T-110.4100 Computer Networks
Mobile Cloud
08.05.2012

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Agenda

- Motivation
- Background
- Cloud databases
- Techno-economic analysis of hybrid clouds
- Optimization of computation based on location, content and QoS
- Secure cloud access using HIP
- Conclusions

Server problems due to load common

Päivitetty 20.9.2011 10:19, julkaistu 20.9.2011 10:08

IT-firmalla uskomaton selitys VR:n lippukaaoksesta: ”monitoimittajahanke”

Kuva: Jarkko Mikkonen

Myrskytuhot: Puhelinruuhka vain pahenee

Julkaistu: 2.1.2012 15:36

Kun uusi myrsky on jo tuloillaan, alkaa vakuutusyhtiöihin vasta vy korvaushakemuksia joulunajan myrskytuhoista. Niin Pohjola, Pohj varoittavat ruuhkista puhelinpalveluissaan. ››

1 kommentti

VEIKKAUS

Järjestelmä on ruuhkautunut

Yritä hetken kuluttua uudelleen, tai kokeile kevytversiota mobi.veikkaus.fi. Jos tämä ilmoitus tuli pelin hyväksymisen yhteydessä, voi olla mahdollista, että pelisi kuitenkin hyväksyttiin. Voit tarkistaa tämän hakemalla avoimet pelisi.

Million phones muted fault repaired

publication 05.02. at 10:24, Updated 06.02. 15:46 pm

Image: YLE

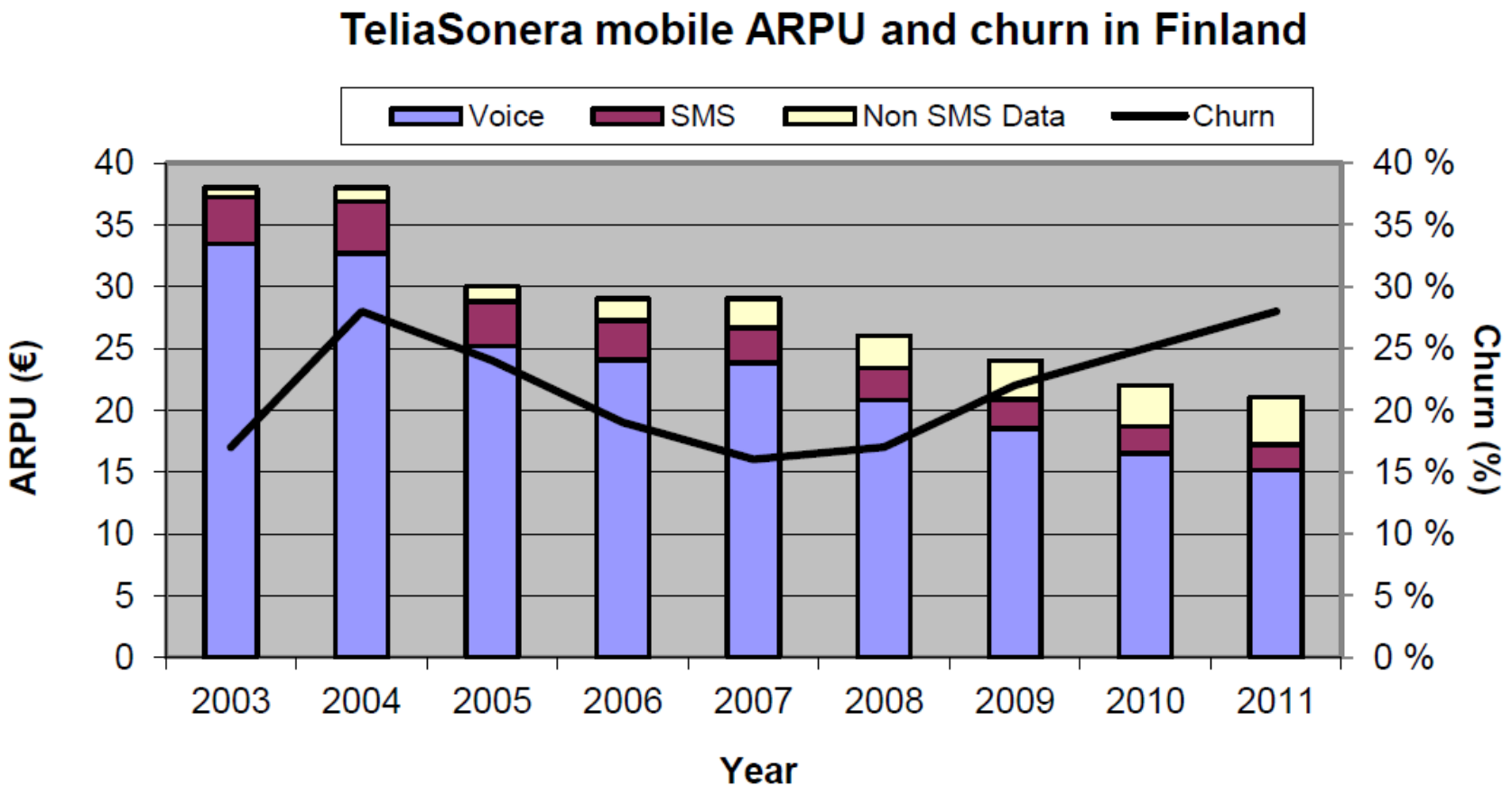
Elisa's mobile network had a large disturbance is corrected. Tampere, an electrical fault occurred in mute one million mobile phone Mikkeli, Vaasa, north of a line for several hours on Saturday. Elisa, all mobile phones are normally operated on that date.

Dysfunction related to 2G and 3G mobile network in the north of Tampere. Southern Finland and the West Coast had not been for the inconvenience.

At 7 o'clock in the morning revealed the fault was corrected at the time of 10.30. Most of the phones to operate normally, shortly after noon and all.

Elisa's broadband service was in Tampere, Kihniön Parkanon areas and problems. Elisa, Sauna and Columbus in the Gulf has a total of about three million mobile phone subscriptions.

Operator profitability declining



Mobile Cloud gains interest

Home > IT Business > News

Ericsson to launch cloud services

Cloud services will be launched in emerging markets where access to a home computer is not affordable

By Håkan Ogelid | IDG News Service | Published 11:20, 23 September 11

+1 1 Like Tweet 0

Telecoms firm Ericsson has announced that they are to expand into the field of cloud services.

IT Business

CLOUD SERVICES: THE RACE IS ON

Alcatel·Lucent

Cloud services are changing the service provider landscape and providing an enormous opportunity to stake a claim in new territory. There is real excitement about the benefits of the opportunity — new services, new revenue, faster deployments, lower costs and greater agility. Cloud services are already transforming the way we live and do business. New entrants are quickly joining the race to win a piece of this dynamic new market. It's still early days in the cloud services market. And service providers have unique assets that will help them take advantage of emerging, high-growth opportunities:

- Multiple regional points of presence
- A carrier-grade infrastructure
- A managed network right to the customer
- Existing customer relationships

Combining the cloud with these assets opens the door for service providers to join the cloud services race and dominate

Home > ITU-T > Focus Groups > Cloud Computing

Areas of Work | Newsroom | Events | Publications | Statistics | About I

FG Cloud

International Telecommunication Union

Focus Group on Cloud Computing (FG Cloud)

(In operation since 2010-05)

ITU-T Focus Group on Cloud Computing (FG Cloud) was established further to ITU-T TSAG ag Geneva, 8-11 February 2010 followed by ITU-T study groups and membership consultation.

