

EXHIBIT C



WHOSE BITTORRENT IS IT ANYWAY?

A Visual Explanation Of BitTorrent vs. FastTrack (Kazaa, etc.)

AND WHY BITTORRENT IS BETTER!

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"I don't care about any of this. Just tell me how to download a file."

Hello. This is my explanation of the BitTorrent protocol. The initial idea was to be very simplistic so that even the most computer-unsavvy person could understand its benefits, but it quickly became obvious that this was something that could not remain simple. I tried to explain everything the best I could, so please read on.

Please note that the following "bee" analogy is unique to this explanation. Most other places you'll generally find terms like seeder and leecher. I personally think adapting the protocol to a bee hive simplifies the analogy.

Glossary

Queen Bee: The person that has the first copy of the original file. Typically, this is the person that owns or rents the piece of software or media and initially rips and posts the first seed. Sometimes called a Super Seeder.

Princess Bee: Someone that has downloaded 100% of the original file. Also called seeds or seeders.

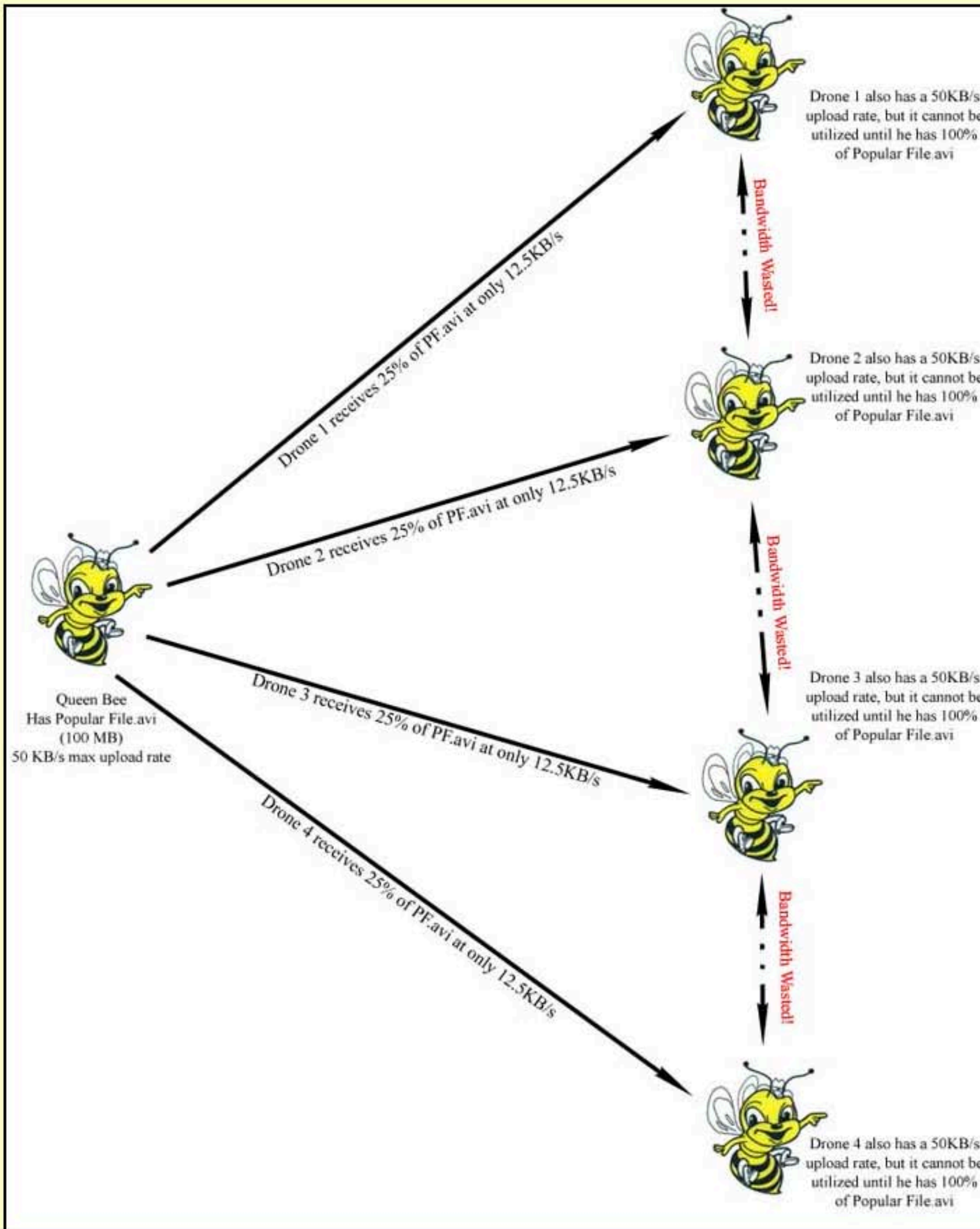
Drone: Someone that is still downloading parts of the file. They will become a Princess once their download completes. Also called leeches or leechers.

