

Real-Time Scheduling 1

# Real-Time Scheduling

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CTT-ORIS-WS Scheduling at 5-1-2001  
Stok, P. van der  
Stok, P. van der

Let's make things better  
PHILIPS

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Real-Time Scheduling 2

## Overview

- Three examples
  - water vessel
  - avionics
  - multimedia streaming

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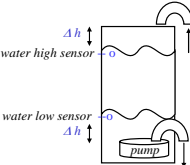
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Real-Time Scheduling 3

## Example of RT system: Problem

- Water vessel problem
  - Requirements
    - Water should not overflow
    - Pump should not run dry
  - Properties:
    - Positive but limited influx of water when pump is off
    - Positive but limited outflux of water when pump is on
    - Sensors are placed  $\Delta h$  from critical levels
    - $d$  time units needed for level change  $\Delta h$




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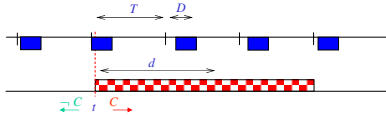
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### Example of RT system: Solution

- Critical conditions should not exist longer than  $d$  without response
  - critical conditions  $C$ : water above/below sensor
- Periodic task is released with period  $T$  and satisfy deadline  $D$  within this period.
  - If water at low sensor: Task stops pump
  - If water at high sensor: Task starts pump
- Schedulability conditions:  $T + D < d$ 
  - If the task finishes within the period ( $D = T$ ):  $2.T < d$




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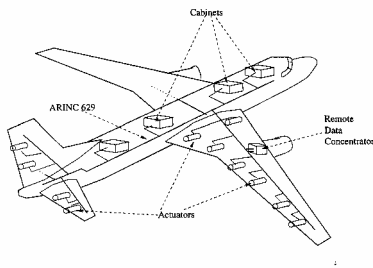
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### Integrated Modular Avionics




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### Avionics functions

- Control and check airplane
  - Navigation
  - Communication
  - Recording
  - Steering
- Specific requirements for IMA
  - auto check
  - maintenance checks
    - cost effective !!
  - reliable
    - one hour  $< 10^{-9}$
    - last fault to maintenance  $> 200h$

