Utility Analysis of API Economy Based on Multi-Sided Platform Markets Model

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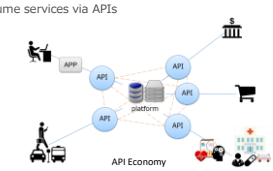
API(Application Programming Interface) Economy 2

- **API economy: service collaborations through APIs**
  - Enables information processing and data provision
  - Expected to increase market value
- **Developers/ consumers connect to the economy**
  - Developers supply services via APIs
  - Consumers consume services via APIs



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API Economy Market Model and Strategy 3

- **API economy market model**
  - Previous work deals with the two-sided market
  - But the other customer group = API evaluator exist
    - e.g. Amazon: customer reviews motivate sellers to sell and buyers to buy

Market revitalization by incorporating API Evaluator (existence that evaluates API)

- **A Strategy for the platform provider**
  - Attract API evaluator ⇒ API evaluation revitalization the market
  - Change the number of function ⇒ activate API development

Measure an impact of API evaluator

↓

Reveal which better strategy is for platform provider

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Purpose and Approach 4

- **Purpose**

・Measure the impact of API evaluators
・Optimal strategy of the platform provider to maximize the utility

- **Approach**
  - Make a multi-sided market model
    - The model consists of the platform provider, developers, consumers and API evaluators to develop [1]
  - Obtain an equilibrium
  - Reveal the impact of API evaluators on the platform utility
    - Change parameters regarding the API evaluators
    - Reveal which **better changing the number of functions or changing reward for API evaluator**

[1] S. Sen, R. Gu´erin, and K. Hosanagar, "Functionality-rich versus minimalist platforms:A two-sided market analysis," *ACM SIGCOMM Computer Communication Review*,vol. 41, pp. 36–43, Sep. 2011.

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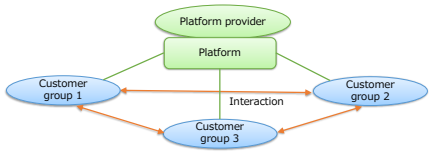
A Multi-sided Market Model 5

- **A market model with multiple customer groups**
  - The customer groups interact to increase the value of their products
  - Customer groups : Classify from the method of using the platform
  - E.g. developers, consumers and API evaluators
- **Can analyze the interaction between customer groups**



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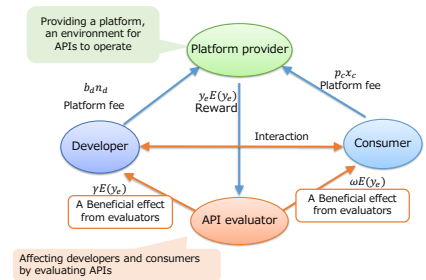
Our Market Model 6



変数	意味
x_c	The number of consumer
n_d	The number of developer
$E(y_e)$	The number of API evaluator
p_c	Platform fee for consumer
b_d	Platform fee for developer
y_e	Reward of API evaluator
F	The number of functions
γ,ω	Marginal value that is associated with evaluators

: Cash flow
: Interactions between customer groups

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Platform provider perspective

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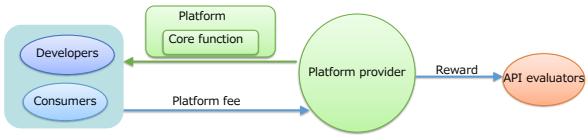
- **Provide a platform**
  - Platform providers optimize the number of functions on their platforms
  - Developers use the functions to develop APIs
- **Reward API evaluators to enter the market**
  - Increasing revenue due to increased the number of developers and consumers



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Interaction from Developer and Consumer

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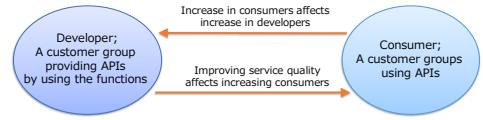
- **Interaction**
  - Increase in consumers affects increase in developers
  - Increase in developers = Improving service quality
  - Improving service quality affects increasing consumers



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Interaction from API Evaluator

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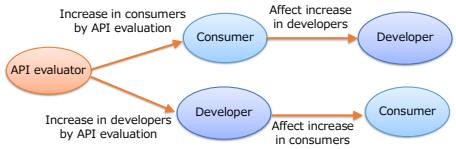
- **Rewarded by the platform provider**
- **Impact of the API evaluators**
  - Consumer: API evaluations motivate to use API
  - Developer: API evaluations motivate API provision



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Utility

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- **Platform provider**
  - $U_p = p_c x_c + b_d n_d - y_e E(y_e) - C(F)$ (1)
- **Developer**
  - $U_d = \alpha x_c - b_d + \gamma E(y_e) - (K(F) + \tau\varphi)$ (2)
- **Consumer**
  - $U_c = \theta\beta n_d + \omega E(y_e) - p_c$ (3)

Marginal value: The value gained from either consuming or producing one additional unit of a product or service.

