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Greedy Heuristic for Dynamic Segment Scheduling

Presented By

Greedy Heuristic for Dynamic Segment Scheduling

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Outline

- Introduction
- Message Schedule for the DS
- Message Grouping
- Proposed Heuristic Algorithm

Introduction

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- In [1] bounds on the generation times and the timing requirements of the signals is taken into consideration to propose a reservation-based scheduling approach that preserves the flexible medium access of the DS
- [1] uses ILP which is computationally very complex, we formulate a fast heuristic algorithm for the scheduling of the dynamic segment

FlexRay Protocol

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- The arbitration procedure ensures that only frames with a FID that equals the current value of the slot counter can be transmitted

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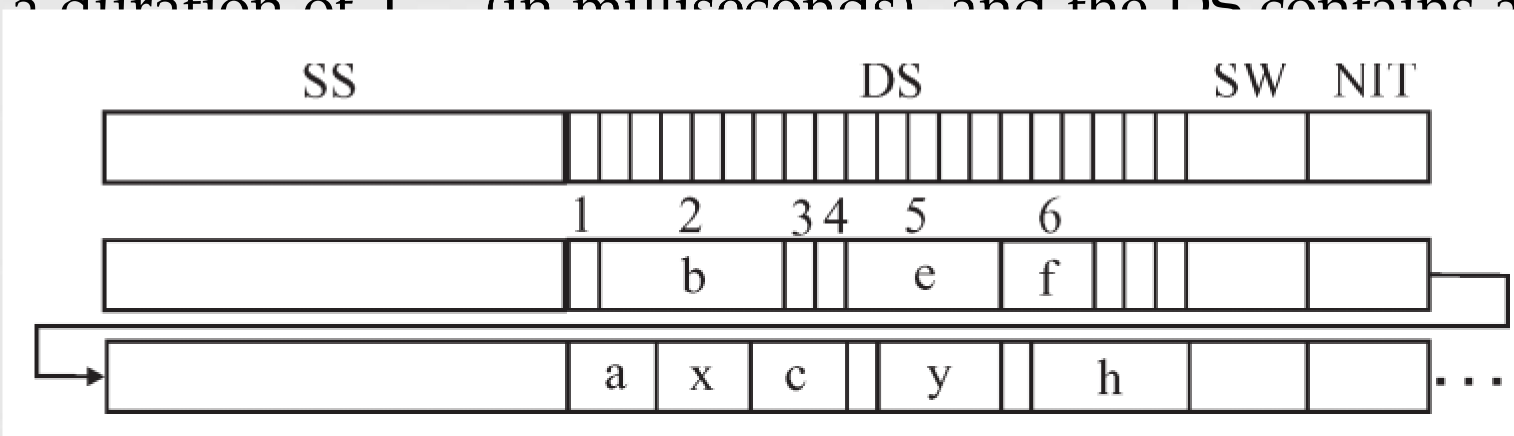

