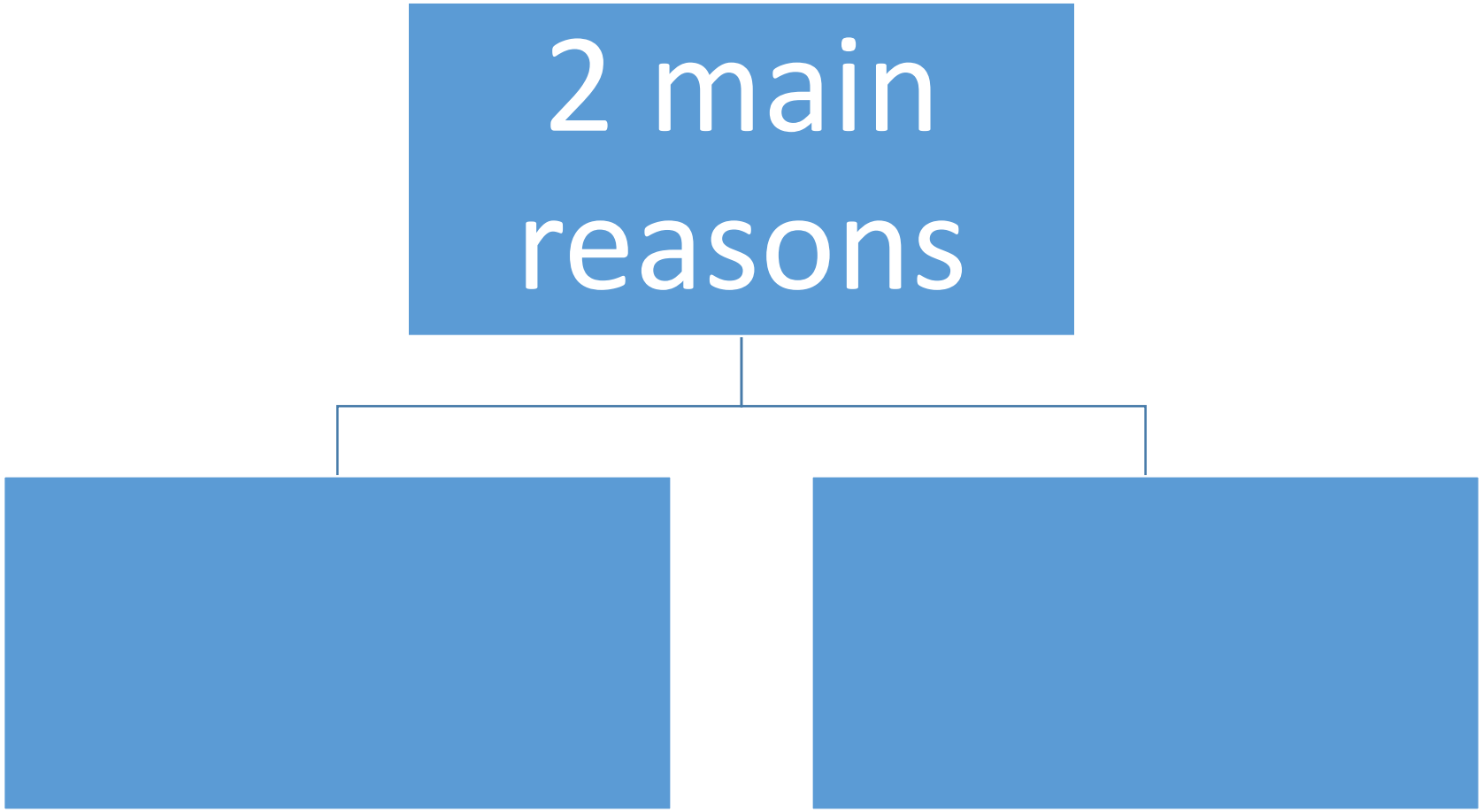
Quality in digital systems

- CAUSES OF QUALITY LOSS
- EFFECTS
- MEASUREMENT

A joint effort by Barbara Costantini and Sean Pethybridge
2015/16 Brescia I.I.S. B. Castelli-Brescia

Why do digital systems provide more quality transmission than analog ones?



