

**Sequoia Capital**

*Money at Work*

# **How Convergence is Driving Consolidation in Communications**

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**Presented to IEEE Comm Soc**

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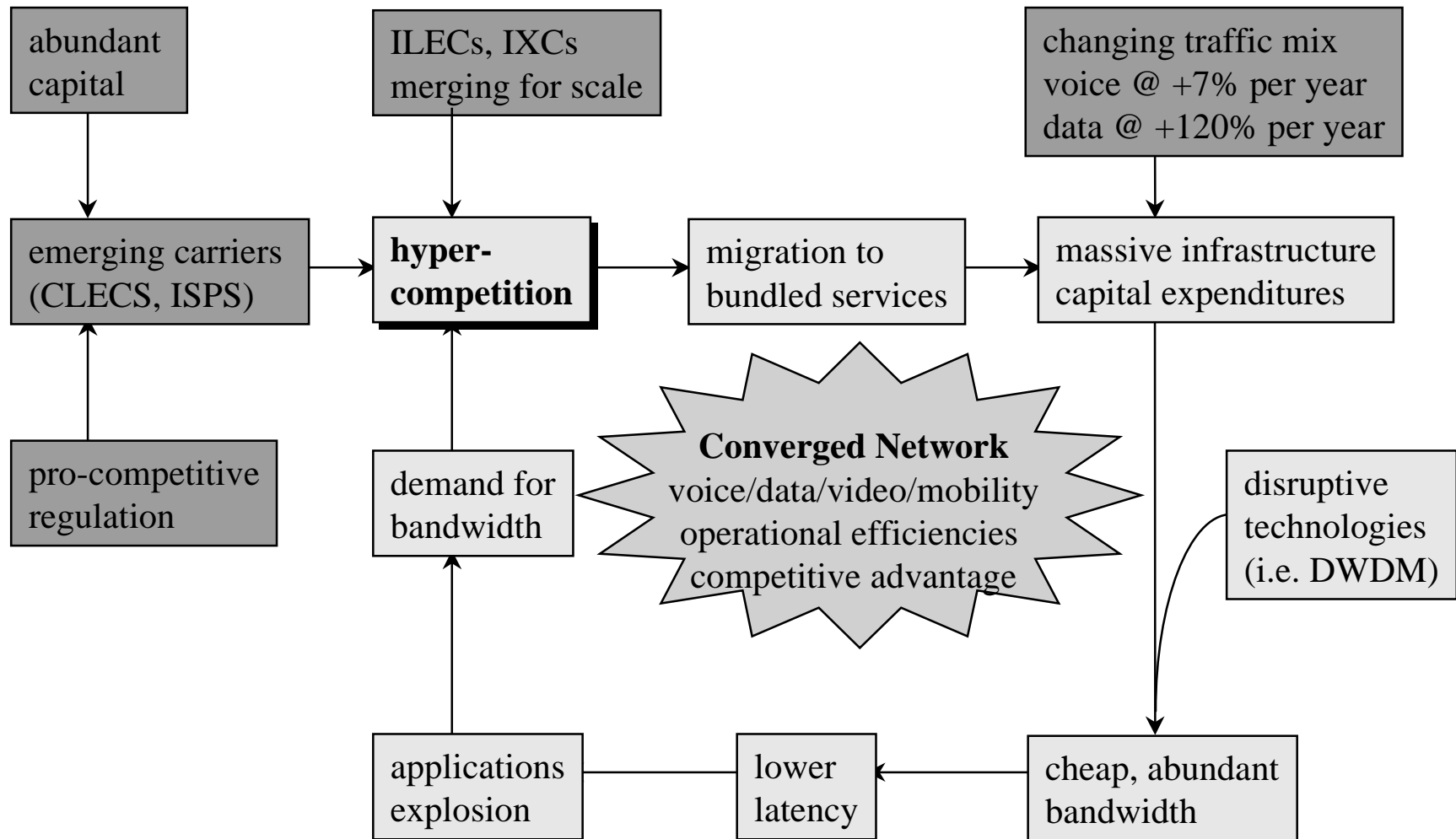
# Introductions

- 83-86 Wang Labs: (co-op) computer networking, volume mfg.
- 87 Nokia: (int'l exchange) telecom field engineering
- 88-91 Mitre: optical transport, fast packet networks
- 92-95 U S West AT/TW Cable: broadband network deployments
- 96 Sourcecom (acq by ACT): DSLAMs, edge router
- 97 Carrier Access (IPO CACS): DLC, M13 equipment
- 98- Sequoia: venture capital for early-stage comm start-ups  
Abrizio (PMC), Avanex (IPO reg), Callnet, Mahi, Mellanox, Syndesis,  
Turin, VxTel, ...

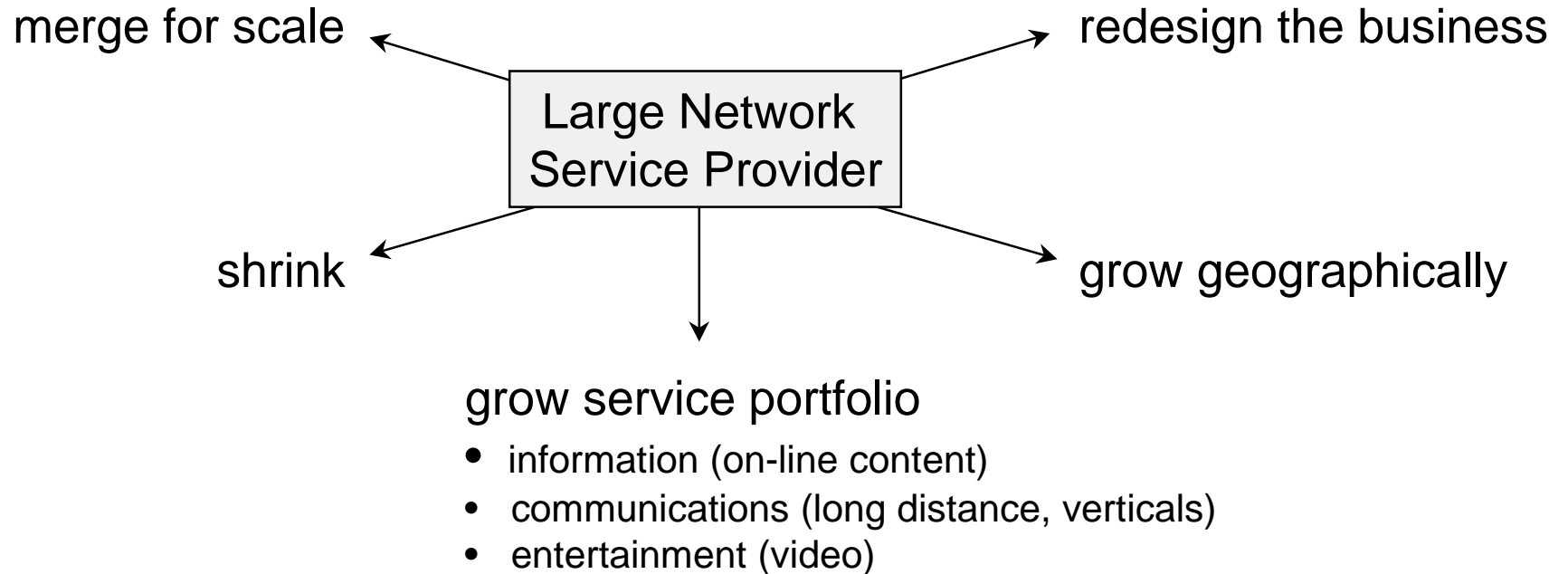
BSEE, MS EE, MS Telecom Engineering,  
MS Engineering Mgmt (1 course remaining)



