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PRICING IN INFORMATION ORCHESTRATORS: MAXIMIZING STABLE NETWORKS

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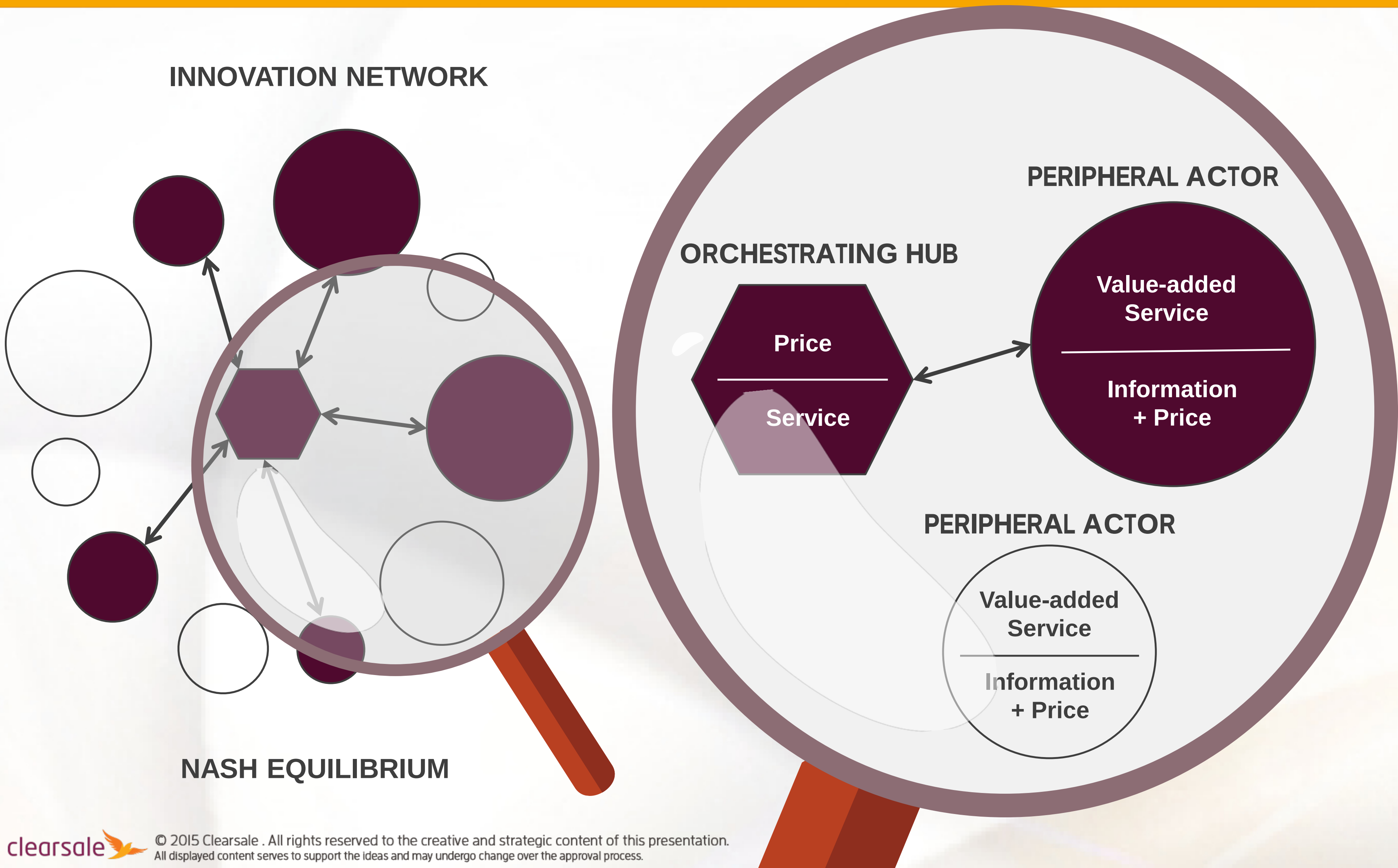
August, 2015

Inhabitants and Companies

Graphic Scheme



ORCHESTRATING HUB

- Captures information from peripheral actors and shares value-added products
- Promotes stability (non-negative growth rates)
- Sets price
- Wants to maximize revenue ~ maximize network's size

PERIPHERAL ACTORS

- Wants to reduce costs of decision making regarding citizens
- Decide whether to connect or not to the network
- If connected, pay the price stipulated by the orchestrating hub
- If connected, share with hub the information they have about the inhabitants

Definitions

Region with a finite number $\boldsymbol{n}$ of inhabitants $\boldsymbol{h_j}$ and finite number $\boldsymbol{q}$ of companies $\boldsymbol{a_i}$ (peripheral actors)

Each peripheral actor $\boldsymbol{a_i}$ knows a certain set of inhabitants $\boldsymbol{A_i}\{\boldsymbol{h}^*\}$

Decision costs among inhabitants:

