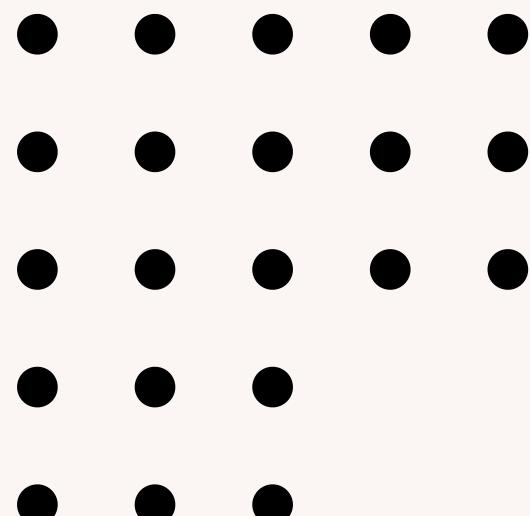


PROBLEMA DE PLANEJAMENTO

Trucks (Propositional, STRIPS)

Tópicos Especiais em Engenharia de Software - FGA UNB



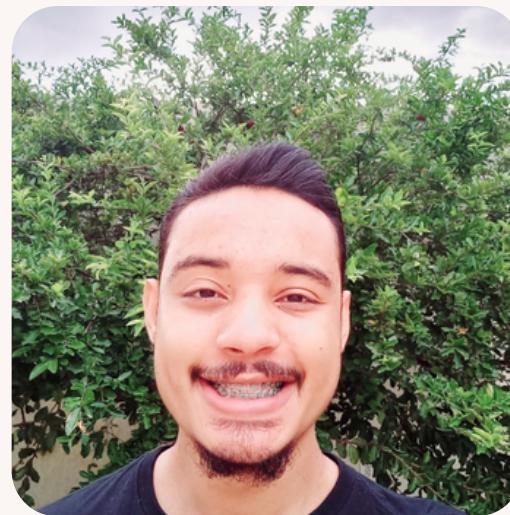
TÓPICOS

- 1 EQUIPE
- 2 INTRODUÇÃO
- 3 DOMÍNIO
- 4 AÇÕES
- 5 PROBLEMA ELABORADO
- 6 CÓDIGO DO PROBLEMA
- 7 SOLUÇÃO
- 8 SIMULAÇÃO
- 9 REFERÊNCIAS

EQUIPE



Davi de Aguiar Vieira
222006641



Gustavo Martins Ribeiro
200019228



Lucas Guimarães Borges
222015159



Leonardo Gonçalves Machado
211029405



Carlos Eduardo Pereira Alexandre
231026803

INTRODUÇÃO . . .

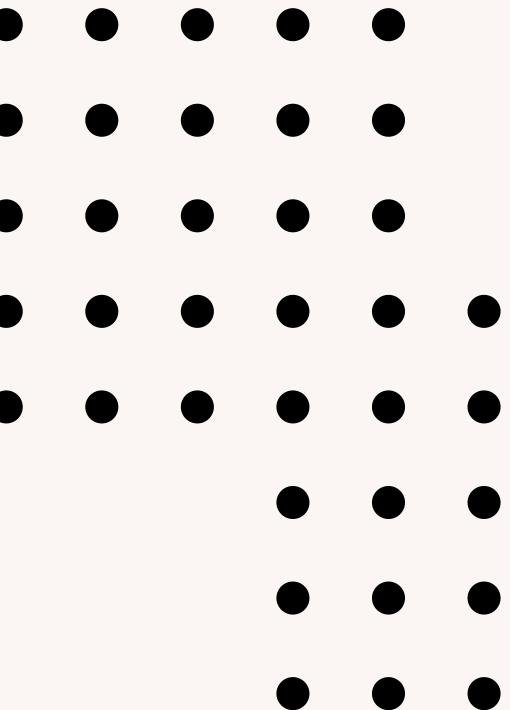
O problema de planejamento intitulado **Trucks (Propositional, STRIPS)** foi um desafio disponibilizado durante o IPC (International Planning Competition) de 2006. O desafio consiste em um problema logístico sobre a movimentação de pacotes entre locais por caminhões sob certas restrições. Diante disso, o presente documento consiste em um estudo sobre o domínio em questão, baseado nas soluções propostas por **Yannis Dimopoulos** (professor do Departamento de Ciência da Computação na Universidade de Chipre), **Alfonso Gerevini** (professor do Departamento de Engenharia da Informação na Universidade de Brescia) e **Alessandro Saetti** (professor do Departamento de Engenharia da Informação da Universidade de Brescia, Itália).

DOMÍNIO...

Como dito na introdução, este é um domínio logístico sobre a movimentação de pacotes entre locais por caminhões sob certas restrições.

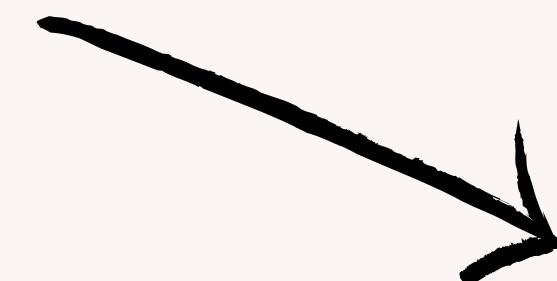
São elas:

- O espaço de carga de cada caminhão está dividido em áreas.
- Um pacote só pode ser carregado ou descarregado de um caminhão se as áreas entre o pacote em questão e a porta do caminhão estiverem livres.
- Alguns pacotes devem ser entregues dentro de alguns prazos.



AÇÕES . . .

- 1. DRIVE_TRUCK (origem, destino, tempo1, tempo2)
- 2. DELIVER_PACKAGE (local, tempo)
- 3. LOAD_PACKAGE (pacote, área, local)
- 4. UNLOAD_PACKAGE (pacote, área, local)



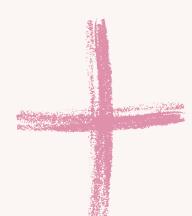
"GASTA" TEMPO!

OBS.: Foi criada uma ação específica para cada possibilidade de parâmetro no domínio analisado.

AÇÕES



PRÉ-REQUISITOS

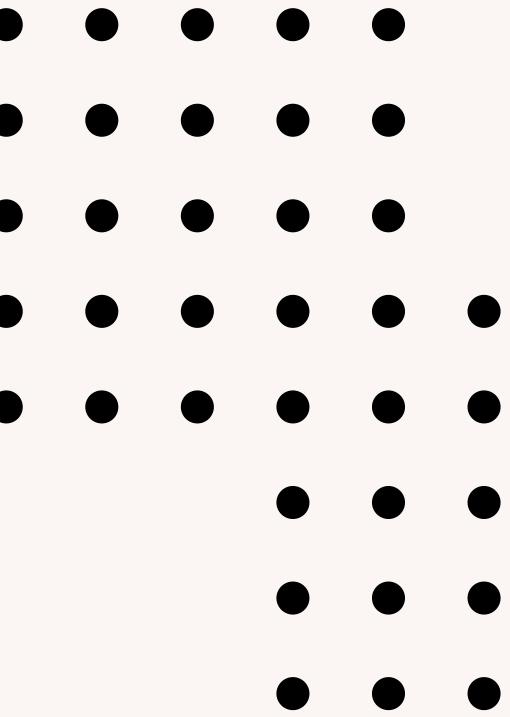


EFEITOS

PROBLEMA ELABORADO . . .

O problema elaborado para o domínio consiste em entregar 3 pacotes em localidades específicas com prazos definidos, sendo que:

- Local inicial dos pacotes:
pacote1 : local1
pacote2 : local3
pacote3 : local1
- Destino e prazo dos pacotes:
pacote1 : local2, tempo3
pacote2 : local1, tempo4
pacote3 : local3, tempo5
- Local inicial do caminhão: local2



CÓDIGO DO PROBLEMA . . .

Adaptado de: **instance-1.pddl**

```
(define (problem GROUNDED-TRUCK)
  (:domain GROUNDED-TRUCKS)
  (:init
    (FOO)
    (time-now_t0)
    (at_package1_l1)
    (at_package2_l3)
    (at_package3_l1)
    (free_a2_truck1)
    (free_a1_truck1)
    (at_truck1_l2)
  )
  (:goal
    (and
      (delivered_package3_l3_t5)
      (delivered_package2_l1_t4)
      (delivered_package1_l2_t3)
    )
  )
)
```

SOLUÇÃO (1) . . .

