Equity Research Note
January 13, 2003

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Cable TV Technology Thoughts

Disclosures applicable to these securities:
see "Companies Mentioned" section herein (disclosure explanation at the end of this report)

Summary

This note summarizes some of our recent thought on several companies in and around our coverage universe, as far as broadband access technology is concerned. Several recent events, while not individually meriting meaningful updates, nevertheless pose the opportunity for comment when viewed as a whole. These events include the presentations at last week's Needham Growth Conference, the Consumer Electronics Show, and DirecTV's incremental charge into local markets. Some of the companies mentioned in this report include Harmonic, Arris, Terayon, C-COR.net, Scientific-Atlanta, Motorola, Concurrent Computer and SeaChange.

Harmonic (HLIT, $3.46, Buy. Disclosures related to this security: A, B, G)

DirecTV last week announced that it intends to launch coverage of approximately 50 incremental local markets. With Harmonic being the incumbent vendor of MPEG-2 encoders to DirecTV, we believe this represents a significant revenue opportunity for Harmonic. If we assume that each market has 10 channels, that means a need for 500 new encoders, plus another 500 for back-up. 1000 encoders in total means a $25m revenue opportunity at a believed ASP of $25,000 per encoder. An order of this magnitude, for delivery in the first half of 2003, should help shore up our 1Q and 2Q revenue estimates of $42m and $52m, respectively. We believe Harmonic has a break-even point in the neighborhood of $55m per quarter.

Another significant positive for Harmonic, which likely contributed to revenue strength in the December quarter just ended, we believe was Yahoo-Softbank in Japan. Yahoo-Softbank is in our opinion the world's most progressive and successful DSL ISP/CLEC, with half a million voice over IP customers and recently announced a TV over DSL offering. Assuming a 100 channel offering, but lacking a back-up facility, the revenue opportunity should equal the kind of incremental sale to DirecTV described in the previous paragraph. This opportunity gives us a healthier comfort level with our December 2002 quarter estimates of $37m in revenue and a pro forma loss of $0.20 per share.

At the other side of Harmonic's business, we continue to believe Comcast's upgrade plans for many of the former TCI systems/cities should contribute to a rebound in revenue for the Broadband Access Networks (BAN) division in 2003. In terms of the optics in the Hybrid Fiber Coax (HFC) network, we believe Scientific-Atlanta (SFA) is now likely to obtain the single largest market share (dollars spent in 2003-04) in the Comcast account, followed by privately held Aurora, Motorola (MOT) and Harmonic. We are not aware that C-COR (CCBL) has won optics business for the former TCI markets, which is where we believe most of the spending will take place. As far as Adelphia is concerned, we believe C-COR is likely to keep its large market share when spending returns, followed by smaller market shares for SFA and Harmonic.

ARRIS Group (ARRS, $4.30, Buy. Disclosures related to this security: B, C, D, E, G)

Arris continues to pay down debt and generate cash. Convertible debt is now $24m and cash above $100m. We believe the customer base is very strong and generally underestimated in its annuity characteristics. However, we have some recent concerns regarding the future architectures of Voice Over IP (VOIP) that we believe are of longer-term concern to Arris. Specifically, we believe the architectural simplicity and attractive business model of privately held Vonage presents an attractive alternative to the cable TV industry as far as VOIP is concerned. If we assume that many of the cable TV operators choose to partner with Vonage for a swift nationwide VOIP rollout, we believe Arris' longer-term future will substantially depend on its ability to be one of the top two or three DOCSIS 2.0 CMTS vendors. A Session Initiation Protocol (SIP) as used in the Vonage model in our opinion puts a greater responsibility on the cable operators to create the kind of symmetric bandwidth enabled by DOCSIS 2.0. On the other hand, a partnership with Vonage would also relieve the cable operators of most of the back-office needs to support switching and more advanced forms of Quality-Of-Service (QOS) enablers. It simply concentrates the cable operator's responsibility into creating a strong symmetric data network, where DOCSIS 2.0 plays the central part, in our opinion.

Terayon (TERN, $2.54, Buy. Disclosures related to this security: B, E, G)

On December 19, the CMTS landscape was cast in its greatest flux ever, with CableLabs awarding Terayon DOCSIS 2.0 qualification for its CMTS. It also awarded Terayon and Cisco PacketCable 1.0 CMTS qualification. The ITU stated its intent to make DOCSIS 2.0 an ITU standard. One may ask what else Terayon could ask for? In our opinion, Terayon stands to gain significant market share in the CMTS market through its leadership in DOCSIS 2.0. In particular, we view the Comcast account as not only the most pivotal in the industry, but also the one where we believe Terayon has a high probability of success. Comcast has three incumbent vendors – Cisco, ADC and Arris. Of those three, we view Cisco having the most to lose from a successful Terayon entry.

