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Internet-based transportation marketplaces: A critical analysis

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Internet-based Transportation Marketplaces: A Critical Analysis

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1 Introduction

Today's transportation market is far from perfect: market participants have admission only to a certain fraction of the market and price formation lacks transparency. However, this state is no law of nature since in principle, all market participants could manage to get together somehow and do business – but gaining new business partners beyond existing bonds usually takes too high efforts. After all, the items in transportation markets are usually traded under extreme time pressure: freights have fixed pick-up and delivery deadlines and free transportation capacity cannot be used thereafter. Here, Internet-based freight markets promise help. Since the early 1990s many of them have come into existence so that a considerable number exists today. For Germany alone, over 50 different electronic transportation marketplaces are listed in a database hosted at University Bremen (2001). These marketplaces are no interchangeable clones. On the contrary – despite the common simple idea to earn money with online mediation of transportation services, their mediation models are quite diverse. Electronic blackboards with no or a fixed monthly fee, open only to a certain part of the market, can be found as well as auction houses and real exchanges with transaction-based fees.

The question comes up which of these markets are economically most promising. This article gives no conclusive answer, which would not be valid long – if existing at all. Instead, the article gets across principle ideas in the design of Internet-based transportation marketplaces. This is done by first identifying the vital factors for such marketplaces (Section 2) and then exploring three Internet-based transportation marketplaces alongside these factors (Section 3). These marketplaces are Teleroute (2001), Benelog (2001a) and Eulox (2001a). They have been chosen because they represent the whole range of possible and actually implemented market models.

2 A Classification Scheme

Basically, a marketplace can be defined as a location where demand for a good meets supply for this good so that trades can be made. A marketplace is Internet-based if the Internet is used as communication medium. With this principal definition three issues are sufficient to characterize Internet-based marketplaces – in a way, they make up their core:

- **Participants:** Who are the participants in the marketplace?
  This issue specifies who hosts the marketplace and who has admission to it. It also determines the market structure and the number of industries that the trading agents belong to.

- **Traded Goods:** What is the object of trade?
  This question covers all relevant aspects related to the traded good. The good traded in transportation marketplaces is transportation capacity. Transportation capacity is no homogenous good. Transportation mode, terms, regional restrictions and vehicle requirements represent its key constitutional points.
• **Trade**: How will trade be coordinated and facilitated?\(^1\)

The market mechanism fixes how trade is coordinated and whether it takes place on the marketplace itself or not. Hence which market mechanism is deployed plays a substantial role. The questions who initiates the trade and to which extent business transactions are supported are also relevant: they have strong implications for the fee model. Facilitation of (buyer) cooperation may represent a new and interesting criterion as well.

The answers to the above questions form the building blocks for the marketplace. Changing one of them is changing the marketplace – which is why these questions represent a good guideline for the following exploration of Internet-based freight markets. A similar guideline along which Internet-based procurement markets are investigated is used in Segev et al. (1999) and Merz (2002).

In an Internet-based transportation market, transportation capacity is the object of trade and demand and supply for this capacity are matched via Internet. The efforts to establish transportation marketplaces based on information and communication technology date back to the early Seventies (cp. Büllingen (1994)). Nevertheless, only few categorizations for Internet-based transportation marketplaces are available (Bretzke et al. (2001), Schneider et al. (2000) and Polzin (1998)). The systematic rigor and the foci of the respective studies vary substantially and with them the extent to which certain aspects are covered. Schneider et al. (2000) surveys existing Internet-based transportation marketplaces and discusses actual trends and obstructions for these marketplaces along eight characteristics all of which can be assigned to the three issues given above.\(^2\) The approach taken is a practical one. On the other hand, Bretzke et al. (2001) approaches transportation markets from both a theoretical side, in which transportation marketplaces are classified\(^3\), and a practical side. The latter contains the results of interviews with users of transportation marketplaces and a survey of European and American transportation marketplaces with a description of the respective services. Polzin (1998) investigates logistical services and their suitability for being traded electronically. For this purpose, a thorough and useful characterization of logistical services and markets is given.

The following sections establish a grid for Internet-based transportation marketplaces. Together with the subceeding case study, this grid gets across the bewildering variety of possible and already existing transportation marketplaces.

### 2.1 Participants

The **host** of a marketplace can either be a buyer of transportation capacity, a seller of transportation capacity or a neutral third party offering the information technological infrastructure.

\(^1\)Technological aspects of Internet-based marketplaces are beyond the scope of this contribution. However, these aspects are covered by the issue trade since technological issues always aim at enhanced usability, i.e. facilitation of trade.

\(^2\)These characteristics are branch of industry, number of trading agents, regional restrictions, fee model, technological requirements and quality management.

\(^3\)The classification is rather coarse: the host, structure, number of industries and order terms are the relevant criteria for Bretzke et al. (2001).
Who runs the marketplace represents a relevant criterion since neutrality is generally considered as key success factor in the literature. The reasoning is that neutral hosts will optimize the marketplace to fit not the own eventual needs but the needs of as many carriers and shippers as possible (cp. Polzin (1998)). Merkel & Kromer (2001) see a lack of neutrality result in competitors refusing the marketplace.

With regard to admission, transportation marketplaces can either be public or private. If agents willing to participate in trade have admission provided they pass certain quality thresholds, the marketplace is public. It is private if only selected agents do have admission. Admission rules are relevant since they must fit the actual market situation. They also influence the number of buyers and sellers in the marketplace.

