# Broadcasting Video Content in Dense 802.11g Sports and Entertainment Venues

## Project Discussion Material

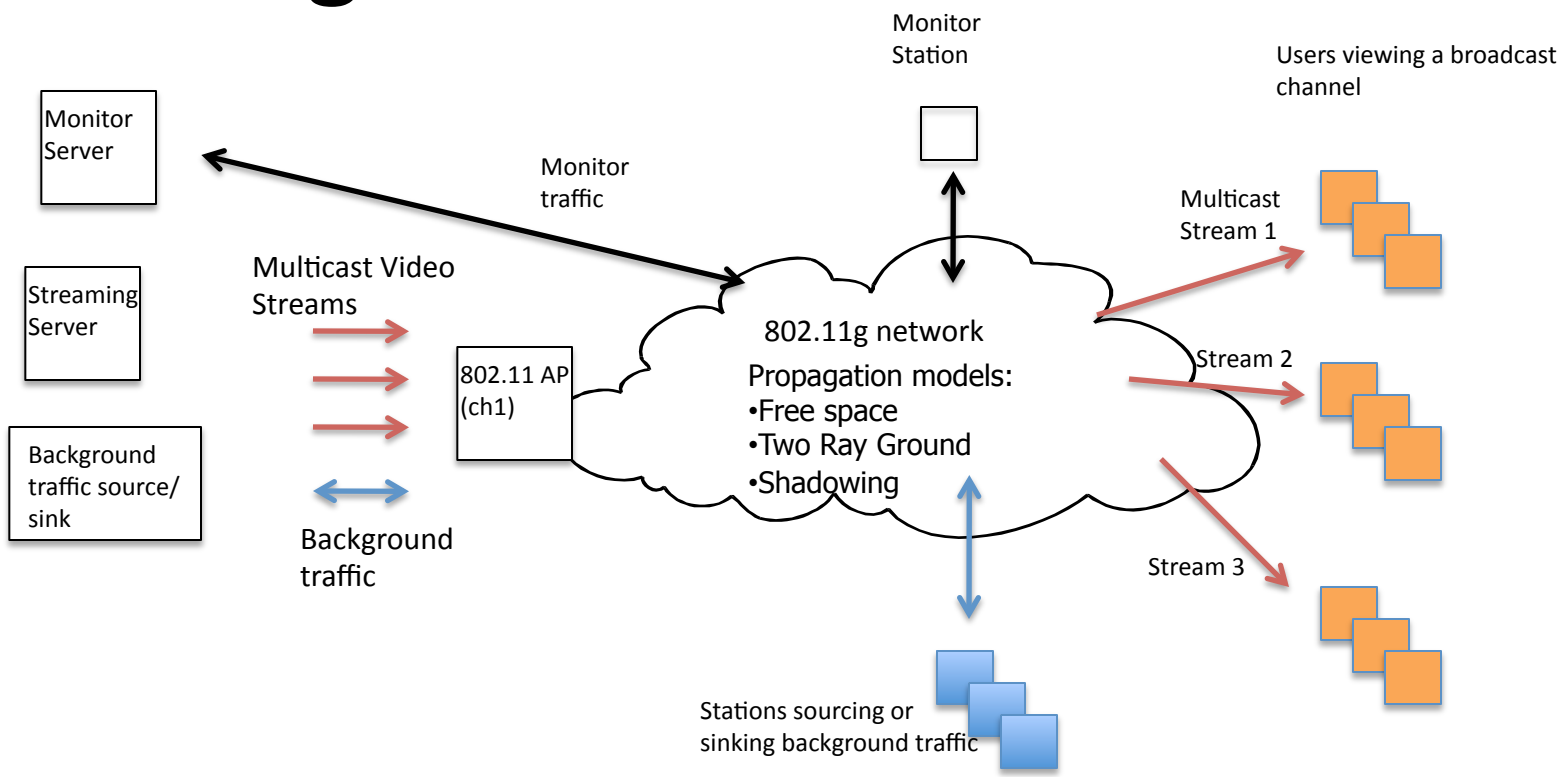
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# High Level Model

