

IEEE Standard 1900.4

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- ▶ IEEE Standard for Architectural Building Blocks Enabling Network-Device Distributed Decision Making for Optimized Radio Resource Usage in Heterogeneous Wireless Access Networks

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Motivation

- ▶ Multimode reconfigurable mobile devices are increasingly being adopted within the wireless industry
- ▶ The choice among various supported air interfaces on a single wireless device is a reality today
- ▶ User devices and networks with Dynamic Spectrum Access capabilities are emerging

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Scope and Purpose

The standard defines the building blocks comprising:

- ▶ network resource managers
- ▶ device resource managers
- ▶ the information to be exchanged between the building blocks

To enable coordinated network-device distributed decision making.

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Scope and Purpose cont.

This will

- ▶ aid in the optimization of radio resource usage, including spectrum access control, in heterogeneous wireless access networks
- ▶ improve overall composite capacity and quality of service of wireless systems in a multiple Radio Access Technologies environment

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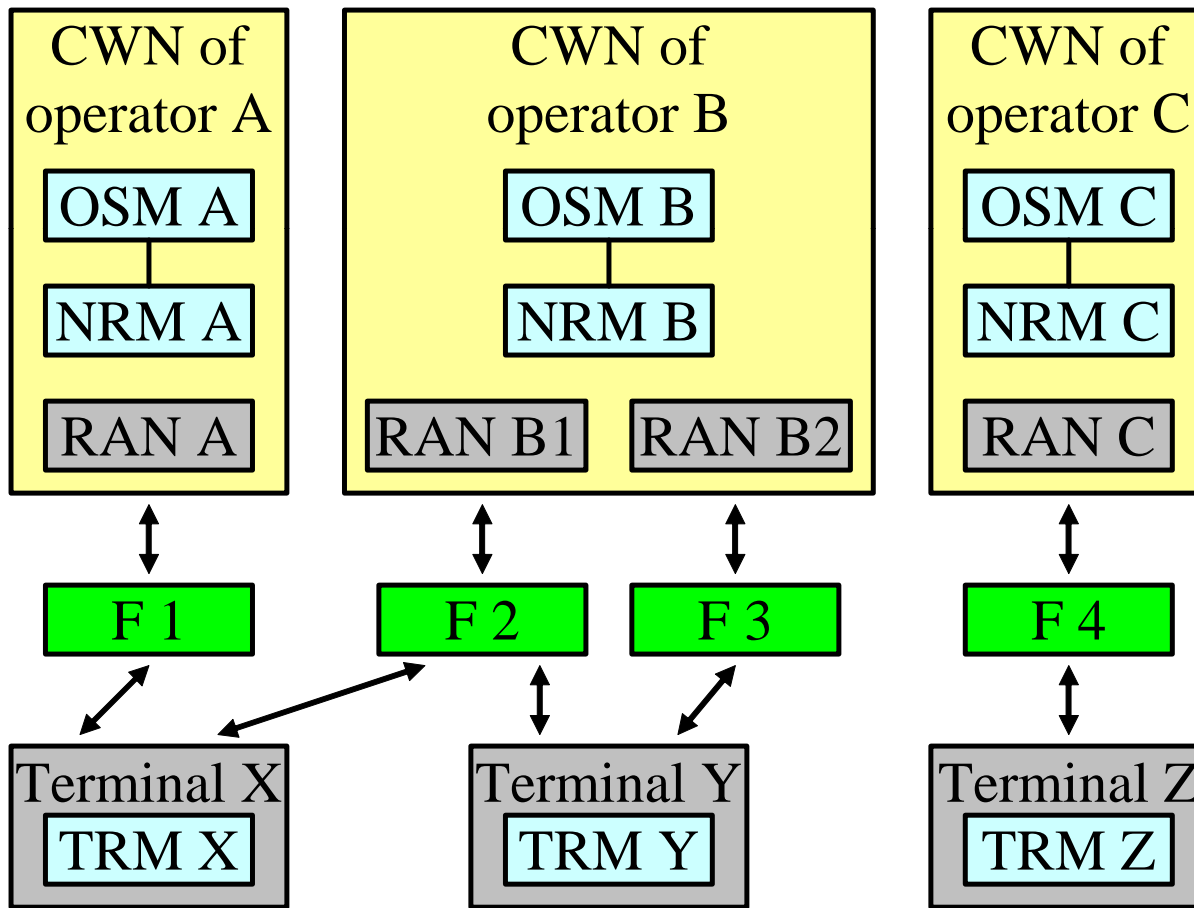
1900.4 Context

The field of application of this standard is a heterogeneous wireless environment that might include:

- ▶ Multiple operators
- ▶ Multiple radio access networks (RANs)
- ▶ Multiple radio interfaces
- ▶ Multiple Terminals

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1900.4 Context



CWN – Composite
Wireless Network

OSM – Operator
Spectrum Manager

NRM – Network
Reconfiguration
Manager

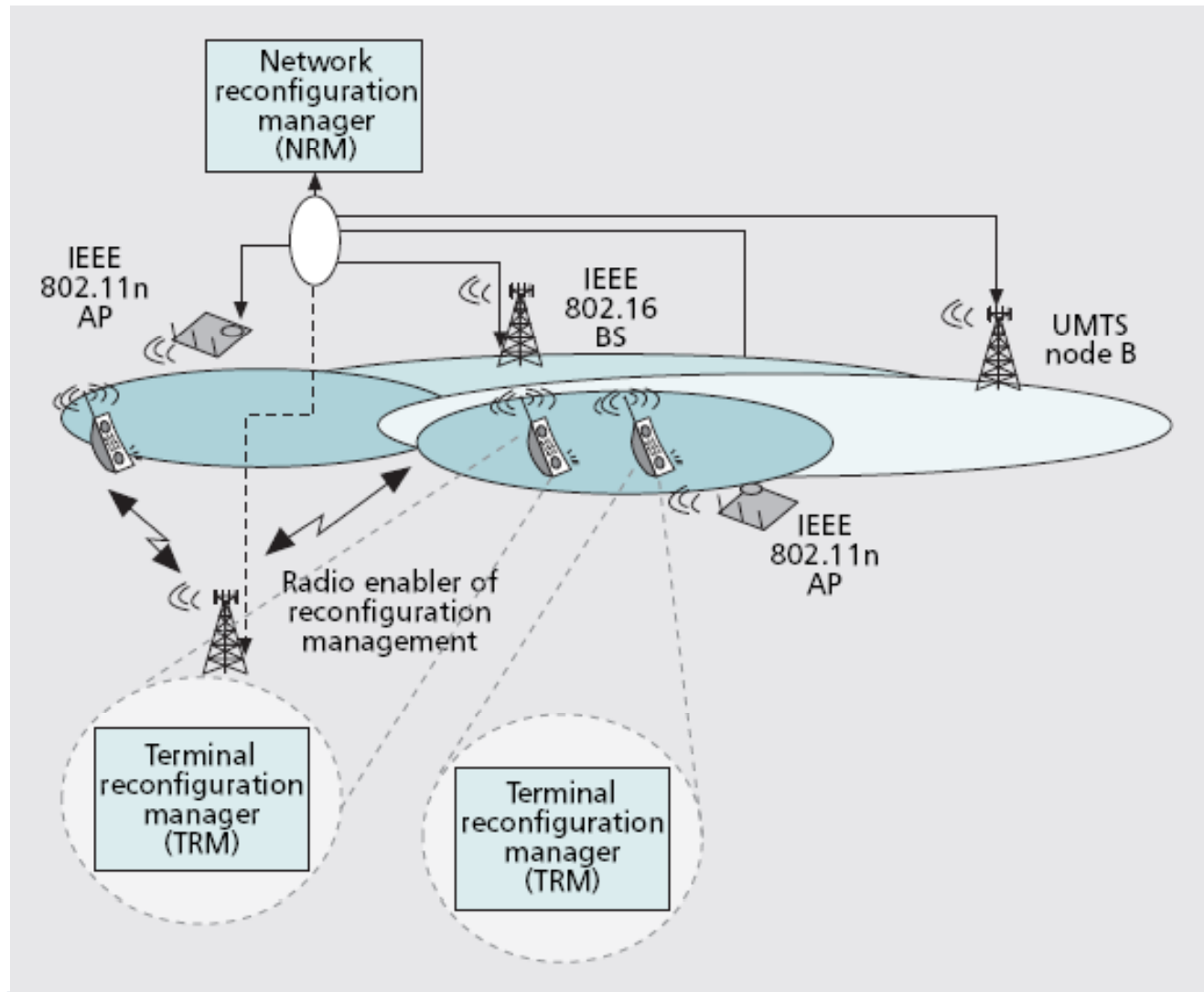
RAN – Radio Access
Network

TRM – Terminal
Reconfiguration
Manager

F1, 2, 3, 4 – Frequency
bands

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The heterogeneous wireless environment considered within P1900.4.



