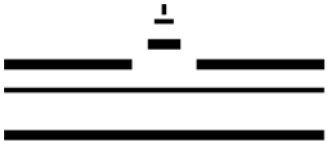


Westfälische Wilhelms-Universität Münster

The University of Waikato
Te Whare Wānanga o Waikato

European Research Center for Information Systems

Gottfried Vossen
University of Münster, Germany &
University of Waikato, New Zealand

Breathing in the Clouds: Thin Air or Bad Atmosphere?

Breathing in the Clouds:
Thin Air or Bad Atmosphere?

Overview

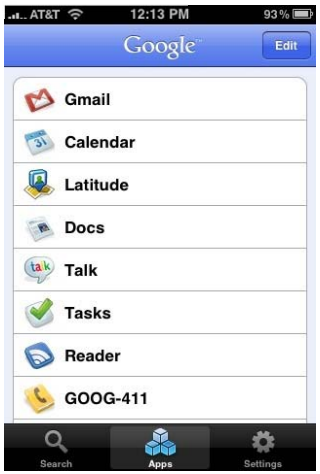
"Cloud computing is using the Internet to access someone else's software running on someone else's hardware in someone else's data center"

Lewis Cunningham, Oracle

1. **A Few Quick Facts**
2. **Bright Spots in the Cloud**
3. **What Makes the Air Thin**
4. **What Makes the Atmosphere Bad**
5. **What the cloud enables**
6. **A Forecast**

Who believes he or she is not in the [consumer] cloud yet?

Google mail



TripIt

Dropbox

WORLDMATE

XING

Spotify

LinkedIn

foursquare

facebook

Cloud success stories beyond your smartphone

My question:
What makes it hard for non-IT SMEs to move to the cloud and what can we do about it?

airbnb
Travel like a human.

MENDELEY

IMDb

redBus.in

NASDAQ OMX

NETFLIX

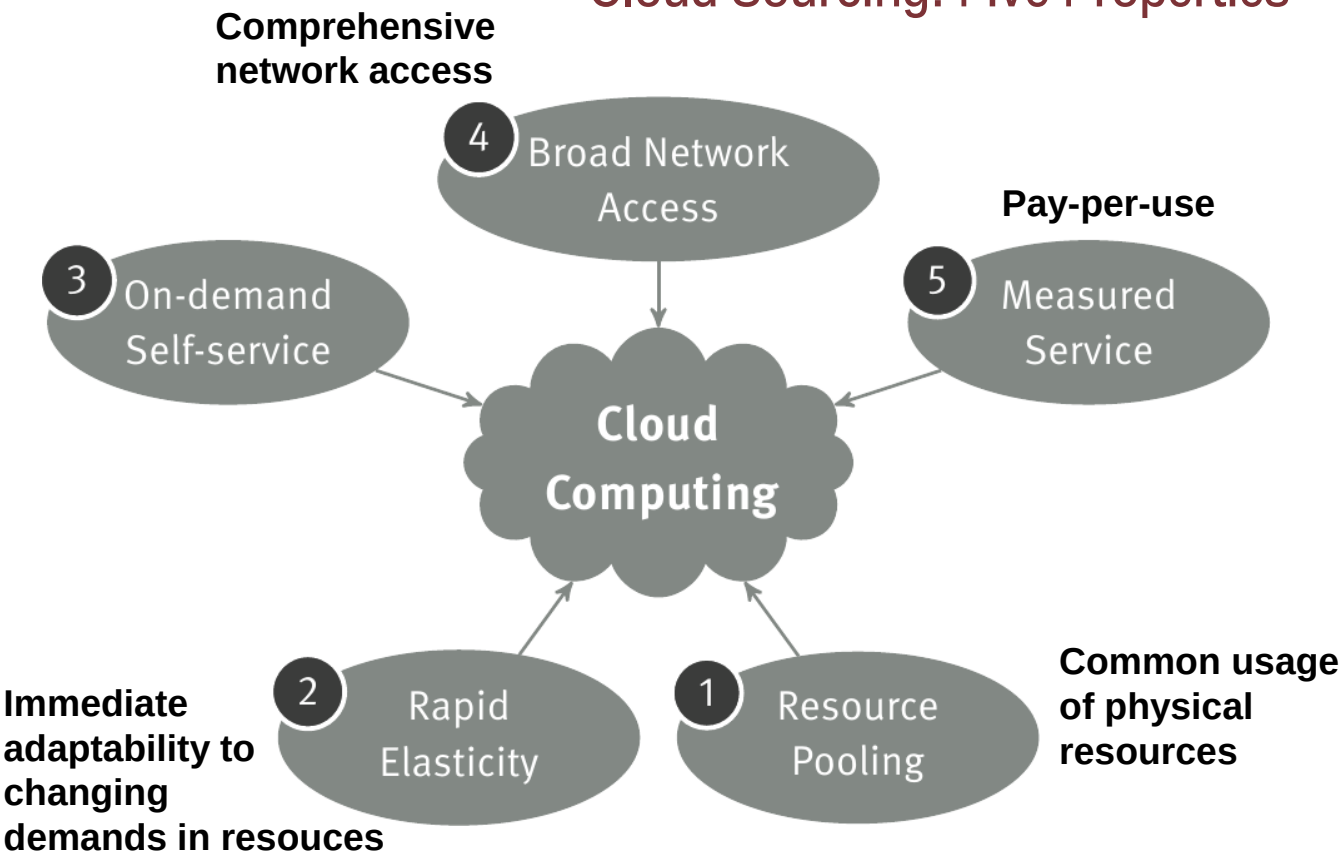
urbanspoon

yelp

Source: http://images.computerwoche.de/images/computerwoche/bdb/944225/890.jpg

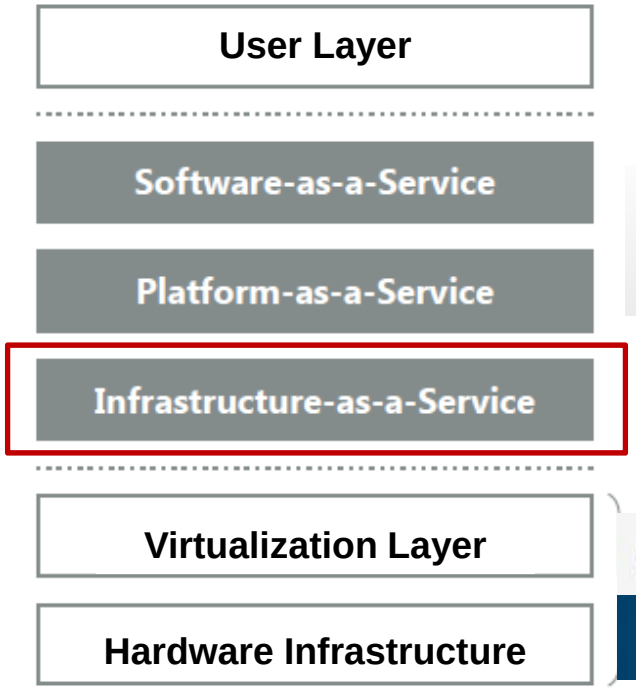
1. A Few Quick Facts

Cloud Sourcing: Five Properties



Three Main Service Models

Technical overview:



amazon web services

GOGRID
Complex Infrastructure Made Easy™

rackspace
the open cloud company

Windows Azure

Google Cloud Platform

IBM SmartCloud

Examples

Live Chat
Sales: 1-800-961-2888
Support: 1-800-961-4454
Login
rackspace
the open cloud company
Hosting Solutions
Cloud Hosting
Managed Hosting
Email & Apps
Company
Search
WE ARE HIRING
NOW AVAILABLE
RACKSPACE® CLOUD
BLOCK STORAGE
POWERED BY OPENSTACK®
Consistent performance for demanding apps
Free I/O. Choice of SSD or standard volumes
IN THE NEWS: Cloud Block Storage Now In Unlimited Avail
Cloud Hosting
Public, private, and hybrid clouds
Based on OpenStack® for no lock-in
Pay-as-you-go pricing available
Chat with Us
Get a Call
Login
GOGRID
Complex Infrastructure Made Easy™
PRODUCTS
SOLUTIONS
SUPPORT
PARTNERS
ABOUT US
SIGN UP
WE MAKE CLOUD INFRASTRUCTURE EASY. REALLY EASY.
CLOUD HOSTING
The easiest way to deploy complex infrastructure.
DEDICATED HOSTING
Innovative options to power flexible dedicated/cloud architectures.
PRIVATE CLOUD
Leverage the benefits of cloud computing plus physical resource separation.
GoGrid Cloud Hosting
See for Yourself

Marketplace for IaaS Products

CompatibleOne & openstack

Federate Open Cloud Resources

Register Log-in

search...

Home Discover Develop Follow About

CompatibleOne: the first real Open Cloud Broker

CompatibleOne offers a simple and unique interface allowing for the description of user cloud computing needs, in terms of resources, and their subsequent provisioning on the most appropriate cloud provider.

Resource descriptions may cover the complete cloud computing paradigm ranging from complete applications (SaaS), through development platforms (PaaS) down to low level compute and storage defined infrastructure (IaaS).

CompatibleOne provides a unique language for the description and management of an unlimited number of cloud service providers.

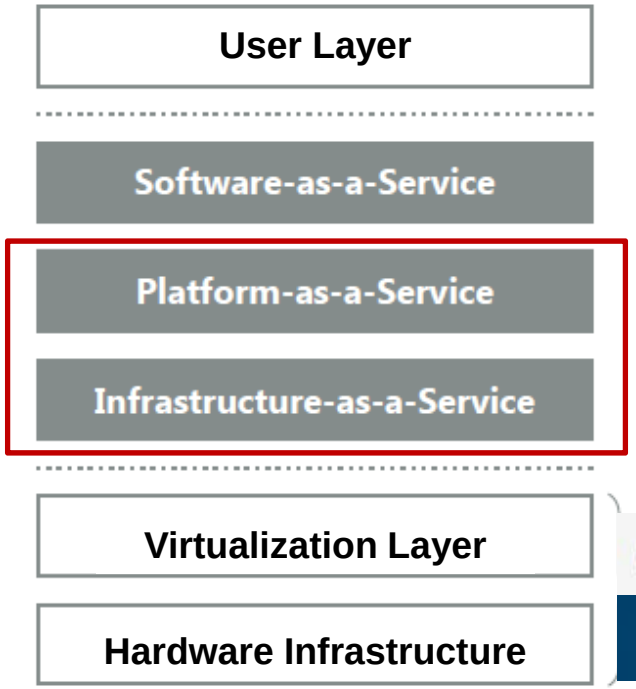
The immediate benefits are:

- Centralized description of all your cloud computing needs in terms of resources
- Rapid selection of the most appropriate provider
- Full automation of the provisioning and the migration process of your resources
- Elimination of any form of vendor lock-in and permit full interoperability
- Monitor and control the service delivery quality of your cloud providers

"Since the IT industry is rapidly adopting service based business models, there is a substantial and growing need for solutions that can reduce the complexity involved in delivering federated business services and can handle the challenges of managing a distributed infrastructure. This is where I believe CompatibleOne cloud service broker provides a unique value – their solutions' ability to address both needs paves the way for building a new generation of IT Infrastructure." *Parviz Peiravi, Principal Architect - Intel Corporation.*
More

Three Main Service Models

Technical overview:



amazon web services

Windows Azure

Google Cloud Platform

IBMSmartCloud

Examples

Google Cloud Platform

Home Products Solutions Pricing Customers Partners **Contact sales** for enterprise level support? - or - Try it now

Build your business on
Google Clou

Google Cloud Platform allows you
websites, store and analyze data

Try it now - or - Need enterprise level

Scale your app

Take advantage of the speed and scale of the same infrastructure that powers Google's applications.