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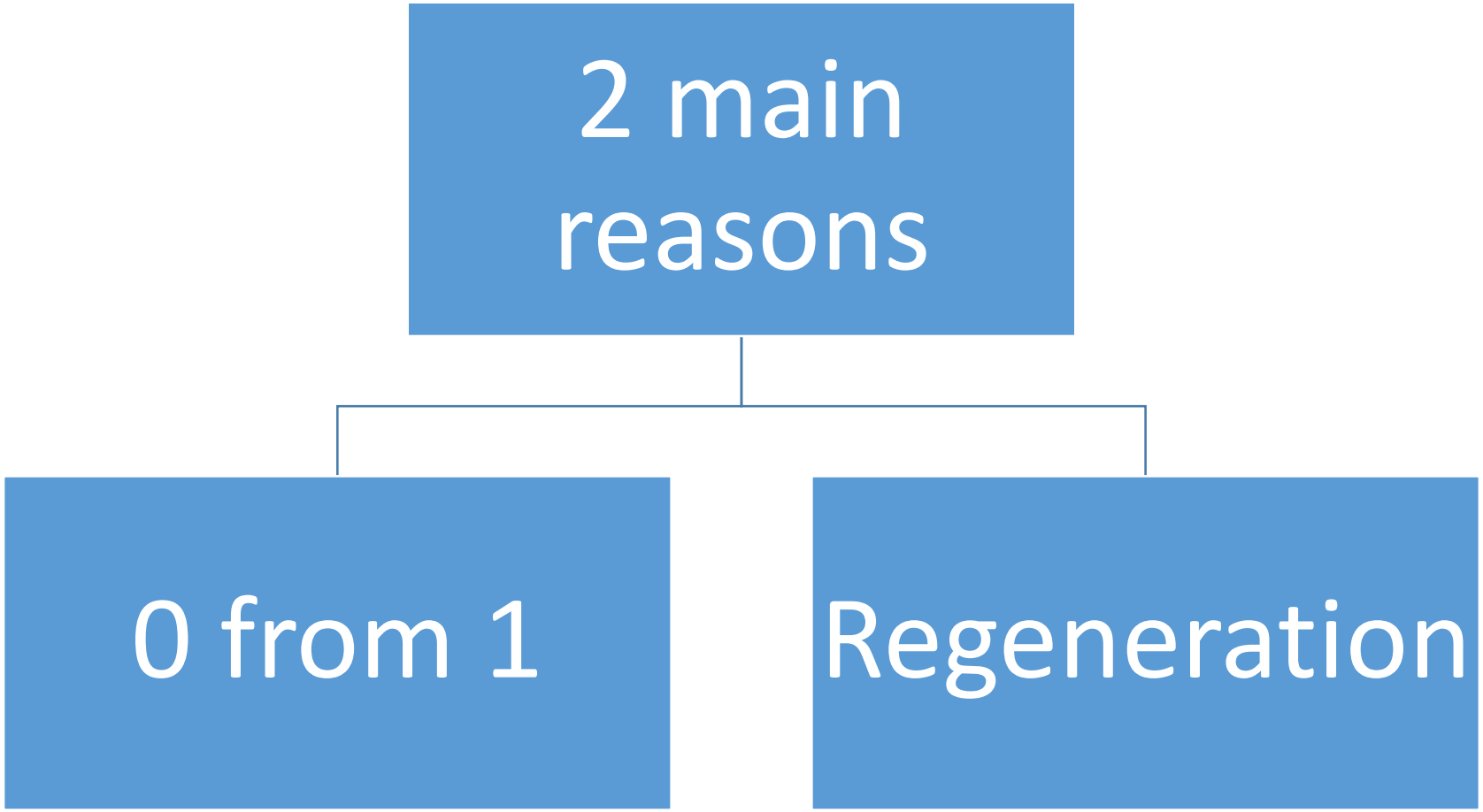
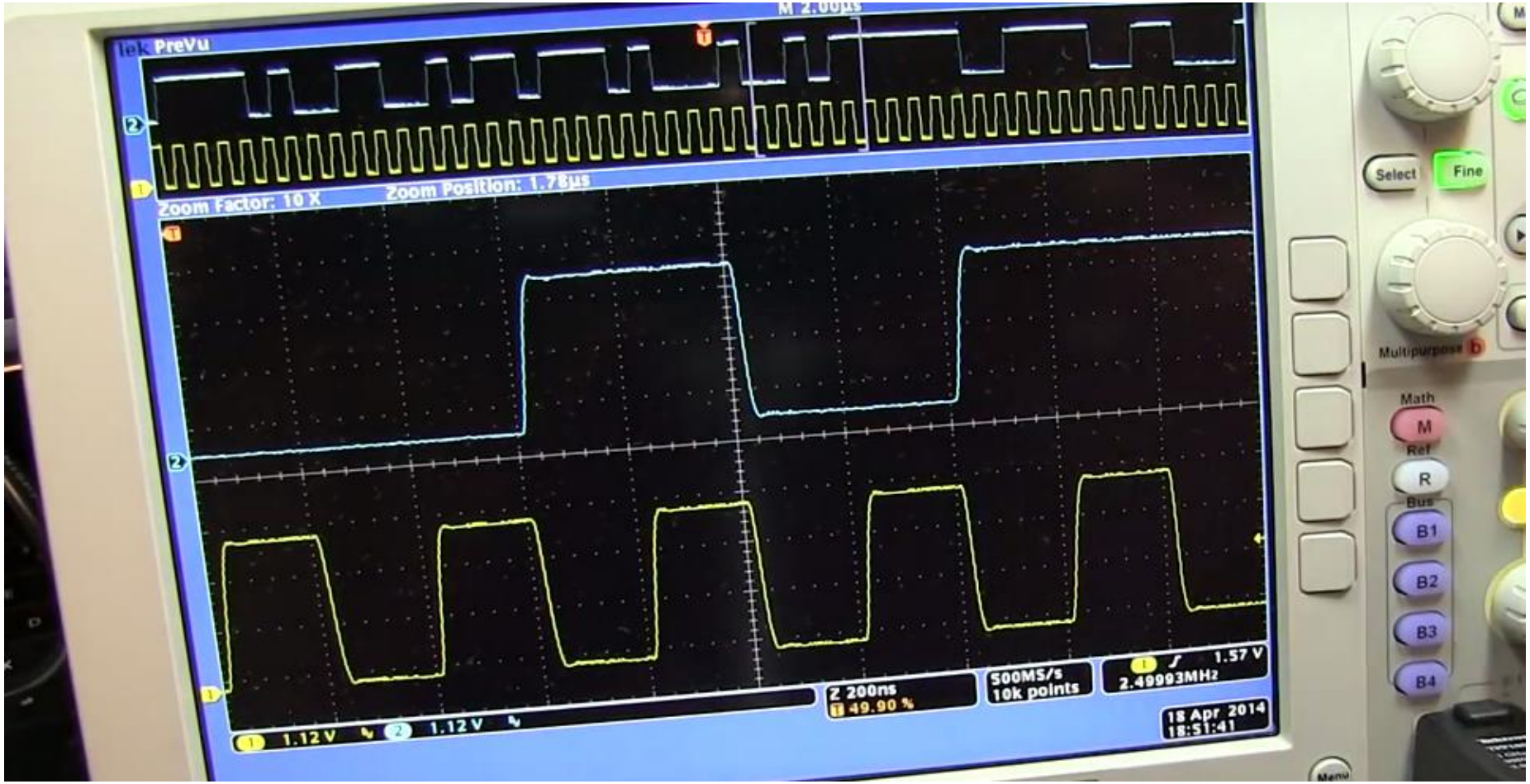
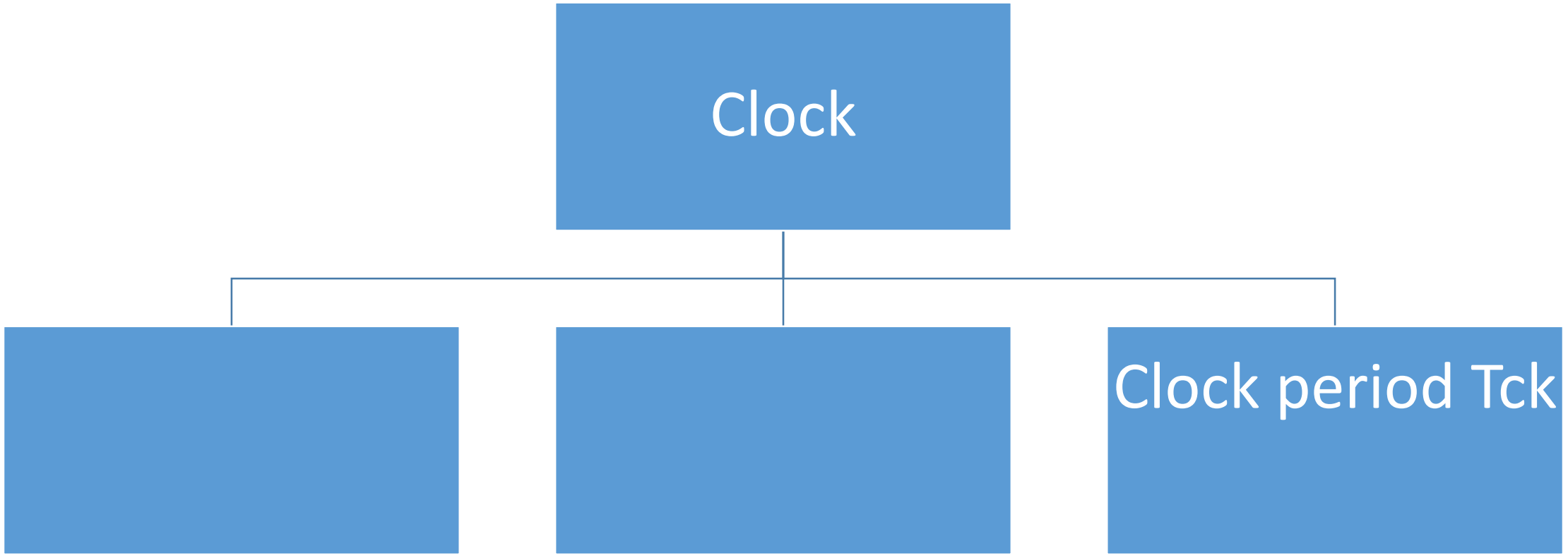
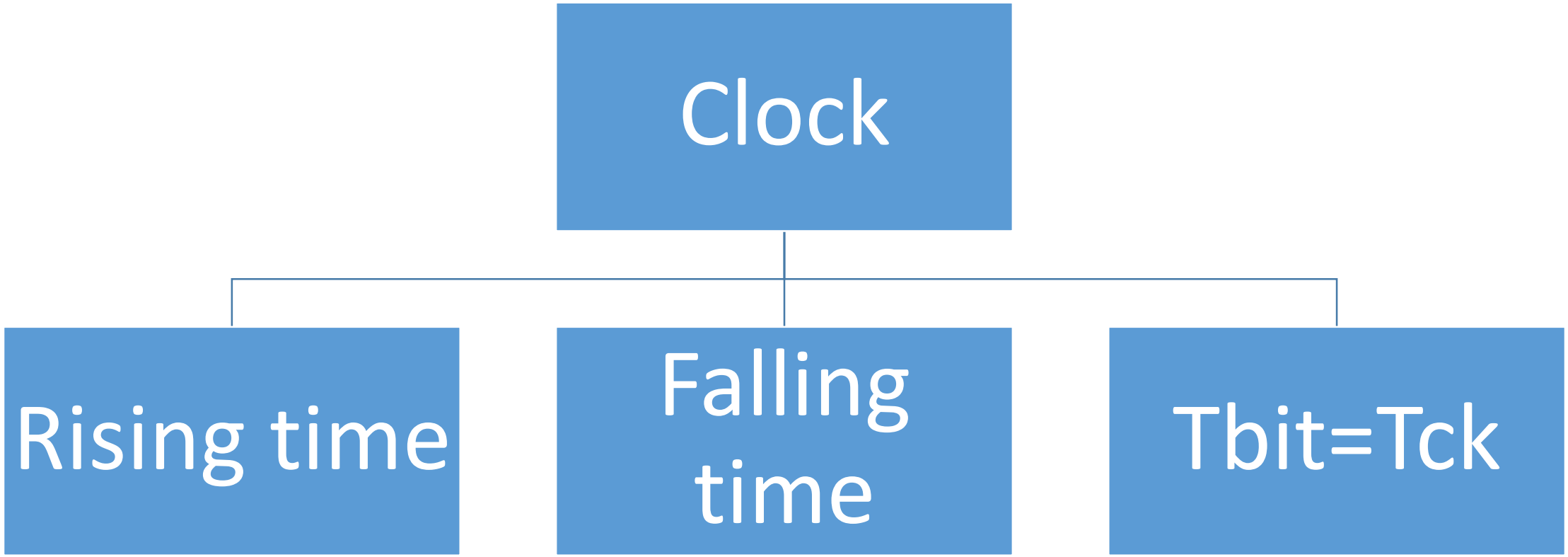


