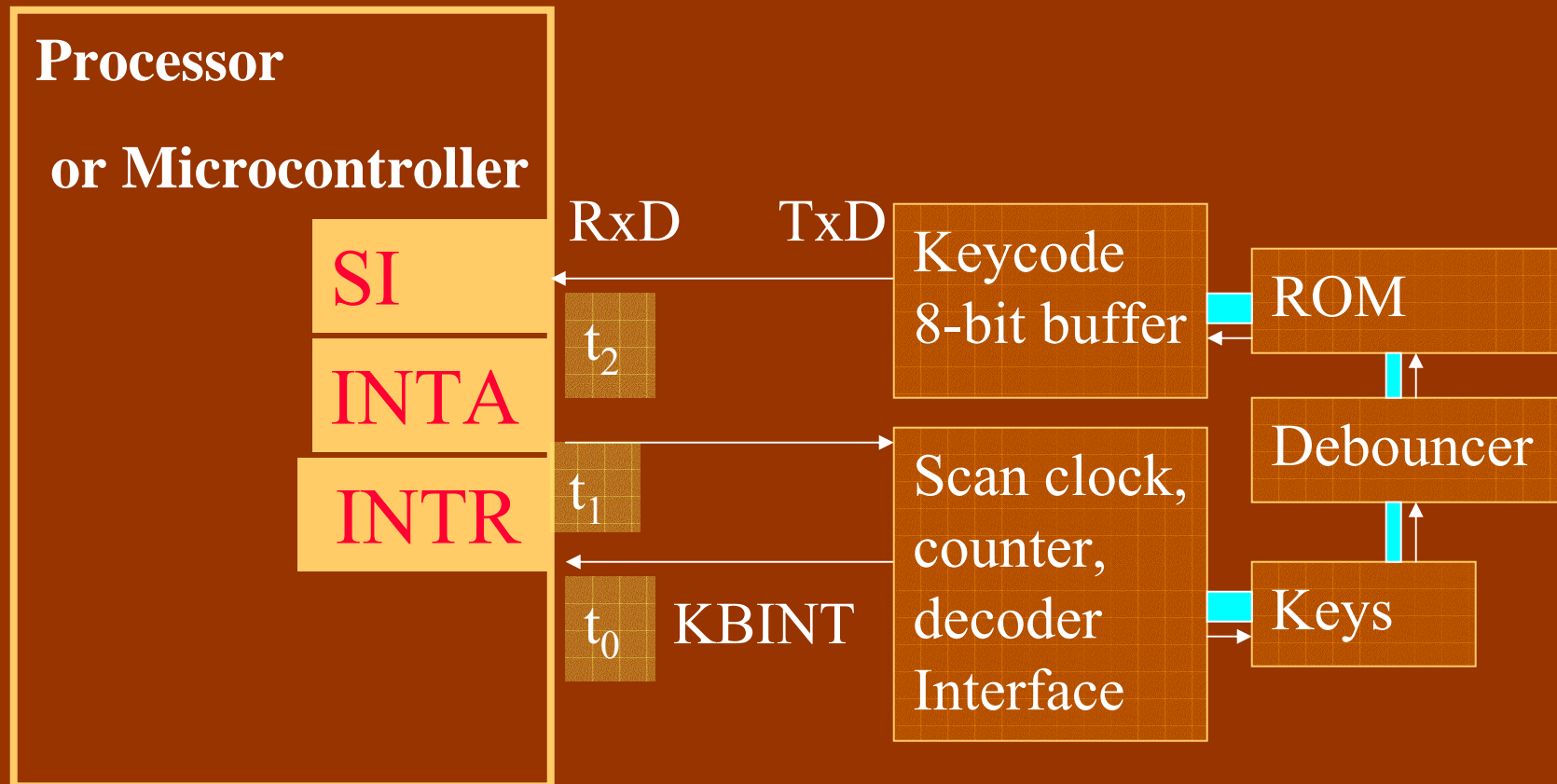# 8051 AND ADVANCED PROCESSOR ARCHITECTURES AND REAL WORLD INTERFACING-
Lesson-9 Interfacing examples with keyboard, displays, D/A and A/D Conversions

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1. Keyboard

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Keyboard Interface to Serial Interface at Microcontroller

Processor

or Microcontroller

SI

INTA

INTR

t_2

t_1

t_0 KBINT

RxD   TxD

Keycode 8-bit buffer

Scan clock, counter, decoder Interface

ROM

Debouncer

Keys

Two signals KBINT and TxD from a keyboard controller

- KBINT is interrupt from keyboard controller.

- TxD is serial UART data output of controller connected to RxD at SI in 8051 or UART Intel 8250 or UART 16550, which includes a 16-byte buffer

Debouncer

- Bounces create on pressing─ Each bounce creates a false pulse.