The number of buyers and sellers of transportation capacity determines the structure of the market. The structure may span the whole spectrum from bilateral monopoly (one seller facing one buyer) over monopoly and monopsony to polypoly (many sellers facing many buyers). The market structure has important implications for the trading mechanism as section 2.3 will show.

The number of industries that buyers and sellers stem from is widely used as criterion for classifying Internet-based marketplaces. A transportation marketplace supporting transactions of only one industry is called horizontal marketplace. As a rule, horizontal marketplaces offer highly detailed functionalities that ease trade within a certain industry, e.g. the chemical industry. In contrast to horizontal marketplaces, vertical marketplaces offer a smaller portfolio of services for all kinds of industries. Hence this criterion could also have been placed under the issue traded goods.

2.2 Traded Goods

Loads can be moved via road, air, sea or railway. This is referred to as transportation mode. Most Internet-based transportation marketplaces focus on road haulage; only buyers and sellers of truck capacities are matched on such marketplaces. Shippers buy transportation capacity for cargo by placing transportation orders and carriers sell transportation capacity by accepting those orders. Forwarding agents fulfill transportation orders themselves but also subcontract orders to carriers, so they can act both as shippers and carriers.

Orders mediated in a transportation market can either be short-term (spot market) or long-term (contract market). In a spot market, short-term demand and supply are matched. Spot orders are usually of no strategic importance. On the other hand as a rule contracts are strategically relevant, and often the specificity is high. Contracts regulate frame conditions for the fulfillment of concrete transportation orders in contract markets. Hence personal negotiation is

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4 Cf. Section 3.1 about Teleroute.
5 Bilateral monopoly is not the most desirable scenario for the host.
necessary so much so that standard auctions are inappropriate, not to mention double auctions.

With respect to significance, long-term contracts outweigh short term orders by far: according to Bretzke et al. (2001), 86% of shippers' transportation orders represent long-term contracts, and 70% of carriers' capacity are bound to long-term agreements. Consequently, the terms of mediated transportation orders represent a vital criterion for classifying transportation markets because it may limit the possible degree of automation in mediation. Hence not all mechanisms presented in Section 2.3 may be appropriate.

All transportation orders specify a pick-up and a drop location for the respective load. Internet-based transportation marketplaces usually restrict themselves to certain regions. These regions can be whole Europe (cp. e.g www.benelog.de), a part of Europe (e.g www.lsxs.com) or only one country (e.g. www.interspeed.de).

The vehicle requirements of orders vary greatly. Basically, it is possible to differentiate between standard loads and non-standard loads and between full and partial loads (the latter referred to a certain truck size). Standard loads can be transported with standard trucks using standard pallets. On the other hand, non-standard loads need special trucks or special treatment. The more standardized an order is, the better it is suited for electronic trade. Moreover, vehicle requirements represent one of the keys to determine which market mechanism is best suited, as the discussion in the following section and Figure 1 will show.

2.3 Trade

Today's Internet-based transportation marketplaces usually deploy blackboards or auctions as market mechanisms. Sometimes, also double auctions can be found. The choice of an appropriate mechanism, i.e. a mechanism that fits the market situation, is crucial as the following shows.

An electronic blackboard is a database that can be accessed through the Internet. Shippers can use it to post their orders. Carriers search it and, if an appropriate order is found, the corresponding shipper is contacted via phone, fax or email. One-to-one negotiations follow and finally a carrier is awarded the freight contract. This procedure can also be vice versa: carriers post their free capacity, shippers search the blackboard and negotiations follow.

In an auction for transportation capacity one carrier auctions off free transportation capacity between several shippers, and the highest bidding shipper wins. In a reverse auction there is one shipper who auctions off a job or contract between several carriers and the carrier with the lowest bid wins.

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7 Closely related is how specifyable an order is. The easier an order can be specified, the more it is suited for electronic trade (cp. Polzin (1998), Merz (2002)).

8 Electronic blackboards can also contain take-it-or-leave-it-orders, orders supplemented with a non-negotiable price. In traditional transportation business, these offers are commonly used by shippers for consigning commodities since here bargaining costs usually outweigh bargaining savings.
In a double auction for transportation capacity, carriers specify their vehicles and offer the corresponding capacities on routes of their choice for a certain price whereas shippers post orders together with a maximum price. Compatibility of requirements presumed, the highest bidding shipper is matched with the lowest bidding carrier and a price is calculated.

So the initiative for trade can be taken by

1. shippers: a shipper offers a transportation order and one or more carriers submit bids for this order. The shipper selects one of the bids and makes a contract with the respective carrier.

2. carriers: a carrier offers available transportation capacity and one or more shippers submit bids for its usage. The carrier selects one of the bids and makes a contract with the respective shipper.

3. both shippers and carriers simultaneously. Both parties simultaneously submit buy and sell offers for transportation capacity. Supply and demand are matched by a mediator.

Mechanisms (1) and (2) seem to be equivalent but in fact are not because in each case the party confronted with the price pressure is different. Mechanism (1) favours shippers whereas (2) puts carriers in a more comfortable position since in (1), carriers have to compete for the lowest price, while it is the shippers’ turn in (2). Both mechanisms are implemented by means of auctions or blackboards.

