

# **Torrenting on Public Cloud: Survey on Policies and Practices**



**Faculty of Gina Cody School of Engineering & Computer Science**

Department of Institute for Information System Engineering

## **INSE 6170: Network Security Architecture and Management**

### **Project Type 2**

**Submitted To:**

**Prof. Carol Fung**

Associate Professor, Department of  
Information System Security,  
Concordia University, Montreal

**Miss. Vaishnavi Naikwade**

Student, Masters of Applied Science  
in Information Systems Security,  
Concordia University, Montreal  
Student ID: 40278569

**Mr. Mukul Prabhu**

Student, Masters of Engineering in  
Information Systems Security,  
Concordia University, Montreal  
Student ID: 40257131

# **Contents**

<b>1. Abstract</b>	<b>i</b>
<b>2. Introduction</b>	<b>ii</b>
<b>3. Plan of Action</b>	<b>iii</b>
<b>4. Cloud Survey</b>	<b>iv</b>
<b>5. Experimental Study</b>	<b>v</b>
<b>6. Conclusion</b>	<b>vi</b>
<b>7. References</b>	<b>vii</b>

## 1. Abstract

As the digital landscape evolves, the BitTorrent communication protocol has emerged as a powerful force in peer-to-peer file-sharing. This report delves into the intricate workings of BitTorrent, elucidating its departure from traditional server-centric approaches and setting the stage for a comprehensive exploration of its utilization in the realm of easily accessible public cloud infrastructure. The legal nuances surrounding torrenting activities are meticulously dissected, elucidating the technical intricacies that delineate legitimate use cases from unauthorized distribution of copyrighted content.

The symbiotic relationship between BitTorrent and cloud computing forms the crux of the report, spotlighting the public cloud's vulnerability to the illicit sharing of digital assets. A discerning analysis of 12 prominent cloud infrastructure providers, including industry titans like AWS, Azure, and Google Cloud, provides valuable insights into potential vulnerabilities and opportunities for torrenting. Furthermore, the report scrutinizes the robust measures implemented by these providers to combat illegal file-sharing on their platforms and their retaliatory strategies.

To augment theoretical insights with practical understanding, an experimental study conducted on the OpenStack platform is presented. This hands-on exploration aims to identify methodologies by which cloud providers can proactively detect and thwart illegal torrenting activities on their infrastructure. The report concludes with a comprehensive summary of key findings, emphasizing the implications for cloud providers, policymakers, and industry stakeholders. Additionally, actionable recommendations are proposed to fortify strategies for fostering a more secure and legally compliant cloud computing environment, thereby contributing to the ongoing discourse on digital piracy and technological evolution.

## 2. Introduction

In the ever-accelerating digital landscape, where information travels at the speed of light, communication protocols play a pivotal role in shaping how data is disseminated across the vast expanse of the internet. One such formidable force in the realm of peer-to-peer file-sharing is BitTorrent—a communication protocol that has redefined the dynamics of distributing digital content. This report embarks on a journey to unravel the intricacies of BitTorrent, laying bare its operational mechanisms and showcasing its departure from the conventional server-based paradigm.

At its core, BitTorrent stands as a testament to the transformative power of peer-to-peer communication. Unlike traditional approaches that rely on centralized servers to disseminate information, BitTorrent operates on a decentralized model, harnessing the collective power of individual users to share files seamlessly. This marks a paradigm shift from the hierarchical structure of server-based systems, ushering in a new era of collaboration and efficiency.

Delving into the underlying technology of BitTorrent, this report aims to demystify the protocol's architecture. It explores the intricacies of how peers interact within the network, breaking down the process of file-sharing into a symphony of decentralized exchanges. By fostering a foundational understanding of BitTorrent's operational principles, this section sets the stage for a deeper exploration into the protocol's capabilities and, notably, its deviation from the established norms of server-centric file distribution.

The conventional server-based approach, characterized by a single point of authority dictating the flow of data, is juxtaposed against the dynamic and distributed nature of BitTorrent. The report

illuminates the stark contrasts between these two paradigms, underscoring the agility and resilience that a peer-to-peer model introduces to the digital ecosystem. This comparison serves as a compass, guiding readers through the uncharted territories of decentralized file-sharing, and establishing a baseline comprehension of the subject matter at hand.

As we embark on this exploration of BitTorrent, it becomes evident that this communication protocol is not merely a technological innovation; it is a catalyst for reshaping how information flows in our interconnected world. By unraveling the intricacies of BitTorrent's peer-to-peer architecture and highlighting its departure from the conventional server-based approach, this report endeavors to provide a comprehensive foundation for the subsequent analyses that delve into the legal, technological, and cloud computing dimensions of torrenting activities in the digital landscape

## **2.1 A Brief History of Torrent Technology:**

The history of torrent technology is a fascinating journey that begins with the vision of a more efficient and decentralized file-sharing system. The development of torrent technology has significantly impacted the way digital content is distributed and consumed across the internet. Here's a brief historical overview:

### **2.1.1. Conceptualization of Peer-to-Peer Sharing:**

The roots of torrent technology trace back to the early days of peer-to-peer (P2P) sharing concepts. The idea of users sharing files directly with each other, rather than relying on a centralized server, emerged as a response to the limitations and inefficiencies of traditional file-sharing methods.

### **2.1.2. Bram Cohen and the Birth of BitTorrent:**

The pivotal moment in the history of torrent technology occurred in 2001 when Bram Cohen, a computer programmer, introduced BitTorrent. Cohen's innovative protocol addressed the challenges associated with large file distribution by dividing files into smaller pieces. This division allowed users to download and upload different segments concurrently, promoting faster and more efficient sharing.

### **2.1.3. BitTorrent Protocol Unveiled:**

In July 2001, Cohen released the first version of the BitTorrent protocol, providing a decentralized alternative to existing file-sharing methods. The protocol gained rapid popularity due to its ability to reduce the strain on servers and distribute the bandwidth load among users.

### **2.1.4. Rise of BitTorrent Clients:**

As the BitTorrent protocol gained traction, various software developers created BitTorrent clients—applications that allowed users to connect to the decentralized network and participate in the sharing process. Popular clients like µTorrent, BitComet, and Vuze emerged, providing user-friendly interfaces for managing torrent downloads

## **2.2 How does torrenting work?**

Torrenting operates on a peer-to-peer (P2P) file-sharing model facilitated by the BitTorrent protocol. This decentralized approach differs significantly from traditional server-based methods and is

designed to enhance efficiency and speed in distributing large files. Let's delve into the workings of torrenting, with a focus on two fundamental concepts: seeding and leeching.

### **2.2.1. Basics of Torrenting:**

- **Torrent File Creation:**
  - A user who wants to share a file creates a small metadata file known as a torrent file. This file contains information about the files to be shared, the tracker (a server coordinating the file distribution), and cryptographic hash values to verify file integrity.
- **Tracker Communication:**
  - Users who want to download the file load the torrent file into a BitTorrent client. The client communicates with a tracker, which helps coordinate connections between peers (users sharing and downloading the file).

### **2.2.2 Seeding:**

- **Seeding Defined:**
  - A user who has the complete file and is actively sharing it with others is referred to as a "seeder." Seeders are crucial for the health of the torrent because they provide the complete file for others to download.
- **Seeders' Role:**
  - Seeders initiate the sharing process by making their complete copy of the file available to others. They continue to share even after their download is complete, contributing to the overall availability of the file in the torrent ecosystem.
- **Benefits of Seeding:**
  - Seeders enhance the download speeds for other users. As more seeders participate, the distribution of the file becomes more resilient and faster. The concept aligns with the principle of mutual benefit, where users share to receive better download speeds in return.

### **2.2.3. Leeching:**

- **Leeching Defined:**
  - On the other hand, a user who is in the process of downloading the file but has not yet completed the download is known as a "leecher."
- **Leechers' Role:**
  - Leechers actively download pieces of the file from seeders and other leechers. As they acquire more pieces, they, in turn, become potential seeders for others.
- **Dynamic Interactions:**
  - The torrent ecosystem thrives on dynamic interactions between seeders and leechers. Initially, a user may start as a leecher, but as they complete the download, they transition into a seeder, contributing to the continuous flow of data within the network.

### **2.2.4. Distributed Download Process:**

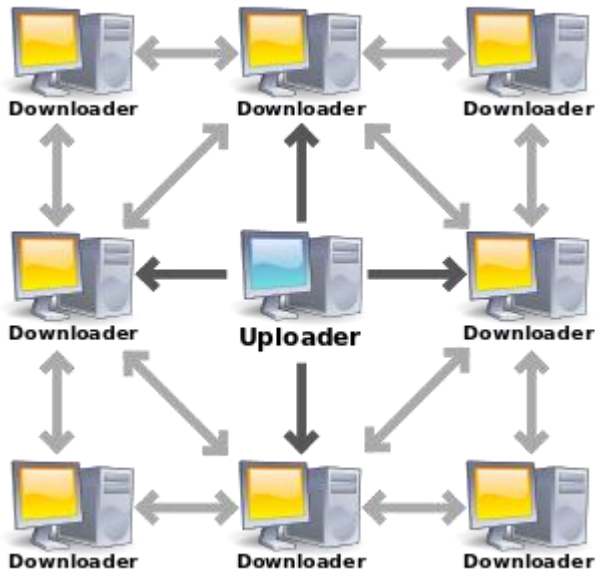
- **Piece-wise Download:**
  - Torrenting breaks down the file into smaller pieces. Each piece is usually a few megabytes in size. Users download these pieces in a non-sequential order from multiple sources concurrently.
- **Parallel Downloads:**
  - Multiple users may download different pieces of the file simultaneously. This parallel download process enhances speed and efficiency compared to traditional methods where a file is downloaded sequentially from a single server.

