# IT-200 Project: Priority Scheduler

## Group - 15

**Vanshika Jolly - 201IT263**
*Information Technology*
*NIT Karnataka*
*Surathkal, India*
**vanshikajolly.201it263@nitk.edu.in**

**Mayur Jinde - 201IT135**
*Information Technology*
*NIT Karnataka*
*Surathkal, India*
**jindemayur.201it135@nitk.edu.in**

**Radhika Chhabra - 201IT144**
*Information Technology*
*NIT Karnataka*
*Surathkal, India*
**radhika.201it144@nitk.edu.in**

**Sanket Hanagandi - 201IT154**
*Information Technology*
*NIT Karnataka*
*Surathkal, India*
**sankethanagandi.201it154@nitk.edu.in**

### *Abstract:*

**Priority Scheduling is a method of scheduling processes that is based on priority. In this algorithm, the scheduler selects the tasks to work as per the priority.**

**The processes with higher priority should be carried out first, whereas jobs with equal priorities are carried out on a round-robin or FCFS basis. Priority depends upon memory requirements, time requirements, etc.**

## *I. Introduction:*

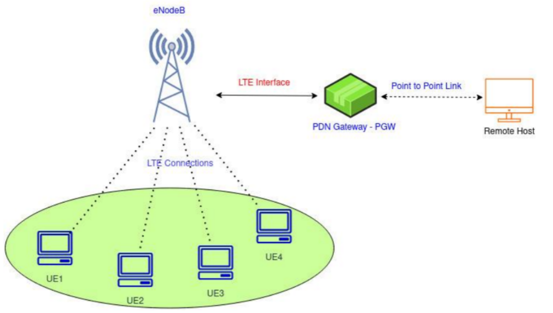


**Figure 1 :** Network topology

Client applications are executed on four UEs, which communicate data to the distant host. The first two are in charge of high-priority tasks.The scheduler on the eNodeB is responsible for packet scheduling based on available Resource Blocks (RB).

Our goal is to construct a "Priority Scheduler" that prioritises higher-priority apps in terms of RB allocation and compares throughput and latency across all applications using the old approach. Scheduler and priority scheduler are two different types of schedulers.

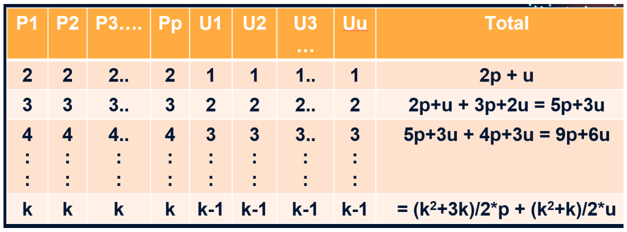
Our solution to this problem is by distributing the RB's to the prioritised and non-prioritised UE's in an **Arithmetic Progression manner**, such that in every cycle the prioritised UE's get RB's at higher rate than non-prioritised UE's.

## *II. Methodology:*

Let 'n' (here 25) be the number of RB's, which are to be distributed among 'p' number of prioritised UE's and 'u' number of non - prioritised UE's .

Our basic idea is to distribute the RB's in Arithmetic Progression.
Initially starting the distribution with 2 RB's to each prioritised and 1 RB to each non - prioritised UE's. Then for each iteration, the RB's will be incremented by 1 for all the UE's.

We continue distributing the RB's till all the RB's get exhausted.
We may encounter a situation where we can't distribute the RB's as per our algo, so the remaining RB's will get distributed among the prioritised UE's. (This will be clearly explained in the implementation section)
At 'kth' iteration the total is "just" less than the total RB's(i.e 25)



| P1 | P2 | P3.... | Pp | U1 | U2 | U3<br>... | Uu | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 2 | 2.. | 2 | 1 | 1 | 1.. | 1 | 2p + u |
| 3 | 3 | 3.. | 3 | 2 | 2 | 2.. | 2 | 2p+u + 3p+2u = 5p+3u |
| 4 | 4 | 4.. | 4 | 3 | 3 | 3.. | 3 | 5p+3u + 4p+3u = 9p+6u |
| : | : | : | : | : | : | : | : | |
| : | : | : | : | : | : | : | : | |
| k | k | k | k | k-1 | k-1 | k-1 | k-1 | = $(k^2+3k)/2*p + (k^2+k)/2*u$ |

Assume at the kth iteration the sum is just less than n (total RB's), i.e ***$(k^2+3k)/2*p + (k^2+k)/2*u) <= n$.***

The remaining ***Rem = (n - $(k^2+3k)/2*p + (k^2+k)/2*u)$*** RB's will almost evenly get distributed among the prioritised UE's only.

