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• Develop an efficient e-business strategy which can bring revenue enhancement and cost reduction

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Abstracts

Price Competition and Uncertainty in Retail E-commerce – Will the Web Lower Retail Prices?

Professor Kevin Anthony Lawler, Anne-Marie Ridley, and Kin Pui Lee, University of Sunderland

The increasing profile that e-commerce plays in retail markets raises issues relating to how ‘digital’ retail markets compare to conventional markets in terms of search costs, types of seller competition, price discovery and forms of intermediation. This paper reviews these and shows when digitised retailing is viewed through the lens of auction theory it is not clear if web retailing prices are lower than in conventional markets. The Key Auction Model demonstrates that prices will range from maximum reservation levels to lower levels but never reach cost prices. The implications of the models are that consumers can loose out shopping on-line compared to conventional markets.

Modelling Mass Customization of Digital News Services

Thomas Ritz, University of Stuttgart

Personalized information services have become typical information products offered online by different media – mainly the web. While these services are well understood from a marketing and distribution technology point of view, the “production” of these services is seldom the focus of research. In this article the author attempts to apply concepts known from the enauge production paradigm “mass-customization” and to transfer these paradigms into processes and technology suitable for the production of personalized information services. The author proposes a model defining the building blocks needed for the production of personalized services and which act as “glue” between production processes and the technology applied.

Quality of Service Provision for Distributed Multimedia via Reflective Service

Edward Babulak, Staffordshire University

This paper presents a detailed review on the Quality of Service (QoS) Provision for Distributed Multimedia (MM) via Reflective Service, based on server-fault initiated session switch. Enhanced Reflective Service lists the resources necessary to support the application’s QoS requirements and makes them available for the Session Manager, which co-ordinates the session switching. Our work demonstrates that all the components of distributed MM system should be involved in the QoS management process. The client’s requirements related to QoS must be adapted to various constraints supported by the distributed MM system components: client machines, server machines and transport system.

Bark or Bite? The Commercial Applications of Bluetooth

Stuart J. Barnes, University of Wellington, New Zealand

Over the past quarter century, modern society has witnessed an incredible proliferation of computing, telecommunications and electronic devices in our everyday lives. Many of the devices, including PCs and related products, have traditionally relied on connection via specific cables. More recently, wireless devices such as mobile phones have grown in popularity based on the use of proprietary networks for communication. Until now, however, these two sets of technologies have existed largely separately. In an effort to try and solve some of the difficulties associated with cheap and simple data communication, various specifications have been created to provide the means for low-power, short-range radio connection through
the use of embedded wireless transceiver chips. Bluetooth is the best known of these solutions, and has a broad base of industry support. The commercial potential is enormous, including applications in the workplace, home, in-transit or public spaces. This paper examines the potential impact of Bluetooth from an application perspective. It examines the key areas of application of such devices, and evaluates the core benefits associated with these emerging Bluetooth applications. The paper draws to a close with a discussion of the possible problems and opportunities associated with the commercialisation of Bluetooth.

Analysing the Business Models on the Web for Internet Commerce
Anshu Saxena, D.P. Kothari, Sudhir Kr. Jain, and Amulya Khurana, Indian Institute of Technology, New Delhi

Business models on the web evolve rapidly. In the most basic sense, a business model is the method of doing business by which a company can sustain itself—that is, generate revenue. The business models spells-out how a company makes money by specifying where it is positioned in the value chain. The paper discusses the implementation of these business models in a variety of ways. Moreover, any given firm may combine different models as part of its web business strategy. Thus, an advertising model may be blended with a subscription model to yield an overall strategy that is profitable. The term “business model” has taken on a new meaning and greater importance in the last few years in the realm of intellectual property protection. Within the legal community, business models are defined within the context of patent law. The paper highlights the usage and importance of various business models on the web for the purpose of revenue generation. The companies should use these web models to shape their approach to their chosen market.

Extended Value Chain Management in Electronic Marketplaces
Otmar Görlitz, Ralf Neubert, Tobias Teich, and Wolfgang Benn, Chemnitz University of Technology, Germany

In this paper we introduce a concept of project-driven co-operation formation between SMEs (small and medium-sized enterprises), supported by IT-infrastructure and -tools on electronic marketplaces. Two crucial factors that determine the success of an SME, especially in electronic commerce, are the time it needs to process a customer’s request and the selection of competent partners to cover the value chain of a complex product. Our concept includes advanced planning and scheduling tools, allowing the SME a fast and precise generation of tenders. In many cases the generation of tenders can be completely automated, eliminating the time-consuming manual processing and creating a distinct advantage over the competition. The search for suitable co-operation partners is supported by a sophisticated service mediator. A concept ontology allows the detailed description of required services and specialisation. It serves as the entrance point for the search in the underlying profile database. A multi-objective selection mechanism helps to choose the most suitable partner for every task in the co-operation. This enables SMEs to accept and successfully fulfill customer requests for complex products, which they could otherwise not handle. Our co-operation concept facilitates the ad hoc co-operation for the duration of single projects. The SMEs are very loosely coupled to the market place, having to provide only their profile in compliance with the concept ontology, in order to be included in any selection process.
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Open Source – The latest fad or here to stay?

It is difficult to define Open Source developments within a few words, since many characterisations exist. There are also many excellent papers (see for example[4]) setting out the basic features of open source and the interested user is encouraged to consult, for example, the papers in the bibliography to this paper however for completeness the main features of open source are:

- The freedom to use software as they wish and redistribute is either for free or for a price.
- The ability to tailor the software to fit specific needs. Including fixing bugs, improving code and so on.

In general the difference between open source software and ‘free software’ is that open source describes the larger set of concerns that cover one or more of these “free software” criteria including: freedom to download, copy, modify, redistribute and use the software.

The distribution terms of an open-source program must cover the following criteria:

- Free Redistribution, Source Code, Derived Work,
- Integrity of the Author’s Source Code,
- No favouritism for specific persons or groups,
- No Discrimination in the distribution of Licenses.

In OSD (Open Source Development) any changes can take place directly, often without any formal change proposal. Any one can do the changes. However in general two ways are used to handle any changes. The first is to submit all the complete changes to the moderator of the software package or changes can be made directly through write access to the software site holding the latest version.

However the overall process would still be the same: first the idea of the change will be created then implemented and evaluated within different tests and discussion and reviews. In a flexible and changing software environment such as that found in some open source developments the free flow of ideas possible with open source coupled with the many experienced and creative minds that often come together round a ‘good idea’ leads to a rapidly changing experimental software laboratory. The World Wide Web has of course hastened this process.

The case for Open-Source software is:

- A major advantage of open source is that users can access code and if they find any problems they can either fix them or at least identify where they think the problem is.
• Reduced Risk: The level of control for users is much higher.
• Quality: In comparison with commercially available products the quality is much higher in open source products since there are a lot of authors involved.
• Favourable licensing and pricing: Open Source licensing is very flexible and it could potentially reduce the time and cost to install a programme.
• Reliability: Since a world wide group of developers can access the source code and help debugging it the products are potentially both reliable and stable.
• Better Customer Service: For the majority of the Open Source software in general use support contracts are available and there are often people willing to offer support for users. Some open source organisations offer free e-mail support, support mailing lists, and Usenet newsgroups.
• Simplified Collaboration: Open Source communities share ideas and programs amongst members with similar interests. Also the level of the informal conversation within the projects partners is quite high.
• Design: The same group often designs and implements open source software, at least initially. This helps when changes are required, as knowledge is concentrated in a few people.
• Another advantage of open source software is that testers are developers. This is good practice and has been recommended in the development of commercial products as well.

However there are some disadvantages of using Open Source:
• Understanding the source code can be a difficult task especially if the code is poorly documented. The majority of development in open source is done in a virtual environment, therefore information needs to be written down and placed in a public context. This way others can be informed about new changes and what still needs to be done.
• When adopting the open source software, any changes made to the system could prevent the software from upgrading to the new version later on, if the community does not accept the changes.
• If organisations treat open source software as a black box (not caring to know what is going on inside) then they might need to change their business models to fit with the business model specified by the software. This mirrors the same problem found within commercially available software.
• Since users do not usually get paid for their contributions in developments, they might not share what they know with others. This can lead to re-inventing wheels in development terms and hence to greater costs overall. This in turn leads to many variants of the source and hence to possible confusion.

The challenge for the user community is whether or not to embrace the benefits of open source for real, mission critical software or whether to rely on software suppliers working in the traditional fashion. Developing specifications with a closed group of users and then proceeding to procurement and delivery of essentially one-off packages has been the way for the previous generation of systems. Perhaps the future lies more in open source rather than proprietary systems.

Andrew Slade
Editorial Board, January 2002
Company Round-up

**FreshLink slashes EDI communications costs**

FreshLook, a specialist EDI solution provider, announced its FreshLink service. FreshLink is a novel way of handling EDI via the Internet, to help users reduce costs and increase profits in difficult economic times. The FreshLink service has attracted keen market interest and is already showing major savings on day-to-day EDI operations for its clients.

Electronic Data Interchange is probably one of the most successful e-commerce applications ever. It is used by over 20,000 UK companies across all industry sectors, for daily operations critical to the efficient management of the supply chain – for logistics, administration, stock management, and customer service benefits.

Typically, EDI is conducted over the major Value Added Networks (VANs) upon which EDI users are totally dependent for service delivery. VAN charges remain unusually high whilst telecommunications and computing costs have otherwise continued on a steep downward curve. Consequently, VAN charges can represent a significant portion of total supply chain costs – and a significant overhead of conducting business electronically. At worst, they can significantly inhibit the growth of e-commerce.

When the Internet began transforming business in the late 1990s, FreshLook (based in Surrey, UK), started looking at how the new medium could assist its customers to obtain the cost saving benefits the Internet offered, while protecting their investment in traditional EDI.

FreshLook believed that such costs were increasingly hard to justify, especially in today’s economic climate, and concluded that a whole new approach was required to break the cycle of ever-increasing costs. The company canvassed its customers to identify what sort of new EDI service they really wanted.

The survey determined the need for lower annual mailbox charges and traffic charges (reduced by at least 33%) whilst retaining the same reliability, resilience, audit trails, user support and security controls as currently provided. High up on the list of priorities was the protection of existing investment in EDI software and internal skills; legacy systems were to be unaffected, and day-to-day EDI operations were to continue as before.

Also on the list was the elimination of any additional traffic charges and excess storage charges that are applied by EDI VANs. The preference was for a fixed annual charge, agreed each year in advance and based upon the previous year’s traffic. Also required was a way of gearing variable future traffic charges to an attractive pricing model; for instance a 50% reduction in traffic (now a real possibility through encouraging trading partners to use the Internet), was to result in a full 50% reduction in the following year’s fixed price charge.

Customers also requested a safe and secure route towards the increasing use of the Internet for EDI traffic, with all administrative work and system testing being performed by FreshLook resources – and at no extra cost! “Some wish list,” states Fidler, “but precisely what we expected, and in line with our own customer expectations and ideas for our proposed FreshLink service.”

FreshLook also offers assistance in providing experienced personnel to visit customers’ selected trading partners to discuss the possibility of transferring to the Internet if this is a requirement.

Looking ahead, Fidler is optimistic that FreshLink will attract more customers because...
of its cost-competitiveness and added value services in helping traditional EDI users to move away from their heavy reliance upon VANs.

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SSPA Europe launches first daily news and information service for support professionals
SSPA Europe, a division of The Service and Support Professionals Association (SSPA) - the leading industry association for IT support professionals – has launched www.supportinsight.com. The first daily news and information service created exclusively for IT support, call centre and training professionals, www.supportinsight.com provides up-to-the-moment news and analysis on developments affecting support operations all over the world.

In addition, visitors to the site will be able to sign up for free daily newsletters as well as obtaining advanced information on conferences and events. www.supportinsight.com features news stories and original articles on critical and newly emerging issues and trends. And online discussions regarding the latest support issues are set to become a key feature.

As well as delivering www.supportinsight.com, SSPA Europe, which was launched in 2000, markets and manages SSPA conferences, awards and membership throughout Europe.

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Perwill powers m-box supply chain and CRM hub
Web EAI and EDI/XML software vendor Perwill Plc is providing the Portal Plus implementation of its Perwill eBiz-Manager product to the m-box hub. The m-box hub integrates and orchestrates all cross-channel processes across multiple enterprises and makes visible every single customer interaction, and every event in the supply chain. The m-box hub software is unique and it is this that enables m-box to operate at high efficiency and provide a robust, reliable and intelligent service to its customers and their consumers.

m-box Chief Operating Officer Duncan Lennard explains “We manage an order from first interaction with the customer to final delivery across many operations and service providers. And what’s more, the information is directly available, like the life story of an order, to call centres, store-based staff, suppliers and even customers. It really is a step-change in customer care and supply chain management”.

m-box offers its major corporate customers an ASP service that cost-effectively delivers the many different facets of the logistics and Customer Relationship Management (CRM) functions that are essential elements of today’s multiple enterprise systems, including:

• Multi-channel order processing
• Multiple delivery and return management
• Advanced technology hosting
• Multiple warehouse management
• Customer service visibility
• Multiple channel customer relationship information
• Sophisticated workflow management
• Payment processing

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Price Competition and Uncertainty in Retail E-commerce – Will the Web Lower Retail Prices?

Abstract: The increasing profile that e-commerce plays in retail markets raises issues relating to how ‘digital’ retail markets compare to conventional markets in terms of search costs, types of seller competition, price discovery and forms of intermediation. This paper reviews these and shows when digitised retailing is viewed through the lens of auction theory it is not clear if web retailing prices are lower than in conventional markets. The Key Auction Model demonstrates that prices will range from maximum reservation levels to lower levels but never reach cost prices. The implications of the models are that consumers can lose out shopping on-line compared to conventional markets.

