Downtime Statistics of Current Cloud Solutions

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Christophe Cérin (France)[†], Camille Coti (France)[†], Pierre Delort (France)[§], Felipe Diaz (Colombia)[*],
Maurice Gagnaire (France)[*], Marija Mijic (Croatia)[*], Quentin Gaumer (France)[**],
Nicolas Guillaume (France/USA)[∥], Jonathan Le Lous (France)[¶], Stephane Lubiarz(France)[‡],
Jean-Luc Raffaelli (France)[x], Kazuhiko Shiozaki (Japan)[††], Hervé Schauer (France)[**], Jean-Paul Smets (France)[‡‡],
Laurent Séguin (France)[‡‡], Alexandrine Ville (France)[**],
[*]Telecom ParisTech [†]Galileo Institute [‡]Institut Mines-Telecom [§]ANDSI [¶]Alter Way [∥]Cedexis [**]HSC [††]Nexedi
[‡‡]VIFIB [x]DSI Groupe LaPoste

I. INTRODUCTION

In recent years, cloud computing has received considerable attention from global businesses and government agencies. Regarding the potential and impact of cloud computing in the world, providing reliable services to meet the requirements of mission critical systems becomes more and more important. Meanwhile, the lack of reliability of cloud services is not commonly known by industry. In order to monitor and analyze cloud computing resiliency, IWGCR[1] presents its short report of aggregated information from press releases and provides a brief summary of availability of major cloud providers.

II. PRESS RELEASES

We gather information from cloud provider status dashboards and press releases. Main press sources are:

- BBC,
- BGR.com,
- Bloomberg.com,
- CIO.com,
- CloudPro.co.uk,
- Computing.co.uk,
- Datacenterknowledge.com,
- DSLreports,
- FastCompany,
- gigaom,
- Huffingtonpost.com,
- Informationweek,
- Silicon.com,
- Zdnet.com.

III. SERVICE DOWNTIME

Table I shows all cloud services downtime we have grabbed from press releases and cloud computing providers. Below are some examples of stories of cloud service failures, their causes and consequences. All the failures we have noted are available on the IWGCR website[2].

[1]IWGCR: The International Working Group on Cloud Computing Resiliency
[2]http://iwgcr.org/

A. Year 2007

- 165, 000 websites hosted by NaviSite suddenly went offline and were offline during 1 full week.
- Hostway migrated several thousand servers from Miami to Tampa. This relocation resulted in thousands of sites going offline during 3 days.
- ServerBeach datacenters were affected by a power outage. The downtime lasted 4 hours.

B. Year 2008

- Twitter was often down, on and off for hours.

C. Year 2009

- OVH was down for 1 full week because of ZFS failure.
- Amazon and Microsoft datecenters downed by lightning in Dublin. Some sites that rely on one of their storage services took between 24 to 48 hours to recover.
- The Gmail service was not available during 4 hours.
- Paypal was down for 5 hours. Performance problem was detected and the outage affects ebay transactions.

D. Year 2010

- Amadeus got two failures in 3 months. This outage forced some airlines to check in manually for 1 hour.

E. Year 2011

- A 3 days blackout interrupted email and Internet services for tens of millions of users of BlackBerry.
- Microsoft Azure was offline for 7 hours.
- Yahoo! mail went down for 6 hours. More than 1 million users were affected.
- Users were unable to access Google Docs List for 1 hour.

F. Year 2012

- Routers failed during 2 hours in OVH.
- Major Facebook outage disrupted users worldwide during 3 hours.
- FirstServer has suffered an outage for 30 minutes by trying to update some servers against security vulnerability. More than 5.000 enterprises have lost data.

TABLE I
A SUMMARY OF CUMULATIVE DOWNTIME (IN HOUR) STATISTICS OF EACH CLOUD SERVICE PROVIDER FROM 2007 TO 2013. THE TOTAL DOWNTIME IS 2218.67 HOURS

