

# BATS codes

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# the multi-hop curse

- it is well known that in a wireless multi-hop network, the throughput drops drastically after 3 or 4 hops
- that's why we don't see wireless networks with more than a few hops
- but wireless networks with many hops are emerging in different applications



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分批稀疏編碼  
BATS code

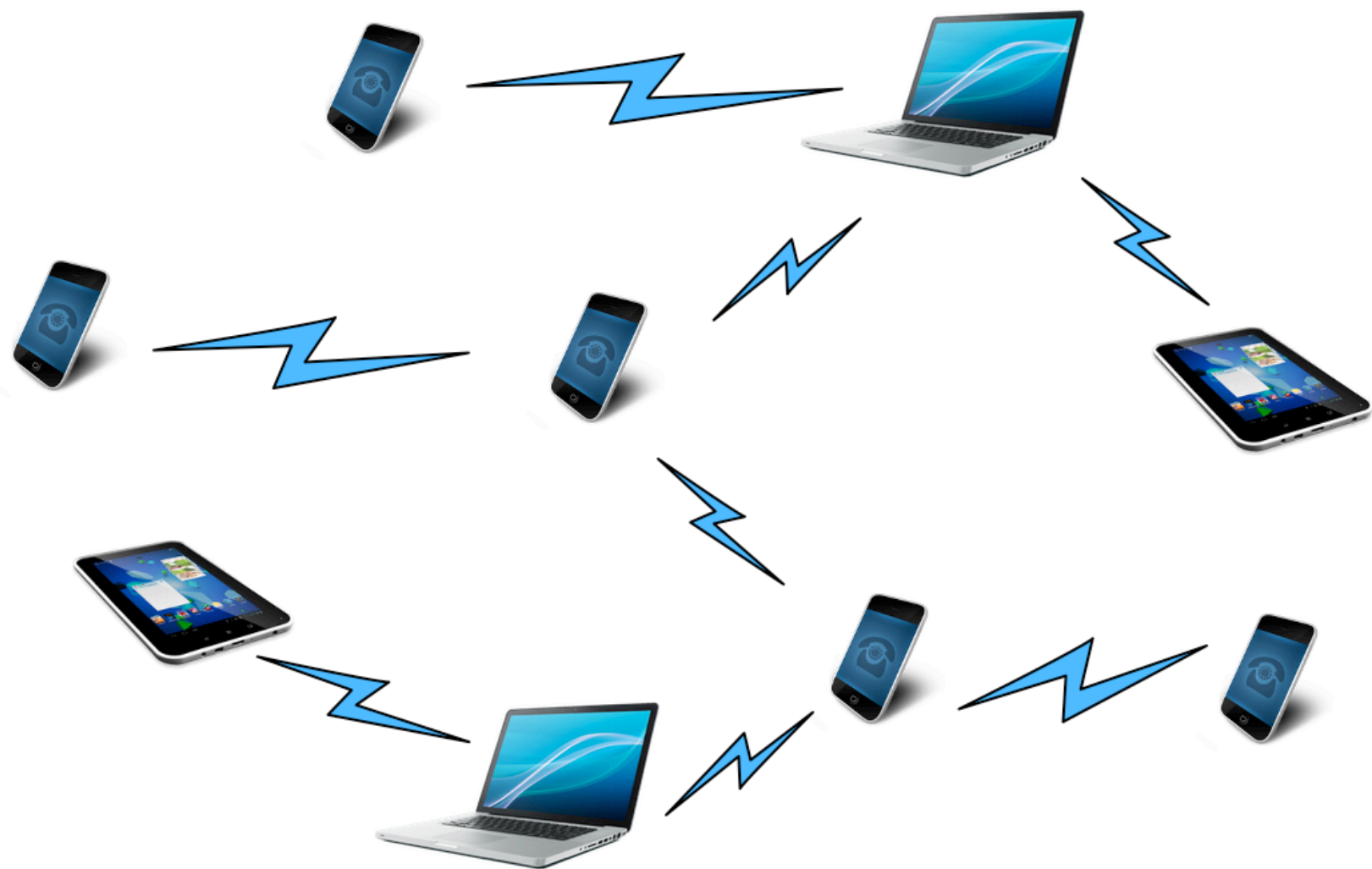
天氣狀況  
Weather conditions

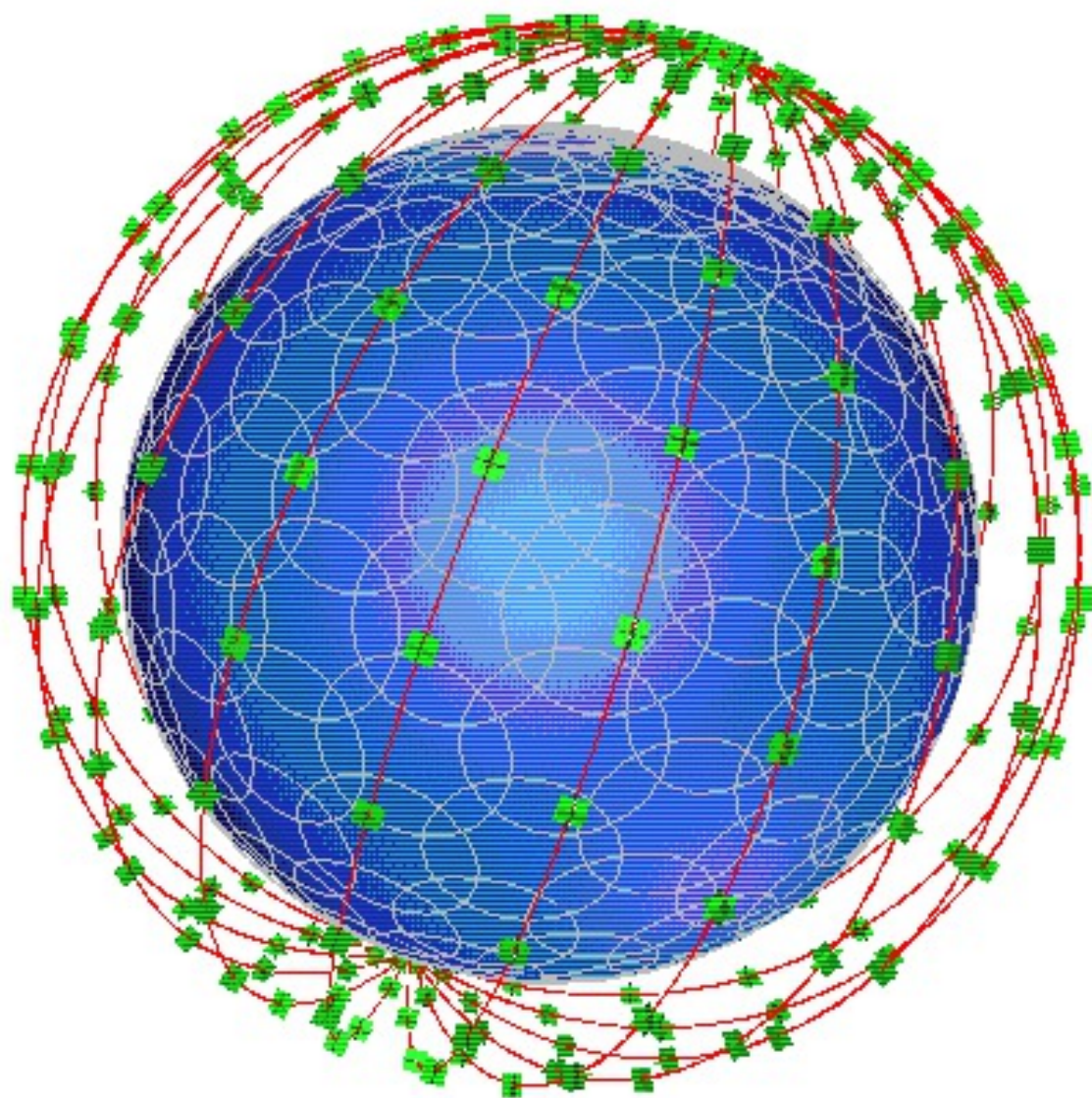
空氣質素  
Air quality

無線網絡  
Wi-Fi & 5G network

交通實況  
Real-time  
traffic conditions













breaking  
the multi-hop curse



introducing BATS

# what is BATS?

BATS code is an advanced **network coding** technology developed at



Institute of Network Coding, CUHK

BATS codes are ideal for **multi-hop** networks with **packet loss**

# what is BATS?

BATS code transmits coded packets in **batches**

a small number of batches are stored and **recoded** at each relay

BATS code **dramatically increases throughput** in a wireless multi-hop network

# an illustration

- comparison between BATS code and fountain code
- packet loss rate = 20% (no retransmission)
- file size = 16
- play animation.mp4 in full screen