# Business Drivers of Convergence

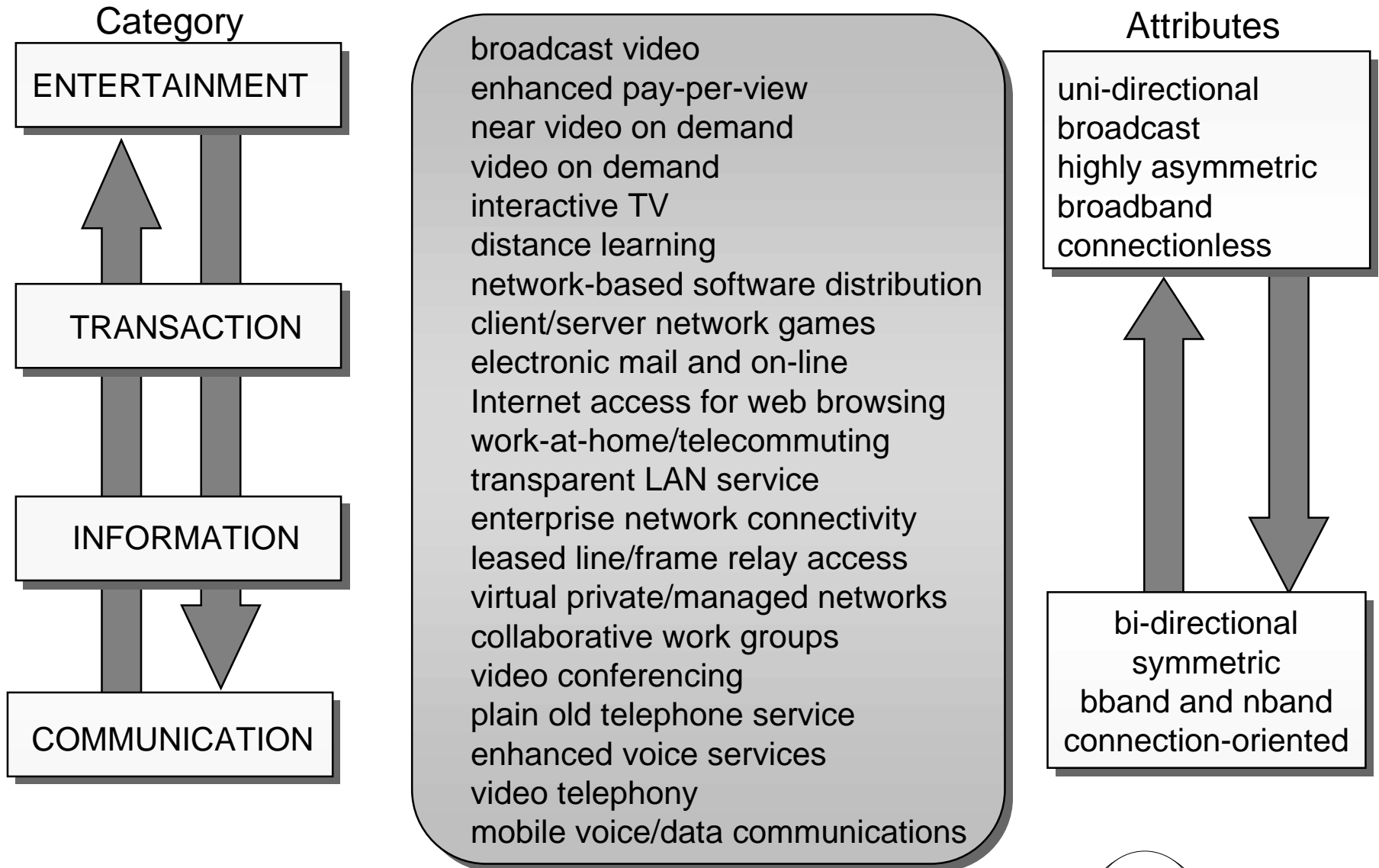


# Service Provider Options

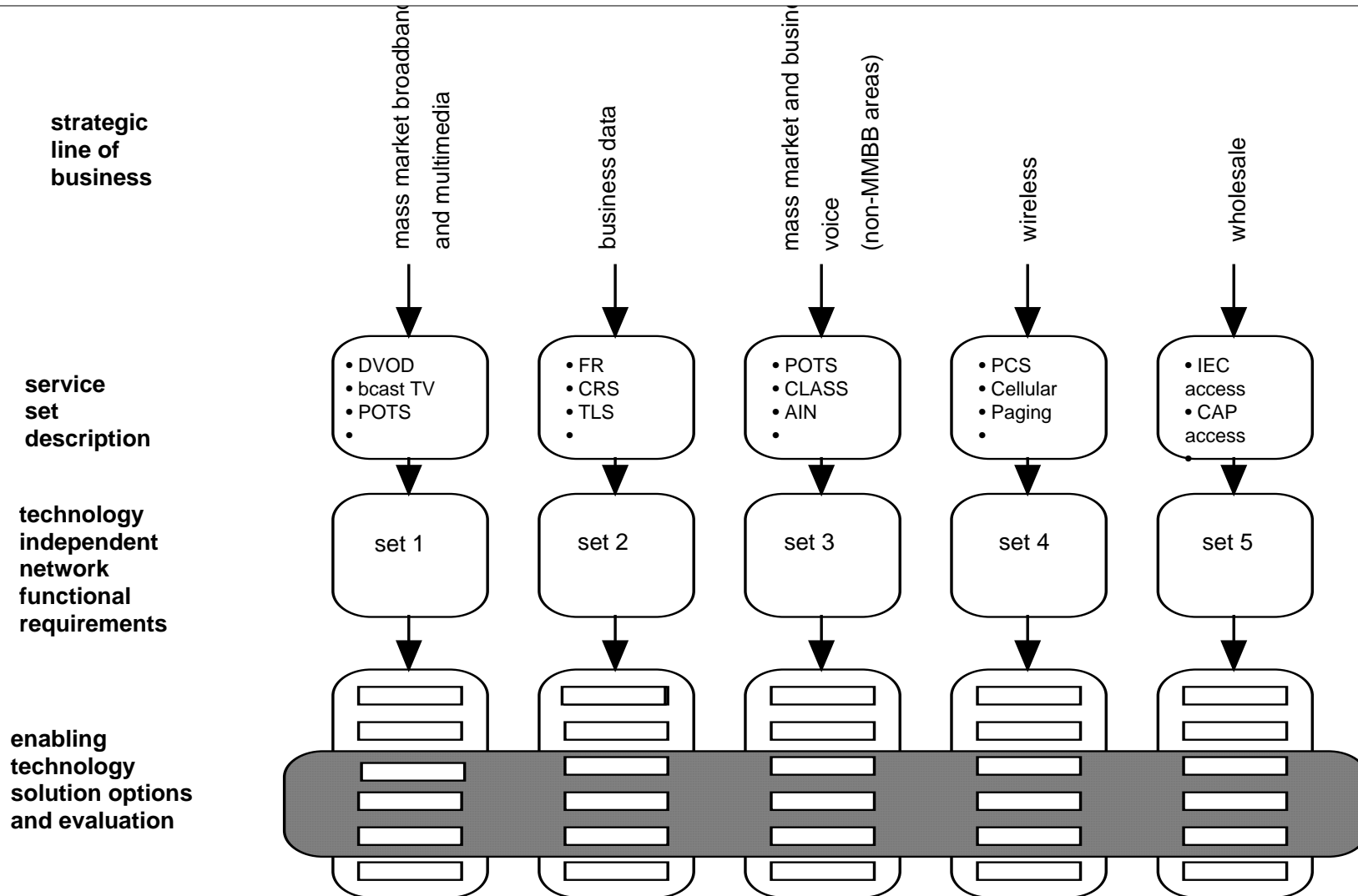


Requires BW, New OSS/Network Elements/Network Control

# Challenges to Convergence



# Evaluating Enabling Technologies



*identify common capabilities horizontally across strategic lines of business*

# Vendor Balance Sheets

## Datacom Vendors

### Assets:

#### Customers

- corporations
- enterprise
- ISPs

### Capabilities

- IP routing
- LAN switching
- packet switching
