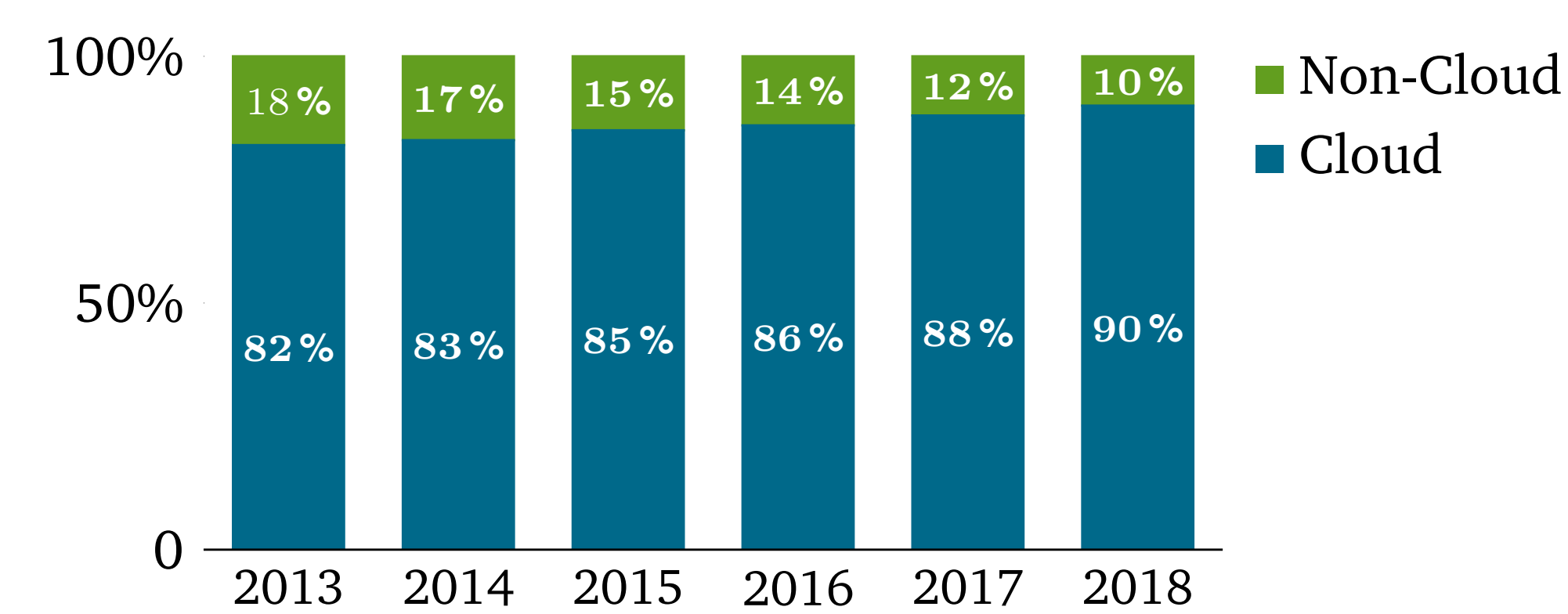


## Introduction

Mobile cloud applications is one of the fastest growing markets:

- Mobile data traffic will rise up to 15 EB per month by 2018
- By 2017 4.4 billion people will use mobile cloud applications
- \$45 billion market
- 90% of all mobile data traffic by 2018



