Multicast in the Mobile Environment and 3G

Next Generation Wireless Networks

Yoan Miché

Department of Computer Science
TKK

November, 23th 2005

Outline

The Need for Information

A few facts showed by last A.T. Kearney study about "Mobile Phone Users Embracing Data Services" :

- More than half of mobile phone handsets are less than one-year old and have robust multimedia capabilities;
- 56 percent of mobile users now access Internet monthly;
- 33 percent download music;

The Need for Information (2)

- 16 percent of users with multimedia phones reported downloading mobile games at least monthly;
- Seventeen percent of users (and 27 percent of those under age 24) said they were willing to pay for mobile TV.

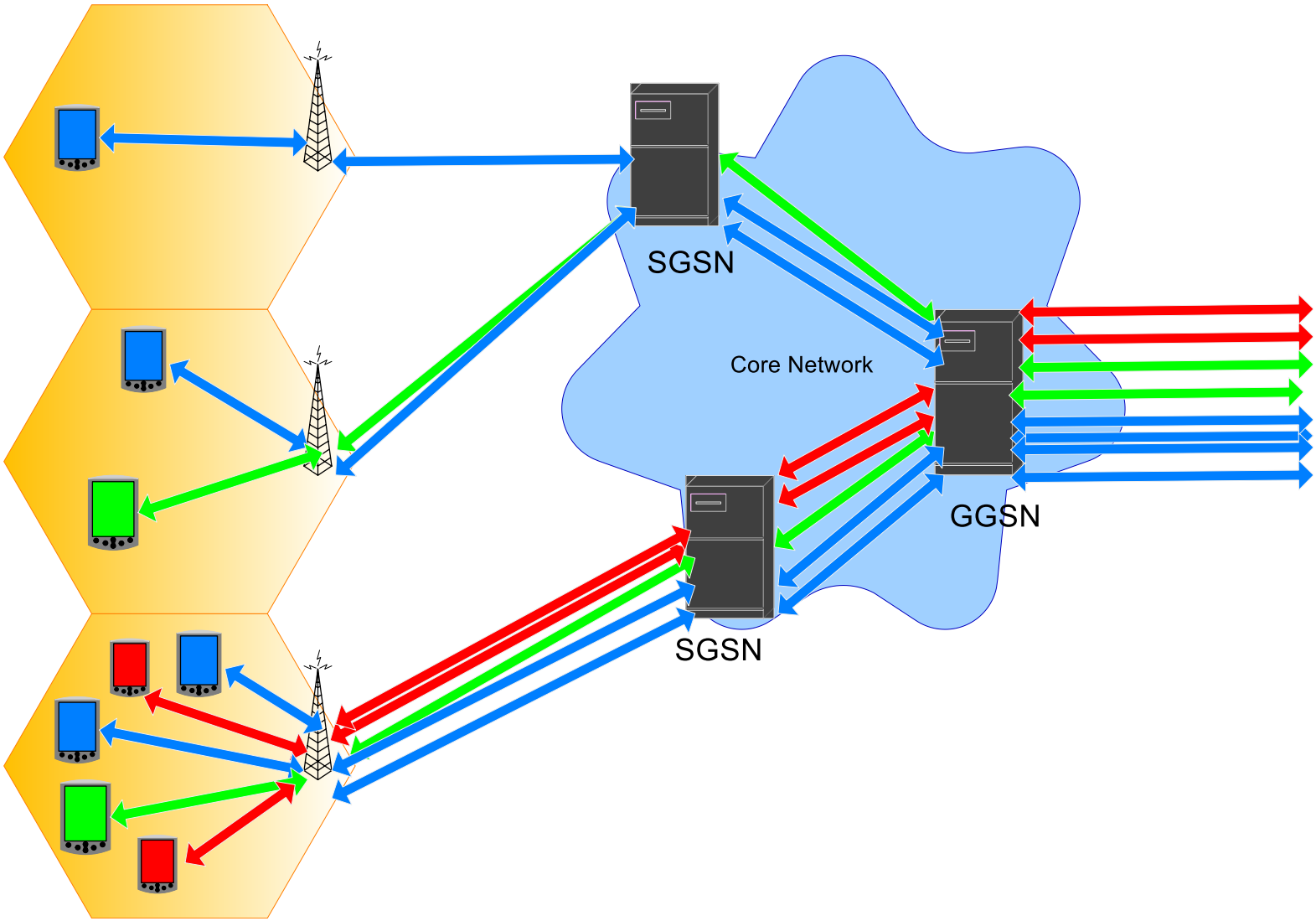
"However, two-thirds of users expressed a desire for time-sensitive TV content"

$\rightarrow$ The need and wish for this kind of service is in place, and growing. User Equipment (UE) seems to be rather globally adapted to those services.

