Robust Header Compression for Multimedia Services

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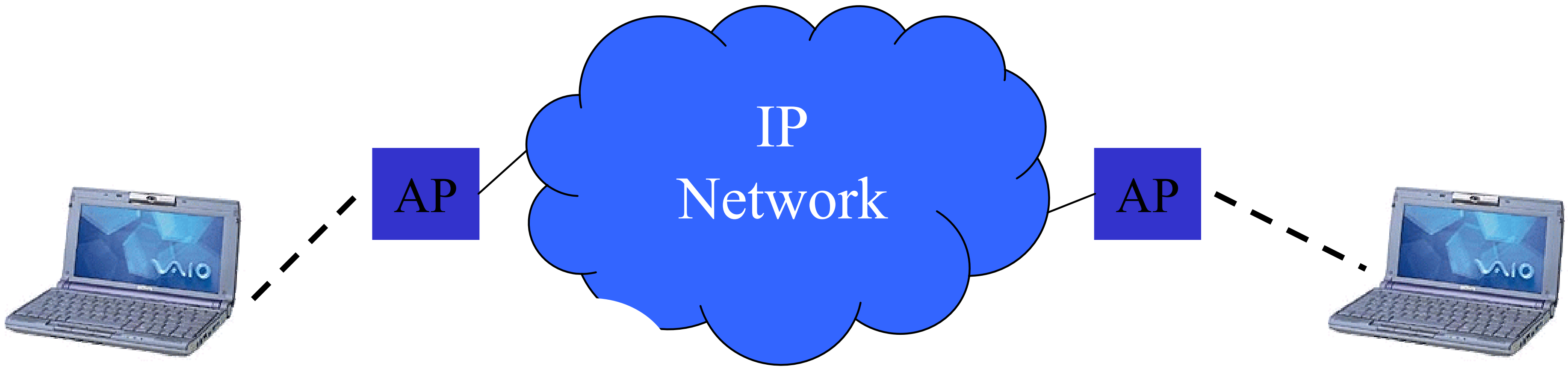
Motivation and Introduction

- Wireless link is highly error-prone
- Large round trip time
- Scarce radio resources
- Large header overhead



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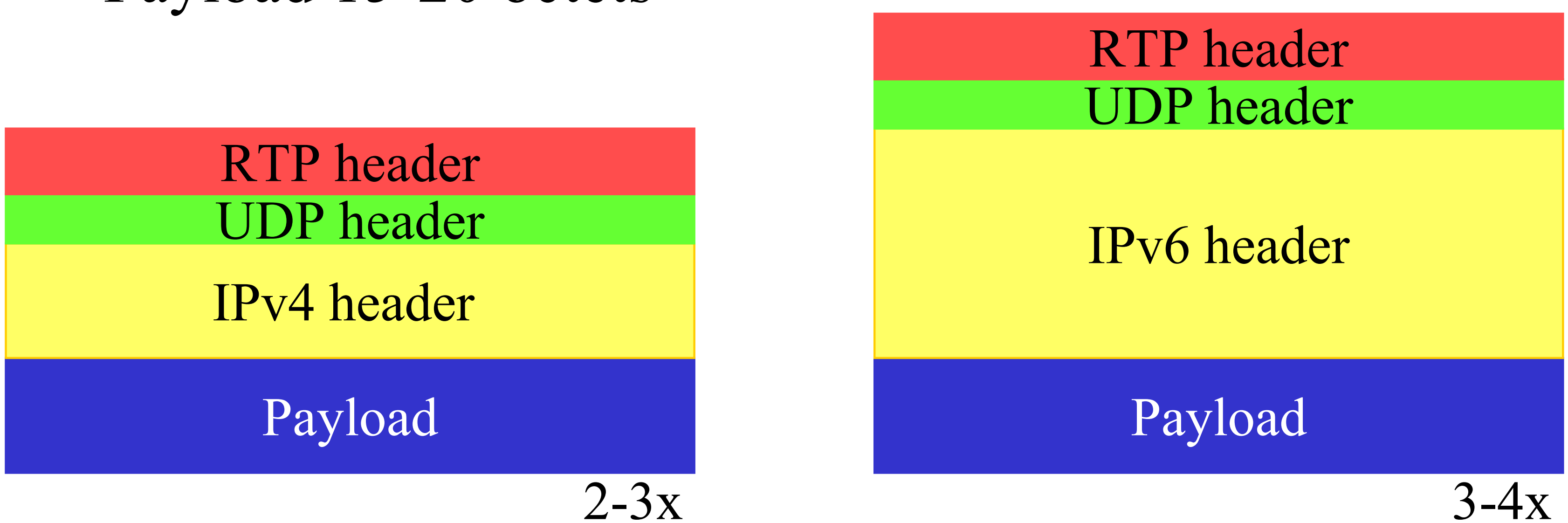
Problem of IP overhead

