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Human Cloud and Crowdsourcing in Future Internet –
Platforms and Modeling Issues

Phuoc Tran-Gia, Matthias Hirth, Tobias Hossfeld

Institute of Computer Science
University of Würzburg

Human Cloud and Crowdsourcing in Future Internet

▶ **Machine-Cloud and Human Cloud**

- Project granularity and evolution of work organization
- Machine Cloud, Human Cloud & Crowdsourcing

▶ **Crowdsourcing Platforms**

- Prerequisites and enabling technologies
- Google and emerging "currencies" in Internet
- Amazon's Mechanical Turk, Microworkers & Co.

▶ **Modeling Issues**

- Modeling methodology for Social Media Networks
- Models of Growth Dynamics

▶ **Quo vadis**

- Sandbox or business models?

http://globaleconomicanalysis.blogspot.com/2010/04/crowd-sourcing-ibm-to-cut-34-of-its.htm

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Monday, April 26, 2010

"Crowd-Sourcing" IBM to Cut 3/4 of its Permanent Staff by 2017?

Computer Weekly and its sister publication, Personnel Today, claim **IBM crowd sourcing could see employed workforce shrink by three quarters**

Multinational firms saddled with huge people costs are considering downsizing their permanent workforce and hiring sub-contractors on a scale never seen before - presenting an "enormous" management task for HR.

ABOUT MIKE SHEDLOCK

Mike Shedlock / Mish is a registered investment advisor representative for SitkaPacific Capital Management. **Continue reading...**

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Wired 14.06: The Rise of Crowdsourcing - Windows Internet Explorer

http://www.wired.com/wired/archive/14.06/crowds.html

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Wired 14.06: The Rise of Crowdsourcing

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All Wired

Issue 14.06 - June 2006

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The Rise of Crowdsourcing

Remember outsourcing? Sending jobs to India and China is so 2003. The new pool of cheap labor: everyday people using their spare cycles to create content, solve problems, even do corporate R & D.

By Jeff Howe

1. The Professional

Story Tools

PRINT   MAIL

Story Images

Click thumbnails for full-size image:

Claudia Menashe needed pictures of sick people. A project director at the National Health Museum in Washington, DC, Menashe was putting together a series of interactive kiosks devoted to potential pandemics like the avian flu. An exhibition designer had created a plan for the kiosk itself, but now Menashe was looking for images to accompany the text. Rather than hire a photographer to take shots of people suffering from the flu, Menashe decided to use preexisting images – stock photography, as it's known in the publishing industry.

Feature:
The Rise of Crowdsourcing

Plus:
5 Rules of the New Labor Pool
Look Who's Crowdsourcing

http://www.wired.com/blogs

Internet

100%

Crowdsourcing National Challenges With the New Challenge.gov - Windows Internet Explorer

http://www.readwriteweb.com/archives/crowdsourcing_national_challenges_with_the_new_ch

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Crowdsourcing National Challenges With the New Cha...

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Crowdsourcing National Challenges With the New Challenge.gov

By Alexander Howard / August 31, 2010 3:04 PM / 1 Comments

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Next month, the federal government will launch a new .gov website with a big idea behind it and high hopes that there will be big ideas generated *within* it. Challenge.gov is the latest effort in the evolution of collaborative innovation in open government. Should the approach succeed, challenges and contests have the potential to leverage the collective expertise of citizens, just as apps contests have been used to drive innovation in D.C. and beyond.

In August, senior government officials and private sector enjoyed a preview of Challenge.gov at the Newseum at the second annual Fedscoop forum on reducing the cost of government. Challenge.gov is already live to federal employees for exploration and contribution. The next step for the site, where the Americans are invited to share, vote and contribute ideas, is likely to

Human Cloud and Crowdsourcing in Future Internet

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Human cloud vs machine cloud

machine cloud

cloud computing provider

outtasking/outsourcing

project/ task

Crowdsourcing (intercloud outtasking)

