

**RRM**

# **Mobile Radio Networks**

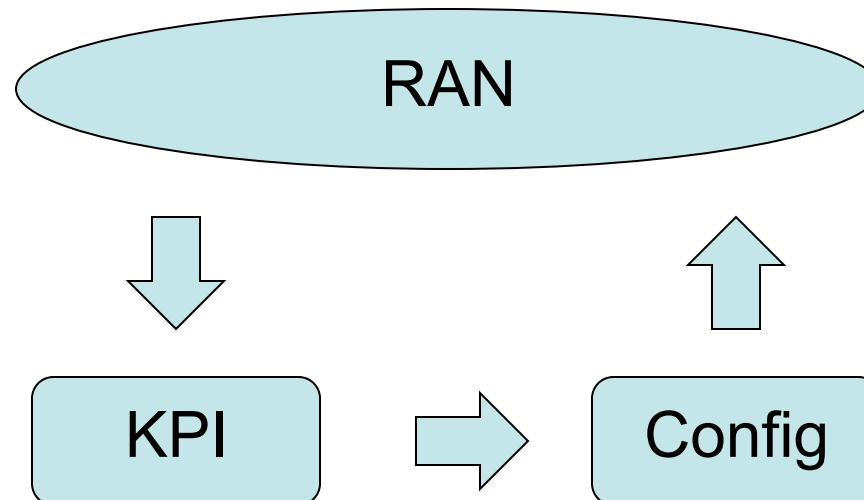
## **Radio Resource Management in Area Coverage Networks**

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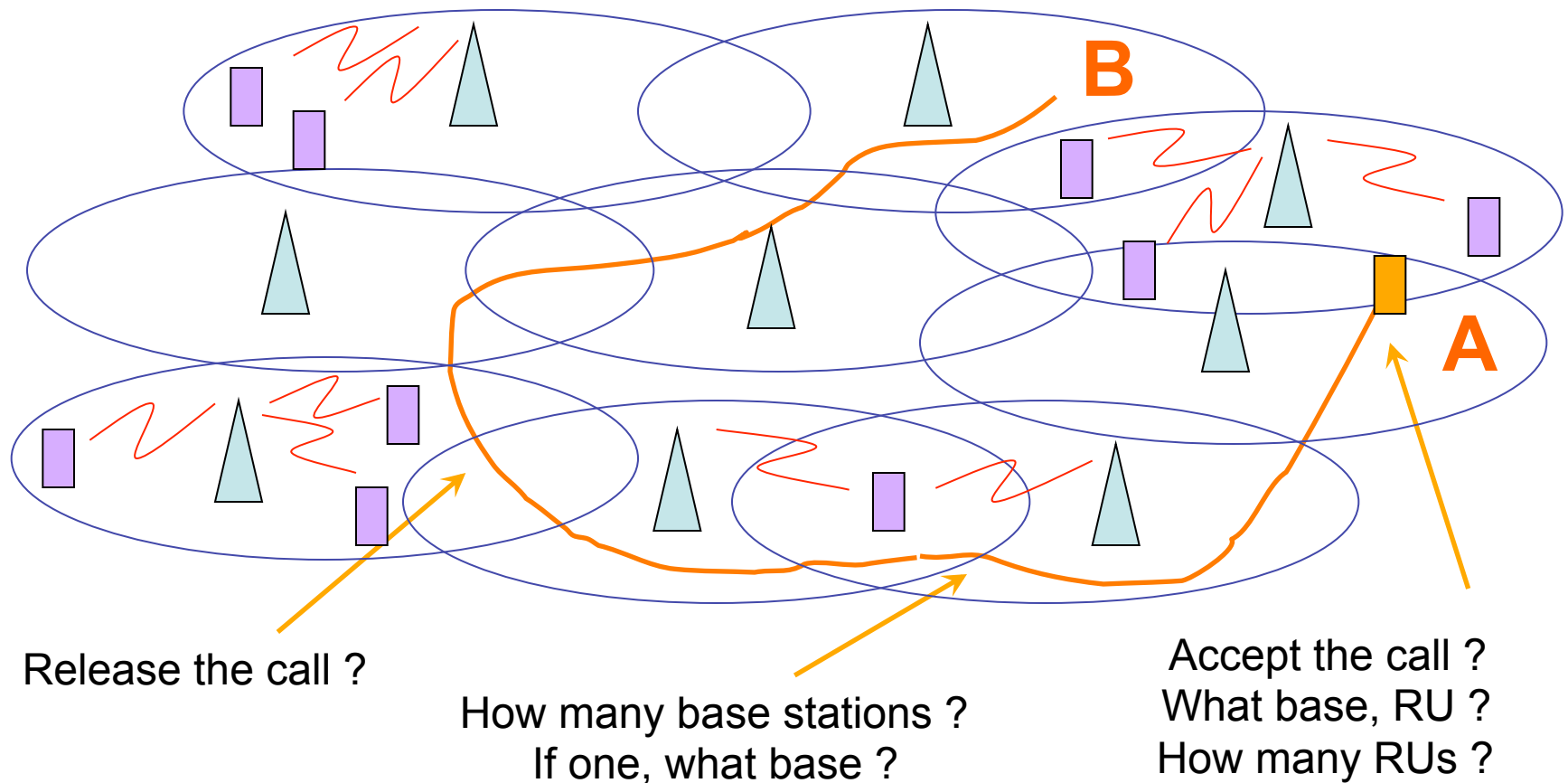
# Radio Resource Management

