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European wireline: 2003 and beyond

It's a marathon, not a sprint

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- This is not a standard piece of broker research. It contains no explicit actionable stock ideas, and we are not changing our 6-month investment stance on the PTTs, which is OVERWEIGHT. Many of the topics we discuss are things, which either have not happened yet, or are only in their early stages of development. We merely seek to hold up some issues for scrutiny and contemplation. We think there are serious emerging challenges to the PTTs, originating from multiple angles. We do not presently believe that any one of them is enough to bring down a telco. However, we believe some of them may act synergistically to impose significant pressure on revenues and margins, and shatter the happy period of relative stability being enjoyed currently by the incumbents in Europe.

- Among the more controversial assertions we make in this document are:

  - Fixed/mobile substitution at the access level would offer a very poor margin trade off, especially if underlying mobile margins are as weak as we think.
  - Broadband is neither a growth driver, nor a defensive weapon. It is in fact an open door to voice price arbitrage opportunities for the consumer, some of which are already among us. SIP-based voice over broadband may usher in price destruction, or worse still, an era of free services.
  - The real threat from Wi-Fi is not to 3G, but to local access, residential broadband, and PSTN voice revenues. Wi-Fi community networks deserve to be taken seriously, and Wi-Fi as a public policy tool of government is another clear risk. Carriers risk dis-intermediation in such an environment.

Contents

Acknowledgements

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Introduction and investment summary

No changes to the short-term view, but lots of questions about the long term

As we made clear in sentence one on the front page, this is not a conventional piece of broker's research, in the sense that it contains no actionable investment ideas, and we are not changing any stock recommendations or our 6-month sector stance on the PTTs, which remains OVERWEIGHT. This report is an attempt to plot where the sector has been in the past couple of years and where it is now, to examine what the operators would like us to believe is a stable situation, and to identify and discuss some threats to the sector, some of which are visible and recurring, and some of which are emerging, with potentially unforeseen impacts.

Prior to giving a brief outline, we think it is important to stress a few points:

- In this document we concern ourselves predominately with the residential fixed line markets of the European incumbents, leaving aside for the time-being the different issues facing the business sector, carrier services, internet and the mobile subsidiary businesses, except where the latter two have relevance to what is happening in the residential fixed businesses, and the overall profit profile, of the integrated operators.
- We have not devoted any space to regulatory issues, though these are likely to be an area of intense activity over the coming years. We have intentionally limited ourselves to an examination of current consumer usage patterns, and how new technological issues may influence the revenue streams derived from them. We believe it is very difficult to estimate with any accuracy how consumer behaviour may be influenced by regulatory intervention in pricing or provision of services.
- Being native English speakers resident in the UK, there is an inevitable bias toward the UK market in some of our data sources. Perhaps this is fortunate, as the UK regulator publishes detailed market data on a quarterly basis, including user surveys. In continental Europe, only the Portuguese regulator ANACOM publishes anything of a similar nature on a quarterly basis. Therefore, we have relied on data from these two markets heavily, augmenting this where possible and appropriate with EU data, operator-supplied data and our own estimates.
- We have avoided, where possible, making hard quantitative predictions about the possible impacts of the developments we discuss here. No one likes looking stupid in print, and we believe the level of visibility is too poor, and the rates of technology change too great, for anyone to stand up and confidently state that telcos will lose x% of revenues by 20xx. We do think the numbers could be significant, however.
- This is not an attempt at a definitive piece on the European sector. We are really just hoping to set down some markers, some flags in the sand, around a few key issues, to which we will return regularly over the course of the next year, through more detailed updates on specific issues raised here.

Our main topics and conclusions

- **Fixed line usage per line per day is in gentle decline**, and while there are signs in certain markets of outright fixed/mobile substitution, we believe the **data is ambivalent on growth in average mobile usage**. Subscriber surveys suggest that there is a growing level of price arbitrage and data cannibalisation in both segments of the market. As such, we do not see fixed/mobile substitution occurring on a one-to-one, minute-per-minute basis.
- The **PTTs appear to be having some success in stabilizing pricing and market share** through pro-active pricing strategies built around bundled discount packages.
- **Fixed/mobile substitution, if it progresses into the access market to a significant level, would be disastrous for the incumbents**. We believe the underlying residential fixed line EBITDA margin is around 35% for PTTs (and the margin on residential calls is probably north of 45%). Conversely, we think the recent mandated cuts in termination rates in the UK reveal a relatively low underlying EBITDA margin for mobile operators. **The trade-off for the PTTs would not be an appealing one, in our view**.
- **Cable operators**, ridiculed and largely forgotten by many in the market, **have continued to take respectable shares of broadband net additions throughout their financial crises**, and are re-emerging with less debt and more operating focus. Though limited in scope relative to the PTTs, they do have some apparent inherent advantages in marketing new services, and on the whole have been more successful at driving penetration. They are still price leaders in broadband, and we think they could still pose a significant challenge to the PTTs, often in their most affluent demographic segments.
- **We expect more aggressive behaviour from ISPs, including forays into voice.** We are already seeing signs of disruptive pricing in the UK ADSL market, and we think a more competitive market place will force a greater emphasis on product differentiation. This opens up the possibility of a **Yahoo! BB** style attack on the PTTs in both broadband and voice.
- **The advent of broadband brings the added spectre of an accelerated erosion of traditional voice usage.** In the past few months we have seen the launch of two VoIP services based on session initiation protocol (SIP) technology, which requires broadband upstream speeds. Already these services offer the possibility of separating the geographic area code from the phone's actual physical location (allowing mobility and international pricing arbitrage), and in some cases, unlimited free calls. We think this is just the beginning of such services, which we believe may proliferate as broadband expands. In such a scenario, **broadband for the PTTs is neither a growth driver nor a defensive weapon, but an open door to price destruction**.
- **The growth of Wi-Fi may exacerbate such trends**. Contrary to much of the press/analyst coverage of the issue, we think that the real threat of Wi-Fi is not to 3G, but to local access, retail broadband marketing opportunities and voice revenues. Undoubtedly, commercial Wi-Fi deployments may create another price arbitrage opportunity (free/cheap VoIP via a voice optimised Wi-Fi enabled device, rather than cellular roaming fees). However, our detailed observation of the development of **free community Wi-Fi networks** in the UK and elsewhere, suggests that these groups **should be taken seriously**. We believe that informal, small local networks using shared broadband access (such as ADSL or SDSL) could seriously depress the potential uptake of residential broadband access, stimulate cancellation of PSTN access lines, and promote VoIP substitution. Additionally, recent forays into free Wi-Fi access by local governments in the US and Europe suggests that **there is a risk of politicisation of broadband for the purposes of economic or social development**, thus putting incumbent operators at risk of dis-intermediation.

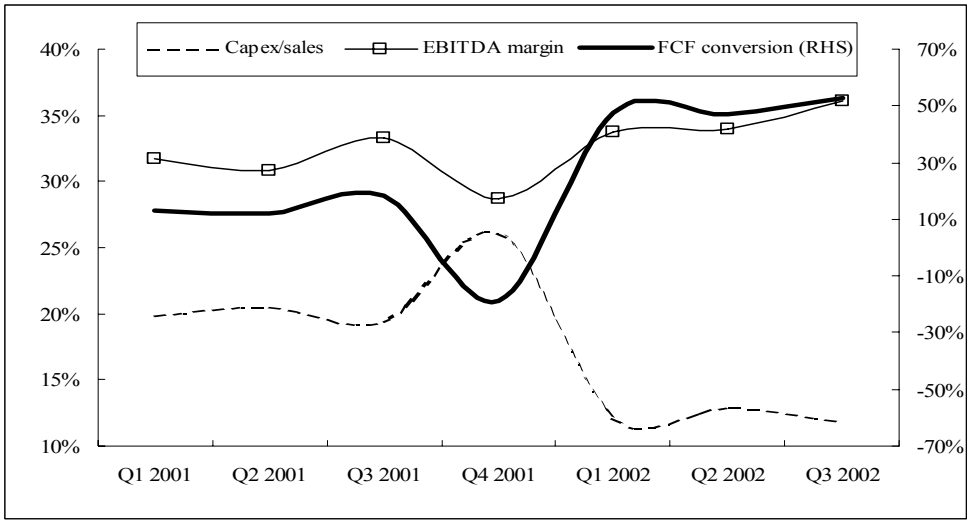
Background

Why we went overweight the PTTs six months ago

We upgraded the PTT segment to OVERWEIGHT on August 2, 2002. Our rationale at the time was really two-fold:

1. **The sector looked attractive on its own merits** - Earnings momentum had turned decisively positive, with most operators in the segment reporting dramatic improvements in cash flow generation over the first two quarters of the year, greater stability in pricing, continued cuts in capex in cash-burning divisions, and in some cases, an actual reversal of market share loss. Following successful recapitalisations at KPN, Sonera and BT via rights issues in mid/late 2001, and with France Telecom and Deutsche Telekom management issues close to some sort of climax, we judged that sentiment toward the sector probably deserved to improve on a short-term basis.

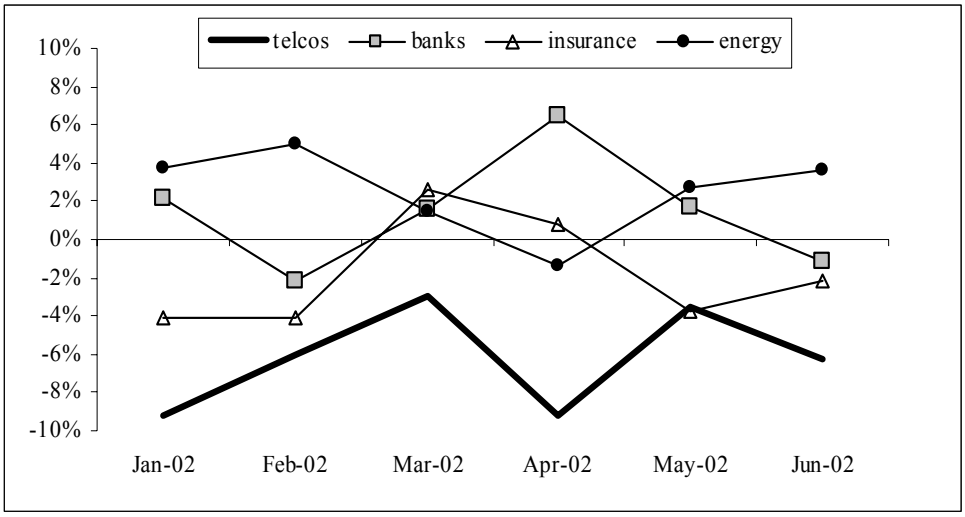
PTT cash flow drivers and free cash flow conversion trends 2001 - 2002



Source: DIR

2. **The sector would benefit from turmoil elsewhere** – In the first half of 2002, investors in other sectors were beginning to encounter a seemingly never-ending parade of knock-ons from 9/11, Enron, Worldcom, the malaise in financial markets, pre-war jitters and a general realization that the much hoped-for economic "soft landing" might not materialize. We argued at the time that, while European telecoms might not look particularly cheap or sexy from a long-term perspective, at least the short-term visibility in the sector was relatively much better than in many sectors in the European market, based on the patterns we had seen developing in the Q1 and Q2 results. Additionally, the sector had underperformed for 11 of the preceding 19 months, and in each of the seven months from November to June.

Relative performance of key STOXX 600 sectors Jan- Jun 2002



Source: DIR

A happy ending…

Happily, part one of our thesis was further confirmed by a strong set of results from operators in Q3, and broadly improved financial positions. This helped to solidify the relative attractiveness of the sector versus others, thus ensuring that part two of our thesis was validated. The result is that the PTTs have to date outperformed the STOXX 600 by 19.8%, and the entire STOXX Telecoms index has outperformed by 20.5% since our move to an overweight position. We must confess to being satisfied with this turn of events, particularly given the recent raft of upgrades from the Bulge Bracket in mid-January, since which the sector has fallen 9.7%, and performed basically in line with the broad market.

Q3 PTT results highlights

	Revenue growth		EBITDA growth		EBITDA margin*		EBITDA/capex		OFCF conversion rate		Net debt/EBITDA	
	YoY	QoQ	YoY	QoQ	YoY	QoQ	Q3	Yr ago	Q3	Yr ago	Q3	Yr ago
Operator												
BT Group	2.3%	1.6%	7.0%	13.4%	1.14%	3.30%	2.6	2.1	42.2%	27.3%	2.2	3.0
Deutsche Telekom	7.2%	3.4%	2.8%	5.7%	-1.13%	0.70%	2.8	1.6	38.6%	10.9%	3.8	4.0
KPN	-3.0%	-1.8%	24.3%	4.7%	8.30%	2.30%	4.8	1.5	56.7%	-5.3%	3.0	6.1
Portugal Telecom	-5.4%	-4.3%	8.1%	1.2%	4.40%	2.30%	4.2	2.0	65.3%	40.9%	1.9	2.5
TDC	-0.3%	1.3%	18.6%	10.5%	4.79%	2.51%	2.2	1.5	45.0%	19.3%	1.8	2.6
Telecom Italia	-0.9%	-3.5%	4.6%	2.0%	2.50%	2.60%	3.7	3.1	57.3%	56.9%	1.2	1.6
Telefonica	-12.9%	-5.4%	-12.3%	-5.9%	0.30%	-0.20%	4.1	1.9	55.2%	29.5%	2.2	2.3
Telenor	21.9%	2.3%	80.2%	19.7%	10.02%	4.52%	1.7	0.8	30.2%	-43.6%	1.8	2.0
Telia	0.5%	1.1%	25.2%	19.4%	5.83%	4.53%	2.4	0.6	54.9%	-72.1%	0.5	1.2
Sonera	0.4%	0.6%	8.7%	2.1%	2.78%	0.53%	3.2	2.0	54.3%	44.3%	2.7	6.1
Telekom Austria	0.8%	7.1%	-9.30%	9.29%	-4.61%	0.82%	3.0	3.0	55.7%	57.7%	2.0	1.8
Swisscom	2.80%	1.30%	-1.40%	4.20%	-1.34%	0.87%	3.6	4.0	79.20%	76.20%	0.3	-0.3

Source: Company data, DIR estimates
Note: *Denotes percentage point change in EBITDA margin

…or is there?

We continue to believe that the PTTs may keep up the positive newsflow through the next couple of quarterly reporting seasons, but we believe that the momentum will slow, and that the increments of operational improvements will, on the whole, fail to match the drama of 2002. As can be inferred from the chart on page four, the overwhelming contribution to the recovery in cash flow generation in 2002 came from capex. Though there was a high variability from operator to operator, PTT capital spending fell by 32%YoY in each of the first three quarters of 2002. Capex/sales ratios for the group fell from 19% on average in Q1 – Q3 2001, to 12% over the first nine months of 2002. On basically flat sales, the uplift contribution to cash flow from capex reductions was more than twice that contributed by EBITDA margin improvements. In some cases we saw fixed line capex/sales ratios as low as 4%, which we think is unsustainable in the long term. Indeed, comments from a number of operators in the Q3 reporting season strongly suggest that the capex-slashing phase has peaked and may begin to reverse. KPN and Telekom Austria, two of the more adept cost-cutters in our view, suggest that a medium term range for capital investment is 12 – 14/15% of group sales, while Swisscom indicated flat mobile capex for two to three years, with fixed capex gradually rising over the period. Deutsche Telekom's CFO stated that he believes that future capex savings will be dictated not by vendor price cutting, but rather by operators' deferral of project spending.

How short-termist can we afford to be?

As the Q2 and Q3 2002 results showed, the sector is generally enjoying a period of stability after a rough couple of years, which contrasts sharply with events in certain other sectors. On this basis we think we can continue to make a reasonable case for PTT outperformance on a six-month basis. However, one flaw with this approach (and with many of the recent upgrades we have seen) is that it is short term-ist, and largely ignores some very important and uncomfortable questions, which the sector should be asking itself. Perhaps a six-month horizon suits the climate of uncertainty in which most of us currently live. However, for many of the clients we speak to, six months is not enough. Widows and orphans require looking after well into the future, unless we all adopt a carpe diem approach to life (in which case, let's stop here – you're wasting valuable time, and we should be looking for another job).

