

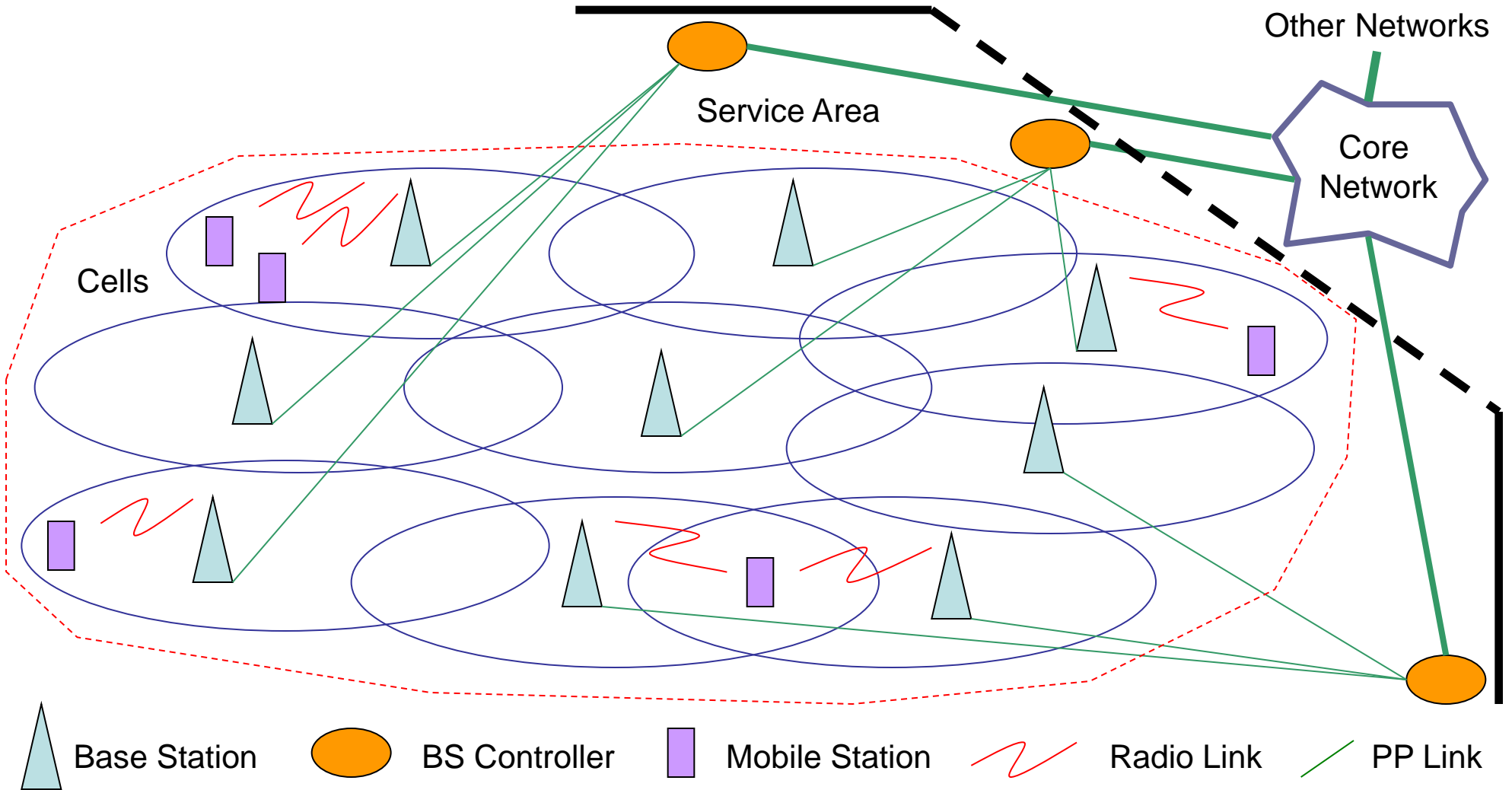
RRM

Radio Networks

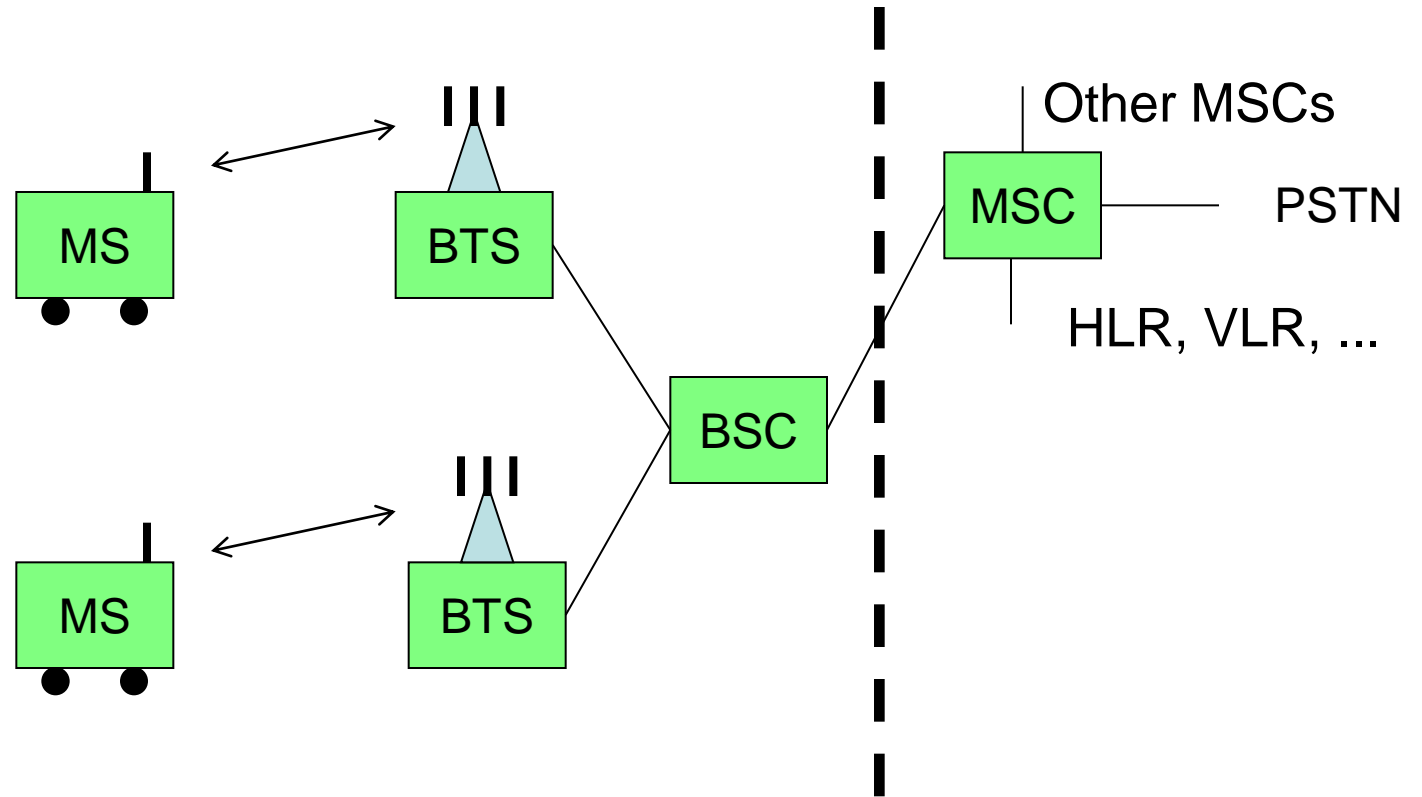
Radio Resource Management in Area Coverage Networks