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Assumptions

The standard

- ▶ Does not specify MAC and PHY layers of RANs and Terminals
- ▶ Does not specify the way measurements are done
- ▶ Considers a heterogeneous wireless environment, including one or several CWNs
- ▶ Deals with reconfigurable terminals with or without multi-homing capability

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Reference use cases

- ▶ Dynamic spectrum assignment
 - ▶ Frequency bands are dynamically assigned to the RANs
- ▶ Example:
 - ▶ spectrum sharing, and spectrum renting between RANs
 - ▶ A new carrier is added for 3G access
 - ▶ A frequency band previously used for 3G is assigned to mobile broadband wireless access (e.g., IEEE 802.16e)

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Reference use cases

- ▶ **Dynamic spectrum sharing**
 - ▶ When different RANs and terminals dynamically access spectrum bands that are overlapping, in whole or in part
 - ▶ Should cause less than an admissible level of mutual Interference
- ▶ **Examples:**
 - ▶ Unlicensed secondary systems (e.g., IEEE 802.22) accessing licensed but locally unused VHF/UHF spectrum bands in an opportunistic fashion
 - ▶ Unlicensed wireless LANs (e.g., IEEE 802.11 in a possible future CR-like variant) accessing licensed but locally unused VHF/UHF spectrum bands in an opportunistic fashion

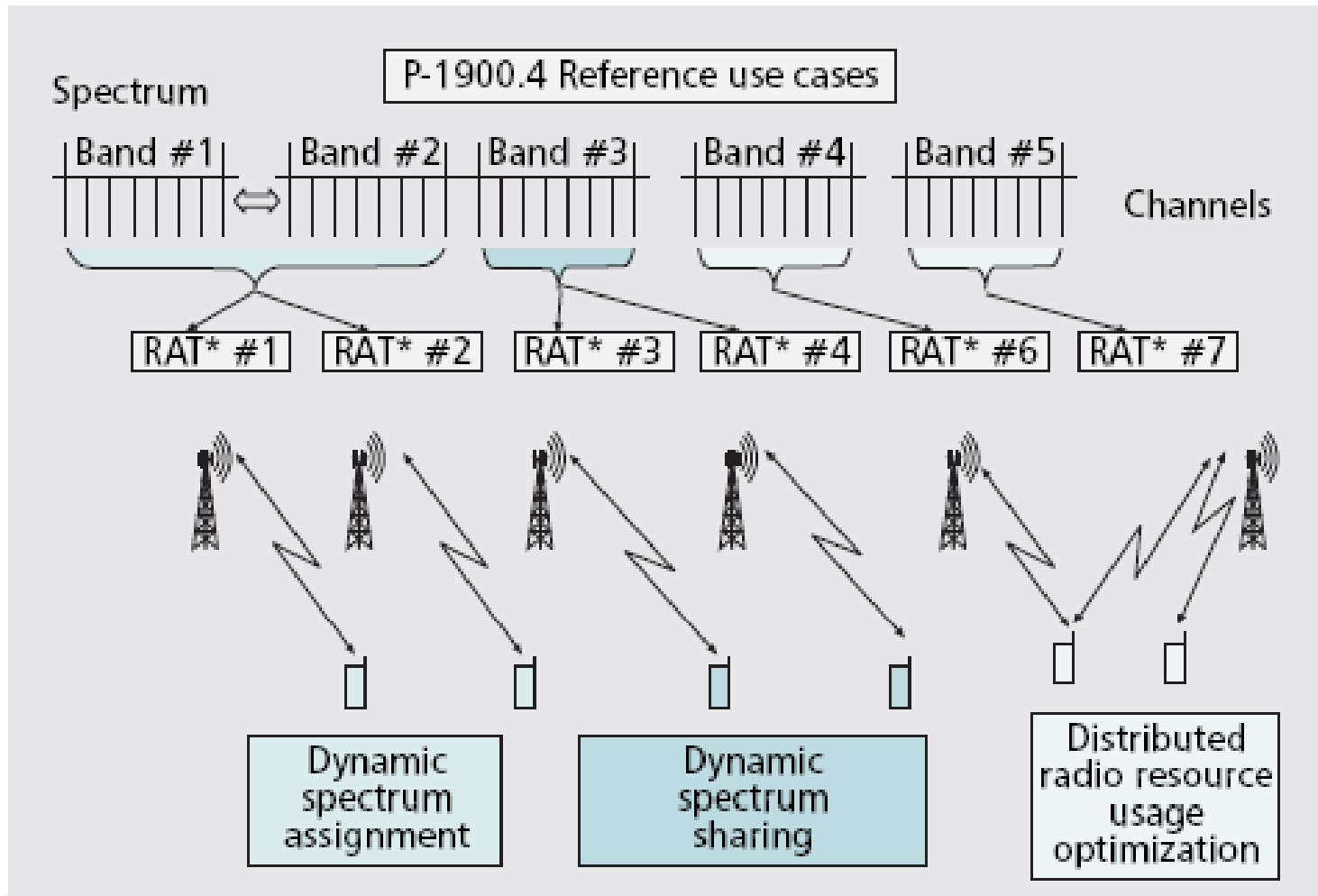
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Reference use cases

