# Game Theoretic Scheduling

Real Time Task Scheduling In Cloud Computing

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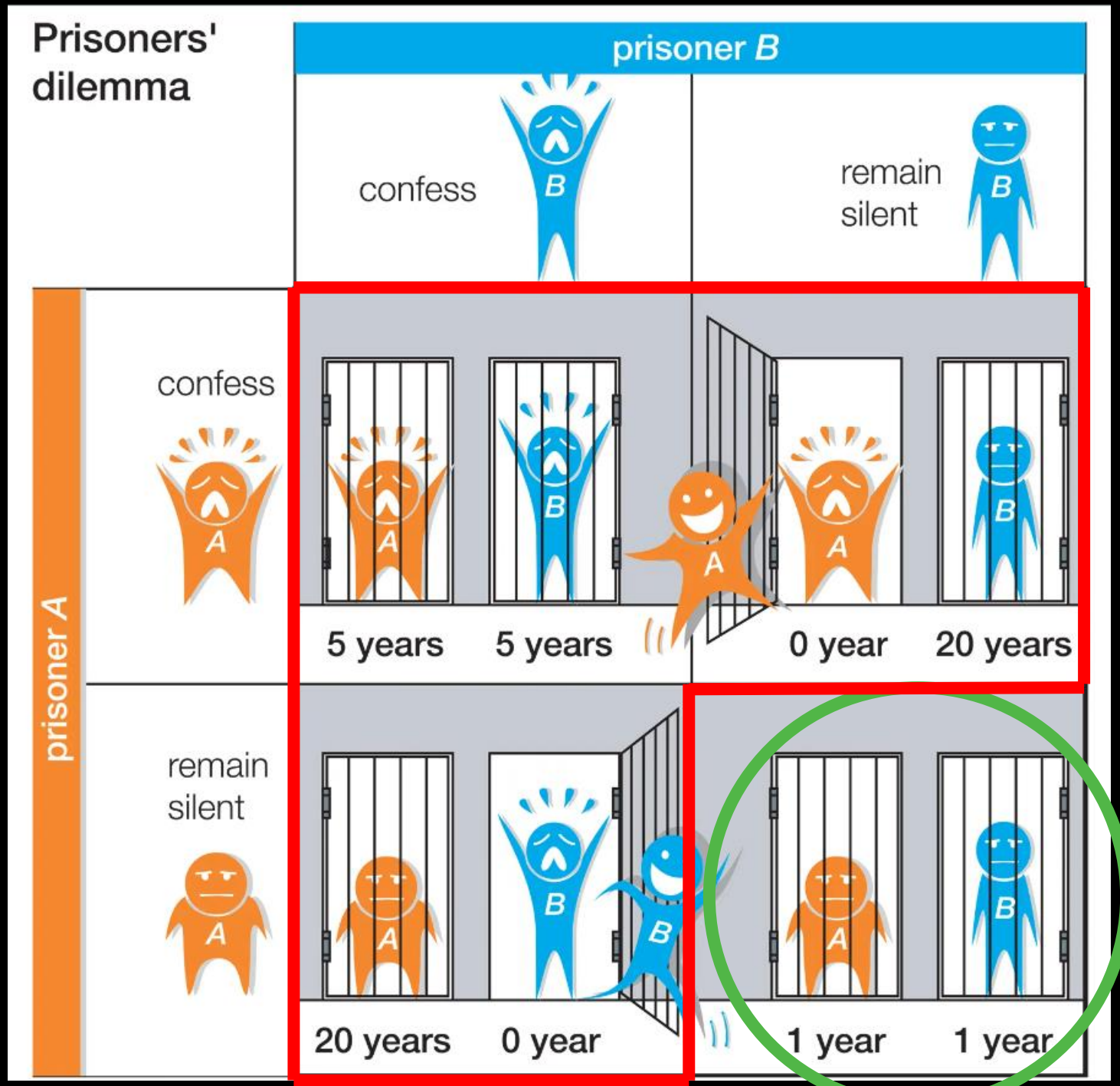
