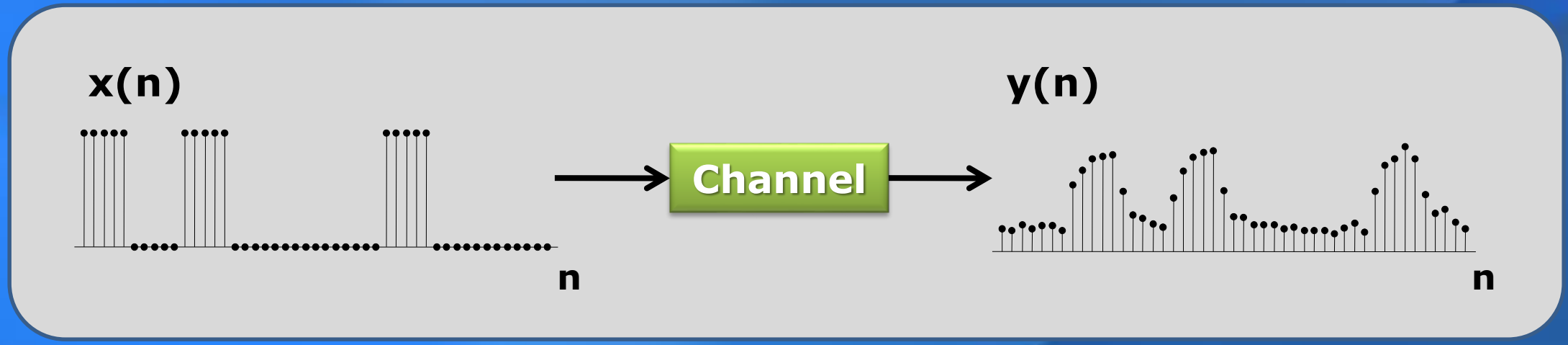
Effects of the Channel

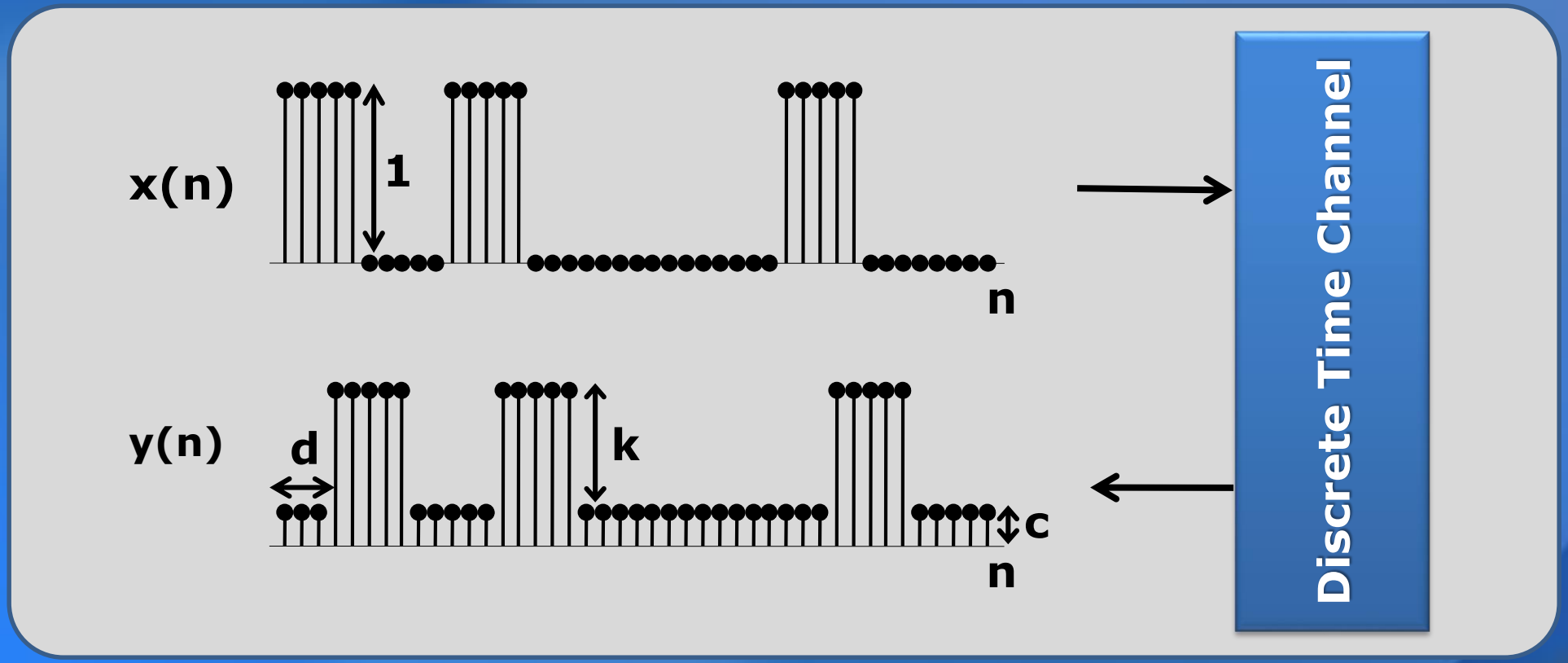
Possible effects of the channel

The channel may cause the received signal y(n) to differ from the transmitted signal x(n) in several ways.