crowdsourcing

human cloud

crowdsourcing platform
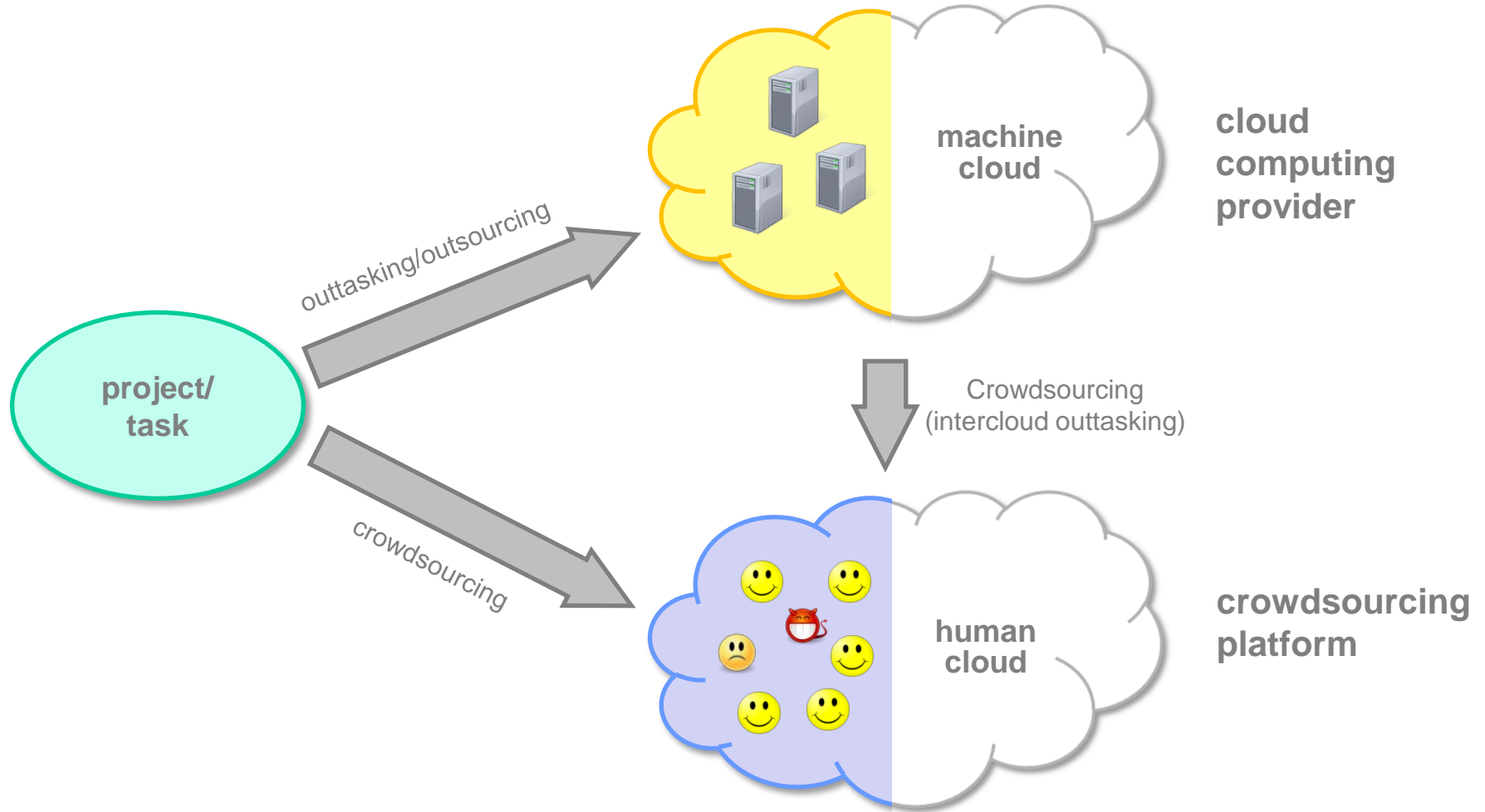
Crowdsourcing & Evolution of work organization in Internet
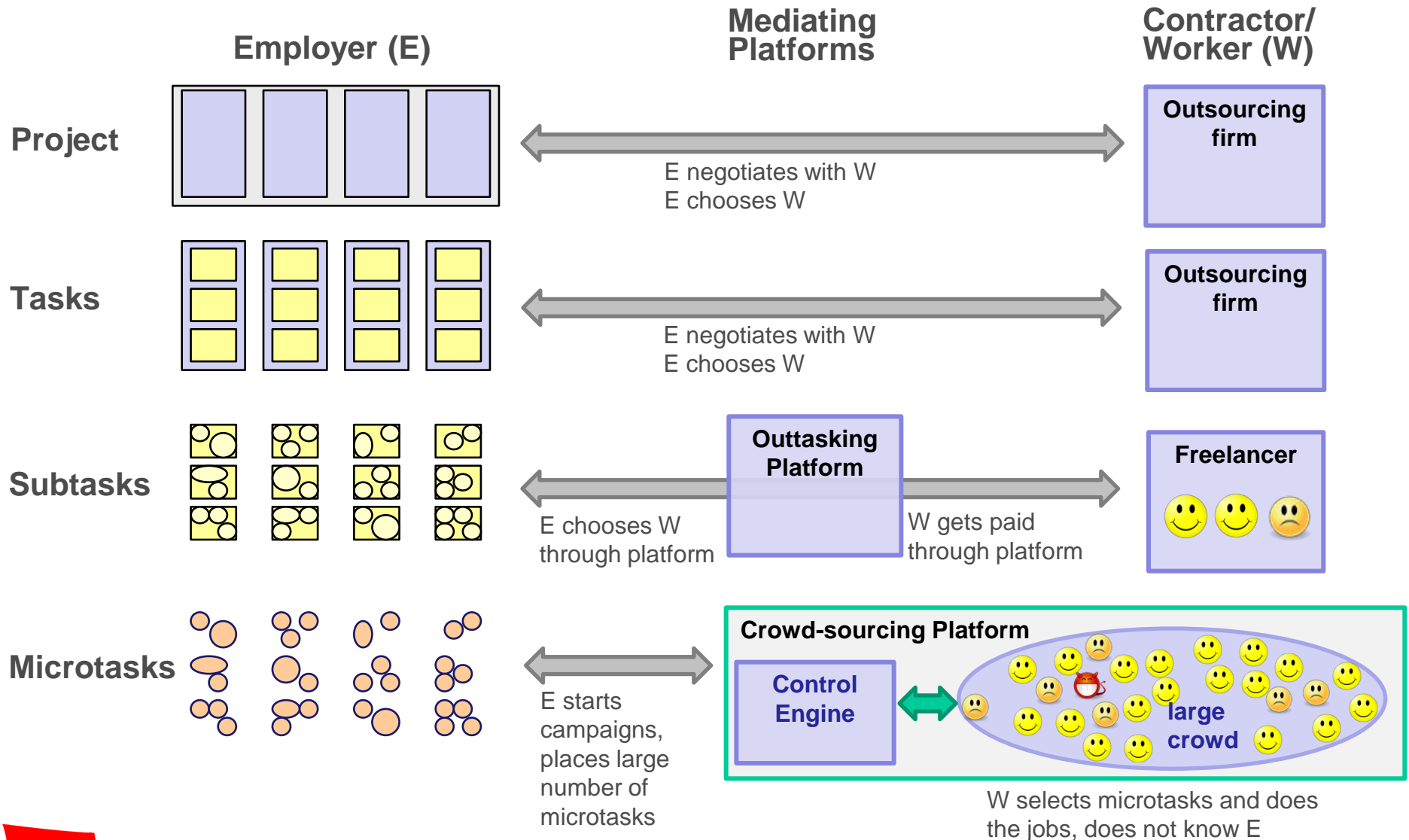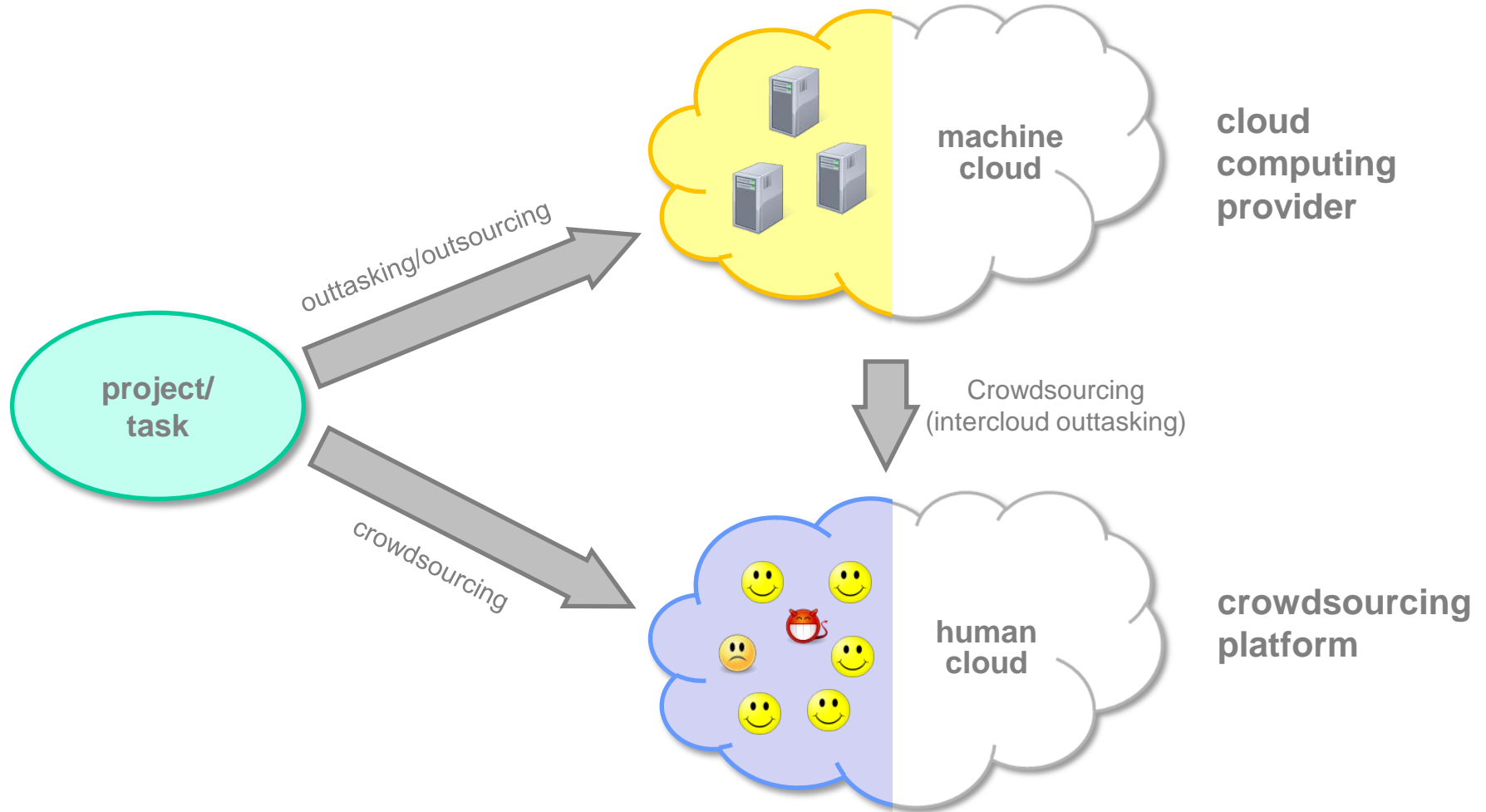
University of Würzburg

Institute of Computer Science

Phuoc Tran-Gia

Evolution of Work Organization

	Employer (E)	Mediating Platforms	Contractor/ Worker (W)

Project — E negotiates with W / E chooses W — **Outsourcing firm**

Tasks — E negotiates with W / E chooses W — **Outsourcing firm**

Subtasks — **Outtasking Platform** — E chooses W through platform — W gets paid through platform — **Freelancer**

Microtasks — E starts campaigns, places large number of microtasks — **Crowd-sourcing Platform** — **Control Engine** — **large crowd** — W selects microtasks and does the jobs, does not know E

Human cloud vs machine cloud

machine cloud — cloud computing provider

outtasking/outsourcing

project/ task

crowdsourcing

Crowdsourcing (intercloud outtasking)

human cloud — crowdsourcing platform

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Definition

Crowdsourcing is the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call.