The Terms of Reference of the Focus Group are available here.

The Focus Group will, from the standardization view points and within the competences of I telecommunication aspects, i.e., the transport via telecommunications networks, security as service requirements, etc., in order to support services/applications of "cloud computing" ma telecommunication networks; specifically:

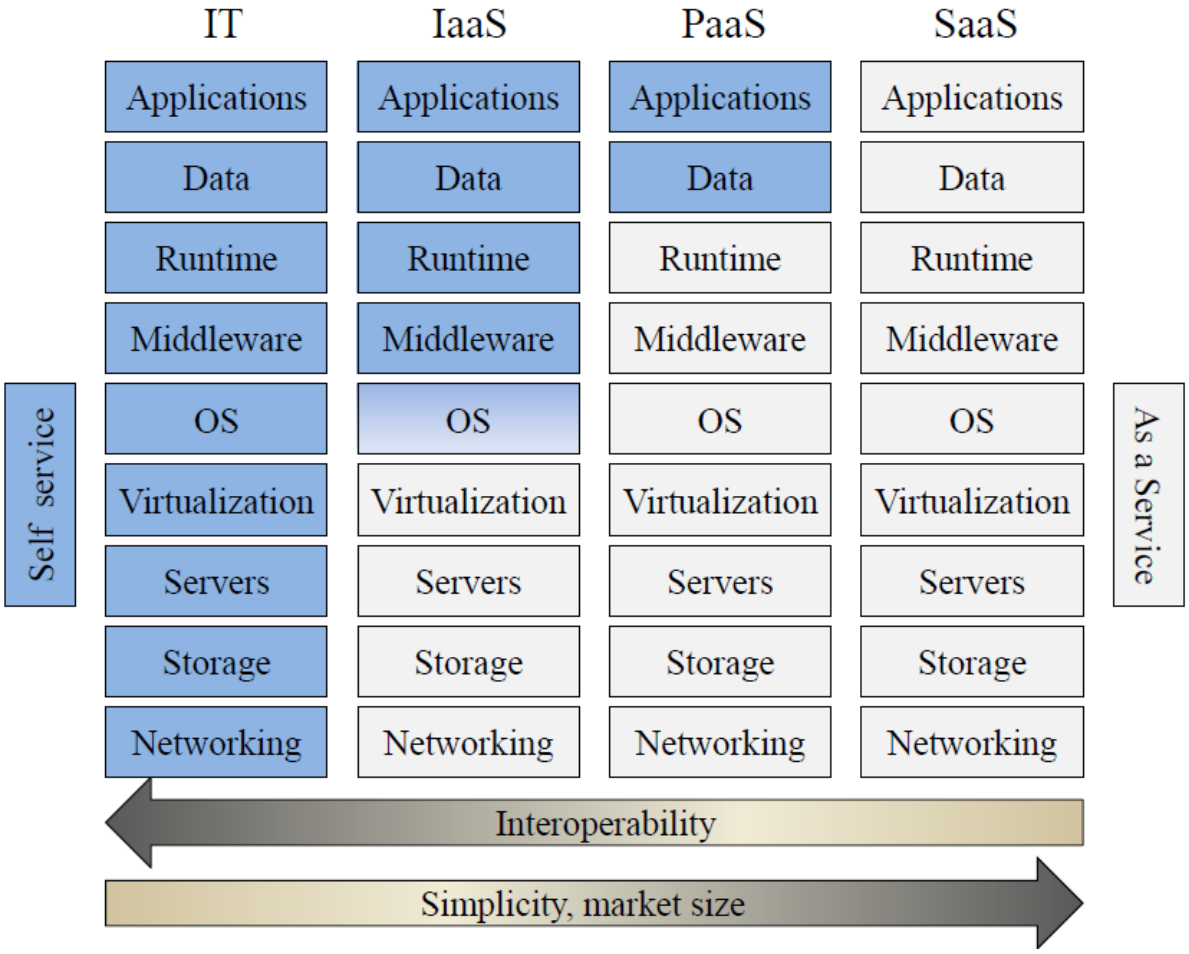
Share Print

Liquid Net

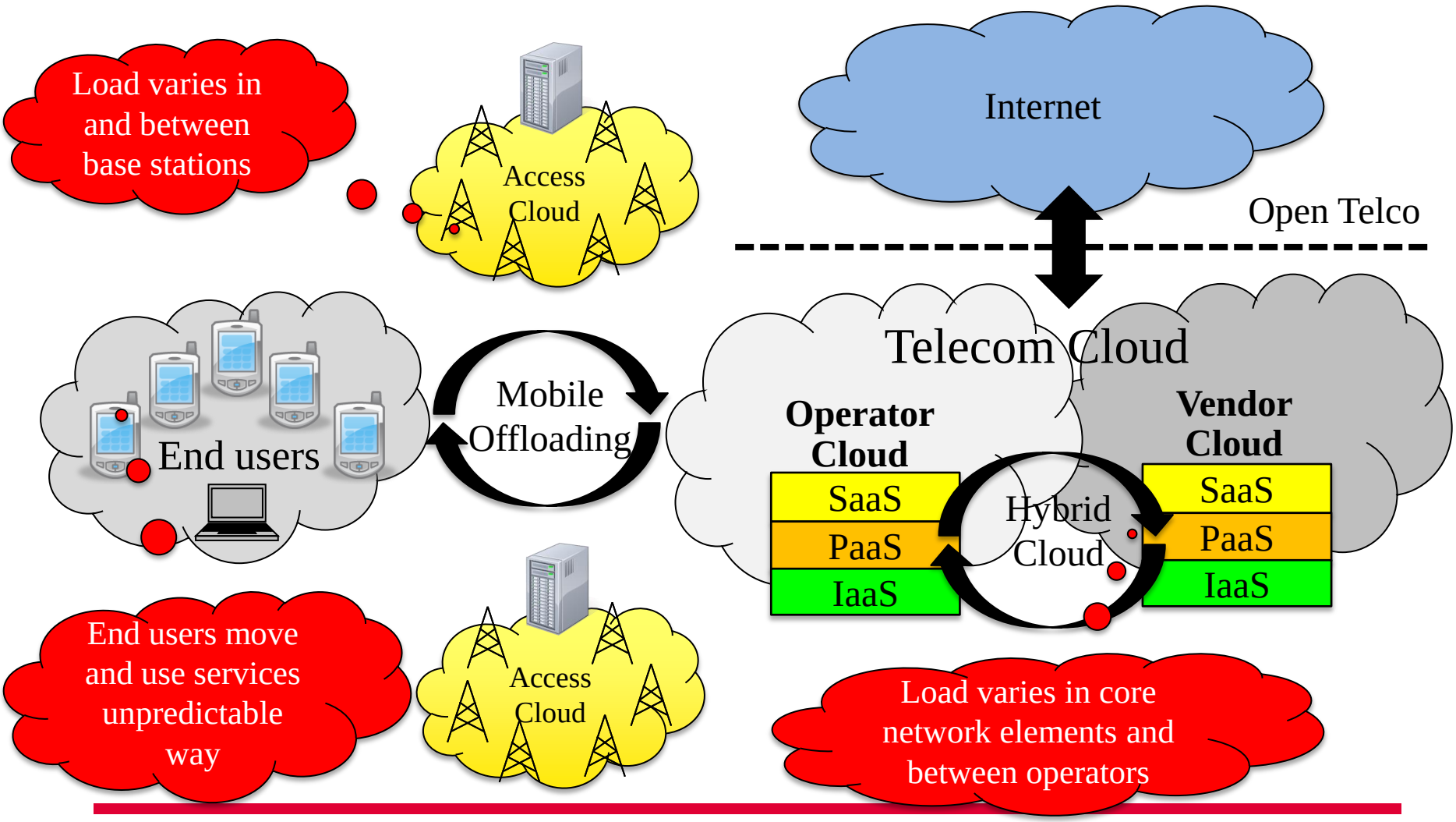
We'll help you overcome conventional network limitations and flow spare capacity where it is needed, when it is needed.

