Emerging Trends in System Software Market:
A Case Study of Operating System Software

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ABSTRACT

Information Technology has evolved over a period of time from Electronic Data Processors (EDP) to Cloud based technologies. Software is a critical component in this industry. The core product component in software is the set of instructions in the form of source code. During inception of the industry, source code was accessible at no cost. In the next era of information technology (1970's & 1980's), programs which were earlier available free of cost were sold at a price through licensing. During mid and early 1980's open source and hardware integrated software emerged. Similar trend was visible in system software market, especially in the operating system software market. Over a period of time Microsoft operating system emerged as one of the dominant players in the market. However, in the recent past Microsoft has considerably lost its market share in operating system products from 94.38% in June 2007 to 84% in May 2014. This paper captures the trend in operating system software market and analyses customers' preference to switch over from the current operating system. The trend in the market was analyzed through secondary data on market share and the customer preference to switch over was captured through a survey of engineers at various multinational IT firms in Bangalore. The study identified that the current trend could be moving towards open source or hardware integrated operating system from proprietary operating software. The survey identified that higher percentage of users preferred to switch over from the current operating system on desktops, laptops and workstations to either open source or hardware integrated operating system except servers.

Keywords : Open Source Applications, Operating System Products, Linux products, Business Model of Operating System

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INTRODUCTION

Operating system (OS) is one of the critical system software. The major players in operating system market are Microsoft, Linux and Apple Mac. These three players represent three different business models. Microsoft Windows™ is proprietary software, Linux is open source software and Apple's Mac OS™ is hardware integrated software. Under Desktop category, Microsoft Windows™ and Mac OS™ are the major players. In server category, it is mostly Microsoft Windows™ and Linux. Mac OS™ presence in this category is very less.

Microsoft Windows™ is a license based operating system, Apple Mac OS™ is also license based operating system, but it is hardware integrated operating system. Mac OS™ is compatible with only Apple computers. Linux is open source code based operating system. A community of users develops and tests the code. A set of distributors download the OS code and sell the code as a package to users under various versions. A few of the major distributors are Redhat, Fedora, Suse, and Ubuntu. (www.linux.com).

Microsoft Windows™ operating system was a dominant player in the operating system software market. However, in the recent past Microsoft Windows™ has considerably lost its market share in operating system products from 94.38% in June 2007 to 84% in May 2014.The decreasing market share of Microsoft Windows™ could be because of its lack of technological edge in today's technology-driven industry. The present cloud in IT prefers Google™ to Microsoft (Hahn and Passell, 2008). Microsoft has also been under scrutiny by customers for its security of its products. Jaikumar (2008) stresses that there is a need to change the perception of customers about the security feature of Microsoft operating system products. Secured application has become the major concern for customers of Windows™ operating system product. The feature referred as Spaces in Mac OS™ provides flexibility of switching between Mac OS™ and Windows™ flexibility in terms of platform independent hardware or software. In addition to this flexibility, the software development kit for iPhone™ and other innovative features offered with Mac OS™ has made customers prefer Mac OS™ over Windows™. The acceptance level of Mac OS™ is growing, meanwhile the acceptance level of Windows™ is on the downward trends since Mac OS™ provide effective and efficient solution in place of many hard-to-use features in Windows™ (Morgenthaler,2008). The customer would like to buy a product which would be compatible with the existing hardware or software. This feature will help organisation to create customer value and results in shift over of customer base from its competitors.

Bonaccorsi et al. (2004) provide an insight into the growth of organizations that use Open Source Software (OSS). The data was collected from 275 companies out of which 146 companies were able to provide valid answers. It was noticed that the average growth of turnover was around 121.3%. Further analysis identified that the organizations that use only OSS have slower growth as compared to the organization which use the combination of OSS and proprietary software. These organizations used hybrid business models. However, hybrid business model has significant challenge under general public license. The analysis on using OSS for production and the impact of network externalities were done. This research identified that hybrid business model produces better results and growth. The study identifies that the perception, acceptance level and awareness of OSS are some of the key elements in a business model.

