

Level (3)
C O M M U N I C A T I O N S

Capacity Trends & Silicon Economics

Jeremy Steventon-Barnes

J.W.R.Barnes@iee.org

www.steventon-barnes.com

Agenda

Current trends in supply and demand

Silicon Economics

Supply side dynamics

Vertical dis-integration

Constraints

Current trends in supply and demand

- **Various studies have projected demand increases of 20x to 200x ⁽¹⁾ over the next 3 years**
- **Based on projected increases in fibre installation, some analysts have predicted a bandwidth surplus**
- **These analyses do not account for capital expenditures required to deploy the necessary opto-electronics**

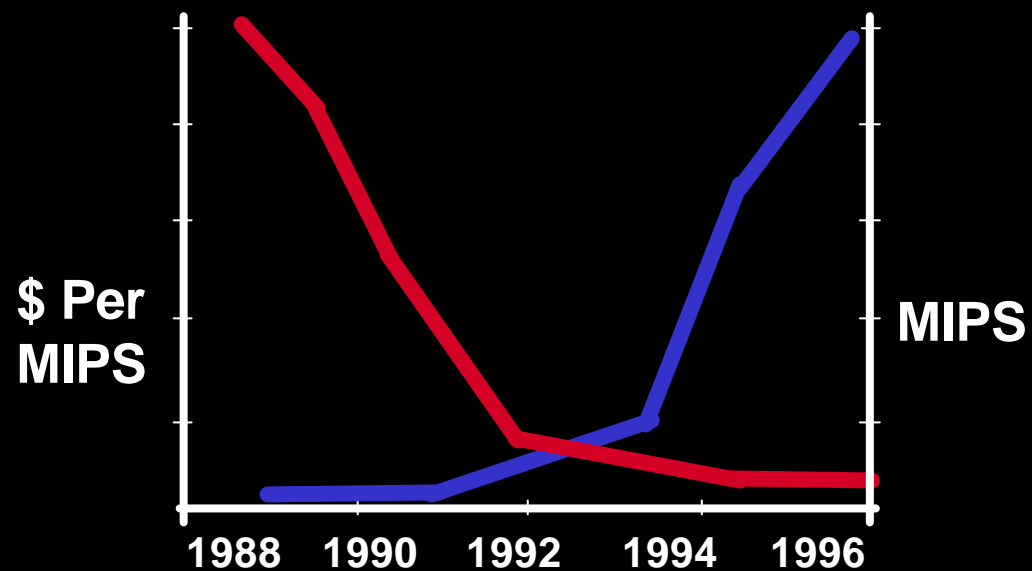
(1) Nortel: "Bandwidth: Boom or Glut?", RHK, MSDW, McKinsey, JP Morgan

Current sources of US bandwidth supply

Company	(1) Lit Fibres	(1) Capacity (Gb/s)	(2) Planned Fibre	(2) Capacity (Gb/s)	(3) Capex to Light	(4) Estimated 2000 Capex	% 2000 Capex to Total	Years to Light
360 Networks	1	320	35	56,000	\$ 31,360	\$ 795	2.5%	39
AT&T	9	2,880	26	41,600	23,296	2,532	10.9%	9
Sprint	5	1,600	15	24,000	13,440	1,646	12.2%	8
WorldCom	6	1,920	18	28,800	16,128	2,165	13.4%	7
Qwest	4	1,280	44	70,400	39,424	1,530	3.9%	26
Global Crossing	6	1,920	18	28,800	16,128	668	4.1%	24
GTE (Genuity)	2	640	22	35,200	19,712	480	2.4%	41
Williams	2	640	118	188,800	105,728	854	0.8%	124
IXC (Broadwing)	4	1,280	92	147,200	82,432	105	0.1%	785
Level 3 (Internal)	2	640	8	12,800	7,168	2,600	36.3%	3
Level 3 (Dark Fibre)	n/a	n/a	170	272,000	152,320	n/a	n/a	n/a
Total		13,120	566	905,600	\$ 507,136	\$ 13,375		
Normalised		1		69				

- (1) Assume fibres lit @ 32 wavelengths @ 10 Gb/s
 (2) Assume planned fibres lit @ 160 wavelengths @ 10 Gb/s
 (3) \$28 per Gb/s per mile assuming average 20,000 mile network
 (4) Level 3 estimates based on public disclosures