- Keyboard controller has hardware debouncer to the care of bouncing of a key.

Scan Clock

- Keyboard controller has counter driven by a scan clock, which continuously increments at certain rate and scans each key whether that is in pressed or released state.

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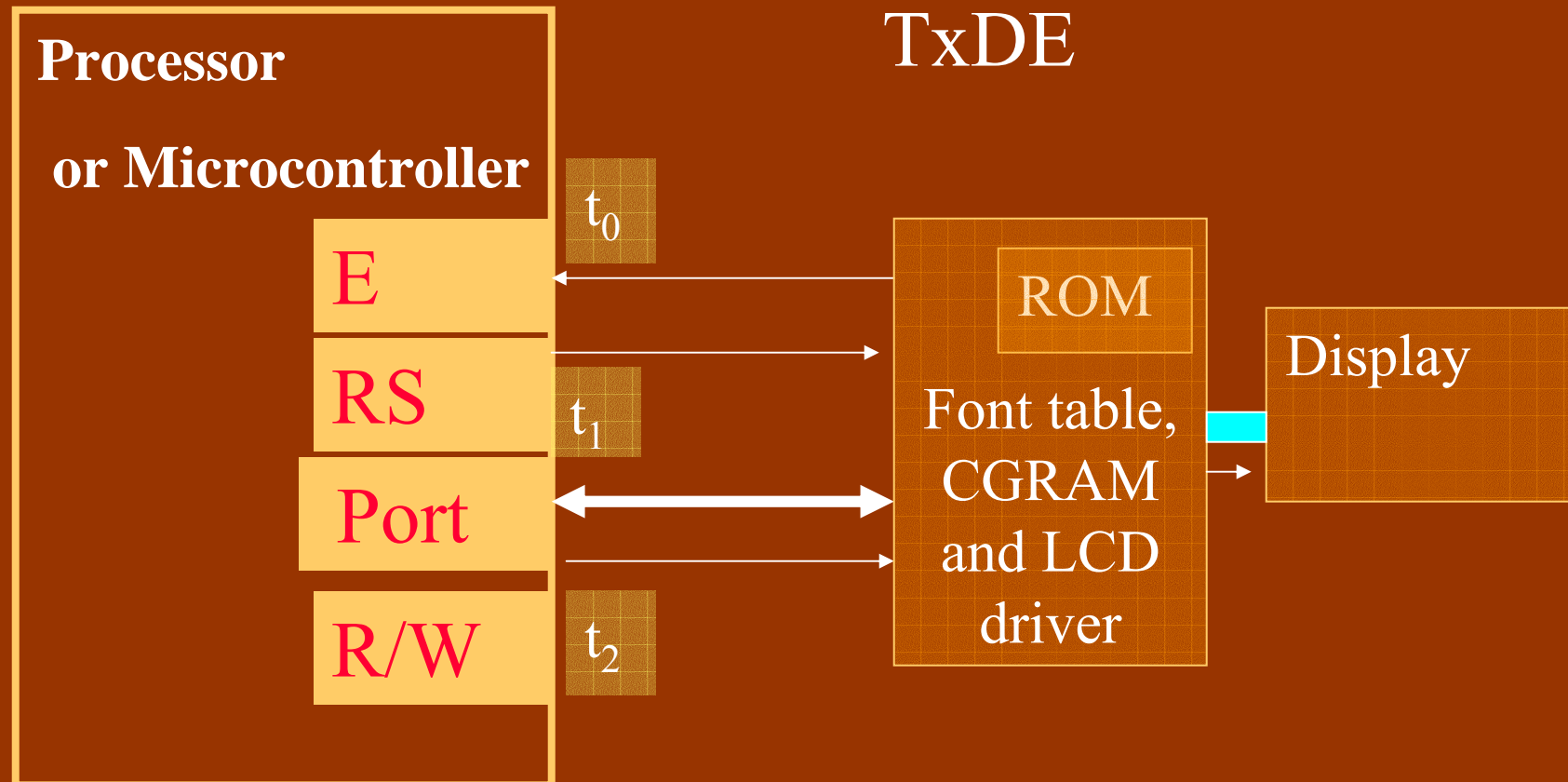
Encoder

- To encode the keyboard output for a ROM.

- ROM generates the ASCII code output for the pressed key.

- The code accounts the multiple keys simultaneously pressed.

- Example, Shift key is also pressed then generate the code for upper case character.

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TxD

- The code bits are serially transferred as TxD output

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2. LCD display controller

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LCD Controller Interface

Processor

or Microcontroller

TxDE

| E |
| RS |
| Port |
| R/W |

t_0

t_1

t_2

ROM

Font table,
CGRAM
and LCD
driver

Display

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Interface to LCD display controller

- 3 bits for E, RS and R/W
- 8 output data.
- One 8-bit port is used for output data for display.
- Another port is used for 3 bits
- Section 3.3.4 for details.

