GSM Mobile reaches cell boundary (both cells in same Location Area)

- BCCH
  - Location Area = Maryland, Signal Strength = Good
- BCCH
  - Location Area = Maryland, Signal Strength = Great

The BCCH on the primary cell is monitored for signal strength.

The BCCH of the neighboring cells is monitored to determine if any of the neighbors have a better signal strength. In this case, the cell has reached the boundary between Rockville and Bethesda cells and it finds that the signal quality of the Bethesda cell is better.

GSM Mobile reaches Location Area boundary (old and new cells are in different Location Areas)

- BCCH
  - Location Area = Maryland, Signal Strength = Good
- BCCH
  - Location Area = Vienna, Signal Strength = Great

Now the Vienna cell is being received with better signal strength, so cell will be picked as primary.

RR Connection Setup

- RR CHANNEL REQUEST
- RR IMMEDIATE ASSIGNMENT
- A radio channel has been assigned to the GSM mobile.

GSM Location Update Procedure

- RR SABM + MM LOCATION UPDATING REQUEST
  - Maryland TMSI, Maryland LAI
- SABM + MM LOCATION UPDATING REQUEST
  - The BSC receives the location update with the SABM.
- The RR connection setup is completed by responding with UA for the received SABM.

MAP/G SEND PARAMETERS

- Maryland TMSI

MAP/G SEND PARAMETERS RESULT

- IMSI

MAP/D UPDATE LOCATION

The Virginia MSC VLR does not find the TMSI in its database. It uses the old Location Area Indicator (LAI) to obtain the address of the old MSC VLR. A request is sent to the old MSC VLR, requesting the IMSI (International Mobile Subscriber Identity) of the subscriber.

The Maryland MSC VLR provides the IMSI corresponding to the TMSI. Note that the IMSI could have been obtained from the mobile. That is not a preferred option as the Location Updating Request is sent in clear so it could be used to determine the association between the IMSI and TMSI.

The MSC sends an update location message to the HLR. This message is needed for two reasons: (1) The HLR needs to update its record to point to the new MSC when
queried for location. (2) The new MSC does not have information about this subscriber.
Pass information about the new subscriber to the new MSC. The message contains a 64-bit ciphering key used as a Session Key (Kc), a 128-bit random challenge (RAND) and a 32-bit Signed Response (SRES). These parameters will be used in the authentication process.

The new MSC replies back.
Ask the Old MSC to delete the record for this subscriber.
The Old MSC replies back to the HLR.
The HLR has updated all records, so it replies back to the new MSC.
The MSC VLR decides to authenticate the subscriber. The RAND value received from the HLR is sent to the mobile.
The mobile passes the computed SRES value in the response.

Enable Ciphering

The BSC sends the CIPHERING MODE COMMAND to the mobile.
Ciphering has already been enabled, so this message is transmitted with ciphering.
The new MSC replies back to the mobile via the Virginia BSC. The message also assigns a new Temporary Mobile Subscriber Id (TMSI) to the terminal. Since the TMSI assignment is being sent after ciphering is enabled, the relationship between TMSI and the subscriber cannot be obtained by unauthorized users.
The GSM mobile replies back indicating that the new TMSI allocation has been completed.

RR Connection Release

The BSC initiates RR release with the mobile.
The mobile sends a disconnect message to release the LAPm connection.
The BSC replies with an Unnumbered Acknowledge message.