RRM techniques aim at **optimising** the exploitation of radio resources while fulfilling the **quality** requirements of the **largest** possible number of users



# Radio Resource Management

## Decisions to be taken by the RRM entities (C.S. Services)



# Radio Resource Management

## Decisions to be taken by the RRM entities (C.S. Services)

### At call set up:

Admission control	(whether to accept a new call)
Initial base station assignment	(what base)
Initial channel assignment	(what RU)
Initial bandwidth assignment	(how many RUs)

### During the call:

Power control	(what power)
Base re-assignment	(what base)
Re-assignment of the number of bases	(how many bases)
Channel re-assignment	(what RU)
Bandwidth re-assignment	(how many RUs)
Call release	(whether to release a call)

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# Radio Resource Management

## Decisions to be taken by the RRM entities (P.S. Services)

### At Packet Data Transfer (PDT) set up:

Admission control	(whether to accept a new PDT)
Initial base station assignment	(what base)
Initial channel assignment	(what RU)
Initial bandwidth assignment	(how many RUs)

### During the PDT:

Power control	(what power)
Base re-assignment	(what base)
Re-assignment of the number of bases	(how many bases)
Channel re-assignment	(what RU)
Bandwidth re-assignment	(how many RUs)
Call release	(whether to release a PDT)

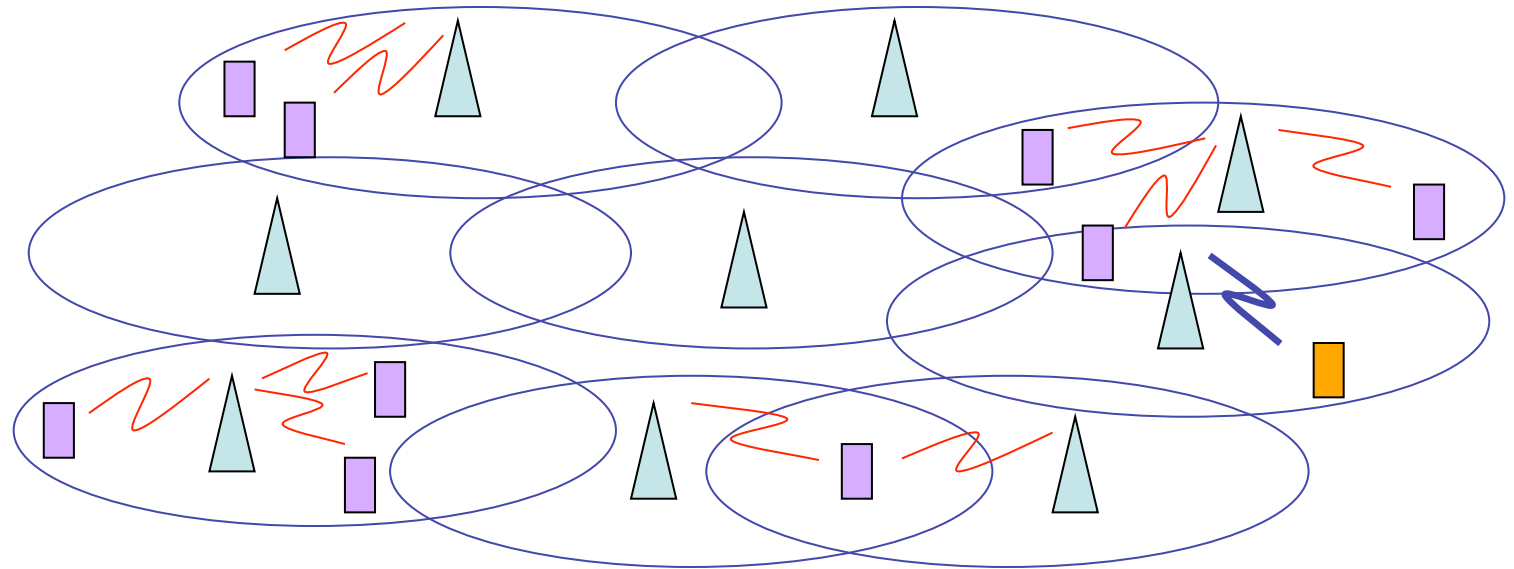
# Radio Resource Management

**Admission Control**

**The process of determining whether a service request can be admitted to the system**

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# Radio Resource Management: Admission Control



**The call could be rejected for reasons related to capacity, or interference levels**

Networks planned with reference to worst case (hard capacity):  
Admission Control is normally absent (e.g. 2G, 4G)

# Radio Resource Management

## Admission Control

The process of determining whether a service request can be admitted to the system

