

# Radio spectrum – a limited resource with a need for global management

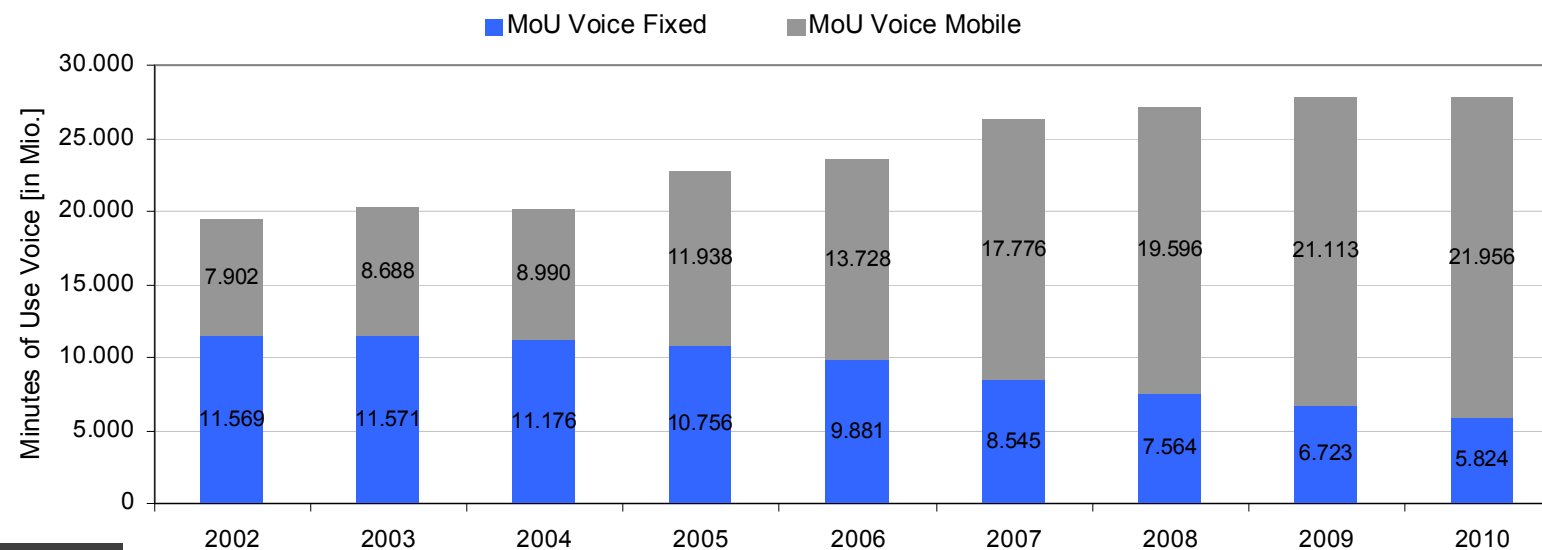
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## Market trend: Voice shifts from fixed to mobile