Swarm: The collective entity of everyone downloading or seeding the file.

In a typical peer to peer file sharing network (e.g., Kazaa, FastTrack) it is cumbersome and time consuming to release a new file unto the world of file sharers. This is exxagerated even more so with large file sizes (DVD-Rips of movies, etc). Why? Because every bee has both upload and downloading capabilities, but the upload bandwith goes wasted until that person has 100% of the file. In a typical home broadband setting (cable and DSL modems) the upload rate is only a fraction of the download rate. For example, on my home machine, here in Ohio, that rate is 360 KB/s down, but only 45 KB/s up.

The FastTrack (and other) networks fail in this aspect. The Drones must download 100% of the file and thereby become Princesses before their upload rates can be activated and utilized, as demonstrated below:

How FastTrack (Kazaa, etc) Works.



$$50 \text{ KB/s} \div 4 = 12.5 \text{ KB/s}$$

Explained: 50KB/s (The Queen's Upload Stream) \div 4 (There are 4 Drones) = 12.5KB/s (Available Per Drone)

Then:

$$100 \text{ MB} * 1024 = 102,400 \text{ KB}$$

Explained: 100MB (Popular File.avi) * 1024 (Because 1MB = 1024KB) = 102,400 KB

Therefore:

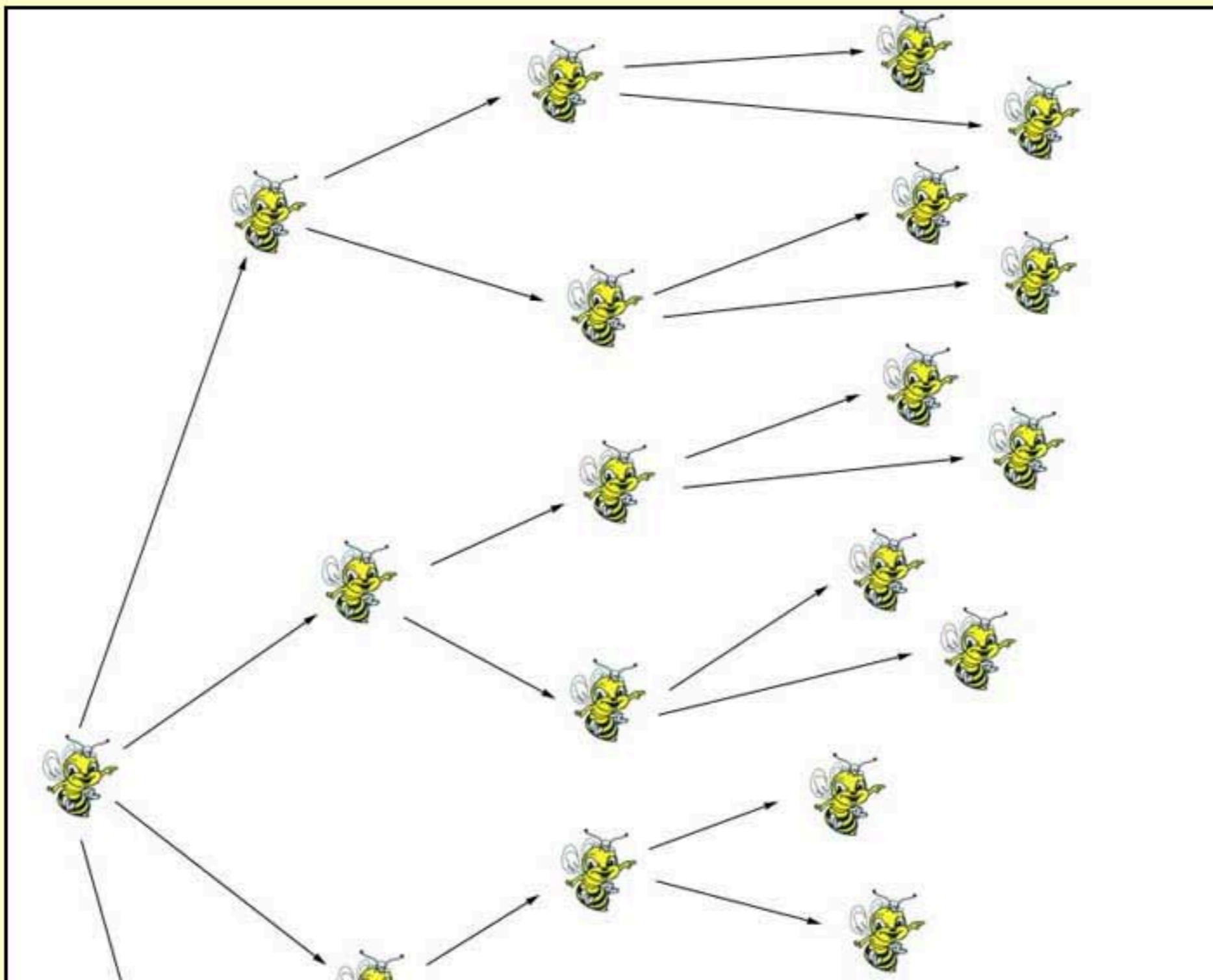
$$102,400 \text{ KB} \div 50 \text{ KB/s} = 2,048 \text{ seconds (or } \sim 34 \text{ minutes)}$$