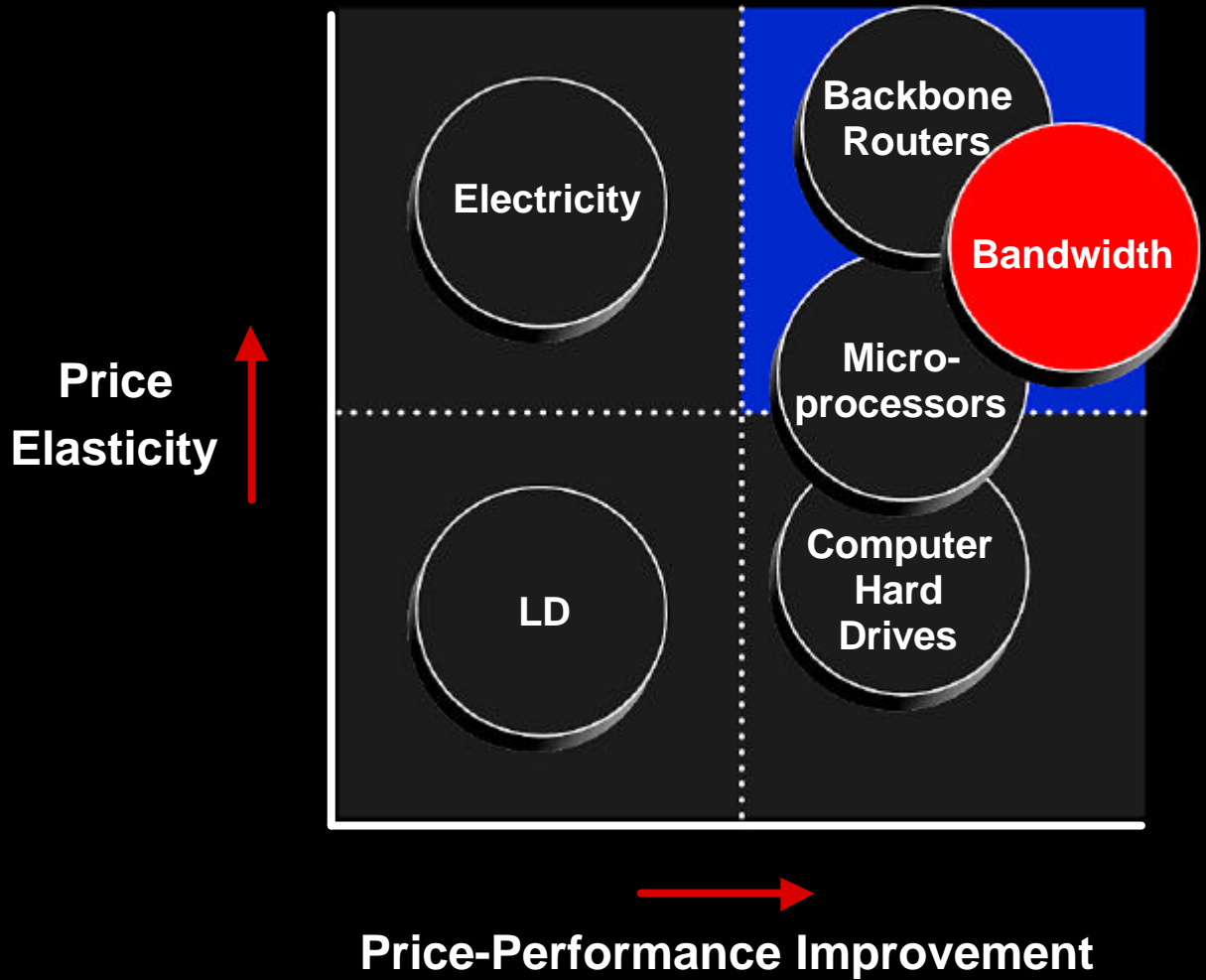
Computing Prices And Demand Illustrate Silicon Economics



Source: Industry Data

- Market based technical improvements have rapidly lowered unit cost and price
- For each 1% decrease in price, demand has increased over 2%

