Business Analytix, Inc.

307 Crescent Drive, Bordentown, NJ 08505 | (609) 291.7160

Addendum

Preliminary Analysis of the Broadcast Overlay Business Opportunity

Pricing the Broadcast Overlay Service

"An Opportunity" as Advanced by

~ Advanced Television Broadcasting Alliance ~

Business Analytix, Inc.

307 Crescent Drive, Bordentown, NJ 08505 | (609) 291.7160

Preliminary Analysis of the Broadcast Overlay Business Opportunity

Pricing the Broadcast Overlay Service

Background

Our earlier report, 'The Economic Value of Broadcast Innovation – Impact on the U.S. Treasury', postulates that Broadband Overlay technology would present a significant business opportunity. Such innovation will create value for the Treasury, the wireless carriers, and the Broadcasters. It arrives at the following key conclusions:

- The consumer mobile traffic is expected to grow exponentially to more than 15 thousand PB in 2015, 60 thousand in 2020, and around 120 thousand PB by 2026.
- The estimated Point-to-Multipoint IP traffic will also witness similar growth. It will reach more than 2 thousand PB in 2015, approximately 15 thousand PB in 2020, and 32 thousand PB by 2026.

The report referred to above was based on the assumption of a gradual rollout of Broadcast Overlay technology after its proposed launch in 2014, eventually covering 81 markets in 2018 adopted by 60% of the stations serving 80% of the households.

The following business opportunity analysis is an extension of the economic analysis done in the study referred above and builds a preliminary "wholesale" business case using the same assumptions as mentioned above with a few additional assumptions, mentioned below.

Objectives of the Business Opportunity Analysis

This analysis computes the following 3 tiers of value generated by Broadcast Overlay:

1. The value of wholesale business opportunity presented by an anchor partnership with at least one major wireless operator;
2. The value derived by the partnering wireless operator from the wholesale Broadcast Overlay service– in other words, the value of "gap" between the present-day costs of the wireless operator and the costs after implementing the Broadcast Overlay technology;
3. The "new" value created by the opportunity offered by the potential monetization of the surplus bandwidth generated by the Broadcast Overlay service ("the headroom") that can be captured by new service offerings.

Underlying Assumptions

The analytical model analyses a wholesale Broadcast Overlay business opportunity from the perspective of a broadcaster. Given below are the major assumptions upon which this analysis is based:

1. Assumptions regarding the adoption of the Broadcast Overlay technology by the broadcasting stations: It is assumed that there will be 3 participating broadcast stations In each market,. Each of these participating stations would dedicate half of their 6 MHz spectrum for the Broadcast Overlay service. This would translate into a 9 Mbps service per station delivering 35,478 GB per year per station or 106,434 GB per year per market.

2. Each of the adopting stations will be required to incur the following Capital Expenditure:

a. Non-recurring Engineering Cost (NRC) and Initial Capital Expenditure: Each station is assumed to incur NRC of $100,000 in the first year of the implementation (Year-0) and Initial Capital Expenditure of $100,000 in the first year of the service (Year-2).

b. Coverage Sites: The Broadcast Overlay service assumptions are based on the fact that the broadcast transport multiplies each bit into huge number of "unicast-equivalent" user-bits (depending on the number of users receiving the broadcast overlay signal at any given time). In other words, a Broadcast Overlay system is highly unlikely to be "capacity-constrained". In fact it will generate significant headroom capacity. However, this analysis assumes that in order to maintain the Quality of Service, each station will need 4 more base stations – the coverage cell sites - per market. Each of these cell sites will cost $250,000 to build and $50,000 annually to maintain.

