

Towards 4G Wireless Services

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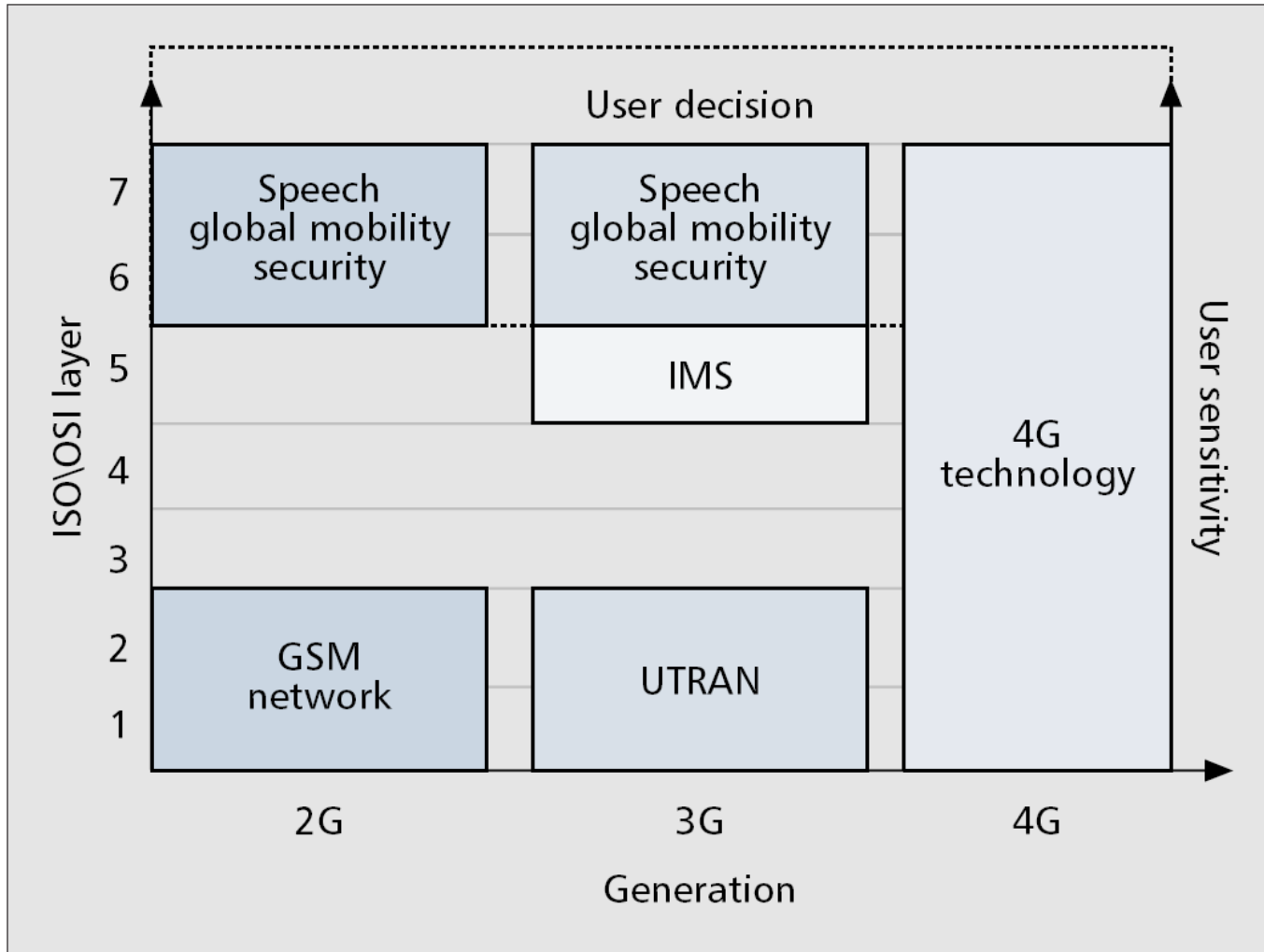
References