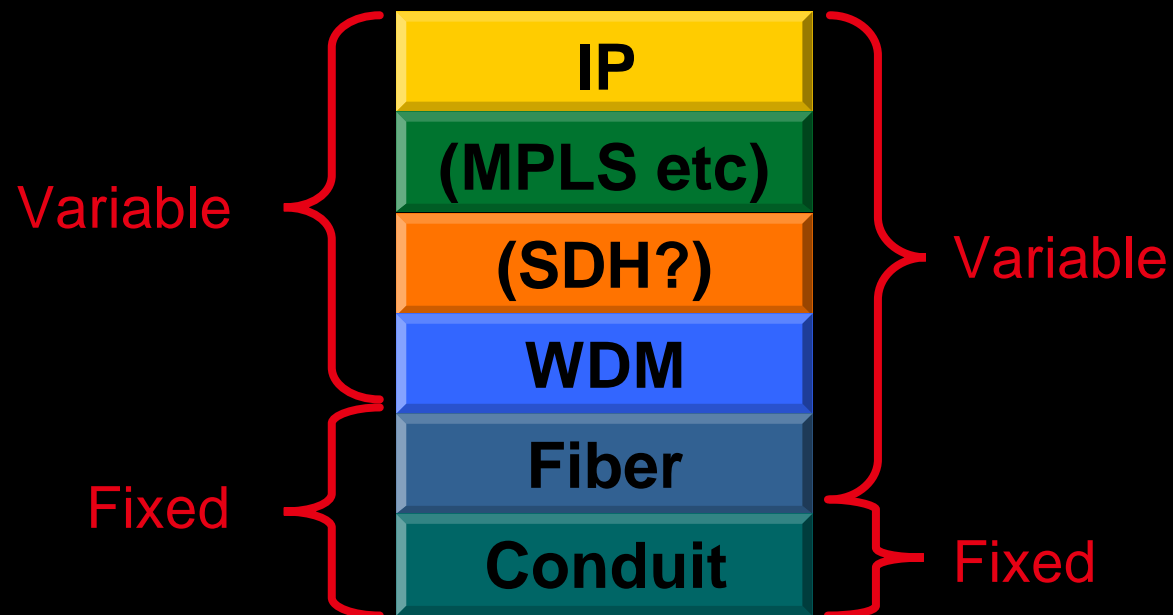
Silicon Economic Model



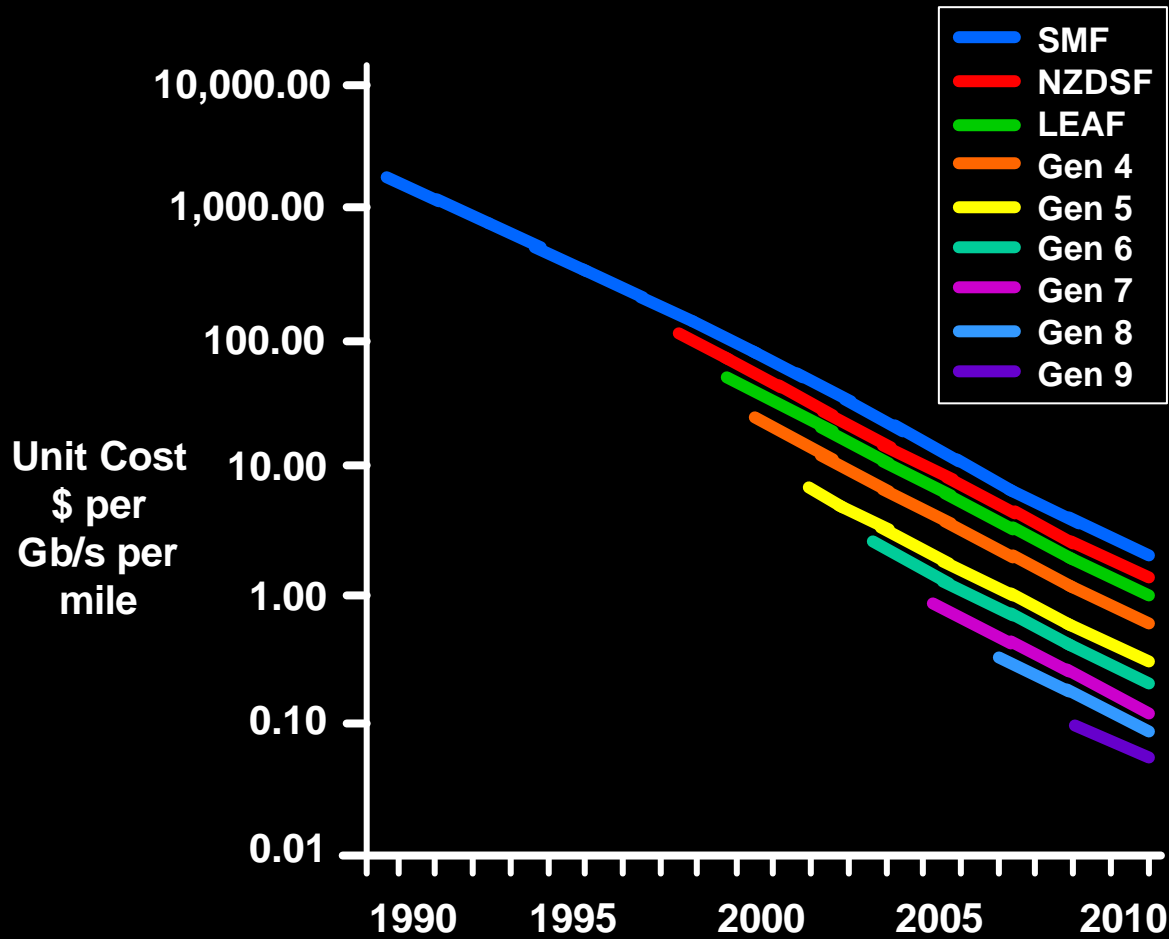
Optical Fibre Is Now A Rapidly Changing Capital Cost Element

