Cisco Cooperative Project

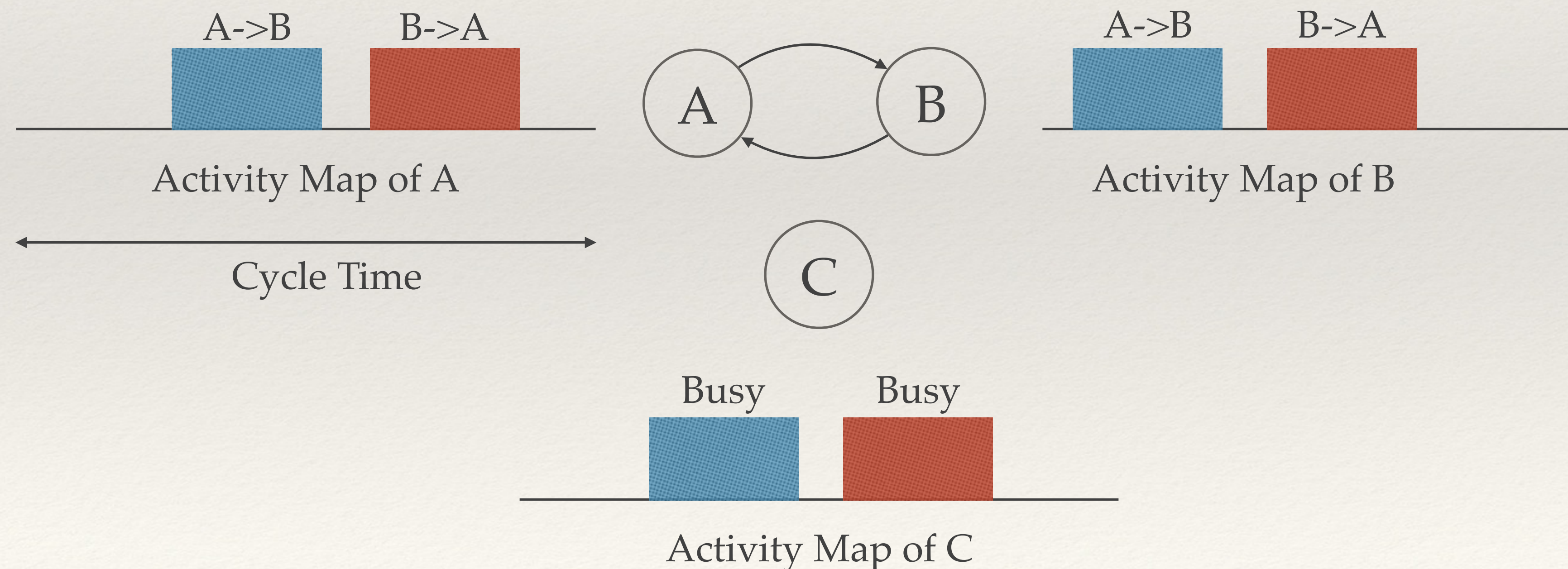# LTE-U and Wi-FI Co-Existence

Student: Steve Chiou
Advisors: Leonard J. Cimini Jr.
Chien-Chung Shen

CSMA/CA

- ❖ Using distributed coordination function (DCF)
  - ❖ Interframe Space (IFS)
    - ❖ SIFS, PIFS, DIFS and EIFS
- ❖ Random backoff to avoid collision
- ❖ Contention based access