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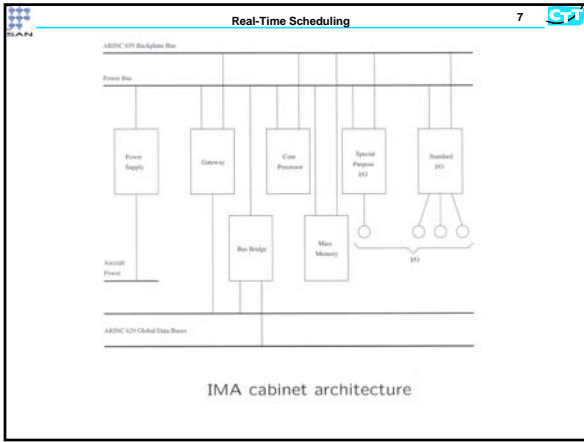
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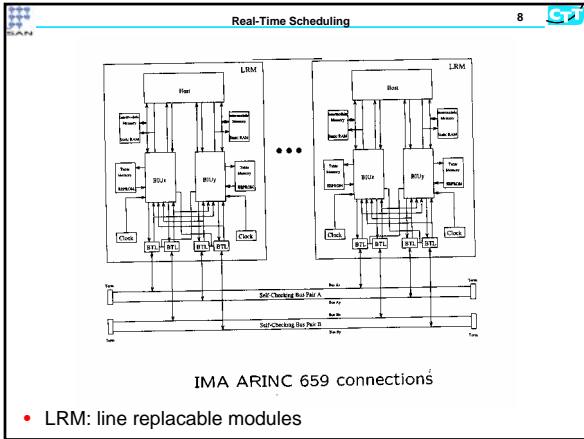
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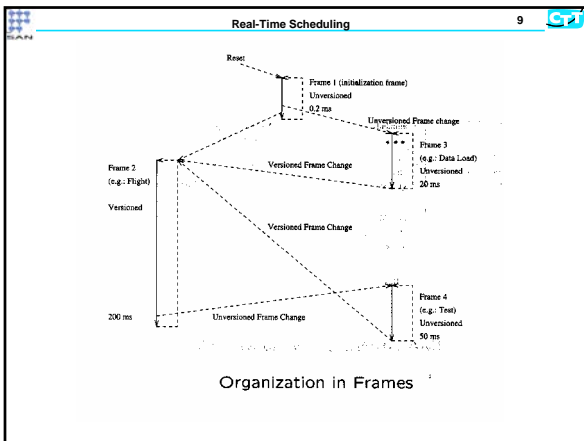
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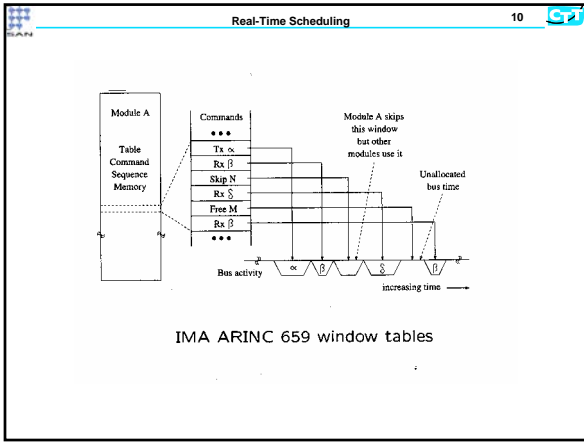
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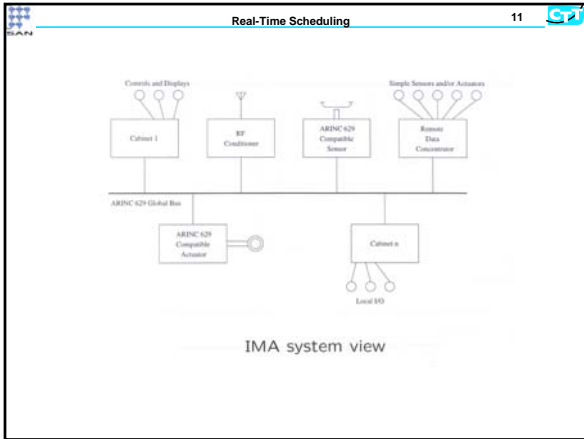
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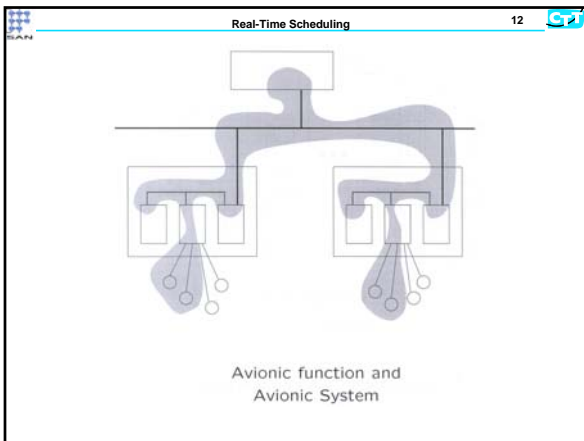
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Real-Time Scheduling 13

M = Message  
 MFT = Message Frame Time  
 MFT = Master Frame  
 TI = Terminal Interval  
 SG = Synchronization Gap  
 TG = Terminal Gap  
 TI = MFT

ARINC 629 periodic mode

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Real-Time Scheduling 14

M = Message  
 MFT = Message Frame Time  
 MFT = Master Frame  
 TI = Terminal Interval  
 SG = Synchronization Gap  
 TG = Terminal Gap  
 MFT > TI

ARINC 629 aperiodic mode

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Real-Time Scheduling 15

Video streaming over network into terminal

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### Terminology

Stream  
Composite stream

Task  
Buffer

User application  
Terminal application

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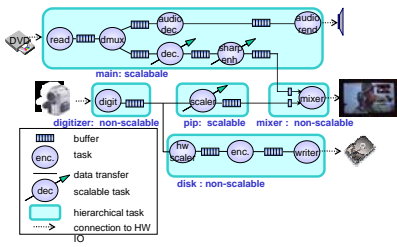
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Application mode  
Mode parameters

