

Raptor Codes for Reliable Transport



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quickly

easily

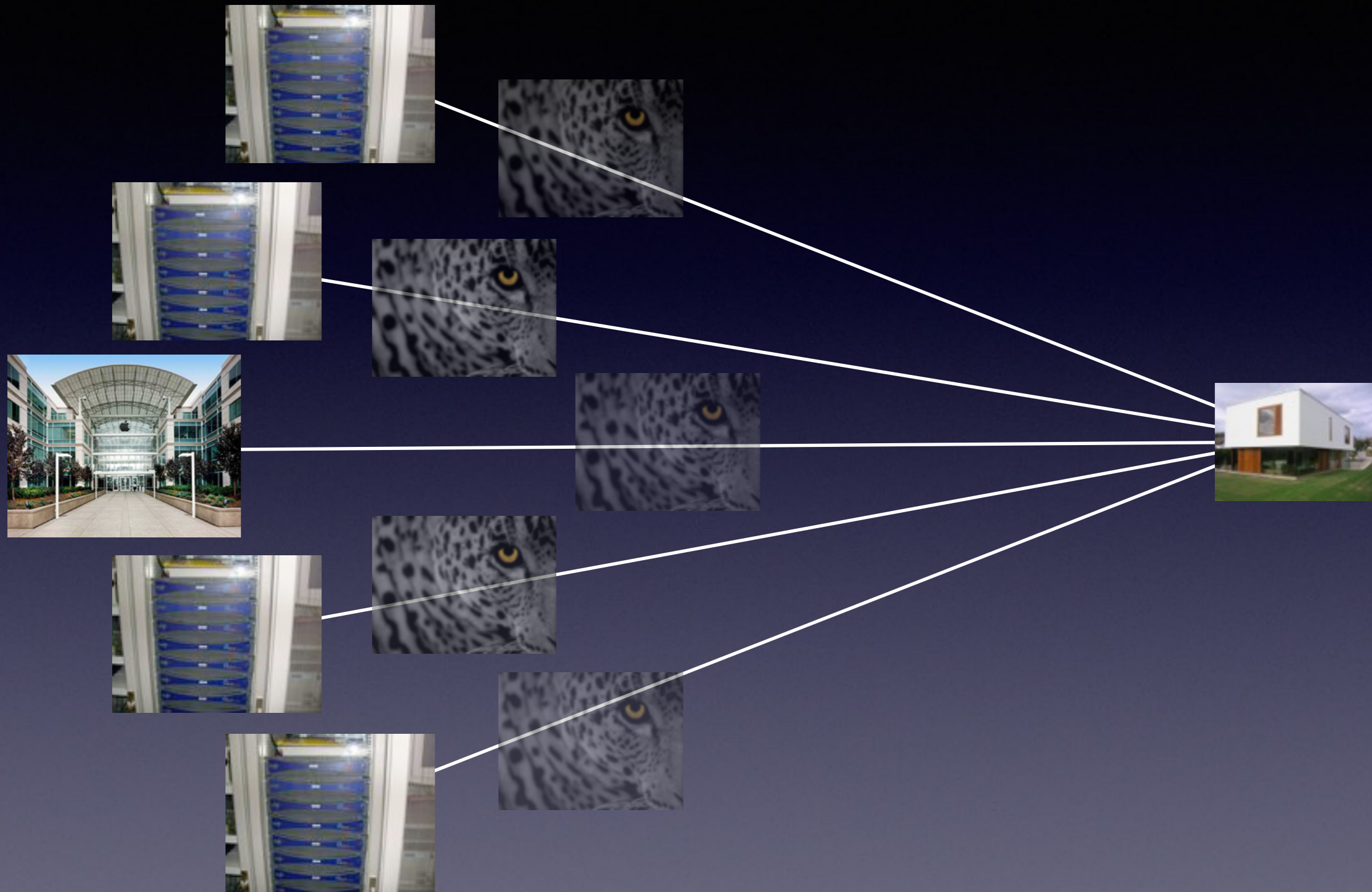
reliably

Point-to-Point Communication



Point-to-Multipoint Communication

Multipoint-to-Point Communication



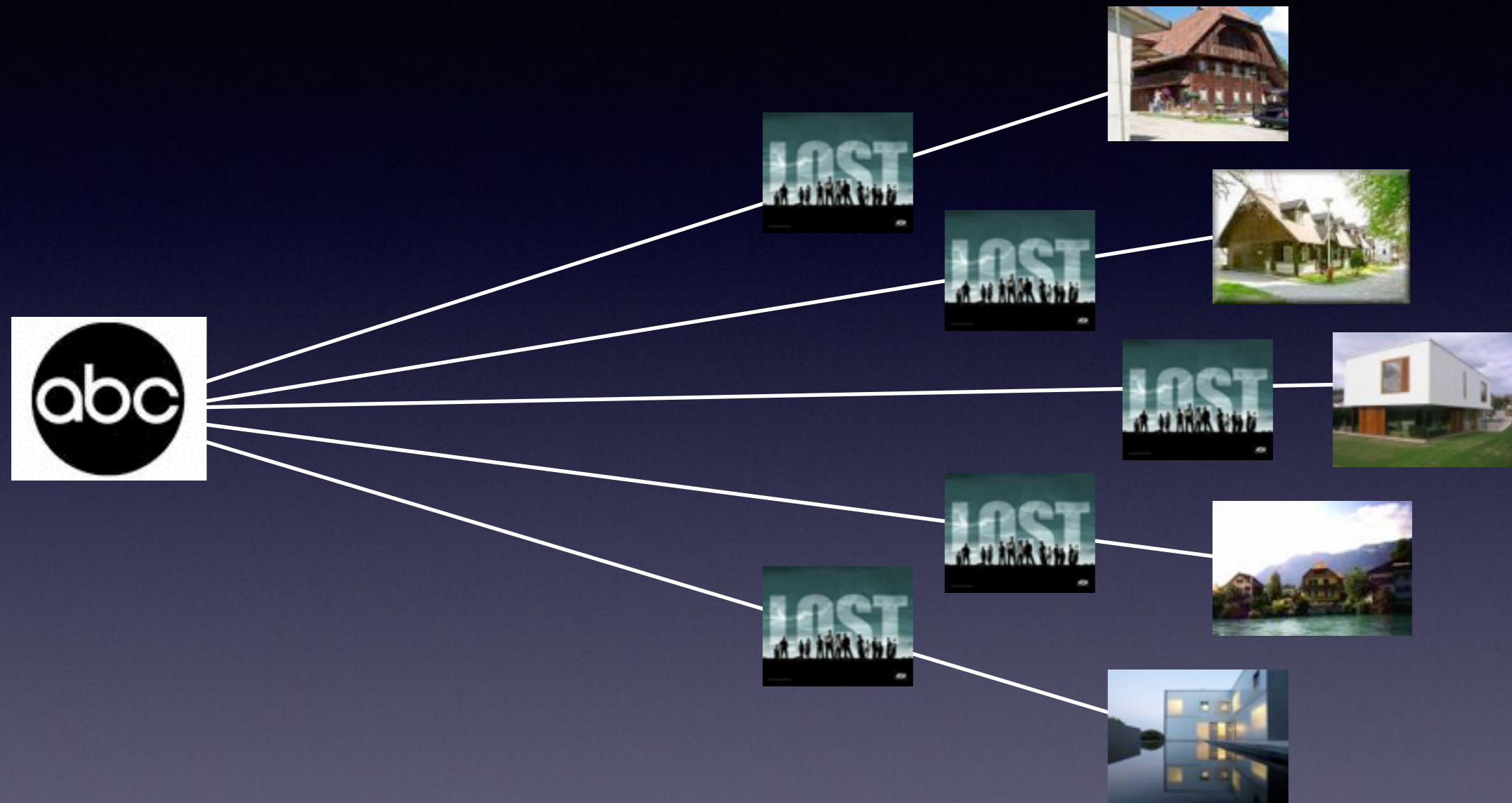
TCP