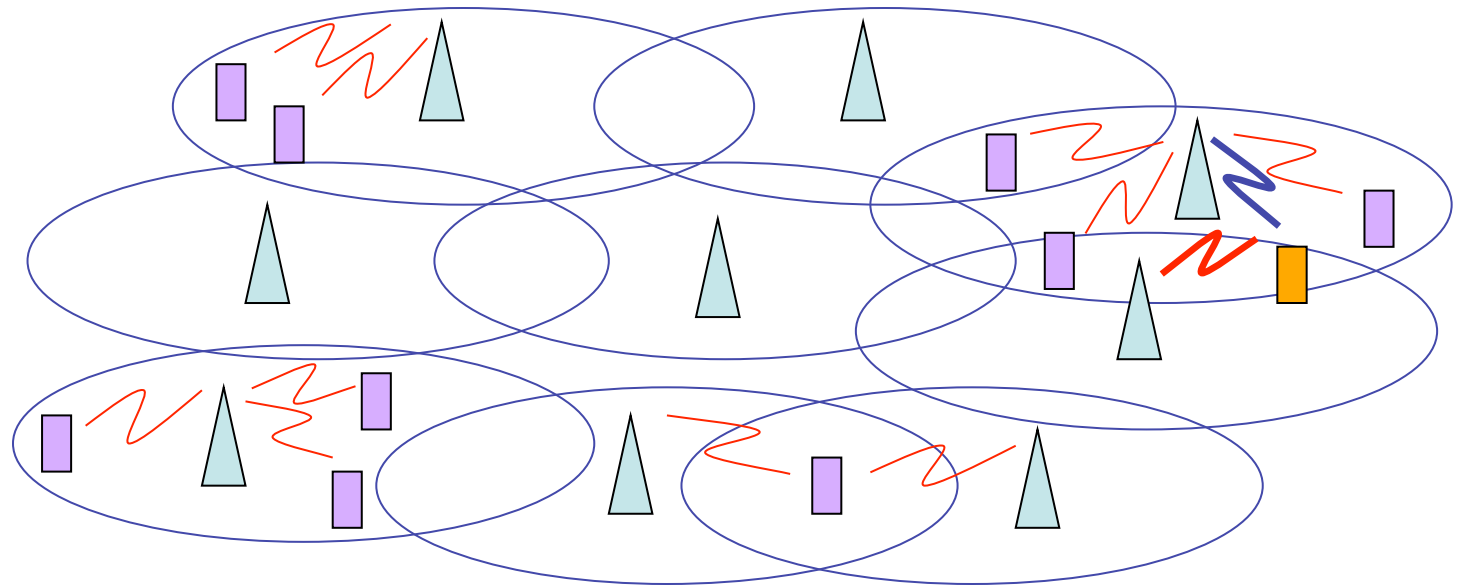
## Directed Retry

The process of re-directing a new user toward a base station different from the one providing the best link budget

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# Radio Resource Management: Directed Retry



**If one base cannot provide service, the call request is re-directed toward a different base (if within range).**

Networks planned with reference to worst-case:

Directed Retry is normally present (e.g. GSM)

# Radio Resource Management

## Admission Control

The process of determining whether a service request can be admitted to the system

