



Broadband Wireless Network Economics Update

January 14, 2003

Signal Lake Background

- **Pure-play telecommunications and Internet infrastructure focus**
- **Extensive knowledge in equipment (hardware and software) and telecom carrier economics, founded in 1999**
- **Early stage and workout focus**
- **Geographic focus in Northeastern US and outside Silicon Valley**
- **Over \$650M to date has been invested in Signal Lake portfolio companies**
- **Roughly 40% of 1999-2000 investments went into wireless equipment companies**
- **Reviewed over 100 business plans for wireless telecom carrier service providers since 1990: funded none**

Signal Lake Wireless Network Access Economics Trade Press Articles

- **Going the Distance**, 1 June 1998, Telephony
- **Fixed Wireless: Do the Numbers Really Work?**, June 2000, Business Communications Review
- Available at <http://www.signallake.com/publications/>



Typical Street Prices for Different Access Alternatives

- Wireline

- » \$50-\$200/month for CATV modem or DSL service
- » \$1000/month for 24 channel T1
- » \$2000+/month for T3/OC-3

- Wireless

- » Cellular: \$50 per phone +\$50/month (Source: CTIA)
- » WiFi: \$200/PC plus \$20/month ISP charge
- » Point to point Microwave: \$5K/link for multiple T1s
- » Point to multipoint Microwave \$5K/sub for multiple T1s
- » Point to point free space optics: \$10K/link for OC-3

Technology Alternatives by Customer Size and Distance

Aggregate Building Bandwidth Requirement

		Low	Medium	High
Distance from Existing Network	High	3G Fixed Wireless	PTMP	PTMP
	Medium	3G Fixed Wireless / DSL	PTMP / DSL	Free Space Optics
	Low	DSL / 3G Fixed Wireless	DSL / PTMP	Fiber

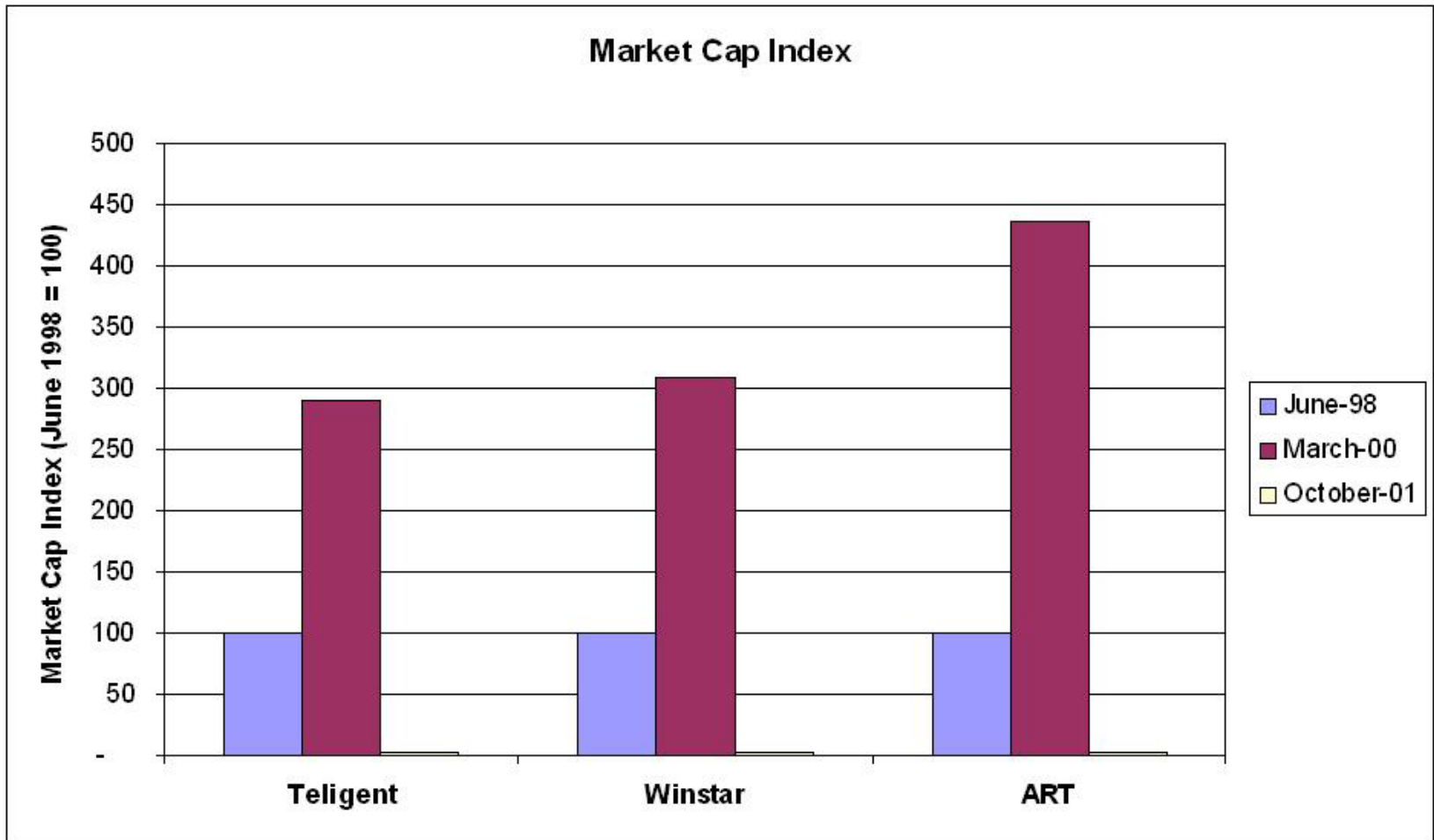


What Is New?

