formulation. The software agents can now afford to be "dumb": they need only know the auction rules and submit a bid. In the Vickrey auction, truthtelling is the dominant strategy, and hence optimal bid formulation is extremely simple. For many other auction types, optimal bidding strategies are only slightly more complex. This approach removes the "cleverness" from the software agents and puts it in the market mechanisms instead. In addition, an auction also solves the ontology problem (the item is successfully described at the outset and cannot change during the course of the auction). Table 1 shows the rules, outcomes, and optimal bidder strategies for some major auction formats. For more rigorous discussion, see (Milgrom 1982 and Vickrey 1961). Each type of auction has special advantages and is suited for special needs. It is important

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to handle these mechanisms flexible and provide easy adaptability. This is achieved through abstract coupling of the e-broker class with the auction class in the framework. So, depending on the special kind of auction, the application changes its behavior. A sealed auction object has a publicly announced deadline, and will make no information about the current bids available to any future bidders until the auction is over. An open auction object will make information about current bids available to any future bidders.

### CONCLUDING REMARKS

The OFFER prototype is a very good testbed for components in an electronic commerce framework. Currently we focus on electronic contracting and non-repudiation of commercial transactions. We investigate the services of an electronic notary in OFFER and experiment with new software component models. OFFER is developed at the Fisher Center for Management and Information Technology at U. C. Berkeley. Information around the project can be found at: http://haas.berkeley.edu/~cmit/OFFER/



# JUST A MINUTE?

BY MARCUS DE FERRANTI, BAND-X, BRITAIN*

*"Companies recognise that transmission capacity will become a commodity – useful, scarce, and eventually as tradable as coffee or copper."*
*Quote from "The Death of Distance" published September 1997*

The development of a clearing house or exchange for telecoms bandwidth has been anticipated by industry experts for some years, yet few predicted its timing or exact nature. Band-X has made such a market a reality, and the number of participants is growing fast. What are the hurdles that had to be overcome, and how does it operate?

### WHY A MARKET IN BANDWIDTH?

An "over-the-counter" market in international bandwidth has existed for many years. In this informal market, carriers with excess capacity on a given route simply telephoned around their industry contacts and sought to strike a deal to dispose of spare capacity or conversely to arrange for the carriage of excess minutes. The chances of successfully finding a counterparty with a matching requirement depended primarily on who you knew. Given that the number of serious international market participants has historically been limited to about what could be comfortably be accommodated in a single rolodex, an over-the-counter market performed reasonably well, and indeed some level of capacity trading via personal contacts will undoubtedly remain a feature of the industry.

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What is changing, of course, is the number of telecom companies in the world, which has escalated at an exponential rate, into the thousands when you include resellers, refilers, callback operators, calling card operators, competitive access providers, ISRs, ISPs and all the other varieties of telecom fauna who make their living in the shadow of the facilities based carriers. The growth rate in the number of telecom market participants shows no signs of slowing. Knowing "everyone" in the industry is no longer possible, leading to the situation in which the buying and selling of bandwidth through informal contacts is time consuming and probably not terribly efficient in the sense of minimising unsold capacity and / or achieving the best prices.

### TRAFFIC GROWTH & DIVERSITY

The requirement for a central market is further fuelled by the rapid growth in the volume and increasing geographic diversity of traffic. The rapid growth in international voice and data is being driven by many factors, including falling prices, competition, new service offerings, global corporate networks, and latterly internet-related traffic. Over the long haul, the internet seems sure to be mother of all traffic stimulants. Absent regionalised caching, each time a thirteen year-old in Milan downloads the latest Metallica video, a wave of data packets roughly equivalent to volumes A-E of the Encyclopaedia Brittanica goes zipping half way around the globe. All those data packets flying back and forth may seem free to the user, but someone, somewhere, is paying. Many industry experts are predicting that, in global terms, data will overtake voice sometime between the year 2000 and 2005 (despite that fact that international voice traffic is itself growing at about 15% p.a.).

### EASE OF SWITCHING CARRIERS

Prior to the launch of Band-X, many industry participants questioned the technical feasibility of "auctioning" telecoms traffic. Without underplaying the real technical difficulties involved, the long term trend towards standard technical interfaces, increased switching functionality and physical clustering of interconnect points have all greatly aided the development of a market by increasing the ease with which customers and resellers can shift from one carrier's pipes to another's. There are a myriad of ways that this can be done. "Smart boxes" located at customers' premises provide addressable least cost routing, which can be updated at any time, greatly facilitating shifting traffic from one carrier to the next. An increasing proportion of larger bandwidth users have traffic concentration points (i.e. switching facilities) physically located in the same place as several carriers. For example, Telehouse in London's Docklands provides a point of presence to a large number of resellers and carriers; redirecting traffic from one carrier to another carrier. Even if this means establishing a new physical interconnect, is a relatively straightforward and quick job given the close physical proximity. Similar European premises are opening in Paris and Frankfurt, and a number of US nodes are well established.