## Directed Retry

The process of re-directing a new user toward a base station different from the one providing best link budget

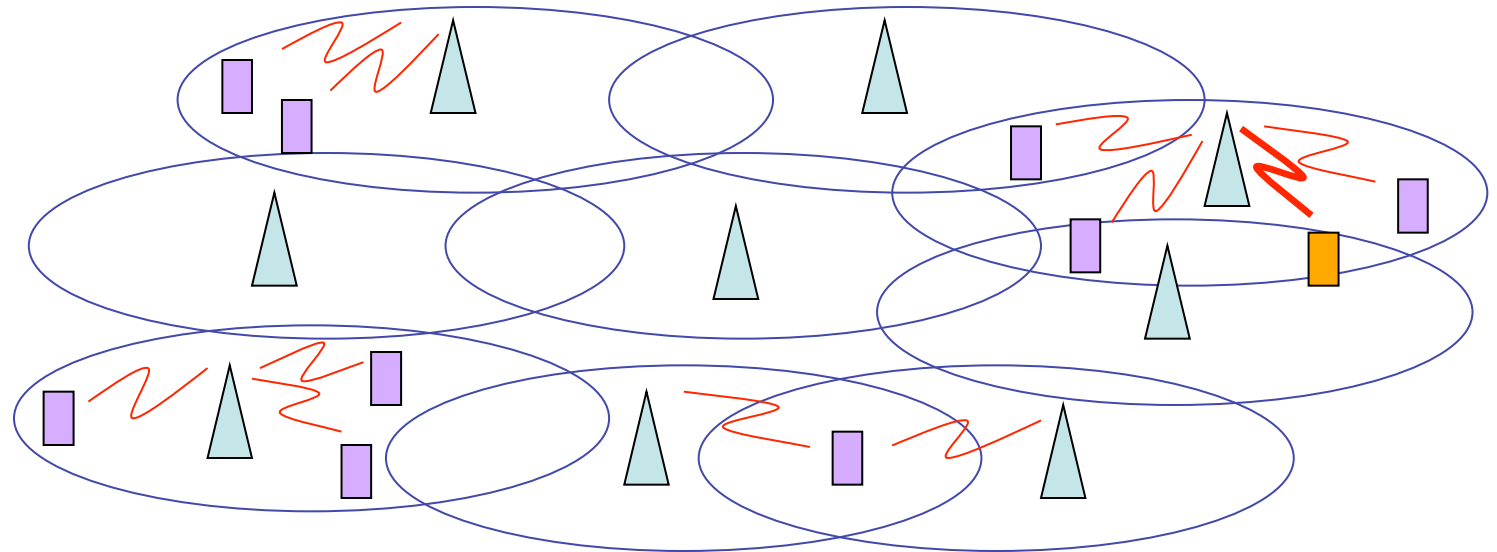
## Channel Assignment

The process of choosing the RU (and its number) to be allocated to the user

### Distinction:

- 1) assignment of RUs to the cells (Channel Allocation)
  - 2) assignment of RUs to the users within cells (Ch. Assignment)
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# Radio Resource Management: Channel Allocation