Mechanism (3) represents an exchange-like mechanism similar to that of stock or electricity markets. But when comparing these markets to freight markets, it becomes quickly clear that freight markets are of a peculiar nature. To fulfill a transportation order, a vehicle must be moved to a loading point, to one or more corresponding unloading points afterwards and finally back to its home base or to the loading point of the following trip. Consequently, the specific routes, vehicle requirements and time restrictions must be accounted for. Hence transportation capacity cannot easily be turned into a commodity like 'capacity per mile for a certain period'. Nevertheless attempts were made to establish Internet-based transportation marketplaces using exchange-like mechanisms.9 These marketplaces tried to tackle variety by restricting themselves to standard loads like palletized freight or container freight.

In today’s freight markets, mechanism (1) is predominant, a fact reflecting the existing oversupply of transportation capacity. Price pressure rests on the shoulders of the carriers. This is why usually shippers initiate trade, regardless if blackboards or auction mechanisms are deployed. Transportation auctions are almost always conducted as reverse auctions. This has had influenced the use of language. The term freight auctions is generally used for reverse auctions. This use of language is adapted for the remainder of this contribution. Unless stated differently, freight auctions stand for shipper-initiated auctions and therefore represent reverse auctions.

9These were Eulox, and, according to Schneider et al. (2000), Back-Pack.
Figure 1 depicts market mechanisms and their appropriateness for different market situations. Face to face negotiations cover highly complex goods. Catalogues are suited for products of low and medium complexity and a low trading volume. Auctions can do with (and need) a 'medium' trading volume and can handle products of preferably low complexity. Double auctions help to deal with (and need) high trading volume but are restricted to true commodities. Translated to transportation business: the use of double auctions is restricted to standard complete loads on highly frequented routes.

As stated at the beginning, a marketplace is a location where demand meets supply, where information is provided and where trade may happen. Trade means allocation of the good(s) and determination of the price. Both allocation and price determination create effort. From the viewpoint of market participants, not all mechanisms are equally 'convenient' since this effort is different for different market mechanisms. Figure 2 captures this idea for a many-to-many market. The horizontal axis depicts different market mechanisms, the vertical axis stands for allocation and price determination effort in a many-to-many market. The area above the bend line symbolizes the effort market participants have while the area underneath represents the effort reduction due to the mechanism. Interleaved one-to-one negotiations do not relieve the market participants from any of the burden, in contrast to double auctions, which reduce effort maximally. Catalogues and auctions lie somewhere in between.

Related to the 'convenience' of market mechanism is the extent the marketplace host can support business transactions – in other words: whether a marketplace is a mere point of aggregated information, which requires an additional communication medium to initiate and finish trade,
or whether it is also the point of trade and transactions. The market mechanism deployed is the
decisive aspect here. Business transactions run through three stages: the information stage, the
agreement stage, and the stage of settlement (cp. e.g. Schmid (1993)). Market participants
gather information concerning services, products or partners and specify supply and demand in the
information stage. An agreement stage follows where negotiations take place and, if successful, a binding contract is made. Contract execution makes up the last stage called settlement stage and in transportation markets this stage includes for example assessment of transport operation or payment handling. Online transactions demand that all stages be processed online. The agreement stage is the crucial one. Since online contracting presupposes online pricing, the market mechanism plays the decisive role in the agreement stage. It determines allocation of items and relieves market participants from some of the burden of price negotiation. Some of the negotiation effort will always remain, but how much depends on the actual mechanism. The less market participants have to negotiate themselves, the easier online contracting can be supported. So the task is to choose and implement the market mechanism that fits the market and reduces negotiation effort to a minimum. Consequently, two types of Internet-based transportation markets can be identified: those that do not provide online transactions and those that do. The issue of online transactions is closely related to the issue of the market mechanism deployed. In online auctions and double auctions, the first two stages are automatically processed online. On the other hand this is not necessarily the case in blackboards or catalogues.

How will the marketplace host generate profit, i.e., which kinds of fee will he charge, and whom? A great variety of different fees exists, including everything from no fees at all to transaction-based fees and basic fees. Principally, both shippers and carriers could be charged. But as the market mechanism mirrors the distribution of market power, so does the fee model: as a rule the weaker side of the market is charged, i.e. the carriers. This resembles procurement markets (cp. Segev et al. (1999)). Closely related to the fee model is the critical mass of a

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10 This stage model was later refined Schmid (1998), Schmid (2000), but for the present purpose, the presented model will do.
11 'Generations' may be the better expression.
marketplace – the number of traders necessary for the marketplace to survive. Bretzke (2001) roughly estimates that the critical mass for a marketplace mediating national freight orders in Germany is about 3,000 transportation orders per day. But such estimations must be treated with caution since the critical mass heavily depends on the business model and on the fee model in particular (cp. ?). Consequently, there is no one critical mass that fits all marketplaces.

The fact that cooperation between shippers and between carriers can bring down transportation costs significantly is known in both the academic and the practical world (cp. e.g Büllingen (1994)). Hence facilitation of cooperation seems to be an interesting but yet new criterion for classifying transportation marketplaces. Marketplaces might support and facilitate cooperation but generally do not.

3 A Critical Analysis

The peculiarities of the traditional transportation business must be taken into account when designing Internet-based transportation marketplaces. On the other hand, the possibilities offered by such marketplaces influence traditional transportation business back. Consequently, Internet-based transportation marketplaces have to be continuously adapted and improved. This all contributes to a very dynamic environment so much so that the following case study represents a snapshot of the perpetually changing landscape of Internet-based transportation marketplaces. Teleroute, Benelog and Eulox demonstrate how diverse Internet-based transportation marketplaces can be, which is why these three have been chosen for the following study. But since the case study does not only describe the status quo but also critically questions the approaches taken, it gets across principal ideas in the design of such marketplaces.