- An example for voice communication
  - RTP header 12 octets
  - UDP header 8 octets
  - IPv4 header 20 octets / IPv6 header 40 octets
  - Payload 15-20 octets



Header Compression Fundamentals

- Compression can be done, because of
  - significant redundancy between header fields in one IP frame, e.g. RTP and IP header
  - significant redundancy between header to header fields in one stream, e.g. RTP sequence number for voice communication (constant bit rate w/o silent detection)
- Initially sending all information
- Utilizing the dependencies, future header information are predictable if no error occurs

Existing Header Compression Schemes

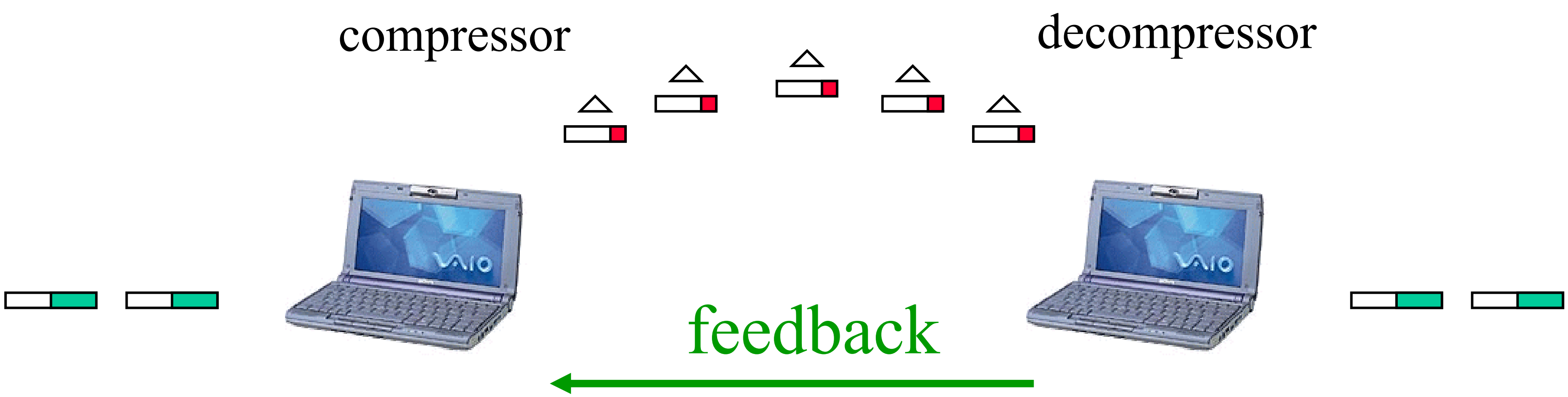
- Compressed TCP header - ***CTCP***
  - by Van Jacobson, RFC 1144, 1990
  - compressing 40 octets to 4 octets for TCP packets only
  - no signalling between sender and receiver
- IP header Compression - ***IPHC***
  - by Degermark, RFC 2507, 1999
  - IP, TCP, and UDP packets, but no RTP
- Compressed RTP header - ***CRTP***
  - by Degermark, IEEE Pers. Comm., vol.7, n. 4, 2000
  - compressing 40 octests to 2 octets
  - performs badly on lossy links with long round trip times

Metric for compression performance

- Compression efficiency
  - Compressed header size versus original header size
- Compression transparency
  - Decompressed headers has to be 100% semantically identical
- Damage propagation
  - Due to error-prone headers or feedback information decompressed headers can be incorrect.
- Loss propagation
  - Loss of headers due to error-prone headers or feedback information
- Residual error
  - Errors after the data link layer
- Robustness
  - Even in case of errors header compression still works without losing packets

Robust Header Compression

- ROHC achieves the compression gain by state information about the compressor and the decompressor
- Three states for compressor and decompressor
- RFC 3095



