A Hot-Patching Protocol for Repairing Time-Triggered Network Schedules

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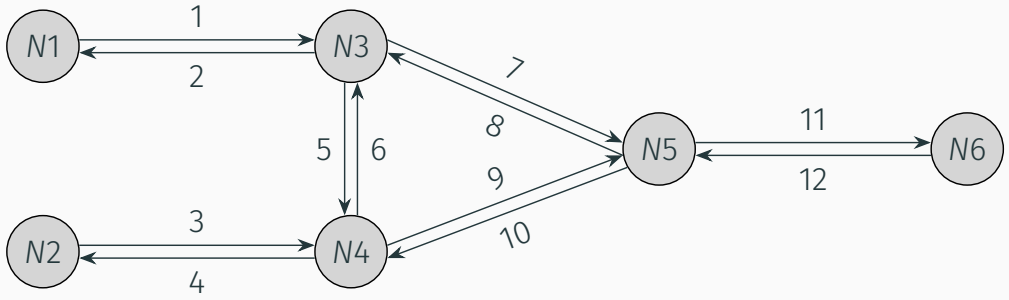
Time-Triggered Paradigm

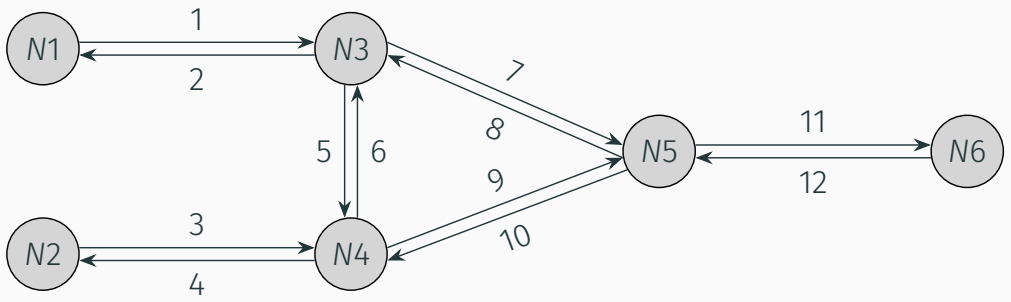
- Offline Schedule
- Nodes follow the schedule
- Shared notion of time



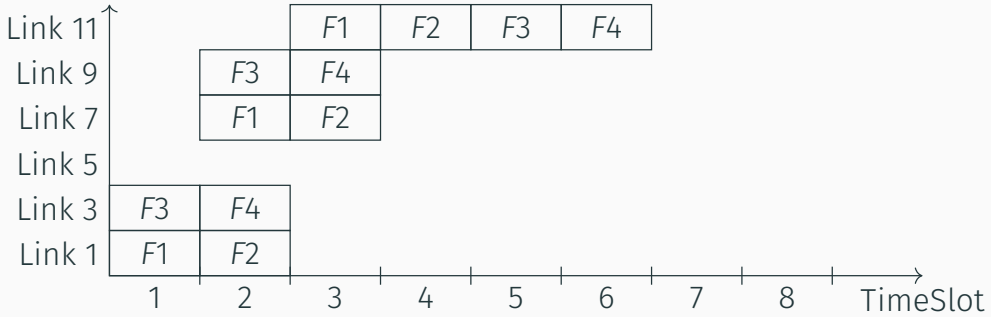
Network

Time-Triggered Paradigm Example

- Frame 1 and 2:
  - From *N*1 to *N*6
  - Path: {1-7-11}
  - Period: 8
- Frame 3 and 4:
  - From *N*2 to *N*6
  - Path: {3-9-11}
  - Period: 8



Network



Time-Triggered Schedule

Time-Triggered Communication Disadvantages

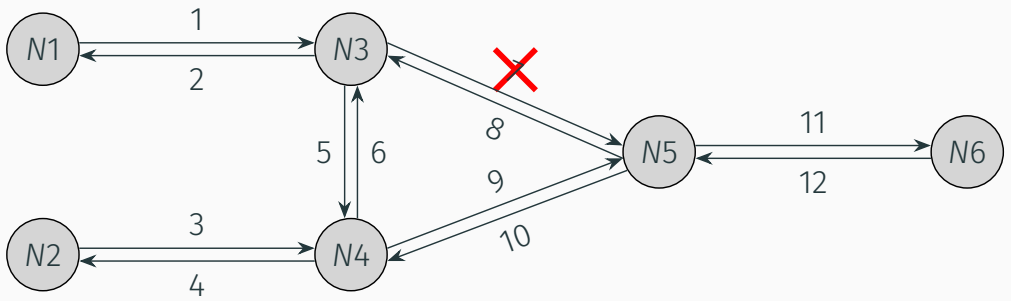
- Not flexible:
  - If something changes during run-time, we must change the whole schedule
  - Vulnerable to failures

