Testing Cloud Services

Martin Pol
Aug 2016

Testing Cloud Services

Topics

- The Cloud

- You and what to do?

- Risks

- Measures

- Summary - Q&A

Traditional

New "Cloud related"

Ways to test

Ways to help reduce the risks

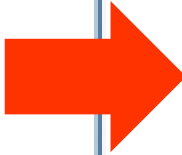# Objectives

- Learn how to
  - Cope with Cloud services
  - Detect the (new) risks
  - Mitigate these risks

  By using
    - Your skills
    - Heuristics
    - Discussions and exchange experiences

Testing Cloud Services

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- Summary - Q&A

In the cloud?

What can be done in the cloud?

searching, recording, accounting, paying, writing, reviewing, tracking, calculating, developing, listening, analyzing, transmitting, learning, controlling, purchasing, testing, alarming, changing, updating, deleting, accessing, rejecting, correcting, studying, booking, receiving, tracing, protecting, deciding, managing, teaching, facilitating, identifying, copying, removing, demonstrating, checking, showing, selecting, subscribing, unsubscribing, sharing, mailing, communicating, reading, playing, working, meeting, gambling, shopping, storing, cross checking, retrieving, configuring, sketching, saving, accelerating, enhancing, creating, growing, checking in, checking out, finding out, reaching, denying, talking, designing, making, verifying, measuring

Develop and Test

Email
Surf
Transfer

Operate and Manage

Store

op and Test

Email
Surf
Transfer

SOA

internet technology

virtualization

standard software

bandwidth

Operate and Manage

Store

Develop and Test

Email
Surf
Transfer

Operate and Manage

Store

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The Cloud

Standards?

ISO/IEC 27001:2013
CSA2 - Cloud Controls Matrix 3.01 (CSA CCM)
AICPA3 - Trust Services Principles Criteria 2014 (TSP)
ANSSI4 Référentiel Secure Cloud v2.0
IDW5 ERS FAIT 5
BSI SaaS Sicherheitsprofile
Open Cloud Standards Incubator
Interoperable Clouds
Architecture for Managing Clouds
Cloud Infrastructure Management Interface (CIMI)
Cloud Infrastructure Management Interface (CIMI) Primer
Cloud Infrastructure Management Interface – XML Schema
Cloud Infrastructure Management Interface – CIM (CIMI-CIM)
TC CLOUD
Cloud Standards Coordination (CSC)
ETSI Terms and Diagrams
Global Inter-Cloud Technology Forum (GICTF)
ISO/IEC JTC 1
SC38 Distributed Application Platforms and Services (DAPS)
ITU-T SG13: Future networks including cloud computing
Joint Coordination Activity on Cloud Computing (JCA-Cloud)
NIST Working Definition of Cloud Computing
Standards Acceleration to Jumpstart Adoption
Cloud Computing Use Cases
Open Grid Forum (OGF)
Open Cloud Computing Interface (OCCI)
Open Cloud Computing Interface Core Specification
Open Cloud Computing Interface Infrastructure Specification
Open Cloud Computing Interface HTTP Rendering Specification
Other OCCI-related Documents
Object Management Group (OMG)
Open Cloud Consortium (OCC)
OASIS Cloud Application Management for Platforms (CAMP) TC11.1.2
OASIS Identity in the Cloud (IDCloud) TC11.1.3
OASIS Symptoms Automation Framework (SAF) TC11.1.4
OASIS Topology and Orchestration Specification for Cloud Applications
(TOSCA) TC11.1.5 OASIS Cloud Authorization (CloudAuthZ) TC11.1.6
OASIS Public Administration Cloud Requirements (PACR) TC
SNIA Cloud Data Management Interface (CDMI)
Open Platform 3.0 Forum

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The Cloud

Essential characteristics

Service models

Deployment models

US: National Institute of Standards and Technology

Essential characteristics

☑ On-demand service

  ☑ Self service provisioning, pay-per-use

  ☑ No human interaction

US: National Institute of Standards and Technology
http://www.nist.gov

Essential characteristics

☑ On-demand service

☑ Broad network access

  ☑ Standard mechanisms over networks

  ☑ "Any" client

US: National Institute of Standards and Technology
http://www.nist.gov

Essential characteristics

☑ On-demand service

☑ Broad network access

☑ Resource pooling

    ☑ Multi-tenant

    ☑ Storage, processing, memory, virtual machines, …

    ☑ Location independent

US: National Institute of Standards and Technology
http://www.nist.gov

Essential characteristics

☑ On-demand service

☑ Broad network access

☑ Resource pooling

☑ Rapid elasticity

    ☑ Rapid scale in and out

    ☑ "Any quantity" at any time

US: National Institute of Standards and Technology
http://www.nist.gov

Essential characteristics

☑ On-demand service

☑ Broad network access

☑ Resource pooling

☑ Rapid elasticity

☑ Measured service

    ☑ Controlled resource use

    ☑ Transparency, pay-per-use

Service models

- No Cloud

- Software as a Service

- Platform as a Service

- Infrastructure as a Service

On Premise | Cloud

| Application |
| Platform |
| Virtualization |
| Hardware |

Amazon Elastic Compute Cloud (Amazon EC2)

Run your web apps on Google's infrastructure
Easy to build, easy to maintain, easy to scale

rackspace HOSTING

Windows Azure

Deployment models

- Public

- Private

- Community

- Hybrid

NIST Working Definition of Cloud Computing

Essential characteristics

- ☑ On-demand service
- ☑ Broad network access
- ☑ Resource pooling
- ☑ Rapid elasticity
- ☑ Measured service

Deployment models

- private cloud
- community cloud
- public cloud
- hybrid cloud

Service Models

Software as a Service

Platform as a Service

Infrastructure as a Service
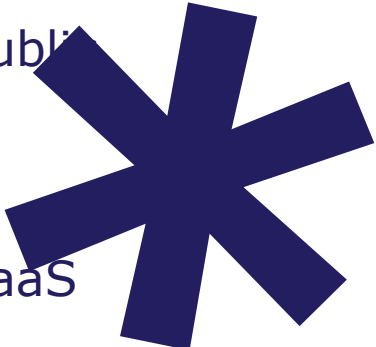
What is "done" in the cloud?

<500 employees	>500	Consumer
Public	Private Hybrid Community	Public
*aaS	IaaS, DaaS, SaaS IaaS *aaS	SaaS
Mail Storage Infrastructure CRM Finance Business processes	Data Centre Data Management Business processes	Surf and mail Social Dropbox Google services Spotify Picasa Games ....

*aaS

What is "done" in the cloud?

AaaS	Application, Audit
BaaS	Back office, Billing
CaaS	Communications
DaaS	Desktop, Data
EaaS	Email, Environment
FaaS	File transfer
HaaS	Hardware
IaaS	Infrastructure, IT, ID
LaaS	Learning
MaaS	Music
NaaS	Network
PaaS	Platform
QaaS	QA
SaaS	Sourcing, Storage, Software
TaaS	Testing
VaaS	V&V
WaaS	Windows, Workspace

What is "done" in the cloud?

AaaS	Application, Audit	NaaS	Network
BaaS	Back office, Billing	OaaS	Operations
	Communications	PaaS	Platform
	Desktop, Data	QaaS	QA
EaaS	Email, Environment	RaaS	R&D
FaaS	File transfer	SaaS	Storage, Software
GaaS	Government	TaaS	Testing
HaaS	Hardware		management
IaaS	Infrastructure, ID	VaaS	Voice
JaaS	JAVA	WaaS	Windows, Workspace
KaaS	Knowledge base	XaaS	Anything, Everything
LaaS	Learning	Yaas	Youtube, Yum
MaaS	Music	ZaaS	Zenoss, Zscaler

*aaS

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- Summary - Q&A
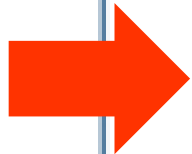
The Boss Chose the Cloud: What Does that Mean for You?

