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DEDICATED TO

my parents, who have always believed in me and my girlfriend Friedrun, who has tirelessly motivated me to reach my goals.

PREFACE

For many years, Microsoft has been a giant in software creation, innovating techniques and procedures and dominating standards. The latest developments in economic theory, practice and jurisdiction show that the era of lone wolves and monopolists is over. This master thesis describes how this company has grown and matured, a company which fearlessly forged its own path to success. From its formation, Microsoft has been a highly controversial company. In the absence of innovation, it presented existing technologies in new ways, giving third-party innovation the Microsoft stamp, wielding the laws of market power and buying from financially weaker players. The first section of this thesis summarizes the fundamental research about competition theory. The second section reviews Microsoft's path from a technical standpoint in comparison to other operating systems. Finally, the third section outlines the legal struggles between Microsoft and the European Commission from an economical standpoint. Rather than striving to provide every minute detail, my thesis gives readers an overview and points readers to the best sources of more detailed information.

Markus Arthur Maier

1. Economic explanations, concepts and solutions

To understand the economic concepts concerning antitrust and Microsoft, a few terms should be explained and defined. This section discusses antitrust, dominance, foreclosure, consumer welfare, product variety, market power, tying and bundling, and monopolistic behaviour in the context of Article 82 of the EC Treaty.

1.1. Competition law and Antitrust

Various member states of the European Union have adopted national competition laws to give smaller companies the legal support to survive tough competition with giant companies. On the EU level, this protection is provided by Articles 81 and 82 of the EC Treaty, which defines how companies are allowed to compete. In the case of Microsoft versus the European Commission, Article 82 of the EC Treaty forms the basis for Microsoft's sentence from an economical perspective.

1.2. An economic perspective on Article 82 of the European competition law

From an economic perspective, Article 82 focuses on improved consumer welfare, protection of competition and protection of competitors to ensure that consumer needs are satisfied with regard to price, quality, quantity, variety, availability, etc.¹. Over time, this process leads to less efficient companies being replaced by more efficient companies, underscoring competition as a key element for a faster growing, consumer oriented and more competitive

¹ An Economic Approach to Article 82 – Report by the European Advisory Group on Competition Policy, Discussion paper 2005-26, December 2005: Page 3ff.

European economy. That said, different business practices require different actions. For example, the business behaviour of a company might include exclusive dealing, tying, or foreclosure, which could have anti-competitive effects. Based on empirical evidence, competition authorities strive to determine whether consistent business behaviour damages competition. Article 82 of the EC Treaty is a “rule of reason” approach to competition policy because every case has to be considered individually, which is not possible under the “per se” approach. As illustrated below, Article 82 of the EC Treaty is worded more generally.

Article 82²:

Any abuse by one or more undertakings of a dominant position within the common market or in a substantial part of it shall be prohibited as incompatible with the common market in so far as it may affect trade between Member States.

Such abuse may, in particular, consist in:

- a) directly or indirectly imposing unfair purchase or selling prices or other unfair trading conditions;*
- b) limiting production, markets or technical development to the prejudice of consumers;*
- c) applying dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage;*
- d) making the conclusion of contracts subject to acceptance by the other parties of supplementary obligations which, by their nature*

² Article 82 EC Treaty, Celex Nr. 12002E082
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:12002E082:EN:HTML>.

or according to commercial usage, have no connection with the subject of such contracts.

Article 82 of the EC Treaty supports competition rather than regulating in detail, which would pose the risk of losing the benefits of efficiency, productivity, growth and innovation. Basically, in the context of Article 82 of the EC Treaty, the question of abuse of market position focuses on competitive harm derived from exclusionary activities. Exceptions include natural monopoly industries and monopolies operated by the state.

The goal of the new European Competition Law reformed in late 2002 is the economics-based application of Article 82 to abuses of dominance. The competition authority adopts an effects-based versus a form-based approach to competition policy.

The main objectives of monitoring exclusionary abuses are to protect market competition and consumer welfare, and to promote the rational use of resources³. Low prices, high quality, innovation and a wide selection of goods and services are guaranteed when competition and market integration throughout the community create and preserve a free market.

1.3. Article 82 of EC Treaty and its connection with other regulations

Article 81 of the EC Treaty regulates what actions by member states constitute prevention, restriction or distortion of competition, if they affect trade between member states. Subsection 81(3) of this Article lays out the specific conditions of Article 81(1) and allows restrictions by agreements or a category of agreements between undertakings which improve the production or distribution of goods, promote technical or economic progress and allow consumers a fair share of the resulting benefit. When Articles 81 and 82 of the EC Treaty are applied in parallel, they help maintain effective competition on the market by

³ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 4ff.

limiting abuse of a dominant market position⁴. According to settled case law, the application of Article 81(3) does not preclude application of Article 82 of the Treaty. The aim of Article 81 and 82 is to maintain anti-abusive and effective competition on the market and, moreover, to prevent abuse of a dominant position as elaborated in Article 91 and 92⁵ of the guidelines on the application of Article 81(3) of the EC Treaty. Not all exclusionary agreements made by a dominant company represent abuses of their dominant position. For example, if a dominant company enters into a non-full function joint venture which is anticompetitive, but it contributes a substantial share of the assets and can prove that it satisfies all other conditions of Article 81(3) of the EC Treaty, the action is not considered an abuse according to Article 82 of the EC Treaty.

Article 82 of the EC Treaty does not apply to public companies for which EC member states have granted exceptional rights. Articles 82 and 86 of the EC Treaty define circumstances when companies cannot avoid abusing their dominant position⁶. This does not permit member states to enact or maintain regulations that oppose the EC Treaty, especially Article 12⁷ and Articles 81 to 89⁸. According to Articles 10⁹, 81 and 82 of the EC Treaty, all member states are responsible for enforcing effective competition. All member states of the European Union are prohibited from introducing or maintaining measures, even of a legislative or regulatory nature, which may render ineffective the competition rules applicable to undertakings¹⁰.

⁴ Communication from the Commission — Notice — Guidelines on the application of Article 81(3) of the Treaty, Official Journal C 101, 27/04/2004 P. 0097 – 0118, § 106.

⁵ Communication from the Commission — Notice — Guidelines on the application of Article 81(3) of the Treaty, Official Journal C 101, 27/04/2004 P. 0097 – 0118, § 106.

⁶ See Celex Number 12002E086, Article 86 EC Treaty.

⁷ Article 12 EC Treaty, first part: “Within the scope of application of this Treaty, and without prejudice to any special provisions contained therein, any discrimination on grounds of nationality shall be prohibited.”

⁸ Article 81 to 89 EC Treaty define the common rules on competition rules applying to undertakings and aids granted by states.

⁹ Article 10 EC Treaty: “Member States shall take all appropriate measures, whether general or particular, to ensure fulfilment of the obligations arising out of this Treaty or resulting from action taken by the institutions of the Community. They shall facilitate the achievement of the Community's tasks. They shall abstain from any measure which could jeopardise the attainment of the objectives of this Treaty.”

¹⁰ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 6.

1.4. Market definition and market power

Competition investigations commonly identify markets and market power in order to help competition authorities reach decisions. Once a relevant market has been defined, the authority can determine whether a company has a dominant market position as defined in Article 82 of the EC Treaty. The relevant market is the business area where competition takes place and consists of a product market and a geographic market. In a product market, consumers have access to substitute products based on product characteristics, prices and use ability. The geographic market is defined as the geographic region in which the company's products and services are available and in which the conditions of competition are sufficiently homogeneous between competitors, entrants and incumbents. The goal of the market definition is to systematize competitive constraints¹¹. To make antitrust investigations possible it is important to identify products and undertakings which are direct competitors in a relevant market. For example, whether a company can increase the price of a product or service above normal competition level depends directly on whether consumers have access to substitute products from competing companies in the relevant market. The fewer substitutes available in a relevant market, the stronger the entry barriers are for an entrant to supply these products. In this case, the demand curve is less elastic and high prices are more likely.

In one of the first cases involving an abuse of dominant position, the influential case of *United Brands v. Commission*, dominance was defined as follows¹²: "The dominant position referred to in this article relates to a position of economic strength enjoyed by an undertaking which enables it to prevent effective competition being maintained on the relevant market by giving it the power to behave to an appreciable extent independently of its competitors, customers and ultimately of its consumers¹³." In the *United Brands* case, an

¹¹ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 6.

¹² Case-27 / 76 *United Brands v. Commission*.

¹³ Case-27 / 76 *United Brands v. Commission*, paragraph 65.

undertaking was considered dominant if it had 40%¹⁴ of market power. Although this is far below being monopolist, a dominant company can more easily profitably increase prices to the monopoly level. In fact, investigations of the leading companies in a market often reveal monopolistic behaviour that merit penalties and sanctions. A company is abusing its dominant position when it takes advantage of its market power to adopt exclusionary practices¹⁵.

1.4.1. The SSNIP test in product market

Market power can be measured along the dimensions of product market and geographic market with a tool called the SSNIP test, or hypothetical monopolist test. The SSNIP test is used in competition law to detect abuse of dominance and to test the effects on competition of a possible merger. SSNIP stands for **S**mall but **S**ignificant **N**on-transitory Increase in **P**rices. Competition authorities use the SSNIP test to protect the market equilibrium from distortion by cartel, oligopoly, monopoly or other forms of market dominance. In the view of a company a relevant market is worth monopolising when a single supplier provides the goods or services and the supplier can profitably increase its price without losing its customers because there are no substitute goods or services available from other suppliers. If there would be a hypothetical monopolist who is the only seller of a certain product, is it profitable for the monopolist¹⁶ to increase the price above its current level in a non transitory way by 5 – 10%? If not enough customers switch from this product A to an alternative product B and the loss in sales is smaller than the earned profit within one year, then a relevant market has been found and competition authorities can analyse the market for any kind of market dominance. But if an increase in price is not profitable because consumers switch from product A to product B, product A is not a relevant market of its own and competition takes place. This implies that the market definition of product A is too small and the SSNIP – test has to be repeated in a wider market definition with another and larger basket of products until a separate relevant market can be found. Additionally it has to be stated

¹⁴ This definition was made by one of the first cases about an abuse of dominant position, namely the case United Brands v. Commission.

¹⁵ Motta, Massimo, Competition Policy: Theory and Practice. 2003, page 43.

¹⁶ Motta, Massimo, Competition Policy: Theory and Practice. 2003, page 136ff.

that the SSNIP - test only works if competition is still possible in the respective market¹⁷.

There are two ways to express the SSNIP – test empirically: *critical elasticity of demand* and *critical loss*. However, both calculations require higher data transparency than is de facto available. *Critical elasticity* is based on linear demand of price and cost margins. If elasticity of demand exceeds the critical elasticity a price increase leads to such a sales drop that the price increase is unprofitable and the products are not part of the relevant market. *Critical loss* is the maximum sales loss due to the price increase that is profitably sustainable over a set period of time. If a hypothetical monopolist can increase prices by 5% and the resulting maximum loss of sales is less than the critical loss, the price increase is profitable and there is a relevant market.

As it often can be very difficult to apply the theoretical concept of the relevant market practically, economists as well as competition authorities tend to use two alternative concepts: demand – side substitutability and supply side substitutability. These two terms will be explained in the following sections.

1.4.1.1. Demand substitutability

From the consumer perspective, demand substitution is when a set of products are substitutes and can be displaced with each other. That is, consumers can freely switch from one product to another in response to higher relative prices, even if the products are located in other geographic areas¹⁸. When demand substitutability is low in the relative market, a relative price increase is profitable. If a profitable relative price increase can be repeated, the market is worth monopolising. According to the SSNIP test, when a hypothetical change of relative prices initiates the reaction to switch to substitutes in an increasingly high number, the market is not worth monopolising.

¹⁷ For an example see section 1.4.1.3. “The cellophane fallacy”.

¹⁸ Commission Notice on the definition of relevant market for the purpose of Community competition law, Official Journal C 372, 09/12/1997 P. 5 – 13, §15 – 19.

As discussed previously, if a hypothetical permanent relative price increase of 5 – 10% causes enough customers to switch from one product to another, even in a different geography, to make the relative price increase unprofitable, the relevant market has to be broadened with additional substitutes and areas until the set of products and geographical areas is found that permits permanent profitable increases in relative prices. The same principle can be applied to the concentration of buying power from the supplier perspective¹⁹. For example, if a primary market orders, say, spare parts from a secondary market, the primary market has power over prices if it is the only customer of the product in the secondary market.

An example for demand substitution is when soft drink producers with strong substitution in demand sell different flavours in the same market. When company A raises the price by 5% - 10%, company B holds the price and A sustains a loss of sales not compensated by the price increase. If company A expands its flavour palette enough to weaken substitution in demand, a price increase will yield profits.

In case of a merger and abuse of a dominant position, the companies may have already increased prices and be in a position of demand substitution and therefore increased prices will not be recognized.

1.4.1.2. Supply substitutability

Supply substitution is when the producer is able to react to small and permanent price increases in a relevant market by changing the production process within a short time without incurring additional high costs, risks or time delays²⁰. One way to change is to switch to production of a substitute product. When these new products enter the market, they activate competitive behaviour and deter and discipline other companies. Supply substitution occurs when a wide range of qualities or grades of one product exist and the different qualities

¹⁹ See also: Commission Notice on the definition of relevant market for the purpose of Community competition law, Official Journal C 372, 09/12/1997 P. 5 – 13, §56 – 58 in conjunction with Article 86 EC treaty.

²⁰ Commission Notice on the definition of relevant market for the purpose of Community competition law, Official Journal C 372, 09/12/1997 P. 5 – 13, §20 – 24.

are not substitutable. When a lot of suppliers of one product market are able to switch production quickly without incurring high costs, the relevant product market and the appropriate sales represent the total volume of the market.

An example for supply substitution is the paper product market. Paper can be produced in various qualities and weights that are appropriate for different purposes, for example photographic paper vs. newsprint. The paper producing machines are capable of producing different types of paper on the same machine, so it is possible to switch the machine from one kind of paper to another within a short period of time and low cost. Relatively low distribution costs of different quality papers makes it possible for the paper producers to compete for orders when sufficient lead time allows the modification of the paper producing machines. The relevant market is not defined for every kind of paper, but all the different types of papers are included in the relevant market and its selling represents the estimation of the total market value and volume²¹.

Another way to measure market power is the concept of potential competition, which looks at geographic and product markets in the neighbourhood and looks for potential markets in the future. A big problem in this hypothetical approach is the distinction between potential supply substitution producers and producers, who enter the market at a later point of time, and therefore do not yet count as potential producers.

1.4.1.3. The cellophane fallacy

When a company already is under investigation under Article 82 of the EC Treaty, the European Commission tests whether the company has abused its dominant market position²². In this case the SSNIP test should not ask whether the hypothetical monopolist can raise prices in a small but significant way relative to current prices. Rather, it should assess whether a hypothetical monopolist can raise prices in a small but significant way relative to competitive

²¹ Commission Notice on the definition of relevant market for the purpose of Community competition law, Official Journal C 372, 09/12/1997 P. 5 – 13, §22.

²² Motta, Massimo, Competition Policy: Theory and Practice. 2003, page 140.

prices. Basing an investigation on current prices may lead to an overly broad market definition because the accused company already has a dominant position on the market. If the company in the correctly defined market already has such high prices that a small but significant increase in price leads to a loss, the SSNIP test would break the market in small market shares, which give evidence of proof that the alleged company is not in a dominant position, even though there are no real substitutes. This case has become famous as the ‘cellophane fallacy’ from the investigated DuPont²³ Company in the United States. The US antitrust authorities found out that a high cross elasticity of demand between cellophane, which is sold by DuPont, and other wrapping materials, like aluminium foil, wax paper and polyethylene needed a wide definition of the market with all possible wrapping materials included. This decision was the starting point for criticism, because the presence of such a high elasticity of substitution is an indicator of DuPont’s high market power. In the investigation of DuPont it became evident that the price of cellophane was so high that customers were replacing cellophane with inferior substitutes. The cellophane argument makes clear that an increase in price of 5% resulting in a small decrease of demand in an unknown monopolistic environment should not be the reason to widen the market definition because the undertaking probably is already exercising monopoly power.

1.4.2. The SSNIP test in geographic market

Most of the techniques discussed above are typically used to define product markets, but can also be used to define geographic markets²⁴. The SSNIP test works fine with the product market, but also serves as the conceptual framework for deriving and explaining data and information in a geographic market.

Let’s look at a hypothetical merger between the biggest hypothetical purified tap water producers in Austria that creates a monopoly market. If the new tap water producer can increase its prices by 5% - 10% profitably, then the new market has been defined, namely Austria. If the hypothetical monopolist cannot

²³ Case U.S. v. E.I. du Pont de Nemours & Co., 351 U.S. 377 (1956)

²⁴ Motta, Massimo, Competition Policy: Theory and Practice. 2003, page 148.

increase its prices profitably, then the hypothetical monopolist test has to be repeated in a larger geographic area, for example Austria and Germany, until a market is found where an increase in price is profitable for the monopolist. When the SSNIP test is applied to defining geographic areas, several additional factors play a role, including estimates of elasticity's, correlation tests, information related to imports, and transportation costs.