	2007(Hour)	2008(Hour)	2009(Hour)	2010(Hour)	2011(Hour)	2012(Hour)	2013(Hour)	Total(Hour)
1. YouTube							0.17	0.17
2. FirstServer						0.5		0.5
3. CloudFlare							1	1
4. Rockstar							1.67	1.67
5. Atlantic.Net							2.35	2.35
6. Zoho						330.5		33.5
7. ServerBeach	4							4
8. Tumblr						2	3	5
9. Cerner						5		5
10. Paypal			5				25.2	30.2
11. Cisco	3						2.33	5.33
12. eBay							6.25	6.25
13. Facebook						3	5.5	3
14. VMware Cloud Foundry					10			10
15. EIG							16.6	16.6
16. Dropbox							17	17
17. MailChimp						14	4.33	18.33
18. Amadeus Check-in				1		21		22
19. Twitter		7	2			4	9.68	13.67
20. Netflix						20	4	24
21. GitHub						12	14.85	26.85
22. Microsoft			24		7		17.05	48.05
23. GoDaddy						6	52.08	58.08
24. Google Apps			4		1	23.93	30.38	59.31
25. Hostway	72							72
26. Apple						30	43.05	73.05
27. RIM					72		3	75
28. Yahoo					6		86	92
29. Rackspace							97.98	97.98
30. SalesForce						34.36	84.72	119.08
31. Microsoft Xbox Live						61	66.17	127.17
32. Verizon							136	136
33. Microsoft T-Mobile Sidekick			168					168
34. Navisite	168							168
35. OVH			168			2	11.63	181.63
36. IBM							223	223
37. Amazon			24		144	56.7	68.18	292.89
38. Microsoft Windows Azure						111.5	272.04	383.54

- Amazon datacenter in Virginia suffered an electric failure for 2 hours.
- MailChimp experienced some hardware issues on a datacenter for 14 hours. User data that was created in a slot of two hours was lost.
- Twitter blamed a double-whammy on Olympics and a cascading bug as root cause of its downtime for 3 hours.
- Cerner Corp. datacenter was down for 3 hours. Dozens of hospitals temporarily lost access to patient records.
- iCloud mail was unavailable for 30 hours. Impacted users were about 1,650,000 people.
- Github suffered 14.5 hours of downtime in two days.
- GoDaddy suffered an issue for 6 hours that impacted hundreds of thousands of websites.
- Google Apps suffered an outage due to a cascading failure on traffic routers for almost 11 hours.
- Amazon ESB of US-EAST-1 Region experienced elevated API failures and delays launching, updating and deleting. These issues impacted many major services, such as Reddit, Foursquare, Minecraft, Heroku, GitHub, imgur, Pocket, HipChat, Coursera, FastCompany, Flipboard, Payvment and many others.

- Hurricane Sandy affected several datacenter in the New York region. US Cloud Computing resisted, thanks to the warnings that were issued 72 hours before the events.
- Google mail suffered 6 hours of downtime almost spread on consecutive days.
- Netflix suffered a 20 hours outage at Christmas Eve as a result of an outage at Amazon Web Services cloud computing center in Virginia.
- Windows Azure Storage at South Central US went down for 77 hours.
- Vodaphone lost all data retention (legal obligation) in a fire in December.

G. Year 2013

- Salesforce customers EU0 instance experienced a 3 day-unexpected DNS fault preventing a subset of customers on the EU0 instance from accessing the Salesforce application.
- Windows Azure SQL Reporting experienced a 5-day outage in the East US sub-region.
- Dropbox users experienced issues connecting to the service during a 16-hour outage.