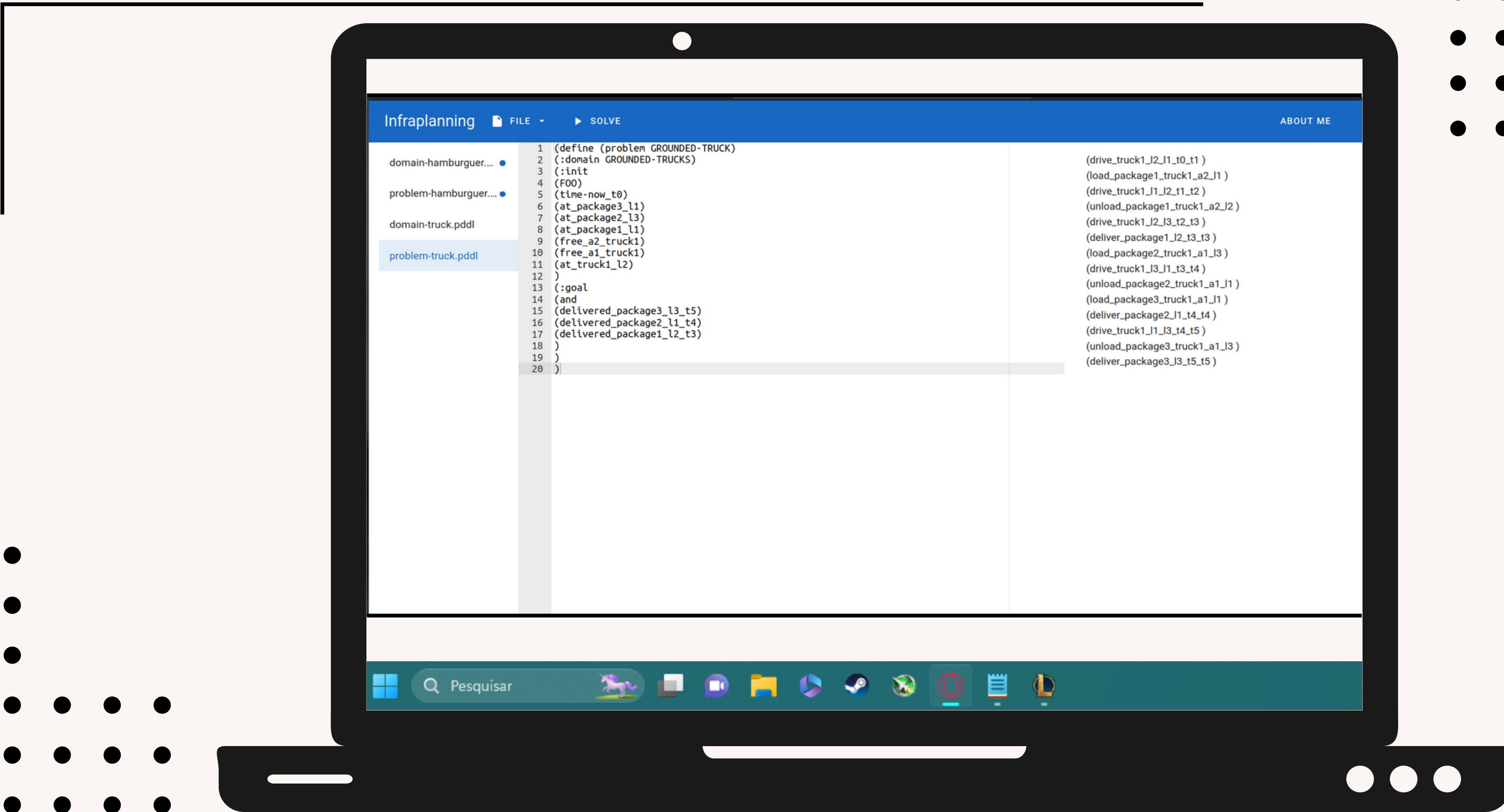
Planejador: **FastDownward**

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

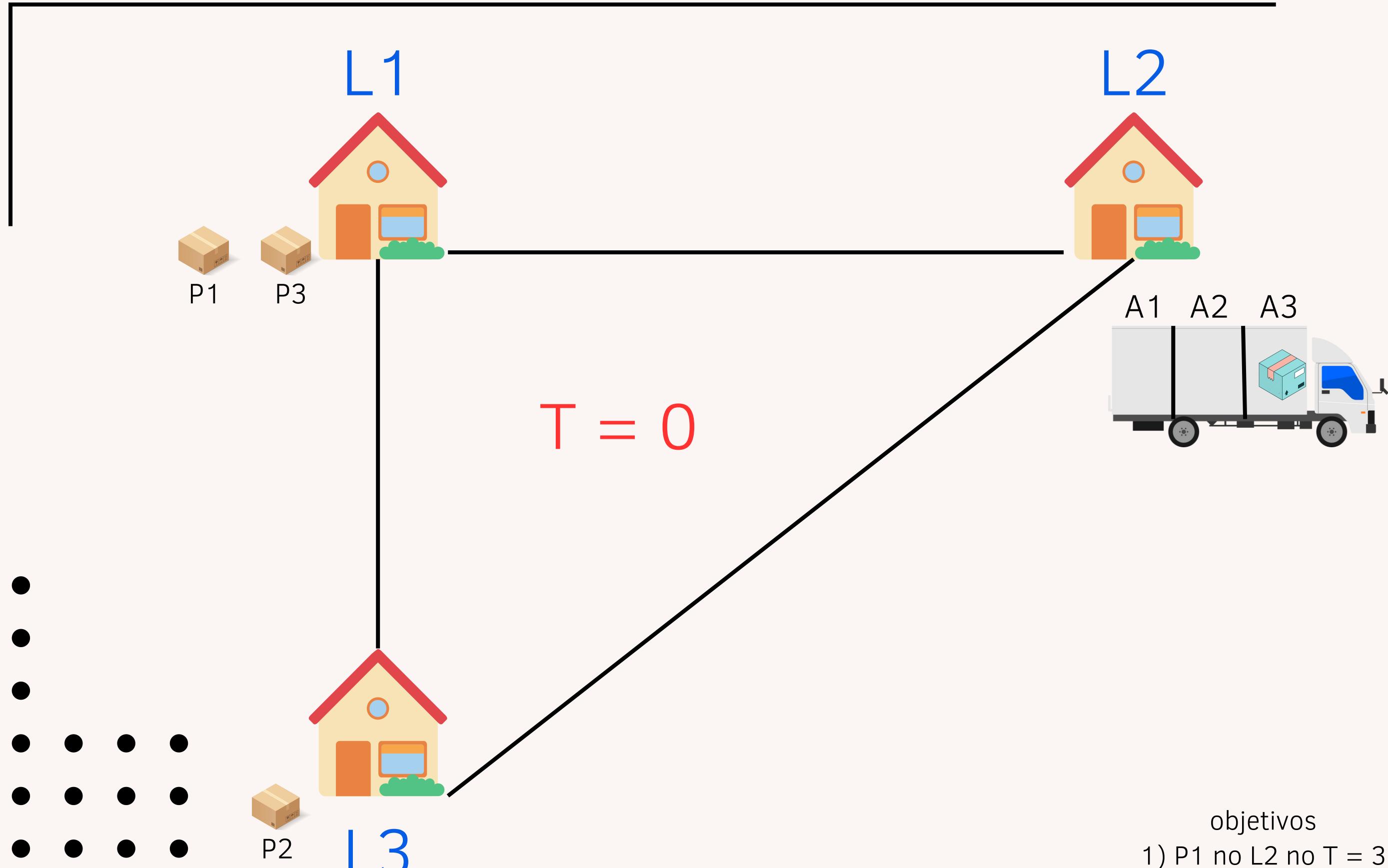
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SOLUÇÃO (2) . . .



SIMULAÇÃO (ESTADO INICIAL) . . .

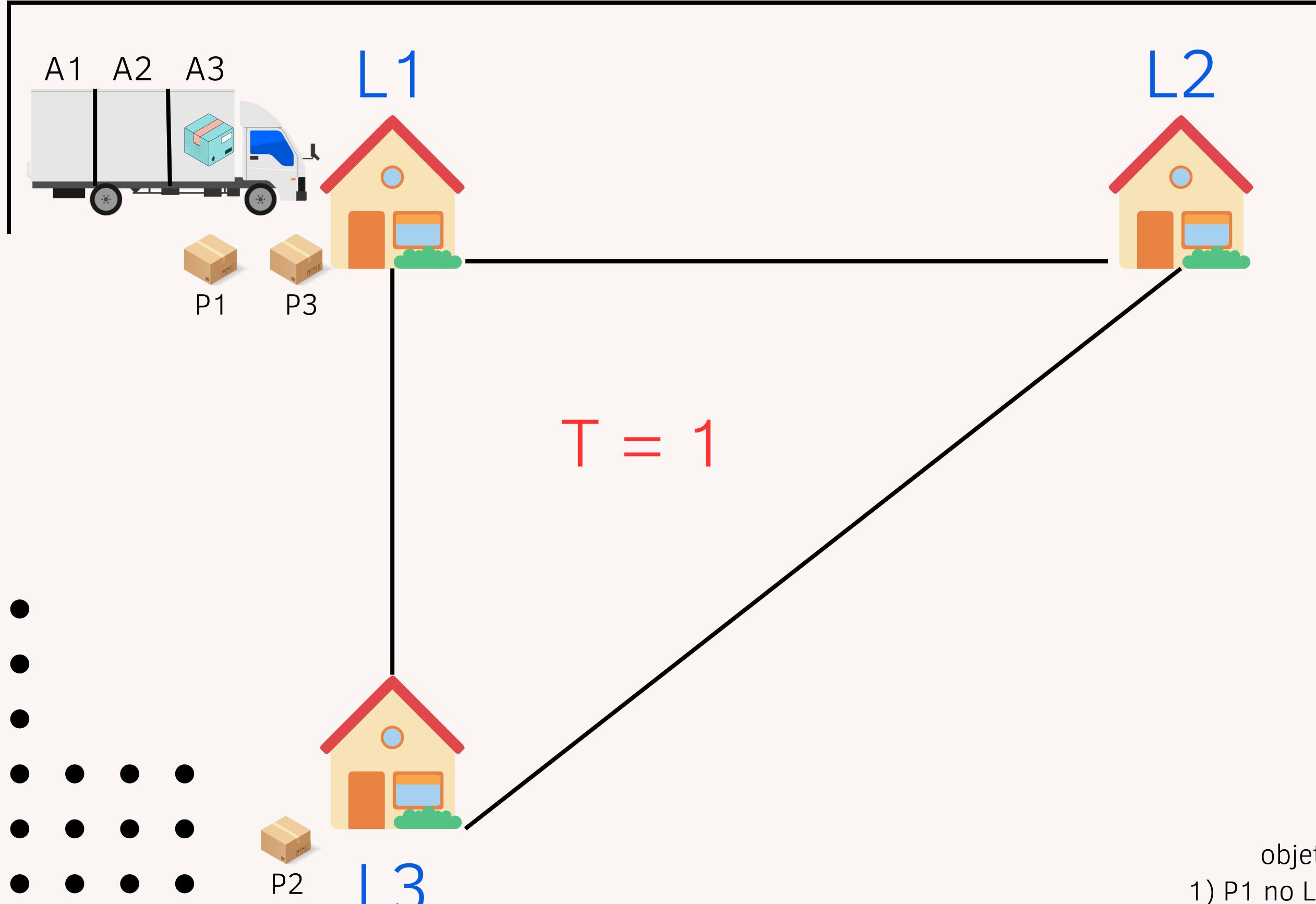


objetivos

- 1) P1 no L2 no $T = 3$
- 2) P2 no L1 no $T = 4$
- 3) P3 no L3 no $T = 5$

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (1) . . .