How is clock signal related to the digital signal?




Clock
Clock period Tck


Clock
Rising time
Falling time
Tbit=Tck

Let’ s take a deeper look at that

- What happens

if the receiver clock

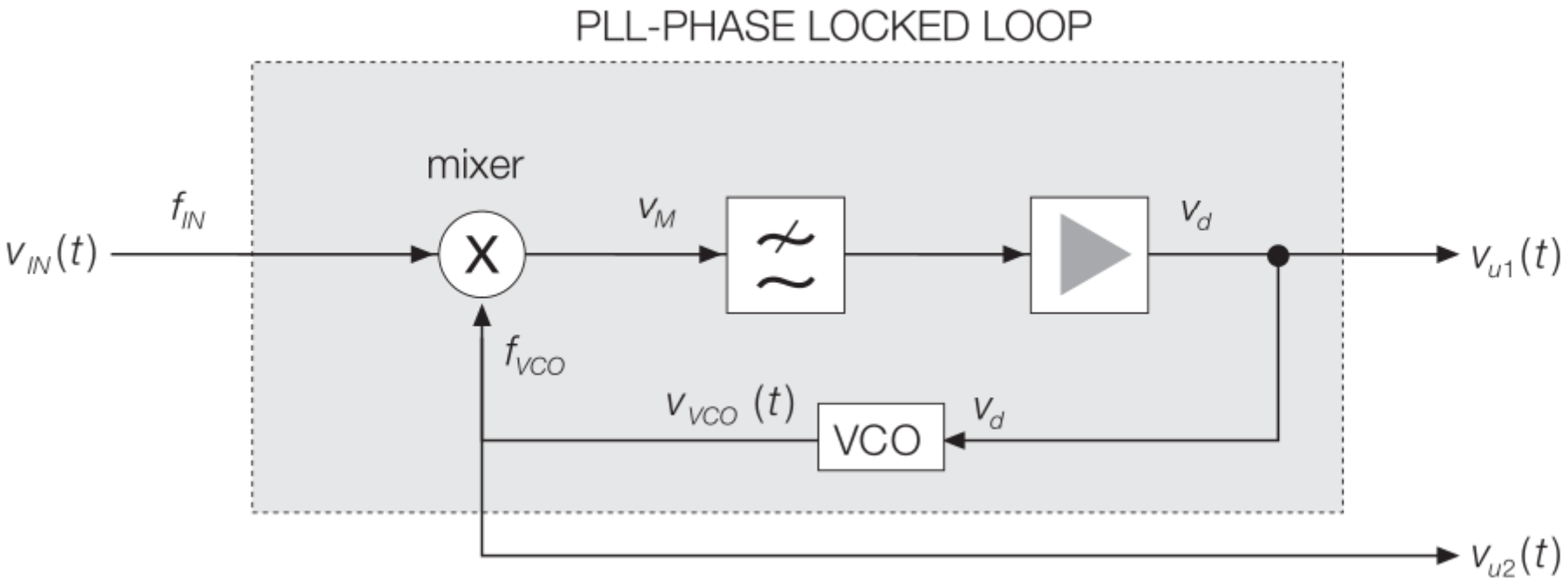
is not synchronized

with the transmitter clock?