### **2.2.5. Mutual Dependence:**

- **Balancing Seeding and Leeching:**

- The effectiveness of torrenting relies on a balance between seeders and leechers. A healthy torrent has an adequate number of seeders to support the growing community of leechers, ensuring a continuous cycle of file distribution.

In summary, torrenting harnesses the collaborative power of its users, with seeders sharing complete files and leechers actively downloading and potentially transitioning into seeders. This decentralized, reciprocal model has transformed how large files are distributed across the internet, promoting efficiency, speed, and resilience in the sharing process.



## 2.3 Is Torrent legal?

The BitTorrent protocol itself is a neutral technology, and its legality is not inherently tied to the act of torrenting. Torrenting becomes a legal or illegal activity based on what content is being shared and whether the user has the legal right to distribute that content. Here's a breakdown:

### Legal Aspects:

1. **Open Source and Legitimate Content:**

- Torrenting is legal when used to share open-source software, freeware, public domain content, or any material for which the user has the legal right to distribute.

2. **Creative Commons and Authorized Distribution:**

- Content released under Creative Commons licenses or distributed with the author's explicit permission can also be legally shared through torrents.

3. **Game Updates, Software Patches, and Legal Distribution:**

- Some developers and software companies use torrents to distribute updates, patches, and other content legally. This is a legitimate and efficient way to manage large file distributions.

### Illegal Aspects:

1. **Copyrighted Material Without Authorization:**

- Torrenting becomes illegal when users share or download copyrighted material without proper authorization. This includes movies, music, software, and other proprietary content.

## **2. Piracy and Unauthorized Sharing:**

- Sharing or downloading content without the copyright holder's permission is considered piracy. This activity is a violation of intellectual property rights and can lead to legal consequences.

## **3. Distribution of Malicious Content:**

- Torrents can also be used to distribute malware or malicious software. Engaging in such activities is illegal and unethical.

### **Key Points to Consider:**

#### **• Torrenting Platforms:**

- Many torrenting platforms host and promote the sharing of copyrighted material without authorization. Engaging with such platforms increases the risk of participating in illegal activities.

#### **• Legal Alternatives:**

- To ensure legal compliance, users are encouraged to explore legal alternatives for accessing and distributing content, such as authorized streaming services, legitimate downloads, or purchasing physical copies.

#### **• Jurisdictional Variations:**

- The legality of torrenting can vary by jurisdiction. While some countries may have stricter copyright enforcement, others may have more lenient regulations. Users should be aware of the laws applicable in their region.

In summary, torrenting itself is a technology that can be used for both legal and illegal purposes. Whether torrenting is legal or not depends on the content being shared and the permissions granted by copyright holders. Engaging in the unauthorized sharing or downloading of copyrighted material is generally considered illegal and can result in legal consequences. Users should always adhere to copyright laws and respect intellectual property rights

## **2.4 Legal Technicality in Torrent Networks: Balancing Liability and Enforcement Challenges**

In the intricate landscape of torrent networks, the absence of a central operating system poses unique legal challenges, notably in determining liability for the illegal downloading of copyrighted materials. This report dissects the legal intricacies surrounding torrent networks, particularly in the context of data leaks affecting businesses. Firms confronted with such challenges confront a pivotal decision: whether to attribute liability to uploaders or downloaders.

Establishing legal fault for downloaders proves to be a formidable task in court. The decentralized nature of torrent networks means that individual pieces of a file are sourced from multiple locations simultaneously. Proving each fragment's connection to a copyrighted work becomes a complex and burdensome legal hurdle, creating ambiguity in pinpointing responsibility.

Conversely, uploaders face a different legal terrain. To share content on the torrent network, an uploader must possess the entire file on their system, rendering them more susceptible to legal targeting. Despite this vulnerability, the prosecution of actual clients on the network remains infrequent. Instead, legal actions are commonly directed towards websites facilitating torrent links, primarily due to the practicality and cost-effectiveness of targeting these platforms over individual network clients.

However, determination on the part of copyright holders can drive legal actions against network clients. Legislation in the United States and the European Union empowers Internet Service Providers (ISPs) to take action against subscribers suspected of infringing copyright. This includes the provision of three notices or "strikes" to subscribers before resorting to measures such as throttling or

disconnecting the internet connection. This legal framework reflects an attempt to balance the interests of copyright holders with the practical challenges of enforcing legal consequences on the expansive user base of torrent networks, acknowledging the complexities and nuances inherent in navigating the legal intricacies of torrenting activities.

## 2.5 Cloud Computing

Cloud computing can inadvertently support torrenting activities due to its inherent characteristics and features. While cloud services are designed to provide scalable, flexible, and accessible computing resources, these same attributes can be exploited for torrenting purposes. Here's an exploration of how cloud computing can inadvertently support torrenting:

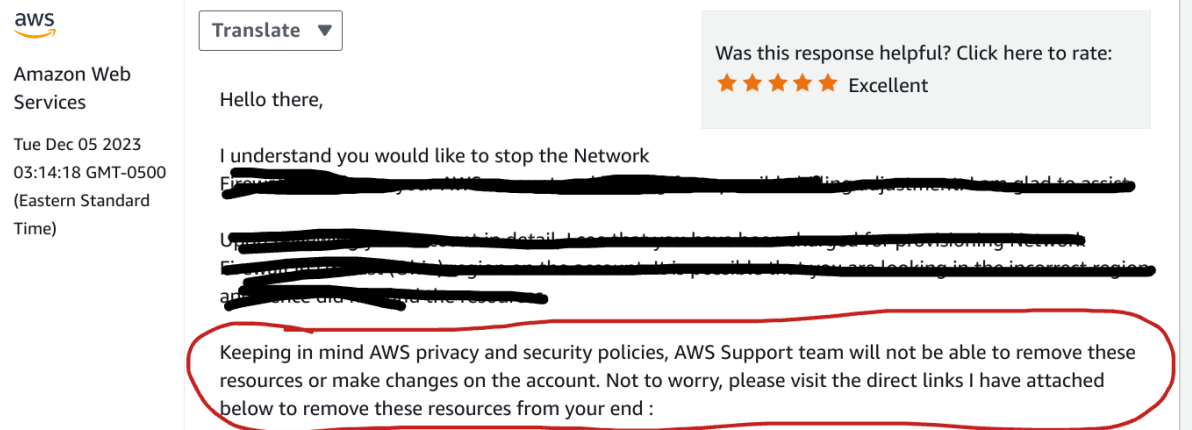
1. **Scalability and High Bandwidth:** Cloud platforms offer scalable resources and high-speed bandwidth, providing an ideal environment for efficient file-sharing. Torrenting, which relies on the distribution of files across multiple peers, benefits from the high bandwidth and distributed nature of cloud infrastructure, leading to faster download and upload speeds.
2. **Anonymity and Privacy:** Cloud services often provide a layer of anonymity and privacy to users. As torrenting inherently involves sharing and downloading files anonymously through a distributed network, utilizing cloud services can add an additional layer of confidentiality, making it challenging to trace the origin or destination of torrenting activities.
3. **Global Accessibility:** Cloud services allow users to access resources from anywhere in the world. Torrenting, being a decentralized peer-to-peer network, can leverage the global accessibility of cloud infrastructure to facilitate file-sharing activities on a broader scale. This global reach enhances the efficiency and widespread adoption of torrenting.
4. **Serverless Architecture:** The serverless architecture provided by some cloud platforms allows developers to run code without the need for managing servers. While this is advantageous for legitimate applications, it can also be exploited for creating decentralized torrenting systems that operate without a central server, making it challenging for authorities to target specific hosting locations.
5. **Ease of Deployment:** Cloud computing offers a user-friendly environment for deploying applications and services. This ease of deployment extends to torrent clients and tracker servers, making it convenient for users to set up and manage torrenting infrastructure on cloud platforms without extensive technical expertise.
6. **Use of Object Storage:** Cloud storage services, particularly object storage, provide a cost-effective and scalable solution for storing large amounts of data. This can be leveraged for hosting torrent files and related data, facilitating the distribution of metadata and content across the torrent network.

It's important to note that while cloud computing can inadvertently support torrenting activities, many cloud providers have strict policies against the hosting or distribution of copyrighted materials without proper authorization. As a result, cloud providers often employ measures to detect and prevent illegal torrenting activities on their platforms, and engaging in such activities may violate their terms of service, leading to account suspension or legal consequences.

The aspect of cloud computing that we want to focus on is its reliability or rather the trust factor. There is a term in cloud computing called the 'Shared Responsibility Model' where users are assured that their data is safe from an infrastructure point of view and that users are responsible for giving proper access control to their data. This also means that the cloud providers themselves are not



allowed to see within the user's cloud account. As proof, this is a screenshot of my chat with the aws support staff regarding a functionality.



All of this can be summarised as users in general are safe. People are free to use torrent clients and not be worried about legal actions. Thus the approach needs to be changed, instead of pursuing legal actions, technological blocks are needed. There are instances where countries have ordered ISPs to block a certain website hosting torrents but it is not enough as mirror sites are just as easily created. So our proposed solution is to inhibit users at the device level, and specifically in this case at the cloud instance level.

### 3. Plan of Action

The previous section covered the implications of using torrents, the following section will demonstrate the ease by which torrent applications can be downloaded and used on the cloud instance. The survey was conducted for 20 cloud providers. We have also formulated a matrix to check up on these cloud providers with the following criteria and gave them a score accordingly:

#### Survey Criteria:

1. **Terms & Conditions Evaluation:**
  - Assessing the terms and conditions of each cloud provider to identify any explicit mention of an anti-piracy policy.
2. **Enforcement Actions:**
  - Investigating whether the cloud providers specify fines or other actions in the event of users engaging in piracy activities.
3. **Active or Passive Piracy Detection:**
  - Differentiating between cloud providers actively searching for piracy activities and those relying on passive detection methods.
4. **Preventive Measures:**
  - Identifying any proactive steps taken by cloud providers to prevent or discourage users from engaging in torrenting activities.
5. **Torrent Application Installation:**
  - Evaluating the feasibility of installing and running torrent applications on the respective cloud instances provided by each service.