Fixed and mobile minutes in Austria



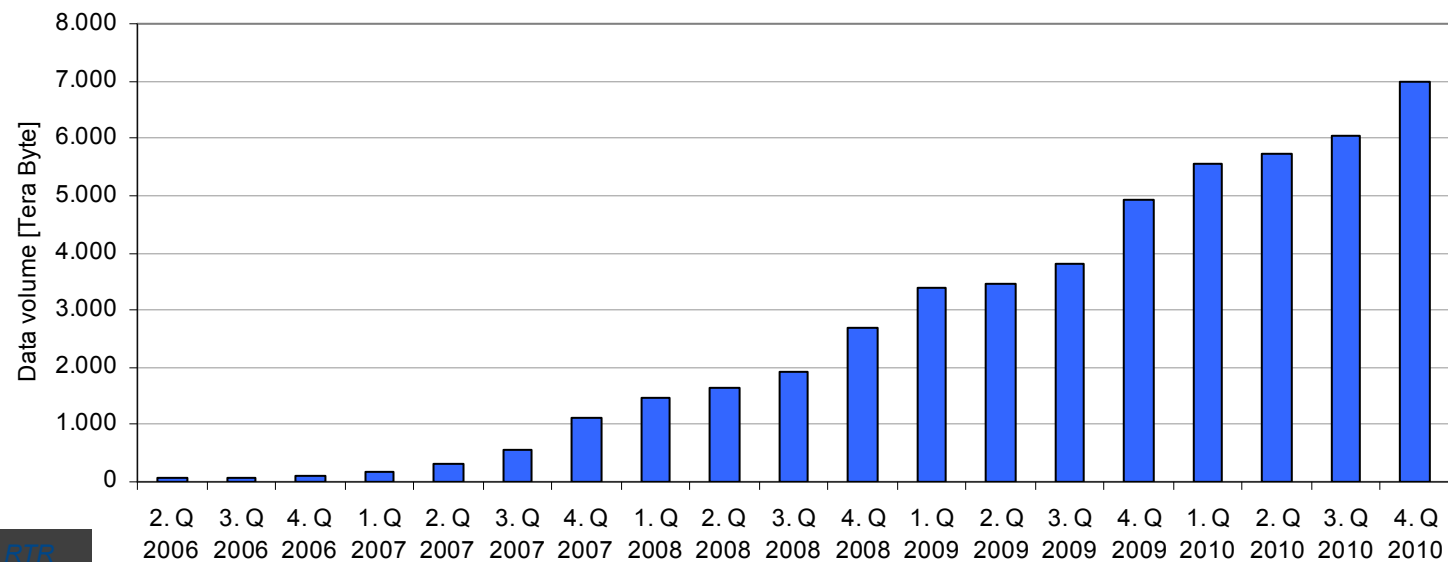
Source: RTR

The share of voice calls that originate on a fixed network has fallen from 60% to 20% since 2002. At the same time the number of mobile minutes has grown by 180%.



## Market trend: Strong growth of mobile broadband traffic

### Development of mobile broadband traffic



Source: RTR

The broadband data volume transmitted over mobile networks has grown by an average growth rate of approximately 80% per year since 2006. The volume per user has increased tenfold.



## Market trend: Rural coverage for mobile broadband

3G coverage lags behind 2G coverage

### 2G coverage

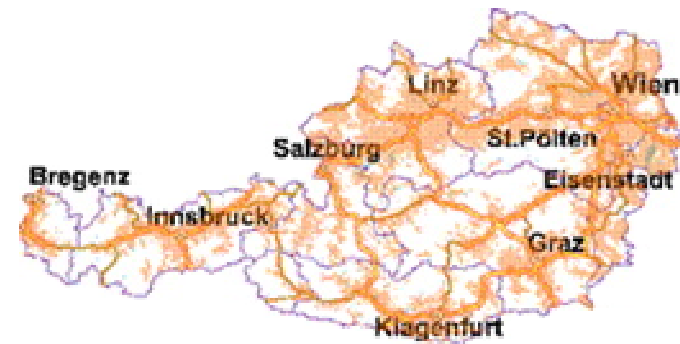
Pop	>98%
Area	> 80%



Source: RTR

### 3G coverage

Pop	60%-90%
Area	15%-60%



3G coverage lags behind 2G coverage. The more Smartphones are in the market the higher is the demand for rural and indoor coverage.



## Future of mobile broadband

High potential, but there are barriers

### Potential

- Internet becomes the universal communication media
- Convergence of voice, media and IT
- Smart handheld devices (Smartphones)
- Can be used every time and everywhere
- Plethora of new mobile applications

### Barriers

- Spectrum scarcity
- Problems of site acquisition
- Backhauling
- Etc.