- packet voice

### Liabilities

- Carrier customers
- telecom products
- scalable OSS
- legacy voice
- signaling/control (SS7)
- cross-connects
- optics/broadband
- wireless

Massive Opportunity  
The Upgrade To  
Data-Centric Multi-Service Networks



## Telecom Vendors

### Assets:

#### Customers that spend huge

- ILECs
- IXC's
- Independent Telcos

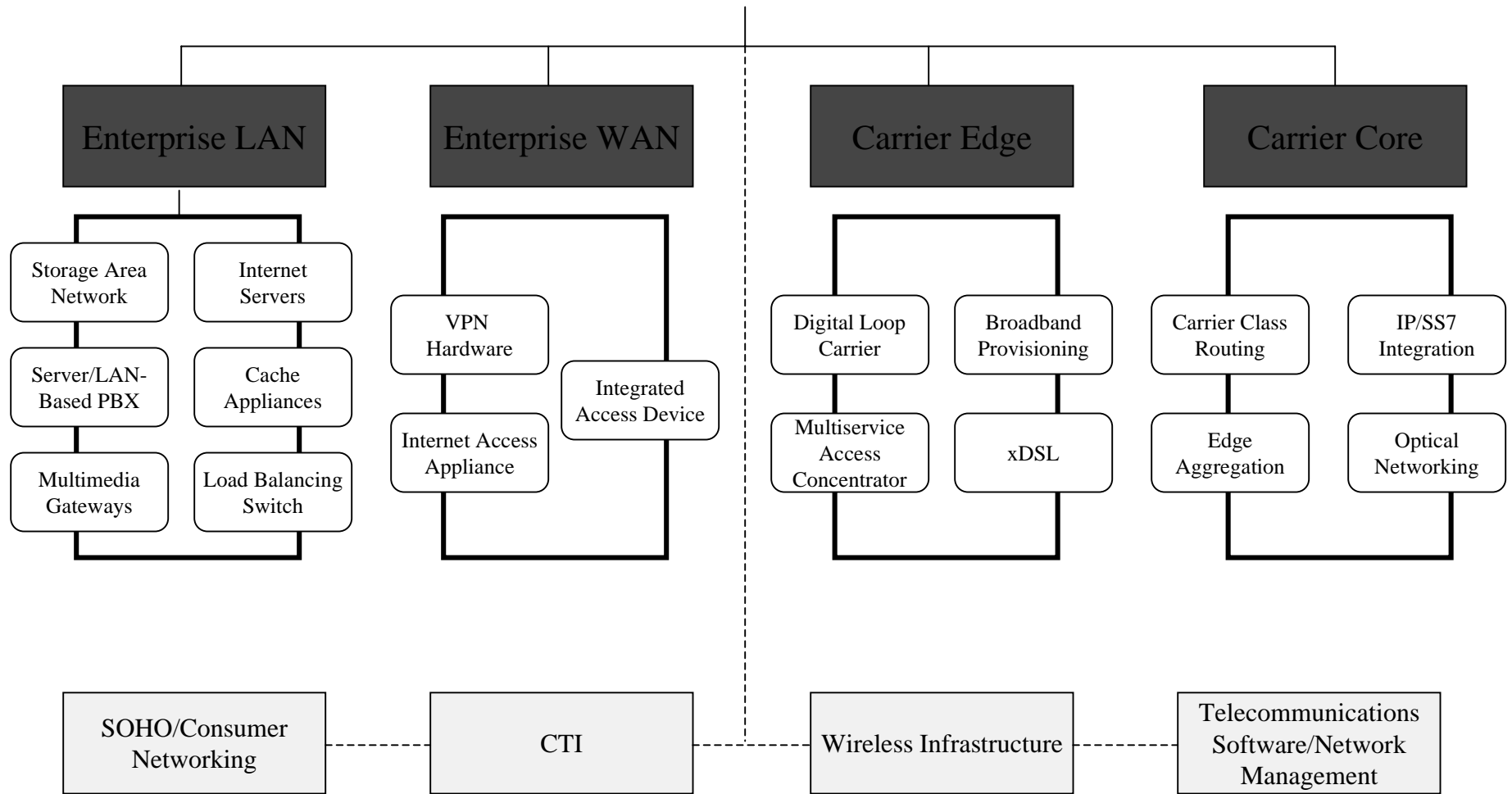
### Capabilities

- CO voice switches
- digital loop carrier
- transport (SONET)
- DWDM
- xDSL
- OSS (billing, etc.)
- wireless

