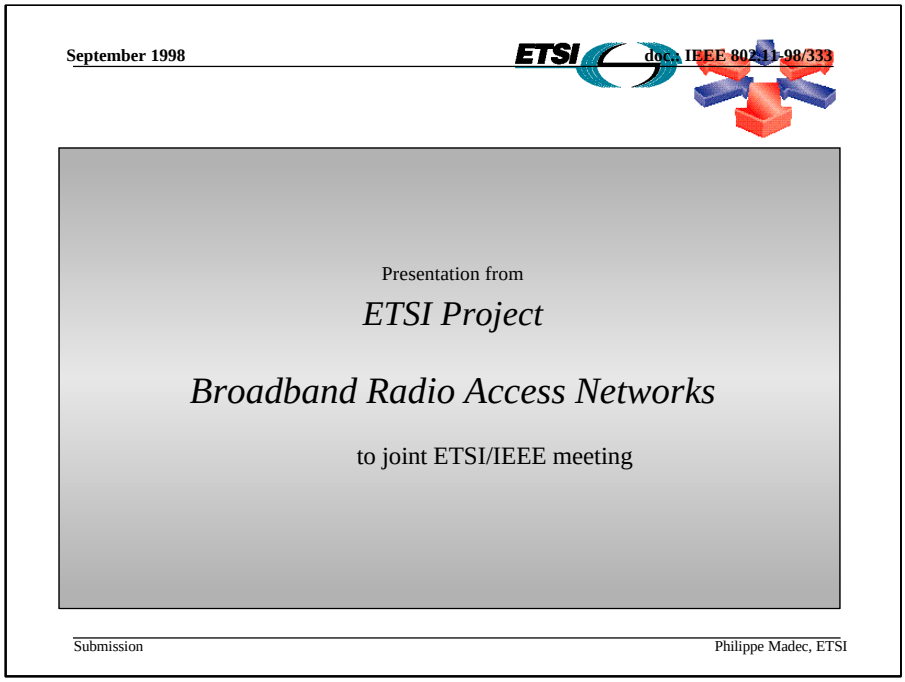
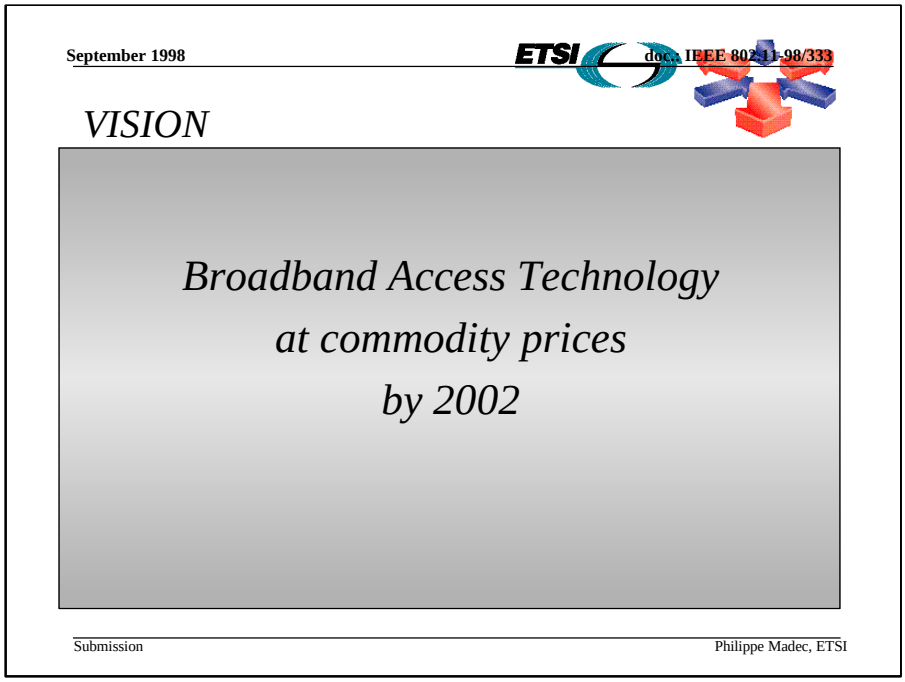


This presentation sums up the basic motivation behind and deliverables of the ETSI Project Broadband Radio Access Networks.

The Broadband Radio Access Networks project was established in April 1997 in response to the opportunity presented by the combination of broadband radio LAN technology an fixed access radio to meet the need of future multi-media applications and services.

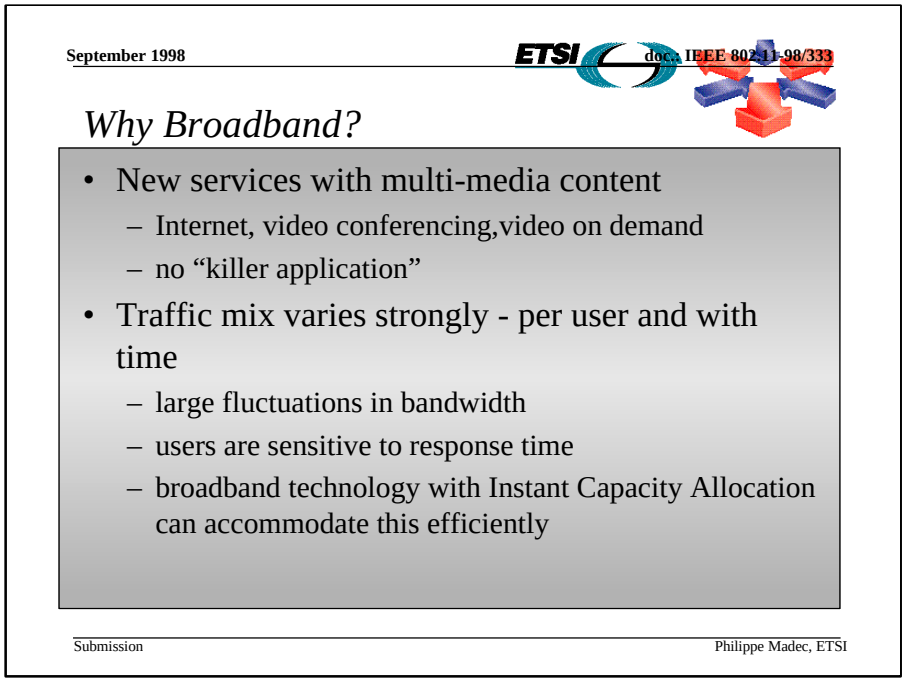
This presentation is concerned with the vision behind the project's goals, areas of application, the planning of the work and deliverables as well as the liaison with other bodies working in this field.

Note: This material is for use within and outside ETSI as an introduction to the BRAN Project. In case of differences between this and the Terms of Reference and the workplan, the latter have precedence.



By the year 2002, broadband service will be available on a variety of media, including upgraded TV cable plant, upgraded telephony plant using ADSL, satellites and terrestrial broadband radio. Because of this competition, the price of subscriber units wil have to be very competitive - it has to come down to commodity level.

The technologies for achieving this are becoming available and the Broadband Radio Access Networks project aims to develop specifications that allow maximum functionality to be achieved at minimum cost. Thanks to the presence of service providers as well as manufacturers, we expect to be able to achieve a useful compromise between the opposing objectives of functionality and cost.

