



Aurora

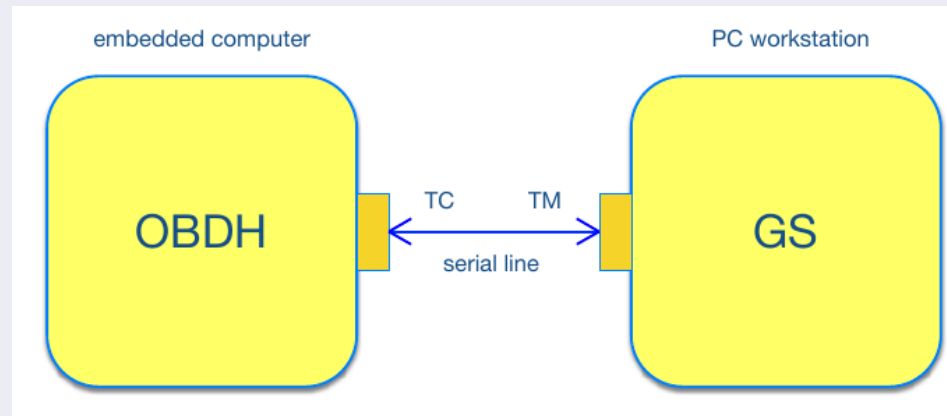
Sistema elemental OBDH
implementado en TASTE/Ada

Ángel Pérez Muñoz • Juan Zamorano Flores
Universidad Politécnica de Madrid

27 de abril de 2022

Introducción al OBDH

- Sistema elemental de adquisición de datos inspirado en el sistema OBDH (On Board and Data Handling) del UPMSat-2.
- Características de alto nivel:
 1. Lectura de los sensores de voltaje y temperatura del computador embarcado.
 2. Gestión de los modos de operación.
 3. Implementación de los TC (Telemandos) enviados desde la estación de tierra (GS).
 4. Envío de TM (Telemetría) periódicamente o bajo petición.
 5. Control de actitud, integración del subsistema de control de actitud (ACS).



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Herramientas para su implementación

TASTE

Simulink

QGen



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Herramientas para su implementación

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Simulink

QGen

- The Assert Set of Tools for Engineering.
- Desarrollado por la ESA para el desarrollo S/W de RTES heterogéneos y distribuidos.
- Sigue las metodologías MBSE y CBSE.

Componente
SW
[Simulink]

Componente
SW
[Ada]

Componente
SW
[C]

Middleware
PolyORB-Hi Ada o C



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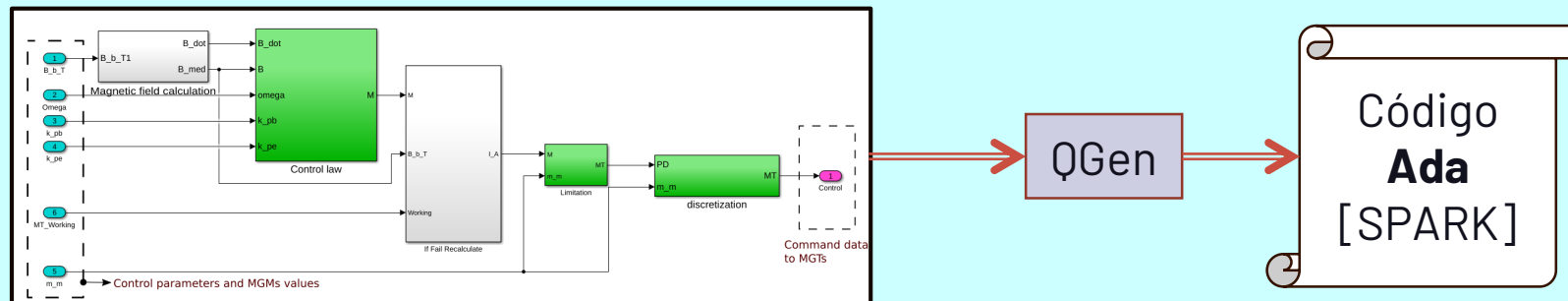


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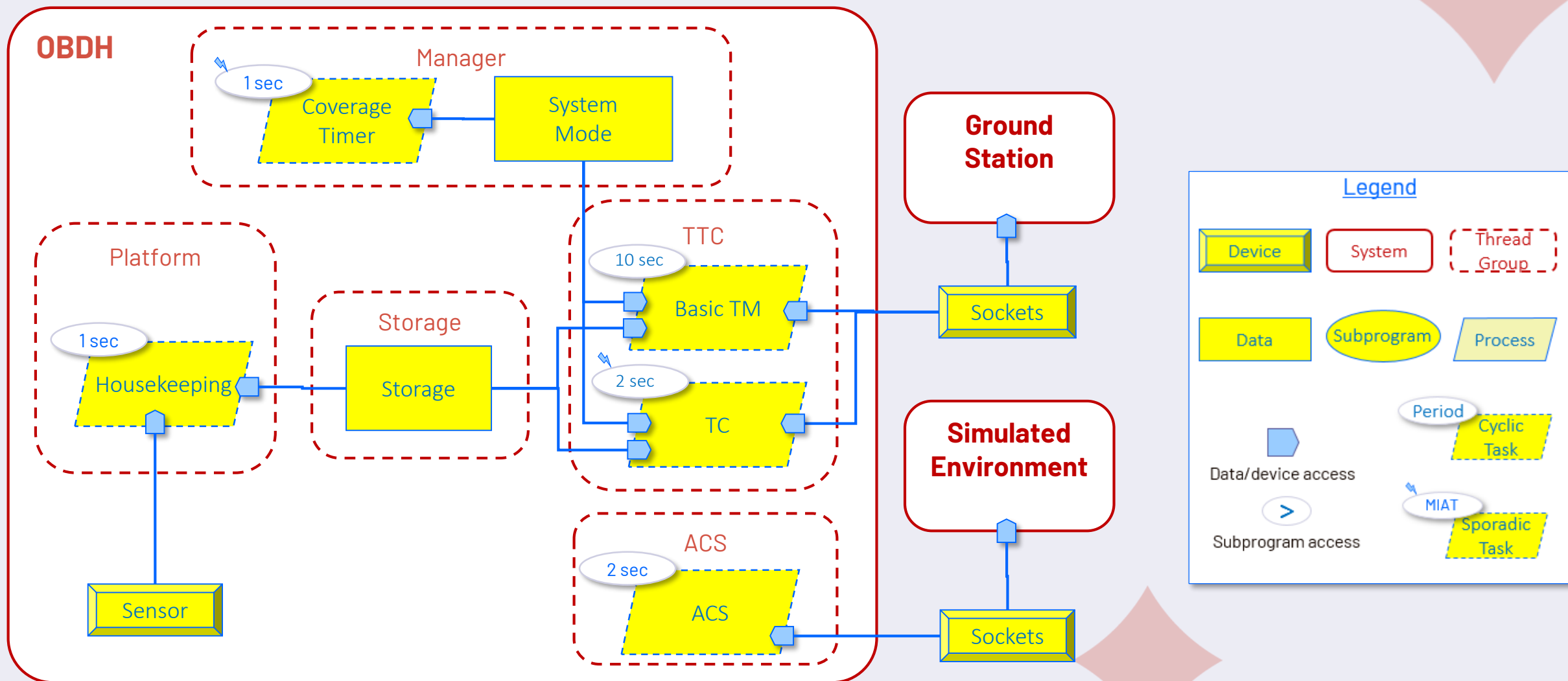
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Arquitectura software del OBDH (AADL)