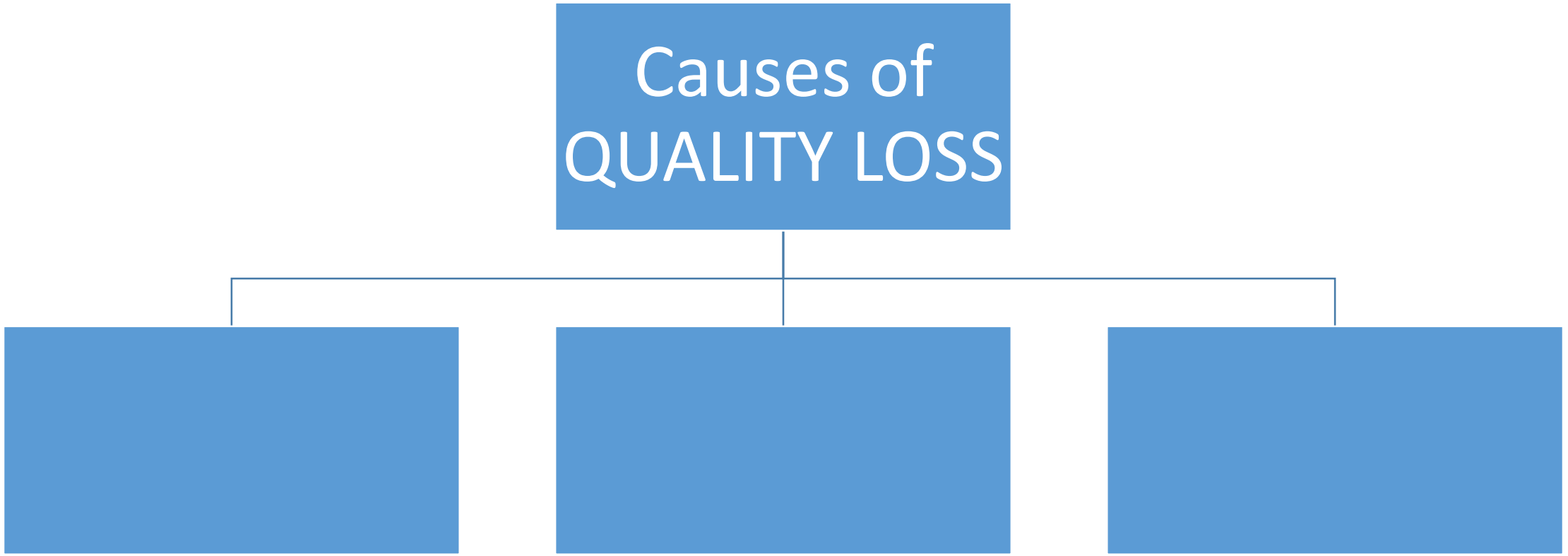
MICROCAP

How can the original clock signal be recovered in order to make the transmission clock lock with the receiving clock?

PLL


PLL-PHASE LOCKED LOOP
mixer
f_{IN}
$v_{IN}(t)$
X
v_M
v_d
$v_{u1}(t)$
f_{VCO}
$v_{VCO}(t)$
VCO
v_d
$v_{u2}(t)$

What are, in your opinion, the main causes of quality loss in digital systems?



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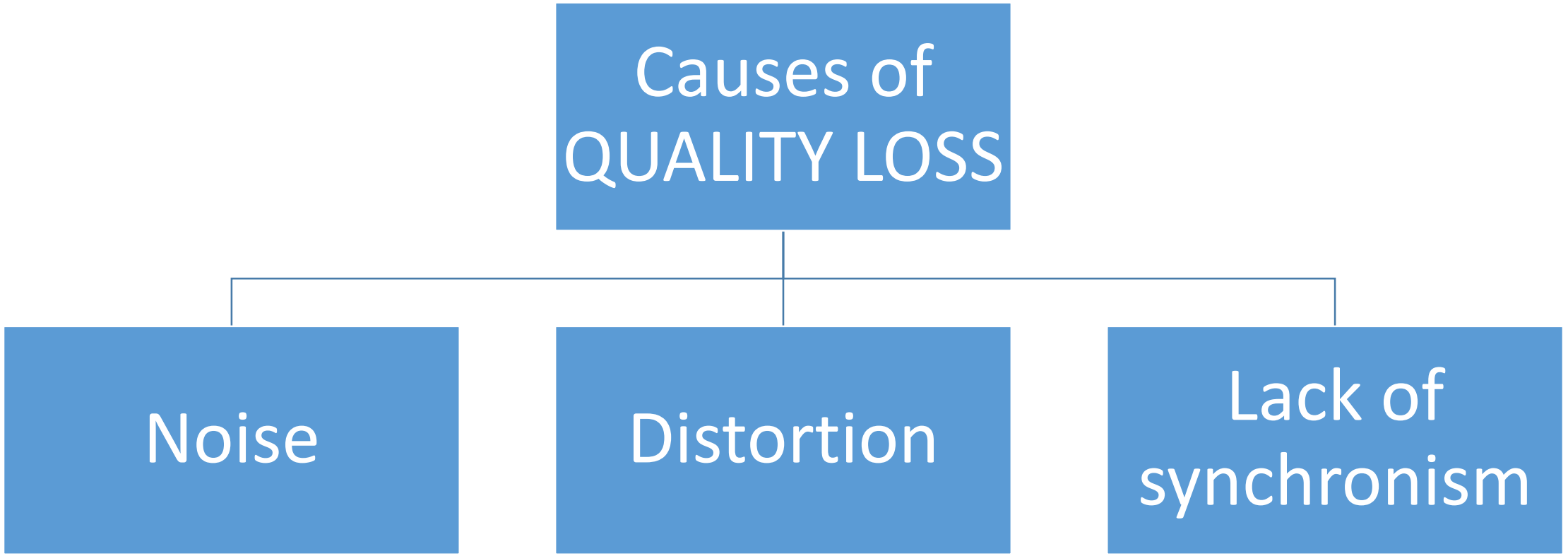