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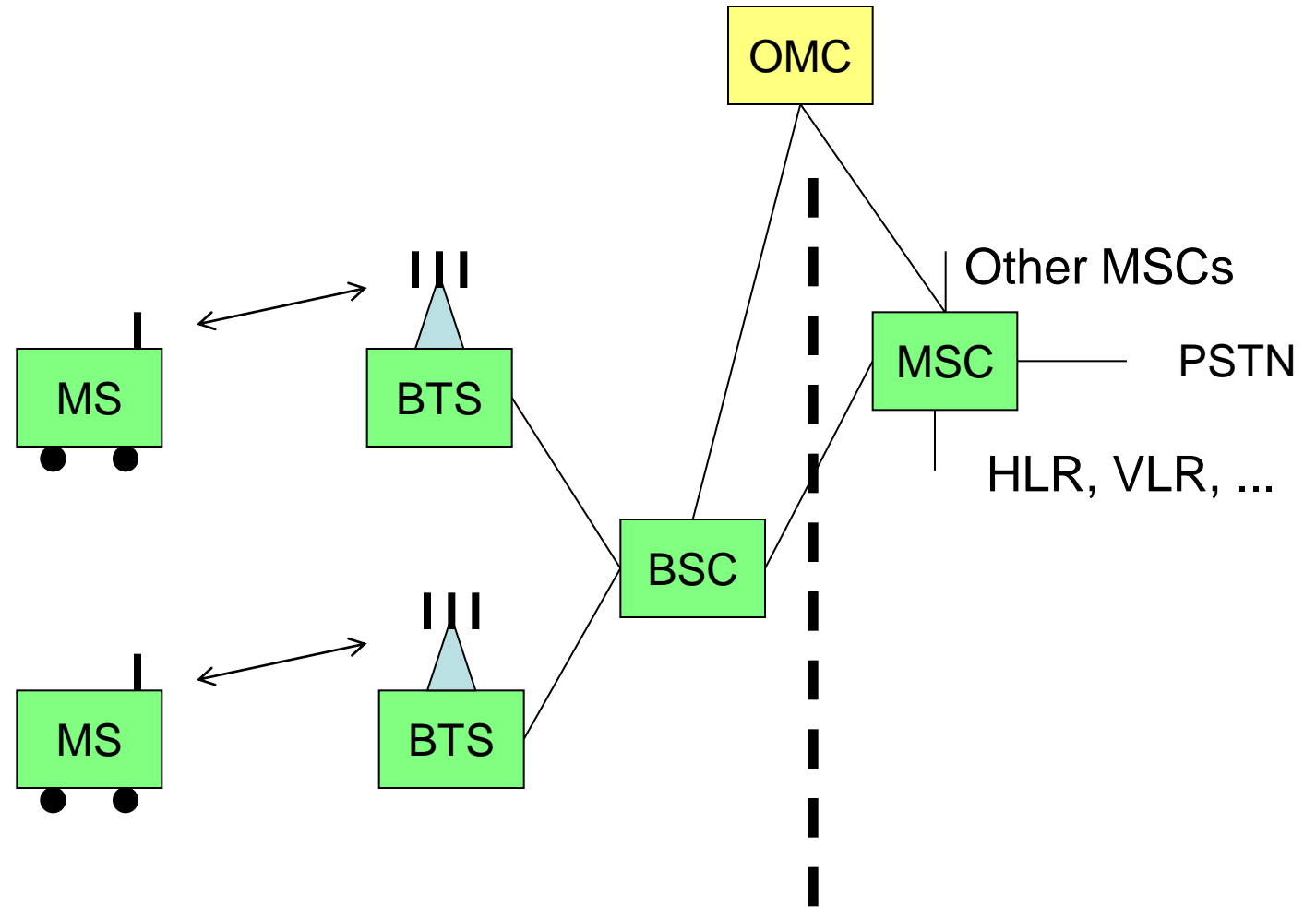
Mobile RAN Architecture: 2G