(Jeff Howe 2008 http://www.crowdsourcing.com/)

What enables crowdsourcing?

Enabling technologies for Crowdsourcing

▶ Widespread availability of Internet access

▶ Search engines & Internet marketing

- Pagerank & Search Engine Result Page (SERP)
- New currencies in the Internet (page impression, click-through-rate, etc)
- Marketing in Internet (Google Adsense&Adwords, Briteads, …)
- Search Engine Optimization (SEO)

▶ Micropayments

- Paypal, Alertpay, …

▶ Communities and social networks

- Rapid growths of social networks
- Change of information diffusion speed

▶ Reputation management techniques

Major crowdsourcing platforms?

Classic outsourcing and outtasking platforms

rather classical approaches

▶ oDesk
- Routine tasks, complex tasks, or creative tasks
- Employer chooses workers dependent on the job demands and worker profiles
- Average payment: per hour $ 9.70, per fixed-price jobs: $ 296

▶ Elance
- Routine tasks, complex tasks, or creative tasks
- Employer post tenders and choose workers

▶ Innocentive
- Target: creative tasks
- Employer chooses best solution submitted by workers and rewards the corresponding worker
- Payment: Fixed rewards depending on the challenge $ 5000 - $ 1,000,000

▶ … much more platforms on the market

oDesk

InnoCentive

Crowdsourcing

… hype at the moment …

▶ Amazon Mechanical Turk (Mturk)
- routine and simple tasks
- pure crowdsourcing platform
- micropayments per task

▶ microWorkers
- international crowds of 120000
- growth rate of 5-10% per month
- pure crowdsourcing platforms
- Micropayments: paypal, alertpay, moneybookers, …

▶ … rapidly growing number of platforms

Major crowdsourcing platforms

Crowdsourcing

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MTurk

Major crowdsourcing platforms

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▶ … rapidly growing number of platforms

microWorkers

Nationality of workers in MechanicalTurk and microWorkers

Nationality (MTurk)
- U.S 57%
- India 32%
- Other 6%
- Canada 3%
- Philippines 1%
- U.K. 1%

Nationality (microWorkers)
- Indonesia 17%
- Bangladesh 15%
- India 14%
- U.S. 13%
- Philippines 5%
- Romania 4%
- Egypt 3%
- Pakistan 3%
- U.K. 2%
- Poland 2%
- Other 22%
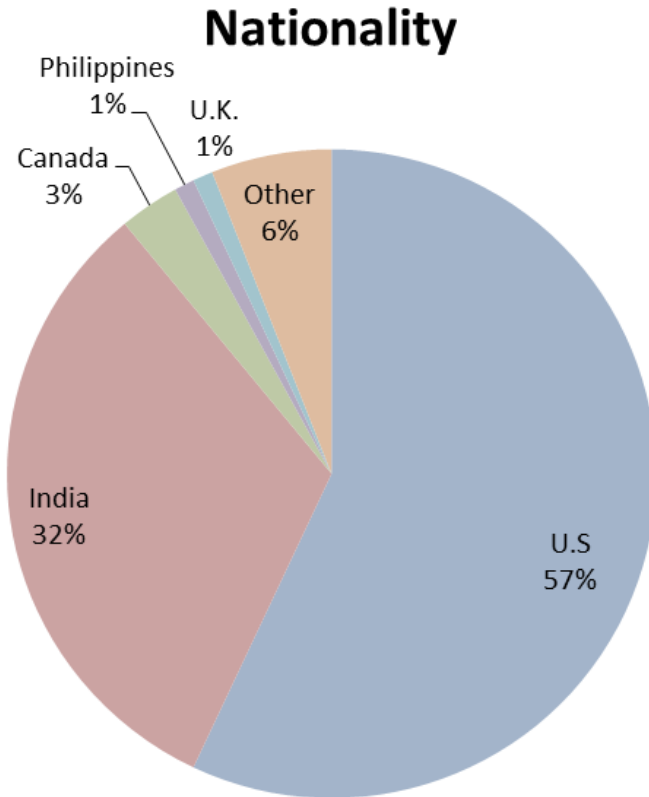
MTurk
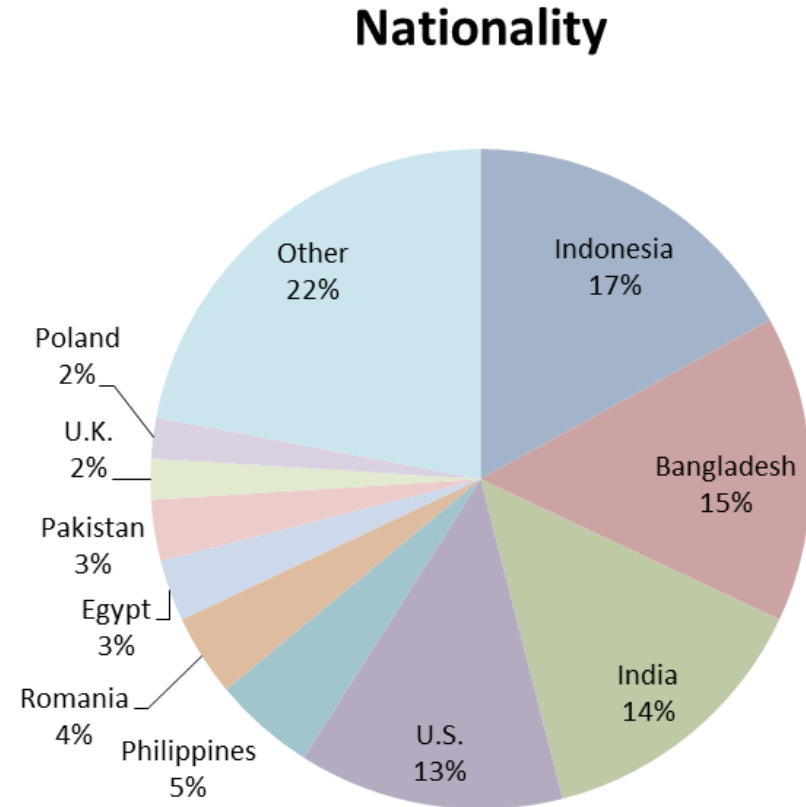
microWorkers

Evolution of work organization

Employer (E)

Microtasks

E starts campaigns, places large number of microtasks

Contractor/ Worker (W)