TABLE II
A SUMMARY OF TOTAL AND AVERAGE DOWNTIME FOR EACH CLOUD SERVICE PROVIDER AND THEIR ECONOMIC IMPACT

	Total(Hour)	Average(Hour)	Availablity	Cost/Hour(USD)	Cost(USD)
1. YouTube	0.17	0.024	99.999	200.000	34.000
2. FirstServer	0.5	0.071	99.997	336,000 [1] (or 180,000 [2])	168,000 (or 90,000)
3. CloudFlare	1	0.143	99.994	336,000 [1] (or 180,000 [2])	168,000 (or 90,000)
4. Rockstar	1.67	4.786	99.990	200,000	334,000
5. Atlantic.Net	2.35	0.336	99.973	336,000 [1] (or 180,000 [2])	789,600 (or 423,000)
6. Zoho	33.5	0.429	99.809	200,000	600,000
7. ServerBeach	4	0.571	99.977	100,000	400,000
8. Tumblr	5	0.714	99.971	100,000	500,000
9. Cerner	5	0.714	99.971	336,000 [1] or 180,000 [2]	1,680,000 (or 900,000)
10. Paypal	30.2	4.314	99.828	225,000	6,795,000
11. Cisco	5.33	0.761	99.970	200,000	1,066,000
12. eBay	6.25	0.893	99.964	225,000	1,406,250
13. Facebook	8.50	1.214	99.951	200,000	1,700,000
14. VMware Cloud Foundry	10	1.429	99.943	336,000	3,360,000
15. EIG	16.60	2.371	99.905	336,000 [1] or 180,000 [2]	5,577,600 (or 2,988,000)
16. Dropbox	17	2.429	99.903	200000	3,400,000
17. MailChimp	18.33	2.619	99.895	200,000	3,666,000
18. Amadeus Check-in	22	3.143	99.974	89,000	1,958,000
19. Twitter	22.68	3.240	99.871	200,000	4,536,000
20. Netflix	24	3.429	99.863	200,000	4,800,000
21. GitHub	26.85	3.836	99.847	200,000	5,370,000
22. Microsoft	48.05	6.8647	99.726	200,000	9,610,000
23. GoDaddy	52.08	8.297	99.668	336,000	19,514,880
24. Google Apps	59.31	8.473	99.661	300,000 [1] (or 200,000 [2])	17,793,000 (or 5,786,000)
25. Hostway	72	10.286	99.589	336,000 [1] (or 100,000)	24,192,000 (or 7,200,000)
26. Apple	73.05	10.436	99.583	200,000	14,610,000
27. RIM	75	10.714	99.572	200,000	15,000,000
28. Yahoo	92	13.143	99.475	200,000	18,400,000
29. Rackspace	97.98	13.997	99.441	200,000	19,596,000
30. SalesForce	119.08	17.012	99.320	200,000	23,816,800
31. Microsoft Xbox Live	66.17	18.167	99.274	200,000	25,434,000
32. Verizon	136	19.429	99.224	200,000	27,200,000
33. Microsoft T-Mobile Sidekick	168	24.000	99.041	200,000	33,600,000
34. Navisite	168	24.000	99.041	100,000	16,800,000
35. OVH	181.63	25.947	98.963	336,000 [1] (or 100,000 [2])	61,027,680 (or 32,693,400)
36. IBM	223	31.857	98.727	336,000 [1] (or 180,000 [2])	74,928,000 (or 40,140,000)
37. Amazon	292.893	41.841	98.382	336,000 [1] (or 180,000 [2])	98,411,040 (or 52,720,200)
38. Microsoft Windows Azure	383.54	54.791	97.811	336,000 [1] (or 180,000) [2]	128,869,440 (or 69,037,200)
Total	**2595.75**	**370.822**	**85.184**		**669,952,730** (or 480,647,930)

- A breakdown within IBM′s servers and software applications brought down the website of major Australian retailer Myer for one week during the Christmas period. The monetary loss on the sales was estimated to be 31 million Australian dollars.
- Apple′s iCloud suffered an outage which left all iCloud services including mail, contacts, calendar, photo stream, and backup unavailable for 11 hours, sparking a problem for about 11 percent of users, or about 25 million people.
- Google Drive has suffered three service interruptions this in March, making it impossible at times for affected users to access their files and applications. The longest of interruptions lasted 11 hours.
- Cloud Load Balancers of Rackspace experienced multiple degradations of service during a week in May due to a combination of active load balancers, new provisioning requests, and overall traffic.
- GitHub.com experienced a DDoS attack that resulted in 7-hour website outage in July.
- Facebook suffered an outage as profiles and pages stop working for users during 2.5 hours in November.
- Customers of BlueHost, HostGator and HostMonster operated by Endurance International Group experienced more than 9 hours of outage in August.
- Microsoft was hit by two outages of Office 365 in span of 5 days. The time of outages combined totaled 13 hours.
- Yahoo Mail experienced partial outage during 3 consecutive days due to a hardware problem.
- Verizon experienced a service disruption that affected email accounts for 5 days.
- eBay experienced global outage for 6 hours due to technical issues which occurred during regularly scheduled maintenance.
- Rockstar Games, experienced major issues with the cloud service thats responsible for saving user game data. A number of players lost a character, game money, items and more when playing GTA Online.
- Googles YouTube experienced worldwide outage for 10 minutes.