- To check if a client can easily install and run torrent applications, we designed the following method:

- 1) Create your instance on your chosen cloud
- 2) On the terminal enter the below code:
  - a) `git clone https://github.com/Bercik1337/rt-auto-install.git`
  - b) `cd rt-auto-install`
  - c) `sudo ./Rt-Install-minimal`
- 3) During installation it'll ask for username, password etc. If you're using ubuntu use ubuntu for everything
- 4) Then a few options will be given with an option to enter zero for installation
- 5) You should see the following screen:

```
-----
Rtorrent + Rutorrent Auto Install
Bercik https://github.com/Bercik1337
-----

Installation is complete.

Your default Apache2 vhost file has been disabled and replaced with a new one.
If you were using it, combine the default and rutorrent vhost file and enable it again.

Your downloads folder is in /home/ubuntu/Downloads
Sessions data is /home/ubuntu/.rtorrent-session
rtorrent's configuration file is /home/ubuntu/.rtorrent.rc

If you want to change settings for rtorrent, such as download folder, etc.,
you need to edit the '.rtorrent.rc' file. E.g. 'nano /home/ubuntu/.rtorrent.rc'
```

- 6) This means the installation is complete.
- 7) For proof of concept, run the command: `ps aux | grep rtorrent`

```
ubuntu@ip-172-31-5-94:~$ ps aux | grep rtorrent
ubuntu    10592  0.0  0.3  8616  3728 ?        Ss   03:57   0:00 /usr/bin/tmux -2 new-session -d -s rtorrent rtorrent
ubuntu    10593  0.0  1.6 177976 15744 pts/2    Ssl+ 03:57   0:00 rtorrent
ubuntu    10807  0.0  0.2   7004  2304 pts/0    S+   05:00   0:00 grep --color=auto rtorrent
```

An easy way to know if our cloud instance can download torrent file is to see if we can access websites hosting such illegal files. A simple ping command to one such website called 1337x is used.  
ping 104.21.42.214

## 4. Cloud Survey

### 4.1 Alibaba Cloud

<https://us.alibabacloud.com/>

- Able to install torrent clients? **Yes**

```
root@iZt4nd79z3cgn87ttna2sxZ:~/rt-auto-install# ps aux | grep rtorrent
root      14998  0.0  0.2   6608  2316 pts/0    S+   14:09   0:00 grep --color=auto rtorrent

root@iZt4nd79z3cgn87ttna2sxZ:~/rt-auto-install# ping 104.21.42.214
PING 104.21.42.214 (104.21.42.214) 56(84) bytes of data.
64 bytes from 104.21.42.214: icmp_seq=1 ttl=57 time=1.46 ms
64 bytes from 104.21.42.214: icmp_seq=2 ttl=57 time=1.42 ms
64 bytes from 104.21.42.214: icmp_seq=3 ttl=57 time=1.43 ms
64 bytes from 104.21.42.214: icmp_seq=4 ttl=57 time=1.48 ms
^C
-- 104.21.42.214 ping statistics --
4 packets transmitted, 4 received, 0% packet loss, time 3004 ms
rtt min/avg/max/mdev = 1.419/1.445/1.478/0.023 ms
```

- Anti-piracy policy present? **Yes**

## 7. Intellectual property

- The intellectual property rights of any data, technology or technical support, software, services, etc. provided by one party to the other party under this clause belong to the party providing them or its legal obligee; Except with the express consent of the provider or legal obligee, the other party has no right to copy, disseminate, transfer, license or provide others with the use of the above intellectual achievements, otherwise it shall bear corresponding responsibilities.
- You should ensure that the materials submitted by Alibaba Cloud, the use of Alibaba Cloud services and the results of using Alibaba Cloud services do not infringe the legitimate rights and interests of any third party. Alibaba Cloud should ensure that the services provided to you do not infringe the legitimate rights and interests of any third party.
- If a third party institution or individual questions or complains about the ownership of the intellectual property rights of the relevant materials involved in your use of Alibaba Cloud services, or questions or complains about the ownership of the intellectual property rights of the Alibaba Cloud services you use, you and Alibaba Cloud are responsible for issuing the relevant intellectual property rights certification materials and cooperating with the other party's relevant complaint handling. The breaching party shall be responsible for the settlement of the claims, lawsuits or possible lawsuits arising therefrom, bear the costs and losses, and exempt the other party from liability.

- Any fine or legal action if caught? **Yes]**
- Any steps taken as preventive measures? **Yes**

[https://ipp.alibabacloud.com/global/aliyun/complaint.htm?lang=en\\_US#/complaintPage/aliyun](https://ipp.alibabacloud.com/global/aliyun/complaint.htm?lang=en_US#/complaintPage/aliyun)

## 4.2 Amazon Web Services (AWS)

<https://aws.amazon.com/>

- Able to install torrent clients? **Yes**

```
ubuntu@ip-172-31-5-94:~$ ps aux | grep rtorrent
ubuntu 10592 0.0 0.3 8616 3728 ? Ss 03:57 0:00 /usr/bin/tmux -2 new-session -d -s rtorrent rtorrent
ubuntu 10593 0.0 1.6 177976 15744 pts/2 Ssl+ 03:57 0:00 rtorrent
ubuntu 10807 0.0 0.2 7004 2304 pts/0 S+ 05:00 0:00 grep --color=auto rtorrent
```

```
ubuntu@ip-172-31-18-34:~$ ping 104.21.42.214
PING 104.21.42.214 (104.21.42.214) 56(84) bytes of data:
64 bytes from 104.21.42.214: icmp_seq=1 ttl=54 time=9.21 ms
64 bytes from 104.21.42.214: icmp_seq=2 ttl=54 time=9.23 ms
64 bytes from 104.21.42.214: icmp_seq=3 ttl=54 time=9.25 ms
64 bytes from 104.21.42.214: icmp_seq=4 ttl=54 time=9.26 ms
64 bytes from 104.21.42.214: icmp_seq=5 ttl=54 time=9.31 ms
^C
--- 104.21.42.214 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 9.208/9.250/9.312/0.035 ms
```

- Anti-piracy policy present? **Yes**

## AWS Acceptable Use Policy

Last Updated: July 1, 2021

This Acceptable Use Policy ("Policy") governs your use of the services offered by Amazon Web Services, Inc. and its affiliates ("Services") and our website(s) including <http://aws.amazon.com> ("AWS Site"). We may modify this Policy by posting a revised version on the AWS Site. By using the Services or accessing the AWS Site, you agree to the latest version of this Policy.

You may not use, or facilitate or allow others to use, the Services or the AWS Site:

- for any illegal or fraudulent activity;
- to violate the rights of others;
- to threaten, incite, promote, or actively encourage violence, terrorism, or other serious harm;
- for any content or activity that promotes child sexual exploitation or abuse;
- to violate the security, integrity, or availability of any user, network, computer or communications system, software application, or network or computing device;
- to distribute, publish, send, or facilitate the sending of unsolicited mass email or other messages, promotions, advertising, or solicitations (or "spam").

- Any fine or legal action if caught? **Yes**. The sentence highlighted in the screen-shot means that violations will be corrected with the help of the user

#### Investigation and Enforcement

We may investigate any suspected violation of this Policy, and remove or disable access to any content or resource that violates this Policy. **You agree to cooperate with us to remedy any violation.**

When determining whether there has been a violation of this Policy, we may consider your ability and willingness to comply with this Policy, including the policies and processes you have in place to prevent or identify and remove any prohibited content or activity.

1.4. In connection with your use of the Services, you are responsible for maintaining licenses and adhering to the license terms of any software you run. If we reasonably believe any of Your Content violates the law, infringes or misappropriates the rights of any third party, or otherwise violates a material term of the Agreement (including the Service Terms, or the Acceptable Use Policy) ("Prohibited Content"), we will notify you of the Prohibited Content and may request that such content be removed from the Services or access to it be disabled. If you do not remove or disable access to the Prohibited Content within 2 business days of our notice, we may remove or disable access to the Prohibited Content or suspend the Services to the extent we are not able to remove or disable access to the Prohibited Content. Notwithstanding the foregoing, we may remove or disable access to any Prohibited Content without prior notice in connection with illegal content, where the content may disrupt or threaten the Services or in accordance with applicable law or any judicial, regulatory or other governmental order or request. In the event that we remove Your Content without prior notice, we will provide prompt notice to you unless prohibited by law. We terminate the accounts of repeat infringers in appropriate circumstances.

