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Analysis for the Overwhelming Success of the Web Compared to Microcosm and Hyper-G Systems

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Abstract

Microcosm, Hyper-G, and the Web were developed and released after 1989. There were strengths and weaknesses associate with each of these hypertext systems. The architectures of these systems were relatively different from one another. Standing above its competitors, the Web became the largest and most popular information system. This paper analyses the reasons for which the Web became the first successful hypermedia system by looking and evaluating the architecture of the Web, Hyper-G, and Microcosm systems. Three reasons will be given beyond this success with some lessons to learn. Currently, Semantic Web is a recent development of the Web to provide conceptual hypermedia. More importantly, study of the Web with its impact on technical, socio-cultural, and economical agendas is introduced as web science.

Keywords: *open hypermedia, Hyper-G, Microcosm, the Web, semantic web.*

1. Introduction

There have been many significant developments over the centuries in hypermedia systems. Before the Web was released in 1991, there were two other hypermedia systems: Hyper-G and Microcosm. Currently, the Web is considered as the most popular and widely used distributed hypermedia systems, whereas the others are disappeared. This paper will begin with presenting an overview of early hypermedia systems. Secondly, open hypermedia system and the Web will be looked at through the lens of their architecture and evaluation. Thirdly, the main causes for growing the Web will be outlined. Fourthly, some lessons to learn from the success of the Web will be drawn. Finally, recent developments of the Web will be discussed.

2. Early History of Hypertext

Hypertext has a fairly long history. Hypertext systems of highest influence will be overviewed in this section.

2.1 Memex

This system was proposed by Bush in 1945[1]. Memex was an electro-mechanical device used for organising information and knowledge. It is considered as the forefather of all subsequent hypertext systems.

2.2 Xandru

The after Memex, Nelson launched the Xandru project as a more comprehensive hypertext system in the 1960s and as a revision of Memex [2]. This project, viewed as an ideal hypertext system, had the compelling features of link integrity and automatic version management. Furthermore, Nelson had invented both hypertext and hypermedia terms [3]. The former deals with text which organised in non-linear format and connected by links. The latter is the hypertext's extension, which is combination of both hypertext and multimedia.

2.3 Dexter

This model was a formal reference model for an open hypertext system which was developed between 1988 and 1990. It was used to design existing and future hypertext systems [4]. The aim of this reference model was for system comparison as well as for interchange development and interoperability standards.

3. Architecture of Open Hypermedia and the Web

3.1 Microcosm

Microcosm was initially designed for desktop-based hypertext systems as a research project at Southampton

University. Then, it was changed to a distributed hypermedia system [5]. Microcosm had three layers: application, link service, and storage layers.

3.2 Hyper-G

Hyper-G was the midway between Microcosm and the Web and it was developed by Graz University around 1989-1990 [5]. Hyper-G was, another distributed hypermedia system, based on client-server model [6]. Hyper-G utilised its own protocol (HG-CSP) and its resource format (HTF).

3.3 The Web

The Web was initially proposed by Tim Berners-Lee at CERN to provide a distributed hypertext environment [7]. The Web architecture encompassed three essential technologies: Firstly, URI as an identifier was to address any resources on the Web. Secondly, a network protocol such as HTTP, which defined how to receive and send messages between clients and servers. Finally, a mark-up language such as HTML was to specify the resource format for documents.

4. Evaluation

The Web and open hypermedia systems had their own strengths and weaknesses. Table-1 presents a summarised evaluation on the Web and open hypermedia systems.

4.1 Linking

The linking model of the Web was different from those of Hyper-G and Microcosm. The Web had simple node link model [8]. Nodes were interconnected with point-to-point, uni-directional, non-contextual, and no-typed links were used to present the Web's content. This simplicity of today's Web leads to link dangling and broken. For example, an "Error 404" will be shown if the requested link is broken or not found. This simplicity of linking model, on the other hand, gives strength of the Web to be implemented easily [9]. Conversely, links were separated from nodes in open hypermedia systems [8]. This separation of data and links allowed users to navigate in various ways. Links were stored in a database in Microcosm. Dynamic linking was supported by Microcosm via generic links so that link destinations were managed on the fly automatically by the system. Likewise, Hyper-G used a central link database to separate links from the nodes, but it was not as comprehensive as that of Microcosm. Consequently, it did not need to maintain the links manually in Microcosm and Hyper-G in case of break. That means, their linking management was costless. This strength of linking model in Microcosm and Hyper-G, therefore, was also their weakness [8]. Hyper-G and Microcosm were complicated to implement technically peculiarly owing to their linking management.