### Liabilities

- IP routing
- packet switching
- packet voice
- signaling/control (MGCP)
- optics/broadband

# Communications Equipment Market



# Private Companies Providing Emerging Technology Solutions

Enterprise LAN	Enterprise WAN	Carrier Edge	Carrier Core
<p><b>Cache Appliances</b>            Cacheflow            Entera            Eolian            Infolibria            Network Appliance            Packetstorm</p> <p><b>Internet Servers</b>            Esoft            Extended Systems            Microtest            Mirapoint</p> <p><b>Load Balancing Switches</b>            Allot Communications  <i>Alteon Networks</i>            Arrowpoint Communications  <i>Foundry</i>            Holon Tech</p> <p><b>Multilayer Switch/Router</b>            Flowwise            NEO Networks            XLNT</p> <p><b>Multimedia Gateways</b>            Netxchange            RADvision</p> <p><b>SAN</b>            Advanced Digital Information            Ancor Communications            Atto Technology  <i>Brocade</i>            Crossroads Systems            G2 Networks  <i>Gadzoox Networks</i>            Gigalabs            Vixel Switch Operations</p> <p><b>Server/LAN-Based PBX</b>            Interactive Intelligence            NetPhone            Phonet</p>	<p><b>Integrated Access</b>            Cayman Systems            Mariposa            Merlot Communications            One Box Networks            Vina Technologies</p> <p><b>Internet Access Appliances</b>            Cobalt Networks            Encanto Networks            FreeGate Corporation            Ramp Networks            Technauts            Whistle Communications</p> <p><b>RAS/Modem</b>            CommVision            RAScom Incorporated</p> <p><b>VPN Hardware</b>            Assured Digital            Altiga Networks            Compatible Systems            Cylink            Ennovate Networks            Information Resource Engineering            Indus River Networks            Internet Devices            Netscreen Technologies            Network Alchemy            Racal Data Group            Radguard            Redcreek            Secant            Timestep            VPNet</p>	<p><b>Broadband Provisioning</b>            Cosine Communications            Redback Networks            Spring Tide Networks            Shasta (Nortel)</p> <p><b>xDSL</b>            Accelerated Networks            AccessLan Communicatons            CopperCom            General Bandwidth            Information View Solutions            Interspeed (Brooktrout)            Jet Stream            OnPrem Networks            RADWIZ            Toll Bridge            Turnstone Systems            ViaGate Technologies</p> <p><b>Multiservice Access Platform</b>            Advanced Switching Comm.            Anda Networks            Controlware Comm. Systems            Entrata            Integral Access            Northchurch Communications            Promatory            Redcom Laboratories            Sonoma Systems            Timeplex Group</p>	<p><b>Carrier Class Routing</b>            Avici Systems            Charlotte's Web            IronBridge Networks            Juniper Networks            Netcore Systems            Nexabit Networks            Pluris</p> <p><b>Edge Aggregator</b>            Net Insight AB            Oresis Communications            Xedia</p> <p><b>VoP Gateways, IP/SS7 Integration</b>            Convergent Networks            Kasten Chase Applied Research            SALIX Technologies            Santera            Sonus Networks            Taqua Systems            Transmedia Comm.</p> <p><b>Optical Metro/Access Infrastructure</b>            Alidan, Amber, Atmosphere            Cerent (acq by Cisco)            Chromatic, Chromatis            Cyras, Lantern, Luminous            Mainsail, Mayan, nCore            New Access Communications            Quantum Bridge            Siara (acq by Redback)            Tenor Networks, TeraWave            Vivace, Yoda</p> <p><b>WDM Systems (Switches/xport)</b>            Astarte, Corvis, Corvia,            Monterey (acq by Cisco), QTera            Optical Networks, Silk Road            Sycamore Networks            Tellium</p>

# Recent Comm Equipment Transactions

(\$ in Millions)

Significant Transactions Since 1/1/99

	Enterprise LAN	Enterprise WAN	Carrier Edge	Carrier Core	Telecom Software
<b>Alcatel</b>	Xylan (\$1,564)		Assured Access (\$350)		
<b>Ciena</b>				Omnia (\$429) Lightera (\$552)	
<b>Cisco</b>			Fibex (\$320) Sentient (\$125)	Cerent (\$6.5B) Monterey (\$500M)	GeoTel (\$2000) Amteva (\$170)
<b>Ericsson</b>			Torrent (\$450)		
<b>GEC</b>	Fore (\$4,500)		Reltec (\$1,663)		
<b>Lucent</b>				Ascend (\$19,775)	Kenan Systems (\$1,484) Mosaix (\$145)
<b>Nokia</b>			Diamond Lane (\$123)		Vienna (\$90)
<b>Nortel</b>	<i>Bay Networks</i>		Shasta (\$340)		
<b>Siemens</b>			Redstone (\$500)	Castle (\$308) Argon (\$240)	
<b>3Com</b>					NBX (\$90)



