FEC and Network Coding for dummies

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Motivation

- **comment made during IETF102 NWCRG**

> “99% of people using TCP don’t know how it works but think the opposite. We need a ”network coding for dummies" document. It’s really important to have people think they understand how NC works for them to adopt the technology."

- **what are the most basic yet essential messages to make people believe they understand?**
- **keep it small**
  - ✓ **it’s not a tutorial**

Idea 1-

- **“We focus on networks where a packet either arrives or is lost”**
  - we’re not at PHY-layer, we are above in the protocol stack and potential bit errors have either been fixed or the packet dropped

Idea 2-

- **“Encoding consists in adding redundancy (i.e., repair packets) to the flow**

- **decoding consists in using redundancy (i.e., repair packets) to recover from packet losses”**

Idea 3-

- **“Math is not an obstacle to understand FEC and NC”**
  - it’s essentially a matter of **linear combination and linear system resolution** (e.g., via basic Gaussian elimination)
  - details (e.g., computations in a certain Finite Field) can be complex, but mastering them is not required

Idea 4-

- **“There are roughly two categories of FEC codes: block codes and sliding window codes”**
  - block: segment the packet flow into blocks and apply FEC encoding per block, independently
  - sliding window: an encoding window slides progressively over the packet flow, the encoder computes a linear combination of packets in this encoding window

Idea 5-

- **“Block FEC codes are great for bulk, non real-time traffic, sliding window FEC codes are great for real-time traffic”**
  - … because splitting the application flow into blocks delays the moment when repair packets can be generated!

Idea 6-

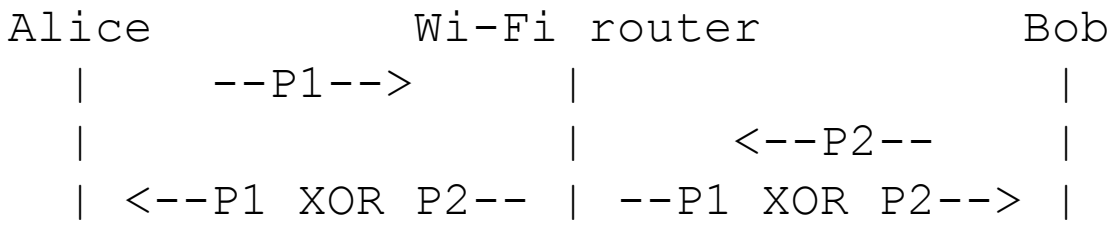
- **“Some codes are restricted to a single encoder (e.g., sender) and single decoder (e.g., receiver)”**
  - usually called FEC

- **“Other codes can be used within intermediate nodes (i.e., multiple encoders)”**
  - usually called Network Coding (NC)

Idea 7-

- **“With NC, network equipments can perform FEC encoding to improve network usage”**
  - trivial example where a network equipment could reduce traffic

    (it sends a single “P1 XOR P2” packet instead of sending both P1 and P2)



(Figure from Zverev Mihail, Ikerlan)

Idea 8-

- **“One can use FEC and NC in a congestion friendly manner”**
  - only stupid persons will further overload a congested network with even more redundant traffic in the hope it may help!