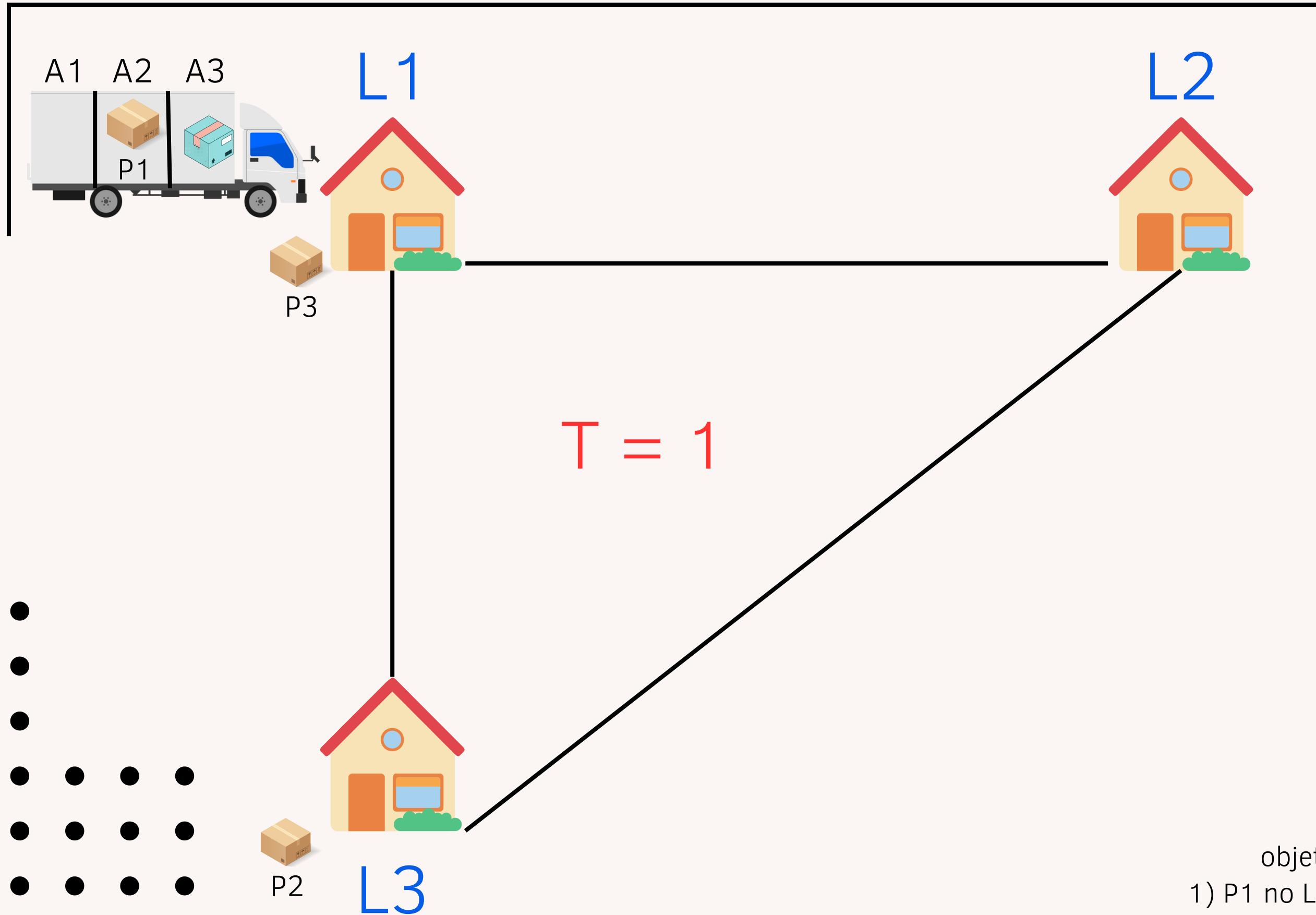


objetivos

- 1) P1 no L2 no $T = 3$
- 2) P2 no L1 no $T = 4$
- 3) P3 no L3 no $T = 5$

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (2) . . .

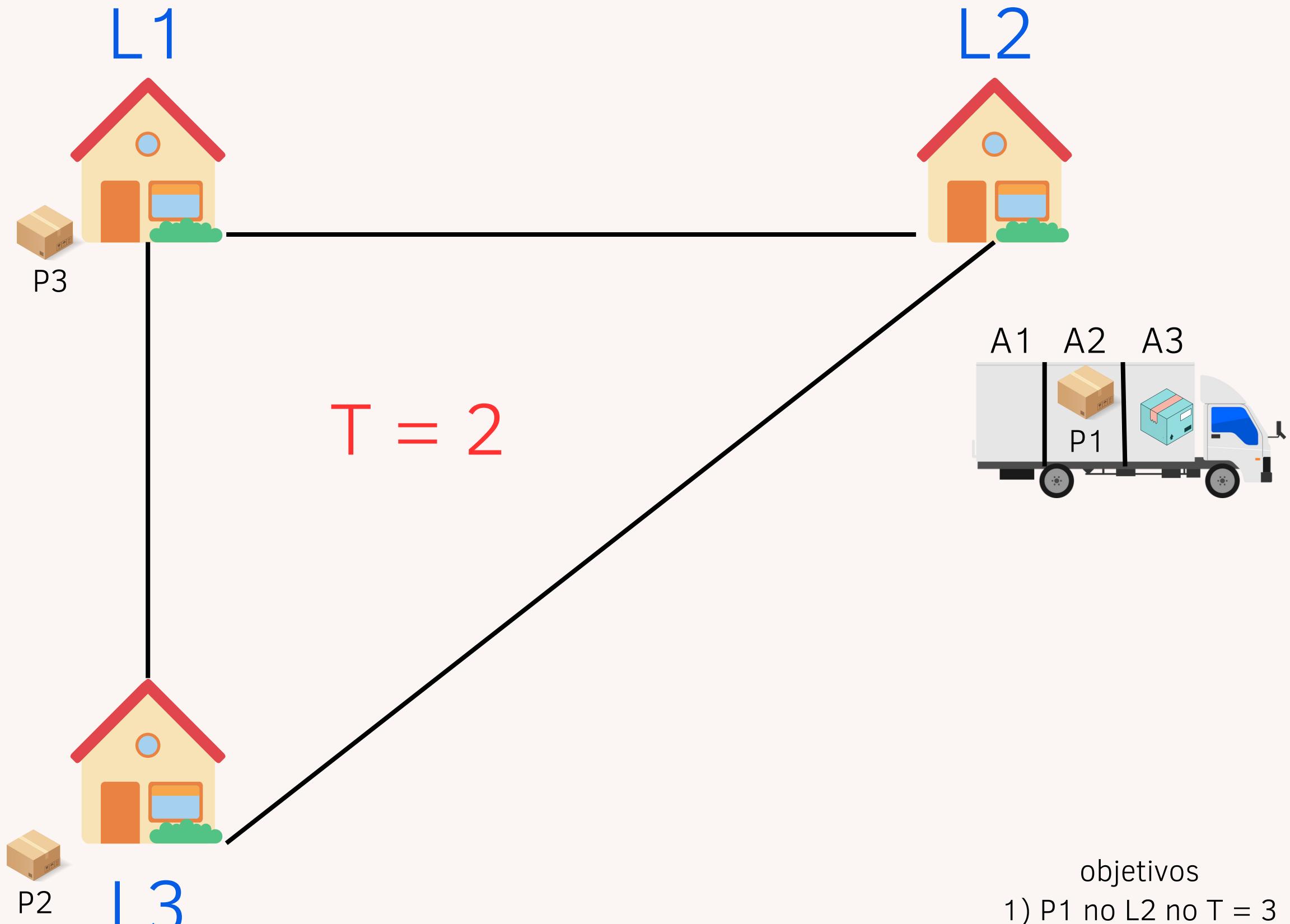


objetivos

- 1) P1 no L2 no $T = 3$
- 2) P2 no L1 no $T = 4$
- 3) P3 no L3 no $T = 5$

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (3) . . .