Supplier	QA and Test	Customer
IT oriented	Test manager	Business oriented
	Test engineer	

Marketing	Test management	Selection
Development	Risk analysis	Introduction
Research	"Testing"	Integration
Releasing	Reporting	E2E test
Beta tests		Transformation
Infrastructure		Production

Project manager	Project manager
Business analyst	Business analyst
Operations	Operations
Product owner	Product owner
Sales	Purchasing

How to test Cloud Services?

- As we always did:
  - Bridging risks to measures
  - By using
    - Your skills
    - Your peers
    - Heuristics

and

- New Risks
- New Measures

CRAFTSMANSHIP

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- As we always did:
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and

- New Risks
- New Measures

and

- Testing during Selection
- Continuous (E2E) Testing in Production

Wider Scope of Testing

- Selection

- Implementation

- Production

Cloud related Risks?

Multi vendor

Cyber crime

Testability

Standards

Continuity

Location

B.Y.O.D.

Elasticity

Privacy

Anywhere, anytime

Energy saving

Performance

Security

Costs

Integration

Vendor lock-in

Migration

Multi platform

Hosting

Backup & recovery

Legislation

Impact organisation

Offline vs Online

User experience

Testing?

Test measures

Interview

Check

Monitor

Proof of concept

Review

Cloud related Risks

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143

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  Traditional

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Practical grouping of Cloud related Risks

Multi vendor
Cyber crime
Testability
Standards
Continuity
Location
B.Y.O.D.
Elasticity
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Anywhere, anytime
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Impact organisation
Offline vs Online
User experience

- Performance

- Security

- Availability & Continuity

- Functionality

- Maintainability

- Legislation & Regulations

- Suppliers & Outsourcing

Performance

- Other (unknown) users
- Internet/bandwitdth
- Change control
- Elasticity

Scale Up

Scale Down

Security

- Other (unknown) users
- Access control
- Third party access

BIG BROTHER

IS WATCHING YOU

Security

- Other (unknown) users
- Access control
- Third party access
- Everything over the Web
  - Hacking
- BYOD
- Data lost

BUSINESS INSIDER UK

Salesforce deleted four hours of its customers' data

JULIE BORT
MAY 12, 2016, 12:45 AM

Salesforce is now mostly up and available to its customers, the company says, after a mega outage of one of its major data centers took it down for a whole day.

The outage lasted from 13:31 UTC time Tuesday until 09:30 UTC Wednesday, or about 6:30 a.m. pacific Tuesday until 2:30 p.m. pacific on Wednesday.

[A c]loud outage that long is almost unheard of these [day]s, and one Salesforce customer we talked to, who [has] been using Salesforce for over five years, told us [he] never experienced that kind of disruption from [the c]ompany before.

[Thes]e companies knew their salespeople couldn't [get] to the site to do their jobs, and
[Internet ...]

Availability & Continuity

- Internet connection
- Synchronization

24/7 AVAILABILITY

Goal: 100% UPTIME!

Prevents frequent sources of storage-related
disruptions from ever affecting applications.

Google Drive   iCloud   Dropbox   OneDrive

Availability & Continuity

- Internet connection
- Synchronization
- Is 99.9 % enough?
- Supplier bankruptcy

24/7 AVAILABILITY

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IBM Cloud Storage Partner Nirvanix Files for Bankruptcy | Wired Enterprise | Wir...   pagina 2 van 4

IBM Cloud Storage Partner Nirvanix Files for Bankruptcy

By Klint Finley
10.02.13
1:58 PM

Photo: Ricardo Liberato/Flickr

The company behind IBM's storage cloud is indeed on the way out.

Last month, Nirvanix — the San Diego, California company that powered IBM's SmartCloud Storage service — told customers and partners that it was shutting down on September 30, giving them just two weeks to migrate data, and now, it has filed for bankruptcy.

Nirvanix finally broke its silence this week with a post to its website revealing the Chapter 11 bankruptcy filing and giving customers and partners an additional two weeks to remove data from its service. The deadline for data removal is now October 15.

"Nirvanix voluntarily sought Chapter 11 bankruptcy protection in order to pursue all

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"Nirvanix voluntarily sought Chapter 11 bankruptcy protection in order to pursue all alternatives to maximize value for its creditors while continuing its efforts to provide the best

Functionality

- Customization
- Multi platform/device/browser
- Mismatch service <> business process
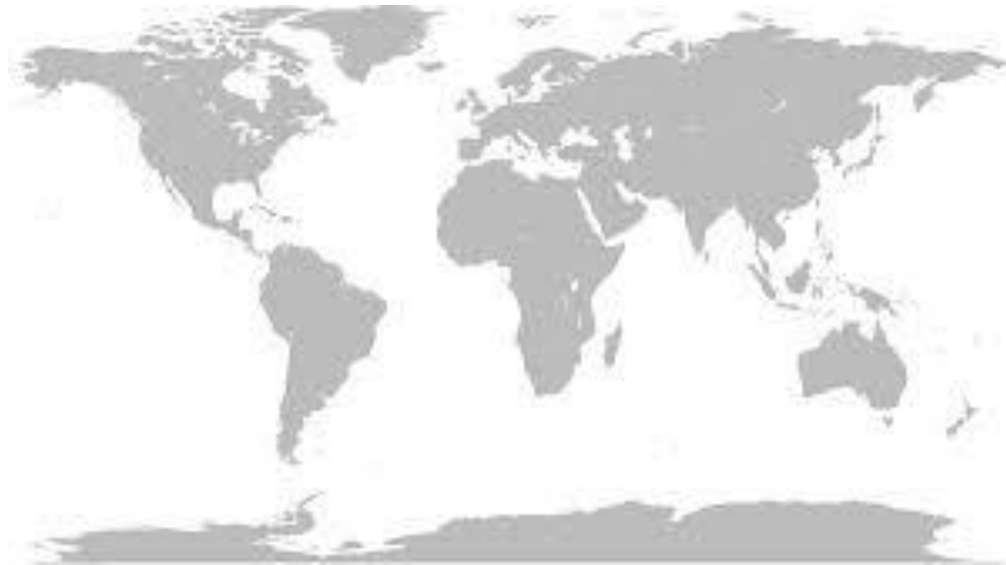- Change control
- Insufficient usability

Maintainability

- Test environment
- Documentation
- Backup and recovery
- Updates, patches, fixes, …

Legislation and Regulations

- Conflicting international laws
- Reliability of regimes
- Where is my data? And is that OK?

Suppliers & Outsourcing

- Vendor lock in
- No agreem
- Supplier of
- Continuity

OUTSOURCING

Arrange the divorce before the marriage

Testing Cloud Services

Topics

- The Cloud

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- Summary - Q&A

Ways to test

Ways to help reduce the risks

Test Measures

- Selection

- Implementation

- Production

Testing during Selection

- *Fighting in*

- Selection criteria
  - Performance
  - Security
  - Availability & Continuity
  - Functionality
  - Maintainability
  - Legislation and Regulations
  - Suppliers & Outsourcing

- Completeness
- Controllability

Example selection criteria

CRITERION	Value/ Range	Weighting factor	Yes/No and Comments
Implementation			
Is the impact on current activities acceptable?			
Is a feasible route for migration to the service available?			
Support			
Are changes in the service announced beforehand?			
Are sufficient test facilities available around the service (test environment, test tools, testware, access to infrastructure, etc.)?			
Are there sufficient support facilities?			
Is it clear how incidents can be reported?			
Are incidents resolved fast enough?			
Performance			
Are response times quick enough?			
Is the number of possible simultaneous users high enough?			
Is bandwidth sufficient?			
Is sufficient potential for growth available?			
Is the actual use charged correctly?			
Security			
Are adequate authorization and authentication in place?			