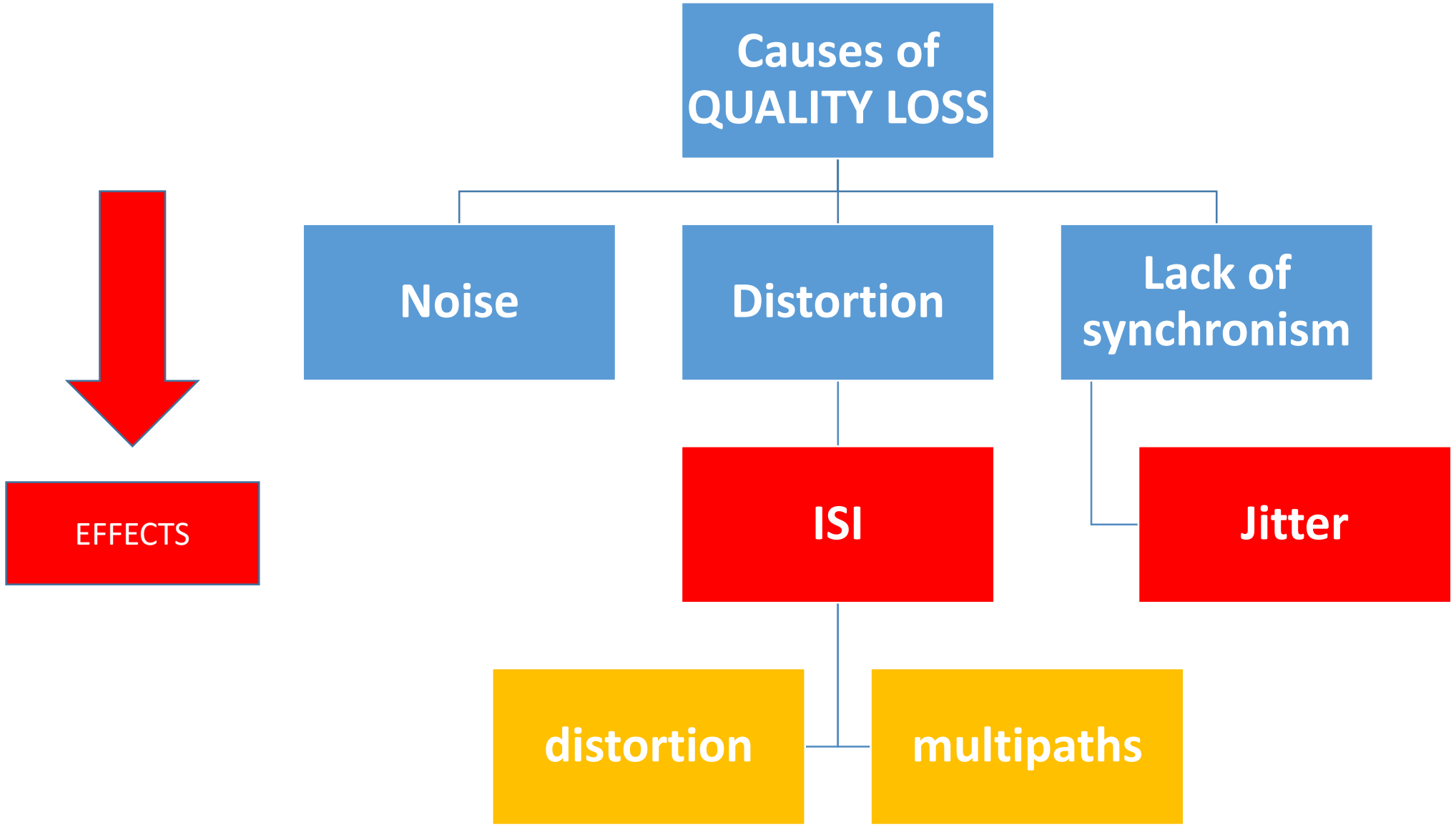
Causes of QUALITY LOSS
Noise
Distortion
Lack of synchronism
EFFECTS
ISI
Jitter
distortion
multipaths

What is Intersymbol Interference ?

ISI

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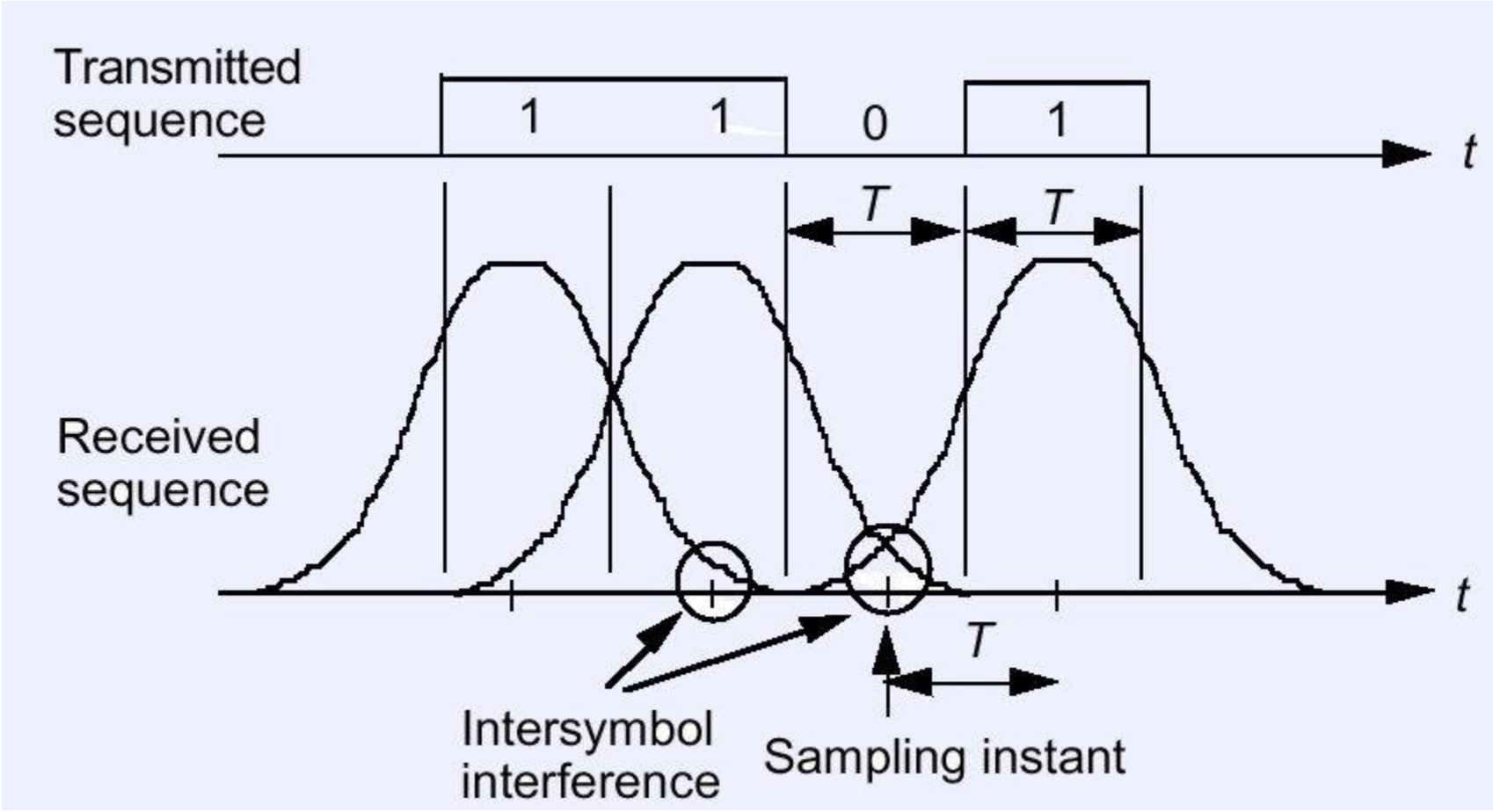
ISI

It is a form of distortion due to the spreading of the pulse

Each pulse of a serial bit stream overlaps with the neighbor

The maximum bit rate is limited by ISI



What is Jitter?