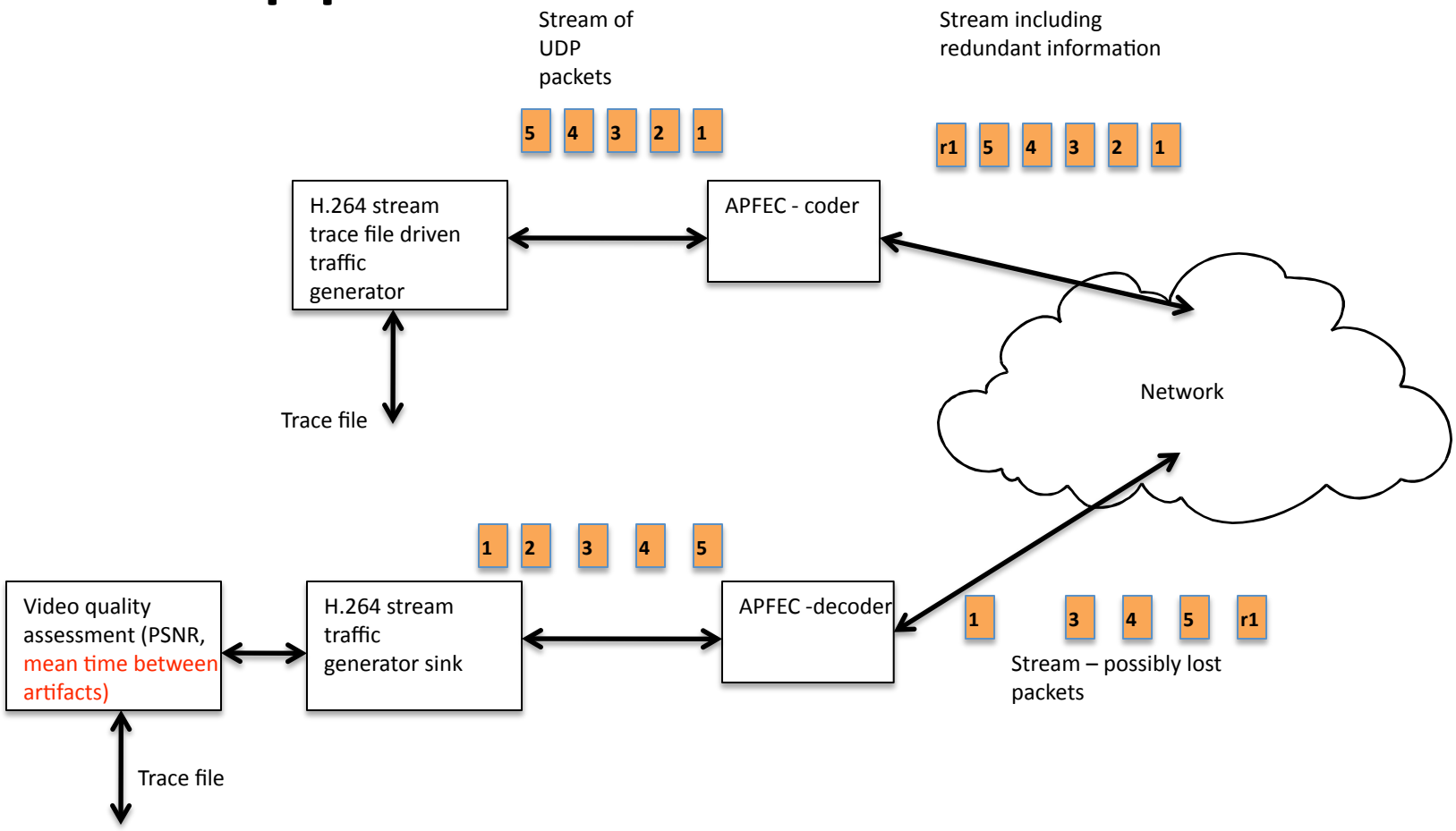



802.11 multicast
- No ACKs
- No RTS/CTS
- MAC broadcasts (filtered at station's IP layer)

# Simulation Model

- Tool: The 'network simulator' (ns2)
  - Open source, available at:
  - http://www.isi.edu/nsnam/ns/
- Important aspects to model
  - 802.11 MAC protocol
    - Adaptive modulation/coding
    - Rx capture
    - Multicast
  - 802.11g PHY
  - Propagation models
  - Application:
    - Video stream traffic generator
    - Application FEC Model

# Application FEC Model



# FEC Model Parameters

- FEC group size: *n* packets consisting of *k* data packets *n* – *k* FEC check packets.
- FEC coding rate: *k / n*
- For R-S codes, receipt of any *k* of *n* permits decoding.
- Modeling implementation:
  - Not necessary to implement the coding system. Just mark simulated packets in a way the supports the *k / n* decision.