- $\boldsymbol{c_1}, \boldsymbol{if}\ \boldsymbol{h_j} \in \boldsymbol{A_i}$ – a minor cost, if the peripheral actor knows the inhabitant;
- $\boldsymbol{c_0}, \boldsymbol{if}\ \boldsymbol{h_j} \notin \boldsymbol{A_i}$ – a major cost, if the peripheral actor does not know the inhabitant;
- $\boldsymbol{c_1} < \boldsymbol{c_0}$

Actors try to reduce their costs by joining a network, orchestrated by $\boldsymbol{H}$

Fraction of inhabitants known by $\boldsymbol{a_i}$: $\boldsymbol{k_i} = \frac{\boldsymbol{n_i}}{\boldsymbol{n}}$

Set of inhabitants known by $\boldsymbol{H}$: $\boldsymbol{A_H} = \cup_{i \in R}\{\boldsymbol{A_i}\}$, leads to a fraction of $\boldsymbol{k_r} = \frac{\boldsymbol{n_H}}{\boldsymbol{n}}$

Game Setup

- Orchestrating Hub sets price $\boldsymbol{p_i > 0, \forall i}$ for peripheral actors
- Peripheral actors simultaneously choose between two strategies: $\boldsymbol{x_i^0}$ and $\boldsymbol{x_i^1}$, corresponding to not joining or joining the network, respectively
- The innovative capacity of the network varies depending on the choices made by the each of the actors
- Nash Equilibrium: nobody regrets their choices, given the others player's choices ➔ leads to network stability

Maximizing Stable Networks

Network is stable and maximized if Nash equilibrium is achieved by each actor, or $u_i^1 \leq u_i^0, \forall i$:

$$u_i^0 = k_i c_1 + (1 - k_i) c_0$$
$$u_i^1 = k_r c_1 + (1 - k_r) c_0 + p_i$$

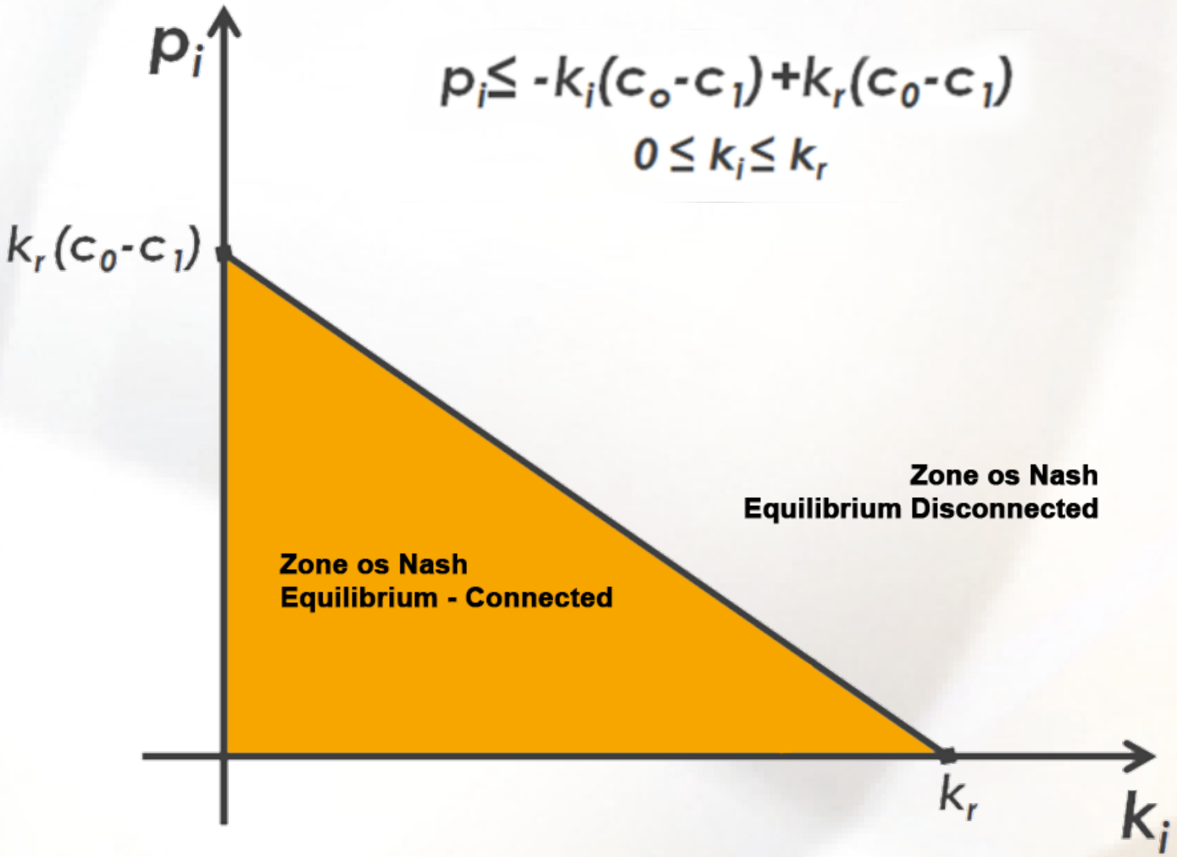
Replacing, simplifying and flipping the signs internally, we have