# prototyping

video streaming between 2 PC's through 10  
RaspberryPi 3

**11 wireless hops** with significant packet loss due  
to interference

play configuration.mp4 in full screen

# performance comparison

BATS code vs fountain code

play demo.mp4 in full screen

# benefits of BATS

high throughput



low latency



low coding complexity



low storage requirement



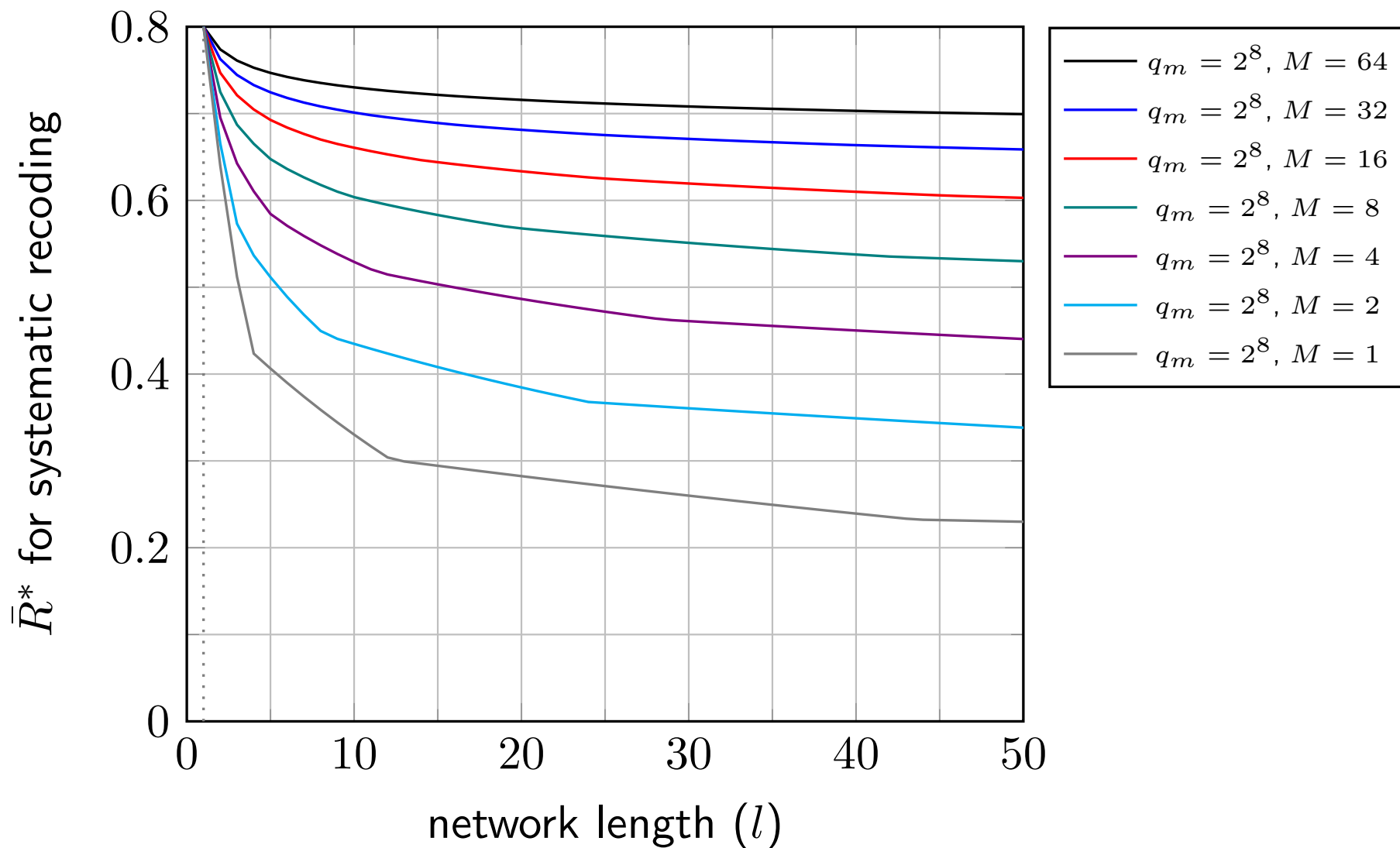
# what is BATS?