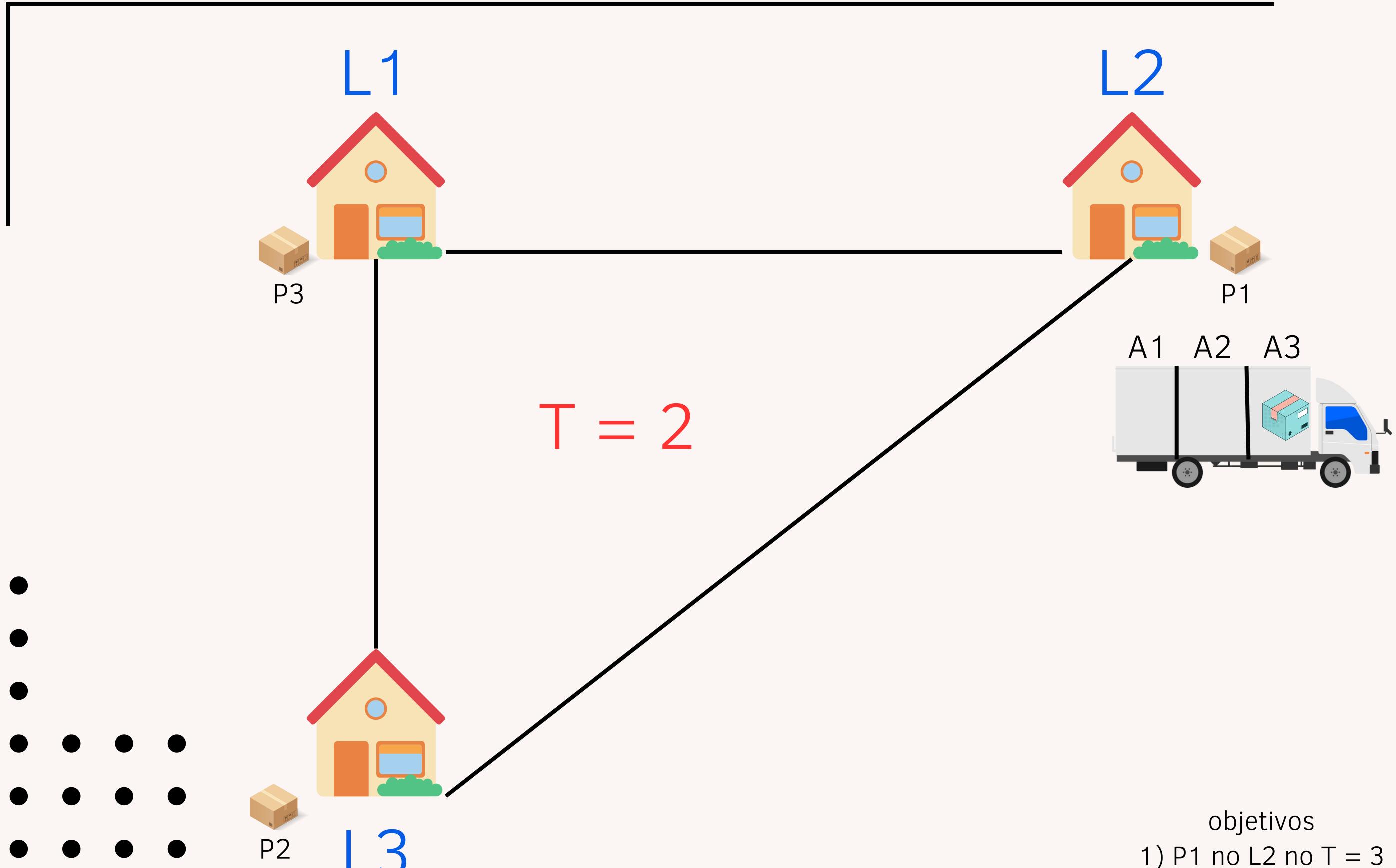


objetivos

- 1) P1 no L2 no T = 3
- 2) P2 no L1 no T = 4
- 3) P3 no L3 no T = 5

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (4) . . .

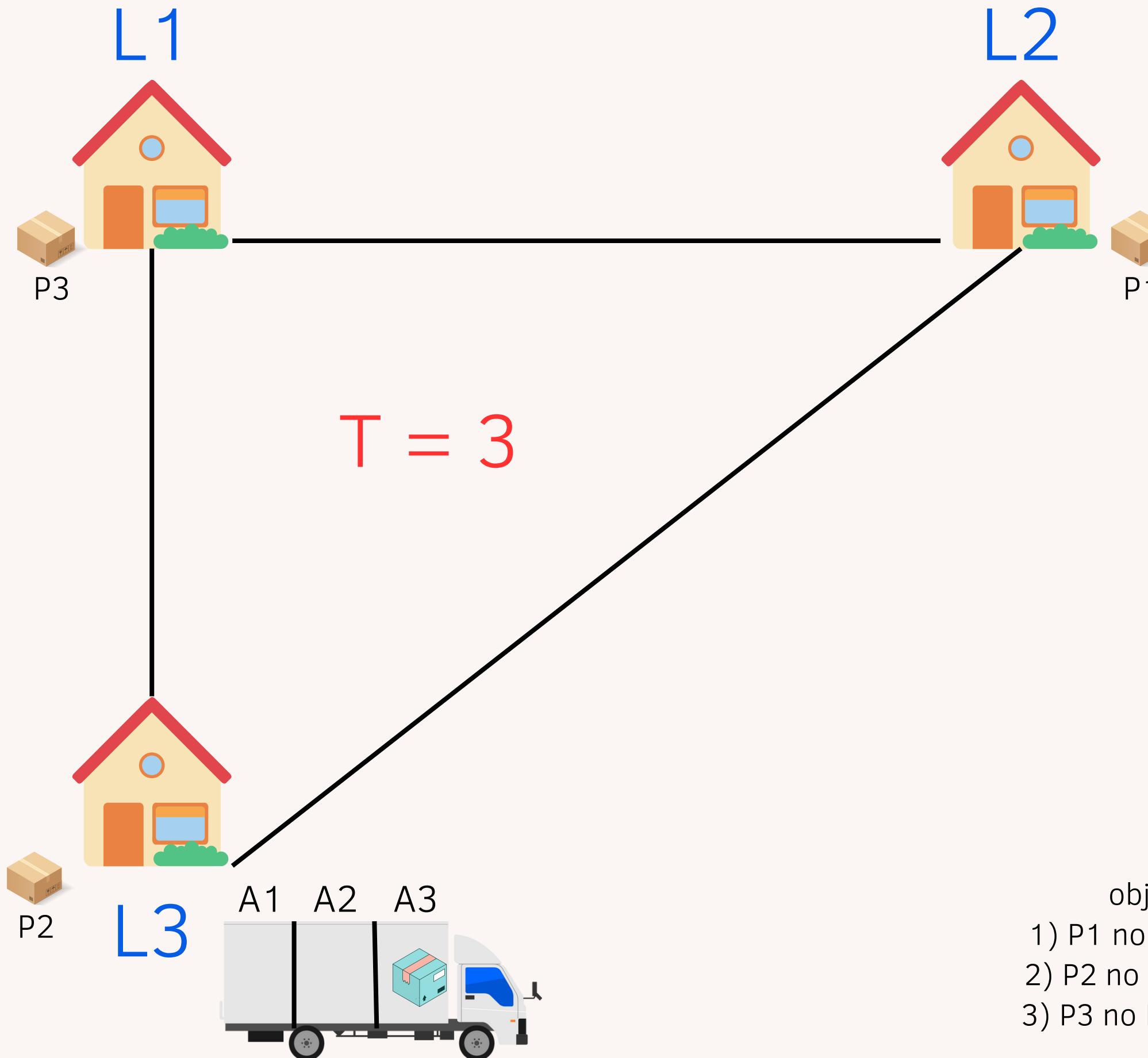


objetivos

- 1) P1 no L2 no $T = 3$
- 2) P2 no L1 no $T = 4$
- 3) P3 no L3 no $T = 5$

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (5) . . .

