Cloud Applications: Less Guessing, more Planning and Knowing

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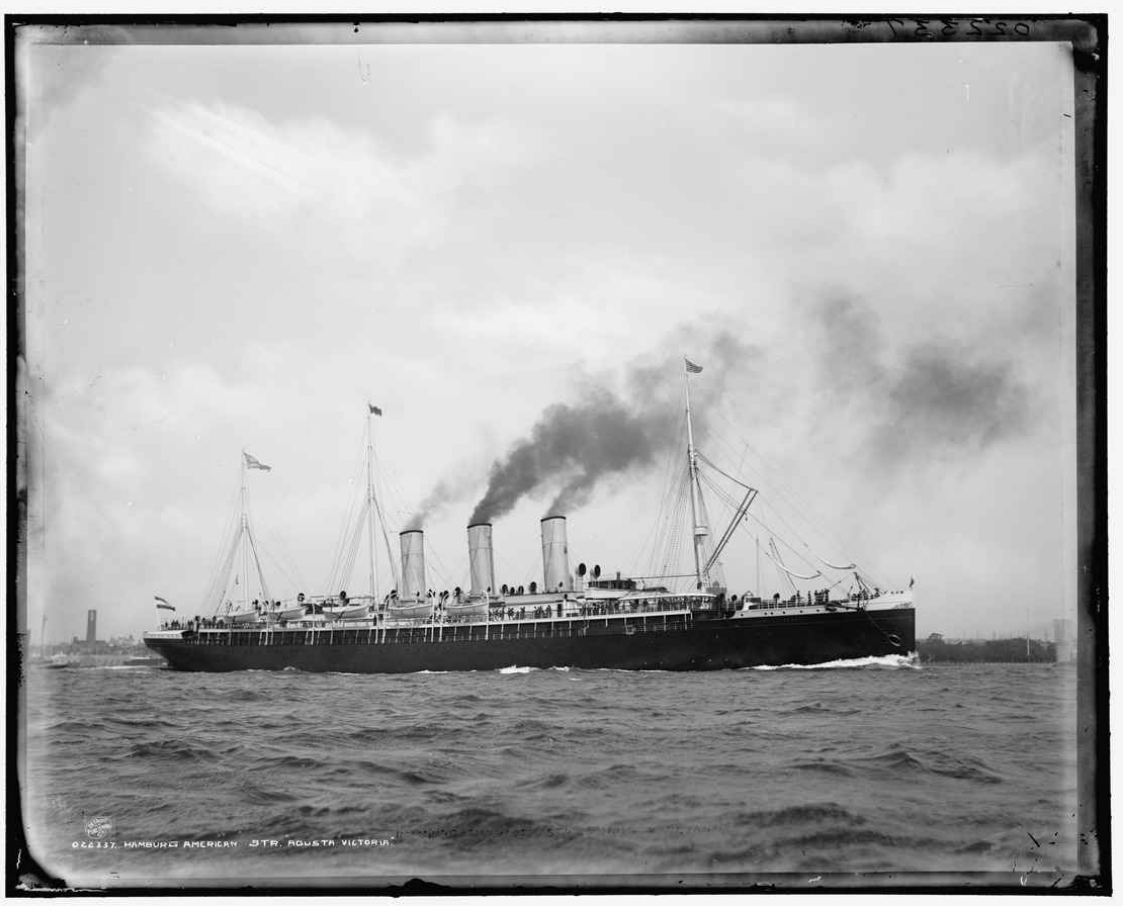
Cruise Ships History

England 1842: P&O → Postship with spare capacity in the Med
Germany 1888: Augusta Victoria → Liner in summer, cruiser in winter time [Klu01]



Winterthur Computer History

Remington Rand (pre-Unisys), Swiss daughter company Mithra [Bru11]:

- M9 (alias Z9), designed around 1953-1954
- using Stibitz coding instead of regular BCD: easier handling of negatives
- users: Winterthur city administration(*), machine producer Rieter in Winterthur, Swissair, Zurich cantonal electricity provider, & many more

- business model:
  - buy
  - lease/rent (with time-based fee)

- (*) only one M9 left world-wide in Museum for Communication, Bern
  - installed in 1961 for computing of bills for utilities
  - using punch cards for input and output (no screen, no printer)

Winterthur Computer History

The M9: Cases and relays [Bru11]

Bringing it all together...

Capacity use: Augusta Victoria → early “virtualisation“
Business model: M9 e.g. in Winterthur → early “PAYG“ service model

+ scaling
+ on-demand provisioning

- risks

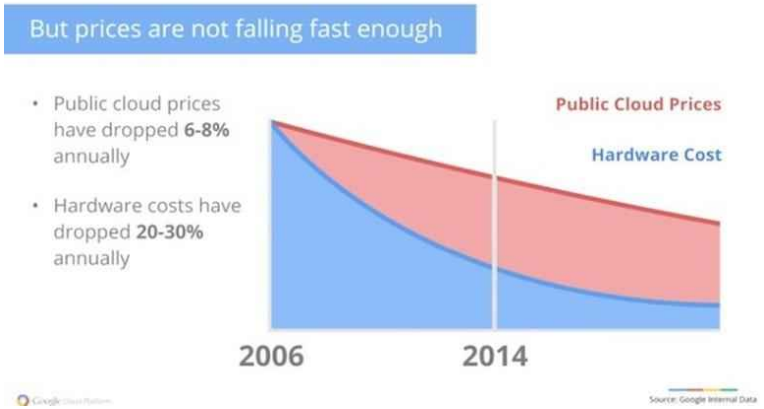
= cloud computing infrastructure perspective