Crowd-sourcing Platform

Control Engine

large crowd

W selects microtasks and do the jobs, does not know E
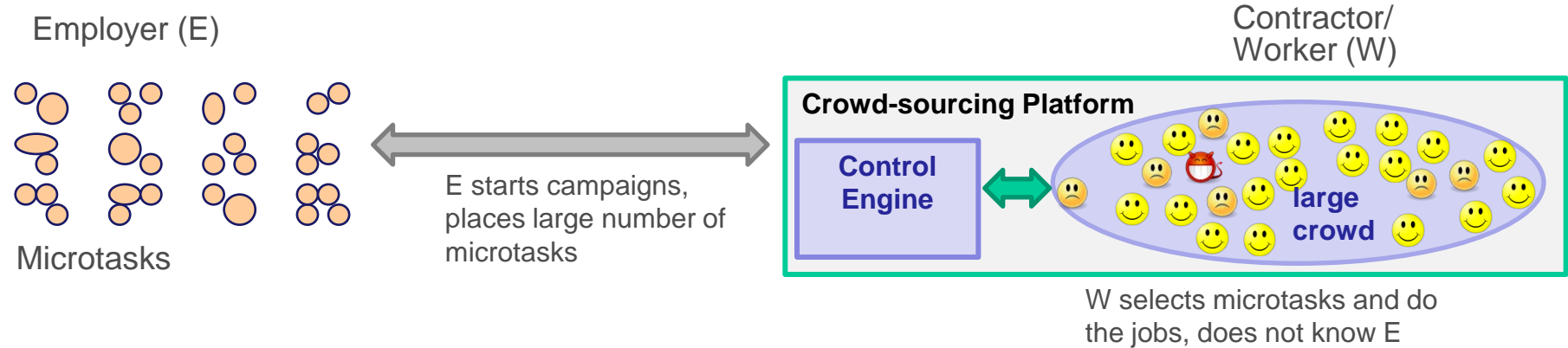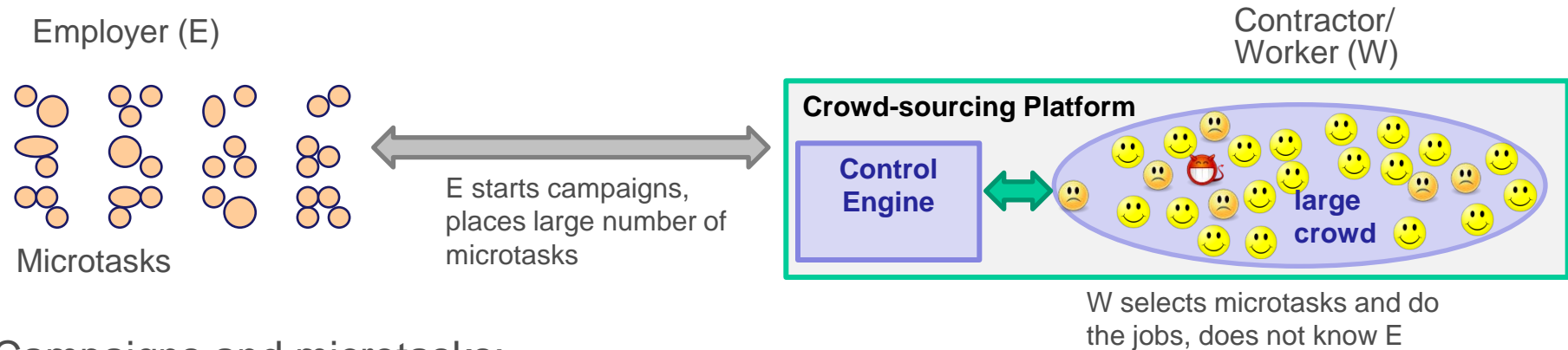
▶ Microtasks:
- (atomic) tasks, hardly can be done by machines
- clear and fair approval process
- fast (example microworkers: campaign with 100 workers needed finished in about 30 min)

Evolution of work organization

Employer (E)

Microtasks

E starts campaigns, places large number of microtasks

Contractor/ Worker (W)

Crowd-sourcing Platform

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large crowd

W selects microtasks and do the jobs, does not know E

▶ Campaigns and microtasks:

- Software tests, e.g. GUI feature and usability
- User surveys for marketing / scientific studies
- Content creation: Forum posts, Blog entries, Writing articles
- Translation, pattern recognition, image labeling
- Online reputation management
- SEO (Search Engine Optimization)
    - Enhance popularity, boosting social networks
    - Posting twitter information, boosting advertisement, linking pages
    - "classical" marketing campaigns

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Modeling what ?

Modeling issues

▶ Understanding the growth dynamics of new Social Media Applications in emerging Internet

- Growth of classic Social Media Networks
- Growth of a crowdsourcing Platform (example microworkers.com)
    - Models of factors influencing the growth
    - critical mass survival threshold of a platform

▶ "Performance" of a crowdsourcing platform

- Anatomy of a crowdsourcing platform
- Speed of task finishing
- Traffic impact and forecasting
- QoI: Quality of Information?
    - Platform specialization and quality
    - Quality enhancement & cheat detection

Growth of Facebook
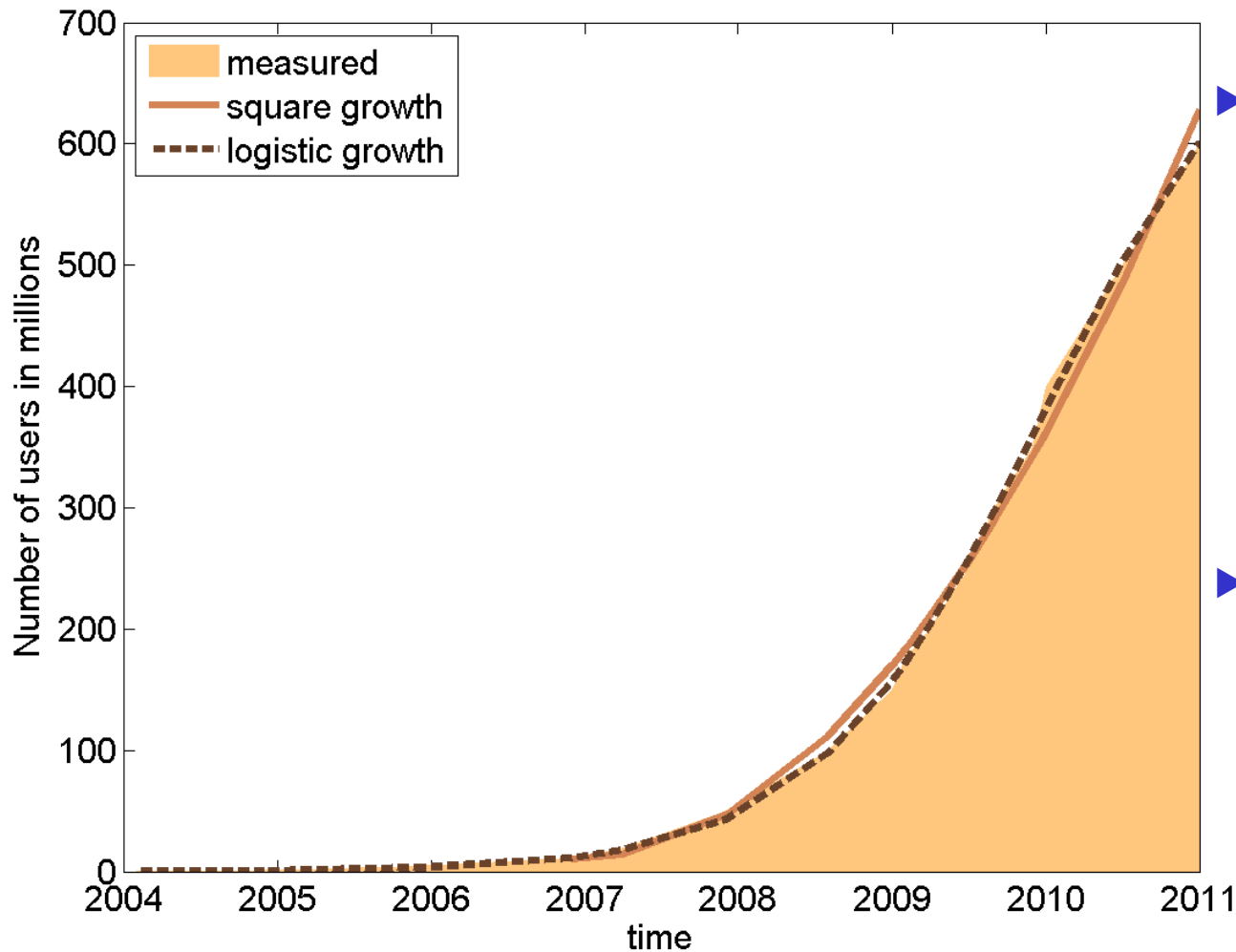
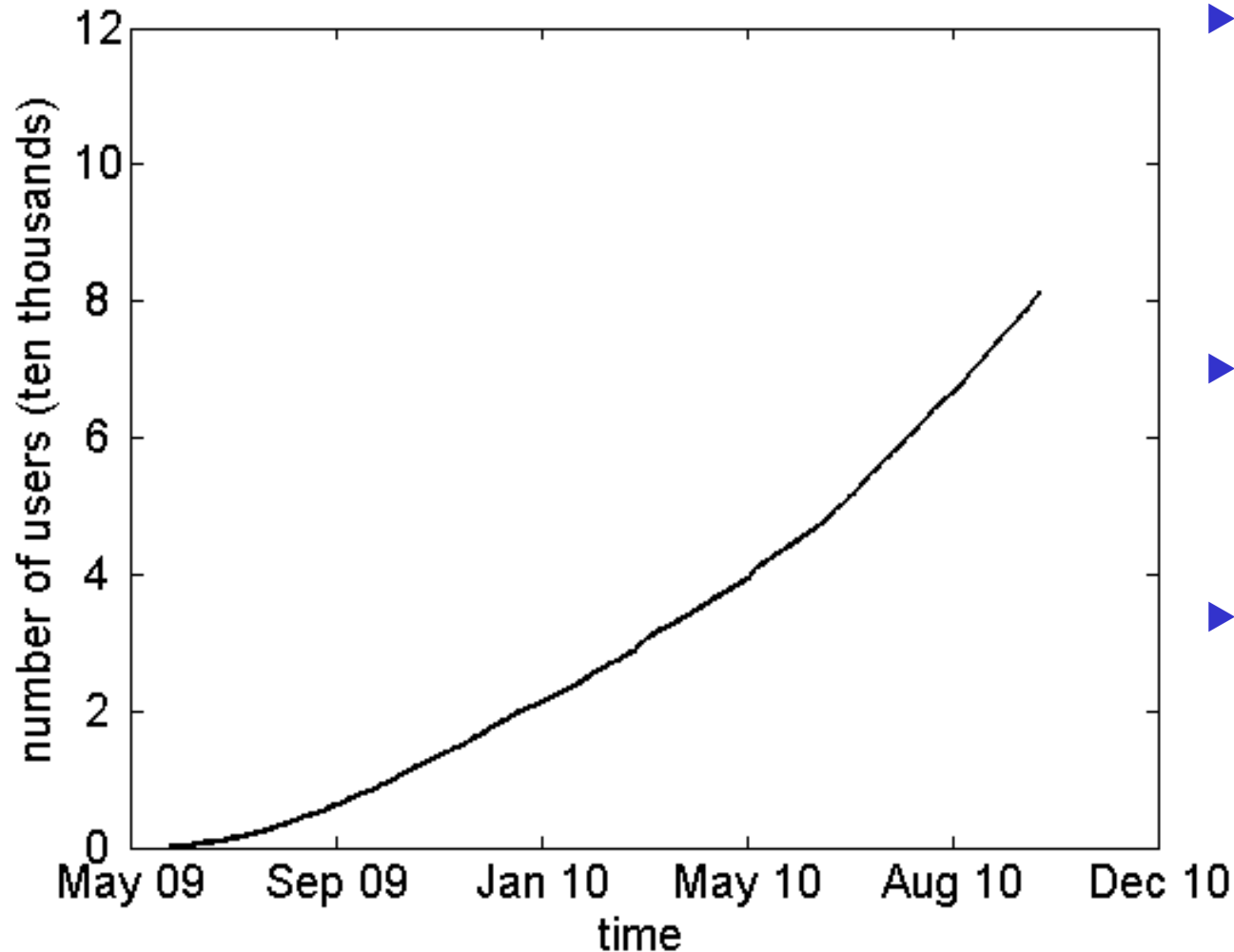► In 2009 about 350 million users:

  ▪ Most visited web page form business PCs in 2009 (about 7%)

  ▪ Together with YouTube consuming 14.5% of the business bandwidth (WindowsUpdate 3.3.%)

► In 2010 about 600 million users:

  ▪ Most used web page in the USA in 2010

  ▪ Facebook : 8.93%

  ▪ Google: 7.19%

Growth models for Microworkers.com

► Measurement data: User Development of Microworkers.com (May, 2009 and October 2010)

► Two basic model types:
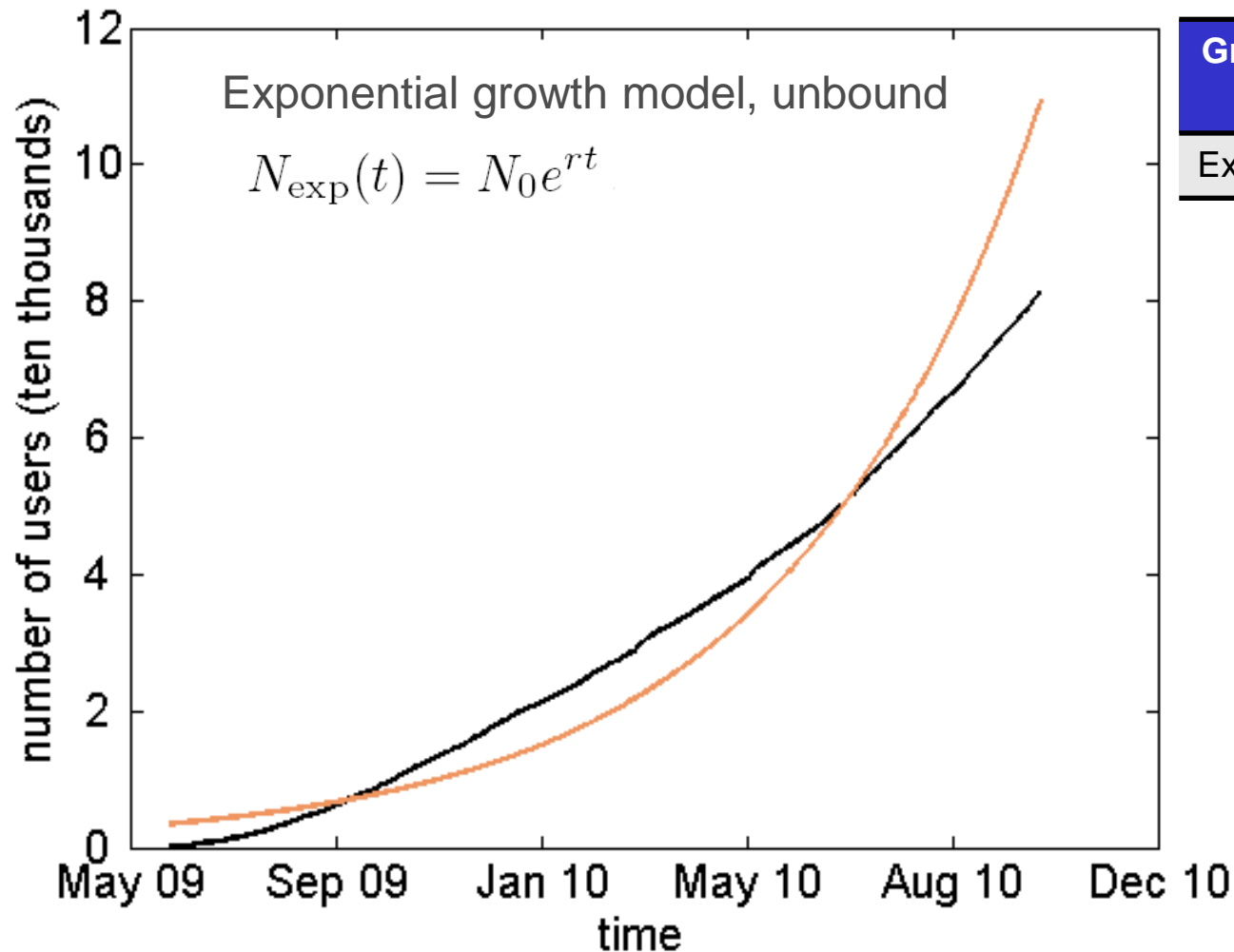 ▪ Unbound population
  ▪ Bound population

► Parameter determination:
  ▪ Minimization of least-square error

Application of growth models

Growth model	Coefficient of determination
Exponential	0.9572

The figure shows the "Exponential growth model, unbound" with the equation $N_{\exp}(t) = N_0 e^{rt}$, plotting number of users (ten thousands) versus time from May 09 to Dec 10.