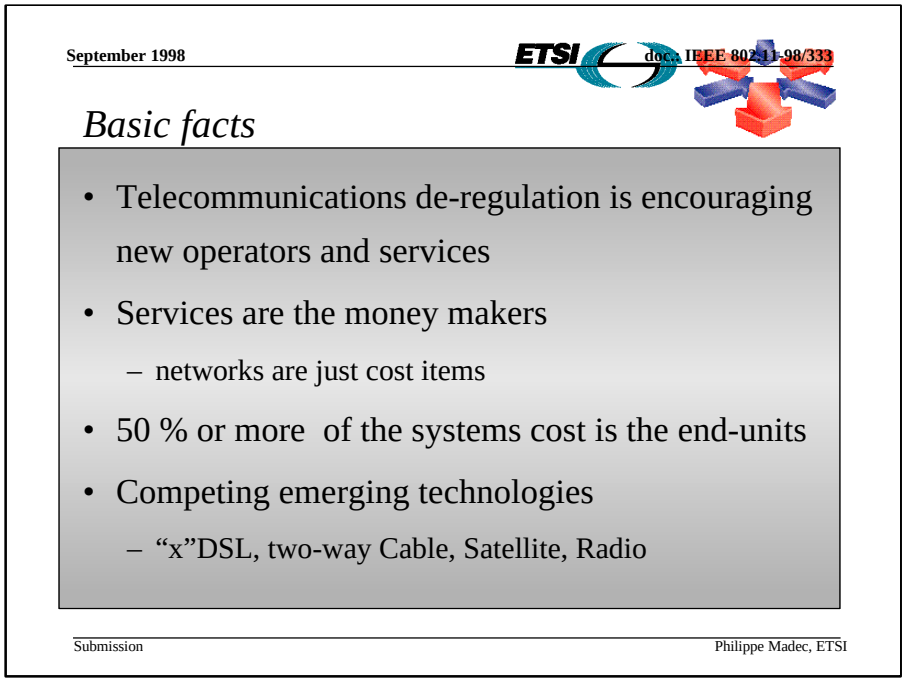


The first question to ask is why “broadband”, The answer is that, largely under the influence of the Internet - which is rapidly becoming the premier platform for delivering all kinds of information related services to an ever increasing number of people, both consumers and professionals - the demands placed on communications systems are changing. Instead of the constant rate bit pipe of ISDN, Internet needs a variable rate medium that can adapt - almost instantly - to wide variations in traffic volume, of the on a sub-second time scale. The key element in this change is the shift of emphasis from capacity to response time.

Research has shown that computer generated traffic (Ethernet) has a self-similar character: the same kinds of fluctuations are visible at any (time) scale. This means that capacity is still important - the peaks have to be accommodated but there is a reasonable limit that can be determined by analyzing the effect on response time.

Response time is a psychological effect: if one asks the computer to do something then the result should be there quickly - irrespective of whether the data has to come from the Net or not.

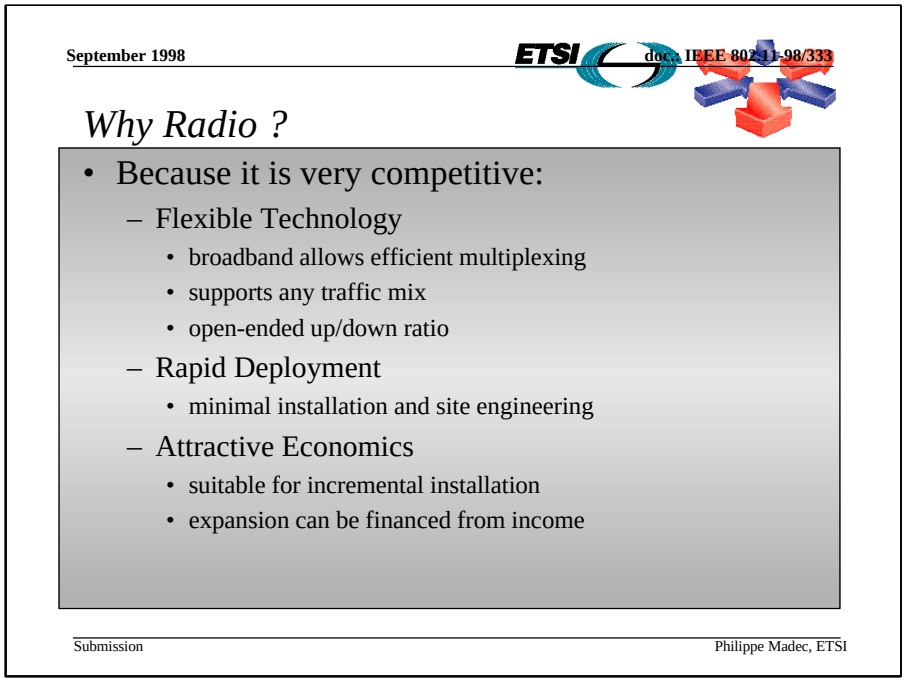
By building systems capable of instantaneous capacity allocation (ICA) the user response time can be dynamically adjusted to meet the available capacity/demand ratio.



The deregulation of the telecommunications market is here and already the players in the field are seen to be adjusting. New entrants in the operator and service provider fields are announced regularly and the established parties are looking for ways to combat the new threats. Typically challengers in a market require competitive advantages to be able to beat the prices of the incumbents - and to convince the investors to pay the initial bills.

Networks are never goals in themselves. Service providers need them to reach their customers, not because of some quality like beauty or elegance. What decides between success and failure in high volume markets is cost/performance ratio.

A very large share of the costs of wireless networks is in the end units. This applies to both indoor and outdoor systems. Therefore, lowering the cost of the end units directly enhances the ability of an operator to compete with other means of delivery like cable, digital subscriber lines, and, in the near future, with satellite based systems.

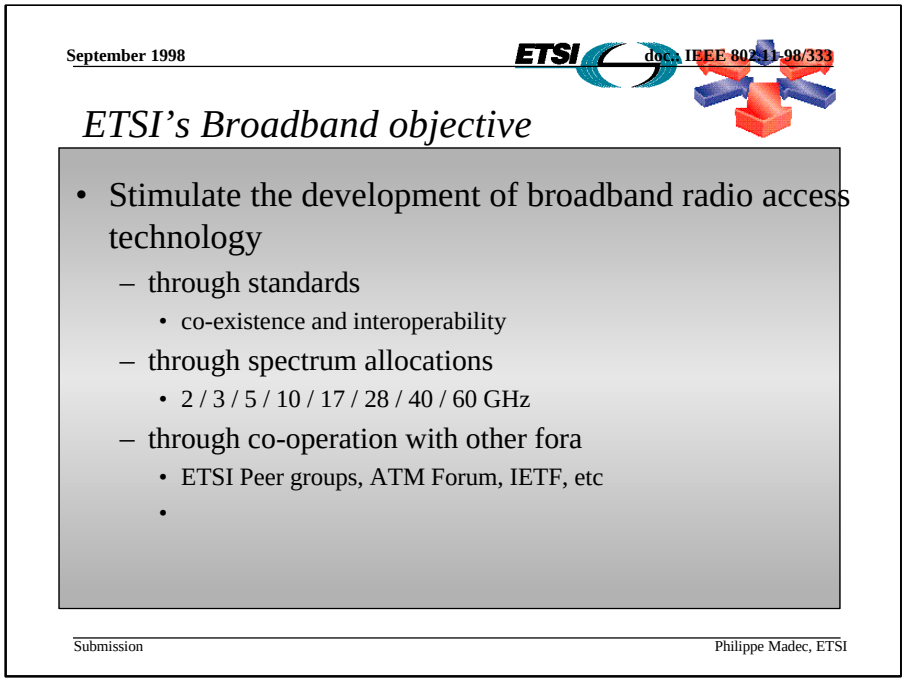


The answer to the question “why radio” is a multiple one: it combines technological aspects with economic aspects and management considerations.

Technically, a broadband radio system - if properly designed - can offer all the flexibility needed to meet the needs of the any application and service mix, in particular, the needs of Internet based services and applications. Without a fixed ratio between up and down- link these systems can adapt rapidly and effectively - and this allows considerable multiplexing efficiencies to be realized.

From an economics point of view, a prime advantage of terrestrial radio based systems is that they allow a phased roll-out at relative low initial investment so that revenue from each phase can pay for the roll out of the next. No other access technology has this feature in the same degree.