Focus on bu

Let us deal wit capacity planr center infrastr and other IT is

IBMSmartCloud

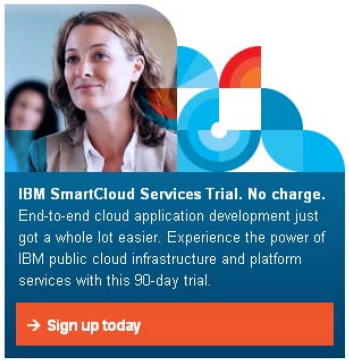
Overview Private Cloud IaaS PaaS SaaS Consulting

Reinventing application development

IBM's platform as a service (PaaS), IBM SmartCloud Application Services, is included with, runs on and automatically deploys virtual resources to IBM SmartCloud Enterprise (IaaS). SmartCloud Application Services delivers a secure, collaborative, integrated cloud environment that supports the full lifecycle of accelerated application development, deployment and delivery.

Deploy a new app during lunch hour and still have time for lunch

- Get web applications to market faster
- Enjoy middleware as a service
- Develop and test application patterns

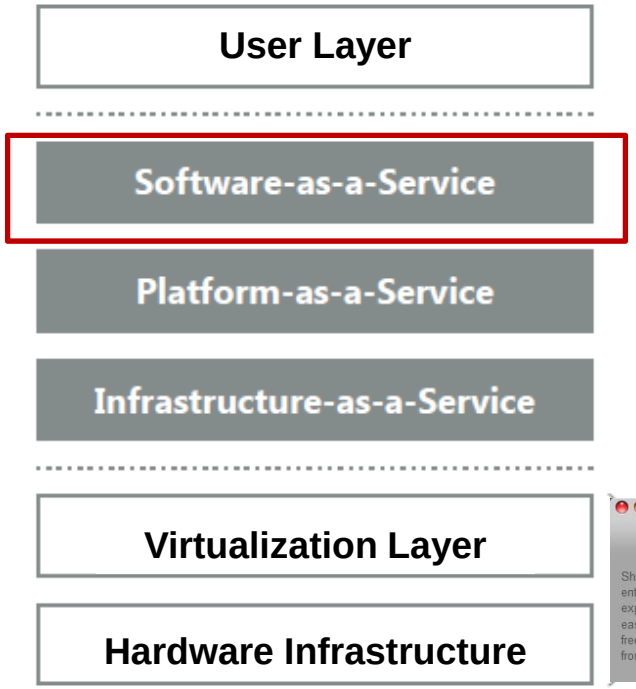


IBM SmartCloud Services Trial. No charge.
End-to-end cloud application development just got a whole lot easier. Experience the power of IBM public cloud infrastructure and platform services with this 90-day trial.

→ Sign up today

Three Main Service Models

Technical overview:



ZOHO Work · Online

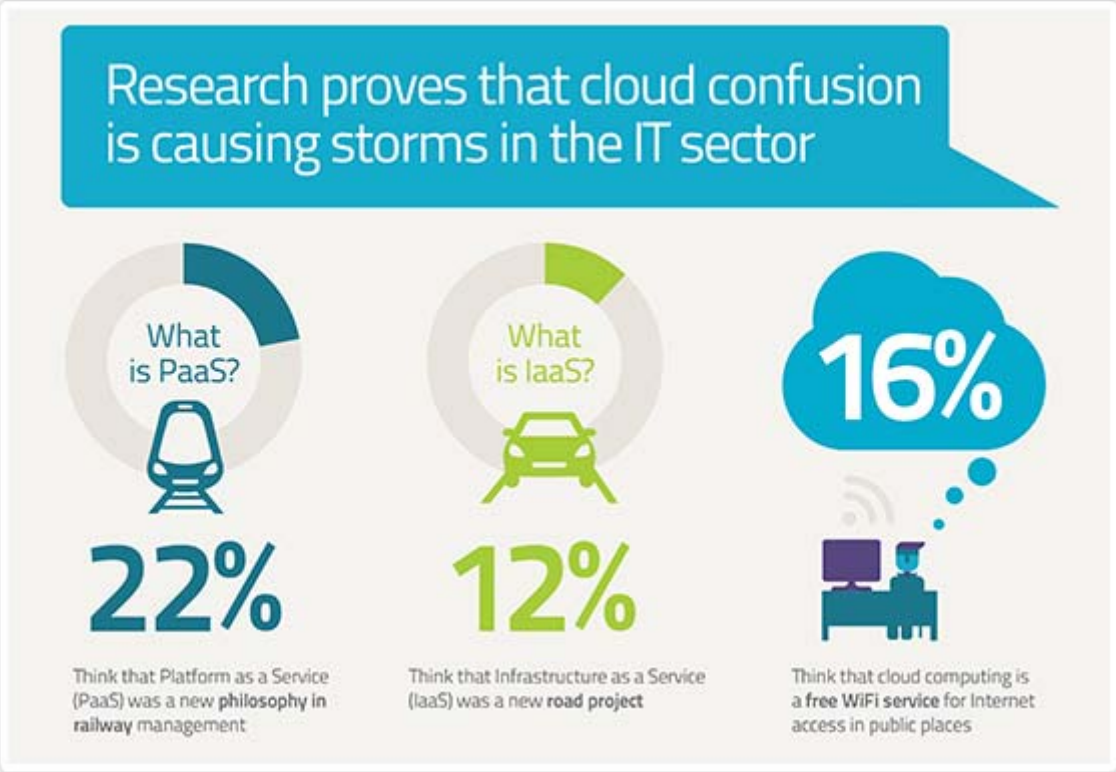
WordPress.com

Scribd.

syncplicity by EMC

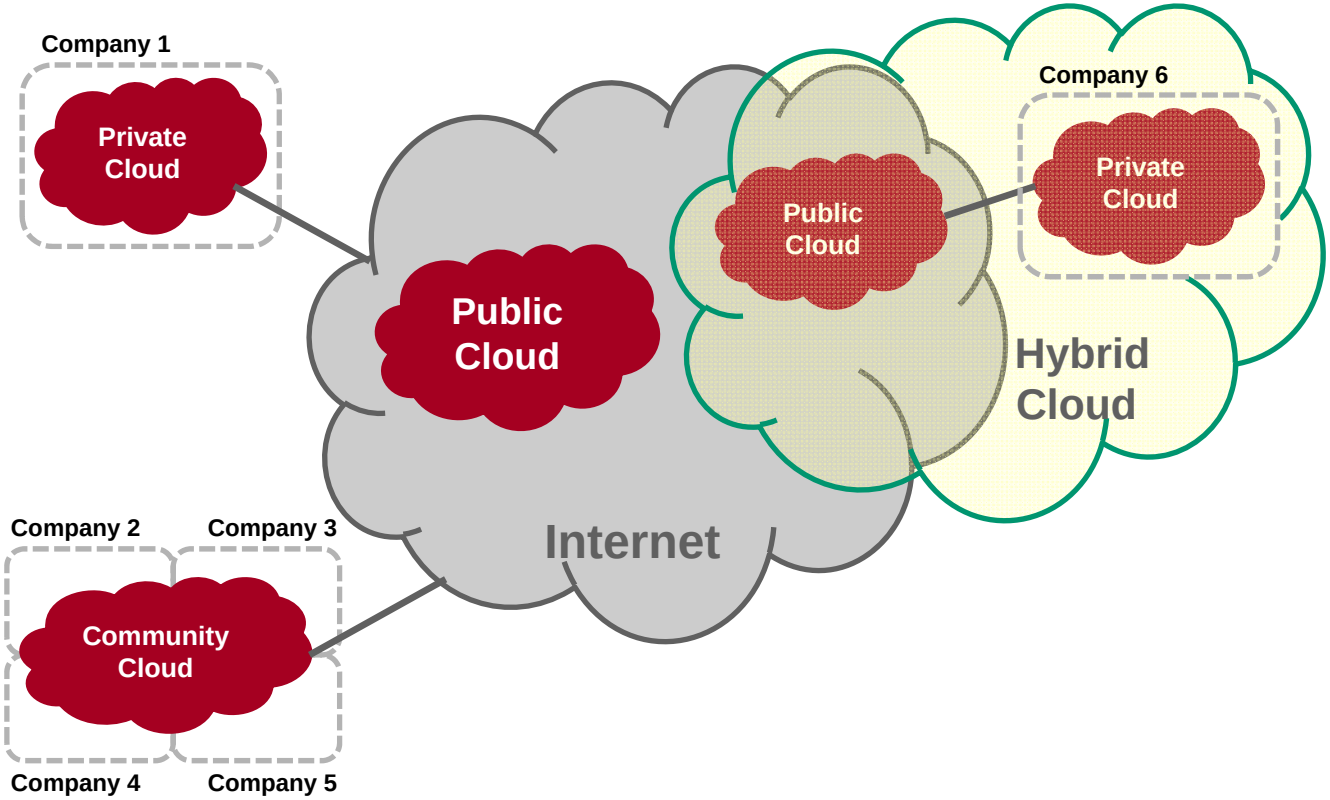
mozy

The “Cloud Washing” Problem



from www.theknowlist.com

Four Modes of Cloud Operation



Cloud Benefits

- Economies of scale w.r.t. hardware and software
- Easy accommodation of demand fluctuations
- No local installations w/ upgrades, patches, service packs, etc.
- End of inefficient utilization of server resources
- No big upfront investments
- Extensive technical support
- Continuous participation in technological advances
- “Pay-as-you-go” business model (as known from other commodities, e.g., water, electricity)

So what makes it so popular for individuals?

