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UBB: Can Wireless Keep Up?

CITI Event: The Next Generation of Communications -
The Dawning of the Ultra-Broadband Era
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Brett Glass
LARIAT.NET
P.O. Box 1693
Laramie, WY 82073-1693

Slides at: <http://www.brettglass.com/UBB/>
(This page; click at top to start presentation)

E-mail: <http://www.brettglass.com/mailbrett.html>

Also see: <http://www.brettglass.com/CR/>

[< Previous Page](#)[Return to Title Page](#)[Next Page >](#)

Brett Glass: Curriculum Vitae

- BSEE Case Institute of Technology (Case Western Reserve University), 1981
- MSEE Stanford University, 1985 (Masters' project: Digital Radio)
- Chip designer, systems consultant, programmer, author, magazine columnist, consultant, inventor
- "Lone Eagle" (Moved to rural Wyoming as the Internet made it possible to work from afar)
- Founder of LARIAT.NET -- the first and longest continuously operating wireless broadband provider
- LARIAT.NET was originally LARIAT.ORG -- a nonprofit (501(c)(12)) rural telecommunications company taken private at members' request

[< Previous Page](#)[Return to Title Page](#)[Next Page >](#)

Can wireless keep up in the UBB era?

Consumers want it to....

- Wireless broadband business is booming in hard economic times as consumers eliminate DSL and/or cable to save on household expenses ("Thank you; we're calling to cut off our phone service now!")
- Many consumers, tired of "bundles," onerous contracts, and 15 minutes of commercials per hour are going with Netflix for video
- Internet, however, remains a "must have" item - both on its own and as a replacement for cable or satellite video. Our ISP's Web traffic increased 30% in Q3 (and we didn't add that many new customers), primarily due to video (including Netflix video-on-demand)
- Many video players (e.g. Adobe Flash) are poorly designed and require much higher connection quality than they should - very low latency, low jitter

[< Previous Page](#)[Return to Title Page](#)[Next Page >](#)

Barriers to Wireless UBB are not technical or economic; they are regulatory and political

- Millimeter wave radio technology now available in cheap CMOS
- TV "white spaces" also usable if remaining stations are "clustered"
- ...but there are two problems to overcome:
 - Where to get the spectrum on which to operate?
 - Where to get the backbone bandwidth to provide to the consumer?
- Current US spectrum policy is antithetical to wireless UBB
 - Most unlicensed bands are congested by consumer devices or are narrow
 - The remainder have operating rules that rule out point-to-multipoint UBB (e.g. 24 GHz) or can't do PTMP UBB at safe power levels (60 GHz)
 - Licensed spectrum - e.g. LMDS - is being hoarded with impunity. LMDS licensees have barely deployed

but are asking for renewals

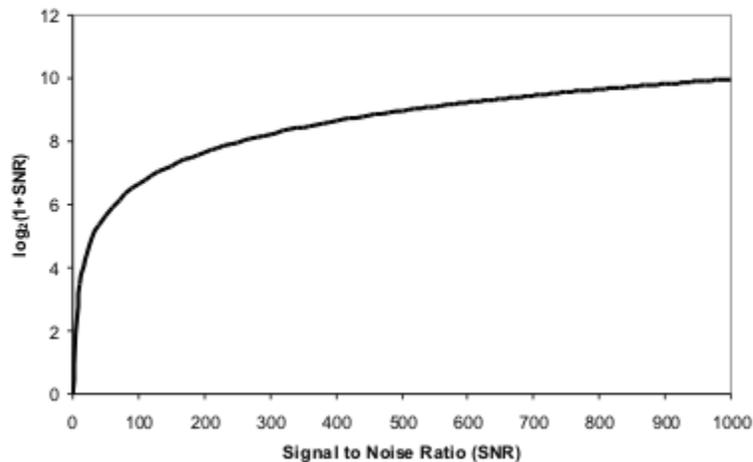
- Lots in recent auctions have covered large geographic areas but have included relatively little spectrum (5-20 MHz channels; not wide enough for UBB)

[< Previous Page](#)[Return to Title Page](#)[Next Page >](#)

Where to get the spectrum for UBB?

- Reclaim LMDS spectrum
- New rules for 24 GHz allowing PTMP with highly directional antennas
- Don't waste TV "white spaces" on consumer devices or carve them up into exclusively licensed channels unusable for UBB

Shannon's Law: $C = BW \times \log_2(1 + \text{SNR})$



Capacity increases linearly with bandwidth but only logarithmically with SNR; therefore best utility is obtained via nonexclusive licensing

[< Previous Page](#)[Return to Title Page](#)[Next Page >](#)

Another hurdle: getting the bandwidth to sell

- Wireless ISPs often have difficulty obtaining backbone bandwidth in wholesale quantities - especially in rural areas, where it can run as high as \$325 per Mbps per month
- Backbone providers are refusing to provide access outside of "NFL cities," making it uneconomical to offer UBB in many areas
- Ironically, this issue is referred to on the Hill as "Special Access" -- when in fact it is perfectly ordinary wholesale access!
- Backbones must be required (or, better, incented) to open POPs
- If upstream and downstream issues are solved, UBB can be UBBiquitous