Jitter

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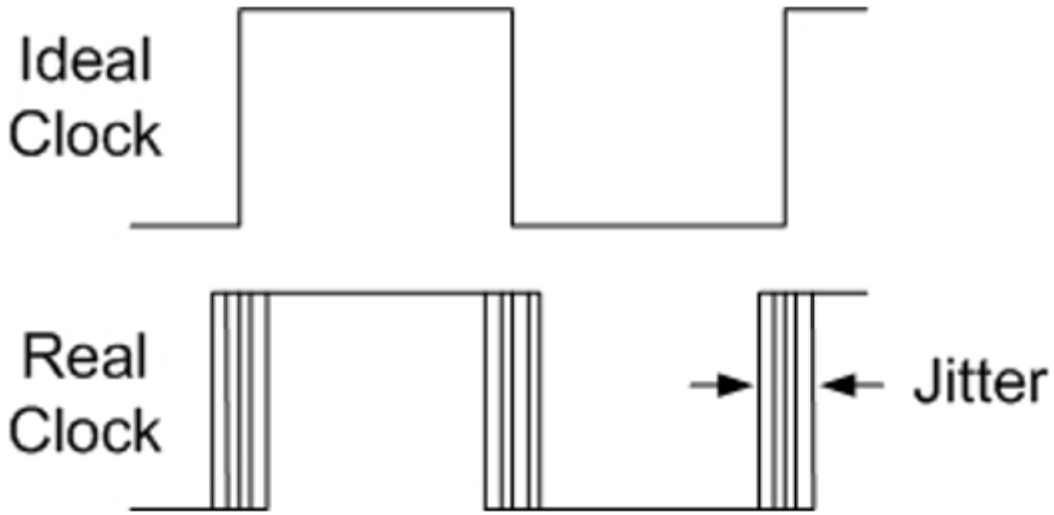
Jitter

It is a random variation of the bit time due to misalignment of the clock signal



How can we take account of ISI and Jitter in a easy way?

EYE PATTERN

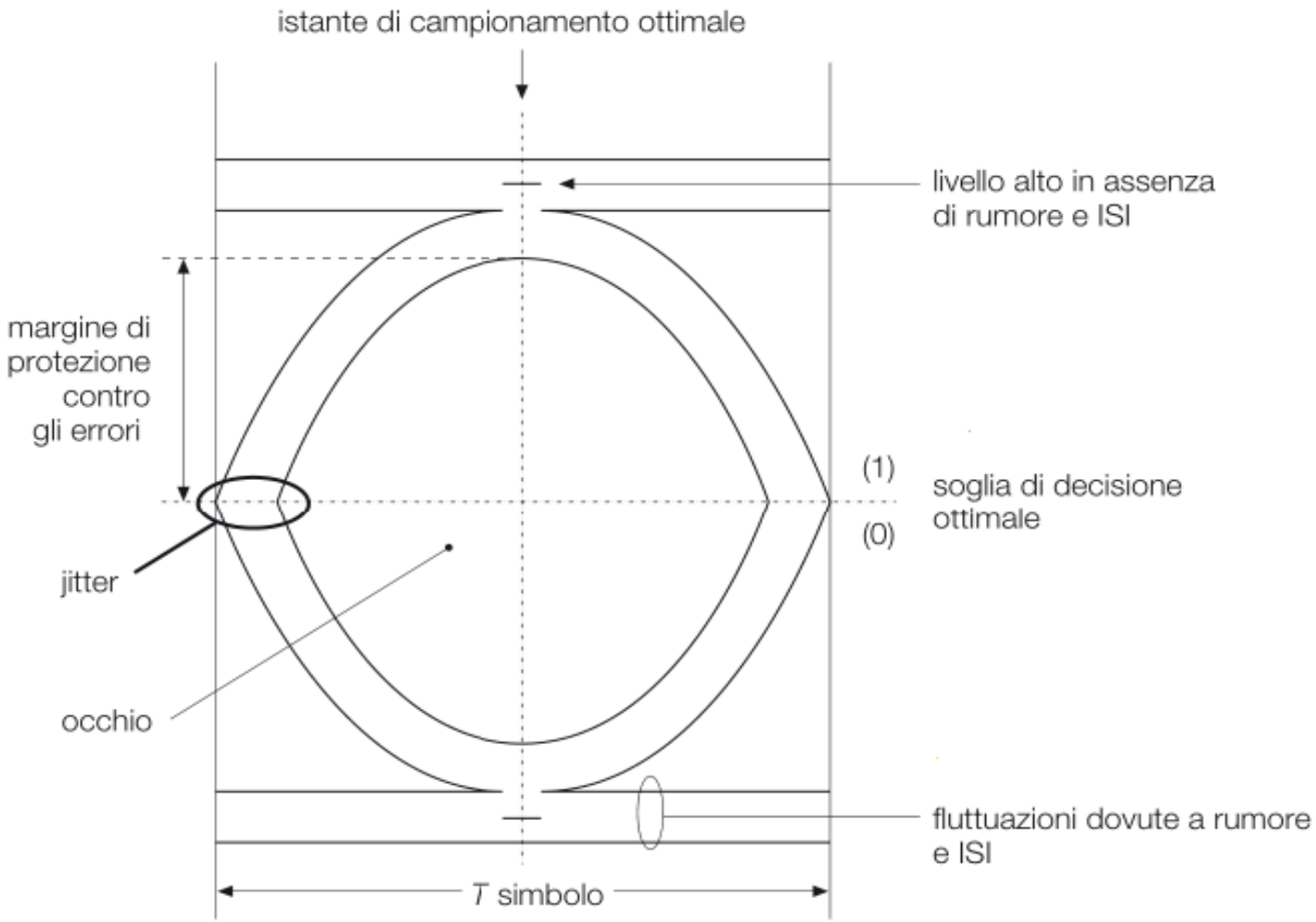


Diagramma a occhio.

