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# Architecture and Experimental Framework for Supporting QoS in Wireless Networks Using Differentiated Services

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# Outline

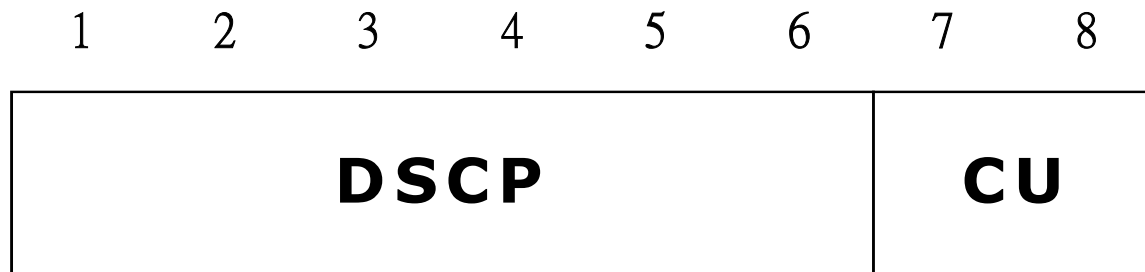
- Introduction
- Proposed architecture and Simulation result
- Conclusion



# Introduction

# Introduction—Differentiated Service

- Using TOS field of IP header for packet classification
- Type of service byte is divided into
  - 6 bits--Differentiated services code point (DSCP)
  - 2 bits--Current unused (CU)



# Introduction--

## Classification of packets within a flow

1	2	3	4	5	6	7	8
<b>PIO</b>	<b>DIFF</b>	<b>PHB code</b>				<b>CU</b>	

- **PIO** : Packet in/out of profile
- **DIFF** : Differential importance
  - 0 : more important
  - 1 : less important
- **PHB** : Per hop behavior code
- **CU** : Currently unused

# Introduction—Differentiated Service

- The component of Diffserv network include
  - Packet classifier
  - Traffic profile
  - Traffic conditioners

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# Summary

## Factors for Wireless Diffserv framework

- Signaling requirement
- User mobility
- High loss rate
- Low bandwidth
- Battery power constraint

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# Proposed Architecture and Simulation Result

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# Traffic classifier and conditioner

## ■ Classifier

- Modified Class based query (CBQ)
- It allows a class to temporarily borrow bandwidth from its parent class