However, that advantage needs to be complemented by low device cost in order to gain its full attractiveness. It is here that standardization can make a big difference.



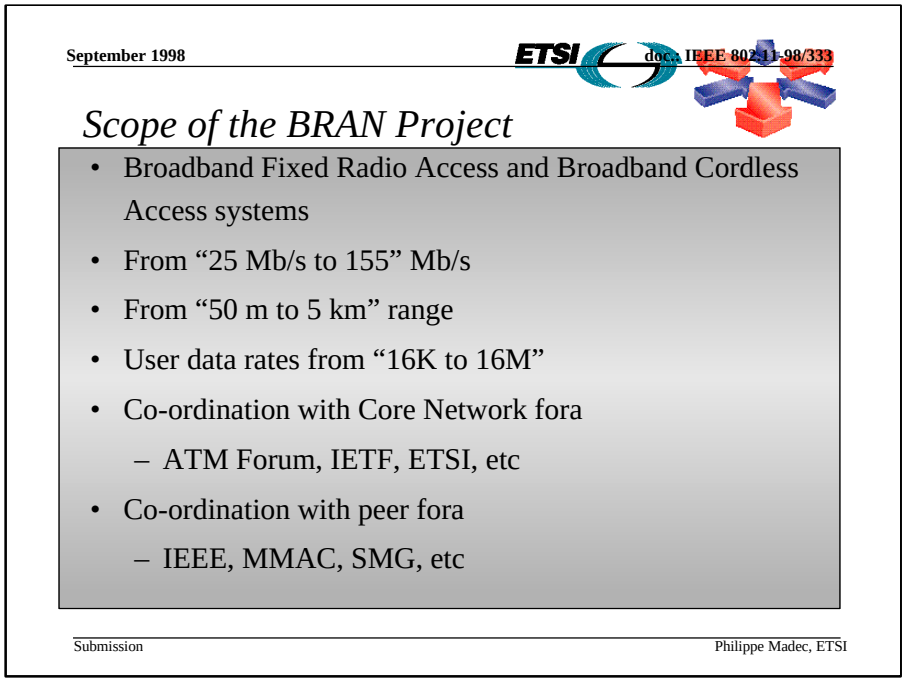
"Broadband radio access networks" here refers to the actual systems rather than the concept: deployed networks will interwork with different core networks, possibly simultaneously.

The etc.. above refers to variants of IP, maybe we decide to support frame relay. We should also remember not to make a tight specification that only fits ATM and IP but leaves little room for other types of network layer protocol.

The data rates given obviously do not apply for all ranges given; what is achievable depends on the environment nd local conditions. 25 Mb/s has been chosen as basic rate because lower rates are adequately covered by other, existing systems. Further, 25 Mb/s is technically aggressive but it is not the limit of technology.

The frequencies now used for fixed links will be re-farmed over time and there will be opportunities for deploying BRAN systems in a wide range of frequencies. Which will become available is difficult to predict. This forces a large measure of flexibility on the radio specifications

Finally, it is certain that no single networking technology will dominate the world in the near future - if ever. Therefore BRAN networks have to be able to operate with a variety of "core" networks. This allows, for example, services offered over mobile networks to be offered over BRAN networks as well.



ETSI's Broadband Radio Access Networks project has been set up to address the standardization of broadband systems for indoor, cordless systems as well as outdoor, fixed access systems. The common elements are more important than the differences in the environments in which they are used: The typical bit rates is in the range of 25 Mb/s but higher bitrates, up to 155 Mb/s will be possible. Multiplexed over a number of users this gives data rates from 16 kb/s to as much as 16 Mb/s per users.

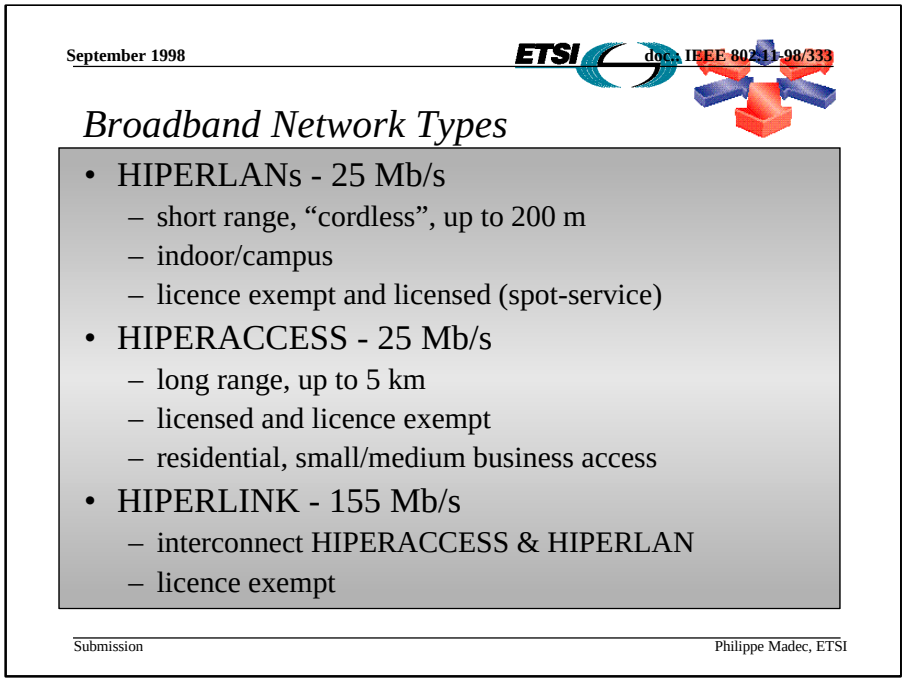
The scope of the project is to develop the necessary specifications and to work with other fora when it comes to interworking with core networks. This approach avoids the duplication of effort and content that could occur when the project would develop all specifications independently.

Finally, the project works with what might be called peer fora: fora which have work in hand to develop specifications for the same type of system in the same frequency range. Examples are the IEEE 802.11 committee that started a workitem on a 20 Mb/s, 5 GHz version of its current standard; the Japanese Mobile Multimedia Access Communications (MMAC) Promotion Council which currently has work in hand for a 18 GHz system for cordless indoor and outdoor use. And there are is ETSI SMG3, the architecture group responsible for UMTS. Here the intent is to align the access network standards to allow the same applications and services to be offered over both UMTS and broadband access networks.

September 1998 doc.: IEEE 802.11-98/333

Role of the BRAN Project

- Catalyst for
  - requirements analysis of broadband wireless
  - technical solutions for broadband wireless
- Focus for
  - specification work for broadband wireless
  - co-operation on broadband with other for a like the ATM Forum, the IEEE, BWA, MMAC, etc
  - spectrum allocations
- Spreading the word
  -
  -

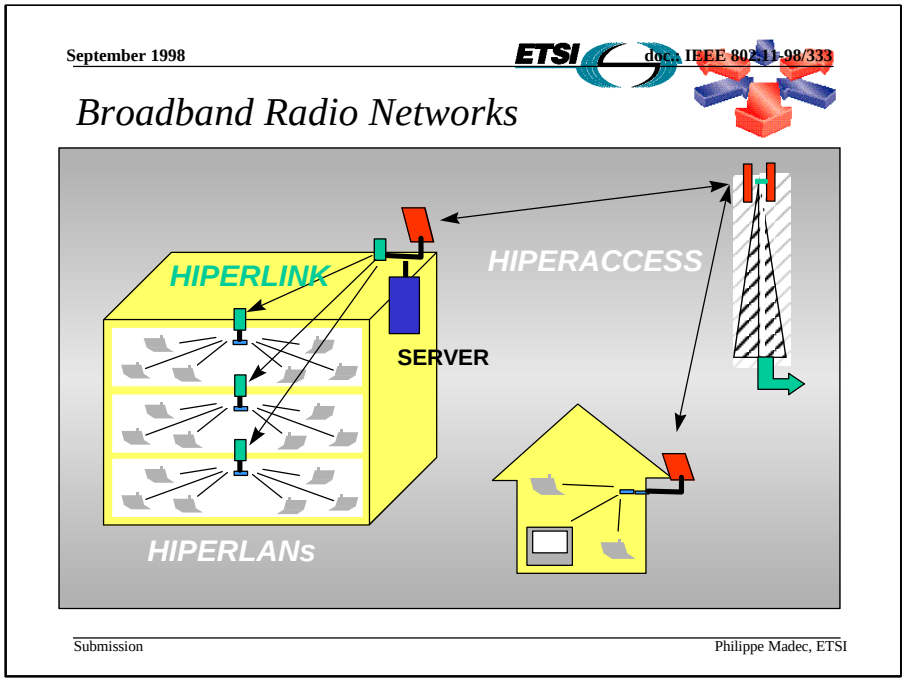


ETSI has defined three types of broadband radio networks:

HIPERLAN/2, a complement to HIPERLAN/1, ETSI’s high speed wireless LAN, is a local access network, providing communication between portable computing devices and broadband core networks, aimed at telecommunications access and capable of supporting the multimedia applications of the future. User mobility is supported, but only within the local service area.

HIPERACCESS is an outdoor, high speed radio access network, providing fixed radio connections to customer premises (other technologies such as HIPERLAN2 might be used for distribution within the premises). HIPERACCESS will allow an operator to rapidly roll out a wide area broadband access network to provide connections to residential households and small businesses. It will be an attractive alternative to wired access technologies such as digital subscriber loop or cable modems, especially in the competitive market of the future where no one operator will have the certainty of monopoly.

The third category is **HIPERLINK**: a very high speed radio network for infrastructure - like applications; a typical use is the interconnection of HIPERACCESS networks and/or HIPERLAN Access Points into a fully wireless network.

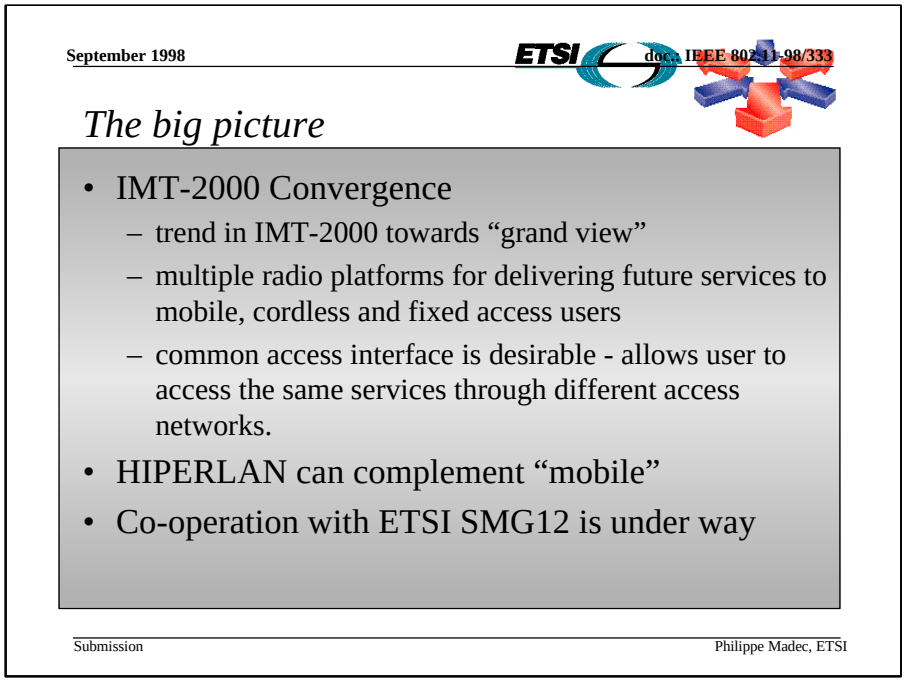


The figure shows an example of how the three network categories might be deployed in a business and domestic environment. In both cases, HIPERACCESS provides the means to reach the premises of the customer.

In the business case, HIPERLINK is used internally in the building HIPERLAN is used to as basic local area network giving the employees access to the server. HIPERLINKs are used to complete the wireless infrastructure and link the HIPERLAN access point to the server and to HIPERACCESS.

In the residential example, HIPERLAN is coupled directly to HIPERACCESS.

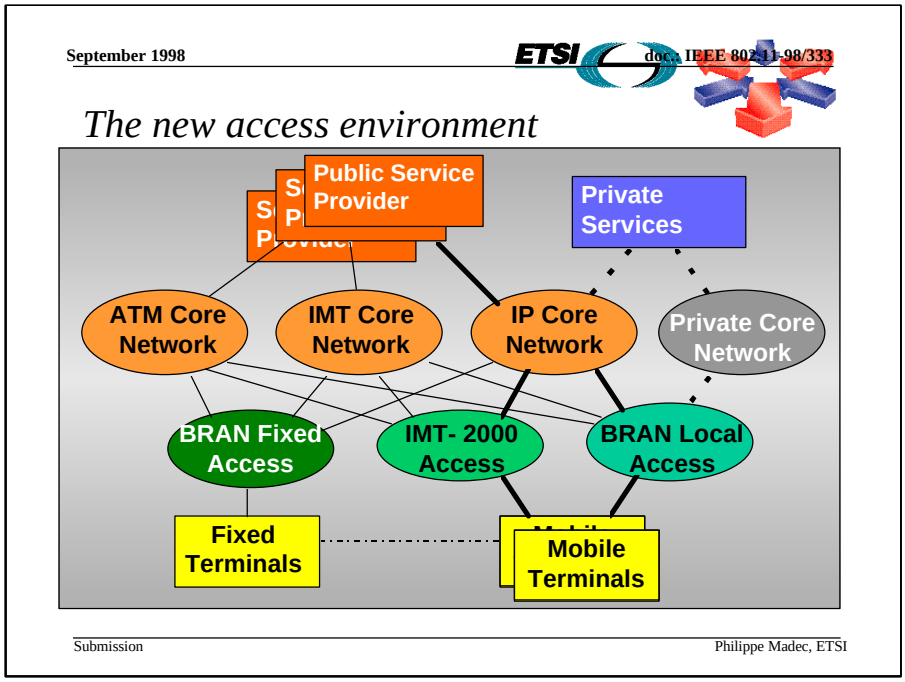
In both cases, variants with different mixtures of wired and wireless networks are possible.



Within the UMTS and IMT-2000 communities there is a trend to seeing the grand view in which the difference between mobile and non-mobile access is ignored in favor of the user or service provider perspective and that is centered around the number of customers that can be reached. Platform independent service provision maximizes the number of platforms (access networks) that can be used. This argument can be taken one step further: by specifying a common interface between core networks and the access networks, service delivery is further simplified.

The value of HIPERLAN based systems as complement to the current and next generation mobile systems is being realized by operators and vendors alike. HIPERLANs do not need the the potentially profitable UMTS spectrum and provide much better performance to boot.

The BRAN project has chosen to base its work on the premise of core network transparency and that opens up the possibility of convergence between the broadband access networks and the mobile access networks such that both provide the same interface to the core network. That possibility is currently being investigated together with ETSI SMG12, the group responsible for the architecture of UMTS.