Our optimism with respect to the need for upstream bandwidth, driven by peer-to-peer file sharing and VOIP among other things, helps make us positive on Terayon's stock. However, Terayon does face continued financial challenges resulting primarily from its resource-demanding undertakings on multiple fronts. Terayon has to battle Broadcom, Texas Instruments, LSI and Conexant on the chip front. Terayon also has to fight the Taiwanese/Chinese on the cable modem front, where Terayon no longer has a significant advantage given DOCSIS 2.0 certifications by modems using Broadcom and Texas Instruments silicon. Finally, the competitive landscape in the CMTS world is formidable, even though we believe Terayon is likely to be the most significant DOCSIS CMTS market share gainer in 2003. The competition includes in particular Cisco, ADC, Arris, Motorola and Juniper. If DOCSIS 2.0 does not see meaningful adoption in 2003 and early 2004, the competitive clouds could conspire to reduce Terayon's current advantage.

Terayon continues to burn significant amounts of money and needs to fight three formidable battles described above (chips, modems, CMTSs). That would be a big challenge for a much bigger company. For Terayon, victory would truly be David beating several Goliaths. Our strong enthusiasm for the importance of DOCSIS 2.0 solving the upstream bandwidth problem makes us believe Terayon has a probability of success good enough to justify a favorable 12-18 month risk/reward given the current stock price.

C-COR.net (CCBL, $3.64, Hold. Disclosures related to this security: B, G)

Our enthusiasm for C-COR comes primarily from the software area, where we believe its network management system is the industry's most comprehensive and enables the cable operator to conduct its operations more efficiently and also be viewed by the customers as a more reliable organization. The two announced deployments to date are with Advance/Newhouse in Tampa, FL, and Time Warner in Hawaii. We believe we will see many more such deployments in 2003 and 2004.

Our enthusiasm is muted by the too-modest signs of competitive success in the HFC architecture business, such as the optics opportunity in the former TCI markets now to be upgraded by Comcast in 2003-05. We do believe C-COR can obtain the larger market share in Adelphia when it likely returns to HFC infrastructure spending in a few months from now.

The cash position is now below $30m and does not appear to be seeing any meaningful growth until the June quarter at the earliest. Given the stock now trading in the neighborhood of our 12-18 month price target, we are therefore less enthusiastic about the stock than we are with other peer group stocks such as Harmonic, Terayon, Arris and Scientific-Atlanta.

Scientific-Atlanta (SFA, $13.72, Strong Buy. Disclosures related to this security: B, E)

In our opinion, SFA is fundamentally the strongest company in the peer group from a variety of perspectives, not the least of which are financial strength and profitability. We believe the stock's almost mysteriously low valuation is a result of ignorance regarding SFA's value-added contribution to the interactive digital cable TV network system. We continue to read comments to the effect that SFA is making "just a box" protected simply by legacy strength of its PowerKey conditional access system. We significantly disagree, claiming that the world of interactive TV, including VOD, is a highly complex client-server proposition demanding high levels of control and integration. This situation looks a whole lot more like the IBM mainframe computer market in the 1960s than the PC market over the last decade.

We agree that it is now becoming technically possible to deploy a multivendor open architecture cable TV system for broadcast digital TV without a linear bandwidth penalty (courtesy of Sony Passage), but that is not where the cable industry needs to go. In our opinion, cable will not successfully compete against satellite by offering a simple broadcast model without product differentiation. In our opinion, cable can only win against satellite by offering a better TV product in combination with bundling a superior high-speed data product and telephony. For this chief reason, we believe SFA will successfully defend the footprint of its client-server systems architecture. This does not mean SFA will sell or brand set-top boxes. SFA's architecture can be licensed or put in cards to be inserted in other set-tops or directly into TVs. SFA does not generate much value to the cable TV consumer by putting together a set-top; rather, it does so by having invested hundreds of millions of dollars into an interactive client-server architecture which is secure, feature-rich, can scale and integrates applications and contributions from numerous third-party vendors. This is in our opinion not too different from Microsoft's role. Microsoft does not need to build boxes to be one of the world's most profitable technology companies; why should SFA have to build boxes in the future? Would Microsoft like to build computers today, like IBM does?

Having said that SFA may not want or need to build set-tops in the future, we believe that SFA's unique experience of building interactive digital cable TV set-tops can enable it to produce a few strong products in the near future. In particular, we believe demand for PVRs/DVRs (Explorer 8000) will materially help average selling prices (ASPs). We believe demand for high-definition TV (HDTV) should also help keep demand for the 3100HD and future versions such as the 4200HD strong.