Downloads

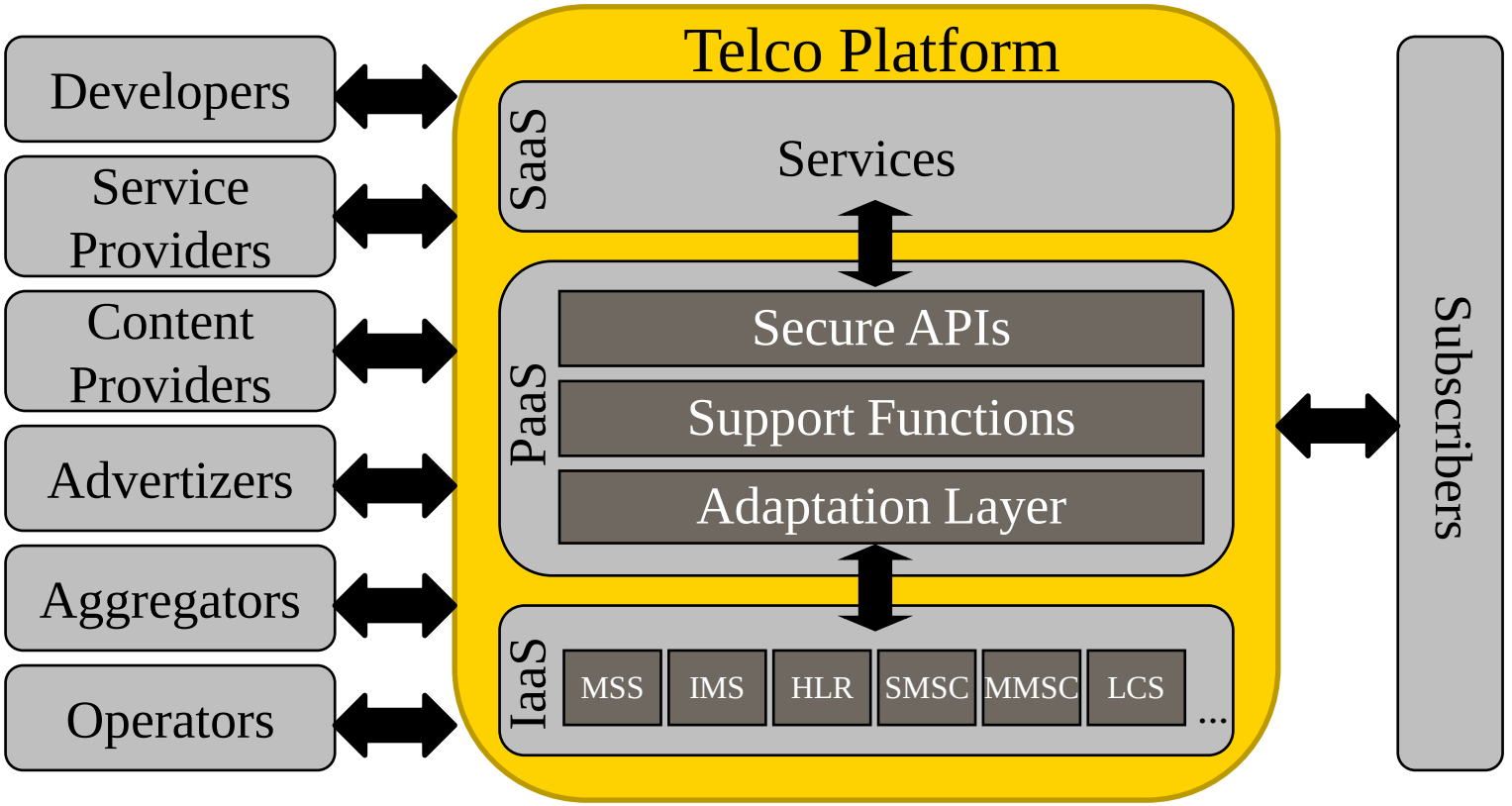
Cloud Service Models



Vision



Cloud service models in mobile networks



Fallacies of distributed computing

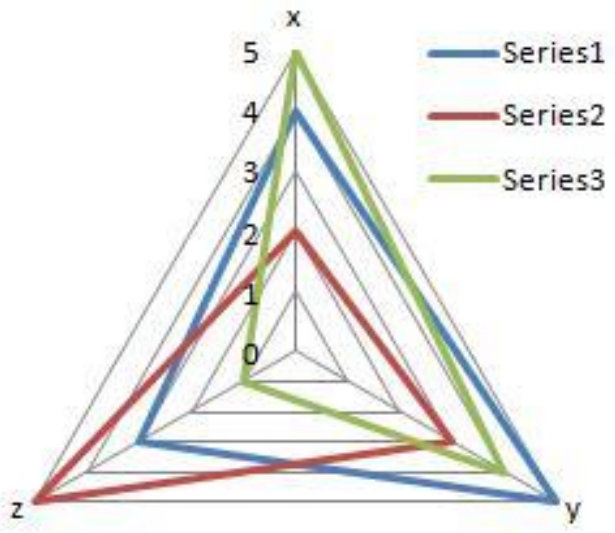
Max Goff (2004):

1. **The network is reliable**
2. **Latency is zero**
3. **Bandwidth is infinite**
4. **The network is secure**
5. **Topology doesn't change**
6. **There is one administrator**
7. **Transport cost is zero**
8. **The network is homogeneous**