Traditional Network

NextGen Network



Unit Cost Of Transport

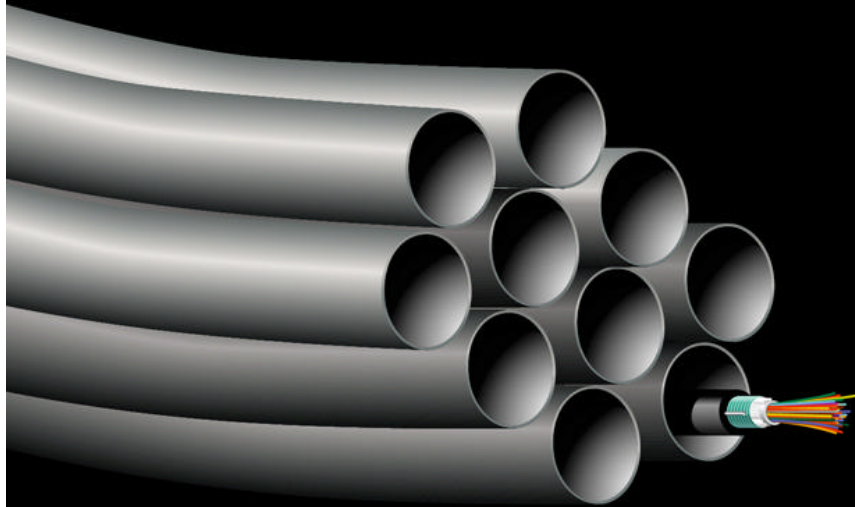


Assumptions

- Cost of opto-electronics for 1,000 mile point to point system
- New fiber generations improve at SMF historic rates (29% per year)
- New fiber generation every 21 months

Source: Corning, Inc.
Nortel Networks, Inc.
Level 3 Engineering

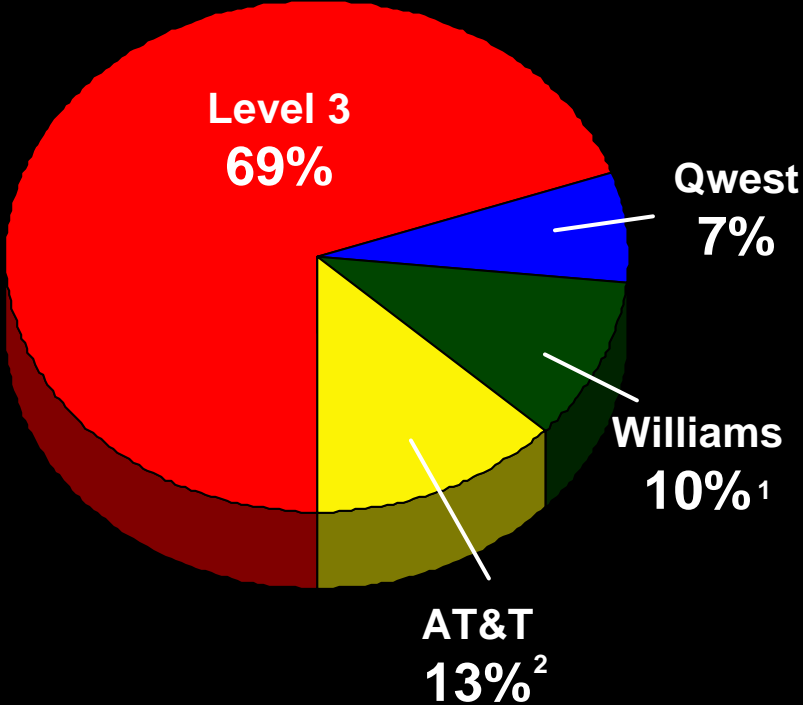
Multiple Conduits Are Required To Leverage Technical Improvements In Optical Fiber