"Inspiration List"

CRITERION	PRIO
Functional	
Do the service and the specific business processes align?	
Does the service fit well in the E2E business process?	
Is the service sufficiently adaptable to specific requirements?	
Are many adjustments needed?	
Is customization possible	
Is (a lot of) customization needed?	
Are the required platforms supported?	
Are "working from home" and BYOD supported sufficiently?	
Is it possible to connect / integrate the service with the other systems?	
Are sufficient manuals and/or courses available?	
Implementation	
Is the impact on current activities acceptable?	
Is a feasible route for migration towards the service available?	

"Inspiration List"

CRITERION	PRIO
Support	
Are changes in the service announced beforehand?	
Are sufficient test facilities available around the service (test environment, test tooling, testware, access to infrastructure, …)?	
Are there sufficient support facilities?	
Is it clear how incidents can be reported?	
Are incidents resolved fast enough?	
Performance	
Are response times low enough?	
Is the number of possible simultaneous users high enough?	
Is bandwidth sufficient?	
Is sufficient potential for growth available?	
Is the actual use charged correctly?	

"Inspiration List"

CRITERION	PRIO
Security	
Are adequate authorization and authentication possibilities in place?	
Is the physical security of the service locations sufficient?	
Is the support access security of the service sufficient?	
Is mutual access security between customers sufficient?	
Are data changes traceable?	
Is data storage for the service reliable?	
Is deleting data in the service reliable?	
Is security of the connection to the service sufficient?	
Are security options for the customer sufficient?	
Does the supplier have security certificates? (for example SAS 70 type II)?	
Availability	
Is the level of availability for the service sufficient?	
Are back-up / fail-over / disaster-recovery provisions sufficient?	

"Inspiration List"

CRITERION	PRIO
Law and regulations	
Does the data location comply to all legal requirements?	
Does the data processing comply to all legal requirements?	
Do the terms contain parts that are conflicting to the duties of the customer?	
Supplier	
Is clear what happens when the contract ends, or in case of bankruptcy or conflict?	
Is a good helpdesk available?	
Does the supplier have experience in: - Offering this particular service? - Offering services in general? - Developing services? - The customer's field? - Developing, testing and supporting services (know how)?	
Do methods used by supplier align with those of the customer (if relevant)?	

"Inspiration List"

CRITERION	PRIO
Supplier	
Is quality assurance arranged?	
Is the supplier ahead in its field?	
Is the size of the supplier in accordance with the expectations of the customer?	
Does the supplier have a good reputation (are there references)?	
Is providing services the core business of the supplier?	
Does the supplier have opportunities for future expansion?	
Does the supplier speak the same language?	
Is transparency and flexibility of the supplier sufficient?	

Testing during Selection

- *Fighting in*

- Selection criteria

- Proof of Concept
  - Dynamic testing
  - More suppliers

- *References*

Test measures

- Selection

- Implementation

- Production

- Performance
- Security
- Availability & Continuity
- Functionality
- Maintainability
- Legislation & Regulations
- Suppliers & Outsourcing

Performance

- User experience
  - Response time
  - System load

- Dependency
  - Service supplier
  - Other *(unknown)* "users"

- Representative?

Representative?

- Combination of tests
  - Load, Stress, Volume
- Requirements and Operational profiles
- Testing bottlenecks
  - #users/load/peaks
  - tod, tow, tom, toy,

Example. Time sheets

Initiators	Operations	Frequency (number/week)	Likelihood
Administrator time sheets application	Arrange screen flow Mark obligatory fields	0.1 0.1	0.0005 0.0005
Project administrator	Add project Close project Add project employee Connect project employee to project Add time sheet codes	0.4 0.4 3 8 20	0.002 0.002 0.015 0.04 0.1
Project employee	Fill in time sheet each week Release time sheet each week	80 80	0.4 0.4
Manager	Approve time sheets	8	0.04
	Total	200	1

Cloud specifics

- "The World"

- Customer devices/resources

- Elasticity

Testing Elasticity

load test – 'up'

load test – 'down'

101

100

boundary values

99

load

path test

extend?