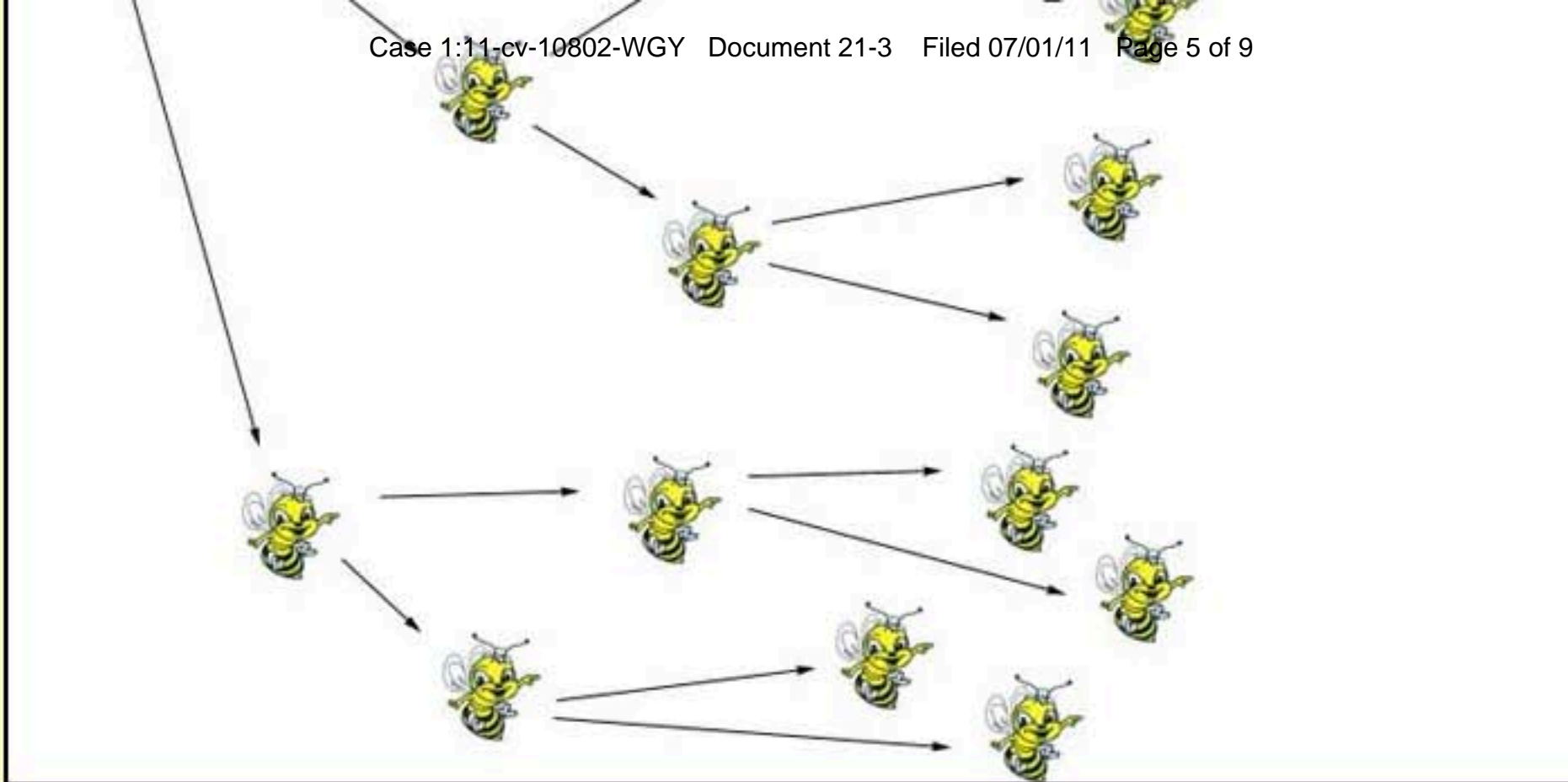
It will take at LEAST 34 minutes for the Queen to transfer 100% of the file.
HOWEVER, the Queen still hasn't delivered 100% of the file to any one individual person yet.

Even in a Utopian world of maximum efficiency, it will still take 34 minutes x 4 drones = **136 minutes** to deliver 100% of the file to all drones.

Now imagine this situation where there are 12 drones. Or 50!!! It becomes very inefficient very quickly.

FastTrack After Popular File.avi Has Been Transferred To A Few People.