- Active or passive? **Passive** as there's no pre-screening before launching ec2
- Any steps taken as preventive measures? **Yes**

<https://support.aws.amazon.com/#/contacts/report-abuse>

### 4.3 DigitalOcean

- Able to install torrent clients? **Yes**

```
root@ubuntu-s-1vcpu-512mb-10gb-sfo3-01:~/rt-auto-install# ping 104.21.42.214
PING 104.21.42.214 (104.21.42.214) 56(84) bytes of data.
64 bytes from 104.21.42.214: icmp_seq=1 ttl=58 time=2.37 ms
64 bytes from 104.21.42.214: icmp_seq=2 ttl=58 time=1.42 ms
64 bytes from 104.21.42.214: icmp_seq=3 ttl=58 time=1.43 ms
64 bytes from 104.21.42.214: icmp_seq=4 ttl=58 time=1.43 ms
^C
--- 104.21.42.214 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3005ms
rtt min/avg/max/mdev = 1.417/1.661/2.372/0.410 ms
root@ubuntu-s-1vcpu-512mb-10gb-sfo3-01:~/rt-auto-install# ps aux | grep rtorrent
root      17328  0.0  0.4   7004  2248 pts/0    S+   07:39   0:00 grep --color=auto rtorrent
```

- Anti-piracy policy present? **Yes**

#### 11. Indemnification

To the fullest extent permitted by law, you are responsible for your use of the Websites and Services, and you shall defend, indemnify, and hold harmless us and our employees, officers, directors, agents, contractors, and representatives from all liabilities, claims, and expenses, including reasonable attorneys' fees and costs, that arise from or relate to your Services Content, User Content, your End Users, or your access to or use of the Websites and Services, including your breach of this TOS or applicable law, willful misconduct, negligence, illegal activity, breach of security or data, unauthorized access to or use of your Account, or infringement of a third party's right, including any intellectual property, confidentiality, property or privacy right. We reserve the right to assume the exclusive defense and control of any matter otherwise subject to indemnification by you, without limiting your indemnification obligations with respect to that matter, in which event you will make best efforts to assist and cooperate with us in defending the matter at your expense.

- Any fine or legal action if caught? **Yes**
- Active or passive? **passive**
- Any steps taken as preventive measures? **Yes**

<https://www.digitalocean.com/company/contact/abuse#dmca>

## 4.4 Google Cloud Platform (GCP)

- Able to install torrent clients? **Yes**

```
mukulsp99@instance-1:~/rt-auto-install$ ps aux | grep rtorrent
ubuntu 10303 0.0 0.3 8712 3600 ? Ss 08:01 0:00 /usr/bin/tmux -2 new-session -d -s rtorrent rtorrent
ubuntu 10304 0.0 1.5 177980 15488 pts/2 Ssl+ 08:01 0:00 rtorrent
mukulsp+ 10323 0.0 0.2 7004 2304 pts/0 R+ 08:02 0:00 grep --color=auto rtorrent

mukulsp99@instance-1:~/rt-auto-install$ ping 104.21.42.214
PING 104.21.42.214 (104.21.42.214) 56(84) bytes of data.
64 bytes from 104.21.42.214: icmp_seq=1 ttl=61 time=9.24 ms
64 bytes from 104.21.42.214: icmp_seq=2 ttl=61 time=8.63 ms
64 bytes from 104.21.42.214: icmp_seq=3 ttl=61 time=8.77 ms
64 bytes from 104.21.42.214: icmp_seq=4 ttl=61 time=8.74 ms
64 bytes from 104.21.42.214: icmp_seq=5 ttl=61 time=8.76 ms
^C
--- 104.21.42.214 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4007ms
rtt min/avg/max/mdev = 8.629/8.827/9.242/0.213 ms
mukulsp99@instance-1:~/rt-auto-install$
```

- Anti-piracy policy present?

3.5 Copyright. Google responds to notices of alleged copyright infringement and terminates the Accounts of repeat infringers in appropriate circumstances as required to maintain safe harbor for online service providers under the U.S. Digital Millennium Copyright Act.

- Any fine or legal action if caught?

### 13. Indemnification.

13.1 Google Indemnification Obligations. Google will defend Customer and its Affiliates using the Services under Customer's Account and indemnify them against Indemnified Liabilities in any Third-Party Legal Proceeding to the extent arising from an allegation that any Service or any Google Brand Feature, in each case used in accordance with the Agreement, infringes the third party's Intellectual Property Rights.

- Active or passive? **passive**
- Any steps taken as preventive measures? **Yes**

[https://support.google.com/legal/answer/3110420?visit\\_id=638374471558392087-4200424217&rd=2](https://support.google.com/legal/answer/3110420?visit_id=638374471558392087-4200424217&rd=2)

## 4.5 HP Helion Cloud

- Able to install torrent clients? **no**
- Anti-piracy policy present? **Yes**

**16. Intellectual Property Rights Infringement.** HPE will defend and/or settle any claims against Customer that allege that an HPE-branded product or service as supplied under this Agreement infringes the intellectual property rights of a third party. HPE will rely on Customer's prompt notification of the claim

CTPS01-Revision 02Apr12 Canada Version 1

Page 2 of 4

Agreement Number(s) where required:

HPE:.....

Customer:.....

Effective Date (if applicable):.....

Term Length (if applicable):.....

and cooperation with our defense. HPE may modify the product or service so as to be non-infringing and materially equivalent, or we may procure a license. If these options are not available, we will refund to Customer the amount paid for the affected product in the first year or the depreciated value thereafter or, for support services, the balance of any pre-paid amount or, for professional services, the amount paid. HPE is not responsible for claims resulting from any unauthorized use of the products or services. This section shall also apply to deliverables identified as such in the relevant Support Material except that HPE is not responsible for claims resulting from deliverables content or design provided by Customer.

- Any fine or legal action if caught? **Yes**
- Active or passive? **Passive**
- Any steps taken as preventive measures? **Yes** there is a pre-screening .Thus it takes at least 7 business days to create an instance

#### 4.6 Joyent Triton Compute

- Able to install torrent clients? **no**
- Anti-piracy policy present? **Yes**

While Joyent reserves the right to monitor your Customer Data, we are under no obligation to do so.

**B. DMCA.** You are responsible for properly handling and processing notices sent to you (or any of your affiliates) by any person claiming that Customer Data violates such person's rights, including notices pursuant to the Digital Millennium Copyright Act.

- Any fine or legal action if caught? **Yes**. Same screen shot as above
- Active or passive? **passive**
- Any steps taken as preventive measures? Yes, there's a pre-screening. Need to contact sales to get a cloud

#### 4.7 Linode

- Able to install torrent clients? **Yes**

```
root@localhost:~/rt-auto-install# ps aux | grep rtorrent
root      10077  0.0  0.2  6608  2296 pts/0    S+   09:45   0:00 grep --color=auto rtorrent
root@localhost:~/rt-auto-install#
```

```
root@localhost:~/rt-auto-install# ping 104.21.42.214
PING 104.21.42.214 (104.21.42.214) 56(84) bytes of data.
64 bytes from 104.21.42.214: icmp_seq=1 ttl=52 time=0.962 ms
64 bytes from 104.21.42.214: icmp_seq=2 ttl=52 time=1.03 ms
64 bytes from 104.21.42.214: icmp_seq=3 ttl=52 time=1.03 ms
64 bytes from 104.21.42.214: icmp_seq=4 ttl=52 time=1.04 ms
^C
--- 104.21.42.214 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 0.962/1.015/1.039/0.030 ms
```

- Anti-piracy policy present? **Yes**

7. **Intellectual Property.** You shall not use Linode's network or services to download, publish, display, distribute, copy or otherwise use or make available in any manner any text, music, software, art, image or other work protected by law unless: (i) you have been expressly authorized by the owner of the property; or (ii) you are otherwise authorized by established Intellectual Property law.

- Any fine or legal action if caught? **Yes**



10. **Enforcement and Effect of Violation.** Violation of any provision of this Policy, whether as a single-instance or repeated occurrence, may result in the immediate interruption, suspension, or termination of your access and use of the Services, as determined by Linode at Linode's sole discretion. You acknowledge, understand, and agree that Linode shall not be required to issue warnings, reprimands, or undergo any formal or informal process prior to causing the Services to be interrupted, suspended, and/or terminated.

- Active or passive? **Passive**
- Any steps taken as preventive measures? **Yes**

<https://www.linode.com/legal-abuse/>

## 4.8 Microsoft Azure

- Able to install torrent clients? **Yes**

```
azureuser@test1:~/rt-auto-install$ ps aux | grep rtorrent
azureus+  11934  0.0  0.4  8712  3856 ?        Ss   00:18   0:00 /usr/bin/tmux -2 new-session -d -s rtorrent rtorrent
azureus+  11935  0.0  2.0 177984 17736 pts/2    Ssl+ 00:18   0:00 rtorrent
azureus+  11955  0.0  0.2   7004  2432 pts/0    S+   00:20   0:00 grep --color=auto rtorrent

azureuser@test1:~/rt-auto-install$ ping 104.21.42.214
PING 104.21.42.214 (104.21.42.214) 56(84) bytes of data.
64 bytes from 104.21.42.214: icmp_seq=1 ttl=53 time=17.5 ms
64 bytes from 104.21.42.214: icmp_seq=2 ttl=53 time=17.7 ms
64 bytes from 104.21.42.214: icmp_seq=3 ttl=53 time=17.8 ms
64 bytes from 104.21.42.214: icmp_seq=4 ttl=53 time=18.6 ms
^C
--- 104.21.42.214 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3006ms
rtt min/avg/max/mdev = 17.464/17.880/18.575/0.417 ms
azureuser@test1:~/rt-auto-install$
```

- Anti-piracy policy present? **Yes**

Certain software may require a key to install or access it. You are responsible for the use of any keys assigned to you. You may not transfer, sell, share, sublicense, assign, or lend keys. Key activity is monitored. Microsoft reserves the right to suspend or terminate your Azure for Students subscription or access to the software, without any notice or obligation to you, if we detect suspicious activity related to keys or activations. Microsoft reserves the right to determine in its sole discretion whether an activity constitutes suspicious activity. Microsoft may deactivate or otherwise limit your keys when your Azure for Students subscription ends. Deactivated keys will not be able to activate software. You will not engage in or facilitate the unauthorized manufacture, duplication, delivery, sale, transfer or use of counterfeit, pirated, unlicensed or illegal Microsoft products or services, or otherwise infringe any of Microsoft's intellectual property rights. You will timely report to Microsoft any suspected counterfeiting, piracy or other intellectual property infringement, and will reasonably cooperate with Microsoft and its affiliates in the investigation of any such activities. You may not use Software Download Benefits to provide any services to others (such as hosting, web agency, integration or outsourced development, etc.).