... and predicting the future

Fundamentals: resource services

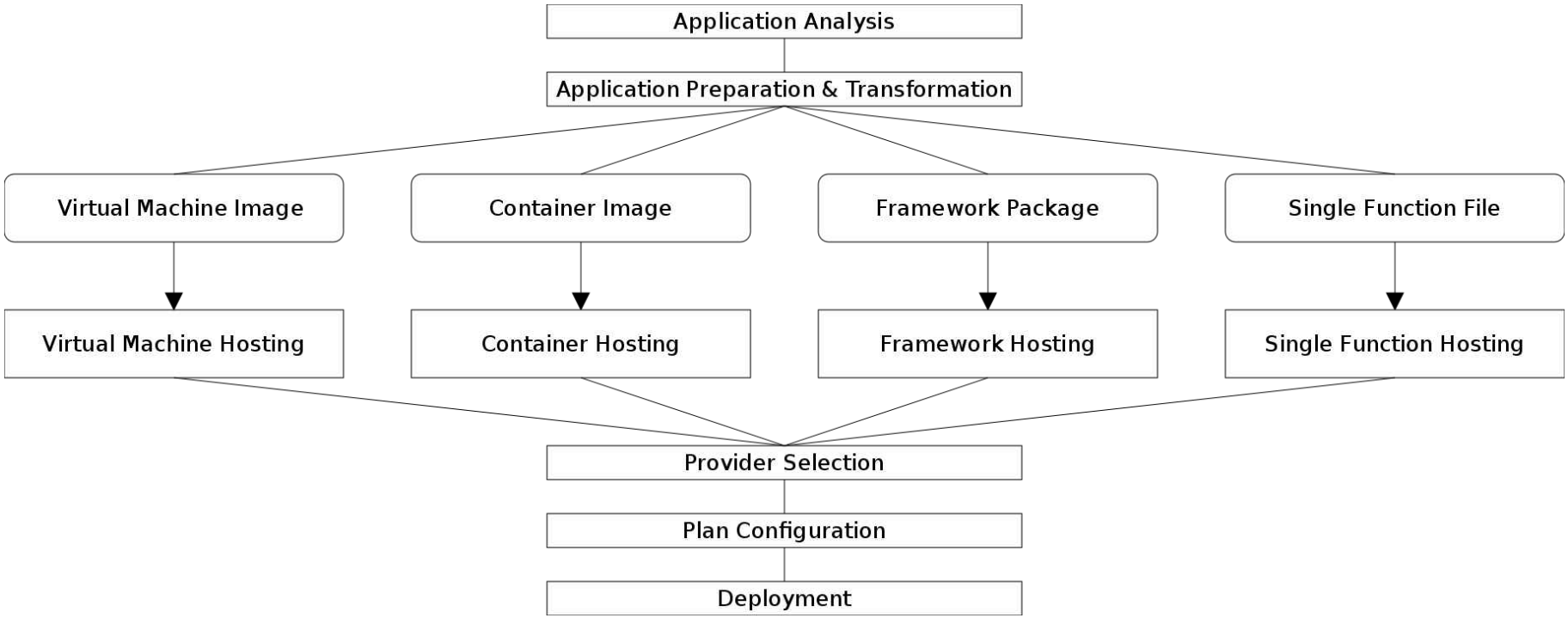
- Compute
  - governed by Moore's Law (for transistors) [CuYo16]
- Networking
  - governed by Keck's Law (for optical fiber) [Hec16]
- Storage
  - governed by Kryder's Law? (for magnetic disks; not quite) [Ros14]

Services on top: not so straightforward - not just speed



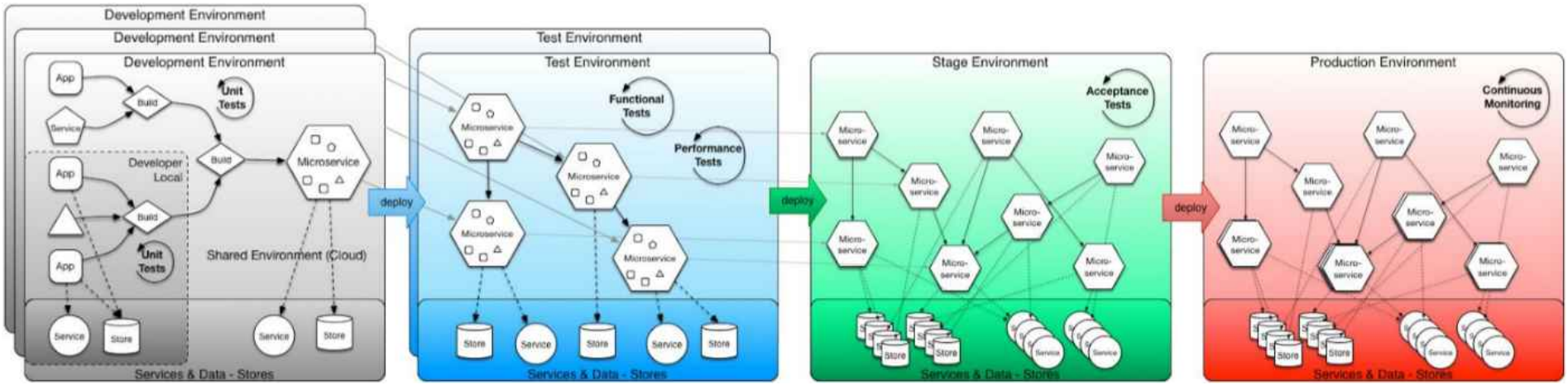
Cloud Applications Perspective

Initial onboarding



Cloud Applications Perspective

Continuous operation and re-engineering



Planning and Knowing

A-priori safeguarding: design for risks/threats...

- failure / unavailability
- unpredictable popularity
- leaks / surveillance
- dependency changes and issues