We are encouraged by Brian Roberts' recent comments that a wholesale swap-out of analog set-tops is starting to look potentially attractive. Such a move would clearly require incremental demand to come from low-cost set-tops such as the SFA Explorer 2250 and future cost-reduced versions (NOT the Explorer 1850 which we believe will be sold exclusively to Cablevision), but volumes would be incrementally higher. The motivation for such a swap-out would be to release hundreds of MHz of spectrum – perhaps 300 MHz or more in modern systems. 300 MHz means 50 channels, each of which could contain 30 Mb/s worth of DOCSIS 2.0 data. That is in turn 1.5 Gb/s worth of downstream bandwidth! How much could that be worth? In the HDSL world, which forms the basis of most T1 offerings, 1.5 Mb/s symmetric service is sold for around $500 per month. At the same price, the cable operator could service the equivalent of 1,000 T1 lines per node, or theoretically yield $500,000 per month per node. Clearly, there are not likely to be that many businesses per node to begin with, and the cable operator would likely charge $100 rather than $500 for T1-type bandwidth, but let's examine the cost of swapping out the analog boxes in a 500 homes-passed node.

500 homes passed means some 300 cable customers and some 100 of them with on average 1.3-1.4 digital boxes per home. That is, let's say, 133 digital boxes per node today. Let us assume the average home has 3 TVs and will want 2 boxes. That means the need is for 600 digital boxes in this 500-homes-passed node. With 133 already deployed, it leaves us with 467 more to be deployed. Such a high volume requirement should lead to ASPs around $200, which would mean almost $100,000 in terms of digital set-top box capex. Everybody would have a digital box and the ability to do VOD and other interactive services. High-speed data could be sold more liberally to high-paying businesses, as described above. There would be plenty of bandwidth for IP telephony, without the need for expensive quality-of-service mechanisms. Signal theft would disappear. HDTV bandwidth limitation problems? History!

We are currently estimating a linear increase in digital cable TV penetration, reaching around 90% by 2009 or so. If our logic is correct, there are strong arguments behind significantly accelerating this trend. We believe several operators will make decisions in 2003 to swap out all analog set-tops in a random city here and there some time in late 2003 or 2004, in order to test the perceived benefits we outlined above. This goes for both Motorola and SFA customers. We believe the logic of swapping out all analog cable TV set-tops is a key reason to own SFA stock over the next couple of years.

Concurrent (CCUR, $3.20, NR) and SeaChange (SEAC, $6.57, NR)

Both companies presented at our annual Needham Growth Conference in New York last week. The concern about both stocks had been going into 2002 – mysteriously, in our view – that Video On Demand (VOD) was not going to be rolled out. We believe that those skeptics were proven wrong in 2002, so the concern going into 2003 is that VOD will fail to see meaningful usage to the point where there will be no need to buy more servers in existing markets. Additionally, the long-time concern regarding barriers to entry into the cable TV VOD business are almost as strong as always.

Both companies presented a credible case to the effect that it will be difficult for new entrants to break into this market. The switchout/overlay costs are too high, and the integration costs will be high for new entrants. VOD needs to be integrated with billing systems, set-top conditional access, operating systems and middleware, among other things.

Our view is that much content will move from linear broadcast TV to server-based VOD. With 500 channels or more, a node of 500 homes simply does not absorb the supply of available channels. We believe that a move to massive VOD will come in conjunction with the swap-out of the analog set-tops described above.

Companies Mentioned (prices as of market close on January 10, 2003):

AOL Time Warner (AOL, $14.88, NR)
ADC Telecom (ADCT, $2.81, NR)
ARRIS Group (ARRS, $4.30, Buy. Disclosures related to this security: B, C, D, E, G)
Broadcom Inc. (BRCM, $19.62, NR)
Cablevision Systems (CVC, $19.44, NR)
C-COR.net (CCBL, $3.64, Hold. Disclosures related to this security: B, G)
Cisco Systems (CSCO, $15.22, Buy. Disclosures related to this security: B, G)
Comcast Corporation (CMCSK, $26.42, NR)
Concurrent Computer (CCUR, $3.20, NR)
Conexant Systems Inc. (CNXT, $1.72, NR)
Harmonic Inc. (HLIT, $3.46, Buy. Disclosures related to this security: A, B, G)
Hughes Electronics (GMH, $12.20, NR)
Juniper Networks (JNPR, $9.26, Hold. Disclosures related to this security: B, G)
LSI (LSI, $6.15, Buy. Disclosures related to this security: B, E)
Motorola (MOT, $9.93, Buy. Disclosures related to this security: B)
Scientific-Atlanta (SFA, $13.72, Strong Buy. Disclosures related to this security: B, E)
SeaChange International (SEAC, $6.57, NR)
Terayon Communication Systems (TERN, $2.54, Buy. Disclosures related to this security: B, E, G)
Texas Instruments (TXN, $16.05, NR)