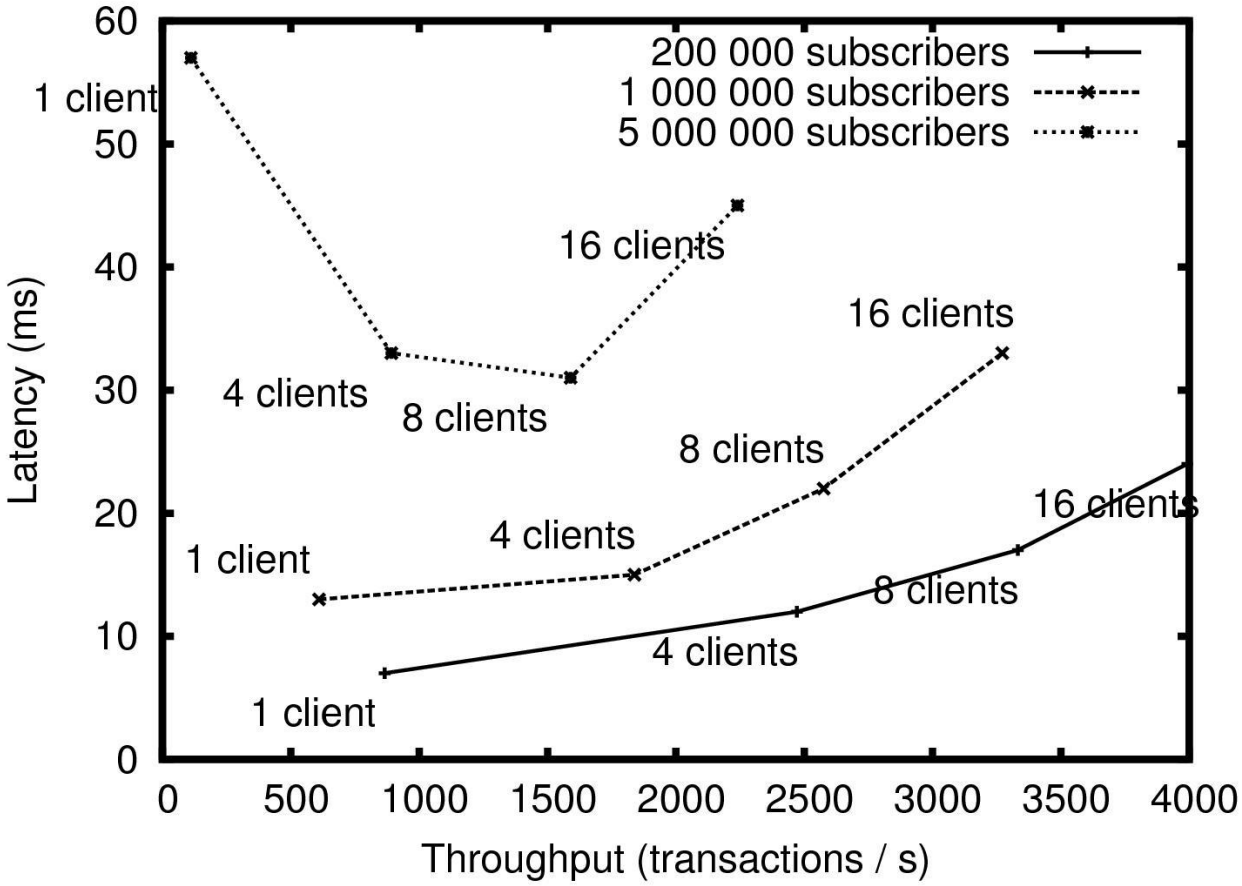
All claims will be proven false sooner or later

CAP theorem

- **Consistency, Availability and Partition tolerance**
  - Consistent data operations can be linearized, which means that clients will not detect any difference in the state of the data between a single or distributed systems
  - Availability defines the probability that each data node responds to a client request in a certain time interval
  - Partition tolerance defines how well the system can recover from message losses or data corruptions
- **Eric Brewer (2000): impossible to optimize the distributed system by all three aspects at the same time**
- **Andras Vajda (2012): Computation, networking and storage cannot be optimized simultaneously**
- **We applied to SLA (latency, throughput, availability)**