# Aggressive M&A To Deliver End-To-End Solutions

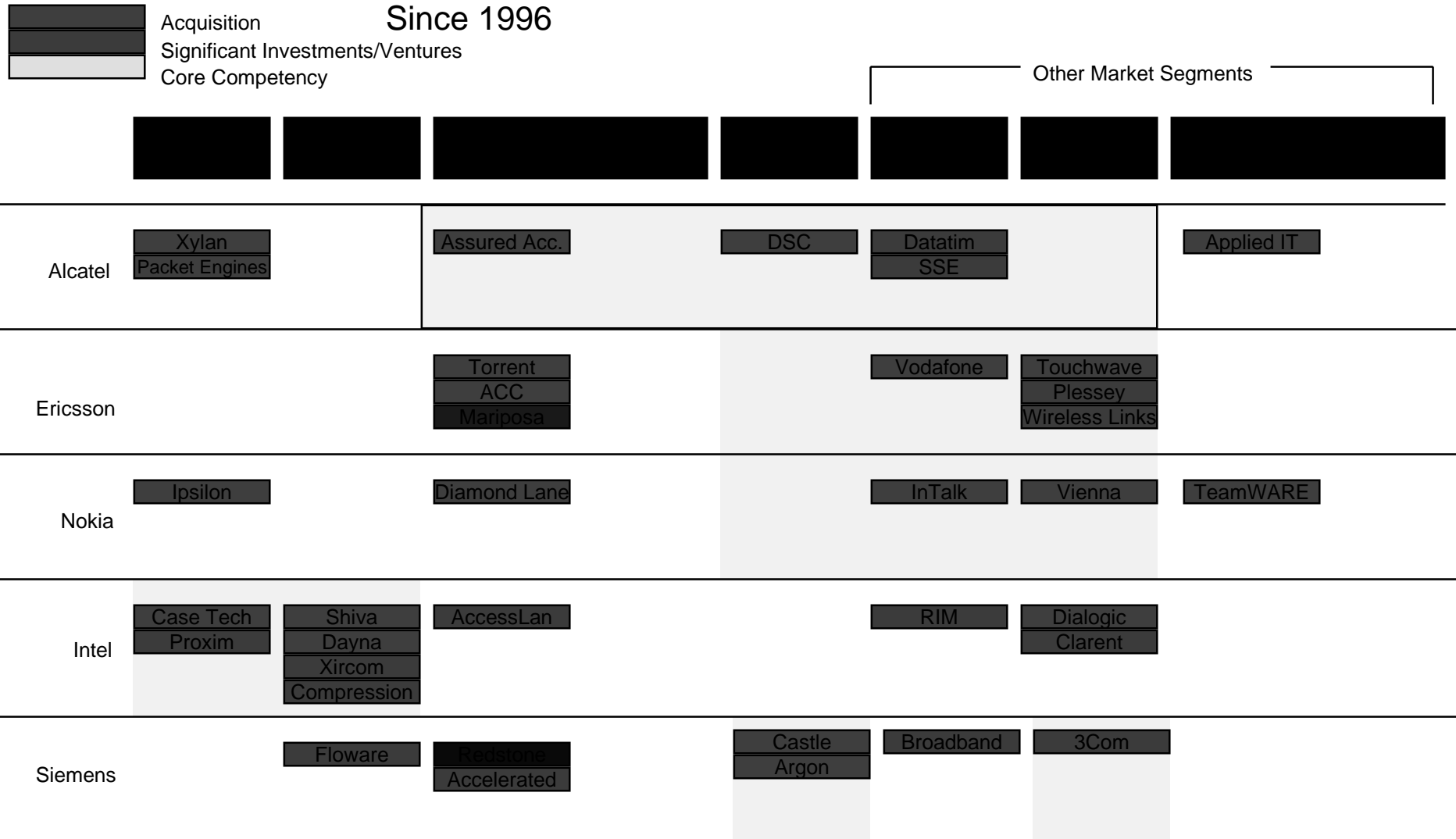
Acquisition  
 Significant Investments/Ventures  
 Core Competency

Since 1996

Other Market Segments

Cisco Systems	Granite Nashoba	Interlink	Sentient Fibex Pipelinks NetSpeed Dagaz	Ardent Telesend Telebit Cerent	Stratacom	Clarity Wireless ShareWave Broadcom RadioLAN	Amteva GeoTel Selsius Sys. Summa Four	Amer. Internet CLASS Data Precept Wheelgroup Lightspeed	Global Internet Netsys Objective Sys.
Lucent Technologies/ Ascend	LANNET Prominet Agile Whitetree		Yurie Livingston Cascade Subspace		Stratus	H - P (LMDS) WaveAccess Home Wireless	Mosaix Octel	Kenan Pario Quadritek MassMedia StonyBrook	Morning Star HydraWeb
Nortel/Bay Networks	Rapid City NetICs Plaintree		Shasta Aptis Micom New Oak LANcity	Penril	Cambrian Avici	BNI NetWave Matracom Interwave	NTH Telecom NetServe Telrad NetSpeak	X-CEL AGL Systems Netstation Isotro	Armon
3Com	Lanworks		US Robotics OnStream				NBX Euphonics Siemens		

# M&A Activity of Euro Giants and Comm Newbies



# What are The Big Guys Buying?

- Customer or Strategic Account Control
- Time-to-Market
- Innovation - Engineering Talent is a Hard Asset
- Elements to Complete Their “Systems Sale”

