

ENSC 835

# Modeling RTP Streams over ATM AAL5

Kevin Ko (kkoa@sfu.ca)

Naomi Ko (nko@sfu.ca)

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# Outline of Presentation

- Project Overview
- Background Information
- Theory and Methodology
- OPNET Implementation
- Conclusion
- References

# Project Overview and Objectives

- End-to-end duplex system
- RTP streams over ATM
- Model system and simulate in OPNET
- Verification and analysis
- Topic chosen out of personal interest
- ATM Forum contribution by AT&T Labs  
(A. Fraser, P. Onufryk, K.K. Ramakrishnan)

## Background Information: Real-Time Transport Protocol

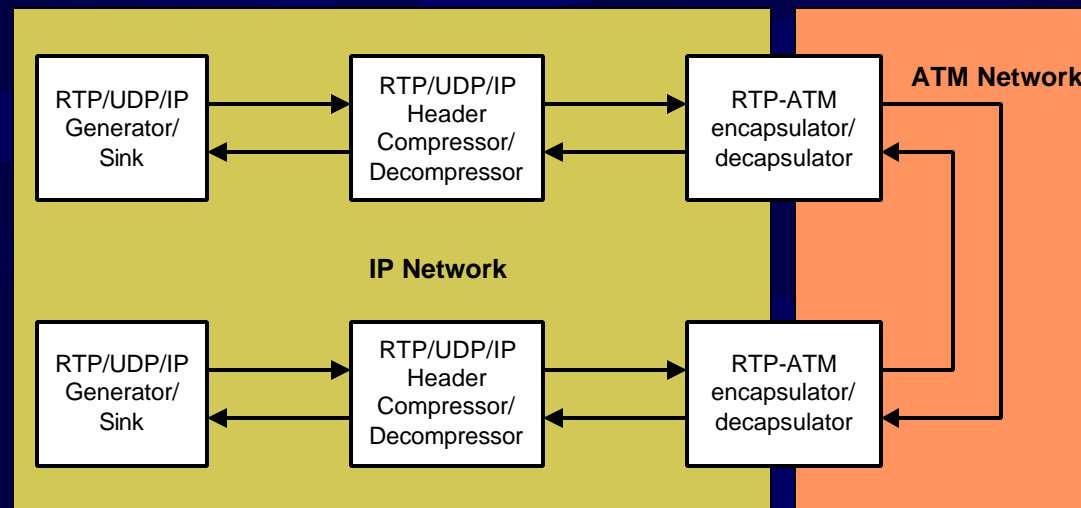
- RFC1889
- Standard for conveying real-time media streams
- Typically over UDP/IP
- Applications in VoIP telephony, multimedia conferencing
- RTP sessions with multiple context sessions or RTP streams
  - defined by source/destination IP addresses, UDP ports, and RTP Synchronization Source (SSRC)

# Background Information: Asynchronous Transfer Mode

- ITU-I.361
- Circuit-switched network technology
- Fixed-size cells
- ATM Adaptation Layer type 5 (ITU-I.363.5)
  - Simple and efficient adaptation layer (SEAL)
  - Used for IP data

# Theory and Methodology

- End-to-end system

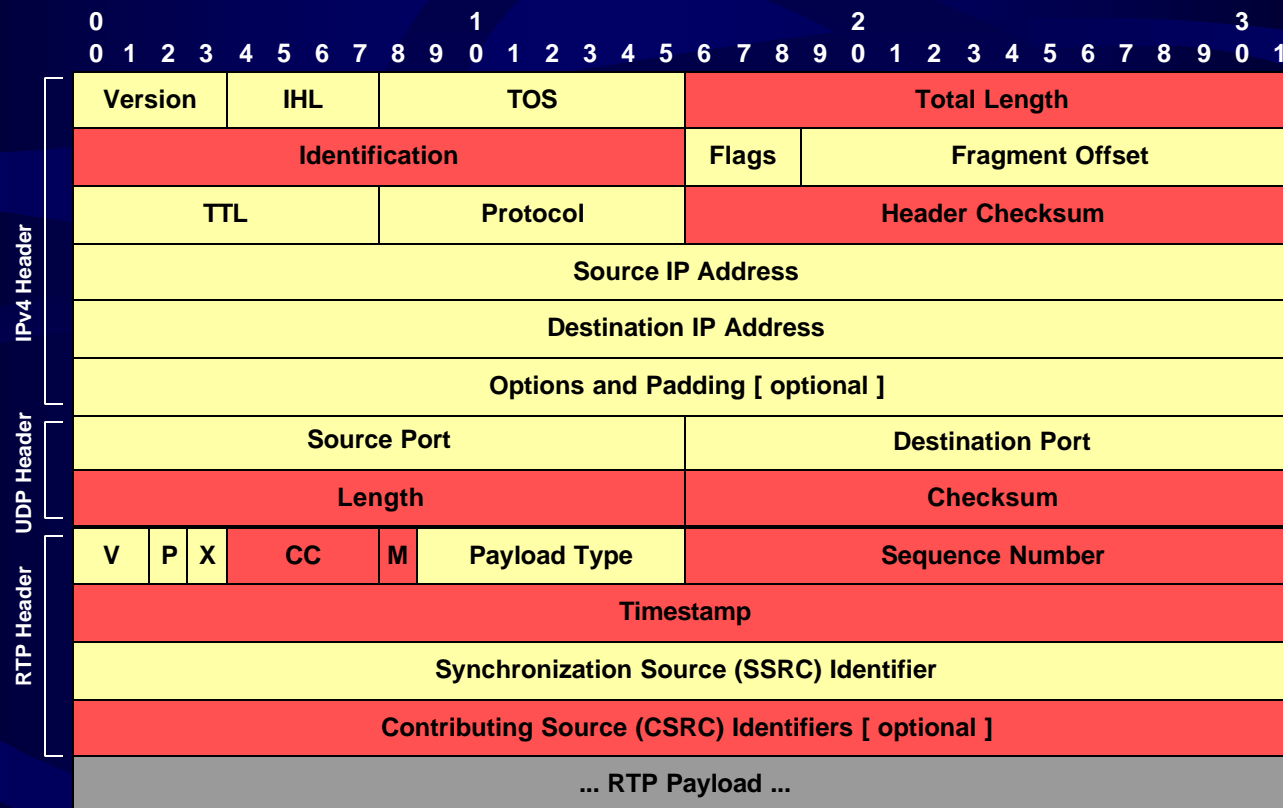


# Theory and Methodology: RTP/UDP/IP Header Compression/Decompression

- RFC2508
- Based on TCP/IP header compression
- Most header fields stay constant or change by fixed amount
- Requirement: Link layer handles error detection
- Our focus on IPv4