Point-to-Point Communication:TCP



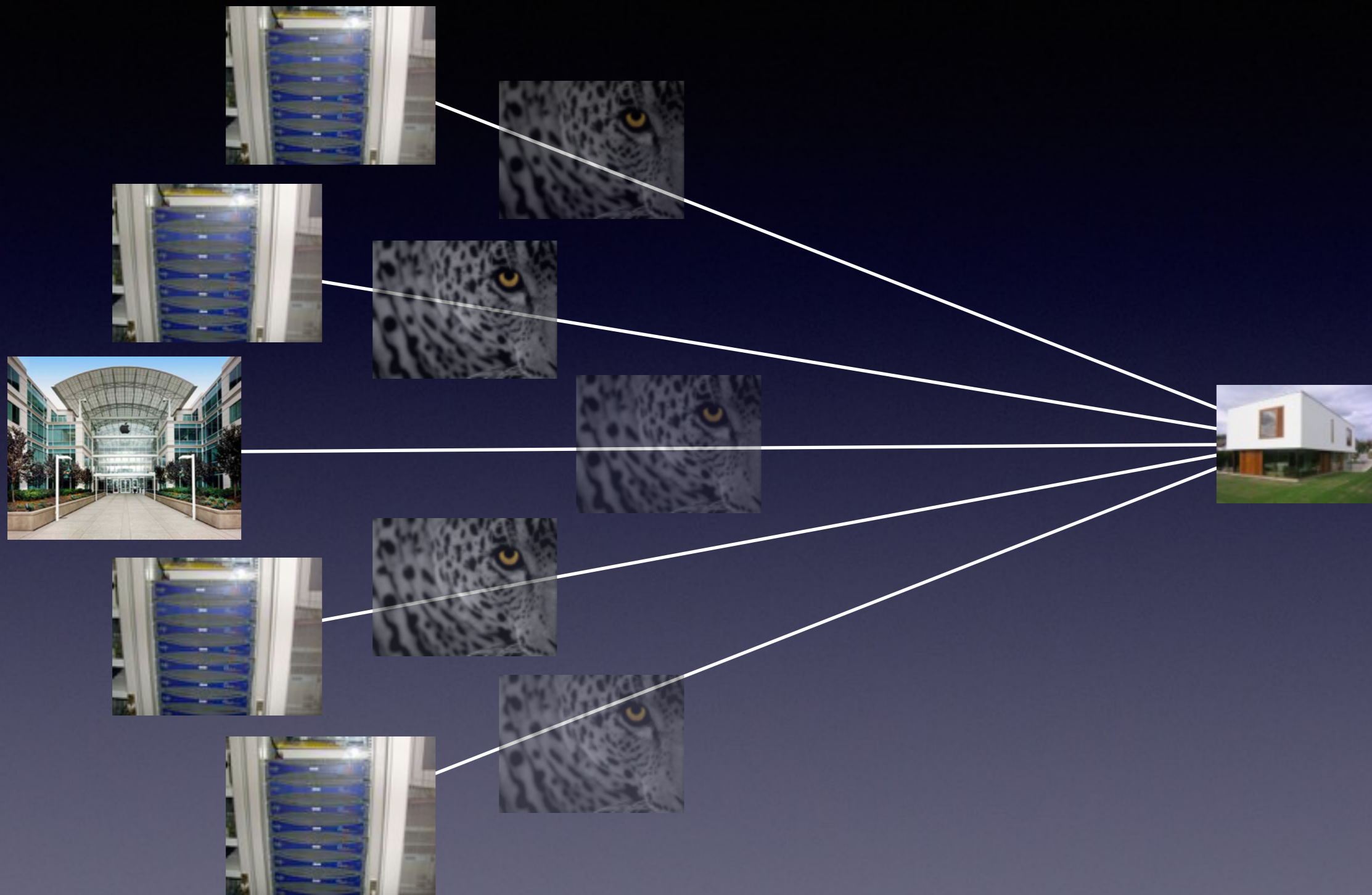
Inefficient if distance is large

Point-to-Multipoint Communication: TCP



Is not scalable

Multipoint-to-Point Communication: TCP



Not scalable, and needs management

Fountain

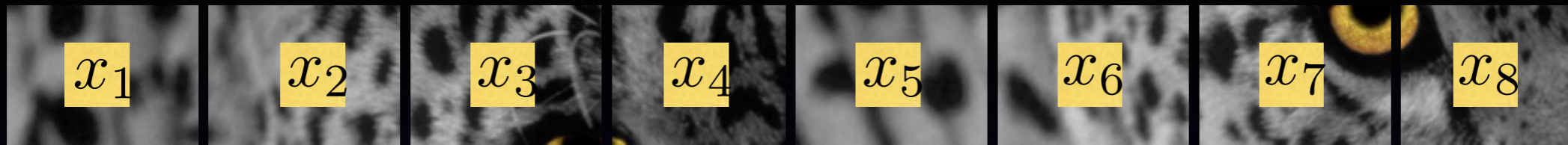
Generates for a given piece of data a **potentially limitless** stream of packets such that:

1. Each packet is generated **independently** of any other packet.
2. It is sufficient to collect any set of packets that is in aggregate of **the same size** as the original piece of data for recovery.
3. Generation and recovery are very **efficient**.