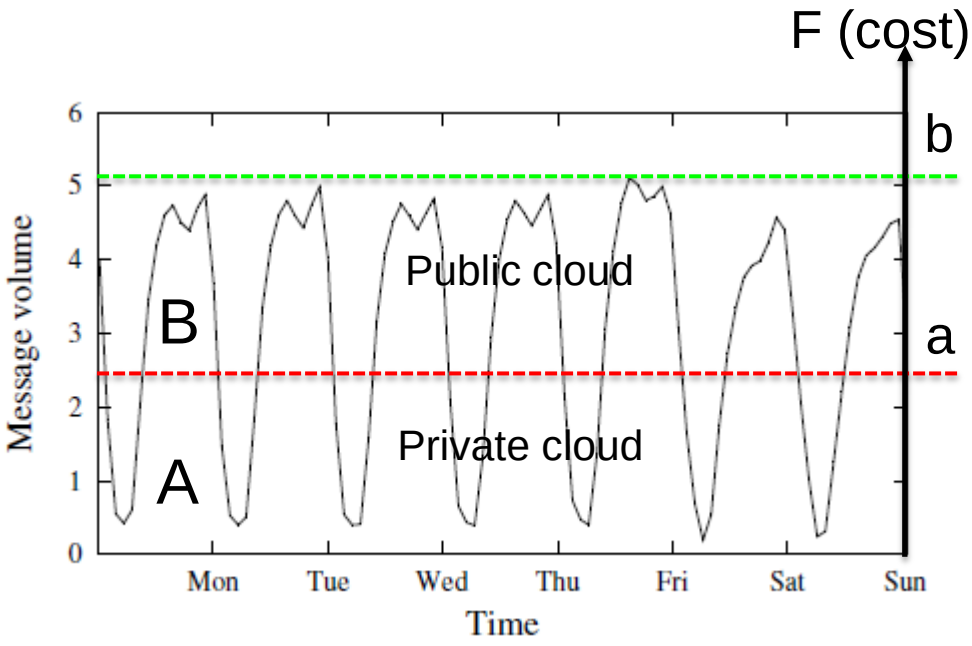


NoSQL databases in telecommunication networks



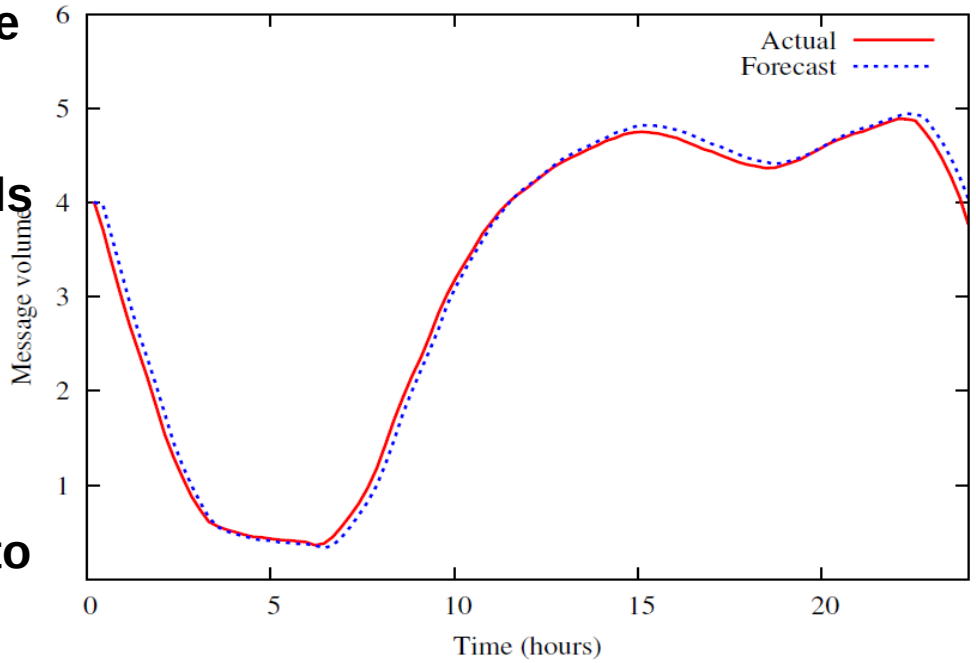
Short Message Service and hybrid cloud

- **Short messages still one of the most profitable mobile services**
- **2010: 6 trillion SMS messages worldwide, á ~10 cent**
- **By 2015 SMS revenues will shrink by 40% (STL Partners)**
- **Sudden peak loads tenfold to normal peaks**
- **Virtualize SMS Center (SMSC) code, utilize hybrid cloud to optimize performance and cost**
- **Our test case: 10 million customers, 10 billion messages/year (0-500 req/s)**



Dynamic resource provisioning

- **Load varies, VM startup time can be minutes => need for prediction**
- **Reactive or proactive models**
- **Optimization based on**
  - Performance, deadline, cost, energy or any combination
  - By client or service provider
- **Autoregressive Moving Average (ARMA) suits well to stationary data**
- **First order ARMA filter applied**
- **Parameters selected offline method; online?**



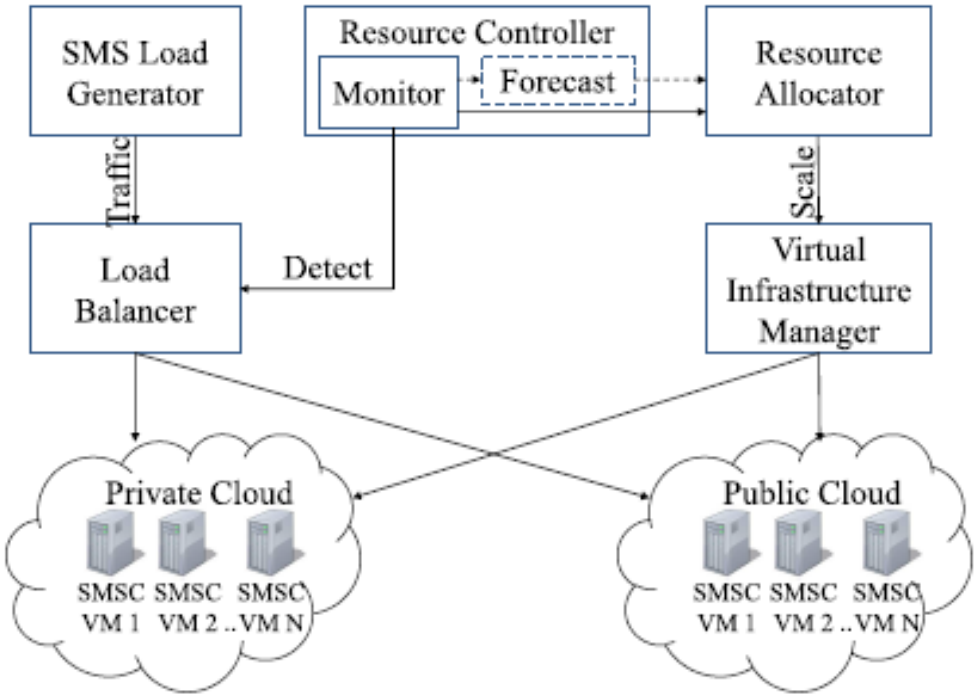
$$X(t) = \mu + \alpha \times X(t-1) + \beta \times \varepsilon(t-1) + \varepsilon(t)$$

$$\mu = Mean \times (1-\alpha)$$

$$\mu = const, \alpha = 0.90, \beta = 0.15, \varepsilon = noise$$

Proof of concept

- **Services and functions implemented by:**
  - Public cloud: Amazon EC2
  - Private cloud: OpenNebula
  - SMSC simulator: SMPPSim
  - SMS load: OpenSMPP
  - Load Balancer: HAProxy
  - Monitor: TCPSTAT
  - Resource Allocator: XML-RPC



OpenNebula Amazon EC2

Cost optimum

$$\tau_c(q_{\min}) = \frac{(p_{co} + p_{bo}k)\mathrm{T}}{u_c p_{co} + p_{bo}k(u_b + \rho(1+u_b))}$$

$$\tau_c(q_{\min}) = 515h$$

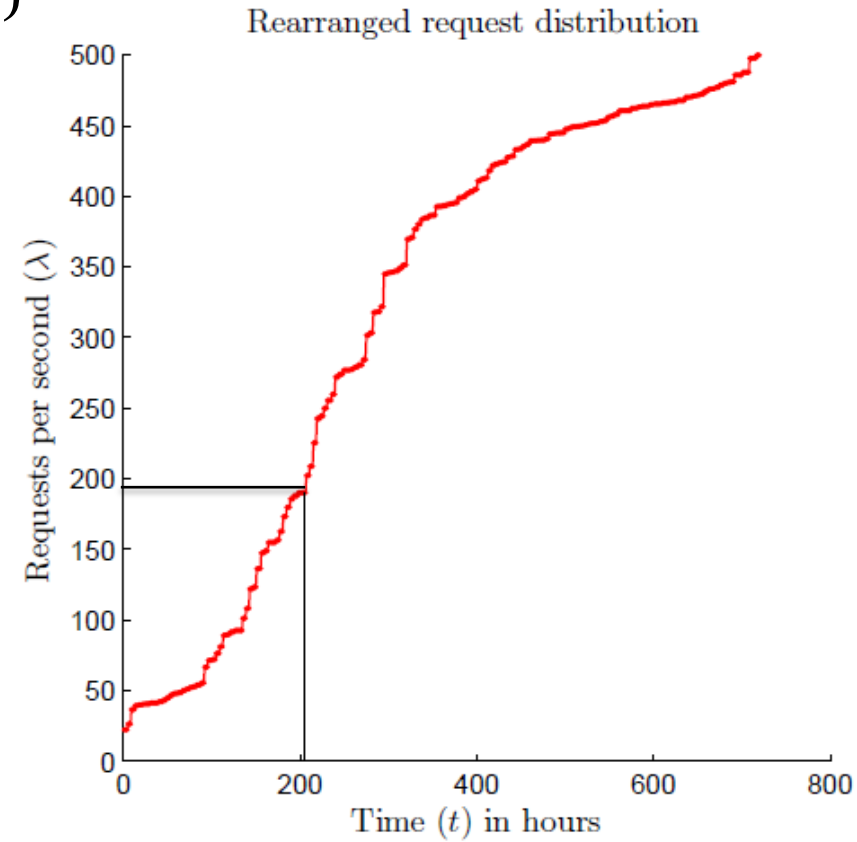
- **515 hours with public cloud and 205 hours with private cloud**
- **Private cloud can manage 190 req/s→2 VMs (100 per VM)**
- **Rest 0-3 VMs in public cloud**