Source: Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2013-2018

## Network Coding in Cellular Networks

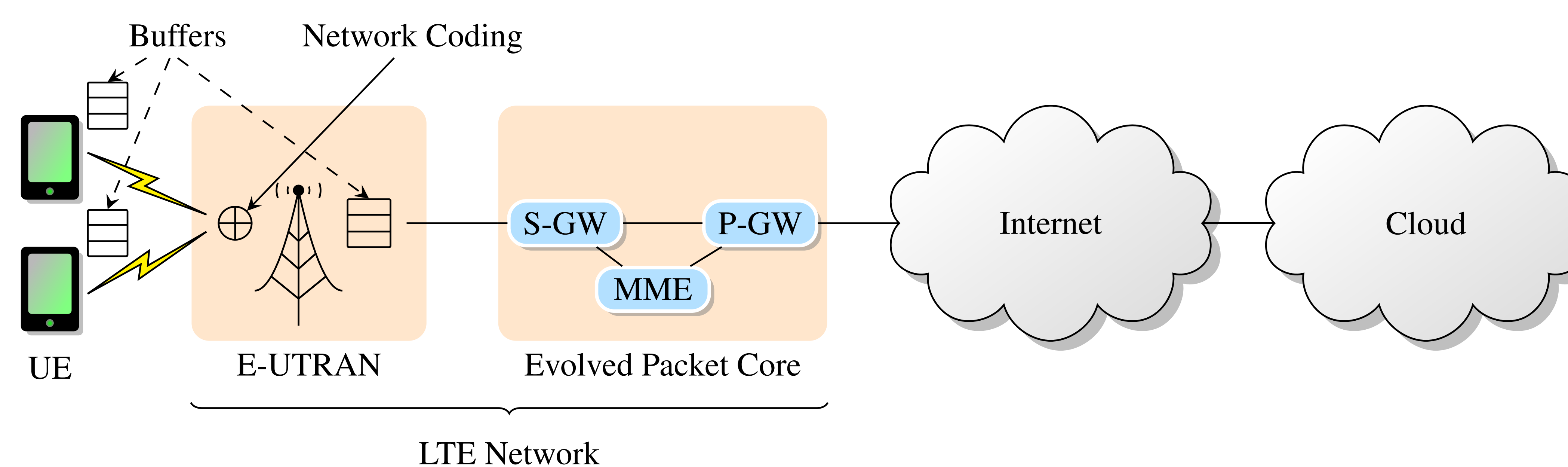
Optimizing information delivery of flows with overlapping or partially overlapping content.

### Important Facts

- Geographically co-located users
- Mobile cloud applications' content
  - Advertisement
  - Maps
  - Meteo
  - Google Now

Network coding to combine information flows

## The NC-CELL Technique



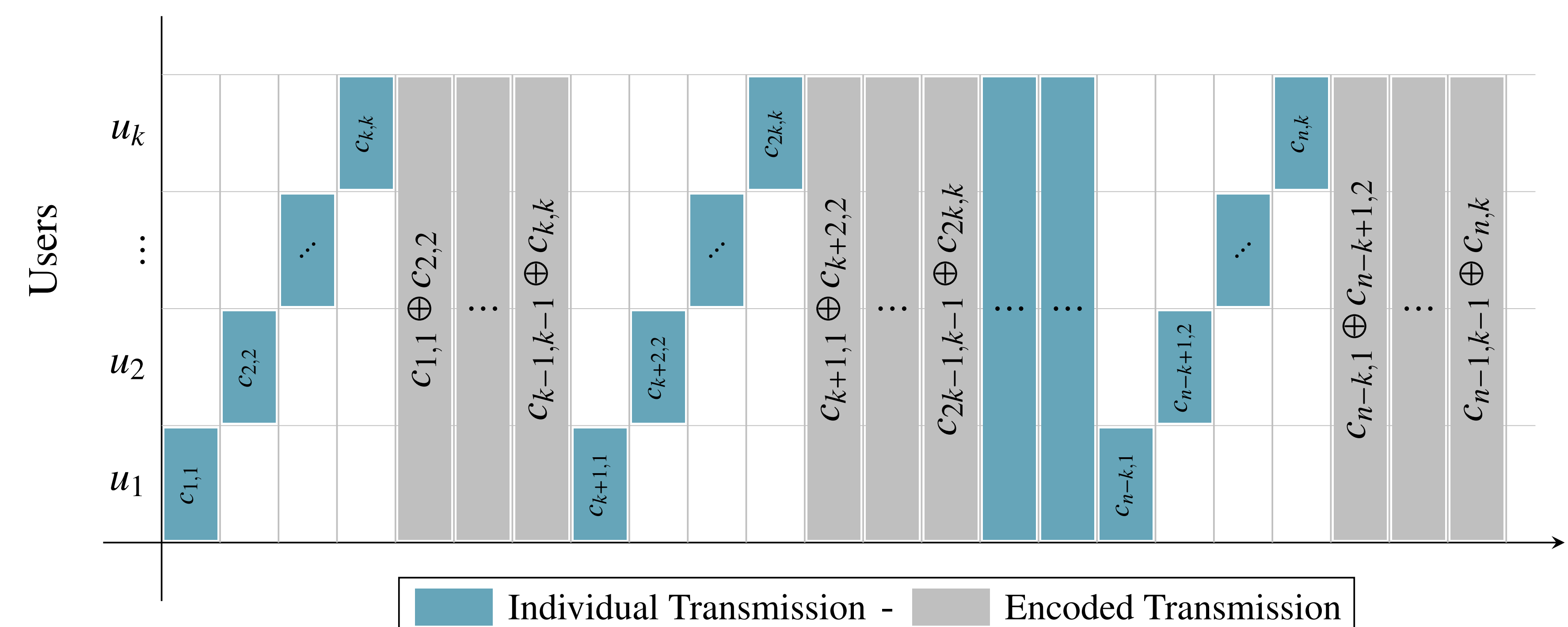
Key aspects:

- Monitor and cache in transit traffic
- Identification of coding opportunities
- Use of network coding to combine packets

### Coding opportunities

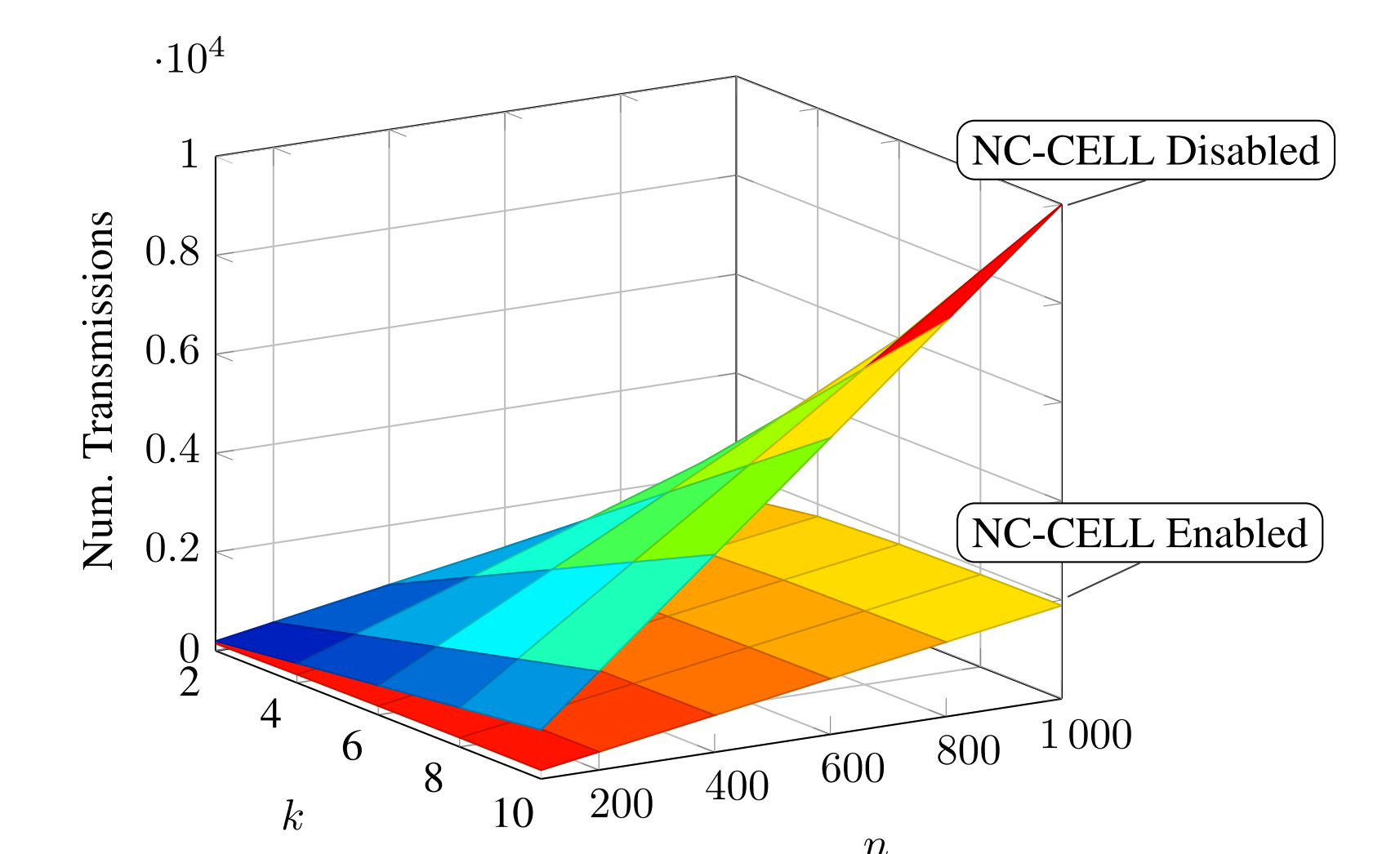
eNodeBs can distribute information needed by two or more users with a single coded transmission.