Source: <http://lisa.innereyes.com/wp-photos>

Nokia CTC visit, July 30-31, 2007

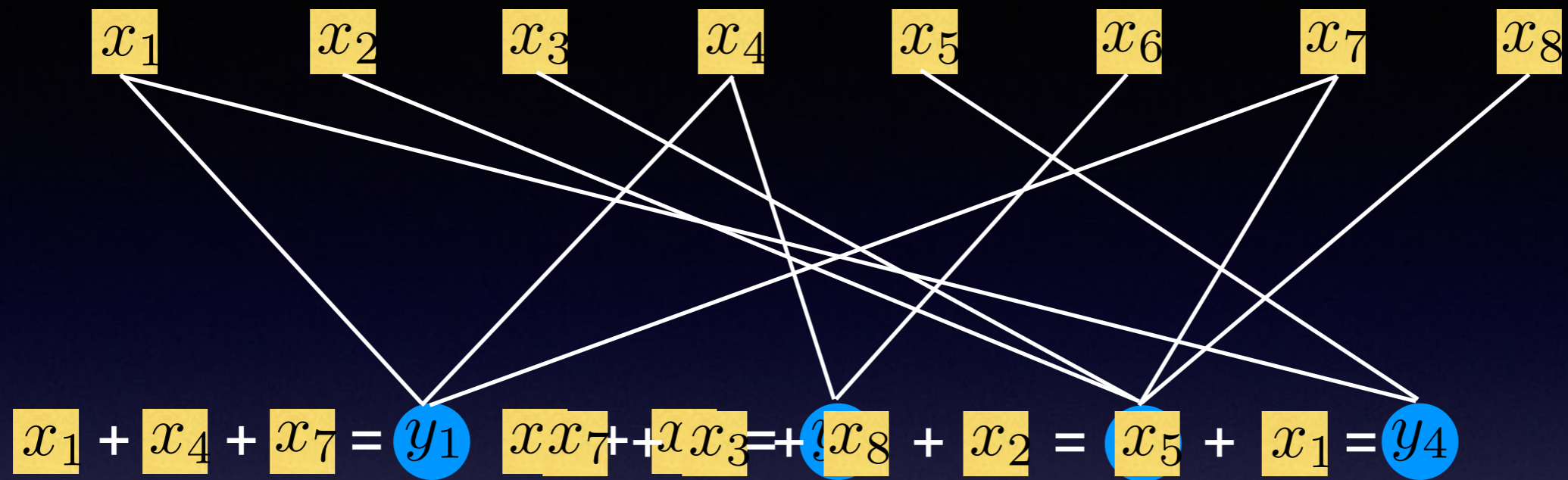


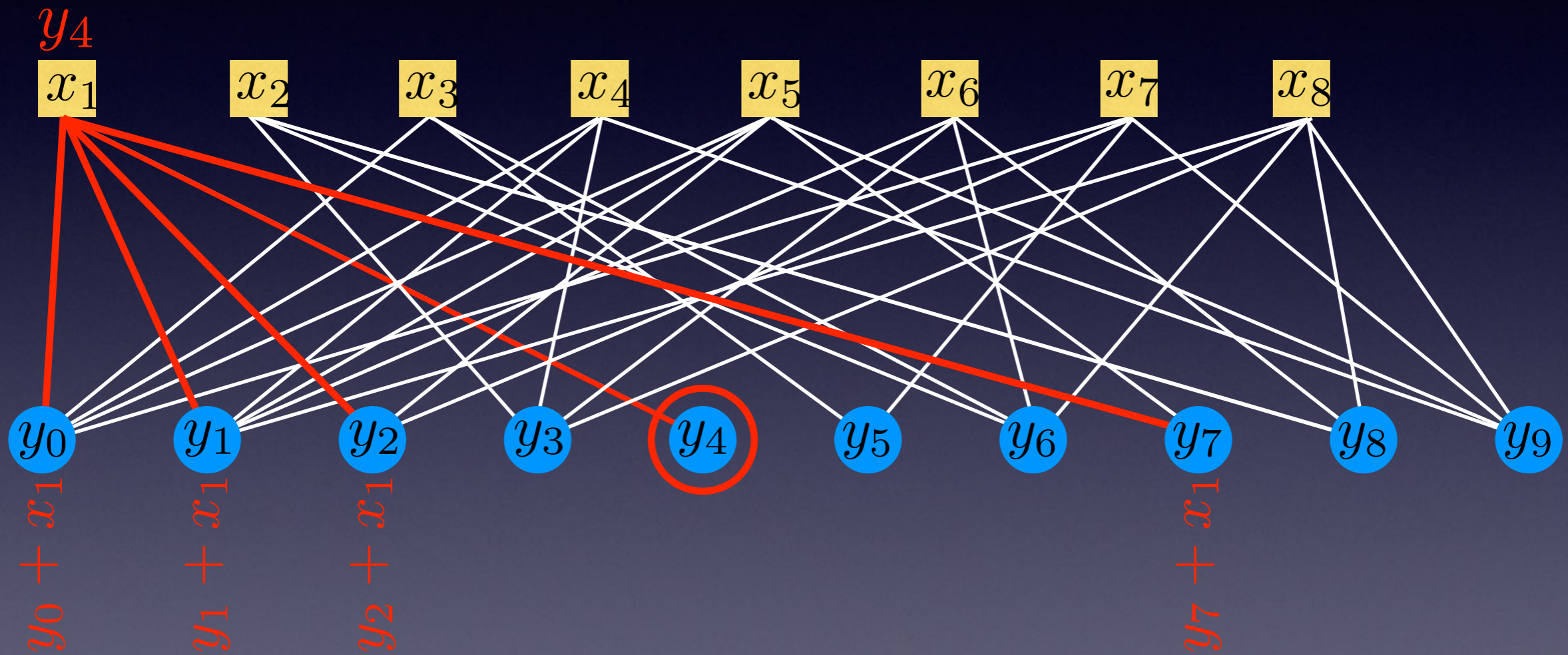
$$x_1 + x_4 + x_7 = \text{Image}$$
A grayscale image of a document page, which is the sum of x_1 , x_4 , and x_7 . It shows the text "69.147.114.210" and "81.221.134.269".