3.1 The blackboard Teleroute

3.1.1 Characteristics

Participants Teleroute is a horizontal marketplace founded in France in 1986. It is run by the publishing company Wolters-Kluwer, which represents a neutral third party. Only carriers and forwarding agents have admission to the blackboard, shippers are not allowed. Teleroute has managed to build up a customer base of 35,000 registered customers and with it the necessary trading volume.

Traded Goods Teleroute mediates regional, national and international freight orders in Europe. All kinds of loads are permitted: partial as well as full loads and standard as well as special loads Teleroute (2001). Each day some 40,000 transportation orders are mediated by Teleroute, the lion share in France and 8,000 odd orders in Germany. Short and long-term orders are to be found.
**Trade** Teleroute deploys a blackboard on which mainly forwarding agents initiate trade by posting orders. Carriers are charged a monthly basic fee combined with a fee for downloading order packages or read accesses to the database.

3.1.2 Analysis

Judging by Teleroute's trading volume, which is by far the largest of all European Internet-based transportation markets, the race to become the European Internet-based transportation market seems to be run since trading volume is a key factor for success in a network economy. But Teleroute carries a historical burden that its competitors may capitalize on: shippers have no admission to Teleroute's marketplace, a trait to preserve the traditional ecosystem of forwarding agents and carriers. Traditionally, shippers engage preferably forwarding agents for their transportation orders. Carriers hardly have access to shippers and get their orders subcontracted through forwarding agents. Consequently, carriers strongly depend on their forwarding agents. This is reflected in Teleroute's mediation model: transportation orders are not offered by shippers but by forwarding agents. Carriers must contact these forwarding agents to get load and so the traditional dependency is maintained. However, the general situation might change by means of Internet-based freight markets that offer online bidding. For shippers, placing a transportation order via electronic auctions or exchanges means no extra effort. On the contrary, it presents them with a possibility to save money. Due to an increased competition among carriers and a decreased number of mediation stages (desintermediation), prices are likely to decline so that electronic freight markets are quite attractive for shippers, and there is a good chance that they will use them. Following a KPMG study Bretzke et al. (2001), 94% of all interviewed shippers plan to place freight orders via electronic freight markets within the next three years. Since shippers generate transportation orders and not forwarding agents do, the number of orders placed by forwarding agents is likely to decline. Hence keeping away shippers from its marketplace might turn out to be disadvantageous for Teleroute.

Two more issues may be harmful for Teleroute: the fee model and insufficient actuality of freight data. How much a carrier must pay for a downloaded order should depend on whether he gets the order and what the order is worth. But this information is not available for Teleroute. Consequently, Teleroute can make its fee depend neither on the success of a mediation nor on transaction value. For carriers this is no good situation. A monthly basic fee means an expense with uncertain return and lock-in. Additionally, orders that have already been placed may still be on offer in the database because freight forwarders themselves have to remove them manually – after all, Teleroute does not know if transactions occurred and, consequently, cannot do this. Hence data quality highly depends on freight forwarders' reliability. The fact that Teleroute has to empty its database every midnight shows that this reliability is not developed too well. From a carrier's perspective paying for a package of freight orders in advance is as if buying a pig in a poke. To pay for ten potential orders and then discover that three offers are antiquated

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12 For a thorough treatment of network economies, trading volume and lock-in effects see Shapiro & Varian (1999).
is rather annoying – even more since also time and money have to be invested to contact the respective forwarding agents via phone or fax. KPMG’s study Bretzke et al. (2001) indicates that fees based on transaction volumes seem to be preferred by the majority in the logistics sector. In case this can be generalized, there are probably many of Teleroute’s customers who have an incentive for switching to a competing freight market.

The described difficulties both have the same root: lacking online transactions. Online transactions demand that all transaction stages (information, agreement, settlement) be processed online. Teleroute lacks online transactions because the agreement stage is not supported: no binding agreement can be reached on Teleroute’s platform. Teleroute could overcome these problems through take-it-or-leave-it offers that carriers can accept via mouseclick. For Teleroute, they would have two advantages. The first is accelerated formation of prices. The second is that these offers do not upset Teleroute’s existing customers – in contrast to auctions, which regularly are suspected to spread more transparency than wanted (by Teleroute’s customers).

However, the ostensible virtue of take-it-or-leave-it offers in Internet-based freight markets seems to be a half-way thought. No matter if online freight auctions are conducted or take-it-or-leave-it-orders are deployed – a shipper’s or forwarding agent’s effort is the same in both: he must specify an order and set a price. In an auction this price is the reservation price, a maximal price which bids must not exceed. The auction itself follows clearly defined rules and does not require its initiator to supervise it. Thus using an auction instead of take-it-or-leave-it-prices can lead to savings for a shipper but not to additional costs or efforts.

3.2 The auction house Benelog

3.2.1 Characteristics

Participants Benelog is a horizontal marketplace founded by former consultants. Benelog started its business in March 2000 and up until Mai 2001, Benelog has been able to register 2,200 companies as customers. The marketplace is open to shippers, carriers and forwarding agents.