Krishnamurthy (2003) opines that the industry trend is moving towards open source business models. He analyzed the business models existing in the open source software and indicates that open source software provides more flexibility and reliability for organization due to which users may prefer to buy open source software. Baseman, et al. (1995) is of the opinion that Microsoft has erected barriers of entries through pricing and non-compatibility techniques. Due to these factors Microsoft is able dominate the market as compared to other players. One of the important features in operating system product is the factor of compatibility. It implies that operating system will have the flexibility to support multiple platform based hardware or software applications. However, the concept of lock-in is prevalent in the industry due to the compatibility factor. Lock-in for either customers or vendors is defined as the situation where a customer is dependent on a vendor for products and services and (s)he is unable to use another vendor without a significant switching cost. Switching costs place a financial constraint on the customers who intends to switch brands or suppliers. Therefore, the industry with significant switching cost generally might have forced customer loyalty. Customer lock-in adds significant value to a company's strategy (Joachim, 2004). Customer lock-in is a significant factor in the operating system market, since it is directly related to the features of compatibility and flexibility. A few years back Apple released Mac Mini™, a low priced Macintosh computer, at a cost of $499. It has hardware compatibility with other brands. This compatibility has resulted in low switching cost for customers. This might impact the lock-in of Microsoft customer base. All these developments make customer lock-in a vital component of the value chain in business model. In one of the studies conducted by Joe McKendrick, it was identified that six out of ten respondents were using open source code operating system. This is an indication that the lock-in of customers is being locked-out through enhanced features of operating system.

DISCUSSIONS

Structural Change in Operating System software market:

Table- 1 shows the average operating system market share of three major players who dominate the market. This data is compiled based on the market share data from four sources namely Net share, Stat owl, Stat counter and w3counter. As shown in Table-1 Microsoft Windows™ has lost nearly 10.5% of the market share between June 2007 and March 2013. It was a dominant player holding nearly 95% of

Table 1: Average Brand wise Market Share of Operating System Product

	Microsoft	Apple Mac	Linux	H-Index
May-07	94.3	3.9	1.3	0.89
May-08	93.9	4.3	1.4	0.88
May-09	92.6	5.6	1.1	0.86
May-10	90.0	7.5	1.3	0.82
May-11	87.8	8.5	1.0	0.78
May-12	86.4	9.3	1.1	0.76
Mar-13	83.8	7.5	1.4	0.71
Aug-14	84.05	8.09	2.92	0.71

Source: Patagundi, Basanna. (2014). Strategies for Sustenance of Market Share: A Study of Operating System Products. PhD Thesis.Manipal University, Manipal, India.

the market share for a long period of time. Linux's average market share has increase by 0.01% from 1.31 between June 2007 and March 2013. However, Apple Mac's OS™ average market share has increased from 3.9% to 7.5%. The market share for Apple Mac OS™ has increased by 3.6%. The last column in the table above is Herfindahl Index(H.I.) which is an indicator of the trends in the state of competition of the industry. The computed H-Index during May 2007 was 0.89. This is an indication of the presence of a dominant player. The H-Index during August 2014 is 0.71. The changing pattern of dominance in the market share is clearly evident from the H-Index. Table-1 also shows the volatility involved in the market share for operating system products.

Table 2: Number of versions released during May 2007 to March 2013.

No. of OS Versions released during – May 2007- March 2013		
MS Windows™	Apple Mac OS ™	Linux
10	4	62

Source: www.wikipedia.org

Table-2 shows number of versions released during May 2007 to March 2013. The number shows the innovation factor in operating system products. Number of versions could be considered as an indicator of increase in demand for changes/updates. The demand for changes results only when customers start using the product. Due to the usage experience, customers demand for a certain change/update to accommodate their technology requirements. The demand changes can be easily accommodated by Linux because of open source. Feedback from users will be continuously monitored and observed. Since it is an open source, the changes are immediately done and new version of operating system is released. However, Microsoft Windows™ and Apple Mac OS™ have to follow meticulous organizations processes to design and release a new version of operating system. The design and development of operating system is restricted to only a team of engineers working for either Microsoft or Apple. Whereas, Linux operating system can be modified and a new version could be released by any developer who is technically sound to modify programme code.

As shown in Table-2 Linux releases more versions of operating system at a faster rate as compared to Microsoft Windows™ and Apple Mac OS™. More releases could be possible due to the flexible process of developing and releasing of operating system. However, the changes/new versions are initiated and developed by users in case of Linux. In case of Microsoft Windows™ or Apple Mac OS™, the changes/new versions are initiated by users and developed by operating system developers in Microsoft and Apple Mac respectively.