Problems

- Main Problem is about bandwidth, server capacities, and the price of all those devices and actual services.
- Following some current existing architecture, users who subscribed to those services are paying a lot, since the operator has to make a connection with each UE in the area.
- An example with mobile TV, on actual network architectures.

A Mobile TV Example



A Few Numbers (again...)

Just to show why this form of unicast will be impossible in the future. Consider a "Mobile Music Box" service :

- 50 000 users ;
- Wireless link speed of 128Kbps each;
- Each file around 3MB;
- Server capable of handling 1000 connections at a time.

With these parameters, each time you want to update a song in each UE, you need 2,5 hours to update them all, generating 128Mbps continuous traffic for this whole time.

This is for songs and relatively "small" content. For TV related content, need for a whole server farm !

The MBMS Concept

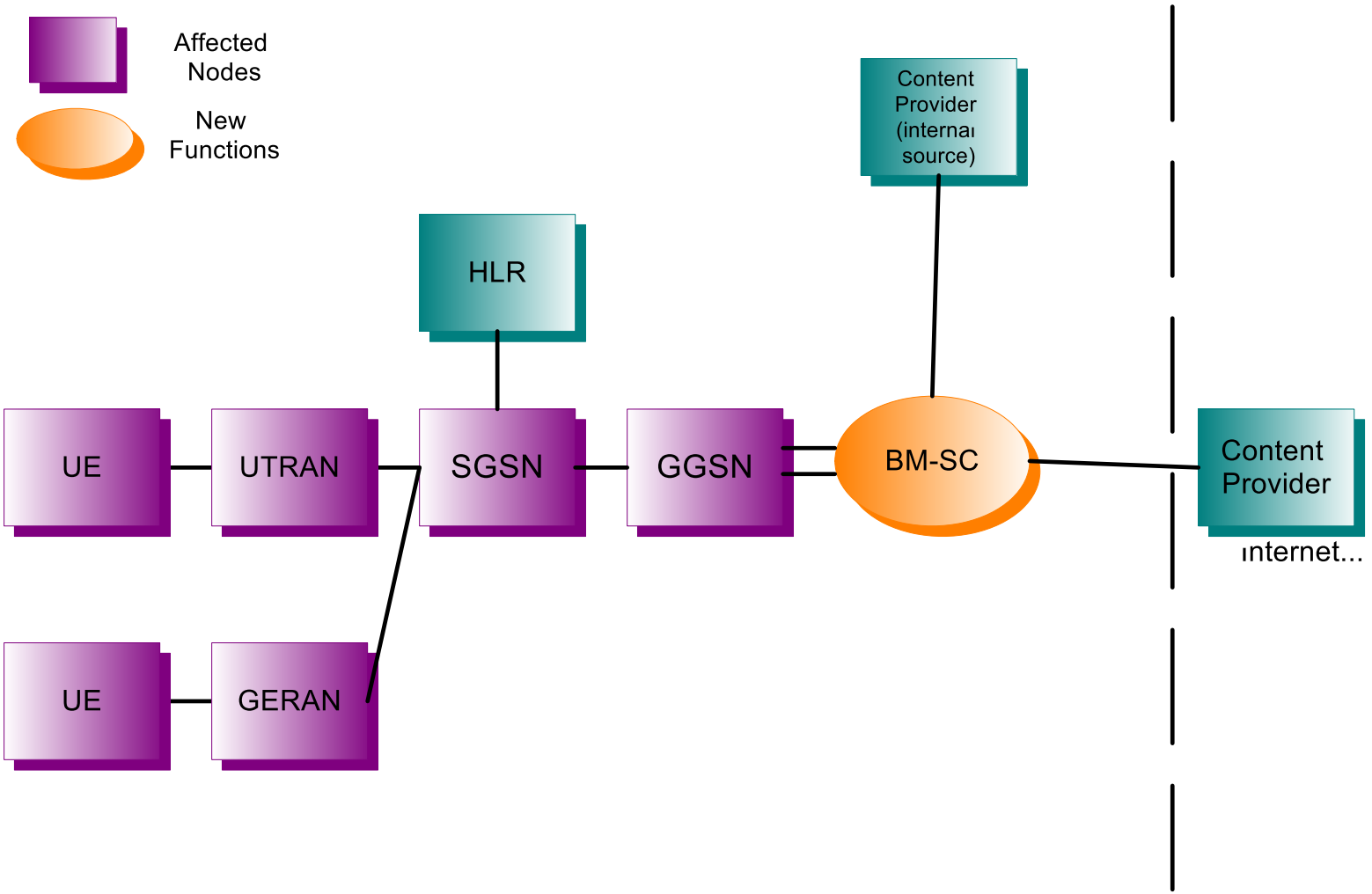
Unicast is useful but resource-consuming. And as we saw it, the need for point-to-multi diffusion means is increasing.