- ▶ Distributed radio resource usage optimization
 - ▶ This is done at two levels: the network and terminals
 - ▶ The NRM, at the network level, derives radio resource usage constraints and evaluates them in order to meet a global objective (global network power minimization or load balancing)
 - ▶ Convey these radio resource usage constraints to the TRM via the RE
 - ▶ At the second Level end-user terminals optimize their use of radio resources (radio links, spectrum bands, and channels)
- ▶ Example: Users arrive/leave the CWN (changing the CWN context)

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The reference use cases for P1900.4



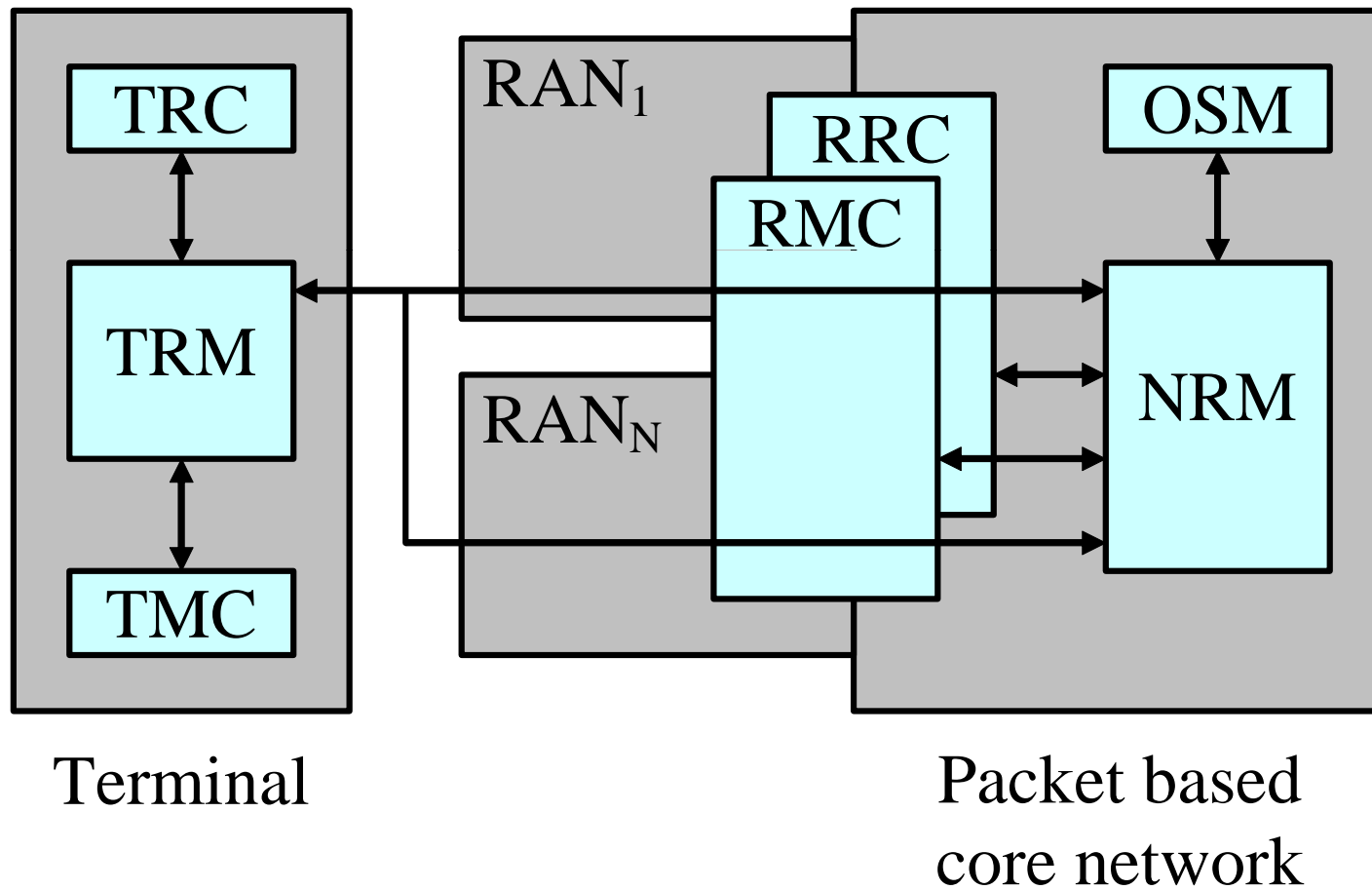
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System requirements