- Any fine or legal action if caught? **No, just account suspension**
- Active or passive? **Passive**
- Any steps taken as preventive measures? **Yes**

<https://www.microsoft.com/en-us/legal/intellectualproperty/infringement>

## 4.9 Oracle Cloud

- Able to install torrent clients? **Yes**

```
ubuntu@instance-20231206-2007:~/rt-auto-install$ ps aux | grep rtorrent
ubuntu    11229  0.0  0.3  8712  3780 ?        Ss   01:17   0:00 /usr/bin/tmux -2 new-session -d -s rtorrent rtorrent
ubuntu    11230  0.0  1.6 177980 15720 pts/2    Ssl+ 01:17   0:00 rtorrent
ubuntu    11246  0.0  0.2   7004  2204 pts/0    S+   01:18   0:00 grep --color=auto rtorrent
```

```

ubuntu@instance-20231206-2007:~/rt-auto-install$ ping 104.21.42.214
PING 104.21.42.214 (104.21.42.214) 56(84) bytes of data.
64 bytes from 104.21.42.214: icmp_seq=1 ttl=60 time=1.18 ms
64 bytes from 104.21.42.214: icmp_seq=2 ttl=60 time=1.14 ms
64 bytes from 104.21.42.214: icmp_seq=3 ttl=60 time=1.14 ms
64 bytes from 104.21.42.214: icmp_seq=4 ttl=60 time=1.14 ms
^C
--- 104.21.42.214 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 1.136/1.148/1.180/0.018 ms
ubuntu@instance-20231206-2007:~/rt-auto-install$

```

- Anti-piracy policy present? **Yes**

#### 6. Your Content

You agree that you will only upload, share, post, publish, transmit, or otherwise make available ("Share") on or through the Site Content that you have the right and authority to Share and for which you have the right and authority to grant to Oracle all of the licenses and rights set forth herein. By Sharing Content, you grant Oracle a worldwide, perpetual, royalty-free, irrevocable, nonexclusive, fully sublicenseable license to use, reproduce, modify, adapt, translate, publish, publicly perform, publicly display, broadcast, transmit and distribute the Content for any purpose and in any form, medium, or technology now known or later developed. This includes, without limitation, the right to incorporate or implement the Content into any Oracle product or service, and to display, market, sublicense and distribute the Content as incorporated or embedded in any product or service distributed or offered by Oracle without compensation to you. You warrant that: (a) you have the right and authority to grant this license; (b) Oracle's exercise of the rights granted pursuant to this license will not infringe or otherwise violate any third party rights; and (c) all so-called moral rights in the Content have been waived to the full extent allowed by law.

You agree that you will neither use the Site in a manner, nor Share any Content, that: (a) is false or misleading; (b) is defamatory, derogatory, degrading or harassing of another or constitutes a personal attack; (c) invades another's privacy or includes, copies or transmits another's confidential, sensitive or personal information; (d) promotes bigotry, racism, hatred or harm against any group or individual; (e) is obscene or not in good taste; (f) violates or infringes or promotes the violation or infringement of another's rights, including intellectual property rights; (g) you do not have the right and authority to Share and grant the necessary rights and licenses for; (h) violates or promotes the violation of any applicable laws or regulations; (i) contains a solicitation of funds, goods or services, or promotes or advertises goods or services; or (j) contains any viruses, Trojan horses, or other components designed to limit or harm the functionality of a computer. Oracle may report you to the relevant authorities and may act under the fullest extent of applicable laws if you transmit or upload content intended or designed to cause harm.

- Any fine or legal action if caught? **Yes**

#### 11. Termination of Use

Oracle may, in its sole discretion, at any time discontinue providing or limit access to the Site, any areas of the Site or Content provided on or through the Site. You agree that Oracle may, in its sole discretion, at any time, terminate or limit your access to, or use of, the Site or any Content. Oracle may terminate or limit your access to or use of the Site if Oracle determines, in its sole discretion, that you have infringed the copyrights of a third party. You agree that Oracle shall not be liable to you or any third-party for any termination or limitation of your access to, or use of, the Site or any Content, including Content that you may have Shared.

- Active or passive? **Passive**
- Any steps taken as preventive measures? **Yes**

### 4.10 Rackspace

- Able to install torrent clients? **No**
- Anti-piracy policy present? **Yes**



## Protection and proper use of company assets and resources

Rackspace Technology provides an array of information and technology resources intended to maximize its employees' efficiency, such as email, computers, computer applications networks, the internet, the intranet, facsimile machines, cell phones, other wireless communication devices, telephones and voice mail systems. Please remember that these tools are Company property and must be used in a manner that reflects positively on Rackspace Technology and all who work here. Occasional, limited personal use of these resources is permitted, but that use cannot interfere with employees' work performance or the work performance of their colleagues. Rackspace Technology will not tolerate inappropriate or illegal use of these assets, and reserves the right to take appropriate disciplinary actions, as needed, up to and including termination of employment. Such inappropriate use of these resources can include, but are not limited to, the following:

- Any fine or legal action if caught? **Yes**
- Active or passive? **Active**, requires a pre-screening
- Any steps taken as preventive measures? **Yes**

### 4.11 Scaleway

- Able to install torrent clients? **Yes**

```
root@scw-stoic-wiles:~/rt-auto-install# ps aux | grep rtorrent
ubuntu    10519  0.0  0.1  6080  3600 ?        Ss   02:16   0:00 /usr/bin/tmux -2 new-session -d -s rtorrent rtorrent
ubuntu    10520  0.0  0.7 175000 15620 pts/2    Ssl+ 02:16   0:00 rtorrent
root      10570  0.0  0.1  4024  2112 pts/0    S+   02:17   0:00 grep --color=auto rtorrent

root@scw-stoic-wiles:~/rt-auto-install# ping 104.21.42.214
PING 104.21.42.214 (104.21.42.214) 56(84) bytes of data.
64 bytes from 104.21.42.214: icmp_seq=1 ttl=56 time=1.03 ms
64 bytes from 104.21.42.214: icmp_seq=2 ttl=56 time=1.02 ms
64 bytes from 104.21.42.214: icmp_seq=3 ttl=56 time=0.971 ms
64 bytes from 104.21.42.214: icmp_seq=4 ttl=56 time=1.24 ms
^C
--- 104.21.42.214 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 0.971/1.063/1.236/0.102 ms
root@scw-stoic-wiles:~/rt-auto-install#
```

- Anti-piracy policy present? **Yes**

#### 4.2.

Users undertake to use the Cloud Services in a legal manner, in line with the regulations in force and in compliance with the General Conditions and Special Conditions. In a general manner, SCALEWAY has no knowledge of the content stored on its Servers. As a consequence, Users undertake to guarantee SCALEWAY against all recourse, claims or legal proceedings relating to content stored on the Servers by the User, in the context of the Cloud Services.

- Any fine or legal action if caught? **Yes**

- The dissemination of tangible or intangible property protected by intellectual, literary, artistic or industrial property rights that may constitute counterfeiting. Under law no. 2009-669 of 12 June 2009, in consideration of the dangers for the renewal of artistic creation and for the economy of the cultural sector from practices not complying with copyright and performing rights, Users are obliged to ensure that their access is not used for the purposes of reproduction, representation, provision or communication to the public of works or objects protected by copyright or performing rights without the authorisation of the holders of the rights specified in books I and II of the Intellectual Property Code. Any breach of this obligation by a User or by third-parties to which the User gives its access, is likely to incur liability on the User's part. In particular, SCALEWAY may be forced by the HADOPI to suspend Users' access to on-line services used to communicate with the public. Users are reminded that a legal product exists providing cultural content on-line and means to secure it that can be used to prevent breaches of the obligation defined in article L. 336-3 of the Intellectual Property Code. In addition, Users recognise that violation of copyright or performing rights (such as for example, the reproduction, representation, provision or communication to the public of works or objects protected by copyright or performing rights without the authorisation of the holders of these rights) constitutes an act of counterfeiting, punishable by civil and/or criminal penalties (up to 3 years' imprisonment and a fine of 300,000 euros). Users recognise that piracy harms artistic creation.

- Active or passive? **Passive**
- Any steps taken as preventive measures? **Yes**

<https://www.scaleway.com/en/legal-notice/>

## 4.12 VMware Cloud

- Able to install torrent clients? **No**, pre-screening by contacting sales
- Anti-piracy policy present? **Yes**

**1.3** You must not upload into the Service Offering any content that: (a) may create a risk of harm or loss or damage to any person or property; (b) may constitute or contribute to a crime or a tort; (c) includes any data that is illegal, unlawful, harmful, pornographic, defamatory, infringing, or invasive of personal privacy or publicity rights; (d) contains any data that you do not have a right to upload into the Service Offering; (e) constitutes information governed by HIPAA unless you have signed the VMware Business Associate Agreement ; or (f) is otherwise prohibited as specified in the Agreement.

- Any fine or legal action if caught? **Yes**

"Upon expiration of the Agreement, or in the event of termination of the Agreement in accordance with 41 U.S.C. chapter 71 (Contract Disputes) and FAR 52.233-1 (Disputes): (a) all rights granted to you under the Agreement, including your ability to use the Service Offering, will be terminated; and (b) you must promptly discontinue your use of the Service Offering and delete or destroy any VMware or our licensors' Confidential Information in your possession."

