4.2 **GSM: BUILDING ON PHASE 2**

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0. Introduction

This paper presents some elements concerning the evolution of GSM planned for the next few years. Two examples are described which may be of particular interest for China, namely, dual band operation and satellite interworking.

1. A platform for evolution.

One of the key features of the GSM standard is that it describes not just a radio interface, but a complete network, including operation and maintenance. The traffic management protocol architecture is shown in the first figure. The key application protocols, MAP, BSSMAP, CC, MM and RR have been adapted in GSM phase 2 to readily accept future evolutions of the protocol. In pareticular, the key protocols MAP and for the radio interface (Technical Specification GSM 04.08) have been thus adapted.

For the radio interface, the phase 2 Mobile Station behaviour has been very tightly specified, leaving little ambiguity as to the behaviour in the face of future evolutions of the network. On the other hand, the network has a fairly "generous" reaction to unknown signals, in general accepting what it can without provoking errors or clearing the call.

For the Mobile Application Part (MAP), two features allow for evolution of one side or other of a network interface (which may be international, for roaming purposes, or may involve two different equipment suppliers). These are the application context and the ellipsis notation. The former feature, in particular, allows for future expansion of the MAP in the form of new operations.

2. Phase 2+ features

A selection of the currently planned phase 2+ features are listed. These are under various stages of definition and development.

3. Dual Band Operation (GSM/DCS)

There are in fact several modes of dual band operation. These include terminal roaming, SIM roaming, and full dual-mode terminal capability. The implementation of GSM900 versus DCS1800 involves a classic dilemma: if the two systems are to compete for coverage of a particular area, the 900MHz system has, from the laws of physics, an intrinsic initial advantage. However, in a later phase, when capacity becomes a problem for the 900MHz band, the 1800MHz systems can absorb a much higher density of subscribers. This problem can be translated into a financial dilemma as shown on page 4.2-7 (upper).

One way to resolve this dilemma is to in some way use the complementarity of the technologies, as shown in the second figure. This may be by dual band operation by a single operator, or by inter-operator agreements.

4. Satellite Coverage

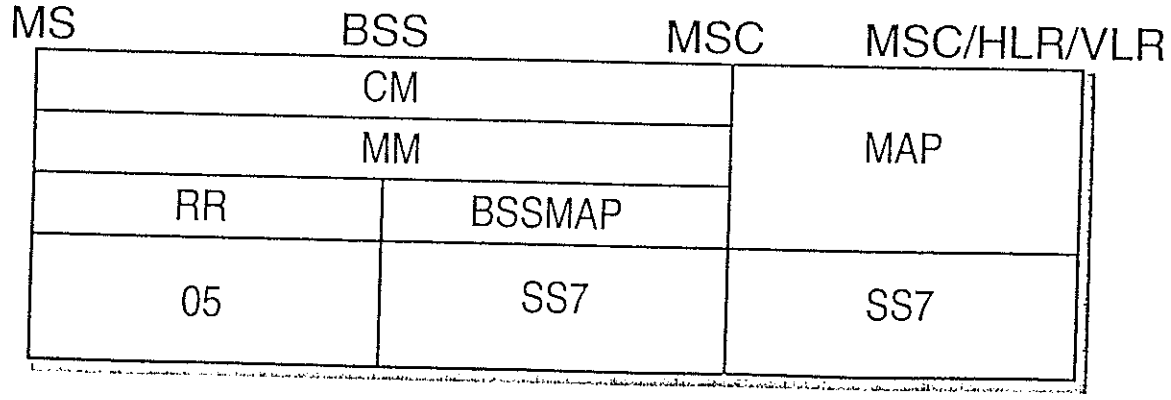
Another "complementary" solution is shown in the lower figure on page 4.2-7, namely satellite coverage of remote regions where it is considered too expensive to justify cellular coverage. There are currently a number of global and regional satellite systems under development. At least for the global systems, most seem to be basing their ground segment architecture on GSM, as being the most widespread and advanced network with which roaming will be necessary. Even more than with GSM and DCS, dual mode terminals are considered to be an essential feature for the commercialisation of these systems. The phase 2+ study item in SMG is to ensure that at least the technical interworking issues are addressed in time to permit as much a "seamless" operation as is commercially feasible for users and operators.

