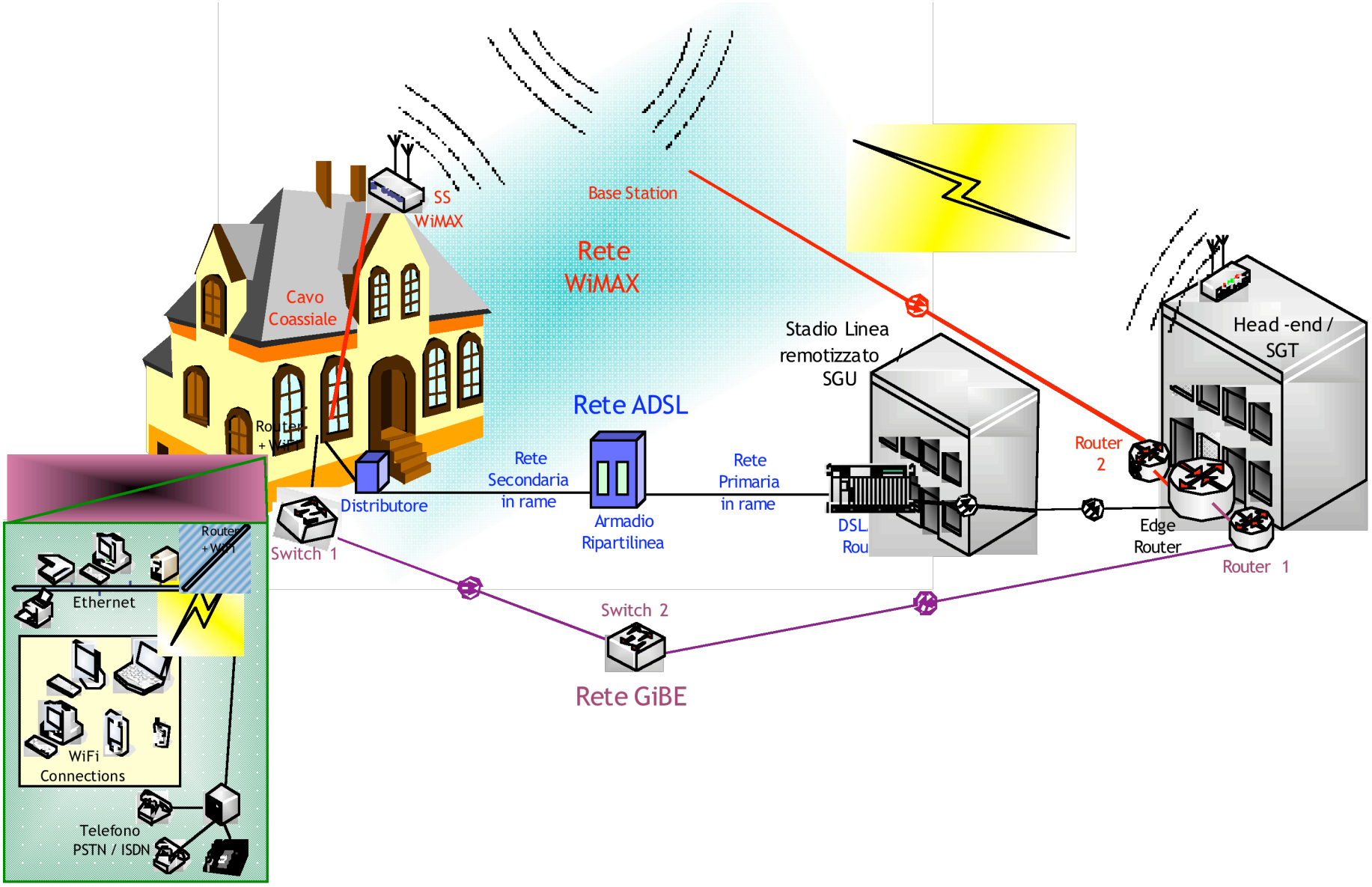
WiMax technology, a reshuffle for Telecom operators ?

