Ans:- The main reasons for developing a cellular mobile communication system over a conventional telephone system are listed below:-

→ Limited Service capability:- A conventional mobile telephone system is usually designed by selecting one or more channels from a specific frequency allocation for use in some autonomous geographic zones. The user who starts a call in one zone has to reinitiate the call when moving into a new zone because the call will be dropped. The disadvantage of conventional telephone system is that the number of active users is limited to the number of channels assigned to a particular frequency zone.

→ Poor Service Performance:- In the past, a total of 33 channels were allocated to three mobile systems: Mobile Telephone Service (MTS), Improved Mobile Telephone service (IMTS) MJ systems, and Improved Mobile Telephone Systems (IMTS) MK systems. MTS operates around 40 MHz and MJ operates at 150 MHz; both provide 11 channels; IMTS MK operates at 450 MHz and provides 12 channels.

These 33 channels must cover an area of 50 miles in diameter. In 1976, New York city had 6 channels of $MJ serving 320 customers, with another 2400 customers on a waiting list. New York City also had 6 channels of MK serving 225 customers, with another 1300 customers on a waiting list. The large number of subscribers created a high blocking probability during busy hours. Although service performance was undesirable, the demand was still great. A high capacity system for mobile telephones was needed.

→ <u>Insufficient Frequency Spectrum Utilization</u>:- In a conventional mobile telephone system, the frequency utilization measurement M_0 is defined as the maximum number of customers that could be served by one channel at the busy hour.

In 1976, In New York city $M_0 = \dfrac{\text{No. of customers}}{\text{Channel}}$.

$$M_0 = \begin{cases} 53 & \text{customers / channel (MJ system)} \\ 37 & \text{customers / channel (MK system)} \end{cases}$$

Assume an average calling time of 1.76 minutes.

Offered load $\quad A = \dfrac{\text{Average calling time (min)} \times \text{Total customers}}{60 \text{ min}}$

$$\Rightarrow A_1 = \frac{1.76 \times 53 \times 6}{60} = 9.33 \text{ Erlangs (MT system)}$$

$$A_2 = \frac{1.76 \times 37 \times 6}{60} = 6.51 \text{ Erlangs (MU system)}$$

Given that the number of channels is 6. Greater the value of offered load, greater is the blocking probability. This means that the service is not good. In the above example, A1 service is not preferable. This shows that the frequency spectrum utilization is not done properly in conventional mobile systems.