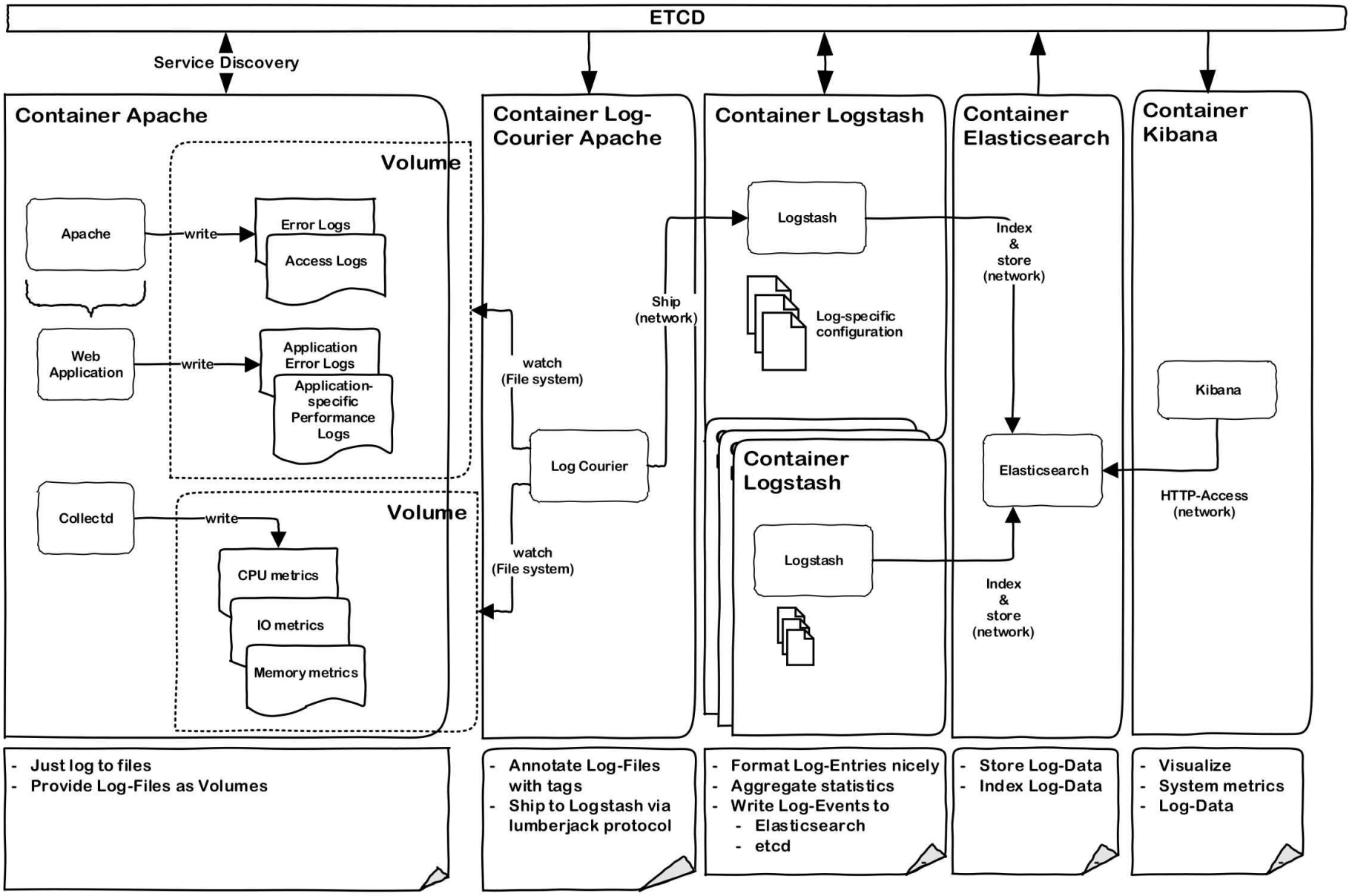
A-posteriori knowledge

- monitoring
- event processing
- log file analysis
- incident detection

Novel Techniques

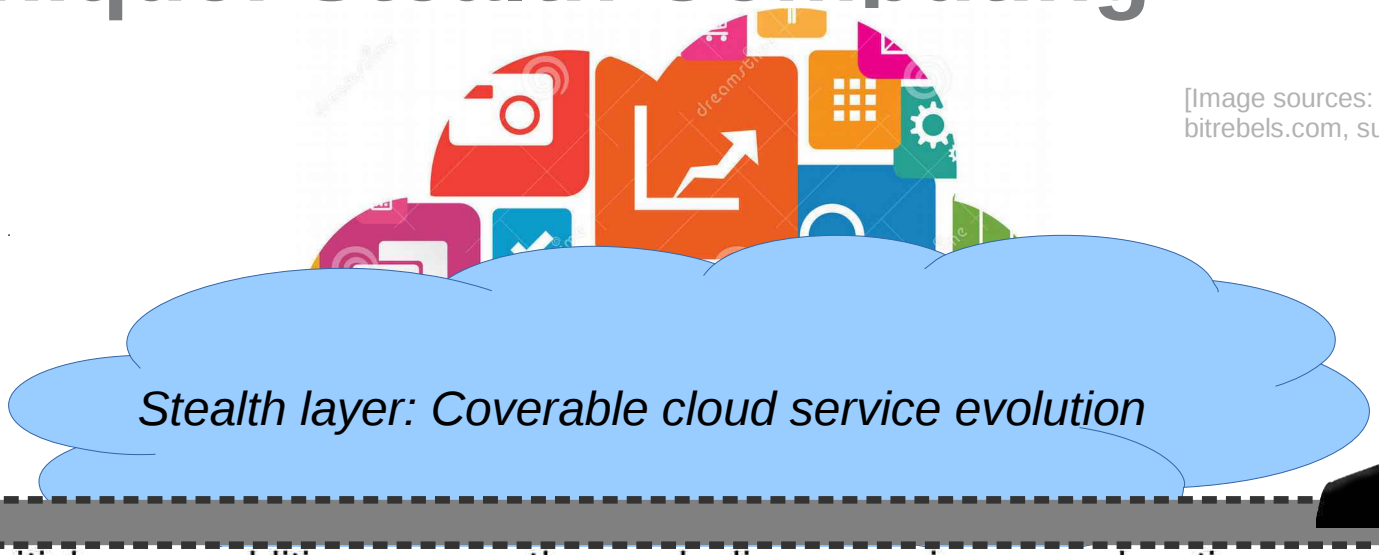
- Cloud-Native Applications
- Stealth Computing
- Active Service Management / Fault Injection

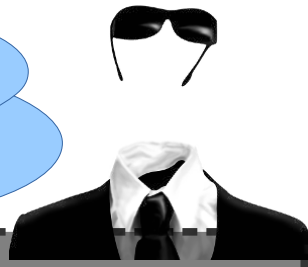
Technique: Cloud-Native Applications



Technique: Stealth Computing

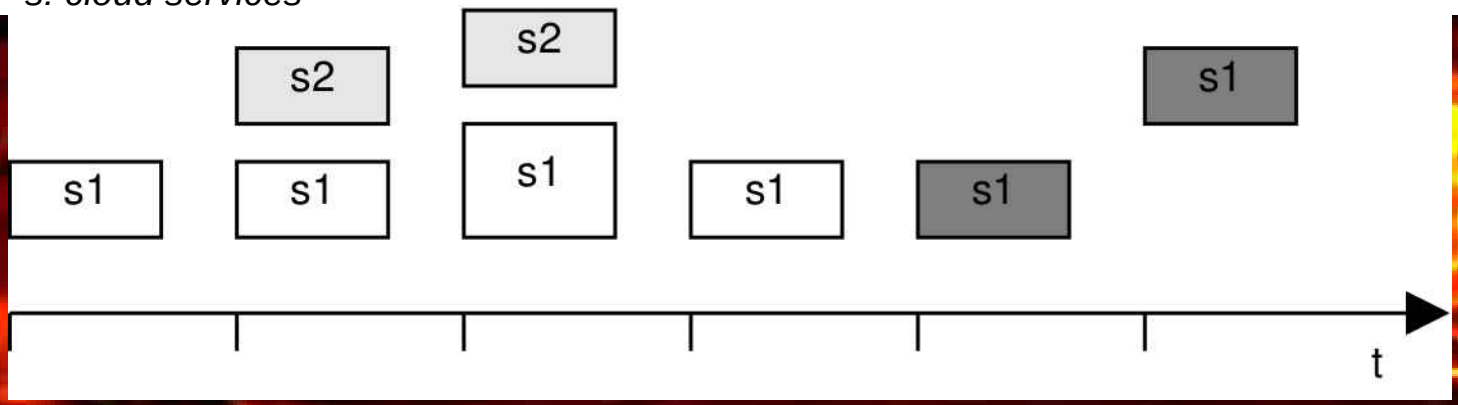
[Image sources: dreamstime.com, bitrebels.com, suitsofarmour.com]