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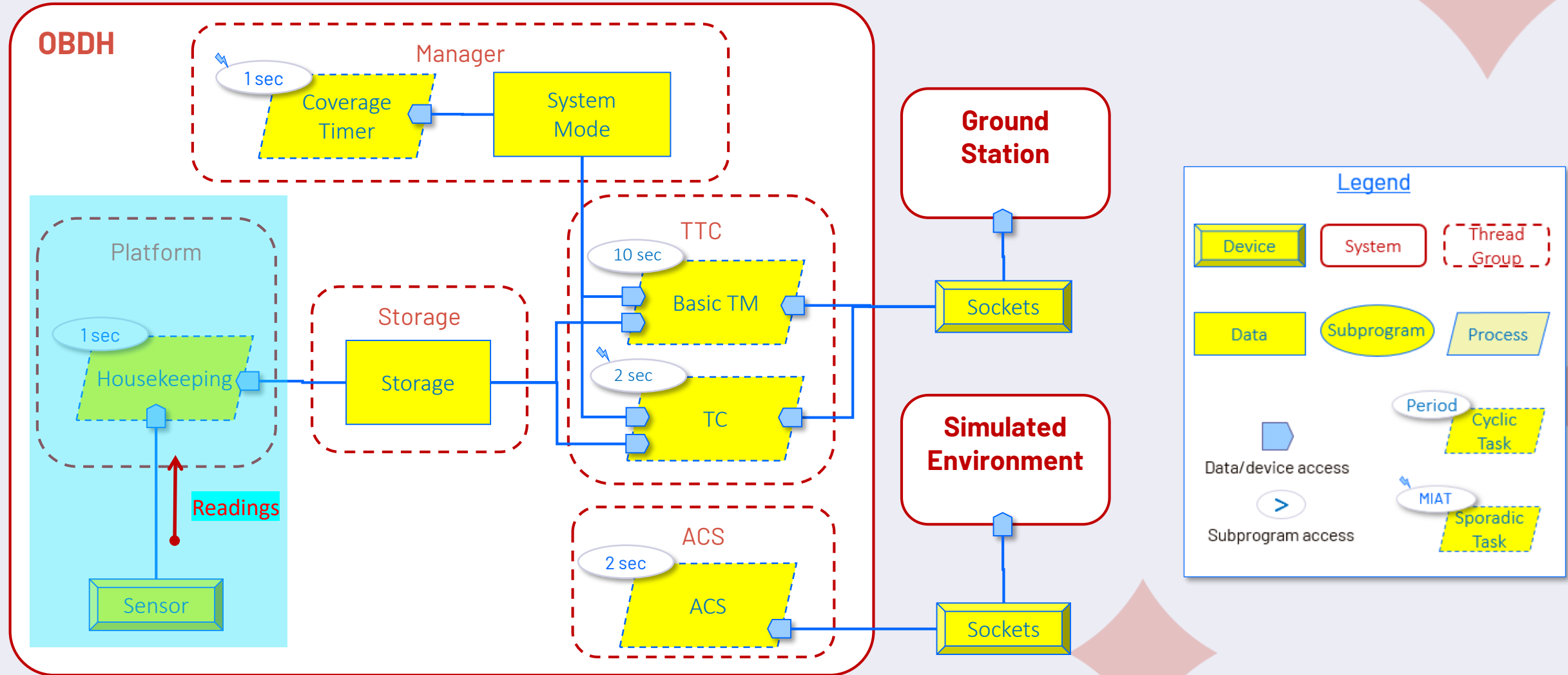
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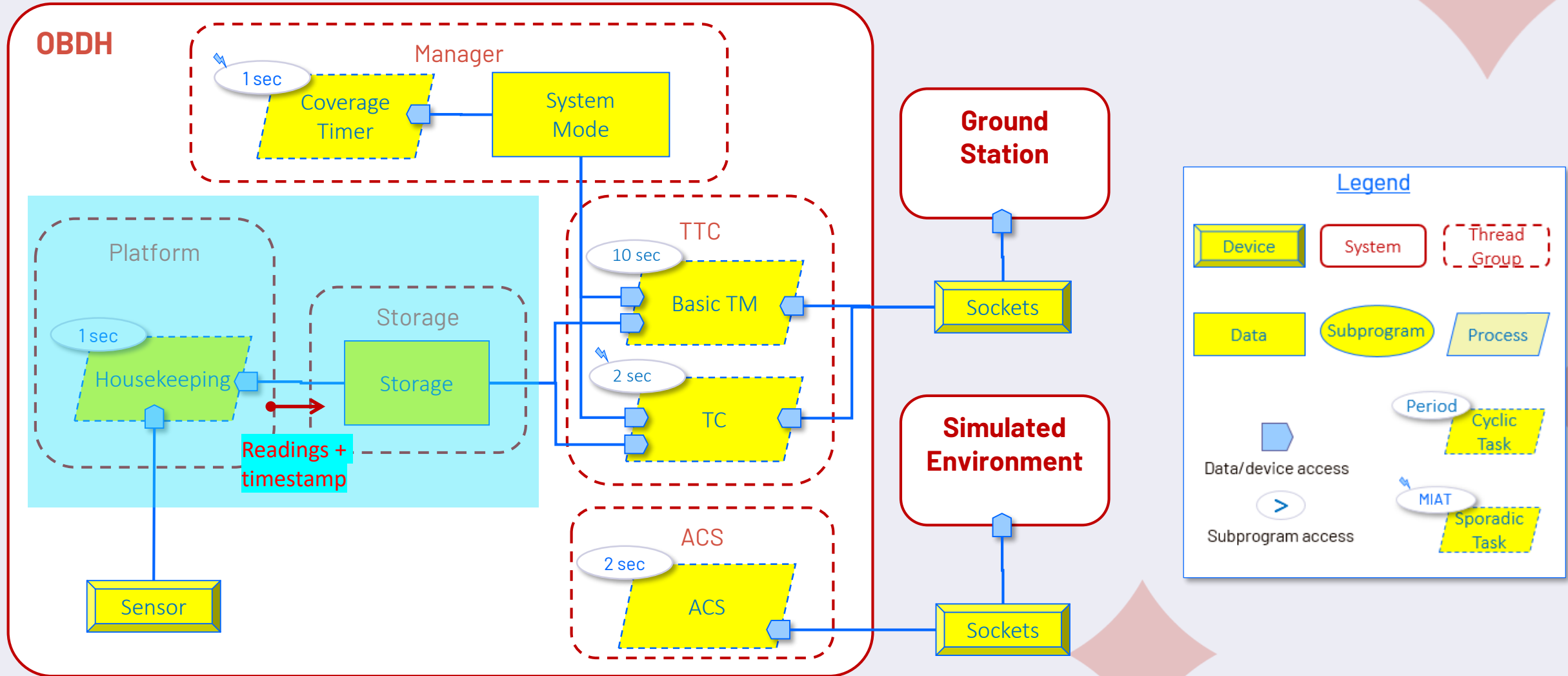
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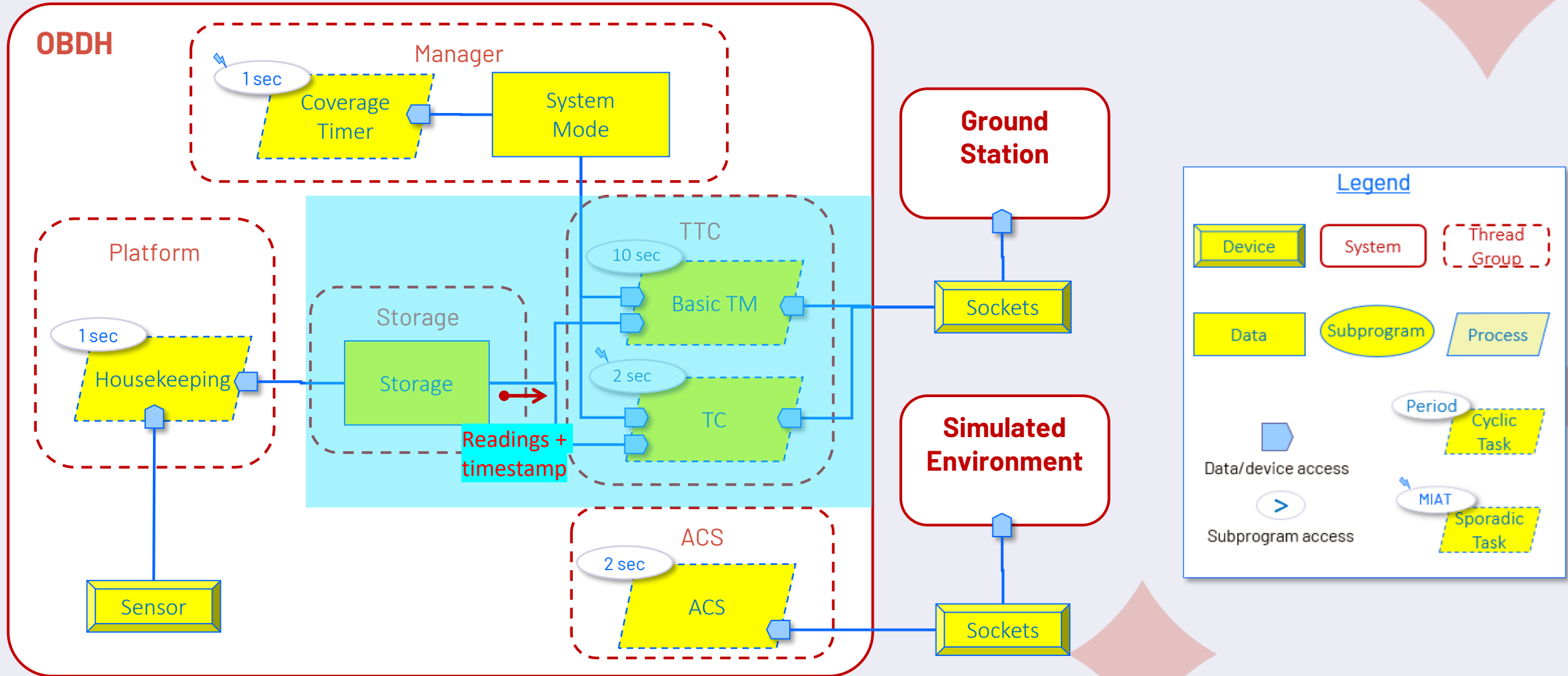
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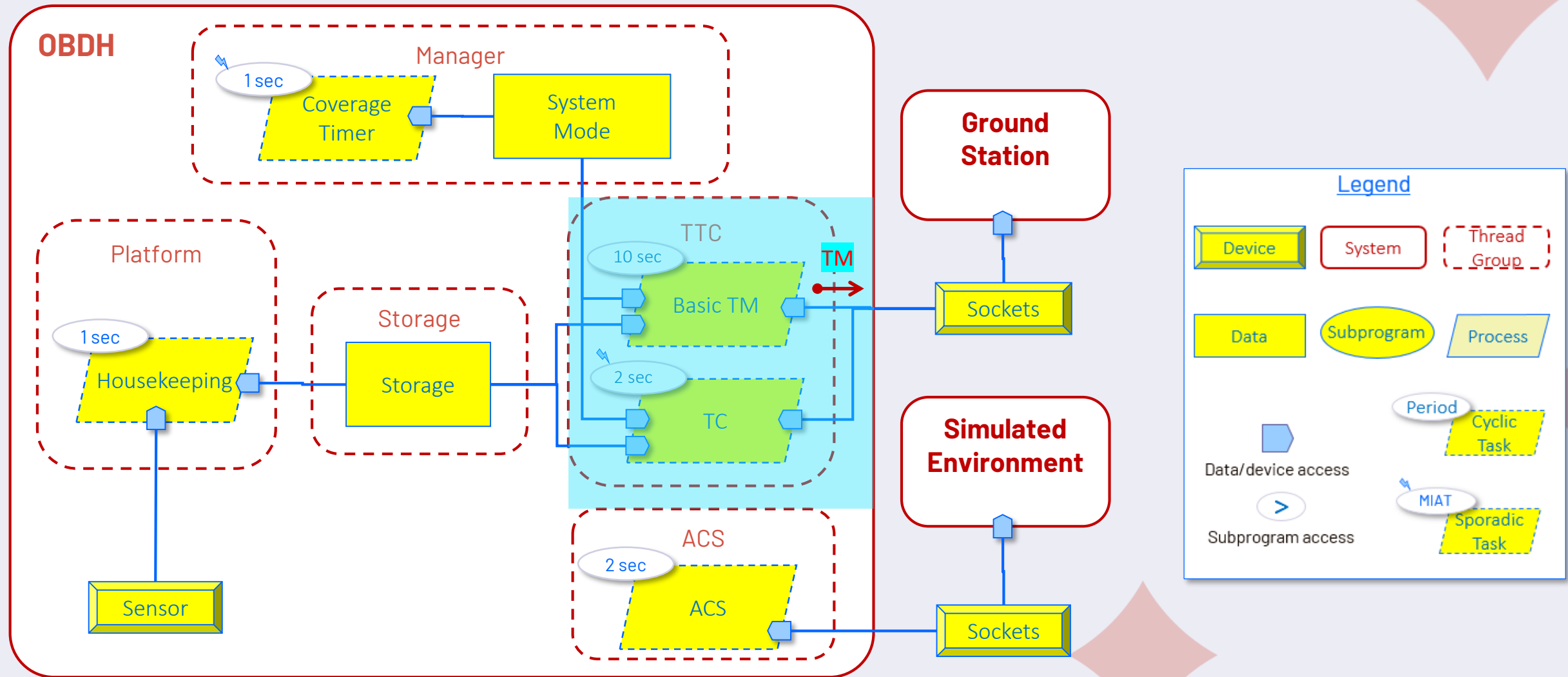