TREND IN OPERATING SYSTEM

The trend in operating system has completed one cycle as depicted below. The trend could result in cyclical trend in future, provided the users prefer to use open source or hardware integrated operating system.

The cycle in figure 3.1 shows that the operating system
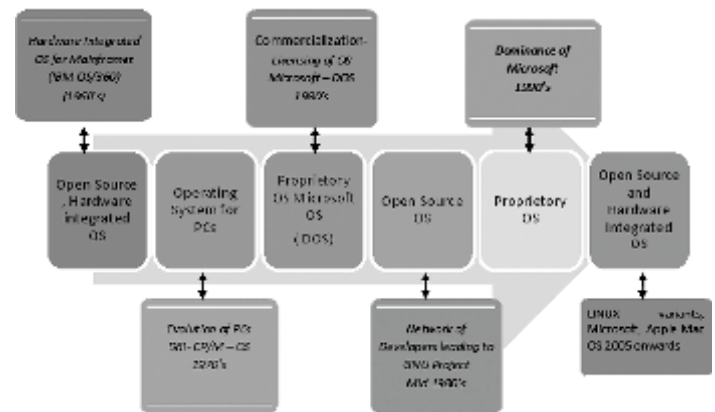
Figure 3.1: Trend in operating System

Source: Patagundi, Basanna. (2014). Strategies for Sustenance of Market Share: A Study of Operating System Products. PhD Thesis.Manipal University, Manipal, India.

products started with hardware integrated and open source applications. Then the trend moved to license based OS. It was an era of commercialization. A group of developers came together and started GNU project to counter commercialization. However, they were able to successfully develop the open source OS by early 1990's. During this time organizations started experimenting the open source OS. Due to its robustness most of the organizations started adopting it. Meanwhile, Apple Mac OS also improvised OS versions which were technically very sound. The acceptance of variants of OS of Linux and Apple Mac OS lead to the decline of Microsoft dominance. The trend started with open source and hardware integrated operating system and passed through phases of proprietary software leading back to open source and hardware integrated operating system practices. The various phases in the trend have been explained below.

In 1976, Digital Research Incorporated (DRI) sold CP/M operating system, to be used on the Machines based on Intel's 8-bit 8080 processor. In 1980, Microsoft paid $100,000 for the rights to a CP/M derivative or clone software referred as "Disk Operating System" (DOS). After minor modifications to DOS, Microsoft referred to this updated operating system as MS-DOS. In 1981, IBM entered into the PC market and it chose Intel's new 16-bit 8088 chip as the CPU. IBM also decided to endorse Microsoft's MS-DOS as the operating system for their PCs. IBM's partnership with Microsoft did not last for long. In the meantime, IBM and DRI continued developing their own operating systems. Under the terms of the dissolution, IBM continued to develop MS-DOS, and consequently its own variant, PC-DOS, which IBM loaded on PCs bearing the IBM

nameplate. In exchange, IBM paid royalty to Microsoft for a predetermined number of units (Baseman, et al., 1995)8. Later, Microsoft's Windows™ turned out to be a major player in the operating system product category, which captured majority of the market. One of the major competitors for Microsoft, right from Microsoft's inception, is Apple Inc.

The aesthetics appearance of computers during this time was not very attractive to the users. Therefore, Steve Jobs and Steve Woznaic designed the computer with cases and other computer peripherals that would attract customers. Steve wrote the operating system for their Machine based on UNIX. They released their first Machine Apple 1 in 1975. Over a period of time depending on the requirements of the customers, Apple enhanced its product by introducing new software and features. These changes were incorporated in Apple 2 which was released two years after Apple 1. In mid 1980's Apple launched Macintosh which incorporated many effective graphical interface. Steve's association with XEROX Palo Alto Research center had a major influence on the design of Macintosh. However, Macintosh had closed architecture which resulted in software/application compatibility issues. Closed architecture implies that the structure and specifications of the computer hardware is not made available to public. Therefore, it will be difficult to write applications compatible to Mac computers.

Apple computers were appealing to customers. It generated demand amongst the business organizations. The other major players also forayed into the personal computers. One of the prominent players amongst them was IBM. They developed personal computers and used the operating system written by Microsoft. IBM Personal computers had open architecture. Open architecture allows others to clone personal computers and have a standardized processors and components in computer. This resulted in entry of other players into PC market. The open architecture was also useful for application software designers and users. Since all these Machines used standard software, there were no problems of compatibility of software.