4.2 Scalability

Scalability has always been a vital feature of hypermedia systems which includes performance with number of users [8]. The Web had generally more scalable than Microcosm and Hyper-G [10]. Firstly, the Web and Hyper-G were developed as large-scale hypermedia over the internet, whereas Microcosm was initially based upon intranet and it was also designed for cooperative and group activities. Secondly, the Web was designed as a decentralised system, whereas open hypermedia systems are centralised ones. Thirdly, open hypermedia had many built-in features such as the harmony browser in Hyper-G and dynamic linking in Microcosm, but the Web de-fined the minimum protocol nonetheless. Finally, Hyper-G document format was HFT and it had search engine facility, while the Web text format was HTML and it did not have a search engine. Instead, it allowed a third search engine [11]. In contrast, Microcosm did not have any document format [10]. Table 1 evaluates the main features of the Web, Hyper-G, and Microcosm.

Table 1: Evaluation of the Web and open hypermedia systems

Features	The Web	Hyper-G	Microcosm
Linking	Simple links and local anchor	All links except dynamic link	Supports all links
Simplicity	Yes	No	No
Scalability	Yes	No	No
Openness	Yes (URI)	No	No
Document format	Yes	Yes	No
Mark-up language	HTML	HTF	No
Proprietary	Non-proprietary	proprietary	proprietary

4.3 Openness

URI was used in the Web to identify any object via a simple text string, while Hyper-G and Microcosm did not accommodate this feature [10]. This brought openness for the Web. Alternatively, there were document systems in Hyper-G and Microcosm.

5. Growth of the Web

This section will present three main causes for growing the Web against its competitors.

5.1 Technical

There were six main technical causes for succeeding the Web. Firstly, simplicity and ease to use were the power of

the Web, especially after developing and spreading web browser technology [10]. There is no doubt that the Web was not complicated com-pared to Hyper-G and Microcosm. Secondly, the Web had more flexibility than other hypermedia systems. For example, users were easily able to create plug-ins such as search engines, and bi-directional links [12]. Thirdly, the Web was the most scalable hypermedia system compared to Hyper-G and Microcosm. Fourthly, the Web was universally standardised and open protocols were provided as well [7]. Fifthly, the implementation of the Web was technically easy compared to the others thanks to its linking model, protocols, and standardisation [8]. Lastly, the Web was compliant with all the Halasz's seven issues on hypertext [13], while the Hyper-G and Microcosm were not utterly compliant with it.

5.2 Economical

First, the Web was entirely non-proprietary [14], while Hyper-G and Microcosm were commercial products [15]. That means, either the Web would be used by everyone or it would not be so. Accordingly, users would always prefer the Web rather than the other systems. Second, the Web was developed by CERN [7], whereas Microcosm and Hyper-G were developed by Universities. Hence, CERN organisation was probably better for funding projects than Universities. Third, linking model and technical complications of Microcosm and Hyper-G made their implementation economically difficult [8].

5.3 Social

Hyper-G and Microcosm were developed in Europe and attempted to spread there-of [10], while the Web was spread not only through Europe but also through the USA on the Internet [7]. This was great benefit to the Web by giving the added global influence.

6. Lessons to Learn

The overwhelming success of the Web addresses three vital lessons. Firstly, the provision of a document format, open protocols and universal standards were the cornerstone of its success. Secondly, the Web was introduced the notion of "scruffy works" [10]. Thereby, this created opportunity to be simpler and more easily usable. Finally, the freeness, openness, and decentralisation of the Web were vital keys of its spread use.

7. Recent Development

At the present time, Semantic Web is considered as the next stage of Web development [14]. The aim of Semantic Web is to change the current machine-readable web into machine-understandable. Furthermore, COHSE endeavors to bring conceptual hypermedia into the Web in order for the Web to be able to implement dynamic linking as Microcosm did [16]. Conceptual hypermedia is presumably considered as Semantic Web and COHSE can be counted as its application. Meanwhile, technical, socio-cultural, and economical agendas have an effect on shaping the future of the Web. An interconnection between those perspectives is needed to form the nature of the Web in the future. Therefore, a new discipline named web science is a highly important area of work [10, 17]. Based on that, web science discipline has been initiated by Southampton University and MIT so as to analyse and monitor these developments of the Web.

Conclusion

This paper has introduced early hypermedia systems, the architecture and evaluation of open hypermedia systems and the Web, and has discussed three reasons for the Web becoming highly popular against its competitors. Three lessons to learn from this success and recent development of the Web have also presented. Each of these hypermedia systems had some advantages and disadvantages over one another. Technical, economical, and socio-cultural agendas and interconnections between them have impact on forming and anticipating the future of the Web. Accordingly, web science, as a new discipline, has recently initiated. With respect to more recent developments of the Web, conceptual hypermedia or Semantic Web, as a description of the Web, has introduced new trends for hypermedia and the Web.

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