### MARKET SUMMARY

Rapidly proliferating numbers of telcos, carrying rapidly growing and evolving traffic, with increased ability to switch traffic between different carriers' pipes all add up to the need for a central exchange for telecom capacity. Markets, in the sense of being centralised exchanges, serve two critical functions; (i) they allow sellers to find appropriate buyers, and vice versa, at minimal cost and effort (quite important if your product is specialised, as telecom capacity / traffic is); and (ii) they allow the general supply and demand situation to both inform and be informed by the setting of prices for individual trans-actions. Centralised markets ideally facilitate the dissemination of pricing information via a "big board" which displays clearing prices for all to see, however this is not a prerequisite for the efficient functioning of a market. For example, a fruit and vegetable market may not have a bid board showing prices, but given that comparitive prices can be obtained simply be walking from stall to stall, a consensus clearing price invariably emerges for a given product.

### BAND-X

Band-X is not the first company to have recognised the tradeability of telecoms minutes and capacity. However, over the past few years, the industry has focused on the software and engineering aspects of least cost routing (which relates the routing of traffic to the carrier offering the best rates), rather than on a centralised market in which the carrier offering the least cost route can in the first place be identified. Against this background, Band-X went live in July 1997, via an internet-borne bandwidth exchange at http://www.band-x.com.

From an electronic market perspective, Band-X is boringly simple. It is a market in the purest sense of the word and acts just as a buyer seller matching service. The buyers and sellers register with the exchange, and are then able to enter bids and offers of capacity or traffic between geographic locations, and to view existing bids or offers already in the system. Traffic minutes and bandwidth capacity are traded using similar but separate data entry forms and displays. Whenever a particular bid or offer is of interest to a market participant, they respond to Band-X. If a deal looks likely Band-X simply introduce the counterparties.

Assuming both the buyer and seller are happy with the identity of their counterparty, a potential trade proceeds. Band-X facilitates the negotiation of final terms, both commercial and technical but only charges commission for successful trades.

### THE BAND-X MARKET SO FAR

Over 1200 buyers and have so far registered with the exchange and new bids and offers appear at the rate of about 10 per week. Approximately one new match is made each day, of which less than half will result in consummated deals.

The participants cover the full range of buyers and sellers, including tier one carriers, large resellers, carriers' carriers, international private lines buyers, switchless resellers, and large and small corporate customers. Geographically, Band-X market participants are located approximately one third in the US, one third in Europe and one third throughout the rest of the world. Band-X's key priority to date has been to build the volume of bids and offers. The experience of other markets is that once a critical mass is reached, the process becomes self-fulfilling, as additional buyers and sellers are attracted to the market because its liquidity and wealth of counterparties.

### NOT YET A SPOT MARKET

It would be pretentious to call Band-X a spot market and it has some way to go before it can call itself an automated electronic trading exchange. The telecoms sector is full of defaulters and participants are quite rightly cautious about who they deal with. In practice, even once a deal is matched, its completion will regularly take several weeks while the counterparties haggle out final prices, agree contractual terms and conditions, set up interconnects, agree reciprocal deals and then finally send traffic.

But this process is bound to speed up. The take up of Band-X has been remarkable considering the amount of entrenched practice in telecoms, and new features appear on the exchange every month. But true spot trading will require the exchange to perform a clearing function which needs a real time switching capability and a counterparty risk undertaking. If Band-X goes this way, it becomes a telecom company in itself, and its independent advantage would be lost.

### QUALITY

Although Band-X's basic premise is that telecoms capacity is increasingly a commodity that can be traded, like with many other traded commodities, there are distinct quality requirements and grades of service. More established resellers are loath to jeopardise their good name by purchasing transmission of a quality beneath the level that their customers expect. Band-X overcomes this potential hurdle by allowing the buyers of capacity to post the technical quality parameters they require, particularly with respect to compression. Similarly, Band-X helps those carriers which target customers requiring higher quality connections by providing sufficiently detailed data entry forms, with quality information that then reappears in the "offer" screen that interested buyers see.

Testing is conducted as it would have been on any interconnect, whether or not brokered via the Band-X market. Those carriers which choose not to enter details of their posting are frequently assumed to be offering inferior quality to those who provide more detail. An undoubted strength of Band-X's concept is that is allows participants to continue their normal quality and purchasing practices without requiring a chance of any sort.

### DERIVATIVES TRADING

Most of the participants on LMX, CBOT or the other commodities exchanges would be deep trouble if, due to failure to close out a market position, they found themselves the proud owner of several thousand tonnes of December pork bellies. This illustrates the fact that most buying and selling on commodities exchanges occurs between parties who have not the slightest requirement for or intention of taking delivery of the underlying product. The commodity is simply something that goes up and down in price, with money made or lost each time it changes hands on the exchange, and with perhaps only the last buyer of the commodity being an industry player with a use for it.