3. Assumptions regarding the Partnering Wireless Operator (the Anchor Partner): We have made the following assumptions regarding the partnering wireless operator:

   a. Market share of the anchor partner: 15% of the total wireless industry. We have assumed that while the industry will grow at an annual rate of 7.3% (based on historic average), the wireless partner will grow at a rate of 3% per annum.

   b. While computing the partnering wireless operators share of mobile data traffic, we have made the following assumptions regarding the overall wireless industry trends:

      i. Estimated wireless connections and the Data subscribers based on CTIA's Semi-annual Wireless Industry Survey Results published by CTIA[1] and Fierce Mobile Content release[2] are 333.5 million and 111 million respectively.

      ii. It is assumed that the number of Data subscribers would grow at an annual rate of 30% till the proportion of data users to the total wireless connections hit a ceiling of 80%.

      iii. The Average Point-to-Multipoint IP traffic per Data Subscriber is computed by dividing the Point-to-Multipoint IP traffic (as estimated by the earlier Economic Study) by the number of Data subscribers in a given year.

4. Current Cost Structure of the Wireless Operator: In order to determine the "value gap" between the current cost structure of the wireless operators and the cost structure offered by the Broadcast Overlay service, we have assumed the base-line cost of $4 per GB[3].

5. Computation of Broadcast Overlay Demand: In order to estimate the demand for Broadcast Overlay service from the data subscribers of the partnering wireless operators, we followed the subsequent steps:

   a. We applied the partner's penetration assumption to the estimated number of people in the markets covered to arrive at the number of partner's subscribers in a given year.

   b. We then used the assumptions regarding the proportion of "data subscribers" to the total subscribers to determine the number of data subscribers served by the partnering wireless operator.

---

[1] "CTIA's Semi-annual Wireless Industry Survey Results." *CTIA-The Wireless Association*. 23 May 2010. Web. 18 Feb. 2012. <http://files.ctia.org/pdf/CTIA_Survey_MY_2011_Graphics.pdf>.

[2] Goldstein, P. "CTIA-The Wireless Association® Semi-Annual Survey Reveals Historical Wireless Trend." *Mobile Content, Mobile Marketing, Mobile Advertising --- Fierce Mobile Content*. FierceMobileContent, 11 Oct. 2011. Web. 18 Feb. 2012. <http://www.fiercemobilecontent.com/print/node/20960>.

[3] The updated (2010) version "The Business Case For Femtocells In The Mobile Broadband Era" by Signal Research concludes that the cost per GB of data is $6.93 if the the technology used is HSPA and $4.76 if the technology used is LTE. (Available at http://www.smallcellforum.org/resources-white-papers - Registration Required)

c. The total Broadcast Overlay IP demand served by the partnering wireless provider is then arrived at by multiplying its Data Subscriber by the Average Point-to-Multipoint IP Traffic per Data Subscriber.

6. Assumptions regarding New Services: Since the Broadcast Overlay is a one-to-many transmission system and each Byte "broadcasted" is used by many subscribers, a relatively small Broadcast Overlay spectrum generates a huge throughout capacity in terms of the "user-bits". This will leave and make available considerable "headroom capacity" that can support multiple new and innovative broadcast services that were hitherto impractical.

   As mentioned above, the throughput generated by a Broadcast Overlay system will be as much as 35,478 GB per year per station or 106,434 GB per year per market. We have, however, used the following additional "filters" to arrive at the actual "monetizable" Broadcast Overlay capacity in user-bits:

   a. It is assumed that the entire Broadcast Overlay would be used to broadcast 60 simultaneous sessions of IP traffic at any point in time in a given market. Thus the throughput per session per market would be 1,774 GB per year.

   b. This analysis further assumes that subscriber devices actually "tuning into" any Broadcast Overlay session would be only a small portion of the entire subscriber device base in a market. We have called it "utilization rate" and have assumed it to be between 2% to 5%, rising gradually over the forecast period.

   Mathematically, the greater the number of simultaneous sessions and lower the utilization rate, the lower will be the effective "monetizable" throughput of a Broadcast Overlay service. However, in real-life, these two are not necessarily independent variables. In reality, the greater the number of sessions, the greater is the likelihood of a higher utilization rate. We have, however, ignored this interrelationship for the purpose of this analysis.