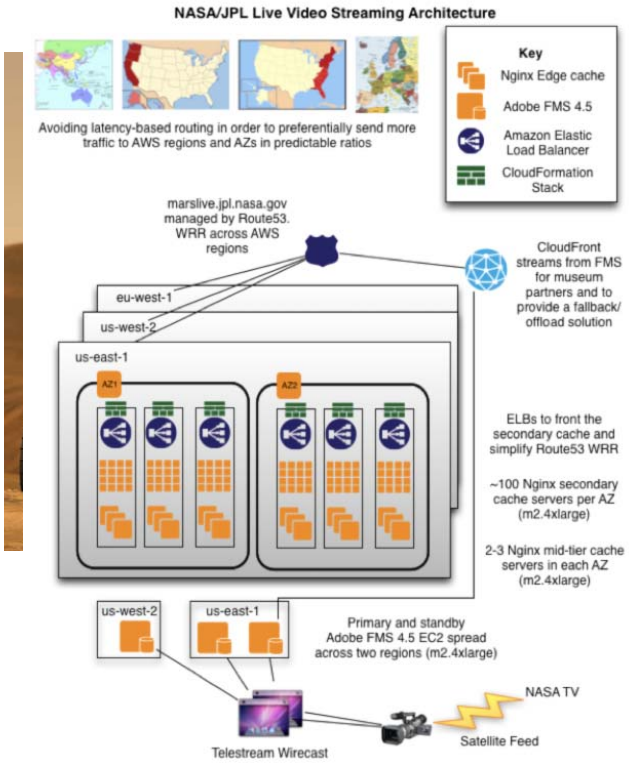
- **No manual backups**
- **Automatic service maintenance**
- **Alerts about almost anything (if you want)**
- **Cheap pricing (e.g., for music)**
- **Better selectivity (e.g., for albums)**

Source: http://images.computerwoche.de/images/computerwoche/bdb/1817240/890.jpg

2. Bright Spots in the Cloud

NASA JPL – Landing of Mars Rover “Curiosity”

- **Landing in August 2012**
  - Broadcast via live stream
  - 3+ M viewers
- **Based on Adobe as well as AWS products for**
  - Streaming
  - Monitoring & provisioning of additional infrastructure
  - Content delivery & load balancing



NETFLIX

- **Netflix: “Watch TV shows & movies anytime, anywhere. For one low monthly price.”**
  - Runs movie rental and on-demand streaming to 30+ M customers
  - In 2011 responsible for approx. 1/3 of the entire US downstream traffic
  - Data centers still not their core competency
  - Therefore moved to AWS in 2008
- **Why Amazon? Can provide the power and scalability that Netflix requires**
- **What is done in the cloud?**
  - Transcoding (2009), Streaming (2010)
  - Own products as PaaS based on AWS

- **Stock exchange info for replay and analysis, allowing users to view consolidated quote and trade data**
  - Replay data is available intraday as soon as 15 min after it occurs
  - 1+ PB of compressed trading data, adding 50+ GB every day
- **Storage is using Amazon S3**
  - Each object contains 10 min of trading data per share
  - Access application is based on Adobe AIR using Data-on-Demand API
- **Advantages achieved by cloud exploitation**
  - Cost reduction
  - Shorter Time-to-Market (1/3 of what it was before)

Customers include

- KLM Royal Dutch Airlines
- Well Fargo Bank
- Spotify
- OpenTable
- Hire A Hubby
- Chipotle Mexican Grill
- Caesar's Entertainment
- Vodafone

Wheelz example:

- Australian company connecting people that need to use a car to car owners who are willing to lend theirs for an hourly rate

Wheelz uses Desk.com

- to manage new leads, existing customer relationships, and strategic initiatives, and
- to track every customer touch point from initial sign up to the most recent rental experience

fileee

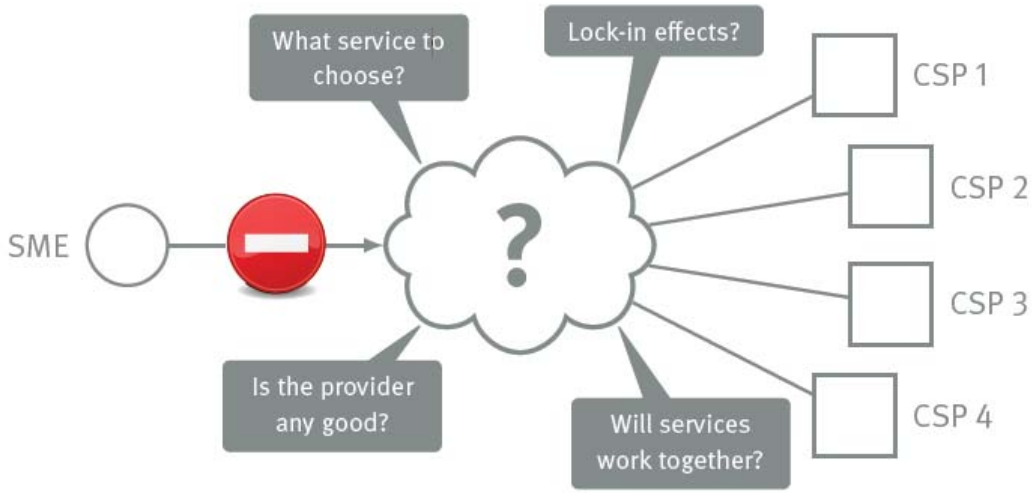
- A startup from the University of Münster, winner of the ERCIS Launch Pad 2010
- An intelligent, personal assistant for the automatic management of all paper-based as well as digital documents in a single system
- Complete and digital file cabinet
- https://www.fileee.com/

Source: http://coakley-baker.com/downundah/part8/images/intoThinAir.jpg

3. What Makes the Air Thin

- **SMEs cannot afford a private cloud, so they need to go public**
- **Yet they are insufficiently prepared**
- **They are afraid of (among others)**
  - Preparation overhead
  - Storing data in the cloud
  - Trusting the CSP
  - Provider lock-in
  - Complexity of migration

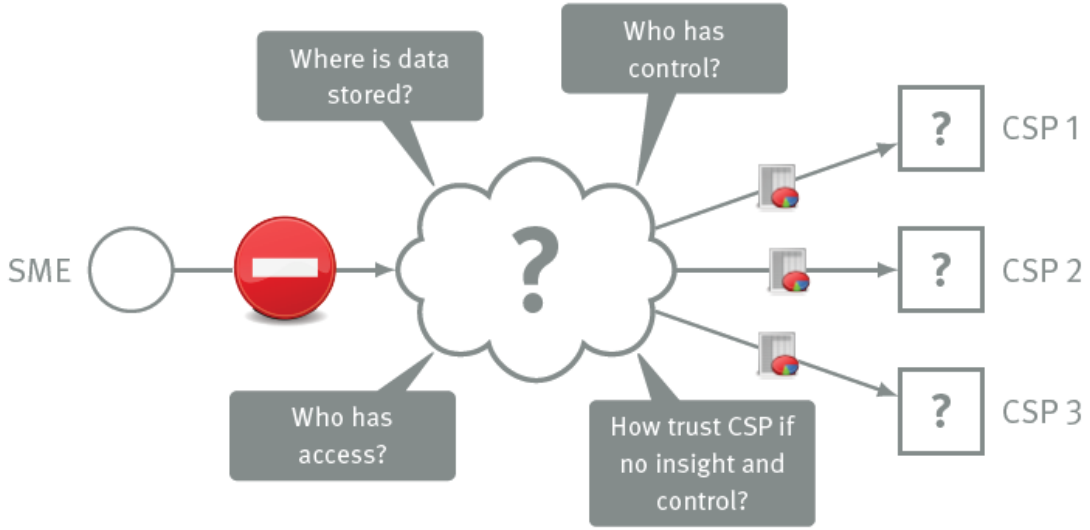
Tedious Service & Provider Selection



High up-front selection overhead, e. g.:

- Identify viable cloud services
- Scrutinize services and providers
- Find optimal implementation

Lack of Trust in the Cloud



SMEs lack trust in cloud services:

- Lack of trust in technical security of CSPs
- Lack of trust in governance over CSPs
- Lack of trust in legal framework for cloud usage

2010 Study among German SMEs

Rank	Prerequisites for using SaaS	$\bar{x}$	N	$SE_{\bar{x}}$
1	Confidentiality of data with respect to 3rd parties	4.95	40	.03
2	Permanent availability of the software	4.63	40	.11
3	Confidentiality of data with respect to CSP	4.50	40	.16
4	CSP has clearly defined backup strategy	4.40	40	.15
5	Performance of the software (no latency during use)	4.38	40	.13
6	Stable prices for service usage	4.10	40	.14
7	Usability resembles traditional desktop applications	4.03	40	.19
8	Possibility of complete data export (e. g., database dump)	3.97	39	.18
9	Guaranteed geographical limits for cloud service	3.51	37	.28
10	Possible integration into existing non-SaaS software	3.42	38	.23
11	Possibility of changing the CSP	3.37	38	.23
12	Custom SLAs	3.28	39	.18
13	CSP is located in Germany	2.97	37	.23
14	Possible integration into other SaaS software	2.88	40	.21
15	Possibility of local installation of the SaaS software	2.87	39	.23
16	CSP is located in the EU	2.62	34	.25
17	CSP has the Safe Harbor seal	2.41	27	.26
18	CSP has the PrivacyMark seal	2.36	25	.29
19	CSP is certified according to ISO/IEC 27001	2.26	31	.27
20	CSP is certified according to SAS 70	1.80	30	.26