La comparazione dei costi e delle performace

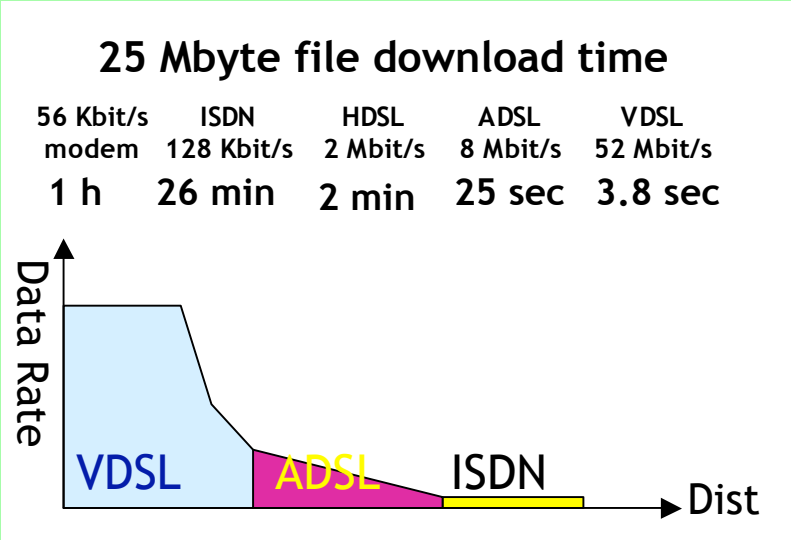
Milano, 1 giugno 2005

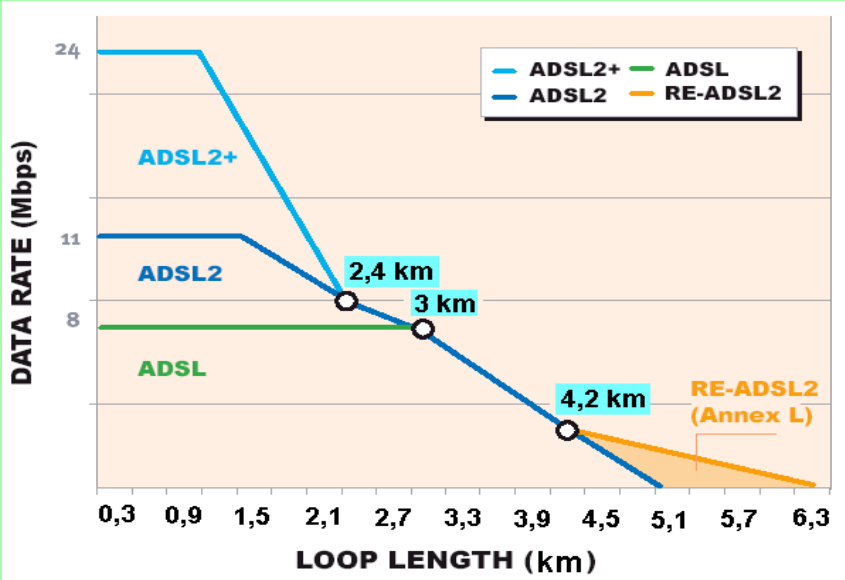
Reference Network Architectures



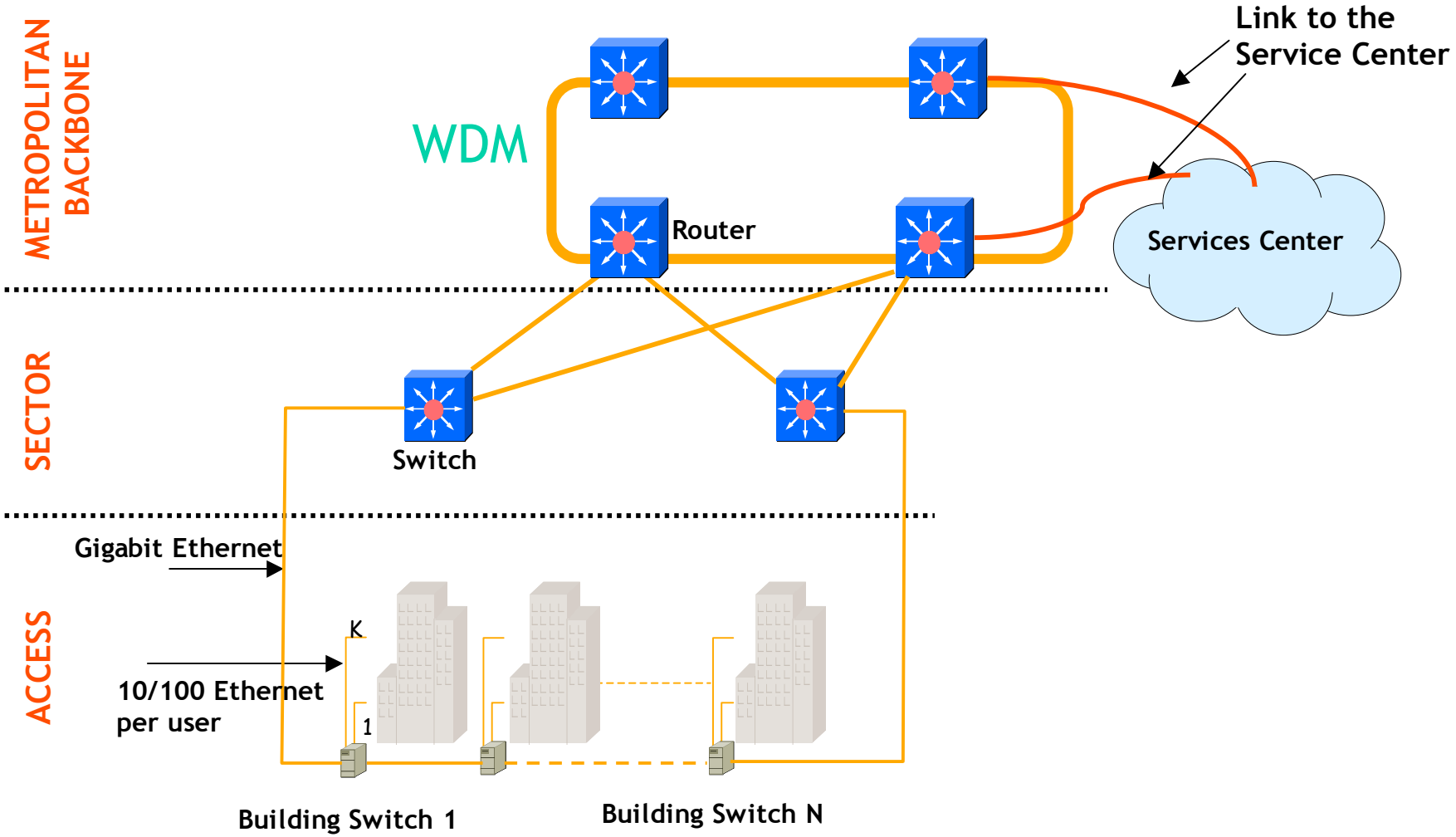
Broadband Wired Access Technologies
xDSL Solutions

xDSL	HDSL (T1)	HDSL (E1)	SDSL (SHDSL)	ADSL (RADSL)		ADSL Lite		ADSL2		ADSL2+		VDSL	
Mode	Symm.	Symm.	Symm.	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
Data Rate	1.544 Mbit/s	2.048 Mbit/s	192 kbit/s to 2312 kbit/s	1.5 to 8 Mbit/s	16 to 800 kbit/s	Up to 1.5 Mbit/s	Up to 512 kbit/s	Up to 11 Mbit/s	Up to 1 Mbit/s	Up to 24 Mbit/s	Up to 1 Mbit/s	13 to 52 Mbit/s	1.5 to 6 Mbit/s
Notes	1,2,3 pairs	1,2,3 pairs	rate adaptive					improved distance		double bandwidth		needs fibre Max 1,5 Km	