Traded Goods Benelog mediates single transportation orders, order packages and freight contracts for all kinds of truck loads in Europe. The majority of the contracts is short-term, but some long-term contracts are also mediated (binding freight contracts) and tenders without binding details of quantity. Each day about 100 orders are placed, so the critical mass has surely not been reached yet.

Trade Reverse auctions play the dominant role for Benelog Benelog (2001a). The outcome of auctions is considered as binding contract. A carrier winning an auction is charged a fixed fee for single national trips and single international trips. For binding freight contracts and auction

\[13\] In the U.S., agreements concluded online represent legally valid contracts. In Europe, corresponding laws have yet to be enacted.
tenders without binding details of quantity, the winning carrier pays a certain percentage of the transaction volume as commission. Since no other fees are charged, all fees are transaction-based and to be paid by carriers.

Registered shippers can choose between reverse English auctions (called best-bid auctions) and price-quality auctions. In a (reverse) English freight auction carriers must underbid each other with openly submitted bids. Carriers can respond to a bid by submitting a lower bid. Ultimately, the lowest bid wins and the winning carrier is paid the price of his bid. On the other hand, carriers do not have to underbid each other in price-quality auctions. In fact, their bids do not even have to be lower than the shipper’s reservation price. The shipper can take quality aspects into account and select the mostly preferred bid.

Each Benelog auction has a predetermined duration of 30 minutes. If bids are received shortly before the auction ends, it is prolonged by three minutes. If again bids are received shortly before the prolonged auction is over, it is prolonged by another three minutes. This goes on until at most 60 minutes, the longest possible duration of Benelog’s auctions. But the end of an auction does not depend solely on the incoming bids. As a specialty of Benelog’s auctions, the initiating shipper is

‘... free to choose the end of an auction: he can let the process run automatically ("Best Bid") or intervene at any time and award the contract to a carrier.’ Benelog (2001b)

Shippers may also define lists of carriers that may participate in the auction process and lists of carriers that must not. If an admissible carrier wants to enter an auction, he has to name the vehicle with which to fulfill the order in case of winning and to submit an initial bid until at latest five minutes before the auction starts. His identity is not disclosed to anyone involved in the auction at this point.

Carriers can participate in several auctions at the same time (‘parallel auctions’) and are allowed to name the same vehicle, say ‘X’, in several parallel auctions. If an auction is won for X, all bids in parallel auctions for which X had also been named are removed.

After the auction, all formerly anonymized data is made known to both shipper and winning carrier. To exclude any transmission errors, the carrier has to confirm receipt of the freight data. After the transportation job has been finished, carrier and shipper have to assess each other with respect to punctuality, completeness, correctness of details etc. Carriers may also assess shippers’ paying habits. For each shipper and carrier, all available assessments are aggregated to a ranking, which is intended to make quality differences transparent. Putting this together: information stage, agreement stage and settlement stage are processed online so that all transactions are online.
3.2.2 Analysis

Commercial auction websites like eBay have had a roaring success and it seemed to be a self-evident step to transfer the auction mechanisms used to other Internet-based markets as well. But the success of standard auctions for selling single consumer goods does not automatically qualify them for other markets as well. For instance, many of Benelog's auctions are conducted simultaneously, so for carriers it is vital to bid in several parallel auctions with one and the same vehicle. Hence it makes sense that they are allowed to at Benelog's marketplace. Unfortunately, a problem occurs: if a carrier is awarded an order in one of the parallel auctions, his bids for this vehicle are removed from all of the remaining parallel auctions. This service makes sense while the orders in question exclude each other due to time or capacity restrictions, but it is annoying if this was not the case. The only possible work-around for carriers is to use different names for one and the same vehicle when bidding in parallel auctions for orders that do not exclude each other.

'Initially, Internet technology was used to try to build marketplaces that conformed to the simple model of a public auction. But real markets are much messier.'

Varian (Dec 12th, 2000)

Benelog’s decision to introduce price-quality auctions was probably devoted to the insight that transportation markets are far from being perfect. But the design of price-quality auctions is a delicate business (cp. ?). In conventional auctions the bidding process is guided by one parameter: price. The lower the price, the better the bid. In a price-quality auction, at least two parameters determine which bid is best: price and quality. Attractive as Benelog’s price-quality auctions may sound, they have a cumbersome feature, especially if many carriers participate — an unguided bidding process.

Suppose that carriers with different ranks participate in an auction. For the worst ranked carrier, the situation is clear. He must submit the lowest bid because with equal prices a shipper will always choose the better quality/ranking. But here clarity ends for him. Comparing to other bids, how much lower must he bid at least? He does not know. Analogously, the carrier with the highest rank may submit the highest bid, but he faces the same problem: how much higher at most? The situation is even worse for all carriers ranked between the best and the worst among participating rankings: they do not know at all in which price regions to bid. The underlying problem is that the carriers are given no information about how the shipper assesses trade-offs between bidden prices and existing ranks. Strictly speaking, the only way to overcome this problem is to give carriers this information after each bid — which requires the shipper’s supervision or a utility function that reflects his preferences and is made known to all carriers. Both means disproportional effort in transportation spot markets. Hence it makes no sense to conduct time-based price-quality-auctions in a spot market since bidders do not know which bid leads and how to improve it. Round-based price-quality auctions may represent a better approach, among them, one-shot probably the best.
Business expertise, flair and some experimentation are also needed to design conventional price-driven auctions. Benelog offers shippers a high degree of flexibility in auction design, higher than it seems at first glance. In fact, not only English auctions and price-quality auctions can be conducted: since carriers have to submit initial bids to qualify for an auction, a shipper is able to create a (reverse) first-price sealed-bid auction. In such an auction, every carrier submits one bid only, the lowest bid wins and the winning carrier is paid the price of his bid.