Received: October 2001

Introduction
Consumers face search costs in acquiring price and product data on products offered by rivals. Similarly sellers face search costs in identifying qualified buyers for their products[13]. This can be classified as market research and advertising costs. Internet based technology lowers buyer search costs. Thus search engines like Alta Vista or Google.com help buyers make price comparisons and specialised agents make specific comparisons for buyers. On-line agents such as R_U_Sure.com monitor consumer behaviour and help buyers identify favourable prices. Moreover, the web assists sellers in reducing search costs by allowing them to communicate new product features and new means to reach new consumers[13].

Competition in Digital Markets
Lowering search costs for buyers and sellers should enhance the degree of price competition. On the other hand, on-line retailers can use web technologies to intensify product differentiation by offering greater customised products. This allows sellers to avoid competition simply on price.

Web Retailing and Price Competition
Lower search costs[12,13] for buyers and sellers should make it easier for consumers to locate low-cost sellers. This should lower prices in commodity markets. Web based retail competition may or may not lower prices in markets where products are differentiated. Since on-line markets have lower barriers to entry or smaller minimum efficient scales this should lead to large numbers of sellers and lower prices. However, few goods are truly homogeneous and sellers in digital markets will seek to use technology to enhance product differentiation. This leads to increased variety and customisation of products. When retail-e-business is linked to modern production techniques it allows for the possibility of building to order. This is particularly true of consumer durables.

Price Discrimination and Internet Retailing
When sellers can collect individual consumer data and use this to differentiate products coupled to reduced ‘menu costs’ for price changing, sellers acquire increased power to price dis-
Comparing price dispersion of on-line retail markets with ‘bricks and mortar’ markets can show the extent to which the ability for product differentiation and price discrimination provide countervailing forces favouring increased price competition in digital markets. A number of studies have found on-line price dispersion comparable to conventional markets\(^4\). On-line price dispersion may reveal heterogeneity in retailer factors such as service quality, brands and loyalty.

**Market Clearing Price Discovery**

The mechanisms for price discovery and market clearing are enhanced by digital formats. Auctions are frequently used in financial markets but in some conventional markets – e.g. motor trading, negotiation between buyers and sellers is routine. E-business allows retail markets to employ new price discovery mechanisms. This is particularly true for web-based auction sites such as Onsale.com, which have created new discovery mechanisms for durables. Airlines frequently use ‘ticket auctions’ to sell last minute unsold seats to the highest bidders. Intermediaries like Priceline.com enable buyers to make offers to sellers reversing the typical pricing dynamic in retail markets. In some cases the authority to negotiate prices can by assigned to trusted software agents allowing sellers to discard non-negotiable prices. These should benefit efficiencies in all digitised markets. However, it is unclear whether web-based retailing results in either lower prices or more price competition than conventional markets. This is because digitised markets for durables particularly increase uncertainty on the demand and supply sides of markets. The aim of this contribution is to demonstrate this using an auction model which shows that prices may vary between high monopoly prices to lower prices. Prices will never hit marginal costs, however, because of these uncertainties.

**Bertrand Retail Price Competition and Uncertainty**

McAfee and Macmillan\(^{10}\) analyse auctions with risk averse bidders whose exact number is not known. They show that the number of bidders being stochastic does not matter in the optimal auction when bidders are risk neutral. Here, the optimal auction is not a first price-sealed bid format equivalent to the Bertrand model. Rather it is an English auction in which bidders bid in sequence, say via marketing messages, and as frequently as possible. Auction theory allows one to show that in such an auction, the winning bid will be second-highest valuation among the bidders\(^{11}\). However, optimal first-price-sealed auctions are common in practice and a representation of one is given below for the retailing game\(^8,5\).

**Applying Auction Theory to On-line Retail Price Competition**

The similarities between Bertrand competition and first price sealed bid auctions is well known\(^5\). The model developed here can be viewed as tackling the issue as to what is the optimal bid if the number of participants in a sealed bid auction is not known. Uncertainty can exist on the demand side when consumers know some retail prices today but they do not know all prices tomorrow. Moreover, uncertainty about the existence of rivals may emerge from uncertainty on the demand side, with respect to consumers’ search behaviour. Time constrained buyers may regard rival goods as perfect substitutes, or search costs may be unclear from the sellers viewpoint or, consumers may vary in sophistication. Such things may result in consumers not...
knowing the prices that every seller is charging within a product class or range of classes.

In digital retailing uncertainty exists on the supply side too. Thus it may not be clearly known if rivals are under/over charging by error or ignorance. Examples exist in on-line retailing supplier chains where in peak periods manufactures are at capacity or where ‘special’ commodity bundles are in fixed supply. Such cases can be modelled as uncertainty as to the number of existing rivals. This supply and demand interpretation allows for the treatment of existing rivals competing for consumers as an exogenous probability independent of the number of potential rivals. This probability distribution is beyond a seller’s control and is a decision by nature.

A Simultaneous Symmetric Bertrand Model for On-line Retailing

Let the variable \( x \) represent the probability that a given retailer periodically is not actively competing and does not bid for particular classes or brands of goods. This could be that the firm has reached capacity, priced grossly in excess of reservation prices by mistake or, that time-constrained consumers have not realised that a particular seller could bid.\(^{[9]}\)

Accordingly we model a first price sealed bid auction for retailing. Such a case is not an optimal auction but it captures the essence of Bertrand competition in retailing, where a number of retailers offer prices to consumers without knowing how many other rivals are actively competing in specific or general branded product classes.

Model I

Let there be a digitised market: of \( N+1 \) risk neutral firms which submit bids \( p_i \) to supply consumers. Each seller has marginal cost of \( c \), or with a probability \( x \in (0,1) \) independent for each firm, infinity, which is increased only if the firms win consumers. Firms (sellers) with a marginal cost of infinity do not compete or exit product classes. The consumer buys commodity bundles at the lowest prices and pays up to a maximum of \( P_{\text{max}} \). If firm \( i \) uses a mixed strategy we depict its distribution of prices as \( p_i; x \) represents the probability that a seller exists but does not compete in specific/general product classes. The sellers announce bids simultaneously via advertising messages to supply branded products. There is no pure strategy Nash equilibrium unless \( x \) is 0 or 1. If \( x \) is zero, firms charge \( c \); if \( x = 1 \), no firms compete and all exit specific product classes.

If \( x \in (0,1) \) no viable unique price equilibrium is possible for \( P > c \). If the two lowest prices that exist are not equal or, where all firms have the lowest price, a firm could gain by increasing prices (the Edgeworth case). If the two lowest prices were equal, one could cut price and gain market share. However, equilibrium is not where \( p_i = c \); This is the zero profits textbook Bertrand point and any firm raising price could get a surplus of \( P_{\text{max}} - c \) with probability of \( x^N \). The equilibrium is now therefore in mixed strategies. Thus, the standard textbook version of the Bertrand Paradox is a false theorem.\(^{[9]}\) Each firm picks price \( > c \), and less than \( P_{\text{max}} \). Since any firm gains positive profits at \( P_{\text{max}} \) and wins with a probability of \( x^N \), the range of strategies must be bounded by \( (P, P_{\text{max}}) \) where \( P > c \). A symmetric equilibrium for \( N+1 > 1 \) exists where:

\[
D(P) = N \sqrt{1 - x^N \sqrt{(1-x^N)[(P_{\text{max}} - P)/(P - c)]}}
\]

(1)

For the price range \( [x^N P_{\text{max}} + (1-x^N) c, P_{\text{max}}] \)

In this case profits are positive but expected

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\(^{[9]}\)
price and profits fall smoothly as the number of firms increases as in Cournot.

In this model the lowest bid wins consumers with certainty and still earns a profit. Risk averse sellers would gain in this model by continually pushing prices down. High prices are a gamble in the hope that rivals are not competing. Hence risk aversion reduces prices.

The model casts some light on the Diamond Paradox\(^6\) which shows that when consumers have to pay for price quotations from extra sellers the equilibrium can be at the reservation price even when all firms have identical costs and there is price competition. This is because consumers are not induced to engage in costly search since perhaps only one firm may offer the lowest prices.

**Model II: An Asymmetric Bertrand Model with Two Sellers: Type D and Type P Retailers**

**Proposition 1:** Two sellers: Firm 1 is always competing, Firm 2 enters and leaves product classes and active with probability

\[
P(c) = (1-x)
\]

where \(x\) is the probability of not competing or withdrawing.

Let both types of seller have different mixing distributions over \([Q, P_{\text{max}}]\). The equilibrium is:

\[
\begin{align*}
F_1(p) & = \begin{cases} 
0 & \text{for } p \leq (1-x)c + xP_{\text{max}} \\
1-x(P_{\text{max}}-c)/(p-c) & \text{for } p \in (1-x)c+xP_{\text{max}}, P_{\text{max}} \\
1 & \text{for } p \geq P_{\text{max}}
\end{cases} \\
F_2(p) & = \begin{cases} 
0 & \text{for } p \leq (1-x)c + xP_{\text{max}} \\
(1-x)(P_{\text{max}}-P) & \text{for } p \in (1-x)c+xP_{\text{max}}, P_{\text{max}} \\
1 & \text{for } p \geq P_{\text{max}}
\end{cases}
\end{align*}
\]

Continuous price dispersion is the clear outcome for the asymmetric case when \(p > c\).

Implications of the auction model for digitised market price strategies are as follows:

- A continuous pure strategy for on-line retailer is not sustainable in repeated plays if consumers search costs change due to say, increased on-line shopping. Moreover, if due to demographic changes, new consumers enter the digital market then the equilibrium strategies for all sellers need to be mixed.
- In particular the on-line retailers will need to use mixed strategies. In such situations, the probability of not competing for previously segmented bundles of goods is \(x\) and \(1-x\) is the probability of competing. The auction model identifies precise boundary conditions for this outcome. Therefore repeated plays will induce greater on-line market price dispersion for all retailers as all utilise mixed strategies. The auction model clarifies this important point as the two groups, being competitive bidders, perceive the game as an ascending and/or descending price auction in branded goods.

Price dispersion will not necessarily narrow even with new entry as prices vary between \(P_i > c\) but less than \(P_{\text{max}}\) for both types of retailing format. Such third degree price discrimination is a probable strategy for both formats. This could be proved using the revenue equivalence theorem\(^9\).

Despite rational expectations, price dispersion will continue to exist across digital markets. Thus entry of new on-line retailers would not necessarily reduce price dispersion if clear market segmentation occurs, because this permits third degree price discrimination to be used by all on-
Online players. Amazon.com has been doing this by randomising its prices to obtain demand elasticity measures[3].

Conclusions
The auction models permit the formulation of the testable hypothesis that non-price factors and uncertainty are a primary cause of price dispersion in digital retail markets. Price dispersion in digital markets could be configured as information failures. However, in these models, the demand and supply uncertainties confronting buyers and sellers create the opportunity for sellers to target clear market segments. These endogenous features are caused by market uncertainties rather than information failures. It is evident in this model, as sellers adopt mixed strategies targeted at different demand characteristics that prices will always be higher than costs and positive profits will be earned by all sellers which will not be competed away. Search constraints faced by consumers allow all digital sellers to use mixed price strategies to induce periodic Edgeworth-type price oscillations generating different degrees of price dispersion in the entry phase in digital markets. Once again, price dispersion might increase with new entry.

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Biographies

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Modelling Mass Customisation of Digital News Services

Abstract: Personalized information services have become typical information products offered online by different media – mainly the web. While these services are well understood from a marketing and distribution technology point of view, the “production” of these services is seldom the focus of research. In this article the author attempts to apply concepts known from the emerging production paradigm “mass-customization” and to transfer these paradigms into processes and technology suitable for the production of personalized information services. The author proposes a model defining the building blocks needed for the production of personalized services and which acts as “glue” between production processes and the technology applied.

1 Introduction to Personalised Information Service

Personalised delivery of content is gaining in importance, and this is reflected in ongoing research. A large number of these services are not primarily designed as information products like a newspaper but are mostly designed to cope with 1:1 marketing. Nevertheless the added value of such information services is proved and can be traded as part of value-added-publishing strategies. As common subset of definitions which could be found in literature (c.f. e.g. [6,7]), we could state that personalised information services are services which deliver the right information at the right time to the media preferred by the consumer. Information is considered in the following as multimedia information (text, audio and video) as proposed by Smyth [9]. Furthermore, we assume publishers are in the right position to produce and deliver such services. While the distribution technology is deeply investigated, we see a lack in research concerning the production processes and technologies for personalised information services.

2 Production of Personalised Information Services applying the mass customisation paradigm

2.1 Production of goods and services

Production in general is characterised by a transformation of inputs into outputs with the intention to add value. The transformation process can comprise qualitative, location or time based changes of the input objects. Personalised information services were clearly identified as services. For a long time it was under discussion as to whether services could be “produced” in the classical sense, due to its immateriality. Nowadays the creation of services is considered to be production. Production is no longer restricted to technical manufacturing, but to the general creation of added value. Nevertheless, the production of services contains some specialties caused by one constitutional element of service, the integration of at least one external production factor. For personalised information services, we are likely to have to handle two sorts of external production factors. First the information itself, which might be generated externally.
Secondly, the profiling of the service by the end users. In addition to this the unu-actu paradigm holds true \(^{21,5,221}\), which means that the presence of the consumer is a necessity for the fulfilment of the service. So it becomes common to treat the production of services as a two phase process (Figure 1).

In the first phase, the service provider ensures readiness to fulfill the service\(^ {20,5,19}\). In the second, a combination of further internal and external production factors is done\(^ {22,3,26}\). This approach appears evident for the production of personalised information services. In the first phase information is gathered, enabled and combined i.e. to articles with pictures and multimedia elements. In the second phase these information blocks are combined for the consumer following his profile.

2.2 The production of information services
As for other products, the production process became part of competition in the media market\(^ {20}\). Most of the efforts spent in research on production of media and information services focussed on “media independent publishing” strategies\(^ {24}\), often referred to as Cross-Media-Publishing\(^ {25,26}\). Hand in hand with this developments it became standard to handle media elements in different formats and media during the production process, as text, audio and video material\(^ {27}\). To stick to this paradigm of cross-media publishing, mark up languages as SGML and nowadays XML became commonly used to handle and integrate the different media elements and to define a semantic structure for the information\(^ {28}\). As the distribution media for information products lost focus in the production chain, more attention was spent on focussing on market demands and target groups on an information level\(^ {23}\). Editorial work got more attention\(^ {27}\) but the discussion still sticks to the production of mass-media\(^ {16}\).