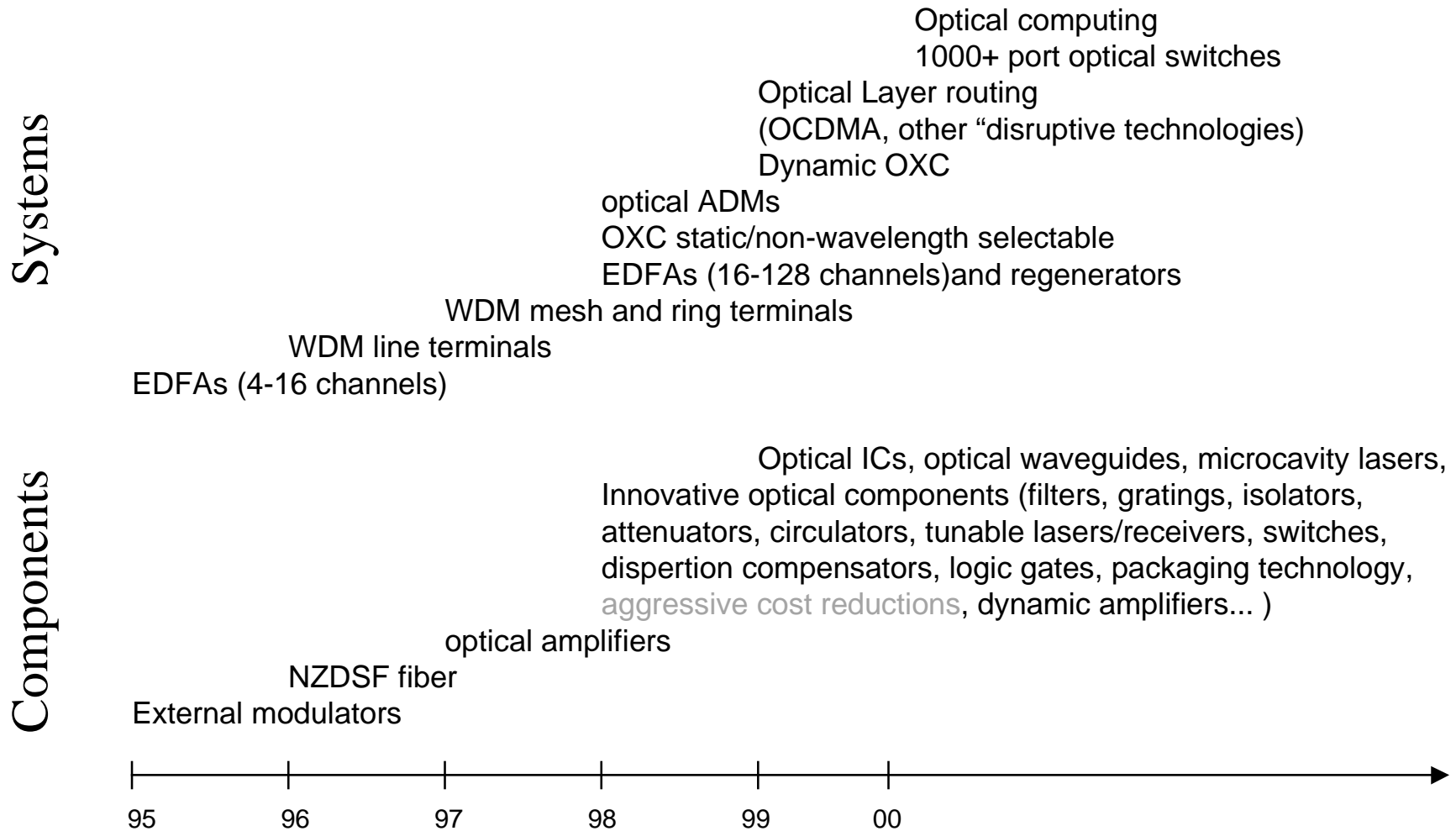


# Future Opportunity Area

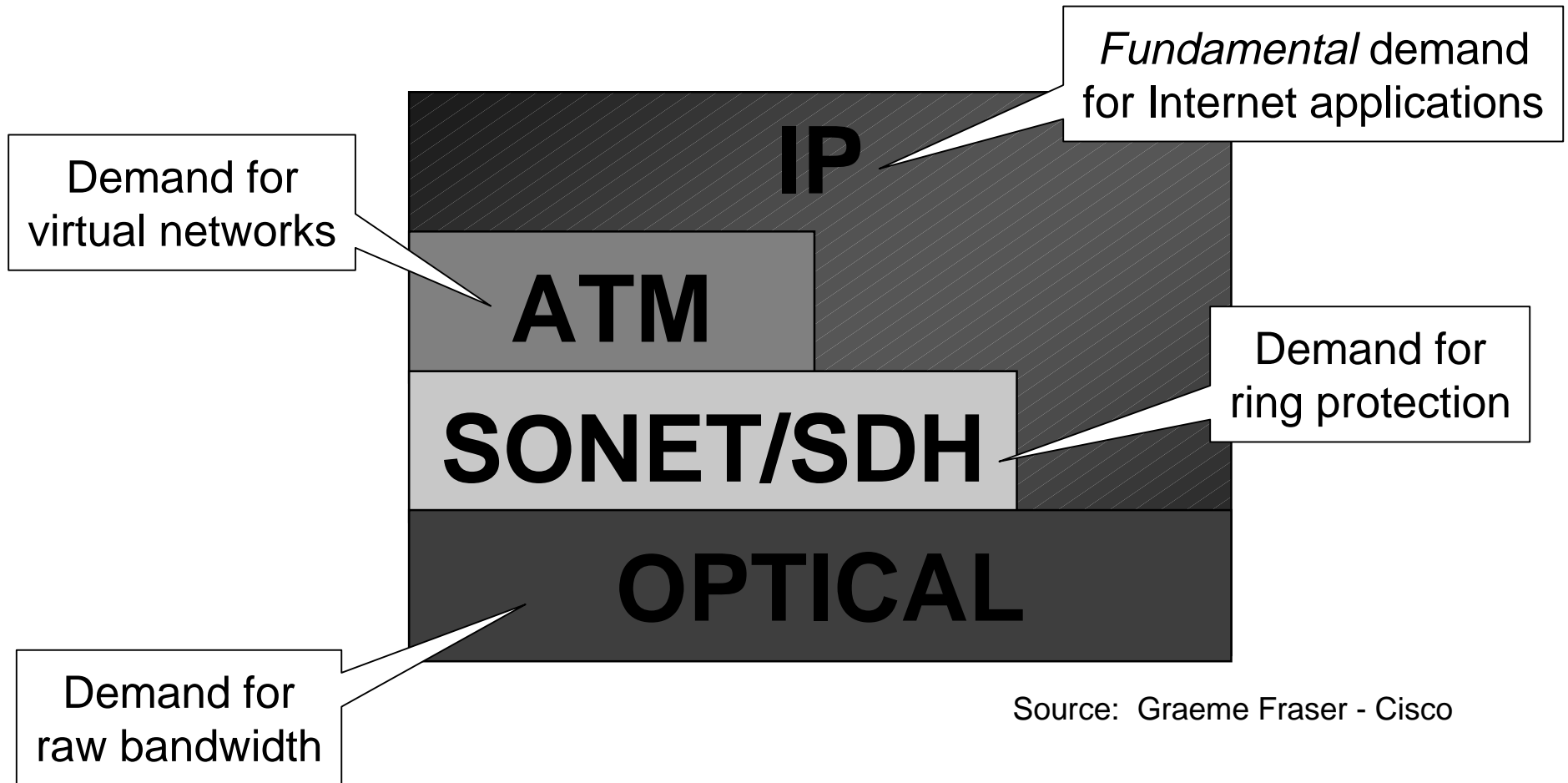
- Optical Communications
- “High Touch” Networking
- Directory-enabled Networks
- Multi-Service Network Elements
- Signaling and Control; Softswitches
- Wireless; FWLL, 3G, BBand Radio, Wline/Wless integration
- Next Generation OSS
- Opportunities at Component, System, Service layers!