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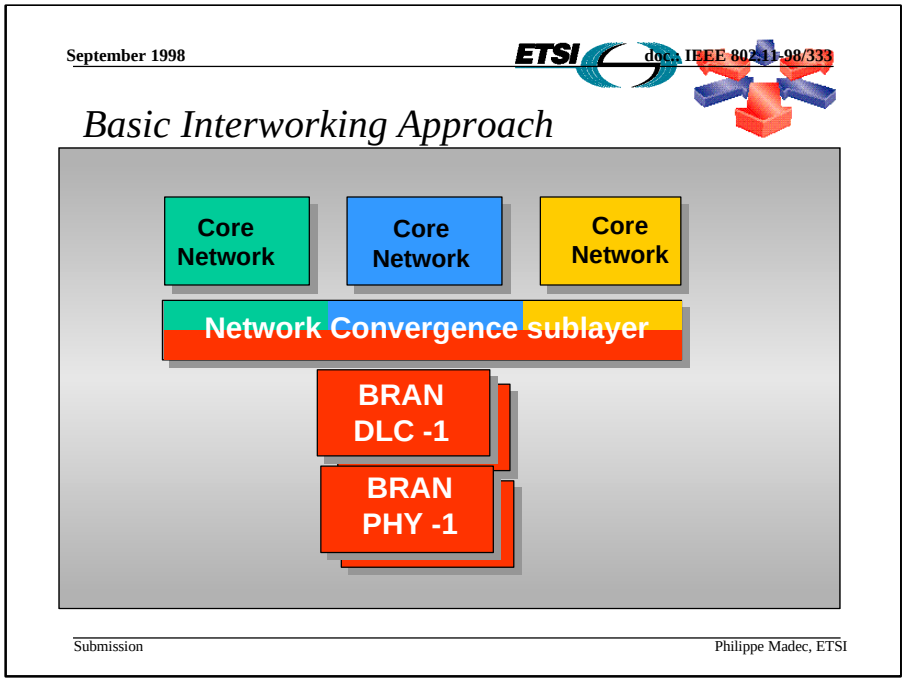
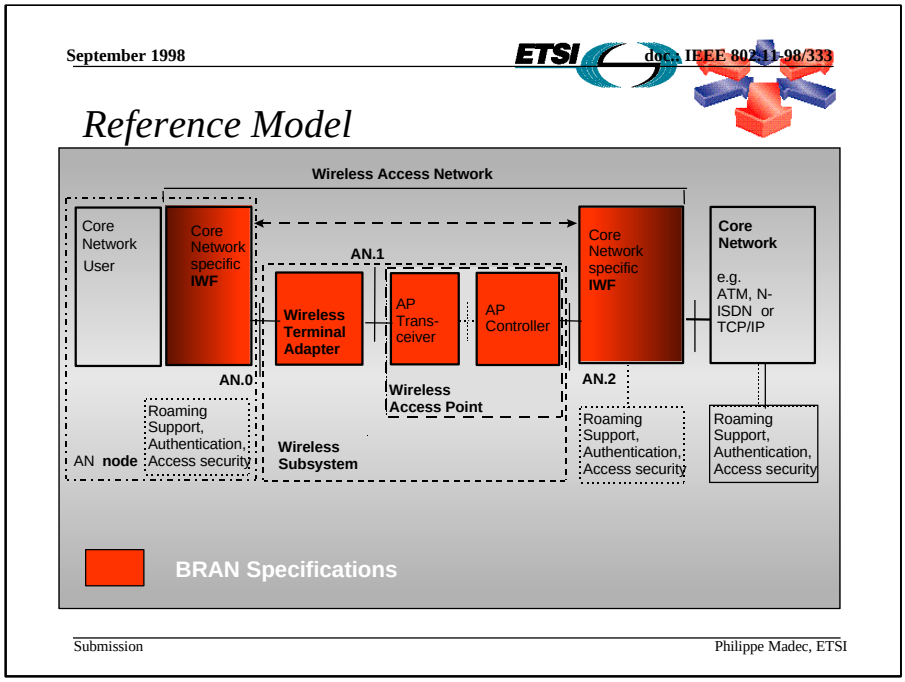


The basic approach to core network independence is the introduction of a Core Network Convergence sublayer where the differences between the different core networks are removed and a common BRAN interface can be used. The difference between the core networks occur in three main areas: call set-up and clearing, changing connections within the network and management of the quality of service provided to the network user. Mapping the different mechanisms or filling in for the absence of certain mechanisms will be performed with the convergence sublayer. The specification of these sublayers will be done in cooperation with the forum that owns the core network standard, e.g. the ATMForum in case of ATM Core networks.

This interface is at the top of the BRAN specific Data Link Control layer. The implication of this approach is that the DLC layer specification must be carefully matched to the superset of the requirements for supporting ATM and IP traffic.

There may be different specifications of the DLC layer - that will be resolved during the actual specification work. However, in view of the various frequency bands in which these networks will operate, a number of different radio physical layers will have to be specified by the project



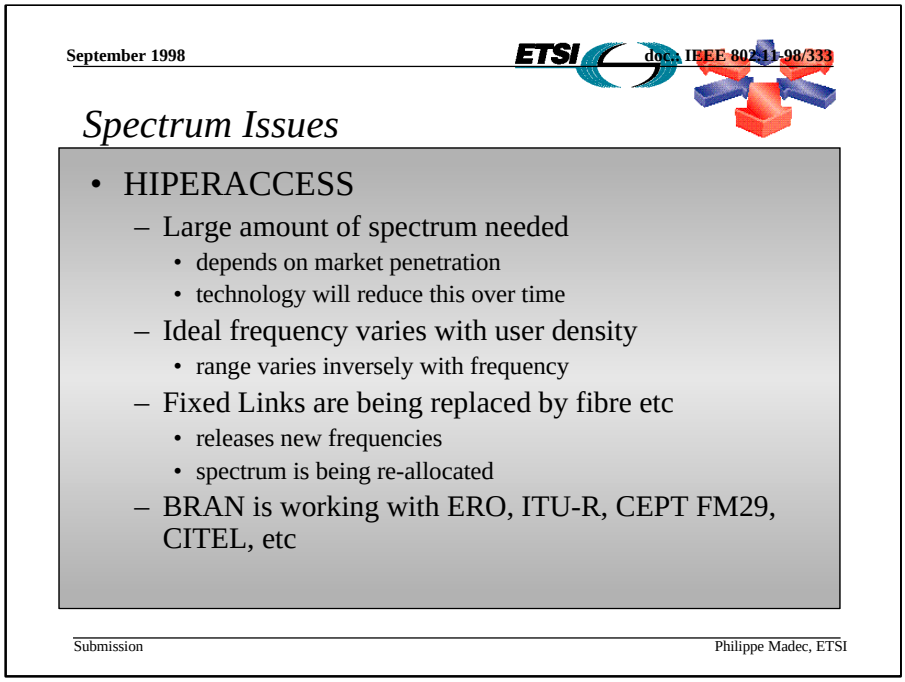
The high level reference model used by the project as basis for its cooperation with the ATMForum and ETSI SMG is shown in this picture which also shows the scope of the work of the project.

The figure has in its centre the wireless access subsystem flanked by Core Network specific **I**nter**W**orking **F**unctions. Together, these make up the wireless access network functionality.

The IWFs support all core network specifics. Examples are not only call set-up and hand-over between access points but also security functions such as user authentication and data confidentiality.

The BRAN project is responsible for the wireless subsystem specifications and, together with the appropriate owner forum, it will develop the IWF specifications or provide the BRAN side of such a specification and leave it to the other fora to fill in the core network specific part.

In approaching its scope in this way, the project is probably unique: it implements a modular approach to standardization and it shares its work with other fora. That saves time and effort and allows implementors maximum flexibility.