2.3 Mass customised production
In contrast to information products investigated so far, personalised information services could be considered as a product with an enormous number of variations (Figure 2).
Traditional production research deals with the production of goods with a large number of variations. Lampel and Mintzberg\cite{29} suggest several strategies for this. In fact these strategies could be seen in relation with the step in the value chain, the “tailoring” for personalising the product is done\cite{30}. Da Silveira et al\cite{31} compare several framework and taxonomies for mass-customisation (Table 1).

For the production of personalised information services, the custom tailoring for a single customer could be neglected due to the revenues, which could be created by these services. We propose to apply customisation on an assembly level. Mass-Customisation is very often defined as the production of goods or services, making use of information technology and flexible production and organisational processes, in order to produce the customised service for a price close to a mass produced product\cite{35-39}. Duray et al\cite{30} postulate that a sufficient number of variations substitute for custom tailoring. As a major success factor, modularity of the product to be produced is considered (c.f. \cite{33}). Pine et al\cite{40} also transfer this need for modularity to the organisational units involved in the production and distribution process. In the following chapter we will model a personalised information service and its production in a modular manner.
We start by setting up a theoretical framework modelling the product to be produced. As discussed before modularity appears to be crucial for mass-customised products\cite{33}. Following the product family modelling approach\cite{41}, we can consider a building block structure\cite{42} as shown in Figure 3.

Depending on the user profile, the product shipped to the consumer consists of templates (T) which aggregate building blocks (B). The building blocks themselves are constructed by a selection of documents (D). Please note that this assignment of documents is not fixed. The dotted line should indicate that the building block is dynamically populated with content, taking the user profile under consideration. Further to the documents, a building block may contain links (L). Links are relations between instances of templates. Finally a building block may contain user interfaces for functions as login etc. The example shown in Figure 4 illustrates the construction of a sample home page with these building blocks. Please note that documents D have to be far more than plain text. It can contain media elements such as images, audio and video. The text should be structured with relevance to its semantic. Finally, the information could be classified with regard to a classification schema (c.f. Figure 5).

Knowing about the structure helps to investigate the production process for personalised information services. We start with the personalisation itself. This could be easily modelled starting with a generic information retrieval model as proposed e.g. by Fuhr\cite{45} (for further formalisms see f.i.\cite{46}). This model shown in Figure 6 shows that Documents D are in real world in certain relations R to user queries Q. In order to process them electronically, both real world entities have to be mapped to a digital representation (i.e. for vector space retrieval or an ontology based classification as shown in Figure 5). This is done by the functions. The resulting digital representat-

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Table 1: Taxonomies and frameworks for mass customisation [31]
Figure 4:
Sample of building clock structure

Figure 5:
Document structure and classification of contents
tions could be optimised by $\beta$ at runtime to a representation appropriate for the particular information retrieval concept applied (i.e. handling of sparse matrices). Finally, the information retrieval is done by applying the information retrieval function $Q : D \times Q \mapsto IR$, which result in a rank of the documents with regard to a users query.

Personalisation could be seen, in fact, as such an information retrieval process. The user query have to be seen as a set of user queries defining the users profile. But as seen, users preferences could contain much more than textual interest [3]. Therefore we define a user query as a structure as shown in Figure 7.

The first component ($C_P$) of the vector is containing the description of preferences in contents (e.g. tennis). The second component ($M_P$) contains a media preference for this (i.e. WAP) while the last component ($S_P$) defines a schedule. So a user could profile his interest, e.g. for “business news every morning on the PDA”. To give the user the chance to tailor his profile, we introduced two functions to change the digital representation of the user profile. The first ($\tilde{\alpha} \circ (Q_i)$) is intended for manually changing a profile. The second one ($\tilde{\alpha} \circ (D)$) is aimed at tailoring the user profile with document representations (i.e. TF vectors). This can be used to tailor the user profile applying relevance feedback methodologies[44,45].

Further to this, the information retrieval model results in a ranking of contents. For personalised information services we want to result in an information product as modelled in Figure 4. So we extended the IR Modell again by the building blocks of a personalised information service (c.f. Figure 3) and resulting in Figure 8.

In this model (c.f Figure 8) the user requests information from a certain media at a given schedule. The presentation function $\beta(P,M,S)$ renders the information product making use of the...
building block structure defined before. So a template is called which contains several building blocks. This building blocks make use of the information retrieval function and retrieve the relevant documents (as in the standard IR Model). The representation of the documents $D$ contains all material of an article elaborated during the editorial process. To tailor it for the special need in the building block, a filter $F$ is employed by the function $\phi(D,F)$. This filters e.g. only the headline and the first paragraph for a teaser presentation.

For the editorial processing, we introduce the editor function $ED(D,Y)$, which is used to markup a document in the real word according to a given document type definition $Y$, which defines the document structure referred to in Figure 5. Due to the fact that $Y,F,B$ and $T$ are not static, we defined design functions $\beta$ for this purpose. The user interfaces to the User Profile functions $(\beta_{\alpha}(Q_{p})\bar{a}_{\alpha}(Q_{p})\bar{a}_{Q}(D)$ and $\beta(P))$ are collected in the set $U_{M}$ for easy notation purpose.

Now we have modelled all the components needed to produce and provide personalised information services. The use of this model is manifold. We can use the model for requirements engineering by assigning model elements to production and workflow processes (c.f. Figure 9). Secondly, we can use the model for software engineering purpose by implementing the components. Our model eases this,
cause dependencies of model components became transparent. But the greatest use is the mediation between requirements engineering and software engineering. We will illustrate this by example. We take the process of designing templates and building blocks (c.f. Figure 3). For the production of building blocks, we assume an online programmer to be in charge. A online programmer can typically design online products and do basic scripting. For example, for teasers in a category the online programmer has to write a small script which uses the business logic functions to retrieve all contents assigned to a given category. Then he has to apply a style sheet filter to result in the information needed (i.e. headline and first paragraph) and finally he has to assign some style sheet classes for later design. This is bundled by the online programmer into a building block which becomes element of B.

For designing templates, we envision online designers to be in charge. They have their core competencies in the field of design and are not skilled in programming. They prefer to use WYSIWIG tools. Now the building blocks have to be combined by the online designer to a template. Furthermore, the online designer has to define all design related configurations (i.e. CSS Style Sheets).

With our model we now know for example, that the business logic has to be encapsulated but be possible to integrate into an online scripting language (e.g. as COM objects). This is due the fact that the online programmer can use scripting languages like pearl, asp but is not skilled in database programming, for example. Further, we know that the design function for the Templates need to be implemented WYSIWIG oriented (e.g. Macro-media Dreamweaver), because the users, at this stage, are used to these tools. It also came up, that the presentation function could be used for preview issues. This means that the designer needs a tool to call the presentation function, which could be a standalone web browser or even better a function embedded in the design environment as the server connections in Macromedias Dreamweaver Ultradev.

We saw that our model helped us to do requirements engineering for the production process of templates and building blocks. Further to this example we used the introduced formal framework to model:

- Editorial work
- Design work
- Users and preferences
- Pull-Type Delivery
- Push-Type Delivery
- Collaboration

Following this, we again used the model and the resulted requirements towards the model components to find best fitting realisation concepts for the model components. For our personalised newspaper production, we resulted in the following instantiation of the model shown in Figure 10.

4 Conclusion
This text proved that the production paradigm "mass-customisation" is applicable for the production of personalised news services. It became evident that the personalisation has to take place at assembly level. Also, we introduced a formal model for the production and provision of personalised information services. This model proved to be a useful tool as a mediator between
Figure 9: Integration of process and personalisation model
requirements engineering and specification of an IT environment for production and provision of personalised information services. In addition to the sample application referred to in this text, the model proved its viability within the PEACH project funded by the European Commission’s IST programme (IST-1999-11345).

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Figure 10: Instantiation of the personalisation model for the PEACH project


Biography

Thomas Ritz studied computer science and economics at the University of Bonn and obtained his degree in computer science in 1997. Since 1997 he has been scientific employee at the University of Stuttgart IAT and the Fraunhofer IAO. He has long standing experience in the publishing industry and focuses his research activities on online communication and information. In several research projects he designed and implemented solutions for electronic information exchange, online communication in virtual communities, branch specific information portals and electronic commerce.

Thomas acts as project manager in the DISMED project (funded by the European Commission in FP 4 Innovation program RSE 067) and in the PEACH project (funded by the European Commission in FP 5 IST programme IST-1999-11345). He has also joined several public and industry funded research, consultancy and development projects.
Quality of Service Provision for Distributed Multimedia via Reflective Service

Abstract: This paper presents a detailed review on the Quality of Service (QoS) Provision for Distributed Multimedia (MM) via Reflective Service, based on server-fault initiated session switch. Enhanced Reflective Service lists the resources necessary to support the application’s QoS requirements and makes them available for the Session Manager, which co-ordinates the session switching. Our work demonstrates that all the components of distributed MM system should be involved in the QoS management process. The client’s requirements related to QoS must be adapted to various constraints supported by the distributed MM system components: client machines, server machines and transport system.

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I. Introduction

Increasing demands for interoperability and Quality of Service (QoS) on current Multimedia (MM) communications encourages developers to look for new solutions and technologies. Common request Broker Architecture (CORBA) is well-established industry standard and offers number of services including Reflective Service, which constitutes founding mechanism for our approach to QoS provision within the distributed heterogeneous platforms. Emerging standards for distributed integrated environments, like CORBA from the Object Management Group (OMG) provide a software bus for distributed MM applications\(^1\). Open system standards are important for the integration of distributed MM system support in order to achieve unified communications architecture. The QoS provides a unifying theme on which the functionality and facilities of new integrated standards can be constructed. For future applications, especially those, which are highly interactive and rely on MM information, it is essential that QoS be guaranteed for the whole system.

Enhanced communications protocol support such as end-to-end QoS negotiation, re-negotiations, degradation, and co-ordination over multiple connections is required. Design of distributed MM applications, such as system for access to remote MM databases or teleconferencing, requires careful consideration of QoS issues, due to the networking bandwidth and processing power required by the presentation quality of live media, such as video.

For applications running in shared environment, the allocation and management of these resources is very important. In general, the best-effort approaches offered by most existing systems are not suitable for distributed MM, because some users may be ready to pay some higher price for obtaining maximum quality, while others may prefer low-cost presentations with lower quality. We briefly review the Reflective Service and define the QoS specifications essential for our research. Based on the QoS specifications and Session Switching delay we evaluate the system performance.

This paper is structured in four sections. The first section presents introduction, motivation, and the QoS problem statement. Second sec-
tion presents proposed solution, the use of Reflective Service, application scenario fundamentals, adaptive MM architecture, service provision and SM via enhanced Reflective Service in video-on-demand application, server failure initiated session switch, and process of session switching from 25 to 5 fps (frames per second). Third section presents enhanced Reflective Service’s specifications and enhanced Reflective Service’s QoS specifications. Last section presents conclusions.

A. Motivation

Today’s mission-critical distributed systems in military, government or business applications have a specific functional and performance requirements being reflected by string QoS constraints[2,3,4]. MM communications research explores human-computer interaction by making use of text, images, graphs, animation, sound, speech, and video[5,6]. When combined, developing distributed QoS-constrained MM applications (e.g., Audio/Video Conferencing) is a difficult task because of the strict requirements on system resources and the great diversity of MM standards and devices[7,6,9]. QoS is becoming increasingly important in distributed MM systems[10,11]. The nature of distributed MM applications is such that they require peer-to-peer communication support mechanisms[12,13]. MM traffic needs to be delivered to end-systems, networks and end-users in a form that they can handle while satisfying the constraints imposed by the applications[14,15,16].

The QoS mechanisms are required to ensure high quality media play out at high-performance workstations while at the same time providing appropriately filtered lower quality media play out at low-end systems, i.e. adaptive QoS[17,18]. Existing support mechanisms such as multicast protocols are performance deficient. They provide the service based on the least capable link or node involved in the multicast session[19,20,21].

B. QoS problem statement

QoS is not a new concept; traditionally it is employed within the domain of computer networks to specify a set of parameters assigned to transport connections. As a rule, QoS is established through negotiation between service users and providers. The process of negotiation is simple if the resources are managed by a centralised entity (e.g. an operating system) or by a set of homogeneous entities. Unfortunately, in distributed MM applications the negotiation and management of resources is a difficult task since resources are very diverse, dispersed and maintained by heterogeneous entities. Much attention has been paid to the use of CORBA Reflective Service at the initial stage of our work, but less to the use of more general trading mechanism that would relate to a SM function, QoS re-negotiation and QoS adaptability.

II. Proposed Solution

Our work is motivated by the challenge of providing a dynamic adaptation of QoS parameters during the MM application set-up. In order to satisfy user’s QoS needs we may apply Reflective Services1 to allocate resources necessary2 to a SM function, QoS re-negotiation and QoS adaptability. The Reflective Service would provide resources necessary for optimum QoS connection3. The customers subscribe through their account for specific QoS parameters. According to the account privileges, the client will be allocated devices and network resources via proposed QoS Provision and SM mechanisms. An enhanced Reflective Service will provide reference of access points to
network resources and end-devices necessary for a QoS provision.

A. The Use of Reflective Service

The growth of computer networks and transmission capacity facilitates an increased amount of service offers in distributed systems[23,24,25]. One of the CORBA services is the Reflective Service, which supports clients in searching for suitable services. To support a client in searching for a special service, a Reflective Service can be used. This Reflective Service has a service directory, which contains available services specified by service type and service property values. If a client requests a service, the Reflective Service procures a convenient one[26]. In case of MM application, CORBA could provide access to the remote objects requested by the application[27]. The selection of objects and communication resource allocation must be optimized for the desired QoS. Trading problem in particular could be approached from three different angles:

- Clients searching for the suitable service,
- Integrating different local Reflective Service functions in order to extend service access support beyond local network boundaries, or
- The service that would take into the consideration the QoS aspects dynamically.