# Optical Opportunity Roadmap

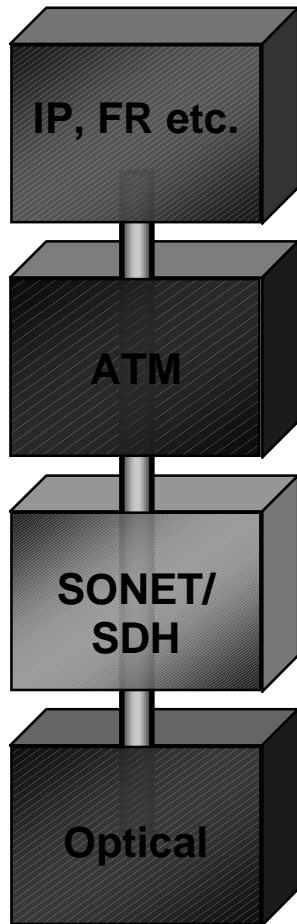


# Which Transport Alternative?



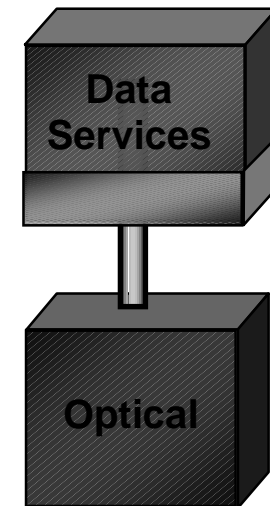
# Technology Integration

## Today's Data Networks

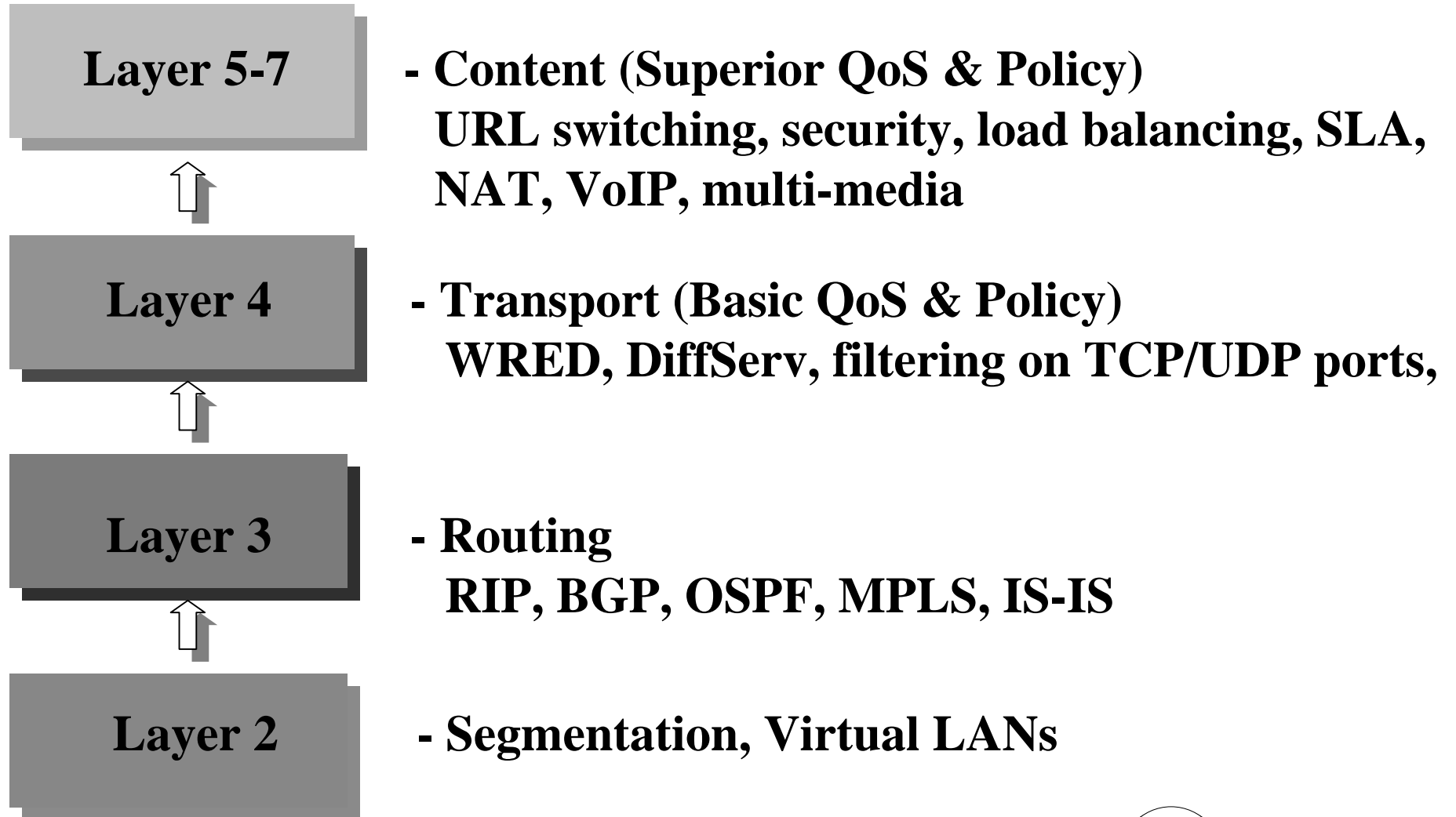


- 
- Lower equipment cost
  - Lower operational cost
  - Simplified architecture
  - Scalable capacity