Fixed line operations: finding our feet

A short history lesson

Fixed line turnover still represents 46% of group turnover for European incumbents

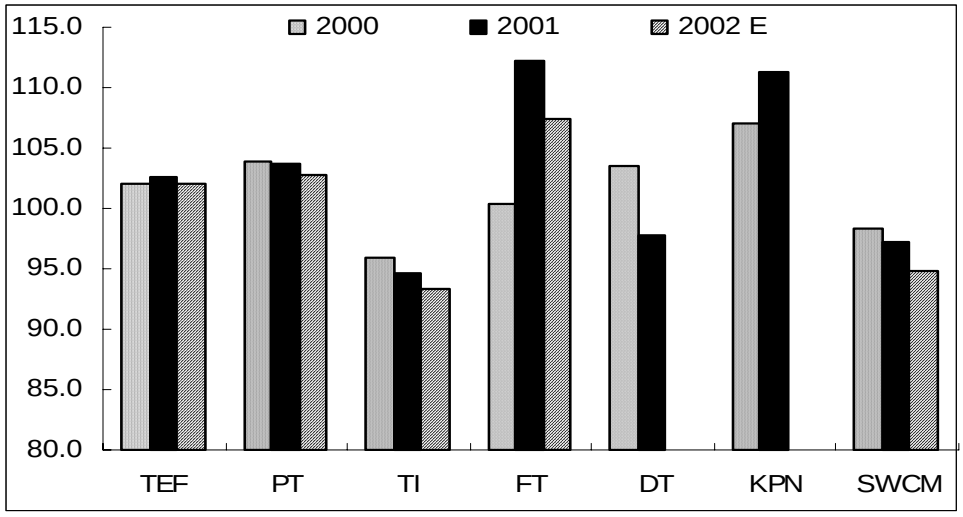
As we stated in our introduction, we think that one of the key drivers for the outperformance of the PTT group over the past six months has been the perception that these businesses have a high degree of quasi-utility defensiveness in the face of economic uncertainty. The theory goes that, as long as the PTTs can neutralize or minimize pricing pressure and subscriber defection through imaginative marketing and pro-active pricing (bundled discount packages and incentive programmes), these businesses will continue to produce the cash needed to service group debt and fund expansion into product areas and international markets which offer long-term growth potential. Additionally, maintaining a stable, active and satisfied residential fixed line user base opens the door to rapid take-up of broadband, itself either a growth driver or at least a hedge against further volatility in variable revenue streams. That's the theory, anyway. First let us briefly consider how the PTTs have apparently reached a greater level of stability in their domestic markets, before moving on to the issues, which may unhinge that stability.

PSTN margins are the bedrock

As we will explore later in this note, we believe the margins earned in the PSTN service are the most attractive available to the PTTs at this point in time, and that the importance of the fixed line business to the incumbents' overall business cannot be underestimated. In 2001, the fixed line business represented, on average, 46% of total group turnover and 53% of total group EBITDA for a group of seven European incumbents under our coverage.

Despite the introduction of competition and tariff rebalancing at the start of 1999 for most EU telecommunications companies, the incumbents have managed to either maintain or grow fixed line turnover (only Telecom Italia has seen a deterioration). This situation was supported by the tremendous growth in dial up internet traffic between 1999 and 2001, interconnection revenue, savvy marketing on behalf of the incumbents who offered discounted bundled packages and a decline in the number of viable competitors after the technology bubble burst in March 2000.

Fixed Line Turnover Re-based to 1999 Fixed Line Turnover (1999 = 100)



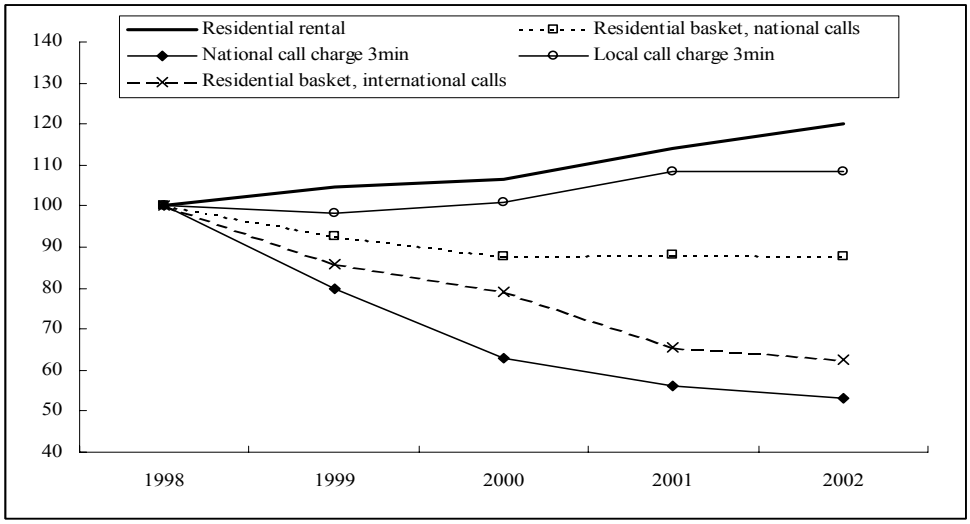
Note: PT turnover adjusted for fixed to mobile revenue, DT and KPN 2002E not comparable due to changes in reporting lines

Source: company data, DIR estimates

Since liberalization, lower margin internet traffic has depressed fixed line margins

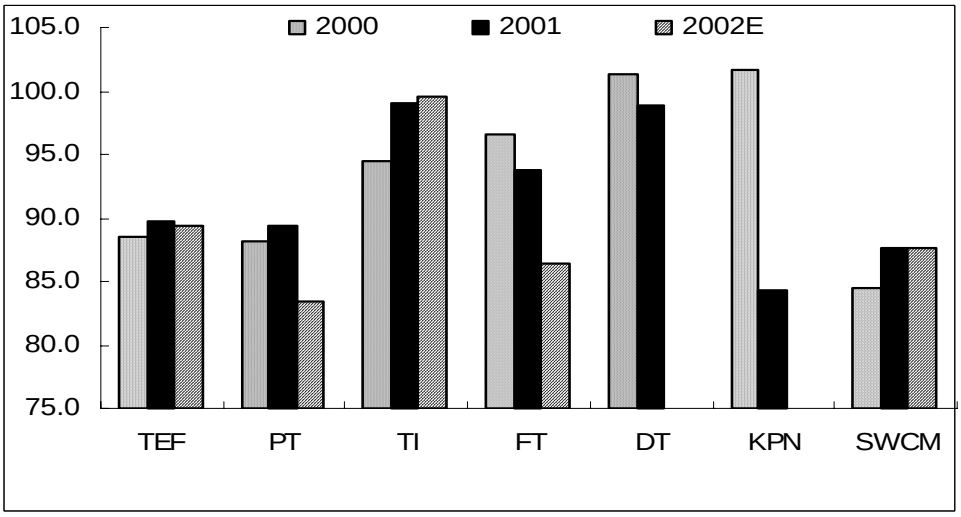
Over the same period, while turnover has been relatively stable, EBITDA levels have, in general, fallen dramatically. Mix shifts in revenue streams (more dial-up internet and interconnection traffic, tariff rebalancing effects, introduction of carrier pre-selection) depressed overall margins at the fixed line business. Perhaps expecting an early uplift in revenues from new services, a recovery in capital market sentiment, or both, companies were initially slow to restructure operations to confront a more challenging and hostile environment.

Effects of rebalancing on prices since 1998, EU15 weighted average



Source: EU Seventh and Eighth Reports, DIR

Fixed Line EBITDA Re-based to 1999 Fixed line EBITDA (1999 = 100)



Source: Company data, DIR estimates

What's the story?

As governments continue to impose pricing restrictions on incumbent operators for the next couple of years and a resurgence of viable competitors materializes, we are anticipating a decline in fixed line turnover for most European incumbents. We are most concerned with the impact on the fixed line voice business of the incumbents, a traditional cash cow, used to fund other parts of the group. At a time when European incumbent CEOs are claiming that their fixed line businesses are stabilizing, we would like to explore the most recent trends in the voice markets, to ask the following questions:

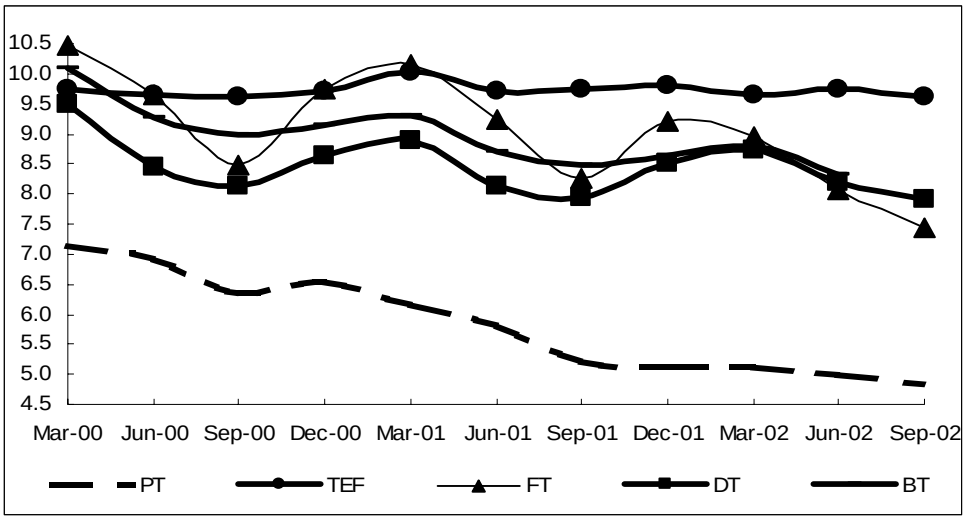
- What is the picture of average residential fixed line usage?
- Are fixed line traffic and users really migrating to mobile networks?
- If so, what are the implications for the operators? If not, where is the traffic going? Is it going anywhere?
- How successful have the operators been at finding a floor in this business? Do the results match the rhetoric?

Trends in Fixed Line Voice Market

Fixed voice traffic per line per day has been on a downward trend since March 2000 …

We have analysed the daily fixed voice traffic per line per day of five PTTs (based on average fixed lines including PSTN and ISDN) over the period March 2000 to September 2002. Apart from Telefonica, the trend in daily fixed voice traffic per day is steadily declining. This coincides with the introduction of full carrier pre-selection in most markets over this period as well as an increasing trend towards substitution behaviours.

Minutes of Fixed Voice Traffic per Line/Day (January 2000 – June 2002)

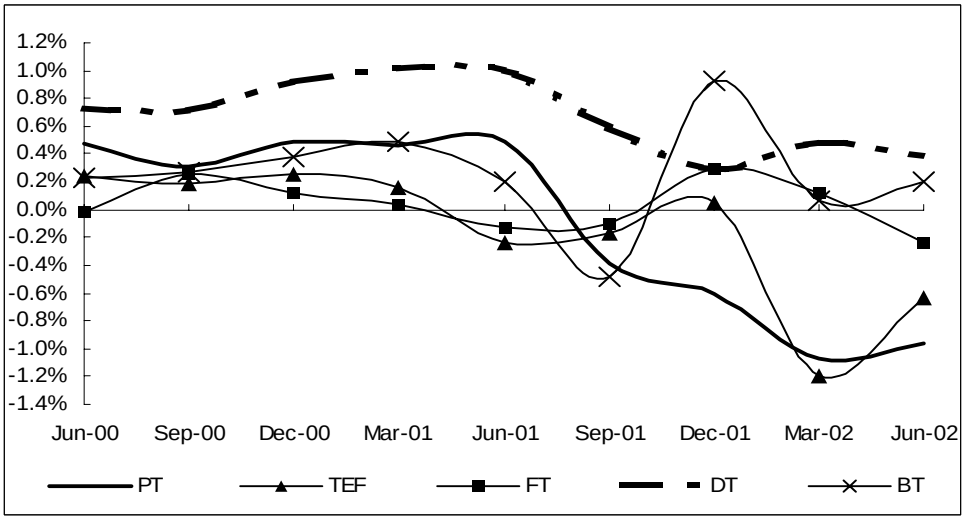


Source: Company data, National Regulators' reports, DIR estimates

…as well as lines in operation

In access, the trend generally across Europe has been that operators have continued to lose customer lines (to competitors or broadband cannibalisation), and in the case of Portugal Telecom, there has been a dramatic shift towards mobile telephony for outbound voice traffic.

Growth in Fixed Lines (June 2000 – June 2002)



Source: Company data, National Regulators' reports, DIR estimates

These figures are for the incumbents' total fixed operations, but in the UK, we also have detailed information for the entire market split between residential and business users. Residential fixed line voice traffic in the UK, according to OFTEL data, continues to account for some 57% of total voice market traffic (excluding mobile roaming) as it has done for the past five quarters, and constitutes c.64% of all fixed line traffic in the UK, including internet/others. In terms of what the average residential user is doing, however, the picture is much the same as in the total fixed business of the PTTs.

Mr. & Mrs. Jones use the phone less

In the year to March, 2002, average minutes of user per line per day fell by 2.6%YoY, and this expanded to 3.7% in the quarter to June 30, 2002, the most recent quarter for which we have data. National calls, the second largest category of residential outgoing traffic (excluding internet/other), fell by 4.5%YoY in the quarter to June. Total residential fixed traffic in the UK fell 1.4%YoY (excluding internet/other) in the year to March 2002, and by 2.9% in the quarter to June.

Minutes of use per line per day, UK residential (year to March 31)

	2001	Q1	Q2	Q3	Q4	2002	Q1
Total minutes	10.06	9.85	9.79	10.00	9.87	9.80	9.48
Local	6.19	5.87	5.76	5.97	5.89	5.82	5.61
National	2.74	2.74	2.75	2.77	2.75	2.73	2.63
International	0.34	0.37	0.40	0.38	0.38	0.38	0.37
Calls to mobiles	0.79	0.88	0.88	0.88	0.86	0.87	0.88

Source: OFTEL data, DIR

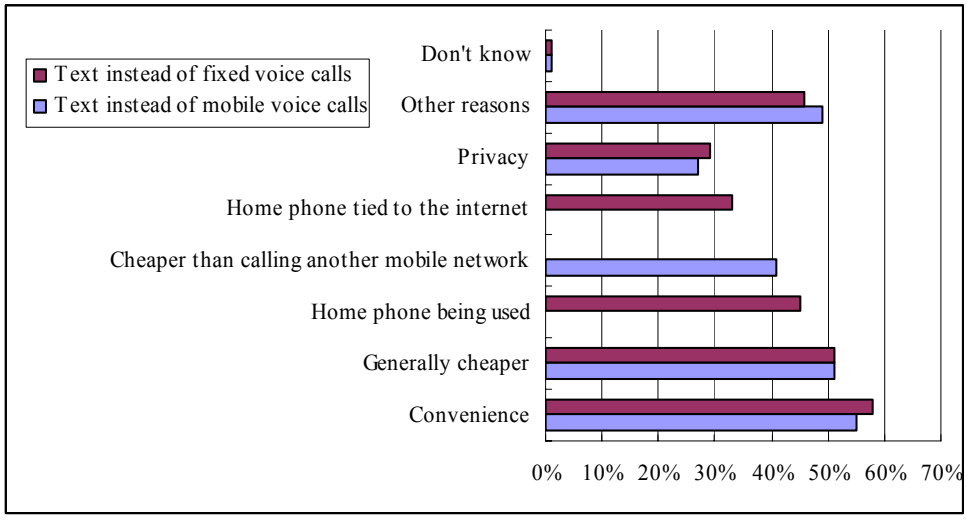
Where is the traffic going?

So traffic on a per-line per-day basis is trickling away from the fixed market as a whole, and the residential market in particular. Where is it going? Most of the market assumes that it is migrating to mobile networks, and there may be some validity to this. OFTEL's January 2003 survey of residential use of fixed line services showed that, under certain circumstances, 41% of mobile users will send text messages rather than making fixed line calls, and 17% do so frequently. Such users are likely to be women, younger consumers, lower income social grades and homes with children (that's a pretty wide group, and suggests that such a practice may take root across much of society). The incidence of such behaviour seems to be particularly high (45%) when another person is using the fixed line connection or (33%) when the fixed line is tied up by internet usage.

Some price arbitrage probably benefiting mobile operators

However, it is also clear that there is an element of pricing arbitrage awareness amongst consumers, as suggested by the 51% response that text messages are cheaper than phoning a mobile network from a fixed line, and generally cheaper than mobile-to-mobile calls. We think it highly likely that consumers have the same awareness of the arbitrage opportunity in making mobile-to-mobile on-net calls from home rather than fixed-to-mobile. This must surely be driving some traffic from the PSTN to the mobile network.

Reasons for using text messaging instead of making a call



Source: OFTEL

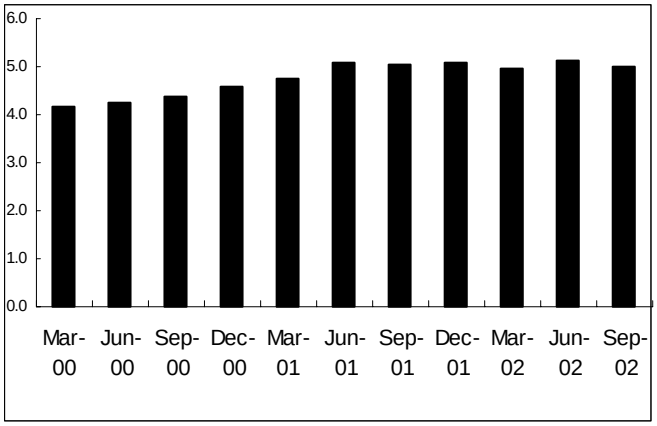
Mobile doesn't appear to be soaking it all up

Where we are a bit less clear about the case for outright fixed-to-mobile substitution is in our observation that, in the quarter to June 2002, though fixed line usage per residential line per day fell by 3.95% from the previous quarter, mobile minutes of use per user per day were up only 0.25% from the previous quarter. There may be some connection with the level of inactive mobile subscribers in the total, or in timing issues, though subscriber growth in the quarter was unspectacular at 1.4%. Conversely, over the past five quarters, when total mobile traffic, excluding roaming, grew at a CAGR of 4.2% per quarter, fixed line residential traffic excluding internet stayed within +/-3% of the 22.1bn minute mark, though the drop in the June quarter of 2002 was quite sharp. Clearly this issue deserves more scrutiny in coming quarters, but at this point, we think the data is less than clearly supportive of a one-to-one, minute-per-minute transfer of volumes from fixed to mobile.