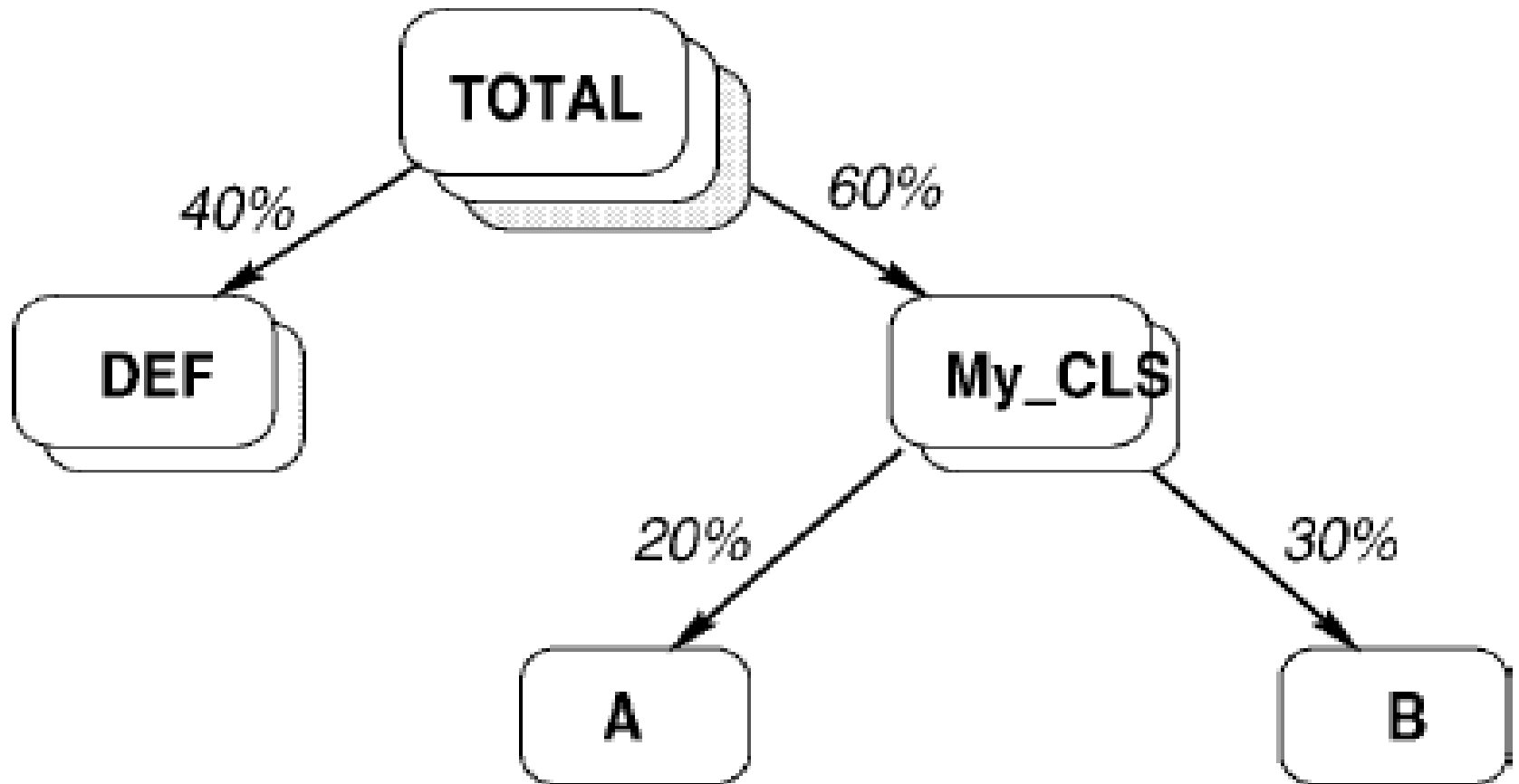
## ■ Estimator

- Estimates bandwidth of each class

## ■ Pack scheduler

- Select packets for class scheduling
  - Weighted round-robin (WRR)