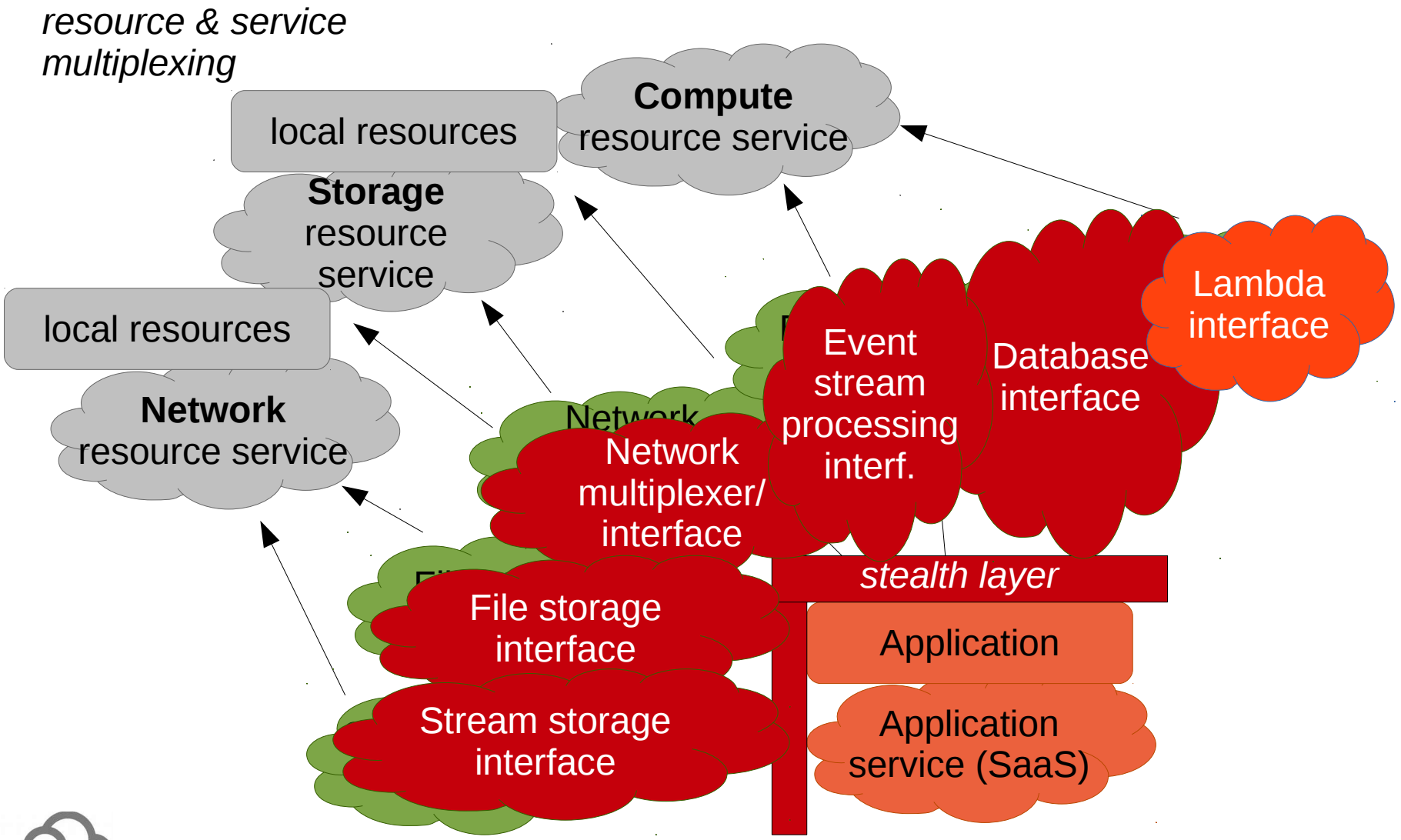


initial | addition | growth | decline & vanish | price change | location change

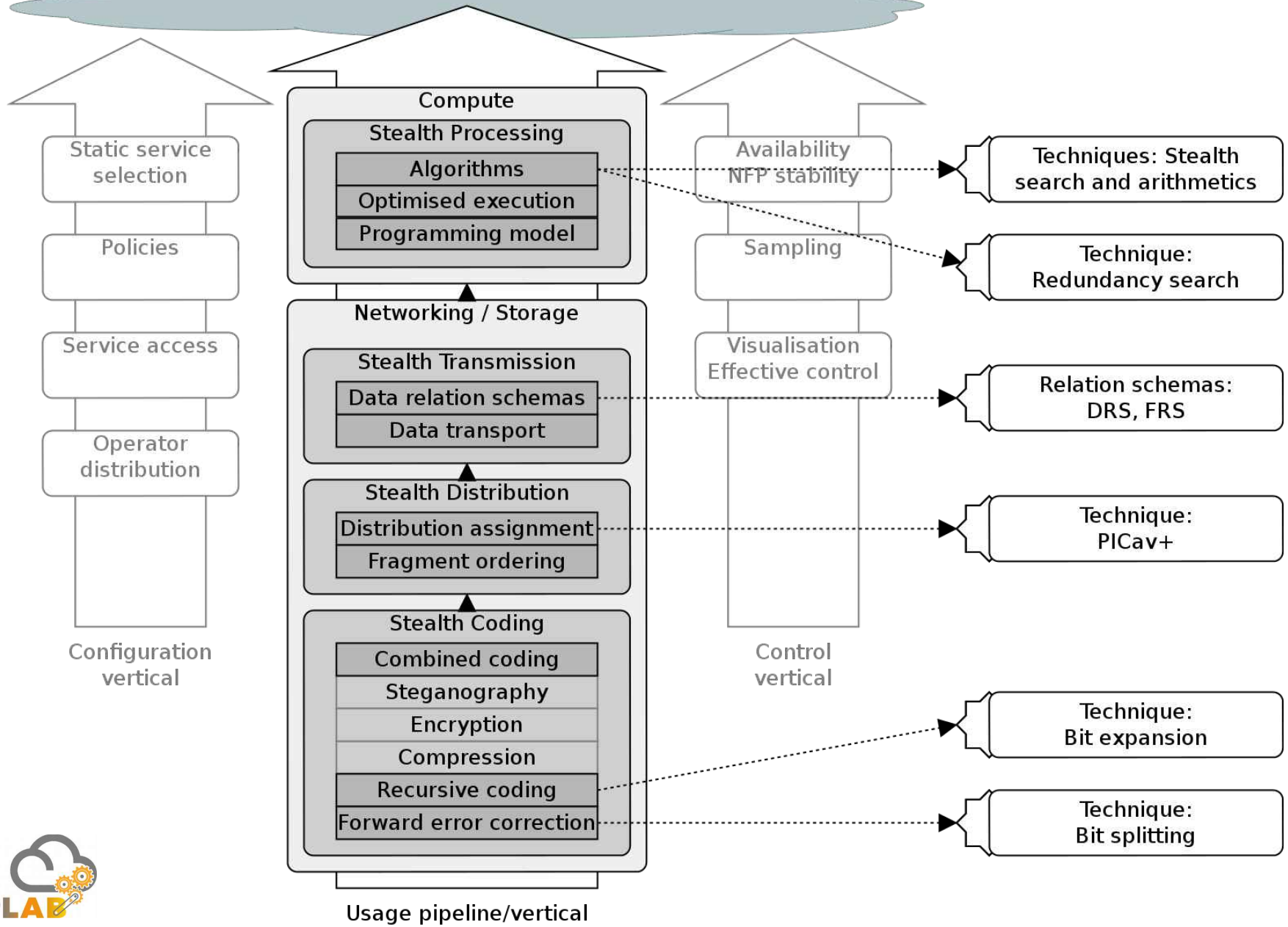
s: cloud services



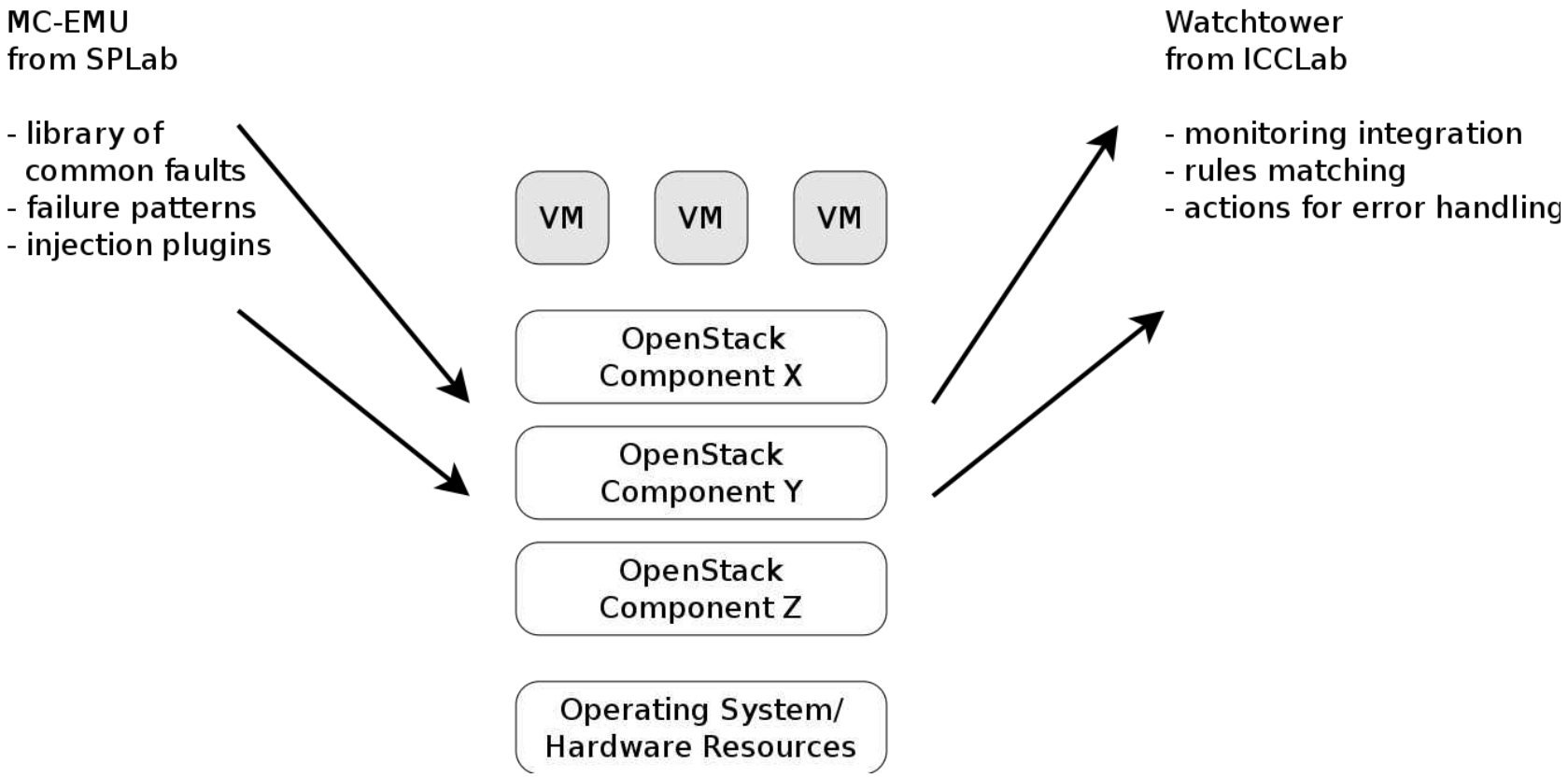
Technique: Stealth Computing



Technique: Stealth Computing



Technique: Active Service Management



Tools

Existing tools for planning and knowing