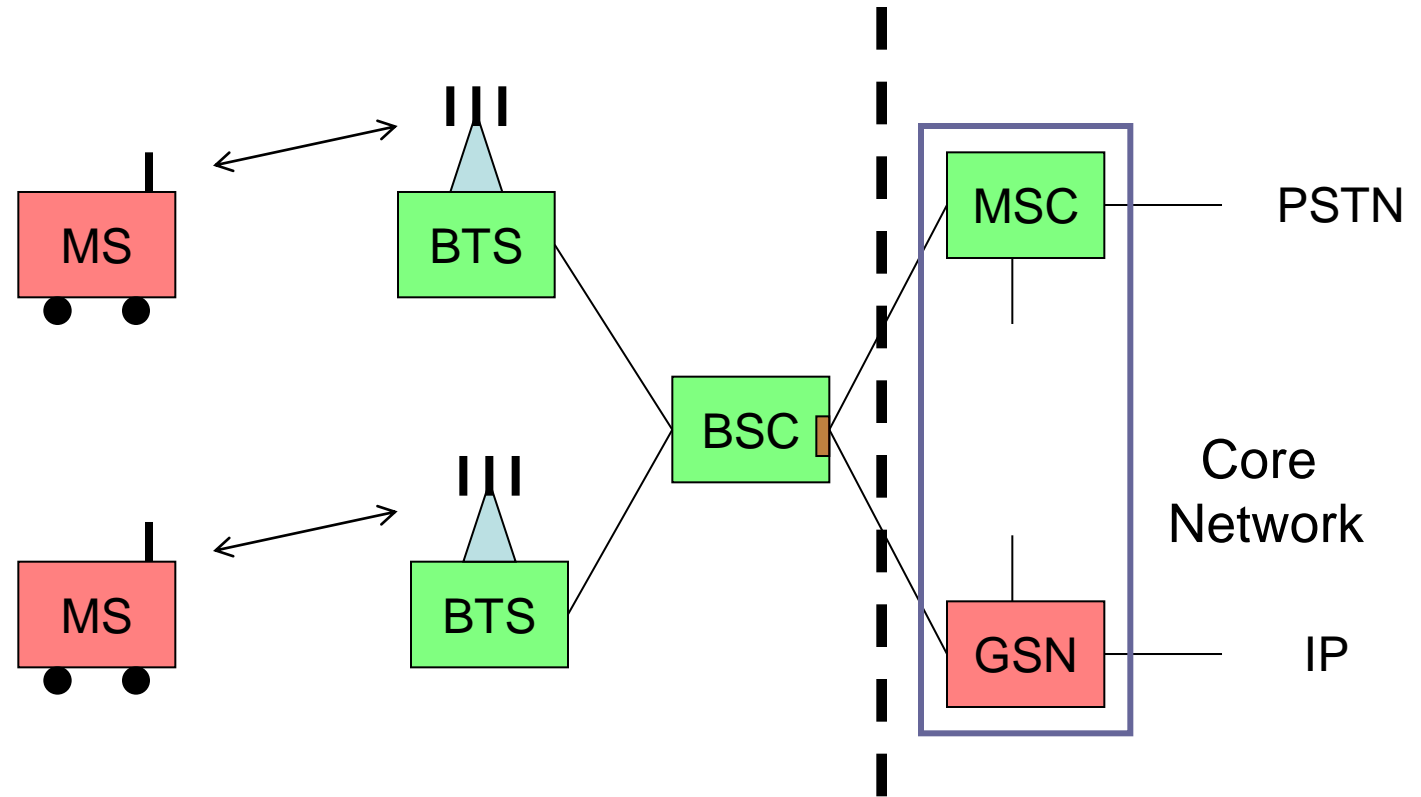
Mobile RAN Architecture: 2G



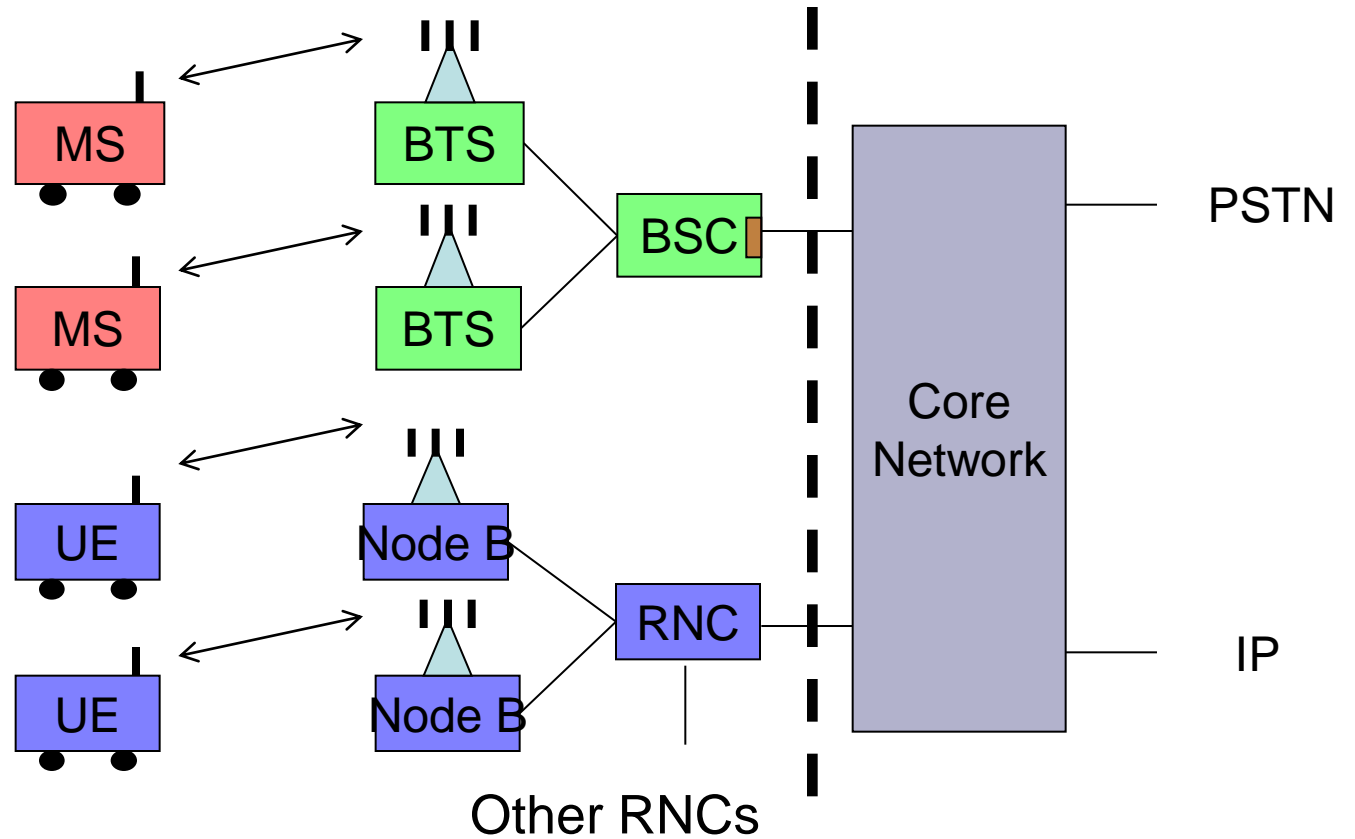
Mobile RAN Architecture: 2G



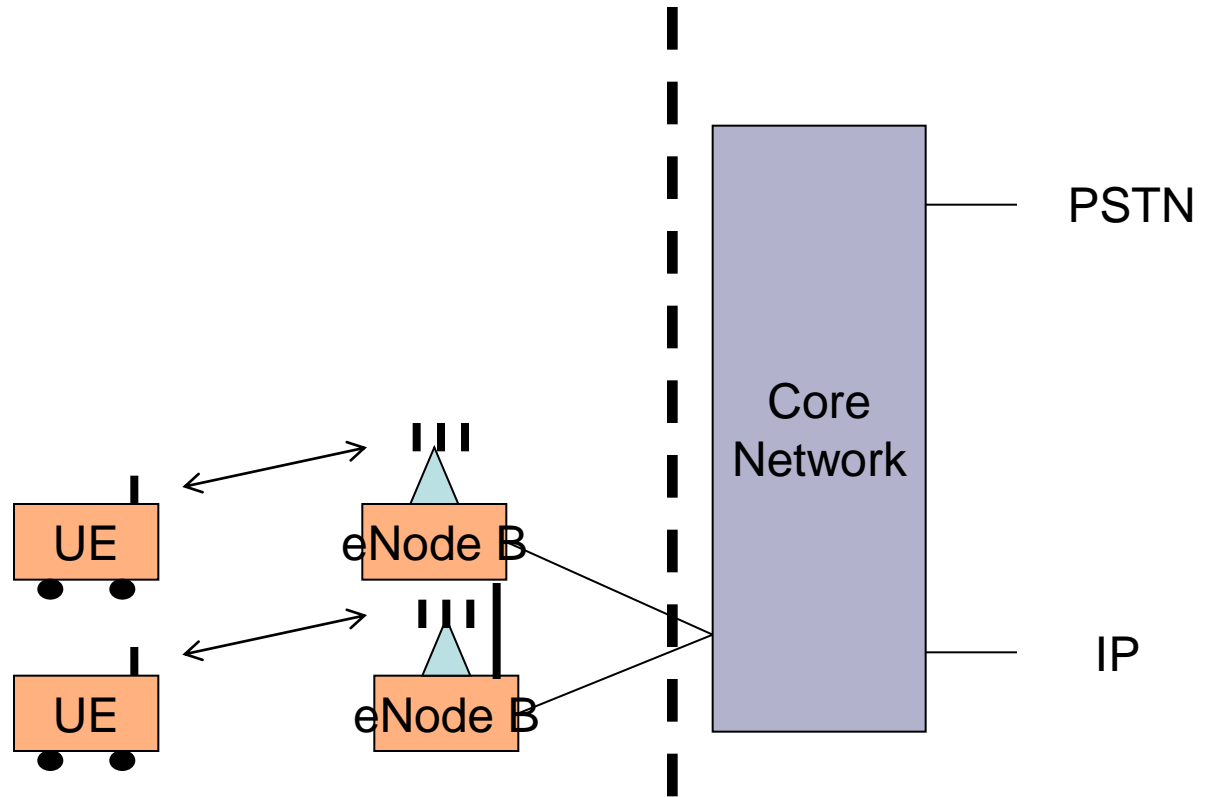
Mobile RAN Architecture: 2.5G



Mobile RAN Architecture: 2/3G