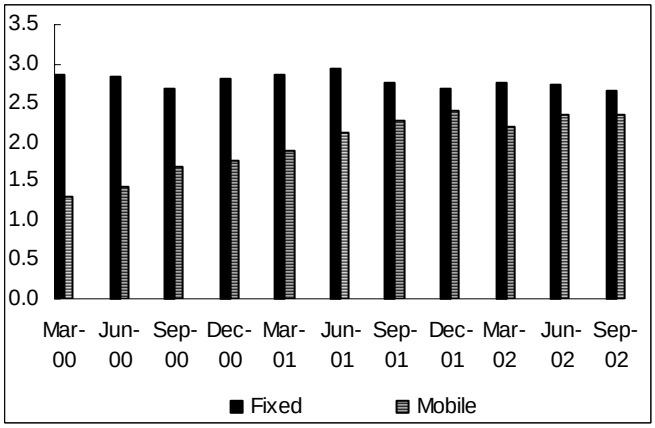
In the case of Portugal, it looks as though, voice traffic does have an upper limit

If the UK provides us with as many questions as answers, Portugal appears to be a clearer case in support of substitution. Although the overall outgoing voice market rose marginally from March 2000 to March 2001, in Portugal, it has not grown since June 2001 despite penetration increasing from 46.8% to 80.7% over the period. (The UK voice market, by contrast, has grown at a CAGR of 3.65% over the same period). This would suggest that voice traffic has an upper limit, indicating that Portugal Telecom has been very susceptible to fixed to mobile substitution over the period. It is particularly interesting to note that as mobile minutes per subscriber per day increased over this period (as seen in the graph on page 12), fixed volumes sustained a corresponding decline.

Portuguese Voice Market bn mins (Fixed & Mobile)



Portuguese Outgoing Voice Traffic bn mins

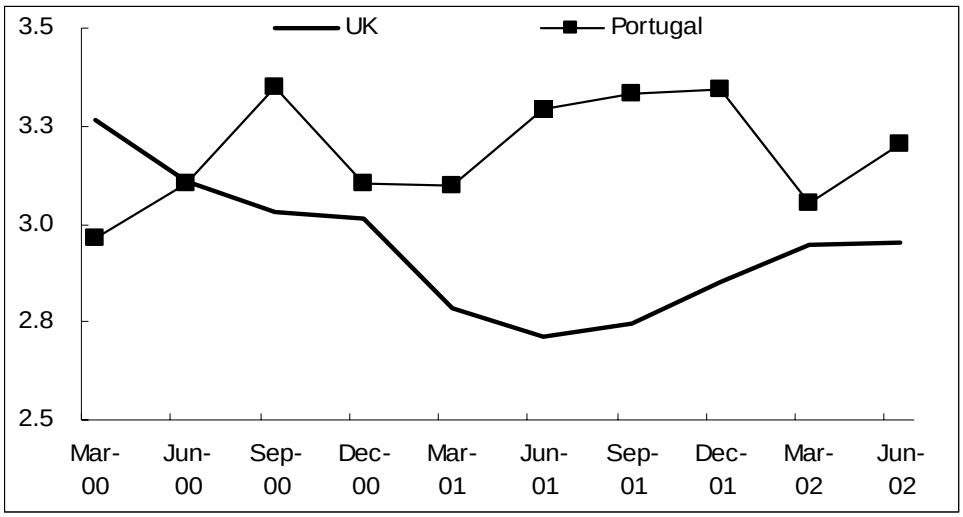


Source: Anacom

A mixed message

While the overall trend in minutes per cellular user per day has shown an upward trend in both the UK and Portugal over the past four to five quarters (UK +6.1%, Portugal +3.5%), looking at a three quarter moving average going back to March 2000 (which hopefully strips out some seasonality and distortions due to market growth), usage per user per day in both markets is essentially flat. The key difference between the two markets is that, while the growth of mobile traffic in Portugal clearly appears to be taking something away from the fixed market in a voice market which is stagnant, the impact on fixed usage in the UK looks to be far more moderate.

Outgoing Minutes per Day per Average Subscriber

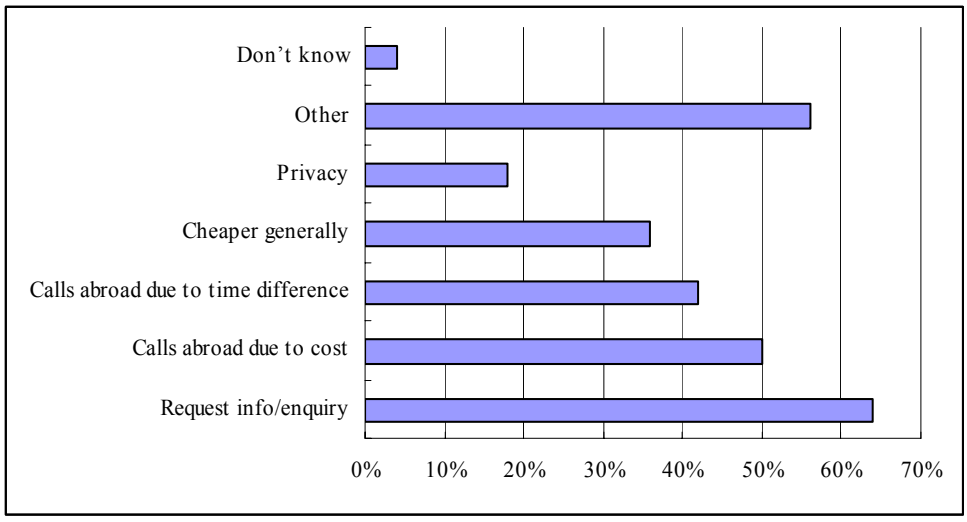


Source: OFTEL and Anacom country reports

Data cannibalization an important factor

Evidence suggests that other sources of fixed volume cannibalization may be at least as important as mobile. Returning to OFTEL's January survey of consumer usage, it is reported that 77% of UK adults with home internet access send e-mails instead of making calls under certain circumstances, and 27% do so regularly. Based on home internet penetration levels, OFTEL calculates that this equates to 35% of all UK adults using e-mail as a substitute for fixed voice calls. Most often this practice is related to enquiries and requests for information (presumably triggered by visits to websites), though e-mail usage as a form of price arbitrage on international call charges is also another key reason given.

Reasons for sending e-mails instead of making fixed line calls



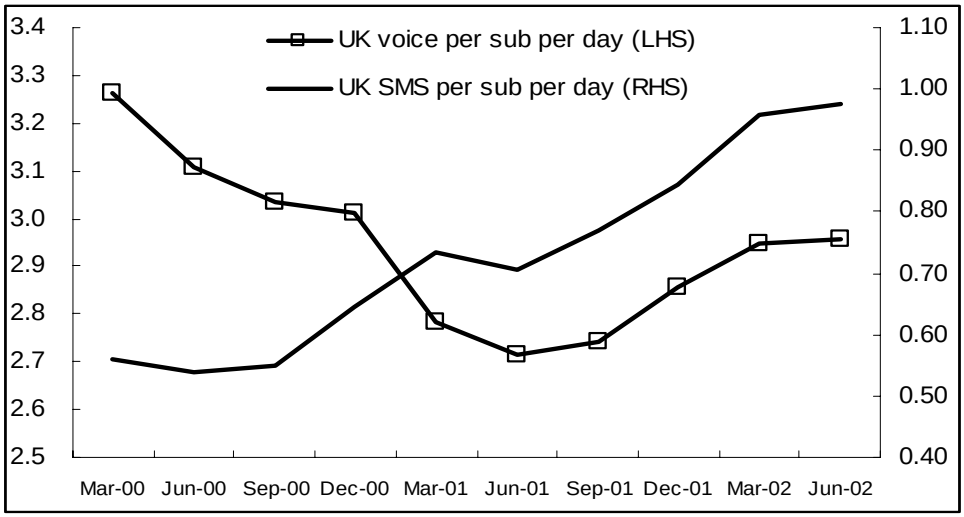
Source: OFTEL

Mobile suffers its own cannibalisation

It appears that mobile may now be generating its own internal cannibalization, as suggested by an OFTEL stat showing that 41% of mobile users send text messages rather than pay the higher charges involved in making mobile calls to another network. The chart below shows a suspicious coincidence in the dip in usage per day and the surge in SMS sent per day in the December 2000 quarter. Perhaps the relationship is less clear in the more recent past, but it is also interesting to note that SMS volumes per user have grown at a CAGR of 7% over the past six quarters, while voice minutes per user per day have struggled to regain December 2000 levels. According to statements from some mobile operators, we believe that SMS origination generates a margin of

something like 60%, and as such it may itself end up regulated as a separate market in future. We note with interest that the Norwegian national regulator ruled in January that Telenor Mobile would have to allow a rival operator, Teletopia, to connect its own SMS switch to the Telenor Mobile network, and to market SMS to Telenor subscribers. If SMS itself is a form of arbitrage against call charges, then competition between SMS services on a single network opens up further arbitrage opportunities for the consumer. The PTT mobile subsidiary inevitably sees another lucrative revenue stream at risk.

UK Outgoing Voice Traffic vs. SMS Traffic



Source: OFTEL

Subscriber inertia

They may not be using the phone much, but subscriber inertia is high

While we have so far seen clear evidence of an erosion of fixed usage, in some cases in preference for mobile or data substitution, OFTEL's survey on consumer use of fixed telecom services and the internet highlights how remarkably stable much of the subscriber base is, and some of the factors underlying this subscriber "inertia."

- Up to 23% of fixed residential subscribers claimed to have changed supplier at least once, though most of these changed more than 12 months ago. For BT Group customers, only 60% claimed to be aware of alternative service providers in their local area.
- Perhaps more surprisingly, while 64% of respondents were aware of indirect access services, only 16% make use of them (indirect access was introduced in 1986!). Carrier pre-selection was known to 32% of users, but only 3% claimed to make use of it.
- Customer satisfaction levels with fixed residential services has risen over the past twelve months, and has stood at 96% for the previous three quarters covered by the survey. This is higher than for mobile (93%) and internet (90%) services.
- There also appears to be a significant latent reservoir of customers of cable companies, who would return to BT if they changed residence and were unable to keep their existing phone number. A total of 9% of such cable users stated that they would potentially move within the next three years and were either likely (6%) or unsure (3%) of returning to BT when they moved, while 19% of total cable users with an original BT number stated that they thought they would return to BT within three years in any event.

As a strictly UK survey, we must treat these results with care in interpreting them on a pan-European basis, but we may potentially extrapolate that customer satisfaction levels have generally improved in some cases, and that there is still a surprisingly large element of goodwill towards the incumbent on the part of consumers.

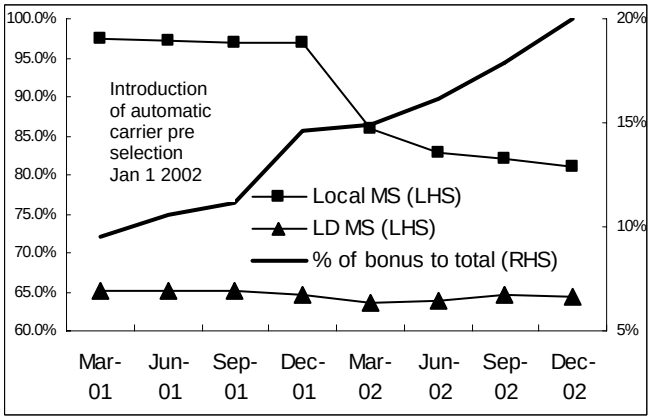
Bundled packages to a key weapon

What may lie behind what appear to be more positive attitudes towards the incumbent, or at least a benign indifference? To hear the operators tell it, the key is in bundled minute packages. Bundled packages were introduced in most European countries to transfer the risks of the variable fixed line business into fixed revenues, and these products typically charge an up front fee for a specified number of inclusive minutes per month, and in some cases have bundled internet access or a mixture of local, national, and international minutes.

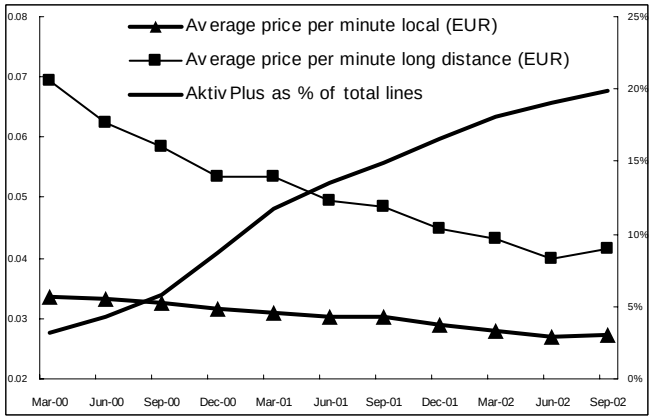
The critical penetration rate for bundled packages is 20%

At the end of September 2002, the average penetration of bundled packages to total lines, for five European operators, was 19.5% with Telefonica reaching a penetration rate of 24.4%. We would also note that Portugal Telecom has had little success in marketing bundled packages, and this could provide a further reason for the apparent consumer shift to mobile use. Telekom Austria's management has cited that the critical penetration rate for bundled packages in its market is near 20%. At this level, the operator expects to see stabilizing market share and prices. The charts below indicate that there is some truth to this assertion. As France Telecom approached a penetration rate of 20% for its bundled packages, market share declines started to slow. At Deutsche Telekom, as it approached the 20% rate, the average price per minute stabilized. In the case of Telekom Austria it would also appear that use of carrier pre-selection has diminished as this level is approached.

FT Market Shares vs Penetration of Packages

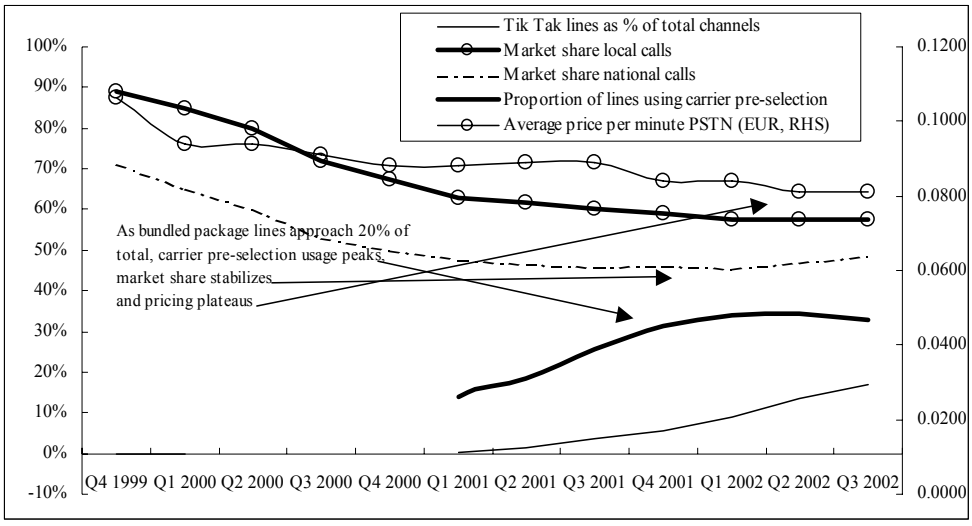


DT Price per Minute vs Penetration of Packages



Source: Company data

Apparent impact of packages on TKA's market share, pricing, use of CPS



Source: Company data

Recurring threats: fixed/mobile substitution – the enemy within

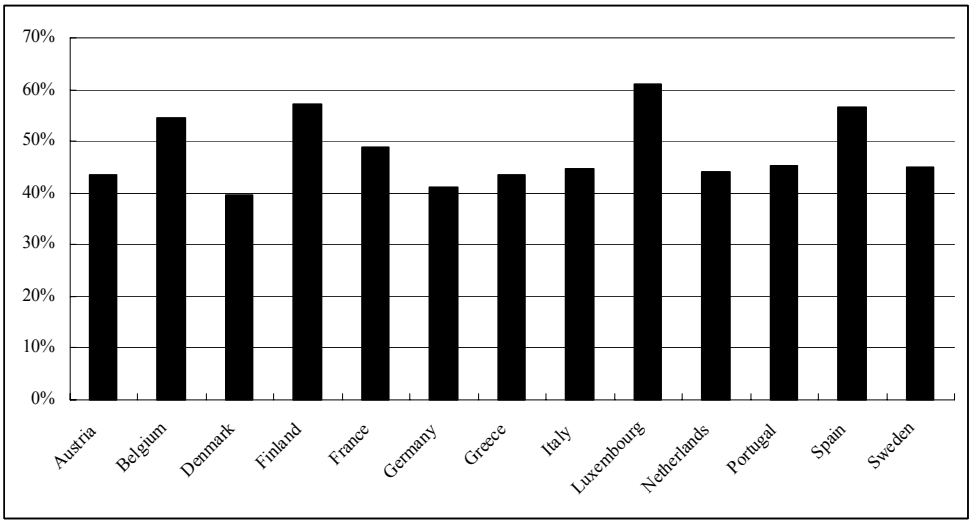
The question of "mobile only" households

We may have some trouble defining or identifying it, but one recurring feature of recent conference calls from the PTTs has been the passing reference by management, usually vague, to fixed/mobile substitution. We have seen what we believe is clear evidence of substitution in Portugal, and certainly traffic data across Europe is suggestive of a decline in fixed line usage per line per day in favour of mobile, though the UK illustration suggests that something more complex is at work. The concept of a shift in access patterns has also arisen in the past year, most noticeably in discussions of the US market, where some estimates show that upward of 5% of telephone users are "mobile-only." UK regulator OFTEL produces market data which shows that 7% of respondents describe themselves as mobile-only households. BT Group says it is confident that a mobile only choice represents a temporary phase in the lives of this segment of telecoms users, and at present, the statistics show these respondents to be overwhelmingly aged 15 – 24, students or unemployed, living in rented accommodation in an urban area characterized by moderate levels of social deprivation, with an annual income below £10,000.