# Theory and Methodology: RTP/UDP/IP Header Compression/Decompression (cont'd)

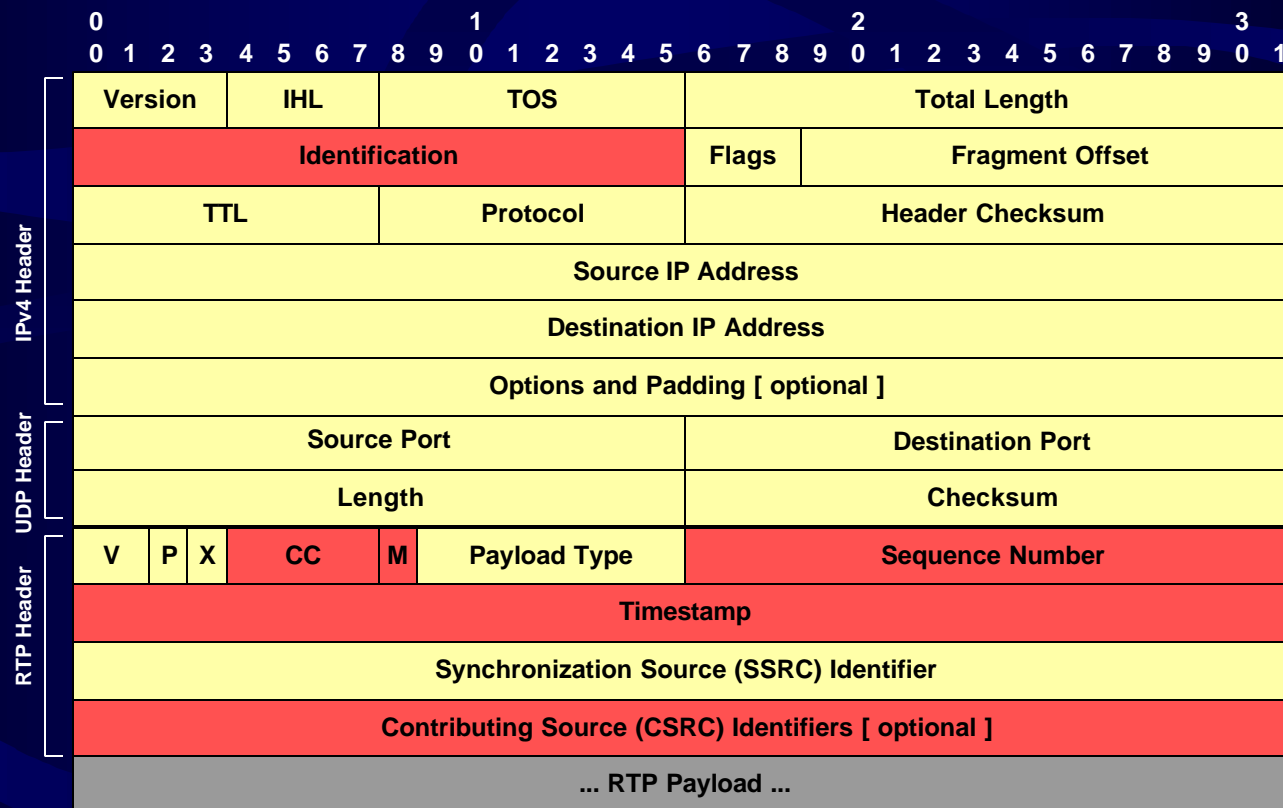
- Regularly changing field values in red





# Theory and Methodology: RTP/UDP/IP Header Compression/Decompression (cont'd)

- Field values that must be sent in red



## Theory and Methodology: RTP/UDP/IP Header Compression/Decompression (cont'd)

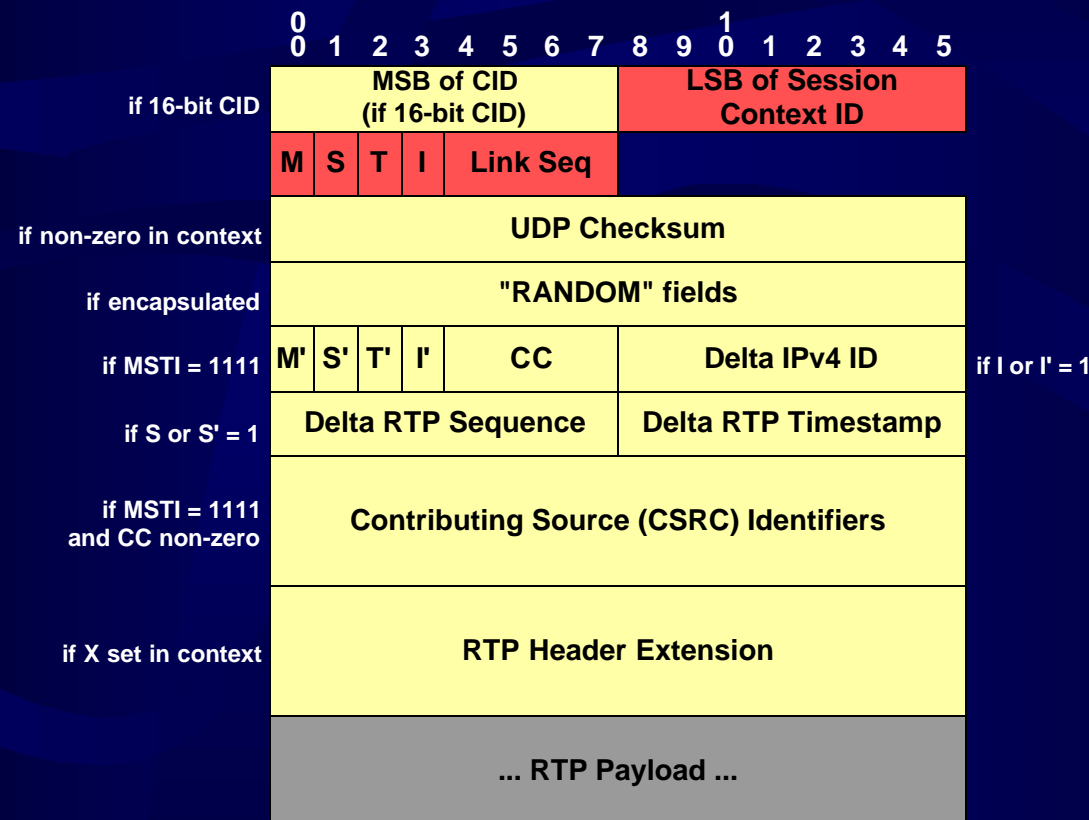
- Compressed packets must carry
  - 8 or 16-bit Context Identifier (CID)
    - Identifies context session
  - 4-bit link sequence
    - Detects packet loss