   Computation of the available "Headroom" for enabling new services: If we subtract the capacity used by the anchor wireless partner from the total "monetizable" Broadcast Overlay throughput, we arrive at the capacity "headroom" available to the broadcaster to introduce new innovative broadcast services using this surplus capacity. However, we have assumed a slow ramp up for these new services beginning with 10% in 2014 and reaching the maximum assumed ceiling of 70% by 2026.

7. Pricing Assumptions: Keeping in perspective the current wholesale wireless cost of $4 per GB, we have tested the business case on the following pricing schemes for the Broadcast Overlay service:

   a. Under the bandwidth pricing model: In the event, the broadcaster follows the pricing model under which it puts the value on the breadth of the pipe rather than the volume of data that flows through this pipe, we have assumed a price of $100,000 per Mbps[4].

      Since the bandwidth will be offered in the chunks of "bits per second", there is a likelihood that the wireless partner may buy the bandwidth on "as needed" basis based on the estimated peak usage and hence the booked capacity may be less than 100% of the available capacity. We have assumed the capacity booking to be 75% for the purpose of this analysis.

   b. Under the throughput pricing model: If, on the other hand, the partnering wireless operator is charged on the basis of the volume that is received by the user (bits

[4] Though, this price is higher than the typical "per MHz" market price prevalent today, we have assumed a generous premium given the fact that Broadcast Overlay bandwidth multiplies into a far bigger "unicast-equivalent" capacity.

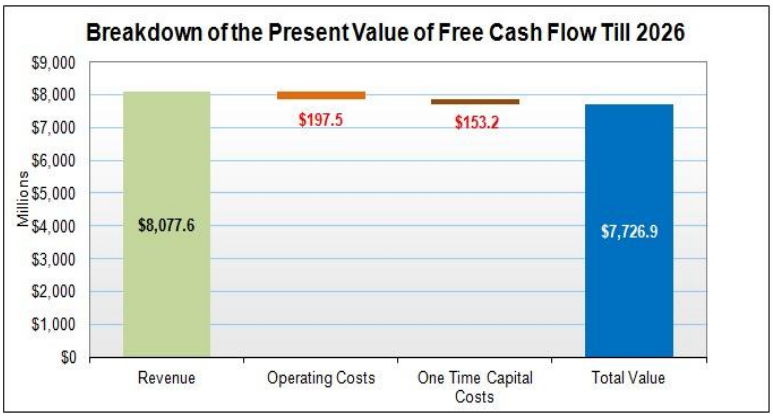
delivered) using the Broadcast Overlay service; i.e. on the basis of the throughout, we have assumed a price per GB of throughput to be $2.50 for traditional wireless data service and a discounted yield of $2.00 per GB for the new innovative services.

Conclusions

This analysis examines the business opportunity presented by Broadcast Overlay based on two different pricing scenarios: (a) the throughput pricing model, and (b) the bandwidth pricing model. The following table summarizes the results based on a partnership with single wireless operator with a penetration of 15% of the total wireless industry:

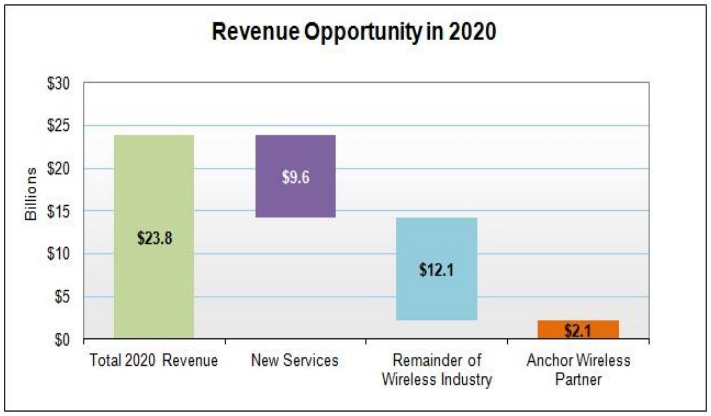
	Pricing Model	
2013-26	Throughput	Bandwidth
Internal Rate of Return	343%	610%
Net Present Value ($ M)	$7,727	$426
Present Value of Gap*	**$5,428**	**$13,605**
Hurdle Rate for NPV		12%