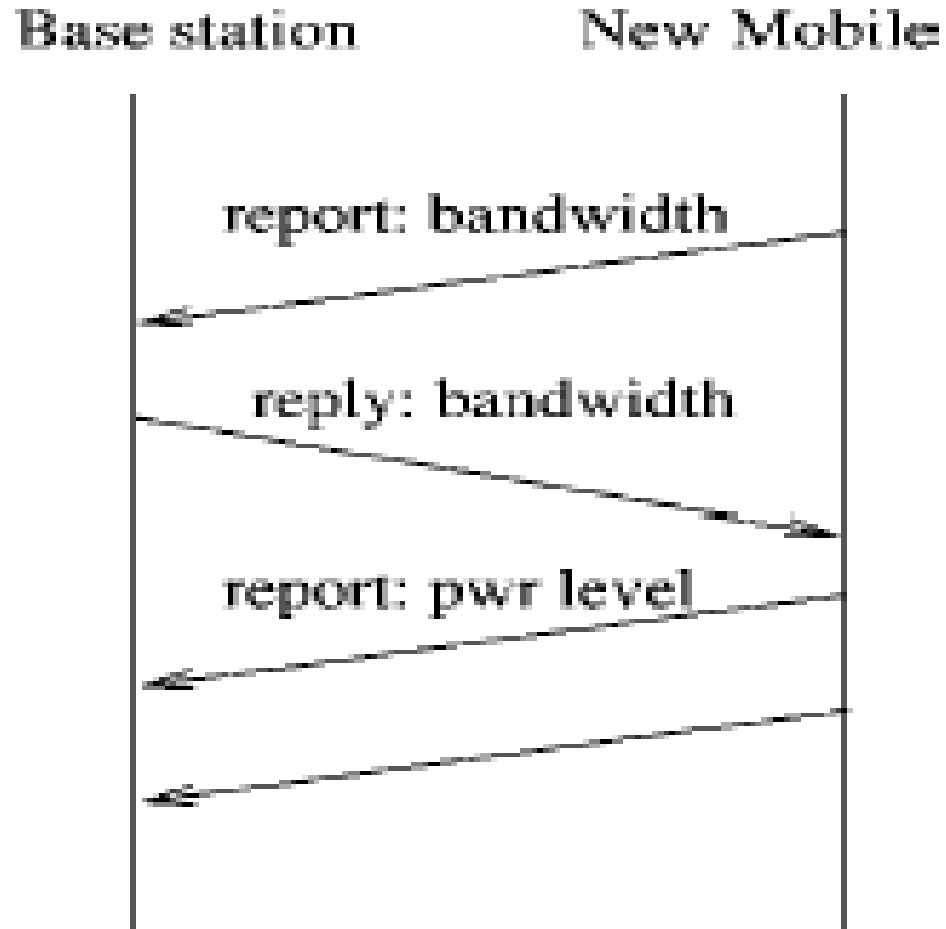
# CBQ mechanism



# Signaling protocol

- RSVP is complex to implement and faces scalability concerns
- Enhanced ICMP
  - Report message
  - Reply message
  - Modify message
- Advantage
  - Simple
  - Do not require major modification to the kernel