1.4.2.1. Geographic market: The shipment test

The shipment test looks at how many products are imported into a geographic area, "little in from outside", and how many products are exported from a geographic area, "little out from inside"²⁵. Both tests are satisfied when only few products are moved in both directions. Thus, a geographical area is a relevant market where few products circulate with other geographical areas. If two regions satisfy the test, the regions' producers may be exercising competitive constraint on each other. In this case, the shipment test has to be expanded to include additional regions. If the test is satisfied, the two regions can still be part of the same market. When products and prices are nearly the same and transportation costs are low and there is low product movement between the regions, then there may be strong constraint between one region and the other. In this case a price rise would make consumers switch from one product to another, making a price rise unprofitable. In this case, the shipment test is biased and does not yield accurate results.

1.4.2.2. Geographic market: Transportation costs

In a geographic area transportation is an important cost factor relative to the product price²⁶. If transportation costs between two regions are low in comparison to the product price and each region has a substitutable product, an increase in price in one region leads to substitution to the other region. If not, a competitive constraint is overriding the increase of prices in one region. But

²⁵ Motta, Massimo, Competition Policy: Theory and Practice. 2003, page 148.

²⁶ Motta, Massimo, Competition Policy: Theory and Practice. 2003, page 149.

exceptions exist. For example, when the geographic market is a city with one big food retailer, even increased prices do not motivate consumers to do their shopping in groceries outside the city. It does not make sense to extend the relevant market because high time and transportation costs are barriers to grocery shopping at another retailer outside the city borders. When markets are nearly monopolized by one product or company and the transportation costs are not very high, this company will try to stay in the home region and keep competitors out of the market, even when exclusion or foreclosure is necessary to reach that goal.

1.5. Foreclosure

Exclusionary behaviour is defined in Article 82 of the EC Treaty as behaviour that limits competition, the efficient use of resources, and consumer welfare²⁷. Dominant companies wishing to exclude or foreclose actual or potential competitors may hinder market entry or limit competitive constraints on themselves. Such firms must be pressured to allow greater competition and new entrants, but also improve product quality, innovation and performance. The primary goal is to protect competition, rather than to protect competitors as such. The main objective of Article 82 of the EC Treaty is to hinder anticompetitive behaviour, regardless of whether the anticompetitive behaviour just began or has been happening for a long time. The Article considers the harm that foreclosure has caused in the past and will cause in the future. The sentence by the European Commission will be harsher the longer the abusive behaviour lasts and varies depending on the harm that foreclosure will cause in the long run and in the short run. Competitors must be able to enter or expand in the market and compete in the market on their own merits. The definition of abuse is formulated by the European Court of Justice as follows:

“An objective concept relating to the behaviour of an undertaking in a dominant position which is such as to influence the structure of a market where, as a result of the very presence of the undertaking in question, the degree of

²⁷ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 17ff.

competition is weakened and which, through recourse to methods different from those which condition normal competition in products or services on basis of the transaction of commercial operators, has the effect of hindering the maintenance of the degree of competition still existing in the market or the growth of that competition.”²⁸

The company accused of abuse must be in the position to foreclose rivals from the market and has to have used its market power in the past to foreclose or hinder entrants or potential entrants from profitably accessing the market²⁹. Aggressive foreclosure is the attempt to eliminate competitors or to make them leave. Quiet foreclosure disadvantages competitors and makes them compete less aggressively. For example, a rival may be disadvantaged when the dominant company directly raises the rival's costs or reduces demand for the rival's products. When the degree of competition or growth of competition is lower than expected from a competitive market and foreclosure distorts the market, competition will likely result in increased or above-competitive level prices. Whether or not the market has been distorted depends on the nature or form of conduct and how the accused company is applying it to the market, including market coverage of the abusive technique and selective foreclosure of customers to entrants or rivals. Other important determining factors include network effects, economies of scale and economies of scope, curve effects and first mover advantages as well as the degree of dominance, which gives the abusing company a large set of tools to distort and foreclose. In general, the more possibilities a company has to foreclose, the more it will foreclose, the more power and dominance it will have and the more abusive foreclosure effects will result in absolute anticompetitive behaviour.

There are two sets of abuses that a company can use to foreclose its competitors from fair market participation: priced-based abuses and non-price-based abuses. Price-based abuses include rebates, price bundling and predatory pricing. Non-price-based abuses include contractual tying, single

²⁸ Case C – 85/76 Hoffmann – La Roche & Co. AG vs. Commission of the European Communities, 13th February 1979. Paragraph 39 and 90.

²⁹ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 18ff.

branding contracts, refusals to supply, and contractual exclusive dealing. These abuses are often intertwined and closely related. For example, setting high stand-alone prices versus a bundled price for two products ties these products together and has similar effects as contractual tying. Single branding in conjunction with high rebates has the same effect as contractual exclusive dealing. If a very high price for a product is given or a high upstream price with a low downstream price is combined, it is similar to a constructive refusal to supply.

1.5.1. Foreclosure in horizontal and vertical markets

Exclusionary behaviour by a company can be either upstream foreclosure or downstream foreclosure³¹. The closer a company and its market is to the consumer, the further downstream it is. In this schematic, the upstream company produces goods or services for a downstream company, for example, an oil processing company sells to a fuel selling company. Horizontal foreclosure is an effort to exclude, marginalise or discipline a competitor at the same level of the supply chain through predatory pricing, single branding and rebates, and tying and bundling. Figure 1 illustrates how the dominant company A tries to foreclose company B from entering downstream market C and D. Another variation of horizontal foreclosure is when company A forecloses a potential or existing rival company B from one or multiple upstream markets, for example by bundling products from these upstream markets. This may also serve to foreclose company B's access to the downstream markets C and D.

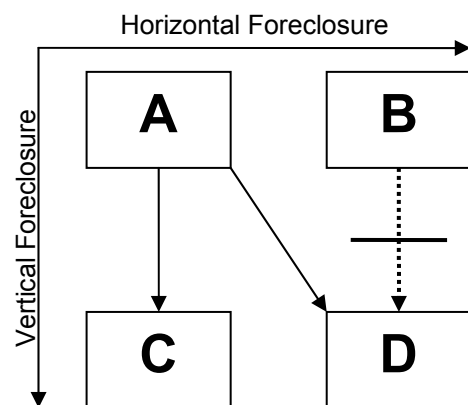


Figure 1: Upstream and Downstream market³⁰.

³⁰ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 22.

³¹ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 21ff.

Vertical foreclosure is when a company refuses to supply to a potential or active participant in the downstream market³³. This is only critical when the dominant company A is active in the downstream market. Figure 2 illustrates how company A is proprietor of company Ca and refuses to supply company D.

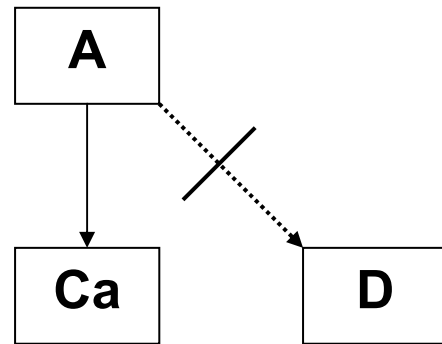


Figure 2: Refusal to supply³².

1.5.2. Foreclosure: Predatory pricing

As derived from Article 82 of the EC Treaty, predatory pricing is when a dominant company deliberately incurs losses or foregoes profits by lowering prices with the intention of eliminating, disciplining, or preventing the entry of competitors who cannot survive the price war³⁴. These phases are known as predatory phase and recoupment phase. In order to succeed, the dominant company has to have enough market power to foreclose rivals and strengthen its dominant position. This is not the case when there are many competitors players in a market because the other competitors would not permit a profitable recoupment phase after the low price attack. It is also not the case when there are only few competitors but they are strong enough to withstand the price war. After eliminating competitors from a market in the predatory phase, the predator regains its losses and earns higher profits in the recoupment phase³⁵. Ultimately, the loss of competition leads to lower product quality, less choice, and higher prices – a clear loss of welfare for consumers.

However, not every decrease in prices is predatory. Lower prices are a desirable outcome of normal competition. Companies often lower their prices for

³² DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 23.

³³ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 22.

³⁴ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 28ff.

³⁵ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 28ff.

a temporary period to attract customers to their product, improve market share or introduce a new product on the market. A risk of predatory pricing is that exaggerated low pricing may lead a competitor to change market segments, positioning itself as a low cost entrant. Even though the predator can now buy rival assets very cheaply, it can keep the rival better under control if the competitor competes less vigorously in the same market segment.

1.5.3. Foreclosure: Tying and bundling

Tying is when a company sells a primary or initial product, known as the tying product, on the condition that an add-on, or tied product also can be purchased. Only the tied product can be purchased separately³⁶. Another type of tying is technical tying, where the tied product is integrated in the tying product, for example Microsoft's Internet Explorer in the operating system Windows. Bundling is when two or more goods are sold as one package. Pure bundling is when the individual products can only be purchased together and mixed bundling is when the individual products can be purchased separately or together at a price lower than the sum of the individual products.

Tying and bundling do not always harm competition because they are techniques companies use to deliver better quality products to their customers at lower prices. Bundling can help companies' lower production, distribution and transaction costs. Anticompetitive effects can occur as well, like foreclosure, higher prices or price discrimination, which are a violation of Article 82 EC treaty. When talking about foreclosing, dominant, and tying and bundling companies, there are a lot of effects on the competing market and its competitors. First, the dominant company thins out potential competitors' customers in the tied market. Second, it marginalizes competitors or forces them to exit the market, creating a barrier for new entrants in the tied market. Tying and bundling are attractive strategies because they leverage economies of scale and create high barriers to entry and positive network effects. Additional motivations include higher profits in the tied market, a broader

³⁶ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 54ff.

customer base, and a stronger dominant position in the tying market. Competitors find it more and more difficult to enter the tying market because the dominance is so strong that the only possibility to compete effectively is to enter tying and tied market simultaneously. Moreover, the dominant company can force the exit of a product from the tied market when it is expected to be a danger for the dominant company in its foreclosed market.

Article 82(d) of the EC Treaty says that “making the conclusion of contracts subject to acceptance by the other parties of supplementary obligations which, by their nature or according to commercial usage, have no connection with the subject of such contracts”³⁷. This means that a dominant company may not in an abusive way tie products together, even when these products are used in a commercial way³⁸, or deter customers per contract from obtaining the product separately, which is known as contractual tying³⁹. If the dominant company deprives its customers of the choice to buy the tying good individually or any of the products individually, it's in the first case tying and in the second case pure bundling. But there are also indirect ways of taking customers their choice, for example by refusing guarantees unless customers use the company's components, consumables or services. As an example take toners for laser printers. Often companies include in their general terms and conditions that the guarantee claim expires when refill toners are used.

A famous case where mixed bundling was abusive is the case Hoffmann – La Roche⁴⁰. Customers had to buy vitamins from the dominant Hoffmann – La Roche Company, who bundled their products and gave fidelity rebates in an abusive way to hold market share and stay dominant.

For the abuse by tying and foreclosing under Article 82 of the EC treaty to become effective, four conditions have to be fulfilled:

³⁷ Article 82 EC Treaty, Celex Nr. 12002E082.

³⁸ See Case C – 333 / 94 P., Tetra Pak International SA v Commission of the European Communities.

³⁹ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 55ff.

⁴⁰ See Case C – 85/76. Hoffmann-La Roche & Co. AG v Commission of the European Communities.

- The alleged company holds a dominant position in the tying market.
- The tying product and the tied product are two different goods and can be sold separately.
- To distort competition, tying and foreclosing is used abusively on the market.
- The conduct of tying is not explainable in an objective or commercial way.

1.5.3.1. Abusive behaviour in the tying market and separate buyable products

As mentioned above, the company that is allegedly abusing tying has to be dominant in the tying market, but it is not necessary that the company is dominant in the tied market too. Dominance in the tied market as well would, however, facilitate the verdict of abusive behaviour.

When there are two different products on the market which are sold as one product, the customer determines whether he considers them one product or two products⁴¹. If he thinks of them as two products not sold separately it is a matter of tying and bundling, whereas the product market can be separated but it needs not to be separated. When the two products are differentiated enough on one market, the company can be suspected of tying and bundling the different products. Strong indications of tying a product are when consumers would prefer to buy the product as stand alone product and not bundled or, in competitive markets, when companies distribute the product only separately to fulfil customer preferences. Indirect evidence of proof can be taken from other geographical regions with higher competition where tied products are sold

⁴¹ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 56.

separately. Tying two products may be considered necessary if they are highly technical and could be damaged or cause harm to the consumer during assembly. Alternatively, over time, products can become integrated and fused, such there may no longer be market demand for the tied product.

1.5.3.2. Distorted competition and the foreclosure effect

To establish a possible foreclosure effect of tying on the tied market, two basic factors play a role⁴². The first is how many customers are tied to the dominant company and therefore unavailable to competitors. The second factor is whether tied customers in the tied market make up a large enough share of the market. It is not important whether the practice is tying or pure, mixed or contractual bundling. It is only important that competitors are not able to bypass the foreclosed situation even by offering high discounts on their products or expiring tying contracts. It is not rational for customers to switch to other products if efficient competitors offer only some components and are not able to compete against discounted bundles of the dominant competitor. Another important question is whether the whole market can be considered foreclosed. This depends on percentage of total sales on the tied market and the dominant company's combined strength on the tied and on the tying market. The attitudes and derivation of the tied customers also strongly influence how attractive market entry is for alternative suppliers. When customers are positioned in regions where different geographical areas with different suppliers clash, the tied market can be softened by establishing network effects over regions. Although the entrant's market share is small, but growing, these actions can irritate the dominant company. In this case it is very difficult for competition authorities to prove foreclosure because of the combination of different tying actions from different companies who make the market entry considerably hard.

Dominant companies can use economies of scale, network effects, learning curves and entry barriers to strengthen their dominant position and raise the

⁴² DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 56 – 60.

foreclosure effect in the tied market. When the dominant company forecloses the tied market and uses economies of scale and learning curves derived by tying and bundling, this excludes rivals from the tied or part of the tied market⁴³. Similarly, network effects allow the dominant company to control the market in small steps and prevent competitors from gaining network effects. Higher network effects therefore heighten the probability that the dominant company will use foreclosure tactics. From the customer point of view network effects increase the value of the bought products because higher product use tends to result in higher personal utility. In such cases, rivals competing with the tying company are forced to offer discounts on their products to compensate customers for the lack of positive network effects and utility. The same scheme is valid for entry barriers. The greater the influence on the tied markets of the dominant company, the greater the power to protect itself from rivals in the tied markets.

An indicator to measure the foreclosure effect is the market performance of the dominant company compared to its competitors. If the dominant company heightens and intensifies the abusive tying actions, its market share rises and some or all competitors are marginalised and even exit the market. Failed entry attempts are additional evidence foreclosure effects and provide evidence to competition authorities.

1.5.3.3. The conduct of tying: Not explainable in an objective or commercial way

It is not logical for the dominant company to argue that it has to tie to maintain the quality, usage and development of its products to satisfy customers, because the dominant company is charged with deciding what products should or should not be on the market⁴⁴. The only exception is whether products are a

⁴³ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 59.

⁴⁴ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 60.

danger to customer safety and health, which would preclude product production. When companies follow the strategy of tying and bundling to reduce production, distribution and transaction costs, they may claim the efficiency defence. The efficiency defence combines two independent products into one single technologically new product and makes it unnecessary to promote and sell two products on the market. The efficiency defence applies to a new product, rather than contractual tying or bundling two independent products. The efficiency defence is valid if⁴⁵:

- Efficiencies are realised,
- There is no other way to realise these efficiencies,
- The efficiencies are credited to the consumer,
- Competition is not harmed by actions taken through the company arguing efficiency defence.

Other explanations are too weak to justify tying and bundling as efficiency defences that serve the consumer.

1.5.4. Refusal to supply: Intellectual property rights

A refusal to supply only harms competition when the refusing company is dominant on the relevant market. This can be an upstream input market or a distinct market where a connection between two markets is needed. The main purpose is to interface information, for example to provide data, which is bound within licensed intellectual property rights (IPR), access to an essential facility or

⁴⁵ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 26.

a network⁴⁶. Five requirements have to be met for the activities of a dominant company to be considered abusive⁴⁷:

- The refusal to supply is obviously practiced by the alleged company,
- The company allegedly refusing to supply is dominant,
- The processed information, good or intellectual property is essential for the non-dominant companies,
- Competition is negatively influenced by the refusal to supply of the dominant company,
- The refusal to supply can not be explained objectively by the dominant company.