By the way, today, no real good solution can be implemented in the "real" world, for p-t-m diffusion.

For this purpose, the 3GPP group has been developing the MBMS idea (called BCMCS in 3GPP2), providing solutions and architectures for broadcast and multicast services. MBMS is not exactly a service in itself, it enables operators and content providers to use it to create new services.

MBMS : Multimedia Broadcast/Multicast Service

The MBMS Concept (2)



The MBMS Concept (3)

A few basic details :

- Direct link from BM-SC to Content Providers;
- BM-SC is the new idea in MBMS;
- BM-SC is an entry point for content-delivery services;
- BM-SC also provide Services Announcements to UE;
- BM-SC can be used for charging data and security functions.

MBMS : Services and Applications

MBMS provides, as one can imagine :

- Broadcast Support;
- Multicast Support.

The Broadcast mode is the usual one, but not based on "multiple unicasts". This a real broadcast where anybody interested in the content can read it.

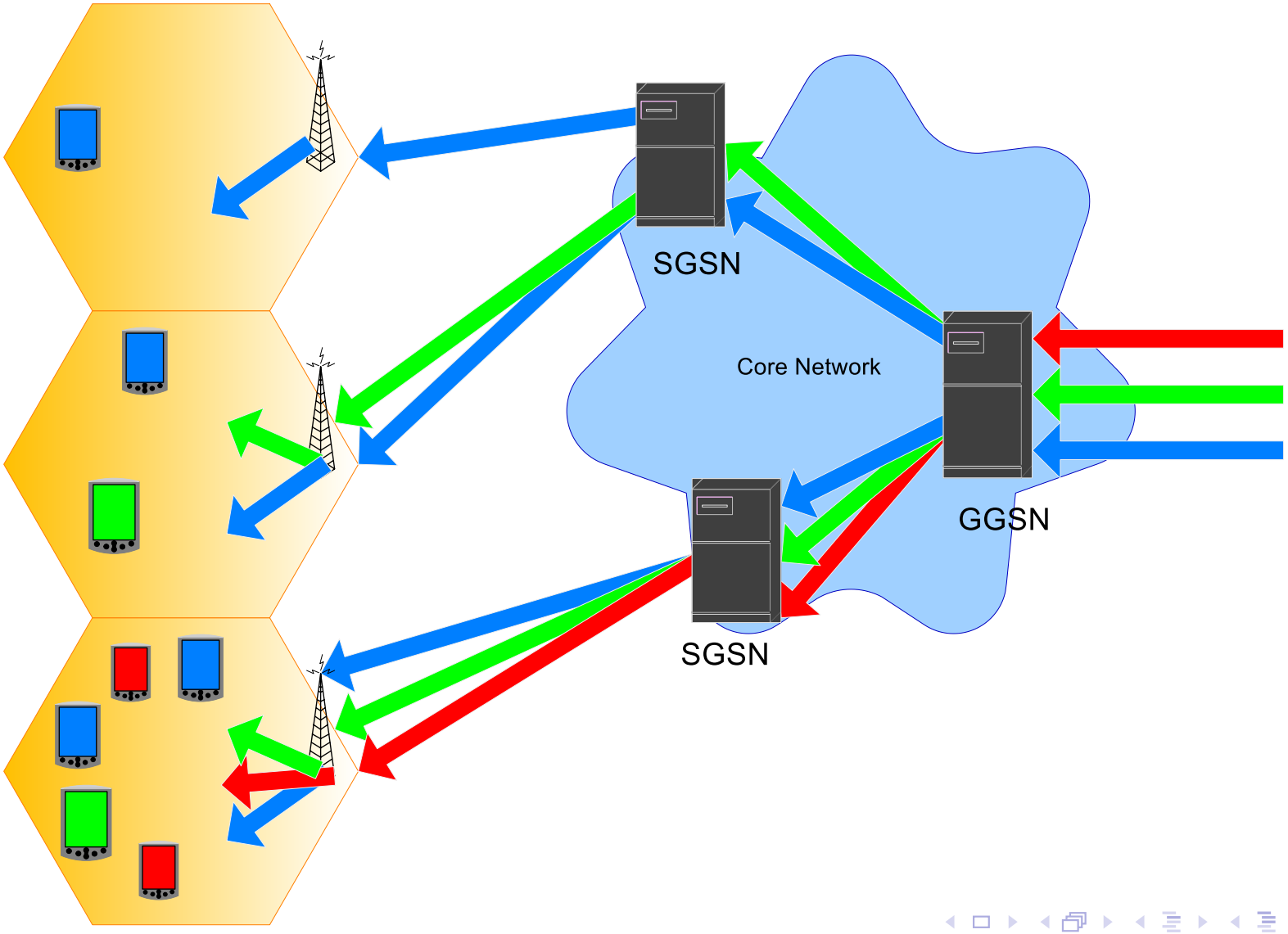
What can it be used for ? *Ads, Service announcements...*