- network simulators and emulators
- CloudSim [Buyya et al.]
- EMUSIM [Calheiros et al.] for performance
- Cloud Workflow Emulator [Senna et al.] for resources/performance

Tools

MC-EMU: Multi-Cloud Emulation

gatling

docker

morebalance

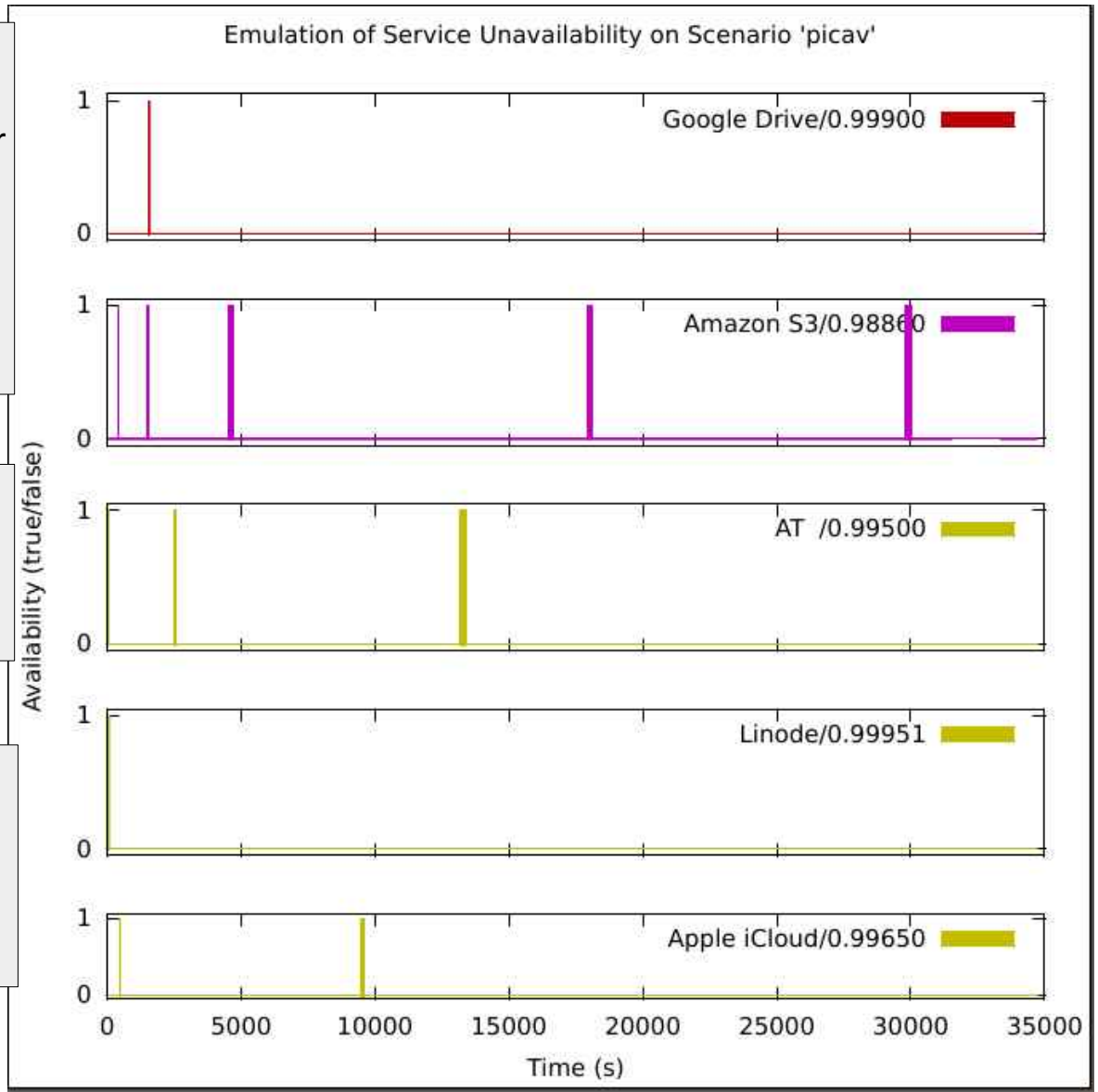
4 targets:
- no-op (sim.)
- web/file server (storage)
- OS container (compute)
- L4 proxy (network)