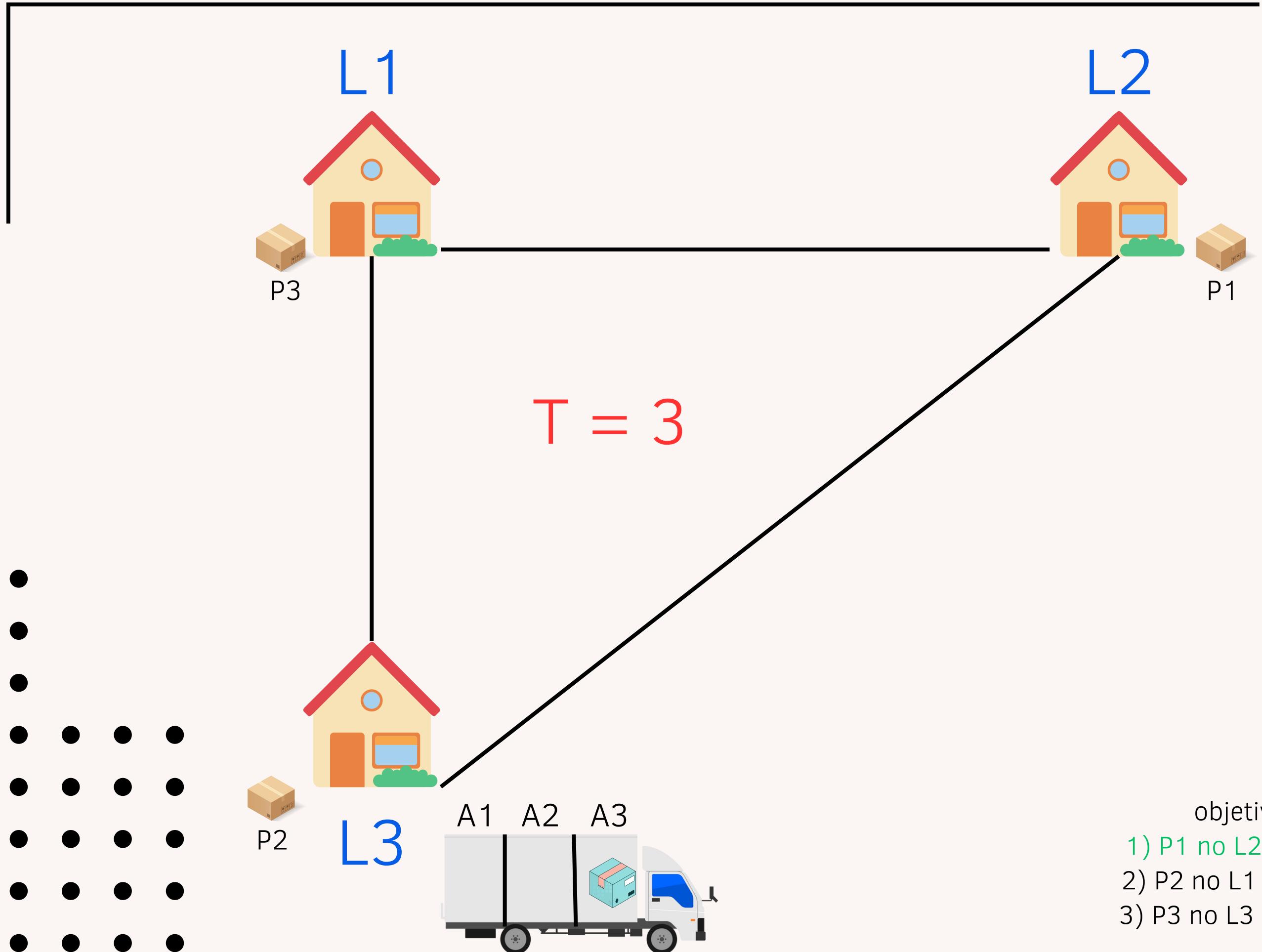


objetivos

- 1) P1 no L2 no $T = 3$
- 2) P2 no L1 no $T = 4$
- 3) P3 no L3 no $T = 5$

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (6) . . .

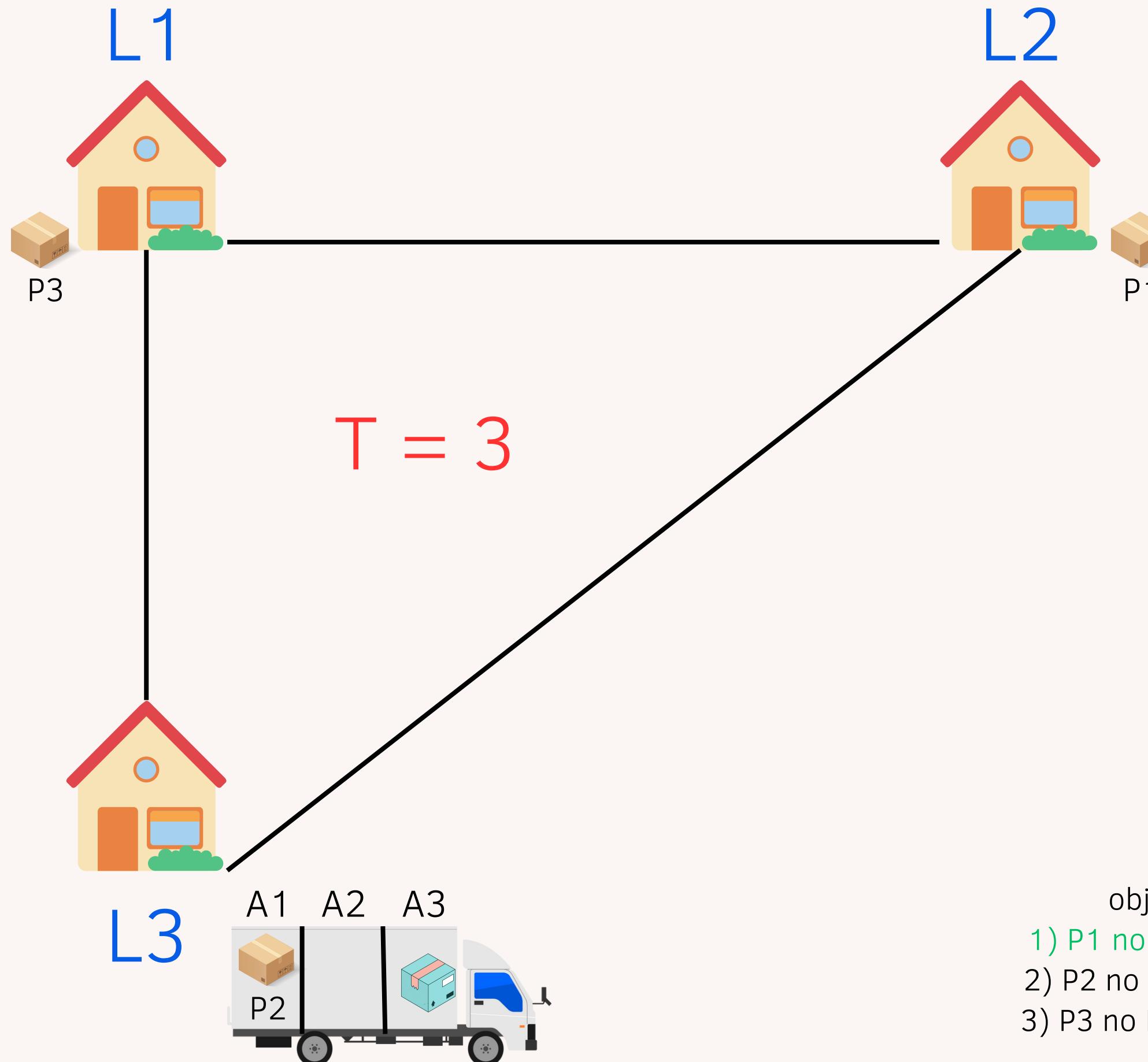


objetivos

- 1) P1 no L2 no $T = 3$
- 2) P2 no L1 no $T = 4$
- 3) P3 no L3 no $T = 5$

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (7) . . .

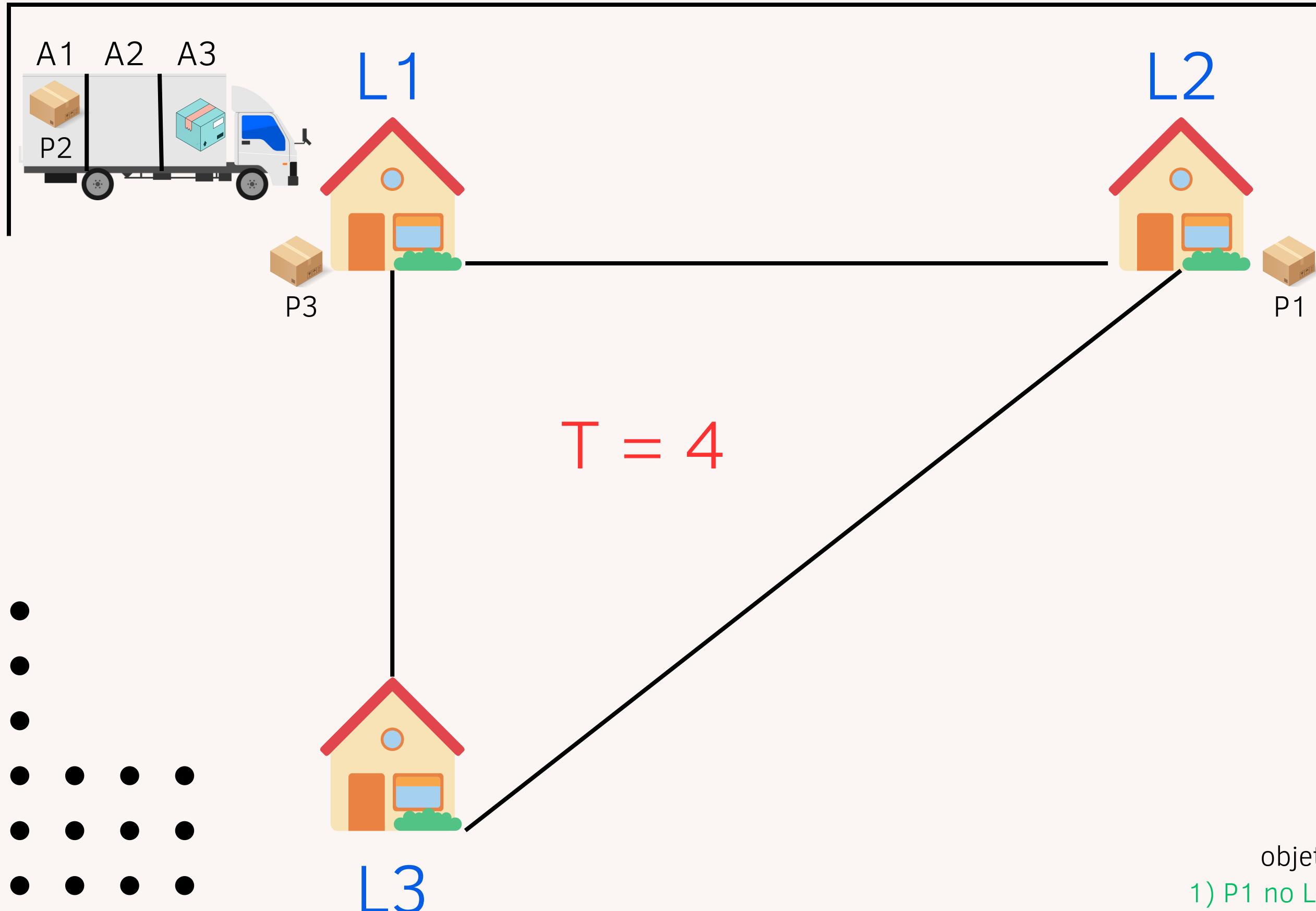


objetivos

- 1) P1 no L2 no T = 3
- 2) P2 no L1 no T = 4
- 3) P3 no L3 no T = 5

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (8) . . .