Reparairing Schedules

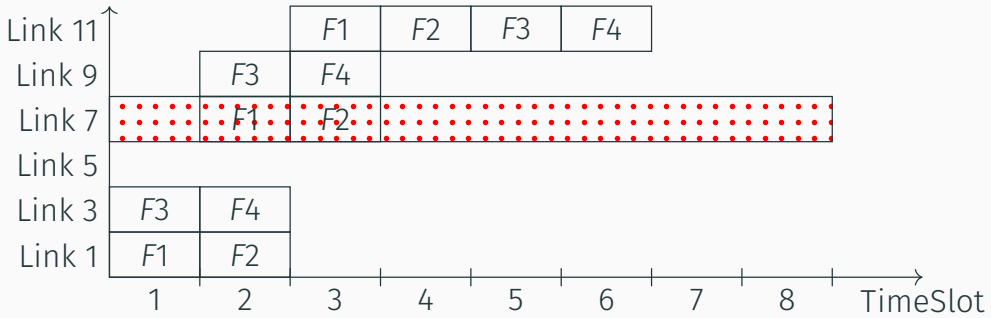
We want to **enhance the reliability** with small cost increase
repairing the schedule during **run-time**

Hot-Patching Protocol

- **React** to Link failures
- **Patch** a small part of the schedule
- **As fast as possible**
- Limit the number of lost frames