### Optimal allocation for content distribution

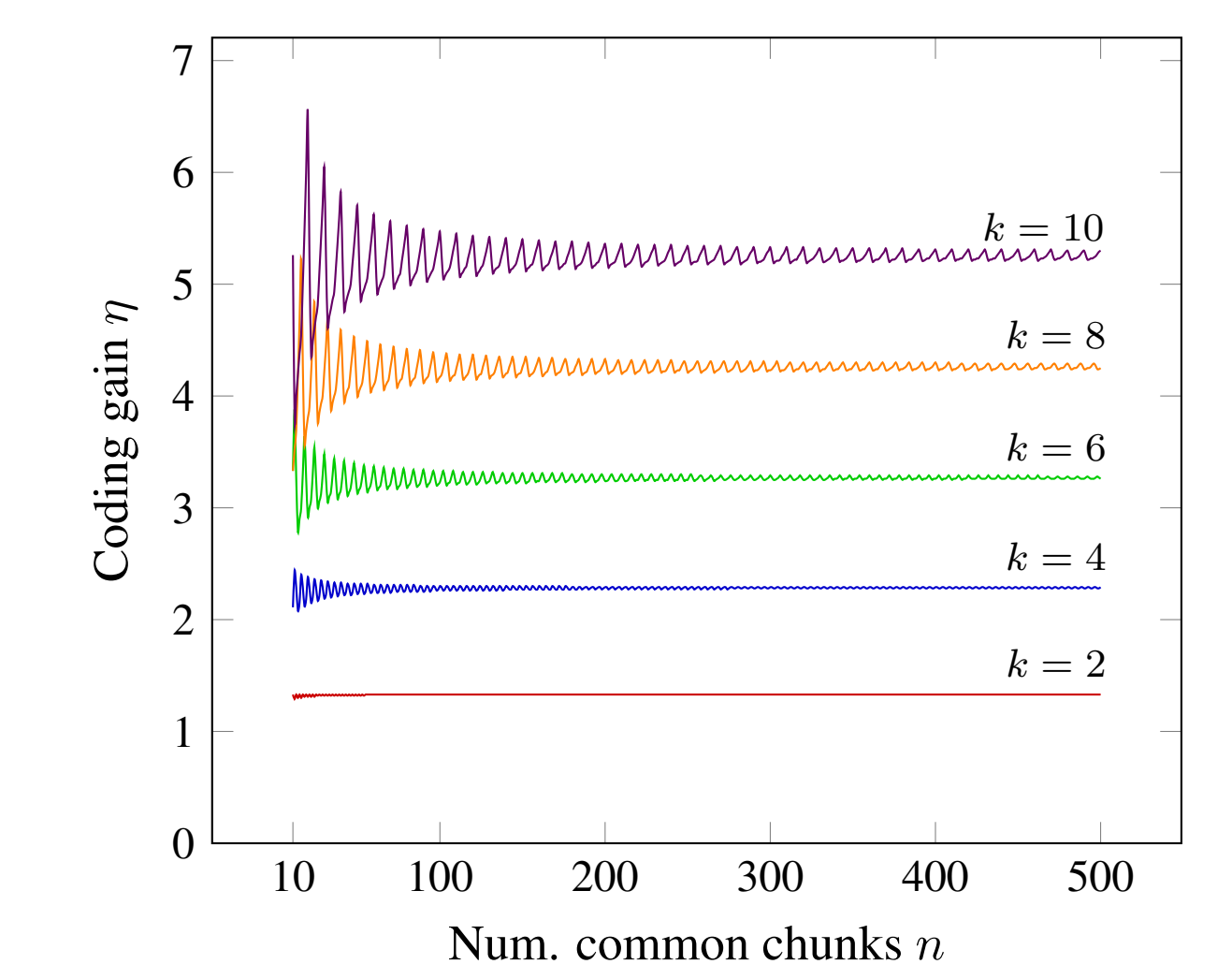


## Results

Transmissions at eNodeB: measuring throughput improvement



Coding gain: measuring the benefit of network coding



## Conclusion

NC-CELL provides efficient content distribution for cloud applications in mobile cellular networks. It enables eNodeB nodes to monitor and cache in transit traffic and exploits network coding to combine packets.

