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## Comparing Clouds with CloudHarmony

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We have written frequently about whether public clouds are suitable for corporate critical applications. We have published many Never Again stories about massive failures in popular clouds such as Amazon, Google, Azure, and Rackspace. However, these are really vignettes – snapshots in time. What are the real availability statistics for these and other clouds over a long period of time?<sup>1</sup>



The web-monitoring site CloudHarmony gives us an insight into this data as well as much more information about cloud performance, cloud pricing, and cloud capabilities for dozens of public clouds. CloudHarmony obtains its data from its own applications that are running in the clouds that it is monitoring.

Furthermore, there are several web services that monitor clouds in real time and provide information on the current status of these clouds. We review these services in this article.

### CloudHarmony

CloudHarmony ([www.cloudharmony.com](http://www.cloudharmony.com)) provides four sets of services:



- *CloudSquare* lets you research and compare cloud services on the basis of uptime, features, pricing and more.
- *CloudScores* provides access to cloud performance metrics.
- *CloudMatch* helps you to compare cloud services in real time with its *speedtest* facility.
- *CloudReports* offers analyses, summaries, and commentary about clouds.

### CloudSquare

CloudSquare comprises CloudSquare Status and CloudSquare Directory.

#### CloudSquare Status

It is CloudSquare Status that gives us direct insight into the availabilities of the different cloud services. The availability of almost 50 public clouds and their 500 regions are shown for a selected period of time, from the previous week to the previous year. The availability for compute services, storage, database, content delivery networks (CDN), Domain Name Services (DNS), and Platform as a Service (PaaS) offerings can be selected.

For instance, the CloudSquare statistics show that Amazon's nine EC2 (Elastic Compute Cloud) regions had the following availabilities over the last year:

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<sup>1</sup> Which cloud providers had the best uptime last year?, *NetworkWorld*; January 12, 2015.

| Regions        | Number of Outages | Total Outage Time | Availability |
|----------------|-------------------|-------------------|--------------|
| us-east-1      | 6                 | 23.6 minutes      | 99.9955%     |
| us-west-1      | 1                 | 1.3 minutes       | 99.9998%     |
| us-west-2      | 0                 | 0                 | 100%         |
| sa-east-1      | 1                 | 11.18 minutes     | 99.9979%     |
| eu-central-1   | 0                 | 0                 | 100%         |
| eu-west-1      | 1                 | 19 seconds        | 99.9999%     |
| ap-northeast-1 | 1                 | 3.13 minutes      | 99.9994%     |
| ap-southeast-1 | 1                 | 1.33 hours        | 99.9848%     |
| ap-southeast-2 | 1                 | 1.38 minutes      | 99.9995%     |

### One-Year Amazon EC2 Availability

Amazon achieved an availability of almost five 9s, averaging an availability of 99.997 over its nine EC2 regions. In fact, it achieved five 9s in all but one region. Its average downtime per region was 27 minutes.

The statistics for Microsoft's Azure cloud tell a somewhat different story. The measured data of its thirteen regions over the past year show the following availabilities:

| Regions         | Number of Outages | Total Outage Time | Availability |
|-----------------|-------------------|-------------------|--------------|
| us-east         | 37                | 3.39 hours        | 99.9338%     |
| us-east-2       | 2                 | 2.33 hours        | 99.9476%     |
| us-central      | 4                 | 4.23hours         | 99.9097%     |
| us-northcentral | 6                 | 3.58 hours        | 99.9361%     |
| us-southcentral | 3                 | 48.35 minutes     | 99.9917%     |
| us-west         | 4                 | 3.03 hours        | 99.946%      |
| brazil-south    | 9                 | 2.9 hours         | 99.9434%     |
| eu-north        | 5                 | 3.12 hours        | 99.939%      |
| eu-west         | 12                | 2.85 hours        | 99.9513%     |
| asia-east       | 11                | 13.16 hours       | 99.743%      |
| asia-southeast  | 3                 | 1.28 hours        | 99.9853%     |
| japan-east      | 4                 | 1.33 hours        | 99.9808%     |
| japan-west      | 3                 | 56.43 minutes     | 99.9886%     |

### One-Year Microsoft Azure Availability

The Microsoft Azure cloud achieved four 9s in only one of its regions. Its average availability over all regions was 99.94. Its average downtime per region was 3.3 hours, almost seven times that of the Amazon EC2 regions. This difference may be explained by the fact that Amazon EC2 is a very mature cloud compared to the relatively new Microsoft Azure cloud.