When the duplication of an input is extremely difficult or impossible because it is legally or physically impossible or economically unviable, then the so-called essential facility, which has become standard or is indispensable for interoperability, is the bottleneck protected by IPR. In this case competitors have no access to needed information and technology important for inventing new products and are often not able to remain on the defined market in question⁴⁸. This type of exclusion has also a negative impact on competition because a competitor who would be able to create new products and services and thus a new market is not able to start due to the missing bottleneck or access to the essential facility. Not licensing Intellectual property is not necessarily an abuse of dominant position⁴⁹. However, when dominant companies refuse to license Intellectual property and the five conditions mentioned above are fulfilled and furthermore the development of market and

⁴⁶ Case COMP / 37.792 – Microsoft. Commission Decision. 24th March 2004.

⁴⁷ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 64.

⁴⁸ Case COMP / 37.792 – Microsoft. Commission Decision. 24th March 2004.

⁴⁹ DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses. Brussels, December 2005. Page 67 – 68.

competition is hindered as a consequence of the refusal to license an IPR, the company is likely abusing its dominant position. Since competitors lacking the essential facility cannot offer new services and products and consumer demand for such services and products cannot be met, this situation decelerates the market and competition. Protected IPR technology in a refusal to supply case may not only hinder direct innovation, but also indirect or follow-on innovation. This is the case when the protected IPR is not directly incorporated into the new technology, but is necessary to develop the new product or service to benefit customers. A well known example is the interoperability information refusal from Microsoft, which was broken by the European competition authorities⁵⁰. Another example of misuse of power is when a dominant company applies information gained in one market to a different market. The keyword for this type of refusal is market information interoperability, which enables the dominant company to leverage its dominance and market power through information. Although this kind of information usage is not prohibited, dominant companies are obliged to ensure interoperability for all participants in the market. When the interoperability information is considered a trade secret, non-disclosure is a clear abuse of dominant position.

1.6. The impact of monopolies on consumer welfare

Monopoly markets are characterized by the presence of one single supplier, barriers of entry, and a large customer base. The goal of competition authorities is to achieve perfect competition, which is impossible with a monopoly supplier. The monopoly supplier sets prices and creates entry barriers to generate high profits. When the monopolist raises its prices, the consumers suffer the welfare loss of consumer surplus. The only winner is the monopolist with its producer surplus. European competition authorities focus solely on consumer welfare. Disequilibrium between a lower consumer surplus and a higher producer surplus produces higher prices and loss of consumer welfare⁵¹.

⁵⁰ Case COMP / 37.792 – Microsoft. Commission Decision. 24th March 2004.

⁵¹ Motta, Massimo, Competition Policy: Theory and Practice. 2003. Page 56ff.

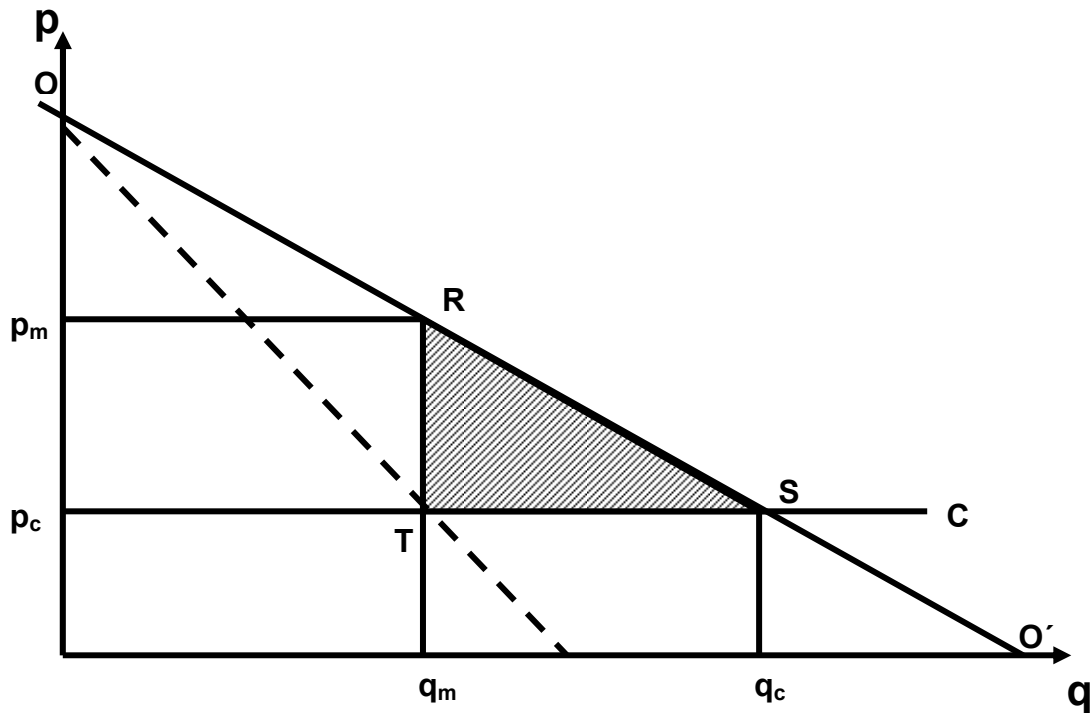


Figure 3: Deadweight loss from monopoly⁵².

As shown in figure 3, the triangle RST describes the deadweight loss caused by the monopolist by charging higher prices. To understand this conclusion, consumer surplus and producer surplus under perfect competition and monopoly has to be defined. Under perfect competition, the marginal cost line $p_c - c$ crosses q_c , the quantity sold to consumers. In the monopoly case, where a single firm holds the whole market power, the price charged is p_m with a monopoly output of q_m . Under perfect competition the triangle $O - p_c - S$ is the consumer surplus, because of the competition the competitive firms gains are equal to zero. Under monopoly conditions, welfare is given by the sum of consumer surplus and producer surplus, which is the object $O - p_c - T - R$, the sum of $O - p_m - R$ and $p_m - p_c - T - R$. As mentioned above, the triangle RST is the deadweight loss, which is the difference of efficiencies between $O - p_c - S$ and $O - p_c - T - R$. But not only this constellation reduces welfare, every price above marginal costs reduces welfare. The higher the price p , the greater the welfare loss caused by market power.

⁵² Motta, Massimo, Competition Policy: Theory and Practice. 2003. Page 57.

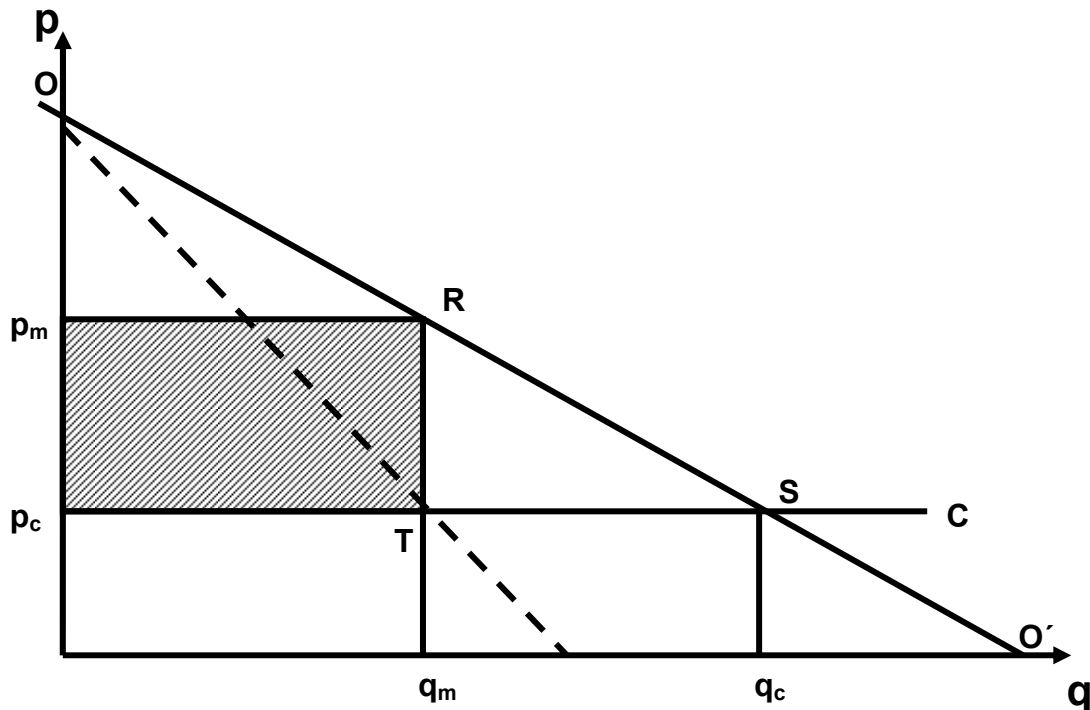


Figure 4: Additional loss from rent seeking activities⁵³.

Figure 4 describes the case where the monopolistic company does not want to maximise only the producer surplus, but monopolistic market power as well. Because of that, a lot of resources are expended on rent-seeking activities like political influence and lobbying power, which avoids the use of resources for technological and productive innovation. This increases consumer welfare loss due to the monopoly. The rectangle $p_c - p_m - R - T$ shows the additional welfare loss or social cost, which illustrates the overall monopoly profit the company earns⁵⁴. Investing in rent-seeking activities by trying to maintain or enlarge monopoly power diminishes the benefits to customers of wise investments into innovation and product diversity.

⁵³ Motta, Massimo, *Competition Policy: Theory and Practice*. 2003. Page 59.

⁵⁴ Posner, Richard. A.: *The Social Cost of Monopoly and Regulation*. August 1975. *Journal of Political Economy*. Volume 83, Number 4. Pages 807 – 827.

2. Technical overview: Microsoft's actions

This section describes basic functionality of operating systems, software and software standards, defines interfaces, compares free operating systems with commercial operating systems, and provides the technological basis to follow the European antitrust case against Microsoft and understand the European Commission's decision. Network functionality and other important concepts, solutions and manipulations critical to understanding Microsoft's actions will also be discussed.

2.1. Definition of operating systems

The operating system is the computer's basic program which controls the hardware, manages the distribution of resources for applications and enables the user to control the computer⁵⁵. The main functions of an operating system are process management or job management, memory management, abstraction and control of hardware, input and output control, file management and user interaction with user interface.

2.1.1. Operating system layer model

The operating system layer model describes the functions of an operating system best. It is based on the Open Systems Interconnection from the International Organization for Standardization (ISO – OSI) reference model. As illustrated in Figure 5 below, the model slices an operating system in seven sections that interact with the computer from the bottom to top. At the very bottom is the computer hardware, which communicates, depending on the programming concept, with or without additional layers directly or indirectly with higher placed layers. The number of layers is a parameter for working speed.

⁵⁵ Kersken, Sascha: IT – Handbuch für Fachinformatiker. 3. aktualisierte und erweiterte Auflage 2008. Galileo Press, Bonn. Page 273ff.

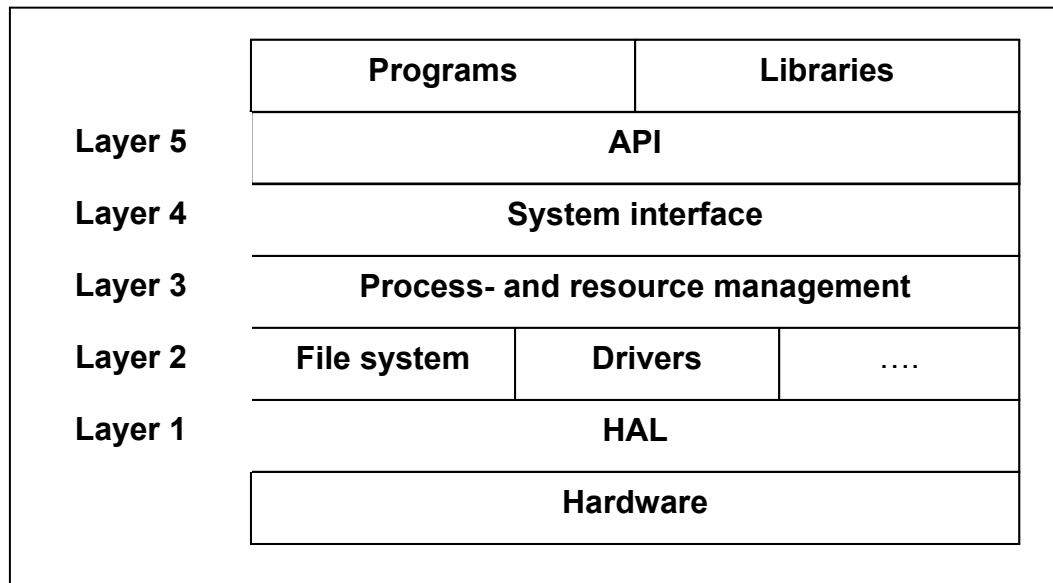


Figure 5: The layer model for operating systems⁵⁶

Layer 1 is HAL, which stands for Hardware Abstraction Layer. The HAL regulates the work and communication of different processor architectures with the layers above⁵⁷. The Microsoft Windows NT 4.0 family, which was ported to the Alpha processor platform and the Intel platform, is an example of a HAL. The operating system in this case looks the same, but differs depending on the processor design. For example, CISC design from Intel and RISC design from DEC used 64 bit, whereas Intel used 32 bit. Alpha was very fast, but because there were too few applications and because of Microsoft's strategy for the future, plans for Windows 2000 for Alpha Processors were dismissed in the beta phase. Today, Windows XP and Windows Vista support 64 bit from Intel as well. DEC no longer exists because it was bought by Compaq, which is now owned by HP.

Layer 2 includes the file system and drivers for the hardware that enable the communication between the different components. Today's operating systems are equipped with standard driver software for common hardware components. Driver software from hardware producers is delivered for proper performance and extended functionality of hardware components.

⁵⁶ http://www.operating-system.org/betriebssystem/_english/w-wissen.htm

⁵⁷ http://www.operating-system.org/betriebssystem/_english/w-wissen.htm

Layer 3 handles process and resource management. It divides processor time into appropriate parts and assigns the needed processor time to the respective task in the multitasking environment. This layer also assigns memory and input / output access.

Layer 4 is the system interface with the kernel. It separates the core of the operating system from the application programming interface (API). The kernel is the heart of the operating system and has ultimate control over everything in the system⁵⁸. The user does not interact directly with the kernel, but rather indirectly via hardware, shell, graphical user interface (GUI), the central processing unit (CPU), memory, disk drives, and so on. The kernel is the first element to load during the boot process and the last to shut down because its services are continuously needed by the operating system. The kernel code is permanently loaded in the kernel space, an area of the memory protected from interference with other program code in the graphical user interface, which is the user space. Programmers keep the kernel space small to fit in the reserved kernel memory and act fast. The part of a program that uses memory and processing time, writes to disk drives, loads other modules of the program and interacts with the user is called a task.

Historically, there have been two types of kernels: the monolithic kernel and microkernel's⁵⁹. The monolithic kernel does most of the jobs itself, whereas the microkernel delegates most jobs to processes in the user space. Theoretically, the smaller microkernel is faster than the much heavier monolithic kernel, but resources are needed to switch between kernel mode and user mode. The monolithic kernel's module system makes it hot pluggable and therefore much faster. Typical monolithic kernels are used in UNIX and Linux systems. A typical microkernel is used by MAC OS X. Strictly speaking, Windows NT and its successors use microkernels, but they are really a mix between microkernel and monolithic kernel.

⁵⁸ <http://www.linfo.org/kernel.html>

⁵⁹ Kersken, Sascha: IT – Handbuch für Fachinformatiker. 3. aktualisierte und erweiterte Auflage 2008. Galileo Press, Bonn. Page 283ff.

Layer 5 is the application programming interface (API). A classic example is Windows API, which provides unlocked operating system functions from software interfaces to program Windows applications using standardized uniform application instructions. The Windows APIs are 16 bit, 32 bit and 64 bit programming interfaces. One point in the European competition authority's case against Microsoft case focuses on interoperability. Specifically, it charged Microsoft with not making Windows API networking public, which is the enabler between client and server computers, the information for programming and the use of software interfaces. Please see Section 3 'Interoperability' of this thesis for more details.

The functions of Windows API in the new operating system Windows Vista fall into the following categories⁶⁰:

- Administration and management
- Diagnostics
- Graphics and multimedia
- Networking
- Security
- System services
- Windows user interface

Each category can be divided in subcategories and contains thousands of callable functions. Every new version of Windows includes more categories, functions and commands. The Windows API of Windows Vista was supposed to be called WinFX until it was integrated into the .Net family and ported to the Windows XP and Windows 2003 operating systems to ensure the operability of new programs coded in .Net on older systems. The history of the Win32 API began with OS/2, which was replaced because of its flop by Windows NT. It was designed to become the star of a new product line of post MS-DOS operating systems⁶¹. When Windows 3.0 under MS-DOS came out, it had a 16

⁶⁰ <http://msdn2.microsoft.com/en-us/library/aa383723.aspx> accessed on 8th April 2008.

⁶¹ Russinovich Mark, Solomon David. Microsoft Windows Internals, Fourth Edition: Microsoft Windows Server 2003, Windows XP, and Windows 2000. Microsoft Press, 2004. Chapter 1, Foundation Concepts and Terms.

bit API, so the decision was clear to make a new API compatible with 32 and 16 bit with the design of the OS/2 API. Starting then, the lines of code grew into the millions. For example, Windows XP has about 40 million lines of code and Windows Vista has approximately 50 million lines of code.

