Wireless Innovation – Opportunities at Crossroads

Carlos Kirjner, McKinsey & Co.
LEADING THE WAY DOWN

Telecom stocks performance
Index, 100% = 03/2000 value

S&P 500
S&P 500 Telecom Equipment Index
AMEX North America Telecom Index (services)
SOME PEOPLE GOT SOME THINGS RIGHT

McKinsey analysis 2Q 2000

Network cost per Terabyte per month
$ Thousands

- Tens of players
- Thousands fiber-miles each
- Wholesale = commodity
- Big3 control enterprise traffic

Market share of total traffic
Percent

Typical attacker

Next generation network
BUT THE INTERNET IS FOR REAL

U.S. online households

- Millions
- 43 (1999)
- 56 (2001) 14% CAGR

U.S. B2C e-commerce

- $ Billions
- 9 (1999)
- 50 (2001) 135% CAGR
BROADBAND IS FOR REAL

U.S. broadband households
Millions

1999: 1.7
2001: 10.9
AND WIRELESS IS FOR REAL

U.S. wireless subscribers
Millions

<table>
<thead>
<tr>
<th>Year</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001E</th>
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<tbody>
<tr>
<td></td>
<td>69</td>
<td>86</td>
<td>109</td>
<td>126</td>
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</table>

22% CAGR
THE 3G CATASTROPHE IN EUROPE

Representative European Countries

GBP Billions; annual free cash flow

Year


-97 5 7 14 16 11 5 0.3 5 9 11 10 9 8 7

39
INCREASING COMPETITIVE INTENSITY IN THE U.S.

Net subscriber adds
Millions

Average carriers per market*

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Source: Source

1980 1997 1999 2001
WIRELESS USAGE

MOU per capita
Minutes/month/inhabitant

Western Europe: 78
U.S.: 154

Average price
Cents/minute

Western Europe: 0.21
U.S.: 0.16
# U.S. Wireless Industry is at a Major Crossroads

## Key Factors

<table>
<thead>
<tr>
<th>Boom</th>
<th>Bust</th>
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<tbody>
<tr>
<td>• Spectrum cap lifted</td>
<td>• 5-7 competitors per market</td>
</tr>
<tr>
<td>• 3G avoided capex</td>
<td>• Spectrum bidding war</td>
</tr>
<tr>
<td>• ARPU growth = data, new apps</td>
<td>• WAP-like experience</td>
</tr>
<tr>
<td>• Opex rationalization</td>
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NEEDS FOR 3G SANITY AND CONSOLIDATION

US Mobile industry
FCF sensitivity – 2001-2005

<table>
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<tr>
<th>Capex</th>
<th>5-7 players</th>
<th>3-5 players</th>
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<tbody>
<tr>
<td>No 3G</td>
<td>-8%</td>
<td>20%</td>
</tr>
<tr>
<td>Some 3G</td>
<td>-33%</td>
<td>-5%</td>
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</table>

EBITDA margin

Footnote: Source

Some yes 3G
No 3G
Capex

US Mobile industry
FCF sensitivity – 2001-2005

Boom
Bust
END USERS PAY FOR NEW SERVICES

- Wireless
- Narrowband
- Broadband
- Messaging
- Vertical services

Residential telecom spending
Percent of disposable income

- 5.7% CAGR

Graph showing the increase in residential telecom spending from 1998 to 2001, with an estimated figure for 2001.
NEW SERVICES PENETRATE MORE RAPIDLY

Years to ~10% penetration

- Narrowband: 2 years
- Broadband: 4 years
- CD ROM: 6 years
- PC: 7 years
- Cell Phone: 9 years
- VCR: 9 years
- ATM: 15 years
- FAX: 22 years
- Cable-TV: 25 years
- Telephone: 38 years
- Pager: 41 years
POWER REVOLUTION

• Smart antennas reduce device power consumption
• Low power RF decreases device power consumption
• Fuel cells increase battery life
• Result: rich mobile data exchange
CHIP UBIQUITY

• Processors, controllers embedded everywhere
• All chips on Net (wireless)
• Robust new operating systems
• Result: 20x devices than people on Net
• Result: accelerating e-commerce
• Result: productivity gains
WI-FI (802.11) REVOLUTION

- Every PC has wireless LAN access
- Every PDA has wireless LAN access
- Every broadband home hubs a wireless LAN
- Every enterprise campus has wireless LAN
- 100% of U.S. big public spaces are wireless LAN hubs (>10,000 locations)
802.11 ENABLES RICH CONTENT EXCHANGE

<table>
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<tr>
<th>Activity</th>
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<tr>
<td>SMS</td>
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<tr>
<td>Voice call</td>
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<td>Browsing (WAP)</td>
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<tr>
<td>email</td>
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<tr>
<td>Stock quotes</td>
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<tr>
<td>Videoconference</td>
<td>400</td>
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<tr>
<td>LAN applications</td>
<td>500-10,000</td>
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</table>
802.11B COST PERFORMANCE VS. 2.5/3G

Average cost
$ per Megabyte

- GPRS: $0.42
- 1xRTT: $0.06
- 802.11b: $0.03
WHAT IS THE CRITICAL MASS REQUIRED TO START-UP POSITIVE NETWORK EXTERNALITIES?

Virtuous cycle of increasing ubiquity

- Increased number of end users
- Increased willingness to pay; lower SAC
- Increased value for infrastructure owners
- Increasing utility to end users
- Increasing ubiquity of 802.11

Source: McKinsey