Surely the PTTs could weather a shift toward mobile only access, right?

As with the example of text-for-fixed substitution, the problem arises if this "mobile only" behaviour becomes rooted in this generation and subsequent ones. This opens up the possibility that the trend towards traffic migration to mobile networks from fixed is followed by a flow-through effect on the access side. Many would argue that the PTTs are ideally suited to weather such a shift, given their almost universal dominance of their domestic markets in mobile (see chart below). Is this an assertion we should feel comfortable with?

Estimated market shares of PTTs' domestic mobile subsidiaries



Source: EU

PTTs lack the overwhelming dominance in mobile which they enjoy in fixed

Firstly, the more fragmented nature of the mobile markets means that, even in national markets which are effectively duopolies, there is only a 40 – 50% chance that a subscriber opting for a mobile-only lifestyle will be a subscriber of the PTT's mobile subsidiary. Automatically, the access revenue disappears, and in 50 - 60% of cases the call revenue migrates to a rival operator. Even though the mobile margin of many domestic incumbent operators is nominally greater than the blended fixed margin on fixed calls and access, the underlying margin on fixed calls is almost certainly higher. As access businesses move towards greater profitability via easing of tariff rebalancing and the growth in penetration of ADSL, the potential cost of losing a fixed access subscriber to mobile rises. Before we consider what the margin trade-off might be in fixed/mobile substitution, we should attempt to determine what the blended margin for residential access and calls is for a typical PTT.

We have estimated that EBITDA margins on traffic are approximately 43%

We have attempted to calculate the margins earned on fixed voice traffic based on BT Group's 2002 retail regulatory accounts. In analyzing the returns, we made some adjustments to the accounts in order to calculate the overall Group's network returns and not just the Retail division's returns. We have adjusted the published regulatory returns for an estimated margin of 20% (after taking into account a charge for depreciation), representing BT Wholesale's margins on services provided to the Retail division. We have also adjusted the reported returns for an estimate of depreciation relating to the network. After making these adjustments, we estimate that BT Group earns a combined EBITDA margin for residential and business access of 24.8% and a weighted average EBITDA margin on traffic (based on reported traffic volumes for each call category) of 42.8%. The total estimated weighted average EBITDA margin for access and traffic is 35%, but we strongly suspect that margins on residential traffic are higher, leading to a relatively higher blended margin for residential services.

Estimated BT Group Fixed Line Returns

Category	EBITDA Returns
Total retail narrowband access	24.8%
Residential access	19.9%
Business access	30.7%
Retail System Business	
Local calls	46.0%
National calls	42.7%
International calls	54.6%
Calls to mobile	19.9%
Weighted average (based on minutes) retail system business	**42.8%**

Source: BT Group's 2002 Regulatory Accounts

These returns could be conservative due to current cost accounting

We believe these returns could be conservative due to the use of current cost accounting in preparing the regulatory accounts as it has a tendency to increase depreciation and therefore, depress earnings (where we have used historical depreciation rates to arrive at our EBITDA returns). Using our assumption of a 35% margin on access and calls for residential, a 40% EBITDA margin for the mobile subsidiary, and basing average monthly residential fixed consumption on the EU 15 average, we conducted the following simulation, and determined that the impact on group EBITDA is likely to be enormous in the absence of significant corresponding rises in mobile ARPU to compensate.

Revenue/EBITDA trade off scenario for residential fixed subscriber (€)

Fixed revenue monthly	
Fixed ARPU (calls)	27.00
Monthly access charge	15.00
Total revenue loss per sub for PTT fixed business (A)	42.00
Migration effects	
Revenue loss per fixed sub if 50% choose PTT mobile subsidiary	28.50
Revenue per sub gained by PTT mobile subsidiary (B)	13.50
Assumed PTT fixed EBITDA margin (C) *	35%
EBITDA loss per sub from PTT fixed (A x C)	14.70
EBITDA margin PTT mobile (D)	40%
EBITDA per sub gained by PTT mobile (B x D)	5.40
Net group EBITDA loss per migrating sub (A x C) – (B x D)	**9.30**

Source: DIR estimates *N.B. cf estimate of BT fixed residential margin

Would fixed traffic really migrate to mobile on a one-to-one basis?

As we highlighted earlier, one area of concern is whether we can realistically expect a minute-for-minute transfer of fixed traffic to the mobile network in any event. For the sake of this simulation we have assumed a full transfer of revenue, just to be generous, though we expect that some usage would simply vanish or fall prey to substitution. Just to reiterate, OFTEL's survey of consumer usage published in January found that seven out of 10 UK mobile users send texts rather than make voice calls, and 36% of them do so regularly. Around 41% of mobile users send text messages from home rather than make fixed line voice calls in certain circumstances.

Underlying margins on mobile are almost certainly well below reported levels

One other thing we question is the true state of margins in the mobile business. Before jumping to conclusions about the positive margin trade-off involved in fixed/mobile substitution, we think it might be instructive to consider the underlying margins of the mobile businesses in Europe. The operators are not much help in this regard, as none has ever offered to reveal what margins are on different segments of the business. In the exercise, which follows, we attempt to get to the answer. We admit that the results are at best speculative (and we invite comment from any operator which would like to confirm precisely what the margin is for termination), though we think the unavoidable conclusion of even a cursory examination of this issue is that **underlying margins on the business outside of termination are significantly lower than the reported group margin at present**.

UK regulator OFTEL released on January 22nd the main conclusions of the UK Competition Commission (CC) enquiry into the cost of calling a mobile phone. The recommended cuts were broadly in line with earlier reports in the *Financial Times*, and we summarize them again just for background:

- A cut of 15% by each operator by 25th July 2003.
- A cut of RPI-15 for both Vodafone and mmO2 in each of the years to March 2004-March 2006. Since 1999, both operators have already been regulated under a RPI-9 charge control for possessing SMP (significant market power).
- A cut of RPI-14 for both Orange and T-Mobile in each of the years to March 2004-March 2006. This reflects the high cost of operating a denser 1800Mhz network.

What does T-Mobile have to say?

To date neither Orange, nor Vodafone, has commented on the impacts of cuts, but we contacted DT to get a steer. DT refused to tell us what proportion of their revenues in the UK is accounted for by termination (the last set of OFTEL data showed that termination for Orange and T-Mobile UK together represented 27.5% of combined revenues, and we think that TMO-UK's higher proportion of pre-paid subscribers is supportive of a level of 30% or more. mmO2's proportion of termination to total revenue `is 22%, but we think its higher quality subscriber base and business market share makes it less reliant on termination than a consumer brand like TMO). T-Mobile UK's termination rate in 2002 went up by 18.6% in € terms, according to EU data.

What DT did tell us was that for 2004, on a full year basis, they are lowering their previous UK EBITDA estimate of €1.1bn to €1bn (-9.1%) as a result of the ruling, before any consideration of possible tariff hikes or cost cuts to compensate. They also said that their previous expectation for revenue was under €4.9bn (we estimate €4.85bn). As the Competition Commission is calling for a real drop of 14% in 2004, we have assumed a 16% cut in termination rates. So, let's consider what this means. A 16% decline in 30% of the revenue base (i.e., a 4.8% revenue decline) translates to an EBITDA drop of 9.1%. Intuitively, this suggests very high margins on termination relative to other parts of the business. We attempt to unravel the mystery as follows:

- We used TIM Spa (the domestic business of Telecom Italia Mobile) as our reference for interconnection costs, as no one else seems to report them consistently. TIM reported in H1 2002 that domestic interconnect costs accounted for 30% of total cash operating costs. Of this amount, c.55% was interconnection with other mobile networks.
- TIM is a market leader in what is essentially a three-player market, with no handset subsidies. The UK is a much more evenly split market, with handset subsidies, so we have assumed a more moderate 20% of costs devoted to interconnect, of which 40% we assume will be to other mobile operators.
- We have assumed that the €100m EBITDA loss is a net figure, after including savings in payments to other operators. The 'headline" impact on EBITDA before this, on our assumptions, would be €148m, or a 14.5% decline in EBITDA. Working back from this, we come up with an effective EBITDA margin on termination of 63.6%.
- Stripping this out from the original revenue and EBITDA figures suggests an EBITDA margin on non-termination revenues of only 5.2%.

Illustrative attempt to determine underlying margin on non-termination revenue

Based on T-Mobile UK (€m)	2004	Comments
Revenue	**4,850**	**Company guidance for revenue below EUR4.9bn**
Percentage termination	30%	DIR estimate
Cash costs	3,750	Difference between company revenue and EBITDA estimates
of which interconnection	750	DIR estimate (TIM says interconnection 30% of cash operating costs)
of which to other mobile	300	DIR estimate (TIM says mobile-mobile is 55% of interconnection costs)
EBITDA	**1,100**	**Company guidance prior to termination cut**
margin	22.7%	
Termination revenue	**1,455**	**DIR estimate**
reduction in pricing	16%	Based on real reduction of 14% (we think RPI - 16%)
Revised termination revenue	1,222	Termination revenue post mandated cuts
Revised revenue	4,617	
Revenue drop	-4.8%	
Revenue lost	233	
Reduction in payments to other operators	-48	
Revised EBITDA	1,000	company estimate
new margin	21.7%	
Net EBITDA loss	100	Company comment on impact of termination cuts was EUR100 full-year 2004
Headline EBITDA loss	148	Net EBITDA loss adding back savings on payments to other operators
Implied EBITDA margin on termination	63.6%	Headline EBITDA loss/Revenue loss
Implied termination EBITDA	925	Applying implied margin to termination revenues
Implied underlying EBITDA margin	5.2%	

Source: DIR estimates, based on company information

Could underlying margins really be this low?

Again, we would stress that this exercise is entirely speculative in nature, based on a profound lack of information from the operators. This estimate is also made just ahead of the publication of the detailed report from the UK Competition Commission, which we believe will shed more light on the true state of termination costs. Using TIM's cost base for TMO-UK undoubtedly introduces distortions to the picture, which may influence the outcome. The assumption this produces for our claw-back calculation may also be too low, as we could argue that the revenue cut should pass directly through to the EBITDA line. The effect of this is to lower the effective margin on termination to 45 – 52%. Depending on the approach used and assumptions made, we have at various times come up with a range of 45 – 63% margin for termination. We assume for this exercise that operators will not pass on the savings from cuts to consumers. We also do not take into account any positive elasticities which may arise from lower prices (we don't think they will be meaningful if operators don't pass on the savings to consumers), and we have not factored in cuts in handset subsidies or increases in tariffs to compensate. In summary, we may or may not be close to the true answer, but this revenue stream clearly carries a disproportionately high margin, judging from operator responses to the ruling, which have ranged from statements of outrage and disappointment to promises of legal action, and on to threats of higher tariffs and hardship for the consumer. This is quite a drastic response to a 3 - 5% loss of revenue.

PTT mobile subsidiaries should be on firmer ground

Having said all this, we believe the real state of underlying margins per individual operator in Europe will differ widely depending on market position and subscriber mix. mmO2, for example, with 22% of revenues in the UK coming from termination, claimed an EBITDA impact of only 5.5%, suggesting a higher underlying EBITDA margin. We would naturally expect such a difference between mmO2, with a solid contract residential and business subscriber base, and T-Mobile UK, a consumer brand with a high proportion of pre-paid subs, which has been generating high acquisition costs in trying to break into the business market. We would expect the positions of the European incumbents' mobile subsidiaries to be stronger, though we would be very surprised if the margin trade-off between fixed and mobile is one, which could work for any of the PTTs at group level.

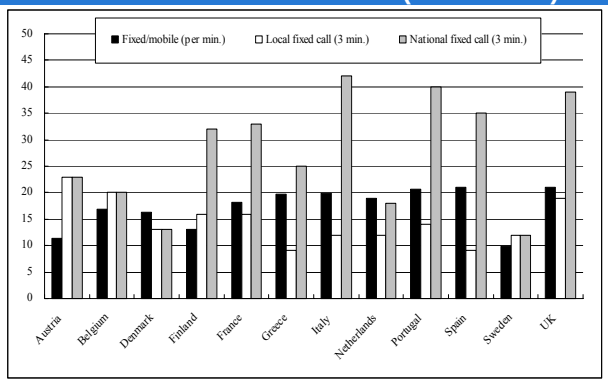
Industry geared to an anomalous system

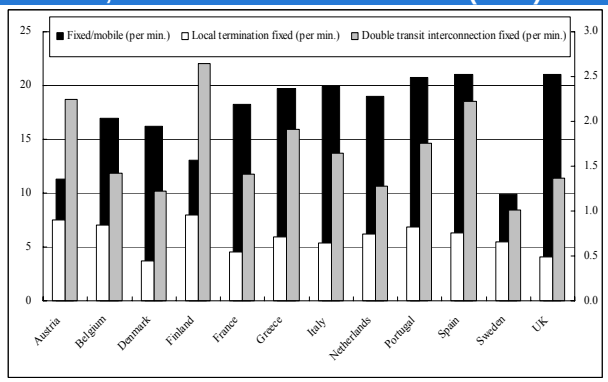
Our conclusion at this point is that the European mobile industry, beneath the cosmetic veneer of termination rates, is not overly attractive in its current state. We expect most operators to take measures to offset termination cuts, including tariff hikes and subsidy cuts, in an attempt to maintain margins. What impact this might have on the consumer appeal of fixed/mobile substitution or text/mobile voice substitution remains to be seen. Nevertheless, we must acknowledge that operators in Europe may have historically geared their cost bases to a system (in effect a generous subsidy) which is anomalous in a global context, and must now adjust to a new reality.

Mobility premium still great in Europe despite ubiquity

The pricing comparison shown below demonstrates that mobility still carries a significant premium in Europe. Fixed/mobile termination charges, on average, are still 3.5x higher on a per minute basis than local fixed line calls, and 1.9x higher than national fixed calls. Versus fixed double transit termination rates, fixed/mobile charges are 31x greater. Mobile operators may argue, with some justification, that the differential reflects their more intensive investment programme of the past decade, as part of the liberalization of telecoms services, and in the pursuit of more choice for the consumer. OFTEL, for its part considers pricing to be 40% higher than any reasonable estimate of fair cost. Whatever the philosophical underpinnings of each argument, the undeniable fact is that similarly positioned mobile players in other markets do not benefit from similar arrangements to the same extent, if at all. Consultation with our counterparts in Asia, as well as examination of ITU data, reveals a huge disparity between European termination rates and those in other regions.

Fixed/mobile termination rates (€cents/min) vs. local, national, and fixed termination rates (RHS)





Source: EU Eighth Report
Finland mobile termination is Radiolinja, UK is Vodafone, all others PTT subsidiary operators. Fixed line call charges exclude VAT.

Why should EU operators need more generous termination rates than those in the developing world?

Singapore and Canada, for example, do not distinguish between fixed-to-fixed and fixed-to-mobile calls, and mobile operators do not generate revenue from fixed carriers on incoming calls. In the US, we believe there is currently parity between fixed and mobile termination rates at an average of $0.0169. In Hong Kong, the fixed to mobile termination rate is HK$0.045 (€0.0052), and is only 2x greater than the fixed termination rate. Taiwan fixed-mobile termination rates are €0.022, and South Korean termination rates, though variable, average €0.042 per minute. Singapore, Hong Kong, Canada and the US operate receiving-party-pays regimes, which inevitably leads to differences in charge structures, but ITU data from developing nations operating calling-party-pays systems (as at 2001) shows a much closer correlation between fixed and mobile termination rates than in Europe, and in some cases, outright parity.

Sample termination rates from calling-party-pays countries ($US)

	Mobile-to-fixed	Fixed-to-mobile	FM/MF (x)
Costa Rica	0.017	0.017	1.0
Malaysia	0.034	0.034	1.0
Guatemala	0.047	0.047	1.0
Mexico	0.026	0.064	2.5
Cambodia	0.050	0.070	1.4
Dominican Republic	0.042	0.078	1.9

Source: ITU 2001, DIR

Recurring threats: resurgent cablecos/broadband players

Cable has been down, not out

It has been relatively easy to laugh at the demise of the European broadband cable sector. The CFO of UPC once remarked that, at the height of the bull market, it felt strange to know that his company had a market cap greater than that of General Motors. From the capital markets perspective, over the past 18 months the three highest profile operators in Europe - NTL, Telewest and UPC - retreated into the nether world of debt/equity swap negotiations and Chapter 11. However, through this dark period, they generally have delivered reasonable subscriber numbers in their key markets, and they are emerging from their crisis period reinvigorated with greater financial flexibility. NTL exited Chapter 11 in early January, Telewest has arranged a £2.2bn facility and proceeds with negotiations to restructure its debt, and UPC has reached agreement in principle with creditors on its restructuring plans. The *Financial Times* recently reported on leaked EU draft regulation documents on European broadband cable services, which suggests that open access could be on the cards for broadband over cable. While this would make life more difficult for the cablecos, the effect on the incumbents would also be negative, in our view, because it would simply throw open more access channels for ISPs seeking to offer differentiated services involving aggressively priced voice.