Because of the growing quality needs of many communication services, a Reflective Service should be able to allow service request with QoS aspects.

Trading could be useful in underlying infrastructures. In other words, the QoS will reflect on what we want as compared to what we get and how that relates to the total resource capacity. A Reflective Service is a third party object that enables clients to find information about suitable services and servers. Services provided by service providers can be advertised, or exported, in a Reflective Service. Such advertisements, known as service offers, are stored in the Reflective Service’s database. The advertising object (the service provider or object acting on behalf of the service provider) is called an exporter. Potential service users (importers) can import the Reflective Service who means obtaining information on available service and their accessibility. The Reflective Service tries to match the importer’s request against the service offers in its database. After a successful match, the importer can interact with the service provider. The relationships between Reflective Service, importer, exporter, and administrator are illustrated in Figure 1.

B. Application Scenarios Fundamentals

This section presents possible application scenarios illustrating the use of Reflective Service, to allow for the SM. We introduce the Server and Client side application scenarios where sessions are switched either due to the server failure or due to the client-initiated request. In our approach, we extend work on QoS Negotiation and Adaptation[9]. We define a framework, which allows for the resource allocation necessary to support the application QoS requirements across distributed heterogeneous platforms. While current work in MM SM has usually been concerned with maintaining the network connection of a mobile clients, it is believed that session hand-off between terminal devices or service providers is essential as well.

SM in general is the ability to simultaneously utilise multiple display devices allowing for a
Figure 1: Reflective Service Function

Figure 2: SM Scenario for display switching.
new application scenarios that will ease the restrictions of session playback on a portable MM device. On the other hand, the ability to transparently re-bind a MM service provider, allows the system to scale well with respect to the number of mobile clients, and will result in better utilisation of the board-band network infrastructure of the future.

Most current work in MM falls into the first category, and is usually restricted to maintaining the network connectivity of a mobile device. However, we believe that the user rather than the mobile device is central to MM SM, which can even be achieved without the physical movement of any device. SM between display devices may be necessary because of the user preference or physical limitations of portable mobile devices, while SM between remote service providers may be needed to balance the utilisation of the network infrastructure and improve scalability. MM SM can be broadly classified into:

- Mobility caused by the actual movement of a device, and
- Mobility caused by session transfer from one device to another.

The limitations of portable MM device arise primarily because of its small form factor. For instance, the physical dimensions of a portable display device will never be the same as those of a large screen. In the scenario of MM presentation or video-on-demand where the slide show has been prepared on a portable device, it is beneficial to move the session to an available large screen in order for it to be better visible to large audience (see Figure 2). Clearly, it is often desirable to utilise alternate display devices during a mobile MM session.

We may expect some some performance gains in a system with portable MM devices, where selecting a media service based on proximity to the device will result in reduced latency, and possibly cost. From the system point of view, utilising nearby media services will also better utilise the network, resulting in a system which scales well with increasing number of mobile users.

Furthermore, such media service re-binding may be necessary because the changes of a display device requires different service parameters. It is clearly an advantage, and often necessary, to change media services during a long-running mobile MM session. Both, MM content providers, and publicly accessible display devices are essential in order to fully realise the potential of portable mobile MM (see Figure 3).

C. Adaptive MM Architecture

The increasing diversity of available hardware and installed networks makes it imperative that MM applications adapt to available resources. Furthermore, application adaptiveness must be dynamic in order to adjust to an increasingly variable availability of resources. The principal pattern of interaction between components in adaptive MM architecture for MM application software is a service contract between a service provider and a service consumer.

This pattern provides a powerful framework to decompose a MM application into a hierarchy of services. Components higher up in the hierarchy are associated with more abstract notions, resulting in the hiding of details and therefore, a simpler application. The same service may be provided by more that one server, and service providers can be changed in order to maintain a service contract. In this architecture, vertical interaction between components at different levels of the
1. Device Movement

Edmonton
Server

Server Transfer due to location change

Server
Montreal

Vancouver

Device Movement

Terminal Device Change

Ottawa

Server

2. Display Device Change

Figure 3: Reflection on MM SM.

Figure 4: Architecture of Video-on-Demand Application
hierarchy can be considered control related, while interaction between components at the same level, typically the lowest, is efficient data movement.

Consider a video-on-demand application shown in Figure 4. At the highest layer, the application is composed of a user interface components (UIC) and media service component (MSC). Both the UIC and MSC play the role of a service provider to the top layer of the application, which maintains contracts with each of them. The user in turn utilises a display and an audio playback device. The contract between the user interface and the application is decomposed into contracts with the audio device and the video display.

Similarly, the media service component decomposes its contract with the application into contracts utilising network resources and video servers. Although the primary motivation for this architecture was to solve the problem of decomposing an abstract notion of QoS into low-level QoS parameters, the architecture can also form the basis for distributed components infrastructure for a MM application.

D. Service Provision and SM via Reflective Service in Video-on-demand Application

We illustrate a case of a service provision and SM via server-failure initiated request. In case of server failure the session is switched automatically in order to continue providing the service of video delivery to client from the next available server registered with the Reflective Service database, allowing client to view the video clip with minimum QoS degradation.

E. Server Failure Initiated Session Switch

This is a typical scenario of the video-on-demand application, where the video clip is delivered to the client at pre-determined frame-rate per second and client captures and displays the image with display resolution reflecting on the application level QoS parameters. In Figure 5, we illustrate the video-on-demand session, where two different servers delivering the video clip with two different frame rates of 25 and 5 frames/second are available. Client is running a Session Manager and Reflective Service database.

Video Server number 1 is sending stored video of 25 frames/sec to the client (socket). Client displays the received video stream. We use available Motion JPEG Encoder & Decoder and IBM Software installed on CITR_C IBM machine.

Video Server uses the Motion JPEG Card accompanied by the IBM software allowing for the frame-rate of video stream delivery to be switched from Service number1 (25 frames/sec) to Service number 2 (5 frames/sec).

We illustrate the scenario where the Server number 1 goes down (dies), the session is switched from Server number 1, to Server number 2. Both Servers number 1 and number 2 QoS parameters (e.g., frame-rate) are registered with the Reflective Service (See Figure 6). Figure 8 illustrated the event when Server number 1 dies (is faulty).

The Client notices image degradation, which triggers the Session Manager to fix the problem. Important issue is the Cell loss caused due to the session switching delay.

For example: if 1 second in our scenario we loose 25 frames if no buffer is used. The QoS agent detects the image deterioration caused by server failure to deliver video frames to the client (see Figure 7). QoS Agent invokes the Session Manager via event function. Session Manager inquires the Reflective Service about the avail-
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Figure 5: Video-on-demand Session.

Figure 6: Video Server registry with the Reflective Service.
able resource to switch the session so that Client may continue viewing the video clip even if it is 5 frames/sec.

QoS specifications for liited Video Server number 2 (i.e., frame rate delivery) must qualify for video frames delivery to the client. Session Manager exports the offer provided by Server number 2. Figure 8, illustrates the process of Reflective Service inquiry and offer export by Session Manager.

Session Manager invokes (connects) the Server number 2 (e.g., via socket reconfiguration), which is capable of delivering 5 frame/sec only and disconnects the faulty Server number 1 (see Figure 9).

At this stage the process of session switching is complete. Session was switched successfully from faulty server to new available server. Server number 2 is delivering 5 frames/sec to the Client who is displaying the 5 frames/sec video clip over Ethernet (see Figure 10). The session was successfully switched from the faulty server #1 to a new server #2, which continues delivering the video clip with lower frame-rate of 5 Fps.

In the following section, we study in details of the video-on-demand application, implemented in our laboratory on the CITR_C IBM Client/Server system.

**K Process of Session Switching from 25 to 5 fps**

As far as the switch from 25 to 5 fps goes on existing CITR_C IBM Client/Server system, it all depended on what was recorded from the input source (i.e., VCR). For the video clips that were 5 fps we simply recorded them at 5 fps, for the 25 fps we recorded them at 25 fps. The tools that came with the MJPEG card for AIX were capable of setting the recording parameters. There was a bit of a trick to it since we had to make sure that the initial frame would line up
Figure 8: Reflective Service inquiry and offer export by Session Manager

Figure 9: Session Manager connects Server number 2 and disconnects faulty Server.
with each other to ensure that during a switchover, it would be at the same point in the clip. During playback, there were presentation scenario’s that described all of the temporal relationships invoked by “pres_scen”. We used also another file that contained other information on the total # of frames in the clip (i.e., located in CBC_*country*). These 2 files would setup the playback, so as long as we load up the CMFS we’re ok.

The setup for CMFS or local readers, was supposed to read data from the CMFS (using CMFSRead()), or at an earlier point, we had everything reading from local data files, but it is not being there in the end. In order to switch the session from 15 to 5 fps we had to do the following:

- Figure out the position in the clip (i.e., are we 8 seconds, 33 seconds, etc., from the start?);
- Then we stop playing (all media streams);
- Then we open a CMFS connection (or file) to the appropriate clip we wish to switch to;
- Then we start retrieving data from the new connection;
- Then finally we play that data.

The good thing is we had wrappers for all of that stuff to make it easier. The process of switching was invoked by “switch:“over” command. Then into that we just pass the appropriate CMFS id, and those id’s were read from a data file.

The data file is all part of the server, and the server reads the data file to find out how many fps to play the data coming from the CMFS at. The video, audio, and text are stored in the CMFS across the network, and the server has it’s own little “database” which consists of the various data files, CMFS id’s, etc... It was either storing that information locally, or in the CMFS or database itself. Storing it in UofO’s database meant ➤
a whole bunch of work in the database schema and would not have provided any visible advantage, and since the data files were simple ASCII files, they were quick to setup, quick to edit, and required just a few lines of code.

III. Enhanced Reflective Service’s Specifications

Reflective Service advertises the state of network objects. Let us consider network elements QoS, the application selects the appropriate resources for execution. QoS could be considered as a usage of resources whereby applying the appropriate control mechanism, Reflective Service selects the appropriate resource that would satisfy the user requirements (e.g., user should express the QoS requirements). Let us assume the scenario where we wish to provide a fast printing without taking care of the QoS. If we advertise the printer through the Reflective Service, we will select one of the advertised printers as fast. Similarly, we may register two services, if we have two mechanisms to transport data, one over TCP and one over UDP (user data packet). In case that we start the application that requires the fast delivery then the Reflective Service would be able to select between the data transport resources available (i.e., TCP or UDP). In order to access the information about the network resources we could store the data in a local MIB (management information base).

In case we want to reserve bandwidth and at the same time, we want to ensure the QoS in this way, we may consider providing the gateway to the RSVP, which should be activated in case of providing the appropriate QoS parameters. The selection of the RSVP would be enabling using Reflective Service. The mechanism that would provide a control of Reflective Service is in fact a program, which is involved with the Reflective Service. This program, running as a CORBA object or having a CORBA gateway, is advertised to the Reflective Service. Reflective Service must provide following answers:

- Why? Service user must find service provider at run-time.
- What? Reflective Service provides match making between objects. Service Users consult the Reflective Service to obtain information about suitable service. Client and Server are the Application Programs. Server has objects with specific methods that are registered with Reflective Service through a Service Offer. Client does not know what Server has to offer, so Reflective Service has a list of Object Services Contained in Server (see Figure 11).

In case we want to chose between ATM and Fast Ethernet or Ethernet, we should have the control program into the switch. If we would have for example a backbone and then we can use FDDI, Ethernet, and ATM Networks, we would have the server object into the router (similar to RSVP, which is installed in on the router and the client runs on the host). Then we can use as selection criteria not only the type of the link but also the state.

The principal operations involve the offer export, import, and final process of binding. In such architectures, each service provider first exports its availability to a Reflective Service. A client imports a provider based on the specifications of a required service, which is indicated in the standard specification format. URN’s[3] can be considered an attempt towards such a universal format for location independent
names. A Reflective Service usually also provides a directory service to determine the available service of a particular type.

The existence of multiple service providers or devices result in a heterogeneous environment in which it becomes necessary to determine a service or device capability. It is believed that while a user may desire to retain control over the session transfer between terminal devices, he would be relatively uninterested in controlling session transfer between servers. Server session transfer should therefore be hidden from the user, and the triggered by changes to global parameters such as relative server load and network load, or implicitly by the users mobility. System support is necessary to trigger such server transfer.

A. Enhanced Reflective Service’s QoS Specifications

In order to design a system where multiple applications coexist within a QoS management framework, it is necessary for them to either have a common understanding of how QoS should be specified, or to be able to map their individual specifications into a common one. To support this...
the integrated resource management that will be required for the efficient and dependable operation of future distributed systems, research is needed in the areas of application-level QoS, application-specific QoS trade-offs and resource management algorithms.

A considerable amount of work is in progress in the area of providing QoS guarantees across high-speed networks\(^\text{28-30}\). The ongoing work mainly concentrates on the problem of bandwidth management and switch-based scheduling to provide deterministic or statistical guarantees on end-to-end delay, throughput, and packet losses. The solutions proposed in this area are valuable in ensuring certain QoS for network traffic. However, another aspect of QoS management, namely, the problem of end-system QoS management is also important. It is not sufficient to ensure that the network traffic is delivered with desired QoS across a path through the network, but it is also essential to supplement the network QoS with mechanisms that ensure that data can be delivered (and processed) in a timely fashion across the data path inside the end-system. The data (and control) path inside the end-system connects the network interface with the source (or sink) of network communication such as MM application running in the user space. To guarantee end-system QoS support one must consider contention for resources such as network interface, CPU (time), memory, and bus bandwidth.

Compare to the research in the area of network-level QoS guarantees, relatively little work has been done in the area of end-system architectures for QoS management\(^\text{31,32}\). Currently, general-purpose operating system (OS) such as Unix do not include support for QoS specifications or include policies and mechanisms to provide predictable service and guaranteed access to end-system resources. The traditional OS model of ensuring fair, on-demand sharing of resources is inadequate to provide such predictive QoS guarantees\(^\text{33}\). In our work, we are currently investigating a new architecture for managing resources within the distributed heterogeneous system via Reflective Service. The architecture provides a common framework for managing resources, such as VideoServers, Client’s Display Monitors, and CPU, network interface, bandwidth taking into account the adaptive and dynamic nature of MM applications.