1. Attenuation (decrease in amplitude)
2. Delay
3. Offset
4. Blurring of transitions
5. Noise



Modeling attenuation, delay, and offset



Legend:

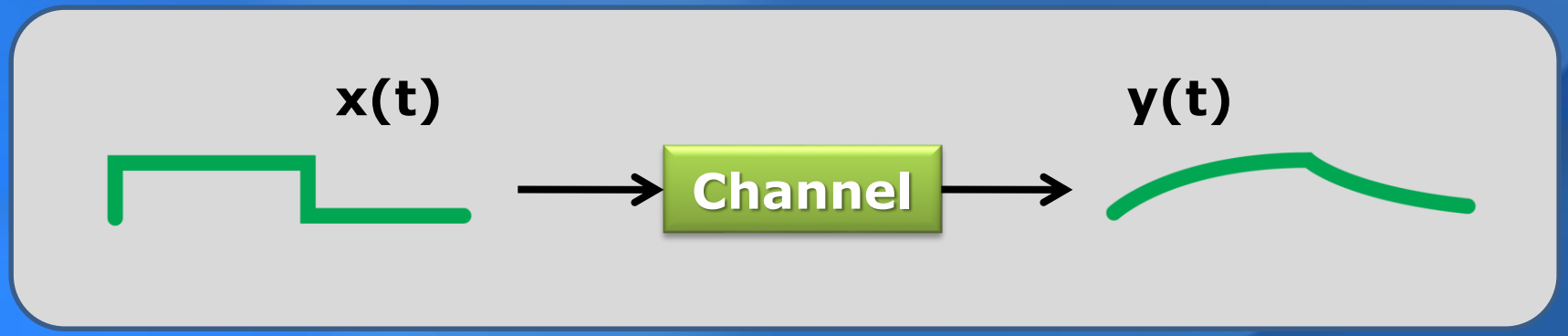
k = attenuation (k < 1)
d = delay
c = offset