# Flow of signal message



# Mobility

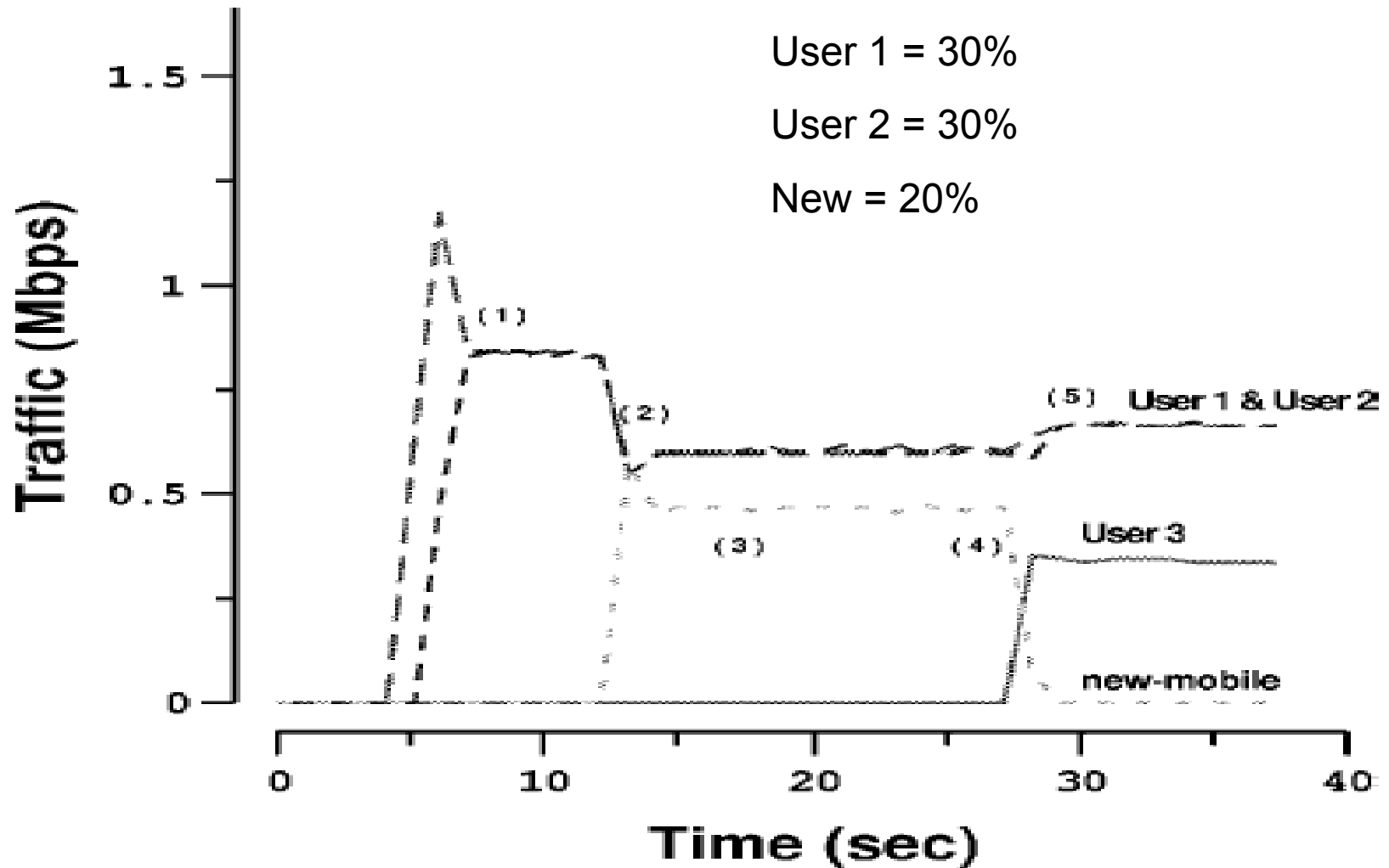
## ■ Condition

- A new mobile's bandwidth needs may not be met completely if the new BS has allocated all its BW.