IV. ANNUAL DOWNTIME

Table III shows the downtime on annual basis. The downtime of the majority of providers has grown from 2012 to 2013. One of the biggest cloud providers, Windows Azure,

TABLE III
DOWNTIME AND AVAILABILITY FOR 2012 AND 2013

	2012(Hour)	2013(Hour)	2012(Availability)	2013(Availability)
1. YouTube		0.17	100.000	99.998
2. FirstServer	0.5		99.994	100.000
3. CloudFlare		1	100.000	99.989
4. Rockstar		1.67	100.000	99.981
5. Atlantic.Net		2.35	100.000	99.973
6. Zoho	3	30.5	99.966	99.652
7. ServerBeach			100.000	100.000
8. Tumblr	2	3	99.977	99.966
9. Cerner	5		99.943	100.000
10. Paypal		25.2	100.000	99.712
11. Cisco		2.33	100.000	99.973
12. eBay		6.25	100.000	99.929
13. Facebook	3	5.5	99.966	99.937
14. VMware Cloud Foundry			100.000	100.000
15. EIG		16.6	100.000	99.811
16. Dropbox		17	100.000	99.806
17. MailChimp	14	4.33	99.840	99.951
18. Amadeus Check-in	21		99.760	100.000
19. Twitter	4	9.68	99.954	99.989
20. Netflix	20	4	99.772	99.954
21. GitHub	12	14.85	99.863	99.830
22. Microsoft		17.05	100.000	99.805
23. GoDaddy	6	52.08	99.932	99.405
24. Google Apps	23.93	30.38	99.727	99.653
25. Hostway			100.000	100.000
26. Apple	30	43.05	99.658	99.509
27. RIM		3	100.000	99.966
28. Yahoo		86	100.000	99.018
29. Rackspace		97.98	100.000	98.882
30. SalesForce	34.36	84.72	99.608	99.033
31. Microsoft Xbox Live	61	66.17	99.304	99.245
32. Verizon		136	100.000	98.447
33. Microsoft T-Mobile Sidekick			100.000	100.000
34. Navisite			100.000	100.000
35. OVH	2	5	99.977	99.943
36. IBM		223	100.000	97.454
37. Amazon Web Service	56.7	28.23	99.353	99.678
38. Microsoft Windows Azure	111.5	272.04	98.727	96.895

has almost tripled its downtime in 2013, standing at a total of 272.04 hours a year.

V. CONCLUSION

Preliminary results (Table II) of cloud service availability show an average of 7.738 hours unavailable per year or 99.91% availability. As a comparison, the service average unavailability for electricity in a modern capital is less than 15 minutes per year. [3] The cost of these failures amounts for almost 285 millions USDs based on hourly costs accepted in industry [2] [1].

Due to imperfect methodology, such figures are most likely underestimated, since many events are not published in the press releases and the current procedure to collect events by IWGCR leaves a lot of room for missed outages. Future work of IWGCR will focus on improving the observation of cloud service availability and better measure the economic impact.

Readers should note that the average unavailability for 2012, 22.77 hours of unavailability or 99.74% availability, has almost multiplied by 3 compared to previous years (Table I). This is due to the addition to our sources reports from the providers themselves in addition to the data from the press. IWGCR members highlight that the highest downtime

of providers outlined in Table I for 2012 do not show any lesser quality than non reported providers, or those who have less downtime. It is a direct consequence of their transparency policy on their own failures which we encourage because more transparency from providers themselves can only lead to more confidence from their customers.

VI. FUTURE WORKS

There are at least several shortcomings in our approach.

Our procedure to gather informations is still far from exhaustive and ranking of availability is still unreliable. In the next version, we will improve our tools, like online detectors or probes to monitor mainstream cloud service providers continuously. In addition, we plan to setup communication channels to enable users to report failures.

Finally, we believe that the messages of the operators should be more transparent and easier to handle automatically.

Second, our data is not based on number of users. However, the social or economic impact of big player failures (Google, Amazon, Salesforce, eBay, etc.) is much wider than the small ones'. It is useful to consider this factor to make average estimation more accurate. Some Software as a Service providers

indicate the percentage of impacted users about their outage, but never indicate the total number of their users.

Further, we still don't have the precise value of economic cost for each failure or average hourly cost for each cloud service provider. This is required to obtain a better assessment of the cloud society.

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