- **Set k=0 (transfer free) →**

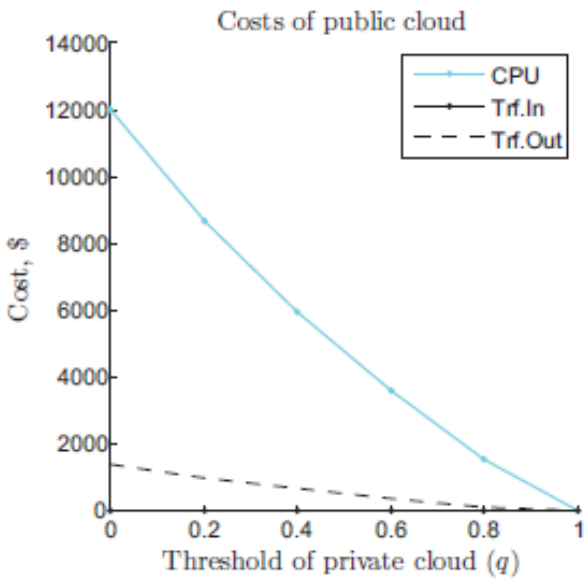
$$\tau_c(q_{\min}) = \frac{p_{co}T}{u_c p_{co}} = \frac{T}{u_c}$$

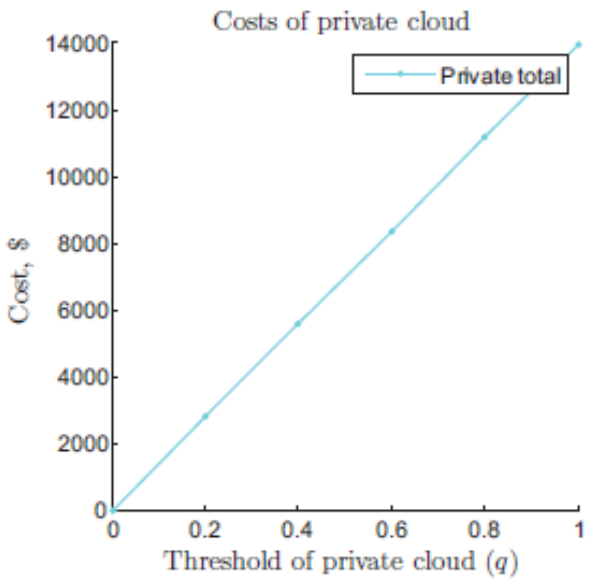
- **As proven by Joe Weinman**

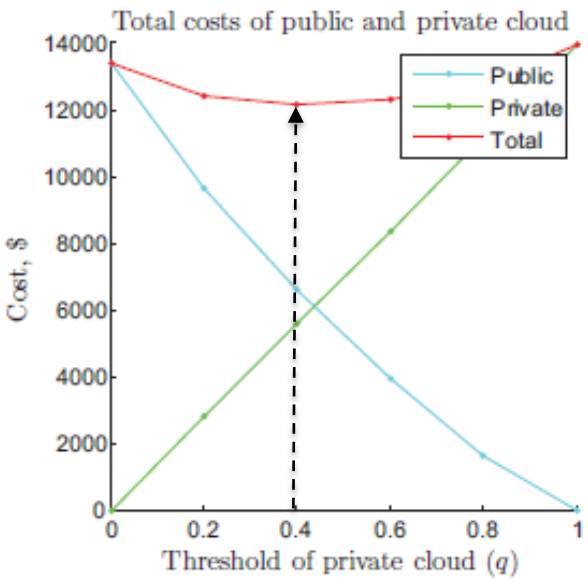
Monotonically non-decreasing



SMSC cost comparison







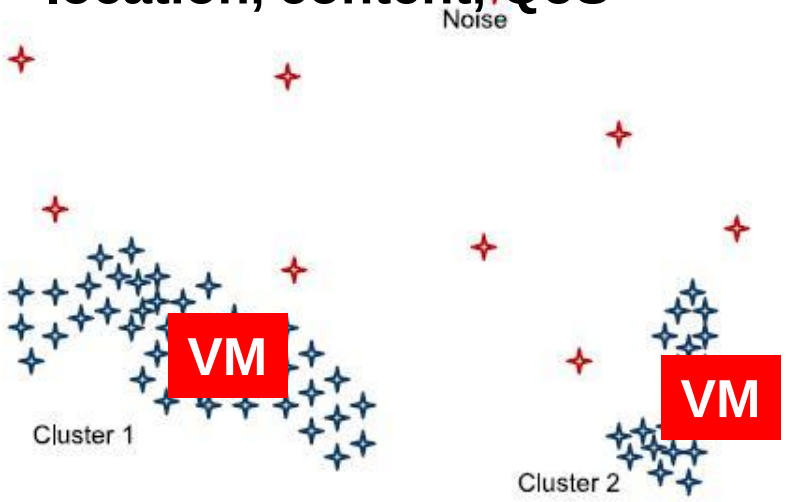
All in public: $13 396

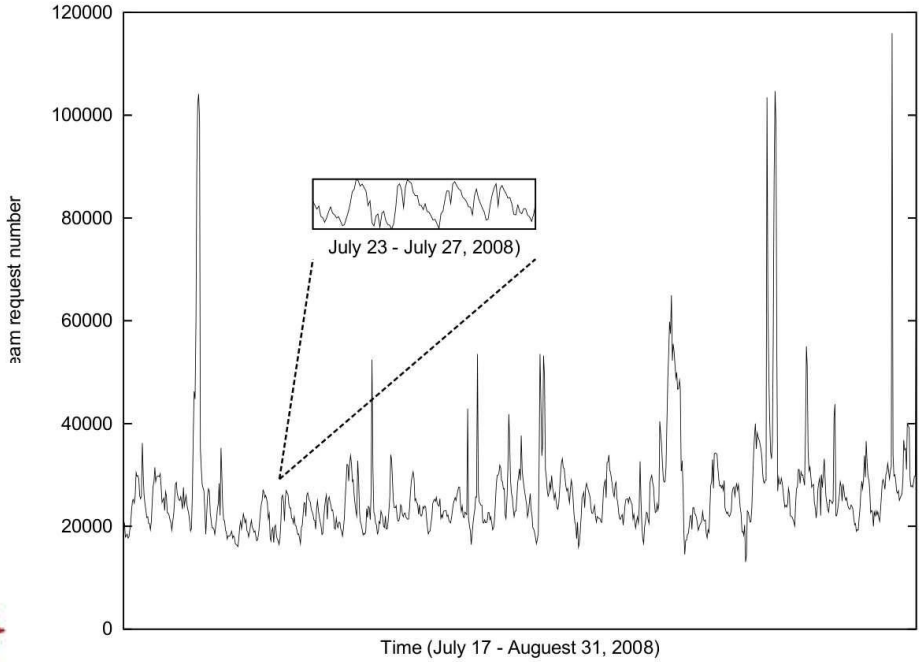
All in private: $13 980

Hybrid: $12 190

Optimisation of computation

- **Slash-dot effect: during peak similar content accessed**
- **90% of IP addresses within 2 time zones from middle**
- **Optimize based on location, content, QoS**





