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: less than 10 ideas**
  - ✓ **it’s not a tutorial on FEC/NC!**

Idea xxx

- **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 Gauss elimination)
  - details can be complex, but mastering them is not required to use the technology…

Idea xxx

- **we focus on networks where a packet either arrives or is lost (AKA "erased")**
  - no bit-error in our case: it's for PHY-layer codes!
  - we are above in the protocol stack, and bit errors have either been fixed or the packet has been dropped

Idea xxx

- encoding = add redundancy (i.e., repair packets) to the flow
- decoding = use redundancy to recover from packet losses

Idea xxx

- some FEC codes are called block codes while other are called sliding window codes
  - ✓ block → segment the application packet flow into blocks
    → apply FEC encoding per block, independently
  - ✓ sliding window → encoding window slides over the application packet flow
    → compute a linear combination of packets in the encoding window

Idea xxx

- **roughly speaking (not to be taken strictly)**
  - block codes are great for **bulk, non real-time** traffic
  - sliding window codes are great for **real-time** traffic

    ✓ **… because splitting the application flow into blocks delays the moment when repair packets can be generated!**

Idea xxx

- **with NC, network equipments can perform FEC encoding**
  - in theory, can improve network usage (more throughput for free)

Idea xxx

- **FEC and NC can be congestion control friendly**
  - …if done appropriately

- **only stupid persons will overload a congested network with even more redundant traffic in the hope it may help**
  - … think about *Shannon capacity equation*:

    sending at a bitrate higher than the channel capacity is counter productive!

$$C = B_w * \mathrm{Log}_2(1 + S / N)$$

We need you

- something else?
- something to remove?
- re-wording proposals?
- in a different order?