The top layer of the operating system model contains **libraries and programs**. Libraries contain functions and commands that software developers can integrate into their software so that they don't have to reinvent functions, for example how to save a file on the hard disk. Programs help the user use the computer to complete tasks, such as writing a thesis. The operating system provides the necessary resources for the programs. Users input data into the computer via a keyboard and a mouse and see displays on the monitor, a classical input and output device with which the user interacts.

2.2. Different types of operating systems

This section describes the most common client and server operating systems. Although Microsoft dominates the market, at the end of 2008, there were 518 different operating systems on the market and 458 derivatives of Linux⁶².

As illustrated in table 1 below, the five most popular client operating systems as of January 2009 are Windows XP, Windows Vista, Mac OS X, Windows 2000 and Linux.

⁶² http://www.operating-system.org/betriebssystem/_english/os-liste.htm accessed on March 7, 2009.

Client Operating System, January 2009		
1.	Windows XP	71.73%
2.	Windows Vista	13.72%
3.	Mac OS X	5.16 %
4.	Windows 2000	2.08%
5.	Linux	2.06%
6.	Windows 2003	0.69%
7.	Windows 98	0.54%
8.	Windows ME	0.22%
9.	SymbianOS	0.12%
10.	WAP	0.05%

Client Operating System, May 2007		
1.	Windows XP	84.48%
2.	Windows 2000	4.34%
3.	Mac OS X	3.72%
4.	Windows Vista	1.91%
5.	Windows 98	1.58%
6.	Linux	1.26%
7.	Windows 2003	0.70%
8.	Windows ME	0.52%
9.	Windows NT	0.07%
10.	Mac PowerPC	0.05%

Table 1: A comparison of popular Operating Systems⁶³ in January 2009 and May 2007⁶⁴

Between May 2007 and January 2009, Windows Vista, which was introduced in January 2007, rose from 1.91% to 13.72% of market share, gaining 11.81% of the market, while Windows XP lost about 12.75% of market share. In the same timeframe, Mac OS X operating system, which still holds position 3 in the ranking, gained 1.44% of market share. Microsoft's total market share of client and server operating systems is nearly monopolistic. Microsoft leveraged its client operating system market power to expand into server operating systems. It undertook rent-seeking activities to generate more market power in other areas, such as the Internet, mobile device operating systems and the gaming market. Its intent was to maintain its market power, leverage it in other business areas, and defend its market share against potentially more innovative competitors.

A very interesting point is the spread of Web servers over the Internet using server software. Statistics from www.netcraft.com, based on monthly inquiries, show that Apache Web servers with Linux and Microsoft servers are leading the

⁶³ The data shown above is collected by www.w3counter.com by analyzing 55.274.276 unique web hits of currently 19.813 web sites whereas the last 25.000 hits of a month are taken for interpretation.

⁶⁴ <http://www.w3counter.com/globalstats.php> accessed on 15th January 2009.

market, followed by Google, lighttpd, and others⁶⁵. In the March survey www.netcraft.com has responses from 162.662.052 sites, which are continuously growing. To realize the operating system structure behind this survey, the various types of servers have to be explained shortly. The Apache web server is running on Linux / UNIX derivates, although it is ported to Microsoft Windows, but only for testing purposes because Linux / UNIX can handle this exercise much better. Microsoft's web servers in its different versions are typically written for Microsoft server operating systems and run only with Microsoft software. The Sun web servers with the Solaris operating system are ported to different hardware architectures like x86 – 32 and 64 but are used in the server business with UltraSPARC and SPARC64 platforms and are not used with x86 technology. Lighttpd is the youngest web server on the net with steady growing numbers of served web sites and German origin, using Linux technology. All the other web server applications run on different platforms too, but the number is too small to explain each one extra. Figure 6 shows the development of Web servers from 1995 until today and as clearly can be seen, Microsoft has a permanent growth in numbers).

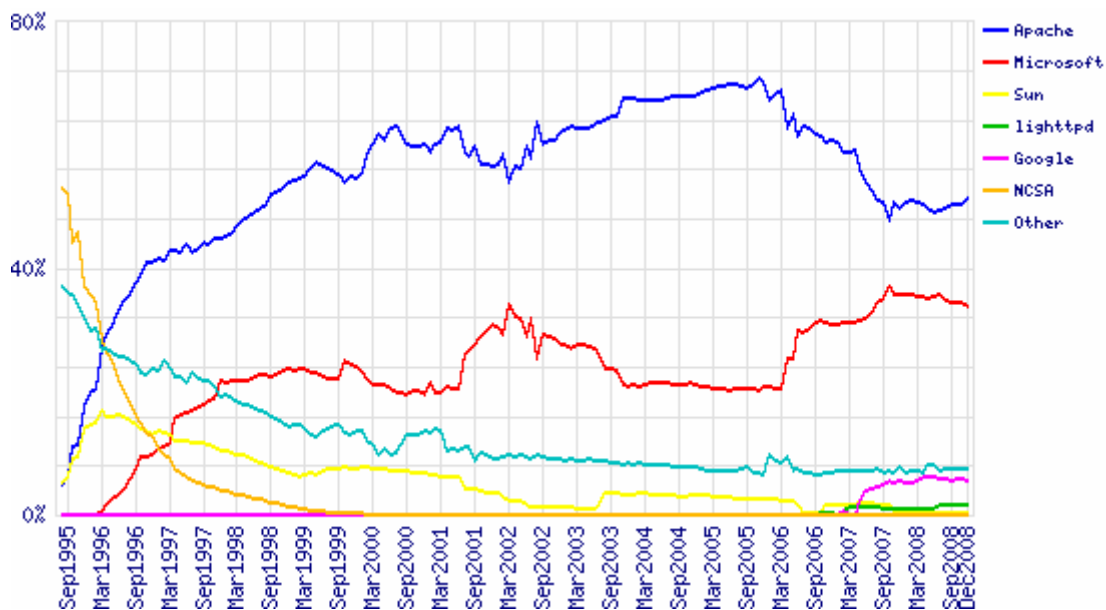


Figure 6: Served web sites with different web servers from 1995 to 2008

In absolute numbers that means that Apache is leading with 95.678.052 web sites, followed by Microsoft with 63.126.940 web sites, Google with 10.455.103 and lighttpd with 3.046.333 web sites in December 2008.

⁶⁵ http://news.netcraft.com/archives/web_server_survey.html accessed on 15th February 2009.

The different operating systems use different technologies, graphical user interfaces and often different hardware platforms. Below is a short description of Mac OS X and Linux, whereas the main focus will be Microsoft and Windows because of its role in the European competition case.

2.2.1. Mac OS X

The actual operating system for Apple is Mac OS X, which has very less in common with the classical Mac operating system up to version 9. The classical

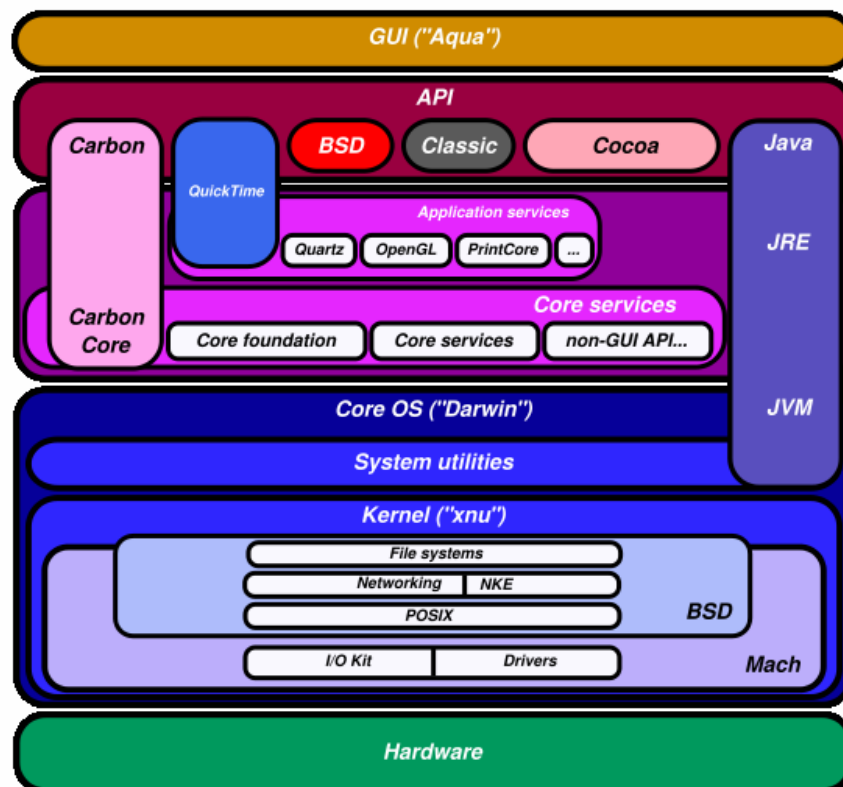


Figure 7: Architecture of the Mac OS X operating system⁶⁶

operating system is not able to support the fast growing hardware sector, it misses functions like multitasking and reserved memory and these functions can not be implemented in the classical system⁶⁷. The Mac OS X operating system is an absolutely new design and underlies the NextStep operating

⁶⁶ <http://www.answers.com/topic/architecture-of-mac-os-x?cat=technology> accessed on 11th April 2008.

⁶⁷ Kersken, Sascha: IT – Handbuch für Fachinformatiker. 3. aktualisierte und erweiterte Auflage 2008. Galileo Press, Bonn. Page 415ff.

system, which is developed by Next in the 1990ies. NextStep is a UNIX based operating system with modern graphical user interface (GUI) design and microkernel architecture. In the 1990s Apple buys Next and announces its new operating system Rhapsody, which is introduced in 2001 as Mac OS X, whereas the “X” stands for version number 10 as well as for compatibility with UNIX. Figure 7 above shows the complex architecture of the Mac OS X operating system.

The Mach microkernel at the bottom of the system architecture has direct access to the hardware. It is based on the NextStep kernel and delivers basic functions like process administration. The Darwin system is the basis or platform for different libraries responsible for the presentation of visual and multimedia content, namely Quartz, OpenGL and QuickTime. QuickTime is Apple's multimedia technology used to display pictures, play videos, play sounds and stream video contents from the Internet. These libraries are used by different programming interfaces which enable Mac applications to be developed. These API's include Cocoa, Carbon, Classic and Java. Java is a platform-independent programming language from Sun Microsystems for programming server, database and multimedia applications. Java plays a major role in the European Microsoft case. The Java basis is integrated into Mac OS X via a virtual machine. At the top of the system is the new graphical user interface, Aqua, which has a semi-transparent smooth design, and the trendy look and feel of Apple systems. The most eye-catching and important characteristics of the user interface are the menu bar, the finder and the Mac Dock.

2.2.2. Linux

Linux is an open-code POSIX-compatible UNIX operating system with a completely new developed kernel from Linus Torvalds. The Linux kernel has been under steady development since 1991 by thousands of volunteers. Today it supports almost every hardware platform, including PowerPC, Alpha, Sun SPARC and several IBM mainframes. Linux systems are characterized by a lot

of system programs, which are compatible to UNIX but stem mostly from the GNU's Not Unix (GNU) project⁶⁸ started by Richard Stallman in 1984 along with the Free Software Foundation (FSF). GNU developed Software from volunteers is published under the General Public License (GPL) to keep the software free and prevent commercial software producers from licensing the code for themselves. There are many different Linux distributions on the market which fulfil different user requirements, including Red Hat for enterprises, Fedora for non-commercial use, ubuntu for Windows-like systems, and many others.

A Linux system usually consists of a kernel, system libraries and system utilities. The kernel handles all important abstractions of the operating system, such as virtual memory and processes⁶⁹. The system libraries provide standard functions for applications to interact with the kernel and implement most of the operating systems functionality. System utilities are programs that perform individual management tasks. A wide variety of user mode programs provide system utilities and user utilities. The system utilities include all the programs necessary to initialize the system. Figure 8 below shows the basic components of a Linux system.

System management programs	User processes	User utility programs	Compilers
System shared libraries			
Linux kernel			
Loadable kernel modules			

Figure 8: Components of the Linux system⁷⁰.

The most powerful tool of any Linux distribution is the terminal window or shell⁷¹. Nearly all modern operating systems are primarily operated by a GUI,

⁶⁸ <http://www.gnu.org> accessed on April 12, 2008.

⁶⁹ Silberschatz Abraham et al. Operating System Concepts. 7th Edition, January 2005. John Wiley and Sons publishing. Page 743ff.

⁷⁰ Silberschatz Abraham et al. Operating System Concepts. 7th Edition, January 2005. John Wiley and Sons publishing. Page 744.

⁷¹ http://www.linfo.org/command_line_lesson_1.html accessed on April 17, 2008.

which are front ends for functions and commands used on the command line. The shell or command line also provides functions which are not yet integrated into the GUI. Advanced UNIX or Linux users prefer to use the terminal window because it is faster and more flexible than its GUI counterpart. In general, Linux distributions offer two types of desktop environments, namely KDE and GNOME, which are both very well developed, customizable and offer new Linux users switching from Windows a user-friendly alternative. Depending on distribution, Linux includes a large set of programs, packages and functions, which are all free under the GPL.

2.3. The story of Microsoft and Windows

This chapter recounts the history of Microsoft, its operating systems, its manipulation of standards, and its strategic decisions to bind customers to Microsoft software. It also outlines key legal complications between Microsoft and others, such as the browser war and the java confrontation.

2.3.1. Microsoft's history and the emergence of a global player

Microsoft was founded on April 4, 1975 by Bill Gates and Paul Allen in Albuquerque to develop software for the IBM PC and port the programming language Beginner's All-purpose Symbolic Instruction Code (BASIC)⁷². Gates and Allen developed a version of BASIC for the Altair 8800 from Micro Instrumentation and Telemetry Systems (MITS). Gates coined the term Microsoft in a letter to Allen in late 1975. In late 1976 they registered Microsoft as a trademark. In 1979 Microsoft relocated from Albuquerque to Bellevue, Washington. In June 1980 Steve Ballmer, the current CEO of Microsoft, joined Microsoft. That year, Microsoft branched out beyond selling BASIC interpreters to computer manufacturers to start selling a UNIX alternative called XENIX, a

⁷² http://www.operating-system.org/betriebssystem/_english/fa-microsoft.htm accessed on April 17, 2008.

licensed and modified version from AT&T. At the same time, Microsoft developed a word processing application called Multi-Tool Word, the first “what you see is what you get” (WYSIWYG) application later well known as Microsoft Word, which was shipped with XENIX. XENIX never sold to end users but to a lot of software original equipment manufacturers (OEM) for resale. In the mid 1980s the project died and Microsoft halted XENIX and UNIX software development.

In 1981 the first IBM PC reached the market equipped with a CP/M (Control Program for Microcomputers) operating system from DEC, developed by Gary Kildall⁷³. IBM asked Gary Kildall to sign a non-disclosure agreement, but he refused, so IBM asked the young Microsoft team to deliver an operating system. Bill Gates found an unfinished CP/M clone at Seattle Computer Products named QDOS (Quick and Dirty Operating System) and bought all legal rights to the system for around \$50,000. Microsoft finished and improved the system and delivered it to IBM as MS-DOS 1.0 on August 12, 1981. The rise of Microsoft had begun. Every PC clone came equipped with MS-DOS and IBM sold it as PC-DOS or as CP/M. In the early 1980s, Microsoft capitalized on its legal rights to MS-DOS to become the leading provider of operating systems for the home computer industry. To this day, Microsoft earns its largest revenues by delivering operating systems with nearly every new computer.

As Apple developed new GUIs in the 1980s, Microsoft saw its market leadership position threatened and started developing the first version of Windows, a graphical add-on for MS-DOS. Version 3.0 and the first Microsoft Office package in 1990 made Windows popular. In 1990, Intel presented its first 32-bit processor, the 80386. However, Microsoft's MS-DOS and Windows were only 16-bit and did not support multitasking, memory protection and more main memory support. In response, IBM started to develop a new 32-bit supporting operating system called OS/2, at first in cooperation with Microsoft and later alone. The Windows technology prevails and the last version of OS/2, Warp 4, was presented in 1996.

⁷³ Kersken, Sascha: IT – Handbuch für Fachinformatiker. 3. aktualisierte und erweiterte Auflage 2008. Galileo Press, Bonn. Page 278ff.

Microsoft stuck to the MS-DOS concept, but in time it was no more than a boot loader for the 32-bit capable Windows. In 1993 Microsoft makes a strategic decisions to continue to support 16-bit technology in Windows 95 through Windows XX for private use while it developed an absolutely new operating system design for the 32-bit architecture, the NT (New Technology) generation for business use. Its first product, NT 3.0, was developed by David Cutler, who had previously developed the legendary operating system VMS for DEC systems. NT abandoned FAT (File Allocation Table) in favour of to NTFS (New Technology File System). It added security capabilities and rights management for business use, achieving nearly universal business coverage and paving the way for Windows XP and Windows Vista to secure its monopolist status.