Record

- ❖ Record transmission activities in the medium

- ❖ Time-windows are occupied by periodic real-time flow

- ❖ The time period between two consecutive packet transmission is called **cycle**
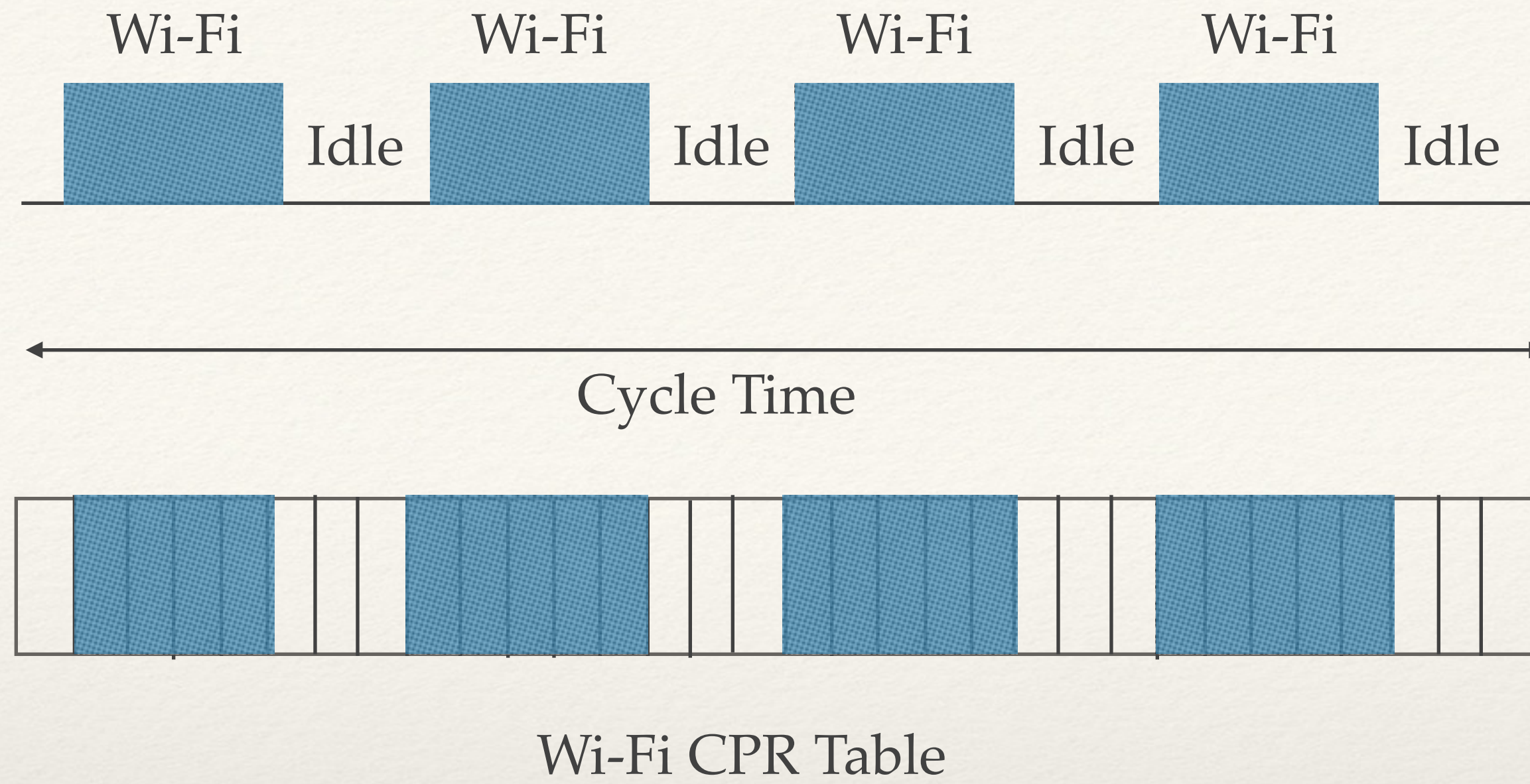
A->B   B->A

A   B

Activity Map of A

Cycle Time

C

A->B   B->A

Activity Map of B

Busy   Busy

Activity Map of C

Carrier Sensing Mechanism

❖ Nodes maintain *Contention Prevention Record/Sensing Table (CPR Table) & Contention Prevention Table (CP Table)*

❖ CPR/CPS Table

    ❖ Log of two interfaces transmission in the same medium which sensed by a node over a cycle