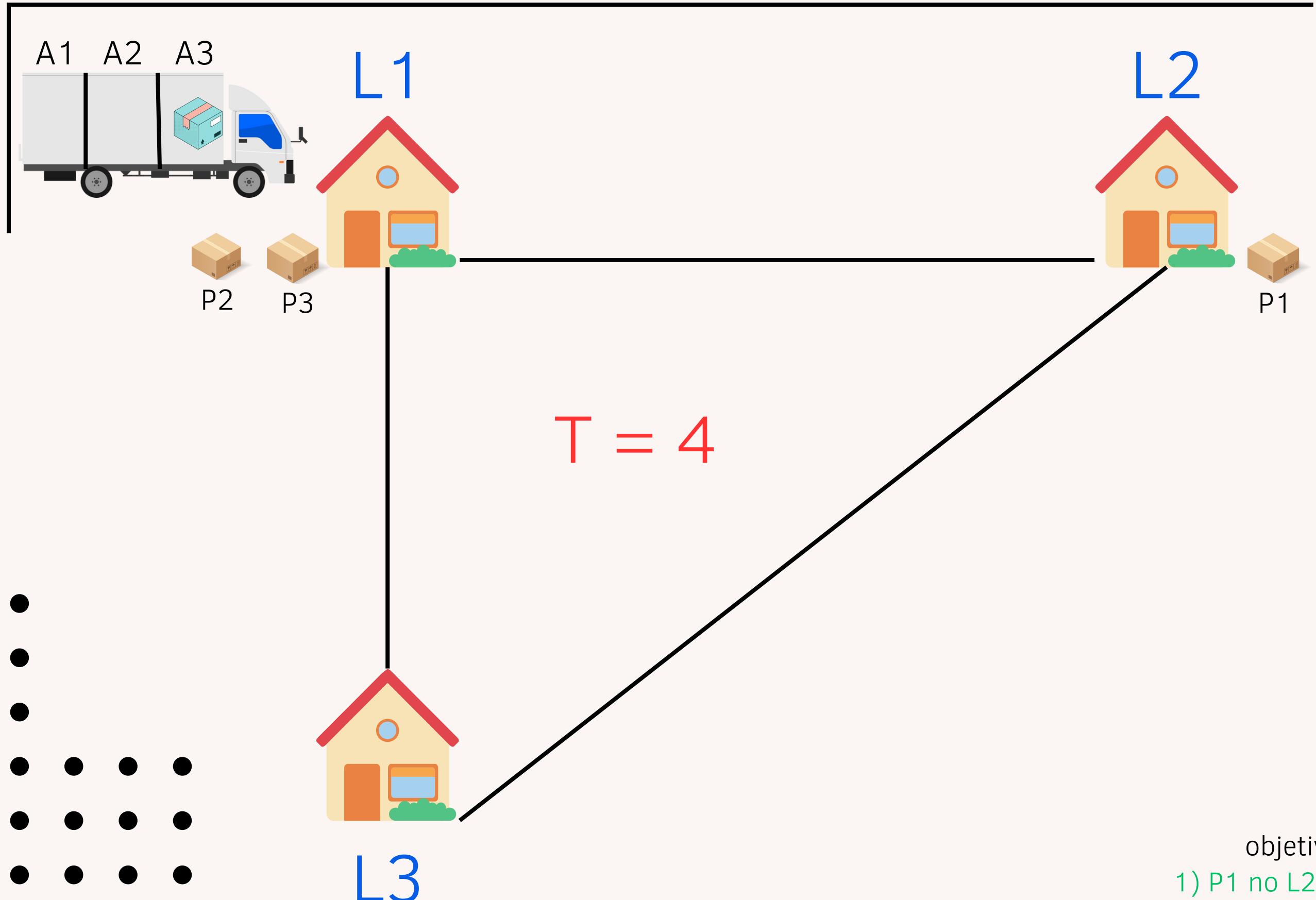


objetivos

- 1) P1 no L2 no $T = 3$
- 2) P2 no L1 no $T = 4$
- 3) P3 no L3 no $T = 5$

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (9) . . .

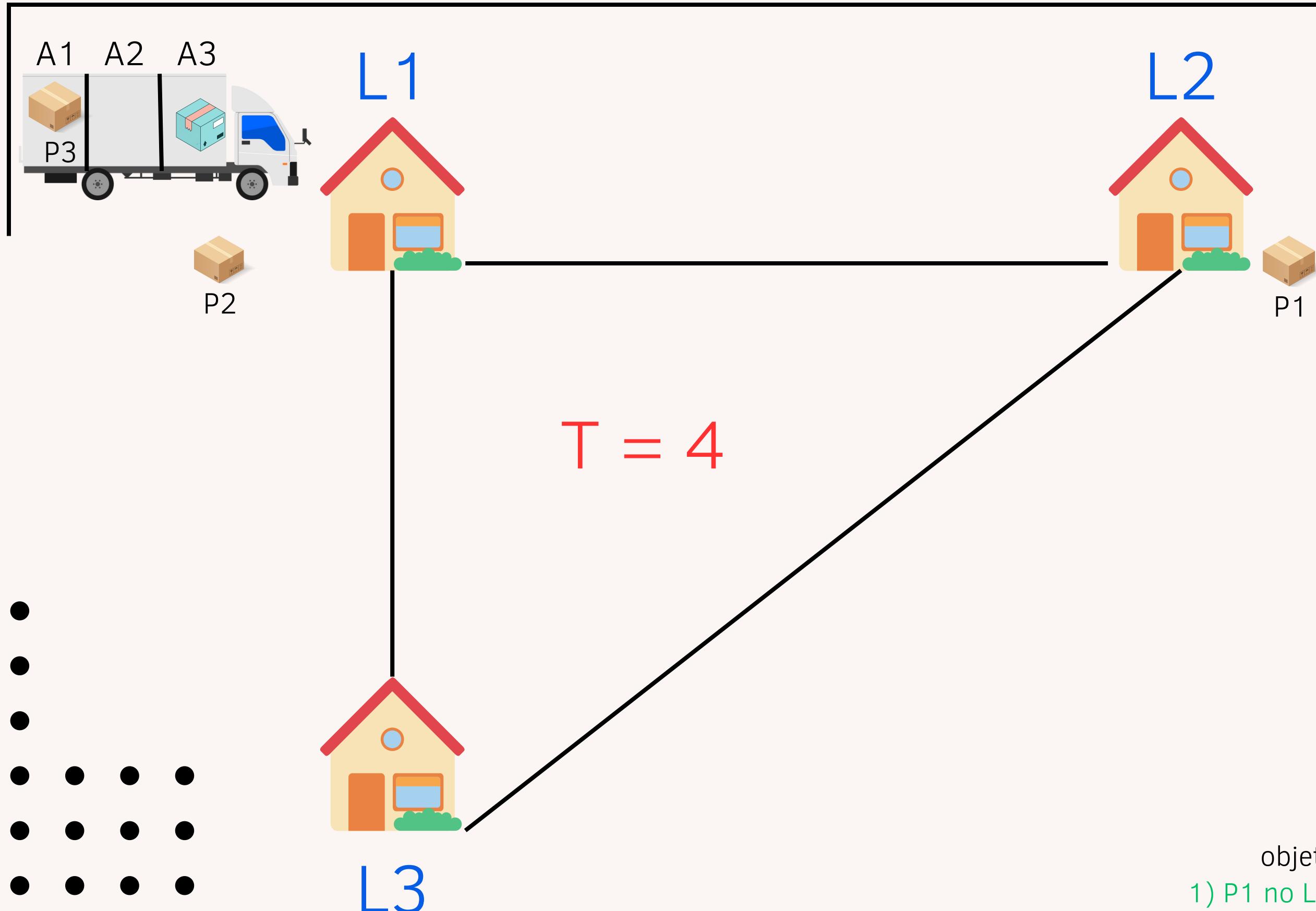


objetivos

- 1) P1 no L2 no $T = 3$
- 2) P2 no L1 no $T = 4$
- 3) P3 no L3 no $T = 5$

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (10) . . .