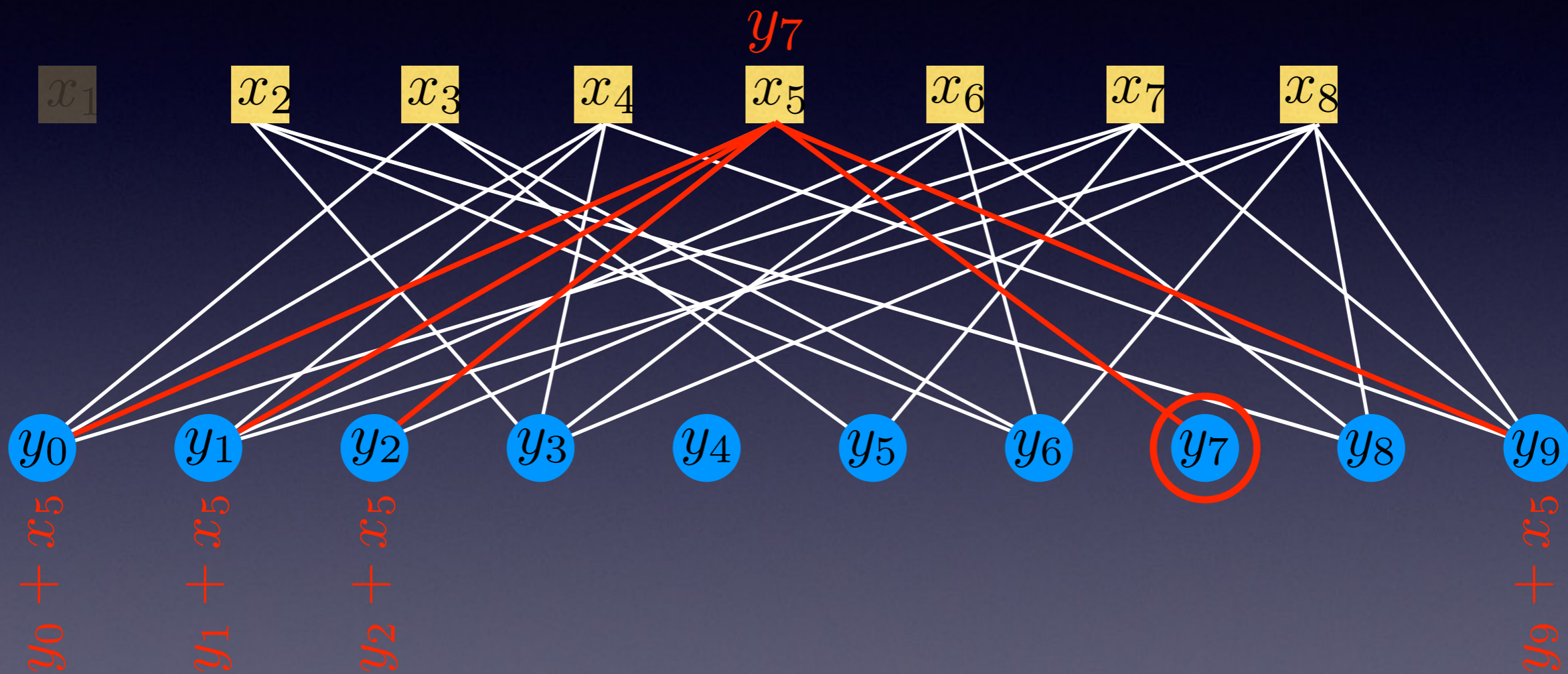
$$x_4 + x_6 = \text{Image}$$
A grayscale image of a document page, which is the sum of x_4 and x_6 . It shows the text "69.147.114.210" and "81.221.134.269".

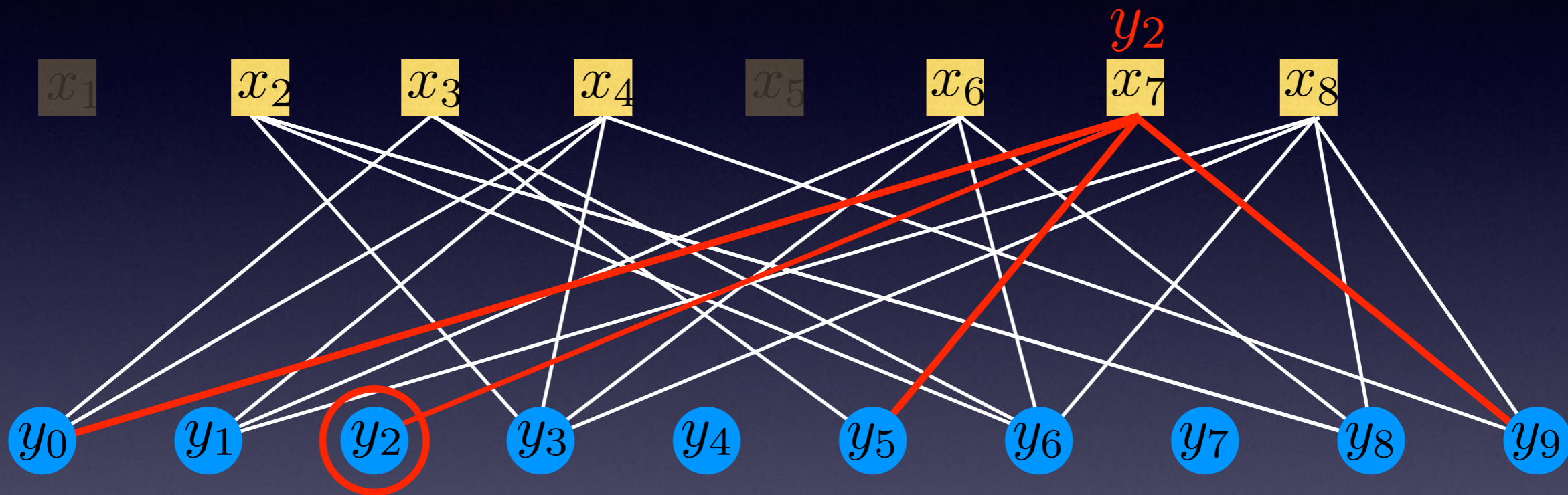
$$x_7 + x_3 + x_8 + x_2 = \text{Image}$$
A grayscale image of a document page, which is the sum of x_7 , x_3 , x_8 , and x_2 . It shows the text "69.147.114.210" and "81.221.134.269".

$$x_5 + x_1 = \text{Image}$$
A grayscale image of a document page, which is the sum of x_5 and x_1 . It shows the text "69.147.114.210" and "81.221.134.269".