-
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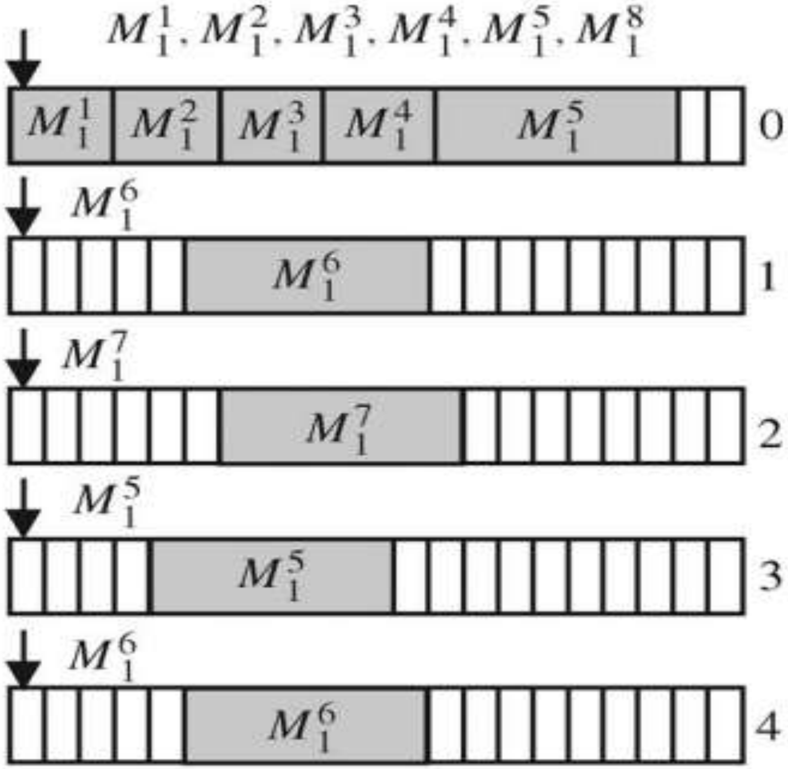
- How DM fails?

Previous Work

M_1^n	lm_1^n [MS]	dm_1^n [ms]	FID
M_1^1	2	15	1
M_1^2	2	15	2
M_1^3	2	15	3
M_1^4	2	15	4
M_1^5	40	15	5
M_1^6	40	15	6
M_1^7	40	15	7
M_1^8	112	25	8



Message Schedule For The DS

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- Each reservation is associated with a FID

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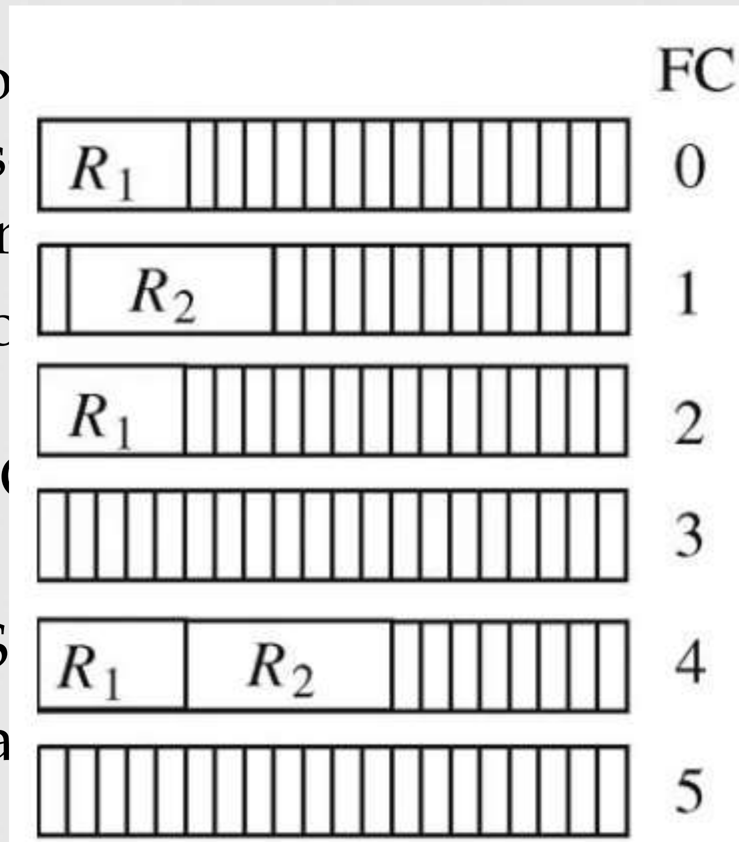

Performance Metrics

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- Cycle Load L_j : The maximum number of MS that is reserved for message transmission in FC j for an arbitrary assignment of FIDs, considering that at most one FID can be assigned per message