Gigabit Ethernet



WiMAX Performance

	Bandwidth	G	Ts [µsec]	QPSK 1/2	QPSK 3/4	16 QAM 1/2	16 QAM 3/4	64 QAM 2/3	64 QAM 3/4
Licensed bands	3,5 MHz	1/4	*80,00*	2,40	3,60	4,80	7,20	9,60	10,80
		1/8	*72,00*	2,67	4,00	5,33	8,00	10,67	12,00
		1/16	*68,00*	2,82	4,24	5,65	8,47	11,29	12,71
		1/32	*66,00*	2,91	4,36	5,82	8,73	11,64	13,09
	7 MHz	1/4	*40,00*	4,80	7,20	9,60	14,40	19,20	21,60
		1/8	*36,00*	5,33	8,00	10,67	16,00	21,33	24,00
		1/16	*34,00*	5,65	8,47	11,29	16,94	22,59	25,41
		1/32	*33,00*	5,82	8,73	11,64	17,45	23,27	26,18
Licensed and license-exempt bands	10,0 MHz	1/4	*27,78*	6,91	10,37	13,82	20,74	27,65	31,10
		1/8	*25,00*	7,68	11,52	15,36	23,04	30,72	34,56
		1/16	*23,61*	8,13	12,20	16,26	24,40	32,53	36,59
		1/32	*22,92*	8,38	12,57	16,76	25,13	33,51	37,70
	20,0 MHz	1/4	*13,89*	13,82	20,74	27,65	41,47	55,30	62,21
		1/8	*12,50*	15,36	23,04	30,72	46,08	61,44	69,12
		1/16	*11,81*	16,26	24,40	32,53	48,79	65,05	73,19

Number of Channels per License

Canalizzazioni [MHz]	Bit rate max teorico/canale [Mb/s]	Banda per licenza [MHz]			
		3,5	7	**14**	28
1,75	6,6	**2**	4	8	16
3,5	13,1	1	**2**	4	8
7	**26,2**	0	1	**2**	4
10	37,4	0	0	1	**2**
20	74,8	0	0	0	1

Hypotheses

- Services provided
  - IPbrowsing
    - 15 GB/Y
    - link loaded up to 70%
  - videoconference
    - 6.000 minutes/Y
    - bit rate of 200 kb/s
    - GOS of 1%
  - VoIP
    - 12.000 minutes/Y
    - Coded bit rate of 64 kb/s
    - GOS dell'1%
  - VoD
    - 24 movies/Y
    - GOS del 2%
- An increasing coverage up to get to at the 7th year at the 90% of the built-up areas at a national level (i.e. 98% of the customer premises)
- The penetration for all identified services fixed at 36% of the covered end users
- Timeframe of 7 years
- Frequencies
  - 3,4 – 3,6 GHz

ADSL & GiBE Results

ADSL	Capacità (4)	Unità di misura	Capex (5) [M €]	Unità Installate (6)	Costi operativi (7) [M €]
ADSL_WiFi	1	Linee	1.072,80	7.662.834	10,73
Linea unbundling	1	Linee	0,00	7.662.834	232,06
DSLAM/Router	4.238	Linee	155,03	7.004	98,40
DSLAM Link	858	Mb/s	0,00	7.004	2.692,31
Edge Router	250.000	Mb/s	0,00	5	0,00

GiBE	Capacità	Unità di misura	Capex (5) [M €]	Unità Installate (6)	Costi operativi (7) [M €]
GbE_WiFi	1	Linee	613,03	7.662.834	6,13
Switch 1	16	Linee	95,79	478.928	49,33
Switch 2	256	Linee	2,99	29.933	0,03
Switch 2 Link	63	Mb/s	0,00	29.933	460,19
Router 1	2.500	Mb/s	0,00	422	34,16
Edge Router	250.000	Mb/s	0,00	5	0,00

4 = capacity of the installed equipment

5 = Capex = sum of the investments up to the 7th year

6 = # of the equipment installed at the 7th year

7 = OPEX related only to the 7th year

WiMAX Results

WiMAX	Capacità (8)	Unità di misura	Capex (5) [M €]	Unità Installate (6)	Costi operativi (7) [M €]
WiMax_WiFi	1	Linee	1.226,05	7.662.834	12,26
WiMax BS	67	Mb/s	816,86	16.463	38,84
WiMAX BS Link	125	Mb/s	0,00	10.438	1.220,80
Router 2	2.500	Mb/s	0,00	422	34,16
Edge Router	250.000	Mb/s	0,00	5	0,00