## Theory and Methodology: RTP/UDP/IP Header Compression/Decompression (cont'd)

- 3 packet formats sent from compressor
  - COMPRESSED\_RTP
  - COMPRESSED\_UDP
  - FULL\_HEADER

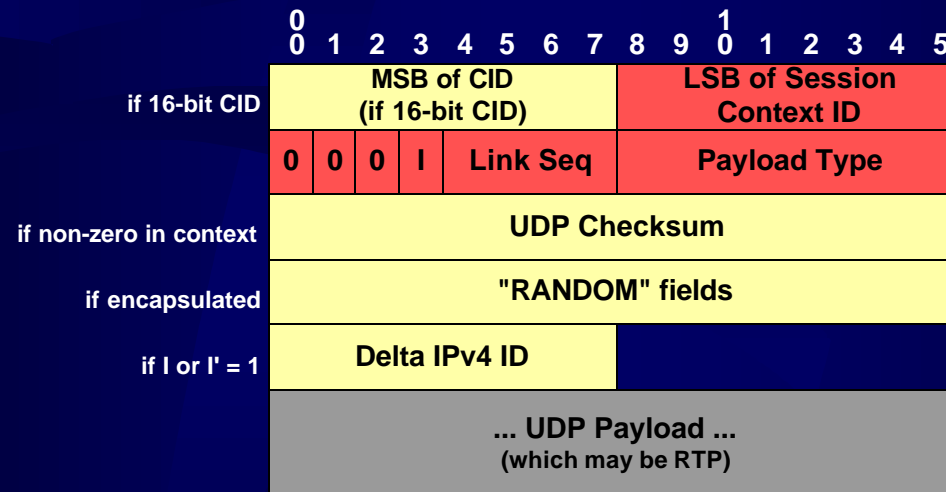
# Theory and Methodology: RTP/UDP/IP Header Compression/Decompression (cont'd)

- **COMPRESSED RTP**
  - Compresses RTP/UDP/IP headers



# Theory and Methodology: RTP/UDP/IP Header Compression/Decompression (cont'd)

- **COMPRESSED\_UDP**
  - Compresses UDP/IP header only



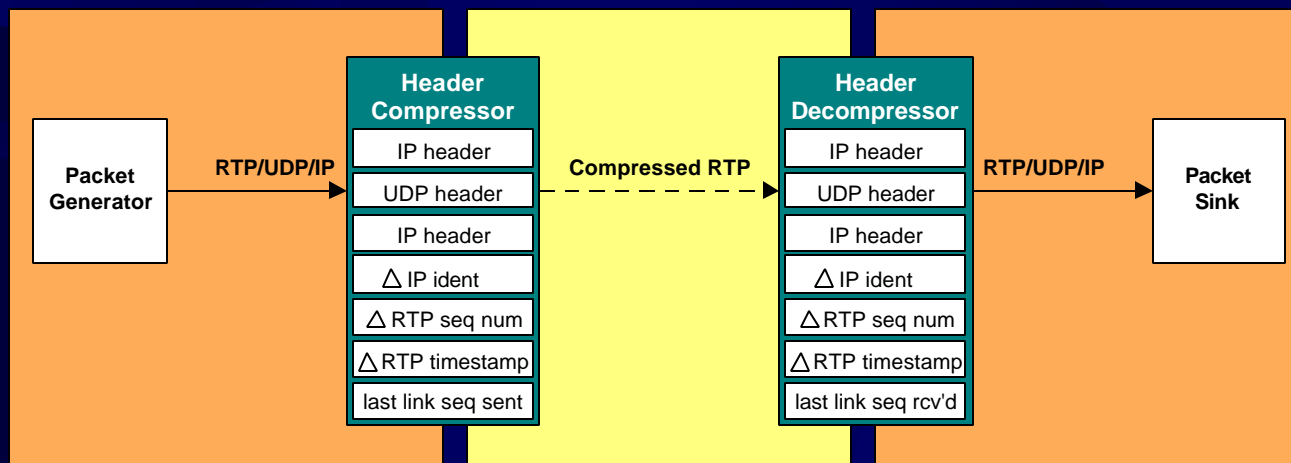
# Theory and Methodology: RTP/UDP/IP Header Compression/Decompression (cont'd)

- FULL\_HEADER
  - No compression
  - Either UDP or IP header cannot be compressed

0				1				2				3											
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3
Version				IHL				TOS				Total Length											
Identification								Flags				Fragment Offset											
TTL				Protocol				Header Checksum															
Source IP Address																							
Destination IP Address																							
Options and Padding [ optional ]																							
Source Port												Destination Port											
Length												Checksum											
V	P	X	CC			M	Payload Type					Sequence Number											
Timestamp																							
Synchronization Source (SSRC) Identifier																							
Contributing Source (CSRC) Identifiers [ optional ]																							
... RTP Payload ...																							