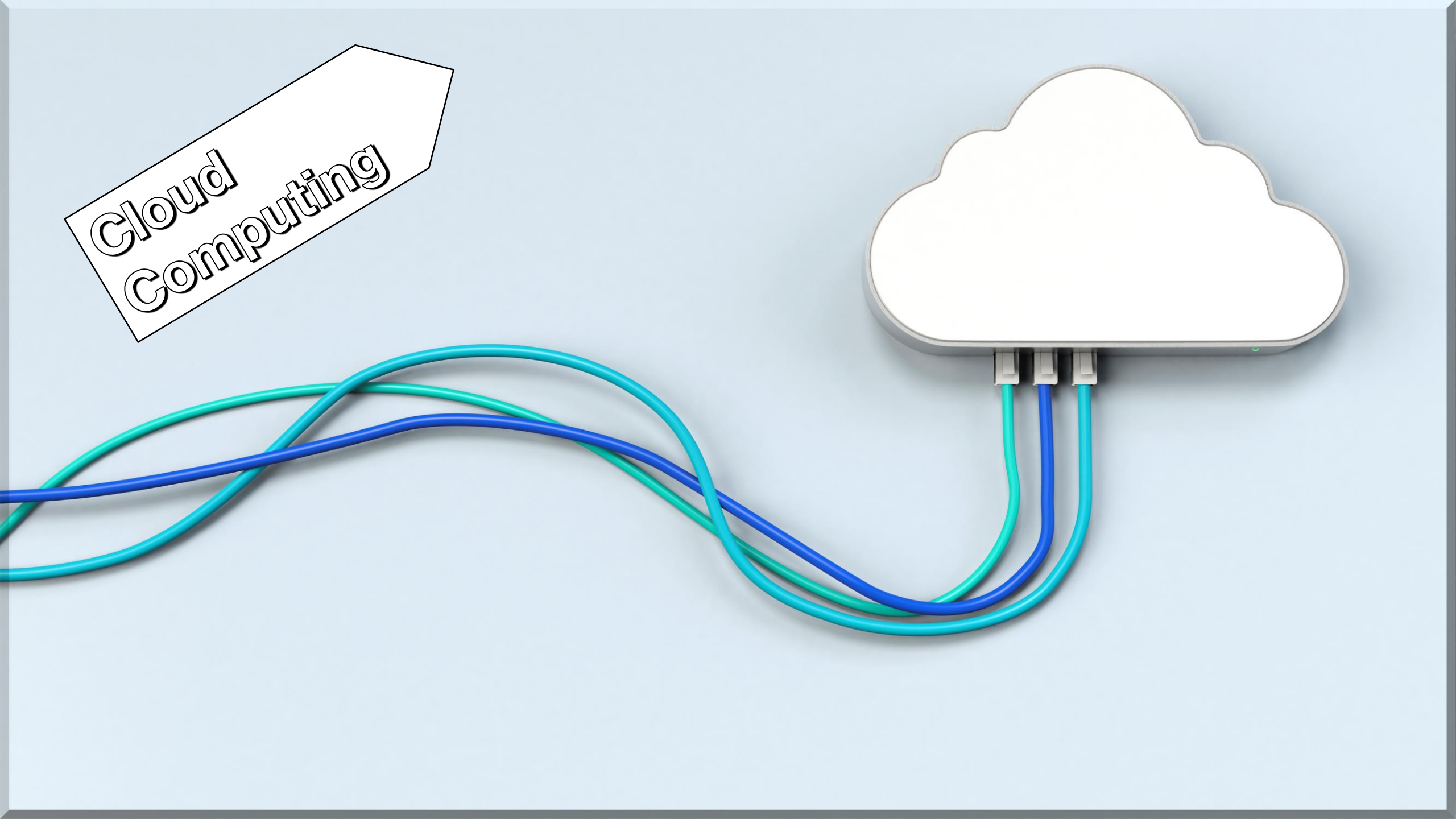
Source :
https://www.youtube.com/watch?v=YueJukoFBMU&ab_channel=OneMinuteEconomics