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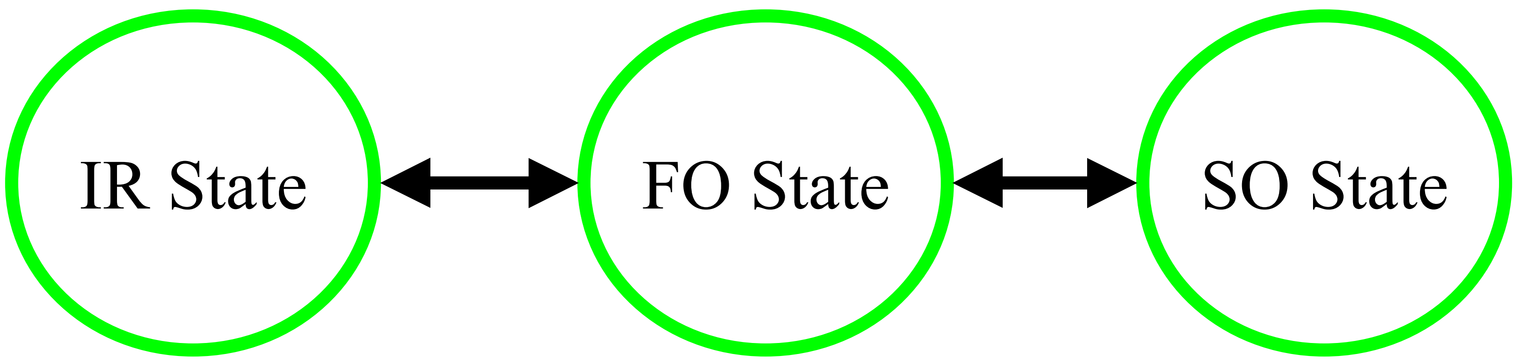
Compressor States

- Three states: Initialization and Refresh, First Order, and Second Order
- Transitions are made because of variation in packet headers, any feedback from the decompressor, and/or periodically timeouts

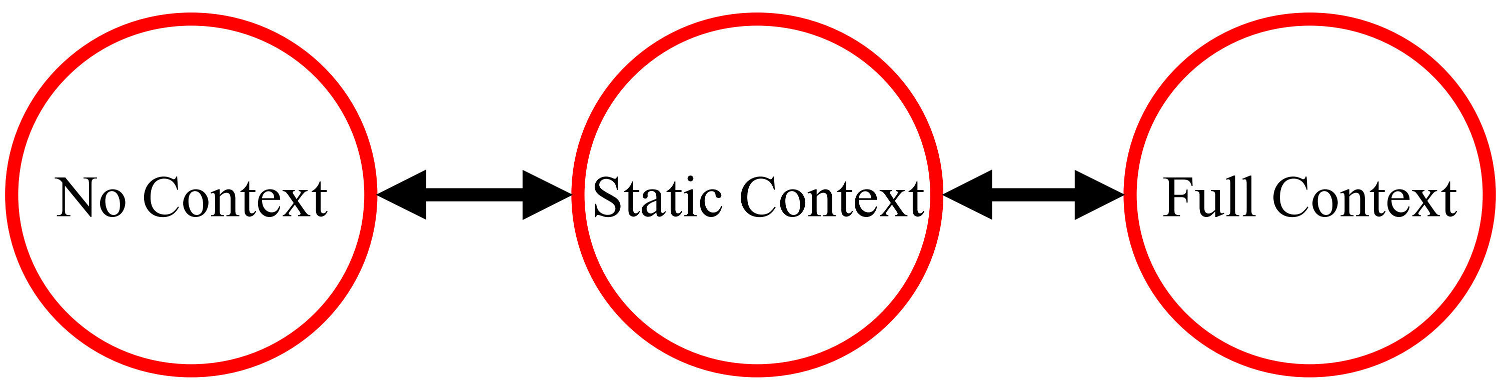


recover after a failure

compression is optimal

Decompressor States

- DC starts at No Context compression state
  - not yet decompressed a packet successfully
- After first successful decompressed packet the decompresser goes into the Full Context state