MBMS : Multicast

MBMS Multicast is the main purpose and advantage of MBMS. One can easily use the architecture and functions provided by MBMS to send content using multicast features.

Still, since there might be not enough users for using multicast (which is also resource-consuming), MBMS can also adopt the solution of unicasting, if cheaper. This decision is to be made in the BM-SC.

MBMS : Multicast, the TV Example (again...)



MBMS : Groups

So, how does the delivery works ?

We assume the user received a service announcement and wants to join it.

- If it is broadcast-based, nothing to do, except for the UE to "tune" to the right channel mentionned in the announcement;
- If it multicast-based :
  - User sends a *session join* request, with the parameters of the service;
  - User becomes a member of the MBMS service group;
  - Then, he receives data as all the group members do.

MBMS : Groups (2)

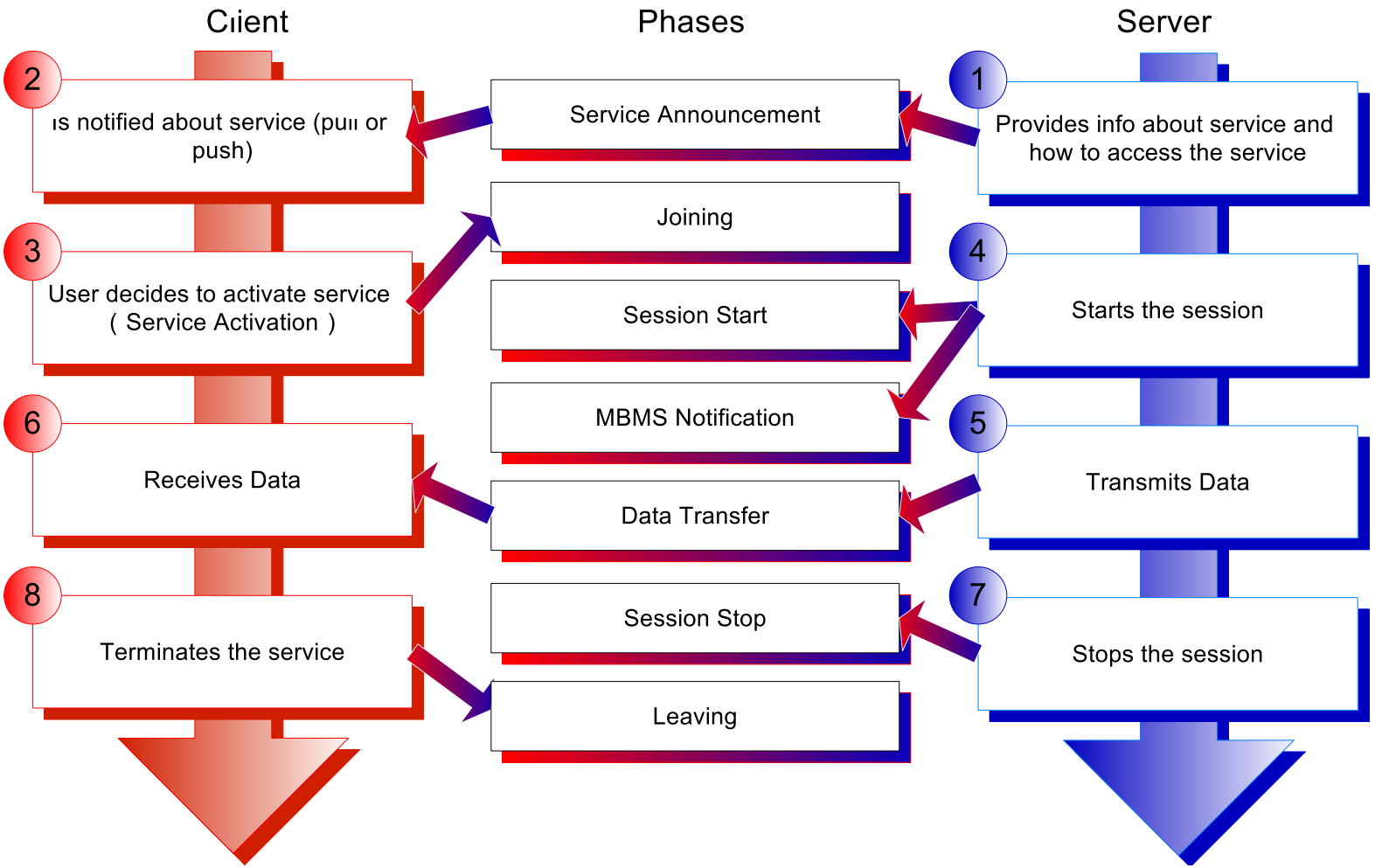
Then, it goes this way, on the "servers" side :