Study, cont'd

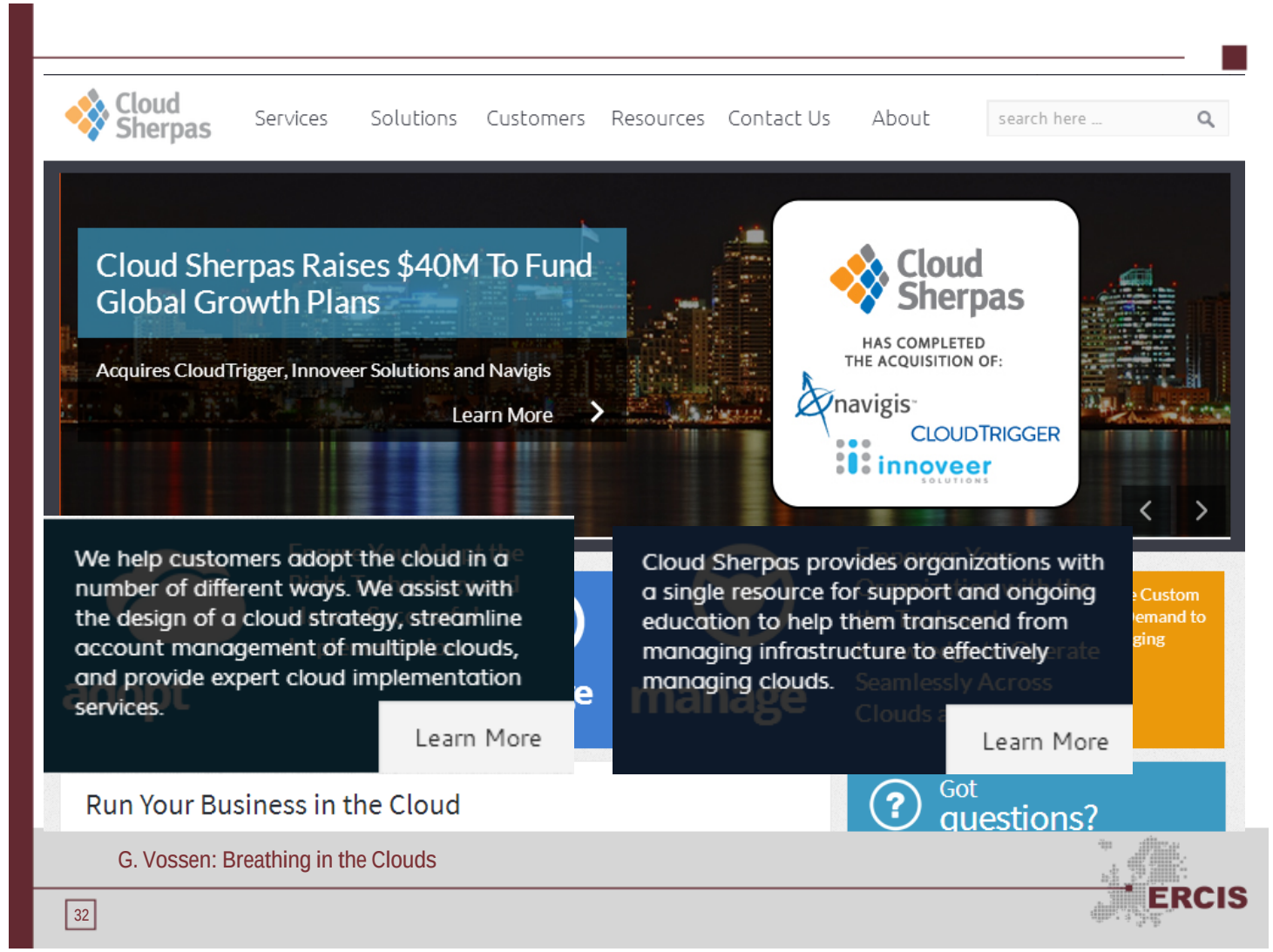
Rank	Reason for not using SaaS	$\bar{x}$	N	$SE_{\bar{x}}$
1	SaaS does not work well with other software	3.63	38	.20
2	Loss of control over access to data	3.59	39	.23
3	Data Migration from existing application too tedious	3.56	39	.23
4	High latency when using software (page loads)	3.44	39	.25
5	Less control over backups of data	3.41	39	.22
6	SaaS software lacks some desired features	2.97	35	.25
7	Permanent broadband Internet connection required	2.92	38	.29
8	Usability of web application worse than desktop application	2.63	38	.26
9	Lack of acceptance among employees	2.58	38	.25
10	Pay-per-use is not attractive	2.49	35	.25
11	Technical implementation too much effort	2.15	39	.23
12	Restrictions from existing contracts	2.14	37	.21
13	Benefits of SaaS are not seen	2.03	37	.26
14	Previous CAPEX has to be amortized first	1.97	38	.23

in Proc. 12th Int. Conf. on Web Information System Engineering (WISE), October 2011, Sydney, AU

The Good News: SMEs, you're not alone!

- **Check the provider's reputation**

- **Check which SLAs can be specified**
- **Check the price models offered**
- **Check the controlling options**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Cloud Sherpas Raises $40M To Fund Global Growth Plans
Acquires CloudTrigger, Innoveer Solutions and Navigis
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HAS COMPLETED THE ACQUISITION OF:
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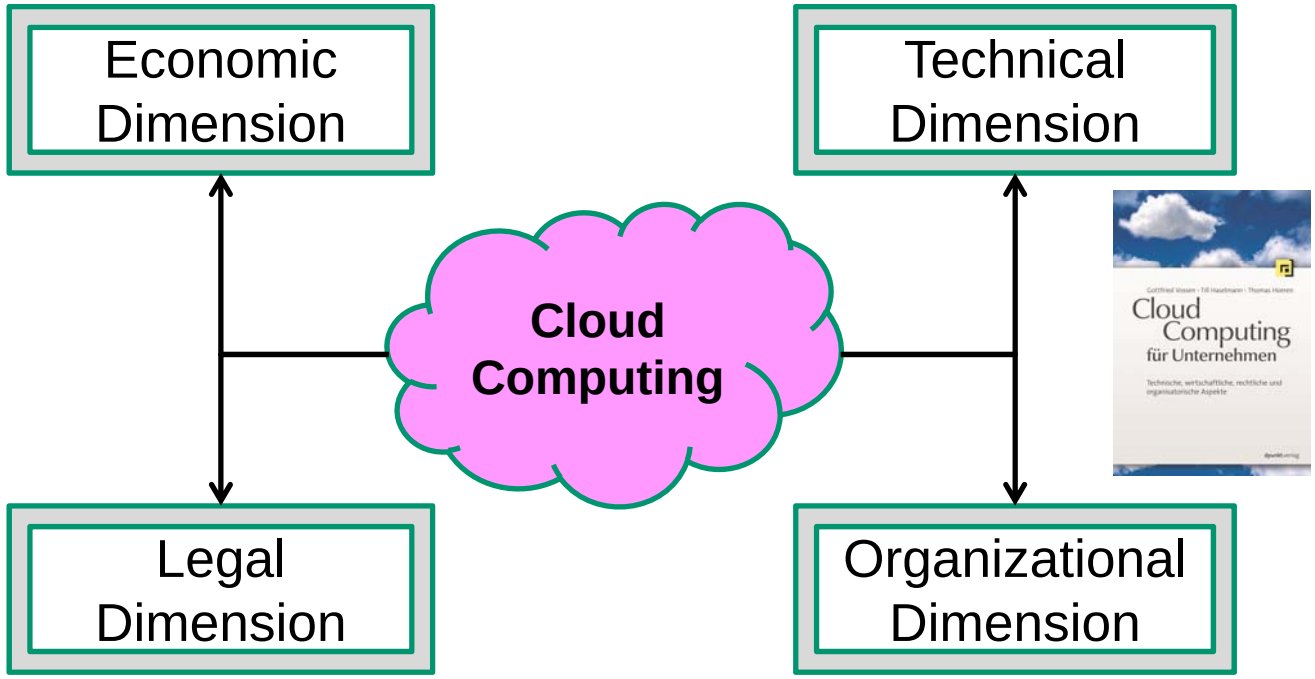
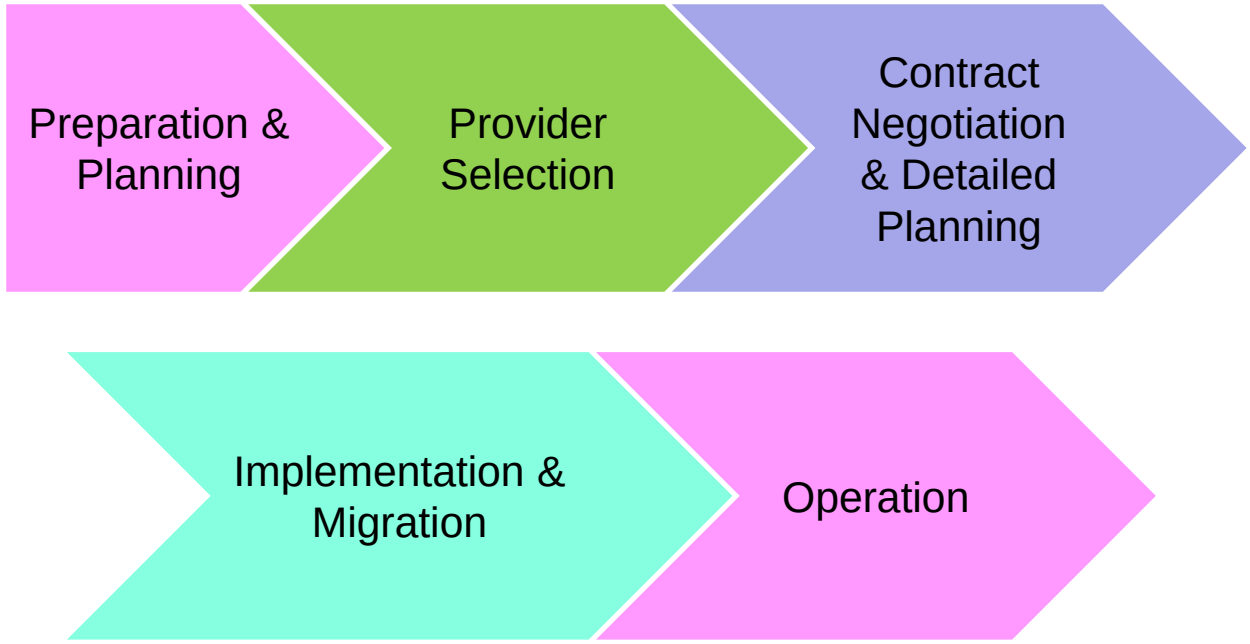
CLOUDTRIGGER
innoveer
SOLUTIONS
We help customers adopt the cloud in a number of different ways. We assist with the design of a cloud strategy, streamline account management of multiple clouds, and provide expert cloud implementation services.
Learn More
Cloud Sherpas provides organizations with a single resource for support and ongoing education to help them transcend from managing infrastructure to effectively managing clouds.
Learn More
Run Your Business in the Cloud
Got questions?

The Cloud is not reversible, so what can we do?