The principal task of Reflective Service is to provide the resource allocation. For the purpose of QoS provision we must define clearly the service parameters at both the application and the network level. The Application-level QoS parameters are dependent on Network-level QoS or Server-level QoS. In our studies, assume that:

- The Session Manager is machine independent (i.e. independent of Operating System, Video Player, etc.);
- Network is bottleneck free;
- If not the we would have consider additional network delay,
- Jitter (i.e. delay variation) is introduced by network and physical distance between the Client and Server.
- We must consider both Network-level and Application-level QoS parameters.

**IV. Conclusions**

The objective of this research was to address the problem of QoS Provision and the SM for the CORBA-based Distributed MM across Heterogeneous Platforms via enhanced Reflective Service. We have studied most typical scenario of the video-on-demand MM applica-
tions and illustrated the case of the server-failure initiated session switch.

Major contribution of our research is in providing detailed studies on the concept of the Session Switching and the QoS Provision via Reflective Service. We allow for different servers and clients to run on different platforms connected through inter-connected networks. Result of our research leads to further analytical studies on system performance measures and efforts to solve the optimum QoS provision, based on the network resource availability and the applications-defined QoS requirements.

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Notes

1 Reflective Service represents the process of arbitration of services.

2 Providing we have “high bandwidth” ATM connection it makes sense to make use of high quality end-devices, such as high-end terminals, workstations, video and audio devices. In case of having a very poor connection available, the use of high quality end-device may not improve the quality of service expected.


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Biography
Edward Babulak received the High National Diploma in Electronics in 1976 and the B.Sc. Degree in Electrical Engineering in 1982, from the Technical University and Electro technical College in Kosice, Slovakia. He received a High National Certificate in Computer Aided Engineering from Brighton College of Technology, U.K., in 1990 and a Master of Science Degree in Computer Science from the University of the East London, U.K. in 1991. Edward has successfully completed all the requirements for his doctoral degree in computing, including four years of doctoral residency, a graduate course work, a PhD and Candidacy examination, and is currently working towards the completion of his doctoral thesis. Edward has successfully published and presented his research all across USA, Canada and UK, including New York, Chicago, Buffalo, Minneapolis, Hawaii, Toronto, Ottawa, Lancaster, Stafford and Liverpool, UK. Edward is currently a Senior Lecturer at the School of Computing at Staffordshire University, Stafford, UK. Edward worked for over 18 years, both in industry and academia as a project manager, consultant, a system engineer, an electrical engineer, researcher and a College Lecturer of Computing and Math. Edward lectured Computing in Czechoslovakia, Mathematics at the University of Ottawa and Polytechnic of Montreal in Canada, Computer Engineering at Penn State Erie in Pennsylvania, and most recently worked an Associate Professor of Computer Science at the Azusa Pacific University in California.
Edward travelled widely and done extensive research in the field of linguistic, telecommunications, multimedia communications, math and an industrial automation. Edward’s research interests are in the areas of QoS provision for multimedia applications, distributed heterogeneous operating systems, parallel computing and advanced engineering math.

He is a professional member of the Association for Computing Machinery (ACM), a member of the Institute of Electrical and Electronic Engineers (IEEE), a member of the American Mathematical Society (AMS) and a member of the Mathematical Association of America (MAA).
**CASE STUDY**

The difficulties associated with connectivity of computing and telecommunications devices are both complex and compelling. The traditional answer is to connect devices with cables to enable desired functionality such as file transfer and synchronisation. File transfer is needed, for example, to move documents between devices, such as a PC and personal digital assistant (PDA). Synchronisation is also important to achieve commonality of information, such as calendars and event-based applications. However, this wire-based solution is often convoluted, given that it may require a cable particular to the products being connected as well as configuration software. Another possibility, infrared, removes the need for a wire-based solution but relies on ‘line-of-sight’ between devices.

In search of a solution to these perennial problems of device connectivity, a number of standards and technologies have been developed to provide a platform for wireless data communication. Short-range radio transmission via embedded transceivers has rapidly gained support from industry sectors including computing, software, electronics and telecommunications. The most popular and well known of these technologies is Bluetooth, the focus of this short paper. For a discussion and comparison of other short-range wireless technologies please refer to related work[4].

The name Bluetooth is derived from a Danish Viking King, Harald Blåtand (Bluetooth), who reigned in the late tenth century and unified and controlled Denmark and Norway. In essence,
Bluetooth is a specification designed to provide unified wireless data communication between electronic devices, particularly small, mobile devices. The standard enables data transmission at speeds of up to 721 kilobits per second over ranges of 10 to 100 meters (with graceful degradation of data rates), using the Industrial-Scientific-Medical (ISM) frequency, 2.4 GHz. The specification is the work of the Bluetooth Special Interest Group (SIG), formed in February 1998, and consisting of more than 2000 members such as Nokia, Ericsson, Motorola, 3Com, IBM, Compaq, Intel and Microsoft[1]. The core benefits of Bluetooth are the low cost, small size and low power consumption of transceiver chips[2]. Combined with the broad-based industry support from the SIG this creates a unique market position; shipments of Bluetooth devices are predicted to rise from 4.2 million in 2001 to 1.01 billion by 2006, pushing revenues from just $2 billion to $333 billion in this period[7].

This paper explores the commercial impact of Bluetooth applications in a number of key areas – in the workplace, at home, in publicly-accessible locations, and in-transit – using a number of up to date examples. Further, the paper examines some key benefits associated with developing such applications, particularly in the areas of mobile data communications and electronic commerce. The paper concludes with some predictions regarding the future of Bluetooth, including possible hurdles and opportunities.

**Commercial applications of short-range embedded wireless**

Applications of Bluetooth are typically aimed at domestic or home use, use in the office or other workplace, applications for public consumption, or travel purposes – as shown in Figure 1. Typically, however, many applications fall into more than one category. Let us explore the key application areas in more detail, drawing on some examples.

**Applications in the workplace**

Within the office or other workplace, technologies such as Bluetooth create a new era of product design. Specifically, it becomes possible to remove all cabling except the power supply to electronic devices; for example, the telephone, keyboard, loudspeakers, PC screen and the PC itself can all be connected using short-range embedded wireless technology[2]. The removal of signalling cables can lead to new ways of furnishing an office, as the central processing unit (CPU) no longer needs to be next to the monitor and keyboard. In addition, laptops will be lighter, since they do not require as many connecting ports; IBM plan to embed Bluetooth antennae around the display screen of future notebook PCs[6]. Bluetooth enabled devices such as print servers and PC dongles are already commercially available[14].

Security is another application in the workplace. Sony have recently developed a Bluetooth-compliant ‘wearable key’[10]. This allows people to identify themselves to computers and mobile devices so that they can access their personal data from a terminal or handset; a special wristband transmits users’ identification numbers and passwords to the network system.

**Applications for travel**

In the situation where the business person is in a car, an in-vehicle network, e.g. Bluetooth, could allow connectivity of personal devices; using a mobile phone as the wide-area network
connection, the employee could connect to the Internet or corporate intranet to receive information such as e-mail. Voice recognition could automate this even further. Microsoft and five Japanese companies recently agreed to develop software for embedded wireless in the automobile industry, enabling in-car computers capable of hands-free communication, access to the Internet, and instant summoning of emergency services or roadside assistance.

Within an aircraft, subway or rail train device connectivity provides similar benefits. Plane manufacturers such as Boeing have already invested large sums in developing sophisticated in-flight entertainment and work systems. Here, connectivity can be provided for gaming, collaboration with fellow passengers, e-mail and Web access. Alternatively, offline data transfer can be used; every time the user passes near an ‘infostation’, such as in the airport, selected information is transferred.

Commercially, there are many more applications of short-range wireless technology. Using wireless IT, inbound inputs to the firm can be accurately monitored. Wireless transceivers let Bluetooth-enabled portable terminals – such as PDAs – communicate with a central database through an in-vehicle transceiver. It is even conceivable to know all inventory in transit – or ‘rolling’ inventory – allowing for an efficient method of selecting a source of components based on their known location.
Applications in the home

Within the home, SRW becomes useful for controlling a range of devices. Wireless transceivers, communicating with a central PC or controller from various locations, allow reliable security of indoor and outdoor facilities. Automatic alarms can alert services to a call-out situation. For example, a break-in could trigger an intruder alarm, instantly informing the police.

In the utilities industry (e.g. gas, electricity and water), all meters installed at customers’ homes connected to a wired ‘hub’ could be read remotely. This saves considerable costs and information can be used to create more advanced differential pricing structures, based on a fuller understanding of the demand for resources and cost of supply.

Another area where wireless IT is likely to have an important role is in field testing and reporting. As the cost of wireless devices falls and performance increases, so impetus is provided for embedding chips in products such as cars, refrigerators, washing machines, vacuum cleaners, industrial equipment and many other devices and appliances. Such devices will be able to store and report information on the performance of products, providing an important source for future product and technology development and refinement. An example is Ariston’s margarita2000.com washing machine, which communicates using the short-message service (SMS).

Applications for the public

Public facilities providing nodes for wireless devices could be useful in many locations – such as shopping malls, hotels and airports. Troy Group recently announced a partnership with InnTechnology to allow hotel access to in-room printers, gain LAN access and communicate with other guests using Bluetooth enabled notebooks, PDAs or phones.

PDAs and smartphones can be used for mobile electronic cash via SRW connection. Visa, Nokia and Merita-Nordbanken are piloting the dual subscriber identity module (SIM) concept for the Nokia 7110 phone, where a second SIM is a Visa credit, debit and bankcard. The consortium plan to use the Bluetooth technology to facilitate point-of-sale (POS) transactions using the phone.

Other possible ‘public’ applications are vending and automated teller machines (ATMs). Typically, remote machines could connect to a server and automatically signal to the corporate computer when they require restocking. Restocking can be managed quickly and efficiently, maximising use. In addition, online communications allows other activities including systems status, transaction information, changing vending prices and updating software.

Finally, Bluetooth applications could also be used for numerous location-based services. The roaming phone user can be provided with information, alerts or even advertisements based on their location. For example, walking down the street in an urban area could set off a plethora of messages from retailers eager to tempt clientele inside – positional (p-) commerce. Similarly, an alert could inform the user of a security threat in a certain part of the city, or information could be given on an exhibition outside an art gallery.

Benefits of Bluetooth

Typically, the technologies offer a high degree of flexibility in the way that they are used. The small size and low-power drain of wireless units means that they can be embedded in all manner of devices and designs to provide a new wave of adaptability in the way that people use them. For
example, a smartphone could be manufactured as separate components: an earpiece, a screen on a wristband, and belt-buckle transceiver.

Technologies have also been designed with regard to affordability; a standard unit costs in the region of $5 to produce. This, along with aspects such as flexibility, has a direct relationship with the ability of companies to embed the technology in a large number of products. Since ubiquity is a key aim of players in the Bluetooth SIG, this is important. In addition, the diversity of product offerings from companies in the Bluetooth SIG (e.g. mobile phones, PDAs, computer hardware, and software) creates a strong platform for market penetration. Eventually, the short-range wireless infrastructure is likely to become as ubiquitous as any other similar fixture such as a phone jack[1].

One of the main espoused benefits of wireless solutions is simplicity. Removing the wires makes connection simpler; for example, Bluetooth allows automatic connectivity to a local network simply by bringing a device into range (such as a PDA or phone), and a large number and variety of devices are supported. Even traditionally isolated devices, such as white goods, can be connected effortlessly to provide additional services (such as information on current performance or maintenance requirements). Thus, the potential for complex interactivity and information sharing between devices is enormous.

As devices become more interactive and software technologies are developed to allow a fuller understanding of capabilities, this enables advanced resource management for devices. No longer are devices independent and they can work in partnership; for example, a PC could automatically take advantage of unused memory in a printer. Moreover, the simplicity, connectivity and interactivity of solutions provide a high level of convenience. In theory, the user no longer has to think about the problems of establishing device networking, only its benefits.

Discussion and conclusions
This paper has examined the state-of-the-art in the commercial application of the Bluetooth specification. The potential applications are many and varied, including use in the wireless workplace, for home networking, for in-transit vehicle connectivity and for management of publicly accessible services. Many of these technologies are still in the embryonic stage of development, but they promise to provide some compelling benefits.

Notwithstanding, the commercialisation of Bluetooth still has a number of key problems, including the availability of suitable software, supporting infrastructure and competing short-range wireless standards. In terms of software, an important part of obtaining optimum use from wireless resources is service-discovery. Software, such as Jini from Sun Microsystems, is still in the early stages[18]. Regarding infrastructure, many of the applications require a combination of short-range and long-distance communication. As such, they are constrained by the cellular networks, particularly until the availability of fast, third generation (3G) solutions[9]. Finally, Bluetooth has a number of competing standards for short-range wireless communication, including IEEE802.11 and the emergent Ultra-Wide Band (UWB)[2]. Although industrial support is not yet as strong for these standards, they offer potentially faster connection speeds. Commercialisation of these competing standards could create fragmentation in the short-range wireless market.

The commercial penetration of Bluetooth
technologies into consumer markets will not happen overnight. It will take time for the technologies and markets to mature enough to deliver the benefits promised. When markets and technologies do become established, even more innovative commercial applications are likely to emerge. The next five years will be critical in the commercialisation of Bluetooth products and services, ultimately determining those that will become pervasive and dominant.