With the release of Windows 95, Apple sued Microsoft for intellectual theft of its user interface but the groggy Apple Corporation makes a deal and guaranteed the bilateral arrangement of free licenses and usability of software for five years. Windows NT 4.0 used the look and feel of the prior Apple design and led to a new generation of operating systems designed according to NT principles, namely Windows 2000 and Windows XP, which offered a Home Edition and a Professional Edition. Version numbers of the design track major development: Windows NT (1996) is version 4.0, Windows 2000 (2000) is version 5.0, Windows XP (2001) is version 5.1 and Windows Vista (2007) is version 6.0, which indicates a step change between Windows XP and Windows Vista. The-DOS era has come to a close and the new Windows 7, formerly codenamed Windows Vienna, is expected to be released in 2009.

Microsoft's history sounds like a fairy tale success story. But what happened behind the scenes? There were a few economic tools at work which guaranteed the steady growth of Microsoft. The first tool is contractual tying. By cooperating with IBM, Microsoft became a powerful partner, and since then, nearly every new personal computer has been equipped with MS DOS. Over the time Microsoft contracted with more and more big computer assemblers and sellers, so that today it is very difficult to obtain a computer without Microsoft OS. Another tool Microsoft used to create entry barriers and defend its monopolist status was to buy competitors, use their technology or simply frighten

competitors with its power. Microsoft forecloses competitors and is omnipresent on the market in different business areas.

2.3.2. Microsoft's development in numbers over time

When Microsoft was founded in 1975, it comprised Bill Gates and Steve Allan. In 1980 Microsoft had 40 employees and net revenues of \$8m, in 1985 it had 910 employees net revenues of \$197m⁷⁴. Rapid growth over the years made Microsoft a global player, and 1995 Microsoft had 17,000 employees and net revenues of \$6,075m. Ten years later, in 2005, Microsoft had 61,000 employees and net revenues of \$39.79b. Microsoft's fiscal year 2007 ending on June 30, shows 78,565 employees and a net revenue of \$51,12b.

Microsoft's market share has been stable at around 90% since the launch of MS Windows 3.0 in 1990 with little deviation⁷⁵. From the beginning of the Microsoft operating system era in 1981 until the introduction of Windows 3.0, Microsoft had annual growth rates of about 10%. Table 2 below shows the development of operating system market share from 2004 – 2008.

	2004	2005	2006	2007	2008
Windows	96.36%	95.97%	94.85%	92.91%	91.54%
Mac	3.25%	3.64%	4.68%	6.40%	7.49%
Linux	0.29%	0.31%	0.38%	0.46%	0.65%

Table 2: Worldwide Operating System Market Share 2004 – 2008⁷⁶.

Table 2 illustrates that Microsoft has a steady decline in market share, whereas Apple with its Mac and Linux grow smoothly every year. Apple's switch from the PowerPC to an Intel processor in 2006 may have been the reason why Apple's market share grew by 1.72% in that period. Another factor may have been the

⁷⁴ <http://www.microsoft.com/msft/download/Yearly%20Income%20Statements.xls> accessed on April 18, 2008.

⁷⁵ Datta, Avimanyu, Apple Computers: From Class to Mass? (January 2005). Available at SSRN: <http://ssrn.com/abstract=720361>.

⁷⁶ <http://marketshare.hitslink.com/report.aspx?qprid=8&qptimeframe=Y&qpsp=2008&qpmr=5&qpdt=1&qpct=2>; Years taken from 2004 to 2008. Accessed on 18th April 2008.

decision of the European Commission against Microsoft in 2004 and subsequent fines in 2006 and 2008 for defying sanctions.

2.3.3. A short review of the new Microsoft Windows Vista operating system

Microsoft Windows Vista is the current Microsoft operating system. Windows Vista is version 6 and is the direct successor of Windows 2000, which is version 5. Windows XP (version 5.1) is a technical extension of Windows 2000. Figure 9 below shows the basic architecture of Windows Vista.

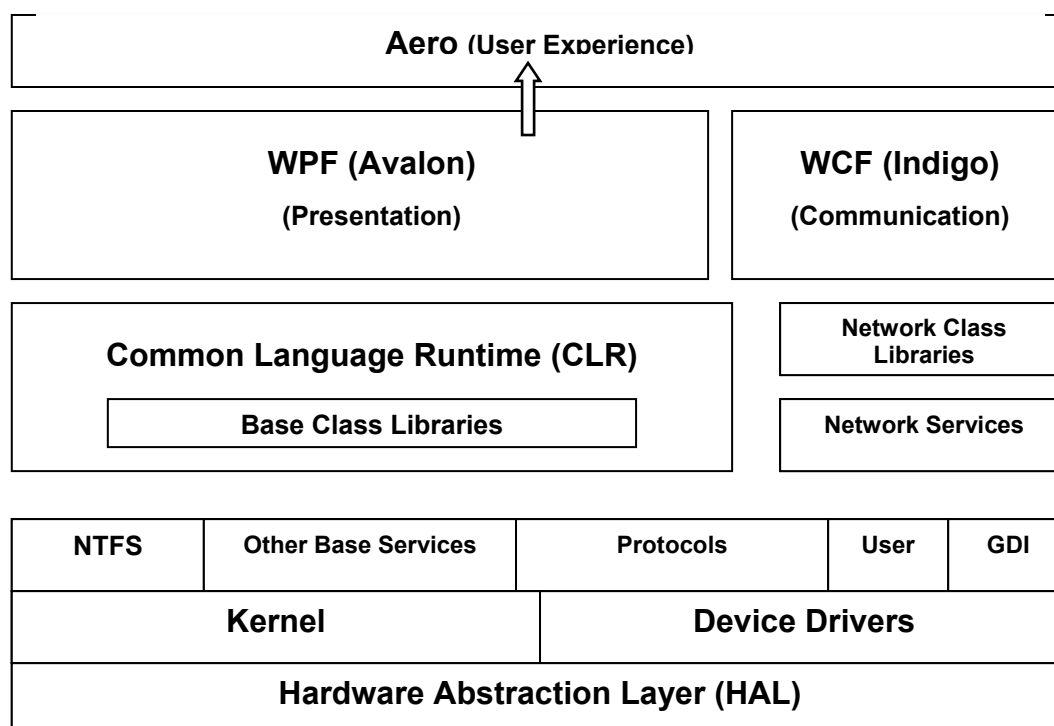


Figure 9: The basic architecture of MS Vista⁷⁷.

The basis for Windows Vista is the NT architecture from Windows NT 4.0 and Windows 2000⁷⁸. Windows Vista comes with new subsystems and APIs, which will change the development of new applications for Windows Vista. The Hardware Abstraction Layer and the kernel have remained nearly unchanged.

⁷⁷ http://www.directionsonmicrosoft.com/sample/DOMIS/update/2003/12dec/1203lpfod_illo.htm accessed on 1st May 2008.

⁷⁸ http://www.directionsonmicrosoft.com/sample/DOMIS/update/2003/12dec/1203lpfod_illo.htm accessed on 1st May 2008.

The new Windows Driver Foundation (WDF) integrates device drivers and supports device drivers starting with Windows 2000⁷⁹. The device driver system was redesigned to simplified programming device drivers to ease creation of drivers rather than requiring knowledge of hardware programming and how subsystems interact with the hardware. Two classes of the Windows Driver Foundation can be differentiated. The first is the Kernel Mode Driver Framework (KMDF), used to create standard kernel-mode device drivers, and the second is the User Mode Driver Framework (UMDF), used to program different classes of drivers running in user-mode. Subsystems like the NTFS file system are the same. The Graphics Device Interface (GDI) has been changed significantly and is presented by the new DirectX 10 environment via the Windows Presentation Foundation⁸⁰ (WPF, former Avalon) and the .Net 3.0 programming framework. Other protocols and the user subsystem remain nearly untouched to guarantee backward compatibility. The Win32 API and older collections of the application programming interfaces have been replaced by the new Common Language Runtime⁸¹ (CLR) that makes Microsoft Windows Vista a platform for managed code design⁸², but backward compatibility for native code support is implemented. Windows Vista has two new subsystems, Windows Presentation Foundation for drawing and displaying graphics, and Windows Communication Foundation (WCF, former Indigo) for communication between programs and communication with the Internet. The new user surface Aero, which is included in the WPF subsystem gives the user a completely new look and feel reminiscent of Apple's Aqua surface.

Windows Vista was launched on January 30, 2007 for private customers and was available to corporate customers in November 2006. Before the EC permits the launch of Windows Vista in Europe, Microsoft has to change a few things in according with the EU Commission decision from March 2004. The default settings for Internet Explorer 7 must enable modification of predefined search service for customers⁸³. Furthermore, the conditions for licensing the XML

⁷⁹ <http://www.microsoft.com/whdc/driver/wdf/wdf-intro.msp> accessed on 1st May 2008.

⁸⁰ <http://msdn.microsoft.com/en-us/library/aa663364.aspx> accessed on 1st May 2008.

⁸¹ <http://msdn.microsoft.com/en-us/library/ddk909ch.aspx> accessed on 1st May 2008.

⁸² Managed code is program code which is executed by a virtual machine. Unmanaged code is directly run by the processor of the computer.

⁸³ <http://www.heise.de/newsticker/meldung/84560> accessed on 1st May 2008.

Paper specifications XPS, a rival of the PDF standard, must change. In addition, Microsoft has to promise to deliver N-versions of their Windows Vista systems which do not contain the Microsoft Media Player and the future Service Pack One must include additional security APIs that display security features transparently for users and developers.

Eight different versions of Microsoft Windows Vista are available on the market. These are:

- Windows Vista Starter
- Windows Vista Home Basic
- Windows Vista Home Basic N
- Windows Vista Home Premium
- Windows Vista Business
- Windows Vista Business N
- Windows Vista Enterprise
- Windows Vista Ultimate

When developing Windows Vista, Microsoft placed great importance on the security features of their operating system. In January 2002 Bill Gates announced Microsoft's new campaign on trustworthy computing⁸⁴, a long-term effort to create secure, private and reliable use of information stored on computers for every computer user. The outcome of the trustworthy computing campaign in Windows Vista are Windows Defender, User Account Control, phishing filter, parental control, Bit Locker Drive Encryption, a variety of privilege restriction techniques and a redesign and upgrade of the Windows firewall which can be controlled in the Microsoft Security Centre. Another new introduced function is the backup and restore centre, which enables users to back up all the files, folders, programs, functions and settings⁸⁵.

⁸⁴ <http://www.microsoft.com/mscorp/twc/overview.mspx> accessed on 7th May 2008.

⁸⁵ <http://www.microsoft.com/windows/products/windowsvista/features/details/backup.mspx> accessed on May 7, 2008.

On April 14, 2008 Microsoft released Service Pack One for Windows Vista that provides three major improvements to reliability and performance, support for new hardware and standards and ease of administration⁸⁶.

⁸⁶ <http://windowshelp.microsoft.com/Windows/en-US/Help/ea7577b8-813f-47a5-ba05-2f5b2e436b281033.mspx> accessed on May 7, 2008.

2.3.4. Microsoft's handling of standards by change and creation and its legal consequences

Since Microsoft was founded, it has copied and pasted liberally. For example, Windows 3.1 counterfeited Apple's Lisa design. It has also often bought potential competitors, renamed their innovations, integrated them into Windows, and touted the new introduced features as Microsoft innovation. Well known examples are MS-DOS (a CP/M clone), PowerPoint (former Forethought), DirectX (former Softimage), Internet Explorer (former Spyglass Mosaic), FrontPage (former Vermeer Technologies Incorporated), MSN (former ResNova Software), Windows Media Player (former Vxtreme), Hotmail (remains Hotmail), Outlook (former Jump Networks), .NET Framework (former NCompass Labs), Windows Search (former Lookout Software), Windows Defender (former GIANT Company Software), and Microsoft Virtual Earth (former Caligari).⁸⁷ Topping this list are Microsoft Word and Excel. Microsoft Word, first known as Multi-Tool Word was developed at Xerox Palo Alto Research Center by Butler Lampson and Charles Simonyi and called Bravo⁸⁸. In this case, Microsoft hired Charles Simonyi, who brought Bravo to Microsoft. The Excel story is similar. The very first spreadsheet program was developed by Harvard Student Daniel Bricklin and called VisiCalc⁸⁹. The program lacked copyright protection, so Microsoft used nearly the same look and functionality as VisiCalc to create Multiplan, which it later renamed Microsoft Excel. The Microsoft Office program suite is essentially a buy-and-copy suite and has become the de facto standard for word processing, spreadsheet accounting and slide projection and presentation. Microsoft achieved de facto standard status by following a market penetration strategy with user programs to promote the exclusionary use of Microsoft programs all over the world, and by leveraging network effects, path dependence, lock-in, tying, appeal to fear, and other techniques. Microsoft

⁸⁷ <http://www.microsoft.com/msft/acquisitions/history.msp#EOAAE> accessed on May 10, 2008. For detailed information click on Microsoft's acquisition information prepared for every acquisition mentioned.

⁸⁸ <http://www.microsoft.com/presspass/features/2007/jan07/01-04word.msp?source=rss&WT.dl=0> accessed on May 10, 2008.

⁸⁹ <http://dssresources.com/history/sshistory.html> accessed on 10th May 2008.

standardises not only programs, it also creates and changes software, programming and interface standards normally standardised by the W3C group (World Wide Web Consortium) and ISO group (International Organization of Standardization). Here are some of the important standards that Microsoft has influenced or changed⁹⁰:

- Java with Microsoft Java Virtual Machine
- HTML and CSS for the interpretation of Web sites
- Character set ISO – 8859 – 1 norm
- Jscript, comparable to JavaScript and ECMAScript
- DOM for representing HTML or XML and related formats
- TCPA, later called TCG
- Audio and video standards (*.wma and *.wmv)
- Email: Extensions and deviation of international standards
- Network protocols, such as TCP/IP
- Office Open XML (OOXML) standard certified by the ISO group⁹¹

A third technique practiced by Microsoft is to thin out users from third company applications by pushing its own products. This practice is used by Microsoft when a change of standards or a hostile takeover is not practicable. The two most famous examples are the legendary Netscape Browser War and the Java confrontation.

2.3.4.1. The Netscape Browser War

When the Internet developed and the first browser applications evolved, Microsoft did not own an Internet browsing technology⁹². It searched the market and bought the Spyglass Mosaic browser, as well as MSN (ResNova Software) as a pendant to AOL and CompuServe. To guarantee fast and wide distribution of its new browser software, which it called Internet Explorer, Microsoft bundled

⁹⁰ For more information visit <http://www.yale.edu/pclt/> accessed on 10th May 2008.

⁹¹ Schüler, Peter: Microsoft gewinnt bei der ISO, C't, Magazin für Computertechnik, 2008, Volume 9. Pages 28 – 30.

⁹² Sietmann, Richard: Das Microsoft Monopol, C't, Magazin für Computertechnik, 2002, Volume 22. Pages 96 – 101.

and tied the Internet Explorer to Windows 95. Before Microsoft took this step, the Netscape Navigator was market leader but after Microsoft's tying it lost its market leadership position as user figures dropped daily. Microsoft also withdrew Compaq's Windows distribution license because it was delivering Windows 95 with Netscape Navigator. As a result, Compaq immediately started delivering Windows 95 with Internet Explorer. Netscape filed suit against Microsoft with the US Department of Justice, but the proceeding lasted too long and Netscape accepted a settlement offer from Microsoft the same year it was bought by AOL. Netscape Navigator has disappeared from the market and has not been supported since 2007.

2.3.4.2. The Java confrontation

Java is a platform independent programming language that can be used on most operating systems⁹³. It functions as middleware for writing applications that run on every computer system and platform. In 1996 Microsoft purchased a license for Java from Sun Microsystems and adapted it to serve its own purposes, creating a second edition of Java called Microsoft Java Virtual Machine (MJVM), which interacts directly with Windows and is not platform independent. In order to benefit from positive network effects, many programmers started writing programs in Microsoft Java Virtual Machine language, a serious blow to Sun's aspired platform independence. Sun sued Microsoft for this infringement and won the case in June 2003. Since this judgement, few applications have been written in Microsoft Java Virtual Machine language and Sun's Java has regained its popularity as a platform independent programming language⁹⁴.

2.3.4.3. Microsoft's most important legal conflicts

⁹³ United States Court of Appeals, Sun Microsystems vs. Microsoft Corporation, No. 03-1116 as of June 26, 2003. <http://pacer.ca4.uscourts.gov/opinion.pdf/031116.P.pdf> accessed on May 11, 2008.

⁹⁴ <http://www.sun.com/lawsuit/summary.html> accessed on May 11, 2008.

2003 – Netscape / AOL Time Warner sued Microsoft and is awarded \$750m⁹⁵.

2003 – Immersion, a gaming input device manufacturer, sues Microsoft for patent infringement on Force–Feedback technology and is awarded \$26m.