A shipper can create a first-price sealed-bid auction in two ways. A first way is to simply set the auction time for an English auction to nearly zero, e.g. a second. In this case carriers do not have the time to submit a bid after the initial bids have been made. The carrier who submitted the best initial bid wins the auction. The second way is not to limit the duration of the auction process but to conduct a normal English auction and let it end prematurely right after initial bids have been made. Does this make a difference? The answer is yes. In the first auction, carriers know that they only have one shot, whereas in the second, they do not know. Hence the shippers' right to end the auction at any time induces risk for carriers. When giving shippers this right it was probably intended to make carriers bid more aggressively and to accelerate the bidding process. There is no empirical data by which one could judge whether the aim of enhanced aggressiveness has been met. But the idea of premature end has two weaknesses.

- First, shippers lose an important benefit of freight auctions: to get a better price than by posting a take-it-or-leave-it-offer without additional effort. In case a shipper wants to end an auction prematurely, he must of course supervise it – which costs this benefit. As a consequence shippers should not be expected to make use of this possibility. This expectation has been confirmed in an interview: The large majority of freight auctions is not ended prematurely. Consequently, the threat of a premature end is rather theoretical and represents no incentive for carriers to bid more aggressively.

- The second weakness is that this approach is more indirect than it would have to be. If a quick auction procedure is wanted, why not simply reduce the auction time or introduce bidding rounds?

Benelog's auctions are sometimes criticized for taking too much time. As Meier Meier (2001) stated, a carrier will not have the time to bid 45 minutes for a single spot order if he has to acquire cargo for some dozens of vehicles.\footnote{Compare also Schneider et al. (2000)} Auctions with one or two bidding rounds could turn out as be a better solution again: they are fast and will not suffer from unwanted phenomenons like 'bid sniping'. Sniping is the name for a frequently observable behaviour in Internet auctions with a predetermined ending time: only few bids are submitted in the course of an auction, but shortly before it ends, bidders 'jump in' and try to make the last bid. This behaviour appears regularly in eBay (2001) auctions which have fixed deadlines. Even sophisticated sniping programmes esnipe (2001) exist which allow to automate this behaviour. According to Roth & Ockenfels (forthcoming) bidders will usually bid less than their true reservation price in auctions with sniping. Consequently the initiator of such an auction is worse off than in an auction without sniping. Since there are at most ten bidding prolongations for
Benelog's auctions, they are not immune against sniping – at least theoretically. Practically, sniping has not turned out as a problem for Benelog, but one should keep it in mind if dealing with auctions that have a predetermined ending time.

On the other hand, it must be taken into consideration that transportation business is highly dynamic and that carriers might easily miss shorter or round-based auctions due to an urgent unforeseeable event. Setting the duration of electronic freight auctions is a tricky task. As already emphasized: it takes business expertise, flair and some experimentation to find a good compromise.

3.3 The exchange Eulox

3.3.1 Characteristics

Participants Eulox went online at the beginning of 2001 and claims to be a virtual forwarding agent, so that Eulox is not neutral but a seller of transportation capacity. Shippers, carriers and forwarding agents have access to the horizontal marketplace. The number of registered users is not made publicly known and neither is the number of transportation orders mediated per day.

Traded Goods Eulox focus exclusively standard full loads between or in the regions Rhine/Ruhr, Paris/North France and East AustriaEulox (2001c). Additionally, swap and return of equipment – pallets and skeleton boxes – are offered. However, it is safe to suppose Eulox not to have reached its critical mass yet.

Trade For each successfully mediated order a fixed fee is charged. This fee is paid in equal shares by the shipper and the carrier who have been matched. Eulox' market mechanism is extraordinary with regard to two aspects. First, a true exchange mechanism (a double auction) is deployed, which alone is somewhat revolutionary in transportation markets. Second, this exchange mechanism is a modified double Vickrey auction. A closer look shows that this is striking.

A common Vickrey auction is a second-price sealed-bid auction. It works exactly like a first-price sealed-bid auction except for the price the winning bidder has to pay: instead of his own (the highest) bid, he only pays the price of the second highest bid. In a reverse Vickrey auction, the carrier with the lowest bid wins the order and is paid the price of the second lowest bid.

In a double auction both sellers and buyers submit bids. Since, generally, the buyers' second highest bid will differ from the sellers' second lowest bid, the extension of a Vickrey auction to a double auction raises the issue of how the final price should be calculated. The price could be the second highest bid submitted by the sellers, the second lowest bid submitted by the buyers or some number in between. The fee for mediation must also be included.