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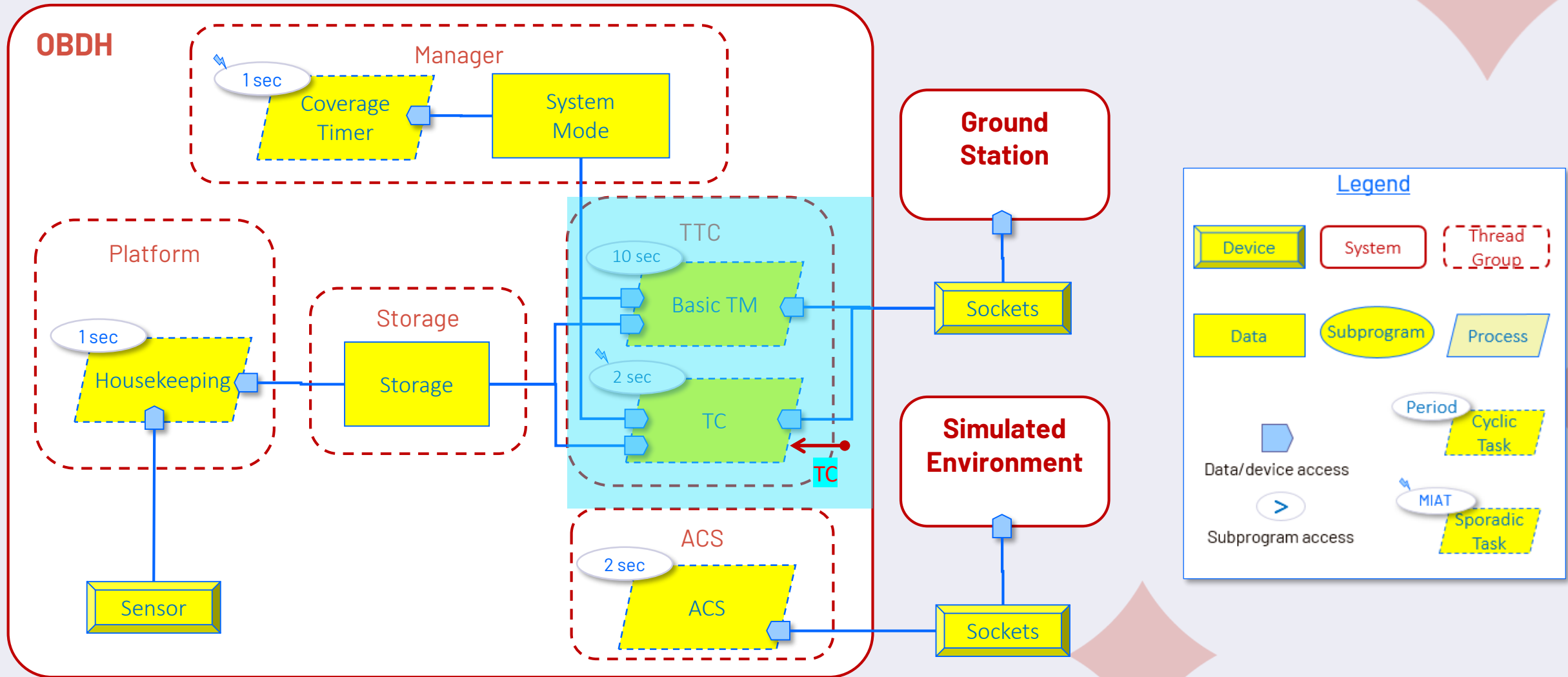
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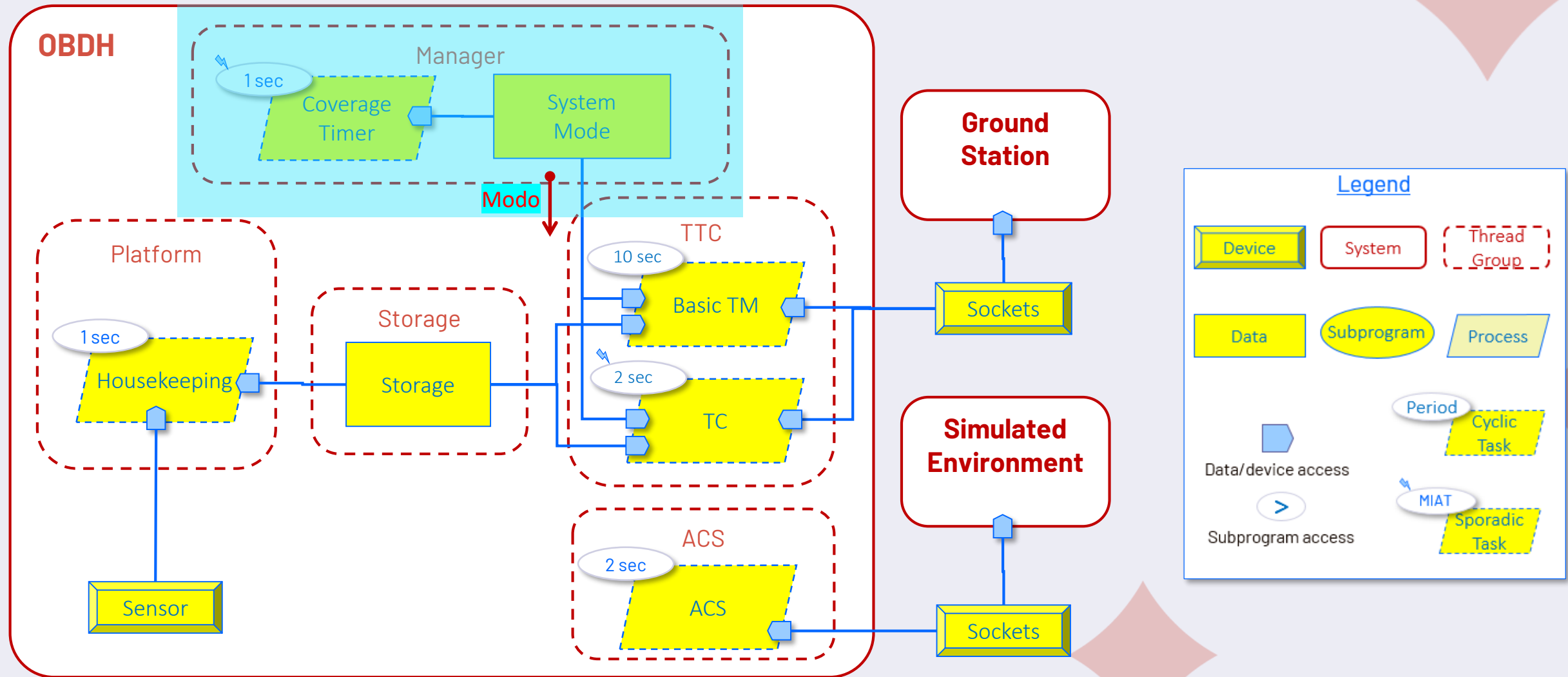
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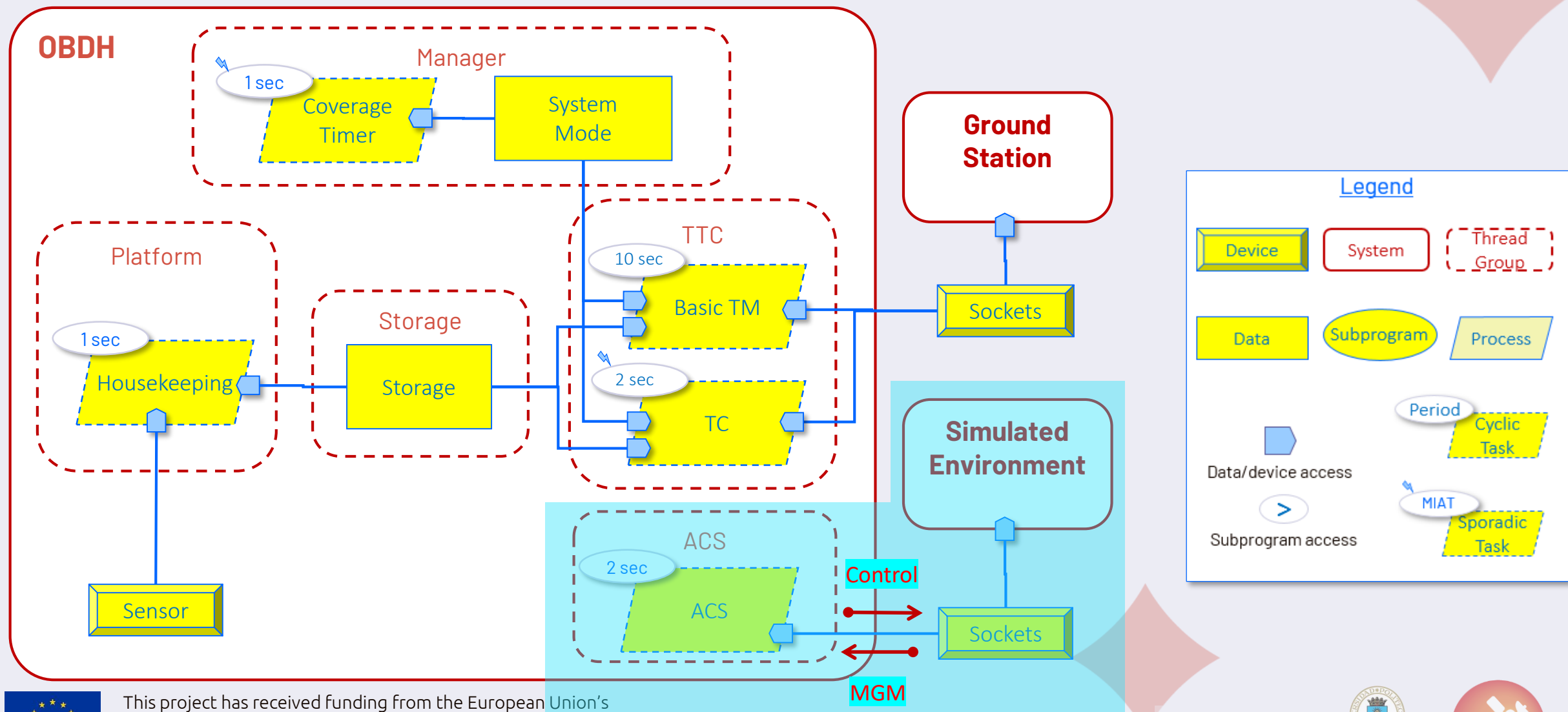
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Arquitectura software del OBDH (AADL)