2003 – Eolas Technologies sues Microsoft for using Eolas know-how to insert plug-ins and applets into Web sites and is awarded \$521m.

2003 – BE Inc. sues Microsoft for distorting competition. They settle out of court for \$23.3m.

2004 – Sun sues Microsoft patent infringement on Java and is awarded \$1.6b⁹⁶.

2005 – Burst.com sues Microsoft patent infringement on streaming technology with Windows Media Player and is awarded \$60m. Gateway is also awarded \$150m.

2005 – IBM drops its 10-year-old lawsuit against Microsoft and settles out-of-court for \$775m plus \$75m in Microsoft software licenses⁹⁷.

2005 - Realnetworks drops an antitrust lawsuit against Microsoft in exchange for \$765m.

2008 Alcatel–Lucent is awarded \$367.4m for patent infringements⁹⁸.

At the end of the 1980s, Apple accused Microsoft of copying Apple's GUI and look and feel. In 1993, the court ruled against Apple⁹⁹. After the release of Windows 95, Apple again sued Microsoft for copying its GUI and accuses Microsoft of imitating Quick Time and Mac OS. Amid financial struggles and after Microsoft threatened to withdraw support of Office for Mac, Apple again agreed to settle out-of-court in 1997¹⁰⁰. Apple agreed to make Internet Explorer the default browser for Mac and Microsoft agreed to continue to develop Office for Mac. Microsoft also agreed to purchase \$150m in non–voting Apple shares¹⁰¹ and both parties accept patent cross–licensing. Finally, Microsoft paid Apple an undisclosed settlement estimated at \$500m to \$2b.

⁹⁵ <http://www.pccopen.de/betriebssysteme/ms/8.html> accessed on May 11, 2008.

⁹⁶ <http://www.sun.com/lawsuit/> accessed on May 11, 2008.

⁹⁷ <http://www.heise.de/newsticker/IBM-fuehlt-sich-wieder-in-Form--/meldung/61817> accessed on May 11, 2008.

⁹⁸ http://www.infoweek.ch/news/nw_single.cfm?news_Id=18242&sid=0 accessed on 11th May 2008.

⁹⁹ <http://lowendmac.com/orchard/06/apple-vs-microsoft.html> accessed on 11th May 2008.

¹⁰⁰ <http://contracts.corporate.findlaw.com/agreements/apple/microsoft.1997.08.05.html> accessed on 11th May 2008.

¹⁰¹ http://news.cnet.com/MS-to-invest-150-million-in-Apple/2100-1001_3-202143.html accessed on 11th May 2008.

Microsoft wields its high market and financial power to buy the technologies it needs and advertise the innovation as its own. Before companies can reap the fruits of their efforts, Microsoft buys them, removing them as real competitors. This is essentially financial or buying power foreclosure.

2.3.4.4. The United States Microsoft antitrust case

In May 1998, the US Department of Justice (DOJ) and 19 US states sued Microsoft for antitrust techniques in the Netscape browser war and the Java confrontation. In October 1998, AOL bought Netscape while it was suing Microsoft. On June 7, 2000, Judge Thomas Penfield Jackson ruled that Microsoft must be divided in two separate and independent companies, namely Microsoft Operating Systems and Microsoft Application Software¹⁰². Judge Jackson based his decision on Microsoft's monopolization strategy of tying that violates Sections 1 and 2 of the Sherman Act. Judge Jackson's decision was also based on the testimony of two expert witnesses from the Massachusetts Institute of Technology (MIT), one pro Microsoft from Richard L. Schmalensee and one contra Microsoft from Frank Fisher. When George W. Bush took office as President of the United States in 2001, the suit took a different course. Bush's election agency Century Strategies had close connections with Microsoft and Charles James, a critic of the split, is appointed head of the antitrust agency and because of that pro Microsoft. Even though Microsoft's appeal verified its antitrust and illegal behaviour, the decision to split Microsoft into two companies was overruled¹⁰³. In what is known as the Consent Decree, Judge Jackson's successor, Judge Colleen Kollar-Kotelly, ruled that Microsoft must disclose its Application Programming Interfaces (APIs) to third parties. She also appointed a committee of three people who have full access to Microsoft's systems, records and source code for five years¹⁰⁴. In November 2007 Microsoft agreed to extend the five year period for another two years until 2010 but no longer than 2012.

¹⁰² <http://cyber.law.harvard.edu/msdoj/> accessed on 12th May 2008.

¹⁰³ http://www.businessweek.com/magazine/content/01_47/b3758009.htm accessed on 12th May 2008.

¹⁰⁴ http://www.microsoft.com/Presspass/legal_newsroomarchive.mspx?case=Settlement%20Proceedings accessed on 12th May 2008.

2.3.4.5. The US Antitrust Case in chronological order

- **May 18, 1998:** The Department of Justice files the lawsuit against Microsoft¹⁰⁵.
- **October 19, 1998:** The lawsuit against Microsoft begins.
- **November 5, 1999:** In the fact finding Judge Thomas Penfield Jackson agrees on all points of the lawsuit.
- **April 3, 2000:** Judge Thomas Penfield Jackson finds Microsoft guilty.
- **April 28, 2000:** The US Government demands the break up of Microsoft in two companies, namely an operating system company and an application software company.
- **June 7, 2000:** Judge Jackson pronounces the judgement of the breakup of Microsoft.
- **February 26, 2001:** The appeals procedure begins.
- **June 28, 2001:** The appeal court annuls the judgement of breaking up Microsoft, the other accusations remain effective.
- **August 7, 2001:** Microsoft files for a new lawsuit.
- **September 6, 2001:** The new US Government under President George W. Bush decides to settle the differences between Microsoft and the US Government.
- **September 28, 2001:** The new appointed judge Colleen Kollar-Kotelly gives the two parties a time limit for an out of court settlement.
- **October 31, 2001:** The Department of Justice and Microsoft come to an agreement.
- **November 6, 2001:** A few US states disagree with the settlement.
- **March 7, 2002:** Microsoft and the Department of Justice change a few points of the settlement.
- **March 8, 2002:** Sun Microsystems files another antitrust suit against Microsoft.
- **August 5, 2002:** Microsoft agrees to make parts of the Windows program code open to the public.
- **September 18, 2002:** Microsoft is accused of bypassing the settlement and not abiding by the agreement of the court.
- **November 1, 2002:** Judge Colleen Kollar-Kotelly accepts the out of the court agreement because of the overriding public interest.

¹⁰⁵ <http://www.heise.de/newsticker/meldung/32027> accessed on 15th May 2008.

3. The European competition authorities and the treatment of Microsoft as monopolist and competition obstructor

This chapter ties together information from the previous two chapters and discusses the European Microsoft case in light of the European Commission, its decision of March 24, 2004 and Microsoft's violation of the decision until 2008.

3.1. Chronology of the European Microsoft Case

December 10, 1998: Sun Microsystems files a complaint against Microsoft addressed to the European Commission (EC) that Microsoft failed to provide the technical information needed for servers running Sun's Solaris operating system to fully interoperate with personal computers running Microsoft Windows¹⁰⁶.

February 9, 2000: The EC starts the investigation of Windows 2000, including the bundling of Microsoft Windows Media Player.

August 1, 2000: A first statement of the EC accuses Microsoft of abusing its dominant position by not giving competitors the needed interface information that would allow interoperability of third-party server operating systems with PC's running Microsoft Windows.

November 17, 2000: Microsoft issues its first statement on the EC's allegation explaining that most enterprise customers already had heterogeneous computing networks and that interoperability was a market reality.

¹⁰⁶ All dates of the chronology refer to <http://www.microsoft.com/presspass/legal/european/04-24-06eccasetimeline.mspx> accessed on May 27, 2008 or to http://www.ecis.eu/issues/documents/Chronology_Complete.doc accessed on May 27, 2008.

August 30, 2001: The EC issues its second statement of affairs that deepened the allegations, accusing Microsoft of 1) leveraging its monopoly power to promote Windows Media Player by tying the Media Player with Windows, 2) unfair competition with Real Networks and other vendors of media players, and 3) hindering interoperability between Windows server and third-party server operating systems by using its power of monopoly in client computer market.

November 16, 2001: Microsoft denies having a dominant position in the market for workgroup servers and maintained that interoperability is a matter of fact in the European computing environments. It argues that including multimedia playback functionality in operating systems is a general development of operating system manufacturers that does not hinder competitors from offering alternative multimedia playback applications to consumers.

2002 – 2003: The EC conducts a market enquiry and undertook a broad survey of IT professionals and industry leaders to get a clear picture of the relationship between interoperability and the tying of Windows Media Player. Meanwhile, Microsoft tries to settle the EC case out of court by holding discussions with the European competition authorities.

August 6, 2003: The EC issues a third statement of objections that confirmed the allegations regarding interoperability and tying. It demands the disclosure of necessary interface information of workgroup servers as well as the unbundling of Windows Media Player from Microsoft Windows.

October 17, 2003: Microsoft admits for the first time that its market share for PC operating systems is over 90%, giving it a dominant position, but concurrently accuses the EC that their evidence does not support the Microsoft case.

November 12 – 14, 2003: The EC holds an administrative hearing at Microsoft's request.

March 18, 2004: EU Competition Commissioner Mario Monti closes the discussions with Microsoft without settlement.

March 22, 2004: The EU member states form an advisory committee to discuss the draft decision and support it unanimously.

March 24, 2004: The European competition authorities publish the following decision against Microsoft:

The decision:

Microsoft is guilty of actively abusing the dominant position by leveraging its quasi – monopoly in the market for PC operating systems on both markets, namely the market for Client PC operating systems and work group server operating systems and foreclose competitors by tying its Windows Media Player with Microsoft Windows operating systems.

The consequences:

Microsoft has to pay a fine of €497m and publish the complete and accurate interface documentation within 120 days to make it possible for competitors in the work group server market to be fully interoperable with Windows PC's and workgroup servers.

Within 90 days Microsoft has to offer to resellers and OEM manufacturers a version of its different Windows operating systems without Windows Media Player.

May 27, 2004: Microsoft submits a preliminary outline of the planned actions in the near future to comply with the EC's decision between 2004 and early 2005.

June 7, 2004: Microsoft files an appeal against the EC's decision with the European Court of First Instance (CFI).

June – December 2004: Microsoft's appeal against the EC leads to a suspension of the remedies until the CFI's decision. On December 22, 2004, the CFI dismisses all points of Microsoft's solicitations, requiring Microsoft to fulfil the Commission's sanctions.

January 2005: Microsoft sends a first abstract to the EC containing the licensing program for its Windows Server communications protocol.

June 2005: Microsoft releases the European versions of Windows XP without multimedia capabilities, which is called Windows XP N. EC experts express serious doubts about the completeness and accuracy of the technical documentation submitted by Microsoft.

October – December 2005: Microsoft nominates computer scientist Professor Neil Barrett as Trustee of the EC to provide technical advice to the Commission about Microsoft's compliance with the Commission's 2004 decision. In November the EC sets a fine of €2m per day until Microsoft delivers the complete technical documentation of the communications protocols.

January – June 2006: Microsoft makes the source code available for technologies covered in the 2004 decision to any licensees in the European licensing program. Microsoft requests an oral hearing and the EC agreed to Microsoft's proposed "7 Milestones" of packages of protocol documentation by June 2006.

July – December 2006: On July 12, 2006, Microsoft is fined an additional €280.5m and threatened a €3m-per-day penalty for any further non-compliance with the EC's 2004 decision. In July, Microsoft delivers the final package of documentation and revises the documents the EC had required by November 2006. Together with the EC, Microsoft announces the availability of the documentation to potential licensees.

March 1, 2007: The EC again accuses Microsoft of failing to comply with the March 2004 decision to disclose interoperability information on reasonable and non-discriminatory terms.

September 17, 2007: The CFI approves the March 2004 decision by the EC and nullifies Microsoft's appeals against the decision.

The EC's commentary on the CFI decision:

"The European Commission welcomes today's ruling by the Court of First Instance upholding the European Commission's 2004 decision on Microsoft's abuse of its dominant market position and confirming the totality of the fine imposed. In this decision, Microsoft was fined €497 million for infringing the EC Treaty rules on abuse of a dominant market position by leveraging its near monopoly in the market for PC operating systems onto the markets for work group server operating systems and for media players. This conduct hindered innovation in the markets concerned to the detriment of consumers. To put an end to this abusive behaviour, the Commission ordered Microsoft to disclose interoperability information which would allow non-Microsoft work group servers to achieve full interoperability with Windows PCs and servers and to offer a version of its Windows operating system without Windows Media Player. The Court's ruling confirms that the Commission was right to prohibit Microsoft's anti-competitive conduct which harmed competition to the detriment of consumers¹⁰⁷."

The Commission's commentary on Microsoft's leveraging its market power from client computers to server computers and mobile devices illustrates the economic complexity of the Microsoft case in Europe. First, Microsoft uses its near-monopoly power to apply the rent seeking activities from client computers to server and mobile devices. Second, Microsoft leverages its power to force mixed bundling with the streaming media player in its operating systems, achieving nearly complete market penetration with the media player. Likewise, it

¹⁰⁷ MEMO/07/359 from 17th September 2007: Antitrust: Commission welcomes CFI ruling upholding Commission's decision on Microsoft's abuse of dominant market position.

bundled its Internet Explorer, leveraging efficiencies from its client operating system to achieve wide market coverage.

October 22, 2007: The EC announces that Microsoft has fully complied with the 2004 Decision and provided the interoperability information on reasonable and non-discriminatory terms¹⁰⁸. It charges Microsoft with updating and correcting the information on an ongoing basis. It agrees not to fine Microsoft further as long as it remains in compliance with the 2004 Decision. New fines for non-compliance will be calculated on a daily basis. The EC agrees to calculate the final fine as soon as possible.

February 27, 2008: The EC imposes a fine of €899m for non-compliance with its 2004 decision¹⁰⁹ based on Article 24(2) of European Council Regulation 1 / 2003 concerning the prices charged by Microsoft for access to interface documentation for work group servers laid down on October 22, 2007. The fine is based on the number of days Microsoft did not comply with the March 2004 decision not covered by the penalty payment decision of July 12, 2006 starting on June 21, 2006 and ending on October 21, 2007. The conclusion of the EC on the penalty, the Microsoft case and its long duration pronounced by Competition Commissioner Neelie Kroes: "Microsoft was the first company in fifty years of EU competition policy that the Commission has had to fine for failure to comply with an antitrust decision. I hope that today's Decision closes a dark chapter in Microsoft's record of non compliance with the Commission's March 2004 Decision and that the principles confirmed by the Court of First Instance ruling of September 2007 will govern Microsoft's future conduct."¹¹⁰

January 16, 2009: The EC states that Microsoft's tying of Internet Explorer to the Windows operating system harms competition between web browsers,

¹⁰⁸ MEMO/07/420 from October 22, 2007: Antitrust: Commission ensures Microsoft's compliance with the 2004 Decision – frequently asked questions.

¹⁰⁹ IP/08/318 from February 27, 2008: Antitrust: Commission imposes € 899 million penalty on Microsoft for non – compliance with March 2004 Decision.

¹¹⁰ IP/08/318 from February 27, 2008: Antitrust: Commission imposes € 899 million penalty on Microsoft for non – compliance with March 2004 Decision. Paragraph two.

undermines product innovation and ultimately reduces consumer choice. Microsoft is given eight weeks to respond.

For the sake of simplicity, I will name operating systems "A", media players "B", and Microsoft "M"¹¹¹. If M wants to enter the competitive and innovative B market, it has to invest its extracted rents from A to B. Other companies with heavy R&D investment in B need to get a minimum price for B to cover R&D investment costs and invest further in R&D to stay competitive. But company M gives away product B as add on to product A to win market share in market B. This distorts competition because other companies have to sell product B to stay competitive and in the market. Unlike its competitors, dominant company M is in the position to extract surplus from product B and rents from suppliers after their investment in R&D in market A. M's integration of B into A forces independent producers of B to charge a lower price than it would under normal competitive circumstances. These independent producers eventually crash, and M either buys them and their R&D investments at a low price, integrating their technologies, or lets them disappear from the market.

Integrated firm M argues colourfully that making the A – B interface available to independent suppliers would be a breach of confidentiality and intellectual property rights. It leverages its monopoly power in foreign markets, foreclosing competitors through market power and dominance using saved rents extracted through rent seeking activities from another market. When the A – B gap is closed, M protects it with IPR and makes it confidential to increase the dependence of producers from other markets, extend its monopoly, stay dominant and position itself as nearly the only supplier in the monopolized market. Even if there is a competitor, it poses little risk less to M.

¹¹¹ Farrell Joseph, Katz Michael L. The Journal of Industrial Economics. Innovation, Rent Extraction, and Integration in Systems Markets. Volume 48, Issue 4, Pages 413 – 432. Page 413ff.