Mobile RAN Architecture: LTE

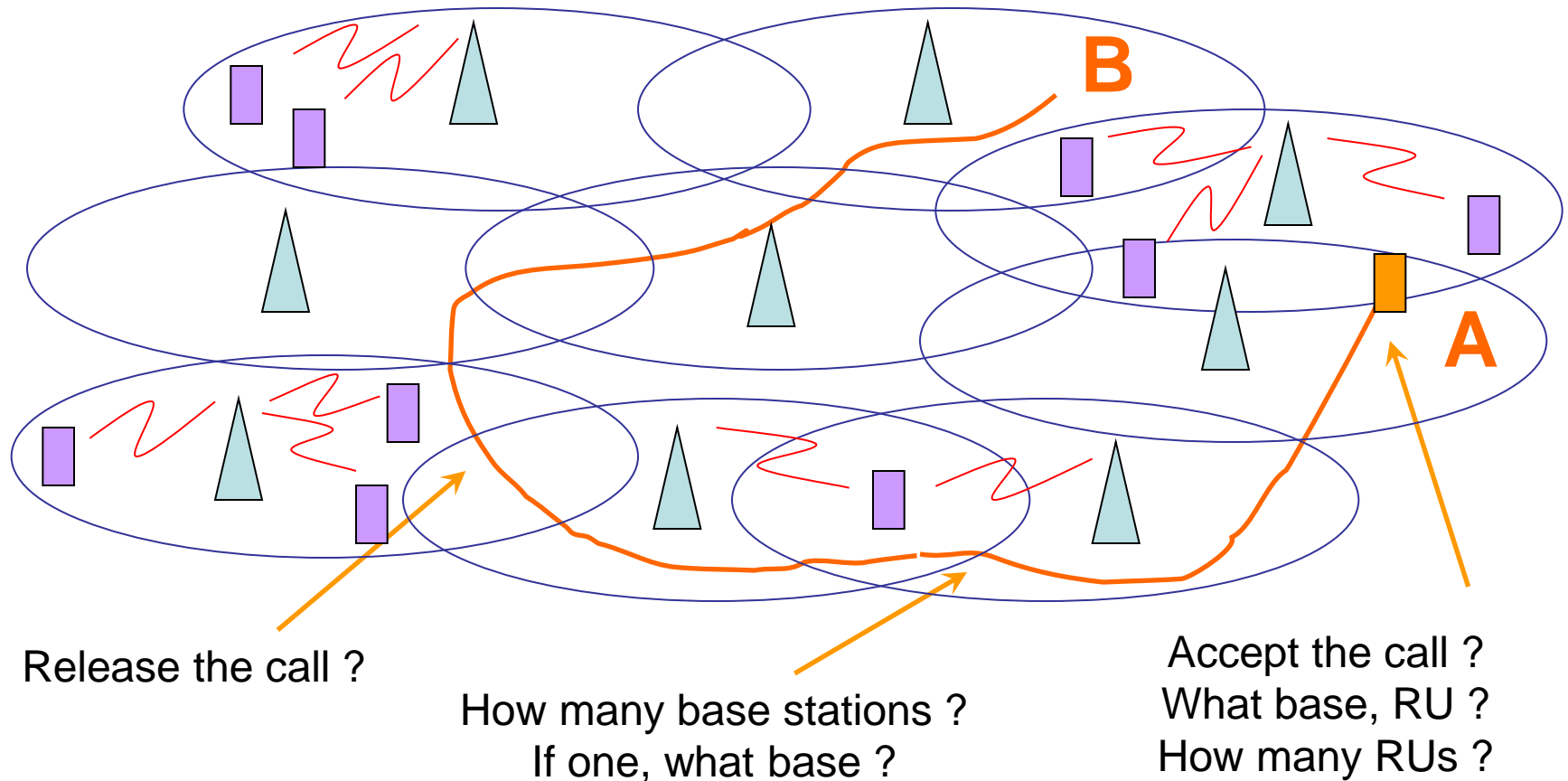


Radio Resource Management

**RRM techniques aim at optimising
the use 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)

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:

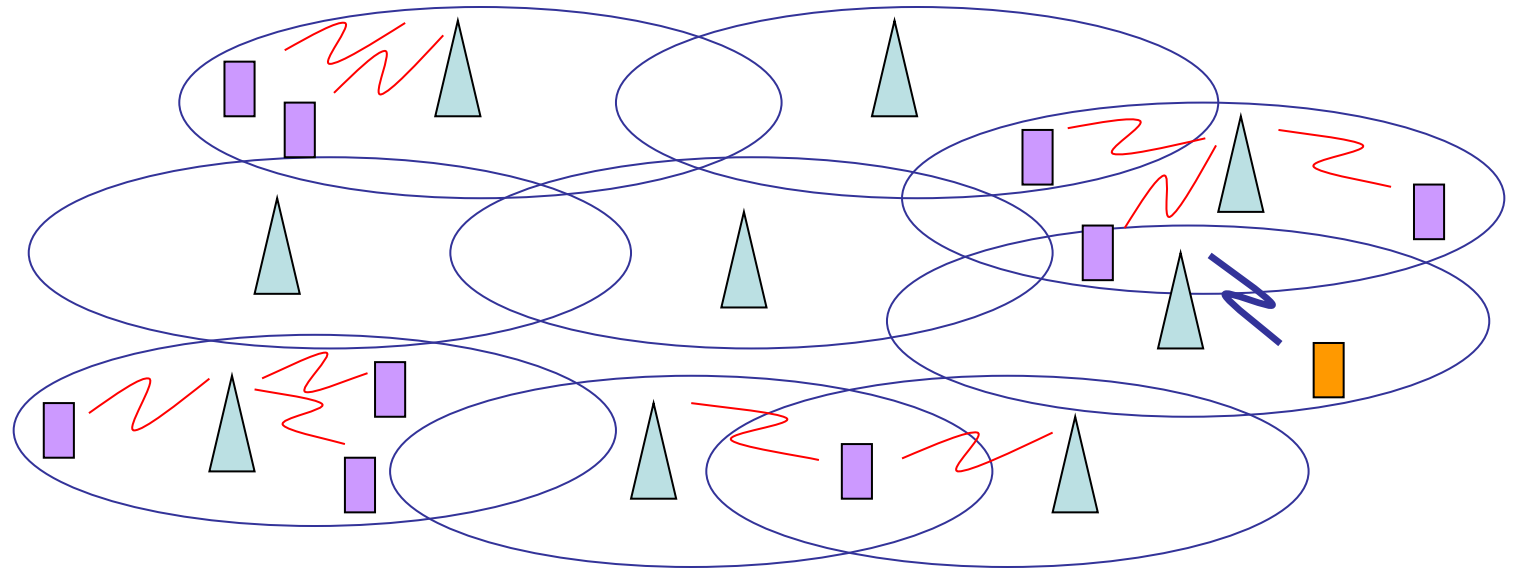
Power control	(what power)
Base re-assignment	(what base)
Re-assignment of the number of bases	(how many bases)
Channel re-assignment	(what RU)
Bandwidth re-assignment	(how many RUs)
Call release	(whether to release a PDT)