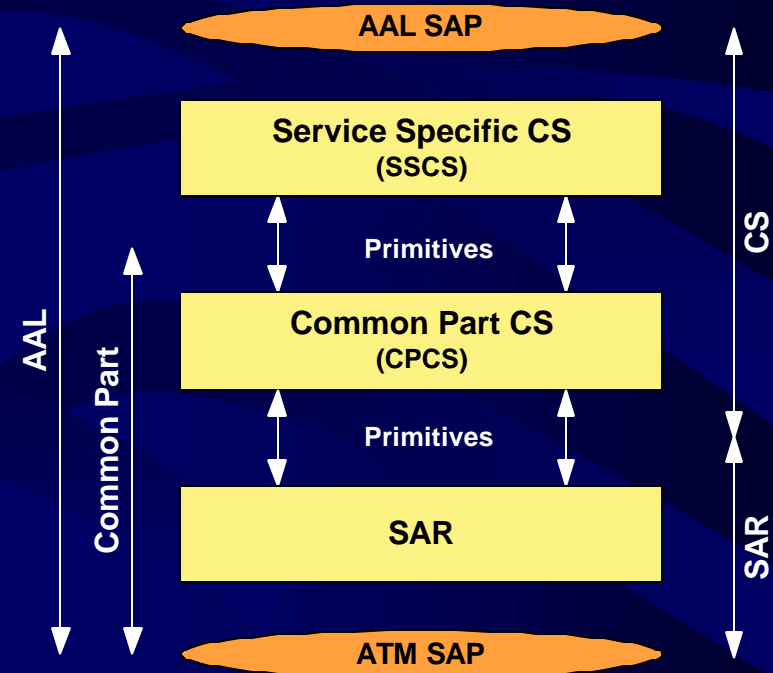
# Theory and Methodology: RTP/UDP/IP Header Compression/Decompression (cont'd)

- Context information shared by compressor and decompressor



# Theory and Methodology: ATM Encapsulator/Decapsulator

- UNI must support RTP/UDP/IP formats
- AAL5
  - Service Specific CS
  - Common Part CS
  - SAR
- ATM encapsulation

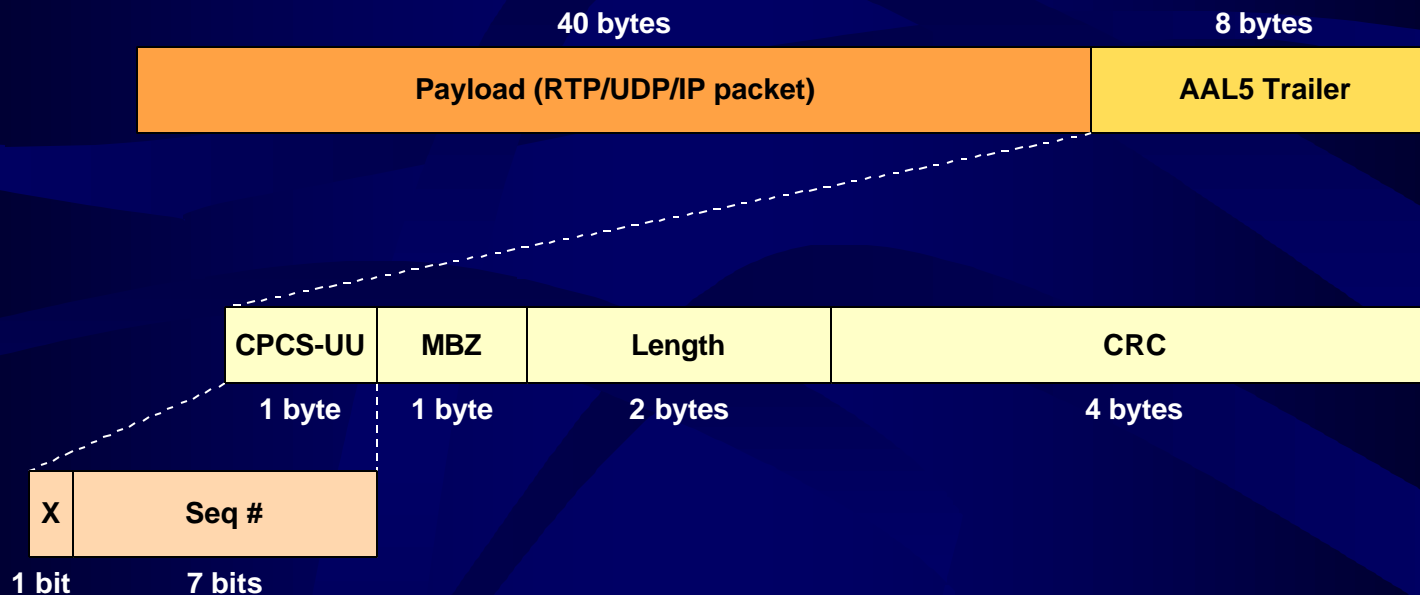




## Theory and Methodology:

# ATM Encapsulator/Decapsulator (cont'd)

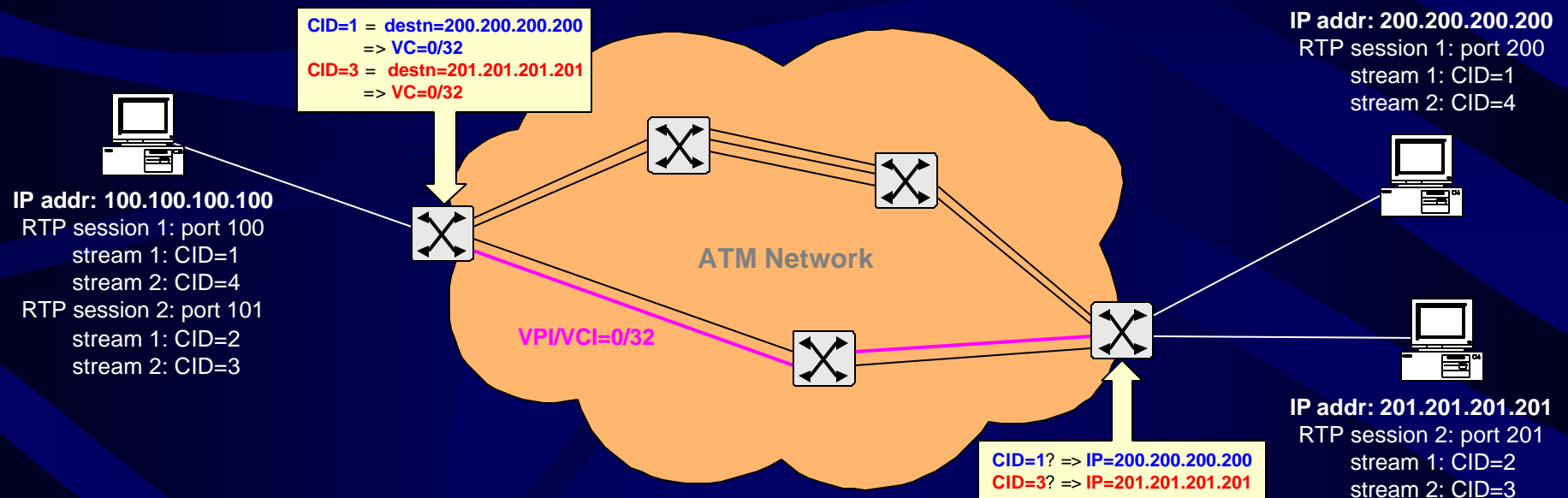
- Common Part Convergence Sublayer (CPCS)