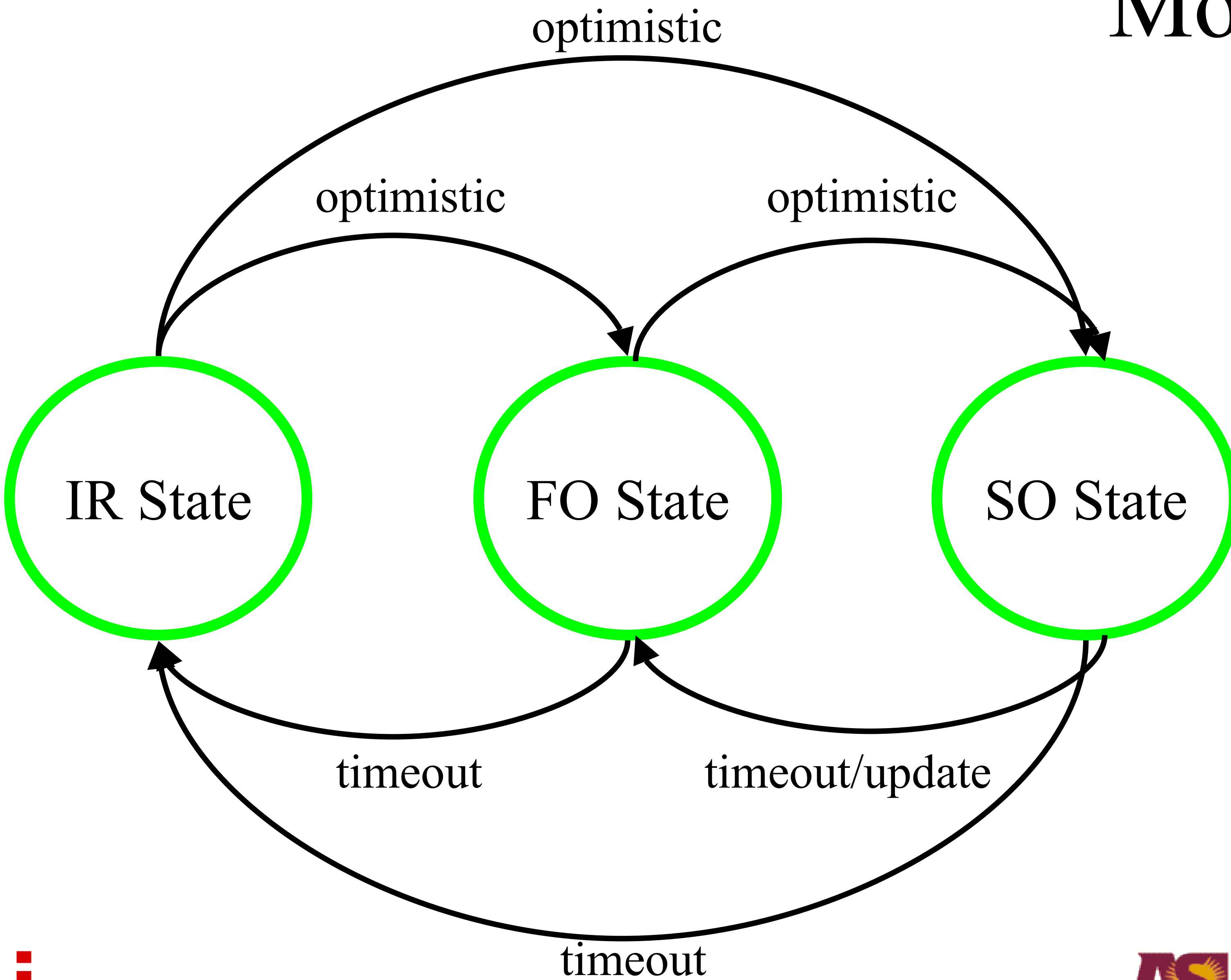
Modes of Operation

- Three modes of operation are defined in ROHC
  - unidirectional (Starting point)
    - no feedback channel
    - periodic timeouts for the state machine
    - compression efficiency is small
  - bi-directional optimistic
    - no periodic timeouts, but feedbacks
  - bi-directional reliable
- States and modes are orthogonal
- All three modes are necessary for a ROHC implementation

Encoding

- Least Significant Bit – LSB
- Window based LSB encoding – WLSB
- Scaled RTP Timestamp encoding
- Timer-based compression of RTP Timestamps
- Offset IP-ID encoding
- Self-describing variable-length values