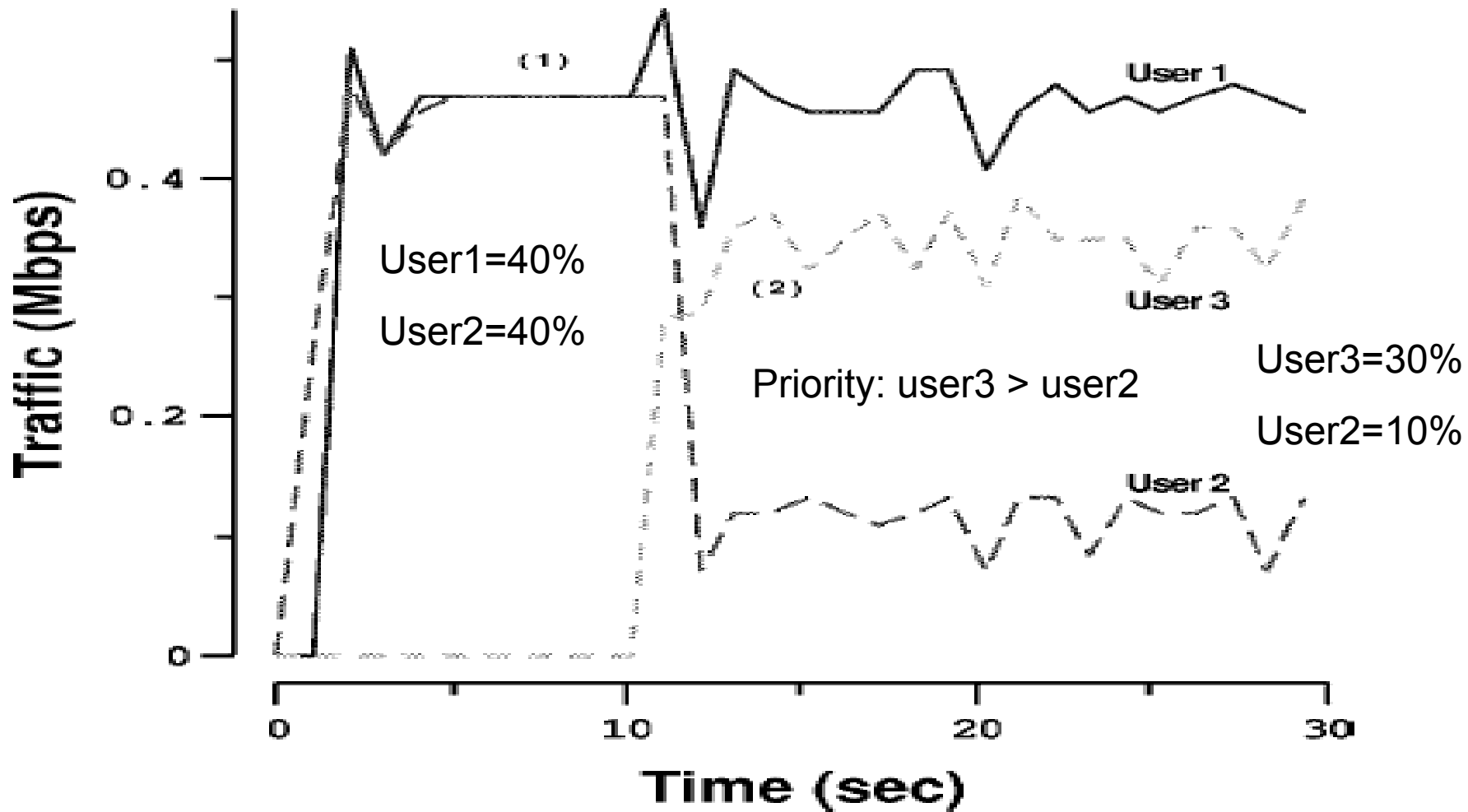
## ■ Solution

- 1. Set up a new-mobile class
- 2. Take BW away from the low priority application in the cell