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Bloque básico de TASTE

Abstracciones de tiempo real



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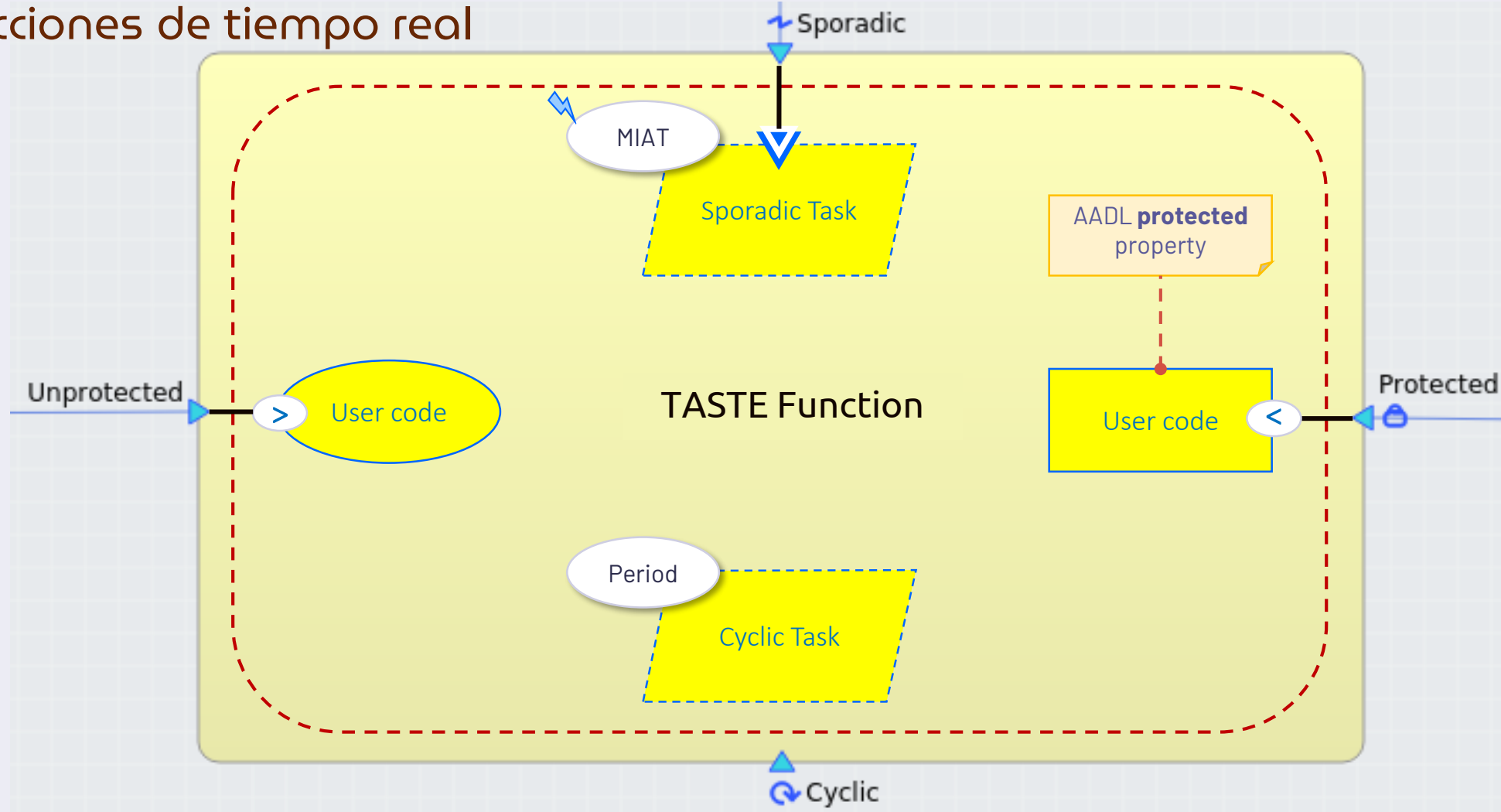


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Bloque básico de TASTE “under the HOOD”

Abstracciones de tiempo real



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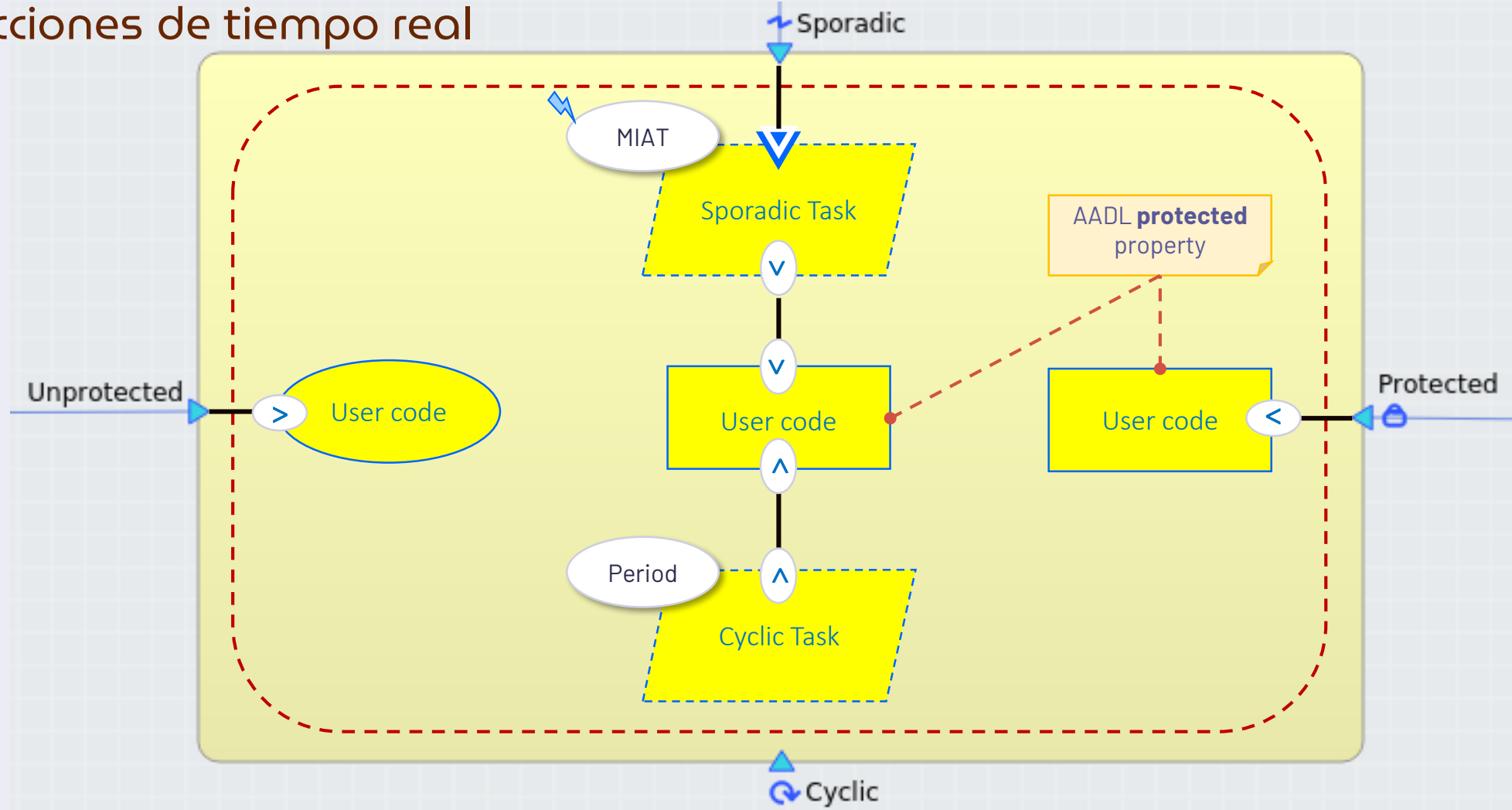


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Bloque básico de TASTE “under the HOOD”

Abstracciones de tiempo real



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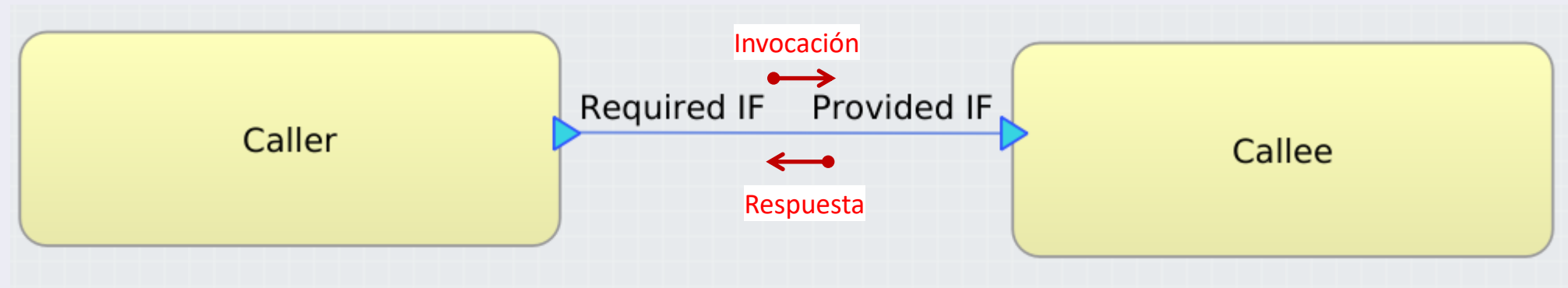


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Bloque básico de TASTE

Conexiones, interfaz provista y requerida



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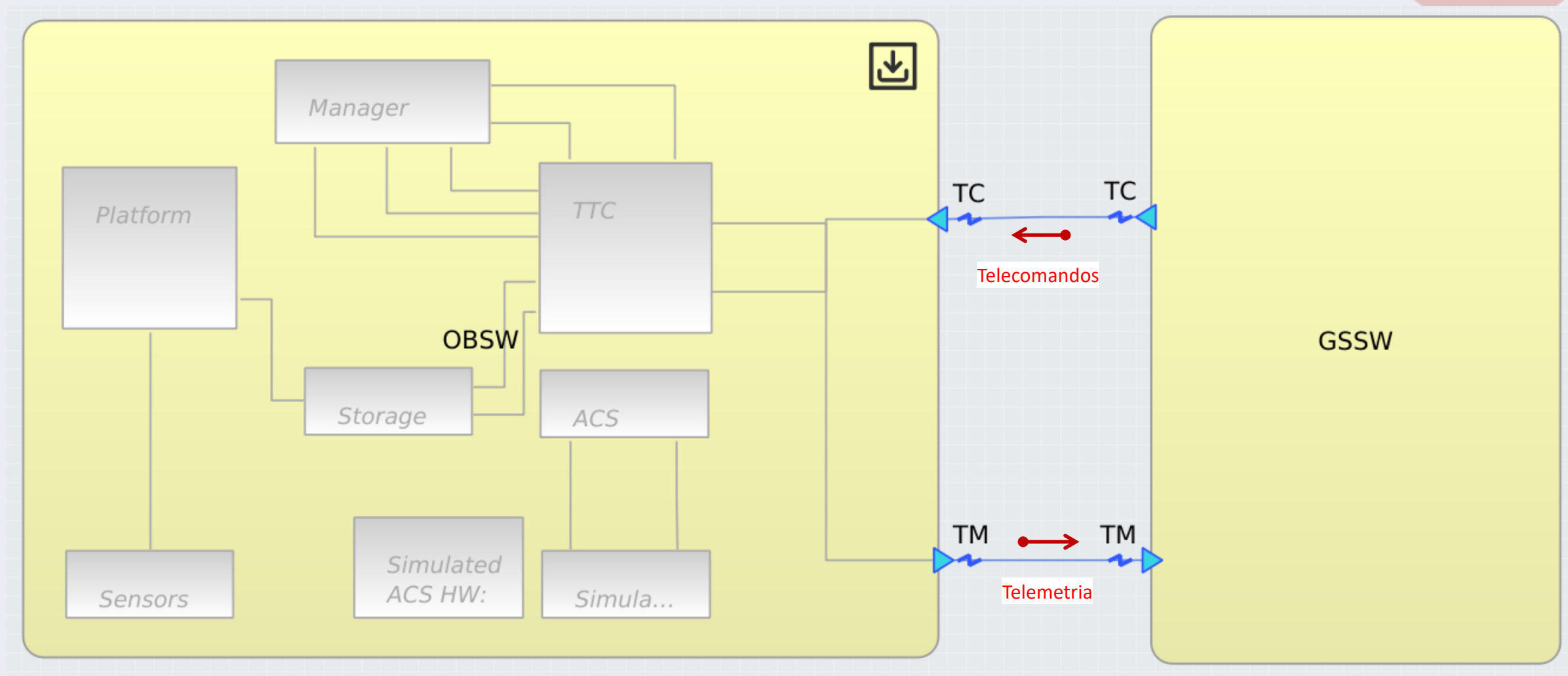
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Implementación en TASTE - 1



