

ASSIA®

Adaptive Spectrum and Signal Alignment, Incorporated

Fixed Broadband Access Technologies

***FCC NATIONAL BROADBAND PLAN WORKSHOP
TECHNOLOGY – FIXED BROADBAND
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**Marc Goldberg
EVP & CTO
ASSIA, Inc.**

**mgoldburg@assia-inc.com
650.654.3400
<http://www.assia-inc.com>**

Key Access Technology Considerations

□ Technology roadmaps that support of future end-user services

Technology	Near-term Peak Downstream Access Speed	Assumed Access Oversubscription	Sustainable Loaded Subscriber Access Speed
Fiber: GPON FTTH ¹	2.4 Gbps	32x	75 Mbps
Cable: DOCSIS 3.0 ²	155 Mbps	7x	22 Mbps
DSL: FTTN VDSL2 ³	50-75 Mbps	1x	50-75 Mbps
DSL: FTTN Vectored/DSM III VDSL2 ³	120 Mbps	1x	120 Mbps

□ Cost structures in light of existing US infrastructure, demographics

- US population density is low compared to other developed countries⁴
 - Singapore: 7,060 2.5 person households/square mile
 - US: < 110 2.5-person households/square mile, excluding DC and 9 highest-density states
- US CapEx case study: FTTH cost of 5x versus FTTN+DSL^{5,6}
 - ATT FTTN+DSL: 19 M homes, US\$ 5B
 - Verizon FTTH: 18 M homes, US\$ 23B
- UK regulatory advisors estimate similar 5x premium for FTTH vs. FTTN in the UK⁷
- the “right answer” for the US will have a mix of technologies

□ Deployment and network management practices

- “What” to deploy is important
- “How” the network is deployed & managed drives end-user experience, OpEx



1: <http://newscenter.verizon.com/press-releases/verizon/2007/verizon-to-begin-deployment.html>

2: <http://www.cablelabs.com/specifications/CM-SP-PHYv3.0-108-090121.pdf> (155 Mbps based on single 4-carrier group)

3: ITU-T G.993.2, ANSI/ATIS Dynamic Spectrum Management and ITU-T G.vector (draft) standards, 17a bandplan, 600m loops

4: <http://www.census.gov/compendia/statab/tables/09s0013.xls>

5: <http://www.govtech.com/gt/articles/99464>

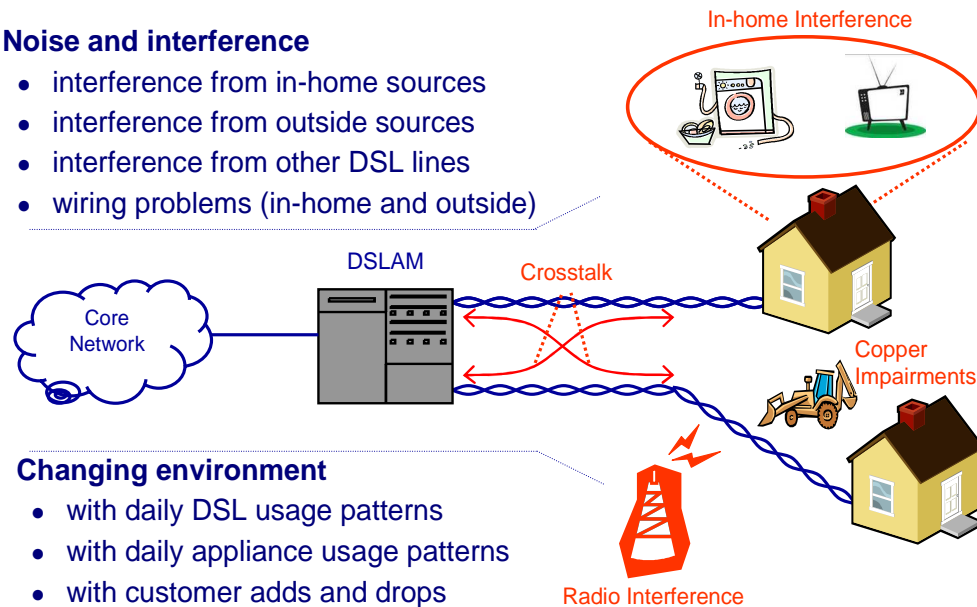
6: <http://www.networkworld.com/news/2006/092706-verizon-fios.html>

7: *analsys mason, Final report for the Broadband Stakeholder Group: The costs of deploying fibre-based next-generation broadband infrastructure*, 8 September 2008, Ref: 12726-371

Deployment & Network Management

❑ Noise and interference

- interference from in-home sources
- interference from outside sources
- interference from other DSL lines
- wiring problems (in-home and outside)



- ◀ DSL Access Technology Challenges
- ▶ FTTH, cable different, but no easier

❑ Changing environment

- with daily DSL usage patterns
- with daily appliance usage patterns
- with customer adds and drops
- with construction in the community

❑ Multiuser networks generally designed for most compromised users

- e.g., deliver “guaranteed” service to 90% of users, 90% of the time
- balances service speed/quality with operator OpEx

❑ Results in familiar rate-reach or coverage-capacity tradeoffs

- lower-quality service to more customers with higher complaint and churn rates
- higher-quality service to fewer customers with lower complaint and churn rates

❑ Deployment and management technologies can fundamentally shift the tradeoff

- Example 1: adaptive antennas in wireless (present in all new standards as “beamforming,” “MIMO,” etc.)
- Example 2: Dynamic Spectrum Management for DSL (standardized in ANSI/ATIS and ITU-T)

❑ Example: Dynamic Spectrum Management in DSL

- line-by-line optimization: each customer moved to highest stable speed consistent with their service plan
- typically moves rate/reach curves >25% “up and to the right” (higher speeds, greater reach)