## Channel Allocation Techniques

**Fixed (FCA):** a predefined (sub-)set of channels is assigned to a base; the channel to be allocated to the user is selected among these pre-assigned channels

**Dynamic (DCA):** channels are in a pool, and can be selected by every base for each link

**Hybrid (HCA):** part of channels are allocated via FCA, part via DCA

## Channel Assignment Techniques

Normally based on measurements performed on the field. **Scheduling.**

# Radio Resource Management

<b>Admission Control</b>	The process of determining whether a service request can be admitted to the system
<b>Directed Retry</b>	The process of re-directing a new user toward a base station different from the one providing best link budget
<b>Channel Allocation</b>	The process of choosing the channel (and the number of RUs) to be allocated to the user
<b>Power Control</b>	The process of setting the transmission power level
<b>Distinction:</b>	<b>fast PC and slow PC</b>

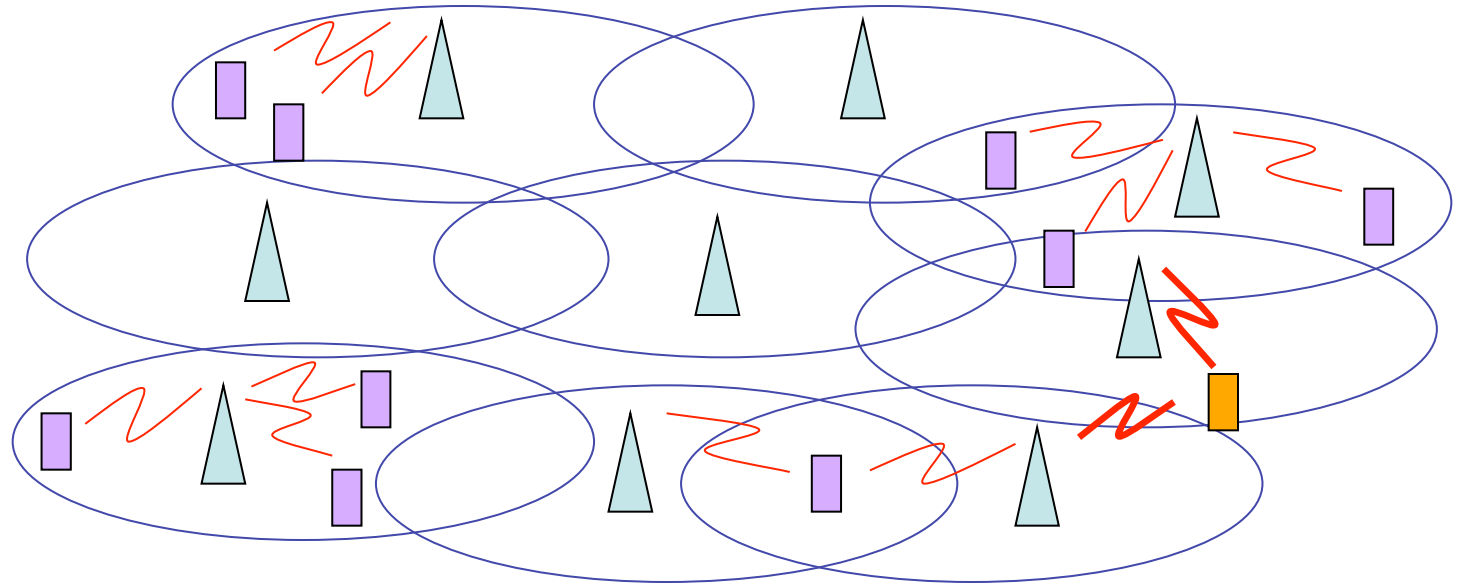
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# Radio Resource Management