Linux is one of the pioneering operating system in open source model. It was developed by Linus Torvalds. He was a student in Finland. MINIX was an operating system code written by Prof. Andrew S. Tanenbaum. He wrote a book on developing operating system. It was a kind of open source code of operating system. Probably, this book inspired Linus to develop a comprehensive open source operating system. Linux was made known to the world because of GNU (Recursive Acronym of GNU's not UNIX) project.

In 1983, Richard Stallman started GNU (Recursive Acronym of GNU's not UNIX) project which aimed at developing free and quality software. The team started working on developing open source software. However, developing an open source operating system was a great challenge. It was taking more time for the team to write open source operating system. During the same time Linux Torvalds developed an operating system as a hobby and was shared with GNU team. That was the birth of Linux operating system which had open source

code in the history of operating system software market.

Amongst these leading operating systems Microsoft Windows dominated the market. In 1993, Microsoft was faced with three different challenges. First, Sun Microsystems designed platform independent software, Java, to free developers from the underlying software/hardware platform. As Windows dominated the PC world, the evolution of a platform-independent software standard could be a serious threat. Second, Netscape introduced Navigator to allow the consumer to exploit the graphical content of the Internet. A Netscape monopoly on the product that allows the consumer to view the Internet could significantly constrain Microsoft's expansion plans. Finally, the open source operating system, Linux, evolved to challenge the Windows (Coate& Fischer, 2004). However, Microsoft was able to overcome the challenges by designing strategies which were perceived to be anticompetitive and sustain its market share during this period of time. Antitrust cases and paying penalty were apparently part of Microsoft's business cycle, but still Microsoft continues to have major share in the operating software market. However, in the recent years Microsoft is slowly slipping out as market leader. The market share of Microsoft is declining at a faster rate in the recent past. This trend is captured in table:1 above through. During the same time the other two players gained the market share. Apple Mac which is one of the hardware integrated operating system gained close to 50% more market share during the same time. Therefore, the trend of Operating system seems to be moving back to the 1970's where, most of the applications were hardware integrated and open source applications. This could lead to a cyclical trend in operating system software in the future.

WITCH OVER OF OPERATING SYSTEM

The switch over preference of users was captured through a survey. The respondents for the survey were the professionals working in information technology industry across MNC's in Bangalore. Operating system is highly a technical product. Therefore, the target group for survey had to be technically sound. The customers of operating system can be classified as enterprise and home segment customers. Generally, Enterprise customers are more informed about operating system as compared to home segment customers and would have more technical knowledge and usage experience of the operating system product as compared to home segment users. Hence, the target group selected for the research was enterprise users. The enterprise users in information technology industry use operating system product extensively either to develop or utilize any IT product.

The survey was a combination of web based survey and selection by reference database. (Referential sampling). The procedure of reference database involved identification of one reference in unit (in person) at random and move towards searching for others through references. The randomness of selection is ensured by accepting without bias but with a reference base. An instrument was developed to capture the present usage and preference to switch over operating system from the existing operating system. Out of 590 responses 554 valid responses were considered for analysis. The data used for the analysis was collected as a part of the doctoral thesis of the first author.
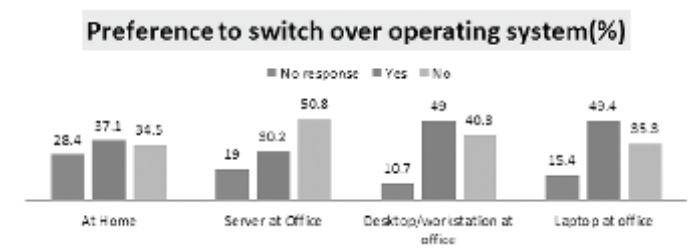
Figure 3.2: Preference to switch over operating system

Source: Patagundi, Basanna. (2014). Strategies for Sustenance of Market Share:
A Study of Operating System Products. PhD Thesis.Manipal University, Manipal, India.