変数	意味
x_c	The number of consumer
n_d	The number of developer
$E(y_e)$	The number of API evaluator
p_c	Platform fee for consumer
b_d	Platform fee for developer
y_e	Reward of API evaluator
F	The number of functions
$C(F)$	Platform cost
$K(F)$	Development cost
α	Marginal value that a consumer generates for a developer
β	Marginal value that associated with a developer
θ	Heterogeneity of utility that consumers get from developers
$\tau\varphi$	Heterogeneity of development cost by developer's skill level
γ, ω	Marginal value that is associated with evaluators
λ	marginal value from a consumer and a developer to an evaluator

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Numerical Examples

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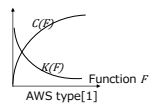
- **Analysis of the benefits from API evaluator**
  - Analysis by changing rewards for API evaluator y_e
- **Parameter settings**
  - Marginal value that is associated with evaluators γ, ω
    - γ, ω = 0.4, γ, ω = 0.8
  - The number of evaluators increases by rewards from the platform provider $E(y_e) = C y_e^P$
    - C = 0.8, P = 1.0, 1.8, 2.5
  - Platform cost $C(F)$ and development cost $K(F)$
    - $C(F)$: The more functions the platform provider implement, the larger cost
    - $K(F)$: The more functions the developer can use, the lower cost



AWS type[1]

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Effect of γ, ω on Platform Utility

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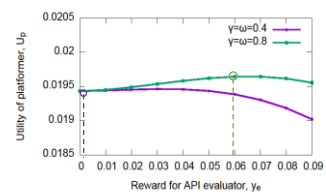
- **When γ, ω is high, maximum platform utility is high**
  - The reward for taking the maximum utility increases

⇒**Platform provider strategy: Give higher rewards in market when γ, ω is high**



Comparison of platform utility when γ, ω is 0.4 or 0.8

γ: A Beneficial effect from evaluators to developers
ω: A Beneficial effect from evaluators to consumers

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Effect of $E(y_e)$ on Platform Utility

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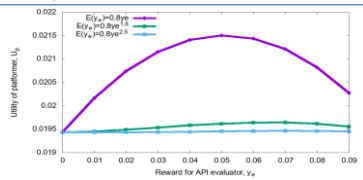
- **The platform utility increases significantly when the number of evaluators increases linearly with reward**
  - However the platform utility is sensitive to y_e

⇒ **Platform provider strategy: Be careful not to make the reward too high when evaluators increase linearly**



y_e: Reward for API evaluator
$E(y_e)$: The number of API evaluators

Comparison of platform utility when $E(y_e)$ is $0.8y_e$, $0.8y_e^{1.8}$ or $0.8y_e^{2.5}$

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Compare with Utility by Changing Function

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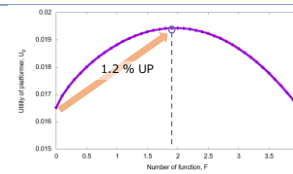
- The platform utility takes the maximum value $U_p = 0.0194$ (1.2 % up) when the number of function $F = 1.98$

⇒ **Better to optimize the reward for API evaluators**
- Utility increases by up to 2.3% when changing the reward for API evaluators



Utility of platformer when changing the number of function F

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Summary and Future Work

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- **Summary**
  - API Economy: service collaborations through APIs
  - Make a multi-sided market model that consists of the platform provider, developers, consumers, and **API evaluators**
  - Reveal the impact of API evaluators on the platform utility
  - Analyze simulation results
    - Give higher rewards in market when γ, ω is high
    - Be careful not to make the reward too high when evaluators increase liner
    - **Better to optimize the reward for API evaluators** than changing the number of functions
- **Future work**
  - consider the effect to market from **another customer group** other than API evaluator
    - e.g. agency, mobile operator and so on

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