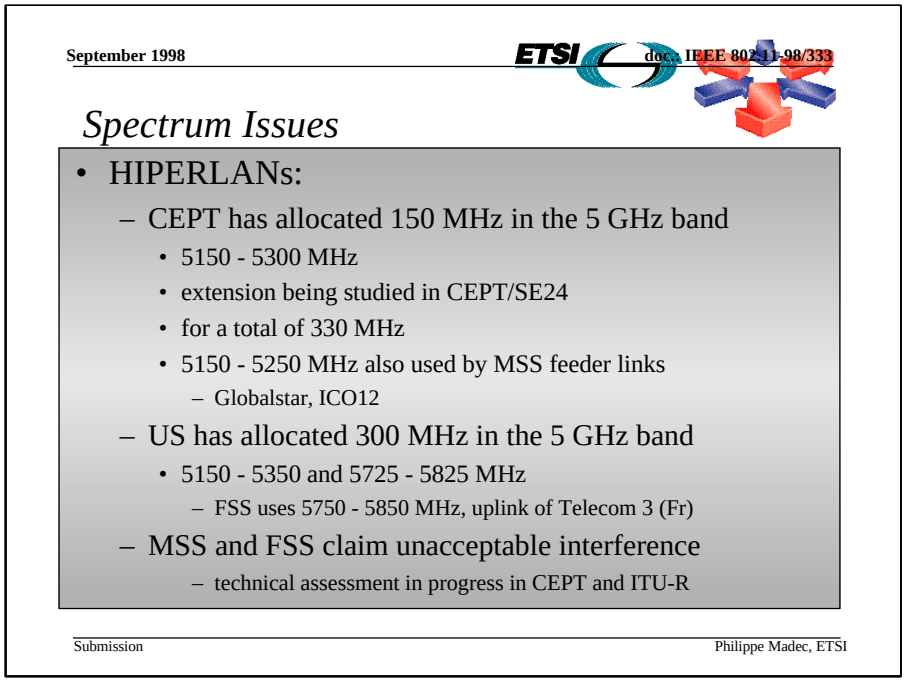
The amount of spectrum needed for HIPERACCESS networks varies with the traffic patterns, the user density, the propagation conditions and the technology used.

Except for the propagation conditions, all will evolve over time. With increasing market penetration both the number of users and the traffic demands will increase as well leading to an increase in the spectrum required. To some extent this increase will be offset by improvements in spectrum re-use resulting from new technologies. Dynamic capacity allocation will not only simplify deployment but also improve spectrum use.

The ideal frequency for a broadband access network varies with user density. At higher frequency, the operating range is lower but the available bandwidth is larger - both factors match the needs of high density deployments. As the market develops, the user density will increase and migration to higher frequencies will provide the necessary larger capacities. This effect will be most notable in urbanized conglomerations.

With the rapidly increasing capacity of public infrastructure networks, there is trend to replace fixed radio links with fiber facilities which are less costly to operate. This rend is stronger in the more densely populated areas than it is in the rural areas. These replacements vacates spectrum that could be profitably employed for point to multi-point broadband access networks.

These and other factors are being considered by the project in its support of the work of the European Radio Office, CEPT, CITEL, and the ITU-R on the provision of spectrum for broadband radio access networks.



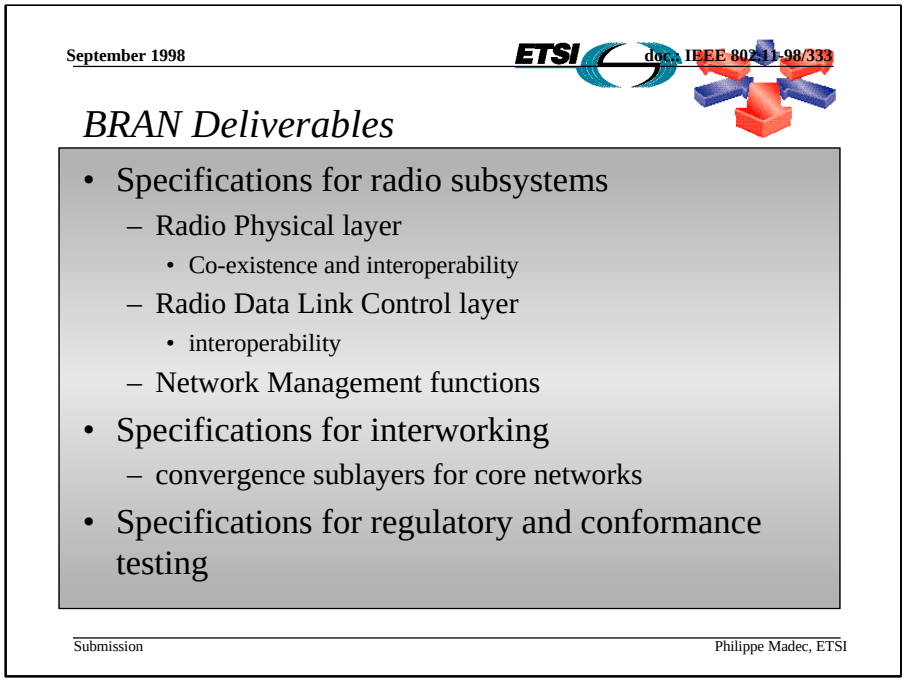
In 1992, CEPT designated 150 MHz between 5150 and 5300 MHz to HIPERLANs, together with 200 MHz between 17.1 and17.3 GHz. The latter are limited to 100 mW of RF power which reduces its usefulness for “mobile” use. In view of the increased demand for multi-media service expected in the near future; CEPT/SE24 is studying the possibility of extending that designation.

A problem has arisen since that time in that the Mobile Satellite Service operators that plan to operate the earth to space links in the 5150 - 5250 MHz range claim to be subject interference from HIPERLANs. The compatibility studies are under way at ETSI and CEPT in order to resolve this issue. With the increased interest in the delivery of broadband services via satellites, the incompatibility claimed by the MSS community gets a clear commercial tinge.

Similarly, the 5.8 GHz range is targeted by a new Fixed Satellite Service - Telecom 3. This will have consequences for the designation of this spectrum to HIPERLANs or license exempt HIPERACCESS systems.

In the US, the FCC designated 300 MHz (in the beginning of 1997) to what is known as the “Unlicensed National Information Infrastructure” devices and Community Networks. The frequencies are 5150 to 5350 MHz and 5750 to 5850 MHz. These devices are not further specified. The FCC allows increasing radiated RF power levels: 200 mW in the lower 100 MHz, 1 W in the second 100 MHz and 4 W in the third 100 MHz.

This implies that the FCC has not found it necessary to prevent the deployment of license exempt devices in the bands shared with the satellite services..



The deliverables of the BRAN project are sets of specifications for PHY, DLC layer and Interworking functions as well as the relevant documents for regulatory compliance and protocol conformance.

In case of the PHY layer, the project will develop co-existence specifications and interoperability specifications. For the DLC layer and for the convergence sublayers, co-existence is not an issue and only interoperability will be specified. The specifications for network management functions will include the managed objects needed to perform remote management of equipment develop by different suppliers.

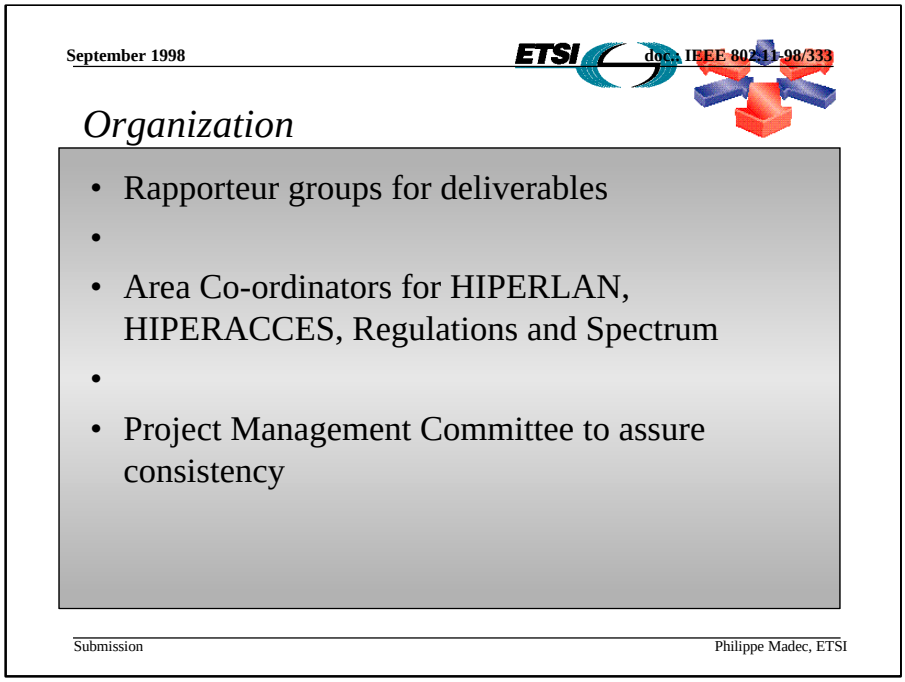
For each type of access network will develop a set of specifications comprised of the components listed here. These specifications will be developed on a set by set basis with significant degree of overlap. This allows re-use of work between to sets. For example: the first set of specifications to be developed is for HIPERLAN/2. The DLC layer specification as well as the ATM and IP convergence sublayers may be fully re-usable for HIPERACCESS. If tat is the case, a lot of work can be saved.