EYE PATTERN

Two figures of merit

Horizontal eye opening/closure

Vertical eye opening/closure

Protection margin against error

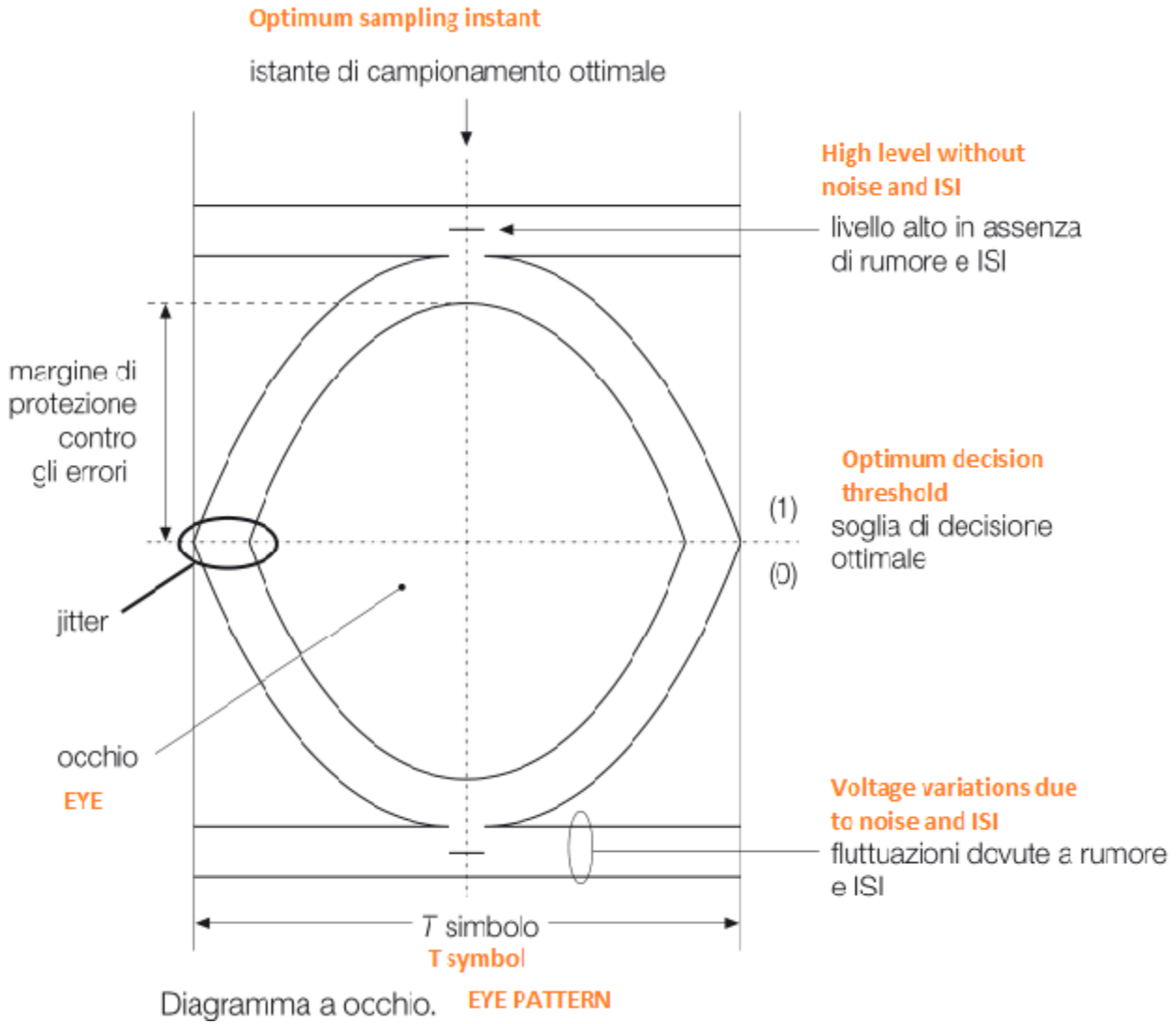
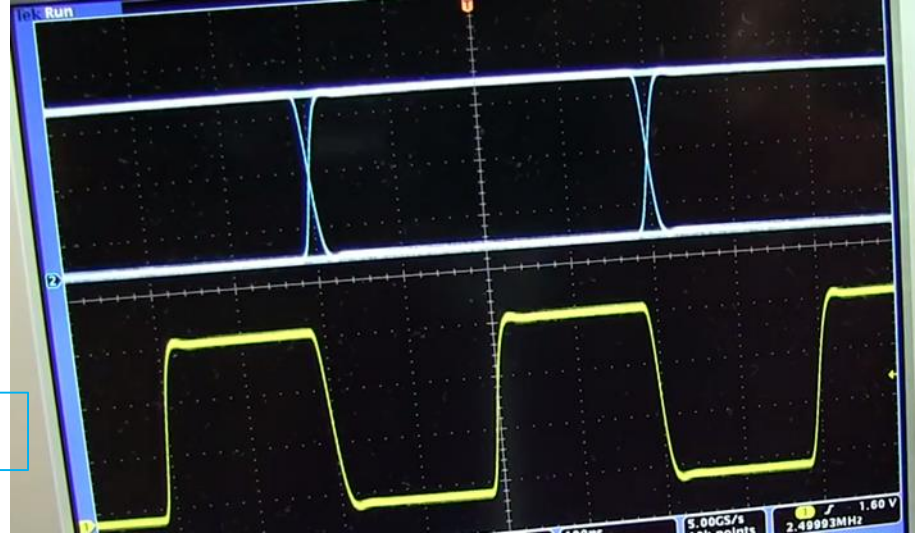