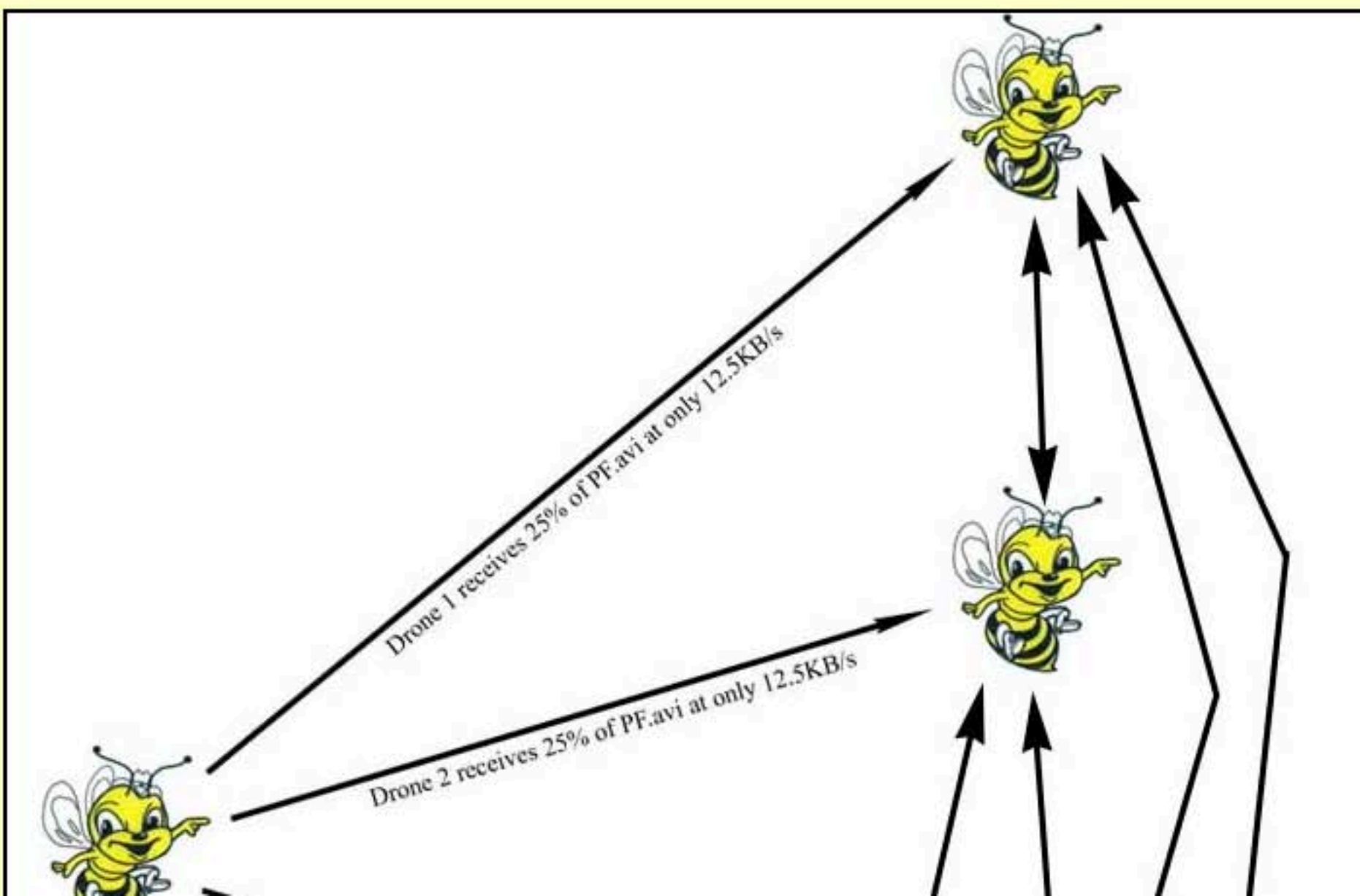


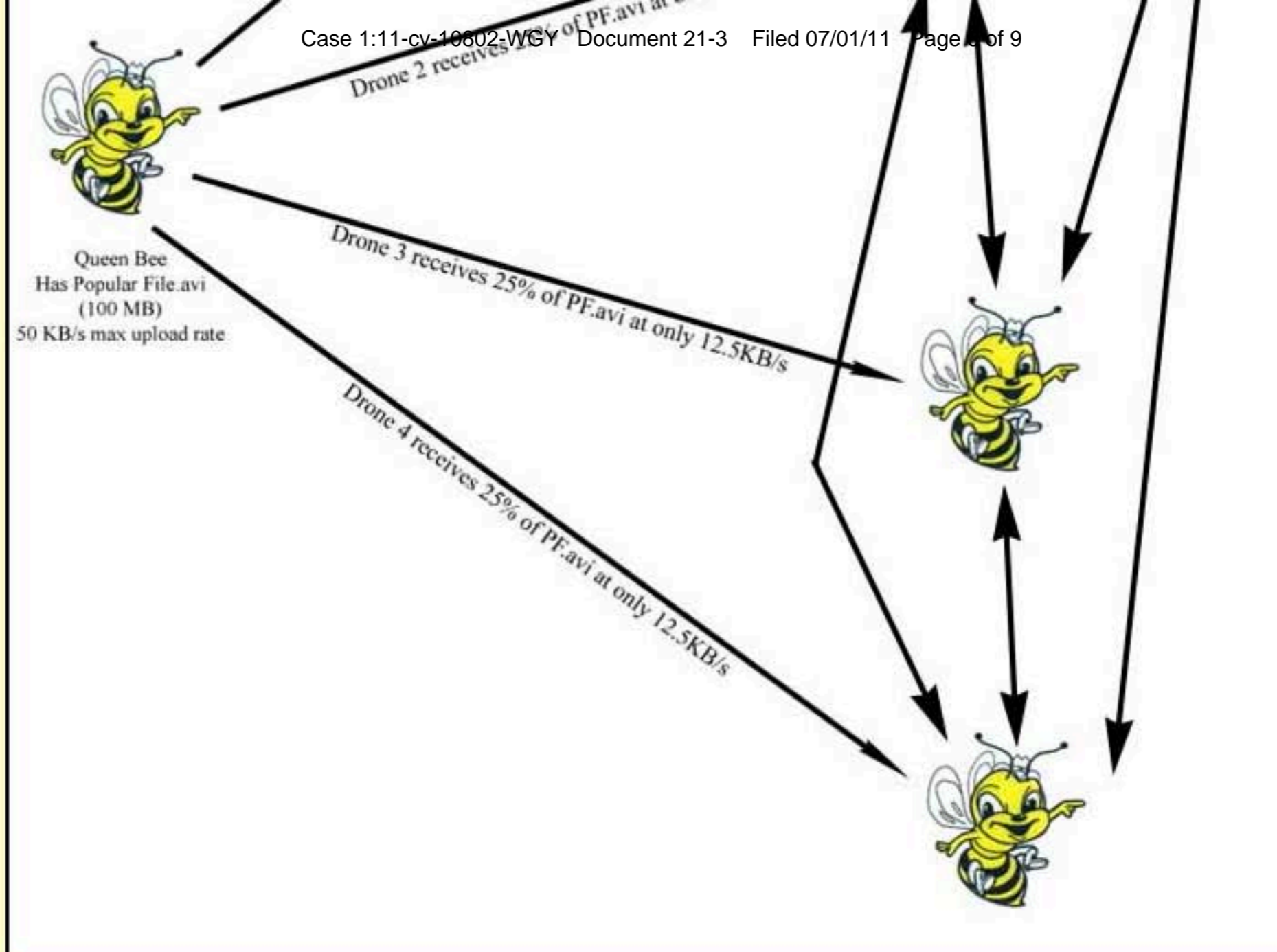


After, and ONLY after the four initial drones have downloaded 100% of the file can they now begin transferring the file to others. But like I said, it took four times as long for this to occur because of the wasted upload bandwidth. The Queen had to perform 4x the work. **This is the fundamental disadvantage of FastTrack.** You could call it a linear-only method of file distribution.

FastTrack works and continues to work... but something better has evolved:

The Beginnings Of A Typical BitTorrent Swarm.





The math here is the same as the FastTrack example, with one huge difference:

Each drone has a 50KB/s Upload Stream that they CAN and DO utilize.

For example, Drone 1 immediately starts sharing with Drone 2. Drone 2 is now receiving parts of Popular File at 12.5 KB/s x 2 (two sources). MOREOVER, Drone 2 starts receiving parts of the file from Drone 3 and Drone 4 (12.5 KB/s x 3).

Ultimately, Drone 2 is receiving Popular File from not only the Queen, but also Drone 1, Drone 3 and Drone 4 (12.5 KB/s x 4).

On top of that, the previous is true for ALL of the Drones:

Drone 1: Receiving from Queen, Drone 2, Drone 3 and Drone 4 (12.5 KB/s x 4).