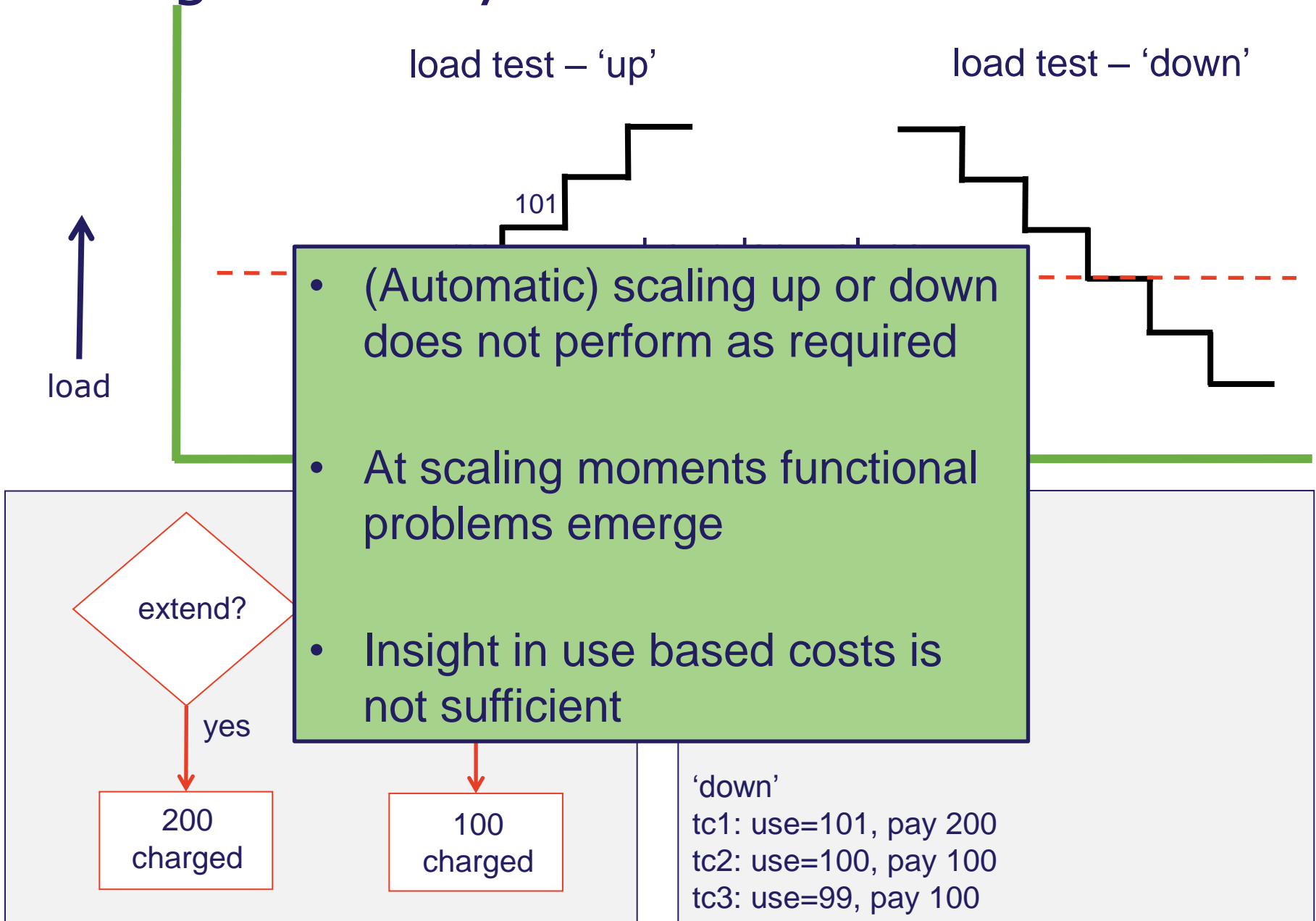yes

no

200 charged

100 charged
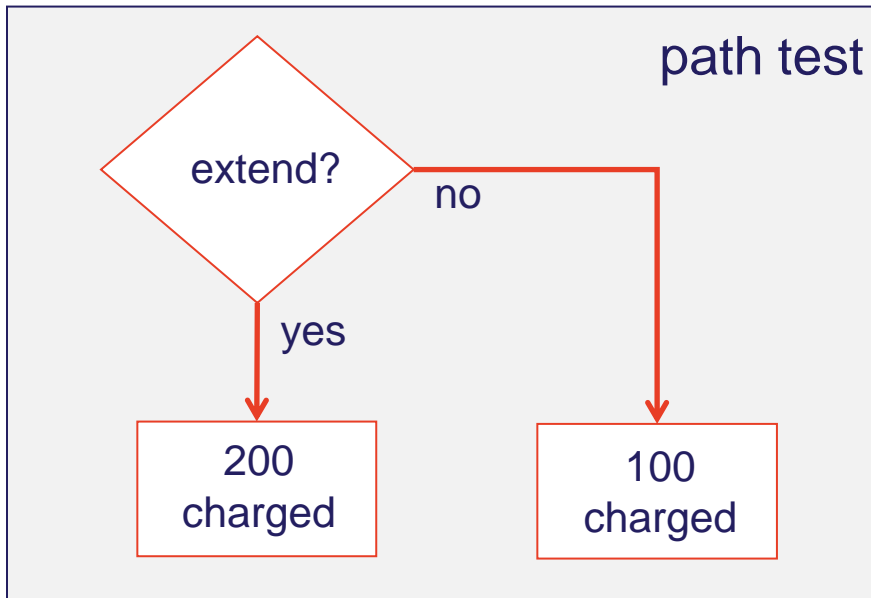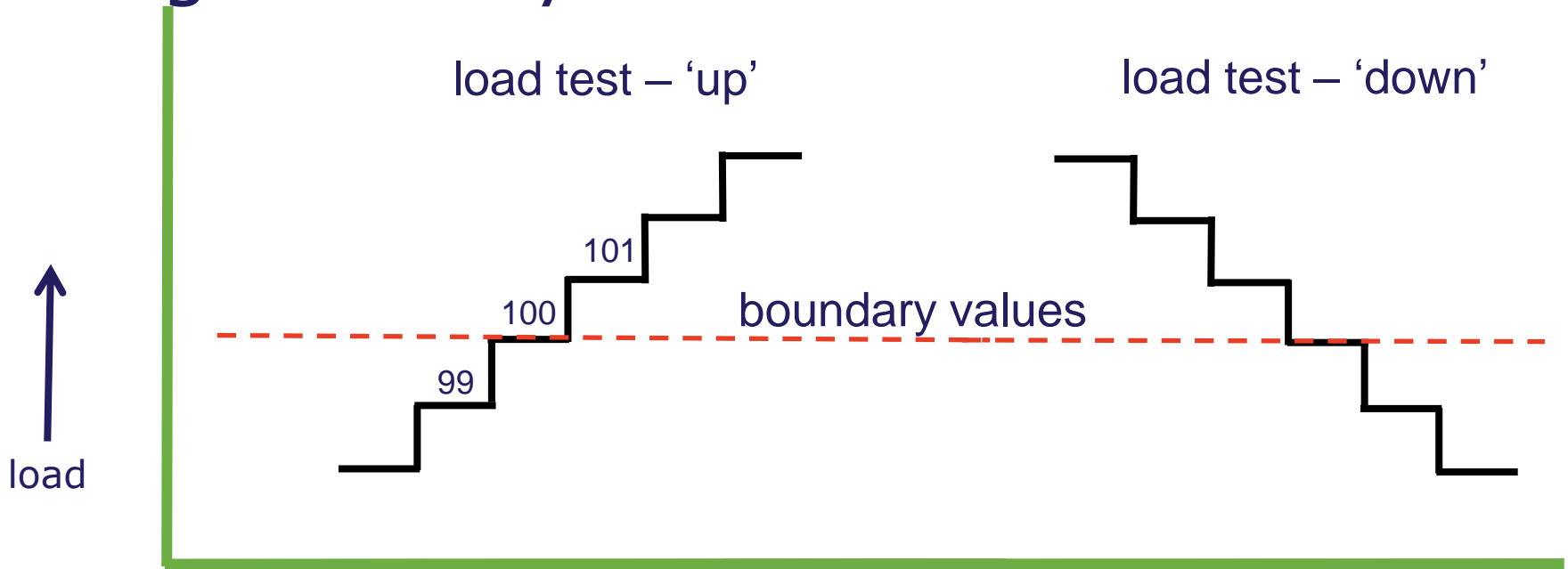
boundary values

'up'
tc 1: use=99, pay 100
tc 2: use=100, pay 100
tc 3: use=101, pay 200

'down'
tc1: use=101, pay 200
tc2: use=100, pay 100
tc3: use=99, pay 100

Testing Elasticity

load test – 'up'   load test – 'down'

load

101

- (Automatic) scaling up or down does not perform as required

- At scaling moments functional problems emerge

- Insight in use based costs is not sufficient

extend?

yes

200 charged

100 charged

'down'
tc1: use=101, pay 200
tc2: use=100, pay 100
tc3: use=99, pay 100

Security

ISO 27001 key aspects:

- <u>Confidentiality</u> of the data and the accompanying risk that unauthorized people can view the data

- <u>Integrity</u> of data and the accompanying risk that data is altered or lost unintentionally

- <u>Availability</u> of data and the accompanying risk that data (and services) is not available when it is required

Security

ISO 27001 key aspects:

- <u>Confidentiality</u> of the data and

  - Who has access to the data?

- <u>Integrity</u> of data and the

  - Can the user trust that the data is correct?

- <u>Availability</u> of data and the

  - Can the user gain access to the data at all times?

Security

- Security at:
  - User/Client
  - Network
  - Supplier

- Testing security robustness against Internet attacks
  - Directory traversal
  - XML external entity attack
  - SQL injection
  - Cross-site scripting (XSS)
  - Session manipulation

Security

- Authentication and IDaaS authorisation

Table 5–2 Example of an authorization table

User group	Adding users	Deleting users	Manage projects	Filling in time sheets	Approve time sheets	Generate monthly totals
Administration	X	X	X	X	X	X
Project manager	X		X	X	X	X
Standard user				X		X

- Security Audits, e.g.:
  - ISO 27001, 27017, … (22301)

Availability & Continuity

- Guarantees and SLA's
- Completeness and correctness of specifications and manuals
  - Supplier
  - User

  Interface specifications

  Supported platforms

  Business process specs

  User manuals

- Test online/offline
  - Work continues?
  - Synchronization?
- Availability of test environments

Functionality

.

- Does the service fit the business processes and vv?
- Is the serv**Does the service do** sufficient (number of bugs)?
- Is the serv**what it has to do,**
- Is the serv**anywhere, anyhow, anytime?**
- Does supp**anywhere, anyhow, anytime?** y?
- Does customer customization ~~...~~ rly?
- Do interfaces work properly?
- Are platforms prope**any device, any platform?**
- Does every~~...~~after changes (is there no regression)?