September 1998 doc.: IEEE 802.11-98/333

Key Liaison Activities

- In support of a world-wide standard
  - IEEE 802.11 - common PHY specification
    - agreed target at last meeting
    - no obvious roadblocks to agreement on essentials
    - subsetting to satify particular needs
    - joint timing of decision making is needed to avoid “dictate” by either
  - MMAC - common PHY and DLC/Interworking
- In support of future-proof scope
  - SMG-12 - UMTS Interworking
  - ATM Forum on wireless (mobile) ATM

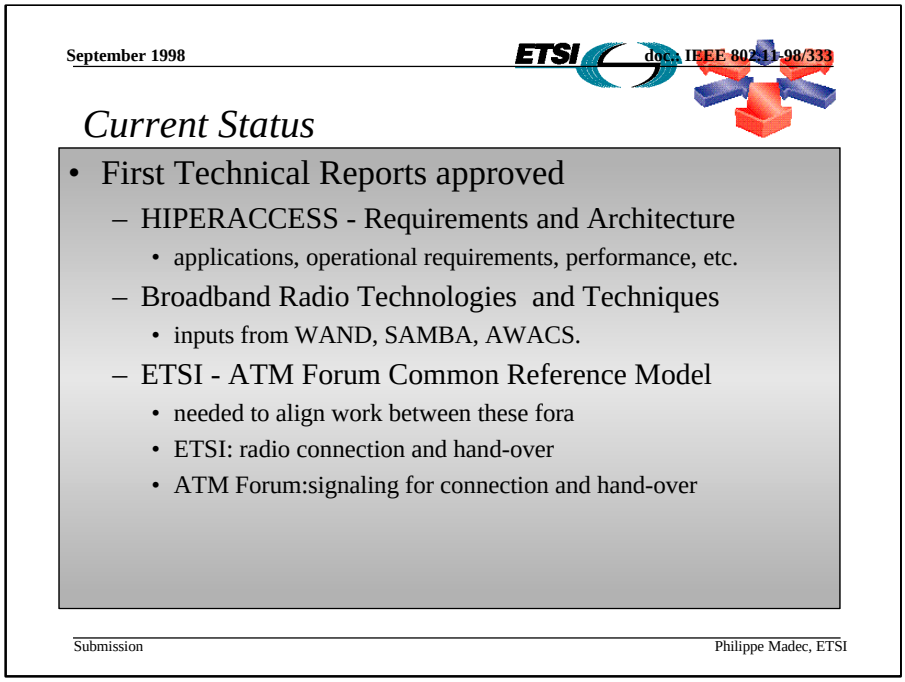
Submission Philippe Madec, ETSI



The project is organised along expertise lines - the working groups represent capabilities under the chairmanship of a qualified person. People with various interests and capabilities can contribute to different working groups depending on their interest and the work in progress. As a consequence, WG membership varies with time.

Within each WG there are rapporteur groups that are responsible for a single deliverable. This provides focus and makes for progress. At the same time, by operating within the parent WG expertise area support from and review by peers is facilitated and encouraged.

An organization like this that works on a large number of subjects in parallel always runs the risk of spreading under the natural “group” forces. Therefore the Project Management Committee has been charged with keeping a good eye on the consistency of the work within the Project.

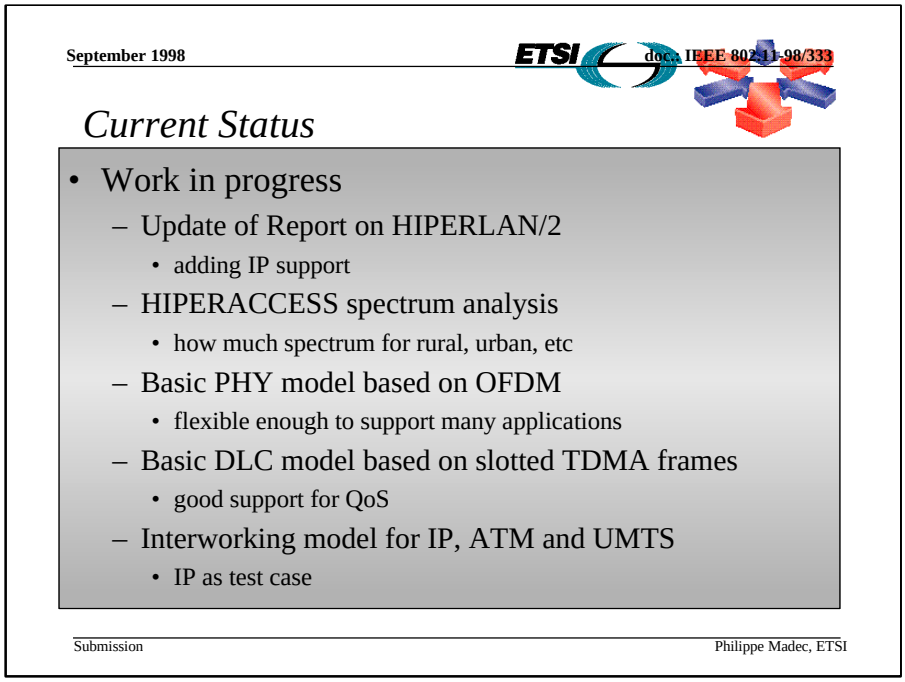


The BRAN project first concentrated on getting the requirements and technologies documented before starting with the technical specification work.

As requirements for HIPERLANs were already available (ETSI TR 101-031), work concentrated on the requirements for HIPERACCESS, the long range, fixed access variant. The resulting Technical Report will be published by ETSI in the next few months. It includes a description of how these networks will be deployed and used, the performance parameters and the basic reference model that describes these systems.

The Report on Technologies and Techniques for Broadband Radio Access Networks lists and describes various solutions that may be applied to the whole range of these networks, including the HIPERLAN< HIPERACCES and HIPERLINK versions. Included are such subjects as antennas, modulation schemes, signaling schemes and data link control schemes.

The third report focuses on how the specifications developed by the project fit within the overall specifications of wireless ATM systems. Notable concerns were to avoid overlap in the call set-up and handover procedures. This work was carried out in conjunction with the ATM Forum. The document defines the areas of work that are the responsibility of the Forum and of the BRAN Project. The main principle is that the ATM Forum will specify the network level aspects whereas the BRAN project will address the radio aspects.