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3G Failures

- Worldwide economy downturn
- Limited novel services
- Cultural and social differences
 - Japan vs. EU
- Technical difficulties and limitations
 - Data rate, coverage, full range multi-rate, QoS, ...
- New broadband technologies
 - WiFi Mesh
 - WiMAX
 - 3.5G(14.4M/384K)/3.75G(14.4M/5.76M)

Towards 4G

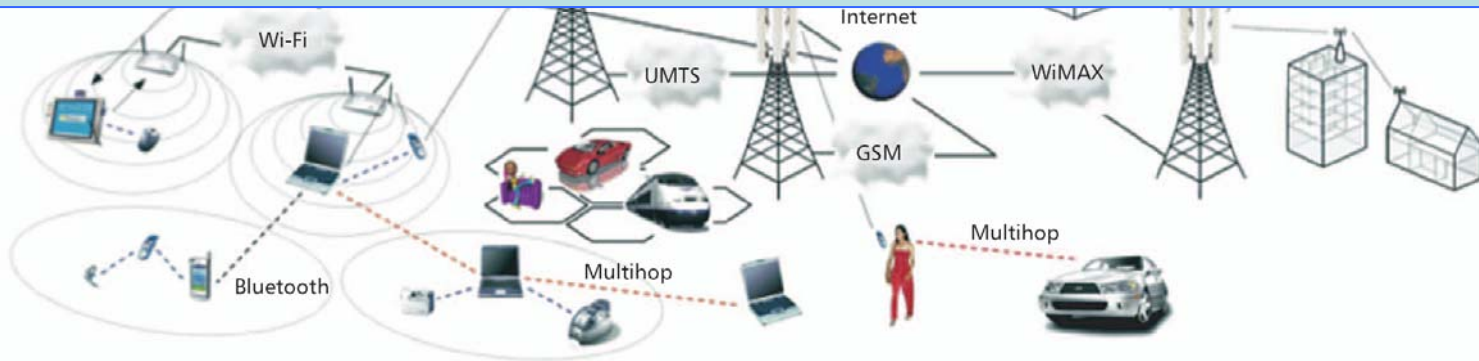


4G?

- “4G will be a convergence platform providing ...heterogeneous services, ...IP datacasting...multi-mode/reconfigurable devices...”



Connecting everything with everything!