Broadband Access Technology

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Broadband Access Technology Sector -- Valuation Analysis

Balance sheet figures current for quarter ended September 30, 2002

Company	Symbol	Needham Rating/ Target	Closing Price 1/10/03	Shares O/S (mm)	Market Cap. ($mm)	Debt ($mm)	Cash & Equiv. ($mm)	Enterprise Value ($mm)	Sales CY 02E ($mm)	Sales CY 03E ($mm)	EV to Sales CY 02E	EV to Sales CY 03E	Price to Sales CY 02E	Price to Sales CY 03E	Fully Taxed EPS CY 02E	Fully Taxed EPS CY 03E	EV to EPS CY 02E	EV to EPS CY 03E	Price to EPS CY 02E	Price to EPS CY 03E
Cable Equipment:																				
ARRIS Group	ARRS	Buy / $6	$4.30	83.1	$357	$213	$94	$476	$703	$750	0.7x	0.6x	0.5x	0.5x	($0.04)	$0.26	NM	22.0x	NM	16.5x
C-COR.net	CCBL	Hold / NA	3.64	36.3	132	2	28	106	251	275	0.4x	0.4x	0.5x	0.5x	(0.12)	(0.04)	NM	NM	NM	NM
Harmonic	HLIT	Buy / $3	3.46	60.0	208	3	55	156	184	231	0.8x	0.7x	1.1x	0.9x	(0.46)	0.04	NM	65.0x	NM	86.5x
Scientific-Atlanta	SFA	SB / $25	13.72	155.7	2,136	10	795	1,350	1,479	1,799	0.9x	0.8x	1.4x	1.2x	0.89	1.27	9.7x	6.8x	15.4x	10.8x
Terayon	TERN	Buy / $4	2.54	73.1	186	69	220	35	129	180	0.3x	0.2x	1.4x	1.0x	(0.81)	(0.36)	NM	NM	NM	NM
Telecom Equipment:																				
ADTRAN	ADTN	Hold / $33	$39.12	38.3	$1,498	$50	$125	$1,424	$342	$390	4.2x	3.7x	4.4x	3.8x	$0.72	$1.10	51.6x	33.8x	54.3x	35.6x
Advanced Fibre	AFCI	Hold / $10	18.96	85.8	1,626	5	742	889	345	345	2.6x	2.6x	4.7x	4.7x	0.24	0.26	43.2x	39.9x	79.0x	72.9x
Netopia	NTPA	Hold / $2	1.59	18.6	30	3	22	11	65	101	0.2x	0.1x	0.5x	0.3x	(0.31)	(0.54)	NM	NM	NM	NM
Next Level	NXTV	Hold / $1	0.91	86.4	79	170	28	221	56	80	3.9x	2.8x	1.4x	1.0x	(0.67)	(0.40)	NM	NM	NM	NM
Paradyne	PDYN	Hold / $2	1.31	42.6	56	1	50	7	111	116	0.1x	0.1x	0.5x	0.5x	(0.20)	(0.27)	NM	NM	NM	NM
Broadband ICs:																				
Centillium	CTLM	Buy / $3	$2.55	34.8	$89	$0	$98	($9)	$103	$110	NM	NM	0.9x	0.8x	($0.43)	($0.22)	NM	NM	NM	NM
GlobespanVirata	GSPN	Buy / $6	5.62	133.7	751	132	359	524	230	225	2.3x	2.3x	3.3x	3.3x	(0.16)	(0.01)	NM	NM	NM	NM
Microtune	TUNE	Buy / $4	2.95	53.4	157	0	135	23	83	86	0.3x	0.3x	1.9x	1.8x	(0.33)	(0.18)	NM	NM	NM	NM
PCTel	PCTI	Buy / $10	7.55	20.0	151	0	112	39	48	60	0.8x	0.6x	3.1x	2.5x	0.16	0.09	12.1x	21.6x	47.2x	83.9x

	% of companies under coverage with this rating	% for which Investment Banking services have been provided for the past 12 months
Strong Buy	13%	25%
Buy	51	19
Hold	33	12
Sell	1	0
Restricted	2	75

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