Admission Control	The process of determining whether a service request can be admitted to the system
Directed Retry	The process of re-directing a new user toward a base station different from the one providing best link budget
Channel Allocation	The process of choosing the channel (and the number of RUs) to be allocated to the user
Power Control	The process of setting the transmission power level
<b>Hard Handover</b>	<b>The process of changing serving base</b>

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# Radio Resource Management: Hard Handover



**One base station at a time (BBM - Break Before Make)**

Not seamless

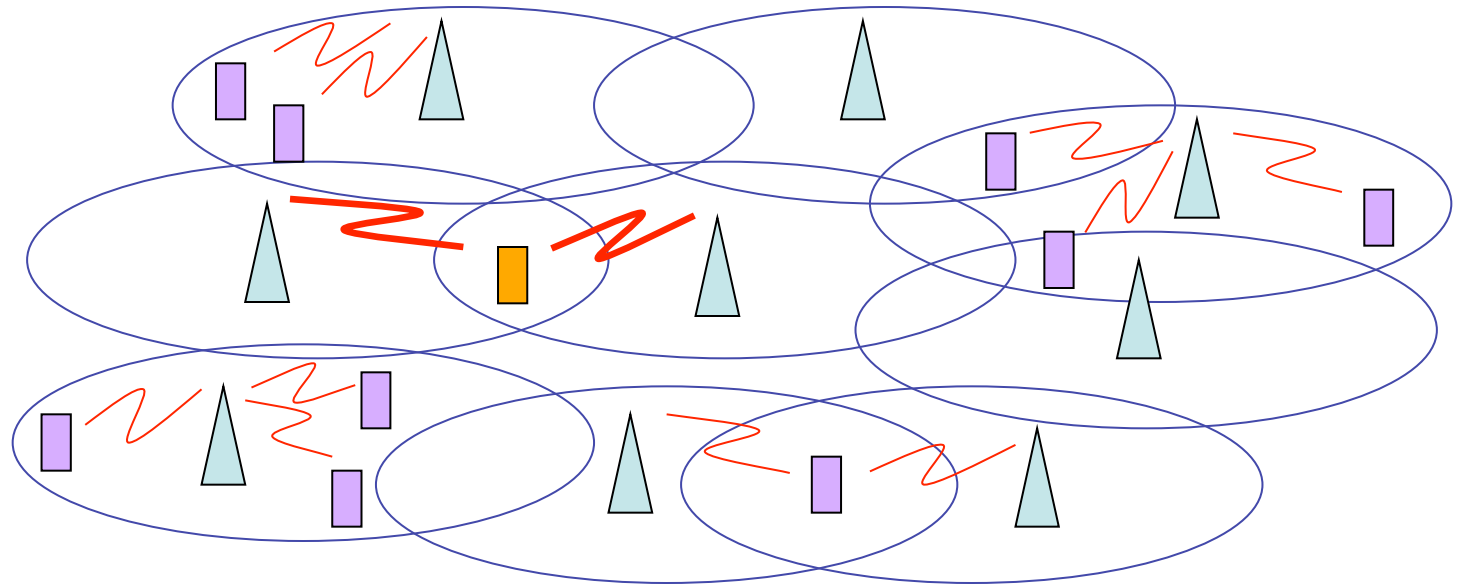
Can have a serious impact on the signalling channels

# Radio Resource Management

Admission Control	The process of determining whether a service request can be admitted to the system
Directed Retry	The process of re-directing a new user toward a base station different from the one providing best link budget
Channel Allocation	The process of choosing the channel (and the number of RUs) to be allocated to the user
Power Control	The process of setting the transmission power level
Hard Handover	The process of changing serving base and/or channel
<b>Soft/Softer Handover</b>	<b>The process of modifying the set of serving bases</b>

