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Problem: Lost packets
Send data from a sender to a receiver over a network.
Size of data is completely variable.
eg. Internet, wireless, etc.

Solution: Erasure codes

Block erasure code: (k, n) $\frac{k}{n}$ = rate

- Reception overhead ε / failure probability δ
  Pr[can recover original k source symbols from $(1+\varepsilon)k$ encoding symbols] ≤ 1.5
- Encoding / decoding times – Workload

RS Tornado codes: XOR
Irregular random graph

Fountain codes k = #source symbols
#encoding symbols is "unbounded"

LT encoding

1) Choose a degree d — a deg. distribution
2) Choose d of the k source symbols randomly
3) encoding sym = XOR of d chosen source symbols.

LT decoder

collect $k(1+\varepsilon)$ encoding symbols
Repeat until all source symbols recovered

1) Find encoding sym. with exactly 1 unrecovered source symbol neighbor.

2) XOR recovered neighbors & enc. sym to recover source sym.

Degree distrib.

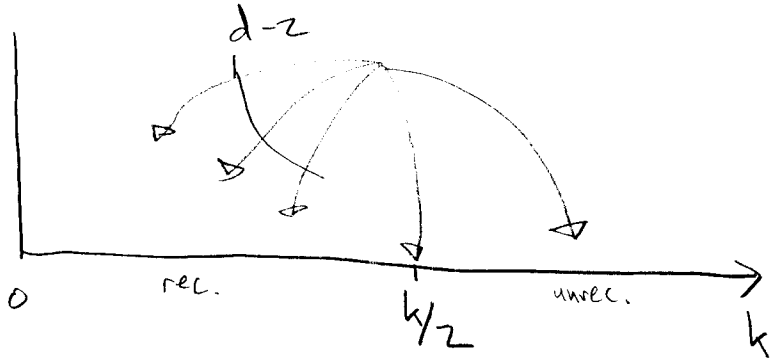
- Any degree is small
- process succeeds w.h.p. (with high probability)

Ideal degree distrib.

$$Pr[deg = 1] = \frac{1}{k}$$

$$Pr[deg = i] = \frac{1}{i(i-1)} \quad \text{for } i = 2, \ldots, k$$

Avg. deg $\approx \ln(k)$



Source symbols recovery