# Co-operative

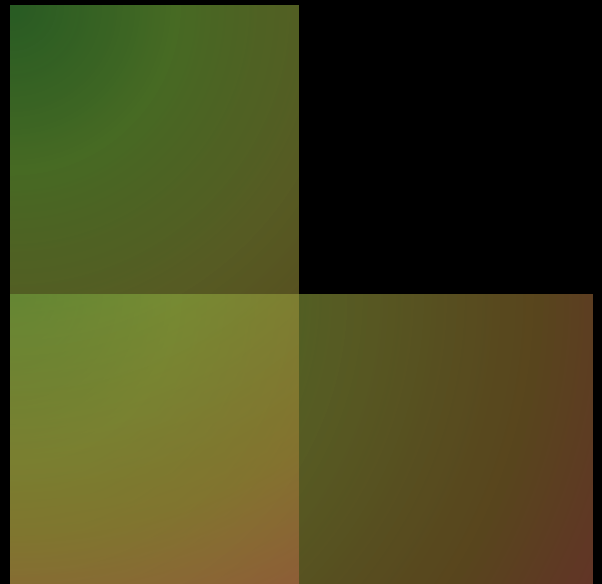
# Non Co-operative




https://cdn.britannica.com/55/91955-050-F444D10D/dilemma-prisoners-participants-game-theory-communication-strategy.jpg