Active or passive? **Passive**

Any steps taken as preventive measures? **Yes**

**2.3 Notification of Copyright Infringement.** If you believe that your copyrighted work has been copied and is accessible on the Service Offering in a way that constitutes copyright infringement you may send a notice to our copyright agent, providing the following information: (a) a description of the copyrighted work that you claim has been infringed and a description of the infringing activity; (b) the location of the material that you claim is infringing, such as the URL where it is posted; (c) your name, address, telephone number, and email address; (d) a statement by you that you have a good faith belief that the disputed use of the material is not authorized by the copyright owner, its agent, or the law; (e) your statement under penalty of perjury that the information in your notice of infringement concern is accurate, and that you are the copyright owner or are authorized to act on the copyright owner's behalf; and (f) your electronic or physical signature, as the copyright owner or as the person authorized to act on the copyright owner's behalf. Solely for purposes of reporting copyright infringement, contact VMware's copyright agent as follows:

VMware, Inc.  
Intellectual Property Counsel  
3401 Hillview Avenue  
Palo Alto, California 94304  
United States of America  
Email: [copyright@vmware.com](mailto:copyright@vmware.com)  
Telephone: +1-877-486-9273

## **5. Experimental Study: Evaluating Cloud Provider Measures - A Proactive Approach**

### **5.1 Methodology:**

To comprehensively assess the effectiveness of measures implemented by various cloud providers in deterring unlawful use of their resources, a proactive methodology was devised. The objective was to gain insights into the cloud provider's perspective by creating a simulated cloud infrastructure using OpenStack. OpenStack, while not as advanced as major cloud providers like AWS or Azure, provides a holistic view of typical backend functionalities, offering a valuable bird's-eye perspective. It is crucial to note that OpenStack's internal functionalities may be limited compared to industry giants; however, its accessibility, documentation, and free availability make it an ideal platform for experimentation and learning in the realm of cloud computing.

The methodology involved the following steps:

#### **1. Creation of Virtual Network Interface:**

- Utilizing OpenStack, a virtual network interface was established to mimic the networking infrastructure characteristic of cloud environments. This step aimed to replicate the foundational network structures of cloud providers.

#### **2. Setup of Virtual Router:**

- A virtual router was implemented within the OpenStack environment, mirroring the routing functionalities inherent in cloud platforms. This step provided insights into how cloud providers manage and control data traffic within their infrastructure.

#### **3. Configuration of Compute Instance:**

- Through OpenStack, a compute instance was configured to emulate the virtual machines or instances that users deploy on cloud platforms. This step allowed for a hands-on exploration of the backend functionality associated with hosting user instances.

### **5.1.1 What is OpenStack:**

OpenStack stands as a free, open standard cloud computing platform renowned for delivering Infrastructure-as-a-Service (IaaS) capabilities across both public and private cloud environments. Analogous to how industry giants like AWS offer services such as EC2 to users, OpenStack provides a versatile framework where virtual servers and diverse resources are accessible to users.

### **Key Features of OpenStack:**

#### **▪ Comprehensive Infrastructure Services:**

OpenStack comprises a robust set of components dedicated to managing processing, storage, and networking resources within a cloud infrastructure. This comprehensive suite of services enables users to build and customize their cloud environments based on specific requirements.

#### **▪ Public and Private Cloud Deployment:**

A distinctive feature of OpenStack lies in its ability to operate in both public and private cloud settings. Whether users seek the flexibility of a public cloud or the control and security of a private cloud, OpenStack caters to diverse deployment scenarios.

- **User-Friendly Management Interfaces:**

OpenStack offers multiple avenues for users to manage their cloud resources. Users can navigate the platform through a web-based dashboard for an intuitive graphical interface, employ command-line tools for more advanced control, or interact with the platform via RESTful web services for programmatic access.

- **Virtualization Support:**

The platform extends support for various virtualization technologies, allowing users to deploy and manage virtual machines efficiently. This virtualization support enhances the platform's flexibility and compatibility with different virtualization solutions.

- **Community-Driven and Open Source:**

OpenStack operates on a collaborative and open-source model, benefitting from contributions and feedback from a diverse community of developers and users. This approach ensures continuous improvement, innovation, and adaptability to evolving cloud computing needs.

- **Scalability and Customization:**

OpenStack's modular architecture facilitates scalability and customization. Users can scale their cloud infrastructure based on changing demands and tailor their setups to align with specific business requirements

## 5.2 Steps Taken to Install OpenStack

The various steps taken along with its commands are as follows. We create a user called stack and give it privileges. After that, we clone the git repository and create a local.conf file that contains the credentials that will be used later for signing in. We run the script and have it installed in 15-20 minutes.

```
sudo useradd -s /bin/bash -d /opt/stack -m stack
```

```
sudo chmod +x /opt/stack
```

```
echo "stack ALL=(ALL) NOPASSWD: ALL" | sudo tee /etc/sudoers.d/stack
```

```
sudo -u stack -i
```

```
git clone https://opendev.org/openstack/devstack
```

```
cd devstack
```

**Touch local.conf**

**Vim local.conf**

```
[[local|localrc]]
ADMIN_PASSWORD=secret
DATABASE_PASSWORD=$ADMIN_PASSWORD
RABBIT_PASSWORD=$ADMIN_PASSWORD
SERVICE_PASSWORD=$ADMIN_PASSWORD
```

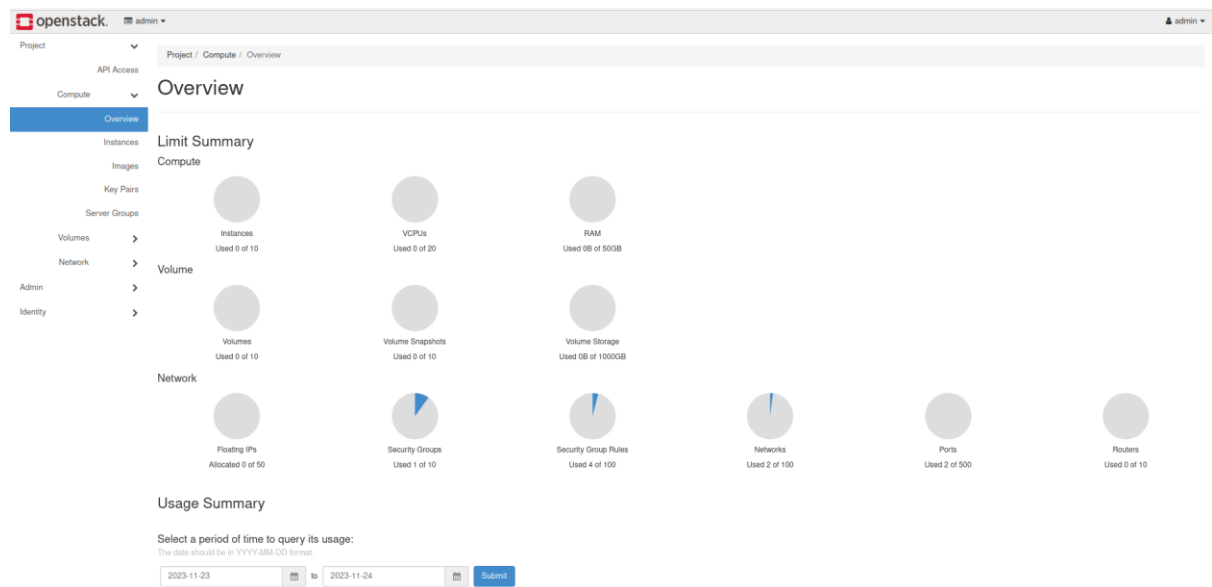
./stack.sh

```
This is your host IP address: 172.31.6.246
This is your host IPv6 address: ::1
Horizon is now available at http://172.31.6.246/dashboard
Keystone is serving at http://172.31.6.246/identity/
The default users are: admin and demo
The password: secret

Services are running under systemd unit files.
For more information see:
https://docs.openstack.org/devstack/latest/systemd.html

DevStack Version: 2024.1
Change: 2211c778db0e18702c7177f7750571c3a3697509 Allow devstack to set cache driver for glance 2023-11-22 06:25:48 +0000
OS Version: Ubuntu 22.04 jammy

2023-11-24 16:42:53.246 | stack.sh completed in 1050 seconds.
stack@ip-172-31-6-246:~/devstack$
```



## 5.3 Setting up an instance and creating Virtual Network Devices

### Step 1: Creating a Key pair

We create a key pair on our computer. The computer acts as the hardware for our platform. The key pair will be used ssh into our instance later.

```
ssh-keygen -t rsa -b 4096 -f ~/.ssh/id_rsa
```

### Step 2: Creating a Network

OpenStack comes with a “public” network by default that can access the internet. We created another network called “net1”, that’ll connect to the public network.

```
network create net1 --share
```

```
(openstack) network list
```

ID	Name	Subnets
388bc94a-2fee-4d14-a9a2-7534515ba41d	shared	b029bab0-95fa-4e56-b568-78bc76831618
63400735-ae8c-48ea-b4b1-78ff94decab4	net1	231f150e-a872-4942-82ce-73140f54212b
a47e7db0-94b9-4635-a584-30e950df70ee	public	010222b9-68c1-41ac-bed4-c94086e8f0ad, 649080cf-75be-45d5-aafd-8f560de4d8f7
cdeed017-d486-4764-8d7e-f41241a24740	private	46438301-b8c6-44ee-aa3d-1f74e9bb59ae, f88044d7-1837-42ee-9cbf-4250e789399b

### Step 3: Creating a Subnet

We now create a subnet to assign to our newly created network

```
subnet create subnet1 --network net1 --subnet-range 192.0.2.0/24
```

#### **Step 4: Creating a Router**

We create a router that'll help create a connection between the public network and our new network. One end of the router is connected to the gateway of the public network and the other to the subnet gateway

```
router create router2
```

```
router set router2 --external-gateway public
```

```
router add subnet router2 subnet1
```

```
(openstack) router list
```

ID	Name	Status	State	Project
11e2a17a-efd2-4f75-a09f-bf390d4b30c3	router2	ACTIVE	UP	d5facbb1069845688b256689993b414e
f1b02a6d-cbf7-4c4b-bd48-cb4412746518	router1	ACTIVE	UP	d5facbb1069845688b256689993b414e

