octopus Cloud Storage System

Octopus Cloud Storage System



- Service, which connects S3-compatible storage service to a RAID 1
- Benefits:
 - Better availability of the data
 - Independence of individual providers
- Developed for the Google App Engine

- Copies files to the storage services and monitors the synchronicity via MD5 checksums
- Challenges of the development:
 - Behavior of services is not 100% identical



Project: <https://github.com/christianbaun/octopuscloud>

Octopus - A Redundant Array of Independent Services (RAIS). Christian Baun, Marcel Kunze, Denis Schwab, Tobias Kurze. Proceedings of the 3rd International Conference on Cloud Computing and Services Science (CLOSER 2013) in Aachen. SCITEPRESS. ISBN: 978-989-8565-52-5, P.321-328

Conclusion

- This presentation demonstrated **some risks** of cloud computing
 - But it is an **exciting technology with a lot of potential** regarding
 - Automation, flexibility, purchase and operating costs,...
- Some basic rules:
 - 1 Define own requirements \implies Market analysis
 - find a matching service offering and avoid a Lock-In!
 - Do competitive offerings and/or free reimplementations exist?
 - Have a „Plan B“ and try it out before it becomes necessary
 - 2 Determine the background of the service provider and the legal situation
 - Estimate the reliability of the service provider
 - Communication with providers from Germany is potentially simpler
 - Major providers usually stay in business for a longer period of time
 - 3 Always have a second backup
 - Either stored locally or stored in another service provider
 - 4 Use encryption and strong passwords
 - Using two-factor authentication is more secure than passwords

The installation of a server in a company takes several weeks. Deploying a virtual server in an IaaS takes less than 5 minutes.

Industry reacts by offering specialized Services

gigaom.com/2011/08/16/amazon-targets-u-s-government-with-govcloud/

Amazon targets U.S. government with GovCloud

by [Derrick Harris](#) AUG. 16, 2011 - 2:38 PM PDT

A ▼ A ▲

SUMMARY: *Amazon Web Services has rolled out a new region, called GovCloud, designed specifically for federal government workloads. The region is designed to meet the myriad regulations that government agencies must meet when deploying new infrastructure, which have proven a hindrance in terms government cloud adoption.*



Amazon Web Services has [rolled out a new offering, called GovCloud](#), designed specifically to run federal government workloads. The AWS region is designed to meet the myriad regulations that government agencies must meet when deploying new infrastructure, which have proven something of a hindrance in terms of letting the government adopt cloud computing services. And the timing couldn't be better.

The [GovCloud site](#) explains that government agencies have had trouble processing and storing data in the cloud, which the government says can be accessible only by U.S. persons. But because AWS GovCloud "is physically and logically accessible by U.S. persons only, government agencies can now manage more heavily regulated data in AWS while remaining compliant with strict federal requirements." Of course, GovCloud will feature high-level security for all this data.

Interesting Example: Dropbox

- Web service, started in 2007
- Provides a network file system for the synchronization of files between different computers and users
- Stores the users' files inside S3 (**see latest news on slide 65**)



Dropbox

Where does Dropbox store everyone's data?

Once a file is added to your Dropbox, the file is then synced to Dropbox's secure online servers. All files stored online by Dropbox are encrypted and kept securely on Amazon's Simple Storage Service (S3) in multiple data centers located across the United States.

Source: <https://www.dropbox.com/help/7/en/>

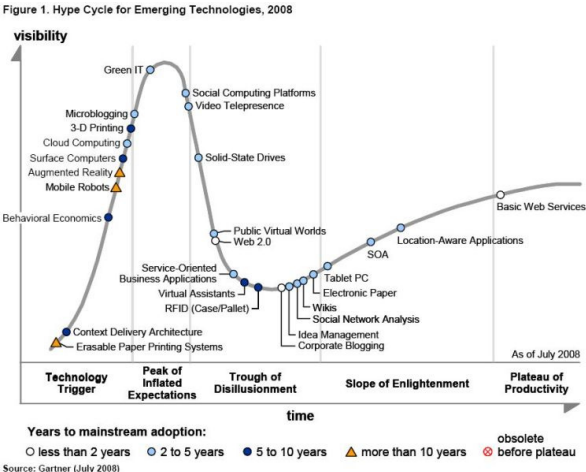
- Business model: **Refine a Cloud service**

- Interesting business model.
- But is it also the best model when the company continues to grow?

Is Cloud Computing still a Hype?

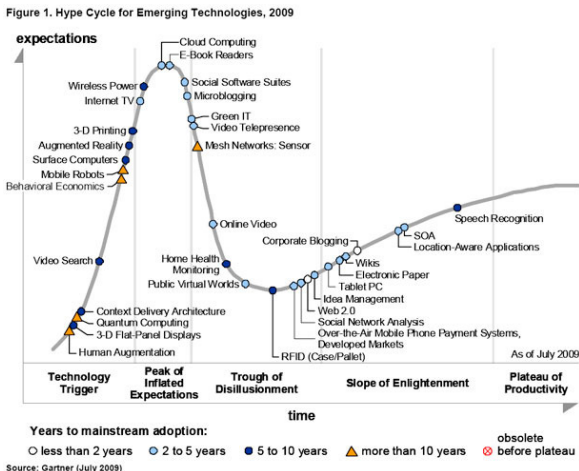
- Is Cloud Computing still a topic, which is helpful to apply for funding?
- Is Cloud Computing still a Hype?
 - Or is it an established and fully developed technology?
- 2 ways to check the „hype status“ of a technology
 - **Gartner Hype Cycle** for Emerging Technologies
 - **Google Trends** (<http://www.google.de/trends/>)