Consider a specific route. As described in Section 2.3, registered carriers specify their vehicles, offer the respective capacities for this route and set a reservation price. A carrier's reservation price represents the minimum payment he wants to receive for an order. On the other hand, registered shippers offer loads for consignment. They too set reservation prices,
each representing the maximum price a shipper is willing to pay for getting his load transported. As a specialty of Eulox, bidders do not stipulate just one reservation price but a whole range of reservation prices Eulox (2001b). After a carrier has submitted a bid, the maximum of his range is taken as reservation price. As time goes by, this is gradually being lowered until the minimum of the range is reached. For shippers, analogously, the minimum is taken at the beginning and gradually being increased until the maximum is reached. For ease of exposition and since at any time the reservation price of a chosen bidder is unique it is henceforth spoken simply of the reservation price.\(^\text{15}\) Provided that the second highest shipper bid exceeds the lowest carrier bid by at least Eulox' fee, Eulox matches the lowest bidding carrier with the highest bidding shipper. The price the shipper has to pay and the payment the carrier gets do not depend on their own reservation prices. Instead, they are based on the mean value of the second highest shipper bid and the second lowest carrier bid as follows. Suppose that the two lowest carrier bids are 1,000 Euro and 1,100 Euro and that the two highest shipper bids are 1,250 Euro and 1,200 Euro. Presently, the Eulox fee for a successful mediation is 38 Euro so that involved shipper and carrier have to pay 19 Euro each. Then the shipper bidding 1,250 Euro is matched with the carrier demanding 1,000 Euro. The shipper pays \((1,200 + 1,100)/2 + 19 = 1,169\) Euro and the carrier gets \((1,200 + 1,100)/2 - 19 = 1,131\) Euro.

If a matching occurs, the involved carrier is informed that a transportation order is available. He then has five minutes in which he has the exclusive right to decide whether he accepts or rejects the order. In contrast to the carrier, the involved shipper is bound to his offer. Carriers are guaranteed to receive the freight rates within the agreed on time. On the other hand, Shippers are guaranteed to get their load transported.

3.3.2 Analysis

Eulox' matchings represent options to carriers but commitments to shippers. These issues present interesting asymmetries in the exchange mechanism and seem to be necessary adoptions to the requirements of transportation business.

According to Eulox, their mechanism leads to prices that are

'better for the shipper and haulier than those in a normal auction' Eulox (2001b)

and establishes a 'fair-price-system' Eulox (2001b). This provokes questions how prices that are better for both sides can constitute, what fair prices may be and whether these slogans are merely marketing slogans.

The statement that prices are 'better for both sides' must clearly be rejected. Since Eulox explicitly refers to 'normal auctions'\(^\text{16}\) in contrast to their double auction the proclaimed 'better prices' must result from the specific type of auction Eulox deploys. But it is clearly impossible

\(^{15}\)The analysis to come also holds when taking into account the dynamic adjustment of reservation prices.

\(^{16}\)Actually, there are so many different auction types and forms that it is hard to tell what makes up a 'normal' auction.
that both shippers and carriers get better prices simultaneously as they face a constant-sum-game in which Eulox’ fee is the constant. To make this point clear: A shipper pays what his carrier gets plus 38 Euro for Eulox. Since Eulox’ fee is the same for all transactions ~ 38 Euro ~, a better price for the shipper means a worse price for the carrier and vice versa. So there is no way making both parties better off simultaneously by simply changing the auction type. Better prices for both sellers and buyers at the same time are possible only if the number of intermediation stages decreases (disintermediation) or if transaction costs sink. This may well be the case with Eulox – but also with other Internet-based freight markets using ‘normal’ auctions, for instance Benelog. Moreover, it is by no means clear which side in fact benefits from Eulox’ exchange mechanism since in a common (one-sided) reverse Vickrey auction the expected final prices do not have to be higher than in a reverse first-price auction. This conclusion may look quite intuitive because the winning carrier is paid more than he has demanded, but it is also wrong since a change of auction rules results in a change of bidding behaviour. Depending on the situation, the expected prices can be higher or lower than in a first-price auction. A double Vickrey auction seems to be far more complicated.

Now for fairness. Vickreys auction induce truthtelling, i.e.: in a common reverse Vickrey auction it is a dominant strategy for every carrier to bid exactly his true costs. As a consequence, Vickrey auctions are efficient – the carrier with the lowest costs wins a reverse Vickrey auction and in this sense the resulting price can be regarded as fair. Indeed this seems to be what Eulox refers to. However, some objections against this argument have to be made. First, it is by no means safe to transfer results from one sided auctions to exchanges. Second, a major problem concerning Vickrey’s upshot is that it is based on special prerequisites that do not hold in general (cp. Wolfstetter (1999)). Without these prerequisites, the transportation domain is an El Dorado for counterexamples (cp. e.g. Sandholm (1999)). Third, Eulox’ bidders do not set just one reservation price but reservation price ranges. Even if interpreting the adaption of reservation prices as time based discounting, it remains questionable if the price ranges are compatible with the fairness concept described above – why should a whole continuity of prices be fair?

Putting this together, there seems to be no reason why Eulox’ mechanism should lead to fair prices in any sense.

But Eulox’ mechanism is also problematic for some other reasons. Suppose that two carriers, C1 and C2, demand 1,010 Euro and 1,015 Euro, respectively, whereas two shippers, S1 and S2, offer 1,100 Euro and 990 Euro, respectively. Principally, a trade between S1 and C1 is possible for some price between 1,010 Euro and 1100 Euro. But since S2 bids less than C1 demands, no trade will be made.