3997 distinct Android devices in 2012

http://opensignal.com/reports/fragmentation.php
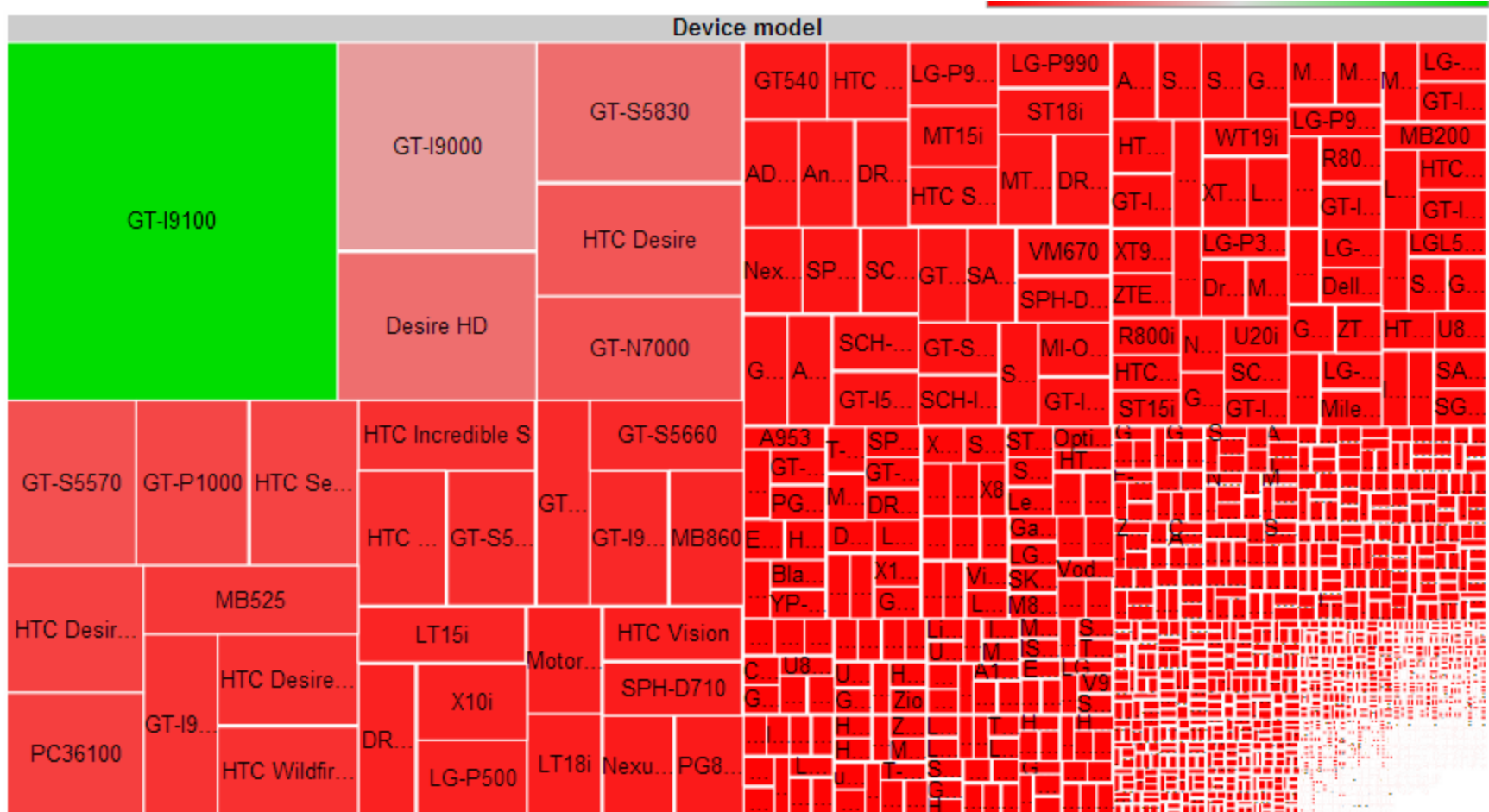
18796 distinct Android devices in 2014

http://opensignal.com/reports/2014/android-fragmentation/

Multi-platform testing

Operating systems
- Windows XP
- Windows Vista
- Windows 7
- Windows 2003 Server
- Windows 8
- Windows CE
- Linux
- Unix
- Mac OS Lion
- Mac OS Snow Leopard
- iOS
- Android
- Windows Mobile

Browsers
- Internet Explorer 6
- Internet Explorer 7
- Internet Explorer 8
- Firefox 3.5
- Firefox 3.6
- Firefox 4
- Safari 4
- Safari 5
- Chrome11
- Opera11

Devices
- Computer
  - PC
  - SUN
  - Macintosh
- Mobile phones
  - iPhone ...
  - Samsung …
  - NOKIA …
  - …
- Tablet
  - ASUS ...
  - Blackberry …
  - MOTOROLA …
  - …

Different use cases

30 minutes	3 minutes	30 seconds	3 seconds
PCs/Laptops	**Tablets**	**Mobiles**	**Smartwatches**
Planned use	Planned & Unplanned	Unplanned use	Unplanned use
Sitting	Sitting / Standing	Standing / Walking	Walking
Booked time	Sudden time	In Hurry	Alerts
Creating info	Modifying Info	Consuming Info	Notification of Info
Focussed task	Multi Tasking	Multi Tasking	Multi Tasking
Emails, Work, Presentations, Coding	Social Media, Video, Music	Calls, SMS, OTT	Information Recording, Alerts, Notifications, Calls and maybe Health monitoring

❑ Based on books and presentation by Tomi Ahonen

Multi-platform testing

Maintainability

- Test environment
- Backup and recovery
- Updates, patches, fixes, …
- Documentation, help functions
- Defect management

Defect Management


```
Incident
├── Supplier resolves it ───────────────── Test
│
├── Client resolves it
│   ├── Change work process ──── Test
│   ├── Change configuration ──── Test
│   └── Custom solution ──── Test
│
└── Incident not resolved
    ├── Service not selected ──┐
    │                          ├── Migrate and test
    ├── Terminate use of service ──┘
    └── Workaround work instruction ──── Test
```
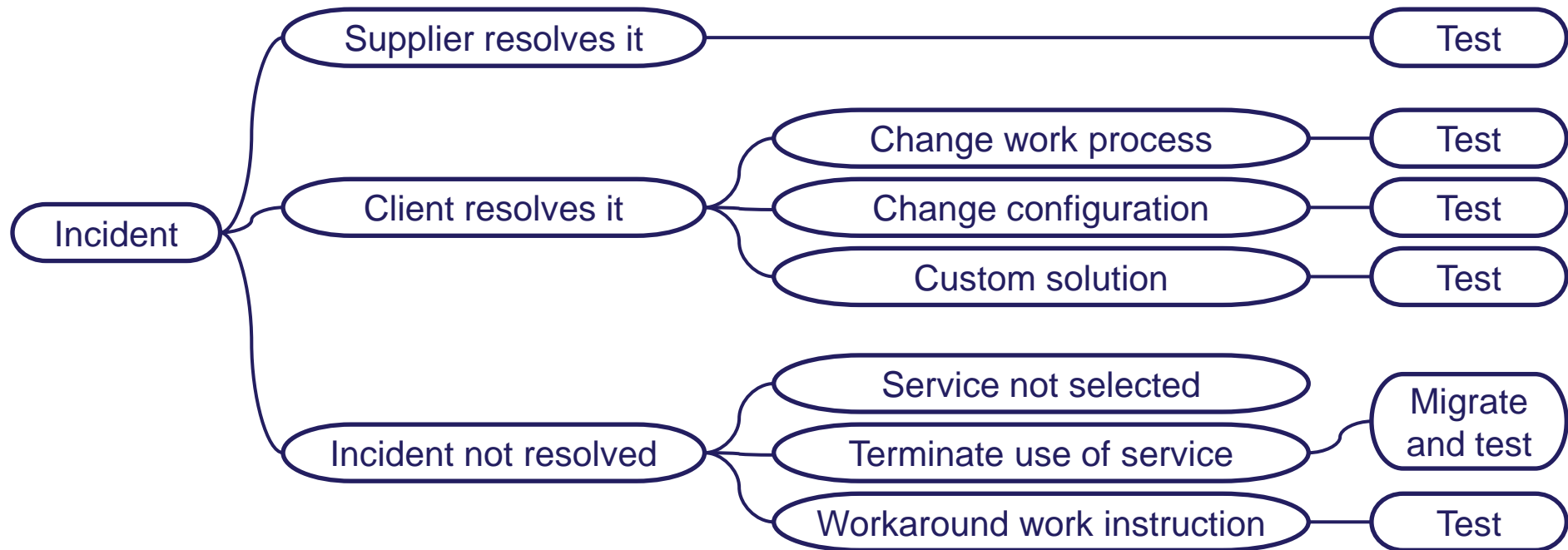
Legislation and Regulations

=

Test basis (rqms for test)

Where is my data stored?