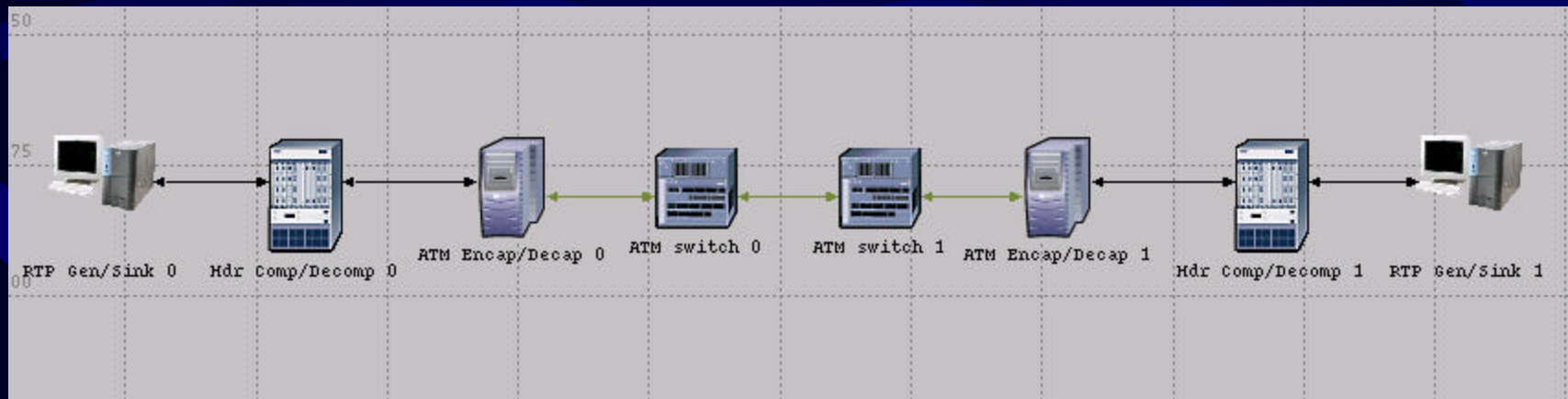
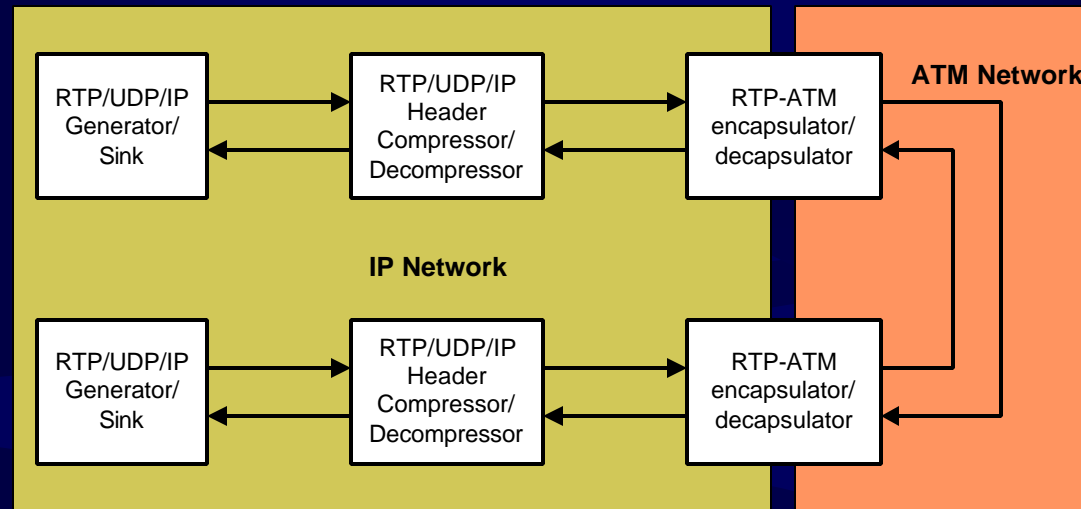
Real-time AAL5 Encapsulation Packet  
(Voice over ATM to the Desktop)

