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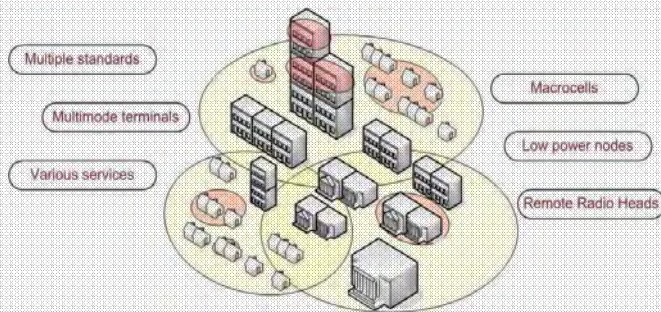
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Radio Resource Management in Heterogeneous Networks

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Network Heterogeneity



Advantages

- Flexible architecture, cost efficient deployment
- Better performance as a whole in comparison to a set of separated networks
- Increased network coverage and capacity
- High network reconfigurability (cell topology, user mobility, radio environment and traffic patterns)
- Ubiquity, connectivity anywhere, anytime from any kind of device
- Seamless switching between the Radio Access Networks (RATs) according to the user preferences, like service cost or network parameters

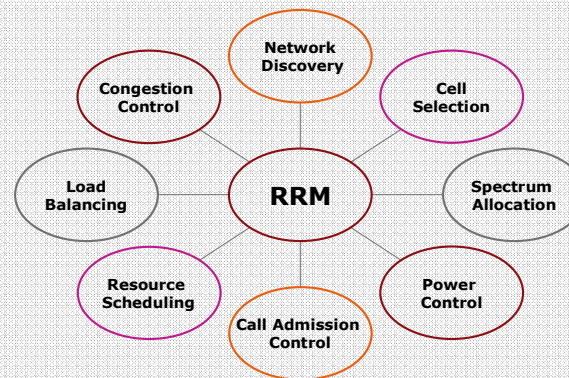
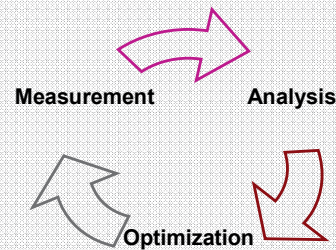
Challenges

- Multiple standards, highly diversified users and their resource demands
- High Quality of Service (QoS) for multimedia applications, especially during a handover
- Better utilization of scarce radio resources
- User mobility, seamless handover between the standards
- Access network detection and selection
- Reliable, fast and efficient signaling
- Authentication and accounting

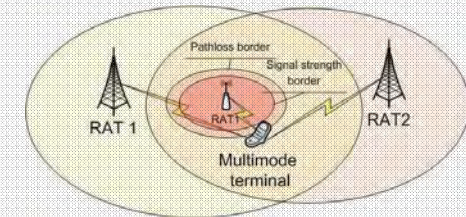
Radio Resource Management

Functionalities

- Responsible for efficient utilization of the radio resources in a coordinated manner
- Ensures planned coverage for each service and required connection quality
- Optimizes the system usage
- Joint RRM systems designed to carry coordinated management of multistandard heterogeneous networks, functionalities depend on the level of coupling between different networks



Cell Selection



Classic Approach

- Connection to the cell offering the highest received power

Challenges and Example Solutions

- Small cells with low power nodes experience interference from a macrocell
 - Range Expansion and InterCell Interference Coordination (ICIC) schemes
- More factors should be taken into account while selecting a cell, e.g. QoS_i required by a terminal t_i , its speed (V_i), cell type (k_j), handover constraints h_i and user preference p_i
 - Better utility value definition

$$u_{ij} = f(QoS_i, V_i, SNR_{ij}, k_j, h_i, \dots, p_i)$$

- Integer Programming (IP) used to model and optimize the problem
- Heuristics to solve it in the real-time

Benefits

- Better Quality of Experience (QoE) for the users
- Improved network load balancing (non uniform traffic distribution)