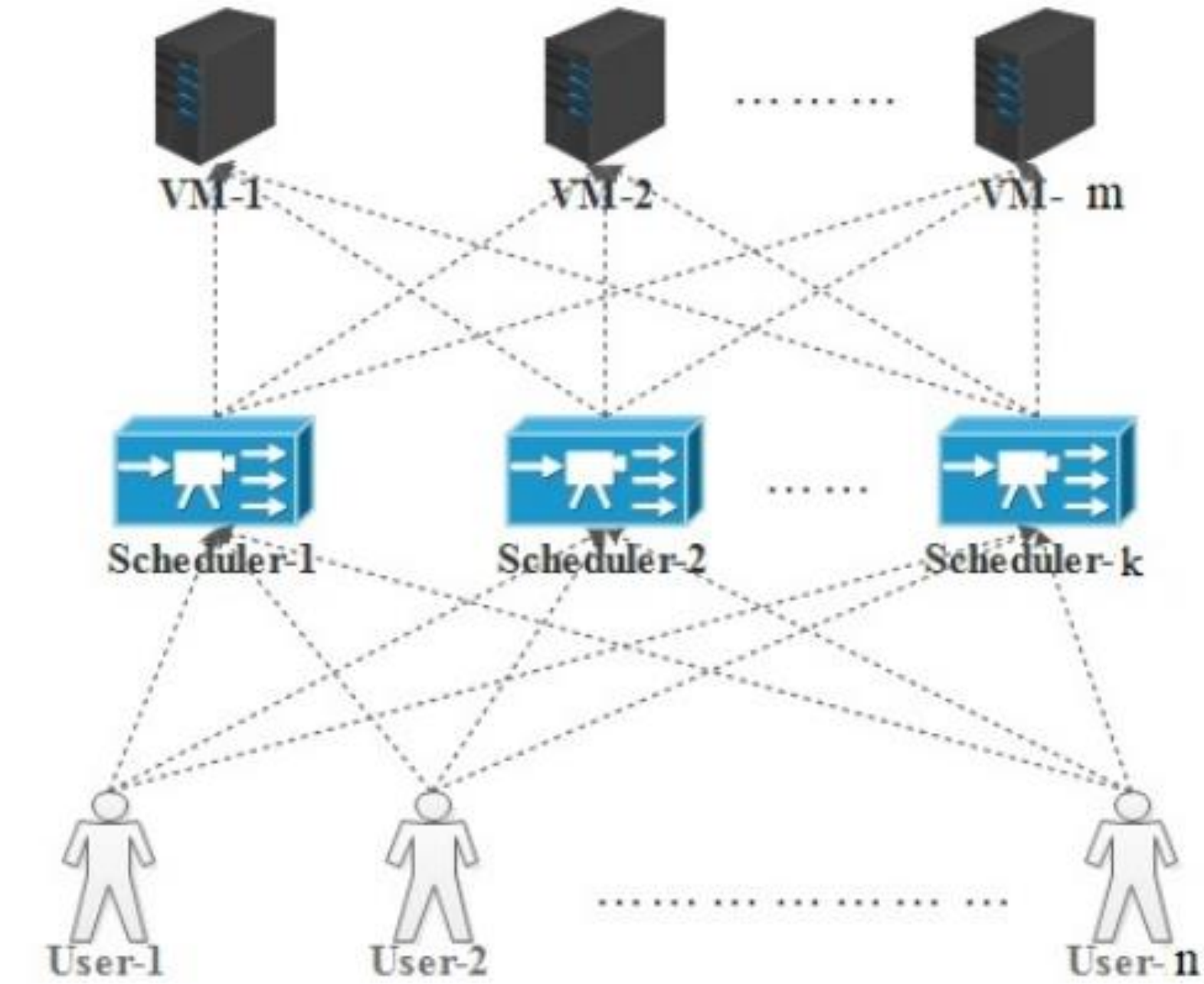

Cloud
Computing

# System Model



- Virtual Machine Model
- Task Model
- Scheduling Model

# System Model



## Virtual Machine Model

V = {v1, v2, . . . , vm}

j = {1, 2, . . . , m}.

Million Instructions Per Second (MIPS)

## Task Model

$$T = \{t1, t2, \ldots, tn\}$$

$$i = \{1, 2, \ldots, n\}$$

$$t_i = \{a_i, s_i, d_i\},$$

$$et_{ij} = \frac{s_i}{sp_j} \quad (1)$$

$$c_{ij} = st_{ij} + et_{ij} \quad (2)$$

$$w_{ij} = st_{ij} - a_i \quad (3)$$

**Player :** Each task is taken as a player i.e., $t_i = p_i$ . The set of player is represented by P = $\{p_i \mid 1 \leq i \leq n\}$

**Strategies :** Every virtual machine functions as a strategy. To maximize their payoff, each player will look for the best strategy $v_j$

**Payoff :** The variable payoff that $t_i$ will acquire while choosing a strategy $v_j$ can either be completion time $c_{ij}$ or waiting time $w_{ij}$ .

**Payoff Matrix :**
player-1 time period $t_1$
player-2 time period $t_2$
Strategy $v_j$ , where j = {1, 2, . . . , m}.

# Non Co Operative

PayOff Matrix

| t1 \ t2 | $V_1$ | $V_2$ | $V_3$ |
|---|---|---|---|
| $V_1$ | (4, 3) | (1, 2) | (3, 2) |
| $V_2$ | (5, 2) | (2, 7) | **(8, 4)** |
| $V_3$ | (5, 9) | (3, 1) | (4, 6) |

Normalised PayOff Matrix

| t1 \ t2 | $V_1$ | $V_2$ | $V_3$ |
|---|---|---|---|
| $V_1$ | 1 | -1 | 1 |
| $V_2$ | 3 | -5 | 4 |
| $V_3$ | -4 | 2 | -2 |

VM Selection

| t1 \ t2 | $V_1$ | $V_2$ | $V_3$ | Row-Max |
|---|---|---|---|---|
| $V_1$ | 1 | -1 | ***1*** | **1** |
| $V_2$ | 3 | -5 | 4 | 4 |
| $V_3$ | -4 | 2 | -2 | 2 |
| Col-Min | -4 | -5 | **-2** | |