3.1.1. Microsoft in the light of the EC's investigation and decision

The EC's March 2004 decision addressed the refusal to supply interoperability information and the tying of Windows Media Player with Windows. The definition of interoperability by the European Commission is as follows:

“The term interoperability information means the complete and accurate specifications for all the protocols implemented in Windows Work Group Server Operating Systems and that are used by Windows Work Group Servers to deliver file and print services and group and user administration services, including the Windows Domain Controller services, Active Directory services and Group Policy services, to Windows Work Group Networks.”¹¹²

In August 2000 the EC delivered its first statement of objections to Microsoft with foregoing investigations on interoperability, initiated by SUN Microsystems, and own investigations concerning the integration of Windows Media Player (WMP) in the Microsoft Windows operating system. After years of investigation by the EC, a handful of statements of objections and lots of poor statements and explanations by Microsoft, the decision¹¹³ was made public on March 24, 2004¹¹⁴. Microsoft is found guilty of infringing Article 82 of the EC Treaty and Article 54 of the EEA Agreement¹¹⁵. The decision defines three relevant product markets, including Client PC operating systems, Work Group Server operating systems and streaming media players and identifies Microsoft as the dominant player in two of these¹¹⁶.

¹¹² Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Page 298, Article 1 (1).

¹¹³ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision.

¹¹⁴ Hereafter Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision, is called ‘the Decision’.

¹¹⁵ Agreement on the European Economic Area, EEA – Agreement, Official Journal L 1, 03/01/1994, page 19 – 20.

¹¹⁶ All references to and quotations from the EC decision in this and in the following section refer to: Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision.

The first relevant product market is the market for Client PC operating systems, in which Microsoft has a market share over 90%, a clear sign of a dominant position creating very high barriers for competitors to enter the market. The decision defines the term 'Windows Client PC Operating System' as "any of the software products marketed by Microsoft Corporation as Windows 98, Windows 98 Second Edition, Windows Millennium Edition, Windows NT Workstation 4.0, Windows 2000 Professional, Windows XP Home and Windows XP Professional, and updates [...], upgrades and successors [...]."

The second relevant product market is the market for Work Group Server operating systems. The workload for Work Group Servers is differentiated in file and print services and group and user administration services. A survey by the European Commission in the investigated years estimated Microsoft's market share at between 60% and 66% for the two workloads. The European Commission thus identifies Microsoft as the dominant company with a market share of at least 60%.

The third relevant product market is the market for streaming media players. The market for streaming media players is not a market where Microsoft holds a dominant position, but a reference market for products foreclosed by Microsoft by tying its WMP to Windows. Microsoft argued that WMP is an integral part of the operating system and that tying it does not foreclose competitors with WMP. The EC argues that this is not true because the two products are distinct, a precondition for tying. See Section 3.2.1 below for a detailed discussion of this issue.

3.1.2. The EC's March 24, 2004 decision and its conditions

"Microsoft Corporation shall, within 120 days of the date of notification of this Decision, make the Interoperability Information available to any undertaking having an interest in developing and distributing work group server operating

system products and shall, on reasonable and non – discriminatory terms, allow the use of the Interoperability Information by such undertakings for the purpose of developing and distributing work group server operating system products¹¹⁷.”

“Microsoft Corporation shall ensure that the Interoperability Information made available is kept updated on an ongoing basis and in a Timely Manner¹¹⁸.”

“Microsoft Corporation shall, within 120 days of the date of notification of this Decision, set up an evaluation mechanism that will give interested undertakings a workable possibility of informing themselves about the scope and terms of use of the Interoperability Information, as regards this evaluation mechanism, Microsoft Corporation may impose reasonable and non – discriminatory conditions to ensure that access to the Interoperability Information is granted for evaluation purposes only¹¹⁹.”

“Microsoft Corporation shall, within 60 days of the date of notification of this Decision, communicate to the Commission all the measures that it intends to take [...], that communication shall be sufficiently detailed to enable the Commission to make a preliminary assessment as to whether the said measures will ensure effective compliance with the Decision, in particular, Microsoft Corporation shall outline in detail the terms under which it will allow the use of the Interoperability Information¹²⁰.”

“Microsoft Corporation shall, within 90 days of the date of notification of this Decision, offer a full – functioning version of the Windows Client PC Operating System which does not incorporate Windows Media Player. Microsoft Corporation retains the right to offer a bundle of the Windows Client PC Operating System and Windows Media Player¹²¹.”

“Within 30 days of the date of notification of this Decision, Microsoft Corporation shall submit a proposal to the Commission for the establishment of a suitable

¹¹⁷ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Page 299, Article 5(a).

¹¹⁸ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Page 300, Article 5(b).

¹¹⁹ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Page 300, Article 5(c).

¹²⁰ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Page 300, Article 5(d).

¹²¹ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Page 300, Article 6(a).

mechanism assisting the Commission in monitoring Microsoft Corporation's compliance with this Decision. That mechanism shall include a monitoring trustee who shall be independent from Microsoft Corporation. In case the Commission considers Microsoft Corporation's proposed monitoring mechanism not suitable it retains the right to impose such a mechanism by way of a decision¹²²."

3.2. Tying and foreclosure with Windows Media Player

Media player software enables computers to play back audio and video content. A software codec compresses audio and video signals into bits and bytes and stores the data in a digital file¹²³. A codec from the media player software is responsible for decompressing and playing back the digital stored video and audio data. Software media players were first developed in the early 1990s and grew with the introduction of media content distribution and streaming media content over the Internet in the mid-1990s. RealNetworks developed the streaming media player software RealPlayer, which enables users to have the feeling of a radio or television broadcast and content providers to broadcast it over the Internet. Apple, Microsoft, and other companies developed their own streaming technologies in subsequent years as broadband Internet connection became more common. Today live streams of Internet radio, video ads and short films, for example on YouTube.com, are very popular. The European Commission's decision in the tying case focuses on media players which work with streaming technology.

The EC argued that Microsoft Windows is installed on over 90% of all PCs and that bundling WMP with Windows guarantees a high market penetration and ubiquity on the market¹²⁴. Furthermore, it argued that rival streaming media players cannot be downloaded or sold as efficiently and cannot reach a

¹²² Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Page 300, Article 7.

¹²³ Ahlborn, Christian and Evans, David S., The Microsoft Judgment and its Implications for Competition Policy Towards Dominant Firms in Europe (April 2008). Page 4.

¹²⁴ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Paragraph 833.

comparably high market penetration. The European Commission concludes that content providers will default to using the WMP format to stream content and software developers will write software primarily for the WMP format. This, they conclude, is the direct result of Microsoft's misuse of its competitive advantage¹²⁵ and network effects, which shift the market in Microsoft's direction¹²⁶.

3.2.1. Are Windows and Windows Media Player separated products?

The European Court does not see tying as a mere peccadillo. Famous Article 82 cases by dominant companies like the Hilti case¹²⁷ and the Tetra Pak II case¹²⁸ involved tying of primary products and consumables. Hilti, a fastening systems producer, was accused of abusing its dominant position by restricting its supply of cartridge strips to certain distributors. The dominant company in the packaging market, Tetra Pak, was accused of tying packaging machines and cartons¹²⁹. In both cases, the European Court upheld the European Commission's decision, just as it upheld the Microsoft decision.

European Community law prohibits tying per se under four conditions first set forth in the Hilti and Tetra Pak II cases¹³⁰:

1. The company is dominant in the market of the tying product.
2. The tied product and the tying product are two separate products.
3. The tying product cannot be obtained without the tied product.
4. Competition is foreclosed.

The Court argued that these four points were fulfilled in the Windows WMP case as well. When the operating system and WMP were combined in 1999,

¹²⁵ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Paragraph 879 – 881.

¹²⁶ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Paragraph 897.

¹²⁷ Case IV / 30.787, Eurofix – Bauco / Hilti, OJ 11.03.1988 L65 / 19.

¹²⁸ Case IV / 31.043, Tetra Pak II, OJ 18.03.1992 L72 / 1.

¹²⁹ Ahlborn, Christian and Evans, David S., The Microsoft Judgment and its Implications for Competition Policy Towards Dominant Firms in Europe (April 2008). Page 12.

¹³⁰ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Paragraph 794.

there were no consumer disputes. Consumers accepted the situation at face value. Microsoft took a form-based approach to challenging the decision, arguing that distributing Windows with WMP does not in and of itself constitute tying nor does it prove the foreclosure of other media players¹³¹. It argues that other media players can be downloaded for free so foreclosure cannot be assumed. The EC took the rule of reason approach to prove foreclosure by Microsoft by proving independent demand for and availability of WMP. Microsoft argued that there is no demand for the Windows operating systems without WMP and that all modern operating systems are delivered with media player features. It concludes that Windows operating system with WMP is a single product and not a bundle of two separate products¹³². To illustrate the arguments in abstract terms, let us take two features A and B which can be combined in various ways. The EC argues that A and B are separate products because B is sold separately. Microsoft argues that AB is a single product because there is no significant demand for A, so the two products are not A and B, but rather AB and B. The CFI draws on precedents set in the Hilti and Tetra Pak II cases as well as the interpretation of Article 82 EC treaty which says that “[...] complementary products cannot constitute separate products for the purposes of Article 82 EC treaty [...]”¹³³ and concludes that the operating system and WMP are two separate products.

3.2.2. Foreclosing competition with indirect network effects

Because WMP is pre-installed on all Windows PCs, the same high market penetration as the Windows operating system can be reached with very little effort through the OEM channel and thus, the EC argues, competition in media players is foreclosed. Other media players do not have such a wide spread distribution channel. The nominal price for WMP and RealPlayer is zero in both cases, but WMP has indirect network effect advantages because the true price

¹³¹ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Paragraph 839.

¹³² Ahlborn, Christian and Evans, David S., The Microsoft Judgment and its Implications for Competition Policy Towards Dominant Firms in Europe (April 2008). Page 13.

¹³³ Ahlborn, Christian and Evans, David S., The Microsoft Judgment and its Implications for Competition Policy Towards Dominant Firms in Europe (April 2008). Page 14.

of RealPlayer must include the cost of delivery. Microsoft's advantage is that the delivery cost of installing the program together with Windows is lower than the cost to the consumer in time and effort that it takes to download and install (i.e., deliver) RealPlayer¹³⁴. Indirect network effects are prices and features of complementary goods that benefit consumers in conjunction with the network good. In the WMP case, the network goods are media players and the complementary goods are varying content¹³⁵. The indirect network effect arises not only through the additional features the media player has, but also through the high grade of distribution, the volume of content and especially software written for WMP and the WMP format. The EC's argument is that the ubiquitous presence of WMP discourages the creation and distribution of content in other formats and hence forecloses competing providers of media players because there is not enough content produced for their media players and the appropriate codec¹³⁶. Do other media players like RealPlayer, QuickTime or FlashPlayer have a chance on the market? According to the EC and network effects theory, they should not survive more than a few years if WMP continues to be tied to the Windows operating system¹³⁷.

The CFI agrees with the EC's accusation that Microsoft is abusing its dominant position and foreclosing competitors by not giving consumers the choice between Windows with WMP and Windows without WMP. The main distribution channel of the Windows operating system, OEMs, have no incentive to add other bundles for the end user other than the one provided by Microsoft itself. Doing so would increase handling and cost¹³⁸. The EC's argument, which the CFI endorses, appears to be logical, but in fact the predicted consequences of tying and foreclosing competition have not materialized in the seven years since the accusation. WMP achieved 50% market share but has stagnated at that level for years due to the rising popularity of iTunes and Adobe-flash supported

¹³⁴ Liebowitz, Stan J. and Margolis, Stephen E., Bundles of Joy: The Ubiquity and Efficiency of Bundles in New Technology Markets (December 2007). Page 33 – 35.

¹³⁵ Spulber, Daniel F., Competition Policy and the Incentive to Innovate: The Dynamic Effects of Microsoft v. Commission. Northwestern Law & Econ Research Paper No. 08-18. Page 118.

¹³⁶ Spulber, Daniel F., Competition Policy and the Incentive to Innovate: The Dynamic Effects of Microsoft v. Commission. Northwestern Law & Econ Research Paper No. 08-18. Page 118.

¹³⁷ Spulber, Daniel F., Competition Policy and the Incentive to Innovate: The Dynamic Effects of Microsoft v. Commission. Northwestern Law & Econ Research Paper No. 08-18. Page 119.

¹³⁸ Larouche, Pierre, The European Microsoft Case at the Crossroads of Competition Policy and Innovation (May 2008). Page 18.

YouTube material. Even RealPlayer has maintained second position behind WMP. This indicates that the market for media players is still very competitive.

Why hasn't Microsoft's tying foreclosed competitors as predicted? Most likely, Microsoft's OEM channel is not as important as assumed, the market is more innovative than previously thought, and users are more flexible in their choice of media players as presumed by the EC¹³⁹. Mainstream users are satisfied with the products and solutions provided and appreciate easy and reliable functionality. Tech savvy users want the best product available, even if they are not included. As long as enough tech savvy users choose the best product and the tech savvy segment is kept open, tying will not have the desired outcome. The US authority's Consent Decree in the US Microsoft case aims to ensure that tying can be defeated or reversed¹⁴⁰. In contrary, the EC has had little success forcing Microsoft to divide its operating system from WMP because it still allows Windows operating system with integrated WMP to be sold alongside Windows operating system without WMP for the same price.

The EC decision counterbalances efficiencies generated by tying. Windows XP N (without WMP) was doomed from the beginning, selling for the same price as Windows XP with WMP and placed on the same shelf as the tied boxes¹⁴¹. Retailers and distributors in Europe ordered 1,787 copies of XP N, which is 0,005% of the 35.740.000 copies of Windows XP sold in Europe. Allowing Microsoft to pursue mixed bundling cannot be successful. Few customers will buy version XP N when they can buy XP with Media Player at the same price. Unbundling would only have been successful if Windows XP was only delivered without Media Player. Then consumers would have had to make a decision which media player to download, levelling the playing field for media players. The EC's attempt to unbundle Windows operating system from WMP to prevent tying and foreclosure was ineffective.

¹³⁹ Larouche, Pierre, The European Microsoft Case at the Crossroads of Competition Policy and Innovation (May 2008). Page 18.

¹⁴⁰ Larouche, Pierre, The European Microsoft Case at the Crossroads of Competition Policy and Innovation (May 2008). Page 19.

¹⁴¹ Larouche, Pierre, The European Microsoft Case at the Crossroads of Competition Policy and Innovation (May 2008). Page 20.

3.2.3. Conclusion on Streaming Media Player, tying and foreclosure

“The fact that an undertaking in a dominant position in the market for client PC operating systems bundles the streaming media player with the client PC operating system – the operating system pre-installed on the great majority of client PCs sold throughout the world – without the possibility of removing that media player from the operating system, allows the media player to benefit from the ubiquity of that operating system on client PCs, which cannot be counterbalanced by the other methods of distributing media players. Thus, owing to the bundling, the media player enjoys an unparalleled presence on client PCs throughout the world, because it thereby allows that media player automatically to achieve a level of market penetration corresponding to that of the dominant undertaking’s client PC operating system, without having to compete on the merits with competing products. Such a tied sale is moreover capable of having an appreciable impact on content providers and software designers, since the market for streaming media players is characterised by significant indirect network effects.”¹⁴²

Why does the EC maintain this strong opinion even after US authorities pass the Consent Decree in 2002? The Consent Decree ensures that consumers can break the tying and switch to other products. Unfortunately, the Consent Decree was only valid through 2007, though prolonged voluntarily by Microsoft until 2010 or at the latest 2012. If the EC had agreed that the US Consent Decree provided an adequate solution, it could have passed its own durable version. Instead, its solution has little effect in the tying case. The EC analyzed how Microsoft might create network effects with future spill-over effects like content with only Microsoft codec spilling over to electronic devices other than personal computers, such as mobile phones, or the shifting of Digital Rights Management (DRM) in Microsoft’s direction. Luckily other strong innovators and business ideas like iTunes or Adobe Flash prevented that.

¹⁴² Case T – 201 / 4, Microsoft v. Commission, 17.09.2007. Judgement (Summary). Paragraph 18 (3).

The now over 10-year-old EC case against Microsoft illustrates that it is not important what solution for tying is proposed, but rather that the EC will not allow monopolist companies to do whatever they want. It has proven capable of action, whether it be with regard to competition, mergers or cartels. The decision will serve as a precedent for future cases. For example, the EC now has more power and confidence in the Intel vs. European Commission case after having shown backbone in the European Microsoft Case. It has earned the right to be taken seriously and has proven capable of being persistent, even in long cases.

3.3. Microsoft's refusal to supply interoperability information

The refusal to supply case started in 1998 when Sun demanded complete information from Microsoft that would enable its operating system Solaris to interoperate with Windows operating systems. When Microsoft failed to respond, Sun filed a complaint with the EC. Ten years later the seesaw between Microsoft and the EC ended when Microsoft published over 50,000 pages of technical documentations concerning the interoperability case via MSDN¹⁴³, including Windows Communication Protocols (MCPPE), Windows Server Protocols (WSPP), Application Services and .NET Framework Protocols and many others.