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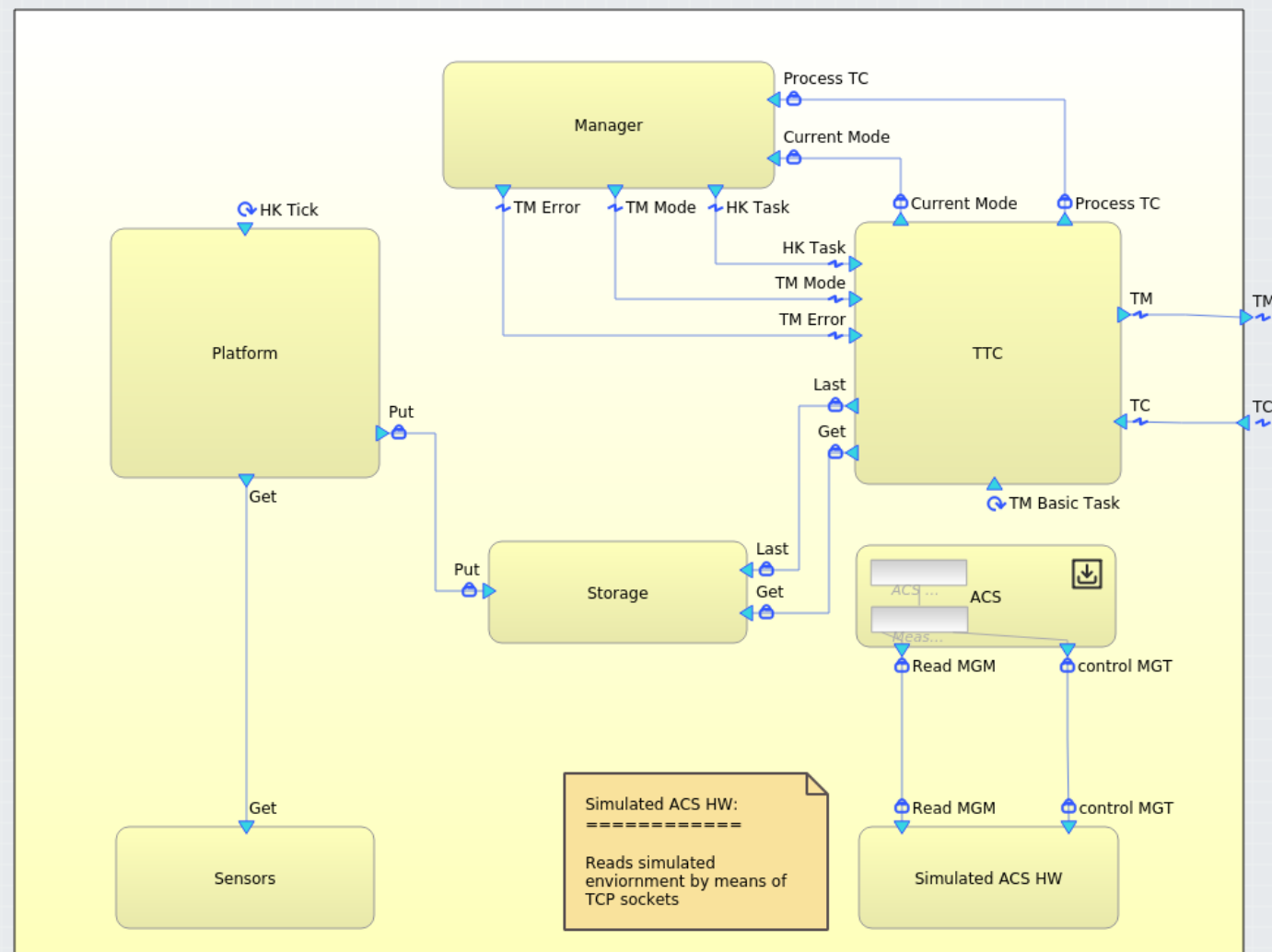
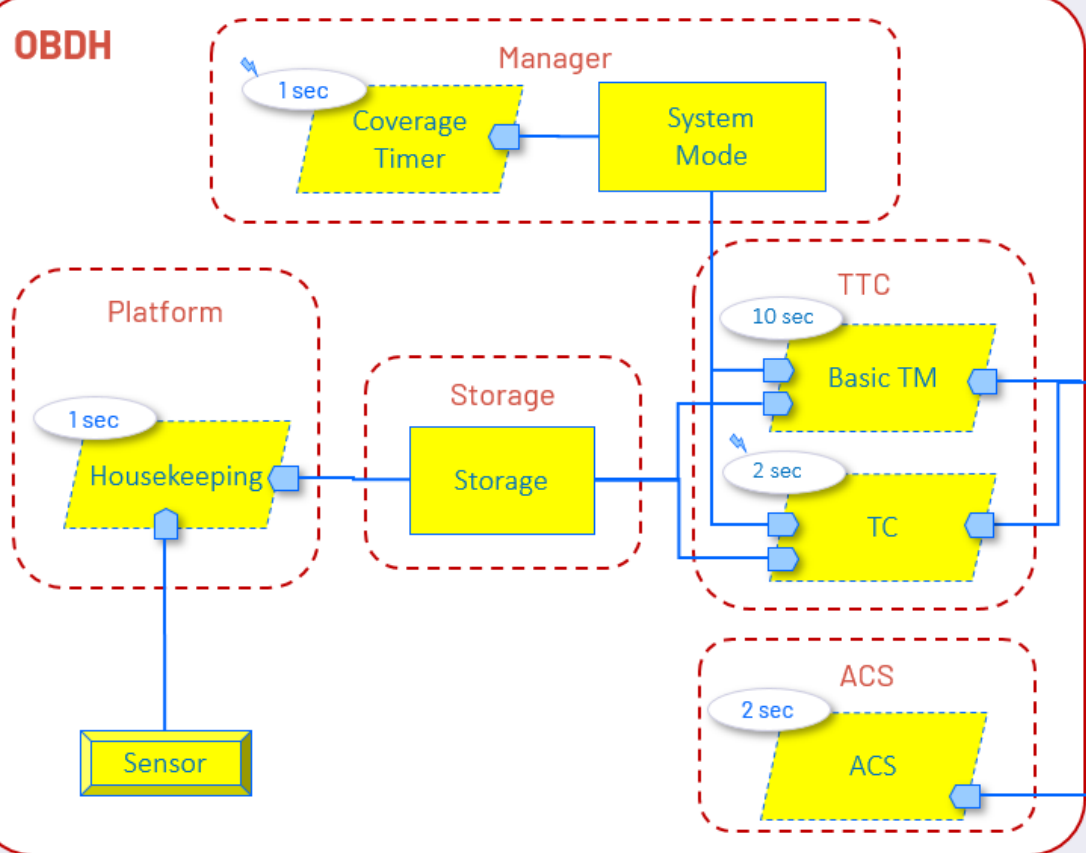


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Implementación en TASTE - 2

OBDH



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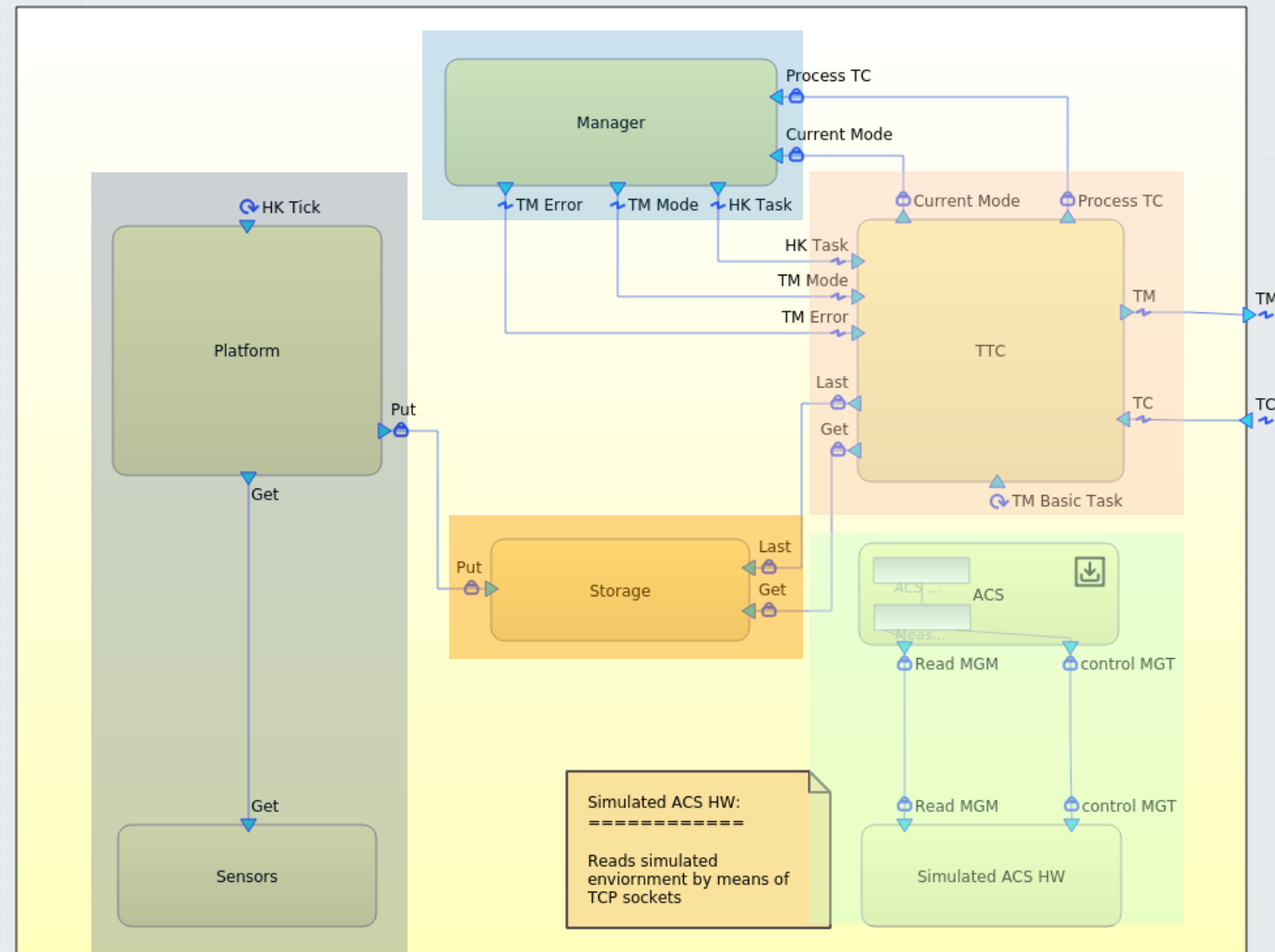
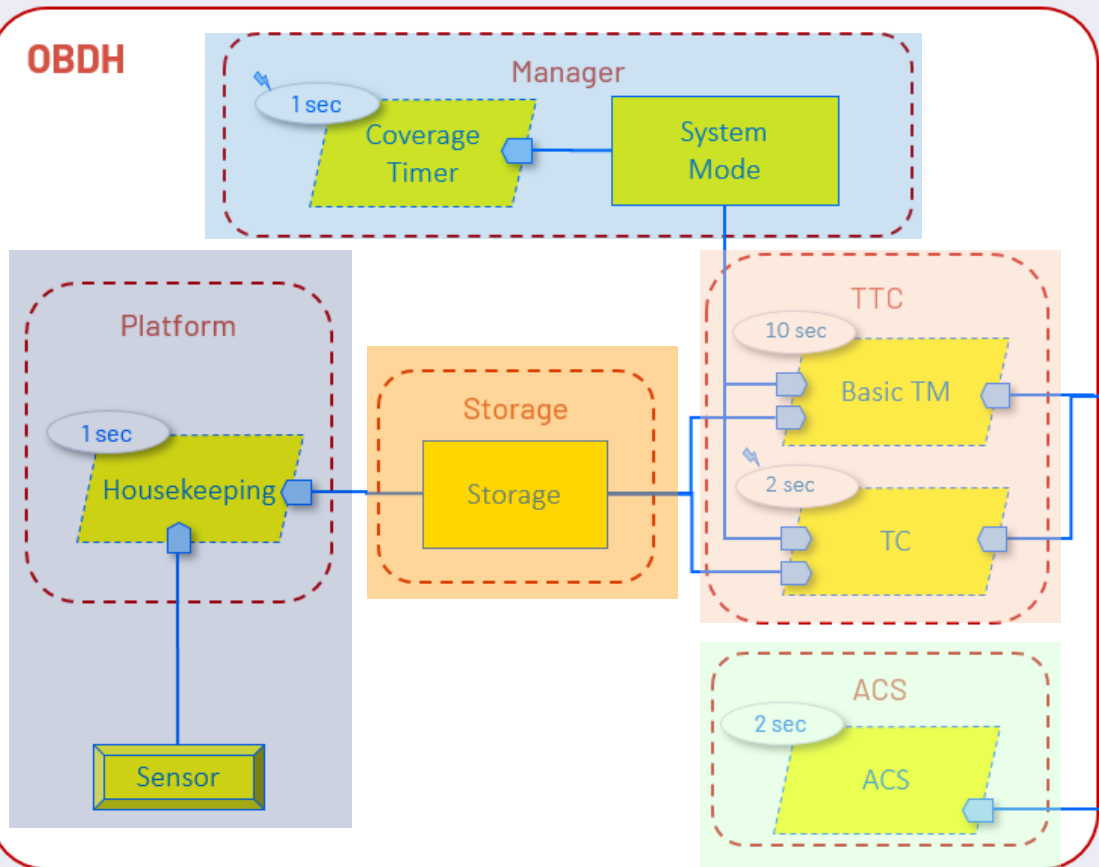