# Co-Operative

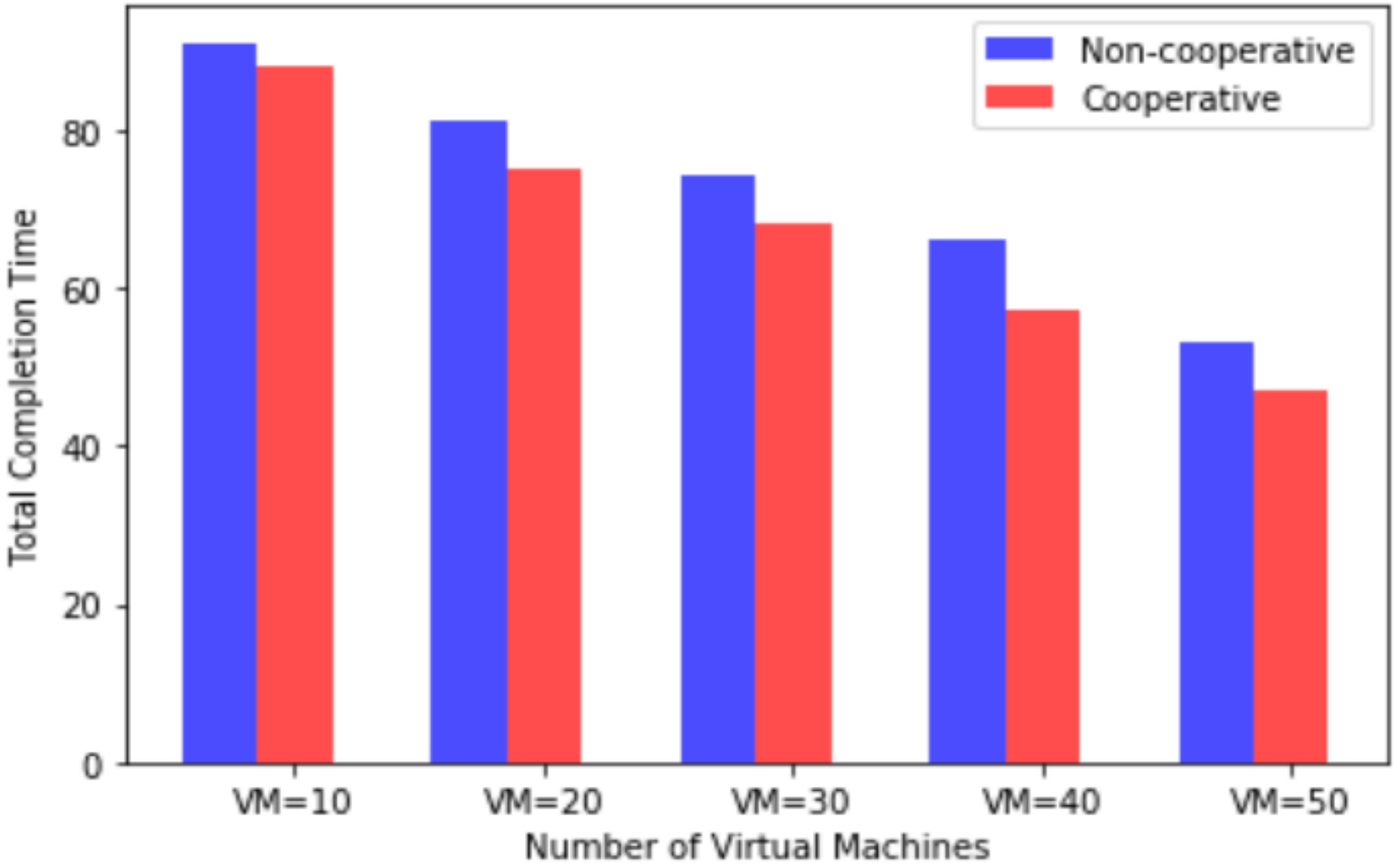
PayOff Matrix

| t1 \ t2 | $V_1$ | $V_2$ | $V_3$ |
|---|---|---|---|
| $V_1$ | (5, 3) | (1, 4) | (6, 2) |
| $V_2$ | (5, 1) | (2, 5) | (1, 4) |
| $V_3$ | (5, 6) | (2, 4) | (4, 7) |