Application of growth models

Hyperbolic growth model, unbound

$$N_{\mathrm{hyp}}(t) = \frac{K}{t_c - t}$$
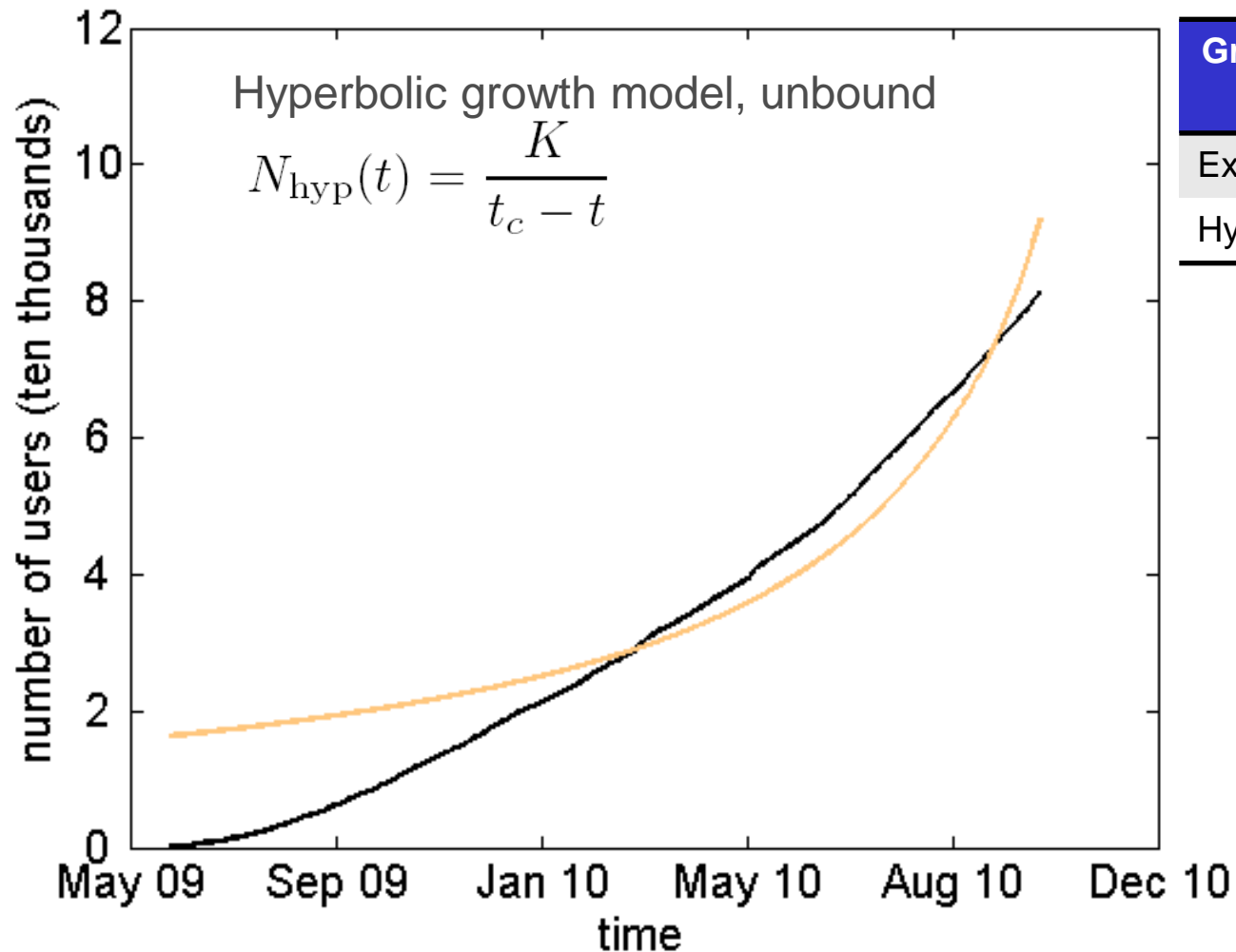
Growth model	Coefficient of determination
Exponential	0.9572
Hyperbolic	0.9302

Application of growth models
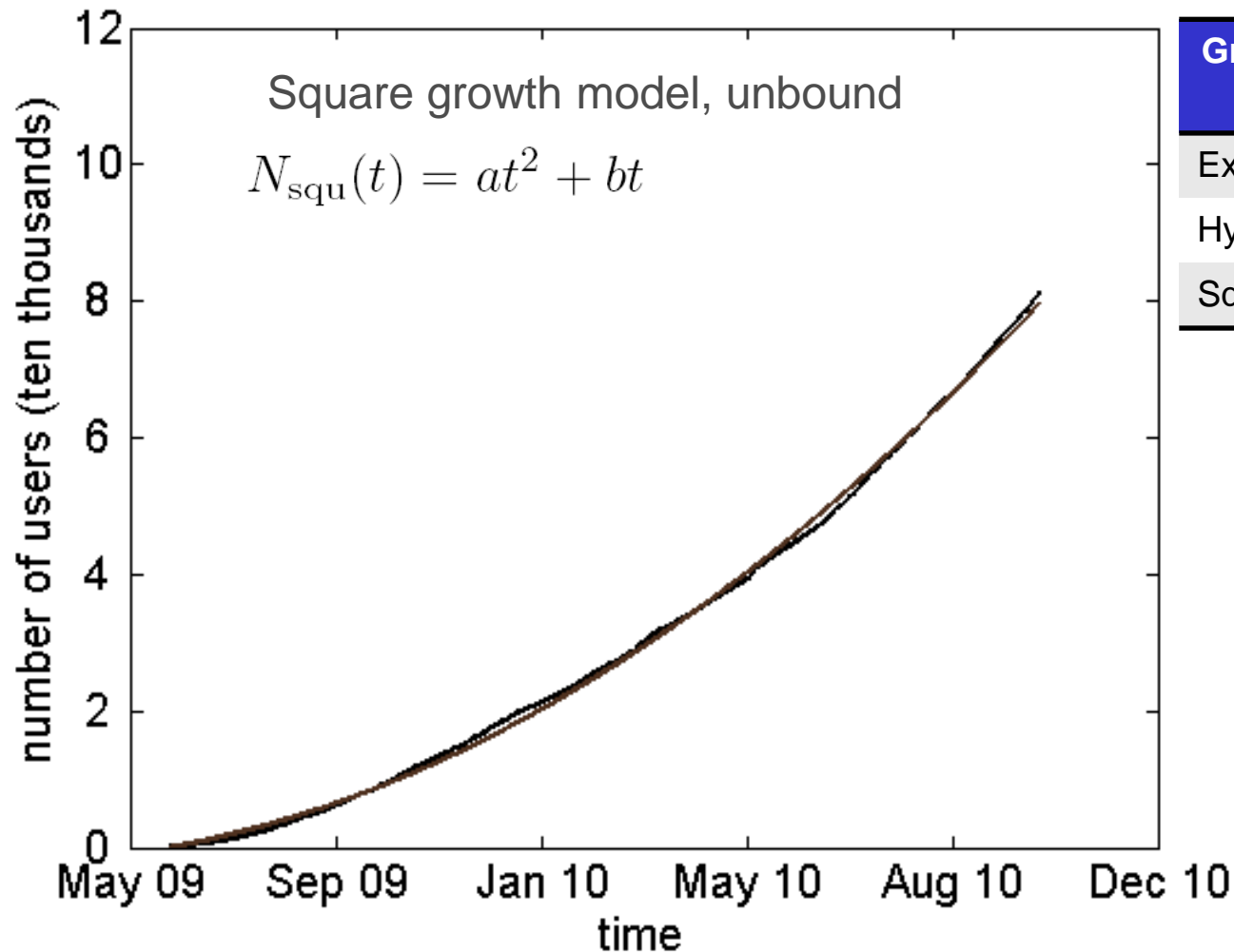
Square growth model, unbound

$$N_{\mathrm{squ}}(t) = at^2 + bt$$

Growth model	Coefficient of determination
Exponential	0.9572
Hyperbolic	0.9302
Square	0.9988