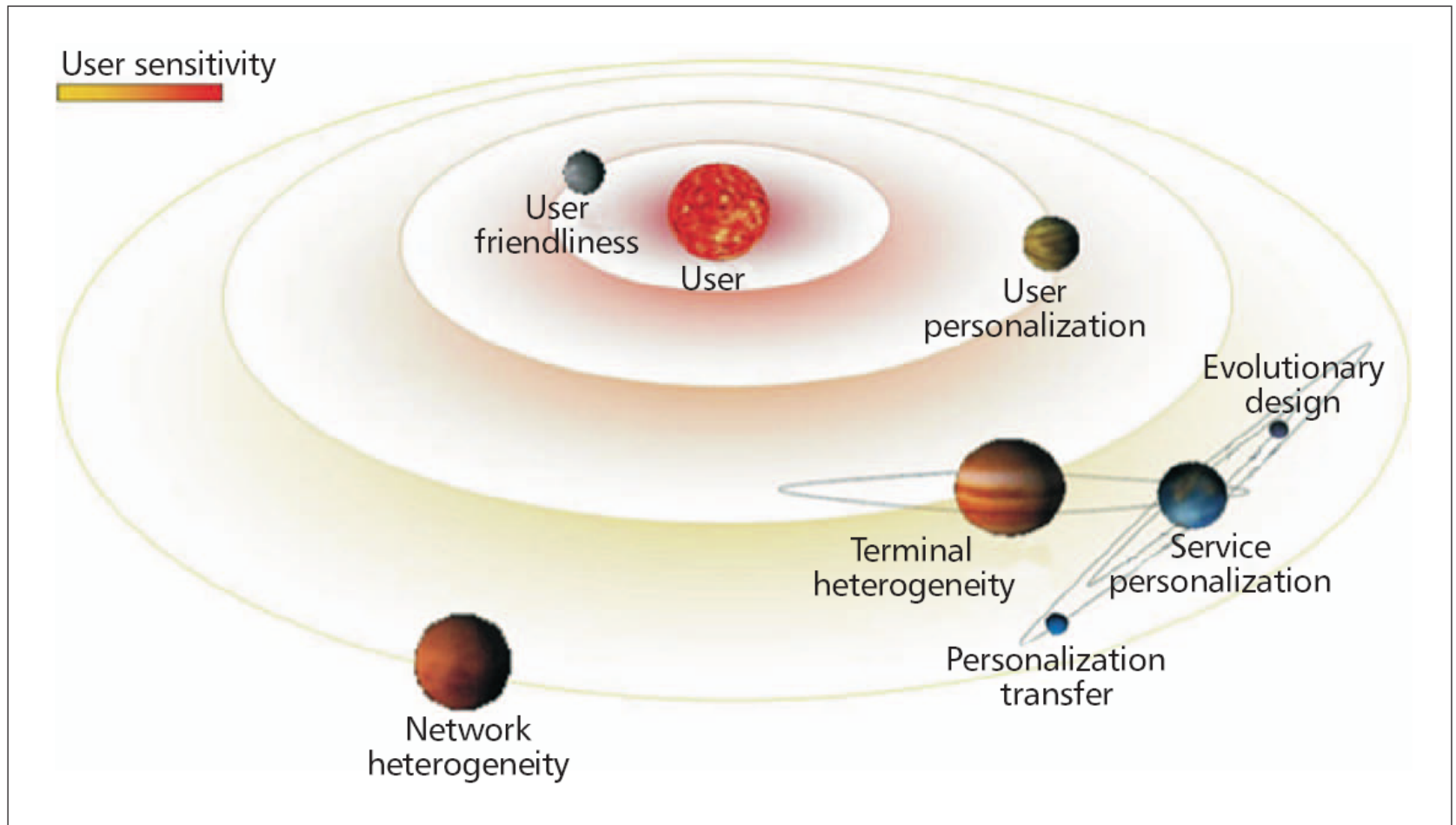


User-centric Model

- Fulfilling users' expectations
 - Failure of WAP
- Understanding users' needs
 - User behavior <-change-> product
- Considering cultural and societal differences
 - Interplay between individuals, society and communications technologies

Co-evolution of society and technology!

User-centric System



4G Service Design Rules

- Coverage
 - Convergence platform
- Bandwidth
 - Resource sharing
- Battery consumption
 - Short-range communications
- Service based on (time, place, terminal, cost, user)

**Cooperative
Communications**

**BETTER services at
LOWER prices!**

4G Services Proposed

- Enhanced Services
- Cooperative Services
- Personalization Transfer Service
- Mobile Relaying Services
- IP Datacasting Services

Enhanced Services

- Security enhancement
- Cost down
 - Unlicensed band exploitation
- Power saving