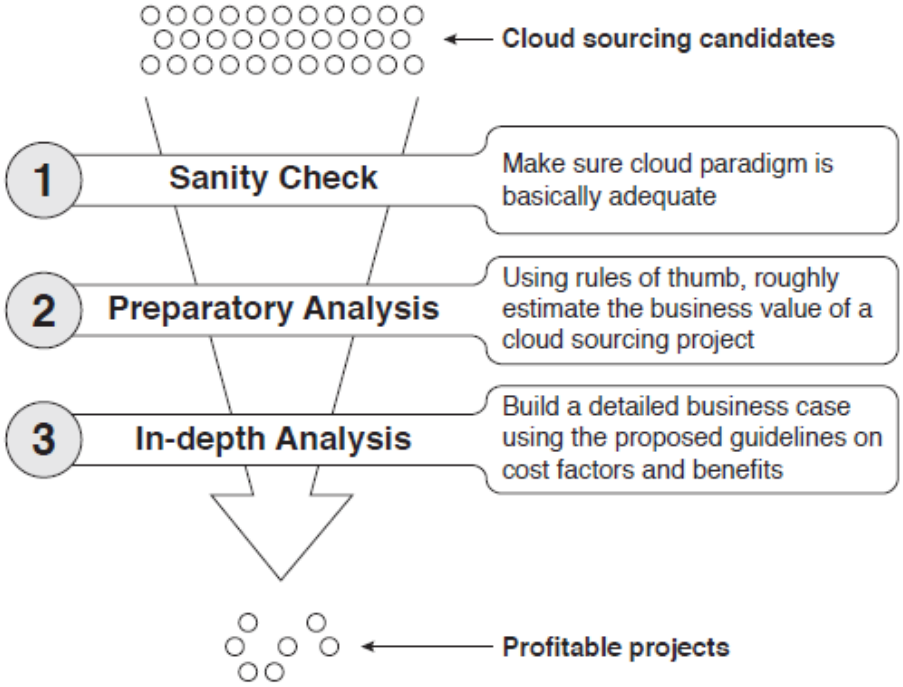
- **Strategy development considering four major dimensions**
- **Structured provider selection**
- **Cloud intermediaries**
- **CCO introduction**
- **Employ monitoring tools such as CloudSleuth or CloudHarmony**
- **Service-level agreements (SLAs)**

The Four Dimensions



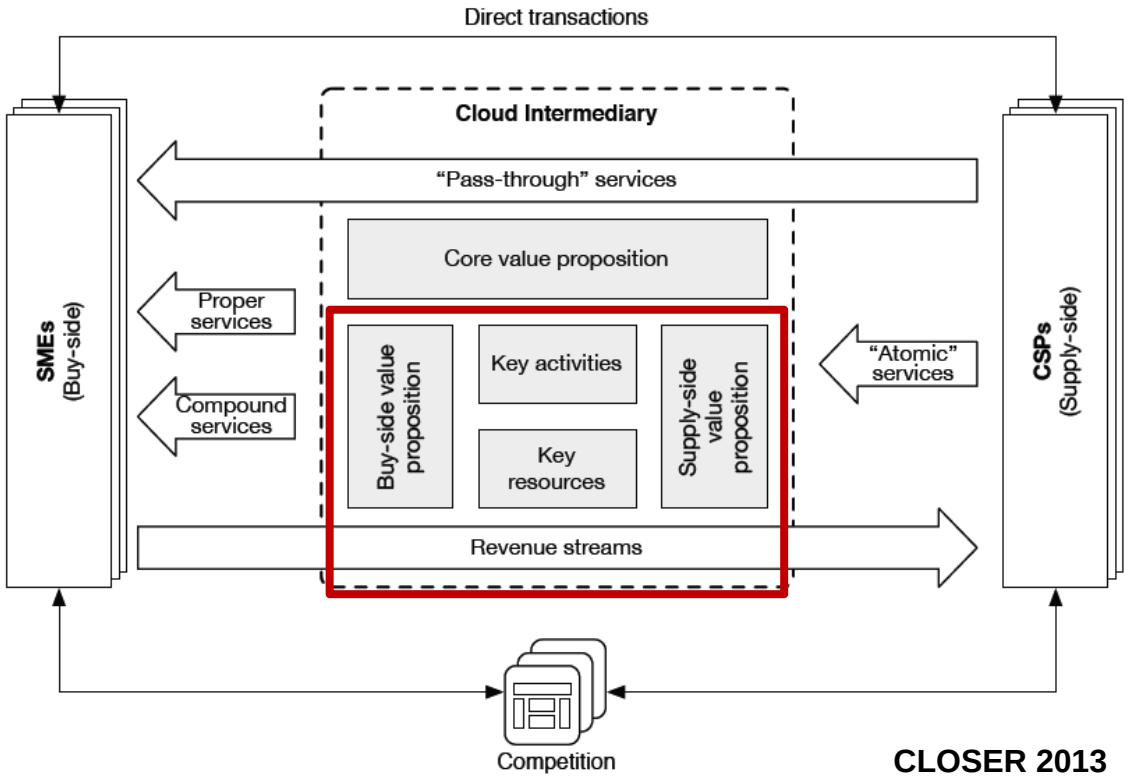

Preparation & Planning
Provider Selection
Contract Negotiation & Detailed Planning
Implementation & Migration
Operation

For Step 1: EVACS Method



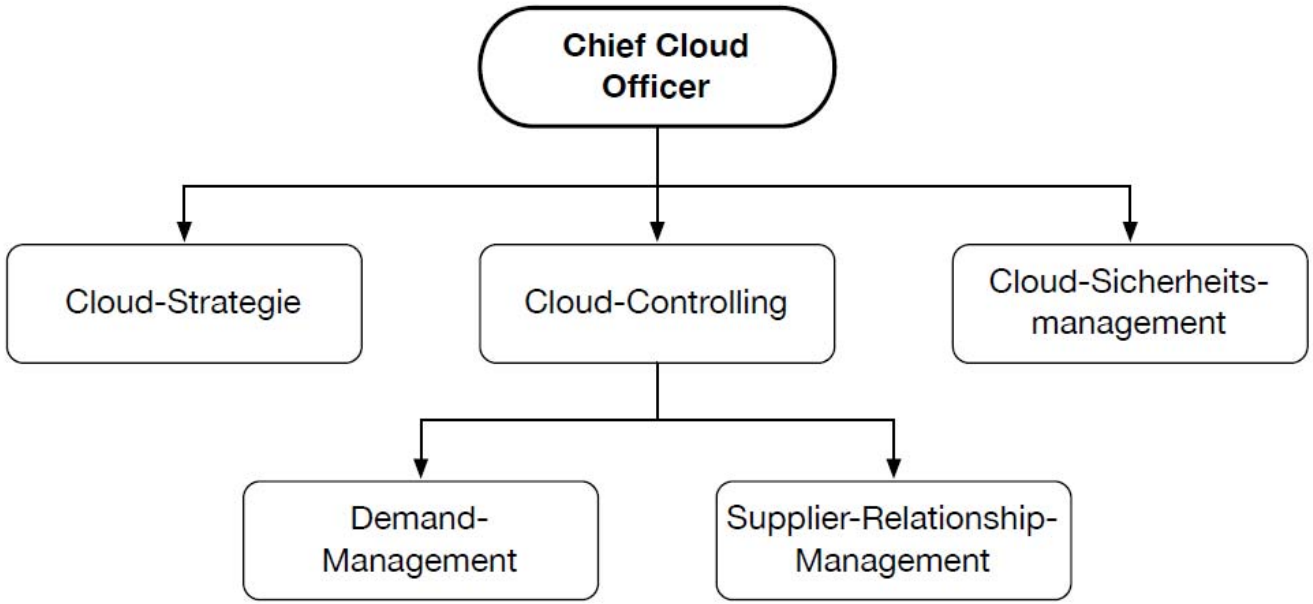
EVACS = Economic Value Assessment of Cloud Sourcing → CloudAsia 2013

(Buy-Side Hybrid) Cloud Intermediary



CLOSER 2013

The New CCO Role



Source: http://news.newclear.server279.com/wp-content/uploads/2010/03/bad-air.png

4. What Makes the Atmosphere Bad

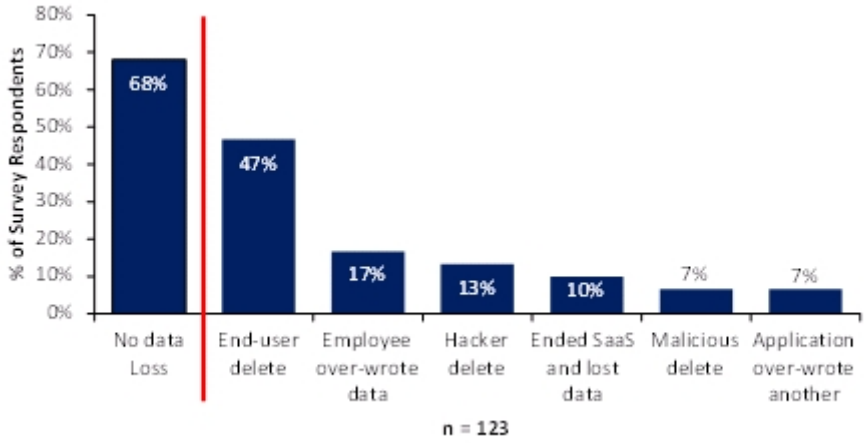
The “Cloud Washing” Problem, cont’d

A survey by Six Degrees Group has found that

- 45% of **IT decision makers** feel that ‘cloud-washing’ by marketing departments at technology brands is an increasing problem;
- 83% feel that cloud service providers could do more to demystify the cloud;
- 82% of IT decision makers say that their cloud-computing provider is not listening to them;
- 51% of **business decision makers** believe that technology companies are guilty of using too much jargon, compared to 24% for Government, 16% for bankers and only 9% for lawyers.