netem

tsung

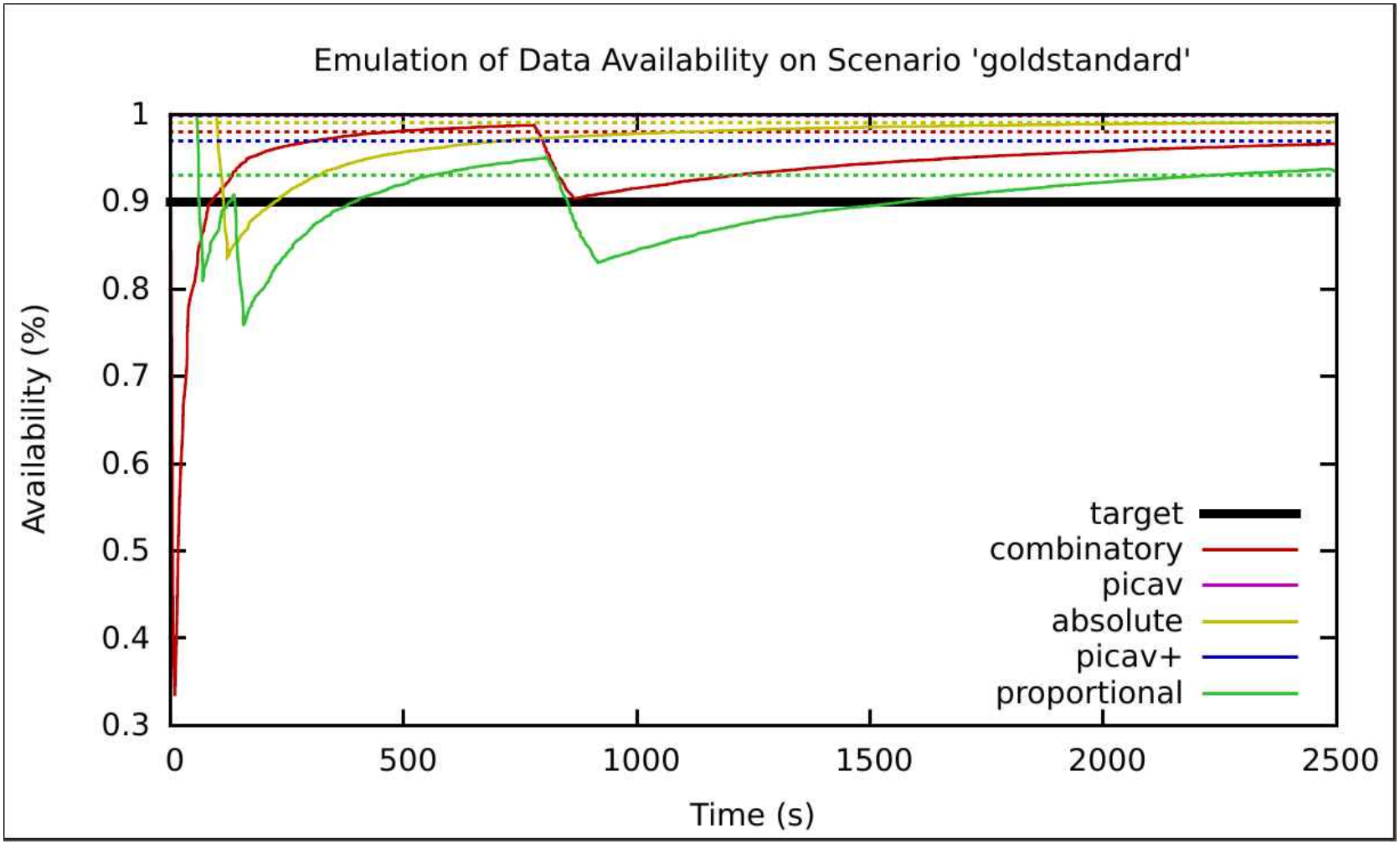
3 properties:
- availability
- slowness
- popularity

3 behavioural models:
- convergence
- incident
- replay/library



Tools

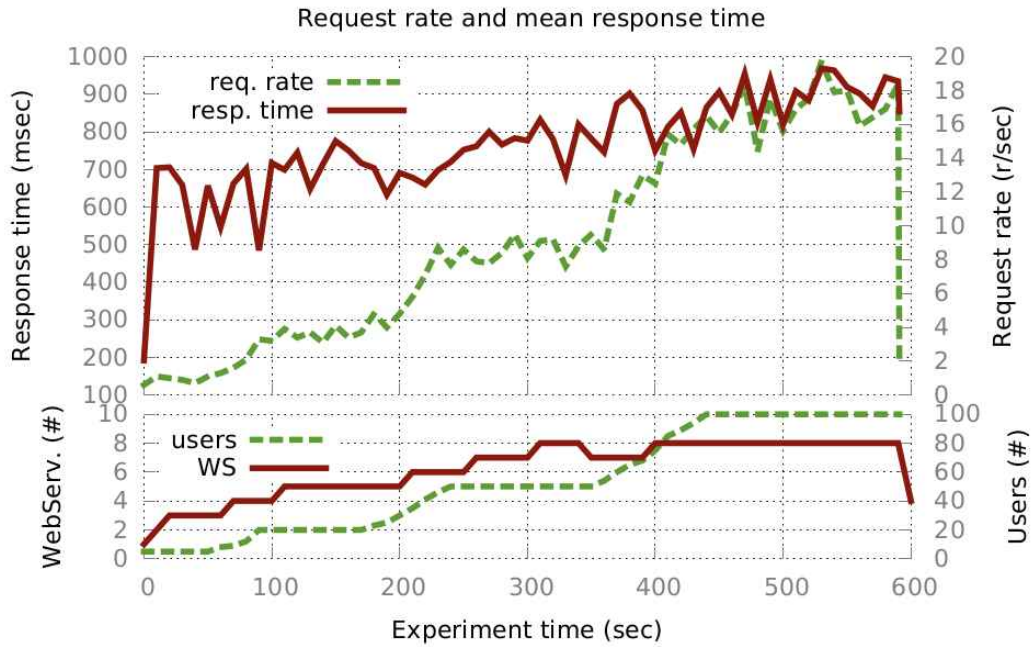
MC-EMU example: storage/availability/convergence