Then from the remaining RB's, each prioritised UE will get ***Rem/p*** RB's. But still ***Rem%p*** RB's will remain, these will get distributed in random among prioritised UE's.

## III. *Implementation:*

Let's try to understand the implementation with some examples:

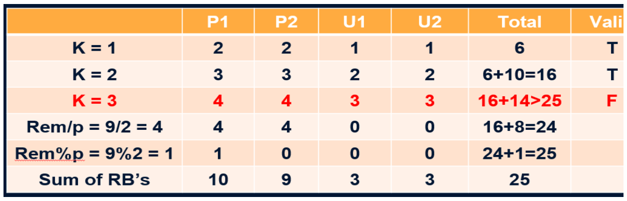
**Example 1**:

Given,

RB's = n = 25

UE's = 4

p = 2 are prioritised, other u = 2 are non prioritised



| | P1 | P2 | U1 | U2 | Total | Vali |
|---|---|---|---|---|---|---|
| K = 1 | 2 | 2 | 1 | 1 | 6 | T |
| K = 2 | 3 | 3 | 2 | 2 | 6+10=16 | T |
| K = 3 | 4 | 4 | 3 | 3 | 16+14>25 | F |
| Rem/p = 9/2 = 4 | 4 | 4 | 0 | 0 | 16+8=24 | |
| Rem%p = 9%2 = 1 | 1 | 0 | 0 | 0 | 24+1=25 | |
| Sum of RB's | 10 | 9 | 3 | 3 | 25 | |

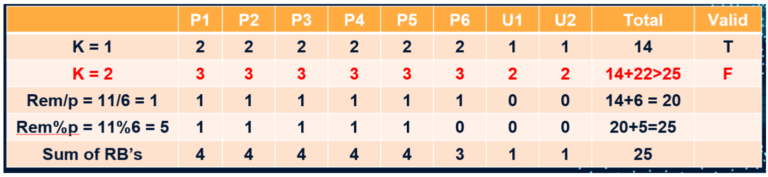
**Example 2**:

Given,

RB's = n = 25

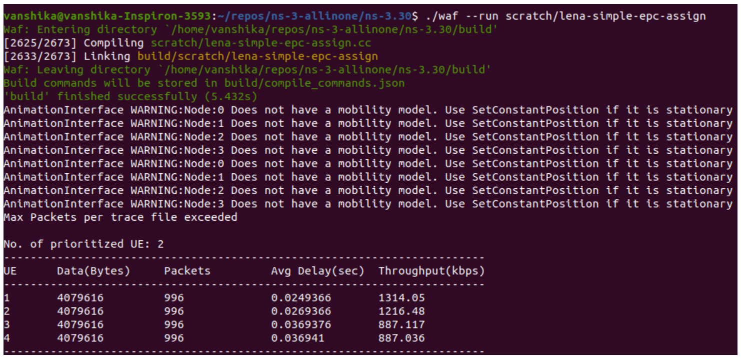
UE's = 8

p=6 are prioritised, other u=2 are non prioritised



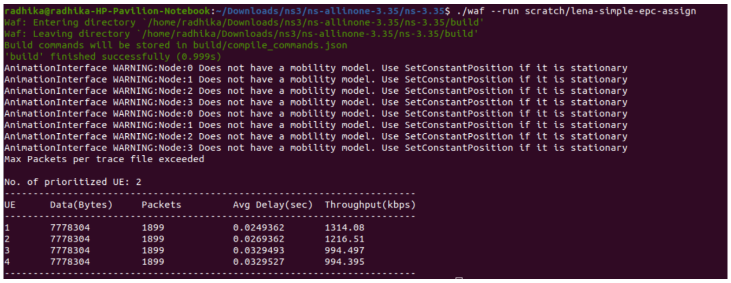
| | P1 | P2 | P3 | P4 | P5 | P6 | U1 | U2 | Total | Valid |
|---|---|---|---|---|---|---|---|---|---|---|
| K = 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 14 | T |
| K = 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 14+22>25 | F |
| Rem/p = 11/6 = 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 14+6 = 20 | |
| Rem%p = 11%6 = 5 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 20+5=25 | |
| Sum of RB's | 4 | 4 | 4 | 4 | 4 | 3 | 1 | 1 | 25 | |