#### **Step 5: Creating a Security Group**

We created a Security Group that'll allow TCP/UDP, SSH and ICMP connections. The security group acts like a firewall.

```
security group create testsec
```

```
security group rule create --proto tcp --dst-port 1:65525 testsec
```

```
security group rule create --proto udp --dst-port 1:65525 testsec
```

#### **Ssh key**

```
security group rule create --proto tcp testsec
```

```
security group rule create --proto tcp --src-ip 0.0.0.0/0 --dst-port 22 testsec
```

```
security group rule create testsec --protocol tcp --dst-port 22:22 --remote-ip 0.0.0.0/0
```

```
security group rule create --protocol udp --dst-port 53:53 testsec
```

#### **ICMP**

```
security group rule create --proto icmp testsec
```

#### **Step 6: Importing a Keypair**

We now import the keypair we had created at the Step 1. This key will be used to SSH into the instance

```
keypair create --public-key ~/.ssh/id_rsa.pub mykey
```

#### **Step 7: Configuring an OS image**

We have by default Cirros OS given to us by OpenStack. But this OS is for testing purposes only and can only be used for ping. So we downloaded an ubuntu image and configured it on openstack

```
Wget https://cloud-images.ubuntu.com/jammy/20231027/jammy-server-cloudimg-amd64-disk-kvm.img
```

```
openstack image create --disk-format qcow2 --container-format bare --public --file /opt/stack/devstack/jammy-server-cloudimg-amd64-disk-kvm.img ubuntu
```

```
(openstack) image list
```

ID	Name	Status
a70c85b7-dd42-4c4f-aeb9-d3b622e8d025	cirros-0.6.2-x86_64-disk	active
e9150bbf-a1b7-4cd9-92f3-569d0dbc4645	ubuntu-image	active

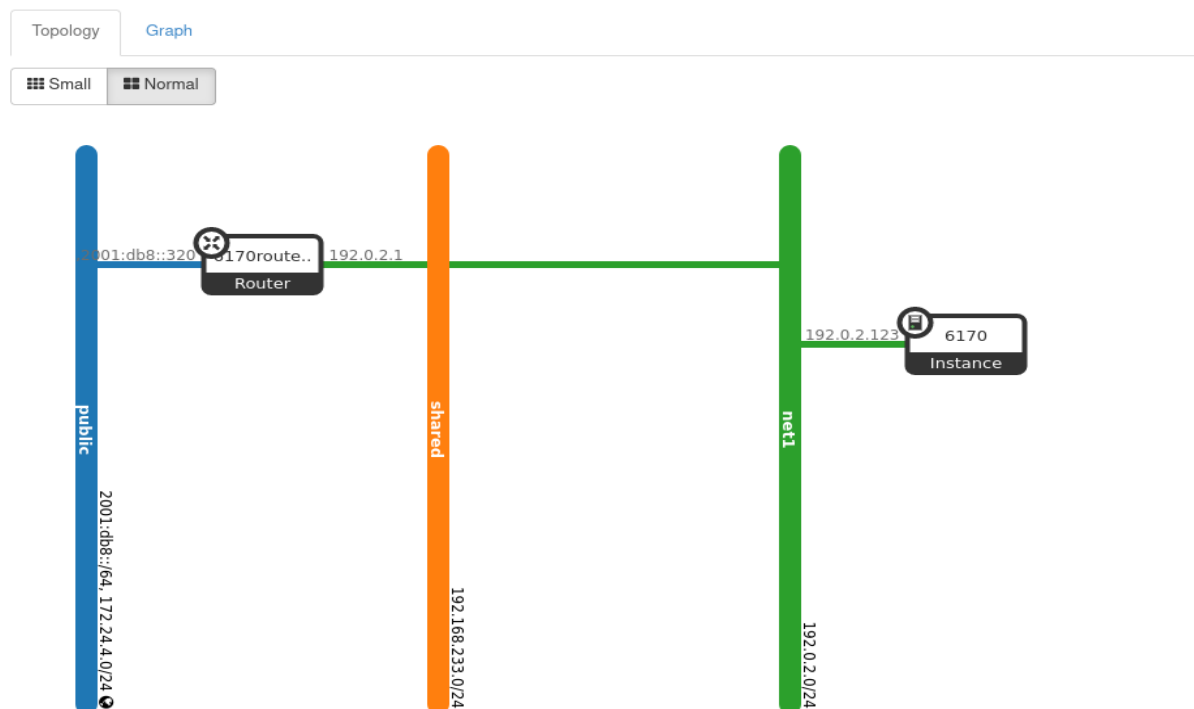
## Step 8: Creating a Server

Lastly, we went ahead and created the instance with all those components created in the previous steps.

```
server create --flavor ds1G --image fe54503e-ff38-4664-aac1-795f157bf32a --nic net-
id=ef5c4244-f20f-4d0f-baff-b8dde01296cf --security-group testsec --key-name mykey
selfservice-instance1
```

```
(openstack) server list
```

ID	Name	Status	Networks	Image	Flavor
4c4f096b-5113-4afc-a187-d6576c86359f	selfservice-instance	ACTIVE	net1=172.16.1.209	ubuntu-image	ds1G



## 5.4 Possible Security Measures

Now that we have created our very own infrastructure with virtual networking devices and an instance for our imaginary customer, we can go ahead and see what functionality is available to cloud providers and propose some of our solutions.


### 5.4.1 Ping torrent sites then use security group to block it and mention how companies block access to sites

One of the easiest fixes we could think of is to use a firewall to block access to piracy sites. So we started with changing the security group rules. But the security group functions in such a way that it blocks all traffic by default and allows for traffic that is mentioned in our rules. That's not a very



practical way of dealing with this problem. OpenStack has a tool called Firewall-as-a-service where IPs can be allowed or disallowed from the instance. AWS also has a similar tool called Network Access Control List. The benefit of using such a method is that multiple instances can be grouped under this firewall. We first found out the IP address of a known piracy website and bound its IP to our firewall and put our instance inside it. The IP was successfully blocked. Doing this on a much larger scale covering regions should be possible.

#### Pirate website IP

IP addresses for 1337xto.to				All DNS records
Our DNS servers responded with these IP addresses when we queried it for the domain 1337xto.to. Some DNS servers may return different IP addresses based on your location.				
IP address	Type	Hosted by	Location	
> 104.21.42.214	IPv4	 Cloudflare, Inc.	United States of America	

#### Before using firewall

```
ubuntu@ip-172-31-18-34:~$ ping 104.21.42.214
PING 104.21.42.214 (104.21.42.214) 56(84) bytes of data.
64 bytes from 104.21.42.214: icmp_seq=1 ttl=54 time=9.21 ms
64 bytes from 104.21.42.214: icmp_seq=2 ttl=54 time=9.23 ms
64 bytes from 104.21.42.214: icmp_seq=3 ttl=54 time=9.25 ms
64 bytes from 104.21.42.214: icmp_seq=4 ttl=54 time=9.26 ms
64 bytes from 104.21.42.214: icmp_seq=5 ttl=54 time=9.31 ms
^C
--- 104.21.42.214 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 9.208/9.250/9.312/0.035 ms
```

#### After using firewall

```
ubuntu@ip-172-31-24-210:~$ ping www.google.com
PING www.google.com (172.217.1.100) 56(84) bytes of data.
64 bytes from ord37s51-in-f4.1e100.net (172.217.1.100): icmp_seq=1 ttl=55 time=16.5 ms
64 bytes from yyz08s09-in-f4.1e100.net (172.217.1.100): icmp_seq=2 ttl=55 time=16.6 ms
64 bytes from yyz08s09-in-f4.1e100.net (172.217.1.100): icmp_seq=3 ttl=55 time=16.6 ms
^C
--- www.google.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 16.476/16.547/16.599/0.052 ms
ubuntu@ip-172-31-24-210:~$ ping 104.21.42.214
PING 104.21.42.214 (104.21.42.214) 56(84) bytes of data.
^C
--- 104.21.42.214 ping statistics ---
7 packets transmitted, 0 received, 100% packet loss, time 6147ms
ubuntu@ip-172-31-24-210:~$
```

### 5.4.2 VPN usage and if common servers can be blocked or if it can be detected that vpn is being used

Another way pirates might try to illegally use instances is by using VPN. To break it down in simple terms VPN helps in masking your IP by diverting traffic through some other IP. Now one way we can detect we a VPN is being used by checking the outbound/inbound traffic of the instance. If all the traffic comes and goes off a single IP, we know it's a VPN.



Now the firewall also has logging capabilities, so it can be used for this use case as well. But we would require a firewall for every instance created. An example diagram is as shown.

#### 5.4.3 Check ports running outside instance before and after torrent

Another way to figure out is to determine if the instance is running a torrent software. This can be more difficult as we would have to make certain assumptions. Openstack provides a functionality called network meter. It enables operators to account the traffic in/out of the OpenStack environment. When a torrent site runs, it usually has a fix port that it uses, if we see that the instance is using that port and has a lot of traffic coming in and out, then it's a sure kill. There are torrent clients that can switch the ports as well, so hardcoding the port number isn't feasible. We can check our firewall logs as well. In case there are multiple outbounds to multiple IPs and the inbound is within a certain range of ports, it can also mean that the ports are used for torrenting.

```
{
  "pkts": "<the number of packets that matched the rules of the labels>",
  "bytes": "<the number of bytes that matched the rules of the labels>",
  "time": "<seconds between the first data collection and the last one>",
  "first_update": "timeutils.utcnw_ts() of the first collection",
  "last_update": "timeutils.utcnw_ts() of the last collection",
  "host": "<neutron metering agent host name>",
  "label_id": "<the label id>",
  "tenant_id": "<the tenant id>"
}
```

#### 5.4.4 Look up software blocking on installing the application like in Concordia

Another solution could be to use a system like software locking and preventing users from downloading certain pieces of software. By maintaining a blacklist of software that could potentially be used to pirate content, cloud providers could inhibit illegal activities. The downside of using this methodology is that if the client requires to download that software for legitimate uses, they would require approval from the cloud provider which could take a long time. A simple example of this would be the system currently being used by Concordia on the library computers.