# Theory and Methodology: ATM Encapsulator/Decapsulator (cont'd)

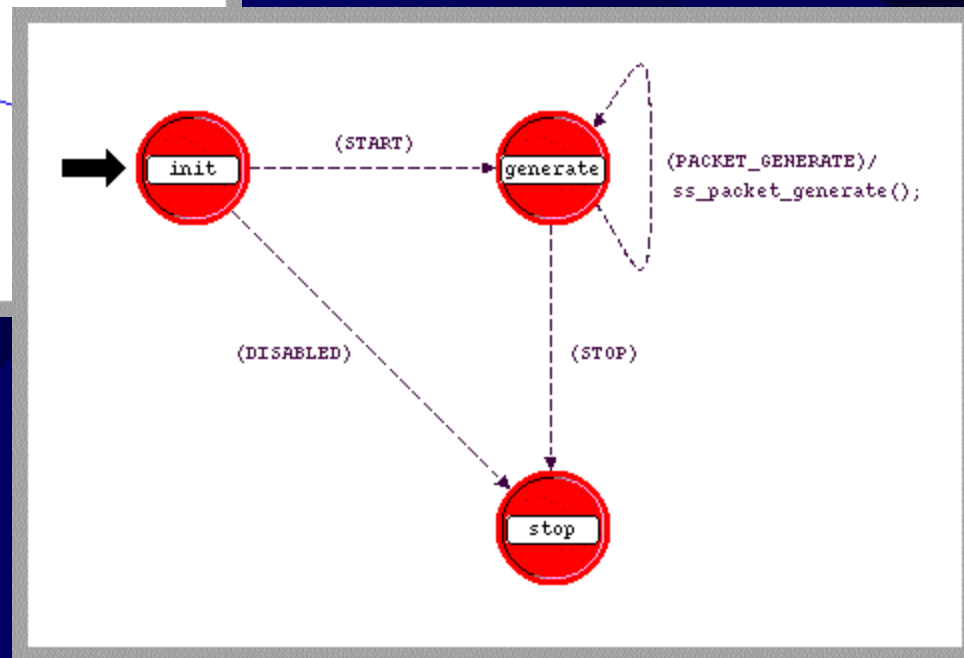
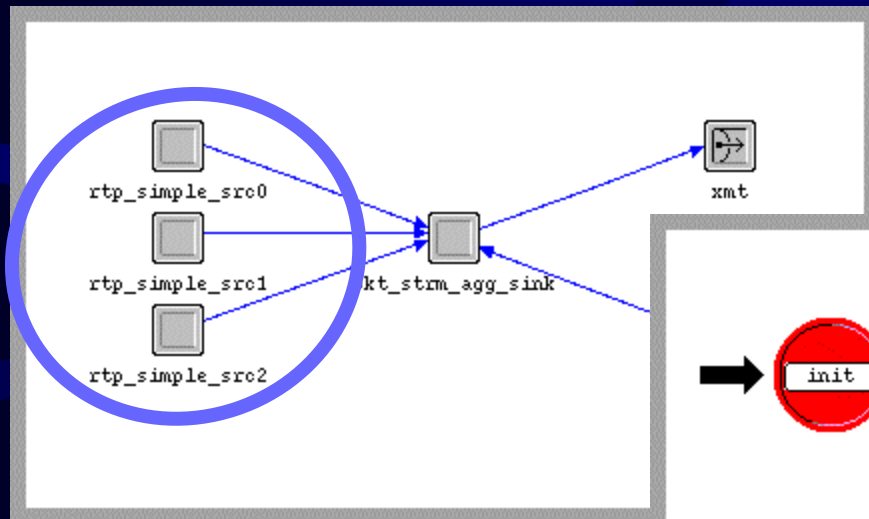
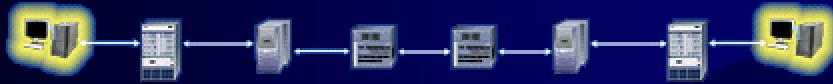
- ATM encapsulation
  - VC assignment based on CID



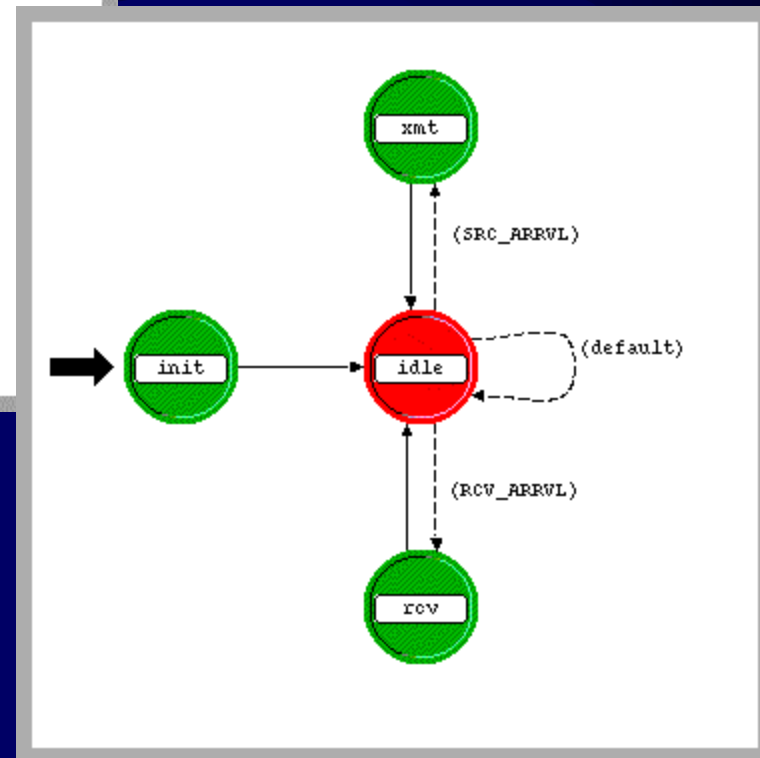
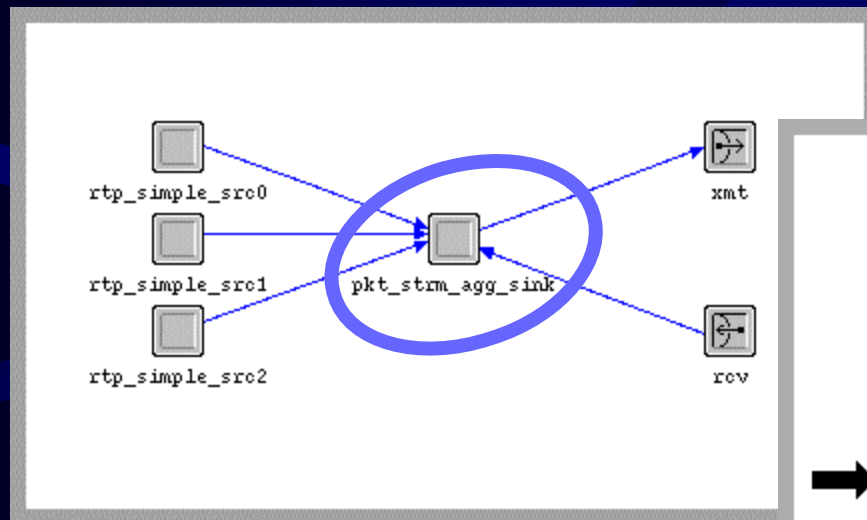
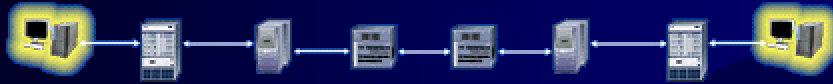
# OPNET Implementation