Compressor States for Unidirectional Mode



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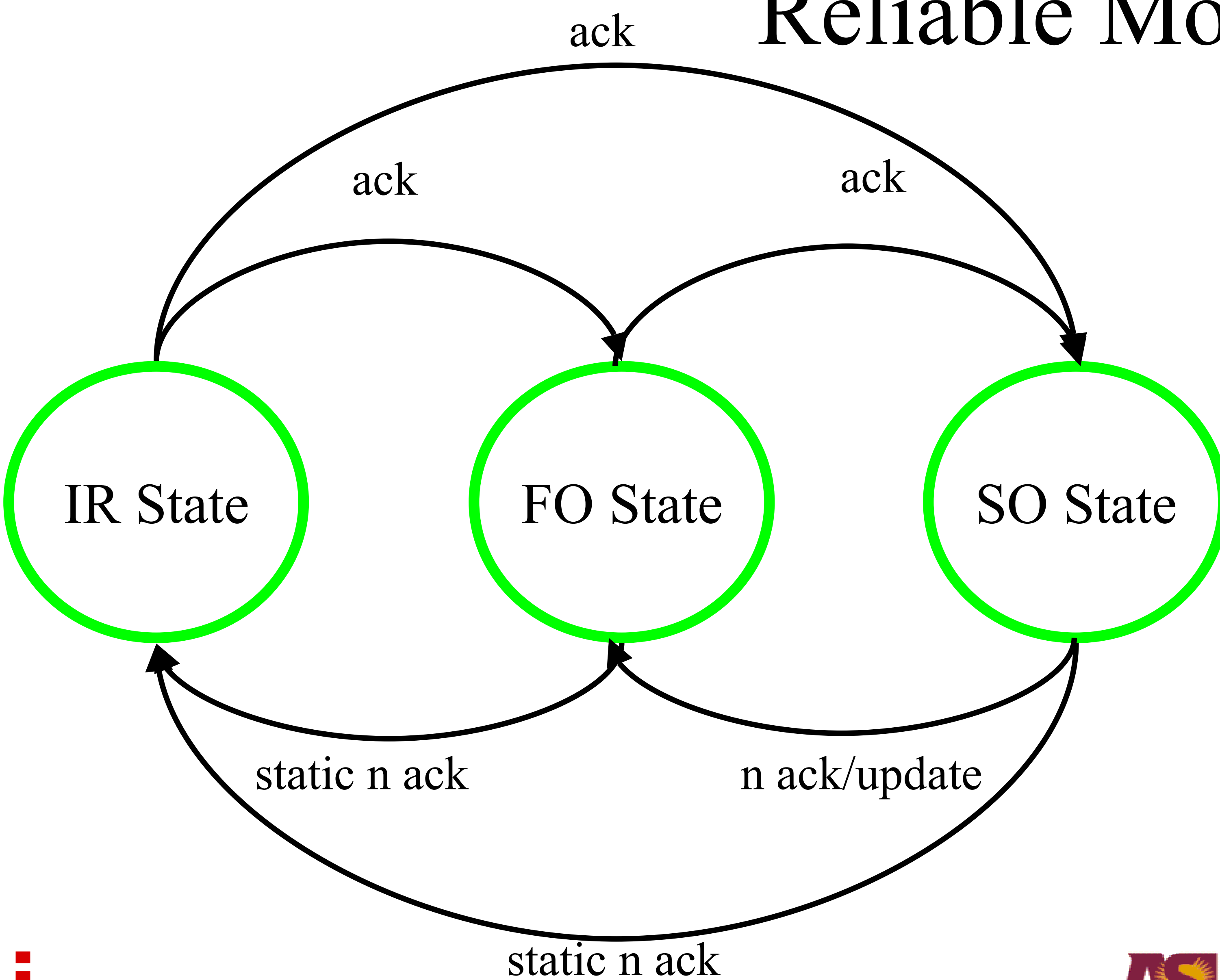
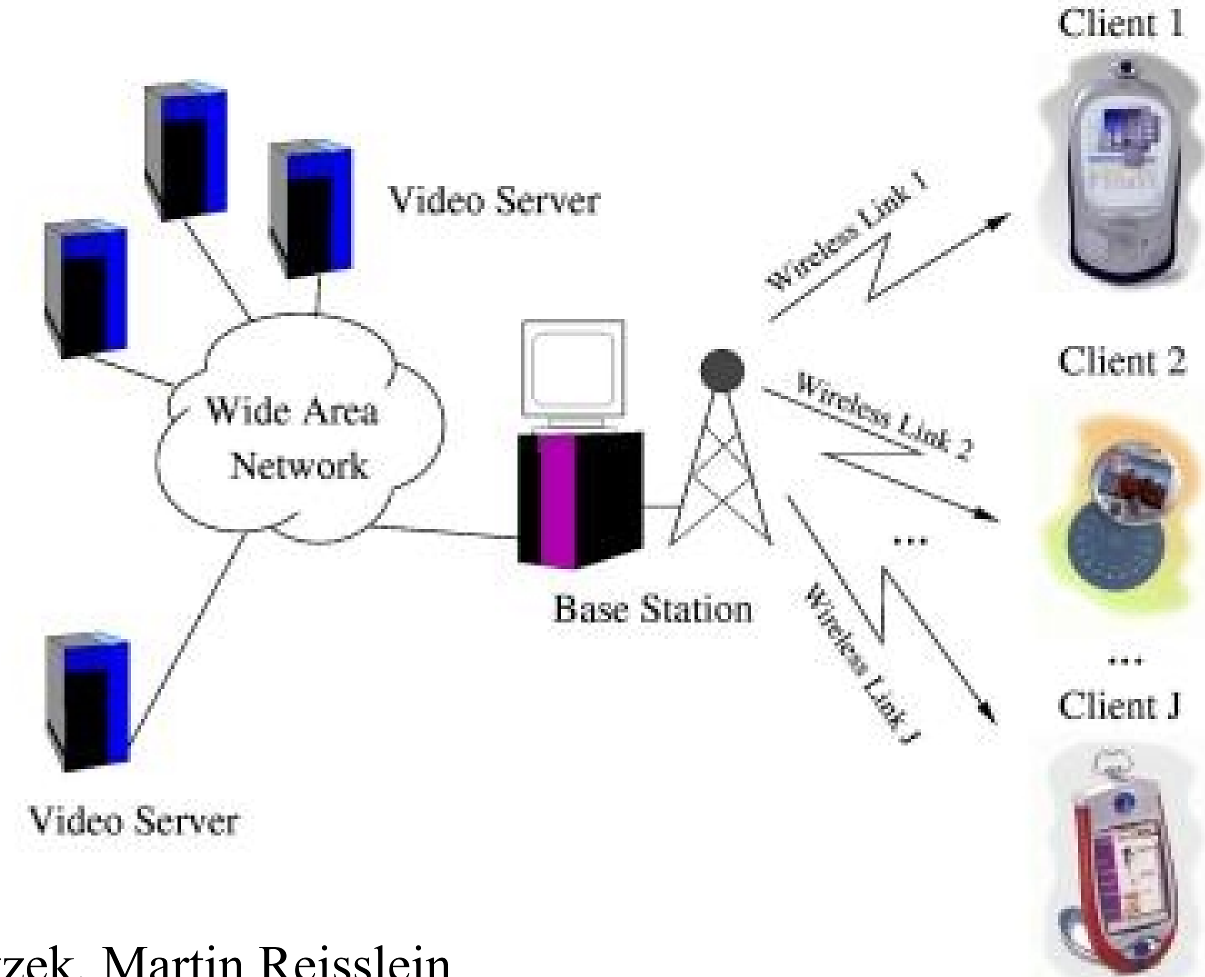
Compressor States for Bi-directional Reliable Mode