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Biography
Stuart Barnes is Associate Professor of Electronic Commerce at the School of Information Management, Victoria University of Wellington, New Zealand. After starting as an economist, Stuart later completed a PhD in Business Administration at Manchester Business School, specialising in Information and Communications Technologies (ICTs). He spent the last six years working at the University of Bath before moving to Wellington in 2002. His current research interests include evaluating Web site and e-commerce quality, e-commerce strategy, information systems implementation, knowledge management systems, and business applications of mobile technologies.
I. Introduction

There are several terms used to describe business that takes place on the Internet\(^8\). These include Electronic Commerce (E-Commerce), the Information Economy, the Online Economy and Internet Commerce. Literal interpretations of these terms denote particular domains of activity and little rigour is applied to their application. As the terms Electronic Commerce (E-Commerce), the Information Economy, and the Online Economy denote activities not limited to the Internet, the term Internet Commerce (or I-Commerce) will be used in this document to denote commercial activities associated with the Internet. The term Electronic Commerce should be understood to include the conduct of business with the assistance of telecommunications and information technology; it is not limited to business conducted on the Internet.

Business models are quite simple. A company produces a good or a service and sells it to customers. If all goes well, the revenues from sales exceed the cost of operation and the company realizes a profit. Other models can be more intricately woven. Radio and television broadcasting is a good example. With all the talk about “free” business models on the web, it is easy to forget that radio, and later television, programming has been broadcast over the airways free to anyone with a receiver for much of the past century. The broadcaster is part of a complex network of distributors, content creators, advertisers (and their agencies), and listeners or viewers. Who makes money and how much is not always clear at the outset. The bottom line depends on many competing factors.

Reading the literature one will find business models categorised in different ways. Presently, there is no single, comprehensive and cogent taxonomy of web business models one can point to. So this paper offers some of the generic forms of business models observable on the web\(^8\).
This can be illustrated by the Figure 1.

They include:

a) Brokerage,

b) Advertising,

c) Infomediary,

d) Merchant,

e) Manufacturer,

f) Affiliate,

g) Community,

h) Subscription and

i) Utility.

The above-mentioned models are implemented in a variety of ways. Moreover, any given firm may combine different models as part of its web business strategy. Thus, an advertising model may be blended with a subscription model to yield an overall strategy that is profitable. Business models on the web evolve rapidly. New and interesting variations can be expected in the future. Figure 1 illustrates not only the existing business models but also the new models for electronic commerce.

Existing Business Models

The various types of Existing Business Models are as follows:

1. Brokerage model

Brokers are market makers: they bring buyers and sellers together and facilitate transactions. Those can be business-to-business (B2B), business-to-consumer (B2C), or consumer-to-consumer (C2C) markets. A broker makes its money by charging a fee for each transaction it enables. Brokerage models can take a number of forms, such as:

- **Buy/Sell Fulfillment**

  This can be an online financial brokerage, like eTrade, where customers place buy and sell orders for transacting financial instruments. Also, travel agents fit into this category. In this, the broker charges the buyer and/or seller a transaction fee. Some models work on volume and low overhead to deliver the best-negotiated price, for example, CarsDirect.

- **Market Exchange**

  It is increasingly common in B2B markets. Good examples are MetalSite or ChemConnect’s World Chemical Exchange. In the exchange model, the broker typically charges the seller a transaction fee based on the value of the sale. The pricing mechanism can be simple offer/buy, offer/negotiated buy, and an auction offer/bid approach.

- **Buyer Aggregator**

  Model pioneered by Accompany, which describes buyer aggregation as the process of bringing together individual purchasers from across the Internet to transact as a group so they can receive the same values traditionally afforded to organisations who purchase in volume. Sellers pay a small percentage to each sale on a per-transaction basis.

- **Distributor**

  A catalogue-type operation that connects a large number of product manufactures with volume and retail buyers. B2B models are increasingly common. Broker facilitates business transactions between franchised distributors and their trading partners. Digital/Market describes the benefits as twofold. For buyers, it enables faster time to market and time to volume as well as
reducing the cost of procurement. By providing the buyer with a means of retrieving quotes from preferred distributors – showing buyers – specific prices, lead-time, and recommended substitutions – transactions are more efficient. For distributors, it decreases the cost of sales by performing quoting, order processing, tracking order status, and changes more quickly and with less labour. [ex: Digital/Market, NECX].

- Virtual Mall
It is a site that hosts many online merchants. The Mall typically charges set-up, monthly listing, and/or per transaction fees [for example Yahoo! Store’s terms. The virtual mall model may be most effectively realised when combined with a generalised portal. Also, more sophisticated malls will provide automated transaction services and relationship marketing opportunities [Ex: Yahoo! Stores, ChoiceMall, iMall, Women.com’s Shopping Network.

- Metamediary
A business that brings buyers and online merchants together and provides transaction services such as financial settlement and quality assurance. It is a virtual mall, but one that will process the transaction, track orders, and pro-
vide billing and collection services. The metamedary protects consumers by assuring satisfaction with merchants. The metamedary charges a set-up fee and a fee per transaction. Export to see virtual malls move more in this direction. [ex: Amazon’s zShops, virtualSellers].

- **Auction Broker**
  It is a site that conducts auctions for sellers (individuals or merchants). Broker charges the seller a fee, which is typically scaled with the value of the transaction. Seller takes highest bid(s) from buyers above a minimum. Auctions can vary in terms of the offering and bidding rules. [Ex: eBay, AuctionNet, Onsale].

- **Reverse Auction**
  The “name-your-price” business model also called “demand collection”, is pioneered and patented by Priceline. Prospective buyer makes a final (usually binding) bid for a specified good or service, and the broker seeks fulfillment. The broker's fee is the spread between the bid and fulfillment price and perhaps a processing charge.

- **Classifieds**
  A listing of items for sale or wanted for purchase, typically run by local news content providers. Price may or may not be specified. Listing charges are incurred regardless of whether a transaction occurs.

- **Search Agent**
  An agent (i.e., an intelligent software agent or “robot”) used to search-out the best price for a good or service specified by the buyer, or to locate hard to find information. [Ex: DealPilot, DealTime, MySimon, RoboShopper, R U Sure, Shopfind] An employment agency can act as a search agent broker, finding work for job seekers or finding people to fill open positions listed by an employer. [CareerCentral]

2. **Advertising model**

  The web-advertising model is an extension of the traditional media-broadcasting model. The broadcaster, in this case, a website, provides content (usually, but not necessarily, for free) and services (like email, chat, and forums) mixed with advertising message in the form of banner ads. The banner ads may be the major or sole source of revenue for the broadcaster. The broadcaster may be a content creator or a distributor of content created elsewhere. The advertising model only works when the volume of viewer traffic is large or highly specialised.

- **Generalised Portal**
  High-volume traffic-typically tens of millions of visits per month driven by generic or diversified content or services (Ex: search engines and directories like Excite, Altavista and Yahoo! or content driven sites like AOL). The high volume makes advertising profitable and permits further diversification of site services. Competition for volume has led to the packaging of free content and services, such as e-mail, stock portfolio, message boards, chat, news, and local information.

- **Personalised Portal**
  The generic nature of a generalised portal undermines user loyalty. This has led to the creation of portals (Ex: My.Yahoo!, My.Netscape) that allow customisation of the interface and content. The profitability of this portal in based on volume and possibly the value of information derived from user choices.
Personalisation can support a "specialised portal" model.

- **Specialised Portal**
  Here volume is less important than a well-defined user base (perhaps 0.5-5 million visits per month). For example, a site that attracts only golfers, or homebuyers, or new parents, can be highly sought after as a venue for certain advertisers who are willing to pay a premium to reach that particular target audience.

- **Attention/Incentive Marketing**
  The "pay for attention" model pays visitors for viewing content and completing forms, or sweepstakes, or frequent flyer-type point schemes. The attention marketing approach has the most appeal to companies with very complex product messages, which might otherwise find it hard to sustain customer interest. The concept was pioneered by CyberGold, with its "earn and spend community" that brings together advertisers interested in incentives-based marketing with consumers looking to save. To facilitate transactions, the company developed and patented a micropayment system. Other loyalty-based relationship marketing approaches are Netcentives, or MyPoints.

- **Free Model**
  Give users something for free: site hosting [Ex: FreeMerchant], web services, Internet access, free hardware, electronic greeting cards [BlueMountain]. Freebies create a high volume site for advertising opportunities. Viability is hardest when based purely on advertising revenue and hence, there is an opportunity to blend with infomediary model.

- **Bargain Discounter**
  The most notable Example is Buy.com, which sells its goods typically at or below cost, and seeks to make a profit largely through advertising.

3. **Infomediary model**
Data about consumers and their buying habits are extremely valuable. Especially when that information is carefully analysed and used to target marketing campaigns. Some firms are able to function as infomediaries by collecting and selling information to other businesses. An Infomediary may offer users free Internet access [NetZero] or free hardware [eMachines.com] in exchange for detailed information about their surfing and purchasing habits. This is likely to succeed than the pure advertising model.

The infomediary model can also work in the other direction, i.e. providing consumers with useful information about the web sites in a market segment that compete for their dollar. One such example is Gomez.

- **Recommender System**
  This is a site that allows users to exchange information with each other about the quality of products and services – or the sellers with whom they have had a purchase experience (good or bad) [See: Deja.com, opinions]. Amazon.com’s zBubbles and ClickTheButton take the concept a step further by integrating the recommender system into the web browser. Such agents monitor a user’s habits, thereby increasing the relevance of its recommendations to the users needs – and the value of the data to the collector. Recommender systems can take advantage of the affiliate model offered by merchants to augment revenue from the sale of consumer information.
• Registration Model
Content-based sites that are free to view but require users simply to register (other information may or may not be collected). Registration allows inter-session tracking of users’ site usage patterns and thereby generates data of greater potential value in targeted advertising campaigns. This is the most basic form of infomedary mode. [Ex: NYTimes.com].

4. Merchant model
Classic wholesalers and retailers of goods and services (increasingly referred to as "e-tailers"). Sales may be made based on list prices or through auction. In some cases, the goods and services may be unique to the web and not have a traditional "brick-and-mortar" storefront.

• Virtual Merchant
A business that operates only over the web and offers either traditional or web-specific goods or services (eg., pure-play e-tailers). The method of selling may be list price or auction. An Example of a service merchant is Facetime, which calls itself an “application service provider”. It offers live customer support for e-commerce web sites. [Ex: Amazon, eToys, Eyewire, OnSale]

• Catalogue merchant
The migration of mail-order to a web-based order business. [Ex: Chef’s Catalogue]

• Surf-and-turf
Traditional brick-and-mortar establishment with web storefront. The model has the potential for channel conflict. Physical stores can prove to be an asset if cleverly integrated into web operations. Also known as “bricks-and-clicks”. [Ex: Gap, Lands End, B&N]

• Bit vendor
A merchant that deals strictly in digital products and services and, in its purest form conducts both sales and distribution over the web.

5. Manufacturer model
This model is predicated on the power of the web to allow manufacturers to reach buyers directly and thereby compress the distribution channel (i.e., eliminate wholesalers and retailers). The manufacturer model can be based on efficiency (cost-savings that may or may not be passed on to consumers), improved customer service, and a better understanding of customer preferences. Perishable products that benefit from fast distribution, like fresh flowers [Ex: Flowerbud], may prove advantageous by eliminating middlemen. The model has the potential for channel conflict with a manufacturer’s established supply chain. [Ex: Intel, Apple]

6. Affiliate model
In contrast to the generalised portal, which seeks to drive a high volume of traffic to one site, the affiliate model, provides purchase opportunities wherever people may be surfing. It does this by offering financial incentives (in the form of a percentage of revenue) to affiliated partner sites. It is a pay-for-performance model – if an affiliate does not generate sales, it represents no cost to the merchant. The affiliate model is inherently well suited to the web, which explains its popularity. Variations include, banner exchange, pay-per-click, and revenue sharing programs.

7. Community model
The viability of the community model is based on user loyalty (as opposed to high traffic volume). Users have a high investment in both time and
emotion in the site. In some cases, users are regular contributors of content. Having users who visit continually offers advertising, Infomediary or specialised portal opportunities. The community model may also run on a subscription fee for premium services.

• Business Trading Community
Or “vertical web community,” a concept pioneered by VerticalNet. It is as a site that acts as an “essential, comprehensive source of information and dialogue for a particular vertical market. VerticalNet’s communities contain product information in buyers’ guides, supplier and product directories, daily industry news and articles, job listings and classifieds. In addition, VerticalNet’s sites enable B2B exchanges of information, supplementing existing trade shows and trade association activities.

• Knowledge Networks
Or expert sites, that provide a source of information based on professional expertise or the experience of other users. Sites are typically run like a forum where persons seeking information can pose questions and receive answers from (presumably) someone knowledgeable about the subject. The experts may be employed staff, a regular cadre of volunteers, or in some cases, simply anyone on the web who wishes to respond. [Deja, ExpertCentreal, KnowPost, Xpertsie, Abuzz]. Also, it is a fee-based model [Ex: Guru, Exp]

8. Subscription model
Users pay for access to the site. High value-added content is essential [Ex Wall St. Journal, Consumer Reports]. Generic news content, viable on the newsstand, has proven less successful as a subscription model on the web [Ex: Slate]. A 1999 survey by Jupiter Communications found that 46 percent of Internet users would not pay to view content on the web. Some businesses have combined free content (to drive volume and ad revenue) with premium content or services for subscribers only.

9. Utility model
The utility model is a metered usage or “pay as one goes” approach. Its success may depend on the ability to charge by the byte, including micropayments (that is, those too small to pay by credit card due to processing fees). [Ex: FatBrain, SoftLock, Authentical].

Are these models appropriate and sufficient enough for Web-business strategy. One requires an agglomeration of these strategies to make e-business models float.

II. Will electronic business model float?
Hatching an online business isn’t easy. One must convince investors to fund, advertisers to support and customers to visit oneself. But why should any of those people do any of those things when they and perhaps even the company doesn’t understand the business in which it is operating? The fact that the business models emerging on the Internet are still fuzzy around the edges is no reason to get discouraged.

Of course, no one is laughing today at the difficulties of discovering ways to make money on the Web. The solution, for many established companies and startups, has been to apply traditional business models such as advertising, subscription services and retail sales to the Web, sometimes giving them a little interactive filip. Hybrid models that allow businesses to market ancillary services to their product lines have sprung up as well. 