*Gap between wireless operator's current cost and BO cost



It is obvious from the above table that the pricing model using "throughput model" yields far greater Return on Investment (still providing good benefit to the partnering wireless operator) than the "bandwidth pricing model". This is due to the fact that Broadcast Overlay service effectively multiplies every transmitted bit multiplies into a substantial throughput of monetizable user-bits. As the chart on the left shows, that it requires only a "marginal" investment in infrastructure to tap into this enormous opportunity.

If we were to include the value potential from (a) other wireless players (other than the anchor partner), and (b) innovative new services that can be introduced utilizing the "bandwidth headroom" offered by the Broadcast Overlay; the total value of the revenue opportunity comes to $23.8 billion by 2020. This is roughly as much as the present revenue of the entire broadcast industry (see Chart on the right).



Feedback from Independent Analysts

We sought feedback/opinions of several independent analysts closely associated with the wireless industry. Given below is a brief summary of their responses:

a. While our assumption of the wholesale price-point of around $4/GB was reconfirmed by all the independent sources, it was opined that the wireless carriers might be willing to pay more (than $4) for video traffic than the "text" traffic given the stricter QoS requirements governing the video transmission.

b. On the other hand, some felt that the wireless carriers may seek pricing discounts for being a "down-stream only" service if our offering is a "spectrum" solution and not a "service". (Analysts' distinction between a spectrum solution and a service is quite similar to our distinction between bandwidth and throughput models, as described above).

c. Given the attractiveness of the proposition, wireless carriers might be tempted to attempt developing a point-to-multipoint solution on their own; especially since it does not require a lot of spectrum to roll out such a service. However, the key deterrent to the rolling out of an Overlay service by wireless carriers will be their lack of operational understanding of the broadcast business. It will be far more efficient for them to pay for an Overlay service than build all the required capabilities and infrastructure from grounds up. This, too, reinforces our belief that broadcasters would be benefited by offering an end-to-end Overlay service to the partnering wireless operators instead of offering a bandwidth/spectrum solution.

d. Development of a supporting ecosystem will be another key factor in turning the concept of Broadcast Overlay in a reality. The common question posed on this issue related to the choice between standardization vs. creating a proprietary Intellectual Property. In reality, however, Broadcast Overlay technology will be based on already prevalent technology platforms such as Enhanced Multimedia Broadcast Multicast System (EMBMS) infrastructure available within LTE Standard Release10. Any proprietary development over and above what is already available is likely to become a *de-facto* industry standard paving way to a quick development cycle of the entire ecosystem.

e. Another commonly voiced opinion related to the present focus of the wireless industry. Though, wireless industry is painfully aware of the economic consequences of the increasingly bandwidth-gorging user behavior, their largest economic cost still remains to be the equipment subsidies. This might make the task of getting a quick buy-in from a willing wireless carrier partner difficult.

   While this might be true, we feel that the wireless operators would still need a Broadcast Overlay solution. The equipment subsidies and churn are directly related to the customer satisfaction; which in turn, will increasingly depend on the carriers' ability to serve video in a mobile environment. Though, Wi-Fi offload and usage caps might temporarily alleviate the spectrum/ bandwidth problem to an extent, unless the wireless carriers find a way to satisfy increasing demand for the mobile video in a cost-effective manner, it will make their business model highly vulnerable.

f. Last but not the least, the third largest US wireless operator Sprint's recent announcements regarding its plans to be a white-label platform service company supporting the wireless needs of multiple devices (such as Kindle, etc.) as well as that of numerous M2M applications; are pointers to the changing dynamics in the wireless industry. Advent of a Broadcast Overlay platform service fits well in this changing ecosystem.