ideal for multi-hop transmission with packet loss

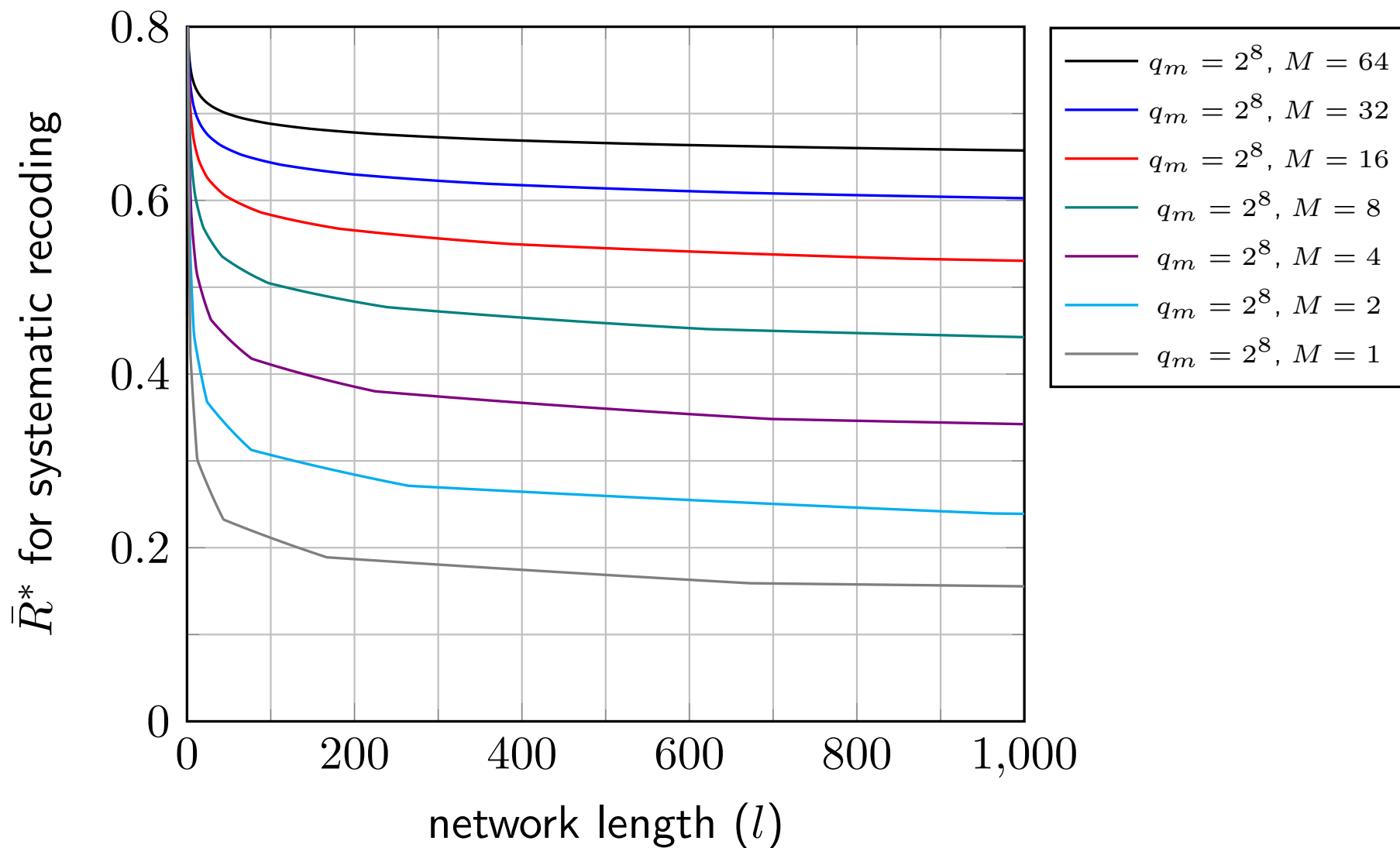
can sustain 10s or even 100s of hops with no significant drop in throughput



# Achievable Rates for Line Networks: Up to 50 Hops



# Achievable Rates for Line Networks: Up to 1000 Hops



# what is BATS?

an enabling communication technology for

- IoT
- 5G
- satellite networks
- underwater communication networks
- power line communication networks

thank you