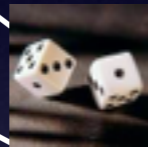




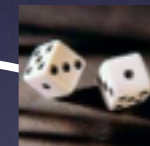




LT Codes



3



deg	probability
1	0.001
2	0.5
3	0.16
4	0.83
5	0.05
6	0.033
7	0.024
8	0.018
9	0.011
.....

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.....



Probability Distributions

The design of the main probability distribution requires the introduction of new theoretical tools.

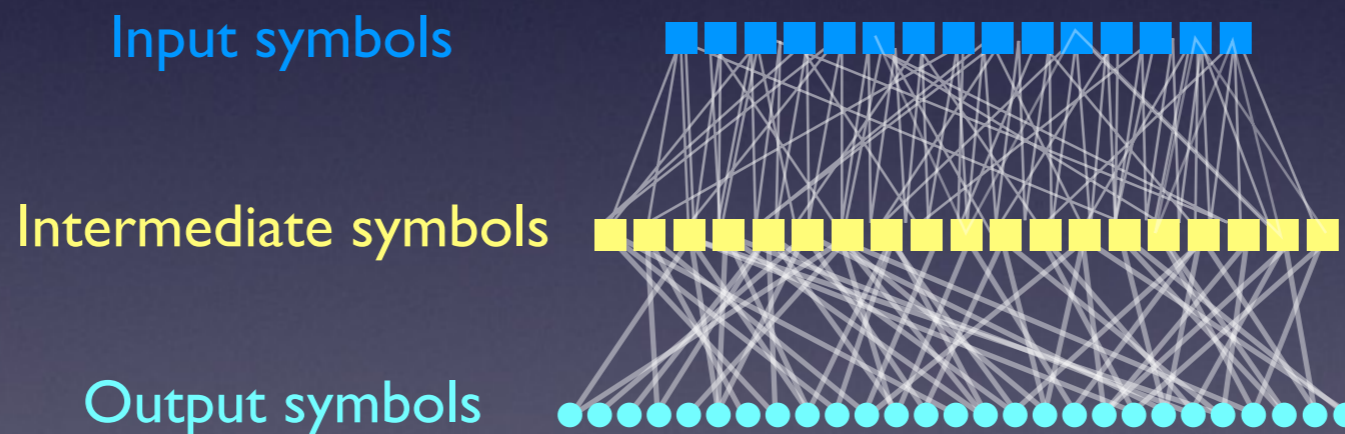
These tools have been developed by Digital Fountain, and later in collaboration with EPFL (ALGO).

Raptor Codes

LT-codes: Luby 1998.

Raptor codes: fountain codes with linear time encoding and decoding algorithms (Shokrollahi, 2000).

All fountain codes in use today are Raptor codes.



Technology Transfer

The newest versions of Raptor codes have been developed in close collaboration between Digital Fountain and the Laboratoire d'algorithmique of EPFL.

Raptor codes with faster encoding/decoding, smaller error probabilities, and smaller memory footprints are subject of ongoing research.