Application of growth models
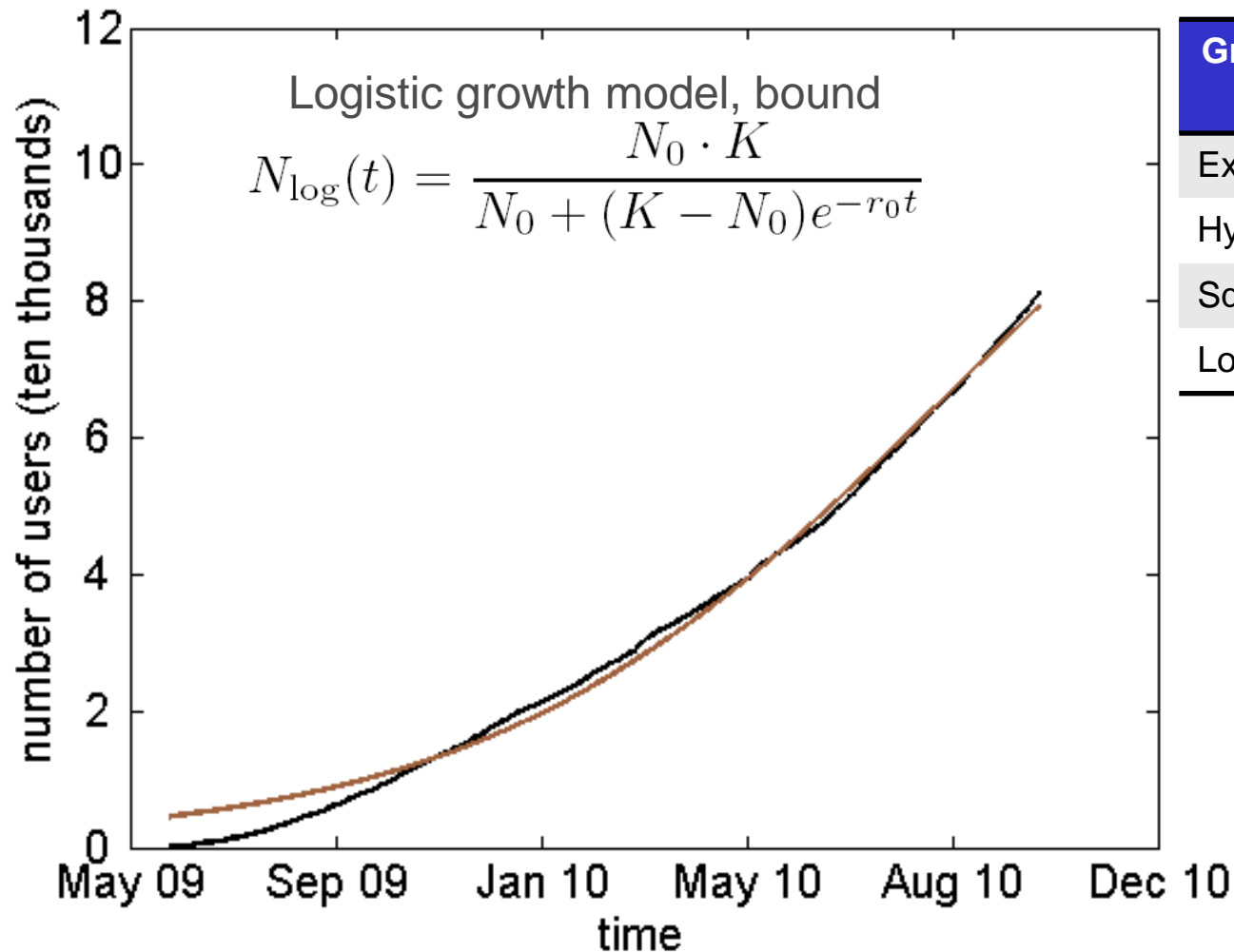
Logistic growth model, bound

$$N_{\log}(t) = \frac{N_0 \cdot K}{N_0 + (K - N_0)e^{-r_0 t}}$$

Growth model	Coefficient of determination
Exponential	0.9572
Hyperbolic	0.9302
Square	0.9988
Logistic	0.9959

Growth prediction
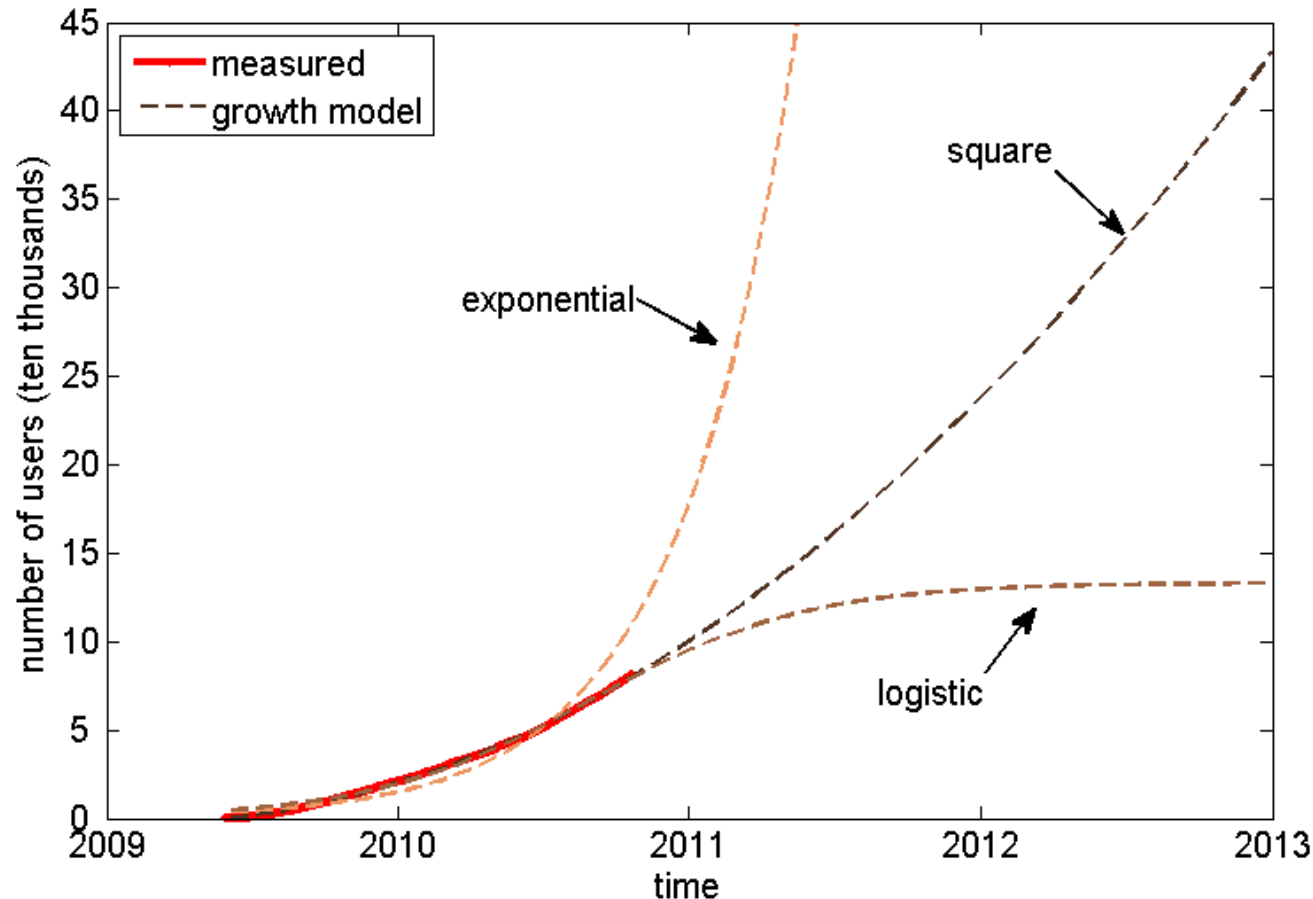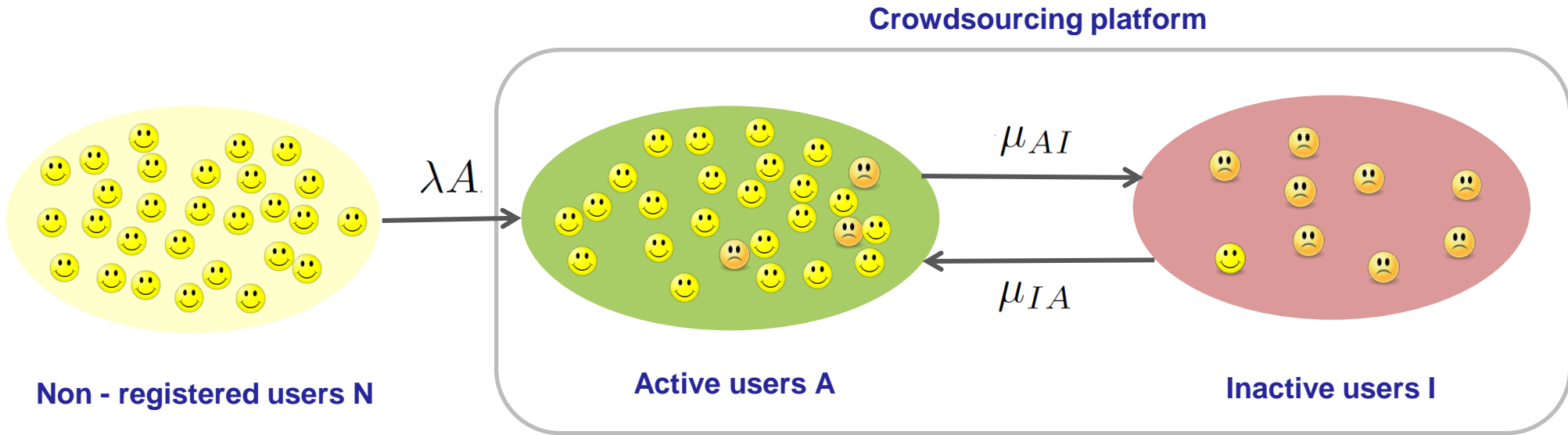

▶ Square growth model:
- One million users in 2015

▶ Logistic growth model:
- End of growth: 2012
- Number of users: About 130000

But: Are all users really active?