## IV. *Results:*



```
vanshika@vanshika-Inspiron-3593:~/repos/ns-3-allinone/ns-3.30$ ./waf --run scratch/lena-simple-epc-assign
Waf: Entering directory `/home/vanshika/repos/ns-3-allinone/ns-3.30/build'
[2625/2673] Compiling scratch/lena-simple-epc-assign.cc
[2633/2673] Linking build/scratch/lena-simple-epc-assign
Waf: Leaving directory `/home/vanshika/repos/ns-3-allinone/ns-3.30/build'
Build commands will be stored in build/compile_commands.json
'build' finished successfully (5.432s)
AnimationInterface WARNING:Node:0 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:1 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:2 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:3 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:0 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:1 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:2 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:3 Does not have a mobility model. Use SetConstantPosition if it is stationary
Max Packets per trace file exceeded

No. of prioritized UE: 2
-----------------------------------------------------------------------
UE      Data(Bytes)     Packets         Avg Delay(sec)  Throughput(kbps)
-----------------------------------------------------------------------
1       4079616         996             0.0249366       1314.05
2       4079616         996             0.0269366       1216.48
3       4079616         996             0.0369376       887.117
4       4079616         996             0.036941        887.036
-----------------------------------------------------------------------
```



```
radhika@radhika-HP-Pavilion-Notebook:~/Downloads/ns3/ns-allinone-3.35/ns-3.35$ ./waf --run scratch/lena-simple-epc-assign
Waf: Entering directory `/home/radhika/Downloads/ns3/ns-allinone-3.35/ns-3.35/build'
Waf: Leaving directory `/home/radhika/Downloads/ns3/ns-allinone-3.35/ns-3.35/build'
Build commands will be stored in build/compile_commands.json
'build' finished successfully (0.999s)
AnimationInterface WARNING:Node:0 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:1 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:2 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:3 Does not have a mobility model. Use SetConstantPosition if it is stationary
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AnimationInterface WARNING:Node:2 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:3 Does not have a mobility model. Use SetConstantPosition if it is stationary
Max Packets per trace file exceeded

No. of prioritized UE: 2
-----------------------------------------------------------------------
UE      Data(Bytes)     Packets         Avg Delay(sec)  Throughput(kbps)
-----------------------------------------------------------------------
1       7778304         1899            0.0249362       1314.08
2       7778304         1899            0.0269362       1216.51
3       7778304         1899            0.0329493       994.497
4       7778304         1899            0.0329527       994.395
-----------------------------------------------------------------------
```

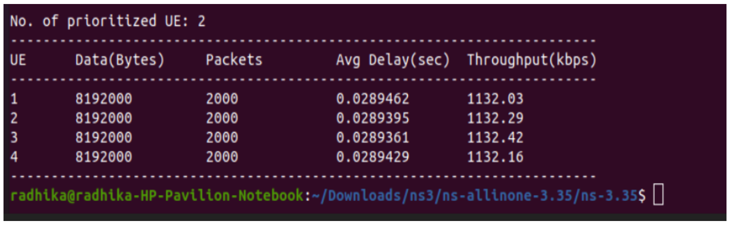

```
No. of prioritized UE: 2
-----------------------------------------------------------------------
UE      Data(Bytes)     Packets         Avg Delay(sec)  Throughput(kbps)
-----------------------------------------------------------------------
1       8192000         2000            0.0289462       1132.03
2       8192000         2000            0.0289395       1132.29
3       8192000         2000            0.0289361       1132.42
4       8192000         2000            0.0289429       1132.16
-----------------------------------------------------------------------
radhika@radhika-HP-Pavilion-Notebook:~/Downloads/ns3/ns-allinone-3.35/ns-3.35$ 
```