- BM-SC sends a *session start* request to the GGSN;
- GGSN allocates needed resources in his structure;
- GGSN tells about this request to the concerned SGSN;
- SGSN requests for bandwidth and radio resources to make the delivery efficient;
- All UE in the MBMS group are notified the data transfer is about to start.

MBMS : Groups (3)

- The servers can then send a *session stop* note to tell all devices the transfer is finished;
- If an user wants to leave the service, he shall send a *session leave* note, removing this user from the group.
- If it is the last user from the group, the group entry in the SGSN list can be removed, and same for GGSN if SGSN has no more list entries.

MBMS : Typical workflow



MBMS : Download

Since Broadcast and Multicast are p-t-m diffusion means, there are not suited for "downloads" (one-way transmission, downlink).

Internet Engineering Task Force has developed a model : FLUTE (File deLivery over Unidirectionnal Transport)

- Uses UDP protocol;
- With FEC, since UDP is unreliable;
- Even with these precautions, errors can occur.

$\rightarrow$ MBMS also provides a point-to-point procedure for files and ponctual occasions, to send requests to the server for file delivery.

MBMS : Cells and Areas

- MBMS gives the operators the opportunity to define geographical areas down to the size of a radio cell, for multicast content delivery.
- These areas are defined by the MBMS service area.
- Each node in the core network has a list of downstream nodes to know where it should forward data :
  - GGSN list contains all SGSN to which data should be forwarded;
  - SGSN list contains all RNC or BSC that need to receive the data.

The idea is then to keep up-to-date lists, to ensure the data transmission is the smallest and most efficient one.

MBMS : Charging

3GPP specs show some examples of how and what can be charged in both Broadcast and Multicast modes :

- Broadcast :
  - Usage duration;
  - Volume of Contents...
- Multicast :
  - Multicast Session Duration;
  - Duration of Membership to a Group;
  - Multicast Session Volume of Contents...

MBMS : Charging (2)

This charging part should be taken of course by the BM-SC server, registering relevant information for charging users, based on the method that has been chosen.

It is, however, mentionned in many papers that broadcast should most likely not be considered for charging, except for some specific reason. This way of delivering content is aimed at publicity, advertisement, news about services, announcements...

A short Summary

- Actual strong need for multicast and broadcast solution;
- MBMS is a structure model proposed by the 3GPP group;
- Provides efficient Multicast and Broadcast ideas;
- Enables "big data" delivery to end user for lower costs;
- Gives replacement solutions if problems appear;
- Seem to need only a few changes to the existing network structure...

Critiques...

MBMS seems like a very good and efficient solution, but :

- It looks like a brand new idea, but the only new idea is about the good use of Multicasting;
- By the way, it is not explicitly mentionned how to make those multicast deliveries, in a practical way;
- Still needs changes at every existing level of the architecture, and a new "server";
- Seems like the BM-SC is going to be doing a lot of work... Too much ?
- Reading 3GPP papers, the user should do a lot of things, in the process... All those steps may better be automated in software, and being completely hidden to the end user...

References

- ARIB STD-T63-22.246 V6.2.0 MBMS User Services; Stage 1, Release 6
- ARIB STD-T63-22.146 V6.6.0 MBMS; Stage 1, Release 6
- Group Management for MBMS, George Xylomenos, Athens University of Economics and Business
- Mobile broadcast/multicast in mobile networks, Martin Bakhulzen and Uwe Horn
- Content Networking in the Mobile Internet, Sudhir Dixit and Tao Wu