3. DAC

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DAC using PWM and integrator

- DAC ─ PWM circuit and an integrator.

- PWM ─ internal device in a microcontroller

- A pulse width register (PWR) is programmed according to a required analog output.
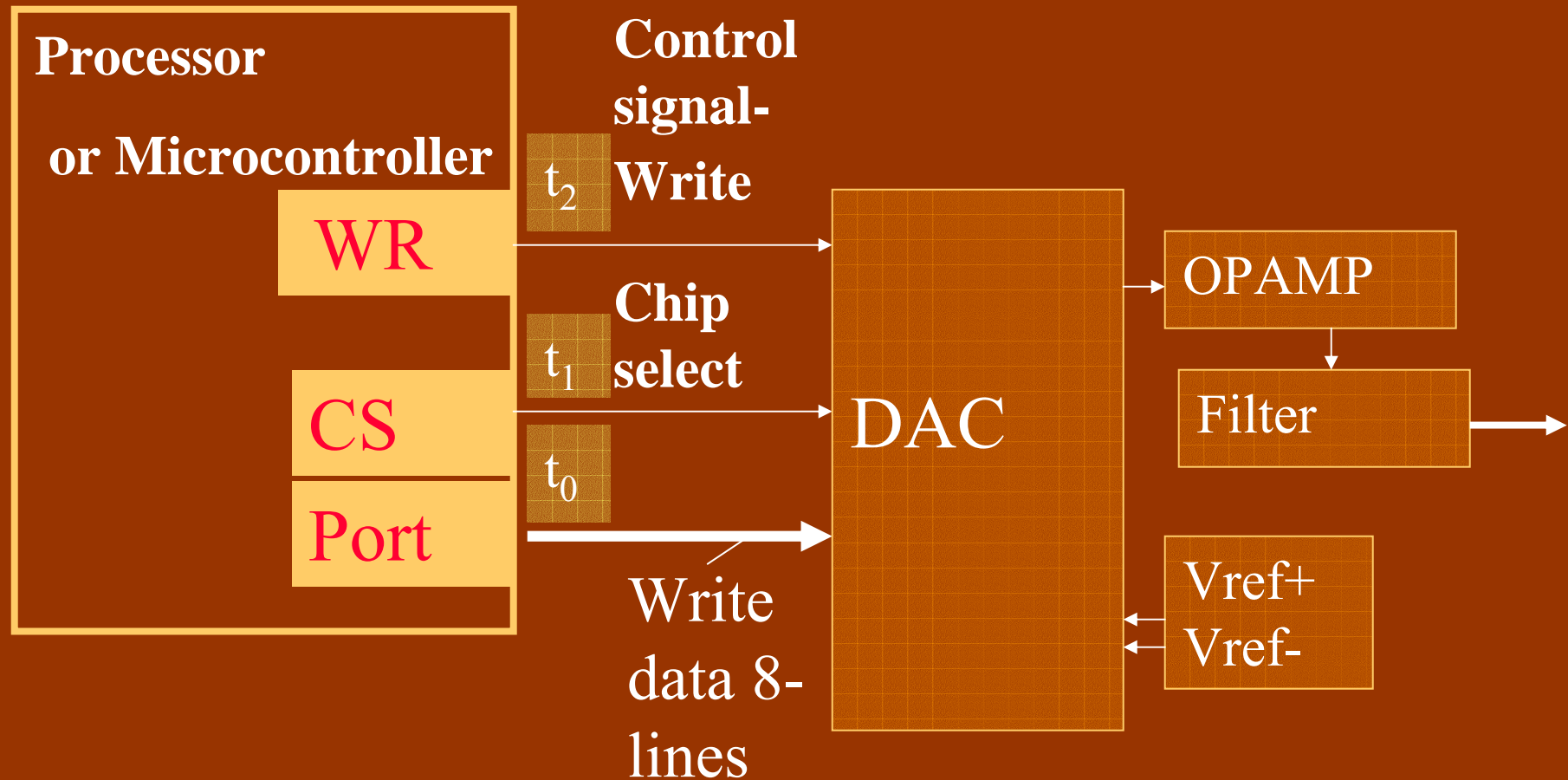
PWM Functioning

- A counter/timer device, which generates two internal- interrupts one on timer overflow and another after an interval proportional to equal to PWR.

