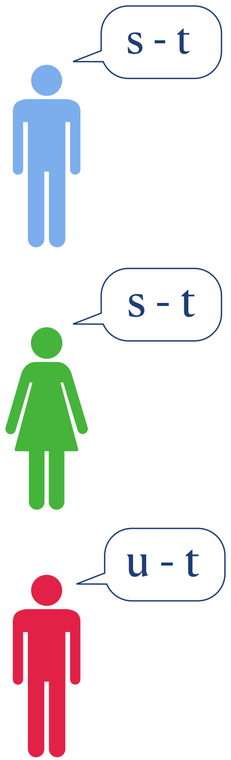
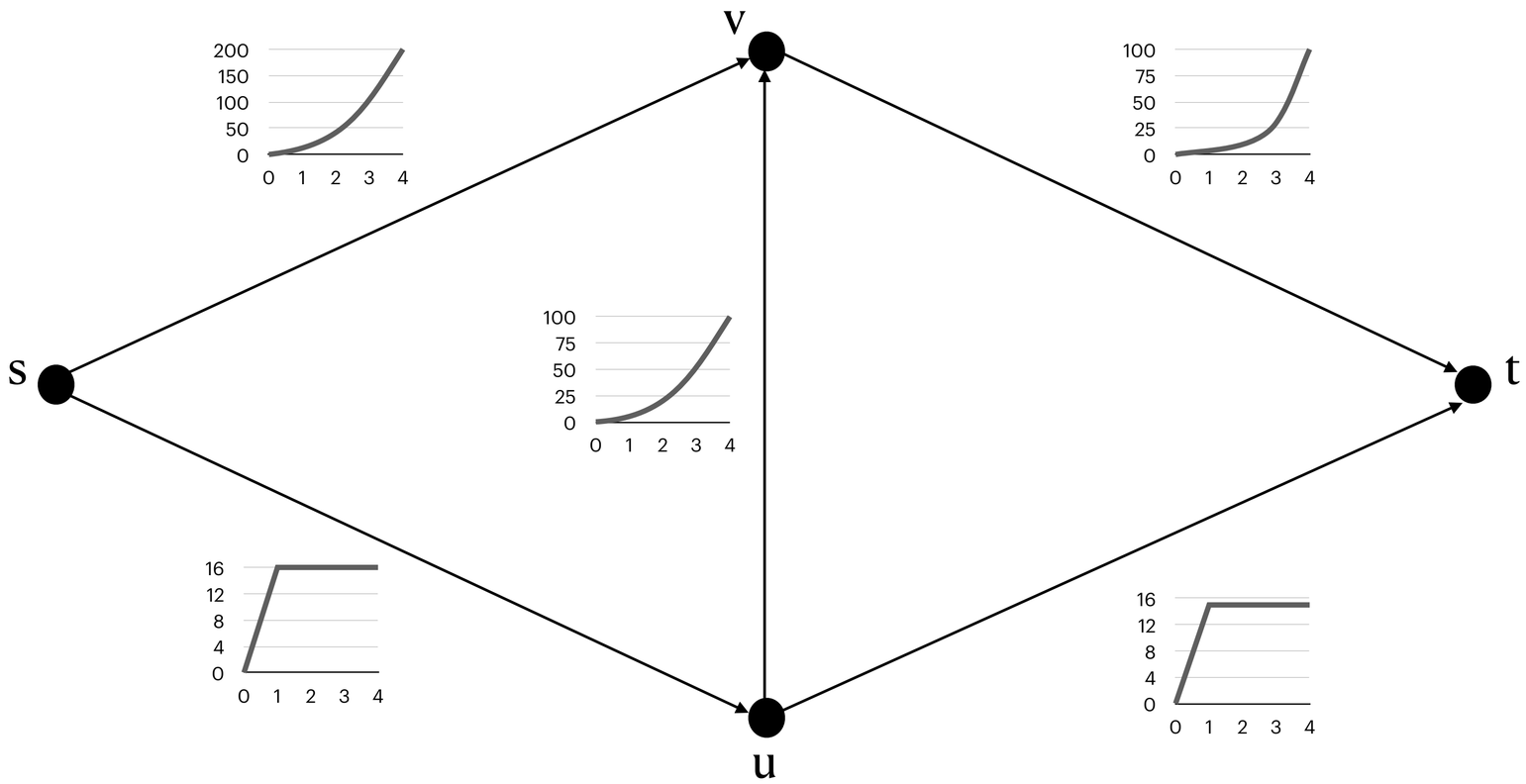
Cost-Sharing Games





Cost-Sharing Games

- **Total cost** of an outcome of the game = **Sum of the costs of the edges.**
- Players' decisions **depend on the protocol**.
- **Selfish behavior** of the players might lead in to **inefficient equilibria**.
- Our goal is to design protocols in which while players only **think about their own cost-share**, the equilibrium still has **low social cost** (i.e. Low PoA)

Cost-Sharing Games

Informational Power

- What does the protocol know in defining the cost share of player i in edge e
  - **Oblivious**: Just the **set of players** using e
  - **Omniscient**: **Everything** about the game
  - **Resource-aware**: Everything about G and set of the **players using** e

How to use this extra information ?

Results

	Concave	Convex
Series-Parallel Graphs (symmetric)	$\text{PoA} = 1$ Generalization of the protocol for parallel links [Christodoulou et al. '17]	$\text{PoA} = 1$ Incremental protocol [Moulin '99]
Directed Acyclic Graphs (symmetric)	$\text{PoA} = 2 + \varepsilon$ $n > 1 \rightarrow \text{PoA} = 1 + \varepsilon$ With overcharging	Budget Balance $\rightarrow \text{PoA} = \Omega(n)$ Overcharging $\rightarrow \text{PoA} > 1.18$
Multicast	Budget Balance $\rightarrow \text{PoA} = \Omega(n)$ Overcharging $\rightarrow \text{PoA} = \Omega(\sqrt{n})$	