Cable faces unique challenges, and must maximize its strengths where they exist

Leaving that aside, we take a few moments to examine how the cable operators have dealt with their existing challenges. It is important to note that the cable players suffer from a number of fairly unique problems and limitations. The cable operators in Europe have a history of numerous poorly integrated acquisitions, involving multiple billing systems and call centers. As a result, customer service levels have generally been poor. Additionally, cable operators also have inherent restrictions in that, in most markets, cable coverage is not ubiquitous. In the UK, NTL and Telewest franchises pass a combined 13.3m homes, versus 20m residential lines and 9.1m business lines for BT. The opportunity for cable operators really lies in being able to push penetration of multiple services to their higher value subscribers and pre-empt the incumbent telco, often in the most lucrative parts of its own residential market. Recent performance trends are mixed, but we should not imagine that these operators are any less competitive than they have been in the past. To the contrary, with dramatically lower debt levels and controlling shareholders who started out as bond holders, we think the companies will be run for maximization of return and value creation. This can only happen if they proceed with promotion of higher value services, particularly broadband. How are they faring so far?

Cablecos more successful at broadband to date

As seen in the tables below, cable operators seem to have had generally better success at penetrating their limited franchises with advanced services than their telco counterparts, with a few obvious exceptions. Below we look at three markets where cable is well established, and the key franchises (NTL and Telewest in the UK, and UPC in the Netherlands and Austria) are somewhat more mature, in an attempt to assess the current state of play.

Cable modem subs %- of cable customers vs. ADSL subs %- PSTN lines

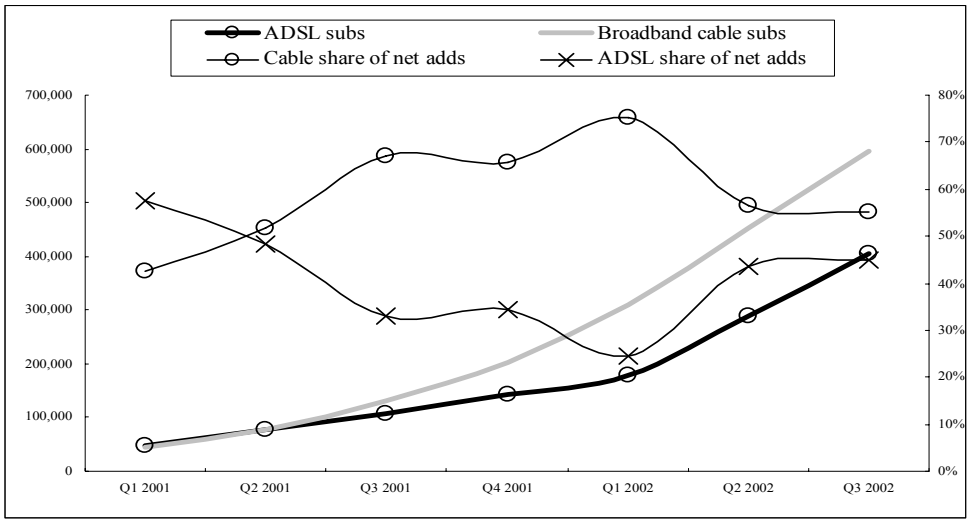
	Cable				ADSL			
	2001	**Q1 2002**	**Q2 2002**	**Q3 2002**	**2001**	**Q1 2002**	**Q2 2002**	**Q3 2002**
Germany	0.18%	0.20%	0.22%	0.22%	4.58%	4.98%	5.38%	5.58%
Netherlands	5.80%	6.37%	6.97%	7.48%	1.48%	2.09%	2.67%	3.03%
Belgium	9.61%	10.50%	12.93%	13.90%	4.31%	6.46%	7.49%	8.50%
UK	5.64%	8.72%	13.16%	16.88%	0.47%	0.59%	0.77%	1.40%
France	5.82%	6.25%	6.86%	7.45%	1.23%	1.72%	2.14%	2.58%
Spain	11.91%	18.25%	20.74%	23.24%	2.23%	3.14%	3.97%	5.13%
Portugal	8.31%	10.05%	11.91%	13.79%	0.03%	0.05%	0.07%	0.20%
Sweden	6.08%	6.82%	7.65%	8.13%	3.40%	4.64%	5.35%	5.93%
Norway	3.70%	4.23%	4.74%	5.10%	0.97%	1.58%	2.32%	2.91%
Finland	3.25%	3.73%	4.09%	3.87%	2.84%	3.60%	4.40%	5.40%
Denmark	6.17%	6.58%	7.79%	8.88%	4.78%	6.14%	7.41%	8.56%
Switzerland	5.54%	6.41%	7.06%	7.58%	0.86%	1.18%	1.90%	2.49%
Austria	13.64%	14.44%	14.98%	15.82%	3.22%	3.88%	4.45%	4.99%

Source: Company data, Telecom Markets, DIR estimates

UK – delivering through thick and thin

In the UK, NTL's share of total broadband quarterly net additions (up to Q3) has been on a par with, or higher in 2002, than in 2001. The Q3 figure was 40.2%, particularly impressive when we consider that NTL's UK franchise passes only 8.4m homes in a country of 59m people. Broadband subscribers as a percentage of the total cable TV subscriber base totalled 18.4%, and 31.5% of digital CATV subscribers, as at Q3 2002. A marketing tool unique to NTL (and other digital cable operators) is that the digital cable programme package includes a separate 24-hour channel devoted to cross selling of other services, including broadband internet and the Talk Unlimited discount calling packages. In this way, NTL can focus its sales promotion efforts on existing subscribers via its own internal marketing route, rather than throwing money at national ad campaigns. There is also a dedicated 24-hour user help channel. This author recently subscribed to the NTL digital cable service, having been a subscriber to the analogue cable service two years ago. Purely anecdotally, our experience with NTL customer relations so far this time around is vastly superior to our experience of two years ago. NTL call centre employees now answer the phone quickly, seem well trained, and are able to access key account details rapidly. The company has received much negative press attention over the past two years and has been the focus of numerous internet hate sites. However, at this point in time, it seems to be doing the right things.

UK cable and ADSL subscribers and share of net adds 2001 – Q3 02 (RHS)

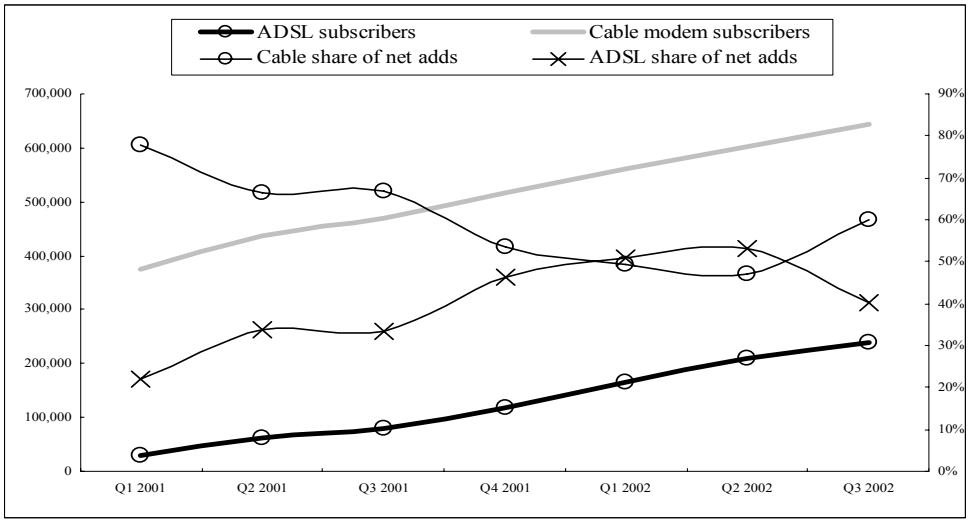


Source: Company data, Telecom Markets, DIR

The Netherlands – untapped potential

In the Netherlands, Europe's most highly penetrated cable market, at 39% population penetration, cable modem service penetration is still relatively limited, at just 7.5% of the subscriber base (though within UPC properties the number is higher than 12%). This is better than ADSL's 3% penetration of the PSTN, but it is far lower than the degree of penetration achieved in the UK, where population coverage of cable is still relatively low. Whatever the roots of the failure to date (UPC had some high profile quality of service issues a couple of years back, which probably did nothing to help perceptions), we note that cable's Q3 2002 share of broadband net adds saw a robust up tick (and third party ISPs using wholesale ADSL from KPN took 32% of net adds). We believe this was a key determinant in KPN deciding to launch a DSL lite product in late Q3, and we await full Q4 numbers to see what the effect was. As things stood at Q3, cable may have reversed the cycle of decline, and we believe that the market has all the ingredients to become the market where cable poses the largest latent threat to telco prospects in broadband.

Netherlands cable & ADSL subs and share of net adds 2001 – Q3 02 (RHS)

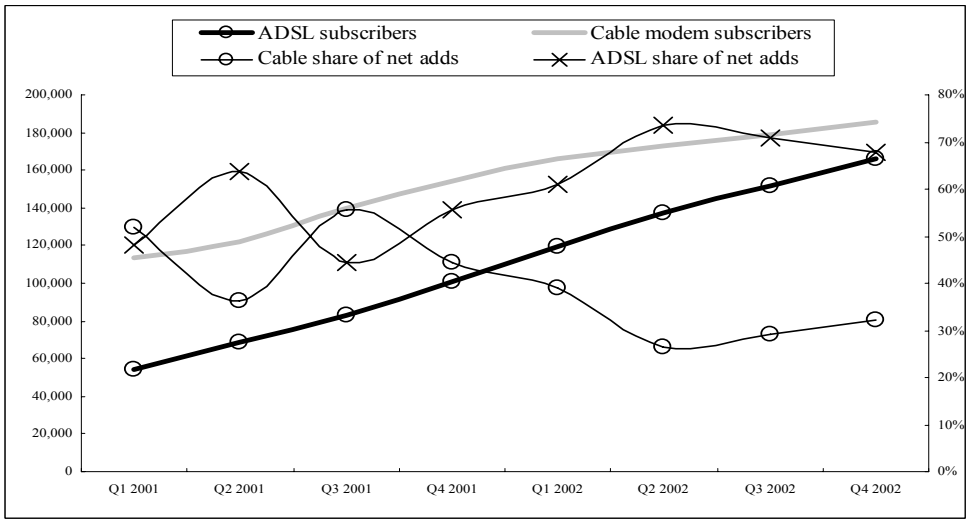


Source: Company data, Telecom Markets, DIR

Austria – has cable peaked?

Austria marks the third market where a relatively mature marketing presence has been established by UPC. Austria in many ways represents a mirror image of developments to those observed in the Netherlands. Austria is a moderate cable penetration country (14.5% of population), but cable modem service penetration has reached 15.8% (33% in UPC's Vienna properties). However, momentum has apparently been lost in recent quarters, driven by a more aggressive push on ADSL from incumbent Telekom Austria.

Austria cable and ADSL subs and share of net adds 2001 – Q3 02 (RHS)



Source: Company data, Telecom Markets, DIR

To each his own

In summary, we think the cable landscape in Europe is far from uniform, and high household penetration is no more a guarantee of success than low household penetration is to pushing rapid take-up of advanced services. The key factor with cable is that, in most countries, it is found almost exclusively in metropolitan areas, and in many cases in the homes of higher income/early technology adopters. Many consider it a superior technology, though we will not pursue that question here.

Cable penetration rates and ADSL share of broadband markets

	Cable penetration of population	ADSL share of broadband market
Germany	26.80%	98.38%
Netherlands	38.96%	34.29%
Belgium	22.79%	55.66%
UK	5.69%	41.70%
France	5.87%	77.35%
Spain	1.81%	82.99%
Italy	0.07%	100.00%
Portugal	12.22%	18.45%
Sweden	21.68%	71.06%
Norway	20.08%	67.75%
Finland	21.45%	77.25%
Denmark	33.06%	65.32%
Switzerland	32.42%	39.87%
Austria	14.35%	45.55%

Source: Company data, Telecom Markets, DIR

Cable risk is greater in some countries than others

Suffice to say that, in countries such as the UK, the Netherlands, Belgium, Sweden, Norway, France, Austria, and Switzerland, a large segment of the potential broadband consumer base will have a technology choice, and where the cableco can offer attractive bundling options and can be a price leader (as in the UK – see our UK broadband pricing table), telcos must move fast and imaginatively if they are to achieve and maintain an edge within the cablecos' footprint.

Alternative broadband technologies

Just in passing we note that the UK has recently seen one new entrant and one old player rescued from insolvency. We do not expect either player to become significant in the overall scheme of things, but each may develop a significant niche within the limitations of its market position. **Liberty Broadband**, formerly Tele2 UK, has been rescued by **Firstnet**, which will take over Liberty's existing 3,000 MMDS customers, and has plans to roll-out its "wireless DSL" product to rural areas not otherwise served by ADSL or cable modem. The UK government is currently planning to auction 15 regional licenses in the 3.4GHz band, so we may see more entrants into the space.
Swiftsat is a one-way broadband satellite service which has just gone live, and is looking to have 100,000 subs by year-end 2003.

Liberty Broadband coverage areas

Source: Liberty Broadband

Emerging threats: ISPs and other attacks from cyberspace

One threat which we believe telcos may have to continually confront in future is from cyberspace – namely, that ISPs, owners of consumer brands with an internet presence, and complete newcomers, may see cheap (or free) voice service as a means to an end, commercial, philosophical or otherwise. What shape might this take?

Web.de – web-based call-by-call reselling – not the end of the world, but one more option

Late last year, we saw the launch in Germany of a portal-based unified messaging system by portal **Web.de**. This relatively simple proprietary service, known as **Com Win 1.0**, offers management of multiple communications tools through an account based in the Web.de portal, for a monthly fee of €4.95/€7.95, depending on package options. Along with e-mail, SMS and FAX, the service includes a discounted call and conference call option which is initiated via the website. Though it sits on the web, it is basically a variation on the call-by-call pre-select model, though an interesting one nevertheless. We understand that Web.de has signed up roughly 1,000 users per week since launch, taking the installed base of users to over 10,000 at present. A mobile extension of the product is to be launched in Q1 2003. We think this sort of service ranks pretty low on the threat scale, though it does offer consumers one additional route to arbitrage between different devices/services/prices.

Yahoo! BB in Japan – upping the ante

One obviously more threatening example is Yahoo! Japan's much-acclaimed BB service. This package will be familiar to our Japanese readers, but for everyone else, Yahoo! BB is an ADSL service priced at ¥3,000 per month, a 25% discount to the average of NTT's own ADSL packages. Initially the service was just an ADSL and ISP service like any other, but the company took the decision to roll out modems with VoIP functionality to its subscribers. The service then took off dramatically, and in Q3 2002 (December 2002) the company saw a 67% sequential rise in subscribers, driven apparently by the bundling of cheap VoIP services. The company recently told us that of its 1.69m subscribers, 1.29m have modems optimised for VoIP.

Cheap VoIP calls/competitive ADSL pricing – a virtuous circle

It is easy to see why. On-net calls are free, which also promotes uptake among friends and families. Off-net calls are heavily discounted – three minutes within the Tokyo metropolitan area is ¥7.5 versus ¥10 on NTT, and calls to the USA are ¥7.5 per minute. Yahoo! Japan now claims a 30% share of the ADSL market in Japan, and says it took 44% of net ADSL adds in the market during Q3. Yahoo! (33.5% stake in Yahoo Japan) already has a successful partnership with SBC in broadband in the US market, and the company recently signalled its interest in entering the access market in Europe. We await more information on whether this includes broadband, but we assume at this point that it does. A Yahoo! BB-type service in Europe could seriously pressure incumbent voice revenues and share of the ADSL retail market, which is already under attack in some markets.

