

Práctica 6: Diseño de un sistema SCADA

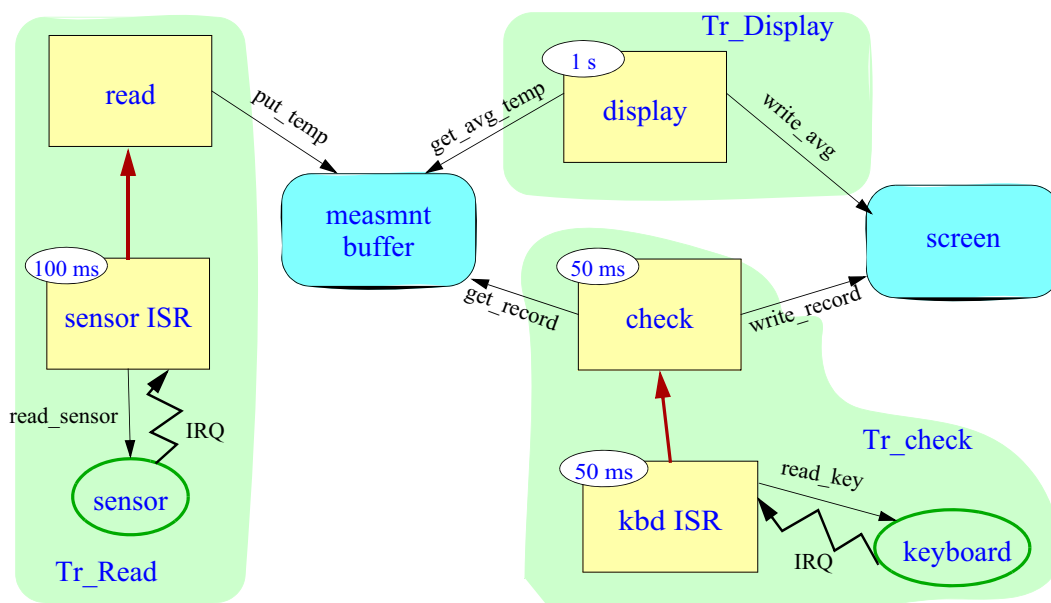
Objetivos:

- Realizar el diseño de una aplicación de tiempo real basada en un sistema de adquisición de datos SCADA y validarlo mediante el análisis del modelo MAST

Descripción:

- Modelar el sistema con MAST tanto en su versión monoprocesadora como distribuida
- Estimar los tiempos de peor caso del sistema y realizar el análisis de sensibilidad
- Explicar las posibles diferencias en los resultados obtenidos para las versiones monoprocesadora y distribuida
- El sistema SCADA presenta las siguientes características:

Práctica 6: Architecture



Práctica 6: Transactions



Tr_Read

- initiated by active sensor through IRQ
- periodic, $T=100\text{ms}$
- involves `read_sensor` by ISR, and `read` task that invokes `put_temp` and other instructions
- $D=1\text{ms}$

Tr_Display

- Initiated periodically, $T=1\text{s}$
- executes `get_avg_temp`, `write_avg` and other instructions
- $D=100\text{ ms}$

Práctica 6: Transactions (cont'd)



Tr_Check

- initiated by operator through keyboard IRQ
- assume keyboard controller limits max keys: sporadic event, $MIT=50\text{ms}$
- the check task protects the timing
 - **alternative 1**: polling task with $T_{\text{poll}}=50\text{ ms}$; initiated by sporadic event ('C' pressed) with $MIT=50\text{ms}$
 - **alternative 2**: sporadic server task with $T_{\text{poll}}=50\text{ ms}$, $\text{budget}=\text{WCET}$; initiated by sporadic event ('C' pressed) with $MIT=50\text{ms}$
- check task executes `get_record`, `write_record`, and other instructions
- $D=20\text{ms}$

Práctica 6: Data for the analysis

Trans	Task	C(ms)	T, MIT(ms)	D(ms)
Tr_Read	sensor_ISR	0.004	100	1
	read	0.500		
Tr_Display	display	3.800	1000	100
Tr_Check	kbd_ISR	0.004	50	20
	check	8.100		

Shared object	Operation	C(ms)
measmnt_buffer	put_temp	0.030
	get_avg_tmp	0.010
	get_record	0.030
screen	write_avg	0.700
	write_record	4.900

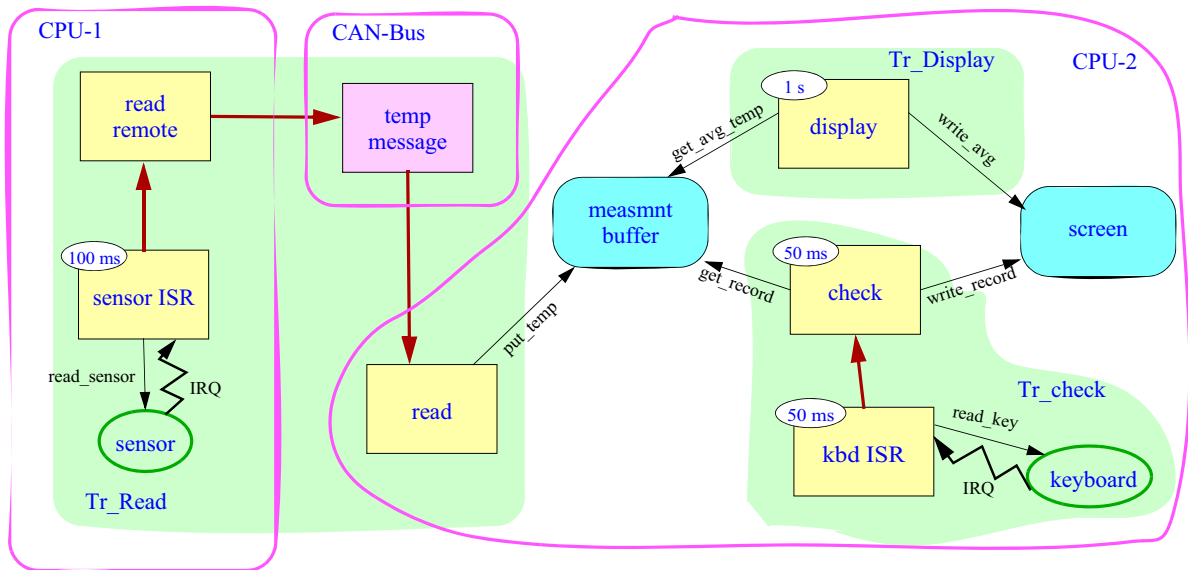
Práctica 6: Platform features

The execution platform has the following features:

- Range of priorities supported
 - Levels 1-30 for tasks
 - Levels 31-32 for interrupts
- Platform overhead model

Overhead	C(ms)
ISR switch	0.010
Alarm clock overhead	0.003
Context switch	0.010

Práctica 6: Distributed architecture



Práctica 6: Additional Data for the Distributed Analysis

Transaction	Task	C(ms)
Tr_Read	read_remote	0.400
	read	0.100

Network Features	Value
Throughput	1 Mbit/s
Blocking time in CAN Bus = 1 large message	0.130 ms
Packet overhead in CAN Bus = packet header	66 bits
Send ISR operation for CAN Bus	0.010 ms
Rcv ISR operation for CAN Bus	0.015 ms
Temp_message (payload)	100 bits