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Implementación en TASTE - 2

OBDH



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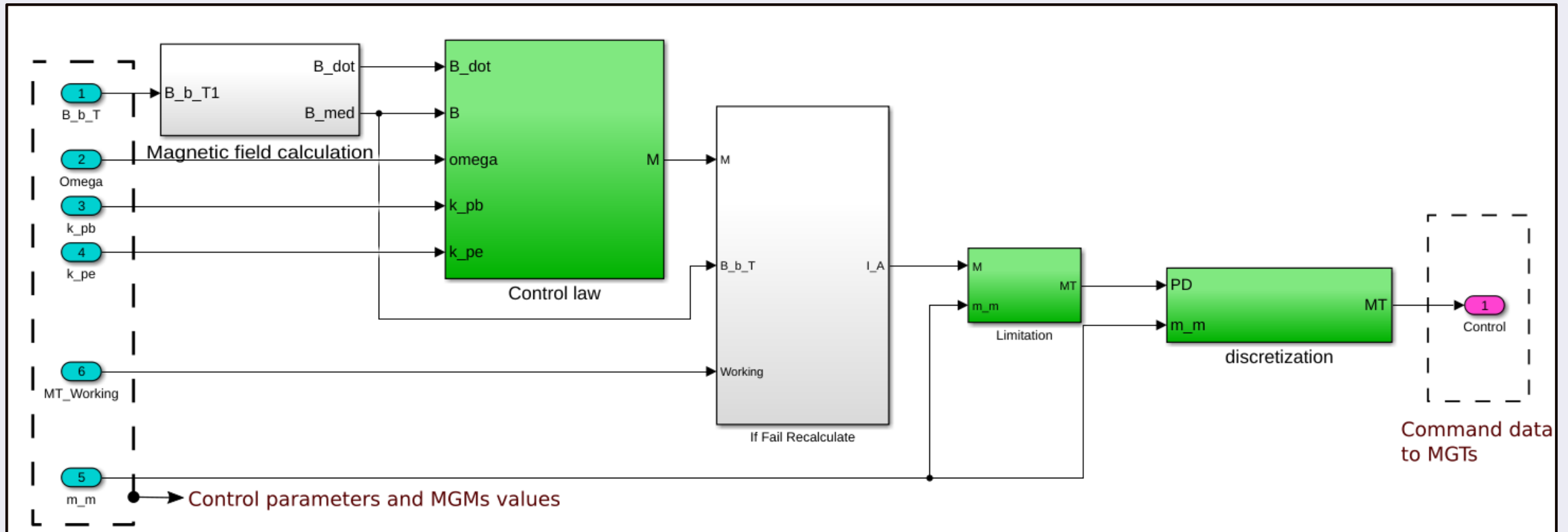
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Modelo de control Simulink (ACS)

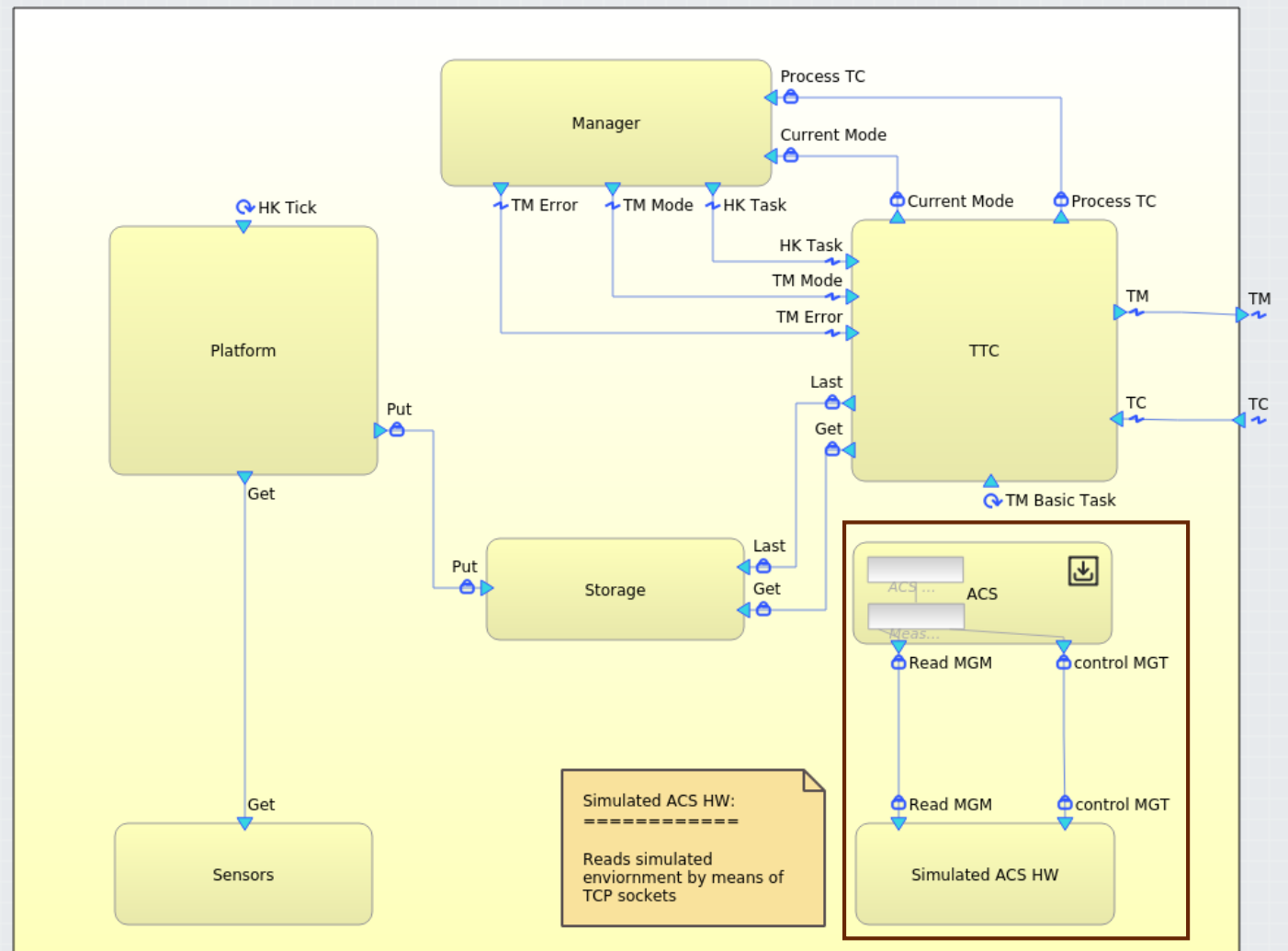


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Intragración del ACS en TASTE - 1



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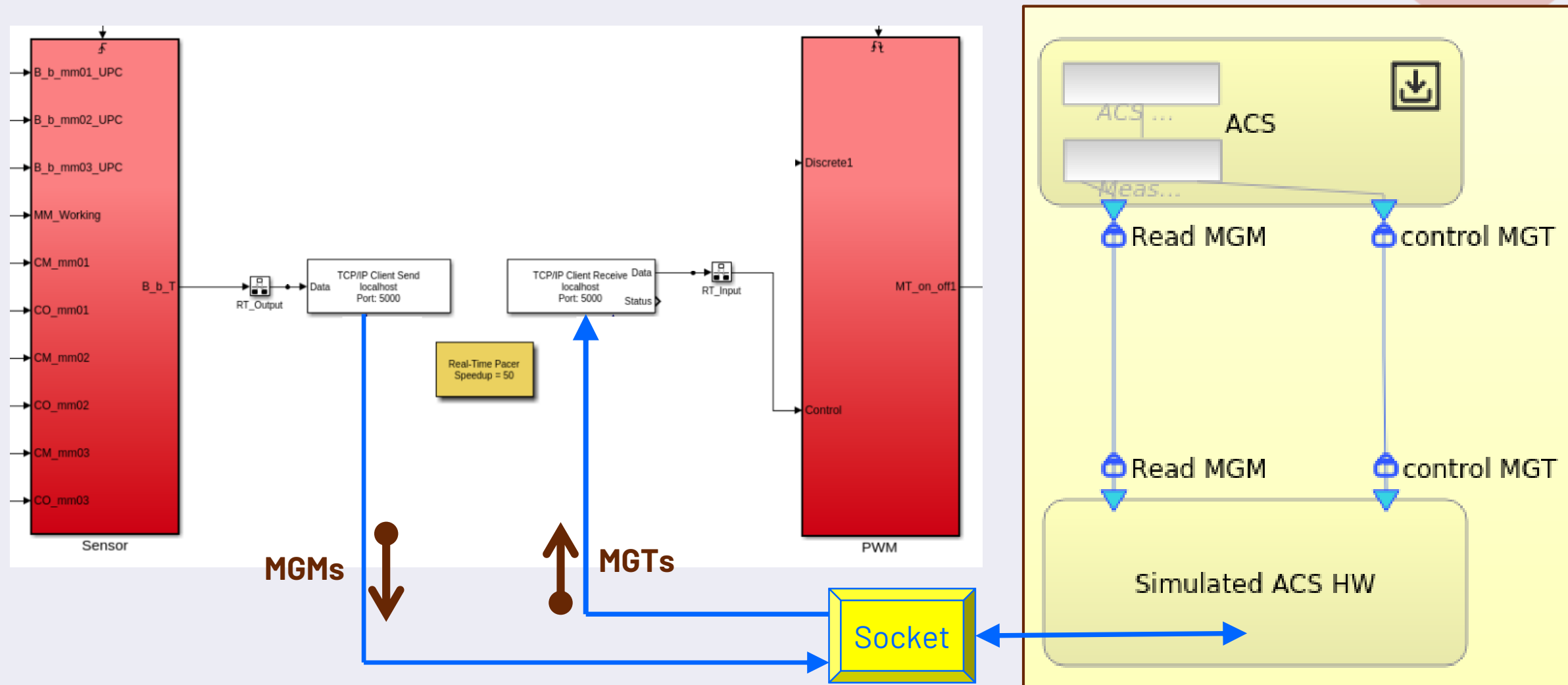
STRAT



