RTT TECHNOLOGY TOPIC
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3G Fixed access

In parallel with cellular radio, fixed access has evolved through three generations. In the 1980's variations of each of the first generation analogue cellular technologies - AMPS, N-AMPS, TACS and N-TACS (Japan) were used to provide POTS (plain old telephone service) - i.e. 3 kHz analogue voice channels and 1.2 kbps or 2.4 kbps in band tone modem service. No dominant technology (or dominant standard) emerged and fixed access wireless failed to establish itself as a generic alternative to copper access. In the 1990's, second generation fixed access products were introduced based either on digital cordless (e.g. DECT or PHS), digital cellular (IS136, IS95, GSM or PDC, e.g. Diva Communications based PDC products), or proprietary digital radio implementations (for example Interdigital's multi-level adaptive QAM, Granger Telecom's proprietary CDMA, DSC Airspan's proprietary CDMA, Nortel's Proximity proprietary TDMA).

Services provided included POTS, 16 kbps or 32 kbps ADPCM speech channels or 2B+D wireless ISDN. No dominant technology (or dominant standard) emerged and fixed access wireless failed to establish itself as a generic alternative to copper or hybrid fibre/copper access in the local loop.

Third generation fixed access wireless products are now emerging both in the US, Asia and Europe. These products are either based on third generation cellular technologies - IMT2000DS, IMT2000MC, IMT2000TC, IMT2000FT, proprietary TDMA or CDMA technologies and/or access techniques borrowed from digital TV (3GTV) - orthogonal frequency division multiple access, coded orthogonal frequency division multiple access or vector orthogonal frequency division multiple access (VOFDM).

These third generation fixed access products are generally described as 'Broadband Wireless Access' and deliver services that typically start at 2 Mbps (where IMT stops), up to 155 Mbps ATM. Services are point to point or point to multipoint (PMP). RF frequencies used range from 2 GHz to 40 GHz with channel spacing of 1 MHz, 5 MHz, 7 MHz, 8.33 MHz, 10 MHz, 14 MHz, 15 MHz or 20 MHz. Solutions are offered both in the unlicensed (ISM) bands and licensed MMDS and LMDS/LMCS bands.

Broadband wireless access services are duplex (downstream and upstream) and either symmetric, asymmetric on demand (usually time division duplexed) or downlink biassed (more downstream bandwidth, less upstream bandwidth).

The air interfaces are TDMA or CDMA, generally ATM or IP over ATM and either use QPSK (eg in CDMA implementations), adaptive multi-level QAM or VOFDM (multi-carrier).

Examples of point to point and point to multipoint technologies propositioned for MMDS (multipoint multi-media distribution service) and LMDS (local multipoint

distribution service or - in Canada - LMCS, local multipoint communication services) include Adaptive Broadband, ADC, Airspan, Arraycom, Breezecom, Cisco, Floware, Granger, Harris, Hughes, Hybrid, Lucent, Netro, Nortel, Newbridge (now Alcatel), P-Com and Wavtrace. Examples of meshed network consecutive point solutions include Meshed Networks, Radiant and Triton. The meshed network solutions have the advantage of being easier to plan (they are intrinsically self adaptive networks) and to a large extent overcome the problem of needing to ensure line of sight or near line of sight communication between a 'customer' - home, office and a 'base station'. In meshed networks, there may or may not be a base station - any node can communicate with any other node, ie use any other node (ie adjacent house or office) as a (wireless) routing option. Generally it seems to be accepted that in a meshed network, a market penetration of, say 1% would deliver 95% coverage - plausibly an economic proposition.

Other longer term candidates for wireless access include infrared and optical access. Terabeam is one example. Point to multipoint optical wireless access may be practically implemented in the longer term over 2 - 3 km. Delivering acceptable upstream performance, ie delivering optical receiver sensitivity at a base station receiving multiple high bit rate uplinks, may be a particular implementation challenge. Note that a narrow band channel at optical wavelengths (1530 nanometer) is either 25 or 50 GHz!

Substantial sums of money are presently being invested in broadband wireless access bandwidth and broadband wireless access technology.

The present problem is one of too many technology solutions, ie exactly the problem that beset first and second generation fixed access wireless development.

This is not a problem that is likely to be solved by the fixed access wireless standards community. In the US fixed access wireless standards are being developed by the IEEE, the TIPI and NTSC (3G USTV). In Europe, standards are being developed by ETSI (ie Telco derived standards), by ARIB in Japan, with parallel (but non-compatible) standards being delivered for European and Asian digital TV (DVB). The hot links listed below vividly illustrate the fragmentation presently besetting broadband fixed wireless access standards evolution.

The number of technology options available together with a fragmented standards process will almost certainly prevent any one dominant technology emerging as a generic fixed access wireless solution. For this reason, it is likely that 3G fixed access will share the same fate as 1G and 2G fixed access - too many product options, too high a price which in turn results in a failure to match ever increasing end user technology expectations in terms of bit rate and bit quality (end to end latency) performance.

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RTT, the Shosteck Group and The Mobile World are presently working on a number of research and forecasting projects in the cellular, two way radio, satellite and broadcasting industry.

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