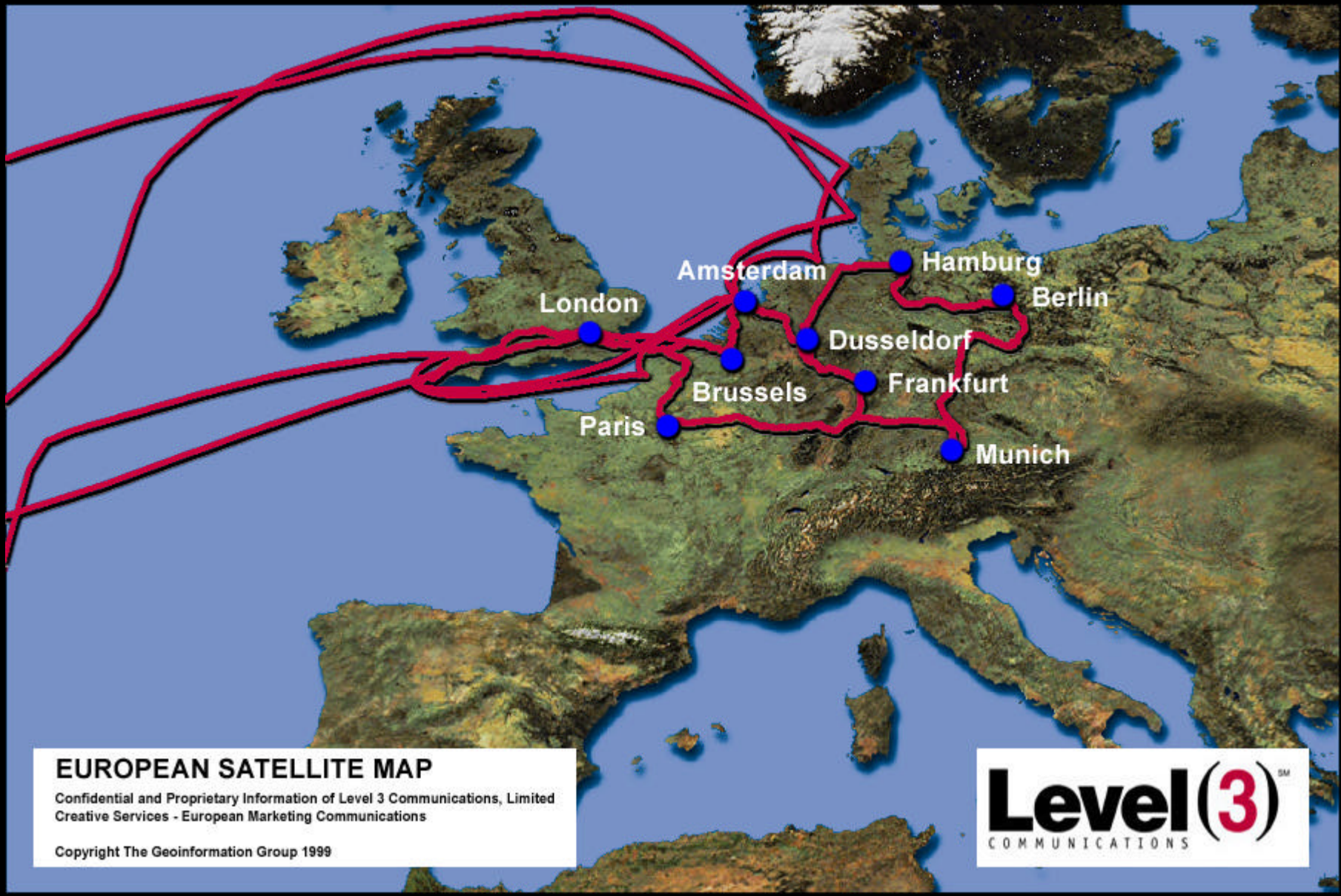
- Pull new fiber when unit cost is lower
- Move traffic when operating cost in oldest fiber exceeds operating cost plus CapEx in newest fiber