Mathematical Model: $y(n) = kx(n - d) + c$

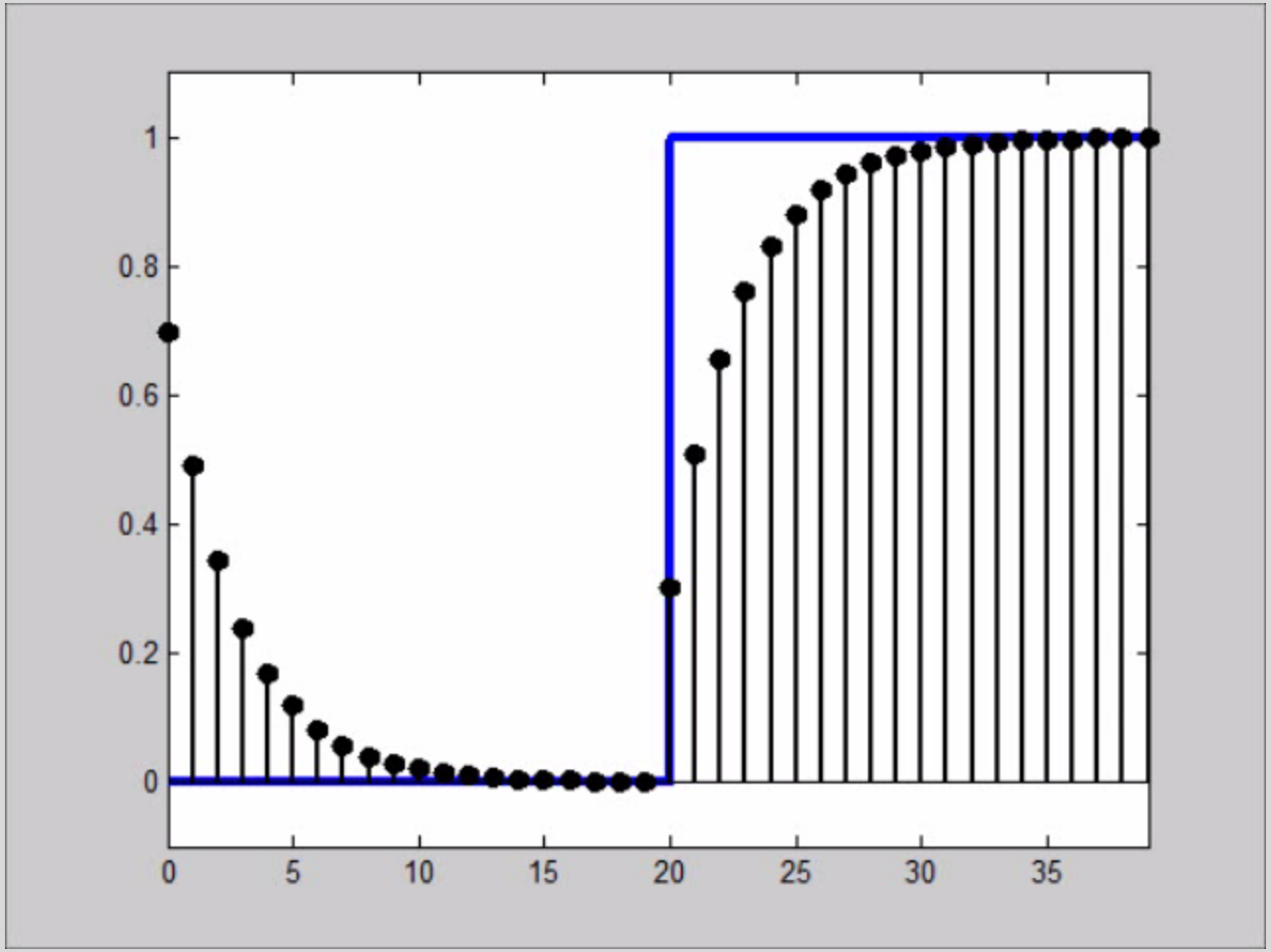
Blurring of transitions

Caused by the properties of

- The transducer that creates the physical waveform
- The electronics that drive the transducer
- The physical medium that carries the waveform
- The sensor that senses the physical waveform
- The electronics that process the sensor signal



Effect of bandlimited channel (bit time=20 SPB)