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Integración del ACS en TASTE - 2



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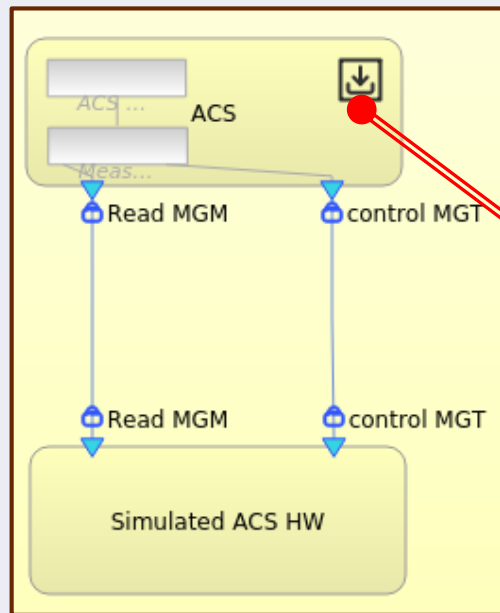
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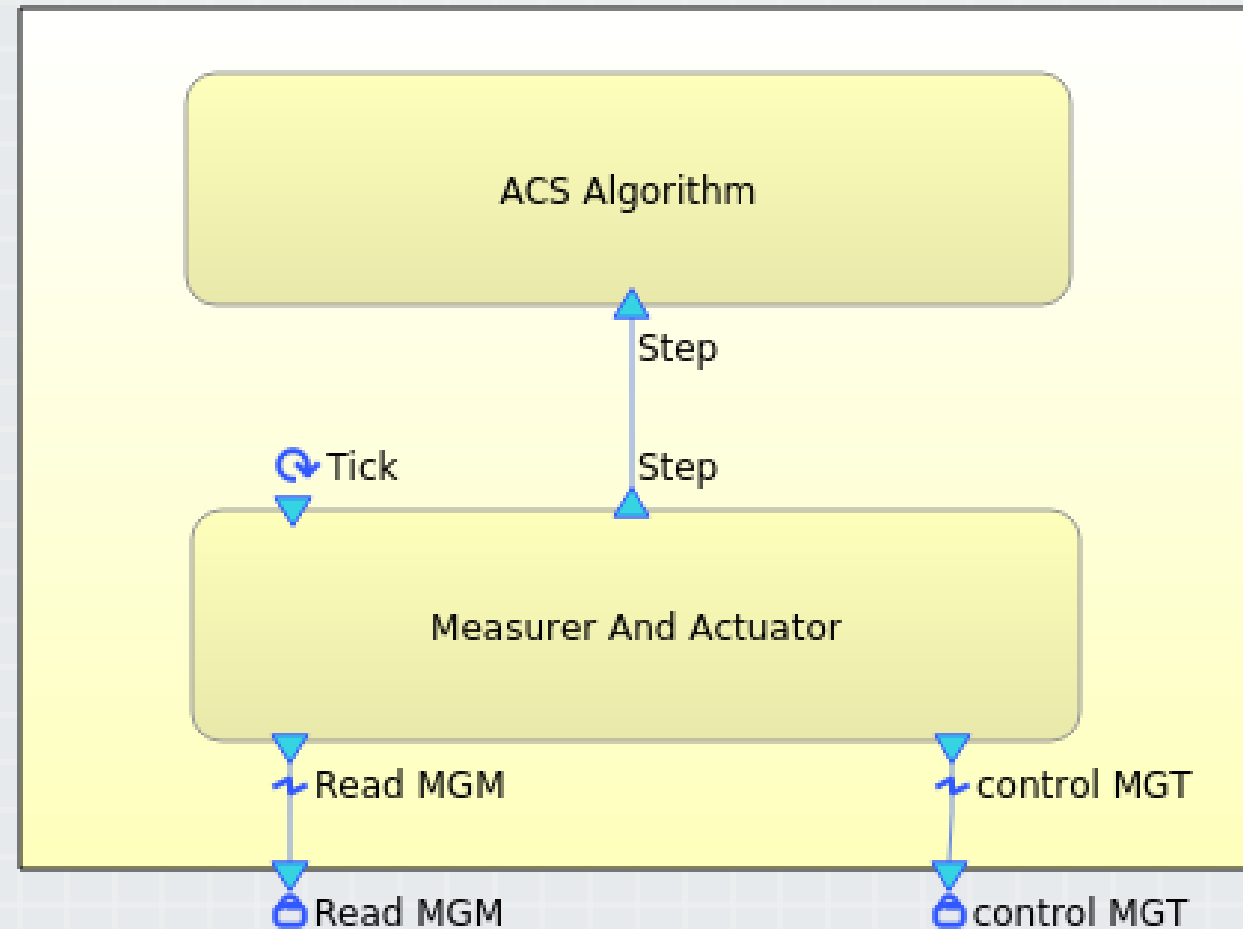
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Integración del ACS en TASTE - 3



Dentro de
ACS



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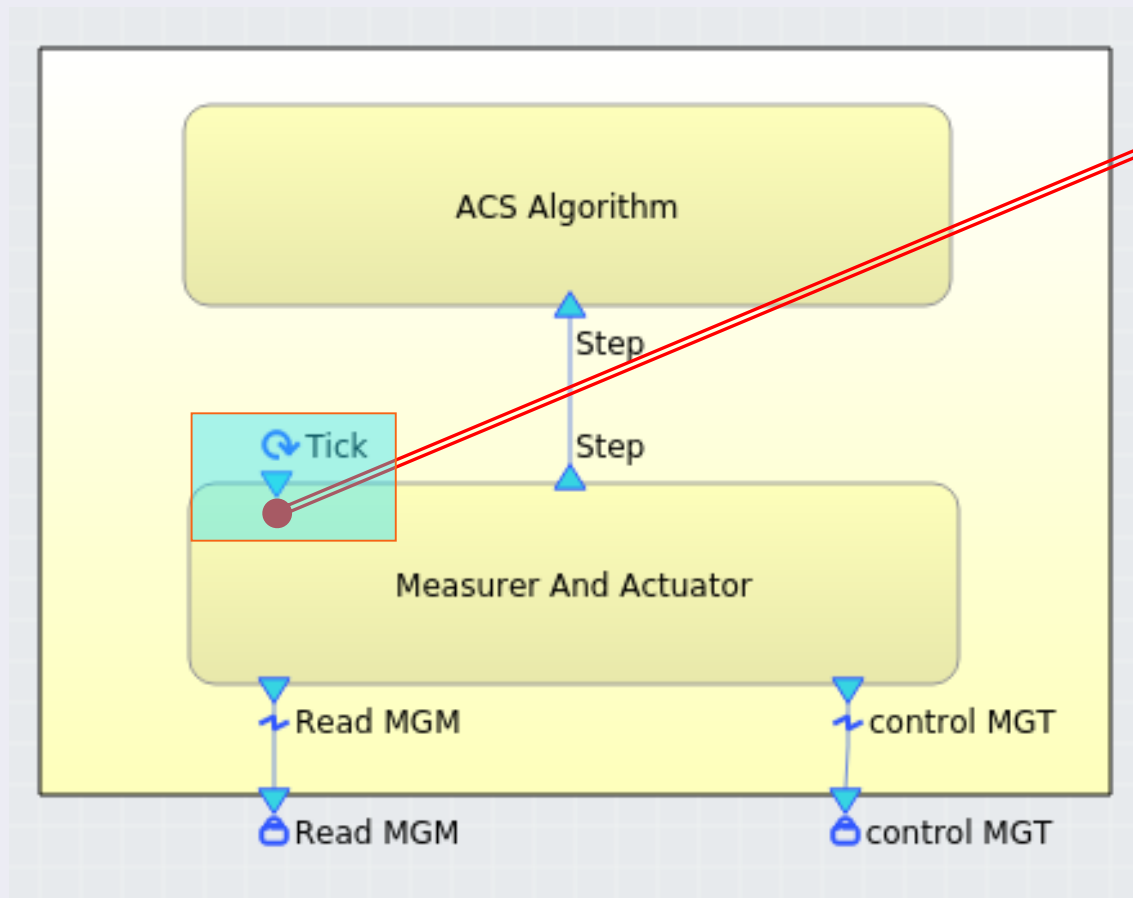


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Integración del ACS en TASTE - 5



```

procedure Tick is
    Bbt      : asn1SccT_B_B_T;
    Omega    : asn1SccT_Omega :=
        asn1SccT_Omega'(Data => (0.0, 0.0, 0.1));
    K_Pb     : asn1SccT_Float := 2.0;
    K_Pe     : asn1SccT_Float := 8.0;
    M_M      : asn1SccT_Float := 15.0;
    Mt_Working : asn1SccT_Mt_Working :=
        asn1SccT_MT_Working'( Data => (1.0, 1.0, 1.0) );
    Control   : asn1SccT_Control;
begin
    Read_Mgm (Bbt);
    Step (Bbt, Omega, K_Pb, K_Pe,
          M_M, Mt_Working, Control);
    Control_Mgt (Control);
end Tick;
    
```

