

Skype Holiday Present – Down for a Day

January 2011

Just as businesses were winding down for the holidays and families were busy making plans to get together, the popular Skype Voice over IP (VoIP) telephone service went quiet. From the morning of Wednesday, December 22nd, customers were unable to place calls for over a day.

We expect absolute reliability from our telephone services. To understand how an outage of this magnitude could have happened, we must first understand the architecture of Skype's peer-to-peer network.

Skype

Skype's VoIP Services

Headquartered in the Grand Duchy of Luxemburg and partially owned by eBay, Skype (originally Sky Peer-to-Peer) offers a full range of communication services using the capabilities of the Internet. Communication between Skype users anywhere in the world is free. Communication between a Skype user and landline phones or mobile devices is available at very low costs.



Starting with telephone service using VoIP in 2003, Skype has expanded its offerings to include texting, instant messaging, video, conferencing, file transfer, and screen sharing.

Skype provides businesses with additional services. They include Skype Connect, which extends Skype to SIP¹-enabled PBXs, and Skype Manager, which allows a business to manage its Skype users.

Skype connects 25 million users worldwide at any given point in time.

Skype has become the largest international voice carrier, carrying 13% of all international traffic. Its share of this traffic is growing by more than 50% every year.

Skype's Peer-to-Peer Network

Unlike traditional telephone systems that depend upon massive investments in central offices and landline networks, Skype uses a peer-to-peer (P2P) network. The backbone of its network is the Internet. Routing of calls is done by *supernodes*, which are customer computers on which Skype has installed its own server software. Except for authentication and certain added-feature

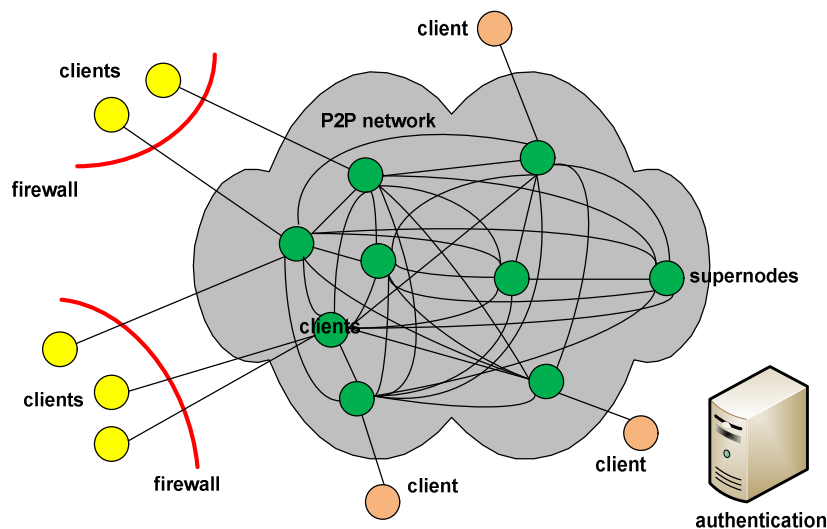
¹ Session-Initiated Protocol

services, Skype has no other servers to which customers connect in order to communicate with each other. Therefore, Skype has very little infrastructure to finance and maintain.

Though the Skype protocol is proprietary and unpublished, the general conjecture in the literature² is that on every customer's computer is a Skype client. Certain of these computers have been commandeered by Skype to act as supernodes. Supernodes must be computers that are not behind a firewall and that have sufficient bandwidth to carry out the supernode duties. It is estimated that the number of supernodes in the Skype network numbers in the hundreds of thousands.

Supernodes

The supernodes provide several functions necessary to the P2P network. First of all, they resolve addresses. Each customer has a user name that uniquely identifies him. When a customer logs in, his user name is authenticated by the authentication server; and he is assigned to a supernode. The supernode network discovers his presence and provides a translation service similar to that provided by a DNS (domain name service) network. Instead of converting URLs to IP addresses as is done by a DNS server, the supernode network converts user names to supernode locations. Therefore, when a customer indicates a desire to connect to another customer, the distributed directory services of the supernode network determine how to route that call; and the two customers are directly connected.



The other function provided by the supernodes is connection of clients behind firewalls. If both clients involved in a connection are behind different firewalls, they cannot communicate directly with each other. Rather, a supernode is assigned to act as a relay node for the connection.

Distributed directory services use distributed hash tables to find clients and their associated supernodes.³ When a supernode enters or leaves the network, the network automatically discovers the event and reconfigures accordingly.

² A Brief Primer on the Tech Behind Skype, P2PSIP and P2P Networks, *Disruptive Technology*; November 10, 2010.

³ Understanding Today's Skype Outage: Explaining Supernodes, *Disruptive Technology*; December 23, 2010.

³ Distributed Hash Tables, *Wikipedia*.