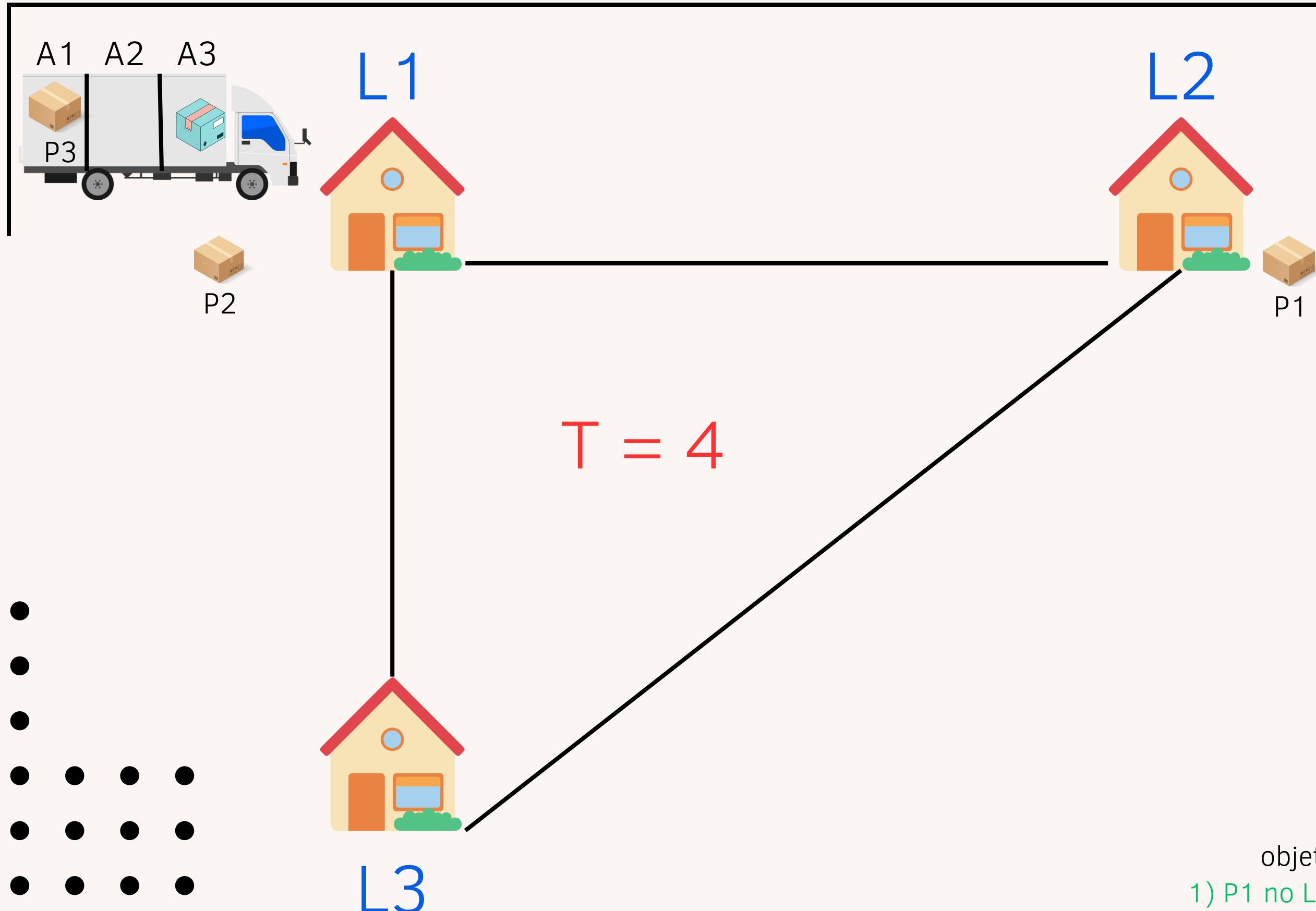


objetivos

- 1) P1 no L2 no $T = 3$
- 2) P2 no L1 no $T = 4$
- 3) P3 no L3 no $T = 5$

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (11) . . .

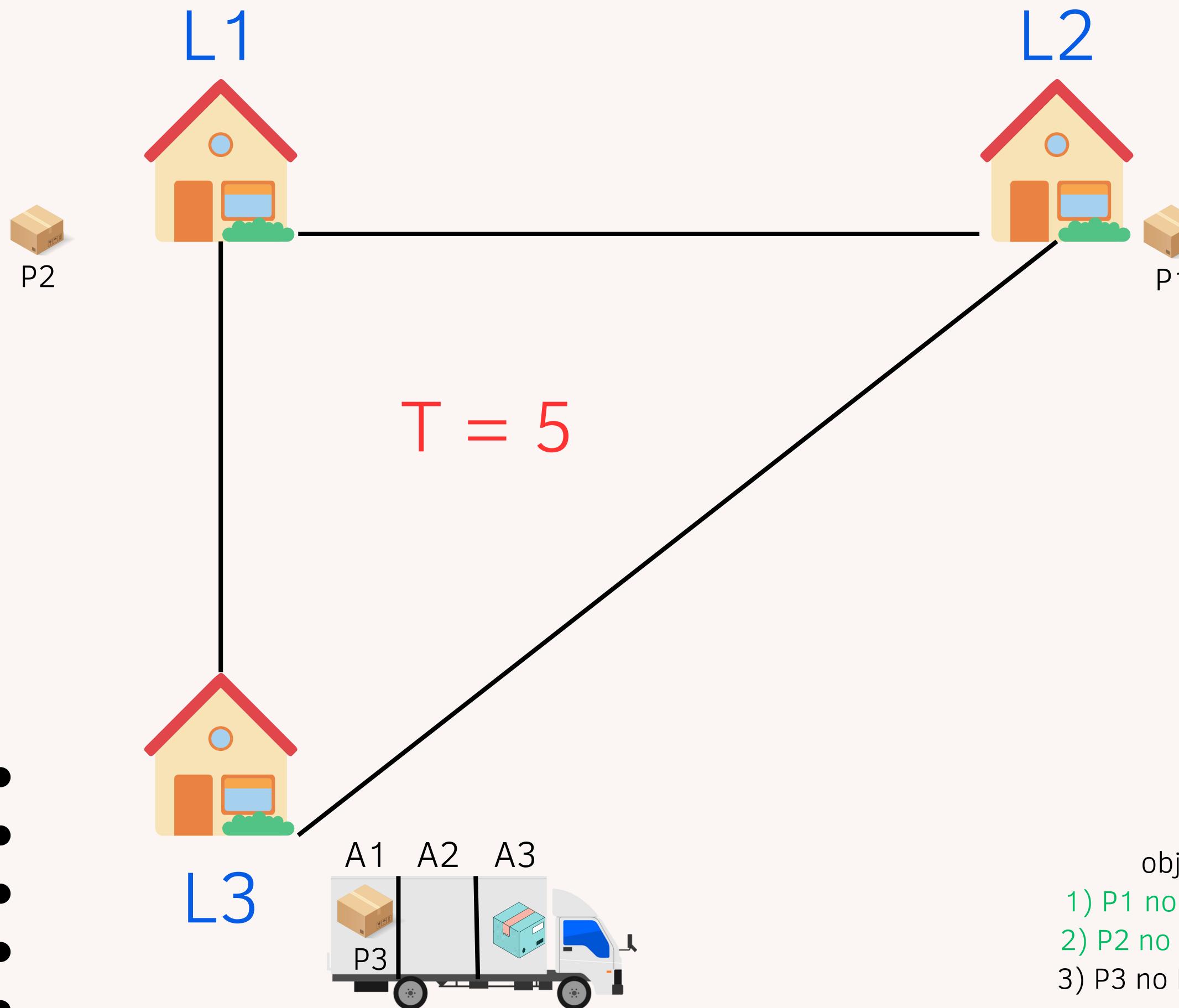


objetivos

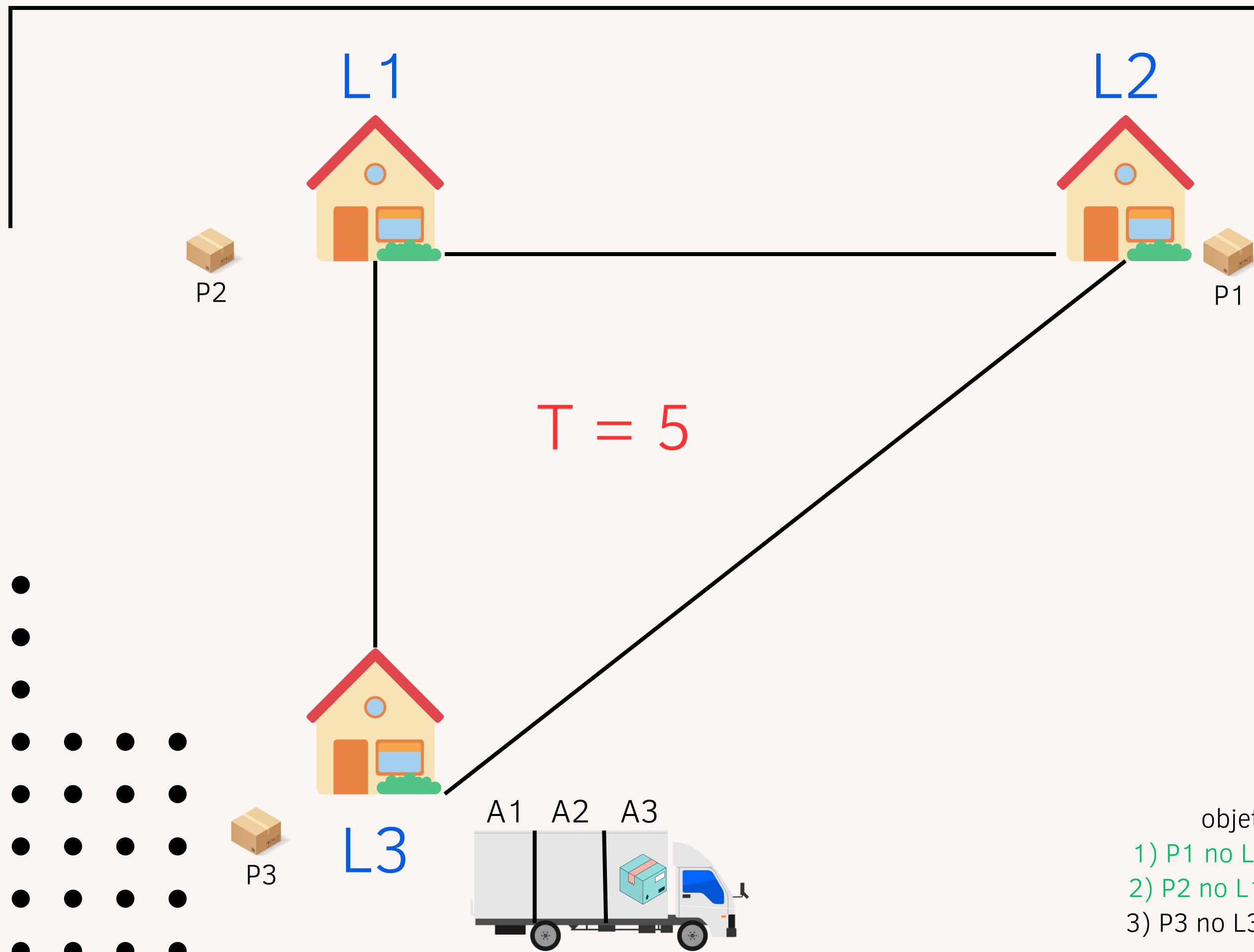
- 1) P1 no L2 no $T = 3$
- 2) P2 no L1 no $T = 4$
- 3) P3 no L3 no $T = 5$