Stream modes

Application graph

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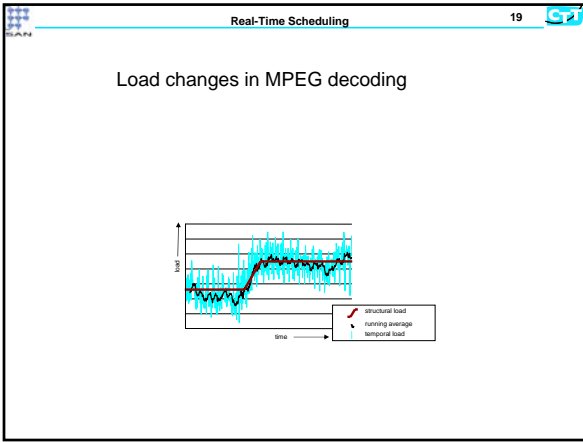
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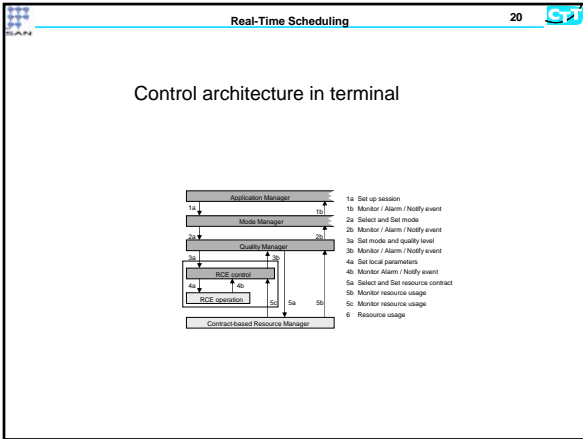
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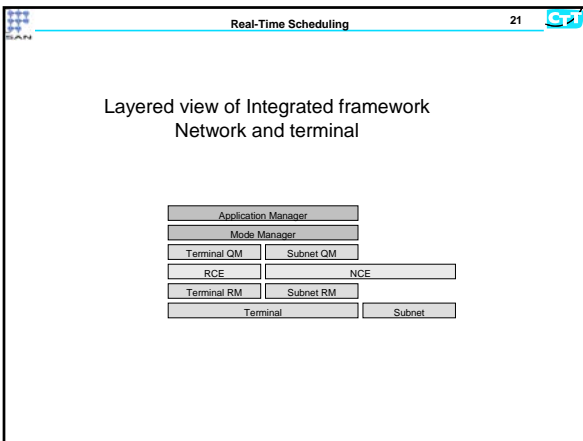
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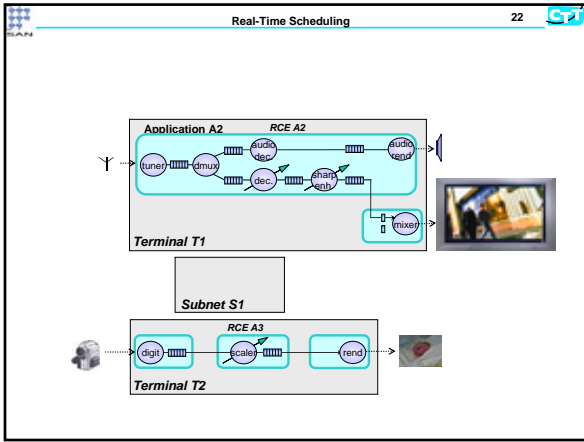
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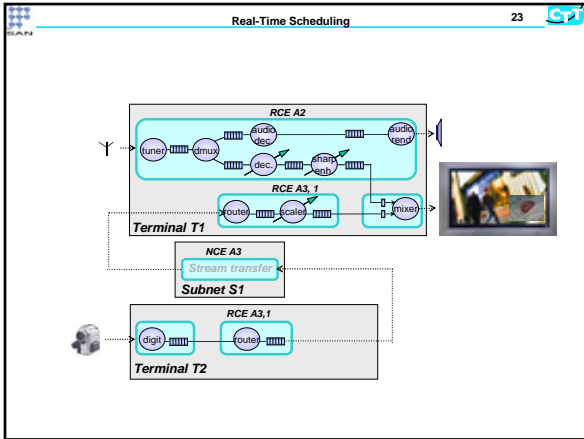
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