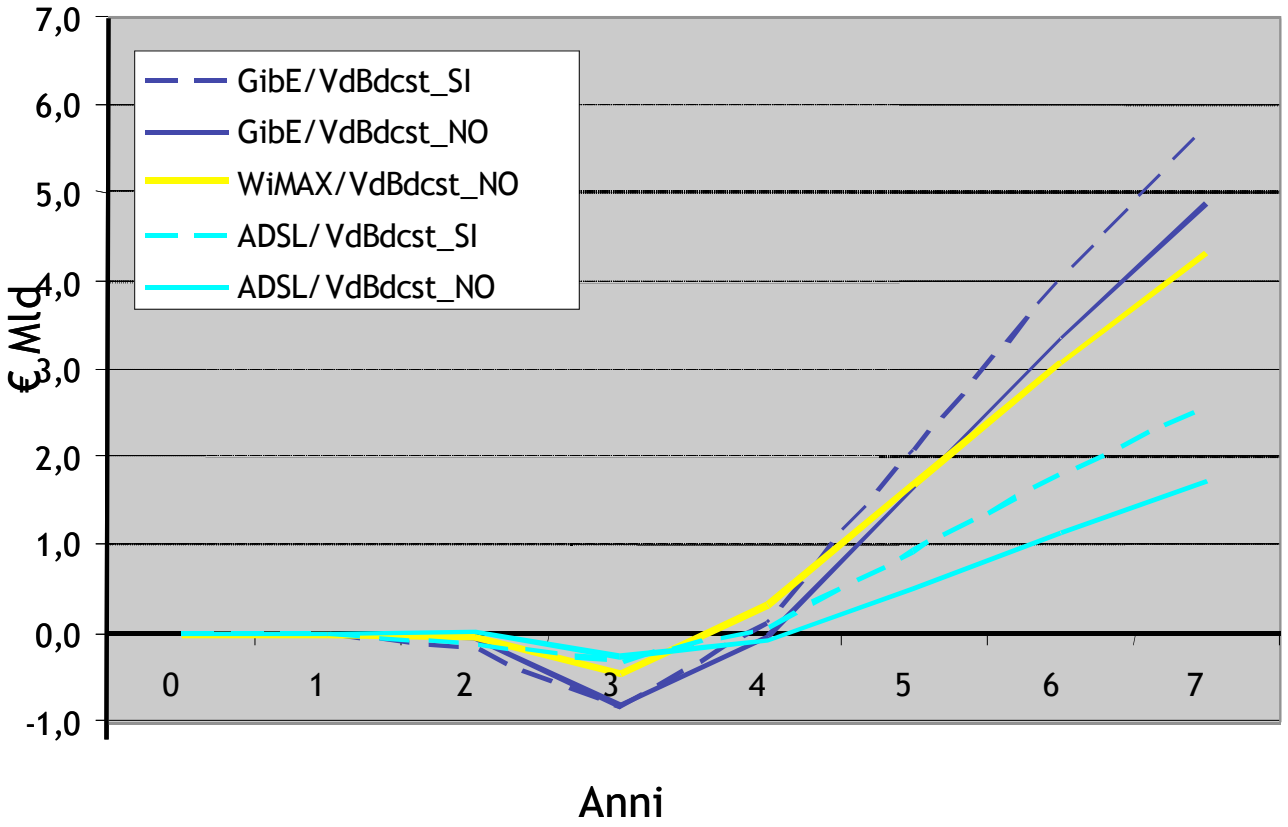
Base Station

- monosectorized (max bit rate of 26 Mb/s)
- bisectorized (max bit rate of 52 Mb/s)
- quadrisectorized (max bit rate of 104 Mb/s)

8 = weighted mean for the installed equipment with capacity of 26, 52 o 104 Mb/s

NPV @ 10%

- IPbrowsing: 36 €/month for 12 months/Y
- Videoconference: 0,02 €/minute
- VoIP: free service
- VoD: 2 €/movie



Final Remarks

- Interesting solution for the urban areas (high density of potential customers) with optimized cell sizes for IPbrowsing, videoconference, VoIP, VoD (symmetric & asymmetric links)
- Interesting solution for remote areas, unlikely served with wired technologies
- Interesting solution for those areas where no excavation permissions are provided to protect the environment, historical finds…
- Interesting solution to extend the broadband coverage in those areas with low penetration and with limited traffic
  - the used frequencies don't require the LoS
  - large cell sizes
- High modularity and scalability to fulfil the progressive increasing number of customers
- Fast deployment
- Lower investment risks
- Interoperability ensured by the WiMAX Forum
- It can be used for the backhaul link of the cellular systems
- Performance strongly related to the channel bandwidth
- IEEE Std 802.16e mobility solution