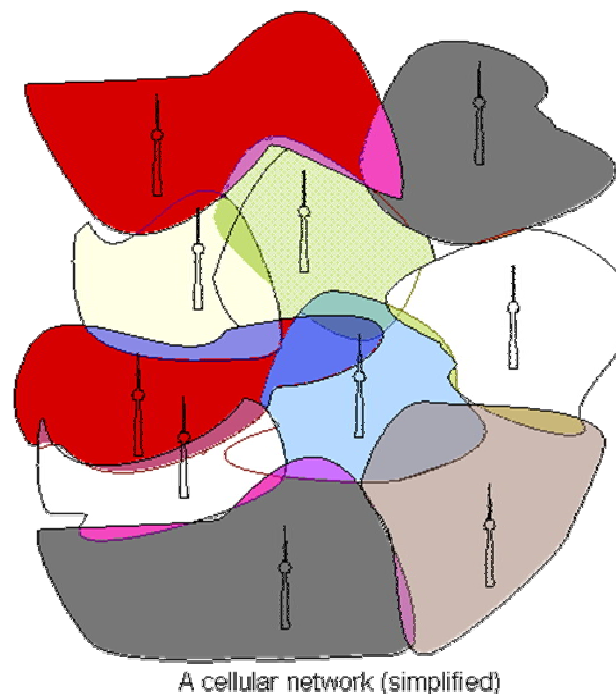
In order to tap the full potential of mobile broadband sufficient spectrum must be allocated to the mobile industry and an efficient use of spectrum must be ensured.



## Spectrum is a scarce resource

### Spectrum

- Occupied by many legacy applications such as broadcasting, military, etc.
- Increasing demand for mobile voice and mobile data
- Utilization and scarcity of spectrum increases
- Different propagation characteristics (area versus coverage spectrum)
- Different spectrum and bands are substitutes and complements
- Trade-off between denser network (higher network costs) and additional spectrum (higher licence costs)



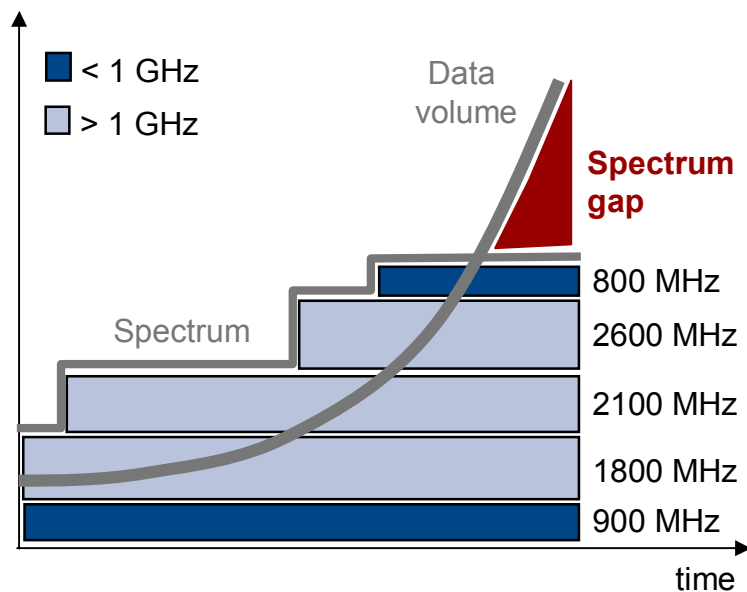
Source: European Commission, Jan 2009



## Spectrum for mobile broadband

Enormous demand for spectrum in the future

### Growth of volume vs spectrum supply



### Measures to increase supply and efficiency

- Allocation of new bands such as 3,4-3,8 GHz for mobile broadband (LTE advanced)
- Fostering of the deployment of new and more efficient technologies in existing bands
- Application of efficient assignment procedures
- More Sub 1 GHz spectrum for mobile broadband



## Assignment is critical for ensuring efficient use

### Assignment of exclusive usage rights

#### Objectives

- Competition in downstream markets
- Efficient use of scarce resource
- Infrastructure investment
- Choice of efficient technology
- Avoid hoarding and warehousing
- Other policy goals

#### Decisions

- Definition of frequency packages (lots, regions)
- Technology and services
- License duration and expiry
- Build out and coverage obligations
- Technical license conditions
- Spectrum caps
- Restriction on cross ownerships
- Access obligations (eg national roaming)
- Infrastructure sharing
- Selection mechanism (auction)





## Spectrum trading and refarming

More flexibility through spectrum trading and refarming

### Why?

- Pace of technology change
- New business opportunities
- Shift of demand between operators
- Temporary bottlenecks
- Convergence

### Potential problems

- Impact on other services and users
- Impact on competition
- Spectrum hoarding and warehousing
- Change of conditions
- Windfall profits

Spectrum trading and refarming helps to correct inefficiencies. Even if assignment and usage were optimal at the time of the primary assignment, markets and technology change.