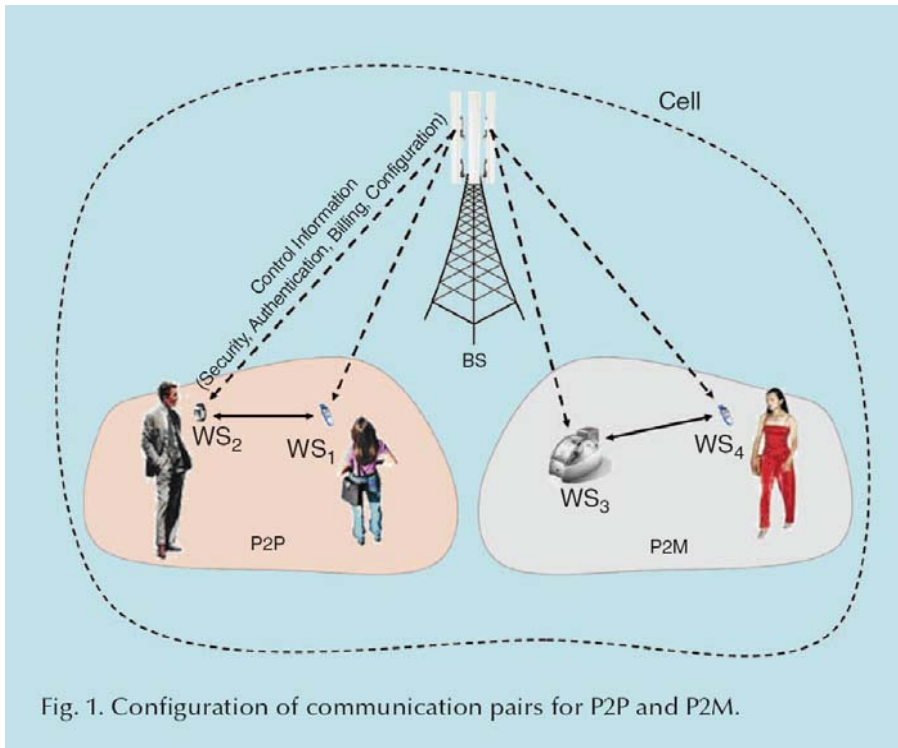


Fig. 1. Configuration of communication pairs for P2P and P2M.

BS: Base Station;
WS: Wireless Station;
P2P: Person-to-Person;
P2M: Person-to-Machine;

Cooperative Services

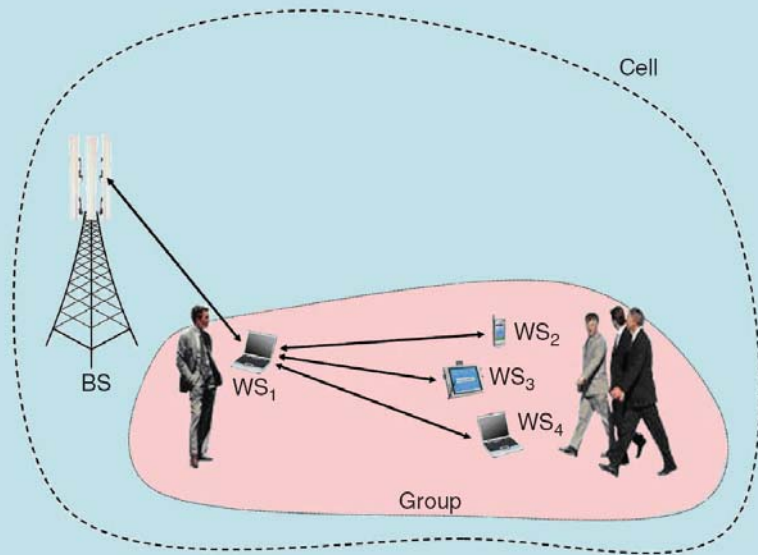


Fig. 2. Gateway functionality.

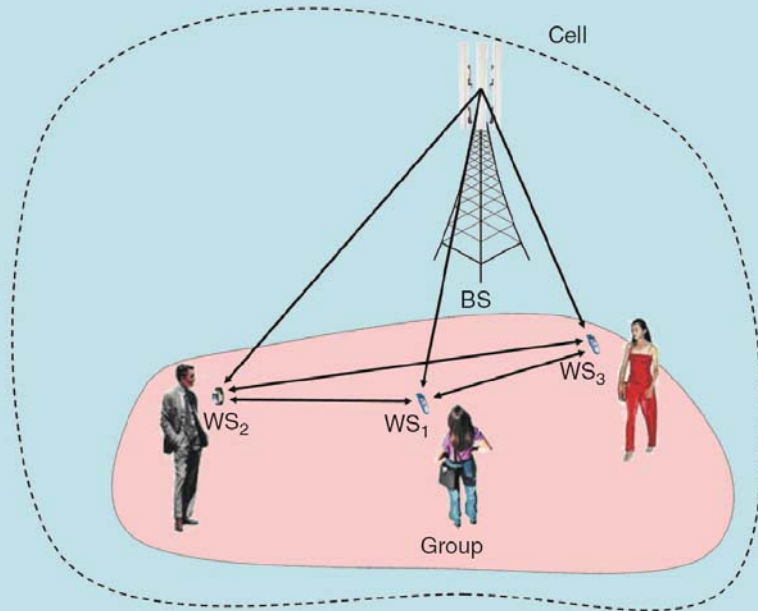


Fig. 3. Cooperative service support by customer diversity.