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# Radio Resource Management: Soft Handover



**More than one base station at a time (MBB - Make Before Break)**

Seamless Service

Macrodiversity: reduced shadowing margin

Microdiversity: MR Combining (downlink) or S Combining (uplink)

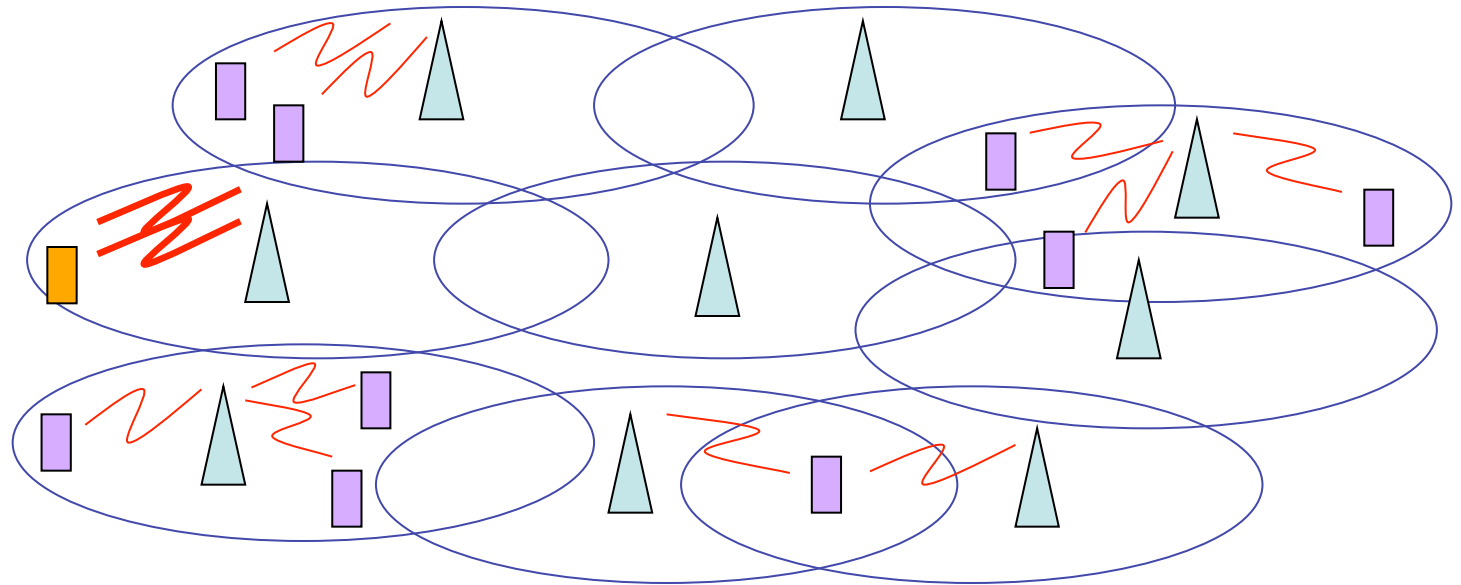
Can have a serious impact on the network capacity