Código para la interfaz proporcionada Tick



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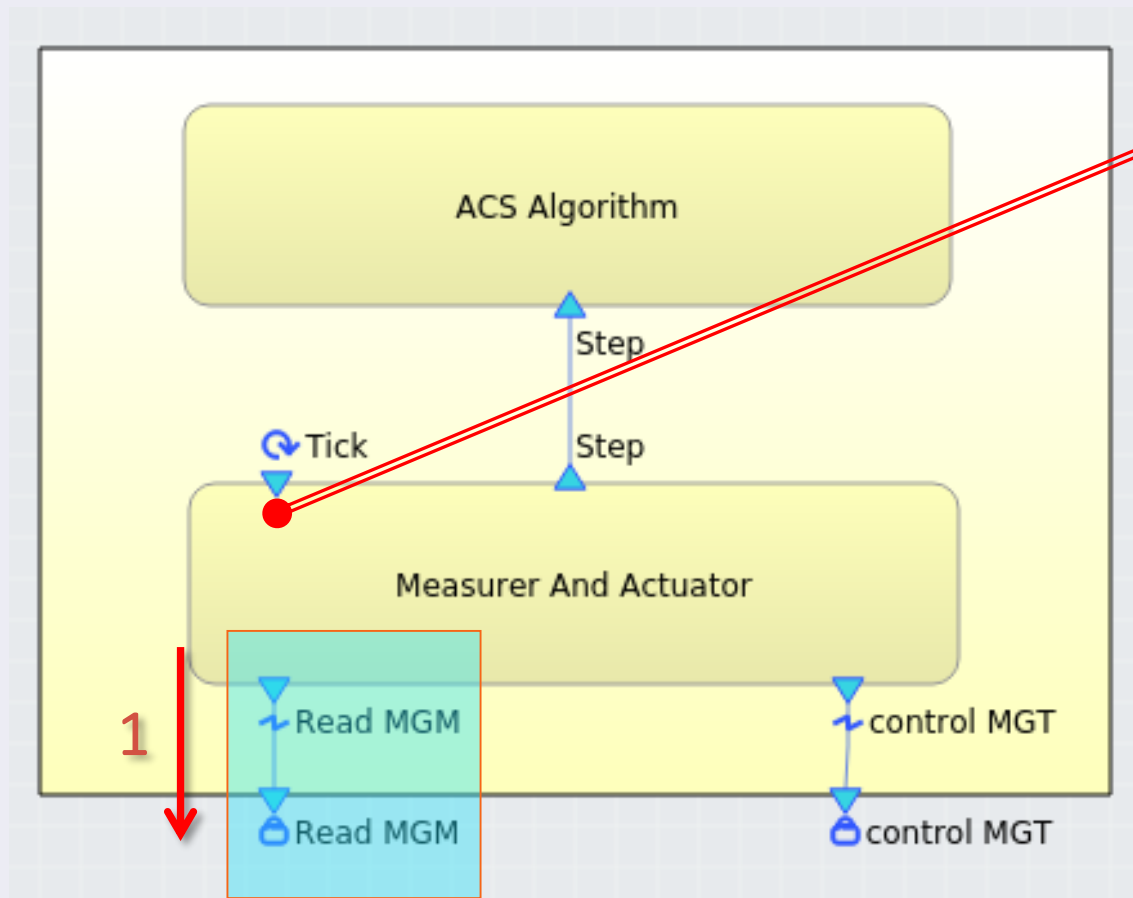
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Integración del ACS en TASTE - 5



```

procedure Tick is
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  Control   : asn1SccT_Control;
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```

Código para la interfaz proporcionada Tick



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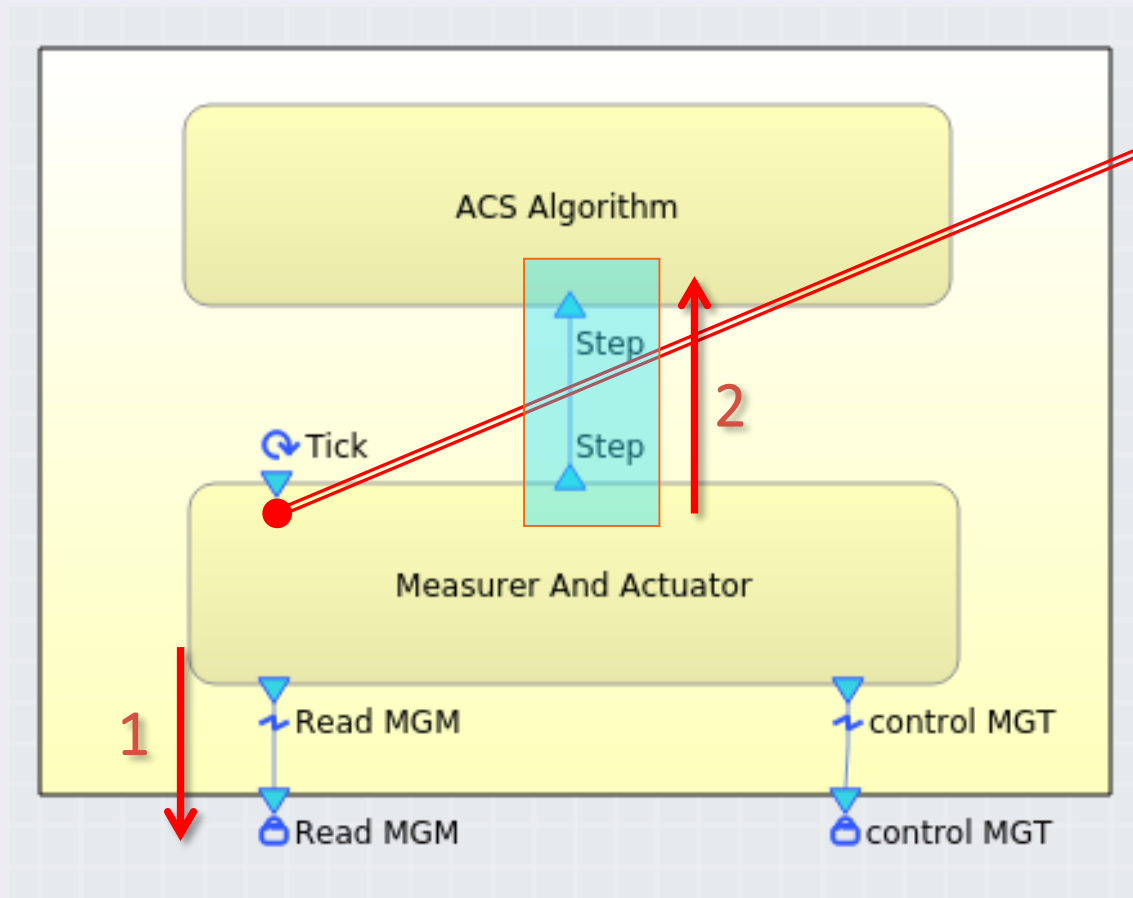
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Integración del ACS en TASTE - 5



```

procedure Tick is
  Bbt      : asn1SccT_B_B_T;
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```

Código para la interfaz proporcionada Tick



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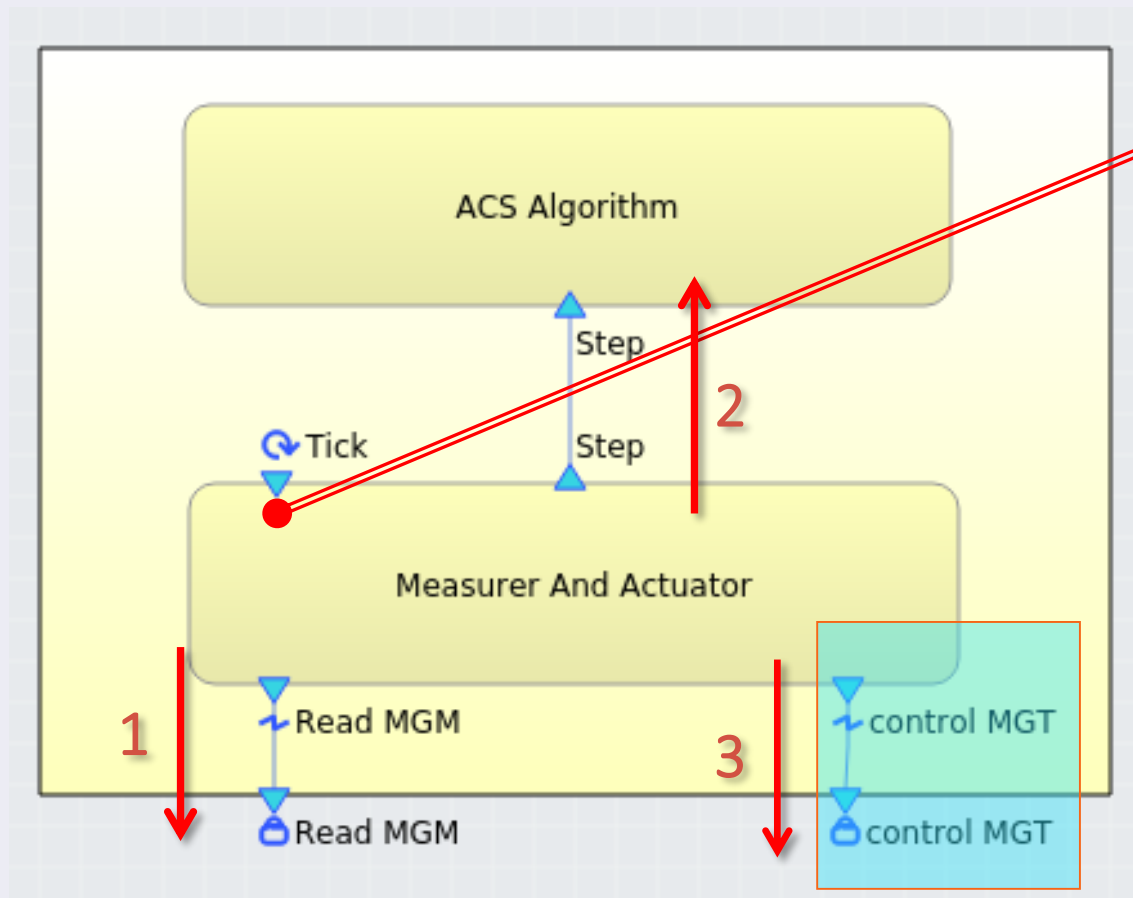
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Integración del ACS en TASTE - 5



```

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  M_M      : asn1SccT_Float := 15.0;
  Mt_Working : asn1SccT_Mt_Working :=
    asn1SccT_MT_Working'( Data => (1.0, 1.0, 1.0) );
  Control   : asn1SccT_Control;
begin
  Read_Mgm (Bbt);
  Step (Bbt, Omega, K_Pb, K_Pe,
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  Control_Mgt (Control);
end Tick;
  
```

Código para la interfaz provista Tick



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Conclusiones

- Se implementó un OBDH en TASTE/Ada basado en el OBSW del UPMSat-2.
- Se integró el componente ACS implementado en Simulink.
 - Autogenerando código en Ada con Qgen.
- Se emplearon técnicas de validación MIL y SIL para la validación y simulación del ACS.
 - Simulink + Qgen + TASTE + Ada.
- Durante esta implementación se descubrieron problemas en la integración Qgen + TASTE:
 - Reparamos estos errores y están integrados en el repositorio público de TASTE.



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Referencias

[1] OBDH Labs Repository. Disponible: https://github.com/STR-UPM/OBDH_LABS/tree/master/docs

[2] OBDH implementation in TASTE. Disponible: https://github.com/AngelPerezM/OBDH_LABS

[3] TASTE webpage. Disponible: <https://taste.tools/>

[4] QGen user guide.

Disponible: https://docs.adacore.com/live/wave/qgen/html/qgen_ug/index.html



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Fin de la presentación



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¡Gracias!

¿Preguntas?

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