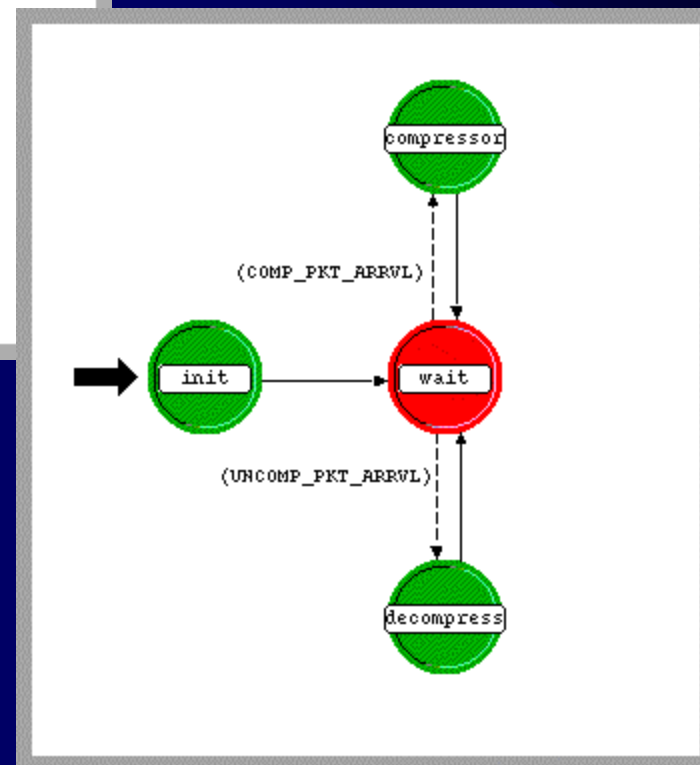
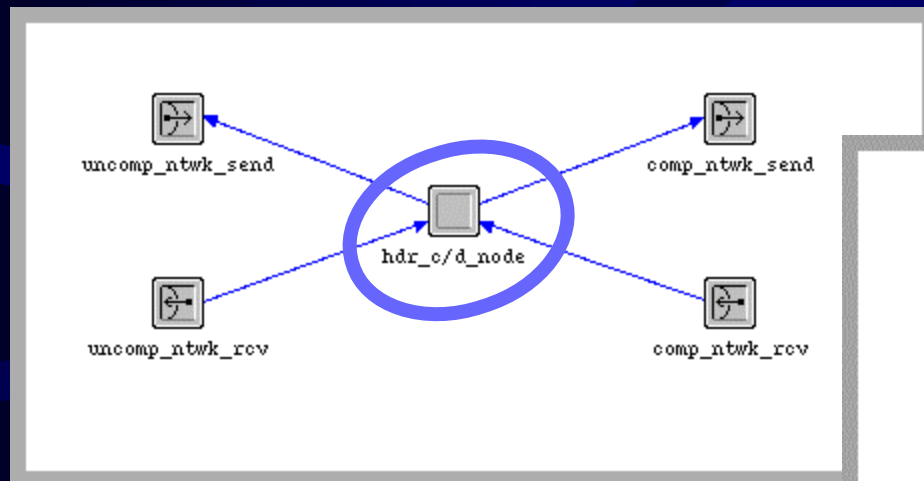
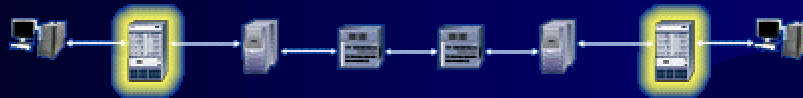
# OPNET Implementation: RTP Generator/Sink



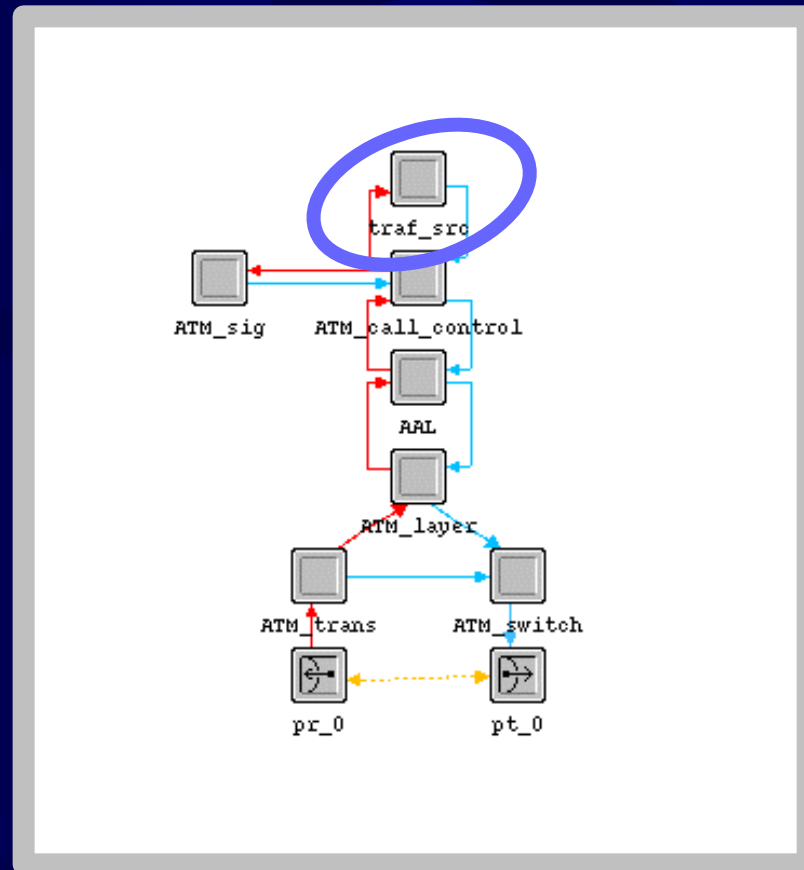
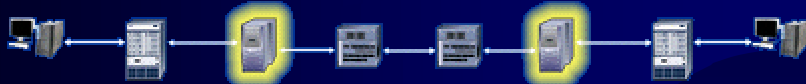
# OPNET Implementation: RTP Generator/Sink (cont'd)