Use of ROHC for WJQ Demonstrator

- Goal: Maximize the number of customers (that you can bill) within your cell offering a sufficient QoS.
- QoS assured by Wireless Join the Shortest Queue
- ROHC increases the bandwidth efficiency

WJSQ Simulation Model



Frank H.P. Fitzek, Martin Reisslein
"A Prefetching Protocol for Continuous Media Streaming in Wireless Environments" vol 19 , no 6 , pages 2015-2028 ,October 2001

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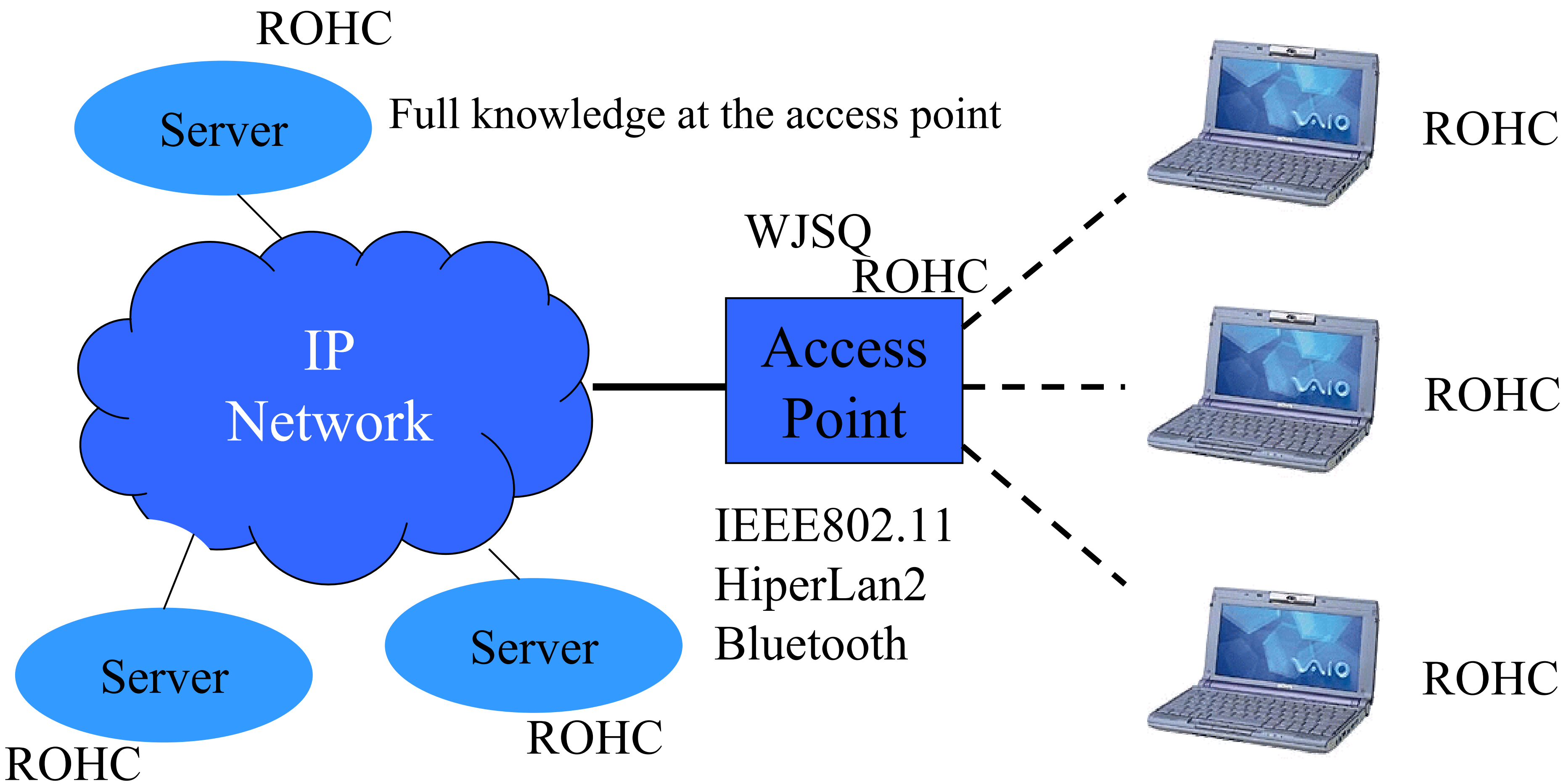
Testbed for Video over WLAN