PTT's share of retail ADSL market

	2001	Q1 2002	Q2 2002	Q3 2002
Germany	91.24%	90.91%	90.63%	90.97%
Netherlands	93.22%	83.73%	72.51%	70.83%
Belgium	80.91%	84.56%	81.83%	83.33%
UK	61.69%	63.44%	61.50%	54.59%
France	95.00%	86.54%	84.93%	83.65%
Spain	77.17%	81.05%	78.18%	69.24%
Italy	63.33%	66.73%	68.29%	67.86%
Portugal	80.00%	75.00%	72.75%	71.91%
Sweden	86.63%	76.49%	76.20%	72.37%
Norway	59.63%	65.52%	57.14%	53.13%
Finland	83.63%	84.42%	83.26%	84.25%
Denmark	72.92%	77.33%	79.57%	81.87%
Switzerland	53.33%	51.64%	54.40%	54.38%
Austria	84.64%	81.71%	81.77%	81.08%

Source: Company data, Telecom Markets, DIR

Disruptive pricing in the UK

In the UK, Virgin.net, a marginal player with an estimated 3% share of ISP subscribers, has broken step with the other resellers of BT Group's wholesale DSL product, discounting it by 10.7%, to £24.99 from the £27.99 common throughout the market, and offering free connection until 31 March, 2003. This pricing point brings ADSL into line with similar bandwidth offerings from cable, which may be one reason that UK cableco Telewest chose January as a time to radically reduce its activation/installation fees and offer further discounts to existing customers for upgrading. As a brand extender with a broad presence in mobile, financial services, travel and media, we think Virgin's pricing strategy is being undertaken with some other commercial aims (and arguably subsidized by some other group companies), though we think the effect on "pure" broadband players may be to force another round of price cuts. Virgin's move followed BT's suspension of activation fees and reduction of modem prices in early January 2003. BT's own cuts followed similar moves by Demon Internet and Eclipse Internet in the early days of the year.

Don't forget about AOL

The jury is still out on what exactly the AOL Time Warner management intend to do with the European access business, given all the press whoopla about AOL's internal struggles and its strategy. We are not sure, but it cannot be denied that AOL's franchise in parts of Europe is quite strong, and arguably one way to increase its profile and market share is via a more aggressively priced, differentiated ADSL offering. Though purely anecdotal, it appears to us as though the volume of TV advertising, being generated by AOL's broadband offering in the UK, supports the view that the company is pushing forward rather than retreating. It is the joint number two UK ISP, according to OFTEL statistics, and should not be written off.

UK internet subscriber market shares

	Aug-00	Aug-01	Nov-01	Feb-02	May-02	Aug-02	Nov-02
BT	15%	18%	16%	20%	23%	18%	22%
Freeserve	27%	19%	21%	21%	20%	20%	19%
AOL	10%	16%	15%	17%	20%	19%	19%
NTL	8%	9%	11%	13%	12%	17%	14%
Tiscali			3%	2%	5%	4%	4%
Virgin Net	3%	3%	3%	2%	3%	4%	3%
Others	37%	35%	31%	25%	17%	18%	19%

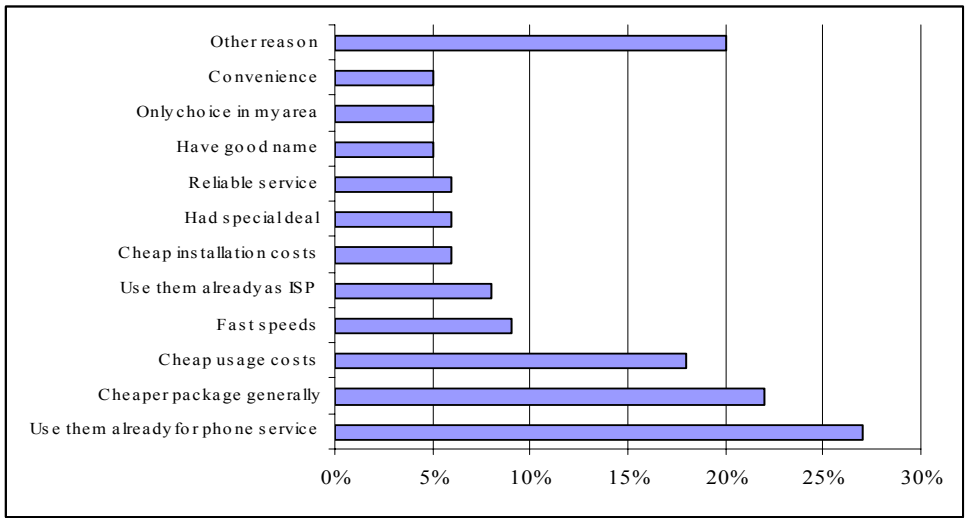
Source: OFTEL

Research suggests that telephony service may heighten the appeal of broadband providers

We believe that research shows the ISPs to have fair scope for taking significant shares of the retail ADSL market, particularly if they price aggressively and include a telephony service. OFTEL's survey of residential internet use, published in January, gives a breakdown of factors which go into consumers' evaluation of prospective broadband providers, and identifies some characteristics of the broadband user in Britain. Of those interested in finding out more about broadband services, 71% cited pricing as their area of greatest interest. Of those who had broadband, one third stated that they did not previously have internet connections at home, suggesting that those previously reluctant to go online due to concerns over price vs. quality now find broadband attractive at current pricing levels.

The chart below gives a ranking of reasons for choosing a broadband provider, identified by those who have broadband. Pricing and telephony service appear to vastly outstrip factors such as brand, reputation, or incumbent position as ISP. The responses suggest that telcos and cablecos may be in a strong position where broadband migration is concerned due to their existing telephone service, but that for the ISPs, aggressive pricing and bundling of VoIP telephony may be strategies to overcome brand obscurity.

Reasons for choice of broadband ISP



Source: OFTEL

This background may give some insight into Virgin.net's pricing strategy, in that it may be simply trying to differentiate its product offering and improve its share of the market. We think that, as ADSL prices in European markets gravitate to the level, cited by BT and others, at which the cost of broadband approaches parity with (and in some cases goes below) the cost of a second PSTN line plus a flat-rate/heavy-user narrowband internet tariff, we may see more radical strategies to differentiate ADSL offerings – such as VoIP. That's when things really begin to get fun, though in some respects the attack has already begun, as our next section shows.

ADSL pricing vs. second line and narrowband flat rate/heavy user packages

France	€/mo.	**UK**	£/mo.	**Spain**	€/mo.
PSTN rental	10.87	PSTN rental	8.08	PSTN rental	11.68
9 Telecom "9 online" (40 hours inclusive)	20.07	BT Surftime Anytime	21.27	Terra 10 hours daytime and 50 hours nighttime	30.65
Total narrowband	**30.94**	**Total narrowband**	**29.35**	**Total narrowband**	**42.33**
eXtense DSL 128kbps	30.00	BT Broadband (512k)	27.99	Terra DSL basic (256k)	39.06
"9 online" ADSL	37.60	Virgin.net ADSL (512k)	24.99	Jazztel DSL lite	39.00

Source: Company data, Tarifica, DIR

Current state of residential broadband pricing in the UK

Technology/ operator	Connection speed	Connection fee	Monthly access fee	Equipment cost	Peripherals	Web-space	E-mail	Other
ADSL								
BT Broadband	£60, but special offer of £30 ran until 31/12/02	512kbps	£27 if by direct debit, £28 otherwise	£50 for modem and two microfilters (special promotion)	£6 for additional microfilters	Various (see below) PlusNet - 25MB clara.net Lycos Yahoo! MSN Easily.co.uk	Various (see below) PlusNet - unlimited e-mail addresses clara.net £9.99 per year for add-on e-mail/storage Lycos - free Yahoo! - free MSN - free £12.99 for two years unlimited personalised e-mail	PlusNet - £1.99 and 3.49 per month for e-mail, web-space, storage and other options
						BT Openworld	BT Openworld - £1.50 per month	
BT Openworld	Free (self-install, previously £65) or £250 (engineer-assisted)	512kbps	£29.99	£50 for modem and two microfilters (from January 2003 - previously £85)		50MB	up to 10	
Freeserve	£84.99 fee covering connection and equipment, previously £149.99	512kbps	£27.99			30MB	Unlimited	£25 worth of incentives, including two months membership to Freeserve Music Club (£4.99 per month), 20 free photo prints from Freeserve Photos, and 150 text message credits on Freeserve textMail
AOL	Free	512kbps	£27.99	£85 for modem and two microfilters			7 addresses plus instant messaging	
Virgin.net	£39.99 - Free until March 31, 2003	512kbps	£24.99	£79.99 starter kit including modem				
clara.net	£50 +VAT	512kbps	£29.99	none - modem must be supplied by subscriber	microfilters available for £10 +VAT	50MB		
Tiscali	£50 for 256kbps option, no connection fee for 512kbps	256/512kbp	£19.99 for 256kbps, £27 for 512kbps	Optional modem at £65, with two microfilters	Extra microfilters for £9.99 incl. VAT	100MB	six	
One.Tel	Free (self-install - normally £60)until March 31, 2003 or £265 for engineer-assisted	512kbps	£28.99 (£27.99 of by direct debit)	Modem £29.99 (normally £99.99) and microfilters £9.99			one	
Cable modem								
NTL	£25 until 28/02/03, normally £50 for existing customers, £75 for new customers free until 28/02/03, normally £50 for existing customers, £75 for new customers free until 28/02/03, normally £50 for existing customers, £75 for new customers	128kbps 600kbps 1mbps	£14.99 £24.99 £34.99 until 31/12/02 (normally £49.99)	fully-subsidized fully-subsidized fully-subsidized		55MB 55MB 55MB	up to 15 up to 15 up to 15	
Telewest	£50 - 75 (depending on equipment requirements) £25 special offer (£12.50 for existing customers) £50 - 75 (depending on equipment requirements) £25 special offer up (£12.50 for existing customers)	512kbps 1mbps	£29.99, £25 for users of other Telewest services £39.99, £35 for users of other Telewest services	fully-subsidized fully-subsidized		30MB	up to 15	priority technical support line
Satellite								
SwiftSat/Isonetric Broadband	£44.99 (installation)	400kbps average (bursts up to 1mbps)	£29.99	£249.99 payable up-front or over 12 months			unknown	Dish also supports free to air digital TV and digital radio. Return path is narrow-band
Fixed wireless								
Liberty Broadband (Tele2)	None	512kbps down, 256kbps up	£39.99	£149 for two storeys, £199 for more than two storeys, includes installation		20MB	up to 10 addresses	Download and upload speeds upgradeable for fees ranging from £10 - 85. Service level upgrades also available.

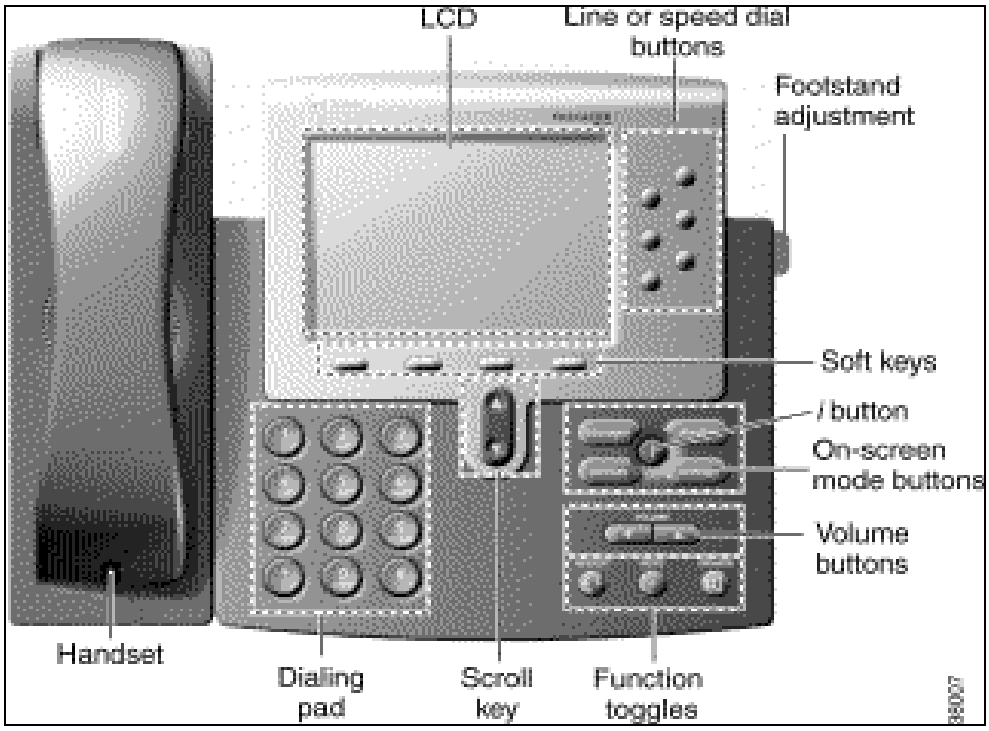
Source: Company information, DIR

Honey, I shrunk the market

VoIP-based virtual operators – one step beyond

Many of the examples of competitive threats we list above presuppose some element of access in the business model. However, in the past year, we have seen examples of operators who are not interested in this portion of the revenue stream, and one of which is not interested in revenue streams at all – at least for the present. These are operators based in cyberspace, which exploit session initiation protocol (SIP) technology to offer VoIP services over broadband at cheap rates/no charge. The front-end cost to the user is relatively limited. In addition to a broadband connection, the only other element required is either a SIP phone such as the Cisco 7960 (retail price c.$650, currently going on eBay for $190 – 325), an analogue phone adapted using Cisco's ATA 186 ($90 – 130 on eBay), or a "softphone" such as the Windows Messenger. We highlight the two most interesting of such operators below:

Cisco 7960 SIP phone



Source: Cisco Systems

Vonage –removing geographical specificity from phones

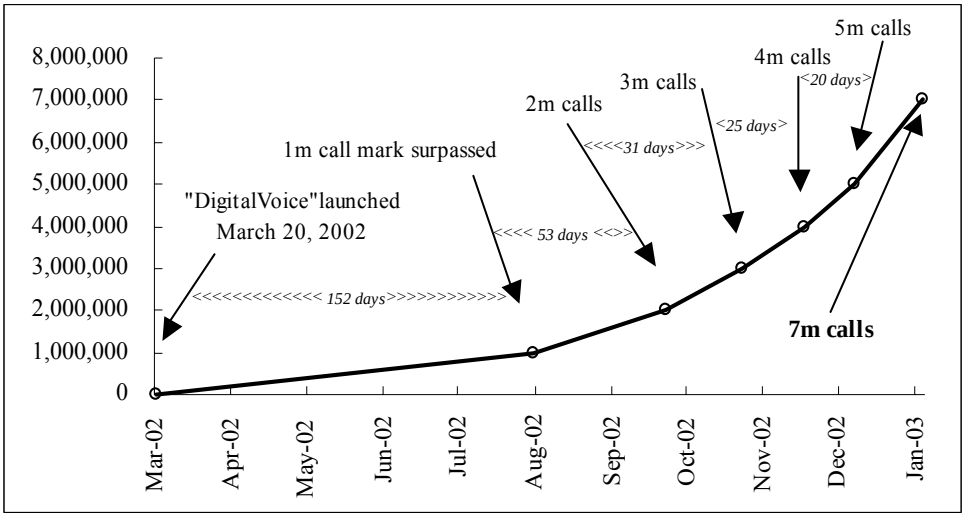
New Jersey-based **Vonage** (www.vonage.com) offers flat-rate VoIP call packages ranging in price from $25.99 to $39.99, which include vertical services such as call waiting, voicemail, call forwarding, call transfer, caller ID, and caller ID block, for which the RBOCs frequently charge. All calls to other Vonage users are free, which adds the crucial element of peer-pressure and viral marketing which we believe may be a key element of such services. The $39.99 premium package offers unlimited local and long-distance calls, while the more basic package covers local calls with 500 long distance minutes included. This may not appear overly generous, except for the important fact that users have the ability to designate a home area code. Thus, a user living in Los Angeles, who normally makes a large number of calls to New York, can designate himself a 212 area code, thus shifting a substantial portion of his long distance calling minutes into the unlimited local bundle!

US-based, but potentially global

We assume that this model would also extend to cases such as US ex-patriots who maintain a US address and phone number. The appeal of making unlimited VoIP calls from London to New York as part of a local bundle must surely be overwhelming for some of the heavier users of conventional international call services. The company clarified for us that, in fact, all the prospective user needs is a US shipping address and a valid credit card in order to initiate the process. The legality of such an arbitrage may conceivably be open to question depending on the country, but we think it would be devilishly hard even to identify such cases without triggering charges of invasion of privacy. The proof of the appeal of the product appears to be in the sharp spike in

traffic, as seen in the chart below. Since "DigitalVoice" was launched in March 2002, the service has signed up 10,000 users and has completed over 7m calls. Usage is clearly accelerating, as evidenced by the fact that it took 152 days to generate the first 1m calls, but only 28 days to generate the most recent 2m.

Evolution of SIP calls on Vonage "DigitalVoice" product



Source: Vonage, DIR estimates

FWD – does it get any more radical than this?

Melville, N.Y., based **Free World Dialup** (**FWD** - http://www.pulver.com/fwd/) launched with no marketing on 11th November, 2002, and is the latest in a series of VoIP services launched by entrepreneur Jeff Pulver. FWD calls are free anywhere in the world, provided that these are to other FWD members. There are no off-net calls via FWD. The service is a community and carries no subscription fees or other charges, and makes no revenue from equipment or software sales. FWD had 4,400 users when we first spoke to Mr. Pulver on 6th January, and in early February FWD confirmed more than 8,000 members, suggesting that the weekly run-rate for subscriber additions is over 800 persons. Management expect to reach 10,000 by the end of March, though this target is looking increasingly conservative. According to Mr. Pulver, 40% of current FWD users are based in Europe, 40% in North America and 20% in AsiaPac/RoW.