Some Applications of Raptor codes

- Delivery of data over long haul connections
- IPTV
- Disaster recovery
- Distributed storage
- Content delivery networks
- Data distribution to cars
- Multicast/broadcast over wireless
- Military
-

Standards



DVB-H file delivery



DVB IPTV streaming delivery



3GPP Multicast/Broadcast multimedia

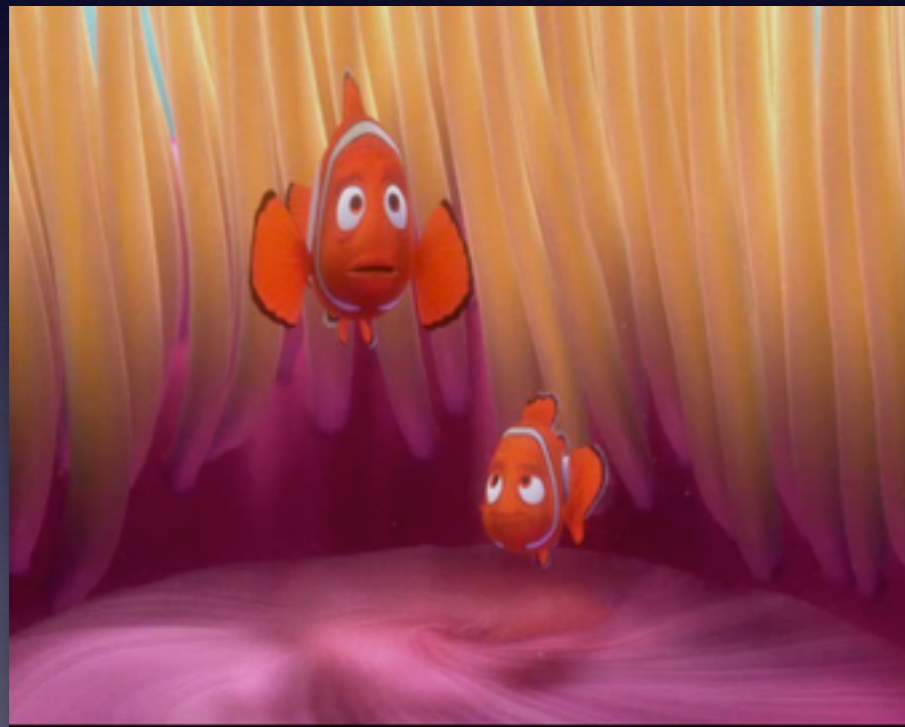


ATIS IIF IPTV delivery

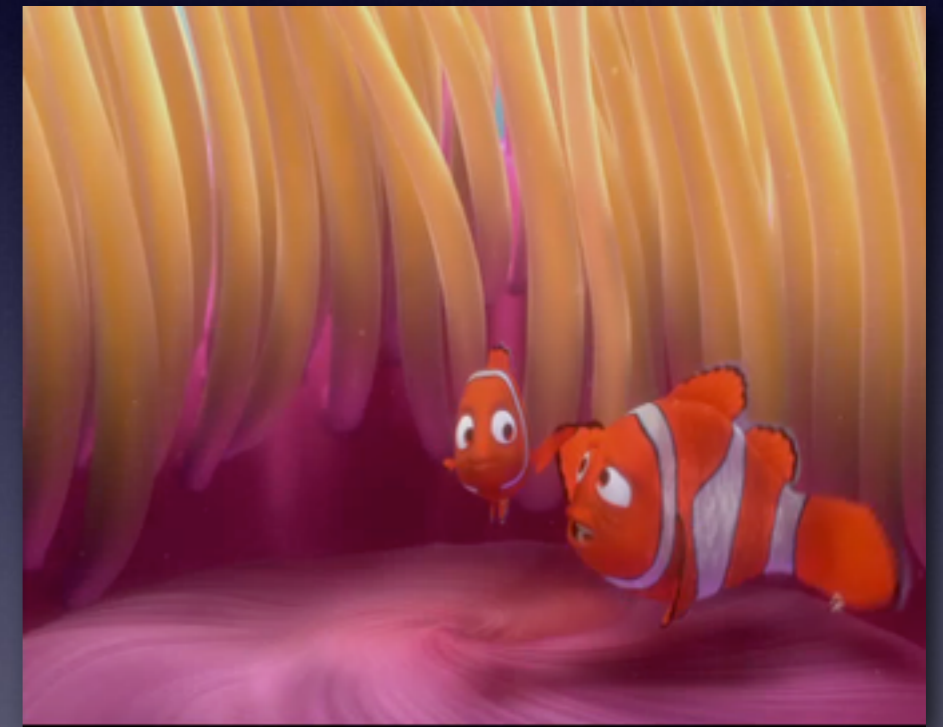


Raptor file delivery approved for publication as RFC (23.07.07)

More to follow.....



With Raptor



Without Raptor

Thank You!