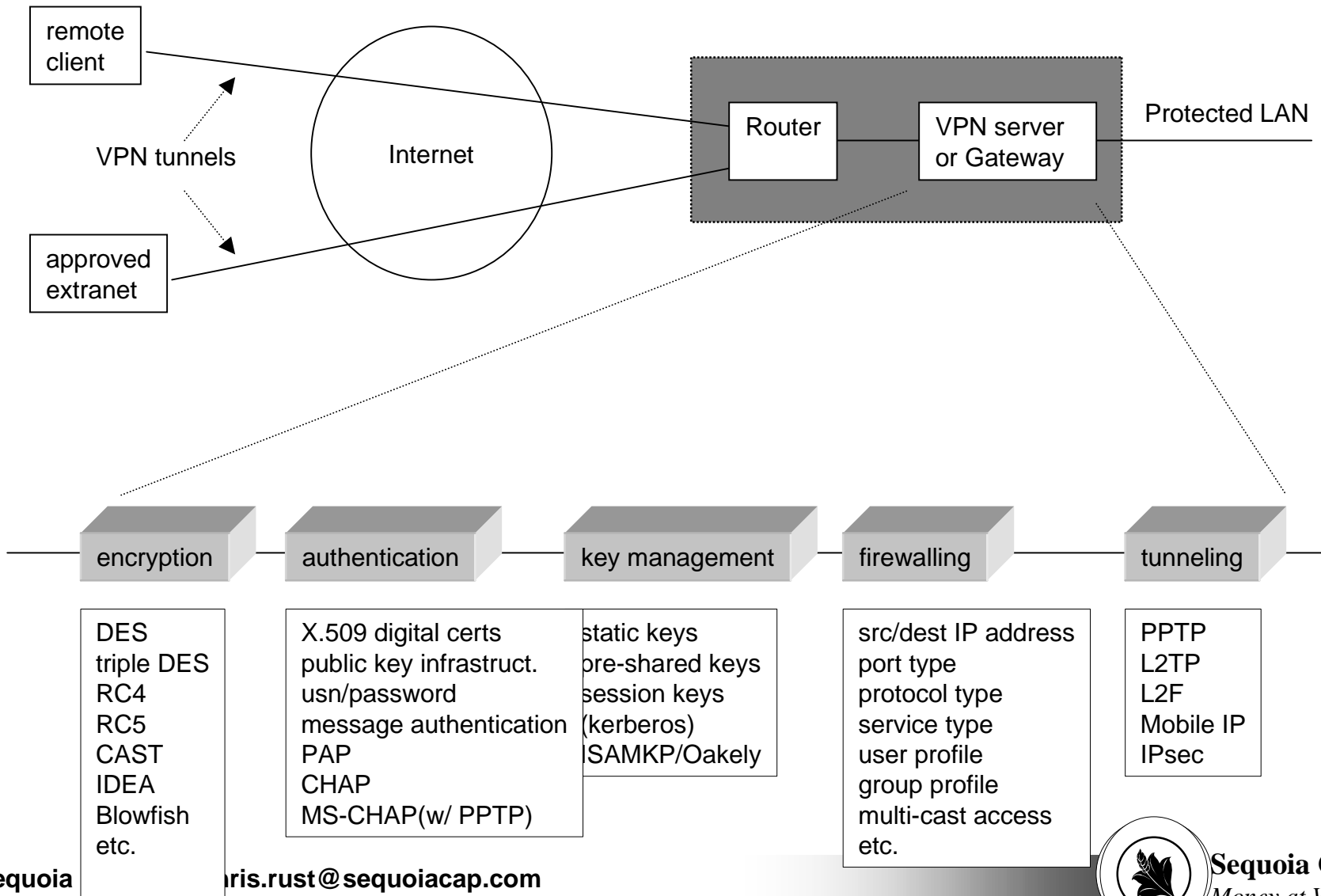
## Optical Internetworks



# Next Wave: Any-Layer Networking



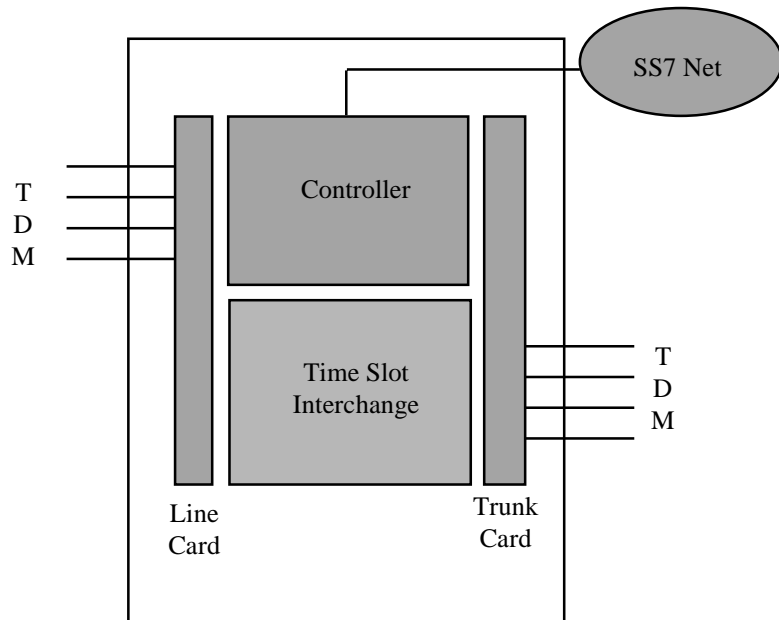
# Changing Functionality of VPNs



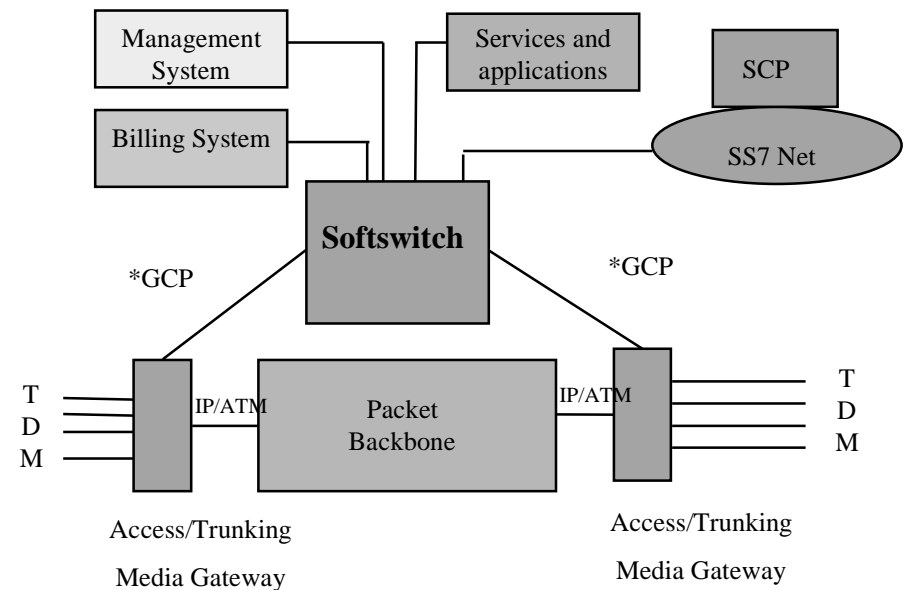
# Impact of the “Softswitch”

## De-Coupling the Signaling and Call Control for VoIP Gateways

Circuit Switch Model



SoftSwitch Model



### Key Features:

- open, standardized protocols which connect distributed hardware and software
- seamless interconnect between transport and signaling networks of IP and traditional telephone networks
- open, standardized application development environments.

# Thoughts on Start-Up Strategy

- Create Paradigm Shifts to Define New Spaces
  - TDM voice -> packet voice
  - Copper networking -> optical networking
  - Voice over copper -> voice over xDSL/Cable
- Be There First with “Adequate Feature Set”
- Value = F [Functionality, Quality, Price]
- Redefine “Value” for Customers in Target Market
  - Broadcom            DSP-intensive mixed signal PHY
  - Ciena                Fiber capacity expansion with WDM
  - Redback            DSLAM aggregation with sub mgmt
- Raise the bar. Incremental advances are uninteresting
- SELL, DESIGN, BUILD



# A VC Checklist for Investing

- Does Anyone Need the Product or Service?
- Is the Value Proposition Compelling to the End User?
- Is There a Sustainable Proprietary Advantage?
- Is There a Realistic Profitable Business Model?
- Is There a Management Team that Can Execute?
- Is There an Opportunity to Create Meaningful Market Cap or Liquidity Event?

If Yes, Go For It!



# About Sequoia Capital

- Founded 72. ~14% of NASDAQ
- Stresses Fundamentals
  - Great teams
  - Markets with rapid growth
  - Large market share in large markets
  - First mover advantage
  - Proprietary edge
- Specializes in
  - Communications/Internetworking
  - Internet technology and Commerce
  - Semiconductors
  - Software
- Focused on Early-Stage
- Brings Much More Than Money
  - In-house recruitment coordination
  - Cookie-cutter startup methodology
  - Access to abundant capital
- Some Sequoia Portfolio Companies
  - AMCC
  - Apple
  - Atari
  - C-Cube
  - Cisco
  - eToys
  - Flextronics
  - Integrated Network Services (INS)
  - Linear Technologies
  - Oracle
  - LSI Logic
  - Network Appliance
  - PMC Sierra
  - Redback
  - Scient
  - Stratacom
  - Vitesse Semiconductor
  - Yahoo!
  - 3Com