Is it even really telecoms?

Pulver.com, which operates FWD, filed a petition with the FCC on 5th February, 2003, seeking a ruling that the FWD service cannot be considered telecommunications, or a telecommunications service, on the grounds that a single service offered free of charge to community members, which offers to link IP devices directly, and which does not involve issuing numbers under the North American Numbering Plan (NANP), is entirely legal and should not be regulated as a telecommunications service. We think that a favourable response from the FCC could be seen as a regulatory precedent and promote further developments along the lines of FWD globally.

Why no charge?

We believe that the FWD service is effectively a loss-leader for the eventual launch of chargeable services from Pulver.com. While FWD's management may have a commercial aim underlying their planning, they are also outspoken advocates of free voice service. Unlike simple (and web-based) resellers, they have no margin to protect in undercutting the incumbent. Unlike the Vonage service, FWD does not rely on recycled NANP numbers obtained from RBOCs, and so the service is available over the internet to anyone in any country, so long as they have a broadband connection. The FWD concept functions equally well in a broadband wireless environment, which opens up the possibility that users of Wi-Fi networks, either commercial or community-based, could use the FWD service either on the go or via local node fed into a collective ADSL connection. We believe that the Wi-Fi bears underestimate what this could mean for the technology if we consider handheld devices such as the iPAQ optimised for voice. Sceptics may wish to visit http://www.telesym.com/ to see other developments in this area.

What could the impact be?

Firstly, we think we are just seeing the very early stages of new services such as these, and at this point it would be very premature to postulate what pain 20,000 SIP phone users may end up inflicting on the telcos. Conceptually, at least, we have to entertain the following:

- **Voice over broadband accelerates decline in traditional voice revenues** - For those in the market of the view that ADSL is somehow either a growth driver (which we do not believe) or a defensive tool for growing access revenues against a background of declining voice pricing and traffic (which we believe in theory), services like Vonage and FWD open up very real possibilities that increased ADSL penetration may in fact *accelerate* the erosion/evaporation of voice revenues from the PTTs, which have long insisted that ADSL was the key weapon against erosion of voice revenues. In essence, the huge emphasis on ADSL expansion by the PTTs may ultimately open up a Pandora's Box of voice arbitrage opportunities for the consumer – including very, very cheap, or free voice.
- **PSTN access revenues come under pressure** - We also think that, in markets where cable plant is currently capable of delivering broadband on a widespread basis (most of Europe with the exceptions of Italy, Germany and Greece, but particularly the Netherlands, Belgium, Sweden, France, and the UK), FWD or a similar service might work in tandem with mobile substitution to put pressure on PSTN lines, and thus access revenues. These typically account for roughly another 30% of PTT domestic fixed revenues, and are the linchpin of the long-term business models for incumbent wireline businesses.
- In a community Wi-Fi network setting, which may be using a shared ADSL/SDSL/MMDS/leased line connection, the potential is obviously for both **lower-than-expected ADSL access revenues** and **greater loss of voice traffic** across multiple households.
- For users on the go, access to **free international voice from within a Wi-Fi hotspot** would undoubtedly prove attractive relative to international mobile roaming charges.

What can we learn from the recorded music world?

We think the only really meaningful point of reference at this point is the proliferation of illegal file-sharing services specializing in music downloads. These services function along similar lines to the SIP based VoIP technology, and have gone from being obscure start-ups to becoming the bane of the recorded music industry, commanding thousands of column inches in the mainstream media at the same time. Our media counterparts at DIR London gave us the following analysis, which suggests that services such as Kazaa deprived the recorded music industry of 5.5% of revenues in 2002, or some $1.7bn. Some estimates suggest that up to 17m downloads are taking place on Kazaa per month. Today's *Financial Times* contains a feature article explicitly linking ADSL penetration in Germany (the highest in Europe) with an increase in illegal file sharing. The article goes on to quote a managing director at the German Federation of Film Distributors as saying that he estimates that illegal file sharing of film content may now equate to 10% of the industry's global turnover. We think that the scale of music and film file sharing serves as a good indication of the potential scale of SIP-based voice services in future. One key difference is that in the case of music and video file sharing, the practice is in violation of copyright laws, and is subject to surveillance and interference from the music and film industry (such as the practice of loading "spoof" music tracks into the system to frustrate users). This fact may mask the true potential demand for such services in the voice telephony world.

Estimate of revenue lost by global music industry to file-sharing services

	Cf. Legal Online Music Market *	Unique users of illegal music download				
		Napster	KaZaa	Audiogalaxy Satellite	Morpheus	Total
	(mil $)	(mil)				
2001 Q1	26	11.96	-	0.55	-	12.51
Q2	269	8.26	0.52	0.72	0.81	10.31
Q3	199	5.72	1.59	0.95	2.27	10.53
Q4	278	2.96	2.99	1.83	4.88	12.66
2002 Q1	230	1.64	4.58	2.91	7.15	16.28
Q2	194	1.06	7.28	3.13	3.76	15.23
Q3	122	0.75	9.43	1.65	-	11.83
Q4						

*Purchases of CD online, music subscription, streaming (pay-per-listen)

Source: ComScore, Nov-02

Avg. unique users in 2002 (mil)	14.45
Potential spending per month **	US$10
Estimated "lost" revenue (mil US$)	1,725
Estimated Industry Sales in 2002 (bn US$)	31.1
Estimated "lost" revenue equivalent % of music market	5.5%

** Monthly fee of music subscription JVs of music giants (Pressplay, MusicNet)

Source: DIR media team

Emerging threats: the many faces of Wi-Fi

A timely issue, but is the market concerned about the right issues?

General awareness and interest in Wi-Fi has risen dramatically over the past 6 months. When we first started looking into some of the wireless networking communities around Europe (listed at the end of this section) about a year ago, we very much viewed the development of Wi-Fi as a fringe movement, outside of the commercial deployments expected from incumbents and other players in the space. It was therefore surprising to us to see almost daily coverage of the community Wi-Fi issue in the pages of the *New York Times* and to see detailed coverage of "war-chalking" (seeking out unsecured private Wi-Fi nodes and marking the pavement or walls of nearby buildings with symbols to identify the access point so that other users may take advantage of the vulnerability) on the London local evening news update. Much of the business press coverage of Wi-Fi has focused on the technology's potential to dilute/displace 3G demand, as ubiquity of Wi-Fi in airports, shopping malls, train stations and other high traffic public places would ostensibly make the relatively less robust UMTS an unattractive option. We think this angle on Wi-Fi misses the real threats, which the technology poses. We think that those threats lie principally in the following areas: access and voice in the local loop; broadband access; and mobile voice roaming.

Commercial deployments – who cares?

So far, we have seen a growing number of commercial deployments in various corners of Europe, but coverage is still relatively limited, and pricing is highly variable, and for the most part, unappealing to anyone outside the business traveler segment. From our observation of early adopters of Wi-Fi technology (see below), we think there is a fair bit of animosity toward commercial Wi-Fi deployments and pricing schemes amongst those most familiar with the technology. We think the much more interesting developments in this space are occurring in small cells dotted around the globe, but increasingly acting in concert.

Wi-Fi pricing packages

Company	Plan	Pricing	Usage	Comments
BT Openzone (UK)	Unlimited	£85, no overage charge	Unlimited usage	
	Openzone 900	£40, 10p per additional minute	900 minutes per month	Looks good value at effective price per minute of 4.44p
	Openzone 300	£20, 15p per additional minute	300 minutes per month	6.66p per minute is not as competitive as the Megabeam offering, but UK coverage better
	Pre-pay one hour pass	£6	One hour of usage within a 24-hour period	
	Pre-pay 24-hour pass	£15	Unlimited usage within 24 hours of first log-on	
T-Mobile UK				Currently free
Megabeam (Europe)	2-hour	€7.50	For use at individual hot spots only	Certainly better value than the T-Mobile USA 15-minute package at €0.0625 per minute.
	24-hour	€30	Multi-location usage within user-defined geographical area	Highly competitive at €0.02 per minute
	7-day	€65	National or pan-European usage	25% discount before 31 March, 2003
	Monthly	€115	National or pan-European usage	25% discount before 31 March, 2003
	Annual	€1,020	24/7 usage on a pan-European basis	Until 31 March, 2003 one additional year free for post-pay, one year free and 10% discount for pre-pay
Telia HomeRun	Base	Connection: SEK200	1 hour free for GSM subscribers	Connection equates to €22
		Monthly fee: SEK40 per month for GSM subs/SEK150 for non-subs		€4.40 per month as GSM add-on, €16 for non-subscribers
		Per minute: SEK2 for GSM subs/SEK2.40 for non-subs		€0.22/€0.264 per minute looks steep
	12 month binding	Connection: free		
		Monthly fee: SEK40 per month for GSM subs/SEK150 for non-subs		
		Per minute: SEK2 for GSM subs/SEK2.40 for non-subs		
	Flat rate	Connection: free	Unlimited usage	
		Monthly fee: SEK1,395 per month for GSM subs/SEK1,495 for non-subs		€153/€163 per month is way out of line with other flat rate unlimited packages
		Per minute: none		
	24-hour subscription	SEK96		

Source: Company data, DIR

Think globally, act locally

We have been monitoring for several months the e-mail lists of the UK-based Wi-Fi community/resource centre known as Consume the Net (www.consume.net). Consume serves as an information forum for individuals and groups looking to establish local community Wi-Fi networks in the UK. While many of the exchanges we observe are between established network operators and involve highly technical aspects of network construction and maintenance, the resource also serves as an opportunity for newcomers to purchase networking components cheaply and to ask advice of more experienced members. Occasionally, we have come across the unusual bit of technical information (such as recent exchanges involving a Norwegian design company which is currently testing a session initiation protocol (SIP) phone with Wi-Fi interface).

What's the message?

If it is possible to succinctly characterise our impressions of the Wi-Fi "movement" as we perceive it from our passive observation of the e-mail lists, we would say the following:

- Barriers to entry are low - The technology involved requires patience and experimentation, but all the necessary components can be purchased off the shelf or, in some cases, improvised from found materials (such as tin cans – believe it or not). LINUX is the operating system of choice, and as such the PC hardware required is basic, and in many cases can be recovered from stockpiles of discarded office equipment at very low cost.
- This is not a group of people to be dismissed lightly - The community Wi-Fi movement is generously populated with individuals from telecoms/IT backgrounds, who possess a high degree of technical expertise, including areas of telecoms regulation.
- The movement is increasingly internationally networked – Consume and Free2air.org in the UK last year hosted joint seminars with Berlin network wLab, which spawned a similar event currently being planned in Copenhagen http://wire.less.dk/wiki/index.php/CopenhagenInterpolation. The international coalition of networking organisations known as FreeNetworks.org (www.freenetworks.org) is planning its first international conference for June 6 – 8, 2003 in Las Vegas. The movement has a missionary element - the FreeNetworks.org conference includes in its key objectives the intention to equip attendees to go out and act on what they have learned. Specifically, "The conference will start with one day of in-depth, hands-on tutorial. Attendees will leave the tutorial with a working piece of hardware that they can build, configure and replicate for use in their own community wireless network."
- There is a clear political agenda - The movement is not merely comprised of hobbyists or technology geeks. There is a clear identification with what many view as the original goal of the internet and the current goals of the open-source software movement (i.e., democratisation of information and resistance to corporate dominance of IT and telecom services). Below are two mission statements, one from Manchester Wireless in the UK, and the other from FreeNetworks.org, both of which we believe accurately represent the philosophical underpinnings of this phenomenon.

"Manchester Wireless are dedicated to setting up a free, public wireless network in Manchester. We believe that the data networks of the future will be as important infrastructure as roads and railways, and it is vital that these networks are not monopolised by a small few, but are run in the interests of the local community. Manchester Wireless aim to create a city-wide wireless network using freely available off-the-shelf hardware, and free, open-source software."

"A freenetwork is an exercise in telecommunications freedom. A network created by those who use it rather than brought to consumers by business. It is not necessarily 'free' as in cost, but more to the point, autonomous and self governing."

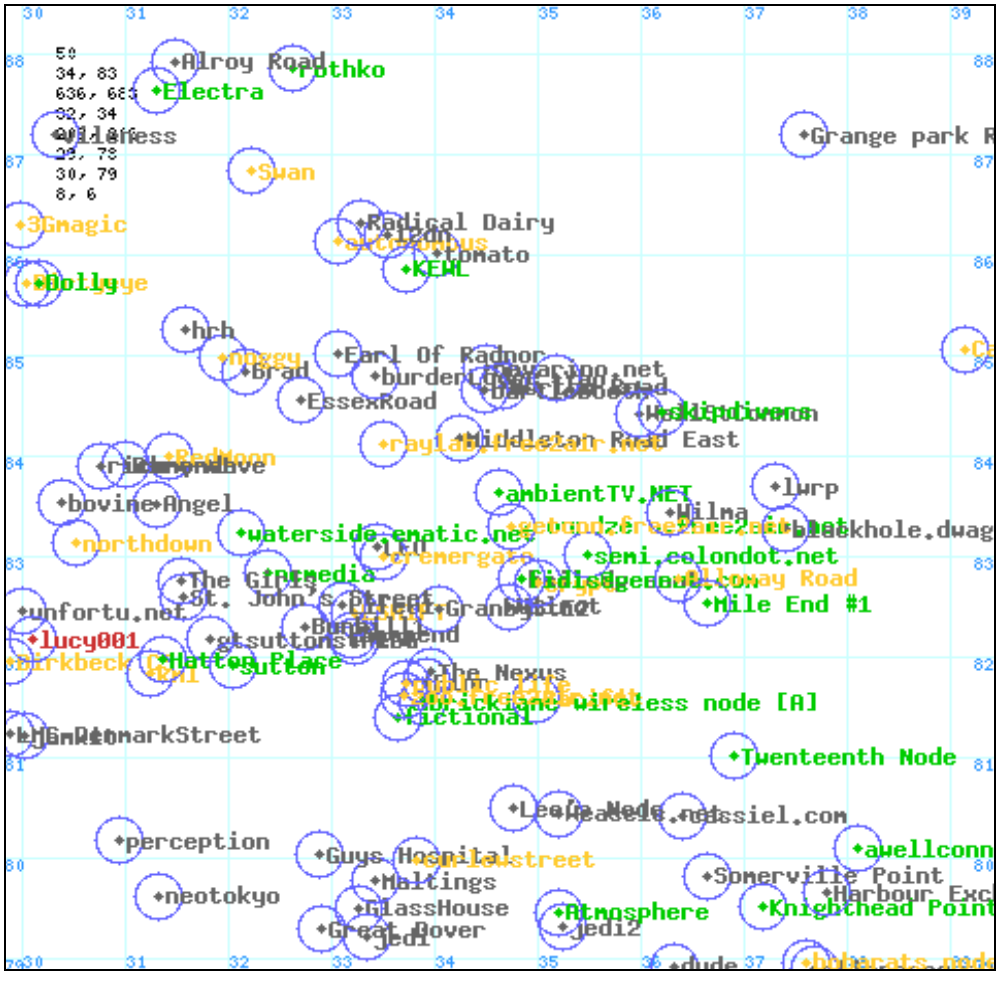
Should the operators be scared? Probably

We think that currently, the community free networking movement is small enough to be dismissed by the carriers. Additionally, the association that some Wi-Fi groups have with the practice of "war-chalking" and the apparent high representation of disgruntled IT professionals, new media/performance artists, veterans of pirate radio initiatives and anti-globalisation sentiment may tempt many of a more reactionary bent to dismiss the phenomenon as a "lunatic fringe of anarchistic, soap-averse crackpots," or something along those lines. This, in our view, would be a very serious miscalculation, as well as a fundamental misunderstanding of the real aims of free networks.

What sort of damage could the PTTs suffer?

What is likely to be the impact of this movement on the PTTs? This is very hard to estimate at present, however, it is fair to say that in the year or so that we have been watching this movement develop, we have been surprised at the level of mainstream press attention it has gained, as well as at the number of networks springing up nearly everywhere. The Consume node database contains several hundred nodes in the UK, and the number is updated regularly for new additions. Conceptually, if we accept that most of these networks operate on the principal that it is desirable to avoid handing money to telcos, especially the incumbent, and that they are operated by people who are early adopters of technology, out to "spread the word," it is not a great leap to assume that revenues could be at risk.

Section of Wi-Fi node map from Consume (East-Central London)



Source: Consume

What would it look like?

What we envisage (and we believe some are already developing in the UK and elsewhere), is the development of numerous small local networks comprised of a Wi-Fi node connected to a shared ADSL connection, though we think that the widespread availability of SDSL will make this an infinitely more attractive proposition. Alternatively, community networks may opt for leased lines, or in the rare cases where it is economical to do so, fibre. Where adjacent networks are known to one another, it is common for them to informally agree terms for transit from one network to the other, similar to "peering" arrangements struck between internet backbone operators.

Stitching the networks together

In time it is conceivable that, in areas of dense Wi-Fi community network activity, a significant amount of traffic may eventually move "on-net". This process may become somewhat easier with the arrival of newly released software from Trepia (http://www.trepia.com/), which allows registered Wi-Fi users to locate and communicate with each other based on which node they are accessing. We can envisage many possibilities, but it really depends on how determined the individuals in question are to have unfettered broadband access and cheap/free voice.

