

## **Paper Review Report**

**Title:** A critical review of “End-to-End Arguments in System Design”

**Authors:** Tim Moors, Polytechnic University

End-to-end arguments, a valuable guide for placing functionality in communication systems, have a great impact on the design of communication protocols. Though end-to-end arguments are one of Internet architectural principles and the most widely applied rules of system design, they have recently been challenged by the advent of new network products and architectures such as firewalls, caches, active networks, NAT, multicasting and network QOS.

The author starts the review by describing end-to-end arguments and their impact on the communication network protocol design. In the paper, it is shown that implementation of the end-to-end arguments is supported by the need for correctness of implementation, ability to ensure appropriate service, and to facilitate network transparency, ease of deployment and decentralization.

The author used careful file transfer as an example to show that it is possible to completely and correctly implement secrecy but not integrity. It is impossible to completely ensure integrity due to the probabilistic nature of integrity checks.

Using the careful file transfer example, the author discusses about the importance of carefully identifying the endpoints, and the decision behind implementing reliable transfer in the transport layer, which is on the basis of trust not end-to-end arguments.

The impact of end-to-end implementation on performance and scalability is also shown in the paper. That is, performance can be improved by localized error detection, error recovery, routing, multicast branching and/or using caching. It is also shown that the localized approach is suitable when efficiency is needed, whereas the end-to-end approach is suitable when this is not the case.

In the paper, additional end-to-end arguments such as, *if a function is implemented end-to-end for reasons of correctness, then any local implementation may be redundant*, and *local implementations may be redundant because certain applications never need the function to be implemented, anywhere*, have been also proposed. The entity and its level of trust to other entities determines whether the end-to-end arguments are applicable to a certain service or not.

It is also shown that congestion control is not well suited to end-to-end implementations.

**Title: Rethinking the design of the Internet: The end to end arguments vs. the brave new world**

**Authors:** David D. Clark

Due to the increasing number of users, commercialization of Internet services and variety of these services, Internet and its use has been changed in recent years. The authors foresee that these changes question the capability of the end-to-end argument design of the Internet, and causes fundamental changes in its original design principles. But in some cases the Internet's original design principle, especially its ability to support new and unanticipated applications, may need to be preserved.

The paper first discussed the motivations of the original proposers of the end to end arguments, how it guided the structure of the Internet. It is suggested that application-level functions should not be built into the lower-level (core) of the network. i.e. keep the general-purpose system services in the core(change to the core network should generally be avoided) in order to reduce complexity, increase generality and improve reliability.

In addition to this, the authors focused on the changing demands of the users of the Internet as the user base grew as the Internet became more accessible to the public. Even some parties propose to change the core of the Internet design, like the need for core modifications. Some of these factors include: operation in an untrustworthy world, more demanding applications, ISP service differentiation, increasing demand (lack of stability), the rise of third-party involvement, and less sophisticated users.

The paper points out a number of requirements, such as trust, anonymity, involvement with other communicating parties, and multi-way communications, to illustrate the breadth of the issues and to suggest the range of solutions that will be required

The paper introduces several network functions and services, such as firewalls, traffic filters, and Network Address Translation (NAT), as a solution, needed based from the current user requirements. In addition to this, labeling which is in the middle ground of security and anonymity was suggested as the last solution

It goes to show that the initial argument, that is no functions should be implemented on the network is nullified.

Overall, I think the paper tries to cover most of the emerging issues of the Internet; so it is good.