SC514-FEC Techniques for Optical Communications

Part X

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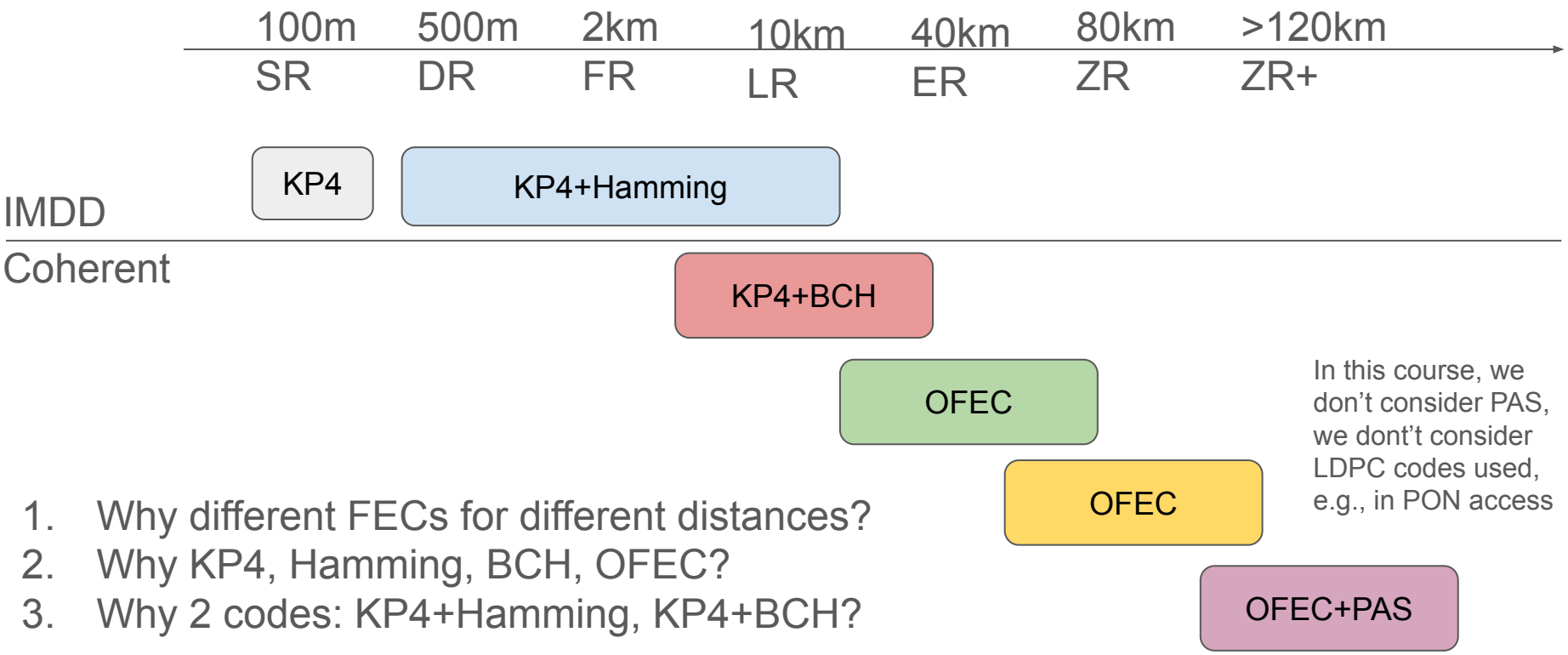
FEC in 800G Standards (IEEE/OIF)



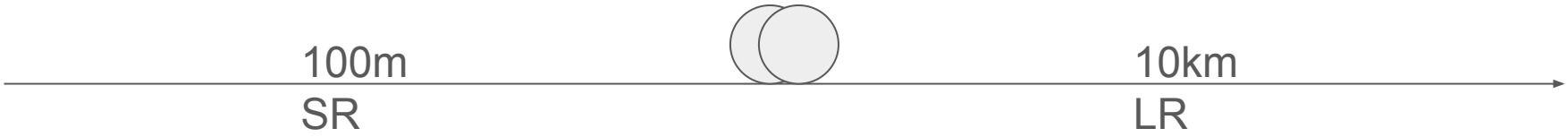
In this course, we don't consider PAS, we dont't consider LDPC codes used, e.g., in PON access

1. Why different FECs for different distances?
2. Why KP4, Hamming, BCH, OFEC?
3. Why 2 codes: KP4+Hamming, KP4+BCH?

PAS=probabilistic amplitude shaping

Why different FEC for different distances?

- Speed of light in glass fiber c = 2e8 m/s
- To travel 100m, 1 bit takes 0.5us
- At 800Gb/s, bit duration is 1.25ps.
- 1 million bits are 1.25us long