Diagramma a occhio. EYE PATTERN

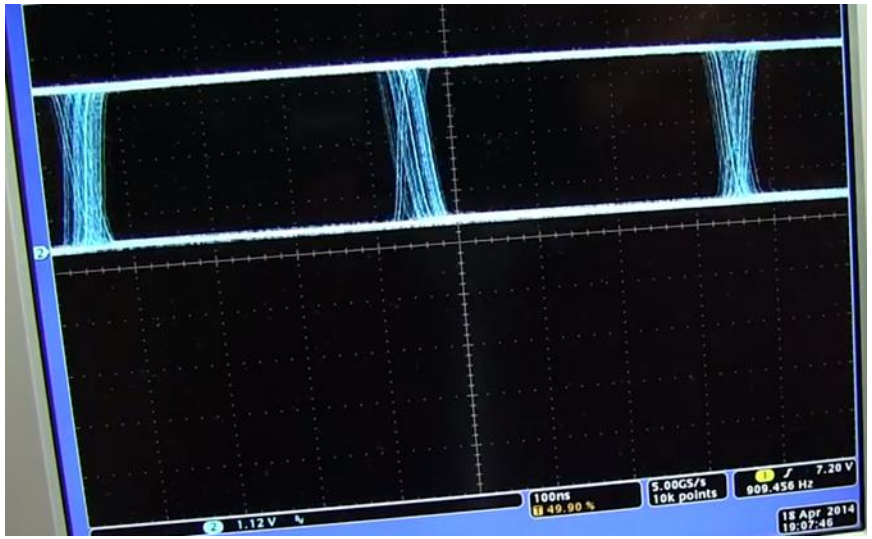
Eye pattern affected by jitter

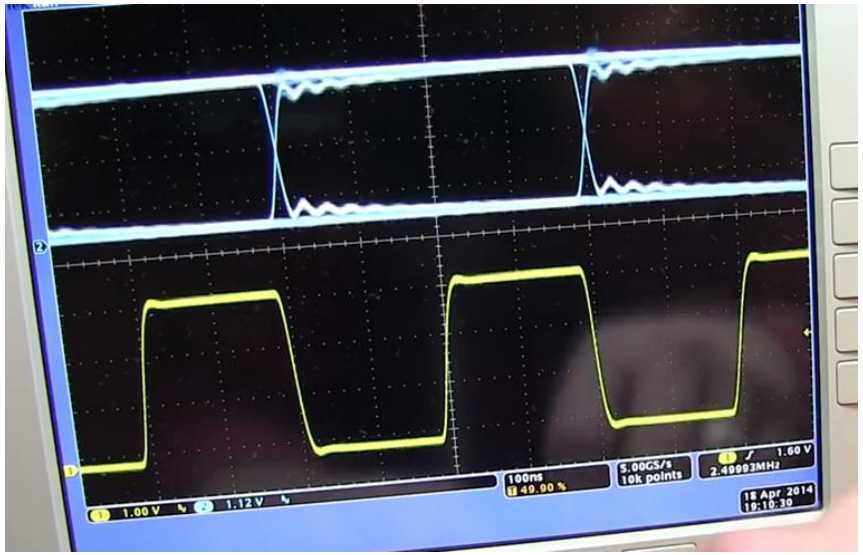
Eye pattern affected by noise and ISI

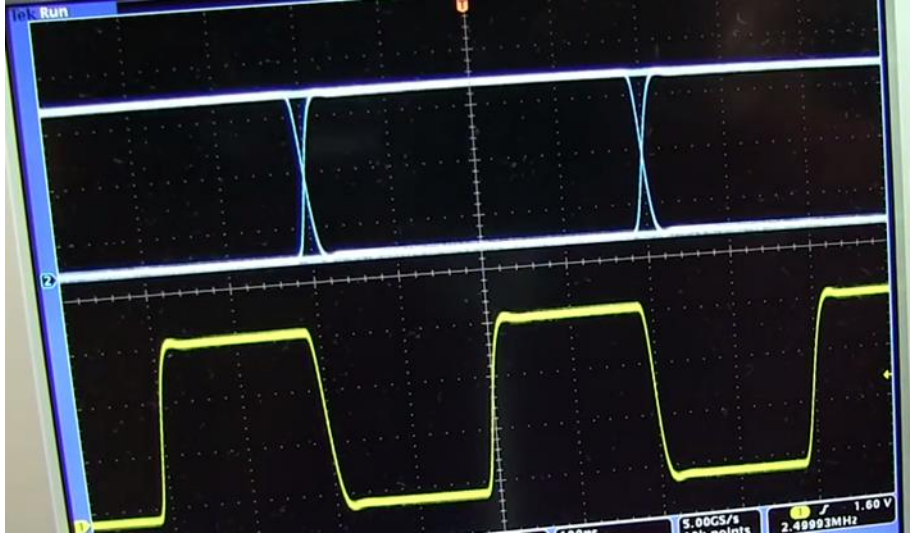
Ideal eye pattern



Match each definition with the right image







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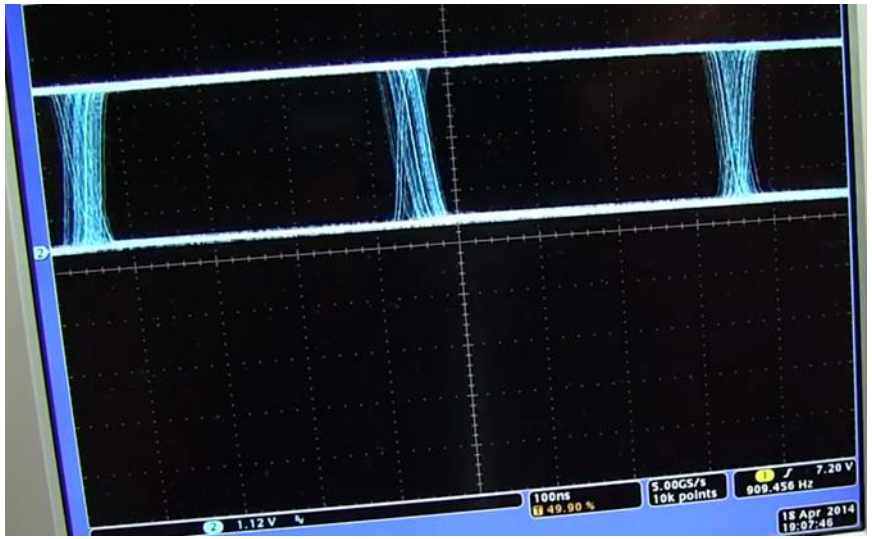
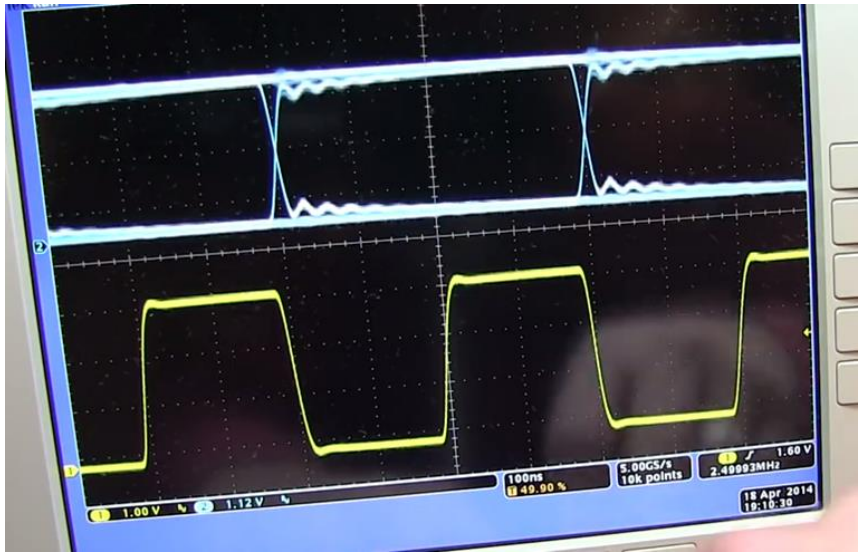


Eye pattern affected by jitter



Eye pattern affected by noise and ISI