Other compute clouds that CloudSquare monitors include:

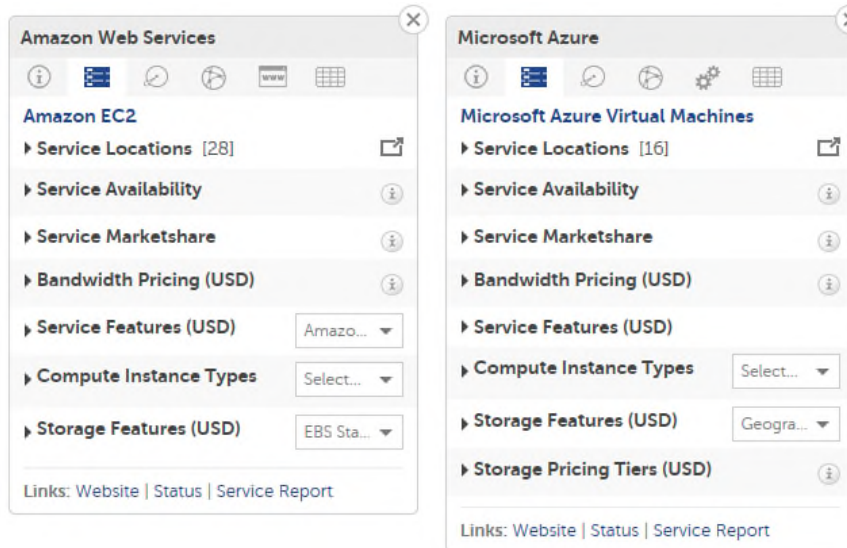
|                 |                  |                    |                  |                   |
|-----------------|------------------|--------------------|------------------|-------------------|
| Aruba           | CloudSigma       | Gandi Cloud        | NetHosting Cloud | StratoGen         |
| agileCLOUD      | Cloudhelix       | GoGrid             | Ninefold         | Tata Instacompute |
| BareMetalCloud  | Collosseum Cloud | Google Compute     | Oktawave Cloud   | VPS.NET           |
| Blue Box VPS    | Crucial Cloud    | Hosting.com        | Open Hosting     | Vultr             |
| BlueLock vCloud | DigitalOcean     | IDC Frontier Cloud | Orion VM         | Webair Cloud      |
| CenturyLink     | ElasticHosts     | Joyent Cloud       | Phoenix NAP      | Dediserve         |
| City Cloud      | ExoscaleCompute  | KT ucloud          | Rackspace        | e24 Cloud         |
| Cloud Central   | FireHost         | Linode Cloud       | SiteHost         | eApps Cloud       |
| CloudProvider   | GMO Cloud        | NephoScale Cloud   | Speedyrails      | vn Cloud          |
|                 |                  |                    |                  | zettaGrid         |

All clouds are monitored for storage, database, content delivery networks (CDN), Domain Name Services (DNS), and Platform as a Service (PaaS) offerings.

## CloudSquare Directory

The CloudSquare Directory provides side-by-side comparisons of cloud providers that can be selected from a list of almost 100 such providers. The comparisons include features, configurations, SLAs, availability, pricing, and more.

The comparison information includes compute services, storage, database, content delivery networks (CDN), Domain Name Services (DNS), and Platform as a Service (PaaS) offerings. The description for each service, where applicable, includes the number of service locations, the service availability, the service market share, pricing, service features, compute instance types, and storage features.