HOTSPOT scenario

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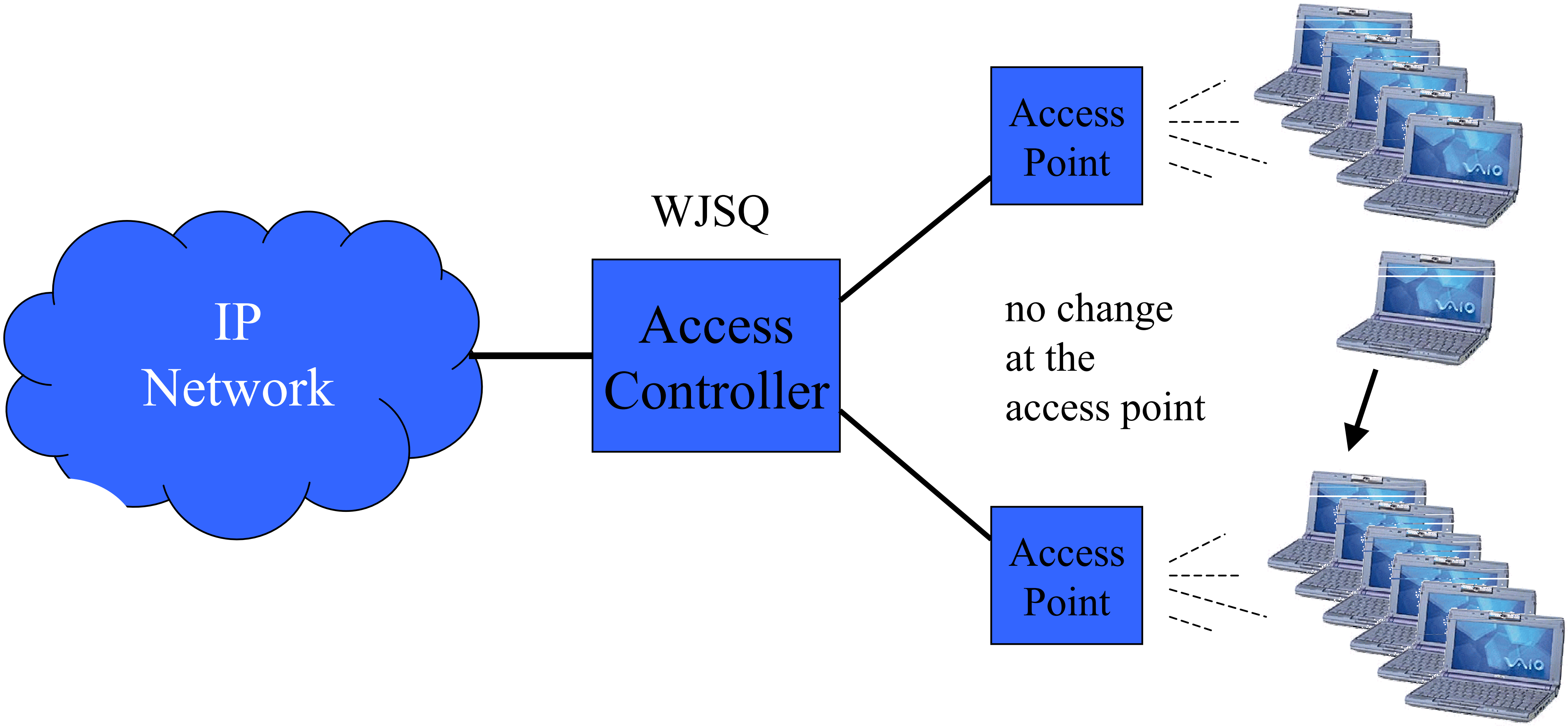
Testbed for Video over WLAN



