Defining a System

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Throughout the various sciences and a multitude of perspectives, the term system is used quite liberally in various ways. However, there are certain traits of these definitions that overlap. Taking this overlap into consideration, a system can be defined as a group of multiple parts that interact with each other to make a whole. Changes to these parts, therefore, change and evolve the system in its entirety. In this paper, I will cross reference various scientific papers' proposals of the definition of system to synthesize the previously stated definition. Next, I will provide my own proposal for a necessary feature of systems. Taking both the papers and my own thoughts into consideration, I will then list the criteria for a group to be considered a system. Finally, I will determine if the World Wide Web is considered a system based on these criteria.

Crossreferencing Ackoff's claim of a system's parts' dependence as well as Lampson's implication of dependence, we can conclude that a system must consist of interdependent parts. In Russell L. Ackoff's paper, "Systems thinking and thinking systems," Ackoff states that a system "cannot be divided into independent parts or subgroups of parts."[3] In Butler W. Lampson's paper, "Hints for Computer System Design," Lampson implies this previously mentioned trait of dependency, stating that, since an interface, which is a system, "embodies assumptions which are shared by more than one part of a system, and sometimes by a great many parts, it is very desirable not to change the interface."[2]

Based on both Lampson's and Reason's implication of a system's reliance on its parts, we can conclude that a system's parts change and evolve the system as a whole. In Butler W. Lampson's paper, "Hints for Computer System Design," Lampson states that it can be "unclear about how one choice will limit freedom to make other choices, or affect the size and performance of the entire system."[2] Similarly, In James Reason's paper, "Human error: models and management", Reason claims that a single "strategic [decision]"

made by a member of a system has "the potential for introducing pathogens into the system."[1]

As a man of science, I tend to follow the definitions that the relevant scientific literature suggests. Thus, I believe that, as synthesized in the previous paragraphs, a system can be defined as a group of multiple parts that interact with each other to make a whole, and that changes to these parts, therefore, change and evolve the system in its entirety. However, one property of systems that I believe that scientific literature fails to mention in their proposed definitions is that some independence between parts is necessary for something to be considered as a system. For example, computers have a CPU, a GPU, a motherboard, a power supply, a case (typically), RAM, and a hard drive, each of which are distinguishable. Thus, computers meet this criteria of a system. However, I would not consider a puddle of water a system. Sure, a puddle of water consists of many water molecules (a group of parts) interacting with each other to make a whole. It also would be affected as a whole if one molecule were to be changed or removed (its volume would decrease). However, puddles of water do not have distinguishable parts. All water molecules are molecularly identical with no specialization whatsoever. Therefore, I think it would be more accurate to call it a body of water molecules rather than a system

Taking all factors into account, for a group to be considered a system, it must meet the following criteria:

- It must consist of multiple parts
- Its parts must interact with each other
- Its parts must be able to be grouped into one whole
- Its parts must be dependent enough so that changes to an individual part will affect the system in its entirety
- Its parts must be independent enough so that each part is distinguishable

Lets determine if the World Wide Web, WWW for short, meets these criteria.

One fundamental piece of the WWW is a web browser. Web browsers are what send and receive information to the WWW. As explained in Tim Berners-Lee's, the creator of the WWW's, Turing Award article, "Sir Tim Berners-Lee", the WWW utilizes "HTTP (hypertext transfer protocol)" in order to fulfill these interactions between a web browser and the WWW.[4] Thus, if one were to consider a web browser as part of

the WWW, which I certainly would considering a web browser is required to communicate with the WWW, then this serves as an example of how the WWW consists of multiple parts that interact with each other, satisfying the first and second criteria for being a system. Additionally, as described in Tim Berners-Lee's paper, "Web Architecture from 50,000 feet", the WWW consists of multiple parts, including (but not limited to) "the HTTP space" as a communication protocol, various "Data Formats" including "HTML" and "XML", and the "web" of information itself.[6] All of these parts, along with others, interact with each other in specific ways, allowing them to be grouped into the one whole that we call the WWW. Thus, both the first, second, and third criteria for a group to be considered a system is satisfied.

In Tim Berners-Lee's paper, "Information Management: A Proposal," Berners-Lee proposes that in order to prevent the structural restrictions a "fixed hierarchical system" provides, an information management system should consist of a "web of notes with links" between them.[5] This idea became the foundation of the WWW we have today. Nearly all web pages are accessed through a reference from another, especially via search engines. Every node is a dependency of all the nodes that reference it, meaning a change in one node will affect all of the nodes that depend on it, fundamentally altering the WWW as a whole. Thus, given the referential nature of the WWW, the WWW satisfies the fourth criteria of a system. In contrast, however, Berners-Lee emphasizes the independence/distinguishability of each part of the WWW in his paper, "Web Architecture from 50,000 feet", stating that the distinguishability that a "URI" provides is "core to the universality" of the WWW.[6] Every webpage has a unique URI, better known today as a URL, meaning the WWW consists of distinguishable parts and satisfying the fifth and final criteria of a system.

In conclusion, as synthesized in the prior paragraphs, the WWW satisfies all 5 criteria for a group to be considered a system. Thus, the WWW is a system.

Word Count: 1018

References

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