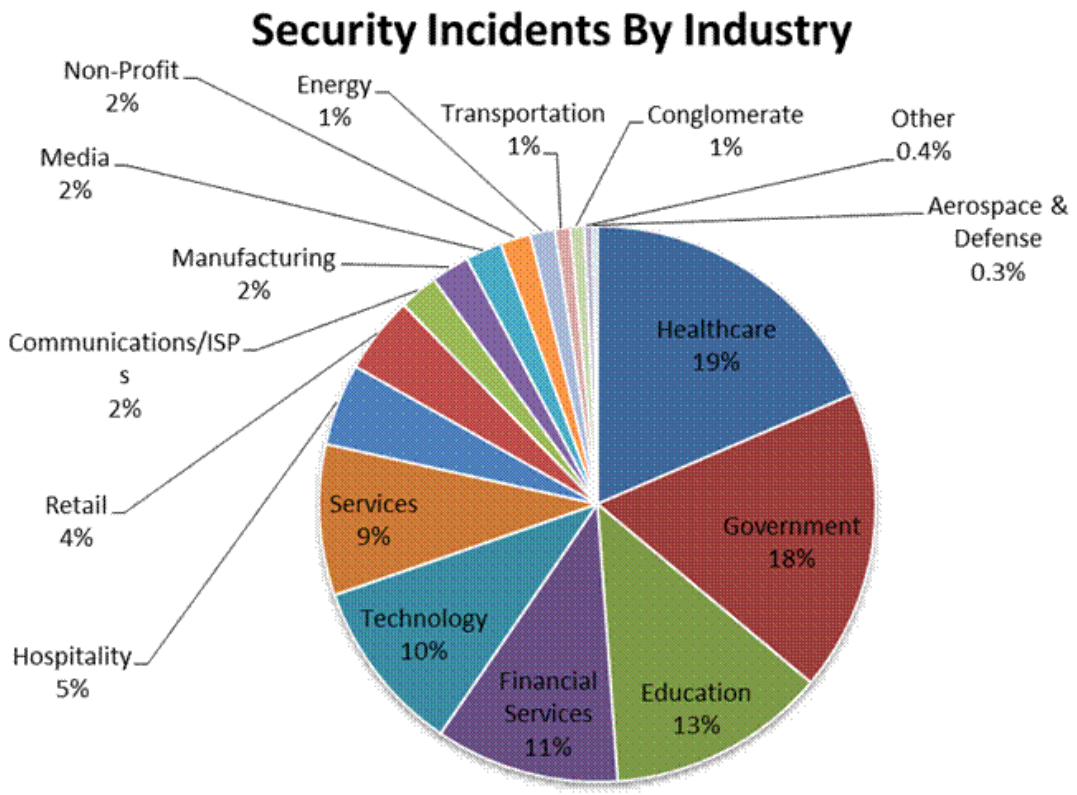
from www.theknowlist.com

- **Aberdeen Group study, February 2013: data losses reported by SaaS users:**

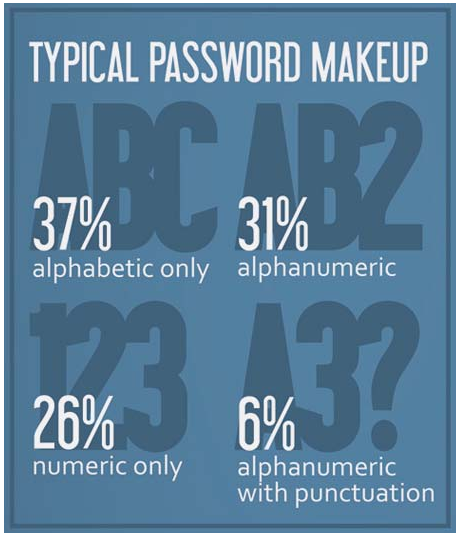


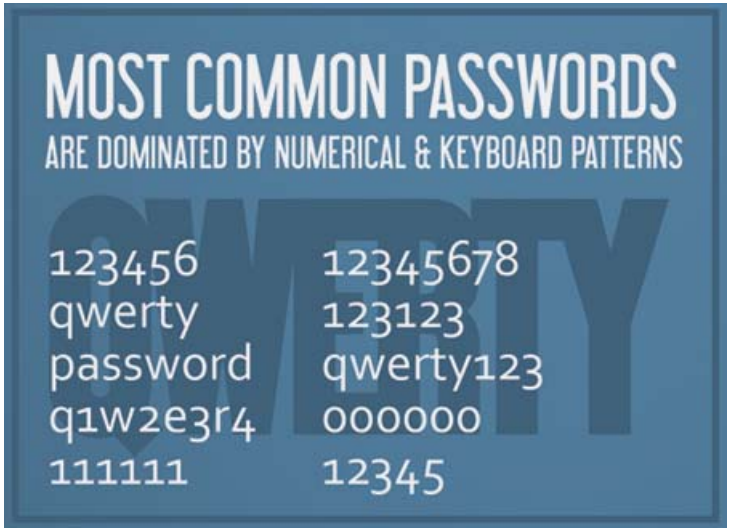
Security Issues: Theft, Exposition, Leakage

- **A hacker stole the names, birthdates and possibly credit-card numbers for 77 M people who play online videogames through Sony's PlayStation console, April 2011**
- **Online shoe store Zappos hacked, January 2012, exposing the names, e-mail addresses, addresses, phone numbers and partial credit card numbers of 24 M customers**
- **Data leakage at LinkedIn and Last.fm, Summer 2012; passwords easily computable due to simple hashes**
- **Data leakage at Dropbox, July 2012 customer data stolen from the dropbox of an employee**


Security Incidents By Industry
Non-Profit 2%
Energy 1%
Transportation 1%
Conglomerate 1%
Other 0.4%
Media 2%
Aerospace & Defense 0.3%
Manufacturing 2%
Communications/ISPs 2%
Retail 4%
Hospitality 5%
Healthcare 19%
Government 18%
Education 13%
Financial Services 11%
Technology 10%
Services 9%

- **61% of users reuse passwords across multiple services and 44% of consumers change their password at most once a year (CSID Consumer Survey 2012)**





- **90+ % of user-generated passwords are vulnerable to hacking, according to a Deloitte report, January 2013**

Legal Issues

- **Applicable laws vary from one country to the next**
- **In Germany alone, cloud users and CSPs need to consider**
  - Telekommunikationsgesetz (TKG)
  - Bundesdatenschutzgesetz (BDSG)
  - Strafgesetzbuch (StGB)
  - Abgabenordnung (AO)
  - Versicherungsaufsichtsrecht (VAG)
  - Betriebsverfassungsgesetz (BetrVG)
- **Most critical: protection of personal data**
- **What is the CSP willing to sign a contract about?**

Source: http://telcocloudforum.files.wordpress.com/2013/02/telco-cloud.jpg

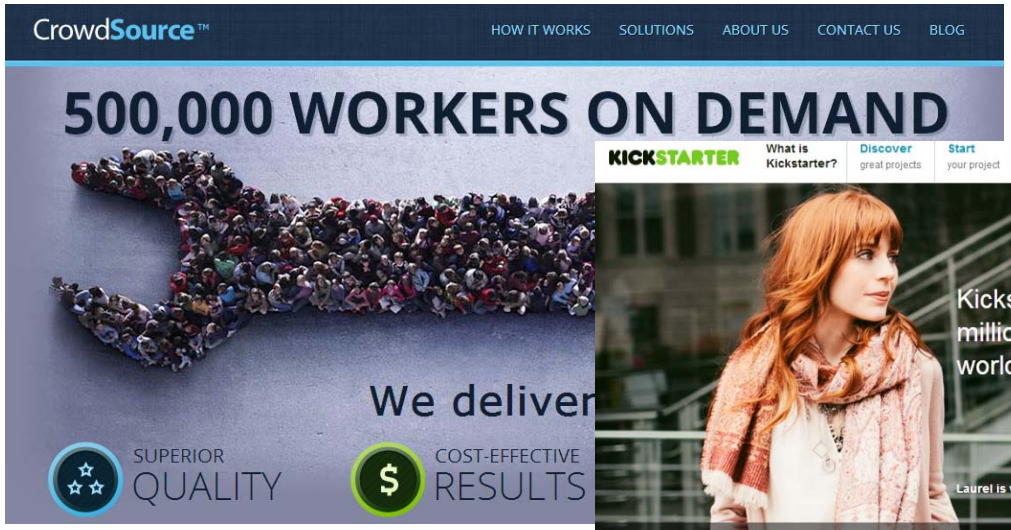
5. What the Cloud Enables

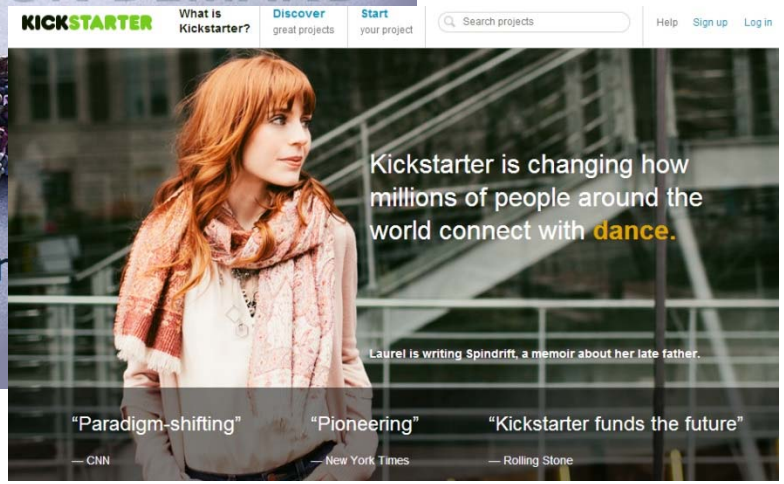
What the cloud enables, cont'd

- Crowdsourcing, crowdfunding
- Health care – big time
- Public security – Boston Marathon example
- Traffic management
- Energy management
- Smart homes
- Marketplaces for data

… to mention just a few areas and applications

- **New ways of working, developing ideas, funding projects**





If you think crowdsourcing isn't serious business ....

- **Projects exploring the potential of hybrid human/computer systems for database query processing:**
  - CrowdDB (UC Berkeley)
  - Qurk (MIT)
  - sCOOP (UC Santa Cruz)

- **Idea is that human workers can perform query operations such as subjective comparisons, fuzzy matching for predicates and joins, entity resolution, etc. These extensions can greatly extend the usefulness of a query processing system.**

molplex Pharmaceuticals

Clouds Against Disease computational platform run by Molplex, Newcastle University, and Microsoft Research

Across the globe, Molplex is helping scientists reduce the time and cost of screening large data sets of chemical compounds to identify potential drugs. Researchers are using automated tools in

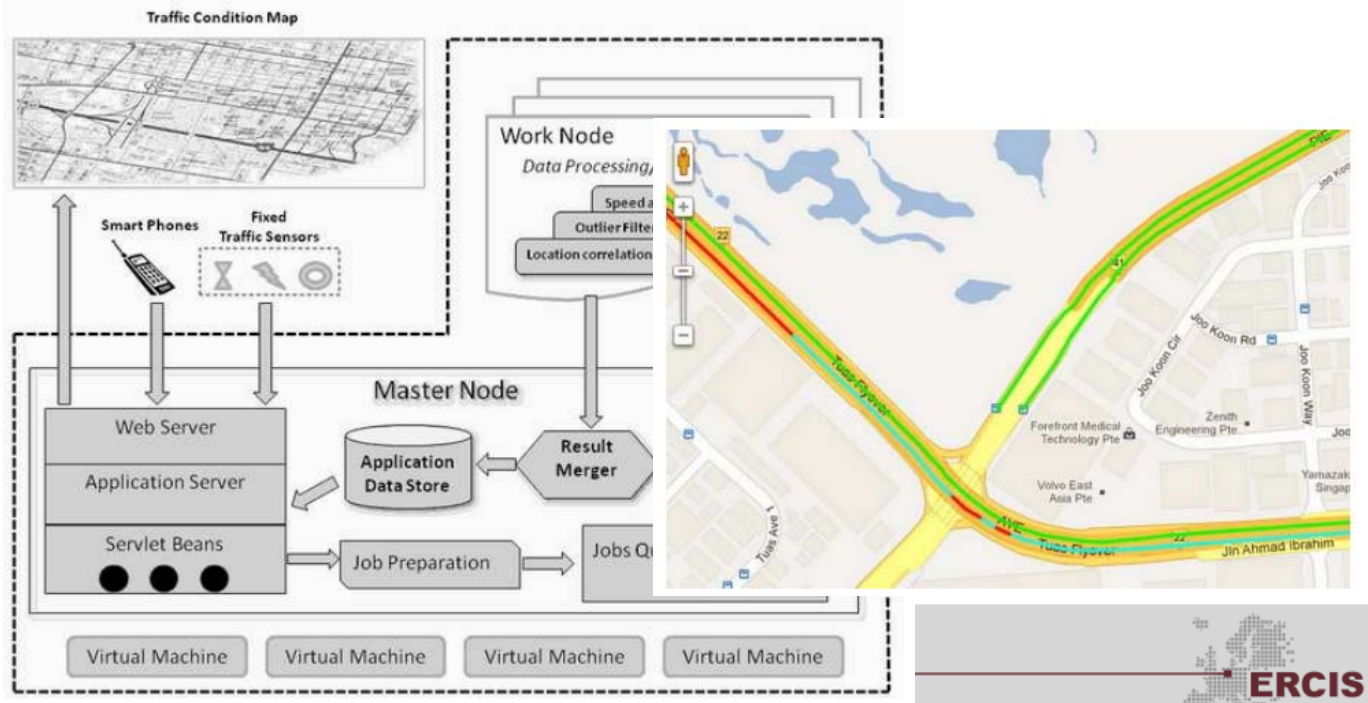
ate
ry
cal

ever.