❖ CP Table

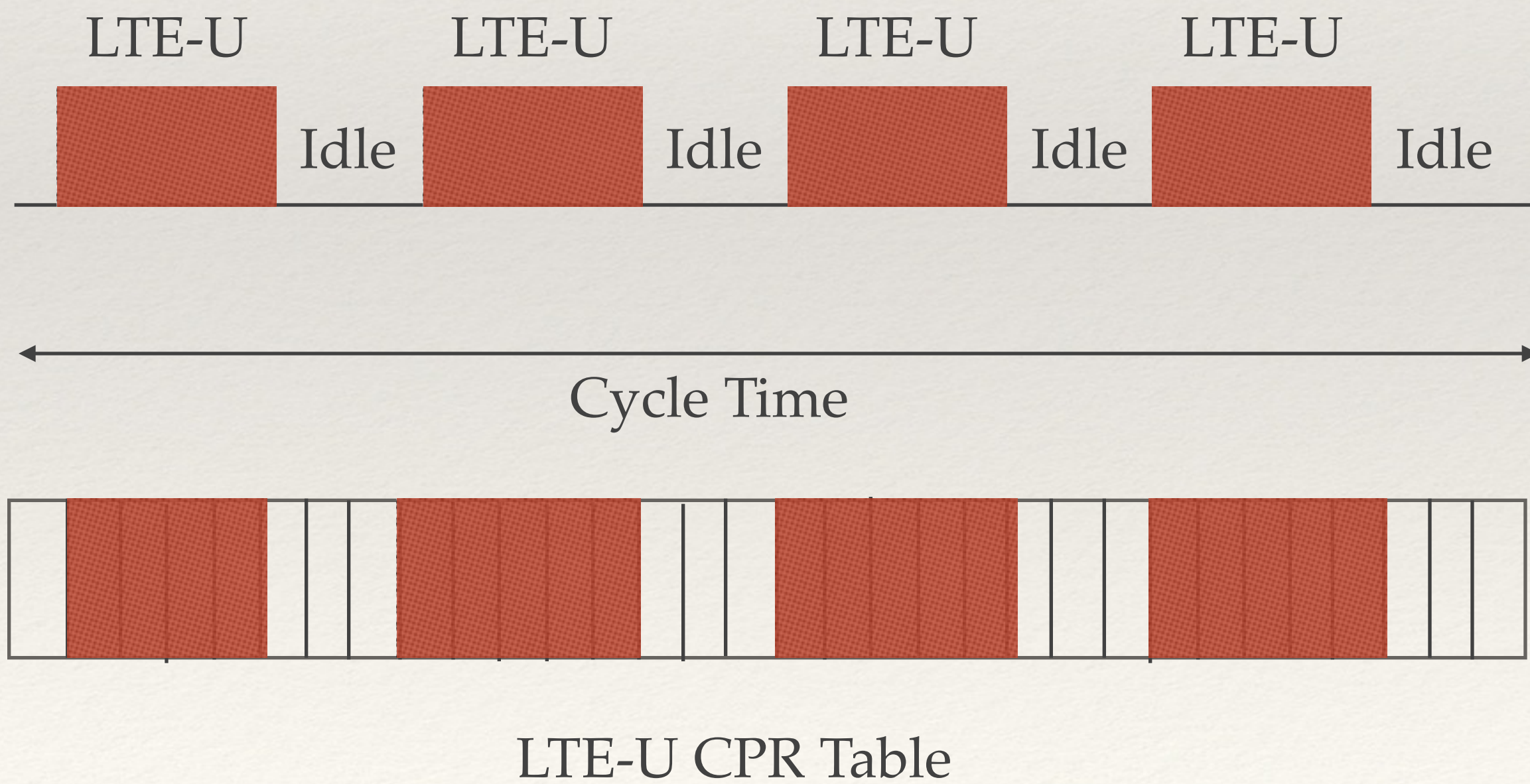   ❖ Derived at the beginning of every cycle using CPR tables over the previous *N* cycles

LTE-U and Wi-Fi Co-Existence Solution

❖ The adapter(LTE-U:eNodeB, Wi-Fi:Access Point) obtains a datagram from the network layer, prepares a link-layer frame, and puts the frame adapter buffer

❖ If the node senses that the channel is idle, it starts to transmit the frame in a time slot. If, on the other hand, the node senses that the channel is busy, it starts to find a free time slot to transfer the data.After the successful transmission, the node will stick on the using time slot for future transmission. And all the used time slot will be record as busy time slot in the **CPR table**

❖ After P cycles, *LTE-Assistant* derived the network activities of previous P cycles from the **Wi-Fi CPR-tables** and **LTE-U CPR-tables** to determine the static period for data transmission

❖ If a node work on particular time slot over than 80% time over the pervious P cycles can get this time-slot for future use or loss the right to get this time-slot on **CP Table**

❖ After calculation for all the time slots in a cycle time, *LTE-Assistant* will generate a **LTE-U and Wi-Fi co-existence CP table** for following network activities

Wi-Fi CPR Table

Wi-Fi   Wi-Fi   Wi-Fi   Wi-Fi

Idle   Idle   Idle   Idle

Cycle Time

Wi-Fi CPR Table

LTE-U CPR Table

LTE-U   LTE-U   LTE-U   LTE-U

Idle   Idle   Idle   Idle

Cycle Time

LTE-U CPR Table

LTE-U and Wi-Fi Co-Existence

LTE-U

Wi-Fi

Cycle N-3

Cycle N-2

Cycle N-1

Wi-Fi   LTE-U   LTE-U   Wi-Fi

7

Scenario – Wi-Fi

Parameter	Value
802.11 Version	ac
Bandwidth	20MHz
Tx power (AP & MT)	20 dBm
RTS/CTS	Enabled
TXOP limit	2 ms
Min CW	15
Max CW	63

Scenario - LTE

Parameter	Value
Bandwidth	20 MHz (DL)
Mode	FDD
Tx power (AP & MT)	20 dBm
Scheduler (Time / Frequency Division)	PF/PF
Max. scheduled users (TD/FD)	20/20