Trading in telecoms capacity currently occurs between people who either have capacity, or have a need for it. With the commoditisation of telecom capacity leading to an active "spot market," the prospect of some form of derivatives market appears feasible, occurring between same mix of market participants that comprise other commodities markets (some parties with the commodity to sell, some with a need for the commodity, and a large number of speculators just buying and selling on risk).

The prerequisite for any speculative trading, and particularly derivative trading, is the existence of (i) standard trading units; and (ii) some form of credible underlying benchmark against which to price the derivative. The standard trading unit could take the form of a standard amount of capacity for the heaviest traffic routes for a standard period (for example: NY - London, 2mb block, commencing January 1 for a period of one month). This standard unit would be analogous to, for example, barrels of Brent crude; as with oil, other "grades" of telecoms (i.e. different routes, capacity blocks, compression rates) would be priced by reference to the benchmark unit. The credit risk element would also have to be stripped out to enhance the tradability of the standard unit.

Indices could comprise actual reported prices of trades, or some form of artificial index used as a benchmark. In October this year Band-X launched a set of indices, based on prices submitted by UK carriers. These have been used to create indices on the top twenty international routes from the UK as devised by Telegeography. A composite index, created by weighting each of the top twenty route indices according to their proportion of outgoing international traffic volumes provides an excellent indicator of underlying wholesale price movement. The indices are available to members of the exchange and raise the possibility of indexed linked selling.

Band-X will in due course publish historical traded price information, and provided the depth and liquidity of the market are

### REFERENCE

*Ackoff, R. L.*
*"Management Misinformation Systems",*
*Management Science (14:4),*
*December 1961, pp. 147-156*

sufficient, these could conceivably provide a reference for derivatives. Realistically, however, this is some way in the future.

Undoubtedly an active derivatives market, should it develop, would have a beneficial impact on the spot market. For the industry as a whole, the existence of an active derivatives market would provide a means of financial hedging against price risk, and a market established prediction of expected future pricing trends.

### SUMMARY: "ANYTHING FOR WHICH YOU CAN BID OR OFFER IS A COMMODITY!"

So said a forthright customer of Band-X recently. Although minutes are not of a homogenous quality, they are similar enough to be traded like a commodity, as much as varying qualities of iron ore are traded. Provided the parties to a trade both understand the quality issues involved, then establishing a price is achievable.

A greater obstacle than quality to commoditisation is that the change of ownership continues to happen over an extended period of time rather than being a change of ownership that occurs at a single moment. Curiously, commercial wrangling is more complex and time consuming than agreeing the increasingly straightforward technical interconnection.

The managed bandwidth trades executed by Band-X to date have been less complex to execute than the switched minutes trades. Payment is normally agreed for a year or longer and does not have the complication of call data and billing data records.

So whilst it is a commodity with similarities to many others, it is difficult to view a minute as just a minute, and it would be truer to say that a bit per second is just a bit per second. It is therefore likely that bandwidth trading will become generally accepted as a commodity faster than minutes. Importantly both are now possible on Band-X.

# PURCHASING ON THE NET – THE NEW OPPORTUNITIES FOR ELECTRONIC COMMERCE

BY DAVID ALDRIDGE, ICAT EUROPE, BOREHAMWOOD, UK*

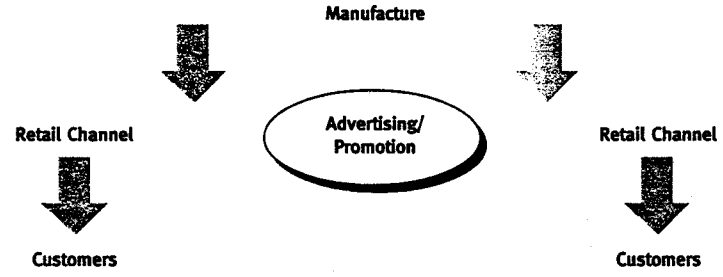
### ONLINE ECONOMICS: THE NEW VALUE CHAINS

While a growing number of retailers have successfully implemented electronic commerce solutions, the experience of these early adopters provides valuable insights into how new value chains are constructed. The electronic commerce model requires a very different approach to customer acquisition, promotion, merchandising, and distribution.

In the conventional retail model, the transaction chain uses established middlemen – retailers, dealers and agents – to handle service, support and fulfilment. Advertising campaigns and instore promotions are employed to create awareness of products and services, and support the activities of the middlemen. The traditional retail model is characterised by a differentiated product offer by a large number of manufacturers, to a mass market of consumers, via a range of intermediary retail channels.

Figure 1
Conventional retail economics

Source: IMRG




In the electronic commerce model, an individual consumer has the power to select one of many suppliers, based on value, price, perceived quality and other criteria.

A major difference is that manufacturers need to deliver both advertising messages, customer communication and products direct to the customer. The most important element in this new chain is the shift in level of control. The customer can manage the sales process to a much greater degree.

Figure 2
Electronic commerce economics

Source: IMRG