## Example: Refarming of GSM bands

Use of 900 and 1800 MHz band for UMTS/LTE

### Advantages

- Mobile broadband in rural areas
- Indoor coverage of mobile broadband
- More capacity for mobile broadband
- Use for a superior technology

### Obstacles

- Spectrum is highly fragmented due to GSM channeling
- Spectrum efficiency requires a redistribution of the spectrum
- Refarming could have a severe negative impact on competition
- Barrier to investment due to short residual term of some of the licenses
- Sensitive to litigation because of existing rights



## Sub 1 GHz spectrum for mobile broadband

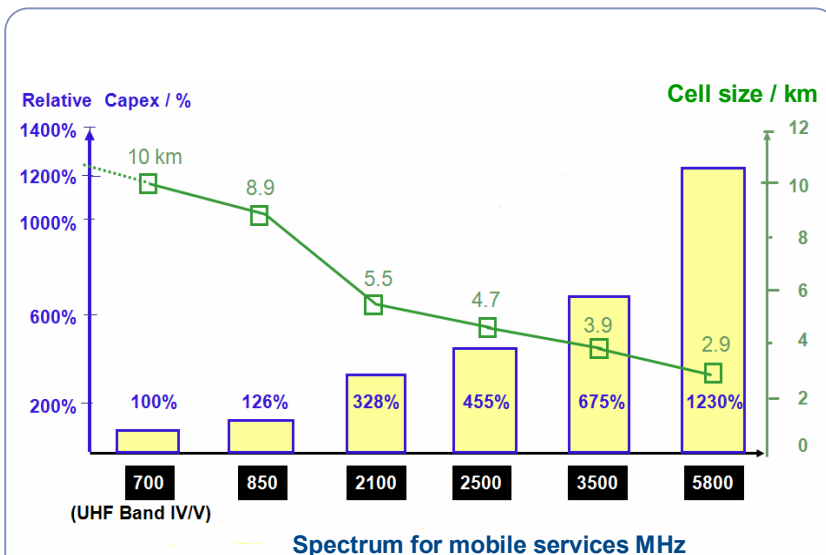
Spectrum below 1 GHz is particularly valuable and scarce

### Bands for mobile services

- Less than 20% of Sub 1 GHz spectrum is allocated to the mobile industry
- 800-MHz-Band is still widely used for broadcasting
- 900-MHz-Band is mainly used for voice services based on GSM

Second digital dividend is needed in order to allow cost efficient coverage in rural areas and improvement of indoor coverage.