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$$L_j = \sum_{R \in \mathcal{R}_j} l + \left(|\mathcal{M}_{\mathrm{S}}| - \sum_{R \in \mathcal{R}_j} 1 \right) = \sum_{R \in \mathcal{R}_j} (l-1) + |\mathcal{M}_{\mathrm{S}}|.$$

Where $j = (z \cdot rp + w)$

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then, we choose $N_{DS}=L_{max}$ and minimize L_{max} to determine a feasible schedule with the shortest possible DS

Performance Metrics

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$$B^n = \sum_{R \in R^n} (l/rp)$$

$$\sum_{n=1}^{N} B^n$$

Optimal Scheduling of Messages

Optimal Scheduling of Messages

- Let N={1,2}. We assume that the groups have been computed by the algorithms in [1].

Optimal Scheduling of Messages

$\mathcal{G}_1 = \{M_1^1\},\ pm_1^1 = 3,\ dm_1^1 = 5$ $R_1 = (1, 2, w_1, 20)$	$\mathcal{G}_2 = \{M_1^1, M_2^1\},$ $R_2 = (1, 2, w_2, 30)$
$\mathcal{G}_3 = \{M_2^1\},\ pm_2^1 = 5,\ dm_2^1 = 7$ $R_3 = (1, 4, w_3, 30)$	$\mathcal{G}_4 = \{M_3^1\},\ pm_3^1 = 4, dm_3^1 = 6$ $R_4 = (1, 3, w_4, 10)$
$\mathcal{G}_5 = \{M_1^2\},\ pm_1^2 = 3,\ dm_1^2 = 7$ $R_5 = (2, 2, w_5, 22)$	$\mathcal{G}_6 = \{M_1^2, M_2^2\}$ $R_6 = (2, 2, w_6, 48)$
$\mathcal{G}_7 = \{M_1^2, M_2^2, M_3^2\}$ $R_7 = (2, 2, w_7, 48)$	$\mathcal{G}_8 = \{M_1^2, M_3^2\}$ $R_8 = (2, 2, w_8, 30)$
$\mathcal{G}_9 = \{M_1^2, M_4^2\}$ $R_9 = (2, 2, w_9, 42)$	$\mathcal{G}_{10} = \{M_2^2\}, pm_2^2 = 7, dm_2^2 = 9$ $R_{10} = (2, 6, w_{10}, 48)$
$\mathcal{G}_{11} = \{M_3^2\}, pm_3^2 = 7, dm_3^2 = 9$ $R_{11} = (2, 6, w_{11}, 30)$	$\mathcal{G}_{12} = \{M_4^2\}, pm_4^2 = 5, dm_4^2 = 5$ $R_{12} = (2, 4, w_{12}, 42)$

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Optimal Scheduling of Messages

- Let N={1,2}. We assume that the groups have been computed by the algorithms in [1].
- Our goal is now to determine G_S and the offsets wi of the corresponding reservations such that Lmax(and, thus, the required duration T_{DS} of the DS) is minimized

Heuristic Algorithm

```
G=set of groups for each node
gsel=[]
for each node n:
    for each group gi:
        GT=Largest(G)
        if NoOverlap between gsel and GT:
            {
            gsel = gsel U GT
            G = G - GT
            }
```

Heuristic Algorithm

- In contrast to the ILP approach used in [1], we propose a fast heuristic algorithm for the selection of optimal groups

```
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        if NoOverlap between gsel and GT:
            {
            gsel = gsel U GT
            G = G - GT
            }
```

Heuristic Algorithm

```
w=0
W=[]
for each reservation R:
#1      if w is in W:
            w++
        if (w < period of R)
            offset=w
            W = W U w
        else
            w=0
            goto 1
```

Heuristic Algorithm

- And for the selection of offsets

```
w=0
W=[]
for each reservation R:
#1     if w is in W:
          w++
       if (w < period of R)
          offset=w
          W = W U w
       else
          w=0
          goto 1
```

References

References

1. Message Scheduling for the FlexRay Protocol: The Dynamic Segment

Thank You