Algorithms, Incentives, and Multidimensional Preferences

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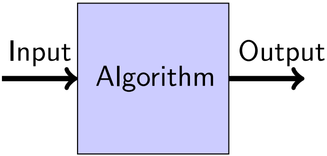
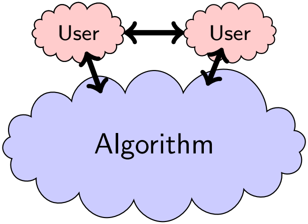
January 15, 2016

Algorithms and Incentives

Past: Algorithms as black box



Now: Algorithm as Platform



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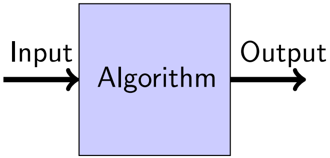

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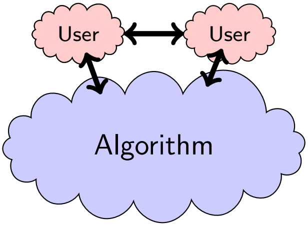

Examples:

- Routing Protocols
- Crowdsourcing
- Electronic Commerce, Sharing Economy

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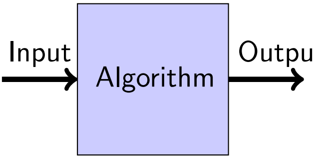

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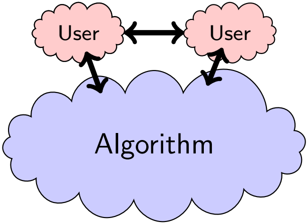

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Design requirement:

Consider user incentives

Revenue Maximizing Mechanisms

ISP service:

- High quality vs. low quality

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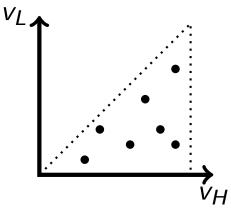
- Distribution f: $(v_H, v_L) \sim f$
- **Goal:** maximize expected revenue



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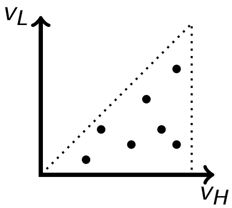
Chen et. al, 2015: computationally hard



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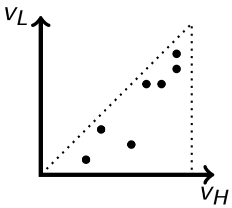
Theorem (Haghpanah, Hartline, 2015)

If types with high v_H are less sensitive $\Rightarrow$ Only offering high quality optimal



Technique

Reduce the **average-case** problem to a **point-wise** problem

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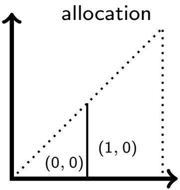
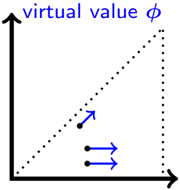
Lemma (Haghpanah, Hartline, 2015)

There exists a virtual value function ϕ such that

1. *Revenue of any mechanism* $= E_{\mathbf{v}}[\mathbf{x}(\mathbf{v}) \cdot \phi(\mathbf{v})]$
2. *Selling only high quality maximizes* $\mathbf{x}(\mathbf{v}) \cdot \phi(\mathbf{v})$ **pointwise**.





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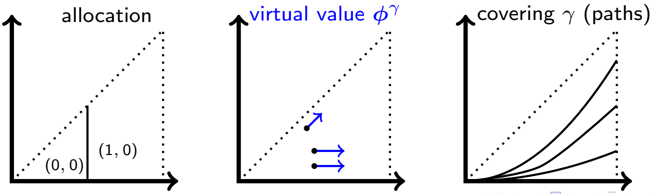

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Challenge:

- Find γ such that ϕ^{γ} satisfies second property