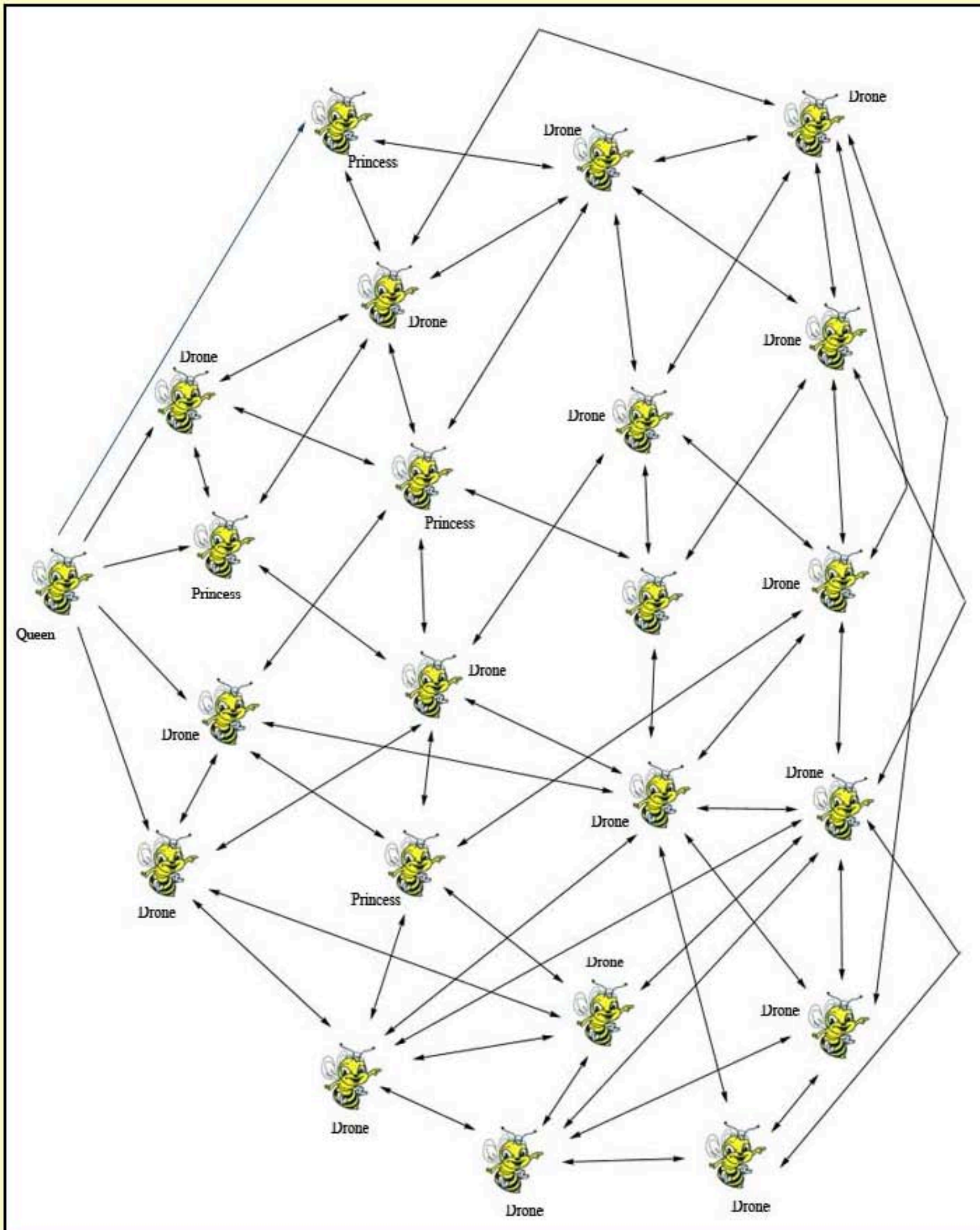
Drone 3: Receiving from Queen, Drone 1, Drone 2 and Drone 4 (12.5 KB/s x 4).

Drone 4: Receiving from Queen, Drone 1, Drone 2 and Drone 3 (12.5 KB/s x 4).

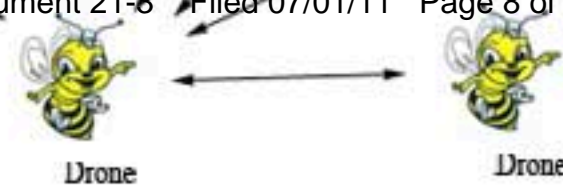
As you may have guessed, the total bandwidth floating around the swarm is now 250 KB/s (50 x 4) because ALL the bees are using their bandwidth at peak efficiency.