#### 5.4.5 Pre-screening

In certain cases that we have found during our survey, a pre-screening takes place i.e. a short meeting where the company discusses the use cases with the client to decide what sort of system will be best suited and how much resources should be allocated. However, this is a very inefficient and time-consuming process.

It is important to note here that OpenStack is not a widely used cloud infrastructure and the functionality provided by it out of the box can be limited. On the other hand, big players like Amazon, Microsoft and Google would have a lot more resources and insights into their instances.

## 6. Conclusion

The exploration of torrenting activities on public cloud infrastructure, coupled with an in-depth analysis of cloud providers' policies, practices, and proactive measures, has illuminated critical aspects of the evolving landscape of digital piracy. Examining the legal technicalities

surrounding torrenting highlighted the challenges in attributing liability, underscoring the complexities faced by entities seeking to enforce copyright protection.

The survey of 12 cloud providers, encompassing a matrix of criteria ranging from anti-piracy policy acknowledgment to the feasibility of torrent application installation, unveiled the varying degrees of vigilance and responsiveness within the industry. This evaluation served as a foundation for a proactive investigation utilizing OpenStack, shedding light on the backend functionalities of cloud infrastructure and providing valuable insights into potential improvements.

The proactive approach, involving the ping of torrent sites and the implementation of firewall tools like OpenStack's Firewall-as-a-Service and AWS's Network Access Control List, showcased practical strategies for blocking access to piracy sites. The success of these measures in restricting specific IP addresses demonstrated the feasibility of more nuanced and scalable approaches, empowering cloud providers to exert greater control over site access and fortify defenses against unauthorized activities.

In conclusion, the dynamic interplay between torrenting activities, cloud infrastructure, and legal considerations underscores the need for continuous adaptation and innovation. Cloud providers must navigate a delicate balance between user accessibility, legal compliance, and proactive security measures. As the landscape evolves, the insights gained from this report contribute to the ongoing dialogue surrounding the responsible and secure use of public cloud resources, emphasizing the importance of collaboration, adaptability, and a proactive stance in addressing the challenges presented by emerging technologies and their potential misuse. When the legal actions are not sufficient to stop the misuse of torrenting, we can implement the technical ways we discussed during this project in order to tackle these issues.

## 7. References

<https://deliverypdf.ssrn.com/delivery.php?ID=953069091068005121064112093110076085042081072032058071029073127099120069096007029018037005034102047046050083081093112120073094055020062006009078092125065005065005060002071103102115118075106115068001086070069098071087108083082098003003092074081067089&EXT=pdf&INDEX=TRUE>

<https://www.pezm.com/portfolio/reports/torrenting.pdf>

<https://pnrsolution.org/Datacenter/Vol3/Issue6/21.pdf>

[https://watermark.silverchair.com/324\\_1\\_online.pdf?token=AQECAHi208BE49Ooan9kKhW\\_Ercy7Dm3ZL\\_9Cf3qfKAc485ysgAABXAwggVsBgkqhkiG9w0BBwagggVdMIIFWQIBADCCBVIQCSqGSIb3DQEHATAeBgglghkgBZQMEAS4wEQQMnWZ1YT\\_H5L5eu528AgEQgIIFixarJCJApihzIqG894w\\_XL4a81RUqdtJ0CU\\_1-uae0-nEZCdYNU6EM3efcUdviT9rIR\\_wWCAnFEYjlibKbXwbsgT98SaqDx8VbQc8iB1u8lgsEPvEA4RfX3iahR-fQzOdv4jH8lAAs9JEj3y4GyaNguIJMJXHMWXvLqhrhirO-Yh2HxRrFkOpqG2iHGS0s66DObaSl-5kCURUDngGmgHoNSf0d4leirqzJS-](https://watermark.silverchair.com/324_1_online.pdf?token=AQECAHi208BE49Ooan9kKhW_Ercy7Dm3ZL_9Cf3qfKAc485ysgAABXAwggVsBgkqhkiG9w0BBwagggVdMIIFWQIBADCCBVIQCSqGSIb3DQEHATAeBgglghkgBZQMEAS4wEQQMnWZ1YT_H5L5eu528AgEQgIIFixarJCJApihzIqG894w_XL4a81RUqdtJ0CU_1-uae0-nEZCdYNU6EM3efcUdviT9rIR_wWCAnFEYjlibKbXwbsgT98SaqDx8VbQc8iB1u8lgsEPvEA4RfX3iahR-fQzOdv4jH8lAAs9JEj3y4GyaNguIJMJXHMWXvLqhrhirO-Yh2HxRrFkOpqG2iHGS0s66DObaSl-5kCURUDngGmgHoNSf0d4leirqzJS-)

[bCE7W5aUBHjjQcwH3ROEJIFCvUoBIv2SWoahh34371BsAMc\\_5E5ZKO8F6ADohjBp  
cS3zO8e\\_37UYsmn0vVVkAVJ5O6-  
eojbT54UWywL2s7gDoGgnCqdInwWWEXvJeJQUiiO\\_kT5giNmHe7GW2x3IxYJ8jEjAW  
YR6zbxmQfxzmPFMEeBlhtkk6dBhCCYyouOTDUKYgaB83F1oKImP4MZN8BIxZkN\\_ofO  
PXyGUGwZ0eG3HC3IMPTxj0-  
4PuvQa6GLKl4o\\_dc7HC5okptL1W1pr1u\\_8y119oh2BDKWTp1kg0uVHaRjLxi0rfG32\\_pOj  
uet7BKWmSG0p5Xzx-ulKibJNIOg1K3wQHERSEqV94SHmYxPzbaPKVzXg6AjA\\_-1e-  
43Ed6m7IV89YLeibkTWG\\_y0ARu533\\_u-  
FTehEZkW5yMif9ANknfcBPlfegQSs4LmOCU\\_hDk3L8n5wYJEuaCE9KdoUCQIEOeYui-  
p3M2wtT2Y00srryzQboVF3XpgwMDgVIVYBMLxsbgg9XSC-j8CvR4nvgr8X6xsW30Jm-  
Esl86WddgAkusyglIWwfa0jEYcIF7f5v1vmIM0OyFCyEptDI4y0tF\\_drHr4nm9K14V0Yqe  
M4Smg088QHHAcyq9Np7-NVB0DFr0GFGHUxqScbeh7nq\\_QZa-  
HVVI9ZdyitskMIZwBwwqch0uPyvxyO7N7tqIV56oxqn0nMmlpIs6bXOO2WTsdxoIJzF1Vi  
xm5ldbCsxk2qPGPOhRczlWHRbmf5CM1Htb3mvbMhBRfXH9jBWeKeECTkxNamm\\_ZII2  
qXBg\\_mFcF05W8YXto4KHofWg1F9MLT84HALZKuOyseDD-  
KGca8D3ul859wxG9y3X8ryIlfuyY9uFNhAox\\_WHWbD8IEBopQmDFXC2VuK\\_jeCxCn  
VS4kYJ7s\\_-  
pC\\_6m9l9LIsp9ujy5ng2IAq89UDjWPaiW8ofSLT0FOU1FxMIHwC4HqvLL4yb6DMKqrA  
Uq14SFMb6ibNZkAul\\_Sp\\_YI8hSyd2krVvSQNXacH6nE6M6YrqJ2ITHQESWvinufcjNfw  
K6b42IYgum9PDFuDeTEqPxIOE18mjktNM-D\\_F1f4CwXE2QD4gGNqwGghoVojBgjO-  
bOyrb1p\\_iq2MLhgQtVlrzUOuClAJ\\_W6UbQ10yXKjxvcrswAn591nNOEcnDIXLzVZ\\_yFa  
NZwdbrPL8l1INB2k62IpnORHqy5iirmGwxNEbERxeLGMi73S0TfTmpp6Uw9BaXr2jTk  
m\\_t\\_ljfmotAowHGLIDOO2SbiqhF5G1vw1KzKzzAo-  
KHpO8CVSUJoECSYJ4t0CmP2ukMMMy4cci4UakMw6cHnwc3TpjbB09jphQ0zd4YleBc27  
T7ikw1xMJfE9sCoFHZSIbc26-UGI9OyK2IPEVBs8AwIfIldOEf8OMf-  
lM8i5XtOqZUyPfuXO0Fod38UZekJZFcUeAeJEfB8FSZ33veTDKbFPhLdPy9nHyXwDokk  
SJJR1uFiQ2zz6FISeY3VdImc3s0dUxC7XIDhGA](#)

[https://research.usq.edu.au/download/e62bddbebbcae2d7e07584aabdd79d94a1339a1016e116  
eb1a2ad97f457550df/124402/B5.%20Managing%20the%20Risks%20of%20Data%20Securit  
y%20and%20Privacy%20in%20the%20Cloud.pdf](https://research.usq.edu.au/download/e62bddbebbcae2d7e07584aabdd79d94a1339a1016e116eb1a2ad97f457550df/124402/B5.%20Managing%20the%20Risks%20of%20Data%20Security%20and%20Privacy%20in%20the%20Cloud.pdf)

[https://ask.metafilter.com/150833/Is-there-a-technological-reason-that-the-RIAA-and-  
MPAA-only-go-after-tracker-sites-and-not-people-downloading-torrents](https://ask.metafilter.com/150833/Is-there-a-technological-reason-that-the-RIAA-and-MPAA-only-go-after-tracker-sites-and-not-people-downloading-torrents)