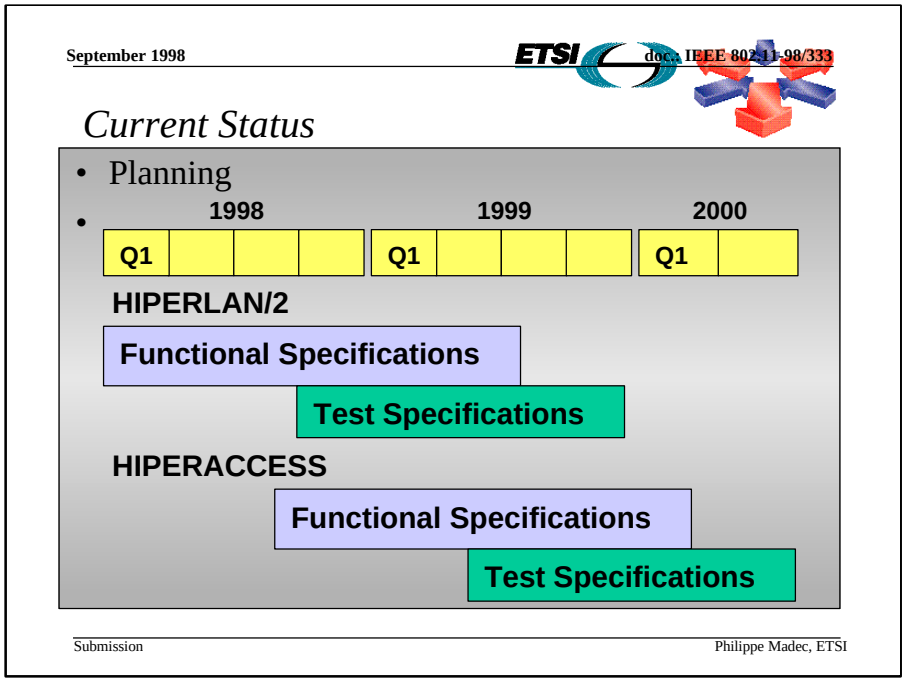


The work of ETSI on Requirements and Architectures for wireless ATM access is now two years old and the emergence of IP as a major protocol for end-user access requires an update of the original report. This work has been started and is expected to be completed by September this year.

A second major action item in the Project is to work out the amount of spectrum required for fixed access applications, taking into account the different capacity requirements for urban and rural applications as well as the characteristics of the different frequency bands in which fixed access systems maybe deployed - these include licensed as well as licence exempt bands.

In addition, work has started on the criteria for the selection of technologies for the PHY and DLC layers. The basis for this work is, of course, the previous work on requirements as well as simulations to decide which provides the best performance.

Finally, work is under way on a proposals for the DLC and PHY layers as well as for the convergence layers needed to couple BRAN specifications and existing core networks.

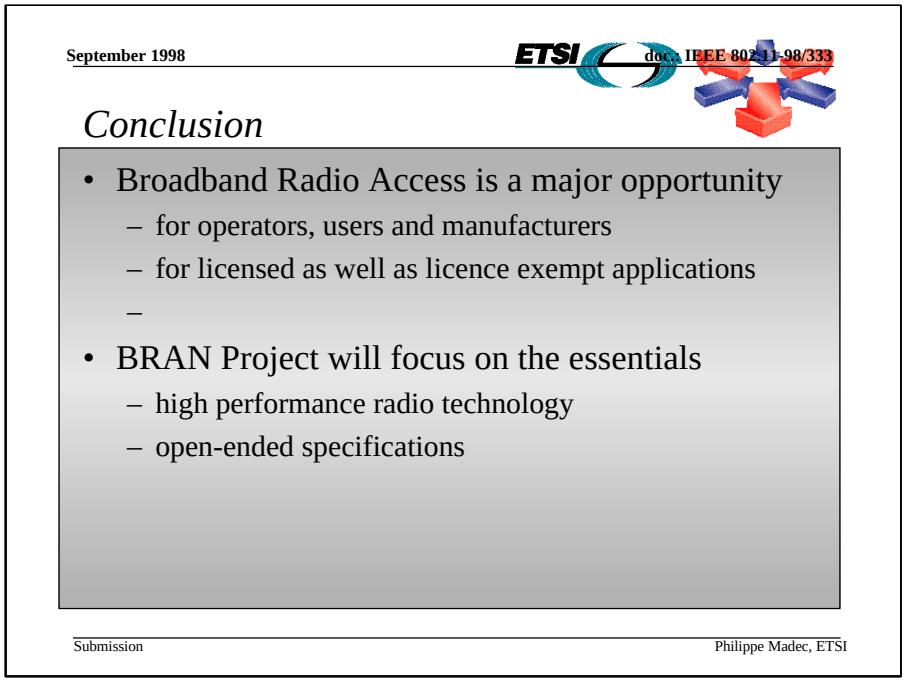


This slide shows in a single picture the rough schedule for the completion of the specifications for HIPERLAN/2 and for the first issue of specifications for HIPERACCESS. Because the former work was already underway, it will be completed about 6 months earlier. This opens up the possibility of re-use of that work for the HIPERACCESS specifications.

The project has set itself the fairly aggressive schedule of getting the first specifications out by the middle of 1999. These will cover the physical layer, the data link control layer and the ATM and IP interworking layers of HIPERLAN/2. The protocol conformance and test specifications will follow shortly into the next millenium.

At that time, the first HIPERACCESS specifications should also become available. It is not known which frequency range the first of theses specifications will address. With those priorities addressed, the work on the HIPERLINK specifications will be taken in hand.

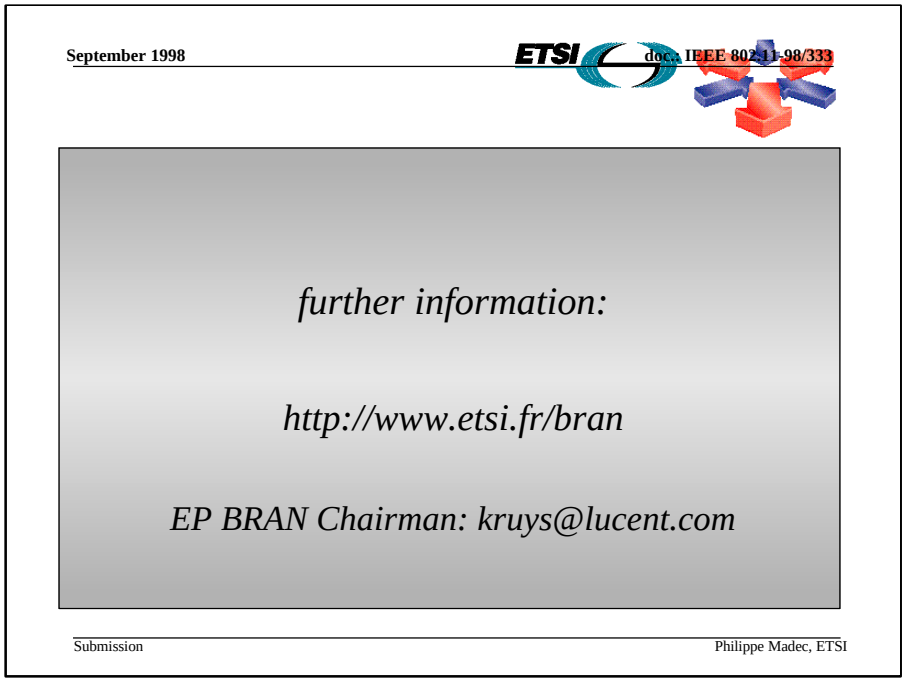
The work of the project should be completed by 2002



Concluding, we can state that broadband radio access networks are a major opportunity, for operators as well as for suppliers as well as for users.

All stand to gain from the rapid specification so that these systems can be developed and deployed in the spectrum that is available and suitable, whether it is licensed or licence exempt.

The BRAN project will keep its eyes on the essentials: the specification of high performance radio technology that others can use to as basis for developing complete systems solutions.



The ETSI WEB site provides a home page for the Broadband Project - it contains the terms of reference, the work progamme and the Executive Summaries of past meetings as well as the invitation and agenda for the next meeting.

For ETSI members, the page also provides a path to the document filing system of ETSI.