Therefore, and although this isn't recommended, the Queen may leave the swarm after she has transferred only 100% of the file (as opposed to 400%) because the Drones will simply populate each other with their unique percentages until all four have 100% of the file.

This is an example of a distributed seed. No one person has 100% of the file, but collectively, the four drones do. This is Awesome Reason #2 that BT is better than FastTrack.



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This is an example of a more common, more popular swarm. You can notice that the swarm is no longer linear (in fact, it never was). All the bees are working bidirectionally with each other. Instead of 25%, each drone needs only small fractions of Popular File.avi to begin populating the file among the swarm. Hopefully you can see why BT is so nice.

Now imagine swarms with 50 Princesses and 2000 drones. There are actually swarms out there that are this big. Some even bigger!!! BT is clearly the way to go.

Apparent Advantages And Disadvantages Of Both Protocols

BitTorrent:	Advantages:	<p>VERY good for zero day releases because they are typically so popular. The Queen can begin propogating the file exponentially quicker than with FastTrack. Certain episodes of television programs have been available to the West Coast on BT before the West Coast is even able to watch it on television (due to time zones).</p> <p>Highly efficient.</p> <p>The Queen need only transfer 100% of the file before it can be further populated.</p> <p>Most BT clients and servers are not only freeware and contain no spyware but are also Open Source and available for editing.</p> <p>BT has managed to stay out of the legal limelight (so far).</p>
	Disadvantages:	<p>If the Queen leaves the swarm too early, no one will be able to use the file.</p> <p>As popularity wavers, so does the speed in which the drones can complete the file.</p> <p>Sites hosting .torrent files are often flaky and bogged down due to excessive popularity.</p> <p>Not as well known and typically not a user-friendly environment. In other words, it helps being a techie.</p> <p>A Queen can only seed one or two files at a time unless they have massive upload bandwidth available.</p>

FastTrack:	Advantages:	<p>More well-known than BT. More people know about it and are able to access it.</p> <p>Older stuff is still available on FastTrack because the files still reside in a person's shared folder. Downloaders may come and go as the please.</p> <p>Because older stuff is not as popular, it will not be requested by a drone as often. This allows a larger number of files to be shared.</p>
	Disadvantages:	<p>Most clients contain computer-harming spyware. Some even cost money to use.</p> <p>Becoming common enough that litigation is being sought after the companies that produce the clients. Therefore, they're shutting down. The RIAA has even sued individual downloaders of music files.</p> <p>Very inefficient.</p> <p>Zero day releases typically take two weeks or longer to be readily available on FastTrack.</p>

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The Short Explanation.

- Step 1** Download a client. Check <http://www.wtata.com>. On the left hand column, there is a list of clients. This would be akin to your kzaaa.exe, etc.
- Step 2** Find a site that offers .torrent files. Bear in mind that the .torrent file is very small (5-30KB) and only contains header information. It is in no way the actual file. Sites that offer these are <http://www.suprnova.org>, <http://www.lokitorrent.com>, just to name a couple.
- Step 3** You MUST open TCP ports 6880-6890 to achieve any reasonable speeds. You can only download fast if you're able to upload (not necessarily fast, but you must). Many firewalls (ZoneAlarm) block these ports. Figure out how to unblock them before you continue.
- Step 4** You've found something you want. Great. Download the .torrent file and open it with your Torrent client.
- Step 5** Your client will read the information found in the small .torrent file and find the tracker (read: middle man) that is communicating with all of the bees in the swarm. Think of the tracker as the beekeeper. If the tracker is still up and functioning (they go down often) it will add you to the swarm and you will become a drone. After file completion, a princess. Congratulations!
- Step 6** Please, stay in the swarm for as long as reasonably possible. Closing your connection costs the swarm another Princess. No Princesses and the file dies off.