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (12) . . .



SIMULAÇÃO (13) . . .

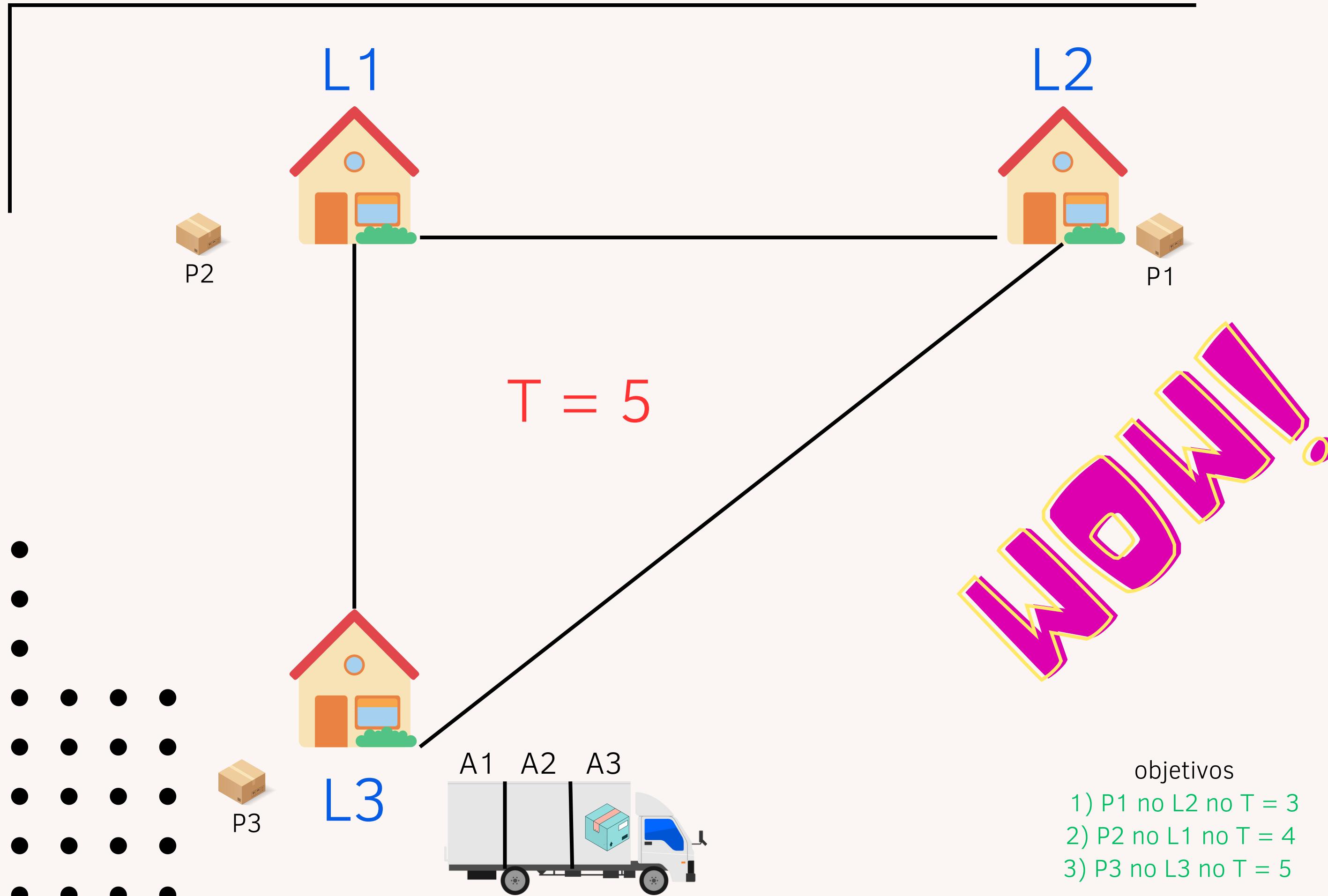


objetivos

- 1) P1 no L2 no $T = 3$
- 2) P2 no L1 no $T = 4$
- 3) P3 no L3 no $T = 5$

(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

SIMULAÇÃO (14) . . .



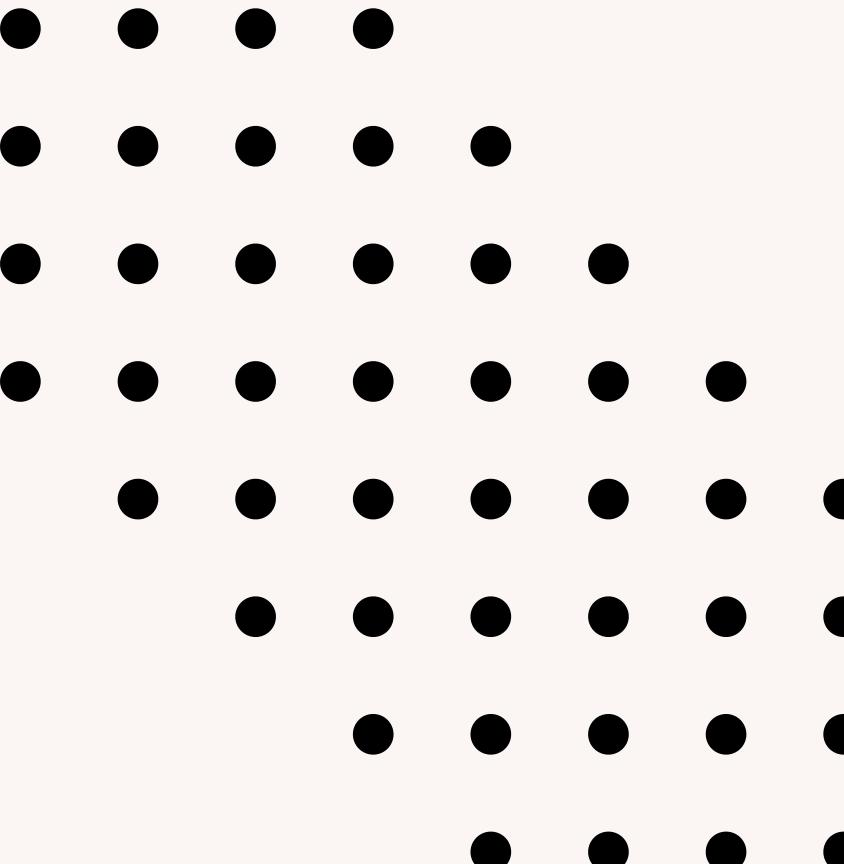
(drive_truck1_l2_l1_t0_t1)
(load_package1_truck1_a2_l1)
(drive_truck1_l1_l2_t1_t2)
(unload_package1_truck1_a2_l2)
(drive_truck1_l2_l3_t2_t3)
(deliver_package1_l2_t3_t3)
(load_package2_truck1_a1_l3)
(drive_truck1_l3_l1_t3_t4)
(unload_package2_truck1_a1_l1)
(load_package3_truck1_a1_l1)
(deliver_package2_l1_t4_t4)
(drive_truck1_l1_l3_t4_t5)
(unload_package3_truck1_a1_l3)
(deliver_package3_l3_t5_t5)

objetivos

- 1) P1 no L2 no T = 3
- 2) P2 no L1 no T = 4
- 3) P3 no L3 no T = 5

REFERÊNCIAS

- 1) <https://github.com/potassco/pddl-instances/blob/master/ipc-2006/domains/trucks-propositional-strips/instances/instance-1.pddl>
- 2) </home/prof/ribas/pddl-instances/ipc-2006/domains/trucks-propositional-strips>
- 3) <https://plan-editor.naquadah.com.br/>
- 4) <https://www.canva.com>



OBRIGADO!