Network

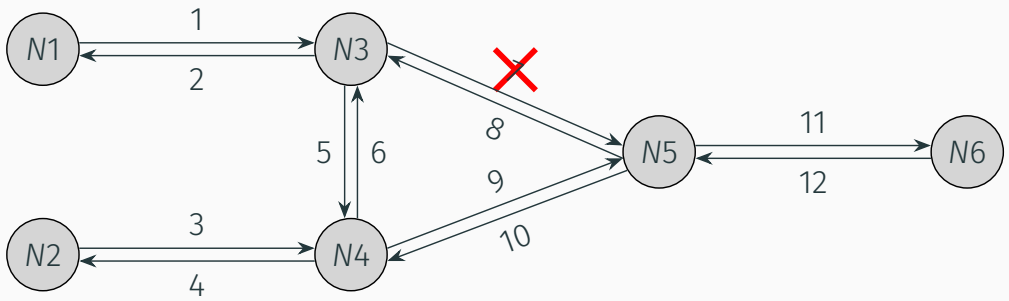


Time-Triggered Schedule

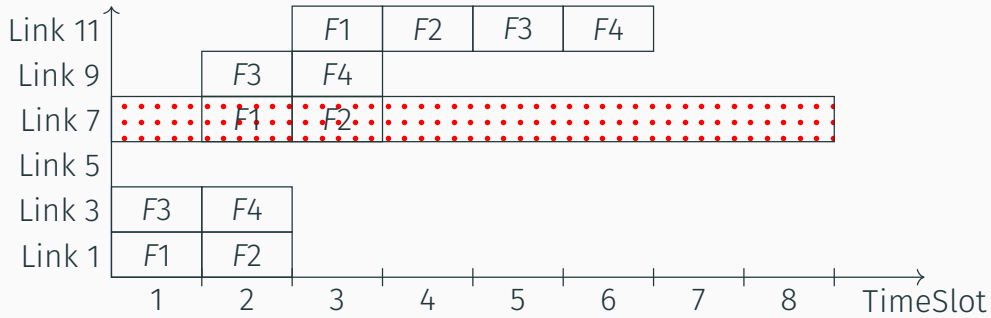
Hot-Patching Protocol

4 Steps:

- Notification
- Membership
- Solving
- Update



Network



Time-Triggered Schedule

Hot-Patching Protocol

4 Steps:

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- Membership
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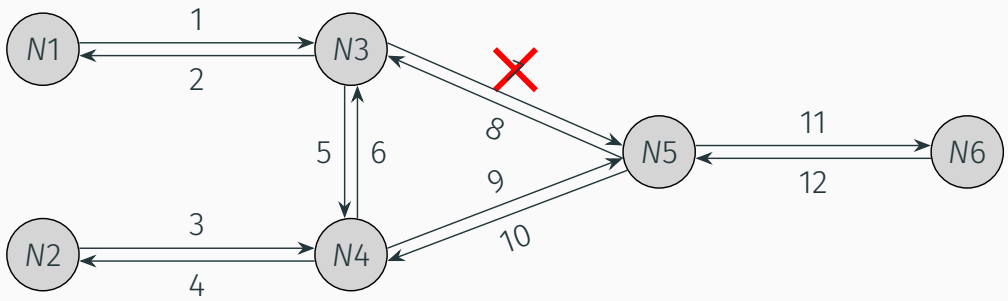

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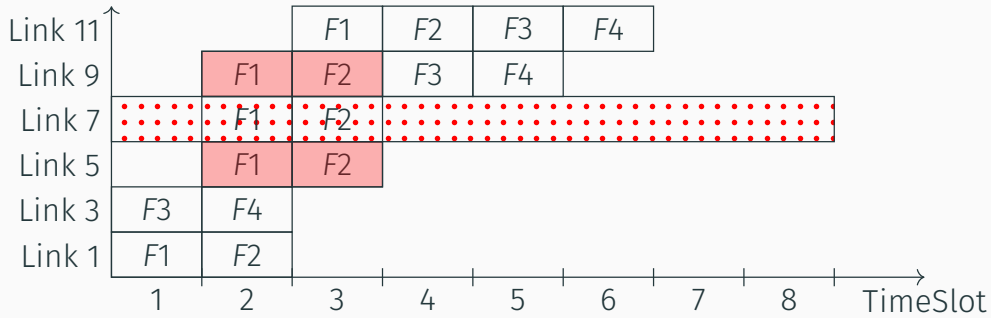


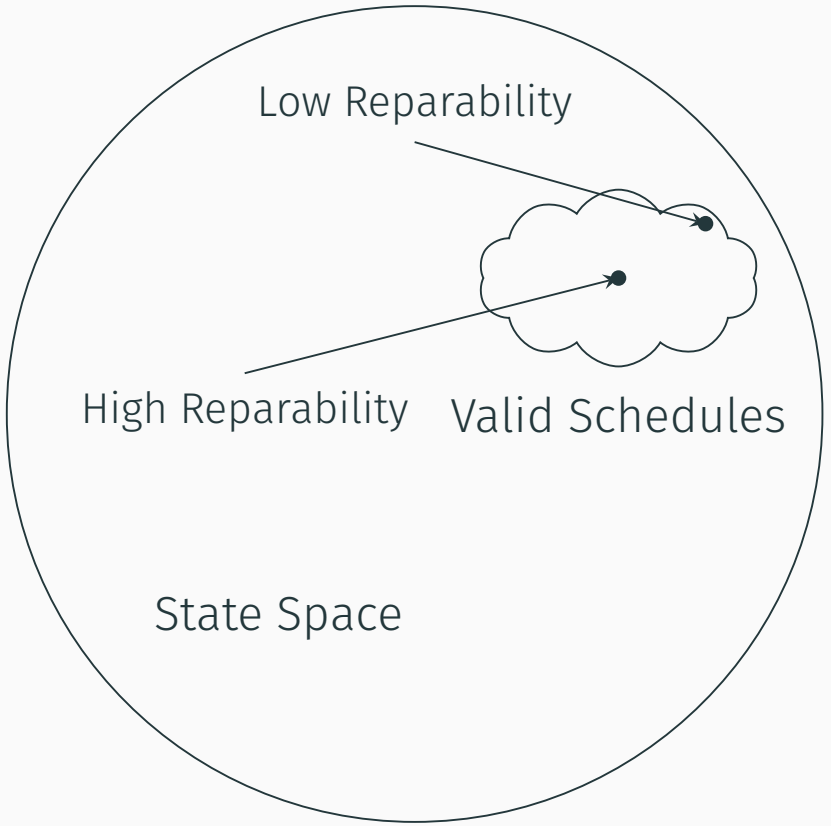
Time-Triggered Schedule

Schedule Reparability

How do we create schedules that are **easy to repair**?