US empty conduit ownership

Empty U.S. Conduit Miles (%)



(1) Assumes 25,900 empty conduit miles
(2) AT&T public disclosures, J P Morgan, Alex Brown, Deutsche Bank



EUROPEAN SATELLITE MAP
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European supply trends

- Network maps remain deceptive!
- Conduit ownership much less concentrated than in US: ~10 builders on key routes
- Conduit count much lower North, South & East
- “New broadband suppliers will enter European markets at their peril” – Ovum 2001
- Consolidation widely anticipated

Communications Industry is Vertically Dis-integrating



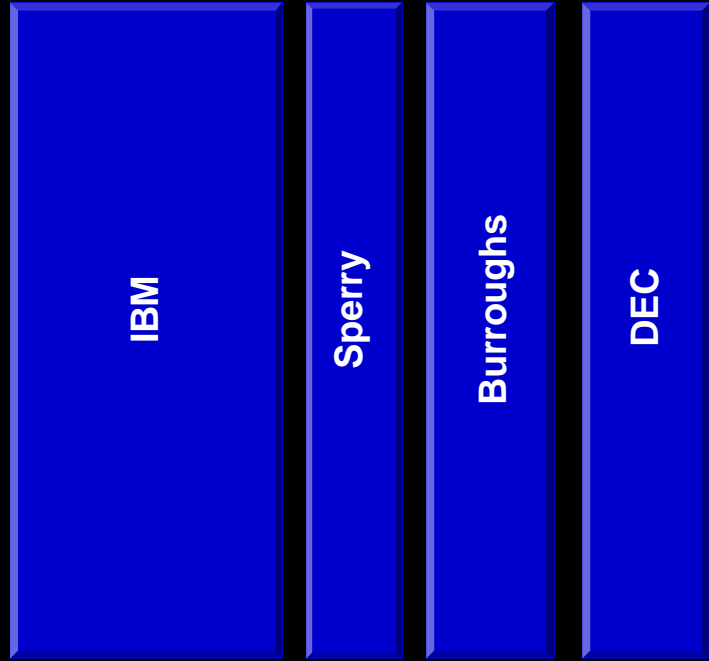
- Technology industries are characterised by horizontal integration
- Many communications companies are visibly disaggregating

**“When a horizontal business model
meets a vertical business model,
horizontal wins every time.”**

**John Chambers
Cisco Systems, Inc.**

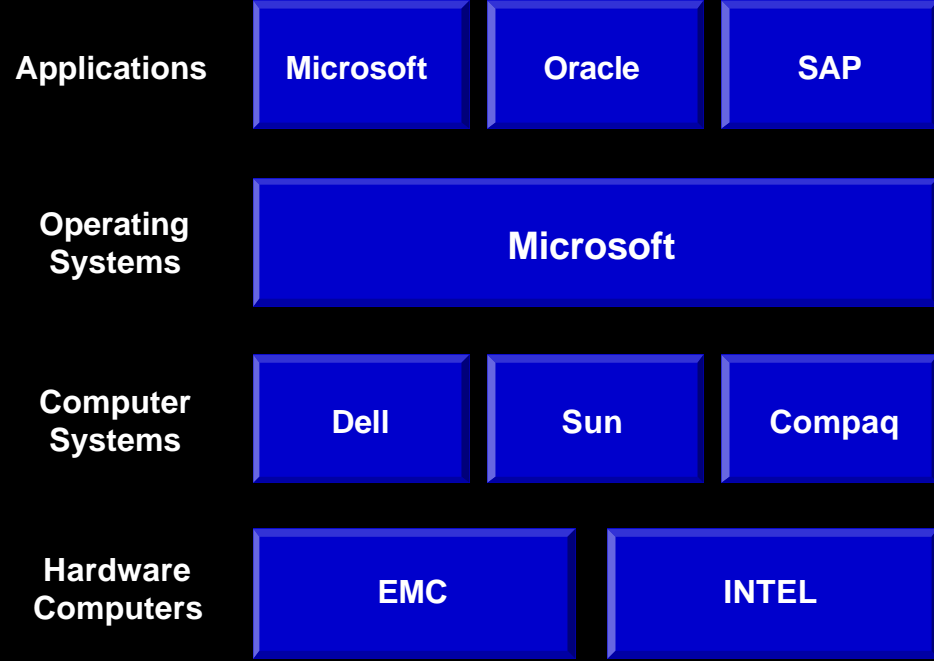
Disaggregation Has Created Substantial Value In The Computing Industry