## **CloudScores**

CloudScores reports benchmark tests made on a variety of cloud services. Metrics include:

- *CPU*: SPECint, SPECfp, Geekbench, Geekbench Multicore, Unixbench, Unixbench Multicore.
- *Memory*: Triad, Add, Copy, Scale.
- *Block Storage*: 4k Rand IOPS, 16k Rand IOPS, 64k Rand IOPS, 128k Seq Throughput, 1m Seq Throughput, 4k Mean Latency, 4k Max Latency, 4k Write Saturation.
- *Internal Network*: Throughput - Large File (4 threads 500MB), Throughput - Small File (8 threads <128KB), ICMP Latency.
- *TeraSort*: TeraSort, TeraGen, TeraValidate.

## **CloudMatch**

CloudMatch uses CloudHarmony's *speedtest* tool to measure connectivity to various cloud services from six continents. It can be used to determine which services provide the best connectivity to your location. Results from this testing are summarized geographically in the Cloud Reports.

The speedtest facility can be used to measure a variety of services, including Content Delivery Networks (CDNs), Cloud Servers, Cloud Storage, Cloud Platforms, and DNS providers.

Several types of tests can be performed, including downloading a few large files, downloading many small files, network latency, and uploading.

### **CloudReports**

CloudReports provides multiple extensive reports whose size is typically in the order of 100 pages. These performance studies provide point-in-time snapshots on performance analysis conducted across different types of cloud services.

The reports can be received on a quarterly basis (Basic) or on a monthly basis (Premium). All quarterly reports are free. Most Premium reports require a fee and include additional information over that provided in the Basic reports.

The reports are organized into three categories:

#### State of the Cloud – Compute

This report examines how to use benchmarks to compare performance among cloud compute services. Services compared in this report include Amazon Web Services (AWS), DigitalOcean, Google Cloud Platform, Microsoft Azure, Rackspace Cloud, and SoftLayer.

“State of the Cloud – Compute” Premium reports are free.

#### State of the Cloud – DNS

In-depth analyses about managed DNS services are presented. Analyses include comparisons of performance, availability, market share, features, and pricing.

DNS networks that are compared include Akamai, Amazon Route 53, CloudFare, DNS Made Easy, Dyn, EasyDNS, EdgeCast, NSONE, Ultra DNS, and Verisign.

#### CDN Performance

Content Delivery Network (CDN) performance is summarized based on public cloud tests using CloudHarmony’s *speedtest* facility. The report includes eighteen major CDNs. It compares real user latency and throughput performance of each CDN in six continents.

### **Other Web Analysis Services**

There are several other facilities for testing connectivity and performance of web sites in real time. These include:

#### **CurrentlyDown**

CurrentlyDown ([www.currentlydown.com](http://www.currentlydown.com)) can be used to check whether a web site is down at the moment. Just type in the URL of the web site, and its status is immediately displayed., along with the response time required to access the site. If the site is one which is being monitored by CurrentlyDown, its availability history will also be shown.



CurrentlyDown displays a list of recent notable outages and web sites that have recently gone down.

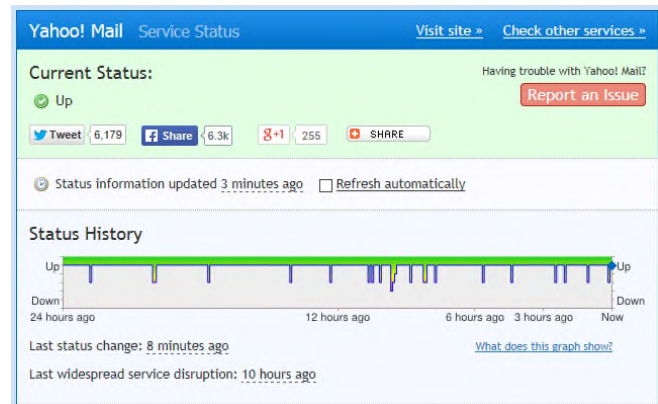
CurrentlyDown gets a great deal of its monitoring information from Twitter feeds. If it shows that a web site specified by you is down, it will alert you as to whether you are alone or whether many have tweeted that the web site is down. CurrentlyDown provides the means for individuals to report current problems with a web site.