# Packet Loss Model

- Must be able to support
  - Dynamic loss rates
  - Correlated loss processes
- Can be driven by
  - NS-2 physical layer model
  - Traces of actual packet data
  - Analytically generated trace streams

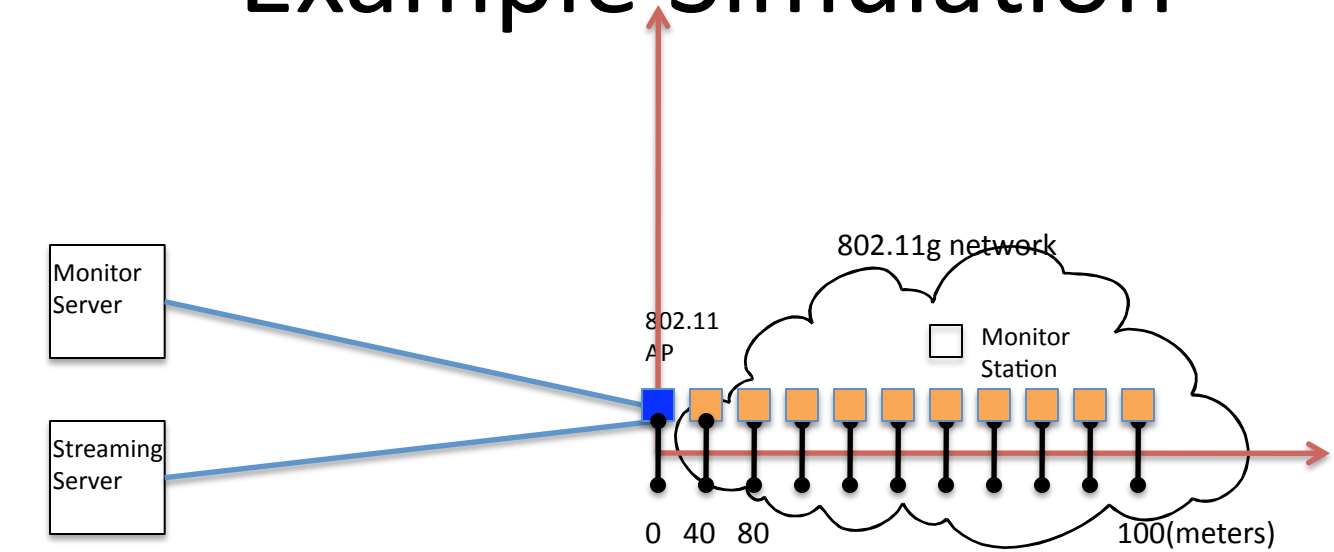
# Research Issues

- What are the best choices of *N* and *K* with respect to delay caused by large FEC blocks versus added robustness?
- What is the relationship of frame size to proper choice of (N, K)?
  - What is the relationship of the choice of video encoding rate with frame size, (N,K) on perceived quality of the video?
- What is the effect of interleaving FEC blocks when compared to simply using larger blocks (i.e. Does interleaving four 5/8 blocks provide more (or less) robustness than just using a 20/32 code?)
- What, if any is the relationship between video codec/streaming, choice of (N, K) and 802.11 MAC parameters?
- What benefits might accrue from dynamically adapting (N, K) and/or MAC parameters to changes in loss rates?
  - What is the relationship of adaptation time scales to perceived quality of the video?
- In multicast scenario's *whose* loss rate should control any such changes?
- Are the advantages of adapting (N, K) based upon the "importance" of protected frames worth the additional complexity?

# Proposed Plan

- Phase 1: fixed error rate (correlated loss process)
- Phase 2: loss process changes over time, explore dynamic adaptation
- Phase 3: Application specific adaptation (stronger FEC applied to more important frames such as MPEG4 I-Frames).

# Example Simulation




Video Stream: CBR (125 Kbps, 1000 byte packets sent every 0.0625 seconds)

Transmit Power: 13 dBm (20mW)

Shadowing path loss model (exponent: 2.4, shadowing deviation: 4.0)

| Packet size | Loss Rate Distance: 10m | Loss Rate Distance: 50m | Loss Rate Distance: 100m |
|---|---|---|---|
| 1000 | 0.0% | 0.0% | 5.3% |