GSM:
Building on Phase 2

- A platform for evolution
- Phase 2+
- Dual band operation (GSM and DCS)
- Satellite interworking

A platform for evolution

Protocol Architecture



Phase 2+ features -1

- Technical enhancements and improvements
- Interworking with non-GSM applications on the SIM
- GSM-DCS roaming
- Operation of dual band GSM/DCS by a single operator
- DECT access to GSM
- UPT
- Universal access to freephone numbers
- Premium rate services

Phase 2+ features -2

- Payphone services
- Location services
- Malicious call id
- Optimized routing
- Call Completion services
- Extensions to SMS alphabet
- Fast moving mobile station
- DCS1800 4 Watt MS
- Packet radio
- Radio Local Loop

Phase 2+ features -3

- 3 Volt SIM
- Broadcast calls
- Fast call setup
- Group calls
- Hot billing
- Prioritisation and Preemption
- Interworking with Satellite Mobile Systems

Dual band operation (GSM/DCS)

- SIM roaming
  - International
  - National
  - "Network"
- ME (terminal) roaming
  - dual band terminal
  - with/without handover
- Dual band networks
  - with/without handover

National dual band networks/ agreements

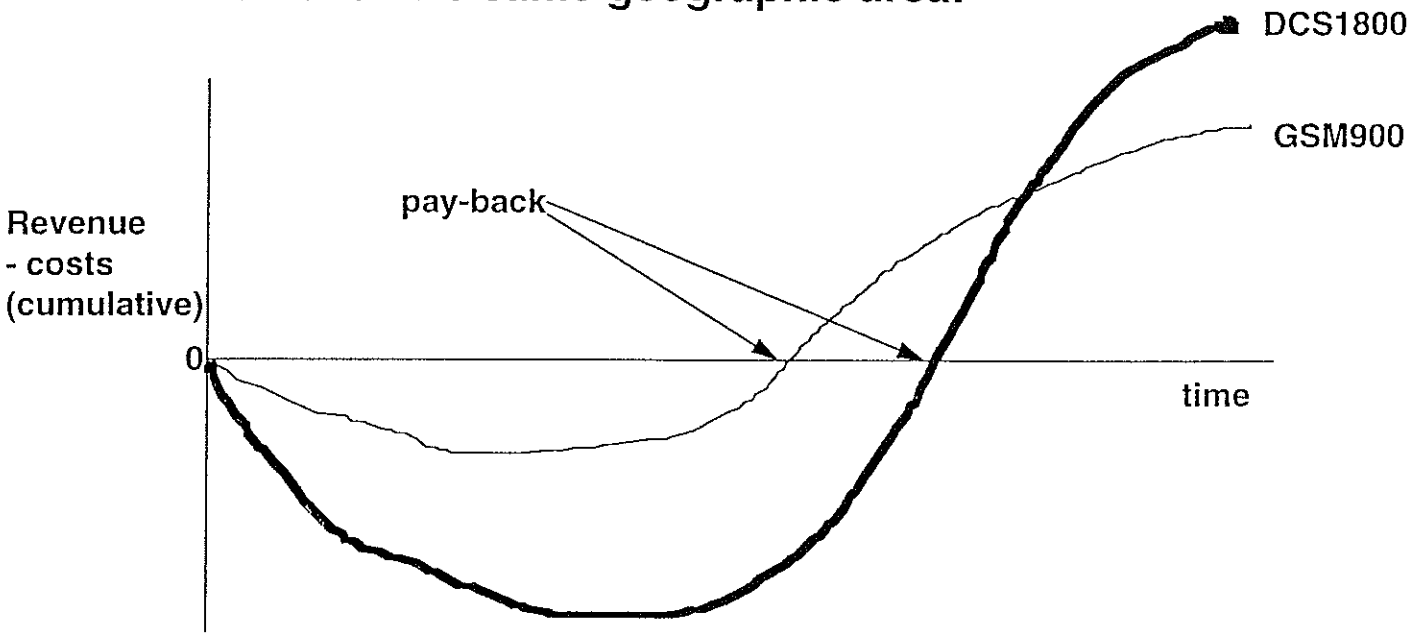
- Benefits to 900 operators
  - Increased capacity
- Benefits to 1800 operators
  - Easier investment
- Benefits to dual operators
  - Both increased capacity and easier investment
- Benefits to users
  - Better coverage, lower blocking, single subscription