- Cost down
 - Resource sharing
 - Wireless gateway
- Power Saving

Cooperative Services

- Cell capacity enhancement
 - Local retransmission
 - Higher modulation

- (Retransmission scheduling)
 - Network Coding
- (Cluster establishment)
- (Relaying node deployment)

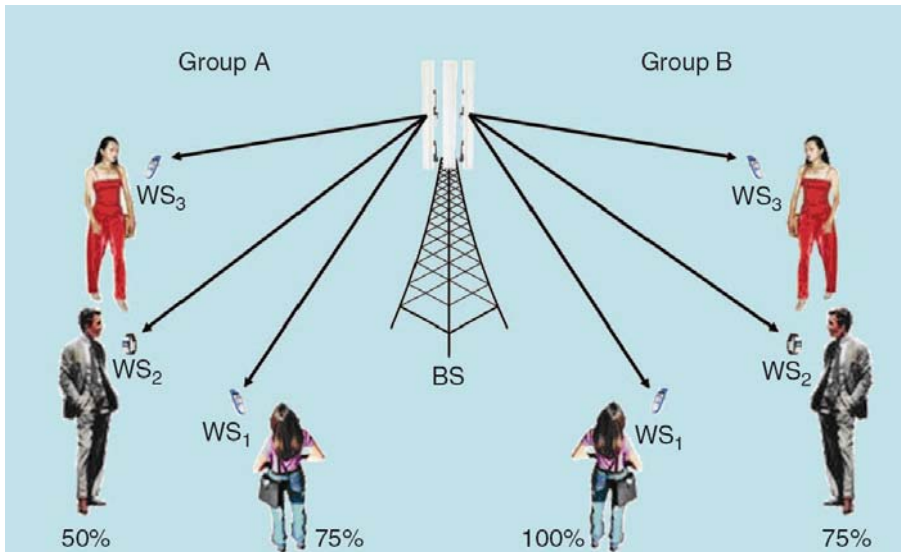


Fig. 4. Example of percentage of data correctly received.

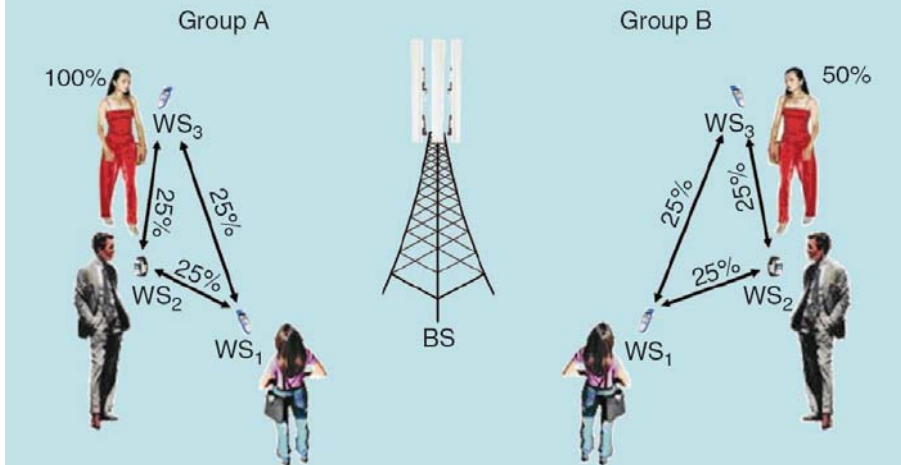
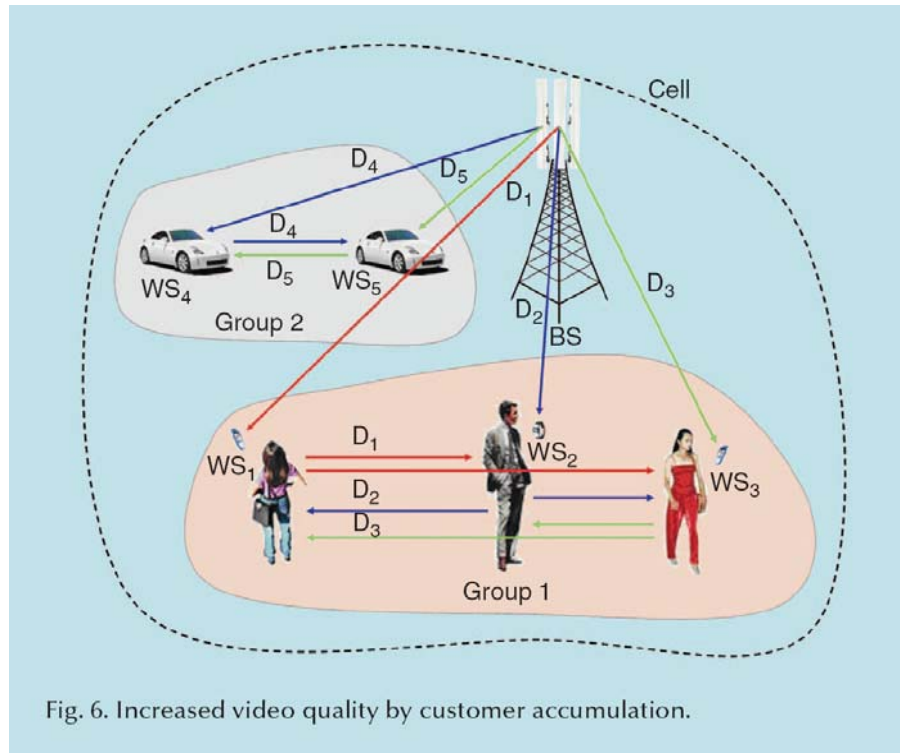