Radio Resource Management

Admission Control

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

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

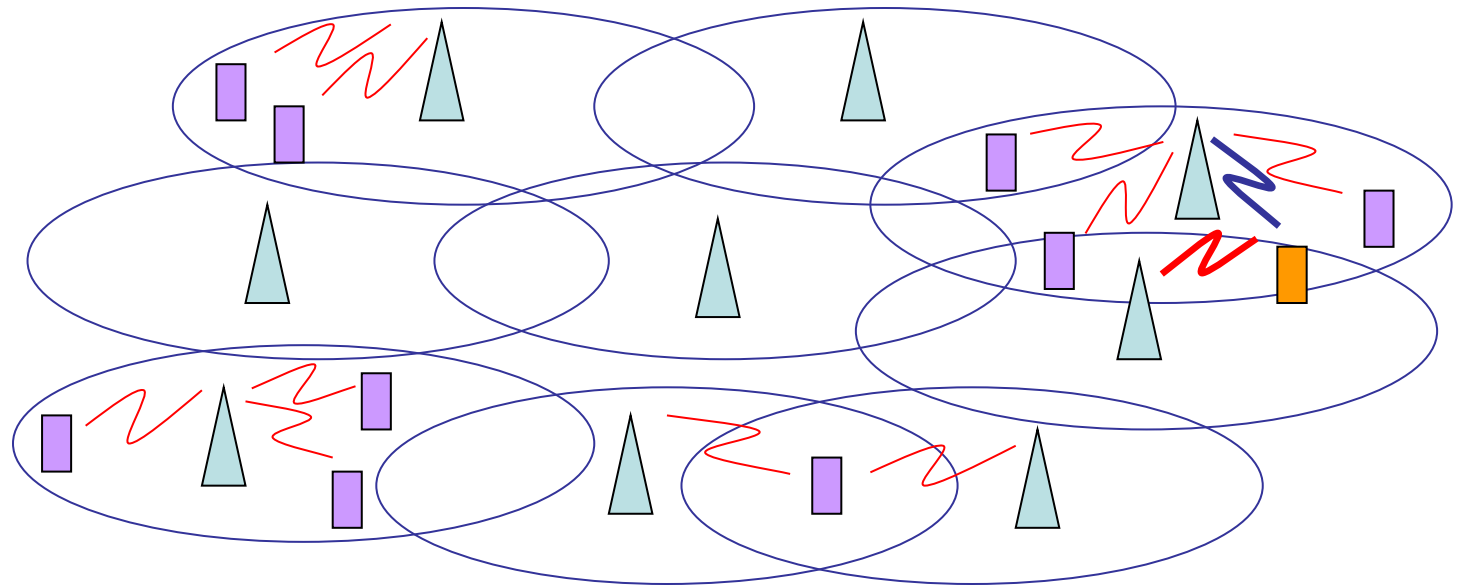
Admission Control

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

Radio Resource Management: Directed Retry



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

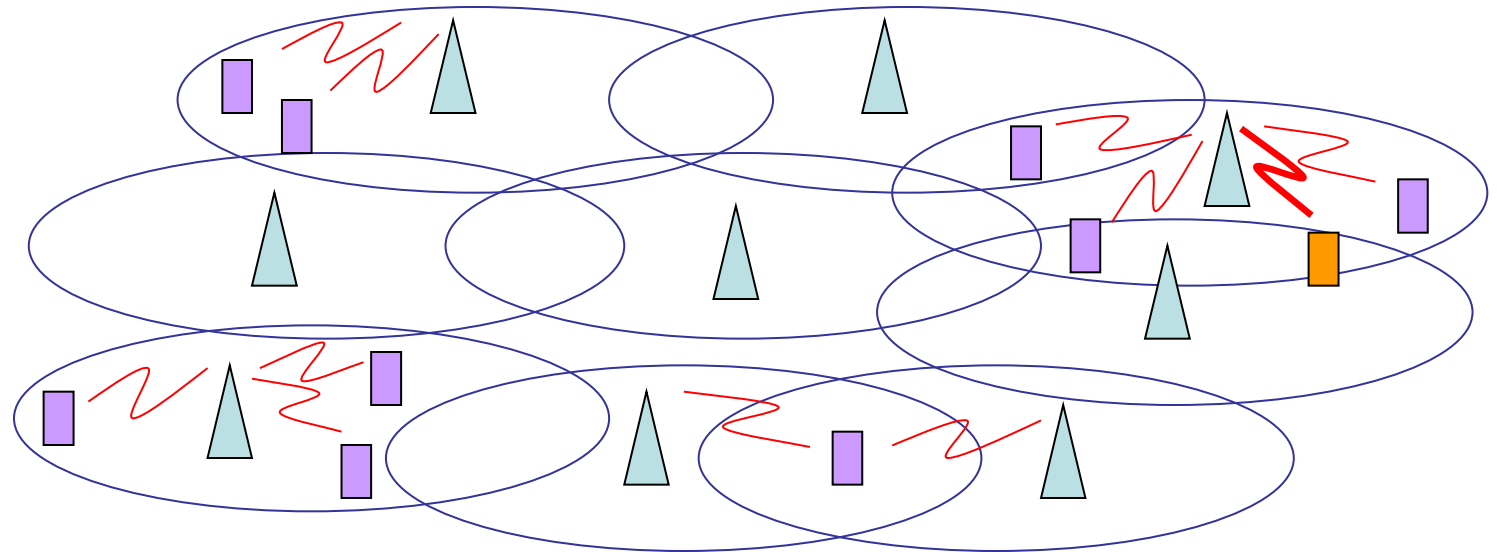
Networks planned with reference to worst-case:

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)

