Reading Report #2
Paper: End-to-End Argument in System Design
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The entire paper is based on this line of reasoning: *"The function in question can completely and correctly be implemented only with the knowledge and help of the application standing at the end points of the communication system. Therefore, providing that questioned function as a feature of the communication system itself is not possible."*.

I would argue that this line of reasoning has some weak points which need to be addressed in order to apply it in reality, especially under the context of the current Internet.

1. The paper doesn't say exactly what *complete and correct implementation of a function* means. Does it mean the fidelity of data being transferred, or integrity, or something else? I think it varies by applications. For example, for file transfer application, we want to achieve integrity of data, but for video conference, we want to ensure that video and audio data be streamed in real time and in sync, some loss of quality is tolerable.

2. Further, the paper draws an absolute line for a function in question. That is, it can be either implemented "completely and correctly" or not. This is not true. Actually, for file transfer application, reliable file transmission cannot be 100% guaranteed. For example, even with "end to end checksum of the file" mentioned in the paper, there is a still slight chance that data could be altered in the path from source to destination while the destination sees the checksum as expected. This is due to the probabilistic nature of the checksum algorithm.

3. The argument is justified mostly by the "careful file transfer" example used in the paper. But in reality, network applications are rich in variety. While *end-to-end argument* is effective for bulk data transfer applications like FTP and BitTorrent, it may need careful evaluation for applications like video streaming or instant messaging. This is especially true when considering the current Internet filled with complex and interactive multimedia applications with different cost and needs for quality of services.

4. Under the context of the current Internet, we need to rethink about the idea of "dumb network" and "pushing the logic to the end points" which are advocated by *end-to-end argument*. This idea has made the regular home network very complex already. Considering the emerging mobile ad hoc network and Internet of Things, they all feature thin client, which means we have to push some functions into network itself to make them work properly. These emerging networks demand new requirements to Internet, and make the *end-to-end argument* not hold under specific context.

5. The paper dose not go deep to give the detailed guidelines of how to apply the *end-to-end argument* in practice. Just letting application programmers implement complex logic seems a horrible idea. Should there be libraries to do these? Should we do these at the kernel space or user space? These questions remain relevant in network system design.

Conclusion: with the changing requirements of the Internet, we need to carefully evaluate and apply the *end-to-end argument* in a context-sensitive manner, rather than adopting it as a general design principle/rule for network system.