Satellite coverage

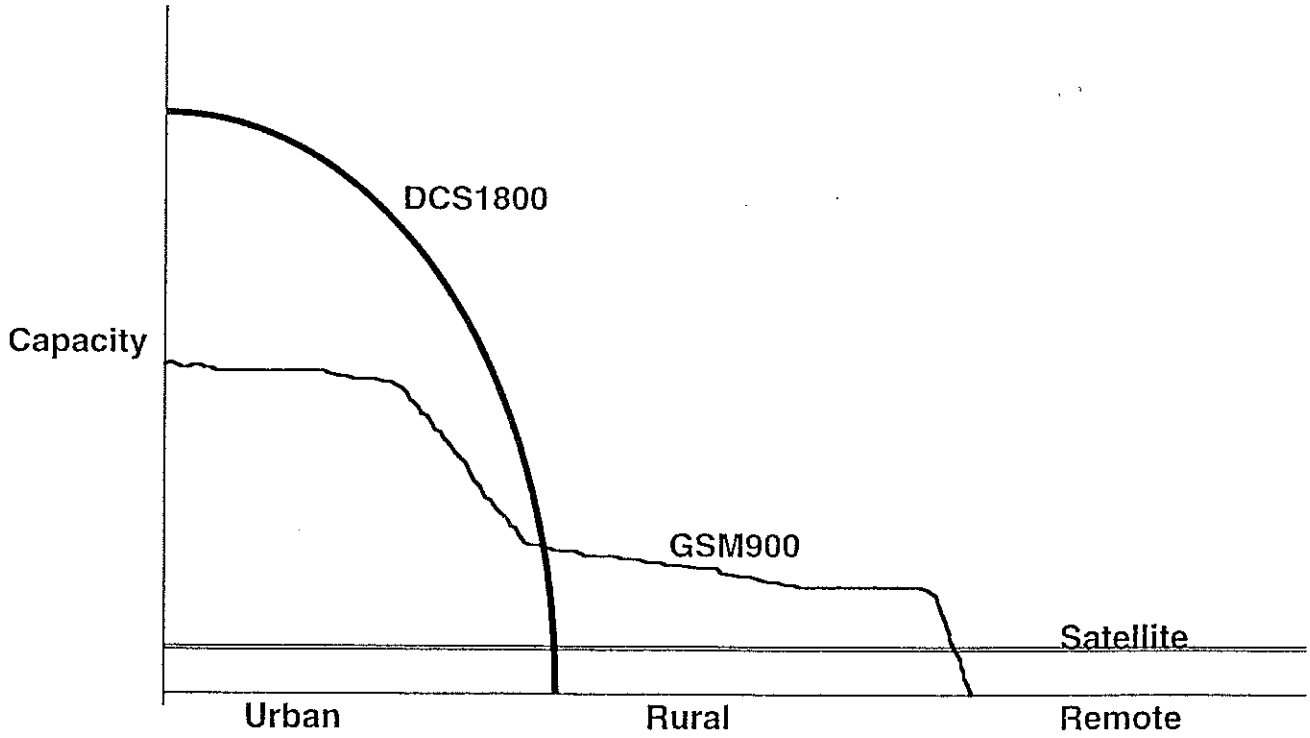
- Cover remote regions and seas at low cost
- "fill-in" for cellular coverage
- provide for international terminal roaming
- user pays for security, convenience and necessity
- GSM network based
- no "roll-out"
- a few years preparation

The economic dilemma

To cover the same geographic area:



Complementary solutions



Which satellite?

- GEO (Optus, AMSC, Asia Mobile Telecom,..)
  - Good: established technology, simple, "low" system cost
  - Bad: Delay, capacity, handportable margin, terminal cost
- LEO (Iridium, Globalstar, Constellation)
  - Good: Capacity, delay, global coverage, handportables, "low" terminal cost
  - Bad: complexity, number of satellites/ground stations,lifetime, new technology, high system costs
- MEO (P21,Odyssey, Ellipsat)
  - compromise

Integration with GSM