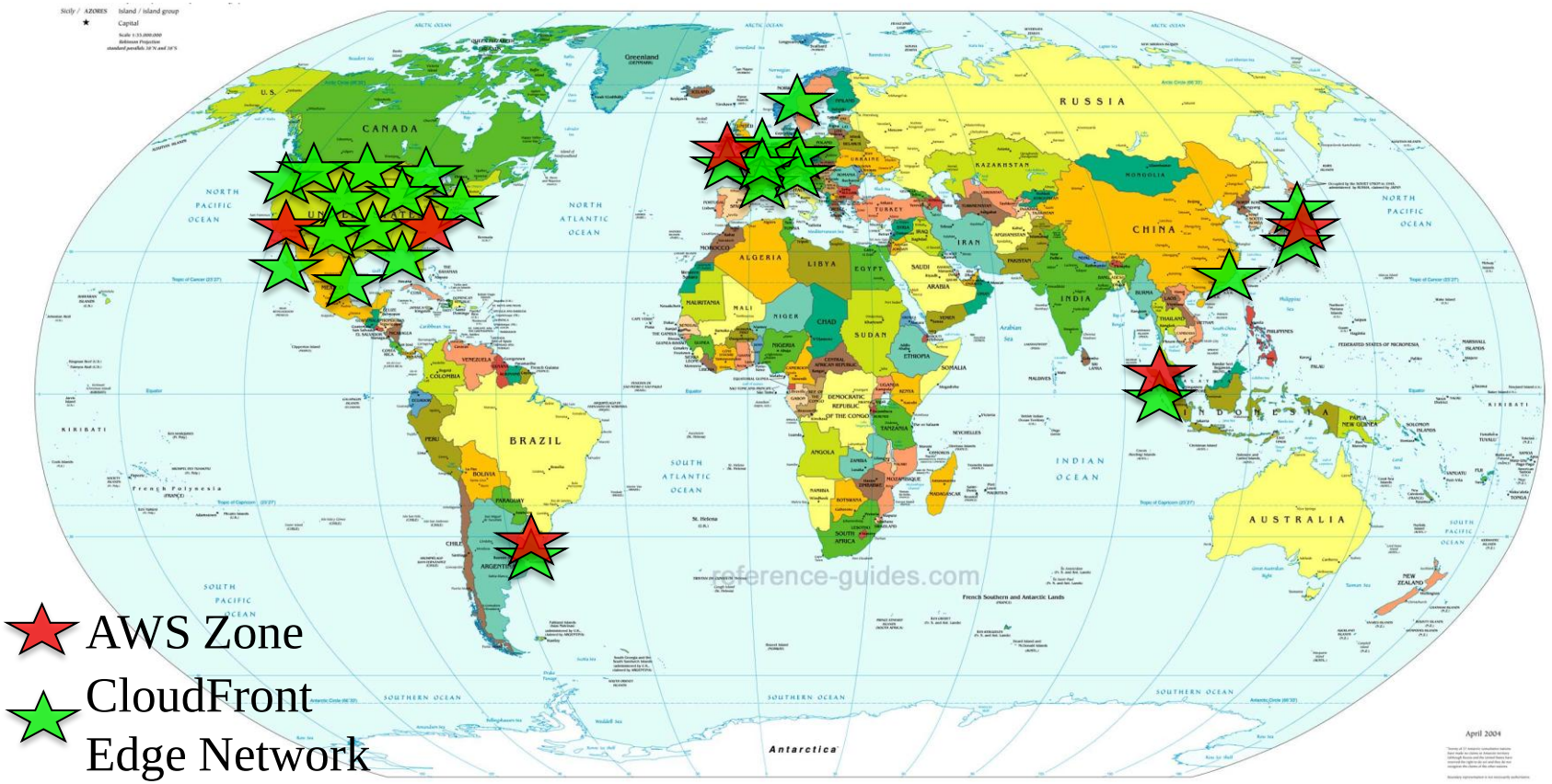
Video stream workload on Yahoo! Video web service

Source: H. Zhang, G. Jiang, K. Yoshihira, H. Chen, and A. Saxena. Intelligent workload factoring for a hybrid cloud computing model. In Proceedings of the 2009 Congress on Services - I, pages 701–708, Washington, DC, USA, 2009. IEEE Computer Society.

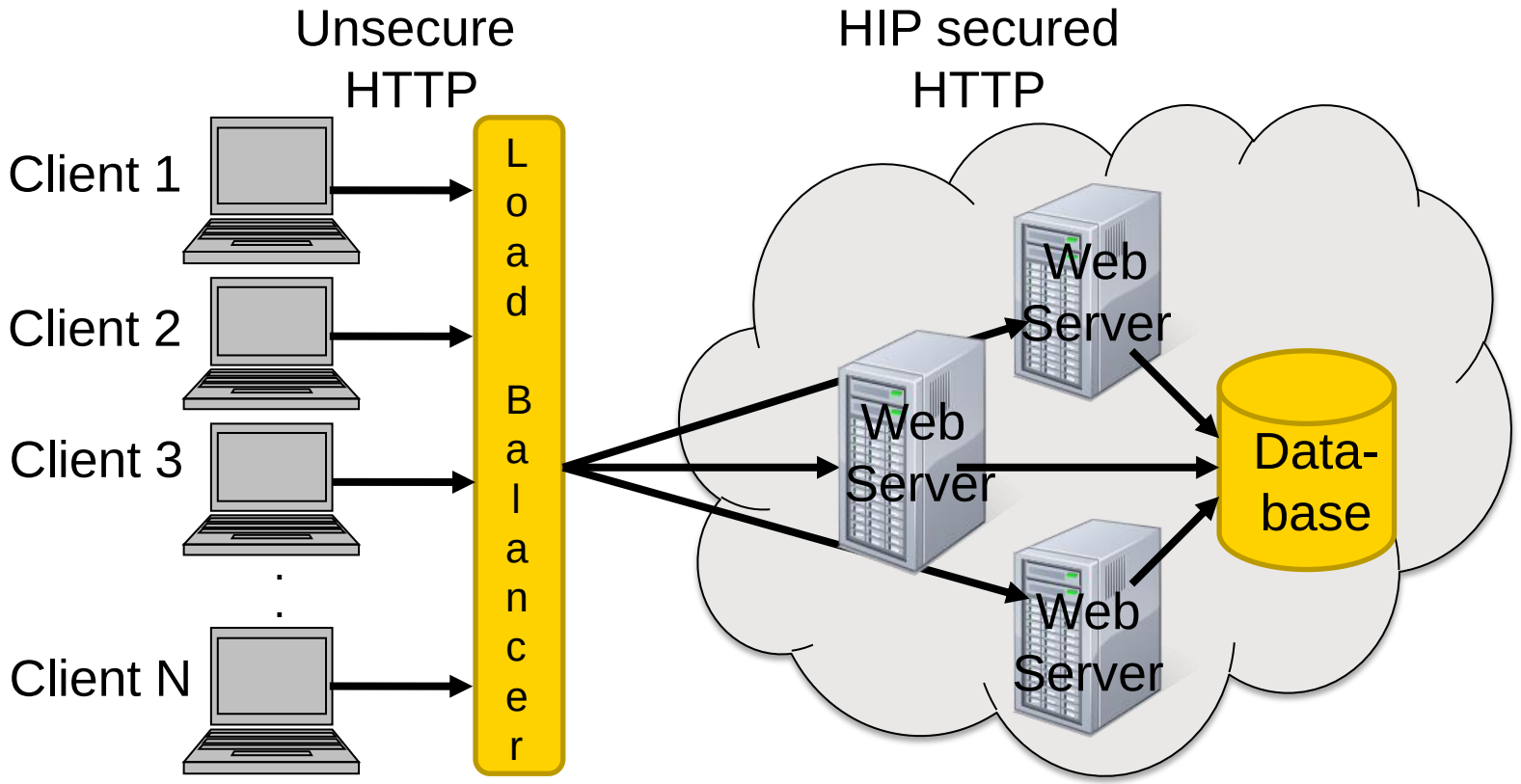
Content Delivery Networks (CDN) using cloud storage

