Chapter 9

Conclusions

FPLMTS is a collection of systems working together to provide harmonious services around the globe. UMTS is one of the FPLMTS, designed in Europe for broadband applications. Flexibility will be vital for FPLMTS to gain global acceptance and provide a convergent point for a diverse range of developments in different regions of the world.

The new satellite consortia (apart from Inmarsat-P) do not use the FPLMTS frequency spectrum and therefore do not need to comply with FPLMTS recommendations. They will require compatibility with FPLMTS if they are to deliver the following benefits:

- Wide area, low capacity, mobile coverage matching rural demand integrated with high capacity terrestrial mobile networks in populated areas;
- Emergency service;
- Service at FPLMTS' debut, while expensive terrestrial infrastructure is still being built.

FPLMTS' radio interfaces will remain distinct and mobile terminals will be designed to operate with a small selection of the possible alternatives. FPLMTS customers will be able to select from a range of offerings from 2Mbit/s service indoors to 2.4kbit/s anywhere on Earth to their hand-portable terminals. Higher bandwidths will be available to larger terminals. Apart from the variation in data throughput, the radio interfaces between the mobile terminal and the base station or FES will be of little interest to FPLMTS customers. The mobile terminal's applications' user interface will harmonise the service from different radio environments to the user. A standard UMTS Network Architecture will harmonise the call control, routing and mobility services across the core FPLMTS networks.

9.1. Satellite Radio Interfaces

Chapter 2 demonstrates the need for multi-tier radio interfaces. The link budget shows the scaling down of data throughput that customers will experience when moving away from intensively served office environments to rural environments. Chapter 4 explains the benefits of features in satellite systems now being designed for the year 2000.

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Chapter 7 investigates channel assignment in depth. The study highlights a number of different ways to achieve efficient channel assignment and concludes that:

- DCA (dynamic channel assignment) can be 2.4 times more spectrally efficient than fixed frequency re-use planning for non-GEO orbits.
- DCA may take a second or so to assign a channel so should only be used at call set-up and on as few other occasions as possible.
- FESs *must* be able to simultaneously control multiple non-GEO satellites to enable efficient handover between satellites
- If a single FES takes responsibility for communications with each mobile terminal then the FES can plan handovers between satellites, allowing groups of mobiles to be handed over together, preserving the efficient channel assignment pattern that DCA creates, without the delay that DCA takes.

9.2. Standard UMTS Network Architecture

FPLMTS and UMTS are intelligent networks. This allows satellite networks to inter-work with the IN model and is the main opportunity for convergence of networks in FPLMTS. The key model is the UMTS Network Architecture being standardized in ETSI from work done by the Race Monet project.

The UMTS Network Architecture defines a handful of functional entities, their role and their interfaces to each other. A satellite access network uses just three specialized functional entities:

- An FES (fixed Earth station), which takes complete responsibility for communicating between a core FPLMTS network local exchange on the ground and the mobile terminals within the FES's geographically defined coverage area.
- Satellites, which can be a single GEO satellite or a number of non-GEO satellites passing through the link between the FES and mobile terminal.
- The mobile terminal, which will have a part of it dedicated to communications with the FES entity of a particular satellite system.

The functions are defined such that they may be distributed amongst the real entities in any satellite system. An FES must be able to guarantee coverage of a geographic area. Chapter 5 shows how for MEOs such as Inmarsat-P and Odyssey a single FES site can guarantee coverage of continents and oceans. For LEOs like Globalstar a single FES site can guarantee coverage of countries and regions but for oceanic coverage two (or more) sites may be required to jointly act as one virtual FES. For systems with inter-satellite links and on-board processing, such as Iridium, an FES site can communicate with the entire world and some of the functions of the FES network architecture entity may be performed on board satellites.

Functions are defined for all types of handovers and location updates, including between networks of different types (as long as the mobile terminal can support both types of network). Chapter 6 explains how these functions are useful in satellite FPLMTS.

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9.3. Terminal's Applications' User Interfaces

On the other side of the radio interfaces to the FPLMTS networks are the terminals supporting the users' applications. These applications also need to adapt to different air interfaces, just as the core network does. Furthermore the applications need to be able to operate with like applications on other terminals through heterogeneous networks. FPLMTS and UMTS are aligning themselves with B-ISDN to facilitate this but more work needs to be done to steer the multimedia community to consider mobile networks as access to their applications. In the UK mobile phone connections now outsell fixed, despite the apparent low quality of voice telephony on mobiles compared to the fixed PSTN. Mobile communication is going to be big business by next century. Bigger than "multimedia".

9.4. Towards the Integrated Broadband Communications Network

EU research stimulated by the CEC's Fourth Framework [FFW] will now continue beyond the exploratory and validatory Race programme into the "make it work" Acts (advanced communications technologies and services) programme, leading up to the implementation of Europe's IBC (integrated broadband communications) network at the turn of the century. The CEC anticipates substantial roll-out of a terrestrial IBC network by 2000, before the integration of intelligence and mobility into IBC between 2000 and 2005. The CEC does not expect a fully transparent IBC network to be widespread until 2010. Realistically, the CEC may be right with these time scales for European mass market acceptance of service, following on from tentative market trialing as much as five years earlier. It is clear that the solutions for mobile IBC and the intelligence in the network and applications required to support it are required now. Acts project AC034, On the Move, is most relevant, including trials and validation of mobile multimedia applications and development of a uniform mobile application support environment and mobile API, both candidates for standardization into UMTS by ETSI.

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