Data owner is responsible for ensuring that the protection of personal data is at the required level wherever it is held

– Nothing, or hardly anything, to be found on this subject

– Service stores data outside the borders of permitted countries → additional measures?

– Service stores data within the borders of permitted counties → okay

Checking for legislation and regulations

- List where data that is stored in the cloud
- Find the requirements that are applicable to this data

Legal support needed for high risk

- Check supplier terms with customer's requirements

Example. A supplier of a storage service claims to be the owner of the intellectual capital of all data stored at their facilities. It is highly unlikely that this is compatible with the interests of the organization that is the actual owner of the data.

- Perform (external) audit for high risk
- Test manager provides advice, management decides

Legal issues – threats
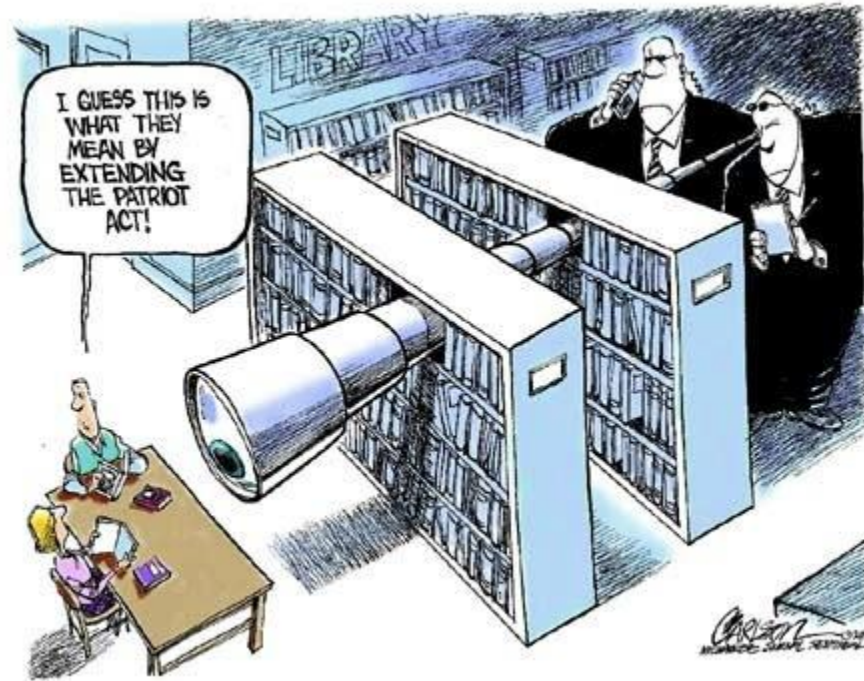
Example: Dropbox

Compliance with Laws and Law Enforcement Requests; Protection of Dropbox's Rights.

- We may disclose to parties outside Dropbox files stored in your Dropbox and information about you that we collect when we have a good faith belief that disclosure is reasonably necessary to (a) comply with a law, regulation or compulsory legal request; (b) protect the safety of any person from death or serious bodily injury; (c) prevent fraud or abuse of Dropbox or its users; or (d) to protect Dropbox's property rights. If we provide your Dropbox files to a law enforcement agency as set forth above, we will remove Dropbox's encryption from the files before providing them to law enforcement. However, Dropbox will not be able to decrypt any files that you encrypted prior to storing them on Dropbox.

Suppliers & Outsourcing

- More suppliers

- References
- Proof of Concept

- Fall-back test

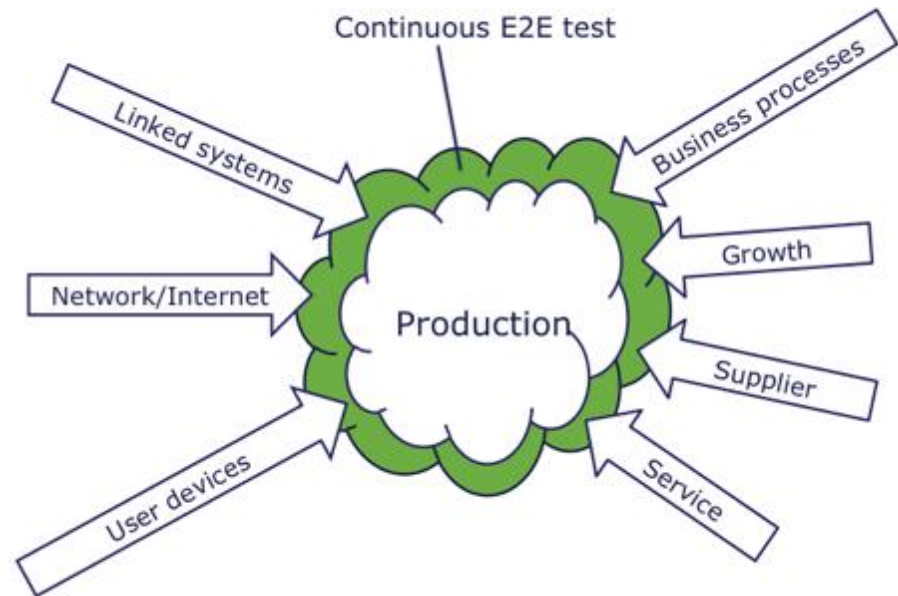- Secure data ownership
- Redundant data storage