# Mobility – Solution 1



# Mobility – Solution 2



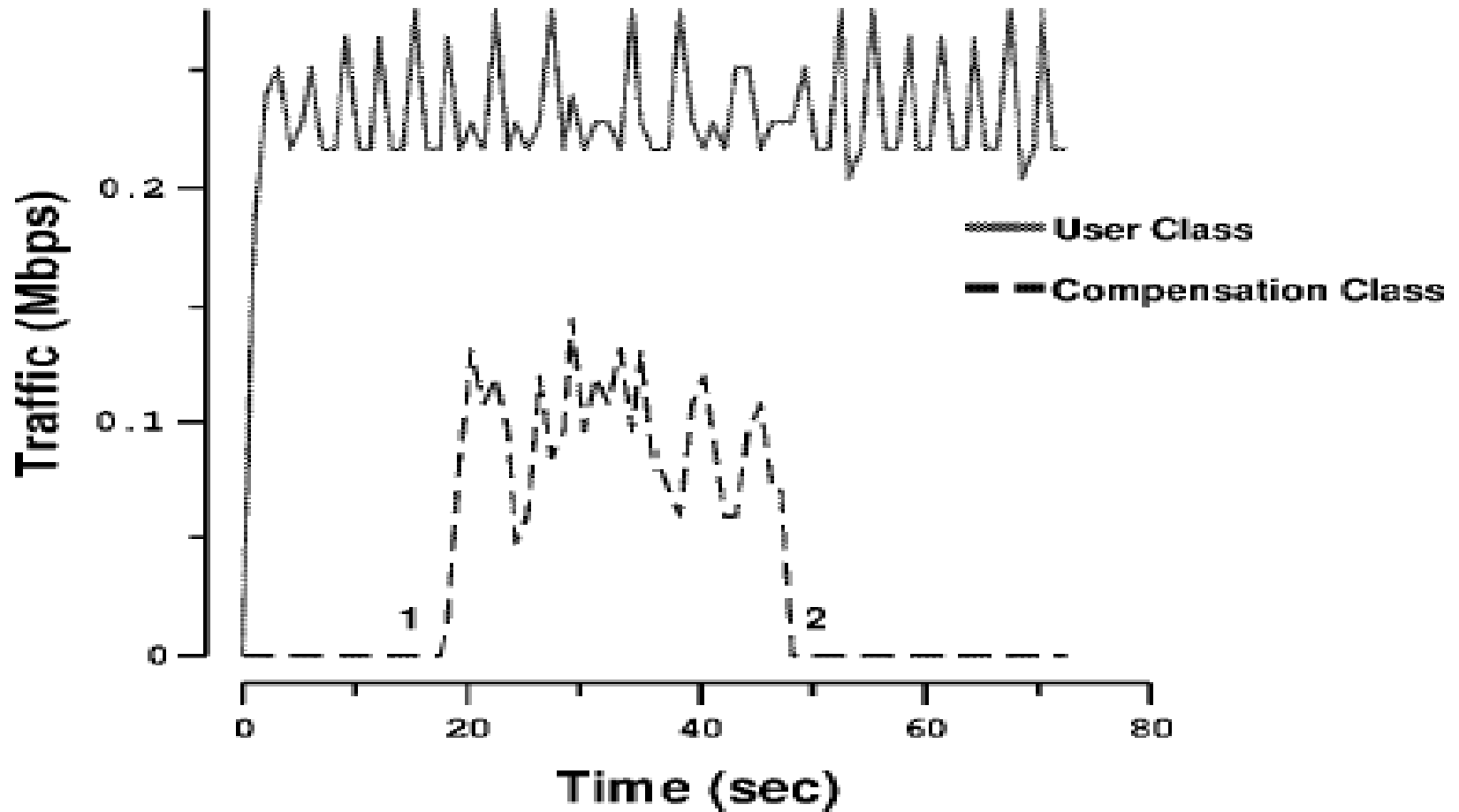
# High loss rate handling

- The receiver periodically sends feedback about receive rate
- The BS creates a compensation class
- Approach
  - Re-marks some of packets of the flow to the compensation class DSCP
  - Modify the police such that bandwidth is temporarily reallocated from the compensation class to the mobile's DSCP class