### Why is that spectrum so interesting?



Source: Forge/Blackman/Bohlin 2007, ABI study for RTR  
Adapted by the Author

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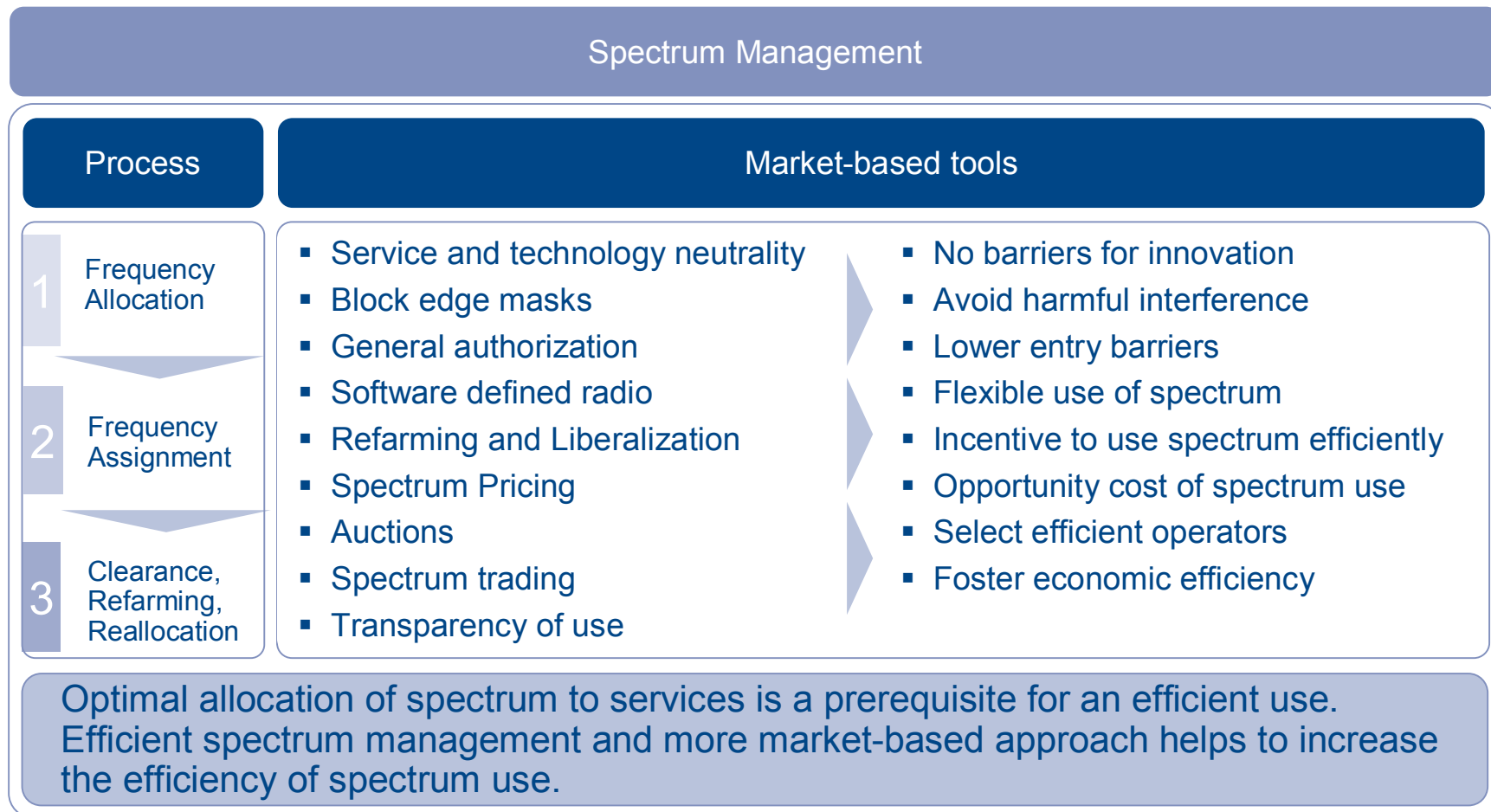
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# Backup



## Framework for spectrum management

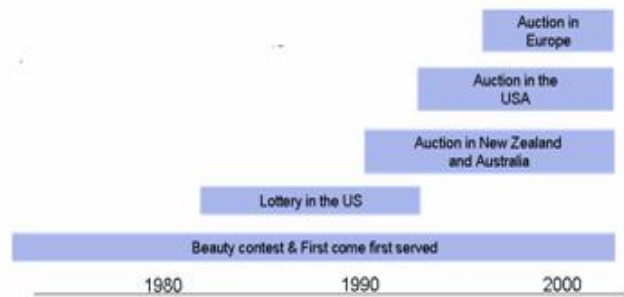




## Selection mechanism: trend towards auctions

### Auctions as a mean of assigning spectrum rights

#### Development



#### Advantages

- Good selection procedure
  - Assign frequencies to the operators that value it at most
  - Normally the most efficient operators
- Produces market prices
  - Foster efficient use
  - Signal scarcity
- Legally secure

Good auction design that is based on clear objectives is critical.