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Systems and Infrastructures

Write Up # 3

Dropbox is a cloud-based storage system, which means that it relies on standards primarily focused on transferring information through the internet. This means that every aspect of Dropbox's framework must focus on interconnectivity so that computing systems across multiple formats and hard wares can communicate with the Dropbox data storage system. This translates to standards associated with Transmission Control Protocol and Internet Protocol. These standards, set by the Internet Engineering Task Force, mandate how data is packaged and transferred between networks and users. The Internet Protocol, now at the sixth version, assigns unique identifiers to networks and systems on the internet in order to record their location. A Transmission Control Protocol ensures the orderly, error-checked and reliable transmission of data bytes from one system to another. Dropbox also uses HTTP, another part of the Internet Protocol suite. HTTP allows users to fetch data from Dropbox and have it delivered to their device through systems of hypertext. Part of the suite of standards involved in allowing data to be transferred between Dropbox and its users is the Border [1]Gateway Protocol language it uses. Dropbox runs primarily using a system of iBGP's which only communicate to other routers within Dropbox's system. These routers communicate with the backbone through eBGP's or exterior border gateway protocol languages, which communicate how data should be routed through different autonomous systems or stacks. BGPs make their route decisions based on existing paths, the nature of particular data packages and rules set by network administrators.

All of this data transfer must be standardized at the router architecture level. The Internet Protocol switched from v4 to v6 in anticipation of the greater volume of IP addresses, which meant that Dropbox had to adopt to a routing system that could accommodate both types of data. Dropbox decided to choose an IS-IS routing protocol, which is a protocol-agnostic architecture that focuses on transferring data between systems in the same network, which use the same point links. According to Dropbox, these characteristics make it easier to carry different types of information and support newer protocols, mitigating future TCP/IP updates.

From a user perspective, the most important function of Dropbox is its ability to render data and a variety of different files. Dropbox has developed its own image compression system, which it calls "Lepton". Lepton compresses JPEG files, which are already bit compressing systems, at a rate of 5 megabytes per second and decodes them back to the original bits at 15 megabytes per second.[2] Lepton also preserves the original file bit-for-bit. Dropbox supports most image files with a limit on the size of image files that can be "previewed" or seen without downloading them onto a computer. For all other files, Dropbox uses an application called zlib, which is also a lossless compression format. These tools are

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[1] Oblumpally, Naveen. "Infrastructure update: evolution of the Dropbox backbone network". *Dropbox.* September 15, 2017. https://blogs.dropbox.com/tech/2017/09/infrastructure-update-evolution-of-the-dropbox-backbone-network/. Accessed February 8, 2019.

[2] Reiter Horn, Daniel. "Lepton image compression: saving 22% losslessly from images at 15MB/s". *Dropbox*. July 14, 2016. https://blogs.dropbox.com/tech/2016/07/lepton-image-compression-saving-22-losslessly-from-images-at-15mbs/. Accessed February 8, 2019.

grouped together under the DiVANS suite, which converts raw bit streams into Intermediate Representation that it standardized to allow diversity of use and the safe conversion of the IR into a format that can be efficiently written out as bits.[3]

Thus, Dropbox operates using a complicated mix of internal and external standards that allow diverse networks to communicate with each other, route data and render files and bits. It is interesting to consider how much Dropbox's operations are affected by the data transfer standards set out by the TCP/IP suite. Developed by the Internet Engineering Task Force in 1980, these two protocols are meant to standardize the way that data is transferred between interconnected systems of packet-switched computer communication networks. The need for Transmission Control Protocol was primarily to address unreliability and availability in congestion in military, government, and civilian environments.[4] The Internet Protocol is concerned with how data is transferred by breaking it into smaller packages and the Transmission Control Protocol ensures that this information is transferred reliably- meaning that all packets arrive complete and in the correct order. Internet Protocol is also involved in assigning unique identifies to systems and networks on the internet to ensure routed data can find the correct location.

As indicated by the motivation behind the development of the TCP, the Internet Engineering Task Force was originally created under supervision of the United States government. It branched out in 1993 to become an independent, international activity associated with the internet society, a non-profit organization. Participation in the IETF is open for any individual with technical expertise to contribute. Participants join a working group, organized by topic into several Areas. Areas are then managed by Area Directors, who are members of the Internet Engineering Steering Group. This group is responsible for upholding rules and procedures ratified by the Internet Society trustees and oversees "entry into and movement along the Internet 'standards track'".[5] A separate group, the Internet Assigned Numbers Authority, oversees the assignment of unique parameter values for Internet Protocols.[6]

The Internet Engineering Task Force has taken pains to be an international and independent organization, which is important considering the amount of control it has. In switching from IPv4 to IPv6 Dropbox, as we have seen, was forced to completely redesign its internal routing architecture. Thus, it would be important that a body controlling how data is transferred internationally through the internet should have many systems of oversight, checks and balances to ensure that one developments in protocols do not favor one interest group, organization or even one nation.

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[3] Reiter Horn, Daniel and Jongmin Baek. "Building better compression together with DivANS". *Dropbox.* June 19, 2018. https://blogs.dropbox.com/tech/2018/06/building-better-compression-together-with-divans/. Accessed February 9, 2019.

[4] "Transmission Control Protocol" Information Sciences Institute University of Southern California. Internet Engineering Task Force. September, 1981. https://tools.ietf.org/html/rfc793. Accessed February 8, 2019.

[5] "Internet Engineering Steering Group". *IETF.* https://ietf.org/about/groups/iesg/. Accessed February 8, 2019.

[6] "About". *IETF.* https://ietf.org/about/. Accessed February 8, 2019.