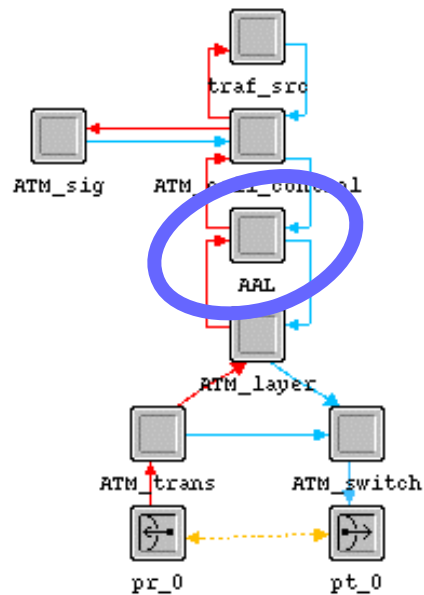
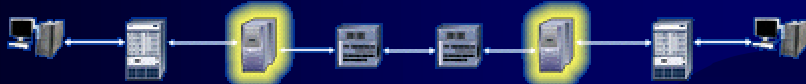
# OPNET Implementation: RTP/UDP/IP Header Compression/Decompression



# OPNET Implementation: ATM Encapsulator/Decapsulator



# OPNET Implementation: ATM Encapsulator/Decapsulator (cont'd)



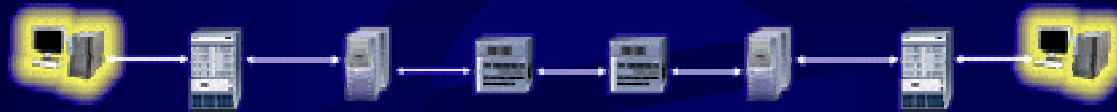


# OPNET Implementation: Assumptions

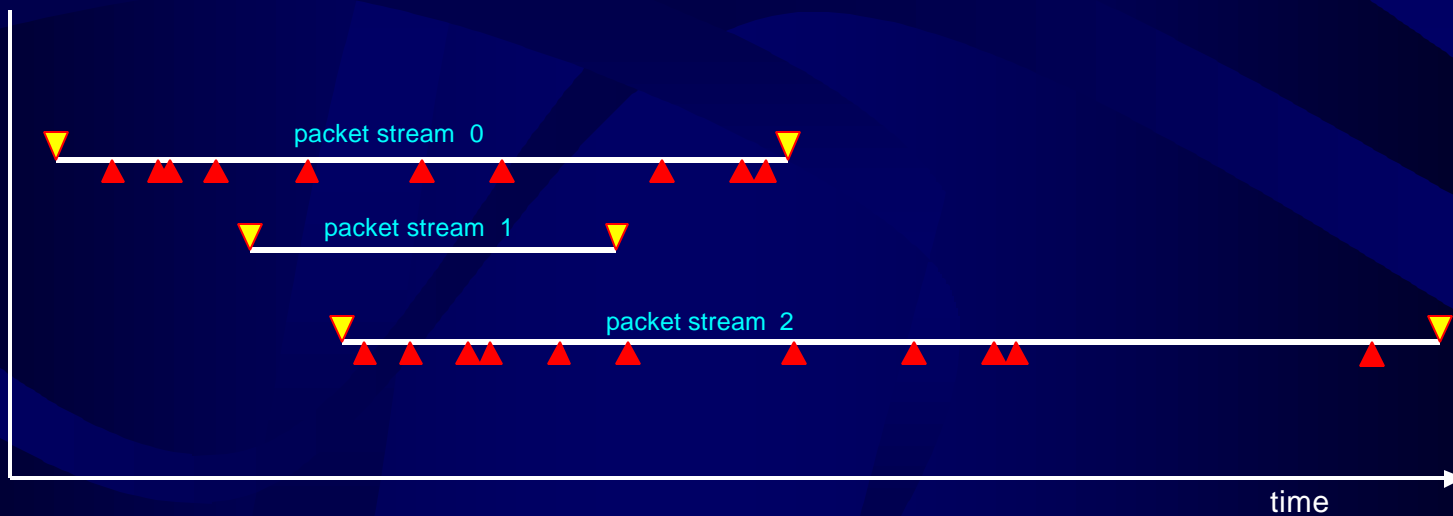
- Session setup / termination
  - RTP session: SIP (RFC 2543), H.323
  - ATM: PVC vs. SVC
- Ideal network ☺
- One RTP session, multiple RTP streams
- IPv4 only

# OPNET Implementation: Verification Methods

- Stage by stage accuracy



- Collection of packet information at “symmetrical” stages of transmission



# Conclusion

- Compression and encapsulation of RTP/UDP/IP packet
- Implementation in OPNET
- Programming in OPNET
- Knowledge of RTP, ATM protocols

# References

- [1] Casner, S., Frederick, R., Jacobson, V., and Schulzrinne, H., “RTP: A Transport Protocol for Real-Time Applications”, RFC1889, GMD Fokus, Precept Software, Inc., Xerox Palo Alto Research Center, Lawrence Berkeley National Laboratory, January 1996.
- [2] Casner, S. and Jacobson, V., “Compressing IP/UDP/RTP Headers for Low-Speed Serial Links”, RFC2508, Cisco Systems, February 1999.
- [3] Cisco Systems, Inc. “Guide to Cisco Systems’ VoIP Infrastructure Solution for SIP – Version 1.0”, pp 1-8., 2000.
- [4] Cisco Systems, Inc. “Asynchronous Transfer Mode (ATM) Switching”.  
[http://www.cisco.com/univercd/cc/td/cisintwk/ito\\_doc/atm.pdf](http://www.cisco.com/univercd/cc/td/cisintwk/ito_doc/atm.pdf), February 25, 2002.
- [5] Fraser, A., Onufryk, P., and Ramakrishnan, K., “Encapsulation of Real-Time Data Including RTP Streams over ATM”, ATM Forum/SAA-98-0139, AT&T Labs. Research, February 1998.
- [6] Heinanen, J., “Multiprotocol Encapsulation over ATM Adaptation Layer 5”, RFC1483, Telecom Finland, July 1993.
- [7] International Telecommunication Union. “B-ISDN ATM layer specification”. ITU-T I.361, February 1999.
- [8] International Telecommunication Union. “B-ISDN ATM Adaptation Layer specification: Type 5 AAL”, ITU-T I.363.5, August 1996.
- [9] Jacobson, V. “Compressing TCP/RTP Headers for Low-Speed Serial Links”, RFC1144, LBL, February 1990.
- [10] Webopedia, “RTP”, <http://www.pcwebopedia.com/TERM/R/RTP.html>, March 14, 2002.

# Modeling RTP Streams over ATM AAL5

Thank You ☺  
for listening so attentively

¿Questions?

Kevin Ko (kkoa@sfu.ca)

Naomi Ko (nko@sfu.ca)