Vertical Integration



Total Market Cap
1980 \$48 B
2000 \$274 B

Horizontal Integration

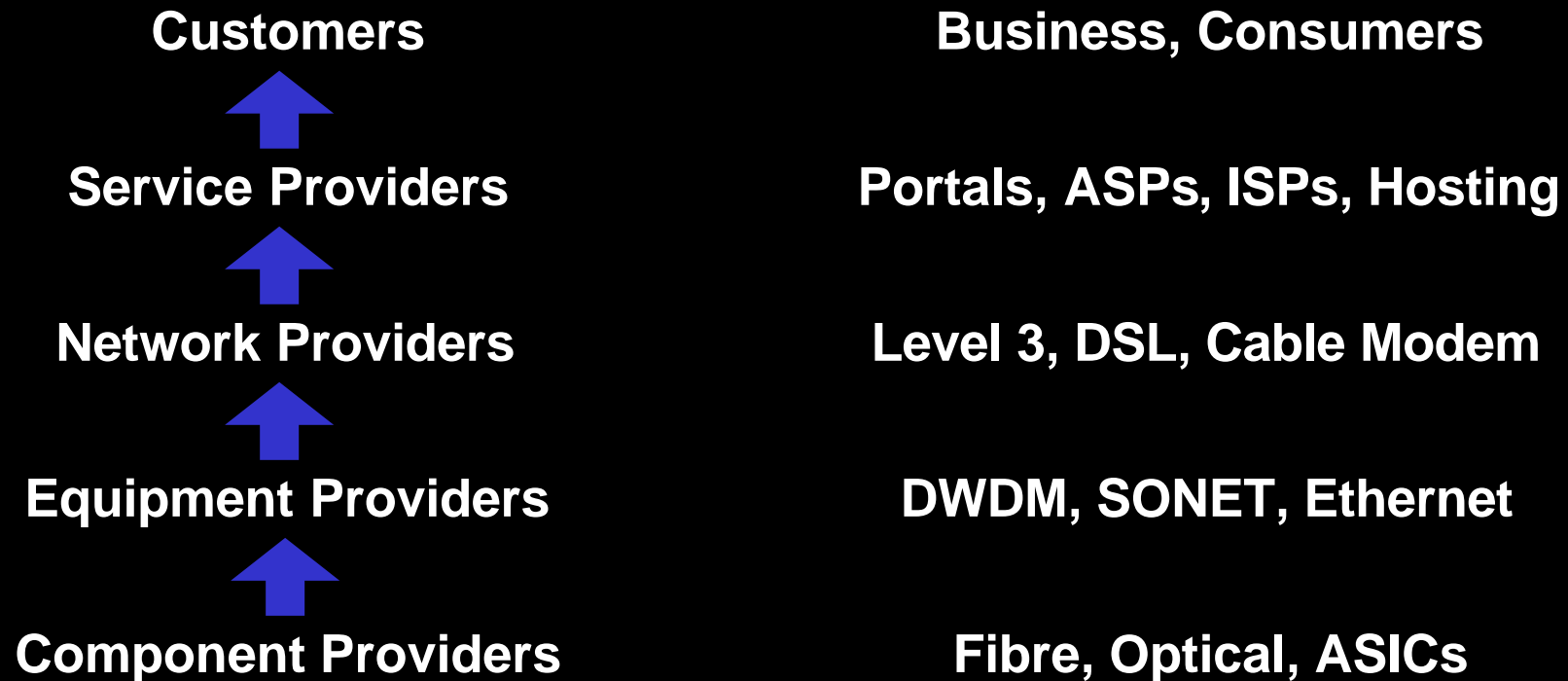


Total Market Cap
1980 \$0 B
2000 \$1,480 B

The Disaggregated Communications Supply Chain

Supply Chain

Example



But constraints remain...

- **Traditional European exchanges (eg LINX) have scaled better than the US NAPs...**
- **...but it's hard to see how this can continue**
- **Traditional aggregation points are physically congested and/or suffer lack of competitive fibre access**
- **Lack of transparency in interconnection pricing with leading backbones**
 - **Incumbent PTO's paradoxically open**
 - **Would-be Internet monopolists**

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