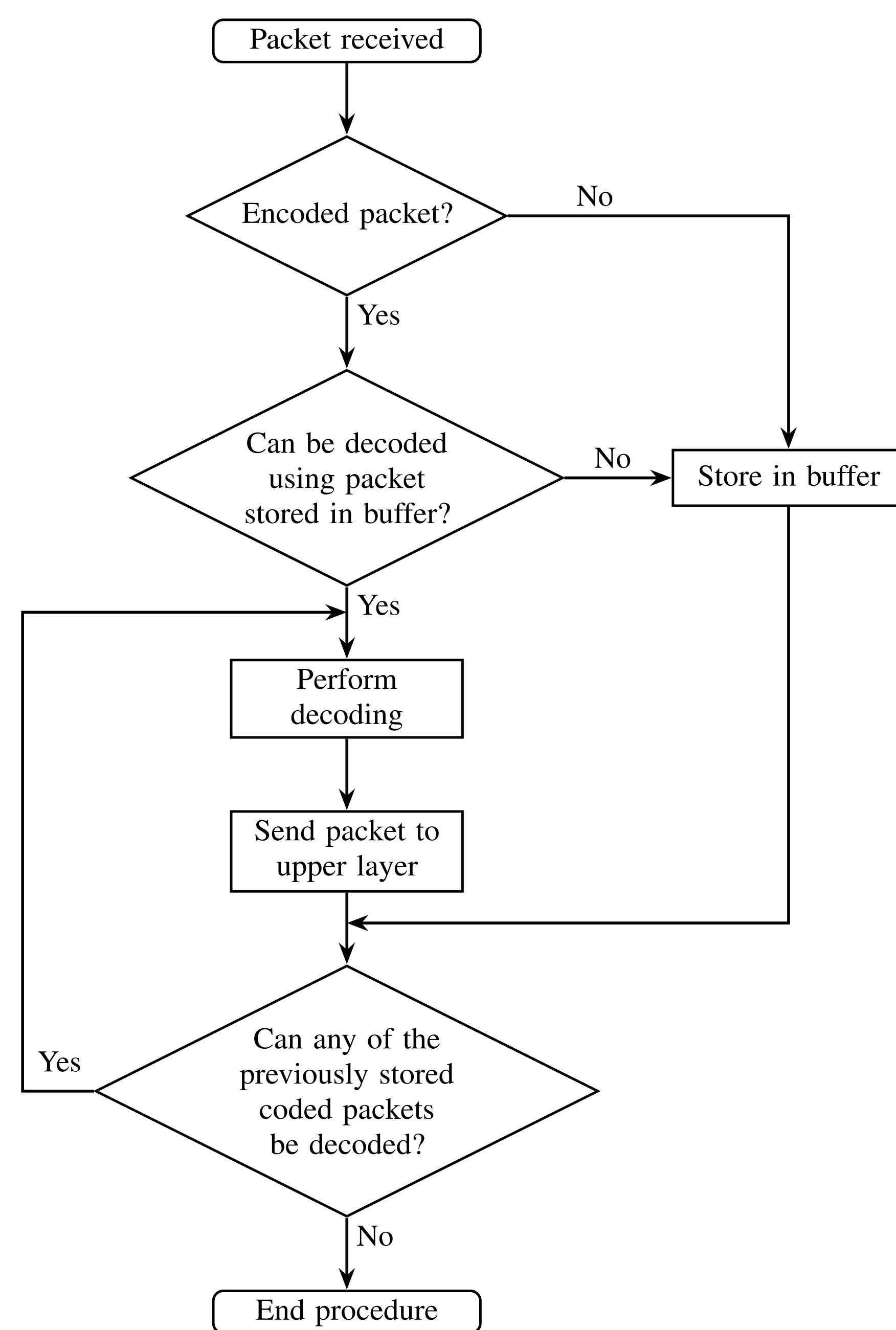
## Acknowledgements

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## Encoding and Decoding Procedure