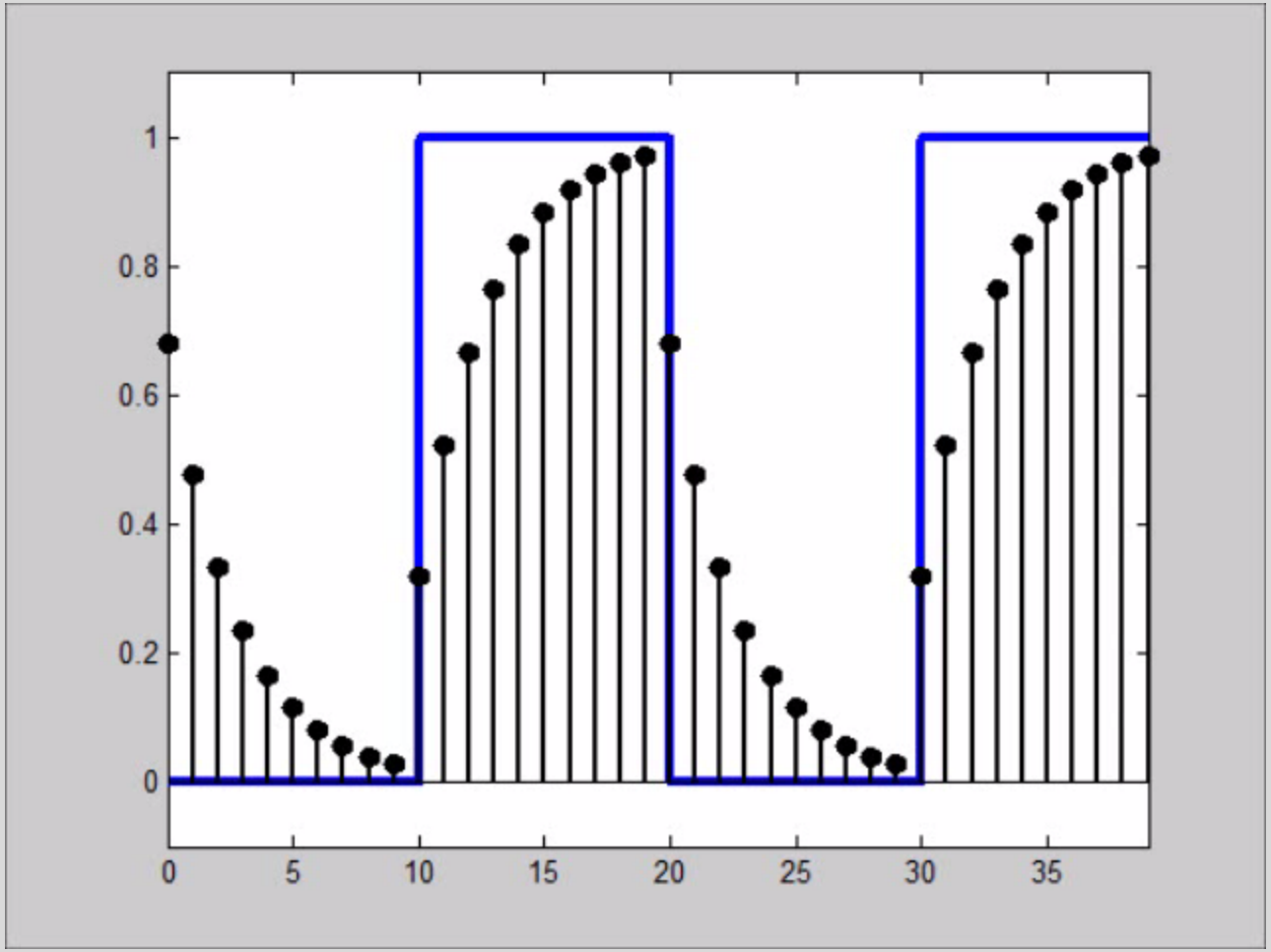
input (blue) →

← output (black)

Discrete Time Channel

Assumes no attenuation, delay, offset or noise.