HOTSPOT scenario

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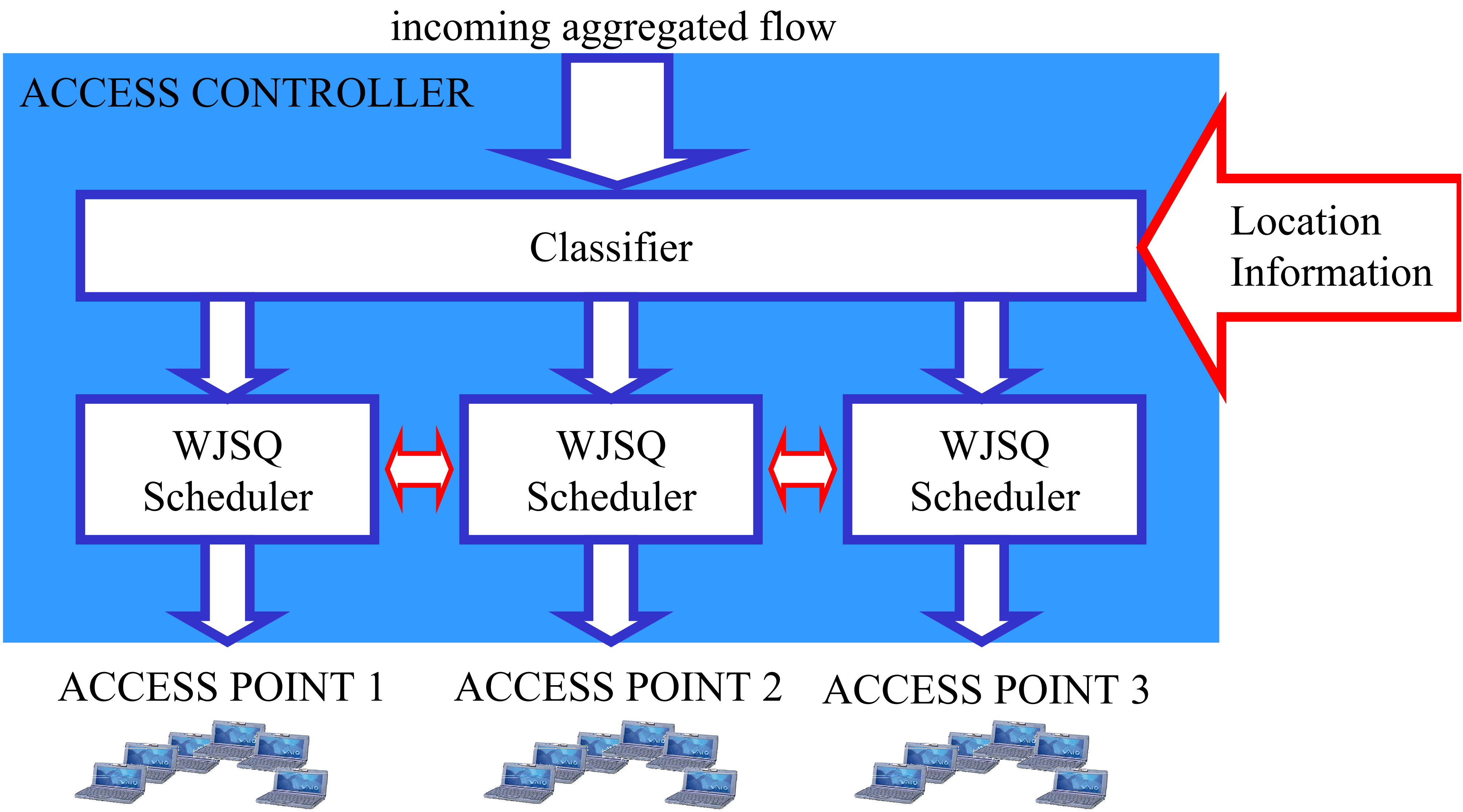
Access Controller for WJSQ



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Thank you for your attention!

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