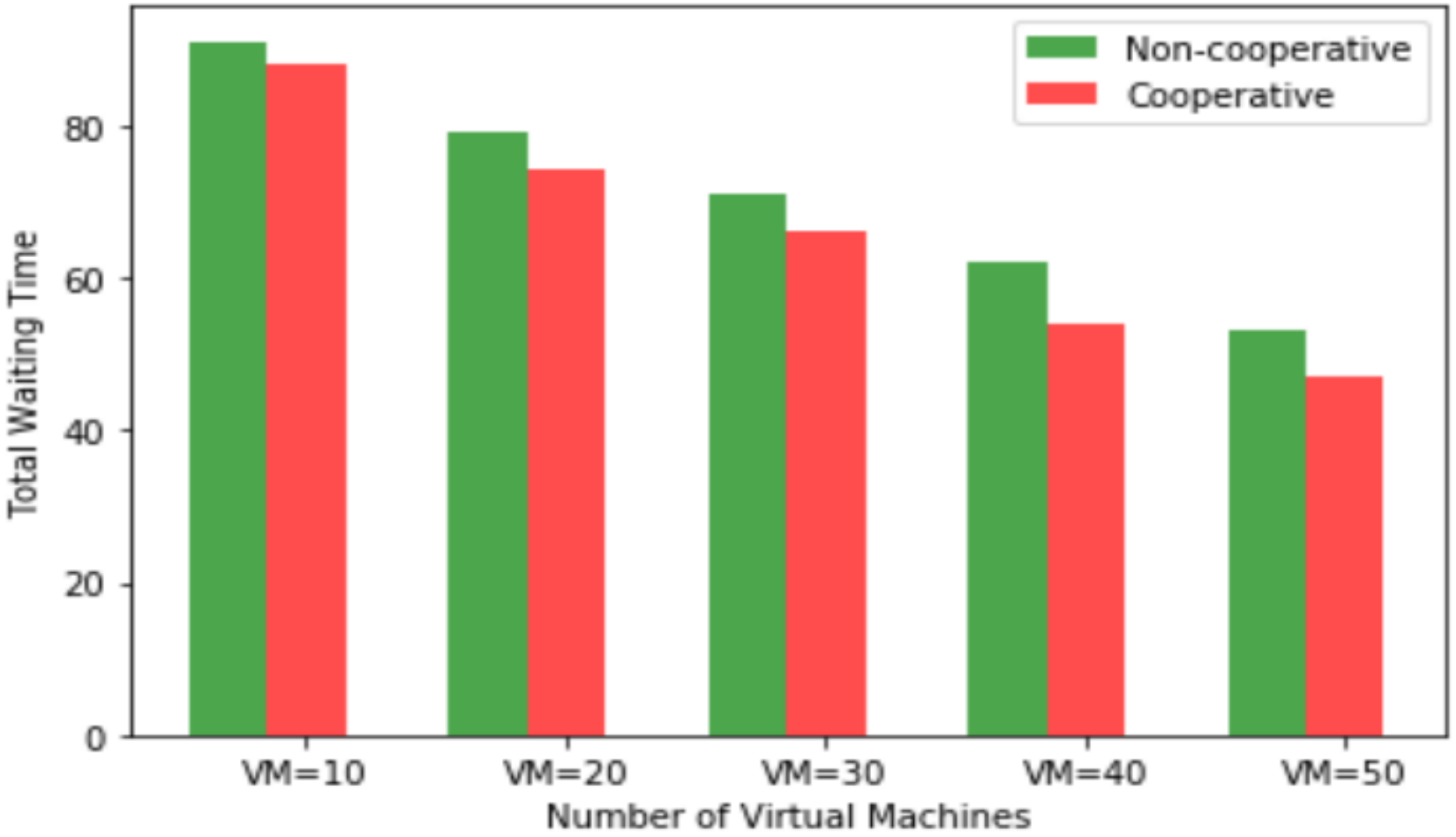
Normalised PayOff Matrix

| t1 \ t2 | $V_1$ | $V_2$ | $V_3$ |
|---|---|---|---|
| $V_1$ | 2 | 3 | 4 |
| $V_2$ | 4 | 3 | 3 |
| $V_3$ | ***1*** | 2 | 3 |

# Completion Time as PayOff



# Waiting Time as PayOff



# Take Away