### Encoding

- At eNodeB
- Combining only content not packet headers
- Delivery to all interested users through PDSCH (primary and secondary users)

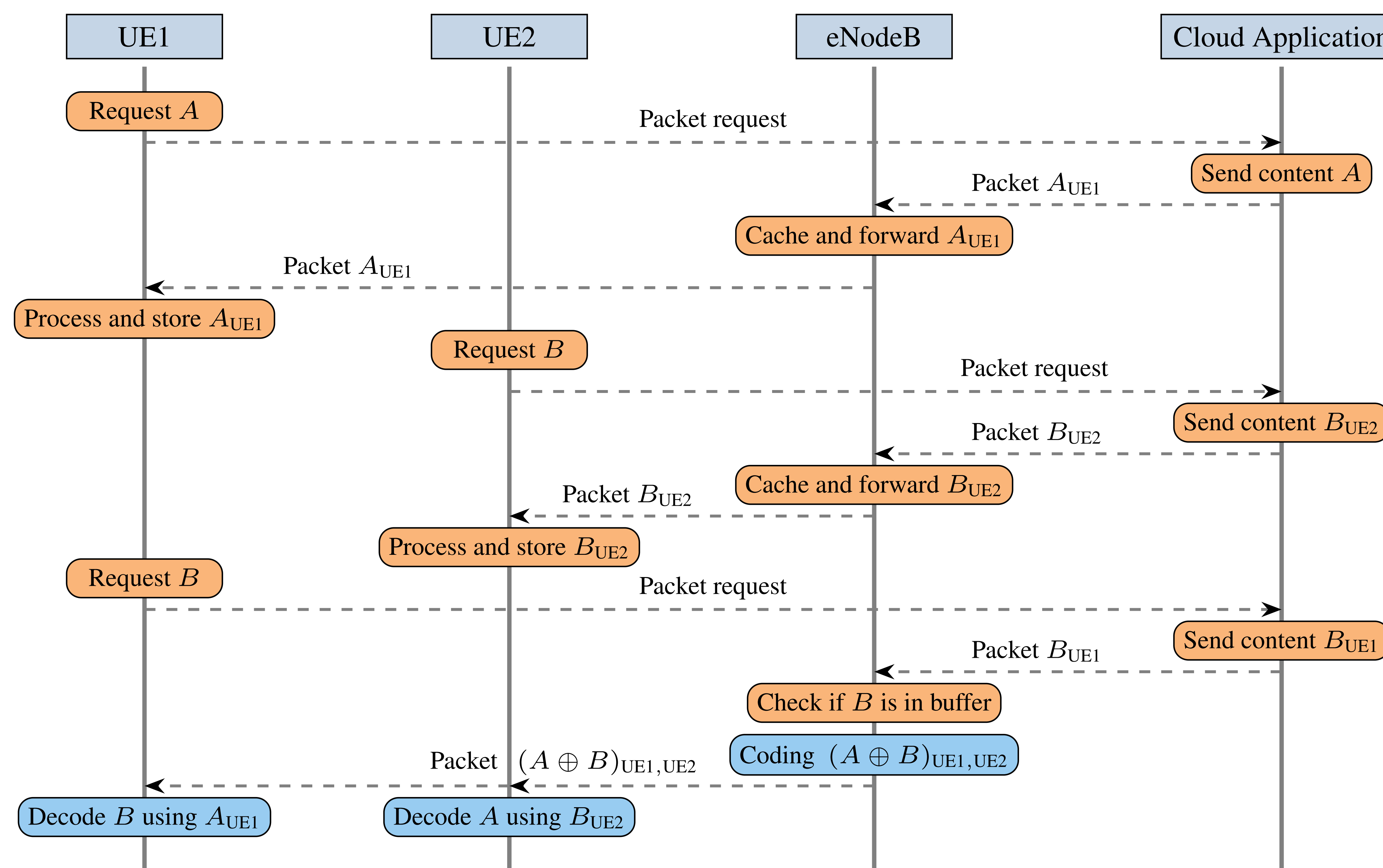


### Decoding

- At users' side
- Immediate if one of the two content packets is already available