Gartner Hype Cycle 2008



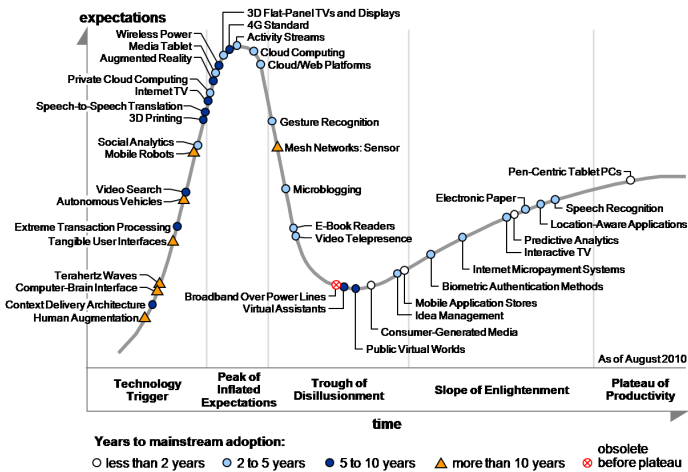
Cloud Computing ⇒ trigger

Gartner Hype Cycle 2009



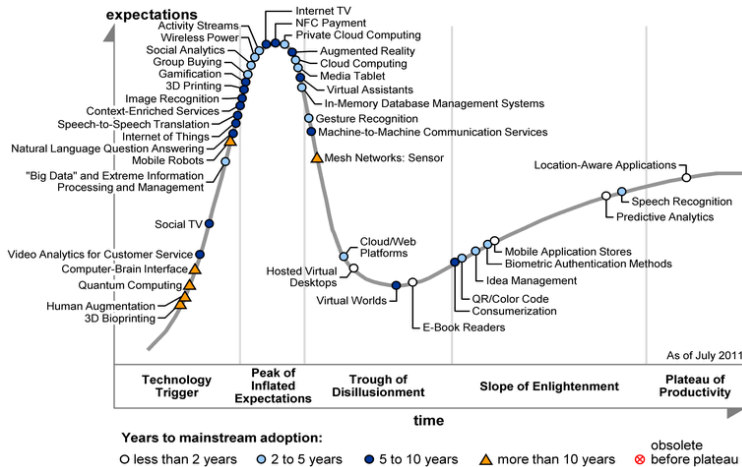
Cloud Computing ⇒ :-)

Gartner Hype Cycle 2010



Private Cloud Computing, Cloud Computing, Cloud/Web Platforms ⇒ :-)

Gartner Hype Cycle 2011

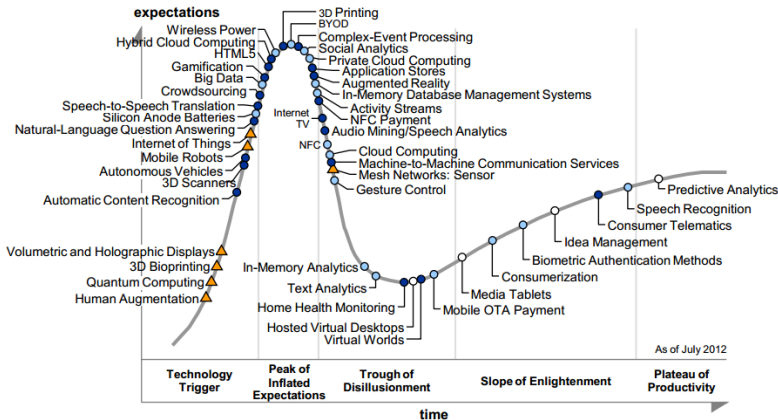


Big Data ⇒ trigger

Private Cloud Computing, Cloud Computing ⇒ :-)

Cloud/Web Platforms ⇒ :-)

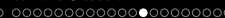
Gartner Hype Cycle 2012



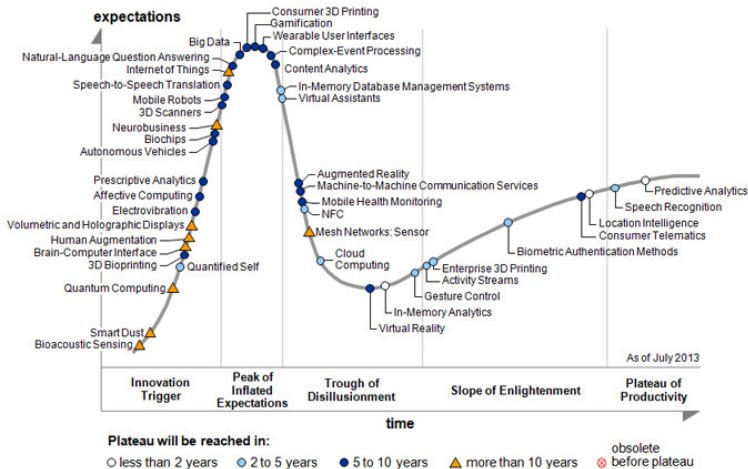
Plateau will be reached in:

- less than 2 years
- 2 to 5 years
- 5 to 10 years
- ▲ more than 10 years
- ⊗ obsolete
- ⊗ before plateau

Crowdsourcing, Big Data, Hybrid Cloud Computing, Private Cloud Computing ⇒ :-)
 Cloud Computing ⇒ :-|



Gartner Hype Cycle 2013



Big Data ⇒ :-)
 Cloud Computing ⇒ :-(
 (Note: The original image contains a typo ':-(' which has been corrected to ':-)')

