Integration Of UMTS And B-ISDN: Is It Possible Or Desirable? Essay, Research Paper

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INTRODUCTION

In the future, existing fixed networks will be complemented by mobile networks

with similar numbers of users. These mobile users will have identical

requirements and expectations to the fixed users, for on-demand applications of

telecommunications requiring high bit-rate channels. It will be necessary for

these fixed and mobile networks to interoperate in order to pass data, in real

time and at high speeds, between their users.

But how far must this interoperation be taken? How much integration of the fixed

and mobile network structures is needed? Here, a fixed network, B-ISDN, and a

mobile network, UMTS, under development at the same time, are examined to see

how well and closely they should work together in order to meet expected user

needs. Work already taking place on this is discussed.

BACKGROUND

The Universal Mobile Telecommunication System (UMTS), the third generation of

mobile networks, is presently being specified as part of the European RACE

technology initiative. The aim of UMTS is to implement terminal mobility and

personal mobility within its systems, providing a single world mobile standard.

Outside Europe, UMTS is now known as International Mobile Telecommunications

2000 (IMT2000), which replaces its previous name of Future Public Land Mobile

Telecommunication System (FPLMTS). [BUIT95]

UMTS is envisaged as providing the infrastructure needed to support a wide range

of multimedia digital services, or teleservices [CHEU94], requiring channel bit-

rates of less than the UMTS upper ceiling of 2 Mbits/second, as allocated to it

in the World Administrative Radio Conference (WARC) ‘92 bands. UMTS must also

support the traditional mobile services presently offered by separate networks,

including cordless, cellular, paging, wireless local loop, and satellite

services. [BUIT95] Mobile teleservices requiring higher bit rates, from 2 to 155

Mbits/second, are expected to be catered for by Mobile Broadband Services (MBS),

the eventual successor to UMTS, which is still under study. [RACED732]

Broadband Integrated Services Digital Network (B-ISDN), conceived as an all-

purpose digital network that will supersede Narrowband ISDN (N-ISDN or ISDN), is

also still being specified. B-ISDN, with its transport layer of Asynchronous

Transfer Mode (ATM) is expected to be the backbone of future fixed digital

networks. [MINZ89]

It is anticipated that, by the year 2005, up to 50% of all communication

terminals will be mobile. [CHEU94] The Mobile Green Paper, issued by the

European Commission in 1994, predicts 40 million mobile users in the European

Union by 2000, rising to 80 million by 2010. This gives mobile users an

importance ranking alongside fixed-network users. [BUIT95]

One result of this growth in mobile telecommunications will be the increase in

teleservice operations that originate in either the fixed or mobile network, but

terminate in the other, crossing the boundary between the two. UMTS is expected

to be introduced within the next ten years, and integration with narrowband and

broadband ISDN is possible in this time. Interoperability between UMTS and ISDN

in some fashion will be necessary to support the interoperability between the

fixed and mobile networks that users have already come to expect with existing

mobile networks, and to meet the expectation of consistency of fixed/mobile

service provision laid out in the initial RACE vision. [SWAI94]

One way of making UMTS attractive to potential customers is to offer the same

range of services that B-ISDN will offer, within the bounds of the lower 2

Mbits/second ceiling of UMTS. [BUIT95]

So, with the twin goals of meeting existing expectations and making UMTS as

flexible as possible to attract customers, how closely integrated must UMTS be

with B-ISDN to achieve this?

ALTERNATIVES FOR INTEGRATING UMTS WITH OTHER NETWORKS

The UMTS network could be developed along one of the following alternative

integration paths:

1. Developing an ‘optimised’ network structure and signalling

protocols tailored for the special mobile requirements of

UMTS. This would be incompatible with anything else. Services

from all fixed networks would be passed through via gateways.

This design-from-scratch method would result in highly

efficient intra-network operation, at the expense of highly

inefficient inter-network operation, high development cost,

scepticism relating to non-standard technology, and slow

market take-up. True integration with fixed networks is not

possible in this scenario.

Given the drawbacks, this is not a realistic option, and it

has not been considered in depth. One of the RACE goals was to

design UMTS not as a separate overlay network, but to allow

integration with a fixed network; this option is undesirable.

[BUIT95]

2. Integration with and evolution from the existing Global

System for Mobile telecommunication. (GSM, formerly standing

for Group Special Mobil during early French-led specification,

is now taken as meaning Global System for Mobile

communications by the non-French-speaking world.) GSM is

currently being introduced on the European market.

This option has the advantage of using already-existing mobile

infrastructure with a ready and captive market, but at the

expense of limiting channel bit-rate considerably, which in

turn limits the services that can be made available over UMTS.

Some of the technical assumptions of UMTS, such as advanced

security algorithms and distributed databases, would require

new protocols to implement over GSM. GSM would be limiting the

capabilities of UMTS. [BROE93a]

3. Integration with N-ISDN. Like the GSM option above, this

initially limits UMTS’s channel bit-rate for services, but has

a distinct advantage over integration with B-ISDN – N-ISDN is

widely available, right now. However, integrating UMTS and

N-ISDN would require effective use of the intelligent network

concept for the implementation of mobile functions, and

modification to existing fixed network protocols to support

mobile access.