Effect of bandlimited channel (bit time=10 SPB)

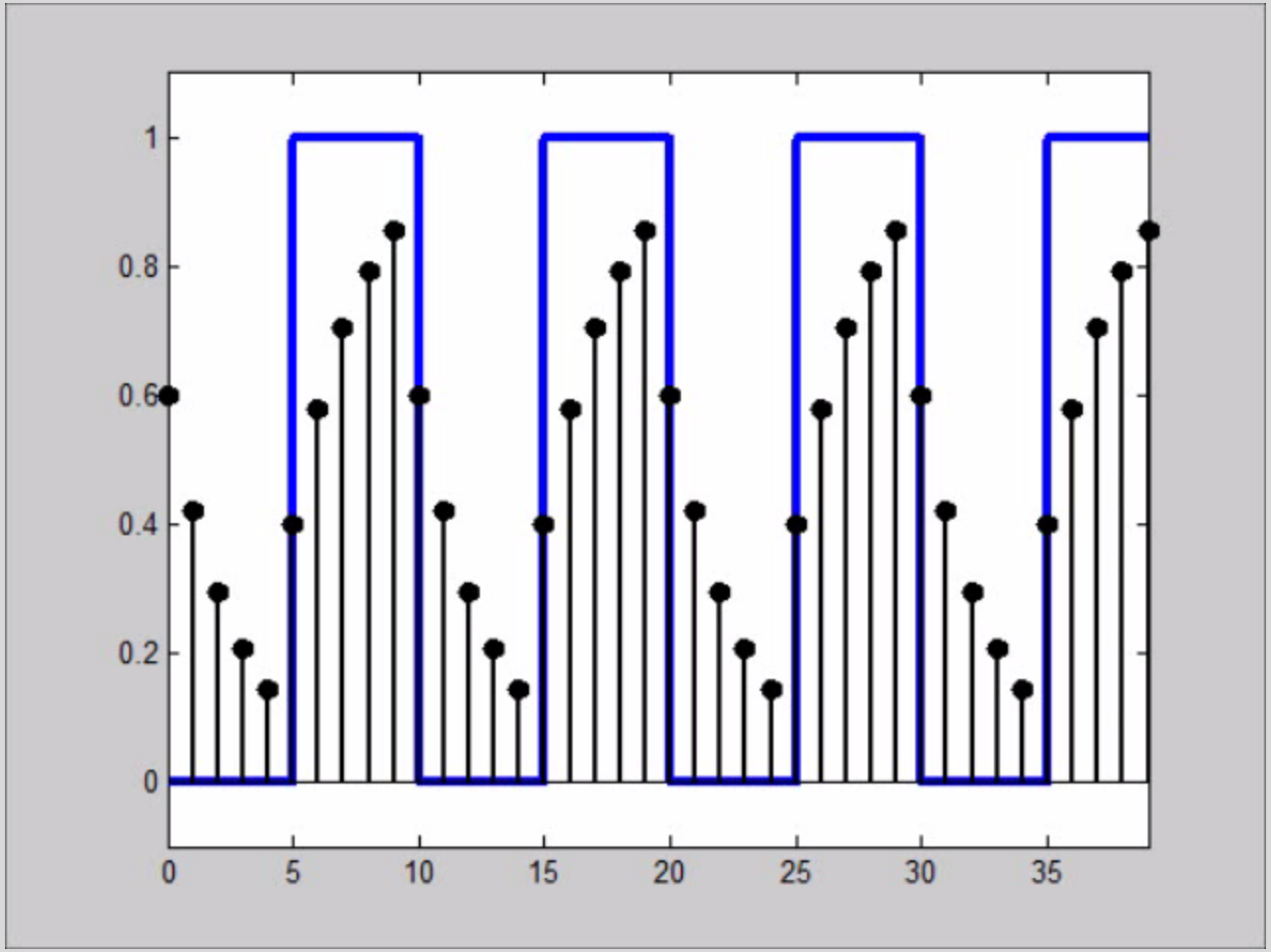


input (blue) →

← output (black)

Discrete Time Channel

Effect of bandlimited channel (bit time=5 SPB)



input (blue) →

← output (black)

Discrete Time Channel

Developing a bandlimited channel model

- To predict the output of a bandlimited channel to any input
  - assume that the channel is linear and time invariant
  - use the fact that any input can be expressed as the sum of unit step functions