Did you say voice?

Given the growing prominence of Wi-Fi compatible devices, we think there is a very short leap to VoIP and/or SIP-based voice services over Wi-Fi. Dell now ships two models of its Latitude notebook computer with a Wi-Fi card as a standard built-in feature, and we were intrigued by the mid-January announcement of the partnership between Motorola, Avaya and Proxim to build converged cellular and 820.11b network technology using IP telephony technology. Neither should the growing number of voice-optimised wireless PDAs be overly comforting to either PTTs or cellular operators, if we assume that they may generate free voice traffic and zero roaming fees.

How much is at stake?

Let's assume that 10 households form a Wi-Fi node and are assessing options for shared broadband connectivity to the PSTN. Under shared access, some might argue that the access speeds on offer would not be sufficient for broadband users, though we note with interest that France Telecom attributed 40 – 50% of its very healthy Q4 ADSL net adds to the introduction of a 128kbps product (at a price of €30 per month). All of the scenarios we list below offer more bandwidth than that, at a fraction of the cost. What are some of the options?

- A shared ADSL connection from one of the "professional user" connections on offer in various countries (in the case of France it is permanent, unlimited connection, 256kbps upstream/1Mbps downstream guaranteed for c. €90 per month). Such a connection might suffice for many users, depending on how responsible they are and what they want to do, and at €9 per household, the cost is below PSTN monthly access charges.
- In Germany, for example a 2Mbps leased line within the same local exchange area costs €340 per month. Installation costs more than €1,000, though there are steep discounts for contracts of longer than one year. The cost per household in this scenario is €34 per month, but with each home having a reasonable chance of consistent upstream speeds over 300kbps, this is easily enough to support voice over broadband applications such as we will discuss later.
- Alternatively, in the UK, for £95 per month, the multi-user business tariff from Liberty Broadband's FWA service offers burstable downstream and upstream speeds of 512kbps, with a minimum guaranteed upstream speed of 128kbps (enough for voice) for an additional £25 per month. This works out at £10.50 per month per household, a third more than the cost of basic PSTN access.
- Then again, German SDSL specialist QSC offers slightly more bandwidth than the DT leased line option for only €99 per month using an SDSL solution. This is an interesting option, as for only €9.90 per month (PSTN monthly access is €13.73, basic T-Net ADSL is €17.23), each household could get enough upstream bandwidth for VoIP over broadband solutions, as well as all the other benefits of broadband, but at a vastly lower monthly cost.

Some shared access options available to community networks

Operator	Speed	Monthly rental
France – FT ADSL "professional user"	256kbps upstream, 1Mbps downstream, permanent, unlimited connection	€90
Germany - QSC SDSL	2.3Mbps upstream/downstream	€99
Germany – DT local leased line	2Mbps upstream/downstream	€340
UK – Liberty Broadband MMDS multi-user business tariff	Variable (burstable to 512kbps up/down)	£94.99

Source: Tarifica, company data

Adding it all together

Let us then do some back-of-the-envelope calculations. Ten German Wi-Fi-linked households sharing an SDSL connection could potentially deprive the incumbent of €137.30 per month in access (PSTN access x 10) if they gave up their PSTN connections. If they also gave up their individual ADSL connections, this number becomes €309.60 per month. If they decide to subscribe to a VoIP over broadband service of the type we describe on pages 28 – 29, then the traffic revenue lost could be from €140 and up per month. Add it all together and we have a potential €450 per month for a cluster of ten households who choose to buck the system. These are very rough numbers, and based on a very drastic set of assumptions, but we think this highlights the seriousness of the risk of dis-intermediation faced by PTTs. (For anyone sceptical about the possibility of such developments, we invite readers to register for the Consume e-mail lists, on which we have recently seen a steady stream of enquiries from Wi-Fi newcomers about the economics, logistics and legality of setting up small, local, not-for-profit wireless ISPs in the UK.) We think there may inevitably be regulatory issues raised, though with a voice-over-broadband solution based on SIP technology, we think defining precisely what a telephony service is, and who is offering it, will be a difficult task.

Broadband – this time it's political

Beyond the pure community-based networks, it is worth highlighting a couple of recent developments, which may give a further indication of where these developments are leading. In January, we witnessed the launch of two civic-backed projects to establish free public Wi-Fi networks, and we believe many more may follow.

- The first was in Long Beach California, where the local government launched its first active free Wi-Fi hotspot as part of an inner city redevelopment programme, which aims to offer ubiquitous free broadband internet access to attract residents and businesses back to the area. Interestingly the press release marking the launch http://www.ci.long-beach.ca.us/bdc/hot%5Fzone.htm stresses that the first spot offers only outdoor service, though conveniently located in an area with numerous restaurants offering outdoor seating. When stimulating the local economy becomes the main goal, the local government is willing to fund the internet connection, and equipment vendors are willing to donate equipment, what is the benefit to the incumbent, other than the revenue from the leased line?
- The second very similar development, also in January, was in the historic university town of Leiden, the Netherlands (coincidentally, also where the insurrection against the Spanish Inquisition began!). In this case, UK-based ISP Demon Internet (subsidiary of Thus plc) announced a partnership with the Leiden Wireless Wi-Fi community to provide free internet connectivity to the network. We do not believe this will necessarily be a permanent arrangement, but for the time being, it is an interesting development, and one we may see more of in the Netherlands and elsewhere. The Netherlands is also the focus of a proposal by local telecoms consultants for the Dutch government to fund the creation of a national free broadband network based heavily on Wi-Fi access. Again, in either of these examples, it is very difficult to imagine the incumbent walking away with much besides some wholesale revenue. On the flip side, the opportunities for revenue cannibalization are great, in our view.

We have provided a partial list of links to Wi-Fi communities and resources below, though it is far from complete. For those readers who are genuinely interested in getting a more complete picture of the real scale of this phenomenon, we highly recommend the comprehensive list of international Wi-Fi communities available at http://www.toaster.net/wireless/community.html. For more on the background to the Wi-Fi community networks, their links to previous technological movements (such as mini-FM in Japan), readers may wish to view the archived presentation http://www.tate.org.uk/audiovideo/archive.htm of Wireless Culture, which we attended at Tate Modern in London on 1st February, 2003. Though too complicated and tangential to go into here, the range of presentations give a good grounding in Wi-Fi as an informational tool, a medium for artistic expression, and as a platform for alternative political activity.

A sample of Wi-Fi community and Wi-Fi resource sites

Denmark
wire.less.dk http://wire.less.dk

France
Wireless France http://www.la-grange.net/2001/02/openwireless.html

Germany
Bootlab http://www.bootlab.org/
wLab http://wlab.de/

Netherlands
Wireless Leiden http://www.wirelessleiden.nl
Rotterdam Wireless.net http://www.rotterdamwireless.net/rw_flash/index.html

Spain
Madridwireless.net http://madridwireless.net/
Araba Wireless http://www.vitoria-gasteizwireless.net/
Salamanca Wireless http://www.salamancawireless.net/
Anuestroaire.net http://www.anuestroaire.net/

Sweden
Elektrosmog http://www.elektrosmog.nu/

UK
Consume the Net http://www.consume.net/
Freenetworks.org http://www.freenetworks.org/
Arwain (Cardiff, Wales) http://www.arwain.net/arwain.htm
Manchesterwireless.net http://www.manchesterwireless.net
Wireless Network Access Project http://wnap.unx.org.uk/
Southport Wireless http://www.southportwireless.co.uk/
Free2air.org www.free2air.org

USA
Bay Area Wireless User Group http://www.bawug.org/
Nocat http://nocat.net/
PersonalTelco http://www.personaltelco.net/index.cgi/PersonalTelco
Austin Wireless http://www.austinwireless.net/cgi-bin/index.cgi
Capital Area Wireless Network http://www.cawnet.org/
NYCWireless http://nycwireless.net/
Seattle Wireless.net http://seattlewireless.net/
Houstonwireless http://www.houstonwireless.org/
Toaster http://www.toaster.net/

Canada
BC Wireless http://bcwireless.net/?menu=Home
Waterloo Wireless http://www.waterloowireless.org/
Toronto Wireless Community Network http://www.esoterraka.com/twcn/
Canada – Wireless.net http://www.canada-wireless.net/

Other
Tetsuo Kogawa (mini-FM pioneer) http://anarchy.k2.tku.ac.jp/
http://youarehere.metamute.com/twiki/bin/view/Home/WebHome
http://www.raylab.com/
http://www.ambienttv.net/
http://www.aaschool.ac.uk/antennaa/

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1 - expected to outperform by more than 15%, 2 - expected to outperform by between 5% and 15%, 3 - expected to deviate no more than plus or minus 5%, 4 - expected to underperform by between 5% and 15%, 5 - expected to underperform by more than 15%. All DIR recommendations are made on a 6 months basis. Our benchmark is the DJ STOXX 600 index.

North America

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Ltd.; Au Optronics Corp.; Australia and New Zealand Banking Group Ltd.; Bals Corp.; BOC Hong Kong (Holdings) Ltd.; The Bank of Fukuoka Ltd.; Bank of Nova Scotia Ltd.; Bank of Western Australia; BCP Finance Bank; Belluna Co. Ltd.; BHW Bausparkasse AG; BMW AG; BNP Paribas; Bradford & Bingley; Bunadarbanki Islands; C-Sam Inc.; CAM Global Finance; Caixa Catalunya International Finance; Canopus Co. Ltd.; Cawachi Ltd.; Central Japan Railway Co.; Central Service Systems Ltd.; Chubu Electric Power Co. Inc.; Chunghwa Telecom; Citigroup Inc.; Club iT Corp.; Concorde Securities; Cosworth Tech/LDV/ MSX Int.; Cota Co. Ltd.; Credia Co. Ltd.; Creed Corp.; Cross Cat Co. Ltd.; CTS Co. Ltd.; CVS Bay Area, Inc.; Daibiru Corp.; Daicel Chemical Industries Ltd.; Daido Life Insurance; Daikin Industries Ltd.; Daikoku Denki Co. Ltd.; Dainippon Ink and Chemicals Incorporated; Dainippon Screen Mfg; Daio Paper Corp.; Dawn Corp.; Denkodo Co. Ltd.; Denso Corp.; Dentsu, Inc.; Dexia Credit Local; Diamond City Co. Ltd.; Dorma Holding GmbH & Co.; Dow Chemical Company; Dowa Mining Co. Ltd.; Dreamtime Holdings; Dydo Drinco, Inc.; E-Liberty Inc.; East Japan Railway Co.; The Eighteenth Bank Ltd.; Eizo Nanao Corp.; Elecom Co. Ltd.; Eneserve Corp.; Ergo-Brains, Inc.; E-System Corp.; Faith, Inc.; Finconsumo SPA; Fuji Co. Ltd.; Fuji Electric Co Ltd.; Fuji Heavy Industries Ltd.; Fuji Soft ABC, Inc.; Fujikyu Corp.; Fujio Food System Co. Ltd.; Fujita Corp.; Fukujin Co. Ltd.; Fukushima Industries Corp.; Furukawa Electric Co Ltd.; Future System Consulting Corp.; Gakujo Co. Ltd.; GECC; Gentosha; GM; G-mode Co. Ltd.; Goldman Sachs Group, Inc.; Goodman Co. Ltd.; Hamakyorex Co. Ltd.; Hamamatsu Photonics KK; Hankyu Corp.; Heiwa Real Estate Co. Ltd.; Heiwado Co. Ltd.; Henkel; Hiroshima Gas Co. Ltd.; Hitachi Capital Corp.; Hitachi Construction Machinery Co. Ltd.; Hitachi Mobile Co. Ltd.; Hokkaido Electric Power; Hokkaido Gas Co. Ltd.; Hokuetsu Paper Mills; Hokuriku Electric Power Co.; Hokuyu Lucky Co. Ltd.; Hon Hai Precision Industry Co Ltd.; Hoosiers Corp.; IBE Inc.; International Business Machine Corp.; Infocom Corp.; Invoice, Inc.; Ishikawajima-Harima Heavy Industries Co. Ltd.; Itochu Corp.; Ito-Yokado Co. Ltd.; IWICS; Jalux, Inc.; Japan Longlife Co. Ltd.; Japan Prime Realty Investment Corp.; Japan Pulp & Paper Co. Ltd.; Jastec Co. Ltd.; J-Stream, Inc.; KGaA; Kanebo; Kanematsu Engineering Co. Ltd.; Kansai Electric Power Co.; Kappa Create Co Ltd.; Kato Sangyo Co. Ltd.; Kawanishi Co.; KBC IFIMA NV; Keihan Electric Railway Co.; Keihin Corp.; Kennedy-Wilson Japan; Keyence Corp.; Kinki Nippon Railway Co. Ltd.; Kintetsu World Express, Inc.; Kirin Brewery Co. Ltd.; Kisoji Co. Ltd.; KOGAS; Komatsu Ltd.; Komeri Co. Ltd.; Konami Computer Entertainment Japan, Inc.; Kose Corp.; Kourakuen Corp.; Koyo Seiko Co. Ltd.; Kubotek Corp.; Kura Corp.; Kyokuto Co. Ltd.;Kyushu Electric Power Co. Ltd.; Leopalace21 Corp.; Link Consulting Associates-Japan Corp.; Maeda Corp.; Macquarie Bank Limited; Mainichi Comnet Co. Ltd.; Malzen Co. Ltd.; Marui Co. Ltd.; Marvelous Entertainment, Inc.; Matsushita Electric Industrial Co. Ltd.; Mazda Motor Corp.; MDM Holdings GmbH; Meadwestvaco Corp.; Media Lynks Corp.; Medical System Network Co. Ltd.; Meiji Dairies Corp.; Meiji Seika Kaisha Ltd.; Meisei Electric Co. Ltd.; Metrocomm; Millennium America; Misawa Homes Chugoku Co. Ltd.; Mitsubishi Corp.; Mitsubishi Chemical Corp.; Mitsubishi Electric Corp;. Mitsubishi Estate Co. Ltd.; Mitsubishi Heavy Industries Ltd Mitsubishi International GmbH; Mitsubishi Tokyo Financial Group Inc.; Mitsui & Co. Ltd.; Mitsui Chemicals, Inc.; MobileOne Ltd.; Morinaga Milk Industry Co. Ltd.; Nagoya Railroad Co. Ltd.; Nankai Electric Railway Co. Ltd.; Nanya Technology Corporation; National Bank of Canada; NEC; NEC Fielding Ltd.; NEC Mobiling Ltd.; NET One Systems Co. Ltd.; Nichii Gakkan Co.; Nichirei Corp.; Nidec Corp.; NIF Ventures Co. Ltd.; Nippon Herald Films, Inc.; Nippon Information Development; Nippon Oil Corp.; Nippon Sanso Corp.; Nippon Systemware Co. Ltd.; Nippon Telegraph & Telephone Corp.; Nippon Yusen Kabushiki Kaisha; Nishimatsu Construction Co. Ltd.; Nishimatsuya Chain Co. Ltd.; Nissan Motor Co. Ltd.; Nissin Healthcare Food Service Co.; North Corp.; NS Solutions Corp.; NSK Ltd.; NTT Data Corp.; NTT DoCoMo Inc.; Obayashi Corp.; Odakyu Electric Railway Co. Ltd.; Oizumi Corp.; OJI Paper Co. Ltd.; Okamura Corp.; Okinawa Electric Power; Okuwa Co. Ltd.; ORIX Corp.; Omega Global Fund; Osaka Gas C. Ltd.; OX Information; PanaHome Corp.; Petrolub International Co.; Phoenix Electric; Pia Corp.; Pietro Co. Ltd.; Pixela Corp.; Plenus Co. Ltd.; Point, Inc.; Postabank rt; Premier Investment Co.; Priority Wireless; Promise Co. Ltd.; Quin Land Co. Ltd.; Rabobank Nederland; R.S. 2 Software; Radoma Overseas Ltd.; Rann International; Renown; Renown; Rentrak Japan Co. Ltd.; Ricoh Co. Ltd.; Ricoh Leasing Co. Ltd.; Rinnai Corp.; S Ishimitsu & Co. Ltd.; Sadamatsu Co. Ltd.; Sanyo Electric Co. Ltd; Sanyo Housing Nagoya Co. Ltd.; Sanyo Shokai Ltd.; Sapporo Breweries Ltd.; Saviso; Sawai Pharmaceutical Co. Ltd.; Secom Joshinetsu Co. Ltd.; Seiryo Electric Corp.; Sekiwa Real Estate Kyushu Ltd.; Sharp Corp.; Shikoku Electric Power Co. Inc.; Shinohara System of Construction Co. Ltd.; Shinwa Co. Ltd./Nagoya; Siliconware Precision Industries Company; Skycomm International; Skylark Co. Ltd.; Softbank Investment Corp.; Softfront; Sohgo Security Services Co. Ltd.; Strawberry Corp.; Studio Alice Co. Ltd.; Sullivan & Associates; Sumitomo Chemical Co. Ltd.; Sumitomo Corp.; Sumitomo Metal Mining Co. Ltd.; Sumitomo Mitsui Banking Corp.; Sumitomo Mitsui Financial Group Inc.; Sumitomo Realty & Development Co. 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The statements in the two preceding paragraphs are made as of February 3, 2003.

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