- Demise of startup fixed wireless telecom carriers
- Equipment Cost Reductions
- Broadband Wireline Network Access
- WiFi



Demise of High Profile Players



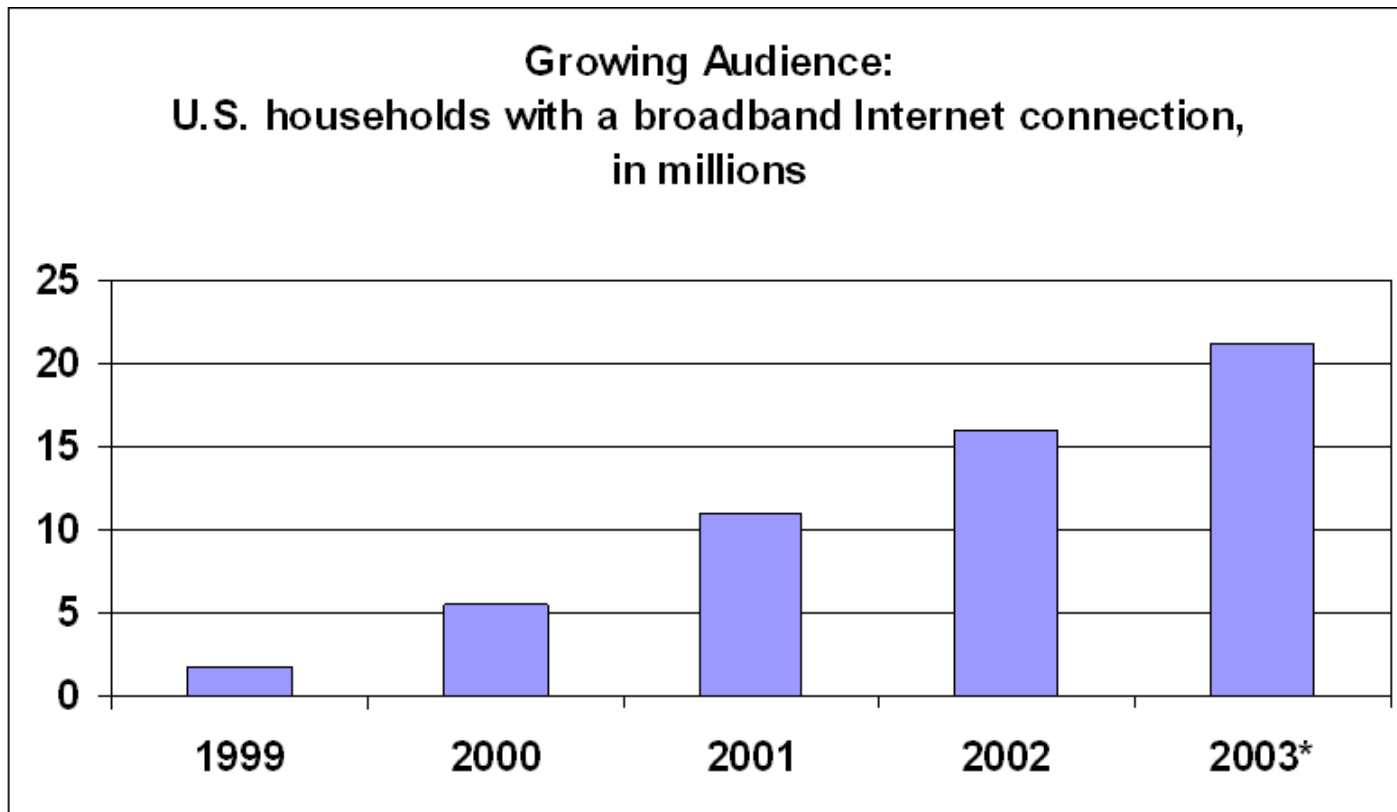
Point to Multipoint Millimeter Wave Radio Equipment Costs

	1998 (actual)	2000 (1998 est.)	2000 (actual)	2003 (est.)
Base Station Capacity (Mbps)	1,600	6,400	2,952	6,400
Base Station Costs	\$300,000	\$190,000	\$190,000	\$140,000
Business Receiver Costs	\$5,230	\$4,150	\$5,300	\$2,850
Blended Cost Per Building Connected (25 Mbps base; 125 Mbps @50% utilization)	\$6,371	\$4,348	\$5,712	\$3,001
Blended Cost Per T1	\$135	\$63	\$91	\$45

Source: Author Analysis



Broadband Wireline Network Access



Source: Yankee Group

* estimate



WiFi

- **Is this a wireline or equipment play rather than wireless telecom service play?**
 - » **Is there a cordless telephone business? For equipment, yes; for telecom services, historically only if you lease the equipment with the service**
 - » **Is there a cordless Ethernet business? For equipment yes; for telecom services, only if you can lease the equipment with the service**
 - » **WiFi plus wireline network connectivity can address a portion of 2.5G/3G markets**
- **Growth of WiFi leads to increasing customer size**
 - » **7M WiFi chip sets shipped in 2002 (Dataquest)**
 - » **Less than 5K network access points in US in 2002 (IDC)**