			PRECLINICAL			CLINICAL		
Indication	**Target**	**Partner**	Hit Development (Activity & ADME-Tox)	Lead Optimisation (Activity & ADME-Tox)	Lead Optimisation (Biology & ADME-Tox)	PHASE I	PHASE II	PHASE III
Infectious Mononucleosis	Epstein- Barr Virus	*internal*						
Androgenic Alopecia	undisclosed	*internal*						
Gram Positive Antibacterials	gram-positive bacteria	*Imperial College London, Sunderland University*						
Dengue Fever	Dengue virus DENV-1 & DENV-2	*Institute for Medical Research, Malaysia*						
Filariasis	Wuchereria bancrofti	*Institute for Medical Research, Malaysia*						
Malaria	Plasmodium falciparum/ Plasmodium Vivax	*Institute for Medical Research, Malaysia*						

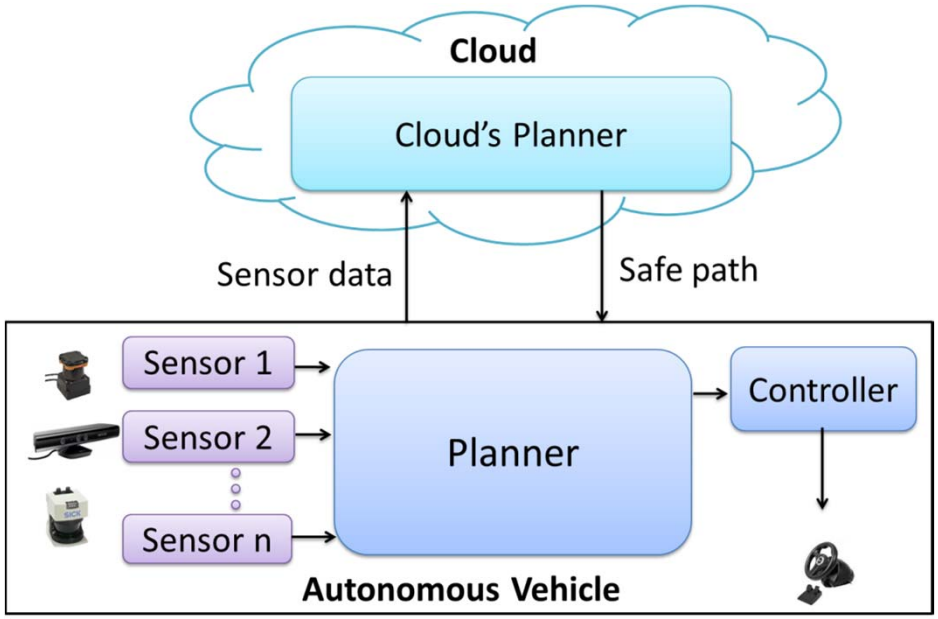
Smart Traffic Cloud Singapore

- **Singapore trials a traffic management system that could improve the monitoring of the city-state's roads by using geo-location data captured from drivers' smart phones**



ERCIS

Cloud-Assisted Design for Autonomous Driving



Smart Homes

Heating is controlled according to time of day

Electrical appliances are switched on and off

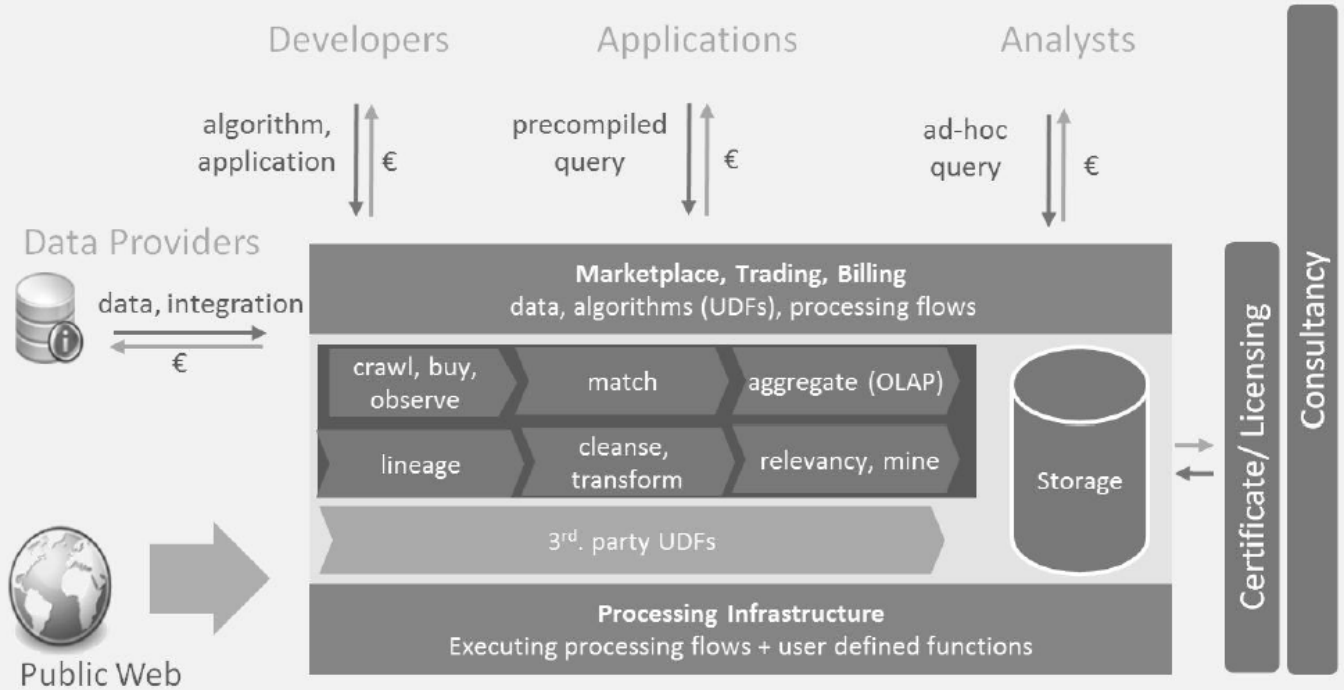
Lighting is coordinated and switched on/off

Remote control even possible from your smartphone

Central control and configuration via PC

Source: www.alsoactebis.com/ec/cms2/de/1010/content/solutions/smarthome_2/smarthome_3.jsp

Data Marketplace Outline



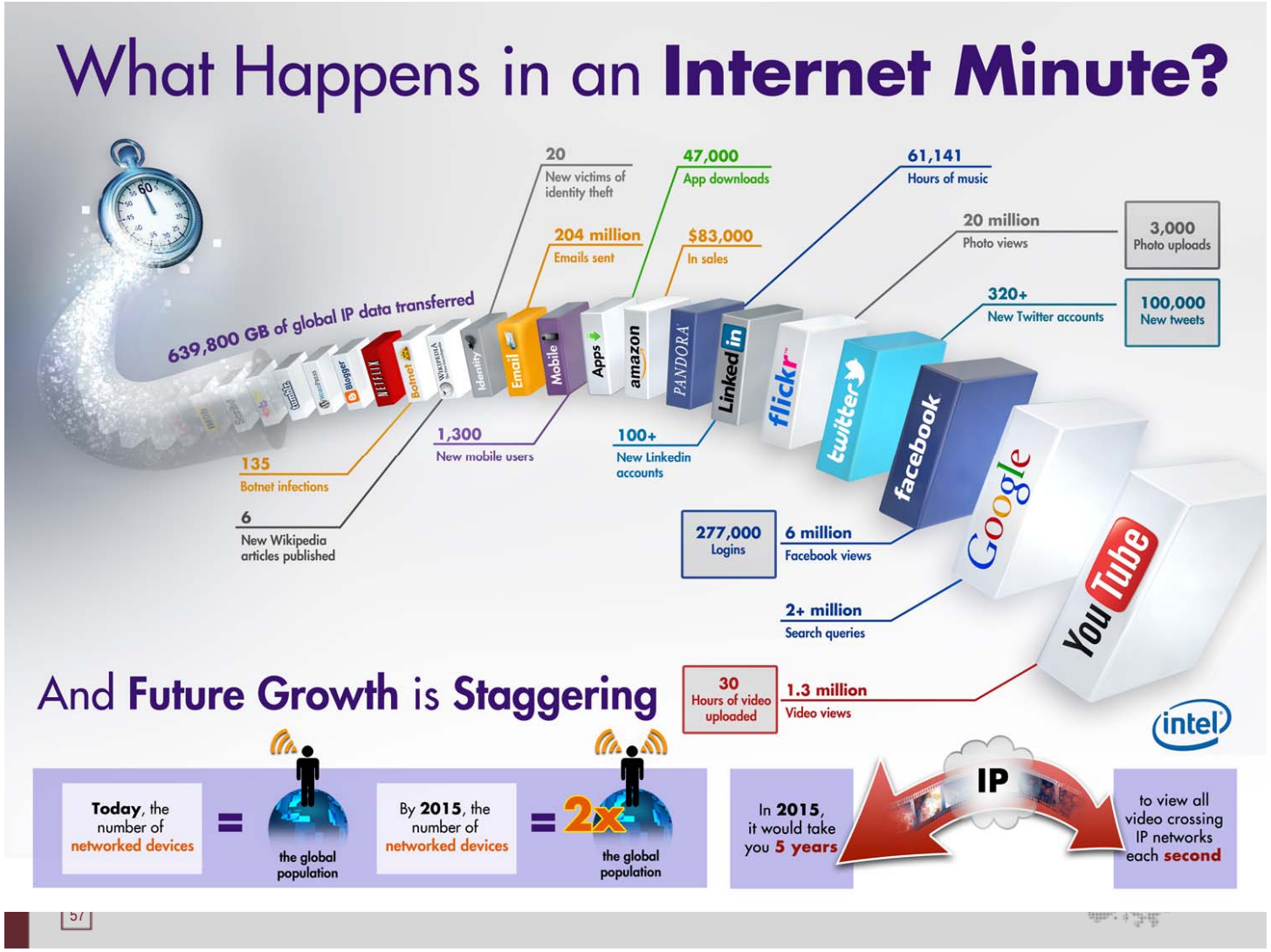
Source: Muschalle, Stahl, Löser, Vossen: Pricing Approaches for Data Markets; Proc. BIRTE 2012