- On first interrupt, the output becomes 1 and on second interrupt it becomes 0.
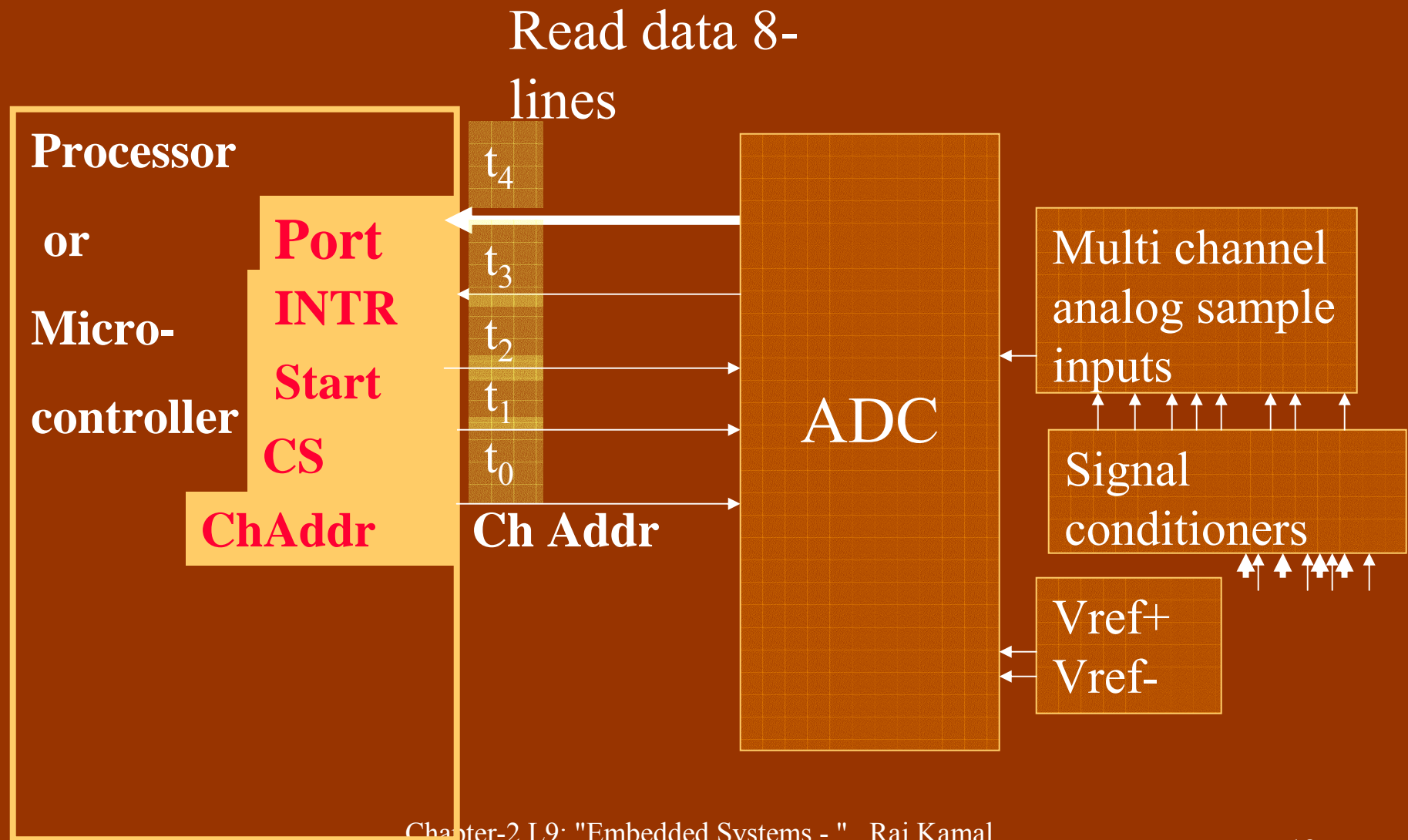
Integrator

- Generates the analog output as per the period of output = 1 (period between first and interrupts) compared   to total period of output pulses (period between successive first interrupts).

DAC Using a DAC external chip

Processor

or Microcontroller

WR

CS

Port

t_2

t_1

t_0

Control signal- Write

Chip select

Write data 8-lines

DAC

OPAMP

Filter

Vref+ Vref-

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4. ADC

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ADC Using ADC external chip

Read data 8-lines

Processor

or

Micro-controller

Port

INTR

Start

CS

ChAddr

t_4

t_3

t_2

t_1

t_0

Ch Addr

ADC

Multi channel analog sample inputs

Signal conditioners

Vref+
Vref-

ADC

- Start of conversion pulse generator circuit,

- A sample hold amplifier circuit to hold the signal constant for the conversion period and signal conditioner

- Voltage references + and − for providing the reference for conversion of analog input

n-bit ADC

- A four or eight channel ADC is inbuilt in microcontrollers or
- an external ADC for example, ADC0808
- Interfacing similar to that to the ports.

Summary

We learnt

- Keyboard controller and its interfacing

- Keyboard units- scan clock, debouncer, encoder, ROM, driver

- LCD display controller interface

- DAC interface using PWM and integrator

- DAC interface using external DAC

- ADC interface using external ADC

End of Lesson 9 of Chapter 2

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