This example shows that Eulox’ mechanism does not necessarily exploit the whole potential for trading, in other words: their mechanism is not pareto-efficient. Generally, this inefficiency

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17 An in-depth exploration of this issue is beyond the scope of this paper. The reader is referred to Milgrom & Weber (1982) and Wolfstetter (1999), chapter 8.
will occur whenever \( p_{S1} > p_{C1} + f > p_{S2} \), where \( f \) is Eulox' fee, and \( p_{S1}, p_{S2} \) and \( p_{C2} \) are the bids of \( S1, S2 \) and \( C2 \), respectively. So the problem is that the second highest shipper bids less must be higher than the highest carrier bid (plus the fee). Inefficiency comes also up if carriers face only one shipper or vice versa. Strictly speaking, no trade is possible since no price can be calculated. But Eulox evades this problem by simply putting in the single bid into the formula for price calculation.

Is the insight of the above example of any relevance to Eulox? Indeed, it is. Efficiency is more than just nice-to-have. Efficiency is critical. If not all possible trades are made, income is forgone, and consequently, Eulox' critical mass of trading volume shifts upwards. Furthermore, Eulox' fee is higher than it would have to be to generate the aimed margin. If creation of trading volume becomes a matter of price, Eulox cannot cut its fee back as much as would be possible with an efficient mechanism. It is questionable if the seeming (marketing) advantages of 'fair and better prices' justify forgoing income in a highly competitive network economy without starting from the pole position.

### 3.4 Summary

Table 3.4 contains the essential characteristics of Teleroute, Benelog and Eulox.

<table>
<thead>
<tr>
<th>PARTICIPANTS</th>
<th>TELEROUTE</th>
<th>BENELOG</th>
<th>EULOX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host Admission Structure</td>
<td>neutral public; restricted many-to-many horizontal</td>
<td>neutral open many-to-many horizontal</td>
<td>seller-sided open many-to-many horizontal</td>
</tr>
<tr>
<td>TRADE GOODS</td>
<td>Mode</td>
<td>Terms</td>
<td>Region Requirements</td>
</tr>
<tr>
<td></td>
<td>road haulage short (&amp; long) Europe standard non-standard; complete partial</td>
<td>road haulage short (&amp; long) Europe standard &amp; non-standard; complete partial</td>
<td>road haulage short German/French/American standard complete</td>
</tr>
<tr>
<td>TRADE</td>
<td>Mechanism Initiative</td>
<td>Transaction Fee</td>
<td>Cooperation</td>
</tr>
</tbody>
</table>

Tab. 1: Teleroute, Benelog, and Eulox. A similar classification scheme can be found in Schneider et al. (2002).

The main value Teleroute offers is information on the market, which shippers and carriers are provided with and which leads to increased transparency and efficiency. However still one-to-one negotiations, interleaved and interdependent, are necessary for price formation and allocation, which is costly in terms of both time and money.

On the other hand, Internet-based transportation markets of the second generation also increase transparency by providing market information and also enable shippers and carriers to enter into contracts for transportation jobs online so that the communication medium needs not
to be changed. Hence market transparency and efficiency are further increased through one-to-
many and many-to-many negotiations that are standardized by means of clear and public rules. Since no faxes or phone calls are necessary, transaction costs are brought down. For both carriers and shippers all this is valuable. Carriers benefit from a reduction of negotiation efforts and a clear and publicly known placement procedure. They also get information on their competitors and can assess their own market position. Shippers profit from a reduced negotiation effort combined with better prices since competition among carriers increases. Consequently, Teleroute has its work cut out for the near future. To take into account future trends, threats and possibilities, Teleroute has to change its marketplace significantly: shippers have to be included, an appropriate market mechanism has to be introduced and the fee model has to be adapted.

The criticism of Benelog relates to rather minor issues in the design of Benelog's auctions. Benelog's marketplace itself seems to be fit for the future: all fees are transaction-based - as the majority in the logistics sector seems to prefer according to KPMG Bretzke et al. (2001) - online transactions are possible, shippers have admission to the marketplace and the scope of traded freight is wide enough to build up enough trading volume to reach the critical mass. This is the main goal for Benelog to achieve in near future.

While fees are transaction-based and shippers have admission to Eulox' marketplace, the crux lies in the market mechanism. It limits the scope of mediated freight to standard full loads on highly frequented routes. It does not extract the whole potential for trading and by this shifts the critical mass upwards. It does not mirror the distribution of demand and supply of transportation capacity. In transportation business, an exchange is perceived as even more exotic than auctions, which for long have faced and still face acceptance problems among carriers. This all makes it harder than necessary for Eulox to reach its critical mass. ¹⁸

4 Conclusion

A considerable number of different electronic transportation marketplaces exist today. Three major categories define how they work: the participants, the traded goods and trade itself. The way that trade is organized - the market mechanism - plays particularly an important role. The market mechanism has implications for smooth transactions and for fees charged. On the other hand, it has to measure up to the market structure and the goods traded. Teleroute, Benelog and Eulox perfectly demonstrate that Internet-based transportation marketplaces are not interchangeable clones. The three marketplaces also symbolize how the landscape of Internet-based transportation marketplaces perpetually changes. While Teleroute's market model mirrors the traditional ecosystem of carriers, forwarding agents and shippers, Benelog and Eulox try to utilise actual possibilities and to anticipate future developments. Teleroute's market model has met the past needs but gets increasingly outdated. Eulox developed a visionary market model - unfortunately, this model does not measure up to the structure of transportation markets and the distribution of market power. For the moment, Benelog has found an appropriate compromise

¹⁸ These findings have been proved by the latest news that Eulox would soon go out of business Mylogistics.net (2001).
between future trends and actual necessities.

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