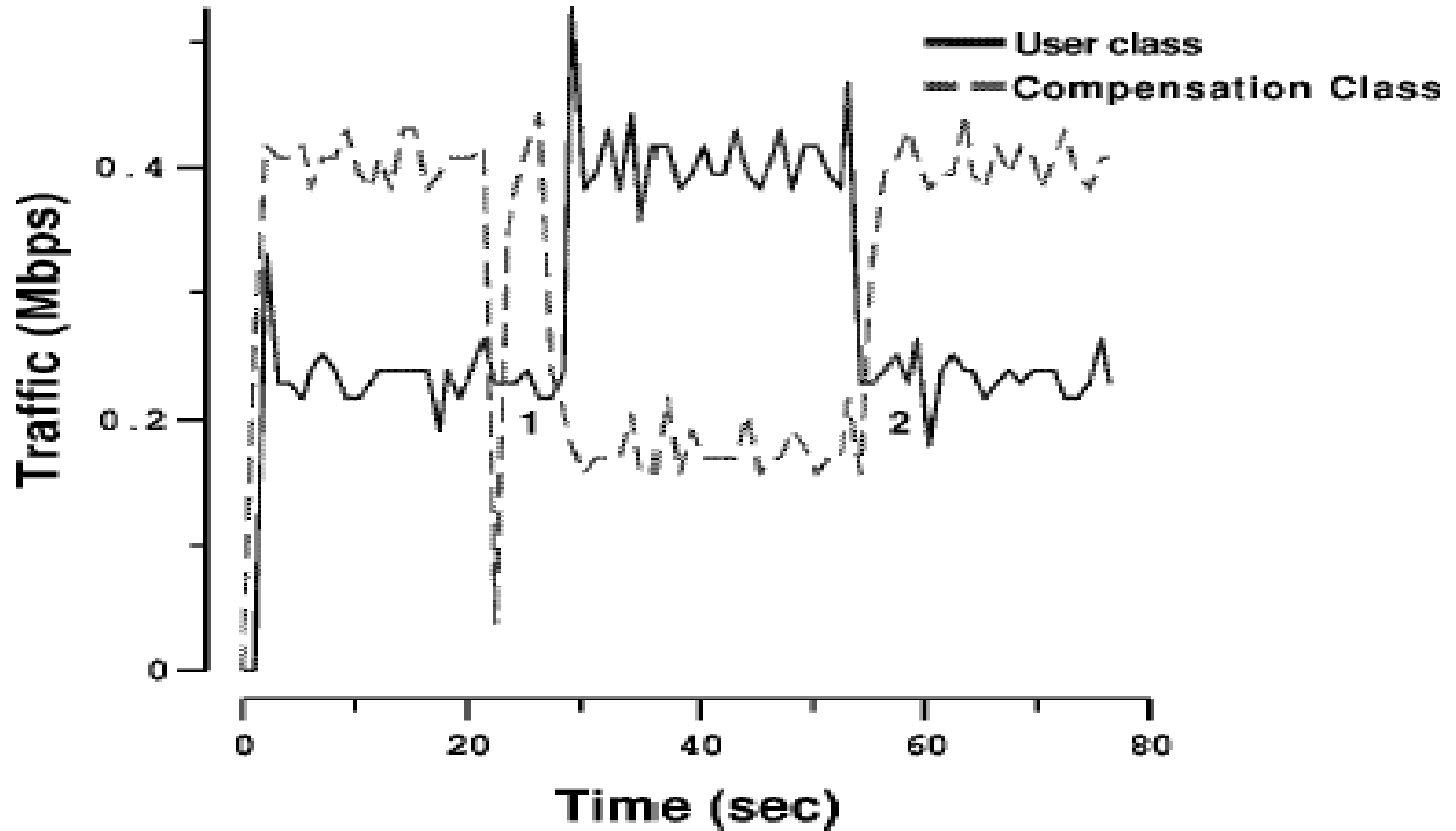
# High loss rate handling

## -- Solution 1



# High loss rate handling

## -- Solution 2



# Low bandwidth

## —bandwidth mismatch

- Standard flow control mechanism
  - Adv.: less data is sent on the wireless link
  - Dis.: for point-to-multipoint applications, all receiver are forced to receive data at a reduced rate
- Proxy scheme
  - Adv.: it works even in point-to-multipoint
  - Dis.: wasting of resources in the link between the sender and the BS

# Power constrains handling

- The battery power level is periodically sent to the BS as part of the power profile parameter
- The BS contains a table containing each mobile's profile and the DSCP code
- According to the power profile, the BS re-marked the DSCP code of a flow
  - Adv.: flows belong to the same DSCP is treated differently
  - Dis.: do additional work

# Example

- Consider an MPEG-1 and MPEG-2 video stream with
  - I (Intra),
  - B (Bidirectional) and
  - P (Predictive)
  - Dropping sequence: B -> P -> I

# Example

- A ten-minute video at the rate 400kbps was assumed
  - A battery level drop of
    - $I + B + P = 5\%$
    - $I + P = 4\%$
    - $I = 1\%$
- The main difference is based on the time taken to receive the packets of video

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# Conclusion

- Signaling requirement
- User mobility
- High loss rate
- Low bandwidth
- Battery power constraint

# Discussion

- Uplink and Downlink environment
- Additional classes
- Mobility
  - Resource replacement when the MH leaves
- Bandwidth mismatch
  - Flow control scheme: enhanced flow control
  - Proxy scheme: need more buffer size
- Power constrains handling
  - Increasing the data rate
- Extension to multi-hop environment