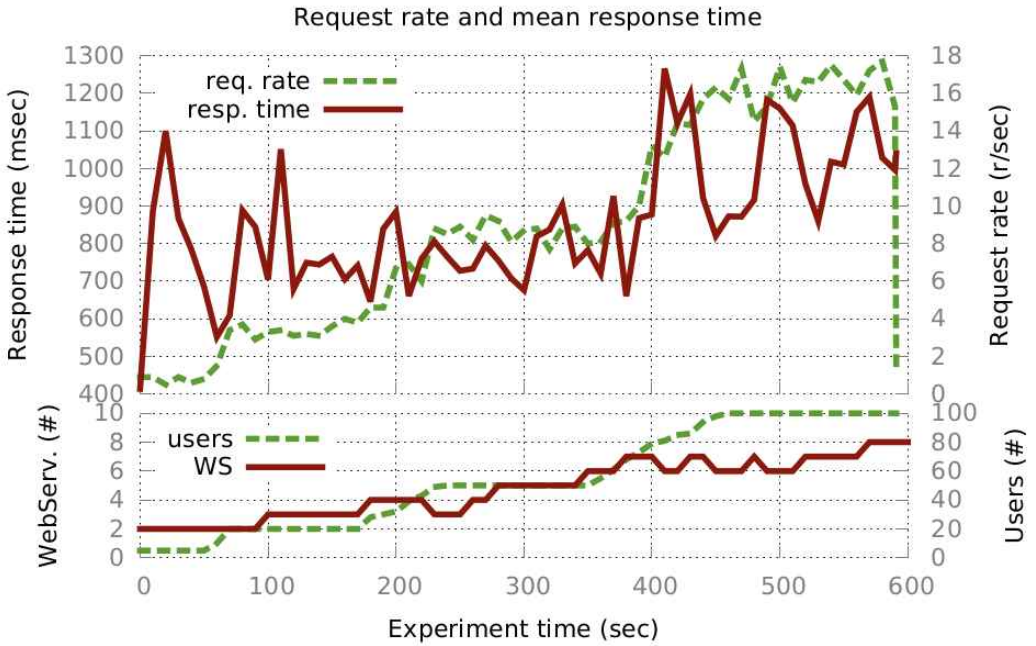


Tools

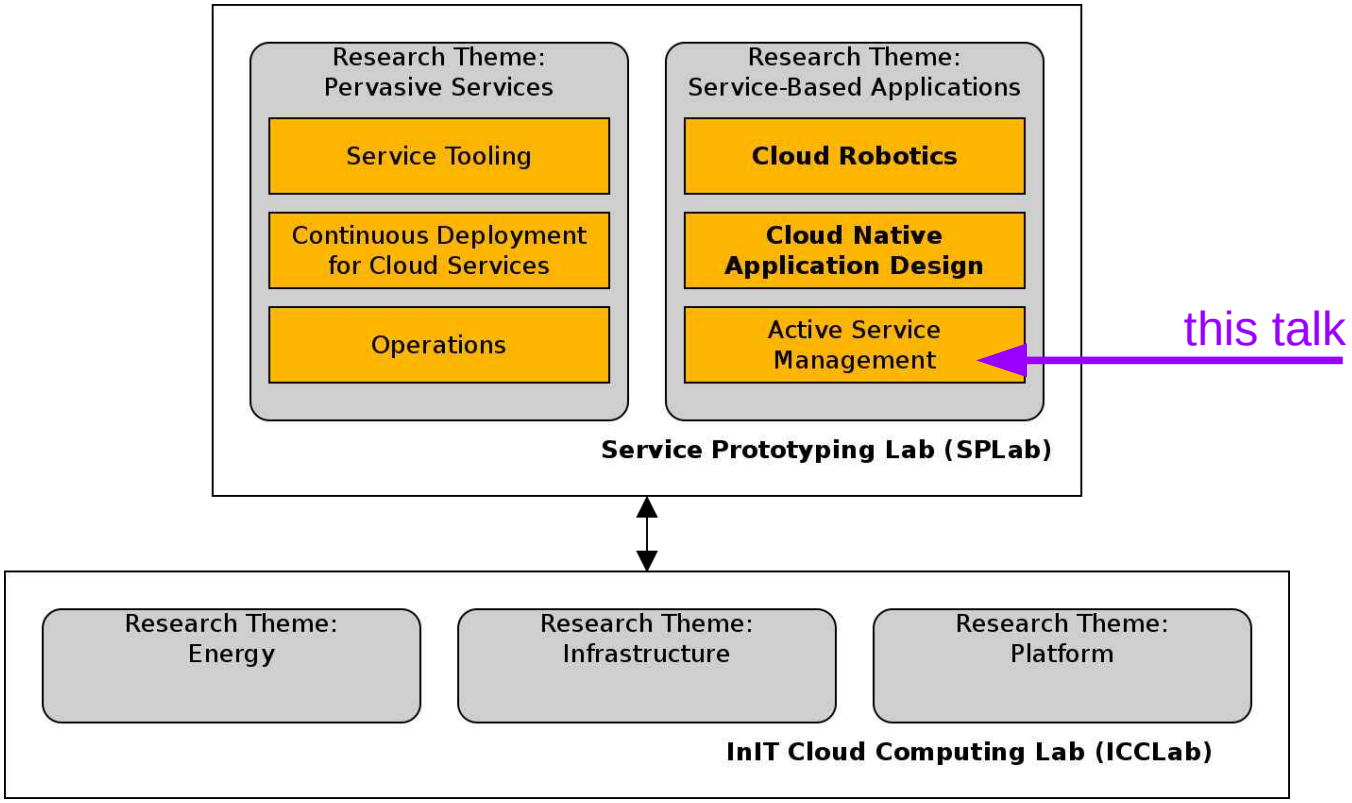
MC-EMU example:
compute/popularity/spikes