Fig. 5. Example of triangular retransmission.

Cooperative Services

- QoS enhancement (Multiple Description Coding)



Personalization Transfer Service

- Service personalization
– > PTS
- Adaptive QoS
– MDC
- Cost sharing

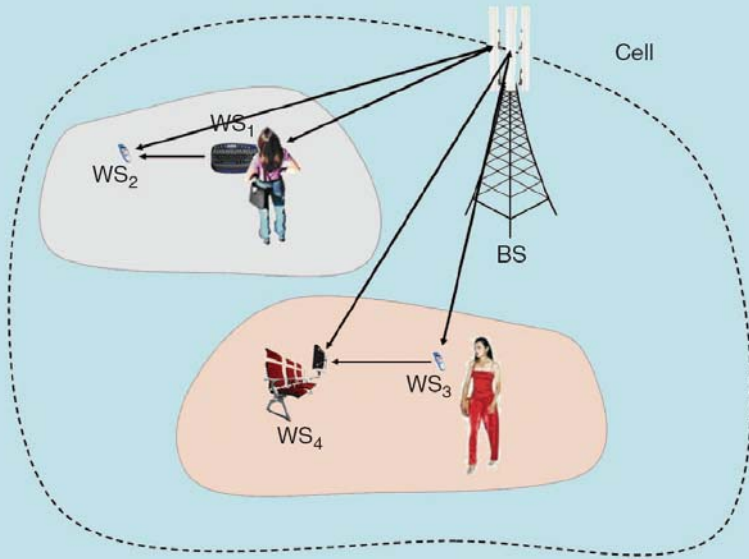


Fig. 7. Personalization transfer.