| Notable Outages        |             | Recently Down Websites    |            |
|------------------------|-------------|---------------------------|------------|
| 01/04 - Tumblr         | ~21min      | Today - Addic7ed          | ~48min     |
| 01/02 - Bing           | ~18min      | Today - Ancestry          | ~20min     |
| 01/02 - Forbes         | ~1h 10min   | Today - Bigpoint          | ~20min     |
| 12/25 - Fitbit         | ~4h 07min   | Today - AeriaGames        | ~20min     |
| 12/22 - E! TV          | ~316h 09min | Today - Keepvid           | ~30min     |
| 12/21 - The Pirate Bay | ~300h 02min | Today - Usajobs           | ~11h 16min |
| 12/07 - Sony           | ~34min      | Today - Joomla!           | ~40min     |
| 11/18 - Last.fm        | ~6h 39min   | Today - Smartresponder    | ~28min     |
| 10/28 - Facebook       | ~19min      | Today - Victoria's Secret | ~30min     |
| 09/30 - StumbleUpon    | ~4h 10min   | 01/16 - Played            | ~1h 50min  |

CurrentlyDown monitors hundreds of the most popular websites and tracks website availability over the long term. The outage history is stored for later reference. Outage data is displayed in easy-to-understand charts so that a website's availability on any particular date can be viewed. CurrentlyDown also researches every issue and posts news about the outage cause and its status. The most notable outages are also posted to its Twitter and Facebook feeds.

### downrightnow

downrightnow ([www.downrightnow.com](http://www.downrightnow.com)) monitors the status of several popular web sites, combining user reports, tweets, information from other web sites that monitor service status, and official announcements to indicate when there is a service problem. The site provides a means for individuals to report a problem.



The status history for the past 24 hours is displayed for any of the web sites that are monitored. Web-site status is posted to downrightnow's Facebook page and is reported via Twitter.

Sites that downrightnow monitors includes:

- |             |              |             |         |
|-------------|--------------|-------------|---------|
| Yahoo! Mail | Tumblr       | LiveJournal | Ning    |
| Facebook    | Twitter      | Blogger     | PayPal  |
| Foursquare  | Windows Live | LinkedIn    | Skype   |
| Google Mail | Hotmail      | NetFlix     | TypePad |
|             | YouTube      |             |         |

### Pingdom

Pingdom ([www.pingdom.com](http://www.pingdom.com)) is a for-fee service that a company can engage to monitor its web sites. Monitoring can be as frequent as once per minute from 50 locations over the world. Thus, problems not only with a web site but with networks connecting the web site can be quickly determined.

Pingdom provides a smart-phone app so that the status of web sites can be viewed at anytime, anywhere.

Pingdom claims over a half-million customers, including HP, Apple, Dell, Microsoft, Google, Twitter, Instagram, Disney, GitHub, and Pinterest.

### Summary

Public clouds still have a ways to go to achieve carrier-grade availabilities of five 9s or better. Some are nearly there now – Amazon's EC2 compute service has achieved an average availability of almost five 9s

(five minutes of downtime per year), which is probably better than the availability achieved by most data centers. Amazon's S3 storage service had an availability exceeding five 9s. However, public clouds like Microsoft's Azure with an average availability of a little over three 9s have a lot of maturing to do before they can become serious candidates for mission-critical applications.

A capability that all companies should consider for critical applications running in public clouds is the use of multiple fault-isolated regions such as Amazon's Availability Zones to run backup copies of the applications in multiple regions so that an application failure can be quickly recovered. Of course, just like any failover mechanism, failover to a backup region should be periodically tested to ensure that it will work. This is what saved NetFlix<sup>2</sup> when Amazon had to reboot many of its virtual machines in September, 2014, to correct a serious vulnerability in the Xen hypervisor.

## **Acknowledgement**

Thanks to our subscriber, Gerhard Schwarz, for suggesting this topic to us.

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<sup>2</sup> Build to Fail, *Availability Digest*, November 2014.