Figure: 3.2 shows preference of switching over of operating system from the current operating system. Most of the respondents would like to switch over operating system from the current operating system except on servers. Half of the respondents do not want to switch over operating system on servers, where as close to 50% of the respondents preferred to switch over operating system for desktop/workstations at office and laptop at office. Close to 38% of the respondents wanted to switch over to a new operating system at home. The data above indicates that more number of customers prefer to switch over operating system on computers at home, office and laptop at office as compared the switch over preference on servers. However, the switch over trend indicates that the customers are ready to switch over operating system and use the operating system other than the current operating system being used. Majority of the respondents are using Microsoft Windows operating system across all hardware and most of the respondents would like to switch over the operating system. This is an indication that the customers would like to experience the operating system other than Microsoft Windows operating system.

Respondents who wanted to switch over operating system on laptops preferred to switch over to Apple Mac OS™.

This is in indication of a customers' preference shift towards Linux operating system and Apple Mac OS ™. The customer lock-in established by Microsoft Windows™ is locked-out and is losing critical mass. The existing literature shows that a superior technology can lock-out the customers and erode the critical mass. In the context of technology, first mover advantage will establish lock-in; however, the superior technology will override the first mover advantage and lock-out.

Microsoft Windows™ was enjoying monopoly till recent days. The market share in table: 1 indicates that it is edging out of monopoly. The preference of users might be moving away towards other operating system. This could be due to natural process of technology life cycle. Probably, the new wave of operating system might begin at the "chasm" stage of open source or hardware integrated operating system. This shift is due to the technological advancement and innovation factor.

In sum, the operating system market share innovation factor indicates that there is a probable shift of customers' preference towards open source operating system or hardware integrated operating system. The Microsoft Windows™ dominance in operating system product space may seize to exist.

CONCLUSIONS:

This research analyzed the trend in operating system software market. The trend was analyzed based on the historical growth and market share data. The recent trend is captured by analyzing the changing market structure. Customer usage experience was captured through a survey. The data analyzed in the present article reveals that there is structural change in the system software market. Most of the Customers were willing to switch over operating system
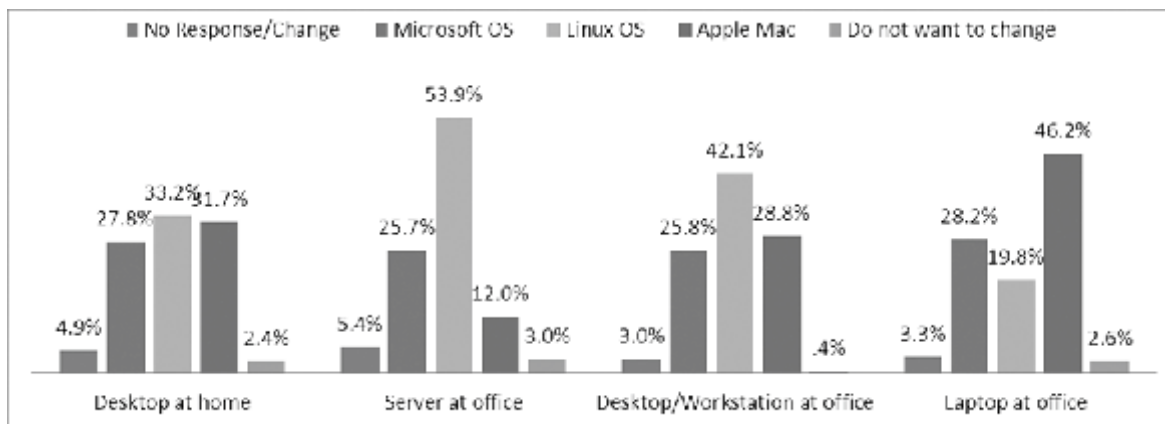

Figure 3.3: Brand preference to switch over of operating system

Source: Patagundi, Basanna. (2014). Strategies for Sustenance of Market Share:
A Study of Operating System Products. PhD Thesis. Manipal University, Manipal, India.

The above graph shows preference of the respondents who wanted to switch over operating system from current operating system. Linux OS was the most preferred operating system for Servers, desktops at home and office. Nearly 54%, 34% and 43% of the respondents who wanted to switch over to other operating system preferred to have Linux operating system on servers, desktops at home and at office respectively.

either towards open source or hardware integrated operating system. Except laptops, open source operating system Linux was preferred on servers, desktops at home and office. Apple Mac OS™ was preferred operating system on laptops. Therefore, trend in operating system may be leading towards open source and hardware integrated operating system which existed in 1970's the early stages of software evolution. This trend seems to have completed on cycle as indicated in figure: 2.1.

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