The EC's core argument against Microsoft was that Microsoft unfairly leveraged market power from the primary market for client operating systems into the secondary, complementary market for work group server operating systems¹⁴⁴. According to Article 82 of the EC Treaty, this is clear abuse of a dominant position using market power in combination with the refusal to supply interoperability information. This abuse was only possible because of Microsoft's market power in the client operating system market with the network

¹⁴³ Downloadable via <http://msdn.microsoft.com/en-us/library/cc203350.aspx> accessed on 4th October 2008.

¹⁴⁴ Kuhn, Kai-Uwe and Van Reenen, John Michael, Interoperability and Foreclosure in the European Microsoft Case (August 2007). Page 5.

effect of applications produced for Microsoft Windows and the resulting barriers to entry. Workgroup servers are the last link between computer client and user and thus have to work smooth with the PC operating system. Microsoft's big advantage is that it designs both the client operating system and the work group server. It reduces interoperability of competitors by controlling the interfaces (protocols, APIs) and, thus, the functionality of operating systems. This gives Microsoft the power to exclude competitors which produce complementary products by denying them access to the operating system functionality. The only way competitors can bypass this situation is through reverse engineering, which often does not work well or as intended, stifling innovation completely.

Based on its analysis of Microsoft's behaviour in the primary and secondary market, the EC concluded that Microsoft had anti-competitive motivations for minimising interoperability in order to monopolise the work group server market with static (short-term) and dynamic (long-term) elements¹⁴⁵. At the time, the software market was already experiencing a relocation of applications from the client operating system to the server operating system, which helps explain Microsoft's desire to extend the Windows platform to the server operating system market and limit competitors. An internal memo from Bill Gates in 1997 reads: *"What we're trying to do is use our server control to do new protocols and lock out Sun and Oracle specifically.....the symmetry that we have between the client operating system and the server operating system is a huge advantage for us. Now, I don't know if we'll get to that or not, but that's what we are trying to do"*¹⁴⁶. Bill Gates' memo foreshadows the growth of Microsoft's work group server from 20% market share in 1996 to over 60% in 2001. The EC argues that Microsoft achieved some of this growth through anti-competitive actions¹⁴⁷.

¹⁴⁵ Kuhn, Kai-Uwe and Van Reenen, John Michael, Interoperability and Foreclosure in the European Microsoft Case (August 2007). Page 6.

¹⁴⁶ Transcript of a February 1997 speech by Bill Gates to Microsoft's sales force, in Sun's submission of October 14, 1999, at Tab. 5, on page MSS 505490, Case IV/C-3/37.345 on page 5823.

¹⁴⁷ Kuhn, Kai-Uwe and Van Reenen, John Michael, Interoperability and Foreclosure in the European Microsoft Case (August 2007). Page 6.

3.3.1. Disclosure of Intellectual Property for enhanced interoperability

Work group servers are designed to deliver basic infrastructure services to a small number of clients. Microsoft's integrated Active Directory Service is responsible for coordinating services like file sharing, e-mail, network printers and user administration. Microsoft's Distributed File System supports file management on client computers and work group servers. Essential protocols regulating interaction between client / server and server / server communication are needed to make these two services interoperable.¹⁴⁸ The way protocols are regulated between Windows server and Windows client is a major hurdle to third party server or client software that lack interoperability. In a truly interoperable setting, all servers would be compatible with each other, so that, for example, a Sun server could interact with a Windows server as well as two Windows servers can interact. To achieve this level of interoperability, third-party providers need access to Microsoft's client / server and server / server communication protocols. Once these protocols are published, Microsoft's competitors should be able to make products with added value that are not clones of Microsoft products. In response to Microsoft's intellectual property claim, the CFI points out that competing operating systems needn't work the same as Windows operating systems, but rather may offer improved security, reliability, processing speed and innovative functionalities¹⁴⁹.

Full disclosure of interoperability information requires Microsoft to open technological views into certain software programs, allowing competitors to mix its own software elements with Microsoft's software. Designing new software under these conditions will require low R&D investment. Newly designed software will automatically have the look, feel and performance of Microsoft software¹⁵⁰. The 2004 EC decision is partly based on lessons learned in the U.S Case v. Microsoft¹⁵¹. It resulted in changes to the consent agreement between

¹⁴⁸ Spulber, Daniel F., Competition Policy and the Incentive to Innovate: The Dynamic Effects of Microsoft v. Commission. Northwestern Law & Econ Research Paper No. 08-18. Page 108ff.

¹⁴⁹ Case T – 201 / 4, Microsoft v. Commission, 17.09.2007. Judgement. Paragraph 240.

¹⁵⁰ Spulber, Daniel F., Competition Policy and the Incentive to Innovate: The Dynamic Effects of Microsoft v. Commission. Northwestern Law & Econ Research Paper No. 08-18. Page 112ff.

¹⁵¹ U.S. v. Microsoft Corp. 253 F.3d 34 (D.C. Cir. 2001).

Microsoft and the U.S. government¹⁵² in 2005, strengthening the U.S. consent decree. The U.S. only unbundled Internet Explorer and Windows operating system, whereas the EC also unbundles functionalities within the operating system, setting the stage for greater innovation and renewed R&D investment. Critics argue that if software is protected under intellectual property rights, its subcomponents, themselves essential facilities, cannot be forced public to promote interoperability and drive investments in innovation and R&D¹⁵³.

3.3.2. Essential facilities and intellectual property in: Microsoft vs. Commission

The interoperability decision in the Microsoft case is partly based on former European cases, namely Bronner¹⁵⁴ and IMS¹⁵⁵ / Magill¹⁵⁶ from which two tests are derived. In the Bronner case, the European Court of Justice (ECJ) defined a refusal to supply an input as abusive and thereby a forced access to the input for rivals as required wherever:

- The refusal input is indispensable,
- The refusal to supply eliminates competition,
- The refusal to supply is not objectively justified.

Because Bronner does not involve intellectual property rights, all three circumstances are applicable to all forms of essential facilities¹⁵⁷. To confine the applicable area, the Magill case is included, which delivers the fourth point of the test, namely the new product condition. This condition is consolidated by the IMS case, ruled out one month after the Microsoft decision in 2004: *“In order for the refusal by an undertaking which owns a copyright to give access to a product or service indispensable for carrying a particular business to be treated*

¹⁵² U.S. v. Microsoft 231 F.Supp.2d 144, 150 (D.D.C. 2002).

¹⁵³ Spulber, Daniel F., Competition Policy and the Incentive to Innovate: The Dynamic Effects of Microsoft v. Commission. Northwestern Law & Econ Research Paper No. 08-18. Page 113.

¹⁵⁴ Case C – 7 / 97. Oscar Bronner v. Mediaprint. 26th November 1998. Judgement.

¹⁵⁵ Case C – 401 / 01. IMS Health v. NDC Health. Judgement. As yet unpublished.

¹⁵⁶ Joined Cases C – 241 / 91 P and C – 242 / 91 P. RTE and ITP v. Commission. April 6, 1995. European Court reports 1995 Page I-00743.

¹⁵⁷ Leveque, Francois, Innovation, Leveraging and Essential Facilities: Interoperability Licensing in the EU Microsoft Case (March 2005). Page 5.

*as abusive, it is sufficient that three cumulative conditions be satisfied, namely, that refusal is preventing the emergence of a new product for which there is a potential consumer demand, that it is unjustified, and such as to exclude any competition on a secondary market.*¹⁵⁸ Although the EC did not rely on the Bronner nor the Magill / IMS test, the Microsoft case passes both tests¹⁵⁹ and is described by Microsoft and accepted by the EC¹⁶⁰ as the cloning of new features in the Windows family of operating systems¹⁶¹. The new product test used by the EC in the interoperability issue is a reformulation of the Magill / IMS test with a lower threshold. The balance between dynamic competition through increased incentives to innovate is shifted toward static or price competition¹⁶². In other words, consumers do not benefit from product improvement when dynamic competition is blocked by high license fees and the refusal to disclose and innovate, a strategy described by Microsoft internally as the tax strategy¹⁶³¹⁶⁴.

Using the incentives balance test, the EC determined that Microsoft limits technical development and stifles innovation by not giving interface information to competitors. In a market where innovation should be the driver of success, it is a great loss when price competition no longer drives innovation. Companies are typically willing to invest in R&D when expected net earnings are higher than investments. However, if they may be forced to disclose essential facilities and intellectual property, they will think twice before investing in innovations and risking losing the innovation to competitors and facing following competition for the own product. The incentives balance test tries to clarify the advantages and disadvantages of mandatory access to interoperability information. The CFI's

¹⁵⁸ IMS, supra note 13, at recital 38, as written in Leveque, Francois, Innovation, Leveraging and Essential Facilities: Interoperability Licensing in the EU Microsoft Case (March 2005). Page 5.

¹⁵⁹ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Paragraph 554, footnote 670.

¹⁶⁰ Leveque, Francois, Innovation, Leveraging and Essential Facilities: Interoperability Licensing in the EU Microsoft Case (March 2005). Page 7.

¹⁶¹ Case COMP / C – 3 / 37.792 – Microsoft. Commission Decision. Paragraph 713ff.

¹⁶² Ahlborn, Christian and Evans, David S., The Microsoft Judgment and its Implications for Competition Policy Towards Dominant Firms in Europe (April 2008). Page 20.

¹⁶³ http://www.linio.org/microsoft_tax.html accessed on 10th October 2008.

¹⁶⁴ "The Microsoft tax is an unofficial, but commonly used term that refers to the licensing fee that Microsoft charges major suppliers of personal computers for each unit sold and that purchasers thus usually pay for such computers, regardless of whether or not they want or intend to use a Microsoft operating system." Paragraph one of web site http://www.linio.org/microsoft_tax.html accessed on 15th February 2009. For more information visit latter mentioned web site.

role was to decide whether the Commission's decision is right or not. On September 17, 2007, it expressed its full support for the Commission's decision. Misunderstanding / Misinterpreting of Microsoft versus Commission by accepting the last decision of the CFI and not to file an appeal at the Court of Justice (ECJ) makes this case the 'Case of the decade'.

4. Conclusion

In March 2004 the EC ended its investigation against Microsoft, concluding that Microsoft leveraged its virtual monopoly in client computer operating systems onto its server operating systems and mobile devices¹⁶⁵. It forced Microsoft to disclose their Workgroup server operating systems to other operating system producers, which will likely result in stiff competition. Microsoft's client operating system controls the proprietary protocol specifications, which allow the client system to communicate effectively with the server system. To enable competitor server systems to communicate with Microsoft's operating system as well as a Microsoft server system without loss of functionality, it demanded that Microsoft publish its interoperability information and license its protocol specifications. The EC justified this forced licensing based on these factors:

1. Microsoft's conduct is part of Microsoft's general behaviour and other abuses like tying.
2. Microsoft only supplies some vendors but not all.
3. Earlier voluntary publications of interoperability information has stopped.
4. Interoperability information has a significant competitive importance and can eliminate competition in the server operating market. No substitutes are available.
5. Microsoft's actions damage consumer welfare and innovative efforts.
6. Disclosure of interoperability information does not endanger intellectual property rights and will not result in lower R&D at Microsoft because no source code is published.

¹⁶⁵ Padilla A. Jorge, O'Donoghue Robert: The law and economics of Article 82 EC. Hart Publishing, Oxford 2006. Page 430ff.

7. It is common practice to publish interoperability information in the software industry.
8. Disclosure of interoperability information complies with European legislation and its understanding of the protection of software programs.

After years of investigation in 2008 Microsoft lost the case definitely and published interoperability information. Dozens of economists, lawyers and judges contributed to solving the “Microsoft problem”. The case popularized economical basic principles such as monopoly, tying, foreclosure and bundling that were previously insider terms among competition economists.

The EC's second accusation was that Microsoft's tying of its Windows Media Player with the operating system was deterring innovation, reducing consumer choice and protecting its monopoly in the operating system market¹⁶⁶ by making the Media Player ubiquitous and not licensing to others wanting to use the Media Player format in their own players. The EC argued that Microsoft's intention was to foreclose entrants in the operating system market. The EC required Microsoft to unbundle its Media Player but permitted mixed bundling, which proved ineffective. However, in January 2009 the EC filed a complaint against Microsoft for tying its Internet Explorer. Perhaps the EC will solve this problem more wisely than it solved the Microsoft Media Player problem.

¹⁶⁶ Padilla A. Jorge, O'Donoghue Robert: The law and economics of Article 82 EC. Hart Publishing, Oxford 2006. Page 496ff.

5. Summary

The European Community was founded in 1957 to unite Europe along economic interests. In 1967, the European Steel and Coal Community and the European Atomic Community were added. Today, Europe is a multinational community that has brought a global giant to its knees. Historically, Microsoft has always found ways to avoid guidelines and limits, even when tried in the US judicial system. Europe proved its individuality by taking on Microsoft on its own. The US had already ruled to break up Microsoft and require it to make its interoperability information accessible, but the US courts were too weak to enforce the decision. In a massive process spanning 10 years, the European Union reached its own decision that leading economists consider the decision of a decade not because the giant has been toppled, but because Europe displayed a unity and strength accepted beyond its borders. The future will tell whether it was a good move to tame the lion and whether the move will strengthen innovation and competition. Regardless of the merits of the decision, Microsoft has announced that the next version of Microsoft Windows, the successor to Windows Vista called simply Windows 7, will not include any additional elements. It plans to make Media Player, Movie Maker, and Outlook Express accessible only via download. Is this nothing more than an advertising scheme by Microsoft, or is it genuinely trying to avoid future conflicts with the European Union? Only time will tell. One thing is certain, everyone involved has learned lessons, and Microsoft finally realizes that it is no longer invulnerable.

6. Zusammenfassung

Die Europäische Gemeinschaft wurde im Jahr 1957 gegründet, um Europas wirtschaftliche Interessen zu verbinden. Im Jahre 1967 wurde selbige um die europäische Stahl und Kohle Gemeinschaft sowie die europäische Atomgemeinschaft erweitert. Inzwischen ist Europa eine multinationale Gemeinschaft, die es schafft, einen global agierenden Riesen in die Knie zu zwingen. Die Geschichte zeigt, dass es für Microsoft immer Mittel gegeben hat, Richtlinien und Grenzen zu umgehen, obwohl dies im amerikanischen Recht schon ausjudiziert worden ist. Doch Europa zeigt sich auch hier eigenwillig und entwickelt sich selbständig. In den Vereinigten Staaten war es bereits beschlossene Sache Microsoft aufzuspalten und Interoperabilitätsinformationen allen zugänglich zu machen, doch waren die amerikanischen Gerichte zu schwach dies durch zu setzen. Die Europäische Union hat es schließlich geschafft, in diesem Elefantenprozess der sich über ein Jahrzehnt hingezogen hat, eine Entscheidung zu treffen. Für führende Ökonomen ist es die Entscheidung des Jahrzehnts, nicht weil der Riese bezwungen ist, sondern weil in Europa Einheit und Kraft gezeigt wird, die auch außerhalb Europas akzeptiert wird. Die Zukunft wird zeigen, ob es richtig war, den Löwen zu zähmen und ob dadurch Innovation und Wettbewerb gestärkt werden. Mag die Entscheidung sein wie sie ist, Microsoft hat angekündigt, dass die nächste Version von Microsoft Windows, mit dem einfachen Namen Windows 7 und Nachfolger von Windows Vista ohne jegliche Zusätze kommen wird. Media Player, Movie Maker und Outlook Express sollen nur noch zum Download angeboten werden. Ist es nur eine neue Werbemasche von Microsoft oder soll es tatsächlich zukünftigen Konflikten mit der Europäischen Union aus dem Weg gehen? Man wird sehen. Aber alle Beteiligten haben ihre Lektion gelernt und Microsoft weiß endlich, dass es nicht mehr unangreifbar ist.

7. Curriculumulum Vitae



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Voraussichtlicher Abschluss des Studiums der Betriebswirtschaft als Magister mit Vertiefung Wirtschaftsinformatik an der Universität Wien am Betriebswirtschaftlichen Zentrum (BWZ). Thema der Diplomarbeit aus dem Bereich Volkswirtschaftslehre und Wettbewerbs- und Regulierungspolitik: "The Microsoft Case: A European Economical and Technical Review".

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Studium der Betriebswirtschaft im Magisterium mit dem Hauptfokus auf E – Economy und Wirtschaftsinformatik. Zusätzliche Ausbildung in den Bereichen eLogistics and Supply Chain Management, Innovationsmanagement und Grundlagen von SAP sowie Wettbewerbs- und Regulierungspolitik.

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Erlangung des Titels Bakkalaureus der Betriebswirtschaft.

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Studium der internationalen Betriebswirtschaft am BWZ.

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Einjährig freiwillige (EF) Ausbildung zum Milizoffizier der ABC – Abwehr.

10/1990 – 06/1997

Matura am Bundesrealgymnasium St. Veit / Glan.

SPRACHKENNTNISSE

Deutsch: Muttersprache.

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Geschäftsprozessmanagement mit Adonis, ADOscore. Controlling mit SAP. Standardofficeanwendungen incl. Ms – Project. Erweiterte Kenntnisse verschiedener Betriebssysteme von Microsoft und Linux. CMS, DMS, Forensoftware, MySQL, html, php, Apache.

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