- "TOGA" …………

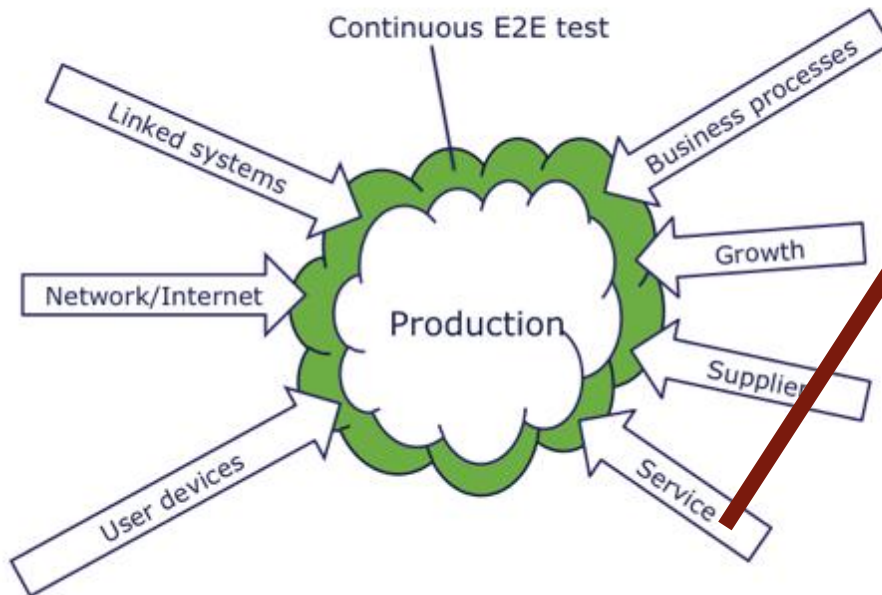# Test measures

- Selection

- Implementation

- Production

Testing in Production

Continuous change
Continuous End-to-End Testing

Continuous Change
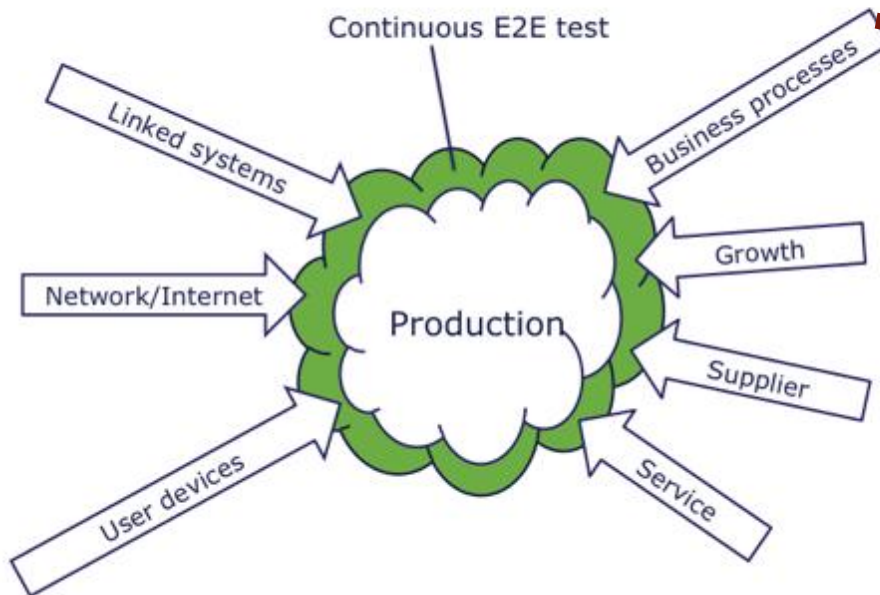

Continuous E2E test

Linked systems

Business processes

Network/Internet

Growth

Production

User devices

Supplier

Service

Changes in the Service

- Announced

- Not informed

Continuous End-to-End Testing
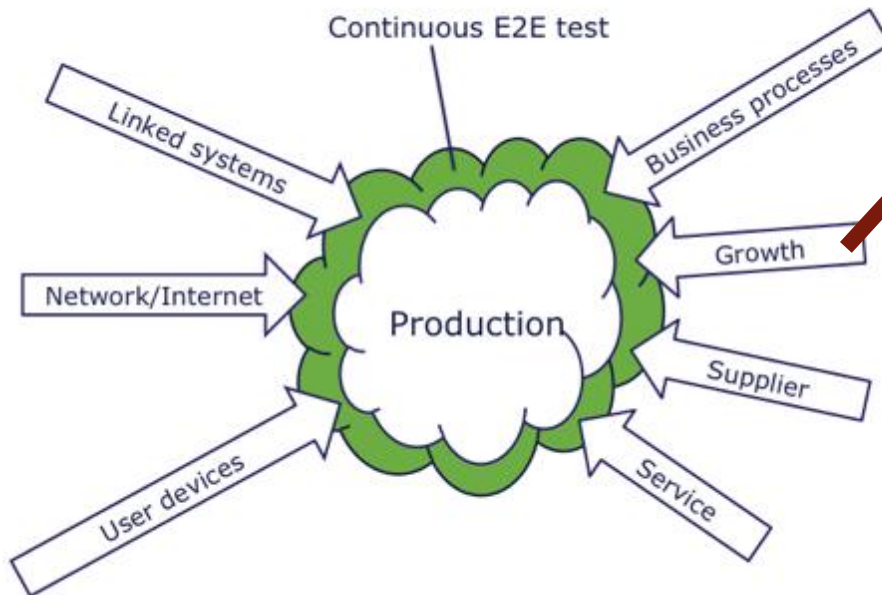*Functionals and Non-Functionals*

Continuous Change

Continuous E2E test

Linked systems
Network/Internet
User devices
Production
Business processes
Growth
Supplier
Service

Changes in the Business Processes

- New service required?

- Different usage?

Continuous End-to-End Testing
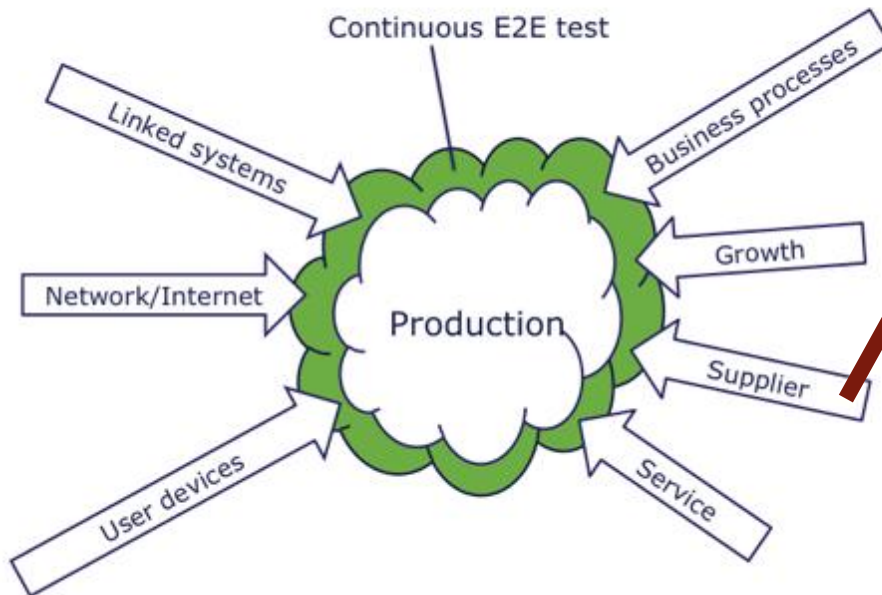*Functionals and Non-Functionals*

Continuous Change

Continuous E2E test

Linked systems

Business processes

Network/Internet

Production

Growth

User devices

Service

Supplier

Growth

- Increasing use

- Bandwidth?

- Supplier?

Continuous End-to-End Testing
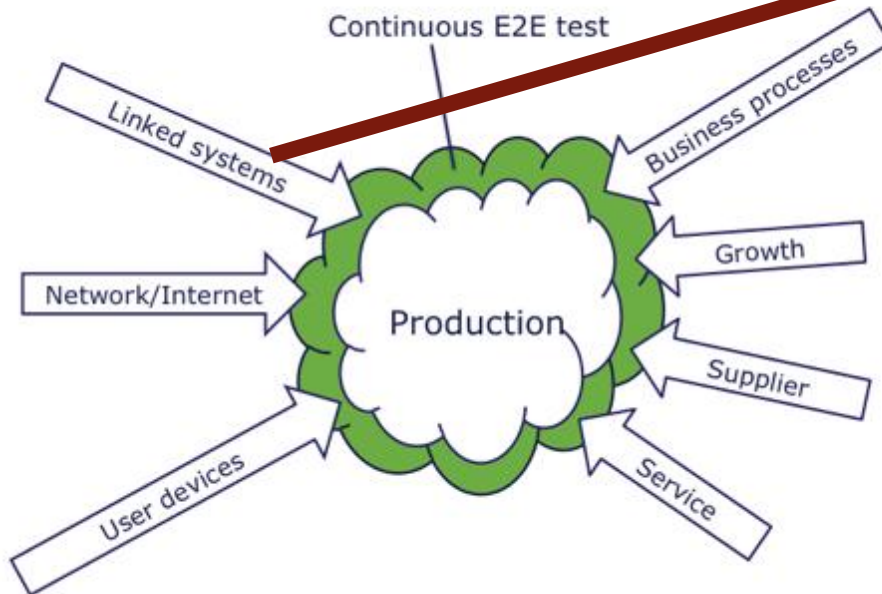*Functionals and Non-Functionals*

Continuous Change

Changes at the Supplier

- Takeover
- Pricing and Invoicing
- Support

Continuous End-to-End Testing
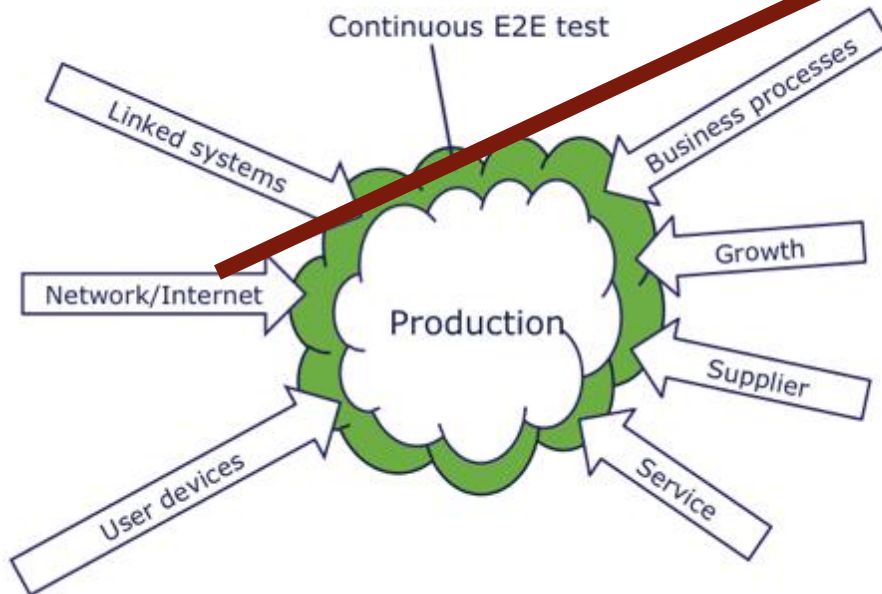*Functionals and Non-Functionals*

Continuous Change

Changes in other Systems

- Out of Control

- Interfaces?