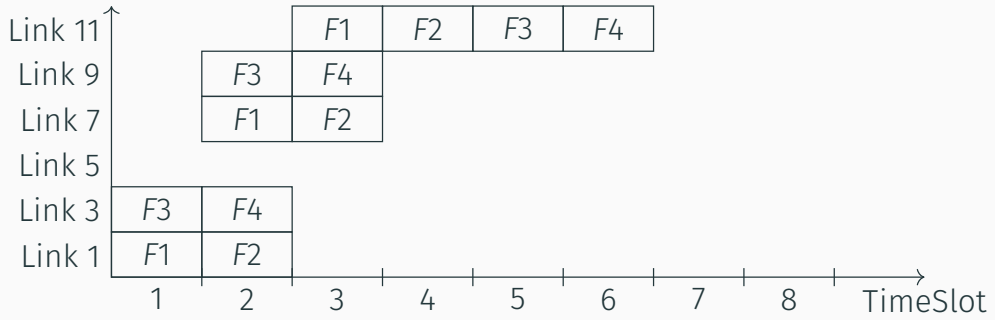
Schedule Reparability

- Choose a high reparability initial schedule
- Low cost to transform to other valid schedules

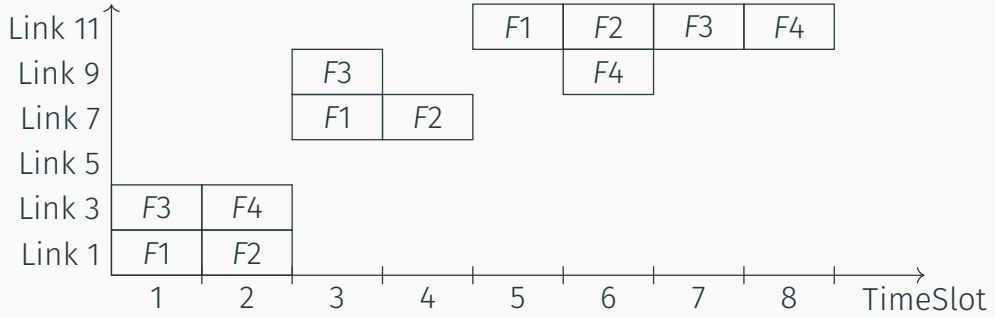


Schedule Reparability

- **Maximize frame distances:**
  1. Between the same frame
  2. Between frames in links



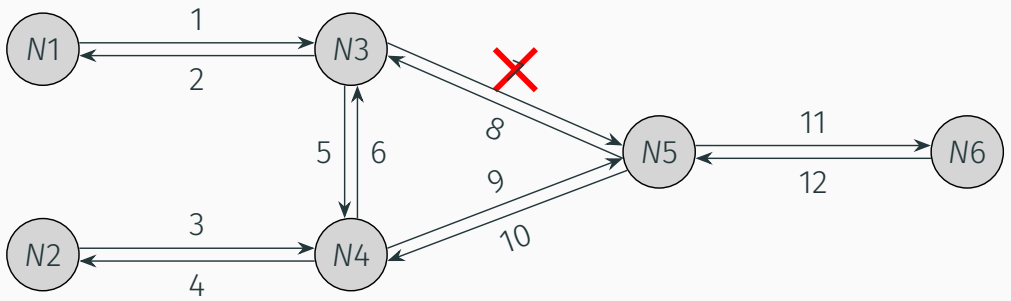
Minimize Make-span



Maximize frame distances

Hot-Patching Protocol

- Minimize the cost transformation
- Allows for fast patching



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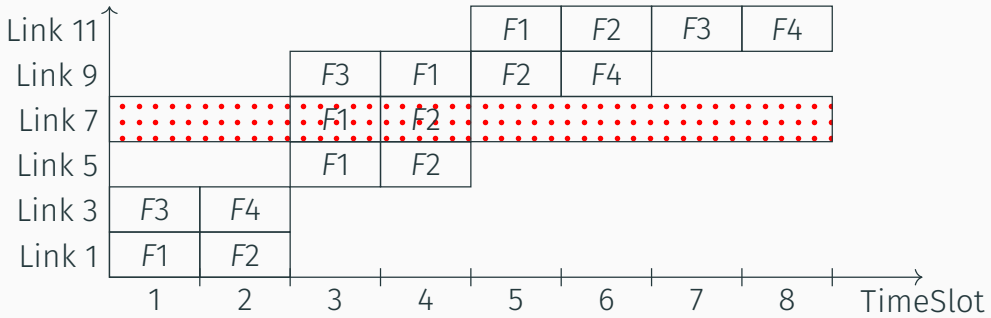

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