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.**

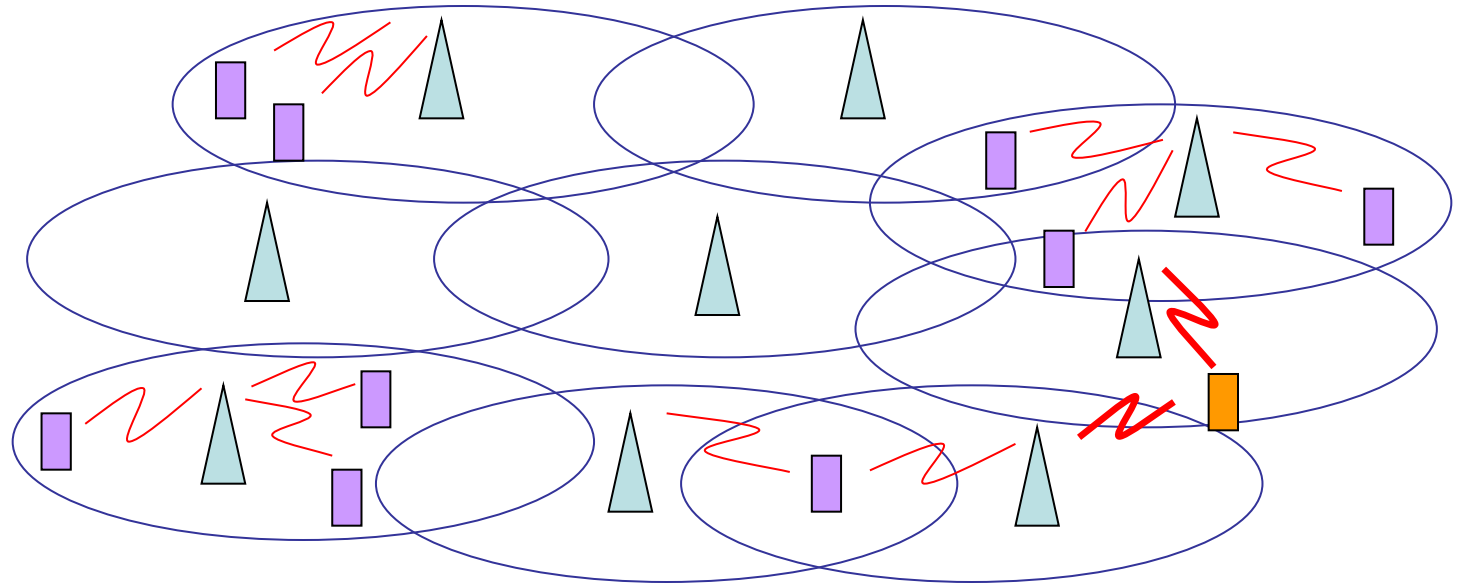
Radio Resource Management

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
Distinction:	fast PC and slow PC

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

Radio Resource Management: Hard Handover



One base station at a time (Break Before Make)

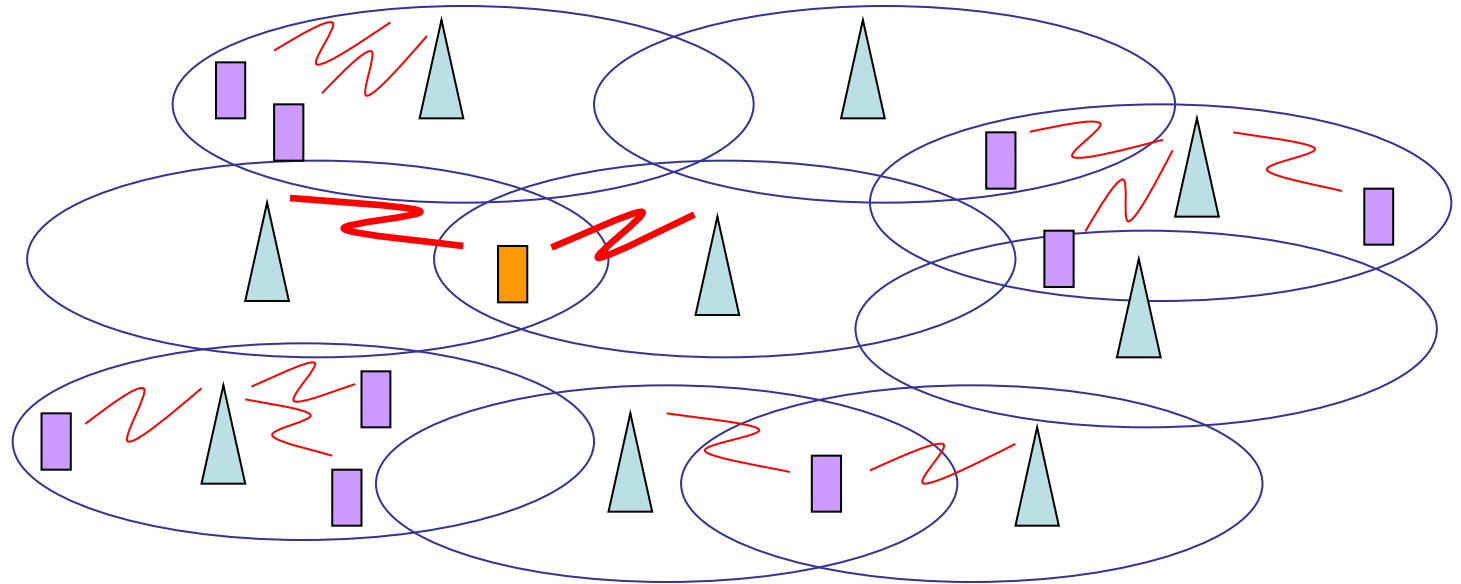
Not seamless

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
Soft/Softer Handover	The process of modifying the set of serving bases