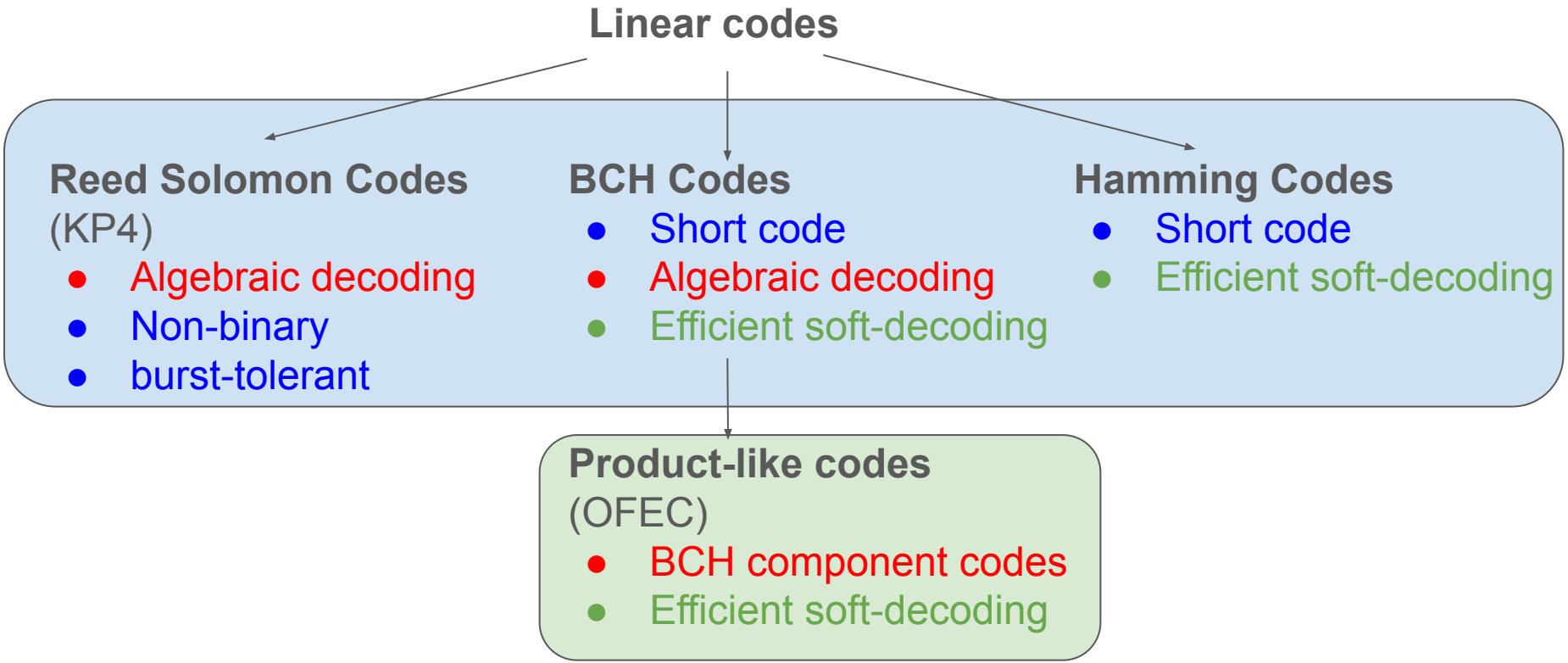


- To travel **100m**, 1 bit takes 0.5us
- ⇒ long **FEC is latency bottleneck**

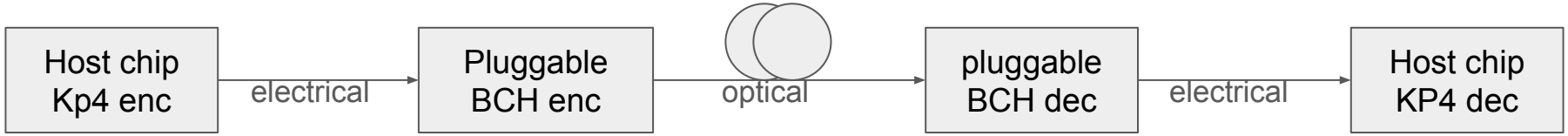
- To travel 10km, 1 bit takes 50us
- ⇒ **Fiber is latency bottleneck**

Why KP4, Hamming, BCH, OFEC?

Color-code
Complexity
Latency
Performance

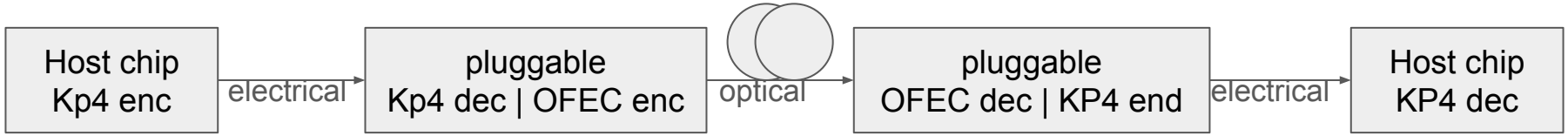


Why 2 codes: KP4+Hamming, KP4+BCH?



Short reach + Low latency

Long reach + high performance



Outline

In the remainder of the course, we develop the underlying principles mainly guided by performance.

- Part 1: Model to quantify FEC performance (“BER”)
- Part 2: **hard-** and **soft-decision decoding**, net coding gain (NCG)
- Part 3 & 4: improving NCG, linear codes (e.g., **Hamming codes**)
- Part 5: Shannon limit: how good can we get
- Part 6: Reed-Solomon (e.g., **KP4**) and **BCH** codes
- Part 7: Product and product like codes (e.g., **OFEC**)

What if the errors are not independent (“AWGN”)?

Correlated errors caused
e.g., by band limitation,
EEPN,...

EEPN=equalizer enhanced phase noise

Very short distance / low latency

Not so short distance

Solve problem in FEC

- Non-binary, burst-error tolerant FEC, e.g., KP4 Reed-Solomon code

Solve problem in DSP:

- Mitigate error correlation in DSP: interleaver, digital sub-carrier multiplexing, compensation…
- Use binary FEC