**Active set**

The set of  
serving base stations



# Radio Resource Management: Softer Handover



**More than one base station within the same site at a time**

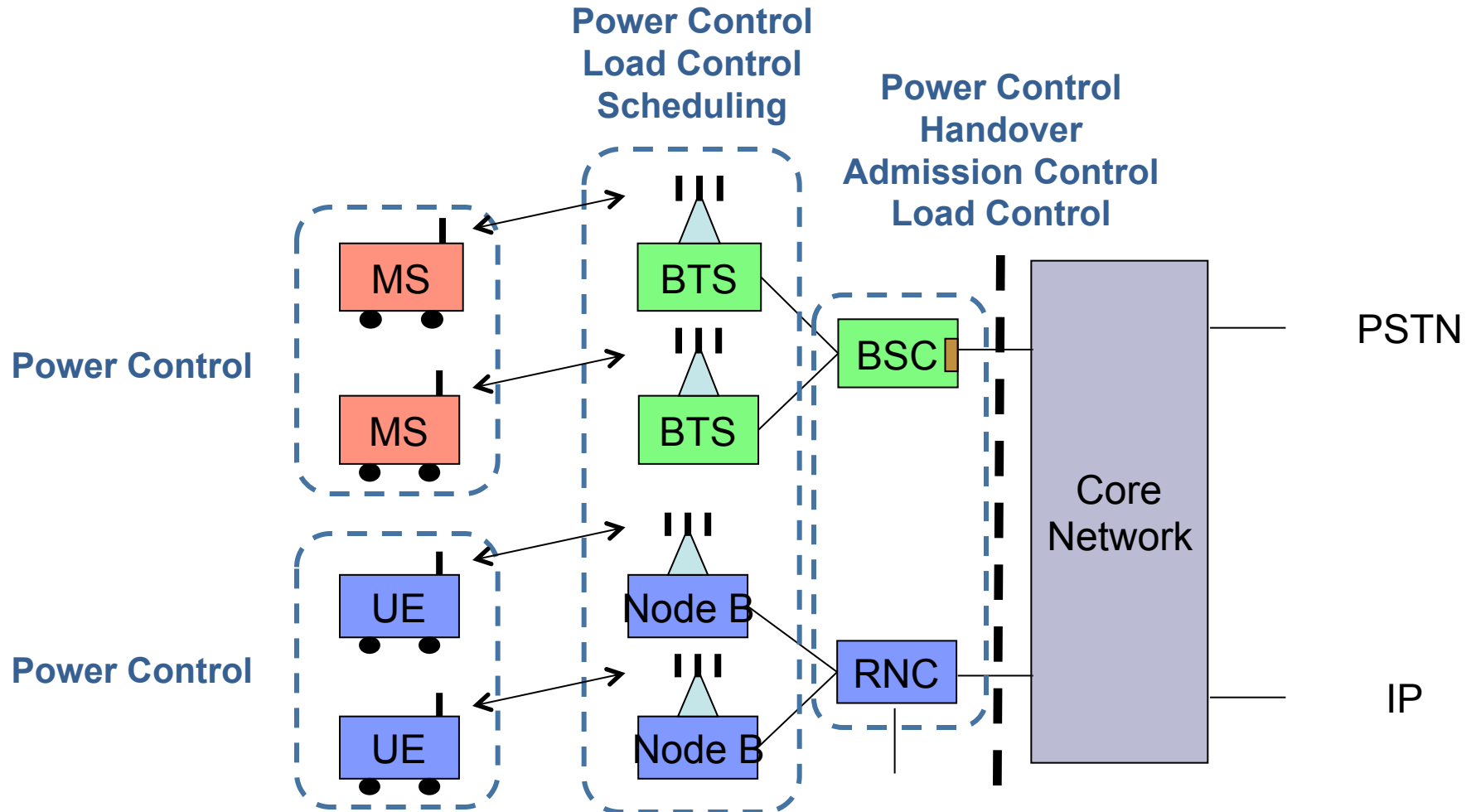
Maximal Ratio Combining both on uplink and downlink

# Radio Resource Management

<b>Admission Control</b>	The process of determining whether a service request can be admitted to the system
<b>Directed Retry</b>	The process of re-directing a new user toward a base station different from the one providing best link budget
<b>Channel Allocation</b>	The process of choosing the channel (and the number of RUs) to be allocated to the user
<b>Power Control</b>	The process of setting the transmission power level
<b>Hard Handover</b>	The process of changing serving base and/or channel
<b>Soft Handover</b>	The process of modifying the set of serving bases
<b>Load Control</b>	The process of controlling the load of the network

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# Mobile RAN Architecture: 2/3G



# Mobile RAN Architecture: LTE