## NC-CELL Operation

- Two users: UE1 and UE2
- Need to retrieve content *A* and content *B* from cloud application
- eNodeB exploits coding opportunity



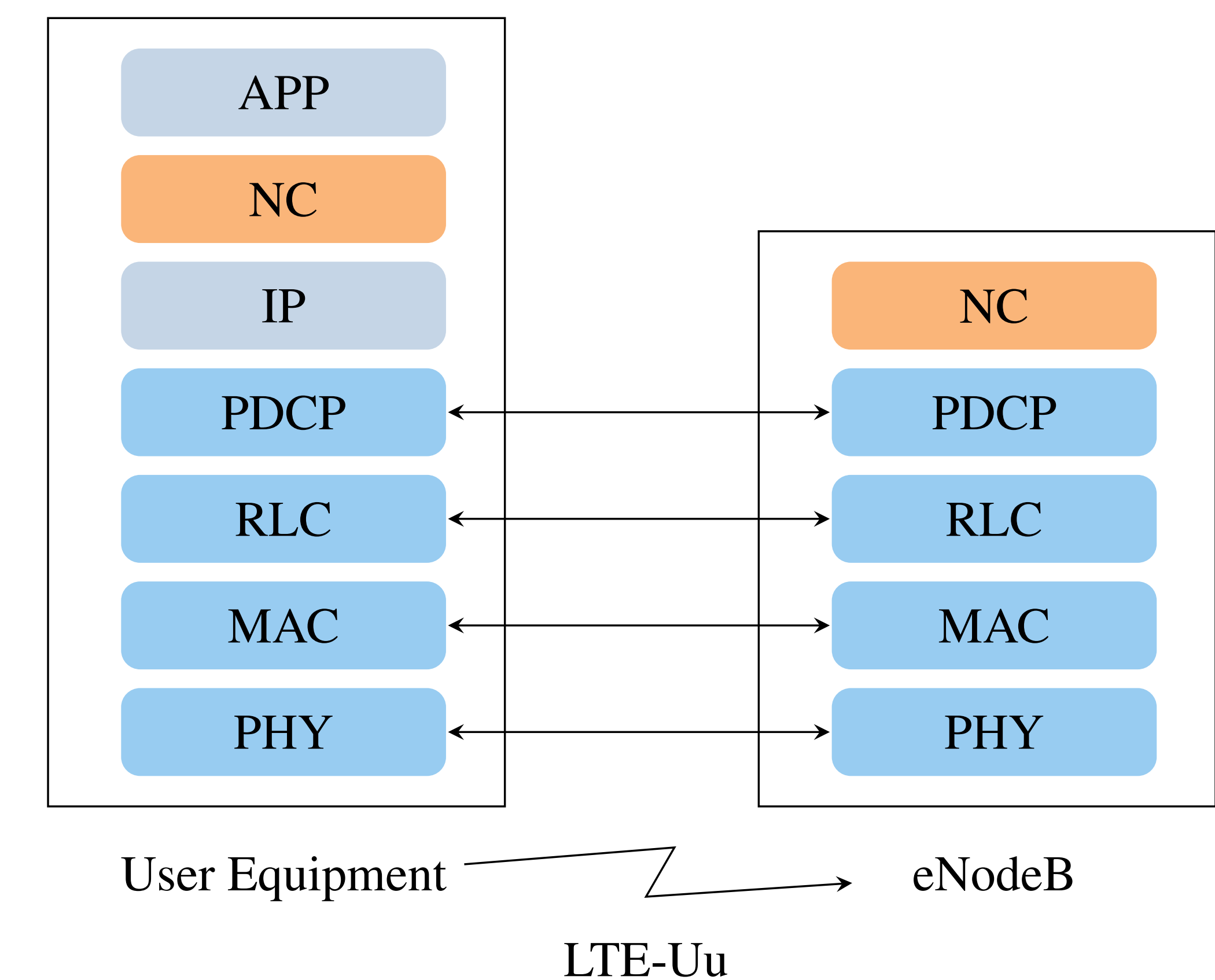
## Protocol Stack

### Encoding

- After GTP header removal
- Before PDCP performs IP header compression

### Decoding

- Primary users receive and decode immediately
- Secondary users do not discard frame



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