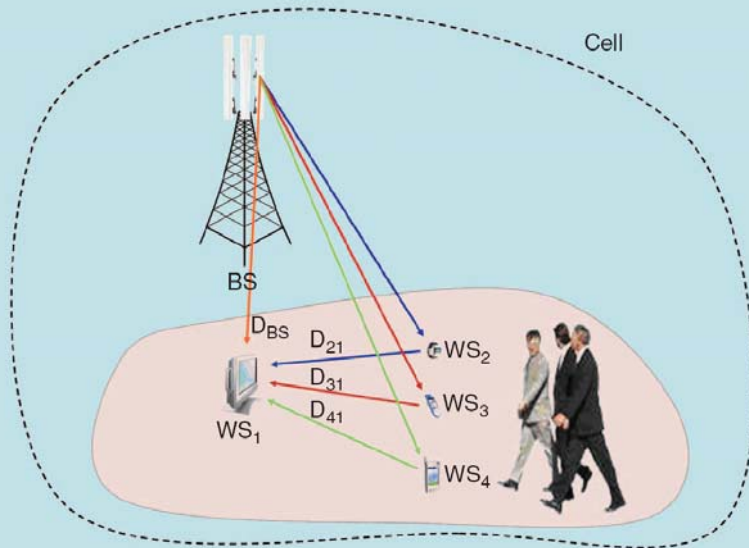
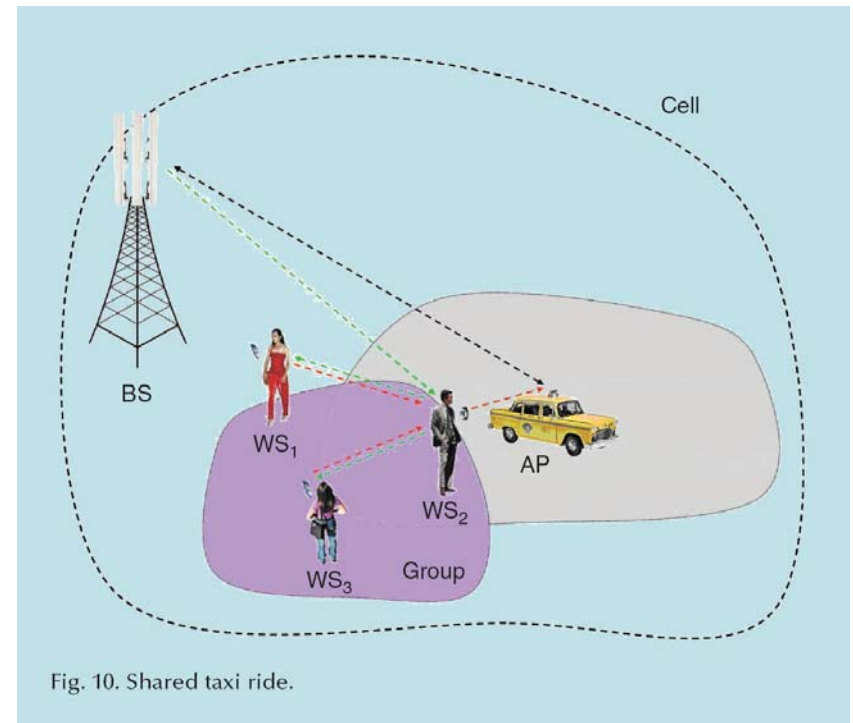
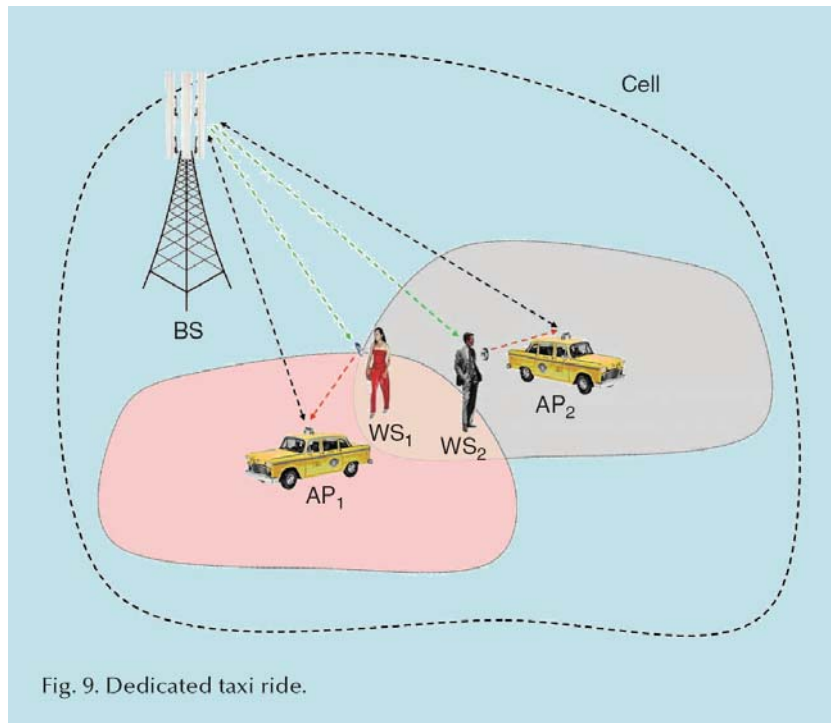