$$(k_r - k_i)(c_0 - c_1) \geq p_i$$

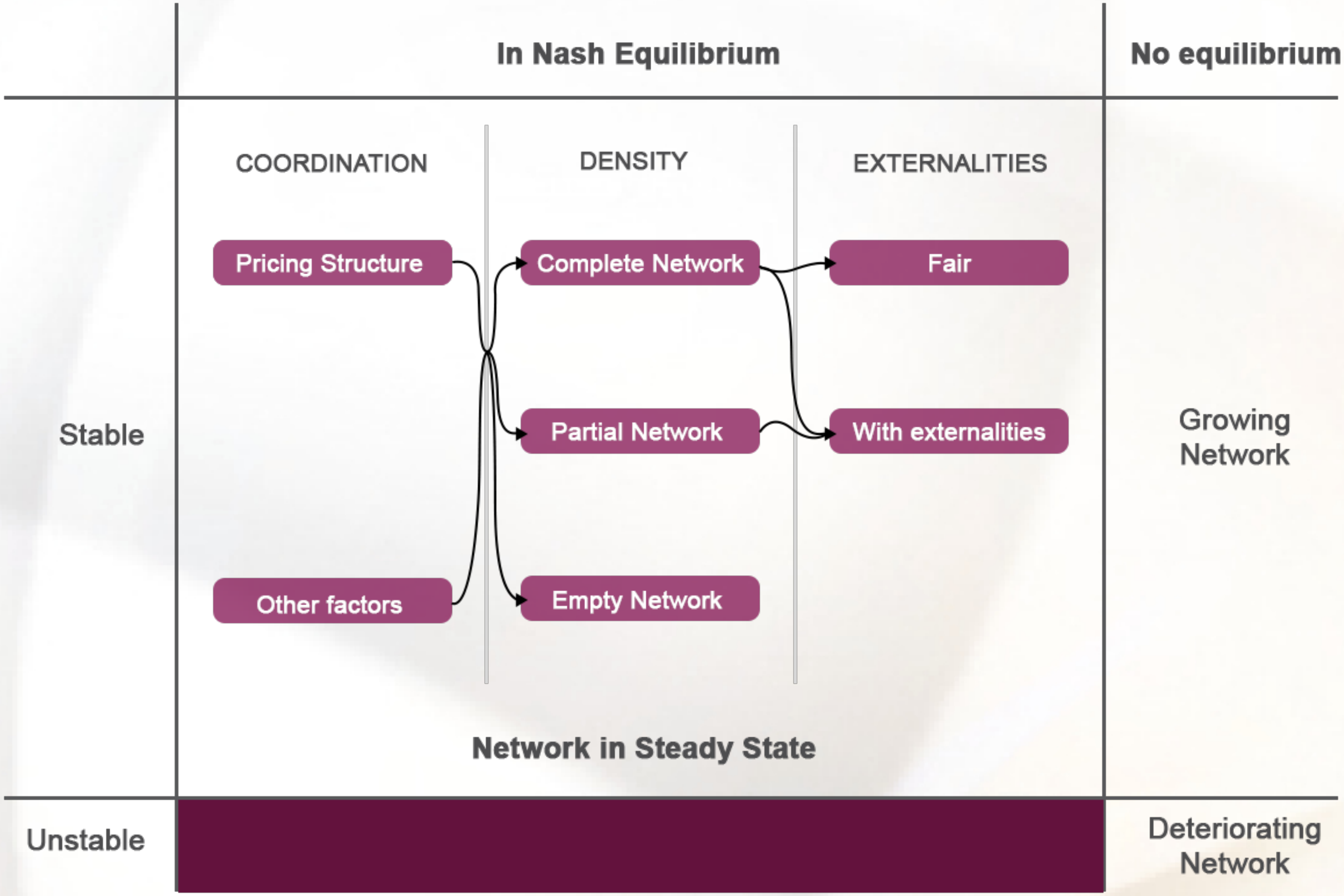
IN ORDER TO MAXIMIZE NETWORKS, THE PRICE CHARGED SHOULD BE PROPORTIONAL TO THE INNOVATION APPROPRIATED BY EACH MEMBER

Relation Between Price and Size of Actor

From $(k_r - k_i)(c_0 - c_1) \geq p_i$, we have:



Stability and Nash Equilibrium



Other Conclusions

With a fixed price for all actors, nash equilibrium can also be achieved in three ways:

- Empty network
- Partial network
- Full network

In all these cases, there will be a externality on the price charged (exceptions in very specific cases):

- Smaller actors will benefit in higher degree for the same price than big actors

All these conclusions are also demonstrated by a numeric simulation of the market

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