Crowdsourcing dynamics

Crowdsourcing platform

λA

μ_{AI}

μ_{IA}

Non - registered users N

Active users A

Inactive users I

▶ User interaction models:

- *Local User Decision (LUD)*
  - User only influenced by personal opinion
    - ➜ Platform has to advertise continuously

$$\mu_{AI} = \gamma \qquad \mu_{IA} = \delta$$

- *Globally Influenced Dynamics (GID)*
  - Users are influence by global opinion
    - ➜ Attractive platforms grow faster
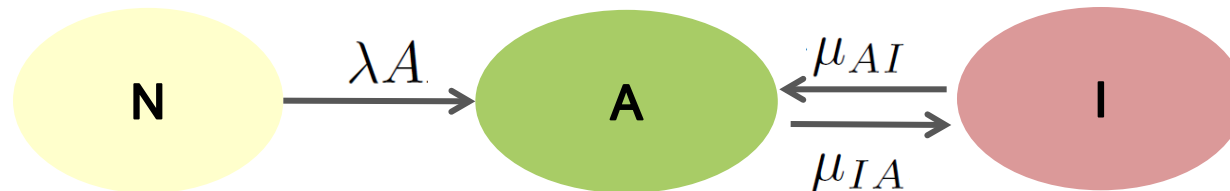   - ➜ Unattractive platforms starve

$$\mu_{AI} = \gamma I \qquad \mu_{IA} = \delta A$$

SIR model for modeling crowdsourcing dynamics

▶ User types
- N: Non-registered users
- A: Active users
- I: Inactive users
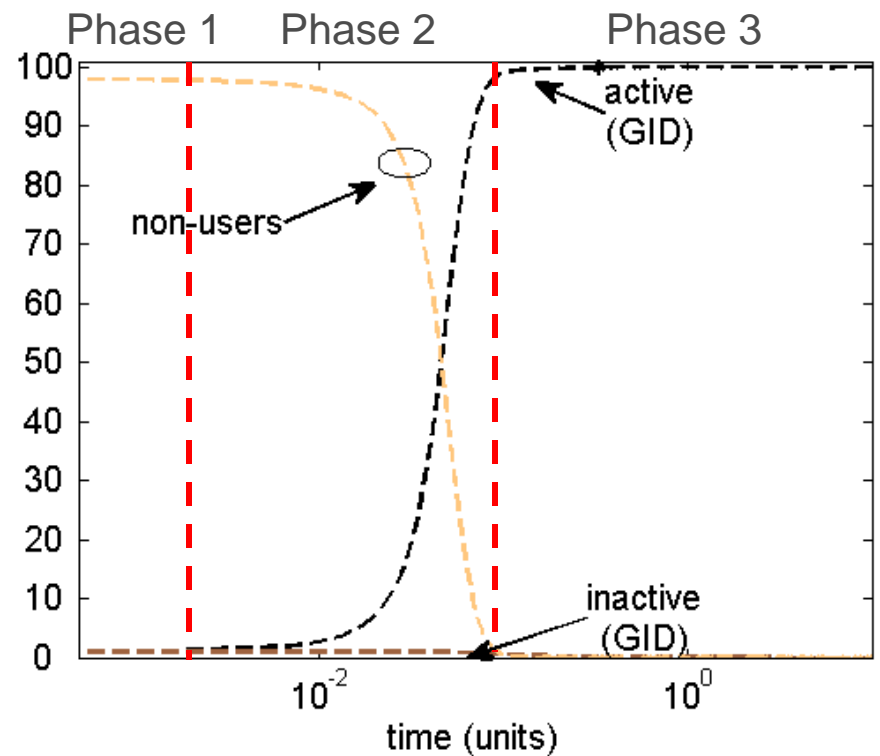- N + A + I = K: Total Population

▶ System description:

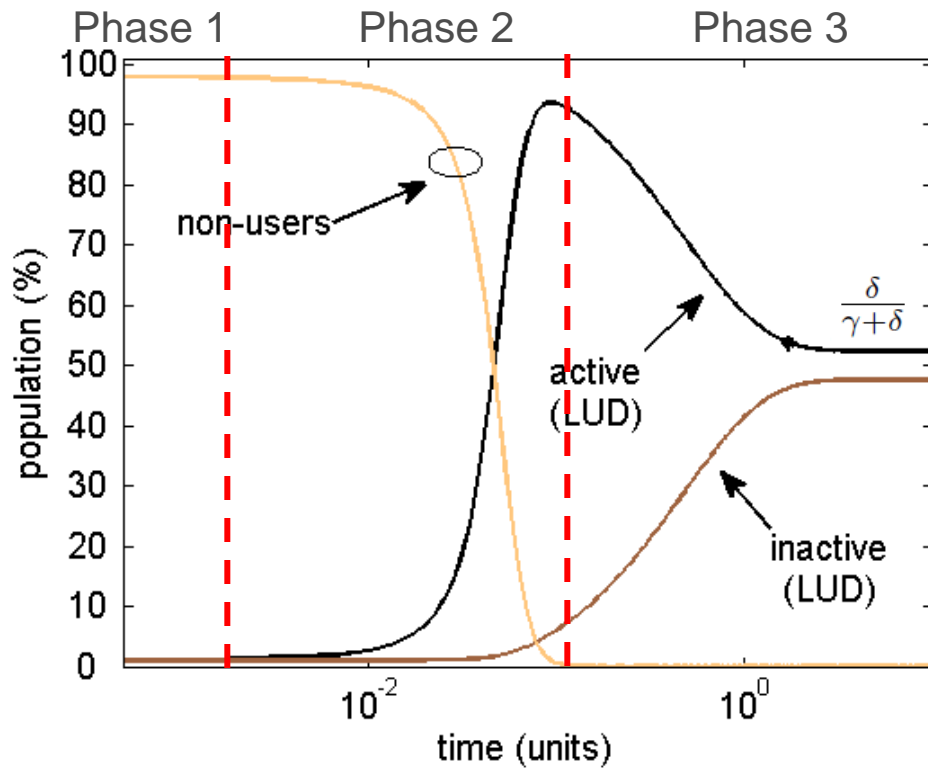$$\frac{dN}{dt} = -\lambda AN$$

$$\frac{dA}{dt} = -\mu_{AI}A + \mu_{IA}I + \lambda AN$$

$$\frac{dI}{dt} = -\mu_{IA}I + \mu_{AI}A$$

▶ Questions:
- When will be all users registered?
- How many users will be active?

Application of the dynamics model

Phase 1: Acquisition of new users

Phase 2: Acquisition of new users and motivation of registered users

Phase 3: Motivation of registered users

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▶ **Quo vadis**

- Sandbox or business models?

quo vadis ?

▶ Sandbox or serious business models?

▶ Traffic models and prediction model of new disruptive services

▶ Building Platforms and Customizing Use Cases
  - Transform a use case into campaigns
  - Preprocessing of data and postprocessing of results
  - Building internal crowdsourcing platforms within companies
  - Supporting automatic creation of microtasks from large projects

▶ Building crowd
  - Forming specialized crowds for predefined jobs
    – Workers with special qualifications for difficult tasks
    – Workers with specific demographic properties, e.g., for surveys
  - Forming "internal" crowd in companies and enterprises
  - Developing cheat detection techniques

Thank you !