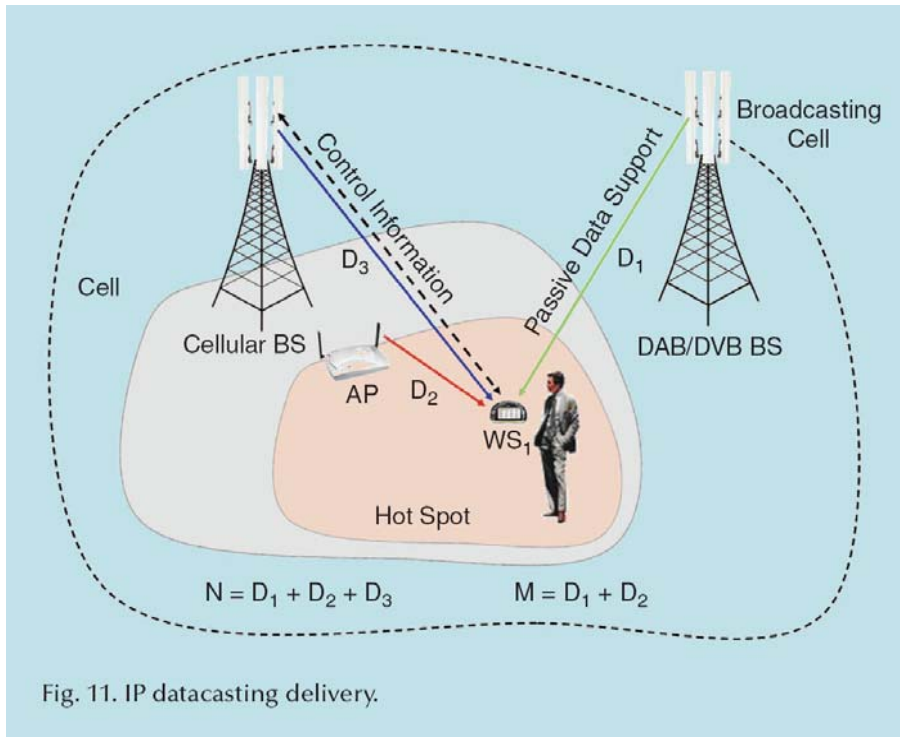
Fig. 8. Multicast personalization transfer.

Mobile Relaying Services

- Dedicated Taxi Ride
- Shared Taxi Ride
 - (Course planning)



IP Datacasting



- (News, advertisements, cinemas, transport schedules, horoscopes, sport results, ...)
- Device-to-user
- User-to-device
- Exploitation of all available networks

Challenges

Mobile station	
Multimode user terminals	To design a single user terminal that can operate in different wireless networks, and overcome the design problems such as limitations in device size, cost, power consumption, and backward compatibilities to systems.
Wireless system discovery	To discover available wireless systems by processing the signals sent from different wireless systems (with different access protocols and incompatible with each other).
Wireless system selection	Every wireless system has its unique characteristic and role. The proliferation of wireless technologies complicates the selection of the most suitable technology for a particular service at a particular time and place.

Challenges & Proposed Solutions

System	
Terminal mobility	To locate and update the locations of the terminals in various systems. Also, to perform horizontal and vertical handoff as required with minimum handover latency and packet loss.
Network infrastructure and QoS support	To integrate the existing non-IP-based and IP-based systems, and to provide QoS guarantee for end-to-end services that involves different systems.
Security	The heterogeneity of wireless networks complicates the security issue. Dynamic reconfigurable, adaptive, and lightweight security mechanisms should be developed.
Fault tolerance and survivability	To minimize the failures and their potential impacts in any level of tree-like topology in wireless networks.

Challenges & Proposed Solutions

Service	
Multi-operators and billing system	To collect, manage, and store the customers' accounting information from multiple service providers. Also, to bill the customers with simple but detailed information.
Personal mobility	To provide seamless personal mobility to users without modifying the existing servers in heterogeneous systems.

Conclusion

- Socio-technical development approaches for 4G wireless services
- Trust and security
- Cooperation and sharing
- Personalization
- Communicative autonomy