For example, FTD Inc., the flower delivery service, and rediffmail.com, now offers to e-mail customers reminders to birthdays, anniversaries and other bouquet-worthy dates.

This brings in the concept of Relationship Marketing to Web based Businesses. Some people, however, believe that for Web businesses to thrive they must cast off their old skins to emerge as new and unrecognisable creatures. “Most people have come to the conclusion that there are entirely new business models on the Web, but we haven’t broken the code yet,” says Bob Weinberger, Vice President of marketing at Open Market Inc., a Web software developer.

III. New business models for electronic commerce
This paper describes three new business models for electronic commerce – virtual retailing, distributed storefronts, and buyer-led pricing. In each case inter organisational networks are so important to the model that it would be impossible or impractical to implement without the networks. The models are described and illustrated with examples of companies that are implementing these models. Various implications for business in areas such as disintermediation and competitive advantage are suggested.

A second wave of Internet commerce is in progress – new business models, developed for the digital environment, they are “changing business on the Internet”. In this new era the Internet is changing the way business is conducted.

In each of the following models, the businesses that apply these models are so reliant on inter organisational networks, such as the internet, that their business practices either cannot exist or would be prohibitively expensive in the non-electronic world.

1. Virtual retailing
Traditionally a retails establishment has been defined by its bricks-and-mortar storefront and its inventory. The typical retailer set up shop in a mall or on street corner, stocked the shelves with goods and sold the inventory to customers who came in the door. While presenting a safe and comfortable shopping experience for the customer, this is expensive in time, effort, and overhead of both the proprietor and the customer. Surely there must be a better way.

The retailers should focus on reducing the inventory of goods-on-hand with automatic inventory replenishment systems. As each item is sold, interorganisational information systems advise suppliers who are under contractual obligations to re-supply the stores. In these stores stock frequently goes from the truck to the shelf, minimizing both capital tied up in inventory and storage space. For example, Wal-Mart’s Just-In-Time (JIT) inventory system was a major innovation that helped make that company, the price leader in the United States retail market.

Then came the Internet. The World Wide Web (WWW) made it possible to extend those electronic links to customers as well. One of the first innovators in virtual retailing was Comp-U-Card, a buying club that changed its traditional face-to-face business model into a virtual one. Electronic links to suppliers crated a virtual inventory and a Web site created a virtual storefront. CEO Walter Forbes described this new business model as “This is virtual-reality inventory: We stock nothing, but we sell everything”.

- Disintermediation
The elimination of intermediaries through the use of digital networks – is a major theme of the digital economy. Disintermediation occurs when
intermediaries such as wholesalers, distributors, and retailers are eliminated from the supply chain. But virtual retailing is not disintermediation, it is reintermediation. Reintermediation occurs when new intermediaries use electronic networks to add value to the intermediation process and replace traditional intermediaries. Usually the only disintermediation occurring in virtual retailing is the traditional intermediaries. Which leads us to the case of Amazon.com. It seems no report on electronic commerce is complete without mentioning Amazon.com, and this report is no exception. Amazon.com is perhaps the most widely known example of virtual retailing, not disintermediating retail stores from the supply chain but replacing them. Amazon.com is dependent on the publisher-to-wholesaler supply chain, so much so that Amazon.com distribution centres are placed near book distribution warehouses to allow quick turnaround on deliveries. Amazon.com represents this new breed of retailers and reintermediaries. These new entrants typically come from outside the industry, understand the new media and add value with lower costs and better-than-traditional (Value-added) services. Amazon.com works as a virtual retailer because it is more convenient, the product itself is suited for the Internet, and because the business model is different, they can sell at lower cost and still offer more selection. That is how virtual retailers such as Amazon.com, are changing business on the Internet.

2. Distributed storefronts
   In a brick-and-mortar shopping mall, the travel agent sells holiday travel, the sports stores sell sporting goods and the bookstore sells books. Maybe a customer is interested in goods and services, all three shops provide. For example, a sports-oriented customer may be interested in travel to the World Series, Tiger Wood's autobiography, and basketball for his daughter's birthday. Could the same store provide all three services? Probably not, because in the physical world the logistics of dealing with multiple suppliers, competition for expensive floor space, and limited expertise of sales staff create problems. Now imagine if customers at the sporting goods store had a direct link to the travel expert at the travel shop and virtual bookcase of sports books. Extend this model to other stores – for example, a camera shop that sells photography books, picture frames, and artistic prints as well as cameras and tripods – and one begins to see connectiveness in the shopping experience.

   On the Internet, these links between shops can be electronic. If the on-line sports shop and camera store have hypertext links to a bookstore's Web site, then the bookstore is not selling books from just one Web site, but from three. Why stop at three? Why not sell books from thirty, three hundred or three thousand Web sites! This is the Distributed Storefront Model. Electronic markets call these arrangements, affiliate programs and the concept is simple. A Web site (the affiliate) agrees to promote goods being sold by an on-line merchant. The representation of these goods on the affiliate's web site has a hypertext link to the merchant. If a visitor to the site *clicks through* to the merchant and buys the product, the affiliate receives a commission. Web site owners benefit by offering additional services to visitors and generating revenue from their site. On-line merchants benefit because buyers, nearly committed to making a purchase are directed to their site and the commission cost of affiliated-generated sales is less than sales generated from banner placement.
advertising. Shoppers benefit too because the goods they find at sites they visit, are relevant to their needs, minimise search time and frequently come with recommendations of the site developers. In summary, this is a plus-plus-plus arrangement made possible by the hypertext connectivity of the World Wide Web.

Perhaps the premier example of a distributed storefront is the Amazon.com. Associates Program. This program allows anyone with a web site to open a bookstore and sell Amazon.com books, CD-ROMs, and videos to the world. Once a customer has clicked through, Amazon.com takes care of accepting the order, collecting the money, and shipping the product. All the Associate has to do is wait for the 5-15% commission cheque to arrive. Other merchants with affiliate programs include eToys and CDNow.

3. Buyer-led pricing
Want to buy an airline ticket? One can but one will have to pay that the airlines charge unless one buys that ticket through Priceline. Priceline has turned traditional seller-led pricing on its ear by allowing customers to specify the price they will pay for products and service. Priceline customers commit to a purchase (e.g., air travel between two cities within a limited timeframe) and a price they are willing to pay. Priceline uses electronic network connections with airlines to determine if an airline is willing to sell an empty seat at that price. If an airline agrees, the purchase is complete. Priceline’s motto is “Simply name your price and let priceline find a seller”. This is Buyer-Led Pricing.

For airlines, the idea works because it fits in well with the yield management systems they already use to maximise revenue. On any given airplane, customers will have paid different prices for what is essentially the same service. The recreational traveller who buys a ticket months in advance gets the deepest discount. The businessperson who buys a ticket a week in advance will pay full fare. These prices and discounts are determined by yield management systems based on customer demand, the prices charged by competitors on the same route, and other factors. Within one or two days of the flight, these same yield management systems can estimate whether a flight will be fully booked or not. If not, then why take off with an empty seat when a last minute traveller is willing to pay a reasonable price to fill that seat.

Not surprisingly, there are some strings attached. Priceline recommends, customers set a price that is no lower than the lowest discounted fare. Although tickets can be requested up to six months in advance, the service is designed to appeal to last-minute leisure travellers who don’t need to fly at a specific time of day or on a specific airline. Tickets are non-refundable, non-changeable, and do not earn frequent flyers miles.

Priceline started the buyer-led pricing concept with airline tickets, but priceline has extended it to cars, hotel rooms, financial services, and, even holiday packages and insurance.

iv. Emerging models for Internet commerce
The Web’s most interesting models are those for which the names have not yet been coined. Like doctors working with laughing gas in the 1800s before the legitimising moniker of “anaesthesia”. Entrepreneurs in basements and office towers around the world are creating new business models without the words to describe them[9].

A startup called Onsale, for example, operates
like a cross between a retail store and a game. The company buys refurbished and close-out products, including PCs and car audio systems, then sells them in a Dutch auction (in which the top five bidders get the product for the second-highest bid). Customers tack e-mail message onto their bids to psyche out the other players, and winners get their names posted on the site.

Another business with an unusual model is GeoSystems Global Crop. The company, which offers several services on its MapQuest site, is pursuing the subscription, advertising, and software and services models simultaneously.

A spin off of R.R. Donnelley & Sons Co., GeoSystems has been making maps for decades, moving to a CD-ROM format six years ago. But the company's executives were disappointed with the results. “We always felt that applications for electronic mapping should be taking off faster, but it didn’t really accelerate until the Web was invented”, says Perry Evans, Vice President and General Manager of the company's Internet Business Unit.

Now GeoSystems makes money by creating and hosting digital maps for companies like “The Sharper Image” for a fee of $15,000 to $25,000 per year. “The company sends us a file with store locations, and we geocode the stores on our server”, Evans explains. An even newer service, called MapQuest Connect, allows companies to dynamically code maps on their own servers. And in order to build a strong consumer franchise and open up a new advertising revenue stream, the MapQuest services allow visitors to plot their own geographic landmarkshome, church, etc.on maps residing on the site.

Then there's PhotoDisc Inc., which sells stock photography over the Web to designers and site developers. The company started off using the Web to market its CD-ROM products and then, for a three-month period in 1995, allowed customers to download one free image each. Now it is sells stock photos, for price as low as $49.95 and as high as $189.95, to Web publishers over the Internet[11].

That would seem to be a fairly standard transaction model, but the marriage of software with the stock photo business has produced something more unusual. PhotoDisc is using technology developed by Virage Inc. that allows customers to search for photos based on criteria such as texture and colour or to isolate a piece of photo, for example, a nose on a face. Such features have generated a surge in demand. According to the company: PhotoDisc generated $300,000 in sales in sales in its first six month, from 60,000 hits and 1,000 unique visitors per day. Those figures are now “screaming upwards” according to Vice President of Business Development, Bill Heston, who says the company currently brings in as much as $100,000 per week.

“We’re still working on our pricing model, and the business model is emerging rapidly”, says Heston. “But we’re starting to see that we’re selling not just image. We’re selling an image acquisition tool right at the desktop”.

That’s a whole new way of thinking for a company born in brick and mortar. But on the Web, nothing less will do.

V. Conclusion

These models are only the beginning. Electronic networks and interorganisational networks are changing supply chains, disintermediating middlemen, opening doors for those savvy in “new media”, rewriting the marketing rulebook, levelling the playing field, and changing basis of com-
petition. These are general concepts, one reads in the news reports, magazine, or on the web. The challenge for businesses is to interpret these concepts into opportunities, to create a new business model, and thrive in the digital economy. It is not clear whether transplanted real-world business models and native Internet business models can co-exist indefinitely. The aggressive nature of Real-World Business and Economic Rationalism tend towards domination. The native Internet Economy and culture is largely free, dis-intermediated, deep-rooted, ecological, decentralised, radical and politically sophisticated. These two cultures are opposed (if not mutually exclusive) and one or the other may ultimately prevail or new hybrids may emerge.

The unresolved debate around Internet regulation is also a limiting factor. The regulatory controls that have evolved in the real-world economy are not generally operational to the Internet. There is reluctance by some governments and some netizens to accept the necessity of such regulation. While such a regulatory limbo prevails, it is unlikely that consumers will embrace I-Commerce en masse. The assumption that consumers will gladly relinquish locally based real-world business (which is usually well regulated by consumer protection regulation and legislation) for a global economic free for all, underpins the hyped projections of the exponential growth of I-Commerce. This mass acceptance of Internet Commerce by consumers has not yet happened and may never occur under current conditions.

Internet Commerce may not fail, but its ultimate successful form is probably not what is envisioned by the current crop of Internet Commerce evangelists.

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Extended Value Chain Management in Electronic Marketplaces

Abstract: In this paper we introduce a concept of project-driven co-operation formation between SMEs (small and medium-sized enterprises), supported by IT-infrastructure and -tools on electronic marketplaces. Two crucial factors that determine the success of an SME, especially in electronic commerce, are the time it needs to process a customer’s request and the selection of competent partners to cover the value chain of a complex product. Our concept includes advanced planning and scheduling tools, allowing the SME a fast and precise generation of tenders. In many cases the generation of tenders can be completely automated, eliminating the time-consuming manual processing and creating a distinct advantage over the competition. The search for suitable co-operation partners is supported by a sophisticated service mediator. A concept ontology allows the detailed description of required services and specialisation. It serves as the entrance point for the search in the underlying profile database. A multi-objective selection mechanism helps to choose the most suitable partner for every task in the co-operation. This enables SMEs to accept and successfully fulfill customer requests for complex products, which they could otherwise not handle. Our co-operation concept facilitates the ad hoc co-operation for the duration of single projects. The SMEs are very loosely coupled to the market place, having to provide only their profile in compliance with the concept ontology, in order to be included in any selection process.

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1. Introduction

Non-hierarchical, regional production networks are the vision of a virtual enterprise model followed in a collaborative research project at the Technical University of Chemnitz. The centre of interest is the evolution of a virtual enterprise model, which is based on small production units, so called competence cells. The general intention of our model is to improve the competitiveness of small and medium-sized enterprises (SMEs).

Our research pursues a path off the beaten track. The objective of already existing models is to restructure the co-operation between large-scale enterprises and dependent partners. The primary objectives of our model are, of course, the same ones as in existing models: reduction of production costs, improved flexibility, higher quality, reduction of the administrative overhead and the bullwhip effect. Already existing approaches dissect organisations into smaller units. These units possess only few and very specific key competences. The rationale behind this top-down strategy is to connect particular units in order to form a network. These networks should improve the companies’ performance in complex production tasks.

By following the bottom-up principle the concept of Virtual Enterprises (VE) can also be applied to small and medium-sized enterprises. Their business is, as a rule, already concentrated on a small number of key competences. That means, they fulfill a particular function very well. 

Keywords: Project-driven IT-infrastructure, Co-operation
However co-operation could enable the SMEs to accomplish comparable tasks as large-scale enterprises do. Today these co-operation are often built up hierarchically, because smaller enterprises are only involved as subcontractors of large-scale enterprises. A prominent example of this pattern, and coincidently the essential driving force of innovation in Supply Chain Management (SCM), is the automotive industry.