Other Developments

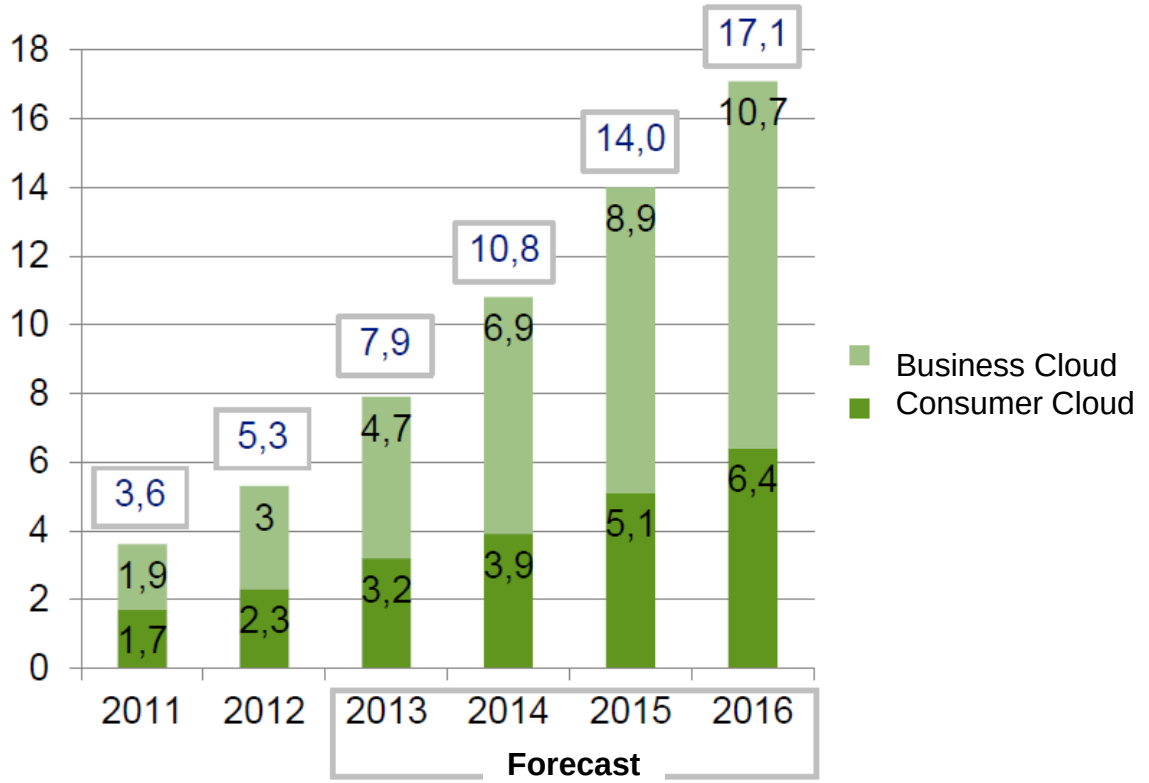
- **ERTICO – Intelligent Transport Systems and Services for Europe**
- **E-Health (23andme, Fitbit)**
- **Big data processing in social media (e.g., Twitter index)**
- **Germany's energy u-turn, i.e., the decision to phase out nuclear power by 2022**

Source: http://images.computerwoche.de/images/computerwoche/bdb/1844691/890.jpg

6. A Forecast


What Happens in an Internet Minute?
639,800 GB of global IP data transferred
20
New victims of identity theft
204 million
Emails sent
47,000
App downloads
$83,000
In sales
61,141
Hours of music
20 million
Photo views
3,000
Photo uploads
320+
New Twitter accounts
100,000
New tweets
135
Botnet infections
6
New Wikipedia articles published
1,300
New mobile users
100+
New Linkedin accounts
277,000
Logins
6 million
Facebook views
2+ million
Search queries
30
Hours of video uploaded
1.3 million
Video views
Identity
Email
Mobile
Apps
amazon
PANDORA
LinkedIn
flickr
twitter
facebook
Google
YouTube
Botnet
NETFLIX
Blogger
Wikipedia
intel
And Future Growth is Staggering
Today, the number of networked devices
=
the global population
By 2015, the number of networked devices
= 2x
the global population
In 2015, it would take you 5 years
IP
to view all video crossing IP networks each second

Sales Volume of Cloud Computing in Germany



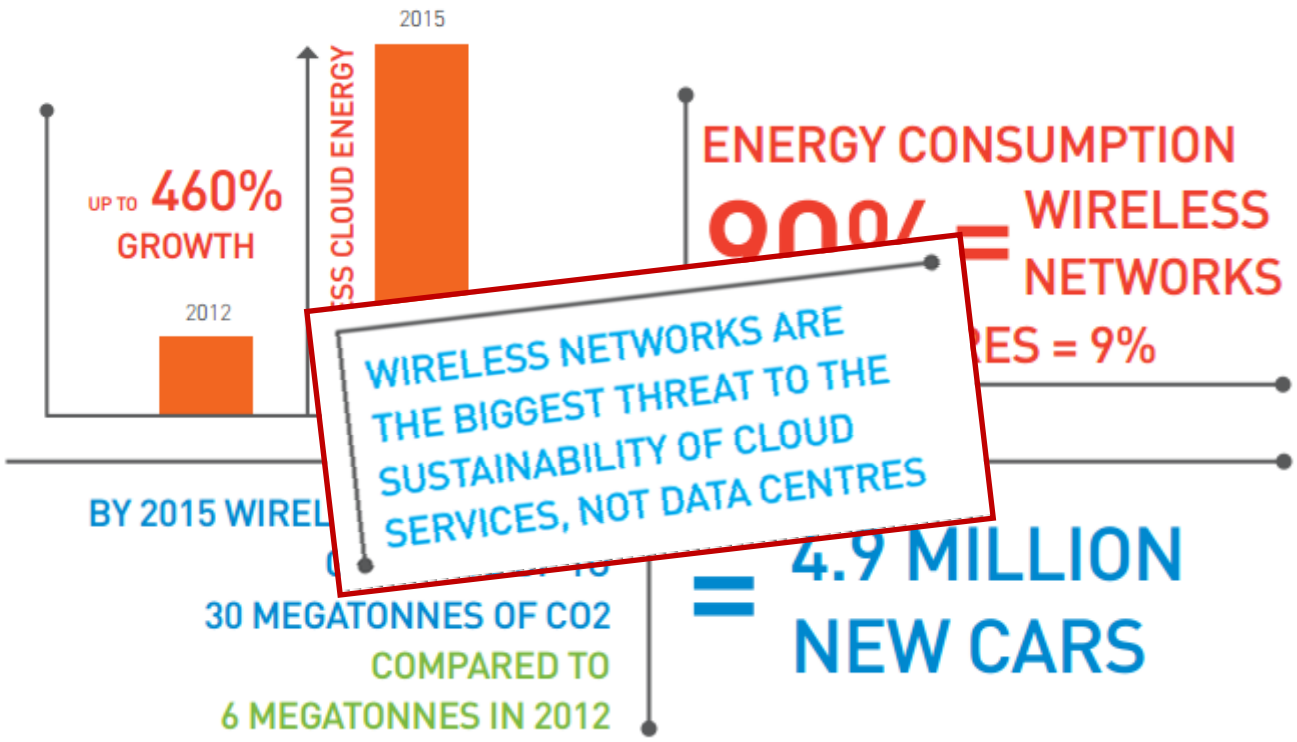
- **Heavy investing by public funding agencies**
  - BMWi‘s Trusted Cloud Program: www.trusted-cloud.de/
  - TRESOR, CLOUDwerker, SensorCloud, cloud4health in Germany
  - Cloud Control in Sweden
  - VERDIKT in Norway
  - Andromède in France
  - NSF, USA
- **Government initiatives such New Zealand‘s Cloud First Strategy,** an all-of-government approach to cloud computing (similar to the G-Cloud in the UK)

Trends (not an exhaustive list)

- **The personal cloud, where business and leisure meet, will get bigger thanks to BYOD and COPE**
- **Cloud interoperability, portability**
- **Cloud standards for configuration, management, security, storage, communication**

Data Portability	Standards	Ease of Migration & Deployment	Developer Choice
How can I keep control over my data?	**What technology standards are important for Cloud Platforms?**	**Will your Cloud Platforms help me migrate my existing technology investments to the cloud?**	**How can I leverage my developers' and IT professionals' skills in the cloud?**
Customers own their data and Cloud Platforms should make it easy and efficient to securely move customers data in and out.	Cloud Platforms should reuse existing and commonly used standards when appropriate and may lead to the creation of new standards where existing standards are not sufficient.	Cloud Platforms should provide, for existing technologies that are appropriate to the cloud, a migration path that preserves, in a secure way, existing investments in applications and IT resources.	Cloud Platforms should enable developer choice in tools, languages and runtimes.

A Warning from CEET in Australia



The End

“Cloud computing might be more accurately described as 'sky computing,' with many isolated clouds of services which IT customers must plug into individually. ... the idea of loosely coupled services running o[illegible] agile, scalable infrastructure should eventually make every en[illegible] in the cloud. It's a long-running trend with a far-out hori[illegible]trends, cloud computing is the hardes[illegible]“ Gruman & Knorr, Infoworld

“Wilber is probably taking this Cloud computering too seriously.

Further Reading

- **http://www.crowdsourcing.org**
  “the industry website”
- **Acatech‘s Future Business Cloud Initiative:**
  http://www.acatech.de/de/projekte/laufende-projekte/future-business-clouds.html
- **http://en.wikipedia.org/wiki/International_Cloud_Atlas**