Continuous End-to-End Testing
Functionals and Non-Functionals

Continuous Change

Continuous E2E test

Linked systems

Network/Internet

User devices

Production

Business processes

Growth

Supplier
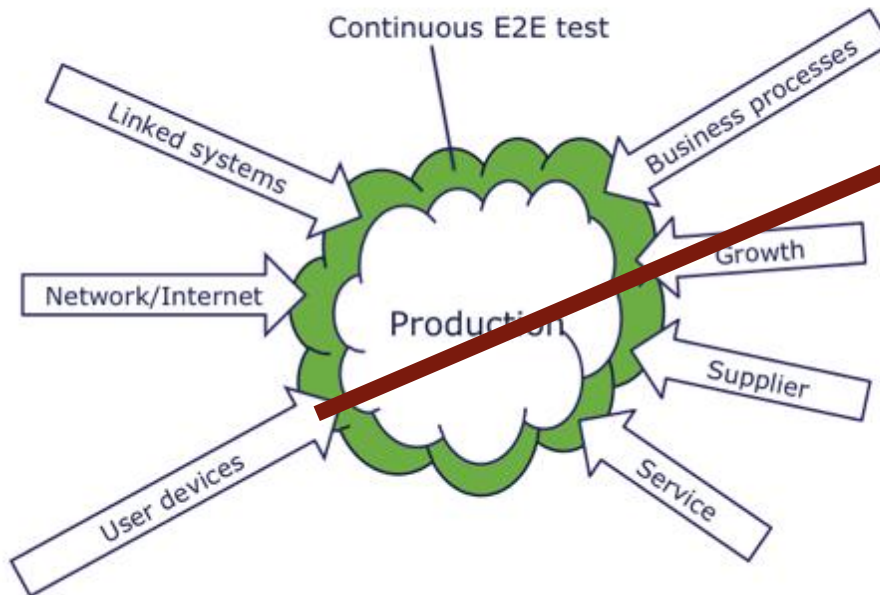
Service

Changes to the Internet

E.g.:
- Addressing
- Routing
- Caching
- Security

Continuous End-to-End Testing
Functionals and Non-Functionals

Continuous Change

Changes in User Devices

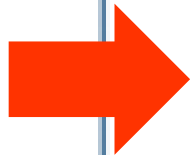- BYOD
- Operating Systems
- Browsers
- Firewalls
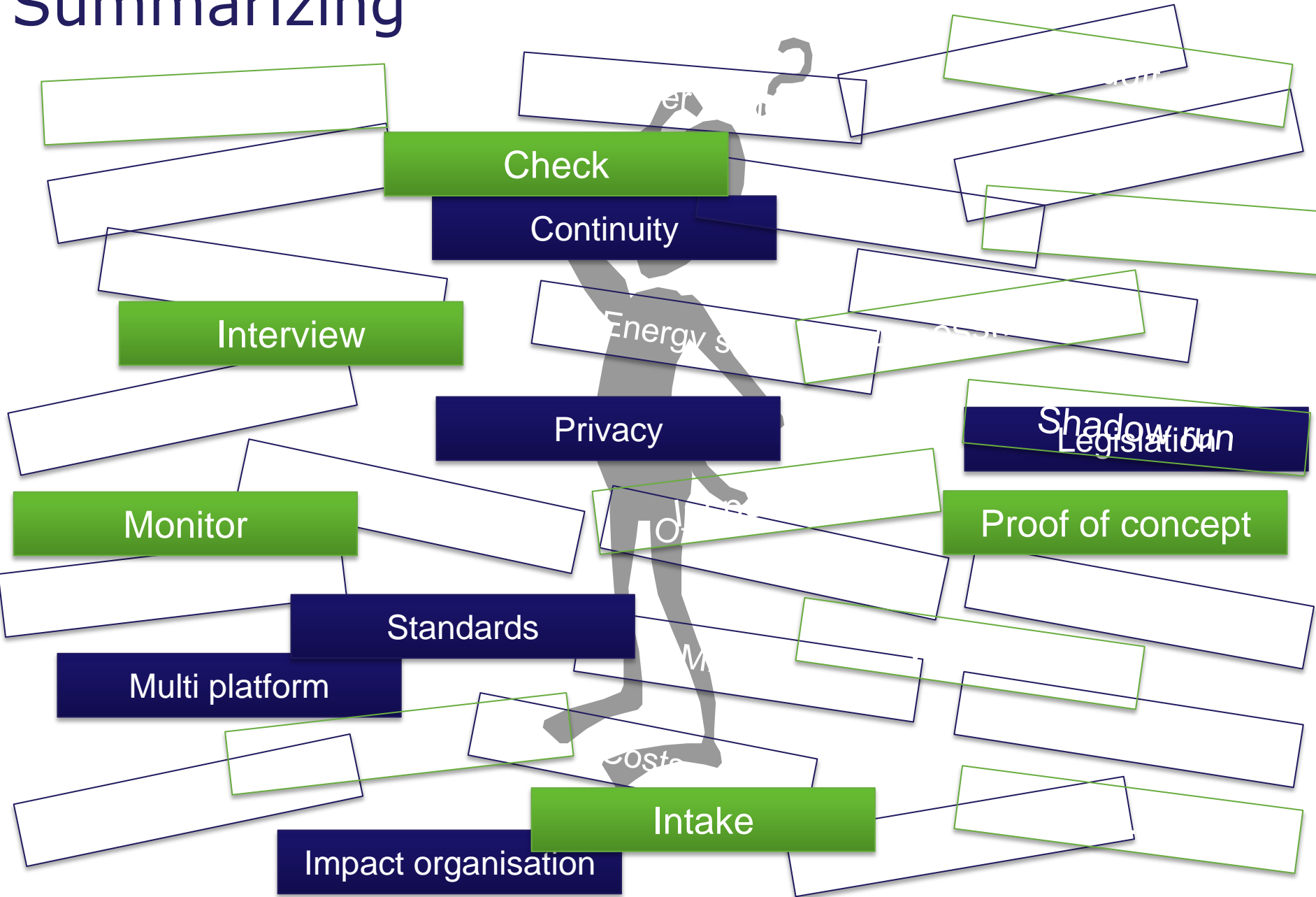- Load balancers
- Routers

Continuous End-to-End Testing
Functionals and Non-Functionals

Testing Cloud Services

Topics

- The Cloud

- You and what to do?

- Risks

- Measures

- Summary - Q&A

Summarizing

Check

Continuity

Interview

Energy s...

Privacy

Shadow run
Legislation

Monitor

Proof of concept

Standards

Multi platform

Intake

Impact organisation

How to test Cloud Services?

- As we always did:
  - Bridging risks to measures
  - By using
    - Your skills
    - Your peers
    - Heuristics
    - The Book

and

- New Risks
- New Measures
- Testing during Selection
- Continuous (E2E)
  Testing in Production

问题

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Thank you

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