Supply Chain Management is a major prerequisite for controlled co-operative production. Supply Chain Management is the integrated, customer-oriented view on business processes beginning with the initial supplier up to the end consumer. It comprises all strategic and functional measures for the efficient and effective coordination of inter- and intra-organisational material and product flows. SCM shifts the focus of planning from the enterprise level towards the objective level.

SCM is concerned with the coordination between the in-house job throughput and the supply chain. This broadens the enterprise-related horizon, which was the focus of MRP II-based concepts (Manufacturing Resource Planning ). The term ‘supply chain’ has to be distinguished from ‘logistic chain’, because SCM handles the single steps of a logistic chain across several business processes. The term chain however is misleading because it implies linearity. In reality SCM has to manage complex supply networks (Figure 1).

The so-called ‘Bullwhip-effect’ requires the consideration of the value-adding network in its entirety. The ‘Bullwhip-effect’ describes the situation in which even the smallest deviations between actual and planned demand lead to severe self-amplifications along the supply chain (Figure 2). Reasons for this effect are primarily the change of forecasts, the optimization of purchase order quantities and price fluctuations. This effect can be countered by intensifying the co-operation among the enterprises, e.g. by use of a common warehouse and an IT infrastructure similar to Just-In-Time.

SCM-systems are superordinated to Enterprise Resource Planning systems (ERP). They represent a ‘2nd generation’ of ERP-systems and are a ‘turn away’ from Orlicky’s and Wight’s MRP II-concepts. The 1st generation ERP-systems still employed MRP and allowed only for a sequential planning. Instead, SCM-systems allow the use of simultaneous plan-approaches.

SCM typically treats suppliers as ‘black boxes’, which means they receive inquiries as input and are expected to produce tenders as output. Their internal situation, such as their current capacity, is hidden to the client. Therefore the client has to delay further plannings until he receives the tender and, more critically, he has to rely on the assurances in the supplier’s tender without being able to check their likeliness. In reality however, delivery time and price statements are often only the supplier’s estimations. This degree of vagueness is not visible to the client and often turns out to be a pitfall in the cooperation.

2. Extended value chain management

Extended Value Chain Management (EVCM) will support the quantization of delivery time and price assurances. The EVCM software is connected to the ERP system and can directly assess the likelihood for the fulfillment of a contract. This means, suppliers can be seen as ‘white boxes’. A product to be delivered can either be in stock – it is available to promise and
Figure 1: Supply Chain Network

Figure 2: The Bullwhip Effect
the likelihood is hundred percent. Or, the product has to be manufactured first. The ERP system provides the information if the manufacturing is possible within the given time frame. In this case the product is capable to promise. However the likelihood now depends on the supplier’s internal situation and reliability of the next level suppliers. This yields a chain of conditional probabilities for supply promises. In contrast to SCM, EVCM allows a more realistic planning on account of the probability chain. Moreover, the automatic processing of inquiries by EVCM software allows for an instant generation of tender. The client receives an immediate response, which drastically decreases the delay in his further planning. By combining the concept of EVCM with electronic marketplaces, the advantage of fast and realistic tender generation is complemented by the option to have a flexible supplier network. The principle concept works as outlined in Figure 3.

The left side of the figure shows a customer issuing an inquiry to a marketplace. The inquiry can also be automatically generated by an SCM-system. Via the marketplace potential first level suppliers for the final product are identified. Each supplier disassembles the value adding chain only in the part he has the technological or manufacturing competences for. Inquiries for the other parts are passed on to a marketplace again. In case a supplier does not need to further disassemble the value adding chain, the roll out process in this branch stops and the supplier returns a tender. Subsequently, in the roll back phase, the tender is returned to the inquiring instance. A supplier receiving tenders for outsourced parts has to calculate his own tender. The selection of the most suitable supplier according to a set of received tenders requires advanced planning and scheduling tools. The roll back phase is sketched on the right hand side of Figure 3. At the end the customer receives tenders for the final product from the first level suppliers.

Finally the technique of decentralized disassembly likely yields a similar network to what a centralized SCM planning procedure would generate. The difference is that a centralized approach can theoretically guarantee a global optimum, if the complexity of the entire task can be managed. A decentralized approach cannot guarantee a global optimum. Nevertheless the striking advantage of decentralized disassembly is the greatly reduced complexity. The fast generation of realistic tenders offsets the lack of a guaranteed optimum. Furthermore the decentralized approach in connection with electronic marketplaces allows flexible, project-driven co-operation formation. The SME’s are not tied in a fixed supply network. Instead they can autonomously choose the most suitable partners for every project.

The implementation of the described approach comprises two main areas. The functionality of the EVCM business logic as Add On to an existing ERP-system is hosted as application service. The objective of this ASP (application service providing) strategy is to provide the SMEs economically feasible access to EVCM tools. Traditionally, SCM-solutions are only affordable for a limited number of users. For SMEs the costs are prohibitive. Our model of production networks offers the opportunity to overcome this exclusivity by integrating the e-business technologies and the enterprises’ system environments of ERP or even SCM. Figure 4 illustrates this.

Hosting of EVCM systems can be accomplished by extending the marketplace functionality. The second area is the installation of a sophisticated
mediation on marketplaces. The mediator has to preselect only suitable suppliers for a given inquiry in order to avoid information flooding. It passes on the inquiry to the selected suppliers and routes their tenders back to the inquiring instance.

3. Mediation on EVCM marketplaces
The automated preselection of suppliers for a given product on a marketplace requires that the inquiry is formulated in compliance with the marketplace’s ontology. This enforces semantic compatibility to the product catalogue and thus the identification of potential suppliers. Each enterprise has to describe itself and its products or services in a profile by using the terminology maintained in the ontology. This establishes a common view of the product catalogue. The concept ontology and the product profiles are stored in the marketplace’s knowledge base. It must be noted however that neither the knowledge base nor the ontology contain static information. For example new products or services might be offered, which requires not only the insertion of another product but also the addition of concepts to the ontology. This in turn requires an extensible ontology and the efficient management of an arbitrarily large product inventory within the knowledge base.

Access to products by name is the exception in industrial applications. More common is the search for products by specifying their desired features or functionality. This content-related approach demands a corresponding organisation of the product catalogue in conjunction with content-based search mechanisms. The search for products with specified features can either be conducted as exact match queries or approximate queries. Exact match means returning only those products having exactly all specified features. Due to the configuration variety of complex products an exact match is not always guaranteed. Therefore the optional approximate match returns not fully matching products. In the first case, the inquiry can be passed on to the respective suppliers. The adherence to the concept ontology on both sides guarantees that these suppliers can manufacture the desired prod-
uct. Therefore exhaustive and up-to-date description of their product range is of economic interest for the suppliers. In case of an approximate match the marketplace can either react in the same way or require the client’s decision. The supplier receiving an inquiry resulting from an approximate match has to decide whether it is technological feasible and he returns a tender, or it is infeasible and he rejects the inquiry.

In order to offer such approximate query mechanisms, the underlying data organisation has to automatically arrange the product catalogue as a hierarchy of similarity groups. The hierarchy is necessary for an efficient identification of completely or partially matching products. The similarity groups have to be restricted in a sensible way, in order to avoid flooding suppliers with infeasible inquiries. Due to the content-based nature of the search, this restriction has to be defined by similarity measures rather than by size criteria.

While the selection of suitable suppliers for a product in the roll-out phase is based on content criteria, i.e. technology, features and functions of products, the choice which tender to accept in the roll-back phase, and consequently which supplier to include in the co-operation, is based on economic criteria. A multi-objective decision has to be made with respect to the amount to be delivered, delivery time, price and other conditions. The EVCM system has qualified each tender with a particular likelihood and thus the decision process is more detailed but also more complex. The risk of failure in a supply point, which was hidden in the SCM world, is now visible and can be included in the utility function of the optimization. This decreases the structural risk in the co-operation formation and operation.

4. Components of the system
The concept of co-operation formation via electronic marketplaces is based on several technologies developed within the scope of the collaborative research project on non-hierarchical, regional production networks. Applicable Advanced Planning and Scheduling tools (APS),
required for the choice of the most suitable supplier and controlling of the co-operative manufacturing are already available. Currently they are customised, in order to host their business logic part by application service providers. APS tools form the core of the EVCM system.

The concept ontology, governing the formulation of product catalogues and inquiries, has to be created in accordance to the specialisation of marketplaces. It would be neither reasonable nor feasible to create one all-embracing ontology. Today many specialised marketplaces are already in existence. Each of them would only use a small, domain-specific part of the ontology. Thus the approach of creating several domain ontologies is more practicable. A domain ontology dedicated to the fields of customised mechanical manufacturing and mechatronical engineering is currently under development in our collaborative research project. However, the necessary functionality for run-time addition to the ontology, as described in, is subject of further tasks.

Approaches to the indexing of objects with respect to their features have been reported for instance in Information Retrieval, and Image Database Systems. The authors have proposed a content-based data organisation technique that supports approximate search mechanisms as well as standard search functions. It is implemented as a prototype, the Intelligent Cluster Index (ICIx). Since ICIx was developed as a new type of content-based database index, it includes many database specific criteria in the creation of similarity groups. For application in the mediator system ICIx needs to be adapted. Of special interest in this regard are group constraints basing on
similarity measures. Figure 5 sketches the embedding of these techniques on electronic marketplaces.

5. Conclusion

In this article we have proposed a concept for flexible co-operation formation. The co-operation formation is project driven. For a complex product to manufacture a network of most suitable participants is created under economic considerations. The partners are identified by a product causal approach, which means they are identified by offered products rather than their competences and abilities. The product causal approach was chosen, because current research results do not allow an in-depth competence description, sufficient for the match-making purpose. As a consequence, the system includes at the moment only manufacturers. Service providers can only be handled if the description of their services is very specific, for instance transport services. The description of more general services, for instance logistics, is a current research topic.

The core of the business logic in the co-operation formation is the electronic marketplace in conjunction with an Extended Value Chain Management system. We propose EVCM as new generation of Supply Chain Management systems. EVCM works on top of the companies’ ERP system. Thus it allows insight into the companies’ current capacities. On this basis realistic tenders as response to inquiries can be created rapidly. In combination with the communication speed in electronic commerce, this can dramatically accelerate the co-operation formation. Hosting EVCM as application service makes sophisticated supply chain management affordable for SMEs. This could turn supply chain management software into a fast growing mass market.

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Glossary of E-commerce Terms

A

Advance Shipping Notice (ASN)
Document sent from the supplier to the customer outlining details of the shipment and delivery details – the electronic version of this document is known as the 856 document.

Advanced Research Projects Administration Network (ARPANET)
The network developed in the 1960s by the United States Defence Department which was the forerunner to the Internet – designed as a network which would survive nuclear attack.

Analog
Data communications transmission technique which works by using a sweeping voltage or frequency, rather than the digital method of switching between two voltages or frequencies.

ANSI ASC X12
The American National Standards Institute, Accredited Subcommittee X12 – creates the format and syntax rules for the variable length X12 standard and the format and content for all business transactions that can be converted to EDI.

Authentication Token
Means of authenticating a user, they operate using techniques such as challenge/response or time-based code sequences.

B

Binary File
File made up of a series of binary digits (bits), the codes that the bits make up identifies the data (i.e. text, graphics).

Bits Per Second (bps)
The speed at which binary digits are transmitted.

C

CCD
Cash Concentration and Disbursement – used in banking to transfer funds from one account to another electronically.

Challenge/Response
A method of authentication – the server challenges the user at random intervals. Once challenged the user’s machine must respond with an authentication token.

Connectivity
The ability of a system to be connected to other systems or devices.

Cyclic Redundancy Check (CRC)
An algorithm used to detect transmission errors. The algorithm generates one or two characters based on the data being sent which are transmitted. When the data is received, the same algorithm is applied at the receiving end and the results compared – if they match then the data has been transmitted without error, but any mismatch indicates that a data transmission error has occurred.
**Electronic Data Interchange Association (EDIA)**
An organisation to promote and provide a common platform for global EDI activity.

**Full Duplex**
The ability for data to be communicated in both directions at the same time.

**Half Duplex**
Data communication which can only occur in one direction at a time.

**Hypertext**
System used by the Word Wide Web. Documents are displayed as text whereby words within the text are links to other documents which can be accessed by simply clicking on that word – these words are known as ‘hyperlinks’.

**Hypertext Transport Protocol (HTTP)**
Protocol for transferring hypertext files across the Internet.

**Interchange**
The transfer of data from sender to receiver in one complete transmission. An interchange uses a header segment and trailer segment to determine the start and end of the data.

**Internet Protocol (IP) Address**
Unique number used to identify every network interface on a system connected to the Internet. Also known as a dotted quad as it is made up of four parts, each part separated by a dot.

**Leased Line**
Telephone connection set up between to locations which are connected permanently – often used to connect LANs to the Internet.

**Logging**
The process of recording information about network events.

**MODulator DEModulator (Modem)**
Device used to convert digital computer signals into analog signals which can be transmitted down a telephone line, the receiving modem then converts the analog signals back to digital signals which the computer can interpret.

**Netscape**
One of the most widely used Web browsers.

**Offline**
Activities which take place when the computer is not connected to another computer or network.

**Protocol**
The set of operating rules which apply to data transmission. The rules are formal and standardized.

**Secure Sockets Layer Protocol (SSL)**
Protocol to allow secure electronic commerce
transactions to take place over the Internet.

**Synchronous Transmission**
Method of transmission using timing signals to control the sending and receiving of characters.

**T**

**Telnet**
Service which provides access to remote computers from a local terminal, allowing the remote computer's features to be used as if the local computer was directly connected to it.

**Trojan Horse**
A program which appears normal, but is designed to attack a system.

**U**

**UNIX**
Family of Operating Systems designed for a multi-user environment.

**V**

**Value Added Network (VAN)**
A service for providing EDI mailbox services to receive and store documents, also provides communications protocol and line speed matching between different systems.
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