(above) without failures
(below) with induced failures
in a CNA application

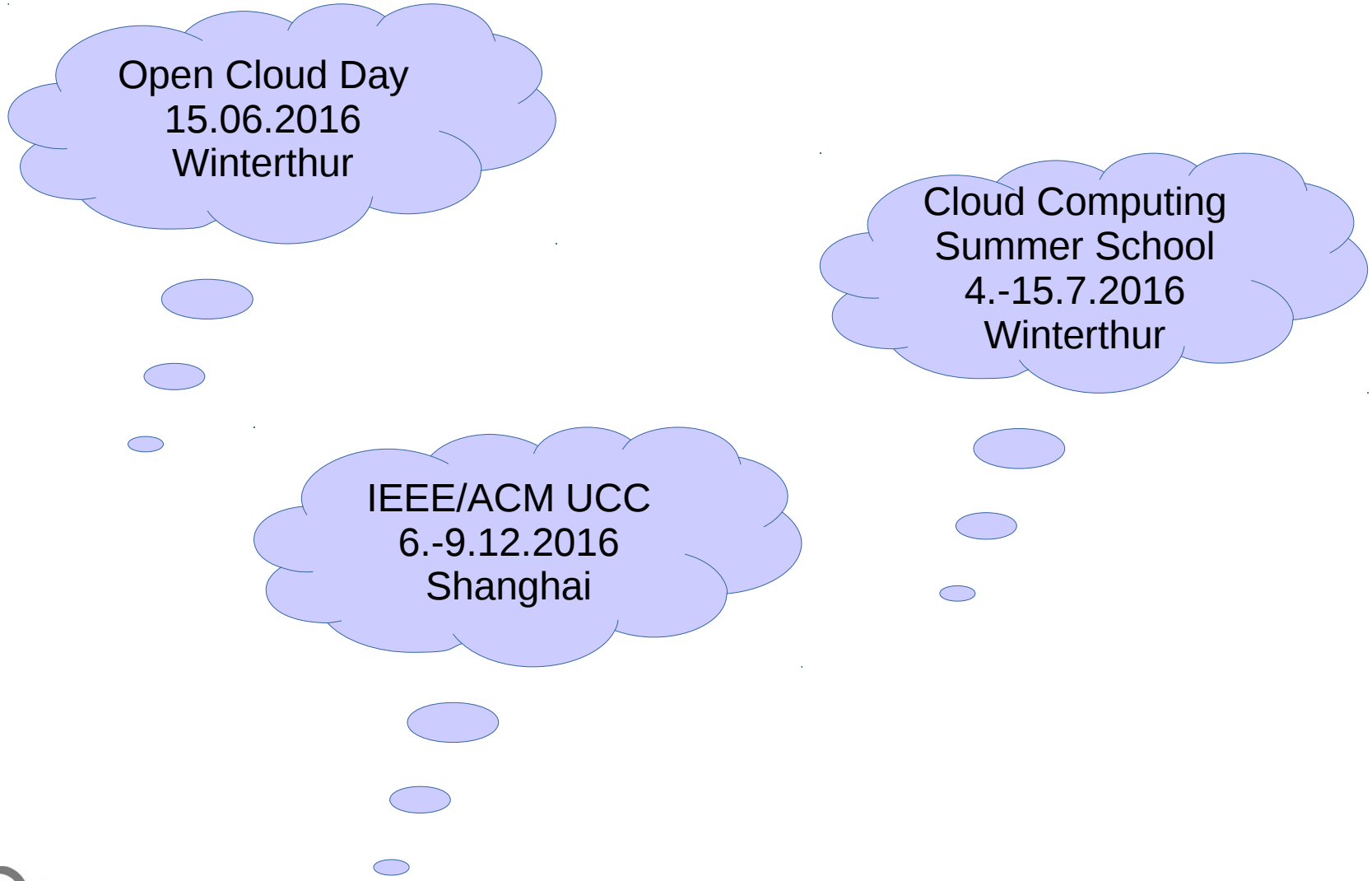




Service Prototyping Lab - Research



Service Prototyping Lab - Events



Conclusion

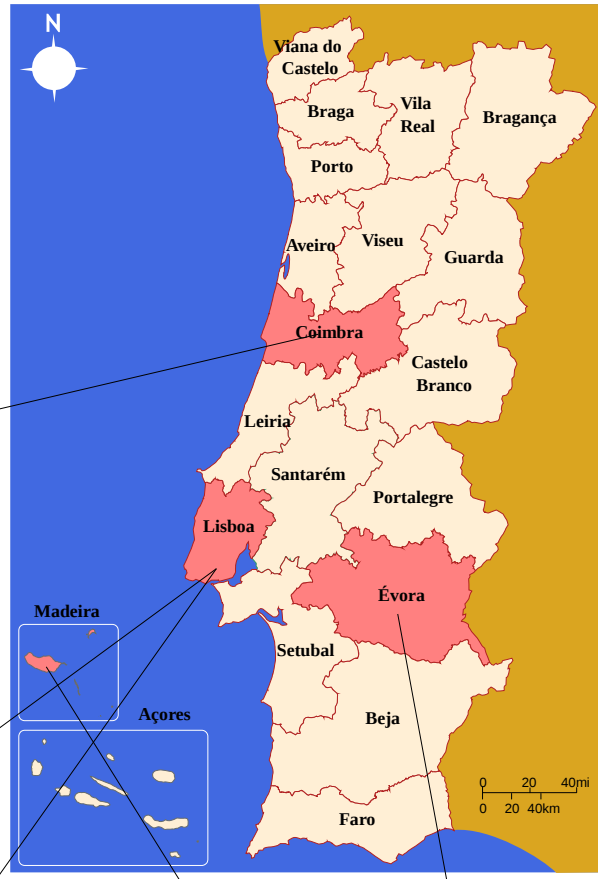
Service Prototyping Lab + Cloud Computing Lab

`blog.zhaw.ch/icclab`
`github.com/serviceprototypinglab`

Active Service Management research initiative

→ enforce predictable application behaviour

→ designs, methods and tools



Obrigadão!

2016

2012

2009

2007

2005

Sources

[Bru11] Herbert Bruderer: Konrad Zuse und die Schweiz. Abschnitt: Rechenlocher M9 for die Schweizer Remington Rand. ETH Zürich, Departement. Informatik, Professur für Informationstechnologie und Ausbildung, Juli 2011.

[Klu01] Arnold Kludas: Vergnügungsreisen zur See. Bd. 1: 1889-1939. Convent-Verlag Hamburg, ISBN 3-934613-21-7, S. 21-28, 2001.

[Hec16] Jeff Hecht: Great Leaps of Light. IEEE Spectrum, 53(2):24-48, February 2016.

[KuYo16] Michael A. Cusumano and David B. Yoffie: Technology Strategy and Management - Extrapolating from Moore's Law. CACM 01/16, pp. 33-35.

[Ros14] David Rosenthal: Talk at Seagate. DSHR's Blog, May 2014. (Analysis in The Register, November 2014.)

(Rosenthal's discussion of Kryder's Law @ UNESCO)
http://www.theregister.co.uk/2014/11/10/kryders_law_of_ever_cheaper_storage_disproven/?page=2