Integrating UMTS with N-ISDN makes possible widespread early

introduction and interoperability of UMTS in areas that do not

yet have B-ISDN available. This allows wider market

penetration, as investment in new B-ISDN equipment is not

required, and removes the dependency of UMTS on successful

uptake of B-ISDN for interoperability with fixed networks.

Eventual interoperability with B-ISDN, albeit with

constrictions imposed on UMTS by the initial N-ISDN

compatibility, is not prevented. [BROE93a]

4. Integration with B-ISDN. This scenario was the target of

MONET (MObile NETwork), or RACE Project R2066. Unlike the

above options, B-ISDN’s high available bandwidth and feature

set does not impose limitations on the service provisioning in

UMTS. Fewer restrictions are placed on the possible uses and

marketability of UMTS as a result. Development of B-ISDN is

taking place at the same time as UMTS, making smooth

integration and adaptation of the standards to each other

possible.

For these reasons, integration of UMTS with B-ISDN has been accepted as the

eventual goal for interoperability of future fixed and mobile networks using

these standards, and this integration has been discussed in depth. [BROE93a,

BROE93b, BUIT95, NORP94]

At present, existing B-ISDN standards cannot support the mobile-specific

functions required by a mobile system like UMTS. Enhancements supporting mobile

functions, such as call handover between cells, are needed before B-ISDN can act

as the core network of UMTS.

Flexible support of fixed, multi-party calls, to allow B-ISDN to be used in

conferencing and broadcasting applications, has many of the same requirements as

support for mobile switching, so providing common solutions to allow both could

minimise the number of mobile-specific extensions that B-ISDN needs.

As an example of how B-ISDN can be adjusted to meet UMTS’s needs, let’s look at

that mobile requirement for support for call handover. Within RACE a multiparty-

capable enhancement of B-ISDN, upwardly compatible with Q.2931, has already been

developed, and implementing UMTS with this has been studied. For example, a UMTS

handover can be handled as a multi-party call, where the cell the mobile is

moving to is added to the call as a new party, and the old cell is dropped as a

party leaving the call, using ADD(\_party) and DROP (\_party) primitives. Other

mobile functions can be handled by similar adaptations to the B-ISDN protocols.

The enhancements to B-ISDN Release 2 and 3 that are required for UMTS support

are minimal enough to be able to form an integral part of future B-ISDN

standards, without impacting on existing B-ISDN work. [BUIT95]

These modifications only concern high-level B-ISDN signalling protocols, and do

not alter the transport mechanisms. The underlying ATM layers, including the ATM

adaptation layer (AAL) are unaffected by this.

THE INTELLIGENT NETWORK

The Intelligent Network (IN) is a means for service providers to create new

services and rapidly introduce them on existing networks. As the IN was

considered useful for implementing mobility procedures in UMTS, it was studied

as part of MONET, and is now specified in the Q.1200 series of the ITU-T

recommendations.

The intelligent network separates service control and service data from basic

call control. Service control is then activated by ‘trigger points’ in the basic

call. This means that services can be developed on computers independent of the

network switches responsible for basic call and connection control. This gives

flexibility to the network operators and service providers, as well as the

potential to support the services on any network that supports the trigger

points. Eventually, IN can be expanded to control the network itself, such as

handling all UMTS mobile functions. [BROE93a]

Any network supporting the intelligent network service set will be able to

support new services using that service set easily, making integration of

networks easier and transparent to the user of those services. The intelligent

network is thus an important factor in the integration of B-ISDN and UMTS. UMTS,

B-ISDN and the intelligent network set are all being developed at the same time,

allowing each to influence the others in producing a coherent, integrated whole.

[BUIT95]

CONCLUSION

In order to be accepted by users as useful and to provide as wide a variety of

services as possible, UMTS needs some form of interoperabilty or integration

with a fixed network. Integration of UMTS with B-ISDN offers the most

flexibility in providing services when compared to other network integration

options, and constrains UMTS the least.

With the increase in the number of services that will be made available in UMTS

and B-ISDN over present standalone services, it is unrealistic to develop two

separate, and incompatible, versions of each service for the fixed and mobile

networks. Integrating UMTS and B-ISDN makes the same service set available to

both sets of users in the same timescale, reducing development costs for the

services, and promoting uptake and use in the market. The intelligent network

concept allows the easy provision of additional services with little extra

development cost. Integrating UMTS with B-ISDN, and with the intelligent network

set, is therefore desirable.

Work on this integration indicates that the mobile requirements of UMTS can be

met by extending existing B-ISDN signalling to handle them, without

significantly modifying B-ISDN. Integration of UMTS with B-ISDN is therefore

technically feasible.

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