- **Akamai expensive for SMEs**
- **Need for more economic solution**
- **Current alternatives such as Amazon CloudFront analyzed**
- **Not optimal solution**
- **Optimize content delivery based on**
  - Location
  - QoS
  - Content type
- **Target: improved performance, cost and trust**

Amazon Web Services and CloudFront



Secure Multi-tenant Clouds with Host Identity Protocol (HIP)

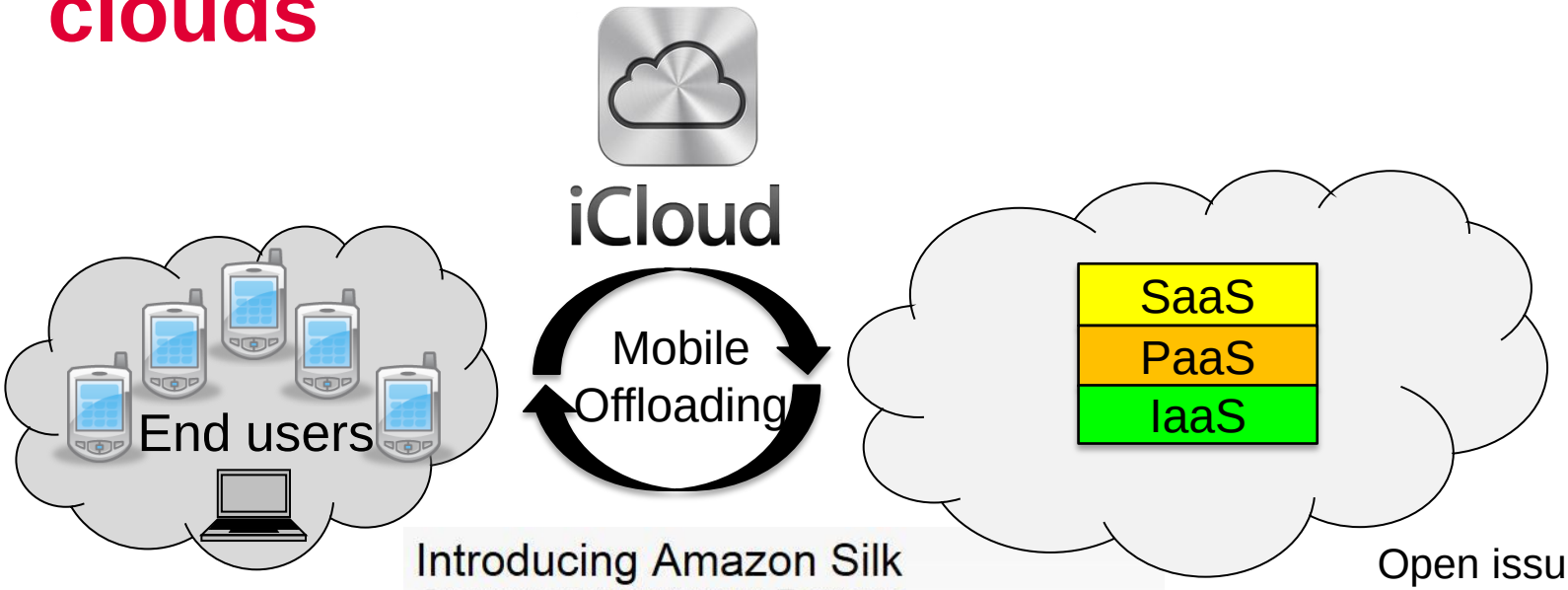


Source: Miika Komu et al., Secure Multi-tenant Clouds with the Host Identity Protocol, submitted to ICCCN 2012

Initial results and future ideas

- **Test system**
  - OpenNebula and Amazon EC2
  - HAProxy Load Balancer, Rubis bidding service, HIP for Linux
  - Performance comparable with SSL
- **Future ideas**
  - Use OpenStack for further experiments
  - Integrate of HIP support for cloud management software
  - Automated DynDNS integration
  - Virtual Machine migration
  - Larger installation for inter-cloud system
  - HIP for cloud thin clients (Amazon Silk)?

Enhancing mobile performance with clouds



Parameters
- Load
- Location
- SLA
- Energy
- Cost

Introducing Amazon Silk

SEPTEMBER 28, 2011 BY THE AMAZON SILK TEAM 717 COMMENTS

Today in New York, Amazon introduced Silk, an all-new web browser powered by Amazon Web Services (AWS) and available exclusively on the just announced Kindle Fire. You might be asking, "A browser? Do we really need another one?" As you'll see in the video below, Silk isn't just another browser. We sought from the start to tap into the power and capabilities of the AWS infrastructure to overcome the limitations of typical mobile browsers. Instead of a device-siloed software application, Amazon Silk deploys a split-architecture. All of the browser subsystems are present on your Kindle Fire as well as on the AWS cloud computing platform. Each time you load a web page, Silk makes a dynamic decision about which of these subsystems will run locally and which will execute remotely. In short, Amazon Silk extends the boundaries of the browser, coupling the capabilities and interactivity of your local device with the massive computing power, memory, and network connectivity of our cloud.

Open issues
- Security
- Usability
- SLA
- Business case
- Energy
- Hybrid cloud
- Interoperability

Conclusions

- **Cloud computing applicable also to mobile apps**
- **Text messaging used to verify the hybrid concept, business applications are elsewhere**
- **More suitable to variable, sudden traffic peaks**
  - Video, voice, ticket sales, gaming..
- **Next**
  - Web use cases
  - Comparison of proactive dynamic resource provisioning algorithms with different traffic patterns
  - Content delivery using clouds
  - Secure access to cloud
  - Cloud interoperability

Questions?

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