Radio Resource Management: Soft Handover



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

Seamless Service

Macrodiversity: reduced shadowing margin

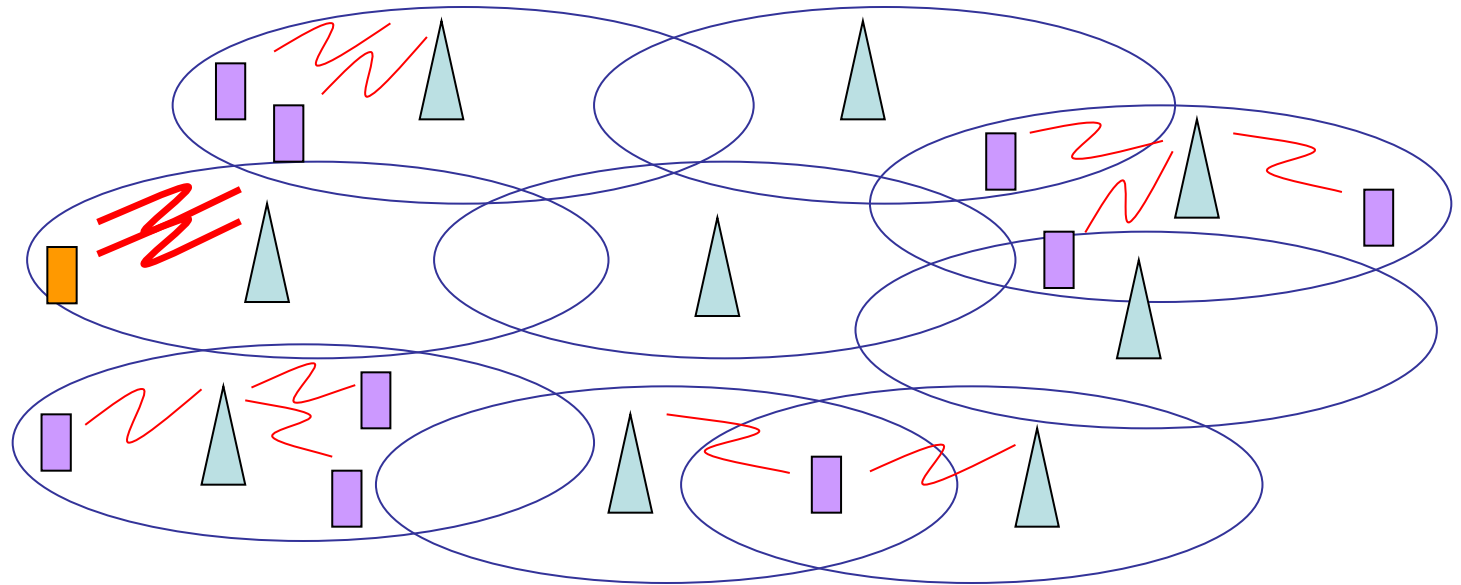
Microdiversity: MR Combining (downlink) or S Combining (uplink)

Can have a serious impact on the network capacity

Active set

The set of serving base stations

Radio Resource Management: Softer Handover



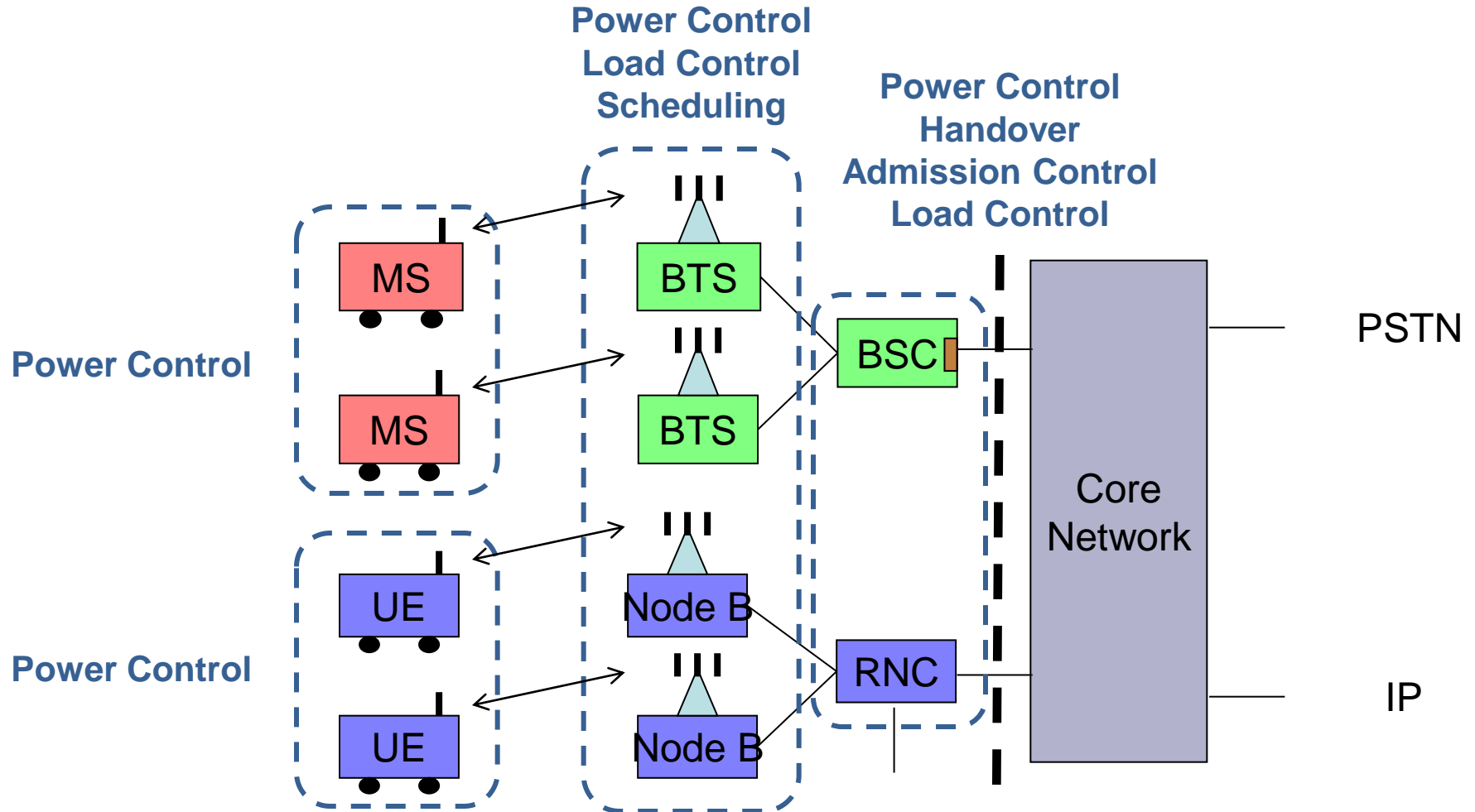
More than one base station within the same site at a time

Maximal Ratio Combining both on uplink and downlink

Radio Resource Management

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
Soft Handover	The process of modifying the set of serving bases
Load Control	The process of controlling the load of the network

Mobile RAN Architecture: 2/3G



Mobile RAN Architecture: LTE