The Outage

The Skype Crash

On Wednesday morning, December 22, 2010, Skype began to act erratically. Calls took longer and longer to set up. Finally, all communication stopped. It was not until the following day that service began to be restored.

A week later, the Skype CIO published a blog detailing what had happened.⁴ The problem started when a number of support servers that handle instant messaging and texting became overloaded. This significantly slowed down responses to the Skype clients active in those services at that time.

The slow down, unfortunately, ran into a bug in certain Windows clients (Version 5.0.0.152) that prevented the client from processing those responses (Version 5 of the client had just been released the previous May). Consequently, the clients crashed.

The big problem was that many of the clients were supernodes, so supernodes started disappearing from the network. It was estimated that half of all Skype customers were running the faulty client, and this triggered crashes in 25% to 30% of Skype's supernodes.

The sudden reduction in supernode count caused the remaining supernodes to become overloaded, and they started to crash. The failures cascaded rapidly through the network, and Skype came crashing down.

The Recovery

Reintroducing supernodes into the network takes a lot of discovery time, especially if the network is unstable and if supernode PCs are being turned on and off. To aid in this recovery, Skype commandeered servers normally used for video conferencing to introduce hundreds of "mega-supernodes" into the network. As the network was recovering, they distributed a corrected version of the client (Version 5.0.0.156) to all customers. The network gradually recovered, and the majority of Skype customers were back online the next day, Thursday.

Video conferencing was restored by Friday, December 24th, barely in time for Christmas.

Do You Want to be a Supernode?

If you are a Skype customer and if your PC is not behind a firewall, you run the risk of being surreptitiously elevated to a supernode (some would say infected).

Skype claims that the CPU and bandwidth load imposed by supernode processing is negligible. They will not elevate a PC to supernode status if it does not have the capability to easily perform supernode functions.

However, what if you don't want to be a supernode? In Version 3.0, Skype introduced a switch to turn off supernode capability. It is not easy. It is an explicit registry switch of the form

```
HKEY_LOCAL_MACHINE\Software\Policies\Skype\Phone, DisableSupernode,  
REG_DWORD= [0,1]
```

```
0 = supernode enabled  
1 = supernode disabled
```

⁴ CIO update: Post-mortem on the Skype outage, *The Big Blog*, December 29, 2010.

Details of this technique are given in the Skype Administrator's Guide.⁵

Others have pointed out that Skype uses ports 80 and 443 to route traffic to other Skype users behind firewalls. By disabling these ports, the supernode server cannot run on the PC.

Lessons Learned

This was not the first major outage suffered by Skype. In August, 2007, Skype went down for two days when a new client version was released. The resulting rash of download activity overwhelmed its network.

In the current outage, Skype had released a corrected version of the client before the crash occurred; but most customers had not yet downloaded the update.

In his blog posting referenced above, the Skype CIO suggested many lessons that Skype has learned from this outage:

- It is reviewing its process for automatic updates to make it more efficient and controllable.
- It is looking into ways of detecting and recovering from such problems much faster.
- It will evaluate its testing procedures to better find bugs that could take down the entire system.
- It will keep under constant review the capacity of its core systems and will continue to invest in both capacity and resilience of these systems.

As an apology, Skype is offering thirty minutes of free calling to its Pay As You go and Pre-Pay users and an additional week of service for those on a subscription plan.

This outage shows once again the bottom line of disaster planning for businesses. If there is a technology upon which you depend, you had better have a plan as to how you will continue in business when that technology fails.

One other lesson – read the fine print. Skype's End User License Agreement states:⁶

“Skype ... may utilize the processor and the bandwidth of [your] computer ... for ... communication between Skype ... users.”

It goes on to say that Skype can give no warranties for the protection of your privacy nor for the integrity of your computer resources.

Acknowledgements

We would like to thank our subscriber, John Hoffmann, for bringing this incident to our attention. In addition to the sources referenced above, material for this article was taken from the following sources:

How to be or not to be a Skype supernode, *VOIP IP Telephony*; October 14, 2006.

Skype – how not to be a supernode, *Visible Procrastinations*; August 24, 2007.

Find out if your computer acts as a Skype Super-Node, *ghacks.net*; June 26, 2008.

Worldwide Skype outage highlights dependence on VoIP, *Christian Science Monitor*; December 23, 2010.

⁵ IT Administrator's Guide to Skype

⁶ Section 3.3, Utilization of Your Computer, *Skype End User License Agreement*.
<http://www.skype.com/intl/en-us/legal/eula/>

Skype outage continues to affect enterprise users, *ZDNet*, December 23, 2010.

Skype offers free service due to global outage, *TG Daily*, December 24, 2010.

Are You A Skype Supernode?, *Chris Pirillo, University of Waterloo*.

Skype blames recent outage on buggy software, *CNET News*; December 29, 2010.

Skype Says Bug in Older Software Caused Outage, *Sci-Tech Today*; December 29, 2010.