- ▶ **Context awareness**
 - ▶ entities on the network side and terminal side responsible for context information collection
- ▶ **Decision making**
 - ▶ Entity on the network side, the NRM
 - ▶ Entity on the terminal side, the TRM
- ▶ **Reconfiguration**
 - ▶ There shall be entities on network side and terminal side responsible for reconfiguration

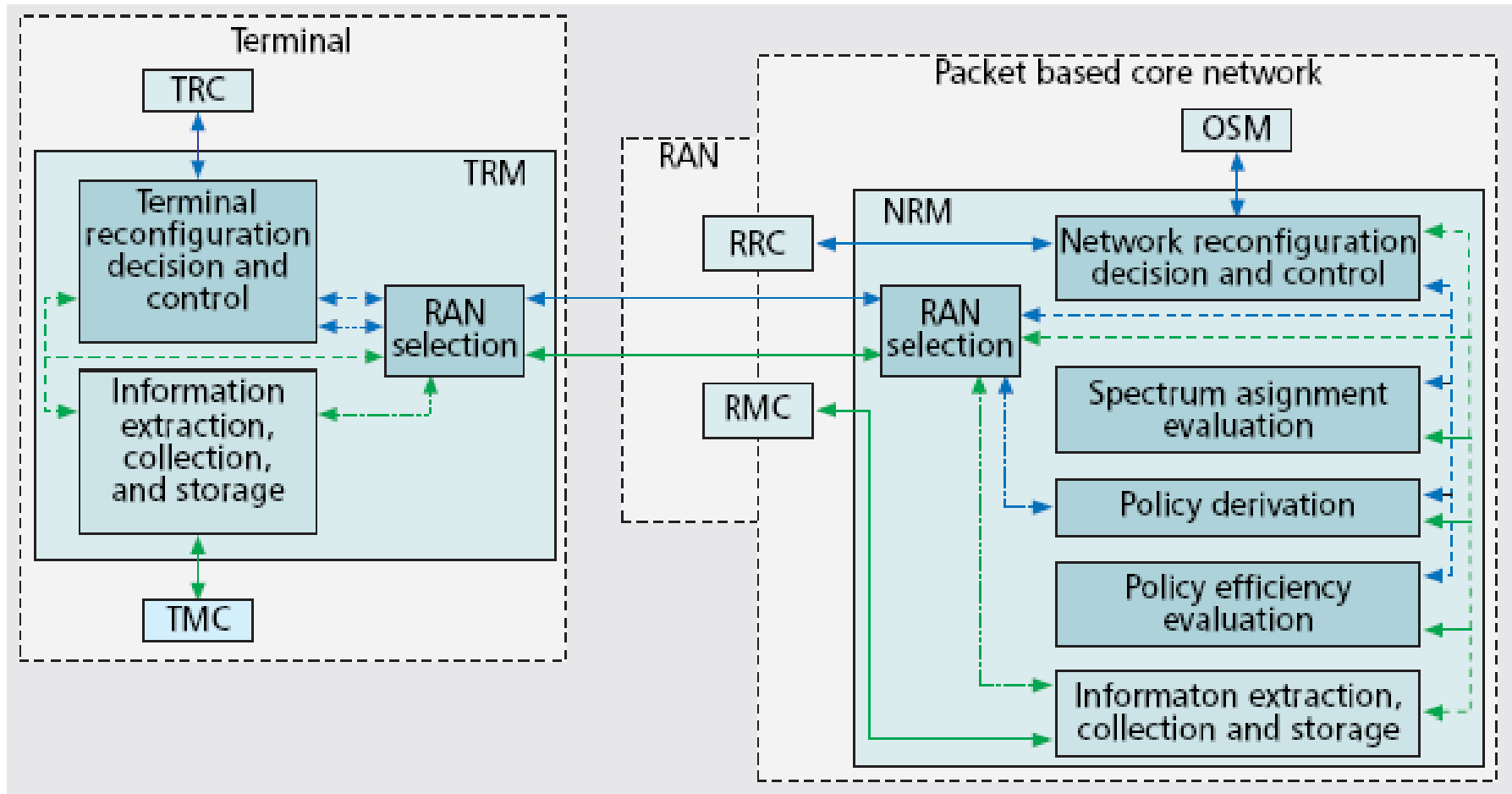
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The P1900.4 system architecture



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The P1900.4 functional architecture



Thanks For Your Attention!!

Questions?